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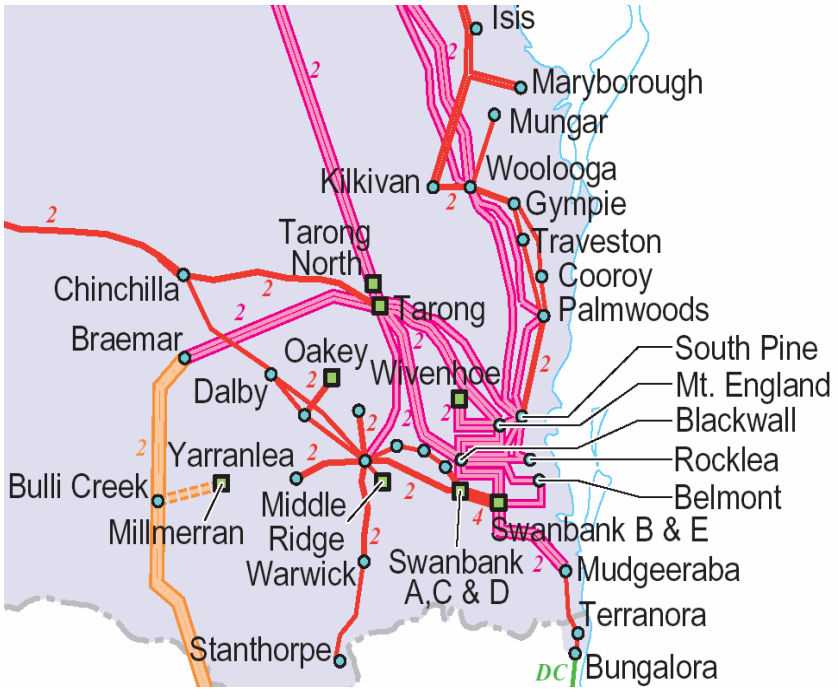
Modelling the Tarong Constraint

Overview

- Explanation of the Tarong Constraint
- Modelling the Tarong constraint in PROPHET
- Comparisons of actual market outcomes to modelled results.

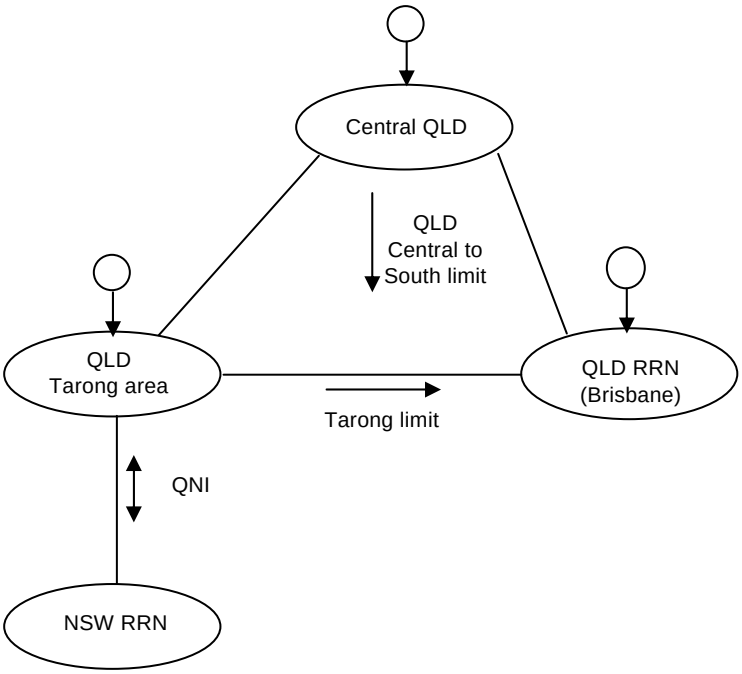
QNI and South-East Queensland Grid



Tarong Constraint

- Limits flow from Tarong to South QLD (RRN) on the following five 275 kV lines and three 110 kV lines (Tarong Flow):
  - Tarong to South Pine (1);
  - Tarong to Mt England (1);
  - Tarong to Blackwall (3);
  - Middle Ridge to Swanbank (2); and
  - Middle Ridge to Postman's Ridge (1).
- For a contingency caused by a fault on any one of:
  - Calvale to Tarong lines;
  - Woolooga to Palmwoods line; or
  - Blackwall to Belmont line.

