Australian Energy Market Commission

REVIEW

SECOND INTERIM REPORT

Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events

Commissioners

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005 to be the rule maker for national energy markets. The AEMC is currently responsible for rules and policy advice covering the National Electricity Market and elements of the natural gas markets. It is an independent, national body. Our key responsibilities are to consider rule change proposals, conduct energy market reviews and provide policy advice to the MCE as requested, or on AEMC initiative.

Contents

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APC	Administered Price Cap
CCGT	Combined Cycle Gas Turbine
Commission	see AEMC
CPT	Cumulative Price Threshold
CRR	Comprehensive Reliability Review
DSP	Demand Side Participation
EAAP	Energy Adequacy Assessment Projection
ESCOSA	Essential Services Commission of South Australia
ESOO	Electricity Statement of Opportunities
JPB	Jurisdictional Planning Body
KPI	Key Performance Indicator
kV	Kilovolt
MCE	Ministerial Council on Energy
MNSP	Market Network Service Provider
MPC	Market Price Cap
MRL	Minimum Reserve Level
MW	Megawatt
MTPASA	Medium-Term Projected Assessment of System Adequacy
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
PASA	Projected Assessment of System Adequacy
PDPASA	Pre-Dispatch Projected Assessment of System Adequacy
POE	Probability of Exceedence
OCGT	Open Cycle Gas Turbine
RERT	Reliability and Emergency Reserve Trader
RIT-T	Regulatory Investment Test for Transmission

Rules	National Electricity Rules
SCO	Standing Committee of Officials
SPP	Statement of Policy Principles
STPASA	Short-Term Projected Assessment of System Adequacy
TNSP	Transmission Network Service Provider
USE	Unserved Energy
VoLL	Value of Lost Load

Executive Summary

This Review

At its meeting on 6 February 2009, the Ministerial Council on Energy (MCE) noted the significance of the interruptions in Victoria and South Australia on 29 and 30 January 2009 as the result of severe heat wave conditions.[1] The MCE agreed to request the Australian Energy Market Commission (Commission) to review energy market frameworks in light of the impact of the heat wave on electricity supply.

On 28 April 2009, the MCE directed the Commission to conduct a review of the effectiveness of the security and reliability arrangements in the National Electricity Market (NEM) in light of extreme weather events. The weather events the Commission is to have regard to are droughts, heat waves, storms, floods and bushfires.[2]

In essence, this review requires the Commission to consider the following questions:

- Under the scenario that extreme weather events become more frequent, are the current arrangements for managing security and reliability in the NEM appropriate to deliver reliable and secure electricity supply?
- If not, what cost-effective amendments could be made to the market arrangements in the short and longer terms to address any identified risks to security and reliability under that scenario.

The Commission was initially required to present its advice to the MCE in two stages. The first stage was the advice contained in the First Interim Report. The First Interim Report described the measures currently under consideration that would improve system reliability and security. It also identified any further cost-effective measures that could be taken in the short-term that would impact on system reliability for the summer of 2009-10.

This Report

The MCE then issued updated Terms of Reference for this review, requiring additional analysis and advice to be undertaken in a Second Interim Report (this report). This report addresses questions specifically asked of us in the amended terms of reference relating to:

- NEM reliability forecasting methodologies and outcomes;

1 Ministerial Council on Energy , Communiqué, Canberra, 6 February 2009, p.1.

2 Under section 41(1)(a) of the National Electricity Law, the MCE may give a written direction to the Commission requiring the Commission to conduct a review into any matter relating to the national electricity market.

- modelling projections of the price-reliability trade-offs of a phased increase in the NEM market price cap to a number of specified levels;
- the interpretation of the NEM reliability standard in the past and its appropriate interpretation and specification into the future;
- the feasibility of mechanisms for recognising differences in jurisdictional expectations regarding the price-reliability trade-off and delivery outcomes consistent with those expectations.
- the appropriate roles of the MCE, the AEMC, AEMO and the Reliability Panel in policy decision-making on reliability standards and settings; and

The Final Report will present the third stage of the Commission's advice to the MCE. That report will concentrate on changes to energy market frameworks that could improve reliability in the longer term and contribute to the more effective management of system security and reliability during extreme weather events. The Commission is required to provide the Final Report to the MCE by 30 April 2010.

Key messages

As discussed in the First Interim Report, disruptions to distribution networks are responsible for 90 per cent of the duration of interruptions to customers. These outages are usually local in nature, affecting a relatively small number of customers and lasting only a short time. In contrast, disruptions caused by failure of transmission or generation are less frequent but affect a larger number of consumers, potentially for a longer time, when they do occur. The questions put to us by the MCE for this Second Interim Report are focussed on the reliability standard and settings which primarily affect reliability as it relates to the generation sector of the NEM.

Under the energy-only market design of the NEM, the primary mechanism for promoting reliable electricity supply is the Reliability Standard. Currently, the standard requires that no more than 0.002% of annual energy consumption for any region is not met due to a shortage of generation. To incentivise timely investment in the generation capacity[3] necessary to meet the standard, the NEM signals investment opportunities via the price payable for electricity in the wholesale spot market. The risk of wholesale price volatility is currently managed by applying a market price cap (or MPC formerly called the Value of Lost Load, or VoLL) to the spot market together with other price regulation arrangements (the cumulative price threshold, administered price cap and the market floor price). The reliability standard and reliability settings are supported by AEMO's ability to intervene in the market to manage any short term imbalances between available capacity and demand. When considering reliability in the NEM, it is important to examine all these mechanisms, standard and settings, holistically, as they are an integrated set of arrangements.

3 Investment in inter-regional transmission capacity is signalled though other planning standards and incentive mechanisms.

The MPC is of particular relevance when considering reliability. It needs to be sufficiently high to provide adequate return on investment to peaking generators which may only operate for a few hours each year, but which are required so that the reliability standard can be met during periods of peak demand. The unserved energy (USE) arising from setting the MPC at a particular level represents a trade off between reliability of electricity supply and the price consumers are willing to pay for that level of reliability.

The MCE requested information on 8 matters in its updated terms of reference for this review. Each of these issues are addressed in this report, with the principal focus being on the key areas of: interpretation and specification of the reliability standard; modelling outcomes for different levels of the market price cap; the feasibility of recognising differences in jurisdictional expectations of reliability; and future governance arrangements for decision making on the reliability settings.

Interpretation and specification of the NEM Reliability Standard

The MCE requested advice on how the NEM Reliability Standard has been interpreted to date and on the appropriate specification and interpretation of the standard in the future.

The standard is specified in terms of a targeted expectation of USE intended to reflect the consumer valuation of electricity in terms of the economic trade off between price and reliability discussed above.

We have concluded that the specification of the reliability standard in terms of a targeted level of USE remains appropriate for a future in which extreme weather is more likely. However, it would be beneficial to provide additional information in relation to the frequency and duration of supply interruptions as well as on USE experience in monitoring performance against the standard. This would assist governments, policy makers and the market operator to better understand how supply interruptions are impacting end-users, and would assist in the early identification of improvements to the current mechanisms available for delivering reliability. We intend to report further on these issues in the Final Report for this review.

In terms of interpretation, the reliability standard has been targeted to be achieved every year, but compliance has been measured over the long term (a 10-year moving average of reliability outcomes is measured against the reliability standard). Although the target has been to achieve the standard every year, this does not mean it is an annual maximum that cannot be exceeded. The nature of the application of the standard means actual outcomes over time will involve a distribution of reliability that is both above and below the target. There are many unpredictable reasons (e.g. extreme demand conditions or significant equipment failure) why a combination of events may result in USE above the standard in a single year.

However, the practice to date of measuring the reliability performance against the standard over 10 years can result in delays in responding to causes of reliability degradation, including an increased incidence of extreme weather. We have concluded that it would be more appropriate to review the reliability of the NEM each year, in particular following incidents that have resulted in USE. Where the level of USE in a year approaches or exceeds 0.002% it is important for stakeholders and decision makers to understand the circumstances that caused the load interruptions. The NEM institutions can then identify potential improvements to the mechanisms that can be assessed and implemented, as appropriate.

This approach would be feasible and could be readily implemented. There have been relatively few major reliability events since the start of the NEM in 1998, and in each case of USE the NEM institutions have reviewed the circumstances and refinements were identified and implemented.

Modelling projections of Price-Reliability trade-offs

The modelling projections of the price-reliability trade-offs of a phased increase in the market price cap have not been included in this Report. To assist us to inform our advice to the MCE on this issue, we engaged ROAM Consulting to provide modelling analysis of the relevant trade-offs. ROAM has since identified an error with its preliminary results, and therefore has indicated that the modelling requires additional work to review the analysis and outcomes. Due to the issues associated with the ROAM modelling, we have also commissioned an independent expert to undertake a thorough review of the ROAM modelling framework to ensure confidence in the final modelling conclusions. We intend to provide the final modelling results and supporting report in our Final Report for the Review.

Recognising differences in Jurisdictional Expectations

The MCE requested advice on the feasibility of mechanisms for recognising differences in jurisdictional expectations regarding the price-reliability trade-off and delivery outcomes consistent with those expectations. We have focused on the mechanism of differential MPCs across regions in this report.

The current market design assumes reliability is valued equally in all regions and this assumption is reflected in policy and operational frameworks used to incentivise the investment needed to achieve the desired reliability outcomes. For example, this approach is reflected in arrangements for the sharing of load reductions across regions in times of shortage in one region.

Implementation of mechanisms to recognise regional differences in the value of reliability would be a fundamental change to the current market design and would require changes to the policies and the operational arrangements used to achieve reliable supply. Under such an approach, regions with higher reliability valuations and MPCs would attract more generation investment and receive higher reliability at a higher price than those with lower valuations.

Our preliminary view is that adopting different MPCs in each region to reflect differences in jurisdictional expectations regarding the price/reliability trade-offs would be feasible and could arguably result in economically efficient outcomes. Provided the MPC for a region is consistent with the value that customers collectively place on supply continuity, then the resultant levels of investment in supply and demand side capacity in that region and thus regional specific supply reliability would be economically efficient in the sense that supply continuity is provided up to the level at which it is valued in each region.

However, there may be implications for economic efficiency, when considered on a NEM-wide basis, from introducing mechanisms to recognise regional differences in the value of reliability. For example, differential MPCs may lead to distortions in investment and operational behaviour which would detract form achieving economically efficient outcomes across the interconnected NEM as a whole. Without detailed modelling it is difficult to assess the wider impacts on investment and operational efficiency and we have not conducted that type of modelling for this report.

Governance Arrangements

The MCE requested advice on the appropriate roles for the MCE, the AEMC, AEMO and the Reliability Panel in future policy decision-making on the reliability standard and settings.

A number of the decisions relating to the reliability settings go beyond determining the reliability standard itself. These decisions are of a detailed economic, market framework nature (reliability parameter decisions). Setting the minimum reserve levels and activating the reliability safety net are also reliability decisions that are more operational in nature and similar to other decisions made by the AEMO on a day to day, operational basis.

We have proposed improvements to the governance arrangements for future NEM reliability decision-making which would involve greater policy input by the MCE regarding the reliability standard and changes to the decision-making responsibilities of the relevant market institutions with the AEMC becoming the principal decision-maker on the reliability parameters. Under this proposal, the MCE's policy guidance would be provided under a Statement of Policy Principles or another appropriate instrument and would inform specific reliability parameter decisions to be made by the AEMC after following the normal statutory consultation processes.

Next steps

Submission of this Second Interim Report to the MCE completes of the second stage of the review. The Commission will now commence the third stage, which requires it to provide advice to the MCE regarding further changes that could be made to energy market frameworks to deliver cost-effective improvements to reliability in the long term. The Commission's advice will be contained in the Final Report, which is to be provided to the MCE by 30 April 2010.

1 Introduction

1.1 Background to the Review

In late January 2009, South Australia and Victoria experienced extreme temperatures. In Adelaide, maximum temperatures exceeded 35ºC for nine consecutive days, with six consecutive days over than 40ºC.[4] For the first time in recorded history, Melbourne recorded three consecutive days over 43ºC.[5]

The heat wave conditions created high demand for electricity in these regions. The maximum demands recorded on 29 January 2009 were the highest ever recorded in the South Australian and Victorian regions. Maximum demands on 30 January 2009 were only slightly lower.[6]

Equipment used in the production and delivery of electricity to consumers is designed to operate safely within specific temperature ranges. At temperature extremes the performance of equipment degrades prior to being required to be withdrawn from service. The high temperatures in South Australia and Victoria resulted in reductions in the availability of transmission elements at short notice, including the Basslink interconnector[7], and progressively reduced the availability of the Victorian generators on both 29 and 30 January 2009. In-order to restore the balance between supply and demand, the Australian Energy Market Operator (AEMO) instructed that demand be reduced in both South Australia and Victoria. Consequently there were supply interruptions to business and residential consumers.

On 6 February 2009, the Ministerial Council on Energy (MCE) noted the significance of the interruptions during this period.[8] The MCE agreed to request the Australian Energy Market Commission (Commission) to review energy market frameworks in light of the impact of the heat wave on electricity supply.

4 ESCOSA, *Performance of ETSA Utilities during January–February 2009 Heatwave*, fact sheet, www.escosa.sa.gov.au/webdata/resources/files/090401-D-PerformancOfETSAJanFeb09Heatwave_df.pdf

5 NEMMCO, *Power System Incident Report – Actual Lack of Reserve in Victoria and SA on 29-30 January 2009*, 26 May 2009, p. 5.

6 Ibid, p. 3.

7 Basslink is protected by a thermal protection mechanism that reduces its ability to transfer electricity between Tasmania and the mainland. For example, its availability reduces when temperatures at the George Town Convertor Station in northern Tasmania exceed 33ºC and is reduced to 0 MW when temperatures exceed 35ºC. These protection mechanisms were activated on 29 and 30 January 2009, when temperatures at the George Town Converter Station reached 37.2ºC and 37.5ºC respectively. Accordingly, the reduction in Basslink's availability on 29 and 30 January was consistent with its operational design.

8 MCE, *Communiqué*, Canberra, 6 February 2009, p. 1.

1.2 Review Requirements

1.2.1 MCE Direction

On 28 April 2009, the MCE directed the Commission to conduct a review of the effectiveness of National Electricity Market (NEM) security and reliability arrangements in light of extreme weather events (MCE Direction).[9] The MCE Direction, which includes the terms of reference for the review, is reproduced at Appendix C.

The MCE Direction required the Commission to, in the context of extreme weather events such as droughts, heatwaves, storms, floods and bushfires:

- examine the current arrangements for maintaining the security and reliability of supply to end users of electricity and assess the capability of those arrangements to maintain adequate, secure and reliable supply;
- provide advice on the effectiveness of, and options for, cost-effective improvements to current security and reliability arrangements; and
- if appropriate, identify any cost-effective changes to the market frameworks that may be available to mitigate the frequency and severity of threats to the security and reliability of the power system.

The MCE Direction required the Commission to focus primarily on the security and reliability performance of those elements of the NEM that are currently within the national energy framework, that is, the generation and transmission elements of NEM. While the MCE Direction invited the Commission to make observations about distribution networks, it noted that matters concerning the reliability and security performance of distribution networks in the NEM (including network planning standards) are determined and monitored by jurisdictional bodies.

The MCE Direction required the Commission to provide an Interim Report by 29 May 2009, reporting on measures that are currently under consideration that would improve system reliability and security. In the Interim Report, the Commission was also required to identify and report on any further cost-effective measures that could be taken to improve system reliability for the summer of 2009/10.

The MCE Direction required the Commission to provide a Final Report by 30 October 2009. This report would investigate and report on cost-effective changes that could be made to energy market frameworks to improve reliability in the longer term and enable reliability to be managed more effectively during future extreme weather events.

9 Under section 41(1)(a) of the National Electricity Law, the MCE may give a written direction to the Commission requiring the Commission to conduct a review into any matter relating to the national electricity market.

