

ELECTRICITY MARKET EVENT REPORT

NEM Operations Review – NSW Summer 2009/10 (70/71 TL Congestion Events)

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FINAL

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Abbreviations and Symbols

ABBREVIATION	TERM
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator Ltd
AER	Australian Energy Regulator
CT	Current Transformer
DI	dispatch interval
EAAP	Energy Adequacy Assessment Projection
kV	kilovolt
MCE	Ministerial Council on Energy
MVA	megavolt ampere
MW	megawatt
GWh	gigawatt hour
MWh	megawatt hour
NEM	National Electricity Market
NER	National Electricity Rules
NGG	Northern Group of Generators
NOS	Network Outage Schedule
TNSP	Transmission Network Service Provider

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1 Summary

During summer of 2009/10, the Transmission Network Service Provider (TNSP) in New South Wales, TransGrid, undertook a major upgrade of the transmission system to convert lines between Bayswater and Marulan from 330 kV to 500 kV. This coincided with drought conditions in New South Wales that restricted the output of some power station, particularly Wallerawang power station. During commissioning activities, some prior outages resulted in a number of market pricing events.

In January 2011 AEMO published a market event report to explain the unusual market outcomes and circumstances that led to high energy prices in NSW and negative energy prices in Queensland on 10 August 2010.

In that report AEMO foreshadowed a broad review of the circumstances surrounding the market event and related instances over summer 2009/10, including matters such as:

- the commissioning program for the western NSW 500 kV upgrade
- the management of the operational arrangements affecting the 70 and 71 Mt Piper–Wallerawang 330 kV transmission lines (70/71 lines)
- the information available to AEMO concerning the availability of critical generating plant during the commissioning program
- AEMO's ability to require additional works to mitigate market impacts from such programs

AEMO's conclusions and recommendations are:

- The sensitivity of market outcomes to a transmission rating change is an important feature of many price events. This is due to a combination of factors including the market design, network topology and participant response. Operational arrangements can be effective in making full extent of available ratings to minimise but not avoid these outcomes.
- Demand, environmental factors, construction delays and plant availability are beyond AEMO's control to manage network congestion. Participants provided correct information to AEMO on the condition of plant and status of work programs to the extent they were able.
- AEMO considers that network congestion issues will continue to arise, but the events of 2010 demonstrate that their market impact is exacerbated by the electricity market design, which does not place incentives on participants to manage congestion efficiently.
- To provide greater operational and investment certainty, these matters need to be addressed through a congestion management regime. AEMO recommends that these issues should first be considered as part of the Transmission Frameworks Review (TFR) with any further actions identified and pursued after and in light of the TFR. AEMO will analyse some of the potential options to address network congestion identified in the TFR with reference to the events identified in this report. The results of this analysis will be published in line with the TFR timetable.

2 Background to this Review

2.1 Western NSW Network Upgrade

A series of 500 kV-construction transmission lines between Bayswater and Marulan in NSW were upgraded from 330 kV to 500 kV throughout summer 2009 and into spring of 2010. Although detailed planning of the work had been communicated to participants and well understood, during the course of some extended outages the flow constraints on the 70/71 lines, coupled with low generation at Wallerawang power station, caused considerable disruption to the market through price spikes and subsequent generator rebidding.

This has caused considerable comment in the market, and has prompted AEMO to undertake this review, covering:

- a review of the development of the 500kV ring in western NSW
- the series of events that lead to the 70/71 binding constraints during the summer of 2009/10
- a detailed chronology of each day of constraint and the actions that were taken by TransGrid and AEMO

2.2 AEMC's Transmission Frameworks Review

The AEMC's Transmission Frameworks Review was initiated by the Ministerial Council on Energy (MCE) in response to the AEMC's final report for the review of energy market frameworks in light of climate change policies. The MCE identified four specific areas for consideration – transmission investment, network operation, management of network congestion, and network charging, access and connection.

The third of these areas – management of network congestion – is relevant to this review.

The MCE requested:

The AEMC shall consider and, as appropriate, develop mechanisms that promote more efficient bidding and pricing behaviours by generations in congested parts of the network. It is key that, in developing mechanisms that address network congestion, the AEMC should assess the extent to which congestion, and measures to manage congestion, may impact on generation investment and the liquidity of forward markets (including intra- and inter-regional contracting). In particular, the AEMC should consider how dispatch and pricing risks might be mitigated with the objective of providing an increased level of certainty to all market participants.

The AEMC proposes to produce a final report by 30 November 2011.

2.3 Submissions to the Transmission Frameworks Review relating to the management of network congestion

Submissions from AEMO and the Northern Group of Generators¹ (NGG) dealt with the management of network congestion in some detail.

- AEMO submitted that the NEM is not managing network congestion efficiently and that improvements to the current design are required. A case study in the submission discussed congestion of the 70/71 lines.
- The NGG submitted that:
 - dispatch inefficiency due to network congestion is negligible
 - the effectiveness of congestion pricing mechanisms is doubtful

¹ Comprising CS Energy, Delta Electricity, Eraring Energy, Macquarie Generation, Snowy Hydro, Stanwell Corporation and Tarong Corporation

- the market impact of the congestion case studies cited in AEMO’s submission could have been significantly reduced through better co-ordination of network planning and operations between AEMO and the relevant TNSPs, and better operational procedures within AEMO

Specifically in relation to congestion of the 70/71 lines during the western NSW 500 kV upgrade, the NGG submitted that:

- the congestion was transitory in nature, and should not be considered system normal;
- the market impact of the congestion could have been reduced by ramping in changes to the 70/71 line ratings, and providing adequate notice to the market
- the congestion could have been avoided altogether if TransGrid and AEMO, in their planning of the western NSW 500kV network upgrade, had identified a plausible scenario where the Wallerawang power station was unavailable due to drought conditions², and TransGrid then re-sequenced its works to either:
 - replace the under-rated bay coupler current transformers (CTs) at Mt Piper and Wallerawang 330 kV switchyards earlier in the upgrade program, as part of commissioning of the new 70 Mt Piper – Wallerawang 330 kV line; or
 - upgrade the Mt Piper – Marulan 330 kV lines to 500 kV before upgrading the Bayswater – Mt Piper 330 kV lines to 500 kV and commissioning the new 70 Mt Piper – Wallerawang 330 kV line, thus reducing flows through the future 70/71 lines
- TransGrid could have, as an alternative to the above, procured a network support agreement with Delta Electricity to operate Wallerawang power station at higher generation levels during periods when AEMO forecast congestion on the 70/71 lines, and compensate Delta Electricity for the high opportunity cost of available water supplies at the time

3 Scope of this Review

The review will cover the period from 1 December 2009 to 31 August 2010, during which operational arrangements were in place to manage congestion on the 70/71 lines during the upgrade works.

The review will consider the following workstreams:

SECTION IN PAPER	WORKSTREAM	DESCRIPTION
4	Western NSW 500 kV Network Upgrade	Programming, coordination and market information relating to the upgrading of the western NSW network from Bayswater to Marulan
5	Congestion Management of 70/71 lines	Information available before, during and after completion of the 500 kV works, including the operational arrangement to manage congestion by using the full extent of 70/71 line ratings
6	Market Information relating to 70/71 Binding Constraint Events	A summary of each event of binding network constraints between Mt Piper and Wallerawang, including market notices, advice between TransGrid and AEMO, and power system and pricing incident reports published by AEMO, the AER or other parties
7	Wallerawang Power Station Availability	Information provided by Delta Electricity relating to the availability of Wallerawang power station, a key factor in managing 70/71 line flows

² NGG argued that AEMO could have made TransGrid aware of the network implications of Delta Electricity’s forecast of Wallerawang energy restrictions under a low rainfall scenario, as this information is provided to AEMO as part of its quarterly Energy Adequacy Assessment Projection process

4 Western NSW 500 kV Network Upgrade

This section:

- summarises the programming and coordination information exchanged between AEMO and TransGrid relating to the 500 kV upgrade of the western NSW network between Bayswater and Marulan
- considers the feasibility of the NGG's suggestion that, in light of Wallerawang unavailability, TransGrid could have avoided congestion issues with 70/71 lines by upgrading the Mt Piper – Marulan 330 kV lines before upgrading the Bayswater – Mt Piper 330 kV lines and commissioning the new 70 Mt Piper – Wallerawang 330 kV line.

4.1 Network Upgrade Program

TransGrid undertook a major upgrade of the western NSW ring of transmission lines during 2009 and 2010. The project involved:

- the commissioning new 330/500 kV switchyards and associated transformers and switching components at Bayswater, Wollar, Mt Piper, Bannaby and Marulan
- rearrangement of transmission line connections at Bayswater, Wollar, Mt Piper, Wallerawang, Bannaby and Marulan
- transmission line realignment works between Mt Piper and Wallerawang, Yass and Bannaby, and Bannaby and Sydney West, and
- the transfer of Bayswater No.3 and No.4 generating units from the 330 kV switchyard to the new 500 kV switchyard at Bayswater

Previously:

- one 330 kV transmission line connected Bayswater to Mt Piper and one 330 kV transmission line connected Bayswater to Wallerawang
- one 330 kV transmission line and one 132 kV transmission line connected Mt Piper to Wallerawang

Figure 1 below provides a conceptual representation of the NSW 500 kV network ring.

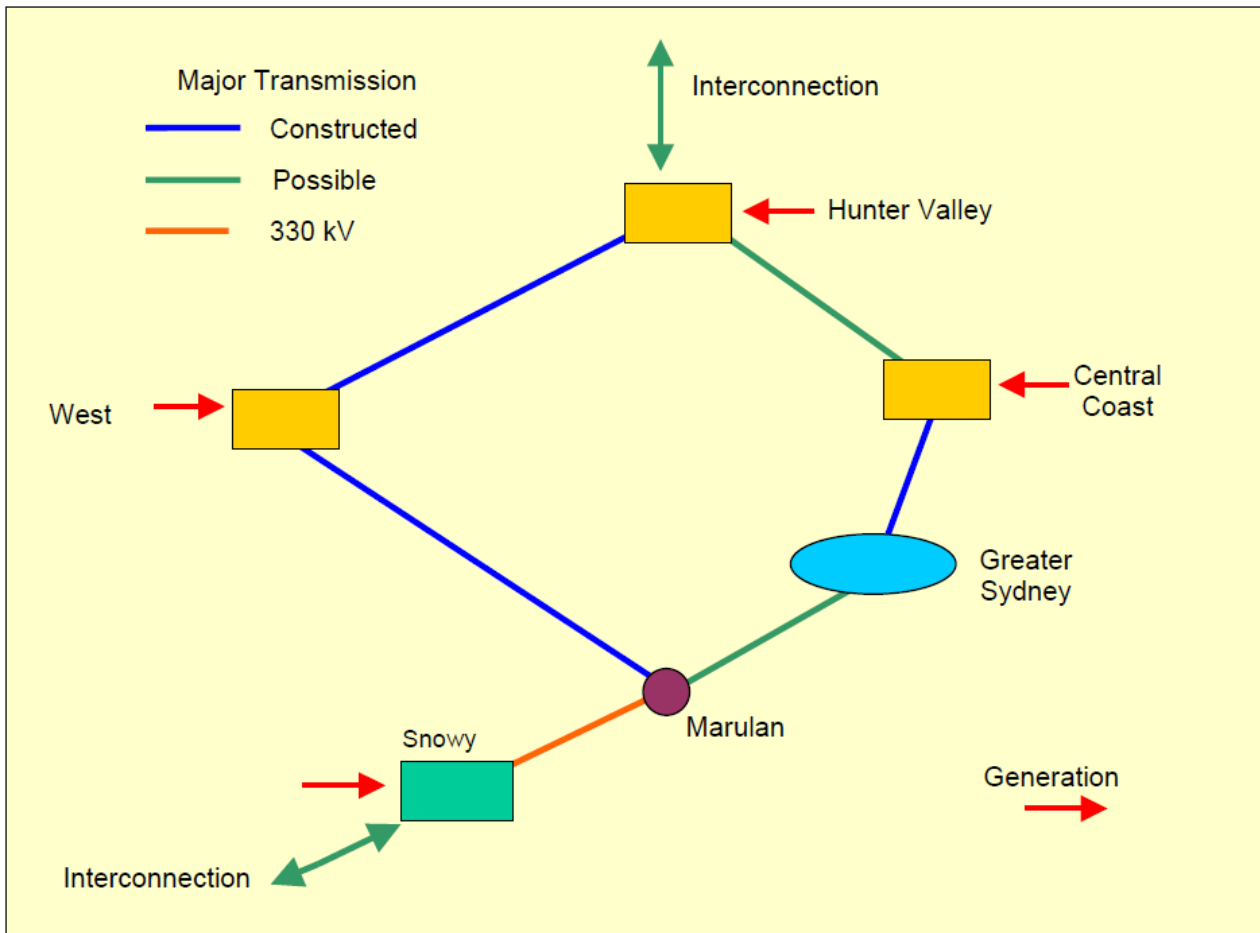
Conversion of the two existing 330 kV transmission lines between Bayswater and Wallerawang/Mt Piper to operate at 500 kV – with both transmission lines connecting directly to Mt Piper – would result in an extra 350 MW of flow on these transmission lines.