Inter-regional Impacts of Tarong Limit



- Tarong limit constrains QNI flow into QLD RRN (Brisbane)
- Counter price flows can occur on QNI when Tarong constrains flow from Tarong to QLD RRN with QNI flow into NSW

Tarong Flow Limit Equations

- Three flow limit equations are available
  - one for each contingency
- Minimum from these three gives the Tarong Flow limit

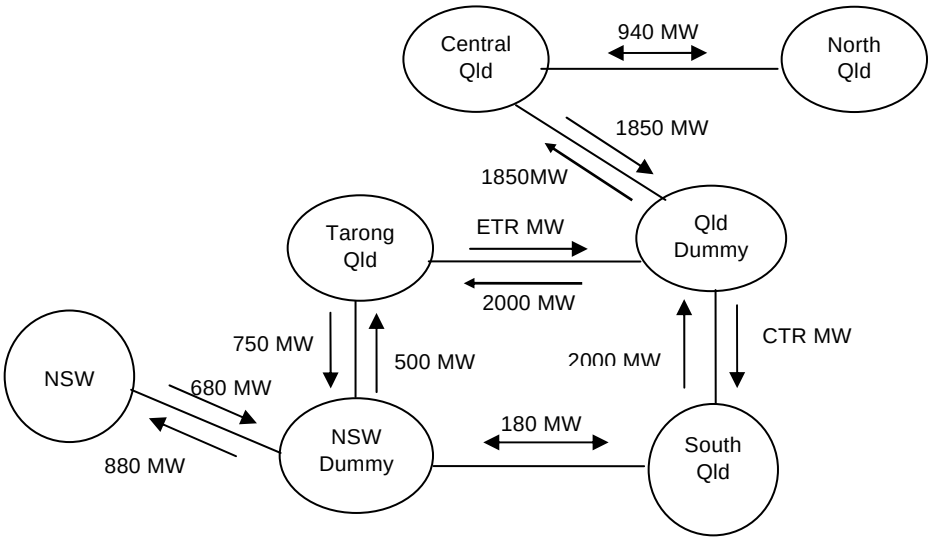
Modelling the Constraint in PROPHET

- Short-term and long-term solution techniques available in Prophet
- Short-term solver:
  - Similar to NEMDE
  - Capable of reproducing the Tarong constraint model as in NEMDE pre-dispatch
- Long term solver:
  - Default market engine
  - Fast solution suitable for 1 to 10 ten year / multi-simulation modelling

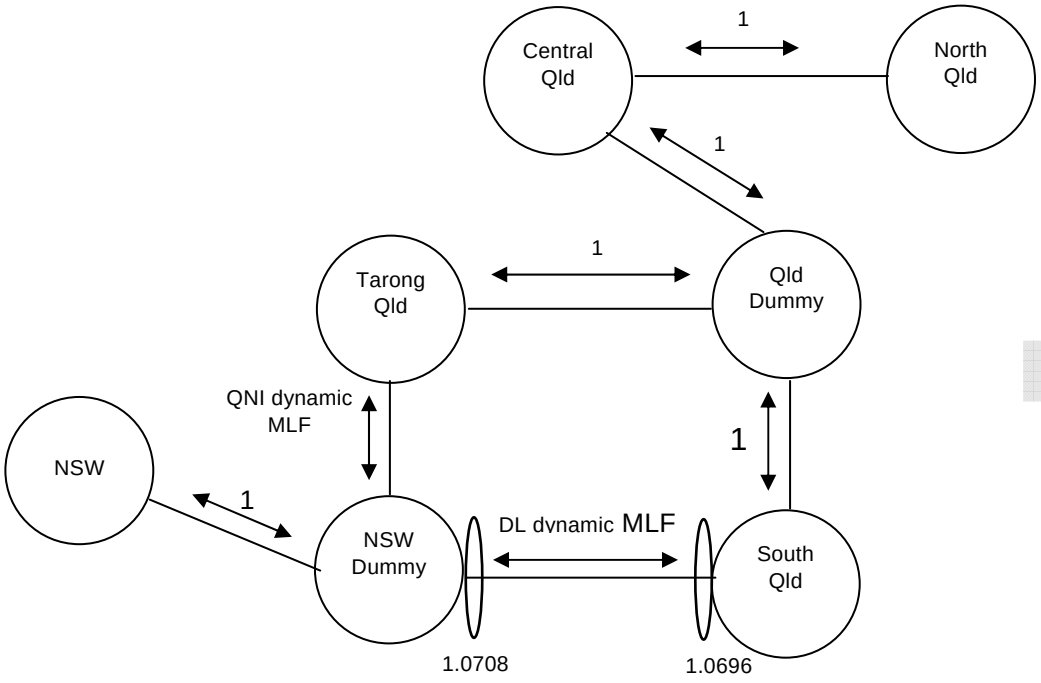
Tarong Model Using the Long-term Solver

- Four region QLD model with price referred to QLD RRN
- Two Dummy nodes with no generation or load
- Intra-regional constraint represented as links using dummy nodes
- Dynamic link limits based on previous dispatch output and actual constraint equations from NEMDE
- Link limits modified appropriately to incorporate loop flows