1.2.2 First Interim Report

The Commission submitted its First Interim Report to the MCE on 1 June 2009. This report outlined recent improvements and measures being developed to further improve the ability of the NEM to withstand extreme weather events in the future. The First Interim Report also identified five key areas in which the Commission would investigate further for the Final Report, including:

- demand and capacity forecasting;
- provision of information to the market;
- market mechanisms
- generator and network technical standards; and
- financial network incentives.

1.2.3 Revised MCE Direction

On 14 August 2009, the MCE directed the Commission (revised MCE Direction) to provide a Second Interim Report as part of the Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events. The revised MCE Direction is reproduced at Appendix D.

In the Second Interim Report, the Commission is required to address specific questions relating to the NEM Reliability Standard and NEM Reliability Settings. Specifically the Commission is required to:

Provide the following information:

(i) a comparison of historical NEM reliability forecasts with outcomes that occurred in the first ten years of the NEM (averages and extremes);

(ii) the expected distribution of reliability outcomes, particularly the frequency of extreme load shedding, that are implicit in forecasts of average levels of reliability in the NEM;

(iii) an analysis of the reliance that may be placed on NEM reliability forecasting methods, taking into account the outcome of (i) and (ii), sensitivity analysis and other relevant considerations; and

(iv) Modelling projections of the price-reliability trade-offs of a phased increase in the NEM market price cap (MPC) to:

   a. An interim level of $20,000 per MWh;

   b. The current value of customer reliability in the study by CRA International dated 12 August 2008 for VENCorp; and

   c. Any other level that the AEMC decides is relevant to the MCE's consideration.

Provide advice on:

(i) whether the NEM Reliability Standard has been interpreted to date either as a maximum which cannot be exceeded, or as a mean which is not to be exceeded over a number of years;

(ii) the appropriate specification and interpretation of the NEM Reliability Standard in the future;

(iii) the appropriate roles for the MCE, the AEMC, AEMO, and the Reliability Panel in policy decision-making on reliability standards; and

(iv) the feasibility of mechanisms for recognising differences in jurisdictional expectations regarding the price-reliability trade-off and delivery outcomes consistent with those expectations.

The Commission is required to provide the Second Interim Report to the MCE by 18 December 2009. The MCE extended the timing for the Final Report to 30 April 2010.

1.3 Structure of the Interim Report

The Interim Report is structured in the following way:

- **Chapter 1 –** Introduction and background to the review
- **Chapter 2** – Context
- **Chapter 3** - MCE questions relating to information
- **Chapter 4** – MCE questions in relation to advice
- **Appendices**

2 Context

> The revised MCE Direction requires an examination of reliability forecasting, the reliability standard, and the key reliability settings. These relate specifically to the adequacy of installed generation and the inter-regional transmission network (that part of the transmission network that transports generation between regions). Accordingly, this Second Interim Report only focuses on one contributing element to end-user electricity supply continuity.
>
> It is important to note that the majority of end-user supply interruptions originate from the distribution network or intra-regional parts of the transmission network (that part of the transmission network that transports generation within regions), and are thus not covered by the reliability standard.
>
> In our Final Report to the MCE for this review, we will be considering all aspects of end-user supply continuity.

The revised MCE Direction requires an examination of reliability forecasting, the reliability standard, and the key reliability settings[10]. As discussed in this section of the report, these all relate to one aspect of the electricity supply chain, that is, generation.

The revised MCE Direction also requires an examination of one particular mechanism for delivering a higher level of reliability, that is raising the market price cap.

Thus this Second Interim Report contains a focussed investigation of one contributing element to end-user electricity supply continuity, and one particular solution.

2.1 The Reliability Standard

Reliability in the NEM is a measure of the adequacy of the electricity generating systems and networks to meet the demand of consumers. Reliability depends on:

- whether there is sufficient generation available to a given region of the NEM to meet the consumer demand in that region; and
- the availability and adequacy of the transmission and distribution networks.

Reliability of the generation sector is measured by the reliability standard. The reliability standard is a measure of the maximum amount of energy that can be at risk of not being delivered to consumers due to a lack of available capacity.

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10 As explained in Section 12.2, the reliability settings include the market price cap, the market price floor, and the cumulative price threshold.

The level of the reliability standard specifies how much unserved energy (USE) is acceptable as a percentage of annual demand. The level is currently set at a maximum of 0.002% of USE per annum measured over the long term. This equates to the interruption of supply to every customer in a region for approximately 10 minutes each year[11]. The reliability standard is measured over the long term because it is not possible to guarantee that USE will not exceed 0.002% in any one year. A particularly onerous combination of random equipment failures, or a very high demand peak, could result in USE greater than 0.002% in a year. The reliability standard is designed to deliver an expectation of 0.002% USE in a year, however USE will be greater than 0.002% in some years and will be less than 0.002% in other years. The reliability settings for the NEM are designed such that on average over the long term the power system will achieve 0.002% USE.

In terms of the electricity supply chain, the standard currently includes generation and those transmission components that contribute to inter-regional transfer capability. The standard excludes distribution and those transmission components that do not impact on inter-regional transfer capability. In terms of events, the standard currently excludes power system security incidents[12] and exogenous incidents such as industrial action and terrorism.

The reliability standard is measured using a moving average of the actual observed levels of annual USE for the most recent ten financial years. However operationally, AEMO aims to achieve the reliability standard in each financial year, for each region and for the NEM as a whole.

2.2 Market Mechanisms to Implement the Reliability Standard

The MPC, the market price floor and the Cumulative Price Threshold (CPT) are the key price mechanisms within which the wholesale spot market seeks to balance supply and demand, and deliver capacity to meet the reliability standard.

The NEM reliability settings as they apply from 1 July 2010 are depicted graphically in Figure 1 below. The reminder of this section describes the settings and their interaction with the reliability standard.

11 In practice, supply interruptions are not evenly spread across users.

12 AEMO is required to operate the power system in a secure state such that if a single credible contingency occurs, such as the loss of a transmission line, loss of a generating unit or generating system, the system will continue to operate in a satisfactory manner. A power system security incident is said to occur if a non-credible contingency occurs or multiple contingencies occur. An example of this might be a lightning strike or a bushfire. A major power system security event is often associated with involuntary disconnection of customer load by emergency control schemes or instructions from AEMO.

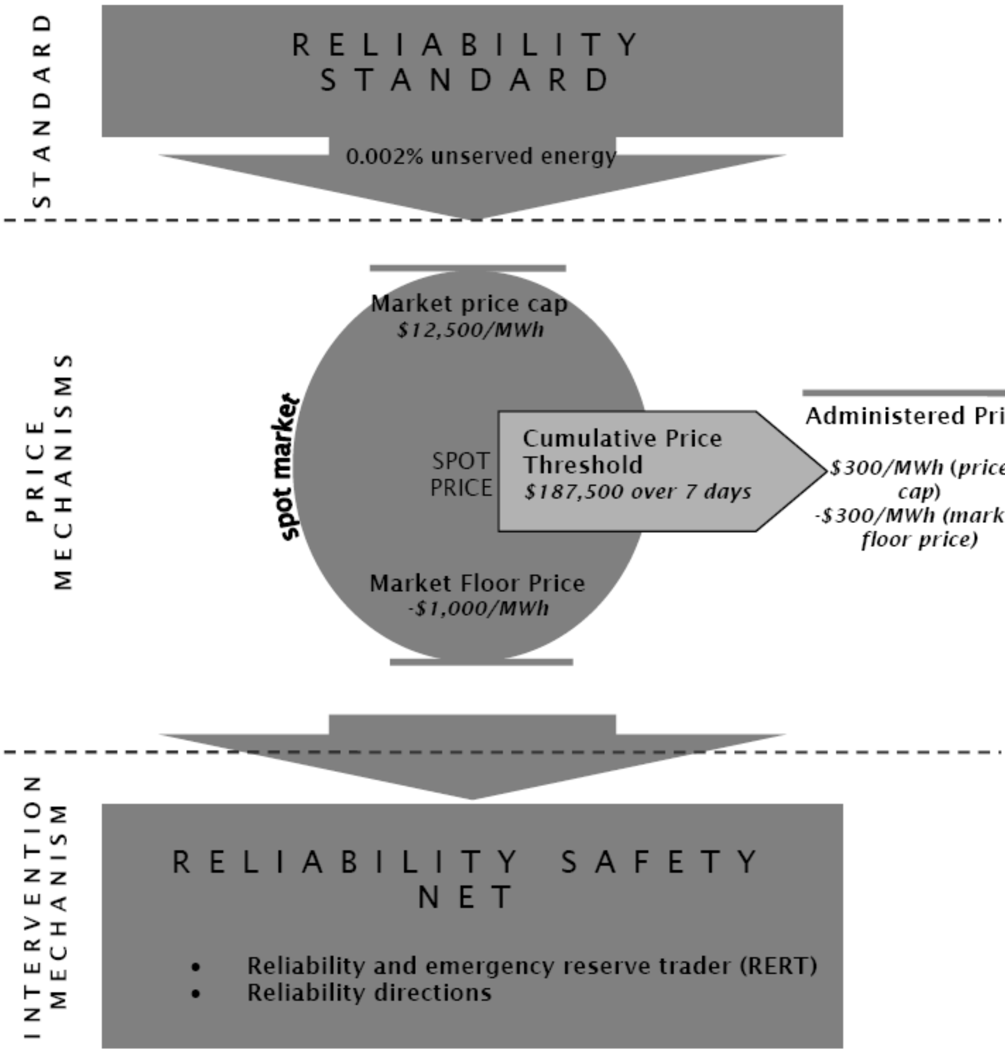

Figure 1 - NEM reliability settings that apply from 1 July 2010

2.2.1 Market price cap and market floor price

The MPC is currently set at $10,000/MWh, but will rise to $12,500 on 1 July 2010.[13] The market price floor is currently set at -$1,000/MWh. The level of the MPC and the market price floor are crucial because they provide key signals for supply and demand-side investment and usage.

If prices were not capped, then prices at peak times could rise to unacceptably high levels for consumers and retailers. Electricity wholesale markets need to be balanced in real time, and it not feasible for consumers to respond to price spikes at very short notice. Furthermore, the required technology is not generally available, and the

[13] From 1 July 2010 the level of the MPC is scheduled to increase to $12,500/MWh as part of the *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No. 13*, available at www.aemc.gov.au/Electricity/Rule-changes/Completed/NEM-Reliability-Settings-VoLL-CPT-and-Future-Reliability-Review.html

transactions costs are currently prohibitively high. Hence, if consumers cannot reveal their willingness to avoid very high prices through their consumption decisions, then there is a case for imposing a regulated proxy to limit the maximum price that consumers are exposed to. Another important rationale for capping prices is that it limits the overall risk for market participants to manage in providing a more stable price for consumers under a retail tariff.

The choice of this regulated spot market price will affect the economics of prospective new generation investment. The specific risk from a reliability perspective is that the price cap is set too low, such that it is not economic to build peaking generation consistent with meeting the reliability standard.

The means by which spot market prices signal the efficient mix of generation capacity, and the potential impact of a regulated price cap, can be illustrated through Figure 2 and Figure 3 below. They use the concept of a price duration curve. This plots how many hours in a year the spot market price is above a given level. The shape of the price duration curve depends significantly on the shape of the underlying time-profile-of-demand.

For any given pattern of demand over time, there will be an associated optimal mix of generation. Figure 2 illustrates this. The proportion of demand that does not change over time is most efficiently served by baseload technologies, predominately coal-fired generation to date in Australia. Baseload technologies are characterised by high initial capital costs and relatively low running costs. The proportion of demand which varies but is predictable, for example the periods of higher demand in weekday mornings and evenings, is most efficiently served by mid-merit plant such as combined cycle gas turbines (CCGTs). These plant generally have lower capital costs and more flexibility, but higher running costs, than baseload generators. The final proportion of demand that is highly uncertain, for example the peak hours during the hottest summer day, is most efficiently served by peaking plant such as open cycle gas turbines (OCGTs). These plant have low capital costs but high operating costs because of their relative technical inefficiency.

An efficient mix of generation is one which minimises the total cost of meeting demand. The shape of the demand profile is a key consideration. For example, a relatively flat demand profile implies a greater role for baseload generation, while a very peaky demand profile implies a greater role for peaking generation.

Whenever the price is above the immediate costs of operation (e.g. fuel, maintenance) for a particular generator, that generator is making a contribution to its fixed costs (including a return on capital employed). The expected level of these payments will determine whether it is economic or not to enter the market. It will also determine what mix of baseload, mid-merit and peaking generation is most economic, i.e. minimises costs, given the underlying profile of demand.

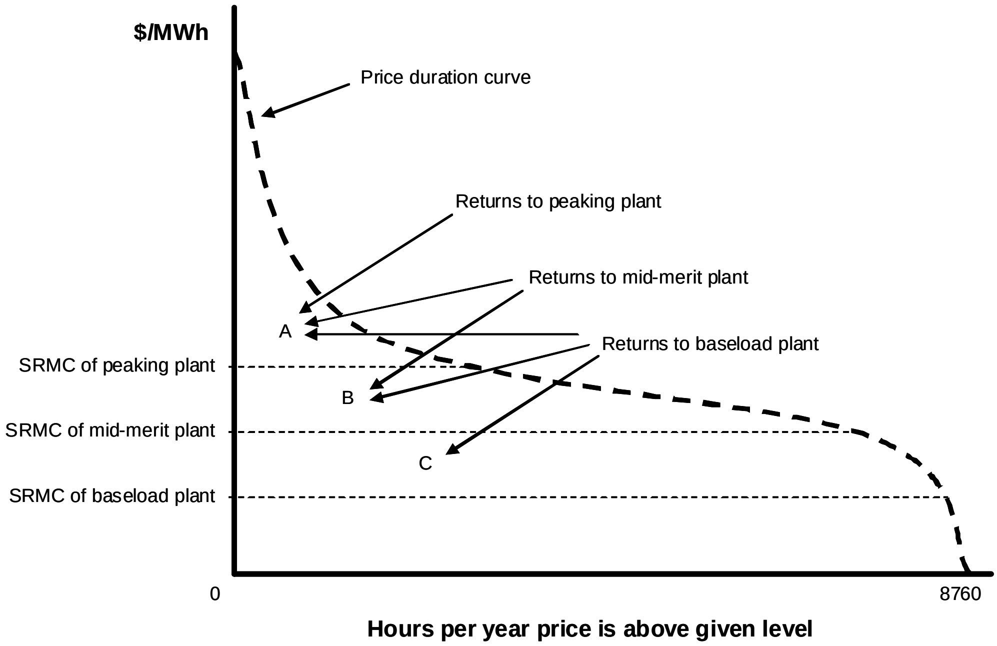

Figure 2 – Relationship between the price duration curve and generation mix

The imposition of a regulated maximum price changes the signals provided through the spot market. Specifically, it constrains the potential returns to peaking plant. This is illustrated in Figure 3. This means that less peaking capacity will be built, or will enter later, relative to if the market price was uncapped. However, a regulated maximum price is designed to address the risk that too much capacity would be built if the market were uncapped (driven by unacceptably high peak prices). It also places a limit on the overall risk exposure for the market as a whole, recognising the associated costs of managing such risks.

