

**NEM Regional Structure
NEMMCO Issues:
Regional Boundaries & Congestion
Management**

31 March 2004

Dr Charlie Macaulay, General Manager Development & Strategy

The Ministerial Council on Energy has recommended

“A new process to be developed for assessing wholesale market regional boundaries, while maintaining jurisdictional boundaries for retail customer pricing”



NEMMCO has Code obligations to review boundaries annually

Progress suspended at request of NEM jurisdictions



The NEM power system has many transmission constraints that do not align with the existing regional boundaries

This has power system security implications

Power System Security
NEMMCO's issue is Network Congestion Management

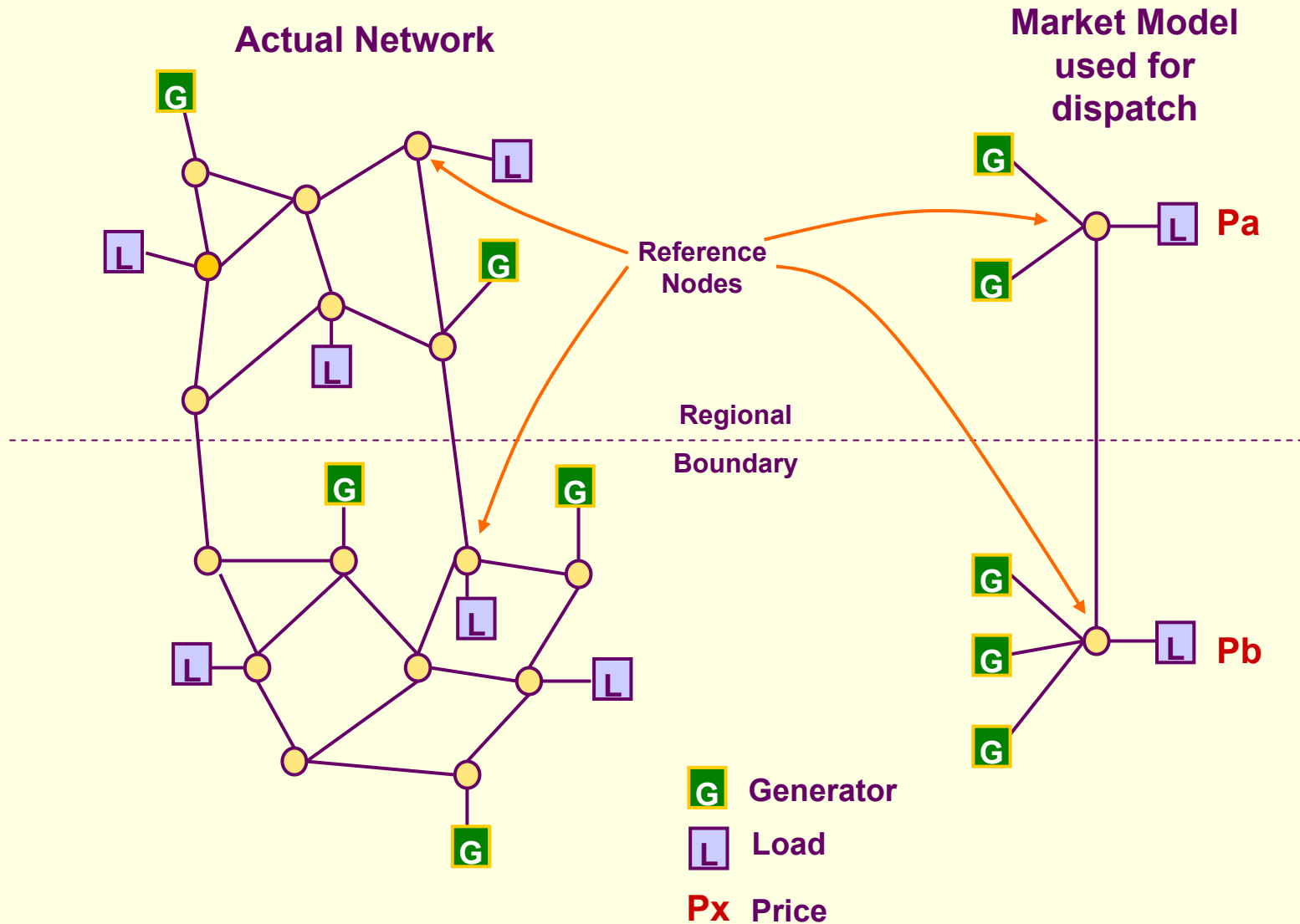
NEMMCO's constraint equations must be able to control the dispatch of all generators contributing to power flow through any potential transmission constraint - "fully optimised form" for all constraints