Queensland Region Model



MLF Allocation to Links



- No change to static QLD generator MLF referred to QLD RRN

QLD Dummy to South QLD Link Limit (CTR)

- Flow on this link is higher than the actual Tarong flow as there is an additional flow from CQ and NQ into South QLD
- Actual contribution to South QLD is about 60% from CQ to SQ flow plus Tarong flow
- Dynamic limit CTR is calculated as follows to include this additional flow:

  CTR limit = Tarong flow limit + 0.6 * CQ to SQ flow

Tarong to QLD Dummy Link Limit (ETR)

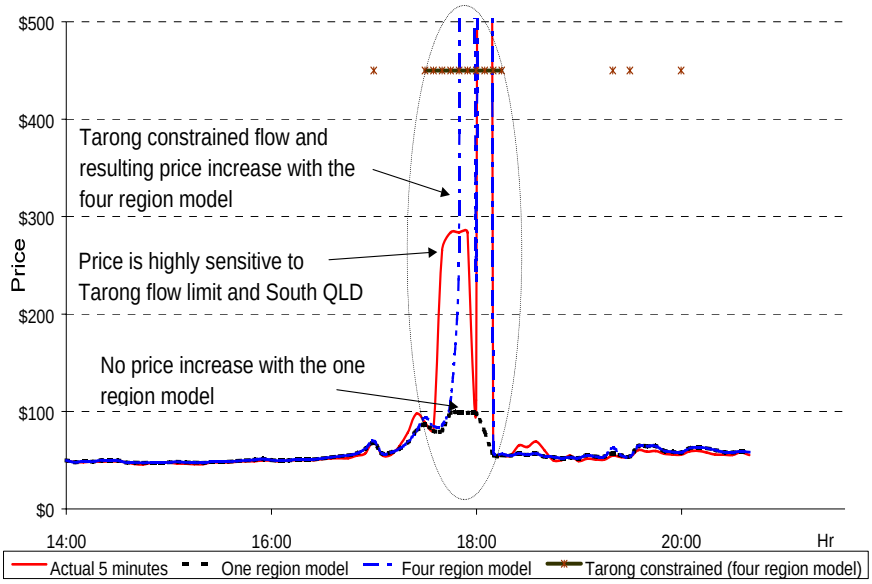
- Flow on this link is less than the actual Tarong flow as contribution from Calvale to Tarong has been excluded
- Estimated contribution to Tarong flow is about 40% of CQ to SQ flow with all transmission in service and high Tarong flow to QLD RRN
- Dynamic limit ETR is calculated as follows:

  ETR limit = Tarong flow limit – 0.4 * CQ to SQ flow

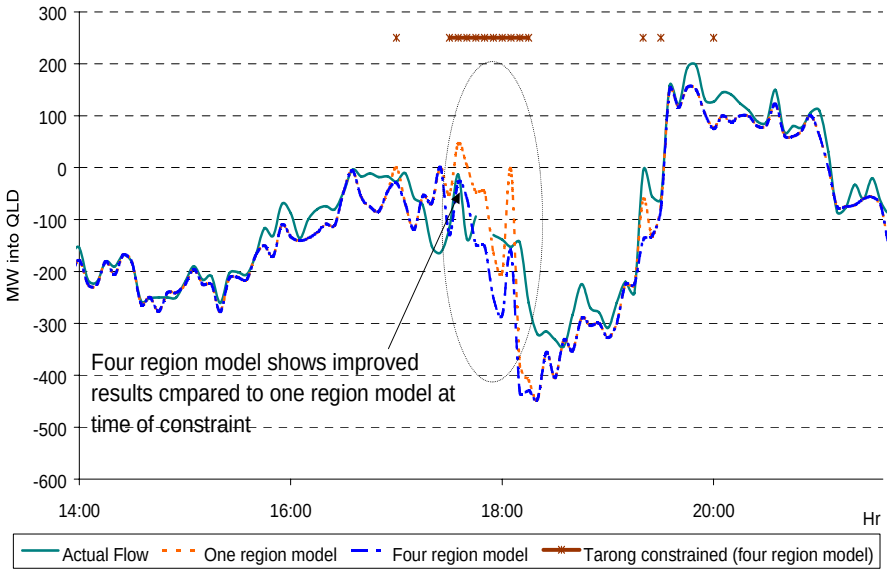
Comparison of Model Results to Actual Market Outcomes

- Model run for two days where the Tarong constraint was binding:
  - 21 May 2001
  - 20 March 2002.
- Qld price and QNI flow are shown in the slides that follow for the following
  - Actual values
  - One QLD region model without Tarong constraint
  - Four region model with Tarong Constraint