However, between August 2009 and early August 2010 TransGrid had not completed works to convert the two 330 kV transmission lines between Mt Piper and Marulan to 500 kV. The higher impedance on these lines remained, limiting the ability to transfer any of the additional power flow (initially 500 MW and then 650 MW) between Mt Piper and Marulan.

This additional flow was instead transferred to the newly formed 70/71 lines and, coupled with low generation at Wallerawang power station, resulted in congestion of those lines which in turn resulted in significant market price spikes.

On 12 August 2010 TransGrid had completed works to remove the 70/71 line restrictions, and by late August 2010 TransGrid had completed the 500 kV upgrade.

Appendix A illustrates the commissioning sequence for the western NSW 500 kV network upgrade.

Figure 1: Concept of the NSW 500 kV Network Ring³

4.2 TransGrid Planning Co-ordination with AEMO

TNSPs provide monthly updates to their works program through regular meetings of an Operations Planning Working Group, which is chaired by AEMO. This included TransGrid providing timely planning information to AEMO relating to the western NSW 500 kV upgrade and advice of any delays to the works program. AEMO publishes these updates to the market via a monthly AEMO Communication, which includes an assessment of the projected impact of network outages on intra-regional and inter-regional power transfer capabilities as required by clause 11.30.2 of the NER.

Changes to transmission outages as a result of changes to the works programs are also communicated to the market via the Network Outage Schedule (NOS) published by AEMO. Recently, the publication frequency for the NOS was increased to hourly.

4.3 Feasibility of Re-Sequencing the Network Upgrade to Avoid Congestion

The NGG's submission to the Transmission Frameworks Review suggested upgrading of the Mt Piper – Marulan 330 kV lines before upgrading the Bayswater – Mt Piper 330 kV lines and commissioning the new 70 Mt Piper – Wallerawang 330 kV line, to avoid 70/71 line congestion

AEMO does not consider that this would have been a feasible option as:

- TransGrid could not have upgraded the Mt Piper – Marulan section first due to delays in commissioning the new Bannaby 500 kV substation for connection between those two sites. Bannaby commissioning was originally planned for November 2009 but was delayed

³ Source: NSW Annual Planning Report 2005, TransGrid, <http://www.transgrid.com.au/network/np/Documents/Annual%20Planning%20Report%202005.pdf>

until August 2010. Consequently the cut-in of the 35 and 36 Mt Piper – Marulan 330 kV lines into Bannaby to form the new 5A6 and 5A7 Mt Piper – Bannaby 500 kV lines was also delayed until August 2010

- the upgrade of the Bayswater – Mt Piper section to 500 kV was opportunistically tied into outages of the Bayswater No.3 and No.4 generating units in reconnecting them onto the new Bayswater 500 kV switchyard

4.4 Conclusions

TransGrid have advised that the sequence of works was determined at a very early stage in the 500 kV network upgrade program, and it was not reasonable to expect significant changes to the program based on the availability of Wallerawang generation. TransGrid advised that their planning was done on the expectation that both generating units at Wallerawang power station would be available, however in practice there was only one over the period concerned.

AEMO accepts TransGrid's view, adding that, in relation to forecasting and managing the congestion on 70/71 lines:

- (1) network congestion issues that arise at short-notice, such as those on 10 August 2010, are not usually the subject of network planning studies
- (2) it is unlikely that the materiality of the network congestion issues could be feasibly identified, and
- (3) the underlying issue is more likely to be that the market design is (from a control perspective) is based on a positive feedback loop which is inherently unstable

The sensitivity of the market outcome to a rating change is an important feature of many price events. This is due to a combination of factors including the market design, network topology and participant response.

5 Congestion Management of 70/71 Lines

This section summarises the information available before, during and after completion of the western NSW 500 kV upgrade works, including:

- the nature of the 70/71 line limits
- the operational arrangement to manage congestion on 70/71 lines by using the full extent of their ratings, and
- market notices issued by AEMO in relation to those operational arrangements

5.1 70/71 Limit relating to Bay Coupler Current Transformer Ratings

An issue identified by TransGrid during planning for the network upgrade was that a secondary system limitation in the current transformers (CTs) associated with the 70/71 line bay coupler circuit breakers at Mt Piper and Wallerawang 330 kV switchyards were preventing the full use of the thermal ratings for the 70/71 lines of around 1430 MVA, and the CTs would need to be replaced to remove this restriction.

TransGrid have advised in relation to these limitations that:

- The 71 line bay coupler CT rating of 1143 MVA was included in TransGrid's Operating Manual OM 304 and issued to AEMO before the commencement of the 500 kV upgrade works.
- The 70 line bay coupler CT rating of 1097 MVA was issued to AEMO on 1 September 2009 in preparation for the commissioning of this line in October 2009.

5.2 Operational Arrangements to Utilise 70/71 Line Ratings

In August 2009 TransGrid implemented network reconfiguration arrangements at Wallerawang 330 kV switchyard to use the full extent of the 71 line rating and minimise binding constraints during Mt Piper – Marulan line outages associated with the upgrade works. TransGrid implemented this operational arrangement if they believed binding constraints were adversely affecting the market impact component of their service target performance incentives. The operational arrangement involved by-passing the under-rated CTs by opening the 71 line bay coupler circuit breaker at Wallerawang 330kV switchyard.

TransGrid informed AEMO of these arrangements and the enhanced 71 line ratings, and AEMO issued a short-term operating procedure⁴ to give effect to this advice. AEMO withdrew the short-term operating procedure in September 2009 on TransGrid's advice that the relevant commissioning works were completed.

In early December 2009 TransGrid extended the above arrangement to use the full extent of the ratings of the new 70/71 lines during outages – again, to manage congestion where it affects their market incentives - and informed AEMO of these arrangements and the enhanced ratings. This operational arrangement again involved by-passing the under-rated CTs, by TransGrid opening the associated 330kV bay coupler circuit breakers at Wallerawang and Mt Piper 330 kV switchyards.

On 11 December 2009 a further operational arrangement was implemented – involving the opening of 76 Wallerawang – Sydney South line – to manage low reserve conditions where there was no Wallerawang generation and the system normal 70/71 line constraint was binding. AEMO issued a short-term operating procedure and AEMO Communication No.161 to give effect to this arrangement. AEMO withdrew the short-term operating procedure on 13 January 2011 and issued AEMO Communication No.548 to this effect.

Between August 2009 and August 2010 the operational arrangement to manage 70/71 congestion was used on 23 separate occasions over 32 days, for which eight of those occasions AEMO issued a market notice.

On 24 May 2010 AEMO issued AEMO Communication No.328 on behalf of TransGrid advising the details of this operational arrangement, as follows:

- AEMO to advise TransGrid that the relevant constraint is binding or expected to bind in pre-dispatch
- TransGrid and AEMO to review prevailing or projected system conditions
- Subject to this review, TransGrid will implement the operational solution and advise AEMO of revised ratings for the lines
- TransGrid will revert to normal operating conditions when AEMO advises the constraint is unlikely to bind or system conditions indicate the arrangement is no longer viable

The communication noted the operational arrangement had already been in place for three months, and would continue to be used pending completion of the work.

On 13 August 2010 AEMO issued AEMO Communication No.417 advising that TransGrid had completed the majority of its work to remove the bay coupler restrictions thus allowing use of the full extent of the 70/71 thermal ratings (around 1430 MVA), adding it was possible that a specific combination of outages may still require the 70/71 lines to operate at reduced thermal ratings. Based on this TransGrid cancelled its operational arrangement for managing congestion on 70/71 lines and AEMO withdrew the related short-term operating procedure.

Table 1 below summarises the occasions when the operational arrangement to manage 70/71 congestion was used. Appendix B provides graphs illustrating the increases to the right-hand-side (RHS) of the 70/71 system normal constraint equation “N>>N-NIL__S” corresponding to increased ratings during use of the operational arrangement.

⁴ These are procedures shared between AEMO and the relevant System Operator, in this case TransGrid

Table 2 summarises AEMO's communications to the market relating to the design and use of that operational arrangement. Appendix C provides more detail of these communications.

Table 1: Instances where operational arrangement used to manage 70/71 congestion

ID	Arrangement Triggered by Binding Constraints in...	Affected Dispatch Intervals		AEMO Market Notice
		From DI	To DI	
1	Dispatch	25/08/2009 12:35	29/08/2009 15:25	
2	Dispatch	23/12/2009 11:00	23/12/2009 17:15	
3	Dispatch	11/02/2010 15:55	11/02/2010 18:20	
4	Pre-dispatch	18/02/2010 06:15	18/02/2010 12:00	
5	Dispatch	22/02/2010 16:05	22/02/2010 19:20	30547
6	Pre-dispatch	18/03/2010 06:40	18/03/2010 07:40	
7	Dispatch	26/03/2010 13:05	26/03/2010 14:30	
8	Pre-dispatch	08/04/2010 06:20	08/04/2010 17:00	
9	Pre-dispatch	09/04/2010 06:25	09/04/2010 17:10	
10	Dispatch	13/04/2010 13:50	13/04/2010 23:10	
11	Pre-dispatch	04/05/2010 07:10	05/05/2010 15:00	
12	Pre-dispatch	21/05/2010 10:10	21/05/2010 15:00	
13	Pre-dispatch	22/05/2010 06:05	22/05/2010 17:55	
14	Pre-dispatch	23/05/2010 06:05	23/05/2010 18:55	
15	Pre-dispatch	23/06/2010 11:35	23/06/2010 11:50	
16	Dispatch	29/06/2010 17:40	29/06/2010 20:30	
17	Pre-dispatch	30/06/2010 17:00	30/06/2010 20:30	32299, 32300
18	Pre-dispatch	01/07/2010 17:10	01/07/2010 20:10	32320, 32322
19	Pre-dispatch	02/07/2010 17:05	02/07/2010 20:15	32327, 32329
20	Pre-dispatch	19/07/2010 18:00	19/07/2010 22:20	32431
21	Dispatch	02/08/2010 18:05	02/08/2010 19:00	32521, 32522
22	Dispatch	06/08/2010 08:15	10/08/2010 08:20	32549, 32550
23	Dispatch	12/08/2010 15:15 ⁵	13/08/2010 11:30 ⁵	32619, 32629