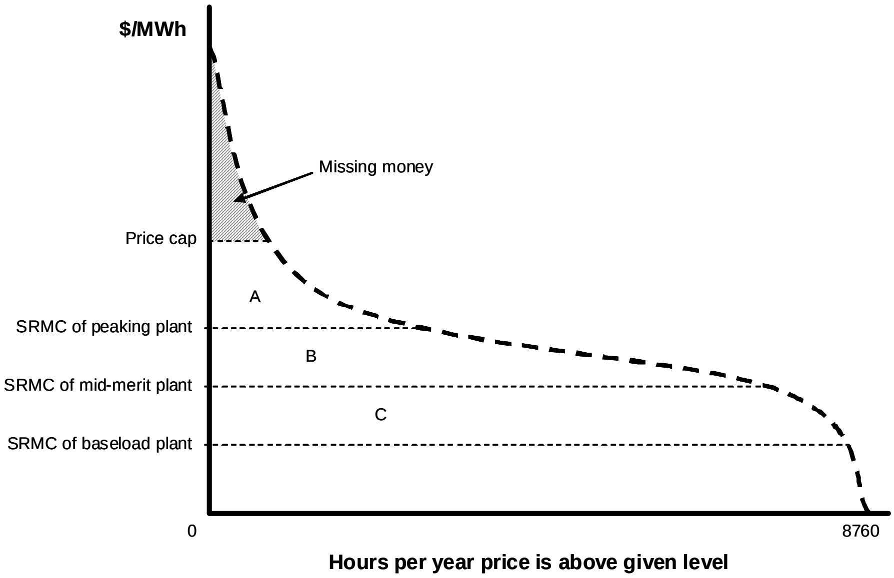

Figure 3 - Regulated maximum price in the spot market

The challenge of maintaining the reliable performance of the NEM then becomes an empirical question as to what level of price cap is likely to deliver a level of generation capacity consistent with meeting the reliability standard. While the price cap has the effect of reducing expected revenue from the market, the objective is to limit the "missing money" to investment that is over and above what is required to support investment consistent with meeting the standard.

Under the current framework, there is an independent, evidence-based framework for reviewing and amending the settings. The Reliability Panel assesses and reviews each of these parameters for consistency with the reliable operation of the market. Where the Reliability Panel considers changes are warranted, it submits a Rule change proposal to the AEMC. If the AEMC agrees that the proposed changes meet the Rule making test set out in the National Electricity Law (NEL), then the changes are implemented in the Rules. The recent decision by the Commission to, among other matters, increase the market price cap from $10,000/MWh to $12,500/MWh from 1 July 2010 is an example of this process in operation.[14]

2.2.2 Cumulative price threshold

The CPT is an explicit risk management mechanism designed to limit participants' exposure to protracted high prices in the wholesale spot market. It is currently set at $150,000, but will rise to $187,500 on 1 July 2010.[15] If the sum of the half-hourly wholesale market spot prices over a rolling seven-day period exceeds this threshold, AEMO must impose an Administered Price Cap (APC) until sustained high prices fall away. The APC is specified in a schedule published by the AEMC. The APC is currently $300/MWh (and - $300/MWh for the administered price floor) for all regions of the NEM, for all time periods.

2.3 Minimum Reserve Levels

To determine whether the NEM is likely to meet the reliability standard, operational and planning decisions are made on a continuous basis. To allow these continuous decisions to be made, it is necessary to convert the 0.002% USE standard into an equivalent minimum reserve level (MRL), such that, it is expected that the reliability standard will be met if the reserves in a given region exceed the MRL for that region. That is, the MRLs "provide AEMO with an operational indicator as to whether each region is expected to meet the reliability standard. When a region's reserve margin falls below the MRL, AEMO may intervene in the market to maintain power system reliability."[16]

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14 AEMC 2009, *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009*, Final Rule Determination, 28 May 2009, Sydney.

15 From the 1 July 2010 the level of the CPT is scheduled to increase to $187,500/MWh as part of the *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No. 13*, available at http://www.aemc.gov.au/Electricity/Rule-changes/Completed/NEMReliability- Settings-VoLL-CPT-and-Future-Reliability-Review.html

16 AEMO, *Electricity Statement of Opportunities*, 2009, section 5.2.

The MRL is defined in terms of the minimum level of installed generating capacity and assumed interconnector support in excess of the 10% probability of exceedence (POE)[17] maximum demand in each region of the NEM required to achieve 0.002% expected USE in all regions simultaneously over a financial year.

2.4 Performance of the NEM against the Reliability Standard

This section of the report explores the performance of the NEM against the reliability standard since the NEM's inception, and explores the role of the reliability standard and reliability settings in the context of overall end-user supply continuity.

Since its inception in 1998, the NEM has performed well against the reliability standard. Table 2.1 below shows the performance of the NEM against the reliability standard for the past 10 years.

	Qld	NSW	Vic	SA	Tas
2008-2009	0.0000%	0.0000%	0.0040%	0.0032%	0.0000%
2007-2008	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
2006-2007	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
2005-2006	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
2004-2005	0.0000%	0.00005%	0.0000%	0.0000%	0.0000%
2003-2004	0.0000%	0.0000%	0.0000%	0.0000%	
2002-2003	0.0000%	0.0000%	0.0000%	0.0000%	
2001-2002	0.0000%	0.0000%	0.0000%	0.0000%	
2000-2001	0.0000%	0.0000%	0.0000%	0.0000%	
1999-2000	0.0000%	0.0000%	0.0004%	0.0019%	
Average	**0.0000%**	**0.0000%**	**0.00044%**	**0.00051%**	**0.0000%**

Table 2.1 Regional USE for the past 10-years

As illustrated above, the average annual USE over the past 10 years is well within the reliability standard of 0.002% for all regions and for the NEM as a whole.

While the USE in Victoria and South Australia for 2008-09 was above 0.002%, this was still relatively low considering the severity of the conditions experienced. The conditions that lead to the 2008-09 load shedding event have been estimated by AEMO as a 1 in 20 year event. As is discussed in Section 3.2 , this would be expected to result in significant USE. As the reliability standard is measured over a 10-year period, Victoria and South Australia could experience a load shedding event similar

17 The probability, as a percentage, that a maximum demand level will be met or exceeded (for example, due to weather conditions) in a particular period of time. For example, for a 10% POE maximum demand for any given season, there is a 10% probability that the corresponding 10% POE projected maximum demand level will be met or exceeded. This means that 10% POE projected maximum demand levels for a given season are expected to be met or exceeded, on average, 1 year in 10.

to that of January 2009 every second year and still remain within the reliability standard.

Table 2.1 shows that the NEM reliability settings (primarily the MPC) and AEMO in its operational capacity have delivered a high level of reliability in the NEM (measured against the reliability standard). However past performance is not necessarily a guide to future performance when the power system will need to be sufficiently resilient to cope with changing demand and possible changing weather patterns. The forecasts used to derive the NEM reliability settings include an allowance for small increases in temperature to account for climate change, but do not model increased severity or frequency of extreme weather.

The 2009 Electricity Statement of Opportunities (ESOO) indicated that Victoria and South Australia are the regions most likely to first experience a reserve shortfall. Between the 2008 and 2009 publications of the ESOO, new investment in generation and a reduction in demand forecasts in Victoria and South Australia have lengthened the projected years until reserve shortfall in Victoria and South Australia from 0-years (2008 ESOO) to 3-years (2009 ESOO).[18] The ESOO uses very high demand forecasts (the 10% POE). Thus if a period of extreme weather such as occurred in Victoria and South Australia in January 2009 (which was estimated at more extreme that 10% POE) were to occur again within 3 years, then it is possible that Victoria and South Australia would experience reserve shortfalls and a heightened risk of supply interruption.

2.5 Whole of Power System Reliability

Customers who experience supply interruptions are unlikely to be concerned with the "type" of supply interruption. However under the NEM design, supply interruptions are categorised according to their source (either generation, transmission network or distribution network) when assessing the performance of the power system. This enables more targeted incentive mechanisms to be developed to efficiently deliver power system performance consistent with end-user expectations. They are also categorised into reliability events (generally caused by a lack of investment) or security events (generally caused by equipment failure).

2.5.1 Origin of Supply Interruption

Supply interruptions can originate from either the NEM's generation fleet, the transmission network, or the distribution network. Supply interruptions within the generation and transmission sectors account for less than 10% of the duration of all interruptions to supply. In contrast disruptions to supply within distribution networks account for over 90% of the duration of all interruptions to supply.[19]

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[18] AEMO, Electricity Statement of Opportunities 2009, Melbourne, 2009, p.1.

[19] Australian Energy Regulator, *State of the Energy Market 2008*, Melbourne, 2008, p. 156.

Generation originated supply interruptions

Supply interruptions that originate from the NEM's generation fleet are assessed against the reliability standard. Investment in generation to satisfy the reliability standard is signalled through publications such the ESOO, and is incentivised through the reliability settings (i.e. the MPC).

Transmission originated supply interruptions

Supply interruptions that originate in the inter-regional components of the transmission network (i.e. that component of the transmission network that transports electricity between regions) are also assessed against the reliability standard. The reliability standard is a regional standard, and it can be efficient for the reliability standard to be satisfied in a region by generation from another region. It is thus important for there to be sufficient transmission capability to transfer generation into the region relying on inter-regional generation. Supply interruptions that originate in the intra-regional areas of the transmission network are not assessed against the reliability standard.

However, investment in transmission is not directly incentivised through the reliability settings. Transmission investment (both inter-regional and intra-regional) is driven by the regulatory framework in the Rules and its application by the Australian Energy Regulator (AER) in its periodic decisions on regulated revenues and prices. Transmission Network Service Providers (TNSPs) must invest so that their networks achieve transmission reliability standards[20] that are currently set by jurisdictions. However there is no direct obligation on TNSPs to invest in interconnector capability.

TNSPs can receive a regulated return on investment in inter-regional transmission capability if it can be demonstrated that the investment meets the Regulatory Investment Test for Transmission (RIT-T)[21]. In addition to a TNSP's analysis of transmission capability, AEMO will identify any need to strengthen inter-regional transmission capability in its National Transmission Network Development Plan[22]. However there is nothing to compel a TNSP to strengthen the capability of its inter-regional network. The AEMC may direct a TNSP to perform the RIT-T on an inter-regional network augmentation under its last resort planning power[23], however the AEMC cannot direct a TNSP to undertake the investment.

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20 On 30 September 2008, we submitted our Final Report for the *Transmission Reliability Standards Review* to the MCE. This report recommended a nationally consistent framework for transmission reliability standards, under which the standards would be economically derived and developed in a nationally consistent form. However the levels of standards would be allowed to vary between classes of customer and between regions.

21 See clause 5.6.5B of the Rules.

22 See clause 5.6A of the Rules.

23 Under clause 5.6.4 of the Rules.

Distribution originated supply interruptions

Distribution network interruptions generally occur without prior notice and it is generally not possible to give consumers advance warning of a disruption. When a supply interruption does occur, it usually persists until the network is repaired or replaced. Distribution reliability standards are generally less conservative than for transmission and generation, and thus less redundancy is built into distribution networks. This increases the likelihood of supply interruptions following equipment failure relative to transmission or generation failures. In addition, less redundancy in the network means that the burden of the interruption is unlikely to be able to be shared by other consumers.

Supply interruptions that originate within the distribution network are not assessed against the reliability standard. Matters concerning the reliability and security performance of distribution networks in the NEM (including network planning standards) are determined by jurisdictional bodies.[24]

Whole of System Reliability

The revised MCE direction (for the Second Interim Report) requires us to investigate reliability forecasting, the reliability standard, and the key reliability settings, all matters relating to the adequacy of generator capacity. As such, this Second Interim Report focuses primarily on the reliability of the generation sector. That is, the reliability of the transmission and distribution networks are not addressed in the specific questions for this Second Interim Report and will be covered in the Final Report.

As noted above, the generation sector has been quite reliable since market start. Therefore it could be concluded that there would be little benefit to end-users by further improving the reliability of the generation sector relative to making improvements to the reliability of the distribution sector which currently accounts for over 90% of end-user supply interruptions. However this may not necessarily be the case. It is far easier to build redundancy into the generation sector as the loss of a generator in Queensland can be covered by a generator in Tasmania or South Australia. However it is prohibitively expensive to build redundancy into many parts of the distribution system, and some of the redundancy that does exist requires manual switching which results in delays to power restoration.

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24 With the transfer of economic regulation of distribution networks to the national framework, decisions on financing of capital, maintenance programs and the suite of financial incentives to maintain distribution reliability will be made by the AER.

On 23 September 2009, we submitted our Final Report for the *Review of National Framework for Electricity Distribution Network Planning and Expansion* to the MCE. This report recommended that the MCE request the AEMC to undertake a review of distribution security and reliability standards to assess whether greater national consistency in the methods for describing and applying standards would deliver benefits. We did not consider that harmonisation of the existing jurisdictional security and reliability obligations is appropriate. As the performance of networks are directly attributable to the network characteristics and the resources which are invested, it is appropriate for the standards to differ across jurisdictions.

For example, if customers were willing to spend an extra dollar to improve reliability at the connection point level, would that dollar deliver the largest improvement in reliability if invested in generation, transmission or distribution, or some combination of all three.

The reliability standards for delivering investment in each element of the supply chain are currently set independently of each other, with no consideration given to how to most efficiently deliver reliable supply at the connection point across all elements of the supply chain. For the Final Report, we intend to take a holistic look at whether investment is currently being apportioned between the various elements of the supply chain to deliver the most optimal reliability outcome for end-users.

It is also important to note that to deliver an improvement in reliability from the generation sector, it is likely that the reliability of the transmission sector would also need to be improved. Thus if the reliability standard (for generation) is tightened, then the reliability standards for transmission would most likely need to be correspondingly tightened.

2.5.2 Reliability versus Security Events

Supply interruptions can be caused by either reliability events or security events. In reality, the boundary between reliability events and security events is not clear-cut. But for the purposes of the reliability standard, the boundary can be thought of as follows.

Reliability events

Reliability events are generally caused by lack of investment. Therefore a supply interruption caused by a lack of installed generation to meet a demand peak would be classified as a reliability event. As the NEM is planned to maintain continuous supply following the loss of a single generating unit, these such events are also classified as reliability events. The NEM is also planned to maintain continuous supply following the loss of one major item of transmission plant (e.g. a transmission line or transformer), and as such these events are also classified as reliability events.

Security events

Security events are generally caused by equipment failure. For example, a power system disturbance that trips a number of generating units at the same time would be classified as a security event.

Reliability events assessed against the reliability standard

Only supply interruptions caused by reliability events are assessed against the reliability standard. This is to ensure that only events that can be efficiently mitigated by new investment in generation or inter-regional transmission are counted against the standard. The main mechanism for delivering investment to meet the reliability standard is the level of the MPC. It would be inefficient to raise the MPC to deliver increased investment in generation to address supply interruptions caused by faults in the transmission network. Supply interruptions caused by transmission faults would be more efficiently addressed though more targeted mechanisms such as well specified technical standards and performance incentives and penalties for transmission owners.

The distinction between reliability events and security events is important in the context of extreme weather. Supply interruptions caused by extreme weather events such as high temperatures (resulting in high demand and generator degradation) would be classified as reliability events and thus assessed against the reliability standard. However supply interruptions caused by extreme weather events such as bushfires or storm activity (which may result in the tripping of multiple inter-regional transmission lines) would generally be classified as security events, and would thus not be assessed against the reliability standard.

2.6 Types of Supply Interruptions covered by this Second Interim Report

As discussed above in Section 2.5, end-user supply interruptions are categorised on the basis of the origin of the interruption, and the cause of the interruption. Supply interruptions can be grouped into the five categories below:

1. Inadequate available generation capacity to meet demand due to inadequate investment (supply interruptions caused by the unplanned loss of a single generating unit are included in this category because the NEM is designed to incentivise adequate investment in generation to maintain continuous supply following the unplanned loss of a single generating unit);

2. Inadequate available generation capacity to meet demand due to unplanned loss of multiple generators (such as due to plant failure);

3. Inadequate installed transmission capacity to deliver generation to consumers under normal system conditions or following the loss of one major item of transmission plant such as a transmission line or transformer (the NEM is designed to withstand the loss of one major item of transmission plant);

4. Inadequate installed transmission capacity to deliver generation to consumers following a failure in the transmission system (other than a failure specified under category 3); and

5. Distribution initiated events;

The reliability standard and settings apply only to category 1 and some of category 2 above (only those parts of the transmission system that transfers generation between regions – known as the bulk supply system).