NEMMCO Intervention

Use of safety margins which reduce network capability

Regions and the Reference Node

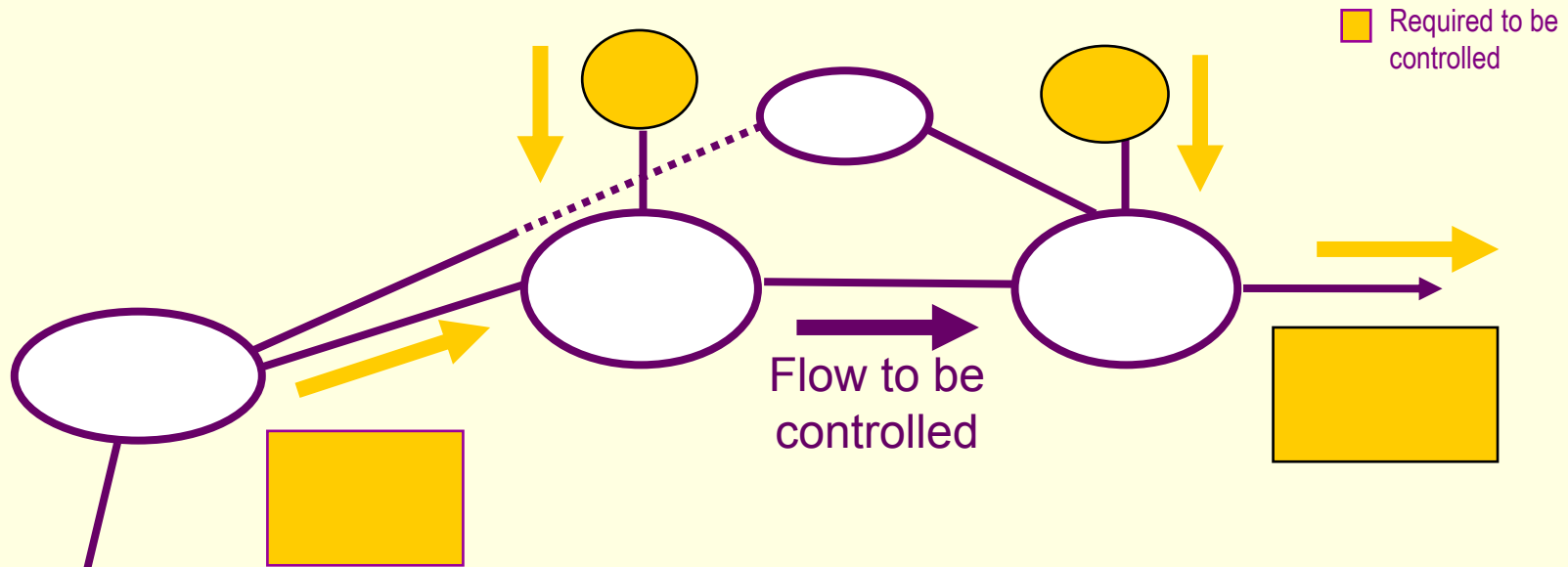
NEMMCO



- **Constraint equations are used to “tell” the market model the capability of the network**
- **Needed to ensure power flows are kept within the network capability – to maintain a secure power system**
- **NEMMCO constructs the equations from information on the network capability. The computer optimisation tool which determines generation loading levels and regional prices takes these equations into account.**
- **The form of the constraint equations can affect the volumes (dispatch levels) from generators and regional prices**