Table 2: AEMO market communications re: 70/71 congestion management

Notice Type & ID	Issue Date	Issue Time	Event
AEMO Communication 161	16/12/2009	11:49	On 8 Dec 2009 the PASA Lack of Reserve (LOR) thresholds increased by 500 MW to cover the loss of a critical generating unit [at Wallerawang] with a particular network constraint [70/71 line] binding. On 11 Dec 2009 an operational arrangement was implemented [open 76 Wallerawang – Sydney South line] to allow LOR thresholds to be restored
Market Notice 30547	22/02/2010	20:00	Operational solution applied. Increased ratings from 1555 to 1920 hrs
AEMO Communication 328	24/05/2010	17:21	AEMO announces TransGrid's operational arrangement to use the full extent of 70/71 line ratings. Flows on 70/71 lines are limited by the ratings of equipment at each end of the lines
Market Notice 32299	30/06/2010	17:00	Operational solution applied. Increased ratings from 1655 hrs
Market Notice 32300	30/06/2010	21:11	Operational solution reversed. Normal ratings from 2000 hrs
Market Notice 32320	01/07/2010	17:29	Operational solution applied. Increased ratings from 1720 hrs
Market Notice 32322	01/07/2010	20:17	Operational solution reversed. Normal ratings from 2012 hrs
Market Notice 32327	02/07/2010	17:22	Operational solution applied. Increased ratings from 1700 hrs
Market Notice 32329	02/07/2010	20:23	Operational solution reversed. Normal ratings from 2012 hrs
Market Notice 32431	19/07/2010	17:55	Operational solution applied. Increased ratings from 1750 hrs ⁶
Market Notice 32521	02/08/2010	18:02	Operational solution applied. Increased ratings from 1800 hrs
Market Notice 32522	02/08/2010	20:05	Operational solution reversed. Normal ratings from 1945 hrs
Market Notice 32549	06/08/2010	13:42	Operational solution applied. Increased ratings from 0800 hrs

⁵ Estimate only

⁶ No Market Notice was issued to advise of the restoration to normal ratings

			until further notice
Market Notice 32550	06/08/2010	14:18	Operational solution applied. Increased ratings from 0800 hrs until 1700 hrs on 11 Aug 2010 pending no other system security issues
Market Notice 32589	10/08/2010	08:33	Operational solution reversed to allow WW7 synchronisation. Normal ratings apply
Market Notice 32591	10/08/2010	08:57	Operational solution applied. Increased ratings applied from 0855 hrs until 1700 hrs on 11 Aug 2010 pending no other system security issues
Market Notice 32592	10/08/2010	09:00	Operational solution reversed to allow WW7 synchronisation. Normal ratings apply
Market Notice 32619	12/08/2011	15:11	Operational solution applied. Increased ratings until 1700 hrs on 15 Aug 2010 pending no other system security issues
AEMO Communication 417	13/08/2010	11:30	TransGrid has completed the upgrade of 70 line bay coupler CB CT thus allowing the full use of 70/71 ratings of 1430 MVA
Market Notice 32629	13/08/2010	12:07	TransGrid has completed the majority of its work to remove the restrictions limiting flows on 70/71 lines, thus allowing the full use of their thermal ratings of around 1430 MVA
AEMO Communication 548	13/01/2011	17:38	Following completion of TransGrid work which increased the thermal capacity of their transmission network the operational arrangement to increase NSW reserves (AEMO Communication No. 161) is no longer required

5.3 Conclusions

The operational arrangement to use the full extent of the thermal ratings of the 70/71 lines between Wallerawang and Mt Piper was effective, in that the relevant binding constraints in Dispatch were either rapidly relieved or avoided altogether once the arrangement was in place.

6 Market Information relating to 70/71 Binding Constraint Events

This section summarises each event where the 70/71 line flow constraints bound during the 500 kV upgrade (the period August 2009 to August 2010) and the pricing incident reports and other market information provided by AEMO and the AER in relation to those events.

6.1 70/71 Binding Constraint Events

The 70/71 line constraints bound in Dispatch for some 148 hours (1783 DIs) on 38 days over the period concerned, for which the constraint marginal value exceeded \$10 per MWh for around 132 hours (1585 DIs). The binding constraint events caused the NSW spot price to exceed \$300 per MWh on 17 days, for which AEMO published a separate Pricing Event Report⁷.

Appendix D provides more details of these binding constraint events.

The AER also reported on the binding constraint events for the period of 7 December 2009 to 10 August 2010 as part of its submission to the AEMC's Transmission Frameworks Review.⁸ The AER reported the constraints bound for 70 hours over that period and caused the NSW spot price to exceed \$5,000 per MWh for 13 half-hourly trading intervals on five days.

The following section summarises the reports published by AEMO and the AER arising from the 70/71 binding constraint events.

6.2 Market Pricing Incident Reports

AEMO publishes two types of reports triggered by significant spot price movements – next-day pricing event reports and market event reports. Both reports aim to identify the cause, impact and

⁷ AEMO prepared but did not publish a Pricing Event Report for 26 March 2010

⁸ Located at: <http://www.aemc.gov.au/Market-Reviews/Open/Transmission-Frameworks-Review.html>

subsequent market response however market event reports provide a more considered analysis of these factors including any recommendations for change. Clause 3.13.1 (b) of the National Electricity Rules (the NER) requires AEMO to make information available to the public on request in respect of any significant movements in prices – to this end, AEMO publishes a pricing event report whenever the spot price exceeds \$300 per MWh. Otherwise, AEMO has no Rule obligation to publish these reports, but they provide positive assurance that AEMO's market systems, and the market design in general, is functioning correctly.

The AER is required under clause 3.13.7 (d) of the NER to publish a report⁹ whenever the spot price exceeds \$5,000 per MWh – and the report must analyse significant factors contributing to the spot price including withdrawal of generation capacity and network availability. The AER also publishes weekly electricity market analysis reports which include a high-level analysis of significant variations between the forecast and actual spot price as required under clause 3.13.7 (a) of the NER.

Appendix D lists the Pricing Event Reports published by AEMO and the AER for the 70/71 binding constraint events.

6.3 Pricing and Market Event Report - 10 August 2010

On 19 January 2011 AEMO published a market event report to explain the unusual market outcomes and circumstances that led to high energy prices in NSW and negative energy prices in Queensland on 10 August 2010 (refer AEMO Communication No.553).

The Wallerawang No.7 generating unit (WW7) in NSW was being returned to service, with the 36 Marulan – Mt Piper 330 kV transmission line on prior outage for construction work as part of the western NSW 500 kV upgrade. Returning WW7 to service required system reconfiguration switching by TransGrid at short-notice to AEMO, resulting in AEMO applying lower thermal ratings for the 70/71 lines. Due to the lower line ratings both the outage and related system normal constraint equation violated in Dispatch, setting the NSW dispatch prices at the market price cap (MPC) of \$12,500 per MWh.

In response to the high NSW prices a number of NSW Generators rebid their generating capacity into negatively-priced bands, resulting in a rapid increase in the amount of generation dispatched in NSW and reducing imports to the extent that there was excess generation and negative dispatch prices in Queensland.

In the report AEMO noted that such events demonstrate a situation where network congestion in the NEM has resulted in bidding and pricing behaviour by Generators that compounded dispatch and price risks faced by market participants.

6.4 Conclusions

The high NSW price outcomes arising from 70/71 binding constraint events between August 2009 and August 2010 were due to a combination of:

- high NSW demands
- relatively low generation availability at Wallerawang power station
- a delay in the commissioning of the critical Bannaby 500kV substation, which resulted in increased power flows from Bayswater to Marulan being re-directed through the newly-formed 70/71 lines, and
- limitations on the CT secondary equipment associated with the bay coupler CBs at Mt Piper and Wallerawang 330 kV switchyards, restricting the use of the full extent of the 70/71 line thermal ratings

⁹ Located at: <http://www.aer.gov.au/content/index.phtml/itemId/714860>

These factors were beyond the control of AEMO, and there was no scope for AEMO under the current regulatory arrangements to influence the sequencing of commissioning works that might have reduced or diverted critical flows through the 70/71 lines.

7 Wallerawang Power Station Availability

Wallerawang power station output was the most significant determinant of 70/71 line flows under both the pre- and post- western NSW ring conversion, with increased output acting to relieve congestion.

For the system normal constraint equation “N>>N-NIL__S”¹⁰, the co-efficient for the Wallerawang power station output variable was -1.000, requiring 1 MW of increased output for every 1 MW of limit reduction to avoid binding the constraint. If increased Wallerawang power station output was not possible, the same could be achieved by:

- ~1.4 MW reduction in Mt Piper power station output, or
- ~4 MW reduction in the Queensland to NSW interconnector flow, or
- ~4 MW reduction in Bayswater / Liddell power station output, or
- ~5 MW reduction in the Victoria to NSW interconnector flow, or
- ~5 MW reduction in Tumut 3 power station output

A simple view is that the constraint could be managed by increasing Wallerawang power station output to full load. Given the operational restrictions forced upon Wallerawang at the time, increased output may not have been possible or only at high cost.

This section summarises the information that Delta Electricity provided to AEMO in relation to Wallerawang power station energy and capacity limitations during the period August 2009 to August 2010.

7.1 Energy Limitations

During 2007 to mid 2010, the mid western area of NSW experienced a 1-in-100 year drought, severely impacting the operation of Wallerawang power station. For long periods, Delta Electricity lowered production at Wallerawang due to shortages of suitable water.

Delta Electricity provided the following advice to AEMO on potential energy limitations on Wallerawang power station during summer 2009/10 for input to AEMO’s quarterly Drought Report and subsequent Energy Adequacy Assessment Projections (EAAP):

- On 6 November 2008 Delta Electricity advised that, in the absence of any mitigating measures under the low rainfall scenario¹¹, Wallerawang power station output could be constrained over the summer of 2009/10 in the order of 1,500 GWh¹².
- On 4 May 2009 Delta Electricity advised that, under the low rainfall scenario, it would be prudent to assume that Wallerawang power station would be unavailable for a period of one month in both early 2010 and early 2011, reiterating that advice on 19 August 2009 and 11 November 2009¹³.
- On 5 February 2010 Delta Electricity advised via the EAAP that, for the period 01/04/2010 to 30/09/2010, the Wallerawang Unit No.7 output under the low rainfall scenario would only be restricted by 364 GWh total or 2 GWh per day, and was otherwise unrestricted.

¹⁰ This feedback-style system normal constraint equation controlled the pre-contingent flow on the 70/71 lines to avoid post-contingent thermal overload of 70 line on the loss of 71 line

¹¹ Scenario is based on rainfall over the period 1 to 31 May 2006

¹² For NEMMCO’s December 2008 Drought Report

¹³ For the June 2009, September 2009 and December 2009 Drought Reports respectively

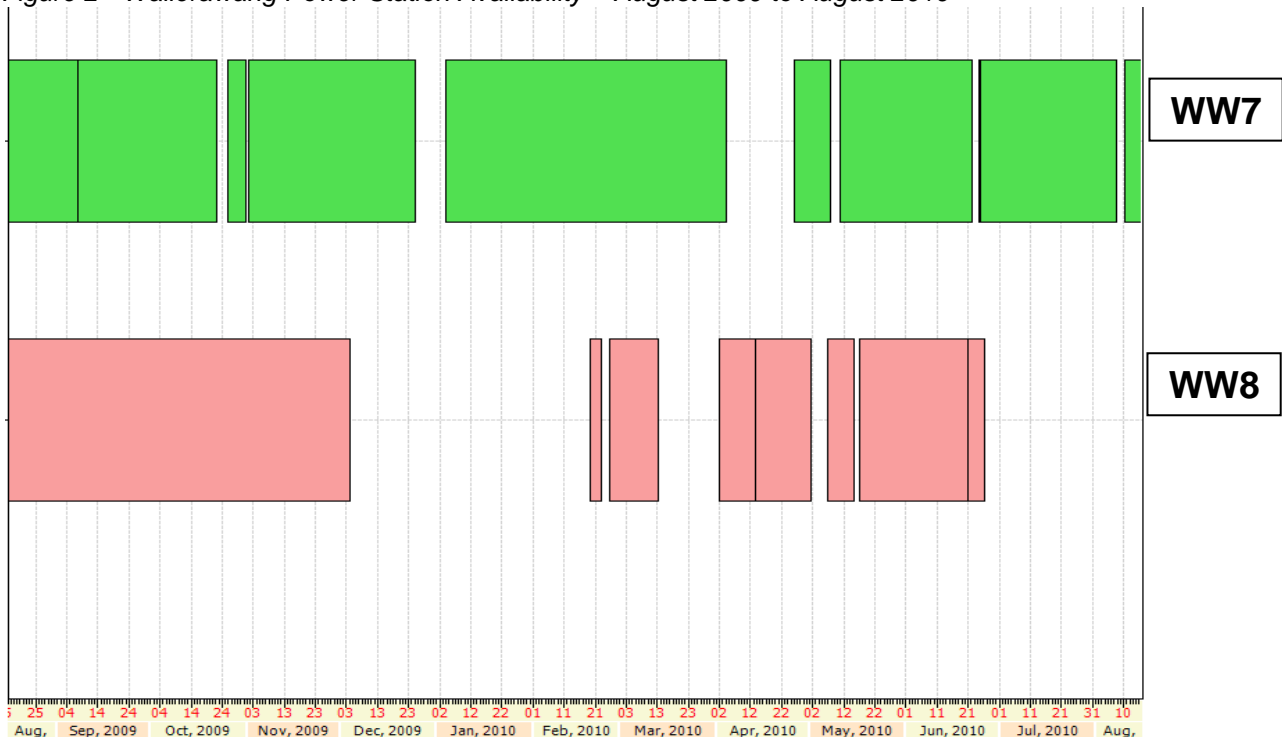
Appendices E and F summarise the Drought Report / EAAP energy restriction information and the MT PASA Availability information provided to AEMO relating to Wallerawang power station.