Thus, the issues being considered in this Second Interim Report would address only some of the supply interruptions caused by extreme weather events. Table 2.2 below shows that AEMO managed 5 involuntary load shedding events in 2008-09.

22 January 2009	Approximately 786 MW of load lost in North Queensland. Caused by faults on and subsequent tripping of the Ross-Strathmore transmission lines.
29 - 30 January 2009	Approximately 280 MW of load lost in Victoria, and 140 MW of load lost in South Australia on 29 January 2009. Approximately 340 MW of load lost in Victoria, and 90 MW of load lost in South Australia on 30 January 2009. Caused by insufficient generation or interconnector capability to meet extreme demands.
30 January 2009	Approximately 1200 MW of load lost in Victoria. Caused by the unplanned outages of the South Marang to Keilor and South Marang to Sydenham 500 kV transmission lines.
7- 8 February 2009	Approximately 200 MW of load lost in Victoria. High temperatures, low humidity, strong winds, bushfires, and lightning caused the reduction of some transmission elements and the tripping of other transmission assets.
8 March 2009	Approximately 178 MW of load lost in Far North Queensland. Electrical storms caused the tripping of some transmission lines.

Table 2.2 - Involuntary load shedding events – 2008-09

The analysis above shows that inadequate installed generation capability contributed to just one load shedding event in 2008-09. The other load shedding events were all due to security events or intra-regional transmission faults. As such, of the major load shedding events in 2008-09, just one counted towards the reliability standard as all the others could not be efficiently mitigated by increased investment in generation.

3 MCE Request for Information

The revised MCE Direction requested information in four specific areas. These are addressed in this section of the report.

3.1 Historical NEM Reliability Forecasts

MCE Direction

The revised MCE Direction requested a comparison of historical NEM reliability forecasts with outcomes that occurred in the first ten years of the NEM (averages and extremes).

Commission Response

The primary purpose of reserve projections is to elicit a market response to address projected reserve shortfalls (such as investment or rescheduling plant outages). A desirable outcome would be for a projected reserve shortfall to never eventuate due to the actions of participants in response to the projections.

It is therefore difficult to assess the performance of the NEM's reserve projections by comparing the projections to actual outcomes, because what may appear to be a large error, may in fact be a sign that the reserve projection has been effective at delivering a market response.

We consider that the performance of the reserve projections could be assessed by asking market participants and AEMO how useful they find these projections. We intend to consult on this question and will report findings in our Final Report.

In response to the high temperatures in Victoria and South Australia in January 2009, AEMO has identified improvements to its demand forecasting to better capture the impact of extreme temperatures in reserve projections.

We consider that there could be merit in requiring AEMO to conduct a comprehensive annual reserve assessment for each regions peak demand period. This would provide policy makers, AEMO, and participants more detailed information on which to base mitigation and management plans for potential supply interruptions. We intend to investigate this further for the Final Report.

AEMO operates a number of processes to assess the likelihood that supply availability will be sufficient to meet demand at various points of time in the future. These can be broadly classified as either deterministic or probabilistic reserve projections. These are explained and discussed below.

3.1.1 Deterministic Reserve Projections

Deterministic models are models in which the outcomes are precisely determined though known relationships among states and events, without any room for random variation. In such models, a given input will always produce the same output.

Deterministic reserve projections assess whether expected supply availability is sufficient to satisfy forecast demand plus a pre-determined reserve margin. In the NEM the pre-determined reserve margin is the MRL (as discussed in Section 2.3). Deterministic modelling is much quicker and simpler to execute than probabilistic modelling, and is as such well suited to reserve projections that require regular updating.

AEMO operates a number of deterministic reserve projections covering a range of timeframes. The reserve projections from each of these processes is compared to the MRL for each region to determine whether projected reserves are sufficient such that there is an expectation that the reliability standard would be met. These reserve projections are discussed below.

Electricity Statement of Opportunities (ESOO) - is prepared annually and provides a ten year reserve projection for both summer and winter maximum demand conditions.

Medium-Term Projected Assessment of System Adequacy (MTPASA) - provides reserve projections at a daily resolution for a two year outlook period. MTPASA results are updated weekly.

Short-Term Projected Assessment of System Adequacy (STPASA)[25] - provides reserve projections at a half-hourly resolution for a one week period. The STPASA results are updated every two hours.

Pre-dispatch Projected Assessment of System Adequacy (PDPASA) - provides reserve projections at a half-hourly resolution for up to thirty-six hours ahead. The PDPASA results are updated every half hour.

The primary purpose of these projections is to:

- inform NEM participants and potential investors of potential periods of low reserves, which would likely correspond to periods of high prices, in order to elicit a market response such as the rescheduling of a planned maintenance outage; and
- inform AEMO of potential periods of low reserves so that AEMO can take action to strengthen reserve levels by:
  - publishing lack of reserve notices to the market;
  - speaking to NEM participants (including TNSPs) about rescheduling planned outages;

25 STPASA and PDPASA also project the reserve outcome following the loss of the largest single generating unit in each region.

- contracting for reserves through the Reliability and Emergency Reserve Trader (RERT)[26] provisions; or
- directing participants to make plant available.

Appendix B provides a comprehensive comparison of the reserve projections provided by these tools with actual reserve outcomes.

Whilst this data provides an interesting insight into the operation of these tools, it does not provide a meaningful assessment of the performance of each projection in servicing their intended purposes.

The main reason for this is that these projections are designed to elicit a market response when reserve shortfalls are projected. Ideally a reserve shortfall signalled in one of the above projections would never eventuate because the market (influenced by the projection and the potential for a high spot price) should respond to that signal. A reserve shortfall projected in the ESOO signals an opportunity for investment. New investment in generation or demand side management would generally be made before the ESOO reserve shortfall eventuates. A reserve shortfall projected in one of the PASAs signals an opportunity to potentially benefit from higher prices. Participants would generally reschedule planned outages to make more equipment available for this period, thus reducing the likelihood of reserve shortfalls.

Differences between reserve projections and actual reserve outcomes can also be due to inaccuracies in demand forecasts. In the ESOO and MTPASA timeframe, it is not possible to meaningfully forecast demand 10 years ahead. As such the high 10% POE demand forecast is used.

It is thus difficult to meaningfully compare reserve projections over different timeframes to actual reserve outcomes as the reserve projections can change significantly as the market responds to the reserve projections.

Electricity Statement of Opportunities

If the market design is working, and the need for new investment is being appropriately signalled and incentivised, then the reserve shortfalls projected in the ESOO should never eventuate. From this perspective, there is little value in comparing the ESOO projections to actual outcomes.

Figure 1 below illustrates the years until reserve shortfall projected for each publication of the ESOO. To simplify the chart, Tasmania has not been included because Tasmania is not capacity constrained but rather energy constrained. The ESOO only considers capacity and cannot indicate a reserve shortfall due to energy limitations. As such the ESOO generally projects adequate reserves for the full

[26] The RERT is a mechanism through which AEMO can contract reserves when it determines that it is likely that reserves in the market will be insufficient to achieve the reliability standard. The RERT is provided for under rule 3.20 of the Rules.

ESOO outlook period for Tasmania.[27] As illustrated, the ESOO projected years until reserve shortfall changes from year to year as new generation is committed to and demand forecasts are revised.

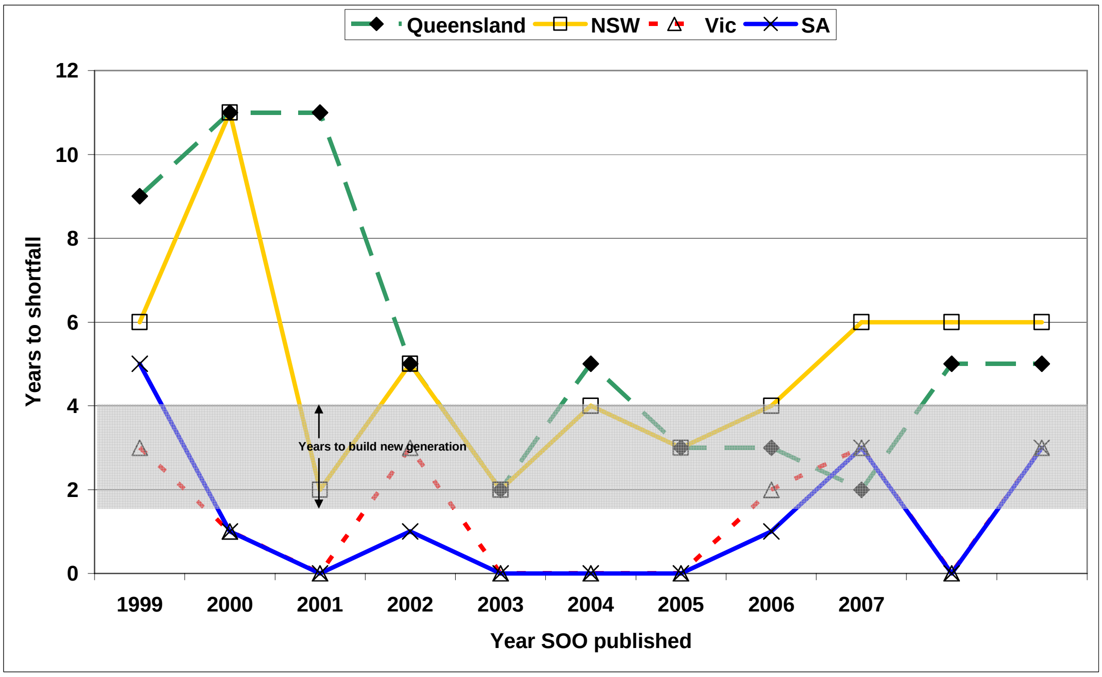

Figure 1 - SOO projected years until reserve shortfall

There would be value in examining whether the ESOO is providing useful information, and whether the market is appropriately responding to those signals.

As the reliability standard has been achieved over the first 10 years of the NEM, there is no reason to suspect that the ESOO isn't delivering useful information to the market. However we intend to consult NEM participants and AEMO to see if the ESOO is the best tool for signalling the need for and timing of new investment in the NEM, and whether any improvements could be made to the ESOO to improve its effectiveness. We will report the findings from this consultation to the MCE in the Final Report for this review.

Further observations of the data provided by the ESOO are contained in Appendix B.

Projected Assessment of System Adequacy

The reserve projections provided by the PASAs are extremely volatile and can change by over 1000 MW over the outlook period.

Figure 2 illustrates the MTPASA reserve projection for Victoria for 13 May 2009. This covers the full MTPASA timeframe from 2 years in advance down to very close to

[27] Except for the 2008 ESOO which was just before the commitment of a major new power station in Tasmania.

real time. This chart illustrates that reserve projections change considerably over this time from as much 3700 MW two years in advance, to a low point of about 1800 MW two hundred days in advance.

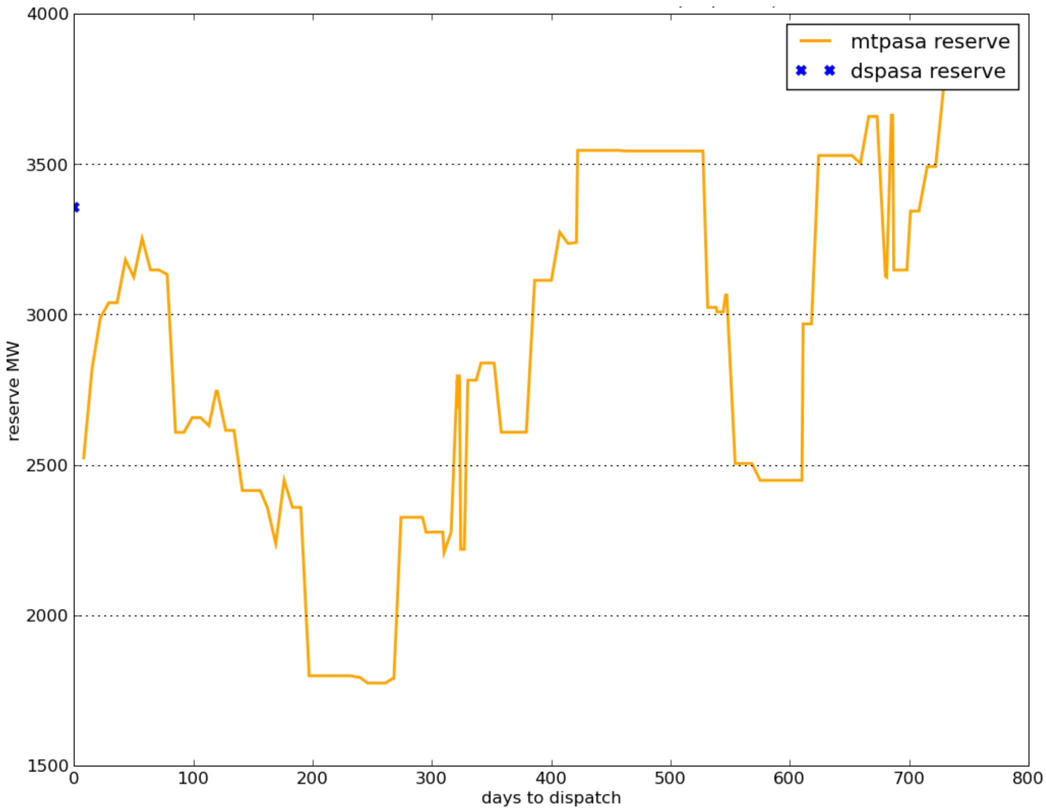

Figure 2 - MTPASA Reserve Projection for 13 May 2009 for Victoria

The two main inputs into PASA reserve projections are demand and generator availability. Volatility in generator availability is the majority contributor to volatility in reserve projections. However there are also considerable changes in demand forecasts over the outlook periods.

Volatility in generator availability is expected as generators adjust the timing of planned outages. Changes in forecast demand are also expected as better information becomes available closer to real time. Again for this reason, it is difficult to compare the PASA projections to actual outcomes. However, there would be value in examining whether the PASAs are providing useful information, and whether the market is appropriately responding to those signals.

NEM participants are best placed to comment on the how useful the information provided by the PASAs is, and whether improvements could be made to improve the usefulness of these reserve projections. As such we intent to consult NEM participants, and AEMO on its experience with the PASA projections, and will report the findings of this consultation to the MCE in the Final Report for this review.

We note that AEMO has commenced a number of projects to improve the accuracy of the PASAs. AEMO is investigating improvements in the accuracy of demand forecasts for very high demand days which are normally associated with periods of extreme temperatures. AEMO has also modified the methodology for developing MRLs to include an extreme demand scenario in its modelling, plant degradation associated with extreme weather, and high temperature wind farm thermal limitations. A full listing of the improvements that AEMO is making in response to extreme weather is provided at Appendix E.

Appendix B contains extensive analysis of the PASA projections of reserves, demand and generator availability.

3.1.2 Probabilistic Reliability Projections

Probabilistic models provide projections on the basis of historical data and the probability of an event occurring again. AEMO performs a number of probabilistic studies to assess likely reliability outcomes. AEMO uses Monte Carlo simulation, which models the probabilities of various power system events (such as generator forces outages), to determine the likely reliability outcome. AEMO performs two main probabilistic reliability studies, the Energy Adequacy Assessment Projection (EAAP), and adhoc probabilistic reliability studies.

Energy Adequacy Assessment Projection

The EAAP[28] is an information gathering and dissemination mechanism that was introduced to enable the market to forecast and respond to projected times where there may be energy constraints that would affect reliability. An example of such an energy constraint would be a drought that limits the generation from hydro generating units and thermal generating units that rely on cooling water from inland reservoirs.

AEMO is required to publish the first EAAP by 31 March 2010 and publish subsequent EAAPs every three months thereafter. The EAAP will provide projected levels of USE for each region for a two year period with a monthly resolution.