21 May 2001 – QLD Price



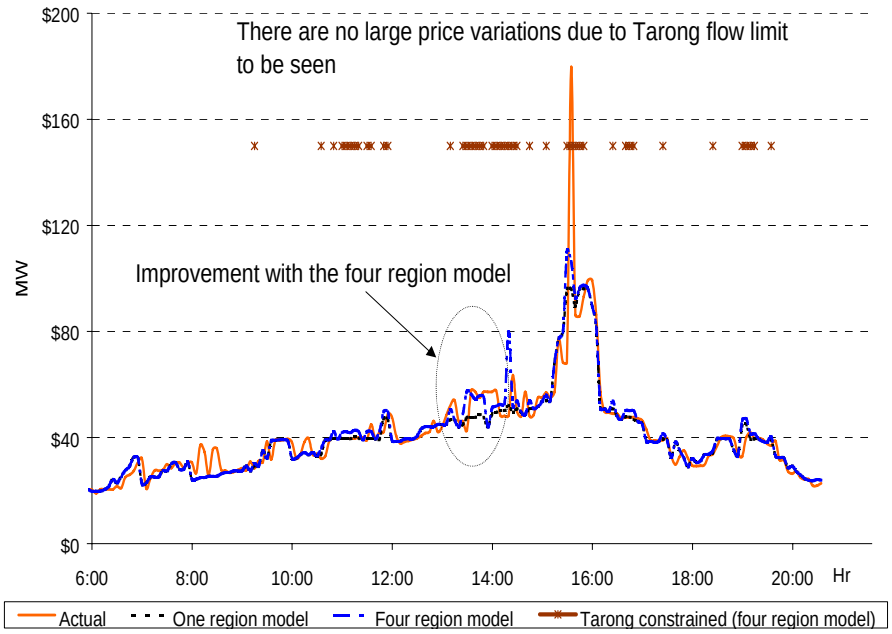
21 May 2001 - QNI Flow



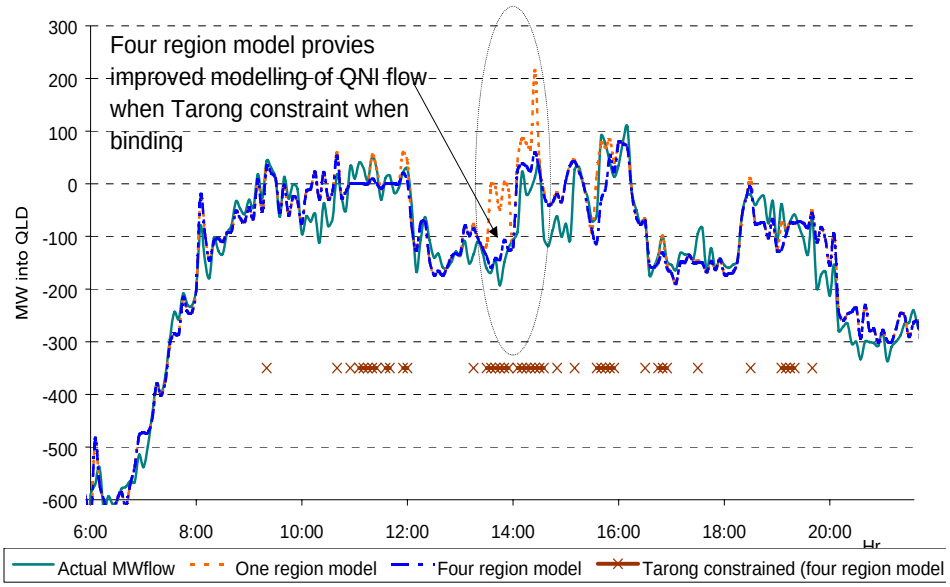
Summary - 21 May 2001

- Tarong constrained QNI flow around 17:00hrs to 18:00hrs
  - QLD price increase is shown in the four region model
  - Price increase is highly sensitive to South QLD demand and dynamic equation applied for the Tarong limit
  - About 25 MW increase in South QLD demand increases price by about $4000

20 March 2002 – QLD Price



20 March 2002 – QNI Flow



Summary – 20 March 2002

- Tarong constrained QNI flow a number of times between 10:00hrs to 19:00hrs.
- Difference between one region model and four region model is clearly seen around 14:00hrs:
  - One region model shows higher flow into QLD due to no Tarong constraint modelled
  - Four region model limits QNI flow into QLD and is closer to the actual flow

Conclusions

- The PROPHET long-term solver can accurately model the Tarong constraint.
- This is done with a 4 region Queensland representation, 2 dummy summation nodes and dynamic link limit constraints (as specified by Powerlink)
- Tarong constraint model representation has:
  - Almost no change to the solution speed
  - QLD price available at the local node level or referred RRN
  - Inter regional impacts (counter price flows) included
  - Other QLD intra-regional limits incorporated as dynamic or static limits