7.2 Capacity Limitations and Outages

Figure 2 below shows periods (indicated as gaps) where the WW7 and WW8 generating units were unavailable.

As shown, WW8 was unavailable for three months over summer 2009/10 returning in late February 2010, with both units unavailable for two weeks over the 2009 Christmas/ 2010 New Year period.

Figure 2 - Wallerawang Power Station Availability – August 2009 to August 2010



7.3 Conclusions

Delta Electricity provided timely advice to AEMO on potential energy and capacity limitations on Wallerawang power station under a low rainfall scenario during summer 2009/10.

Delta Electricity also provided timely advice to AEMO on planned generating unit outages at Wallerawang power station for the period concerned, and this advice was consistent with their advice on energy limitations and the need to restrict Wallerawang operation to a single unit during summer 2009/10.

The detailed energy limit information provided to AEMO is confidential and not available to the market. The capacity limit information provided to AEMO in dispatch offers for a particular trading day is made available to the market the next trading day.

8 Recommendations

8.1 Previous Recommendations from 10 August 2010 Market Event Report

The Market Event Report for the 10 August 2010 incident highlighted a number of potential areas for improvement by AEMO:

- **Removal of redundant system normal constraints when outage constraints for the same network element are applied:** AEMO are proposing greater use of automatic constraints to partly address this issue
- **Ramping constraints for non-outage changes such as transmission ratings:** AEMO noted this is likely to require substantial development effort
- **Better Pre-dispatch profiling of overridden transmission ratings:** Again, the report noted this is likely to require substantial development effort and would not have been effective for this particular event owing to the short-notice WW7 return to service
- **Additional Market Notices:** AEMO to advise of short-notice changes to transmission ratings, such as occurred in preparation for the WW7 return to service.

8.2 Progress on Recommendations

The following progress has been made on the recommendations in the 10 August 2010 report:

- **Removal of redundant system normal constraints when outage constraints for the same network element are applied:** In August 2011 AEMO consulted the market on its proposed “Constraint Automation: Closing the Loop” design, which would fully automate the creation, updating and invocation of thermal overload constraint equations in Dispatch. AEMO is currently considering feedback received on the paper.
- **Ramping constraints for non-outage changes such as transmission ratings:** In August 2011 AEMO commenced an internal review of the effectiveness of its current planned network outage ramping process, and is considering a broader review of ramping as part of a development roadmap for the central dispatch algorithm. A report of this investigation will be produced before the end of 2011.
- **Better Pre-dispatch profiling of overridden transmission ratings:** Changes to the NOS are targeted for late 2012 to allow rating information to be sent electronically to AEMO. Design work to incorporate predispatch into this process has not commenced.
- **Additional Market Notices:** AEMO has agreed to issue additional market notices for short-notice changes to transmission ratings. AEMO already uses this approach for expected system conditions such as bushfires and lightning activity.

8.3 Conclusions and Recommendations

The sensitivity of market outcomes to a transmission rating change is an important feature of many price events. This is due to a combination of factors including the market design, network topology and participant response. Operational arrangements can be effective in making full extent of available ratings to minimise but not avoid these outcomes.

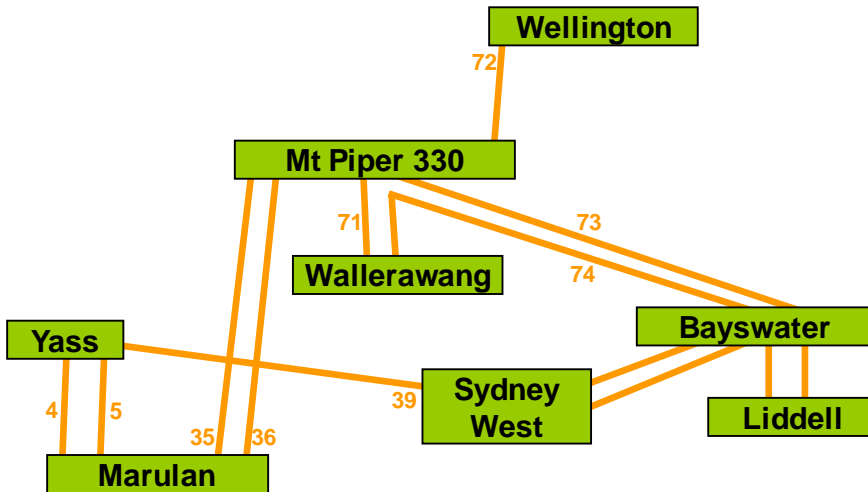
Demand, environmental factors, construction delays and plant availability are beyond AEMO's control to manage network congestion. Participants provided correct information to AEMO on the condition of plant and status of work programs to the extent they were able.

AEMO considers that network congestion issues will continue to arise, but the events of 2010 demonstrate that their market impact is exacerbated by the electricity market design, which does not place incentives on participants to manage congestion efficiently.

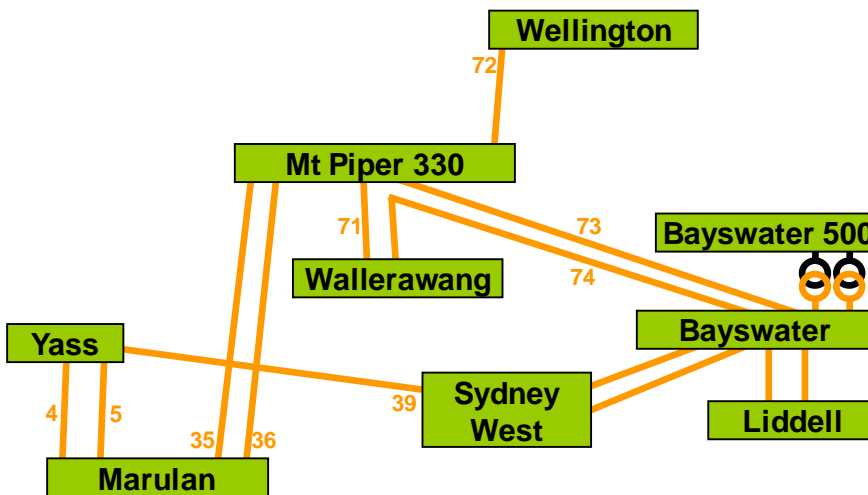
To provide greater operational and investment certainty, these matters need to be addressed through a congestion management regime. AEMO recommends that these issues should first be considered as part of the Transmission Frameworks Review (TFR) with any further actions identified and pursued after and in light of the TFR. AEMO will analyse some of the potential options to address network congestion identified in the TFR with reference to the events identified in this report. The results of this analysis will be published in line with the TFR timetable.

Appendix A - Western NSW 500 kV Upgrade – Commissioning Sequence

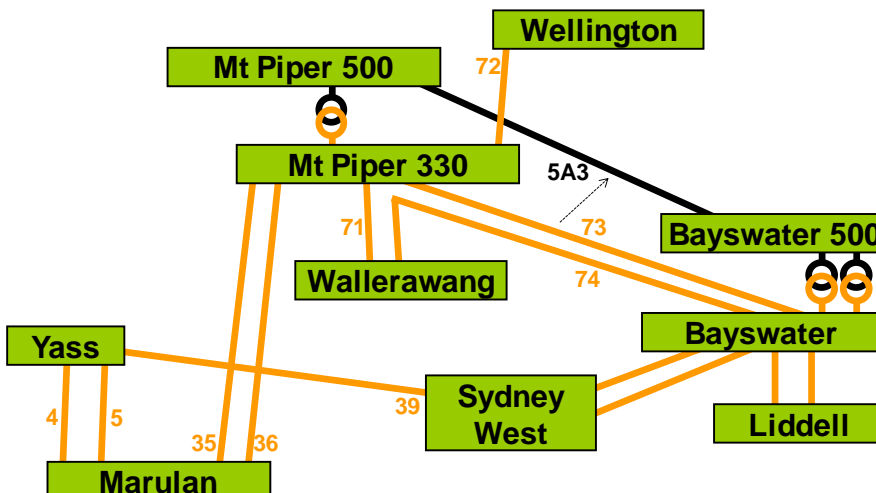
Pre-upgrade



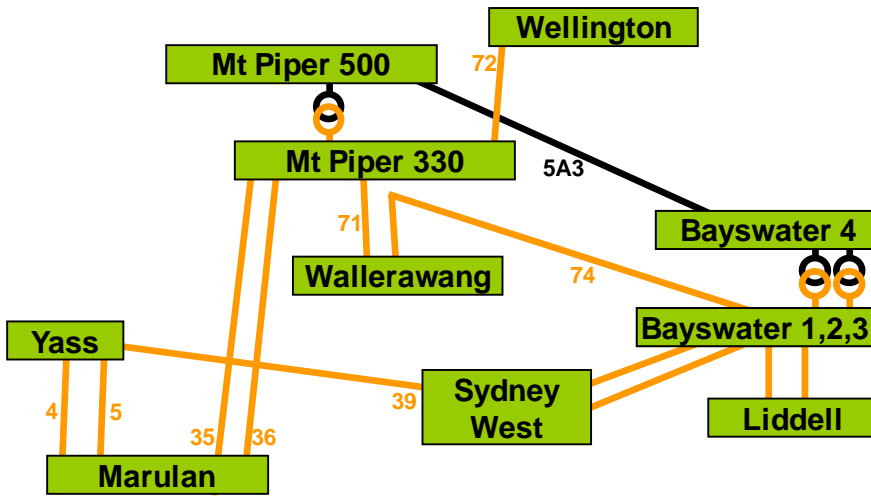
Feb 2009 – New Bayswater 500 kV switchyard energised via 500/330 kV transformers



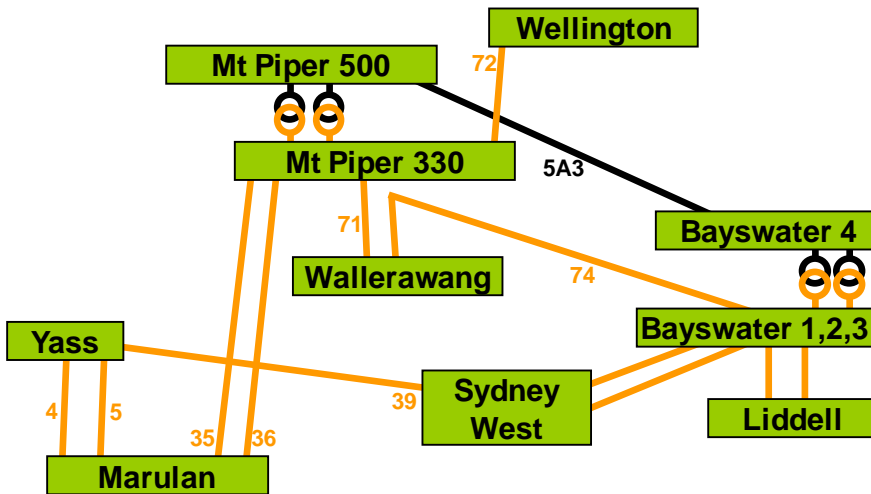
Mar 2009 – New Mt Piper 500 kV switchyard energised via 1st 500/330 kV transformer.
73 Bayswater – Mt Piper 330 kV line reconnected to create new 5A3 Bayswater – Mt Piper 500 kV line.