The purpose of the EAAP results will be to inform stakeholders, including market participants, of periods of low energy availability. It is anticipated that periods of energy scarcity, and hence projected high energy prices, would solicit a market response (which would then be expected to be reflected in MTPASA through changes to unit availability) such as rescheduling maintenance or reallocating scarce resources such as water for cooling or hydro generation.

Currently AEMO produces quarterly drought reports which study the potential impact of drought on the generating capacity of both hydroelectric and coal-fired plants operating in the NEM. The quarterly drought reports will be replaced by the EAAP from March 2010.

We have not reported on the results of the drought reports because the modelling for the EAAP is far superior to that used for the drought reports.

[28] Rule 3.7C describes the requirements for the EAAP.

Adhoc Probabilistic Reliability Studies

AEMO performs detailed probabilistic reserve studies when it considers it is necessary to obtain a more comprehensive assessment of the likely reliability outcome for a period. Such an assessment would generally be triggered by a reserve shortfall flagged in MTPASA. Probabilistic reserve studies provide more accurate estimates of likely reserves for a period than PASA, and can also derive probabilities for particular reserve outcomes.

In August 2008, MTPASA reserve projections for summer 2008-09 indicated reserve shortfalls of 168 MW in Victoria and no reserve shortfall for South Australia. In response to this projected reserve shortfall, AEMO performed a detailed probabilistic assessment of reserves for summer 2008-09.

The probabilistic studies forecast the expected USE for Victoria and South Australia to be less than 0.002%. However as explained in Section 4.1 , this is an expectation and not a guarantee.

The actual USE on 29 and 30 January is estimated at 1.88 GWh in Victoria and 0.42 GWh in South Australia. The probabilistic studies conducted by AEMO at the time indicated about a 28% chance in Victoria and a 50% chance in South Australia that the USE would exceed these values.

As the probability studies are more accurate and more comprehensive than the reserve projections provided by MTPASA, there could be merit in requiring AEMO to perform a probabilistic reliability assessment of each region's annual peak demand period on a regular basis. This could be performed annually just before the annual peak demand period, or it could be updated quarterly. The new EAAP might be capable of fulfilling this function, or at the very least there should be significant synergies with the EAAP as AEMO is required to perform probabilistic studies for the EAAP's reliability assessment (although the EAAP's focus is on energy rather than capacity).

Comprehensive reliability studies would provide governments, NEM participants, and the NEM institutions a comprehensive assessment of likely reserves and the probability of supply interruptions around the period of annual peak demand. This would enable informed decisions to be made in relation to the mitigation and management of supply interruptions.

We intend to investigate in consultation with AEMO and market participants the merit of a regular formal publication (possibly in conjunction with the EAAP) that provides a comprehensive reliability assessment of each regions annual peak demand period.

3.1.3 Conclusions

The data presented in this section and in Appendix B illustrate how difficult it is to assess the performance of the NEM's reserve projections by comparing these projections to actual reserve outcomes. As such we consider the performance of these projections could be better judged by assessing how useful NEM participants find the reserve projections in informing investment and outage timing decisions. We intend to consult market participants and AEMO on this question and will present our finding in the Final Report for this review.

We also consider that there could be merit in requiring AEMO to establish a regular publication that provides a comprehensive probabilistic reliability assessment of each region's annual peak demand period. We intend to investigate this further.

Finally, the limitations in reliability forecasting identified in this section highlight the importance of designing the specification of the reliability standard and settings to be consistent with the capability of the forecasting tools (as discussed further in Section 4.1).

3.2 Expected Distribution of Reliability Outcomes

MCE Direction

The revised MCE Direction requested information in relation to the expected distribution of reliability outcomes, particularly the frequency of extreme load shedding, that are implicit in forecasts of average levels of reliability in the NEM.

Information for stakeholders

We would like to inform stakeholders that we have not included advice for this request due to its linkages with work we commissioned regarding the modelling of the price-reliability trade-offs of raising the level of MPC that is applied in the NEM.

To inform our advice to the MCE of the modelling price-reliability trade-offs, we engaged ROAM Consulting to perform detailed modelling analysis of the relevant trade-offs. ROAM has advised that it has identified an error in its preliminary modelling results. As a consequence the modelling requires some additional work to review the analysis and outcomes. We intend to provide advice for this request in the Review Final Report.

As a result of the above, we have since commissioned an independent expert to undertake a thorough review of ROAM's modelling framework to ensure confidence in the final modelling results. We will be providing the modelling results performed by ROAM, with its supporting Report in the Review Final

3.3 Reliance Placed on Reliability Forecasting Methods

MCE Direction

The revised MCE Direction requested analysis of the reliance that may be placed on NEM reliability forecasting methods, taking into account the outcome of (i) and (ii), sensitivity analysis and other relevant considerations

Commission Response

NEM participants and investors rely on the reliability projections to inform decisions in relation to new investment and the availability of their equipment for service. AEMO relies on the reliability projections to inform its decisions in relation to the management of NEM security and reliability.

We intend to consult NEM participants and AEMO on whether these tools are fit for purpose in a future in which extreme weather events are more likely. We will report the findings and any recommendations for improvement to the MCE in our Final Report.

Following the load shedding event of January 2009, AEMO has commenced processes to improve the ability of the reliability forecasting tools to respond to extreme weather events. AEMO is working on modifying its demand forecasting methodology to improve the accuracy of forecasts for extreme demand days. AEMO is also now explicitly modelling extreme weather scenarios, and including thermal limitations on wind farms, in the calculation of the MRLs used in PASA.

NEM participants and investors rely on reliability forecasts to inform decisions in relation to new investment and the availability of their equipment for service. AEMO relies on the reliability forecasting tools to inform its decisions in relation to the management of NEM security and reliability.

The reliance on NEM reliability forecasts are discussed below.

3.3.1 Informing NEM participants and investors

Electricity Statement of Opportunities

Investors in the NEM rely on the ESOO as an important source of information. The reserve adequacy projections in the ESOO assist investors assess future dispatch and pricing expectations and thus the economic viability of a prospective investment.

If the ESOO fails to project a reserve shortfall, necessary new investment may be delayed beyond the period when it is needed. However, most investors use the ESOO as a guide in addition to their own analysis. As demonstrated in Appendix B, investment in generation can take place sooner or later than signalled in the ESOO. As such the ESOO is one consideration in the timing of new investment. In regions like New South Wales and Queensland, investment in new capacity has generally taken place in advance of when it is signalled to be necessary as stated in the ESOO.

Investment decisions could be driven by factors outside of the NEM framework such as the Queensland's 13% Gas scheme. Investment in regions like Victoria and South Australia have generally taken later then New South Wales and Quensland. This could be due to the adequacy of the price incentives to support private investment, or it could be due to factors outside of the NEM framework such as uncertainty about the timing and details of climate change policy.

The accuracy of the ESOO reserve projections is sensitive to demand forecasts, MRLs, and information on new investment commitment. Demand is difficult to forecast up to 10 years in advance. The ESOO contains sensitivities including for different economic growth assumptions, and different demand growth assumptions. MRLs represent the level of reserves required to deliver an expectation that the reliability standard will be achieved. As a single MRL is used for each region for the entire outlook period, some inaccuracies are inherent in the MRLs in later years. AEMO seeks information from the market on commitments for new investment. This of course is expected to change over the ESOO outlook period as investors respond to reserve shortfalls projected in the ESOO.

Projected Assessment of System Adequacy

Market participants rely on PASA reserve projections to fine tune the timing of planned maintenance outages. Generators would generally reschedule an outage so that equipment is available during a period of supply scarcity to take advantage of likely high prices. The PASAs thus play key roles in maximising equipment availability during periods of supply scarcity. If the PASAs failed to signal a period of reserve shortfall, some generators that would otherwise be available to generate may commit to maintenance outages.

The accuracy of the PASA reserve projections is sensitive to demand forecasts, MRLs, and availability information provided by market participants. The 10% POE demand is used in MTPASA. The accuracy of demand forecasts improves closer to real time, and as such more closely resembles actual demand in STPASA and PDPASA. As discussed above, inaccuracies are inherent in the MRLs due to averaging over a long period. We have directed the Reliability Panel to consider the merit of developing specific short-term MRLs under their *Review of the Operational Arrangements for the Reliability Standards.*[29] Changes in generator availability also have a significant impact on MTPASA reserve projection.

As discussed in Section 3.1, AEMO has commenced a number of projects to improve the accuracy of the PASAs[30]. AEMO is investigating improvements in the accuracy of demand forecasts for very high demand days which are normally associated with periods of extreme temperatures. AEMO has also modified the methodology for developing the MRLs used in the PASAs to include an extreme demand scenario in its modelling, plant degradation associated with extreme weather, and high temperature wind farm thermal limitations.

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[29] More information on this review can be found at: www.aemc.gov.au/Market-Reviews/Open/Review-of-Operationalisation-of-the-Reliability-Standards.html

[30] See Appendix E.

Drought Report / Energy Adequacy Assessment Projection

Market participants use AEMO's drought reports, and from next year the EAAP, to inform their decisions to reallocate energy from periods of projected excess energy capability to periods of shortage through the reallocation of fuel or water resources. The EAAP may also facilitate the release of additional energy or water allocations, possibly in consultation with a jurisdiction. The EAAP will play an important role in minimising the risk of energy constraints creating reserve shortfalls.

3.3.2 Informing AEMO

AEMO monitors the reserve projections from MTPASA and the market response to these projections closely. If MTPASA flags a period of reserve shortfall, and the market fails to respond to this information, then AEMO will investigate the need to procure reserves to restore adequate reserve margins.

As discussed in Section 3.1.2, AEMO performs a probabilistic reliability study, when low reserves are flagged in MTPASA, and will use the result of the probabilistic study to trigger reserve contracting under the RERT provisions. However, as detailed above in Section 3.3.1, MTPASA reserve projections are very sensitive to the inputs to the model. If MTPASA fails to signal a reserve shortfall, there is a risk that action to strengthen reserves could be delayed.

As such, we intend to investigate the merit of requiring AEMO to establish a regular publication that provides a comprehensive probabilistic reliability assessment of each region's annual peak demand period (discussed in Section 3.1.2). Under such an arrangement, it would be assured that a decision to contract reserves under the RERT provision (or not) would be based on comprehensive analysis.

In addition, this Summer 2009-2010, AEMO will be able to procure reserves at very short notice for the first time under the new Short-Notice RERT.[31] This will enable AEMO to more effectively address reserve short-falls that were not flagged in longer term reserve projections.

3.3.3 Conclusions

NEM participants and investors rely on the reliability projections to inform decisions in relation to new investment and the availability of their equipment for service. AEMO relies on the reliability projections to inform its decisions in relation to the management of NEM security and reliability.

We intend to consult NEM participants and AEMO on whether these tools are fit for purpose in a future in which extreme weather events are more likely. We will report

31 The Short-Notice RERT facilitates short-notice reserve contracting. The AEMC's final Rule determination on the Short-Notice RERT is located at: http://www.aemc.gov.au/Electricity/Rule-changes/Completed/Improved-RERT-Flexibility-and-Short-notice-Reserve-Contracts.html

the findings and any recommendations for improvement to the MCE in our Final Report.

3.4 Modelling Projections of Price-Reliability Trade-Offs

MCE Direction

The revised MCE Direction requested modelling projections of the price-reliability trade-offs of a phased increase in the NEM MPC to: an interim level of $20,000 per MWh; the current value of customer reliability in the study by CRA International dated 12 August 2008 for VENCorp; and any other level that the AEMC decides is relevant to the MCE's consideration.

Information for stakeholders

To inform our advice to the MCE of the modelling price-reliability trade-offs of raising the level of MPC that is applied in the NEM, we engaged ROAM Consulting to perform detailed modelling analysis of the relevant trade-offs.

We would like to inform stakeholders that we have not included modelling projections due to an error which ROAM has identified in its modelling results. As discussed in section 3.2, ROAM are undertaking some additional work on their modelling to ensure the outcomes are robust. Given the ROAM error, we have commissioned an independent expert to undertake a thorough review of ROAM's modelling framework to ensure confidence in the final modelling results. We will be providing the modelling results performed by ROAM, with its supporting Report in the Review Final Report.

4 MCE Request for Advice

4.1 NEM Reliability Standard Interpretation to Date

MCE Direction

The revised MCE Direction requested advice on whether the NEM Reliability Standard has been interpreted to date either as a maximum which cannot be exceeded, or as a mean which is not to be exceeded over a number of years.

Commission Response

The reliability standard has been targeted to be achieved every year, but compliance has been measured over the long term (a 10-year moving average of reliability outcomes is measured against the reliability standard). Although the target has been to achieve the standard every year, this does not mean it is an annual maximum that cannot be exceeded. The nature of the application of the standard means actual outcomes over time will comprise a distribution of reliability that is both above and below the target. There are many unpredictable reasons (e.g. extreme demand conditions or significant equipment failure) why a combination of events may result in USE above the standard in a single year.

However the practice to date of measuring the reliability performance against the standard over 10 years could result in delays in responding to causes of reliability degradation including an increased incidence of extreme weather. There is also scope to provide better information in relation to the frequency and duration of supply interruptions. This would assist governments and policy makers better understand how supply interruptions are impacting end-users, and may identify improvements to the current mechanisms available for delivering reliability. We intend to report further on these issues in the Final Report for this review.

To date the reliability standard has been targeted to be achieved every year, but compliance with the standard has been measured over the long term. (A 10-year moving average of actual reliability outcomes has been measured against the reliability standard). The appropriate specification and interpretation of the standard to be adopted in future is discussed in Section 4.2.

It is not feasible to build the power system to guarantee that USE would not exceed a cap in a year. There will always be some combination of events that would result in the reliability standard being exceeded in one year. Hence the reliability standard for power system performance has been interpreted as an expectation that over the long-term the reliability standard will be achieved but with some year on year variability around the expected level. In practice, for some years in which peak demand is very high and in which particularly onerous combinations of random events occur, the reliability standard may be exceeded. In years in which the peak demand is not particularly high, there may be no load shedding to count towards the reliability standard. Thus to date the expectation has been that over the long term the good and bad years will balance out so that the reliability standard is achieved.

AEMO's practice has been to target the 0.002% USE specified in the reliability standard every year. If its analysis determined that it was likely that USE would exceed 0.002% in a year, AEMO would contract for reserves under the RERT provisions. However due to demand and generator availability uncertainty, AEMO is not able to guarantee that the USE would not be greater than 0.002% in any year. In real-time, AEMO targets zero USE by taking all possible action to avoid involuntary load shedding. AEMO is able to target zero USE in real-time because close to dispatch it has a higher degree of certainty regarding demand and the availability of generators and networks and the likelihood of a capacity shortfall.

Prior to the Reliability Panel's Comprehensive Reliability Review (CRR)[32], the reliability standard was expressed as a target of 0.002% USE defined as being 'over the long term'. However the Panel considered that this timeframe was unclear and changed the definition of the reliability standard to measure USE by means of a 10-year moving average.[33]

Interpreting performance against the standard in this way has a number of problems. These include:

- More than ten years of data would be required to give a statistically meaningful estimate of compliance with the reliability standard (e.g. a 1 in 100 year weather event could result in significant USE such that the reliability standard remains exceeded for 10 years);

- The underlying distribution of possible USE outcomes can vary over time, so that it is not statistically meaningful to use the moving average as an effective measure; and

- A ten year delay in measurement is not satisfactory if its purpose is to promote continuous improvement of the processes for meeting the reliability standard (i.e. an assessment of the January 2009 load shedding would not be fully assessed against the reliability standard for 10 years).

The last two points above are particularly relevant in the context of extreme weather. If the delivered level of reliability is degrading because the incidence of extreme weather events is increasing, this would indicate a structural shift in the underlying distribution and it would not be satisfactory to delay responding to the impact of more regular extreme weather events on reliability for 10 years. Accordingly, the practice of measuring compliance with the reliability standard over 10 years could result in delays in responding to causes of reliability degradation including increased extreme weather. This issue is discussed further in Section 4.2.