Constraint Equation Basics

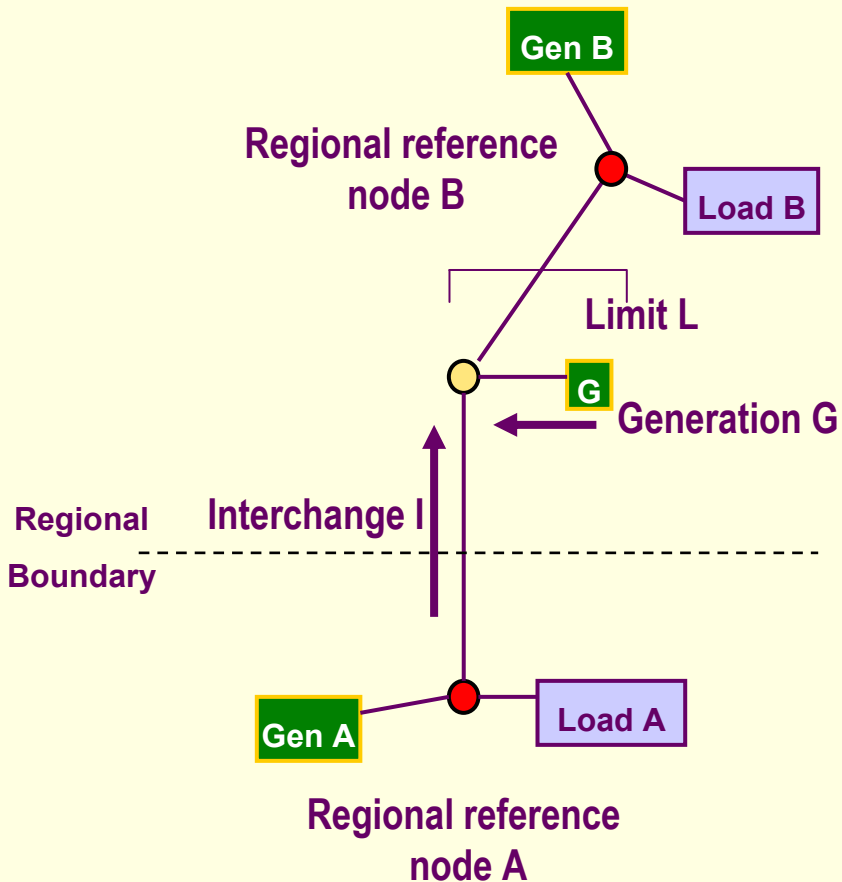
NEMMCO



Power flow control is achieved if Tumut and Murray (indirectly) generation as well as Victorian export and Snowy to NSW import are constrained to control the flow limit. However if this constraint formulation is used generally in the context of a regionally settled market, a number of problems are exacerbated (see next slide).

Note: This constraint solution has been implemented for the Snowy Region

Example problems arising from broad constraint equation formulation in context of a regional market



➤ Facts

- Generator G will always receive the regional price B
- If limit L binds then Generator B sets price in region B and Generator G can bid as low as it likes and still receive price B.

➤ Inefficient outcomes, market problems

- When limit L binds Generator G can increase its dispatch at expense of Generator A, irrespective of whether it is higher cost generation.
- Generator G can always push back interchange and result in counter price flows from region B to region A. This effectively is a “levy” on consumers as it reduces the positive residues used to offset consumer network charges.
- These occurrences are hard for participants to predict e.g. could lead to unanticipated price outcomes, increasing risk management costs
- To overcome these problems NEMMCO attempts to minimise negative residues and reformulate constraints to limit the flow. This can result in the line less utilised than otherwise.

➤ Issue

- The current approach to constraint equations does not promote Security of Power System

➤ Elaboration

- System security regularly requires manual override of the automated dispatch process
- The large number of manually managed constraints is prone to error and inefficiency
- The operation of constraint equations and the current regional settlement configuration is causing tension between management of power system security and market pricing outcomes

➤ Drivers

- Most constraint equations have been inherited from earlier State based systems and/or driven from pre market start policy
- There are inconsistencies in the way the present equations are formulated, they have different characteristics one to the other
- The alignment of regional boundaries with constraint locations is generally deteriorating as power system evolves

➤ Problems

- Equations often do not control all relevant variables and are inefficient at controlling line limits leading to the need for manual override to maintain system security
- Constraint equations (there are over 4,000) are manually developed through a complex process of network modelling and statistical analysis, and are manually entered into the dispatch engine, and so are prone to error
- These problems result in generators being dispatched out of merit order, negative residues, market confusion, and of transmission lines being less utilised than they could be

➤ Now

- Economic problems arise due to intra regional constraints that impact on inter regional flows
 - the more these constraints are managed automatically by consistent equations, the more the network physics can make the problems worse
 - that is, congestion inside a region causes some generators to receive inappropriate market signals

➤ Future

- These problems are getting worse
 - as load grows, new generation is built and transmission lines are upgraded, regional boundary alignment with constraints will deteriorate
 - and will increase
 - the difficulty in managing power system security
 - negative residues
 - cases of inefficient utilisation of transmission lines
 - uneconomic dispatch

Effective Power System Security Management

NEMMCO's constraint equations must be able to control the dispatch of all generators contributing to power flow through any potential transmission constraint - "fully optimised form" for all constraints

Changes to regional boundaries no guaranteed fix

Adoption of fully optimised constraint form may lead to market outcomes that require policy decisions

From the Market Operator's Perspective

Options

- **A number of options are available that can manage system security effectively. A policy decision is required on the option chosen due to consequential market outcomes**
 - **NEMMCO would favour a long term solution that can settle this issue**
 - **Solution should be compatible with fully optimised constraint formulation**
 - **Such a solution should aim to provide a secure power system, long lasting market efficiencies, and improve investor confidence**

NEMMCO