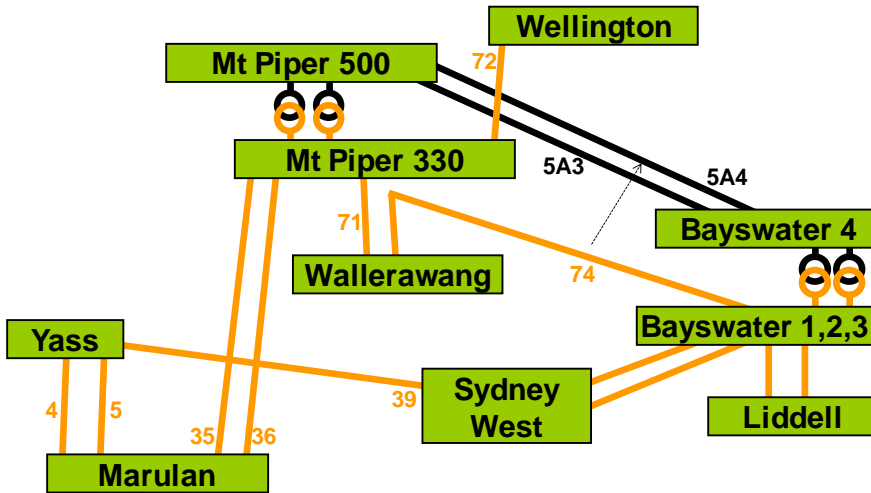
Jun 2009 – Bayswater Unit 4 reconnected to 500 kV – additional 150 MW transfer capability from Bayswater to Mt Piper/Wallerawang



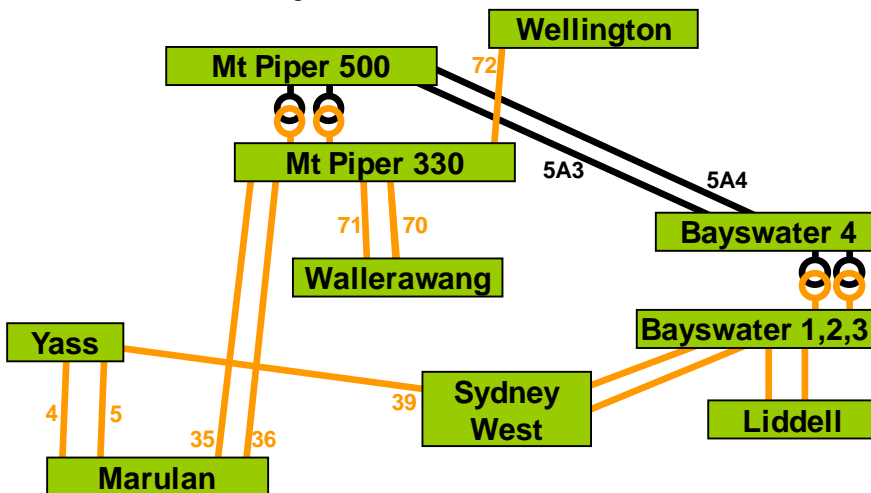
Jul 2009 – 2nd Mt Piper 500/330 kV transformer connected



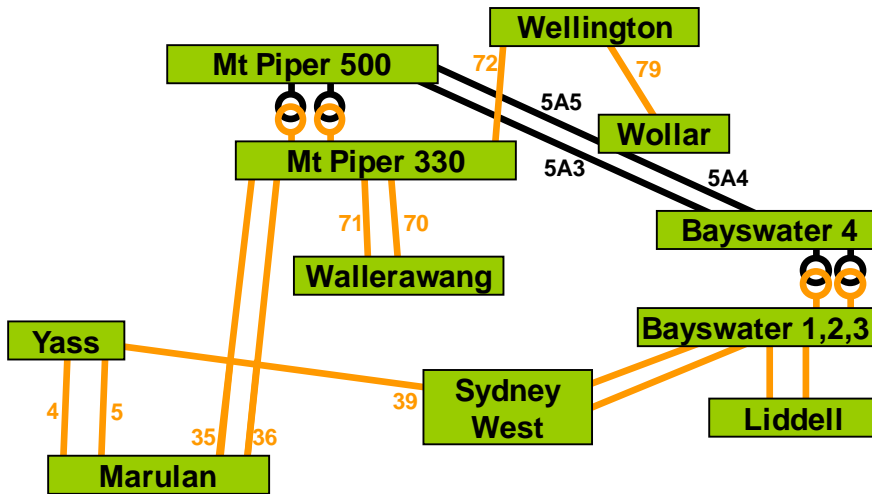
Aug 2009 – 74 Bayswater – Wallerawang 330 kV line reconnected as new 5A4 Bayswater – Mt Piper 500 kV line – additional 350 MW transfer capability from Bayswater to Mt Piper/Wallerawang (total increase 500 MW)



Sep 2009 – New 70 Mt Piper – Wallerawang 330 kV line created from remaining section of 74 Bayswater – Wallerawang 330 kV line

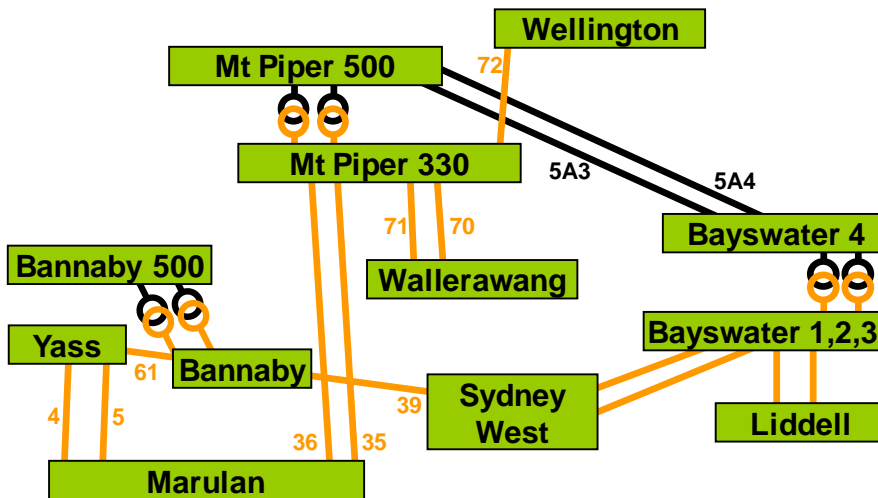


Jan 2010 – New Wollar 500/330 kV substation cut into 5A4 Bayswater – Mt Piper 500 kV line to form new 5A4 Bayswater – Wollar, 5A5 Wollar – Mt Piper 500 kV lines

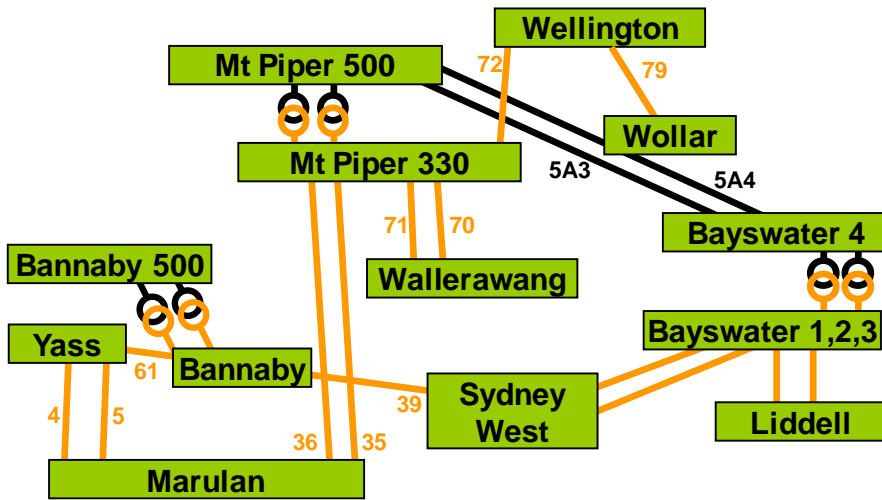


Feb 2010 – Wollar 500/330 kV transformer commissioned

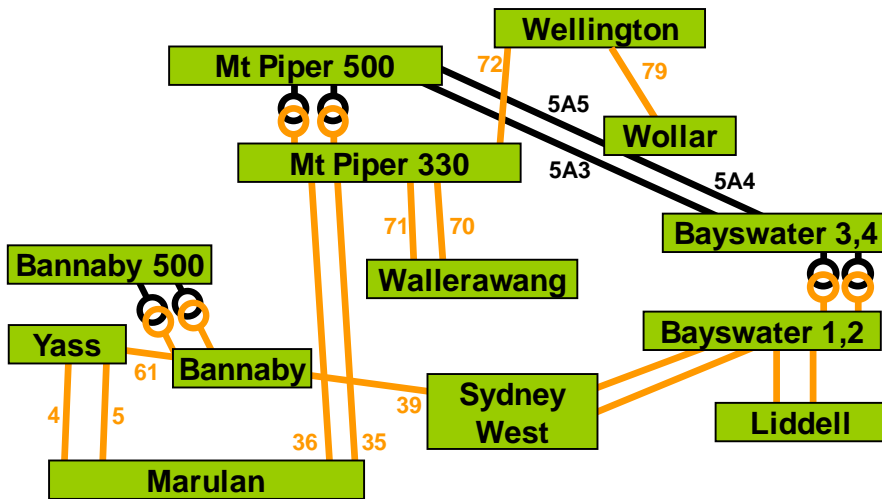
Mar 2010 – New Bannaby 500/330 kV substation cut into 39 Sydney West – Yass 330 kV line to form new 39 Sydney West – Bannaby, 61 Bannaby – Yass 330 kV lines (originally Oct 2009)



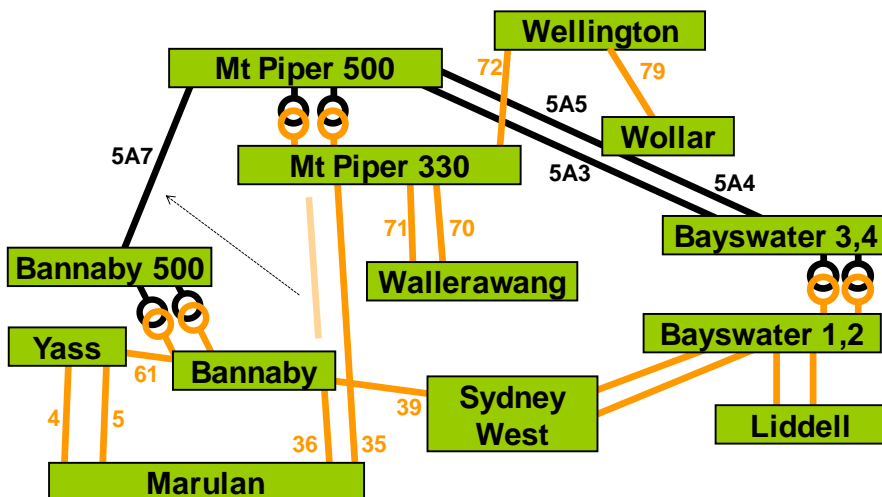
May 2010 – New 79 Wollar – Wellington 330 kV line commissioned