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[32] Available at the AEMC's website: www.aemc.gov.au

[33] Page 25 of the Final Report of the Panel's CRR.

4.2 Specification and Interpretation of the Reliability Standard in the Future

MCE Direction

The revised MCE Direction requested advice on the appropriate specification and interpretation of the NEM Reliability Standard in the future.

Commission Response

The specification of the reliability standard impacts on how efficiently and effectively the reliability expectations of customers can be delivered.

We consider the specification of the reliability standard to be generally appropriate for a future in which extreme weather is more likely. However there is scope to provide information on the frequency and duration of supply interruptions to better inform policy makers and market institutions. We also consider that it is inappropriate to continue measuring the reliability standard as a rolling average over 10 years, and that there are potentially better ways to assess the performance of the power system against the reliability standard. We will be making recommendations in relation to these matters in the Final Report for this review.

To meet the community's expectations regarding reliable electricity supply in the future, the reliability standard must be specified and applied so as to facilitate the most efficient delivery of reliability at costs that reflect the value placed on reliable power supply.

There are three main aspects to any reliability standard: form, level and scope.

- The <u>form</u> of the standard is the method by which reliability is measured. The current NEM standard is an output-based measure expressed in terms of targeted permissible USE as described in 4.1 above.

- The <u>level</u> of the standard specifies the targeted level of permissible interruption to supply that is judged to reflect the community's valuation of the trade-off between supply reliability and the associated cost. This is also an expression of risk. The current level of the standard is described in 4.1 above and is defined as 0.002% of USE per annum over the long term.

- The <u>scope</u> of the standard defines what does and does not count towards the NEM's reliability performance. In terms of the electricity supply chain, the standard currently includes generation and bulk transmission capacity (that part of the transmission network used to transport electricity between regions). The current standard does not include the reliability performance of intra-regional transmission (that part of the transmission network used to transport electricity within regions) or distribution networks. In terms of events, the standard currently excludes power system security incidents and exogenous incidents such as industrial action and terrorism.

4.2.1 Form of the Reliability Standard

Different countries use different measures to define reliability for their respective electricity systems. Typical definitions of reliability include:

- How frequently supply is interrupted – for example, the number of days per year in which an interruption occurs;
- The cumulative duration of interruptions – for example, the total number of hours per year that interruption to any (not necessarily the same) consumer occurs; and
- The amount of energy that is not supplied in a period.

The NEM's standard expressed in terms of USE is an example of the third definition above.

Measuring reliability through one form alone does not provide perfect information about the reliability of and interruptions to supply. For example, the NEM's USE standard provides no information about the frequency of supply interruptions nor about the depth of any single interruption. The USE standard also does not capture the difference in the actual experiences of consumers in different regions. For example, in a region where the demand profile is very peaky (e.g. air-conditioning use increases dramatically on occasional very hot days), the entire allowance of unserved energy (the whole 0.002%) could be experienced in a single hot day. Alternatively, in a region where the demand profile is quite flat (e.g. air-conditioning use is minimal or fairly constant because temperatures are consistently high), shortfalls in supply are likely to be less severe but may be more frequent.

For the Comprehensive Reliability Review (CRR)[34], the Reliability Panel considered the introduction of a hybrid standard which would be a combination of a number of the reliability definitions outlined above. The Reliability Panel concluded that:

> "The current USE standard in the NEM is an energy standard for an energy-only market. This design is well suited to placing value on cumulative, long-term energy shortfall and thus rewarding additional energy generation or consumer responses to reduce that shortfall. Introducing a hybrid standard is likely to create conflicting objectives that cannot readily be incorporated into the market design. For instance, introducing parameters to limit the frequency or depth of individual events may unavoidably affect the cumulative, long-term energy shortfall. Such parameters are also incompatible with the ability of the energy-only market to provide the necessary financial incentives for investment in generation.
>
> Hybrid standards, in effect, are as restrictive as their most restrictive element, whether that is long-term USE, annual shortfall, or shortfall from an individual event. Introducing an additional parameter, therefore, may cause the USE

34 Available at: www.aemc.gov.au

standard to be inadvertently tightened, with an associated cost to the consumer."[35]

We consider:

- the Reliability Panel's reasoning for maintaining a single form of reliability standard is still relevant today;
- USE remains the most appropriate form for the reliability standard[36], because it is relatively easy to measure and interpret from an operational perspective, reflects the economic impact on typical end-users and aligns with the existing mechanisms in the NEM to incentivise and deliver reliability; and
- it is essential that the form of the reliability standard be consistent across all regions of the NEM.

However, there is scope to provide better information in relation to the frequency and duration of supply interruptions while maintaining the USE form as the single parameter for specification of the standard. This would assist governments, policy makers and market institutions better understand how supply interruptions are impacting end-users, and would also facilitate early identification of problems and the need for improvements to the current mechanisms available for delivering reliability. This is relevant to extreme weather as the total level of USE may not change, but the impact on end-users could change considerably (such as fewer customers being impacted, but those customers being impacted to a much greater extent). Information on the frequency and duration of supply interruptions caused by generators could be packaged with similar information for the transmission and distribution sectors. As this information is currently readily available, this is simply a question of determining responsibility for data collation, presentation and analysis.

4.2.2 Level of the Reliability Standard

The level of the reliability standard has been set at 0.002% USE since the commencement of the NEM.

The Reliability Panel reviewed the level of the standard as part of the CRR and concluded that the reliability standard should be maintained at 0.002% for the following reasons:

"The reliability standard in the NEM is not inconsistent with reliability standards that apply for comparable power systems in other countries.

- Countries that appear to have more stringent standards generally have characteristics (such as larger system size and high levels of

[35] AEMC Reliability Panel, *Comprehensive Reliability Review*, December 2007, p. 24: www.aemc.gov.au

[36] The Panel is currently investigating alternatives to USE as the measure reliability as part of the *Reliability Standard and Settings Review*. As part of our Final Report for this review we will comment on the recommendations of the Panel.

interconnectedness) that would make a higher standard less costly to achieve.

- Reliability events are responsible for a very small proportion of actual or forecast interruptions.

- Any tightening of the level of the standard would likely have a substantial cost in terms of required new investment."[37]

The Reliability Panel also noted that there was no call from stakeholders, including those of consumer representative groups, for a change to the standard's level. This is consistent with the NEM's historical out-performance of the targeted level of reliability and hence the absence of an evident case for change.

The Reliability Panel is currently reviewing the level of the reliability standard under the current *Reliability Standard and Settings Review*.[38] To date only one submission to that review proposed a change to the level of the reliability standard (a relaxation of the standard).

The objective of the reliability standard (and the assigned level of reliability under the standard) is to deliver an expectation of reliability that reflects the value that customers place on reliability. The current approach specifies that value in terms of the targeted quantum of USE (supply interruption) and applies a derived MPC that is set at a level sufficient to incentivise the investment and operational behaviour needed to deliver the expected reliability outcome.

An alternative approach would be to not set a target for reliability but to set a very high price cap that is based on some estimate of the value customers place on reliability. That is an estimate of the energy cost above which energy users would prefer not to consume rather than pay the cost involved, often referred to as the value of lost load (VoLL). However the value of customer reliability for all NEM customers has never been evaluated and such an evaluation will necessarily have to address complex issues such as variations in VoLL across different classes of customers and customers in different locations. Under such an approach, changes to the arrangements for the management of any short term imbalances between supply and demand by AEMO may need to be developed.

On balance we consider that the current approach to the setting of the level of the standard should be maintained. However, we have proposed changes to the governance arrangements for the reliability standard and settings in Section 4.4 that would enable the MCE to provide guidance and direction regarding the community's valuation of reliability of supply to be used in deriving the level of the reliability standard and the associated price caps for the wholesale market.

Section 4.1 outlined the problems associated with measuring compliance with the reliability standard over a 10-year period. It is in fact very difficult to measure compliance with the reliability standard because it is not appropriate to assign

[37] AEMC Reliability Panel, *Comprehensive Reliability Review*, December 2007, p. 32, www.aemc.gov.au

[38] Available at www.aemc.gov.au

significant meaning to individual historical outcomes or to an average of a number of outcomes over a long period of time.

It would be more appropriate to review the reliability of the NEM each year, in particular following incidents that have resulted in USE. Where the level of USE in a year approaches or exceeds 0.002%, it is important for stakeholders to understand the circumstances that caused the load interruptions. The NEM institutions can then identify potential improvements to the mechanisms that can be assessed and implemented, as appropriate.

This approach would be reasonable given that there have only been a few reliability events since the start of the NEM in 1998, and in each case of USE the NEM institutions have reviewed the circumstances and refinements were identified and implemented.

The load shedding events on 29 and 30 January 2009, resulted in levels of USE that exceeded 0.002% in both Victoria and South Australia. Following these events AEMO undertook reviews of the circumstances that led to the load shedding on these days. In addition, the MCE requested us to conduct this review.

The Reliability Panel is currently reviewing this issue as part of their *Reliability Standard and Settings Review*.[39] We will be informed by the Reliability Panel's work, and make final recommendations to the MCE in our Final Report for this review.

4.2.3 Scope of the Reliability Standard

The scope of the reliability standard defines those elements of the supply chain that are covered by the standard and the causes of supply interruption that are, or are not, taken into account when targeting reliability and measuring reliability outcomes.

The reliability standard covers the generation and bulk transmission elements (that is that part of the transmission network that transports generation between regions). In relation to causes, the reliability standard takes into account 'reliability events, but not 'power system security events' and 'external factors' (such as industrial action).[40] It is important that the reliability standard only measure supply interruptions that can be addressed through investment in new generation. It is for this reason that power system security issues and external factors are excluded.

Other standards and incentive mechanisms are available to address other areas of end-user reliability (i.e. network investment, is driven by the regulatory framework in the Rules and reliability standards that are currently set by jurisdictions).

We consider it is appropriate that the reliability standard applies to bulk transmission in addition to generation. As a region can rely on generation from

[39] Available at: www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Reliability-Standard-and-Settings.html

[40] Refer to Section 2.5 for more detail.

another region to satisfy its customer load, it is important that the inter-regional transmission system is capable of delivering that generation to the load. We have discussed the incentives for investment in inter-regional transmission in Section 2.5.1.

We also consider it is appropriate that the reliability standard excludes system security events and external factors. System security events are often location specific. As such, new generation delivered by a regional price signal could be located in the wrong location to address the issue. In addition, it may be more efficient to better incentivise existing equipment owners to minimise system security events rather than investing in new generators that would largely remain on standby until an item of equipment fails.

USE due to external factors such as industrial action at a power station is not included in the reliability standard. It would not be efficient to lift the MPC to incentivise additional generation to manage the rare event of industrial action causing load shedding.

4.2.4 Putting the Standard into operation

The reliability outcomes at any point in time are influenced not only by the standard and the related MPC but also by the assumptions used by AEMO in calculating the level of reserves required.

In addition to work being undertaken by the Reliability Panel at the request of the AEMC (in their *Review of Operational Arrangements for the Reliability Standard*[41]) AEMO has been reviewing its processes in the light of 2008-09 summer events.[42]

We will comment further on the operational arrangements in the Final Report after considering the Reliability Panel's report.

4.2.5 Conclusions

Based on our initial analysis, we consider the specification of the reliability standard to be generally appropriate for a future in which extreme weather events are more likely.

There are two areas in which we consider there is potential for improvement and will provide further analysis and recommendations in our Final Report to the MCE.

- It is inappropriate to continue measuring the reliability standard as a rolling average over 10 years. If the ability of the power system to maintain continuous supply is degrading due to an increase in extreme weather events, measuring the reliability standard over 10 years may result in delays in responding to this degradation.

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41 Available at: www.aemc.gov.au

42 The work being undertaken by AEMO in response to the January 2009 supply interruptions is outlined at Appendix E.

- The provision of better information in relation to the frequency and duration of supply interruptions. This would assist governments and policy makers better understand how supply interruptions are impacting end-users, and may identify improvements to the current mechanisms available for delivering reliability.

4.3 Recognising Differences in Jurisdictional Expectations

MCE Direction

The revised MCE Direction requested advice on the feasibility of mechanisms for recognising differences in jurisdictional expectations regarding the price-reliability trade-off and delivery outcomes consistent with those expectations.

Commission Response

The current market design values reliability equally in all regions. This principle determines the policy and operational frameworks used to deliver, as near as technically possible, the desired consistent reliability outcomes. For example, this principle determines that there will be a sharing of load reductions across regions in times of shortage in one region.

Implementation of mechanisms to recognise regional differences in the value of reliability would be a fundamental change to the current market design. The change in principle from one of targeting consistent reliability outcomes across the NEM to a principle of differentiation or preference, would require changes to the policies and operational framework used to deliver reliable supply. Under such a model, the region(s) placing the higher value on reliability would be given first preference to supply. Regions with lower values on reliability may have supply constrained in order to support the higher valuing region(s). Operating the market in any other manner would defeat the purpose of introducing differentiation in the value of reliability.

Our preliminary view is that adopting different MPCs in each region to reflect differences in jurisdictional expectations regarding the price/reliability trade-offs would arguably be feasible and result in economically efficient outcomes. Provided the MPC for a region is consistent with the value that customers collectively place on supply continuity, then the resultant levels of investment in supply and demand side capacity in that region and thus regional specific supply reliability would be economically efficient, i.e. economically efficient because supply continuity is provided up to the level at which it is valued.

However, there may be implications for economic efficiency, particularly on a NEM-wide basis, from introducing mechanisms to recognise regional differences in the value of reliability. Without detailed modelling it is difficult to determine the impact on investment efficiency. The arrangement would be likely to have a negative impact on operational efficiency, and would increase regulatory complexity.

4.3.1 Introduction

Point of consumption reliability is achieved through multiple reliability mechanisms as discussed in Section 2.5. Differences in jurisdictional expectations regarding the price/reliability trade-off can be delivered for each reliability contributing element in the electricity supply chain.

For transmission and distribution networks, higher reliability in a region could be delivered by setting higher network reliability standards in that region, which would deliver higher levels of network investment. Jurisdictions are currently able to determine the level of the network reliability standards that meet the price-reliability expectation for customers in their region.

For generation, higher reliability in a region could be delivered by varying the incentives on new generators to locate in a particular region. This could be achieved through changes to various features of the existing energy only market (e.g. varying the MPC between regions, varying the level of the CPT between regions) or by introducing capacity payments of varying types on a regional basis (e.g. a reserve ancillary service or a broad capacity payment). Any change may have an element of sovereign risk and could have unanticipated distortionary impacts on investment and market operations.

We understand that the MCE is specifically interested in the feasibility of setting a different MPC in each region to deliver a different price-reliability trade-off. As such our response to this question focuses on this particular approach.

4.3.2 Analysis of Implementation

The level of the MPC, the market floor price and the CPT form the price envelope within which the wholesale spot market is expected to deliver the capacity required to achieve the NEM reliability standard. This price envelope, together with expectations of spot prices within the envelope provides important signals to participants concerning both supply and demand side investments. Thus raising the MPC in one region relative to others would likely deliver additional investment in that region. This would be expected to deliver higher reliability at an increased cost to customers in that region.

An arrangement allowing a different MPC in each region is a fundamental change to the market design in that it is assigning a higher reliability standard to the higher priced region(s). Consequently the higher priced region/s would be given preference in times of supply shortage.

