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Dear Brian

OPTION 4 CONSTRAINT FORMULATION

As the result of undertaking a review of the implementation of the Option 4 constraint equation formulation throughout the NEM Macquarie Generation has made a number of observations. We are outlining these to you in order to seek your comments and clarify our understanding.

Network utilisation

NEMMCO expressed a view in its June 2003 report, *Management of Network Limitations within the Snowy Region and Constraint Formulation in the NEM – Interim Actions*, that a key reason for supporting an option 4 constraint formulation over the alternatives was that it would allow better network utilisation:

... [the] Option 4 constraint formulations would allow fuller utilisation of the network at times when network capability was at a premium, and would consequently tend to reduce the incidence and duration of network constraints. Other network constraint formulations require the use of additional safety margins in order to maintain power system security. This means that other network constraint formulations would tend to bind more often, increasing the times during which the offer prices for some generation sources would no longer be subject to competitive pressures. (p. 10)

Macquarie Generation has previously raised doubts about the lack of data to support the argument that an Option 4 configuration would result in improved network utilisation and whether this should be objective of the system operator.

Macquarie Generation has reviewed the constraint equations in New South Wales, Queensland, Victoria and South Australia that NEMMCO had converted from Option 1 to Option 4 as at 31 January 2006. There were 107 equations in total.

Macquarie Generation found that there were no changes to the line ratings that NEMMCO applied in any of the reconfigured equations. In terms of safety margins, NEMMCO changed the margins in only three equations, two of which involved significant increases in the margin under the Option 4 formulation (see below). The third change involved in a minor 10MW reduction under the Option 4 approach.

<i>Equations with safety margins</i>	<i>Option 1</i>	<i>Option 4</i>
1. $N > N-82_{14}$ $N \gg N-LDTM_{14}$	Nil	45MW
2. $N > N-82_{15}$ $N \gg N_LDTM_{15}$	10MW	55MW
3. $N.N_{81_{19}}$ $N \gg N_{81_{19}}$	10MW	Nil

Macquarie Generation notes that of the 107 constraint equations examined, the three equations listed above were the only equations to incorporate a safety margin.

Consistency of constraint formulation

The Ministerial Council on Energy its May 2005 Statement on NEM Electricity Transmission stated that “all constraints should be developed in a consistent form” by NEMMCO using a fully co-optimised direct physical representation (the Option 4 formulation).

Setting co-efficients

Under the original Option 1 formulation, if a generator or an interconnector had a coefficient of less than one-fifth of the highest coefficient then NEMMCO would place the generator or interconnector on the right-hand-side of the equation. NEMMCO had previously considered that generators and interconnectors below this level had only a minor influence on system security.

Under the revised Option 4 process, NEMMCO has altered the coefficient thresholds that it uses to determine whether to include an interconnector or generator term on the left-hand-side of the equation. For some interconnectors the coefficient is now one-tenth whereas for others it is still one-fifth. The coefficient for generators has reduced significantly, as all generators with an impact greater than 0.07 of the highest coefficient, equivalent to one-14th, are now included on the left-hand-side.

This change in the threshold increases the likelihood that NEMDE will constrain on a generator, thereby removing that generator from the price setting process. Macquarie Generation is interested to understand the basis for this different treatment of interconnectors and generators.

Consistency between regions

Macquarie Generation has observed that NEMMCO has converted 46 intra-regional equations associated with the Tarong constraint in Queensland, none of which contain terms for Swanbank B, Swanbank E or Wivenhoe, even though these generators have a significant impact on the Tarong constraint limit. As a consequence of this formulation, these generators are not constrained-on during periods of binding Tarong congestion. Macquarie Generation considers that this treatment is at odds with the

approach applied in NSW where all generators are potentially included in the equations and subject to constraining-on.

Application of new Option 4 equations

NEMMCO in its June 2003 report on constraint formulation in the NEM, reported the following observation from Delta Electricity:

Delta stated that the report by NEMMCO seems to have missed the point that a clear desire expressed in the feedback for a consistent manner refers to inconsistency in managing intra-regional congestion as illustrated for example: Murray Tumut intra regional constraint – option 4/Southern Sydney intra-regional constraint – option 1. Both constraints are intra-regional, yet NSW generation will be backed off in both cases. (p. 18)

In response to this particular concern raised by Delta, NEMMCO stated:

As regards the specific case raised by Delta Electricity, if Delta are referring to the constraints maintaining flows on transmission elements south of Marulan, NEMMCO certainly agrees that these are inter-regional in nature and currently has a project to reformulate these constraints as inter-regional. (p. 19)

NEMMCO's reformulation of constraint equations has produced 25 new equations in New South Wales for which NEMMCO previously agreed were interconnector constraints. These equations are generally for lines between Snowy and Marulan/Kangaroo Valley previously formulated as Snowy to New South Wales interconnector equations. In converting these constraints to Option 4 NSW intra-regional equations, NEMMCO has chosen to 'constrain-on' all NSW generation with negative co-efficients greater than one-14th during periods of binding congestion.

Macquarie Generation does not understand why NEMMCO has chosen to reformulate these inter-regional constraints as intra-regional constraints when the previous interconnector equations were capable of adequately controlling system security. This change in approach is at odds with the previous NEMMCO statement agreeing with Delta that the constraints were inter-regional in nature.

Generators that are constrained-on are prevented from participating in the NEMMCO price setting process. This can result in inefficient production patterns as generators are often paid less than their offer price.

Level of manual intervention in the market

NEMMCO in its June 2003 report on constraint formulation in the NEM made the following comment on manual intervention under an Option 1 approach:

Under Option 1 constraints, NEMMCO currently has to manually constrain interconnector flow and generation to manage the system security issues caused by these constraints. This manual process is, in itself, heavy handed to a higher degree than the proposed process under option 4 constraints, and, in addition, has a high risk of error that could lead to system security problems. The process of constraining interconnectors to curtail negative residues is less likely to lead to security problems

while at the same time addressing many of the issues raised by participants in relation to the accumulation of negative residues. (p.24)

We observe that under the Option 4 formulation there has been a significant level of manual intervention to manage counter-price flows. Our observation is that the introduction of Option 4 has not eliminated the need for manual intervention in the NEM, but altered the nature of the intervention.

Price setting processes

The adoption of the Option 4 formulation and the inclusion of additional generator terms of terms on the left hand side as a result of changes to generator coefficients increases the complexity of real-time price setting in the NEM. This is caused by the higher incidence of constraining on and off of individual generators making it more difficult for spot traders to understand pricing outcomes. Complexity and uncertainty in the spot market is ultimately reflected in the derivatives market, potentially adding to the cost of hedging contracts.

Macquarie Generation has observed that the Option 4 formulation has led to an increase in the number of over-constrained dispatch periods. NEMDE has delivered pricing outcomes that exceed the value of lost load in certain circumstances. It seems a curious result that the mathematics can produce such pricing outcomes when participant's bids are capped at the value of lost load.

Invitation to comment

As indicated Macquarie Generation would value NEMMCO's comments on the observations made in this letter.

Yours faithfully

A handwritten signature in black ink, appearing to read 'Russell Skelton', with a long horizontal line extending to the right.

RUSSELL SKELTON
MANAGER, MARKETING & TRADING

12 April 2006

cc: Dr John Tamblyn, Chairman, Australian Energy Market Commission
Mr Steve Edwell, Chairman, Australian Energy Regulator