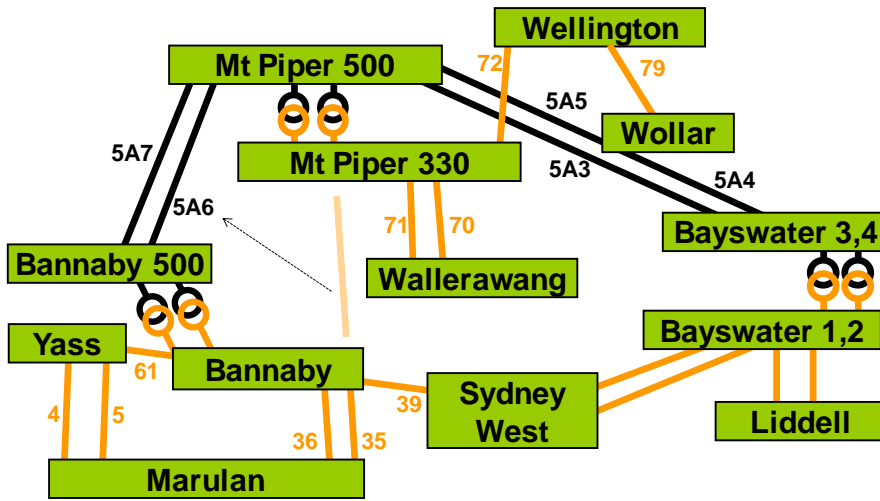
Jun 2010 – Bayswater Unit 3 reconnected to 500 kV – additional 150 MW transfer capability from Bayswater to Mt Piper/Wallerawang (total increase 650 MW)



Aug 2010 – 36 Mt Piper – Marulan 330 kV line reconnected as 5A7 Mt Piper – Bannaby 500 kV and 36 Bannaby – Marulan 330 kV line (originally Dec 2009)

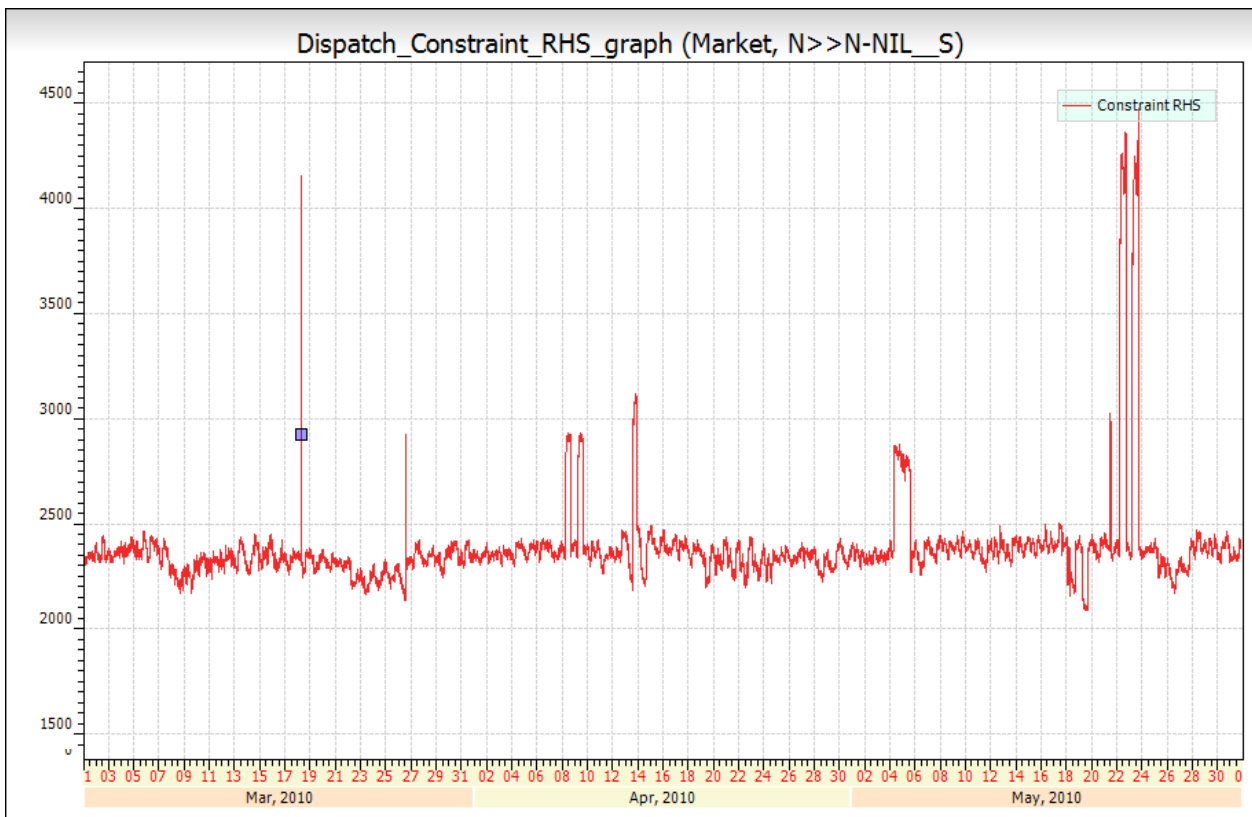
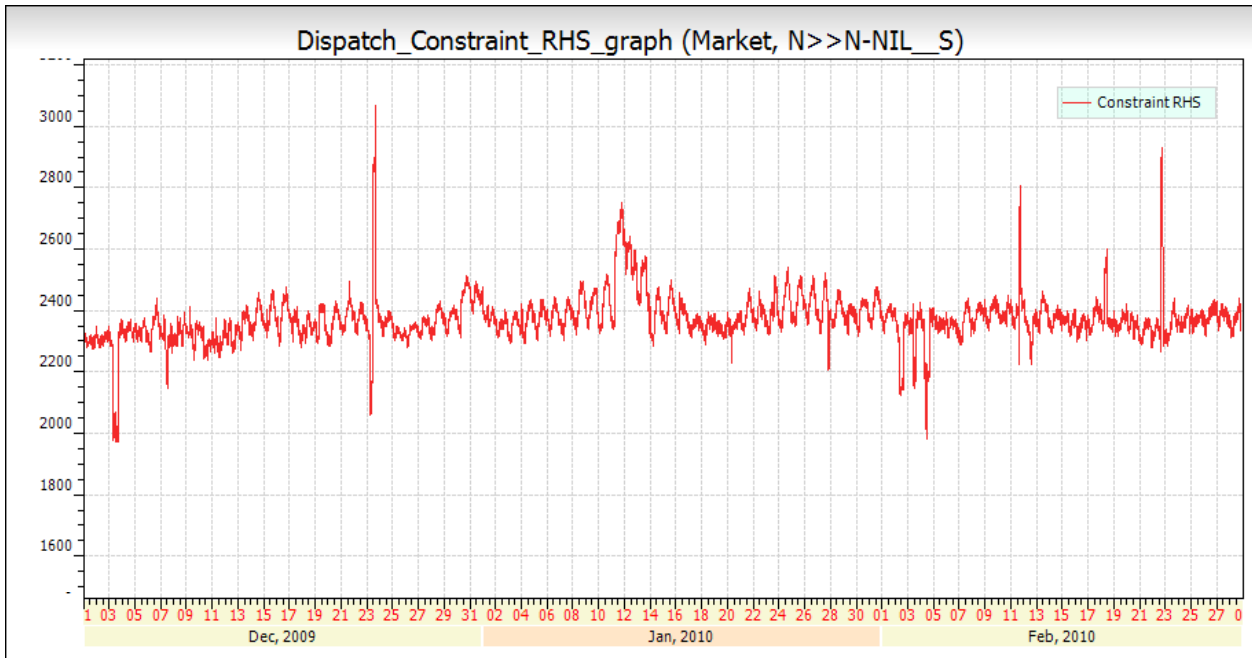


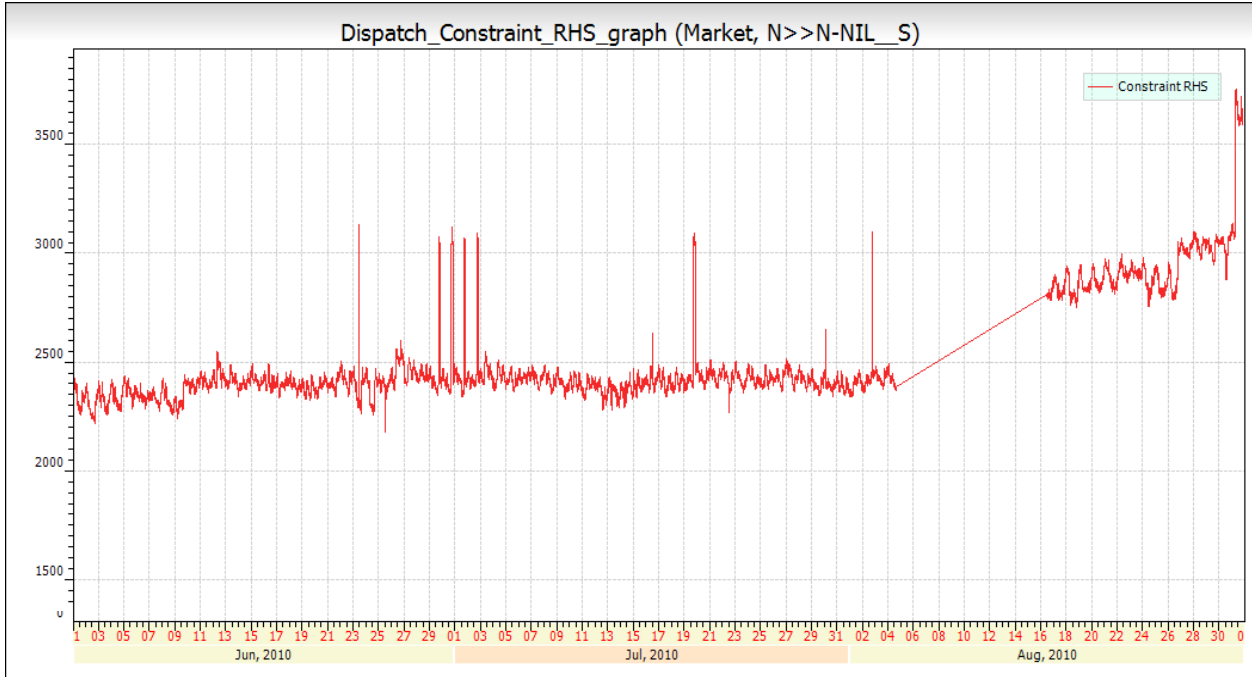
Aug 2010 – 35 Mt Piper – Marulan 330 kV line reconnected as 5A6 Mt Piper – Bannaby 500 kV and 35 Bannaby – Marulan 330 kV line (originally Nov 2009)



Appendix B: RHS of 70/71 system normal constraint “N>>N-NIL__S”

The following graphs illustrate the RHS of the 70/71 system normal constraint equation “N>>N-NIL__S” for the period December 2009 to August 2010, with step increases corresponding to increased ratings applied during use of the operational arrangement.