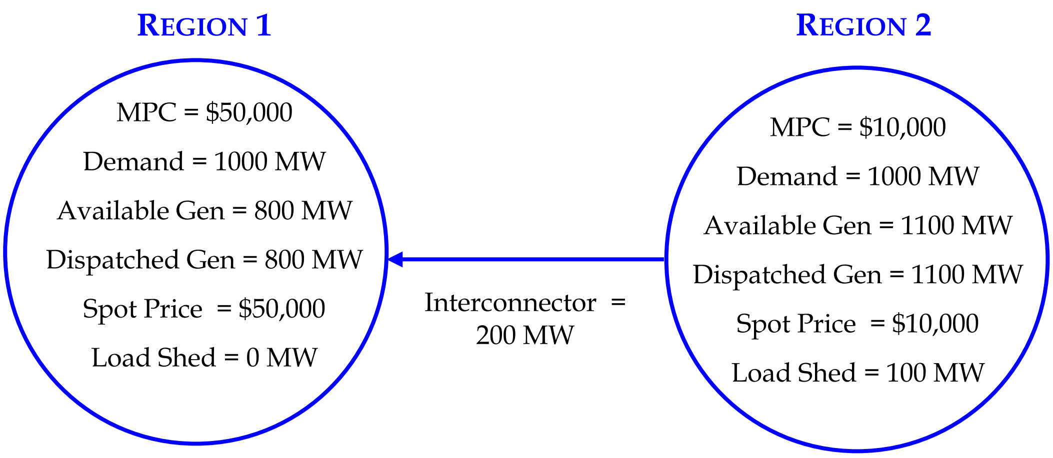
The current market design assigns a consistent reliability standard in all regions and the market is operated to as far as technically possible, target consistent reliability outcomes across the NEM.

The following two sections of this report set out the practical outworking of such a change in relation to load shedding and interconnector flows as examples of the impact of differentiated regional MPCs.

4.3.2.1 Sharing the Pain of Load Shedding

The introduction of different MPCs in each region will have implications for how load shedding is shared between regions. Currently, load shedding as a result of a supply shortfall in any region is shared between all NEM regions in proportion to the demand in each region. This is because customers in each region are assumed to value reliability equally. However under a market design where customers in each region value reliability differently, any requirement for load shedding would be fulfilled in the region that values reliability least. That is, the region with the lowest MPC. This outcome is economically efficient as the customers that value reliability the most, and are willing to pay the most for their electricity, have their electricity supply interrupted after those who value reliability less.

This is illustrated in the example below. The MPC in Region 1 is $50,000 and the MPC in Region 2 is $10,000. There is a supply shortfall of 200 MW in Region 1, and 100 MW of spare capacity in Region 2, leaving a supply deficit for the system of 100 MW. As Region 2 customers value reliability less than Region 1 customers (as indicated by the MPC), the load shedding to address the supply deficit takes place in Region 2. As such, although the supply shortfall originated in Region 1, all load shedding takes place in Region 2.



What this means in practice is that customers in a region with a lower MPC relative to other regions will carry a greater share of total NEM load shedding.

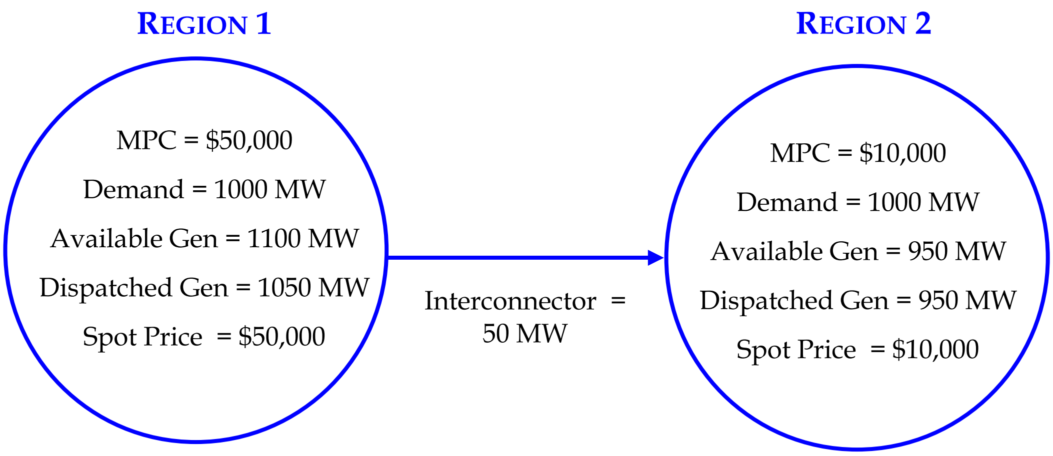
4.3.2.2 Managing Market Settlement Shortfalls

The introduction of different MPCs in each region would create market settlement shortfalls for AEMO.

Market settlement shortfalls can result when the market dispatch outcome results in greater payments to generators than is collected from customers. An example of this would be when power flows on an interconnector from a high priced region to a low priced region. In this situation, generators in the high priced region are being paid more than is being collected from customers in the low priced region.

This situation is quite rare under the current market design where the MPC is the same in all regions. But by allowing a different MPC in each region, a credible dispatch outcome could be for electricity to flow on an interconnector from a high priced region to a low priced region.

Consider the example illustrated below involving a simple two region model. The MPC is $50,000 in Region 1, and $10,000 in Region 2. Region 2 has insufficient available generation to satisfy demand. As such 50 MW is imported from Region 1 across the interconnector to avoid load shedding in Region 2. Due to supply scarcity, the spot price is at the level of the MPC in both regions.



Region 1 Settlements	
Paid to Generators	$52.5m
Paid by Customers	$ 50.0m
Net Settlements	-$ 2.5m

Region 2 Settlements	
Paid to Generators	$9.5m
Paid by Customers	$ 10m
Net Settlements	$ 0.5m

Settlement Shortfall = $2m

Outworking

- A settlement shortfall of $2m per hour.
- Created because insufficient money is collected to pay generators in Region 1.
- AEMO currently has no means of funding this settlement shortfall.

Options to Eliminate Settlement Shortfall

Option A – Clamp interconnector flow to 0 MW to eliminate the settlement shortfall

Consequences

- Customer load would be shed in Region 2 whilst generation is available in Region 1
- Economically efficient because supply continuity is provided up to the level at which it is valued.

Option B – Customer uplift in Region 2 to fund the settlement shortfall

Consequences

- No load shedding

- Additional $2m charge to customers in Region 2 results in effective spot price of $12,000. This violates the MPC of $10,000.
- Economically inefficient because supply continuity is provided in Region 2 at a price above the level at which it is valued.

Option C – Cap the price in Region 1 to eliminate the settlement shortfall

Consequences

- The price would only be capped when a settlement shortfall required addressing.
- No load shedding.
- Economically inefficient because the price in Region 1 is capped below the level at which supply continuity is valued. Would weaken the investment incentive intended by the higher MPC.

Thus the only economically efficient approach to managing a settlement shortfall caused by different MPCs in each region would be to clamp interconnector flow and shed load in Region 2.

4.3.3 Implications for Economic Efficiency

Our preliminary view is that adopting different MPCs in each region to reflect differences in jurisdictional expectations regarding the price/reliability trade-offs would arguably be feasible and result in economically efficient outcomes. Provided the MPC for a region is consistent with the value that customers collectively place on supply continuity, then the resultant levels of investment in supply and demand side capacity in that region and thus regional specific supply reliability would be economically efficient, i.e. economically efficient because supply continuity is provided up to the level at which it is valued.

However because the NEM is an interconnected system with power flows between regions, differential MPCs may lead to distortions in investment and operational behaviour which could detract from achieving an economically efficient outcome across the NEM. Whilst it may be economically efficient for load shedding to occur in the lower MPC region to achieve continuity of supply in the higher MPC region, the general public may not understand or accept such an outcome.

We have undertaken a preliminary consideration of the arrangement for differential MPCs against the relevant elements of the National Electricity Objective including, efficient investment in the NEM, efficient operation of the NEM, reliability, price, and regulatory complexity. Each of these is discussed below.

Efficient Investment in the NEM

Jurisdiction specific and different MPCs would change locational investment signals. If generators are able to earn a greater return on investment in one region over another, it is expected that there would be an incentive for new investment to locate in that region relative to other regions. This could result in the region with a lower

MPC having less than the desired level of investment in capacity (less than suggested by the MPC/reliability trade-off). Such a distortion in investment may drive further augmentation in interconnector capability above that which is economically efficient.

This could result in higher overall costs for supply of electricity in the NEM for a small increase in reliability in one region.

Efficient Operation of the NEM

Jurisdictional specific MPCs would increase the risk of entering into hedging contracts with counter parties in other regions. When a contract is agreed between two participants operating in different regions, the contract reference price for one of the participants will not be the same as the regional price to which they are exposed. This creates basis risk. If MPCs were different in each region, basis risk may be increased significantly, potentially discouraging participants from contracting with inter-regional counter-parties. This may reduce competition and liquidity in contract markets, and potentially the efficiency of these markets.

Increasing the MPC in one region would also increase the prudential requirements for retailers in that region. This may influence new entrant retailers to locate in a region with a lower MPC.

Reliability and Price

Increasing the MPC in a region (relative to others) would be expected to increase the level of installed capacity in that region and thus increase the level of supply reliability in that region. The higher MPC would attract additional investment in generation that would not have been made if the MPC had not risen. This increase in reliability would not be shared equally between all regions consistent with the assumption that their different MPCs reflect their different reliability valuations. Whilst reliability would be expected to increase in a region with a higher MPC, reliability in the low MPC region could fall below that suggested by the MPC/reliability trade-off because of the greater incentive for capacity to locate in the higher MPC region. In other words customers in the low MPC region may not get the supply reliability expected for the price they pay for electricity.

Regulatory Complexity

The introduction of the NEM has streamlined the regulatory arrangements for electricity supply across participating NEM states. This has reduced regulatory complexity and has facilitated the growth of efficient national power flows and trading by nationally focussed energy companies.

If jurisdiction specific pricing arrangements were re-introduced, regulatory complexity and trading risk would increase and the administrative cost of NEM participation may also increase. The perception of regulatory complexity can affect an investor's willingness to invest and ability to obtain competitive finance. Regulatory complexity could to some extent counter-act the objective of the jurisdictional specific MPCs by delaying investment in new generation. It could lead to regionally rather than nationally focused generation and retail participants with a potential reduction in competition in both the generation and retail sectors in some regions.

4.3.4 Conclusion

Our preliminary view is that adopting different MPCs in each region to reflect differences in jurisdictional expectations regarding the price/reliability trade-offs would arguably be feasible and result in economically efficient outcomes. Provided the MPC for a region is consistent with the value that customers collectively place on supply continuity, then the resultant levels of investment in supply and demand side capacity in that region and thus regional specific supply reliability would be economically efficient, i.e. economically efficient because supply continuity is provided up to the level at which it is valued.

However there are a number of impacts of such an arrangement that could lead to distortions in investment and operational outcomes than that suggested from purely the price/reliability trade-off arising from differential MPCs which in turn could detract from achieving economically efficient outcomes across the NEM.

We have not been able to conduct a comprehensive assessment of the efficiency implications of allowing a different MPC in some or all regions. Such an analysis would require a detailed specification of implementation assumptions and modelling to identify the more complex interactions and outcomes that would be involved and to understand the implications on achieving the National Electricity Objective.

Outcomes that would need to be considered in some detail include:

- the most economically efficient approach to address a settlement shortfall created by different MPCs in each region would be to clamp the interconnector to eliminate transfers into the low MPC region (this could result in load shedding in the low MPC region and thus lower reliability for customers in that region);

- implications for inter-regional trading and thus implications for achieving competitive generation and retail sectors within regions, particularly for the low MPC regions;

- behaviour of participants, which may be markedly different to that experienced and thus present a different paradigm for modelling.

Without detailed modelling it is difficult to determine whether the outcomes from having differential MPCs is economically efficient in terms of achieving or contributing to the achievement of the National Electricity Objective.

4.4 Governance Arrangements

MCE Direction

The revised MCE Direction requested advice on the appropriate roles for the MCE, the AEMC, AEMO and the Reliability Panel in policy decision-making on reliability standards.

Commission Response

There are a number of decisions relating to reliability. Those decisions go beyond determining the reliability standard. The decisions to determine the reliability standard, the reliability settings and the administered price cap are decisions of a detailed economic, market framework nature (reliability parameter decisions). Setting the minimum reserve levels and activating the reliability safety net are also reliability decisions that are more operational in nature and similar to other decisions made by AEMO on a day to day, basis in its capacity as market operator.

The MCE should provide high level guidance on community expectations and the value that consumers place on reliability. It should be provided under a MCE Statement of Policy Principles or another appropriate vehicle and would inform any decisions made in this regard.

Given the governance framework established through the Australian Energy Market Agreement and reflected in the NEL, the AEMC is best placed to make reliability parameter decisions. The application of the reliability safety net measures and the minimum reserve level decisions should remain with AEMO but, in respect to the latter, consideration should be given as to whether the Rules should specify how that decision is made.

We have suggested some governance options based on the AEMC making reliability decisions with a role for the MCE in providing policy guidance. Each option has its advantages and disadvantages. The options can be developed further on request

4.4.1 Approach to advice

This aspect of the advice relates to governance arrangements, and more particularly, to how the reliability standard policy decision-making should be structured and managed in the future. This involves addressing a series of questions:

- As a starting point, it is necessary to consider how decision making should be managed at a general level.

- What are the decisions on reliability standards and how should they be characterised? To determine appropriate roles for the MCE, AEMC, AEMO and the Reliability Panel it is necessary first to define and characterise the decisions that relate to reliability standards.

- What is an appropriate framework against which governance arrangements regarding reliability standard decision-making can be assessed? When assessing future governance options and the appropriate roles for the MCE, AEMC, AEMO and the Reliability Panel, it is necessary to have a framework against which to test them.

- What are the current governance arrangements for reliability standard decisions and what alternative governance models for reliability standards decision-making would be feasible?

- How do the status quo arrangements compare with the alternative options, in terms of the assessment framework?

Having addressed these questions, we draw conclusions about appropriate governance options for future decision-making on reliability standards and make some suggestions for further work in this area.

4.4.2 How should decision making be managed generally?

Considering appropriate roles for decision-making in the context of reliability standards involves a consideration of *how* such decisions should be managed. As a general proposition, good governance arrangements for decision making should ensure that:

- the decision is made at the appropriate level in the governance structure;

- the decision-maker has access to the relevant information and considerations;

- the decision is made in an appropriate manner, with a sufficient degree of independence, transparency, and accountability; and

- the decision is unbiased, evidence-based, and rigorous and that stakeholders have confidence in the basis and objectivity of the decision.

4.4.3 Defining and characterising decisions relating to reliability

A number of decisions are made under the Rules which relate to reliability in the NEM. They are the decisions to determine:

- the reliability standard;

- the reliability settings – the MPC, the market floor price and the cumulative price threshold;

- the APC;

- the MRLs; and

- the application of the reliability safety net measures such as the RERT.

Collectively, these five decisions are referred to in the remainder of this section as the 'reliability decisions'.

Reliability parameter decisions

Reliability is generally regarded as a measure of the adequacy of the electricity generating systems and networks to meet the reliability expectations of consumers. As such, the composition and the level of the reliability standard is a critical and determining feature of the reliability performance of the NEM. The reliability settings, being the level of the MPC, the market floor price and the CPT, form the key price envelope within which the wholesale market seeks to balance supply and demand and deliver capacity to meet the reliability standard at any given point in time. The MPC and market floor price provide key signals for supply and demand side investment and usage. The CPT is an explicit risk management mechanism designed to limit participants' exposure to protracted levels of high prices in the wholesale market. The APC comes into effect when the CPT is exceeded. In this regard it is also a risk management tool, designed to limit exposure during periods of sustained high prices.

Decisions on the reliability standard, the reliability settings and the APC form an integrated package and they should be reviewed and as necessary varied together in recognition of their interactions. They should not be subject to constant review because they provide signals for long-term investment in capacity by market participants. This requires a relatively stable and predictable investment requirement. They also affect a number of other decisions and practices of the market operator and market participants.

The decisions on the reliability standard, the reliability settings and the APC may be regarded as decisions that relate to the framework for the operation of the energy market. They are decisions that have a strong economic, market framework focus. They are referred to as 'reliability parameter decisions'. These decisions could be contrasted with more operational and administrative decisions which are made for practical purposes or in response to the needs of the market at any one point in time. They may also be contrasted with higher level, strategic policy decisions; for example, determining the community's expectations regarding reliable electricity supply relative to its cost.