Appendix C: 70/71 Line Congestion Management - AEMO Market Communications

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
AEMO Comm 161	16/12/2009 11:49	<p>NEM - Revised LOR (Lack of Reserve) Threshold Levels for Reporting of Reserve Conditions in the Projected Assessment of System Adequacy (PASA) NSW Region.</p> <p>On the 8th December 2009 at 1000 hrs the LOR thresholds in PASA were increased for the NSW Region, with LOR1 increasing from 1400 MW to 1900 MW and LOR2 increasing from 700 MW to 1200 MW respectively. This represents the total of the two largest inputs for the NSW region for the current technical envelope. Input (1) 1200 MW represents the LOR2 threshold resulting from the loss of a generator and subsequent reduction in generator capacity due to a network constraint to maintain power system security for the current technical envelope; and input (2) represents a value of 700 MW resulting in a LOR1 threshold = 1200 MW + 700 MW = 1900 MW.</p> <p>The reason for the revised reserve thresholds was due to a specific power system configuration (technical envelope) where to maintain power system security following the disconnection of a specific generator would require a reduction in other generation capacity in the NSW region by a further amount of 700 MW due to a network constraint. The combined effect would have resulted in a decrease in capacity reserve of 1200 MW for the loss of that single input.</p> <p>On Friday 11th December 2009 AEMO implemented an agreed contingency plan with the Transmission Network Service Provider (TNSP) that utilises a network solution (system reconfiguration) to manage the increased reduction in capacity for the above condition by effectively alleviating the requirement to further reduce generator capacity associated with the disconnection of the critical generator.</p> <p>The contingency plan has eliminated the requirement to maintain higher LOR threshold levels in PASA for the NSW region. On the 11th December 2009 at 1700 hrs AEMO reset the PASA LOR threshold values for the NSW region to the previous values. Input (1) 700 MW, Input (2) 700 MW for a total of 1400 MW resulting in the LOR2 threshold of 700 MW and LOR1 threshold of 1400 MW respectively for the NSW region.</p>
Market Notice 30547	22/02/2010 20:00	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Monday 22 February 2010</p> <p>Due to system security requirements associated with system normal constraint N>>N-NIL__S, the TNSP performed system reconfiguration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) transmission lines (NSW)</p> <p>The increased ratings applied from 1555 hrs to 1920 hrs Monday 22 February 2010</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS: NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
AEMO Comm 328	24/05/2010 17:21	<p>The following AEMO Communication is forwarded to Rules Participants and interested parties on behalf of TransGrid.</p> <p>NEM - Capacity of NSW Mt Piper to Wallerawang Nos.70 and 71 330kV Transmission Lines</p> <p>TransGrid has recently completed an assessment of the factors limiting the ratings of the above 330kV transmission lines and is now undertaking work to remove these restrictions, with the intention of ultimately raising the rating of both lines to around 1430 MVA.</p> <p>Currently, the rating of the lines is limited by equipment at each end of these lines, but TransGrid is prepared to adopt an operational solution that minimises this limitation when system conditions permit. The following procedure has been adopted by AEMO and TransGrid:</p> <ul style="list-style-type: none"> • AEMO to advise TransGrid that the relevant constraint is binding or expected to bind in predispatch • TransGrid and AEMO to review prevailing or projected system conditions • Subject to this review, TransGrid will implement the operational solution and advise AEMO of revised ratings for the lines. • TransGrid will revert to normal operating conditions when AEMO advises the constraint is unlikely to bind or system conditions indicate the arrangement is no longer viable. <p>The objective of this arrangement is to minimise the occurrence of binding constraints on these lines when possible. The above arrangement has been in place for 3 months and will continue to be used pending completion of the work.</p>
Market Notice 32299	30/06/2010 17:00	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Wednesday, 30 June 2010</p> <p>To manage constraint headroom associated with system normal constraint N>>N-NIL__S, the NSW TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) transmission lines (NSW)</p> <p>The increased ratings are applied from 1655 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS: NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
Market Notice 32300	30/06/2010 21:11	<p>Cancellation - Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Wednesday, 30 June 2010. Refer market Notice 32299</p> <p>The NSW TNSP has restored the Network configuration associated with increasing ratings on 70/71 Wallerawang to Mt piper 330 kV transmission lines. The normal ratings are applied from 2000 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS: NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32320	01/07/2010 17:29	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Thursday, 1 July 2010. Refer Market Notice 32318.</p> <p>To manage constraint headroom associated with system normal constraint N>>N-NIL__S, the NSW TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV transmission lines (NSW). The increased ratings are applied from 1720hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS: NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32322	01/07/2010 20:17	<p>Cancellation - Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Thursday, 1 July 2010. Refer market Notice 32320</p> <p>The NSW TNSP has restored the Network configuration associated with increasing ratings on 70/71 Wallerawang to Mt piper 330 kV transmission lines. The normal ratings are applied from 2012 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
Market Notice 32327	02/07/2010 17:22	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Friday, 2 July 2010.</p> <p>To manage constraint headroom associated with system normal constraint N>>N-NIL__S, the NSW TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV transmission lines (NSW). The increased ratings are applied from 1700 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32329	02/07/2010 20:23	<p>Cancellation - Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Friday, 2 July 2010. Refer market Notice 32327</p> <p>The NSW TNSP has restored the Network configuration associated with increasing ratings on 70/71 Wallerawang to Mt piper 330 kV transmission lines. The normal ratings are applied from 2012 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32431	19/07/2010 17:55	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Monday, 19 July 2010</p> <p>To manage constraint headroom associated with system normal constraint N>>N-NIL__S, the NSW TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV transmission lines (NSW). The increased ratings are applied from 1750 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32521	02/08/2010 18:02	<p>Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Monday, 2 August 2010</p> <p>To manage constraint headroom associated with system normal constraint N>>N-NIL__S, the NSW TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV transmission lines (NSW). The increased ratings are applied from 1800 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
Market Notice 32522	02/08/2010 20:05	<p>Cancellation - Inter regional transfer limit variation, Mt Piper to Wallerawang (70 & 71) transmission lines (NSW) - Monday, 2 August 2010. Refer market Notice 32521</p> <p>The NSW TNSP has restored the Network configuration associated with increasing ratings on 70/71 Wallerawang to Mt piper 330 kV transmission lines. The normal ratings are applied from 1945 hrs</p> <p>The system normal constraint N>>N-NIL__S contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1</p>
Market Notice 32549	06/08/2010 13:42	<p>Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 6th August 2010</p> <p>To manage constraint headroom associated with a planned outage in the NSW region, the TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV Lines. The increased ratings applied from 0800 until further notice</p> <p>This outage constraint (N-MNMP_ONE) contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1, VIC1-SA1</p>
Market Notice 32550	06/08/2010 14:18	<p>Update - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 6th August 2010. Refer to MN 32549</p> <p>To manage constraint headroom associated with a planned outage in the NSW region, the TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV Lines. The increased ratings will apply from 0800 (today) until 1700 hrs (11/8) pending no other system security issues.</p> <p>This outage constraint (N-MNMP_ONE) contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1, VIC1-SA1</p>
Market Notice 32589	10/08/2010 08:33	<p>Update - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 6th August 2010. Refer to MN 32550</p> <p>The TNSP has reversed the system configuration switching and the the real time ratings on Mt Piper to Wallerawang (70 & 71) 330kV Lines have been restored to normal. This has been done to maintain a secure system during switching at Wallerawang to restore a generating unit to service. The outage of Mt Pipir Marulan 36 line is continuing and constraint sets N-MNMP_1 and N-NIL_PRE36__S violated in dispatch from DI 0820hrs</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
		This outage constraint (N-MNMP_ONE) contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1, VIC1-SA1
Market Notice 32591	10/08/2010 08:57	<p>Update - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 10th August 2010. Refer to MN 32550 and 32589</p> <p>To manage constraint headroom associated with a planned outage in the NSW region, the TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV Lines. The increased ratings will apply from 0855 hrs (today) until 1700 hrs (11/8) pending no other system security issues.</p> <p>This outage constraint (N-MNMP_ONE) contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1, VIC1-SA1</p>
Market Notice 32592	10/08/2010 09:00	<p>Date correction to MN 32589. The date should read 10 August 2010</p> <p>Update - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 10th August 2010. Refer to MN 32550</p> <p>The TNSP has reversed the system configuration switching and the the real time ratings on Mt Piper to Wallerawang (70 & 71) 330kV Lines have been restored to normal. This has been done to maintain a secure system during switching at Wallerawang to restore a generating unit to service. The outage of Mt Pipir Marulan 36 line is continuing and constraint sets N-MNMP_1 and N-NIL_PRE36__S violated in dispatch from DI 0820hrs</p> <p>This outage constraint (N-MNMP_ONE) contains the following interconnectors on the LHS NSW1-QLD1, N-Q-MNSP1, VIC1-NSW1, VIC1-SA1</p>
Market Notice 32619	12/08/2010 15:11	<p>Update - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 12th August 2010. Refer to MN 32591</p> <p>To manage constraint headroom associated with a planned outage in the NSW region, the TNSP has performed system re-configuration switching and provided increased real time ratings for Mt Piper to Wallerawang (70 & 71) 330kV Lines. The increased ratings will apply until 1700 hrs 15 August 2010 pending no other system security issues.</p>
AEMO Comm	13/08/2010 11:30	<p>The following AEMO Communication is forwarded to Registered Participants and interested parties on behalf of TransGrid. This AEMO Communication references to AEMO Communication No. 328 - (TRANSGRID) NEM - Capacity of NSW Mt Piper to</p>

NOTICE TYPE & ID	ISSUE DATE TIME	DESCRIPTION
417		<p>Wallerawang Nos. 70 and 71 330 kV Transmission Lines</p> <p>NEM – Update on the Capacity of NSW Mt Piper to Wallerawang Nos. 70 and 71 330 kV Transmission Lines</p> <p>TransGrid has completed the majority of the work to remove the restrictions that were limiting the ratings of the above 330 kV transmission lines. This outcome allows the full extent of the thermal ratings, around 1430 MVA, to be used for the above 330 kV transmission lines.</p> <p>It is possible a specific combination of outages at one of the switchyards may require the above 330 kV transmission lines to operate at reduced thermal ratings.</p>
Market Notice 32629	13/08/2010 12:07	<p>Cancellation - Inter regional transfer limit variation - Mt Piper to Wallerawang (70 & 71) Lines (NSW) - 13th August 2010. Cancellation of Market Notice 32619</p> <p>TransGrid has completed the majority of the work to remove the restrictions that were limiting the ratings of the above 330 kV transmission lines. This outcome allows the full extent of the thermal ratings, around 1430 MVA, to be used for the above 330 kV transmission lines.</p>
AEMO Comm 548	13/01/2011 17:38	<p>NEM – Cancellation of Contingency Plan to Manage NSW Capacity Reserve Levels</p> <p>AEMO Communication No. 161 published on 16 December 2009 advised of an agreed contingency plan with the Transmission Network Service Provider (TNSP) that utilises a network solution (system reconfiguration) to manage an increased reduction in capacity reserve in the NSW region for a specific technical envelope.</p> <p>Following completion of work by TransGrid in 2010 which increased the thermal capacity of their transmission network the increased reduction in capacity reserve no longer exists for that specific technical envelope and therefore the requirement for this contingency plan no longer exists.</p>

Appendix D – 70/71 lines - Binding Constraint Events during Western NSW 500 kV Upgrade – August 2009 to August 2010

70/71 Constraint Binding Events in Dispatch August 2009 - August 2010						
Date	DI from	DI to	Daily Total DIs	Daily Total DIs with Constraint Marginal Value > \$10	AEMO Pricing Event Report? Spot Price Above \$300	AER Pricing Event Report? Spot Price Above \$5000
16/08/2009	18:20	18:35	4	0		
17/08/2009	07:55	07:55	60	30		
	09:05	10:05				
	10:20	10:20				
	17:30	21:10				
18/08/2009	06:25	06:30	186	173		
	06:40	13:35				
	13:45	22:00				
19/08/2009	06:25	21:25	183	168		
	21:35	21:40				
20/08/2009	06:35	12:30	125	104		
	12:40	13:00				
	13:10	13:30				
	13:40	13:40				
	13:50	13:50				
	14:00	14:00				
	17:50	21:05				
21/08/2009	06:50	11:15	120	74		
	17:05	17:30				
	17:40	19:05				
	19:45	19:50				
	20:00	22:20				
	22:30	22:40				
	23:05	23:40				
22/08/2009	17:45	18:00	4	3		
24/08/2009	06:55	12:25	147	132		
	12:55	13:25				
	13:45	14:05				

70/71 Constraint Binding Events in Dispatch August 2009 - August 2010						
Date	DI from	DI to	Daily Total DIs	Daily Total DIs with Constraint Marginal Value > \$10	AEMO Pricing Event Report? Spot Price Above \$300	AER Pricing Event Report? Spot Price Above \$5000
	14:15	14:30				
	15:45	15:45				
	16:00	21:10				
25/08/2009	06:40	12:30	71	71		
26/08/2009	08:05	08:05	7	2		
	08:15	08:20				
	08:35	08:35				
	09:15	09:15				
	18:25	18:30				
09/11/2009	19:30	19:30	5	0		
	19:50	20:00				
	20:10	20:10				
16/11/2009	15:00	15:00	4	0		
	15:20	15:25				
	15:45	15:45				
20/11/2009	10:30	11:20	11	11	Yes	Yes
07/12/2009	10:10	10:10	84	79	Yes	Yes
	10:20	13:05				
	13:20	17:00				
	17:45	18:00				
08/12/2009	11:40	17:00	65	65	Yes	
16/12/2009	12:35	14:30	57	52	Yes	
	14:40	17:10				
	17:30	17:35				
17/12/2009	09:40	20:25	130	130	Yes	Yes
22/12/2009	11:25	11:55	45	44		
	12:05	15:10				
23/12/2009	08:55	09:20	24	21		
	09:30	10:55				
24/12/2009	12:30	12:30	6	6		
	12:40	12:40				

70/71 Constraint Binding Events in Dispatch August 2009 - August 2010						
Date	DI from	DI to	Daily Total DIs	Daily Total DIs with Constraint Marginal Value > \$10	AEMO Pricing Event Report? Spot Price Above \$300	AER Pricing Event Report? Spot Price Above \$5000
	15:45	15:45				
	16:15	16:15				
	16:25	16:30				
12/01/2010	12:30	12:55	60	60	Yes	
	13:00	17:10				
	17:25	17:35				
21/01/2010	14:45	14:55	28	28	Yes	
	15:05	17:05				
22/01/2010	11:15	18:30	96	89	Yes	
	18:40	18:40				
	18:55	19:00				
	19:10	19:10				
	19:20	19:35				
23/01/2010	10:25	14:45	62	58	Yes	
	14:55	15:35				
02/02/2010	12:45	12:50	4	0		
	13:00	13:05				
04/02/2010	09:10	10:20	38	36	Yes	Yes
	10:30	12:00				
	12:10	12:15				
	12:25	12:30				
10/02/2010	14:40	15:25	18	18		
	15:35	16:10				
11/02/2010	14:05	14:35	11	11	Yes	
	15:00	15:00				
	15:10	15:10				
	15:30	15:30				
	15:40	15:40				
12/02/2010	10:30	17:00	79	77	Yes	
22/02/2010	15:40	16:00	5	5	Yes	Yes

70/71 Constraint Binding Events in Dispatch August 2009 - August 2010						
Date	DI from	DI to	Daily Total DIs	Daily Total DIs with Constraint Marginal Value > \$10	AEMO Pricing Event Report? Spot Price Above \$300	AER Pricing Event Report? Spot Price Above \$5000
26/03/2010	12:20	13:00	9	9	Yes ¹⁴	
13/04/2010	13:35	13:45	3	3	Yes	
28/06/2010	17:35	17:35	11	10		
	18:00	18:00				
	18:30	19:05				
	19:25	19:25				
29/06/2010	17:15	17:35	5	5	Yes	
02/08/2010	17:45	18:00	4	2		
06/08/2010	08:00	08:10	3	0		
09/08/2010	18:30	18:30	1	1		
10/08/2010	08:20	08:35	8	8	Yes	Yes
	08:40	08:45				
	08:50	08:55				
38 days			1783 DIs	1585 DIs	17 reports	6 reports

¹⁴ Report prepared but not published

Appendix E - Wallerawang Power Station - Drought Report and EAAP Declarations

Wallerawang Power Station - Drought Report advice

Drought Report	Date of Advice	Rainfall Scenario	Period Covered		Advice
			Start	End	
Nov 07	30/10/2007	Low, Average	01/10/2007	30/09/2009	Delta Electricity is unlikely to experience generation losses against our forecast production in this period.
Mar 08	29/01/2008	Low, Short Term Average, Long Term Average	01/01/2008	31/12/2009	Delta Electricity is unlikely to experience generation losses against our forecast production in this period.
Jun 08	14/05/2008	Low, Short Term Average, Long Term Average	01/05/2008	30/04/2010	Delta Electricity is unlikely to experience generation losses against our forecast production in this period.
Sep 08	15/08/2008	Low, Short Term Average, Long Term Average	01/08/2008	31/07/2010	Delta Electricity is unlikely to experience generation losses against our forecast production in this period.
Dec 08	06/11/2008	Short and Long Term Average	01/11/2008	31/10/2010	Delta Electricity is unlikely to experience generation losses against our forecast production in this period for either of the short term or long term average rainfall scenarios.
		Low			<p>In the absence of any mitigating measures, output from Wallerawang could be constrained over the summer of 2009/10.</p> <p>However, Delta Electricity is currently investigating options that would ameliorate any such losses if the low rainfall situation was to occur, and is confident that such measures could be implemented in a timely manner.</p>

Drought Report	Date of Advice	Rainfall Scenario	Period Covered		Advice
			Start	End	
Mar 09	03/02/2009	Low, Short and Long Term Average	01/02/2009	31/01/2011	Delta Electricity is unlikely to experience generation losses against our forecast production.
Jun 09	04/05/2009	Short and Long Term Average	01/05/2009	30/04/2011	Delta Electricity has no constraints arising from either the short term average rainfall or long term average rainfall scenarios.
		Low			<p>It is conceivable that Wallerawang power station could be constrained for periods during the 2009/10 and 2010/11 summers.</p> <p>Delta Electricity has the ability to transfer generation within its own portfolio and take other drought mitigation steps as necessary. However, for your purposes, it would be prudent to assume that for the low rainfall scenario, Wallerawang would not be available for a period of one month in both early 2010 and early 2011 (assume February 2010 and January 2011).</p>

Drought Report	Date of Advice	Rainfall Scenario	Period Covered		Advice
			Start	End	
Sep 09	19/08/2009	Short and Long Term Average	01/08/2009	31/07/2011	Delta Electricity envisages no constraints arising from either the short term average rainfall or long term average rainfall scenarios.
		Low			For the low rainfall it is conceivable that Wallerawang power station could be constrained for periods during the 2009/10 and 2010/11 summers. Delta Electricity has the ability to transfer generation within its own portfolio and take other drought mitigation steps as necessary. However, for your purposes, it would be prudent to assume that for the low rainfall scenario, Wallerawang would not be available for a period of one month in both early 2010 and early 2011 (assume January 2010 and January 2011).
Dec 09	11/11/2009	Short and Long Term Average	01/11/2009	30/09/2011	Delta Electricity envisages no constraints arising from either the short term average rainfall or long term average rainfall scenarios.
		Low			It is conceivable that Wallerawang power station could be constrained, due to lack of suitable water, for a period during the 2010/11 summer. Delta Electricity has the ability to transfer generation within its own portfolio and take other drought mitigation steps as necessary. However, for your purposes, it would be prudent to assume that for the low rainfall scenario, Wallerawang would not be available for a period of one month in either January or February 2011. Reduced availability of Wallerawang during December/January of the 2009/10 summer has already been advised by Delta Electricity through the MTPASA.

Wallerawang Unit 7 - EAAP Declarations

EAAP Run	Date of Submission	Rainfall Scenario	Period Covered		Energy Constraint (GWh)	Constraint Explanation in Submission	Subsequent Advice via email
			Start	End			
2010Q2	05/02/2010	Low	01/04/2010	30/09/2010	GWh limitation advised	Nominated GWh limitation Output restricted by nominated amount per day	On 08/03/2010 Delta Electricity advised that Wallerawang station would have a total energy constraint , nominated on a daily and period basis, for the period 01/04/2010 to 01/11/2010 , with only one unit in-service but both available for short durations. This was what was modelled in the EAAP run
	None		01/10/2010	31/03/2012	No limit ¹⁵		
	None	Medium High	01/04/2010	31/03/2012	No limit ¹⁵		
2010Q3	None	Low Medium High	01/07/2010	30/06/2012	No limit ⁶		
2010Q4	09/08/2010	Low	01/10/2010	30/09/2012	0 ¹⁶ (No limit assumed)		
	09/08/2010	Medium	01/10/2010	30/09/2012	0 ¹⁶ (No limit assumed)		
	09/08/2010	High	01/10/2010	30/09/2012	0 ¹⁶ (No limit assumed)		

¹⁵ No submissions covering the period, hence no limitation is assumed

¹⁶ Subsequent advice from Delta Electricity on 01/09/2010 confirms that Wallerawang will not experience drought related generation shortfall for any of the 3 rainfall scenarios over the two year period commencing 1 October 2010, hence no limitation is assumed

Wallerawang Unit 8 - EAAP Declarations

EAAP Run	Date of Submission	Rain Scenario	EAAP Period		Energy Constraint (GWh)	Constraint Explanation in Submission	Subsequent Advice via email
			Start	End			
2010Q2	05/03/2010	Low	01/04/2010	01/10/2010	GWh limitation advised	Nominated GWh limitation WWang8 out of service	On 08/03/2010 Delta Electricity advised that Wallerawang station would have a total energy constraint, nominated on a daily and period basis, for the period 01/04/2010 to 01/11/2010 , with only one unit in-service but both available for short durations. This was what was modelled in the EAAP run
	None		02/10/2010	01/04/2012	No limit ¹⁷		
	None	Medium High	01/04/2010	01/04/2012	No limit ¹⁷		
2010Q3	None	Low Medium High	01/07/2010	01/07/2012	No limit ¹⁷		
2010Q4	09/08/2010	Low	01/10/2010	30/09/2012	0 (No limit)		On 01/09/2010 Delta Electricity advised that Wallerawang station will not experience drought-related generation shortfall for any of the 3 rainfall scenarios over the two year period commencing 1 October 2010, even though Delta Electricity had submitted zero energy constraints. Hence no limitation is assumed
	09/08/2010	Medium	01/10/2010	30/09/2012	0 (No limit)		
	09/08/2010	High	01/10/2010	30/09/2012	0 (No limit)		

¹⁷ No submissions covering the period, hence no limitation is assumed

Appendix F - Wallerawang Power Station Outages based on MT PASA Availability

MT PASA Offer Submission Datetime	WW 7			WW 8		
	Outage from	Outage to	Duration (Days)	Outage from	Outage to	Duration (Days)
Mon 13/07/2009 16:58:05	03/04/2010	16/04/2010	13	02/07/2010	10/09/2010	70
Tue 18/08/2009 10:05:16	same			same		
Mon 21/09/2009 16:52:31	same			same		
Fri 06/11/2009 16:03:52	same			same		
Tue 10/11/2009 12:34:28	24/12/2009	03/01/2010	10	11/12/2009	11/01/2010	31
	03/04/2010	16/04/2010	13	02/07/2010	10/09/2010	70
Mon 14/12/2009 11:40:14	25/12/2009	03/01/2010	9	11/12/2009	18/01/2010	38
	03/04/2010	16/04/2010	13	22/03/2010	30/03/2010	8
				02/07/2010	10/09/2010	70
Mon 18/01/2010 14:04:47	same			11/12/2009	20/01/2010	40
				22/03/2010	30/03/2010	8
				02/07/2010	10/09/2010	70
Tue 19/01/2010 14:50:18	same			11/12/2009	30/03/2010	109
				20/04/2010	10/09/2010	143
Mon 08/02/2010 14:51:03	10/04/2010	23/04/2010	13	29/05/2010	28/08/2010	91
Mon 22/02/2010 14:08:55	10/04/2010	23/04/2010	13	02/07/2010	10/09/2010	70
				13/09/2010	01/11/2010	49
Mon 15/03/2010 14:24:15	05/04/2010	23/04/2010	18	02/07/2010	01/11/2010	122
Mon 15/03/2010 15:06:31	05/04/2010	23/04/2010	18	02/07/2010	01/11/2010	122
Tue 16/03/2010 13:57:32	05/04/2010	23/04/2010	18	02/07/2010	01/11/2010	122
Mon 19/04/2010 16:54:05	No further outages in 2010			02/07/2010	01/11/2010	122
Fri 07/05/2010 14:49:52	No further outages in 2010			29/10/2010	12/11/2010	14
Mon 24/05/2010 15:07:46	No further outages in 2010			02/07/2010	10/09/2010	70
Mon 24/05/2010 16:28:43	No further outages in 2010			02/07/2010	10/09/2010	70
Mon 07/06/2010 14:36:08	No further outages in 2010			02/07/2010	10/09/2010	70
Mon 07/06/2010 15:34:07	No further outages in 2010			02/07/2010	10/09/2010	70
Mon 21/06/2010 15:04:38	No further outages in 2010			27/06/2010	10/09/2010	75