Reliability operation decisions

The reliability standard is currently defined as a level of annual USE that is targeted every year and reliability performance is measured over a moving 10-year average. To determine whether the NEM is likely to meet the reliability standard, operational and planning decisions are made on a continuous basis. To allow these continuous decisions to be made the MRLs are developed. They represent the minimum reserves of generation capacity and transmission interconnector support required to ensure that the reliability standard is met. MRL decisions flow from, and reflect, the decision on the reliability standard. They are practical tools to assist in the day to day management of the system.

The 'reliability safety net' refers to AEMO's powers to intervene in the market to address potential shortfalls of supply against the reliability standard where AEMO considers that there has been a failure of the market to deliver sufficient reserves or there is a risk to the secure and safe operation of the power system. The Rules enable AEMO to procure additional reserves using the RERT or by issuing directions or instructions.[43]

The decisions on MRLs and activating the reliability safety net measures are more responsive and operational in nature and similar to other decisions made by AEMO in its role as market operator. They are referred to as the 'reliability operation decisions'.

4.4.4 Framework for assessing governance models for reliability standard decision making

When considering appropriate roles for the MCE, AEMC, AEMO and the Reliability Panel the most appropriate frame of reference is the energy governance framework established under the Australian Energy Market Agreement and reflected in the NEL and, more recently, the National Gas Law (NGL).[44]

Introduced in 2005, the new governance framework was designed:

- to improve the quality, timeliness of decision-making for, and to strengthen and streamline governance of the NEM;
- to provide an enhanced framework of accountability to governments and market participants through the separation of functions to avoid perceptions of conflicting interests;
- to provide for clear consultation, reporting obligations, transparency and avenues of appeal; and
- to guide future energy policy decision-making by jurisdictions and to provide increased policy certainty for energy users and for the energy sector.

A critical feature of the arrangements is the separation of high level policy direction, rule-making and market development, market operation and administration, and economic regulation and rule enforcement. This is reflected in the roles assigned to the MCE and the institutional bodies. Each of these bodies has been allocated functions and provided with powers to ensure that the benefits discussed above can be achieved. The role and function of each of the MCE, AEMC, AEMO and the Reliability Panel in the electricity context are summarised below. [45]

[43] Refer to rule 3.20 and clause 4.8.9 of the Rules.

[44] The focus of this discussion is the NEL.

[45] Note that the roles and functions are similar under the NGL.

MCE

The MCE is responsible for high level policy oversight and future strategic direction for the national energy market. The MCE establishes the policy framework and governance arrangements for the national energy markets but it does not become involved in the day-to-day operational activities of the institutional bodies. The MCE is best placed to make high level decisions on the market design or framework and to provide general policy guidance to the AEMC, the AEMO and other institutional bodies as needed.

AEMC

The AEMC was established as a statutory commission and is the independent rule maker. It also has a market development function. The AEMC has the legal power to make decisions within the existing market design or framework through its consideration of Rule change requests and to provide advice to the MCE on energy policy or market design or framework changes. It must carry out its functions openly and transparently, and in accordance with the requirements of the NEL.

AEMO

AEMO was established as a company and is the independent market operator. In its role as market operator, it is responsible for the day to day operation and administration of the power system and wholesale exchange for electricity. Its role is to administer the market and make decisions around technical operations and undertake actions that allow the market to run efficiently in accordance with requirements in the Rules and the NEL. AEMO must comply with and apply the Rules insofar as they are relevant to its functions.

Reliability Panel

The Reliability Panel is established as a panel by the AEMC under the NEL. Its functions include monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system. It also has a number of other functions under the Rules that it inherited from the previous governance arrangements. Currently they include determining the reliability standard. The composition of the Reliability Panel is set out in the Rules. It includes retailers, generators, transmission network operators, distribution network operators and end users.

4.4.5 Current arrangements for making reliability decisions

Since the establishment of the NEM, the NEL and the Rules (and previously the National Electricity Code) defined the roles of the market bodies and the decision-making processes regarding the NEM reliability arrangements.

The reliability decisions are made by the Reliability Panel, the AEMC either directly or via a Rule change request, and AEMO. How each reliability decision is made is set out briefly below.

Reliability standard

Under clause 8.8.3(a)(1) of the Rules, the Reliability Panel must determine the reliability standard. The Reliability Panel publishes the standard on the Reliability Panel's page on the AEMC website. By 30 April of each second year (commencing 2010) the Reliability Panel must conduct a review in accordance with the Rules consultation procedures on the reliability standard and reliability settings and publish a report on the reliability standard and reliability settings that it recommends should apply from 1 July in the year commencing 2 years after the year in which the review is conducted.

Reliability settings – MPC, market floor price and CPT

The reliability settings, being the MPC, market floor price and CPT are set out in the Rules (clauses 3.9.4(b), 3.9.6(b) and 3.14.1(c)). A decision to amend any of them is made by the AEMC via a Rule change request.

As set out above, the Reliability Panel must conduct a review in accordance with the Rules consultation procedures on the reliability settings.[46] The Reliability Panel must include in the report of the review the reliability settings that it recommends should apply. Following completion of the review of reliability settings, and depending on the outcome of the review of the reliability settings, the Reliability Panel may submit a Rule change request to the AEMC to amend the Rules to change the reliability settings.

Administered Price Cap

Under clause 3.14.1(a) of the Rules, in conjunction with each participating jurisdiction, and after consulting market participants in accordance with the Rules consultation procedures, the AEMC must develop, authorise and publish a schedule to specify an administered price cap for each region. The schedule is published on the AEMC website.

Minimum Reserve Levels

MRLs are determined by AEMO on a periodic basis. They are not determined as a requirement under the Rules.

Reliability safety net measures

The reliability safety net measures are applied by the AEMO in accordance with requirements in the Rules. The Rules provide that AEMO can intervene in the market either by:

- Issuing directions or instructions under clause 4.8.9 of the Rules. In relation to reliability they are most likely to be a direction to a generator to increase its output to the extent that this physically possible and safe to do so. It may

46 Clause 3.9.4 of the Rules provides further direction to the Reliability Panel in how it should undertake the review of the MPC. Clause 3.9.6 provides further direction to the Reliability Panel in how it should determine the market price floor.

include instructions to disconnect load during periods of low reserves if it is necessary to maintain the secure operation of the NEM power system; or

- Procuring additional reserves using the RERT mechanism under rule 3.20. AEMO has the power to contract for additional reserve capacity (known as reserve trading) when it considers that the market has failed to deliver sufficient reserves to meet the MRLs.

Observations on the current arrangements

Prior to considering alternative arrangements for the making of reliability decisions, some observations may be made in respect of the current arrangements. Historically there have been two principal anomalies in the reliability arrangements:

- there has been no high level policy input into the process; and
- the reliability standard has been decided by a different decision maker and process to the reliability settings.

Under the current arrangements, higher level policy guidance on community expectations regarding reliability standards is not part of the governance framework for reliability decisions, in particular decisions on the reliability standard. There should be a role for policy input in this regard and the MCE is best placed to provide such guidance through an appropriate vehicle, such as an MCE Statement of Policy Principles.

The NEM's reliability arrangements were reformed significantly following recommendations in the Reliability Panel's CRR[47]. This included a Rule change made by the AEMC that resulted in the reliability standard and the related reliability settings being reviewed as an inter-related package every two years.[48] In making further changes to the NEM reliability governance arrangements, we are of the view that this integrated approach to decision making on the NEM's reliability standard and settings should be maintained.

As outlined above, the reliability standard is currently determined by the Reliability Panel, an advisory body established under the auspices of the AEMC, while the other reliability settings are determined by the AEMC on the basis of advice provided by the Reliability Panel. All of the reliability parameters should be determined under a consistent process by the one decision making body. This would reduce complexity, and ensure that appropriate alignment between the reliability standard and the reliability settings.

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47 Available at: www.aemc.gov.au

48 AEMC 2009, *NEM Reliability Settings: VoLL, CPT and Future Reliability Review*, Final Rule Determination, 28 May 2009, Sydney. In that Final Rule Determination the AEMC agreed that there was merit in the reliability standard and the reliability settings being reviewed in an integrated manner. A review every two years would strike the appropriate balance between giving certainty to market participants and retaining sufficient flexibility to amend these variables when necessary. Refer to pages 29-30.

4.4.6 Alternative Arrangements for Reliability Decisions

We have characterised the reliability parameter decisions as decisions of an economic, market framework, nature. They are made relatively infrequently to maintain a relatively stable and predictable investment environment. A number of consequential, administrative and operational decisions and practices are based on these decisions. They require a consideration of a number of factors and should be subject to an open and transparent decision making process with the decisions being made by a body that is appropriately independent and accountable. Further, in developing any alternative arrangements for how reliability decisions are made, it is necessary to address the historical anomalies identified above when considering options for improved alignment of roles.

The MCE is the appropriate source of policy advice on matters to be taken into consideration by the reliability parameter decision-maker. That policy advice should be at a relatively high, principles-based level and should identify a range of considerations relevant to an assessment of the community's expectations regarding the value and cost of reliable electricity supply. The governance framework does not envisage MCE involvement in detailed economic or technical matters within the existing market framework, and the MCE is not well placed or resourced to make detailed economic and market framework decisions of the kind required for the reliability parameters.

Accordingly, we envisage that the MCE's policy guidance would involve high level policy principles and objectives that are consistent with the National Electricity Objective rather than going to specific targets and their quantification. This would provide guidance for the reliability standard and related reliability settings to be determined having been subject to the required transparent consultation process.

More specific advice on the nature and form of the policy guidance that could be provided by the MCE will be presented in our Final Report after considering any policy response to these comments and proposals.

Given the broader governance framework outlined above we consider that the AEMC is best placed to make all of the reliability parameter decisions on the basis of high level guidance from the MCE on the community's expectation and valuation of electricity reliability. The AEMC is an independent decision maker and, via the Rule change process, regularly makes decisions that are similar in nature to the reliability parameter decisions. The AEMC has well established, open and transparent processes for decision making which are reflective of the AEMC's obligations under the NEL. To the extent that advice on technical or economic issues is required, the AEMC has a range of means of ensuring it is well informed.

Having regard to its composition, the Reliability Panel is more appropriately placed to provide advice on technical, commercial and consumer impact issues rather than make reliability parameter decisions. Under the current energy governance framework, the Reliability Panel was established primarily with the purpose of providing advice and to undertake monitoring of more technical and operational matters.

As the market operator applies, administers and implements the reliability parameter decisions through its day to day operation and administration of the NEM, AEMO is not the appropriate body to make reliability parameter decisions. The reliability parameter decisions are economic and market framework in nature and are distinct from the technical and operational decisions generally allocated to the market operator under the Rules such as the decision to determine MRLs and to apply the reliability safety net measures. Providing for AEMO to make the reliability parameter decisions would be inconsistent with its more general role and with the intention of the governance arrangement to maintain separation between framework rule-making and the administration and operation of the market framework. There could also be perceptions of conflicting roles and interests were AEMO to make such decisions. In reliability parameter decision making AEMO's role should be to provide information and advice to the decision maker.

The reliability operations decisions are currently made by AEMO. This is appropriate and should remain, given AEMO's role and function as market operator.

4.4.7 Comparison and assessment of alternatives for making reliability policy parameter decisions

On the basis that the AEMC is the appropriate reliability parameters decision-maker, with policy guidance from the MCE, and that AEMO should continue to make the reliability operations decisions, the next matter to consider is how should the AEMC carry out this decision making function.

We have assessed three indicative options for the AEMC to make the reliability parameter decisions. In all three options the MCE would provide high level policy guidance on community expectations about reliability. In two of the options the AEMC would make the decisions via a Rule change request. The third option provides for the AEMC to make the decision in accordance with functions imposed on it either under the NEL or under the Rules. Each is described at a high level below.

Option 1

The MCE would provide policy guidance on the community's expectations regarding the value of reliability via a MCE Statement of Policy Principles. The reliability standard, reliability settings and APC (reliability parameters) would be set out in the Rules. The Rules would require the Reliability Panel to undertake periodic reviews of the reliability policy parameters. Following the conclusion of the review, the Reliability Panel would report to the AEMC with recommendations as to whether or not one or more of the reliability parameters should be amended. If the recommendations of the review were to amend one or more of the reliability parameters, the Reliability Panel would lodge a Rule change request with the AEMC to that effect. In making its Rule determination the AEMC would have regard to any policy input on community expectations regarding reliability set out in a MCE Statement of Policy Principles. It would also take into account submissions from interested parties such as the Reliability Panel and AEMO.

Option 2

The MCE would provide policy guidance on the community's expectations regarding the value of reliability via a MCE Statement of Policy Principles. The reliability parameters would be set out in the Rules. The MCE would direct the AEMC to undertake periodic reviews of the reliability parameters. Following the conclusion of the review the AEMC would make recommendations to the MCE as to whether or not one or more of the reliability parameters should be amended. The MCE would review the recommendations of the AEMC. If the MCE accepted the outcome of the AEMC's review to amend one or more of the reliability parameters, the MCE would lodge a Rule change request with the AEMC to that effect. In making its Rule determination the AEMC would have regard to any policy input on community expectations regarding reliability set out in a MCE Statement of Policy Principles. It would also take into account submissions from interested parties such as the Reliability Panel and the AEMO.

Option 3

The MCE would provide policy guidance on the community's expectations regarding the value of reliability via a MCE Statement of Policy Principles or another mechanism. The reliability parameters would not be set out in the Rules but in another instrument such as a schedule, which would be published on the AEMC website. The NEL or Rules would require the AEMC to amend the reliability parameters in accordance with a prescribed process. In making its decision, the prescribed process in the NEL or Rules would require the AEMC to have regard to any policy input on community expectations regarding reliability, set out in a MCE Statement of Policy Principles. That prescribed process would also require the AEMC to take into account submissions from interested parties such as the Reliability Panel and the AEMO.

Each of these options is depicted in the table below, with the status quo arrangements included for comparison.

	Status quo	Option 1	Option 2	Option 3
MCE policy input	n/a	MCE SPP[49] on customer value of reliability	As for option 1	As for option 1 or other input from the MCE
Location of reliability policy parameters	Schedule/Rules	Rules	Rules	Schedule or other instrument on AEMC website
Decision maker	AEMC/ Reliability Panel	AEMC	As for option 1	As for option 1
Decision trigger	Review, exercise of functions under Rules	Reliability Panel Review	AEMC review directed by MCE	In accordance with process set out in Law or Rules
Decision mechanism	Rule change request, exercise of functions under Rules	Rule change request from Reliability Panel	Rule change request from MCE	In accordance with process set out in Law or Rules
Other input	Including AEMO	Including AEMO, Reliability Panel	Including AEMO, Reliability Panel	Including AEMO, Reliability Panel

The advantages and disadvantages of the status quo and the three options are set out in the table below.

	Advantages	Disadvantages
Status quo	• The processes for making reliability parameter decisions are clear and transparent as they are set out in the Rules.	• There is no policy input provided by the MCE. • Certain reliability parameter decisions are made directly by, or driven by, the Reliability Panel which is not an appropriate decision maker given the nature of the decisions. • Some of the reliability parameters can be subject to more frequent review as any person may lodge a Rule change request to amend them at any time, thereby creating uncertainty.
Option 1	• It includes policy guidance from the MCE on the customer value of reliability. • The reliability parameters would be determined in a consistent manner. • The process for amending the reliability parameters is clear and transparent.	• There can be a perception that, due to its composition, the Reliability Panel has conflicting interests in undertaking reviews of the reliability parameters which form the basis for changes to those parameters via the Rule change process. • The Reliability Panel would still undertake the principal review and initiating body for reliability policy parameter decisions.

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	Advantages	Disadvantages
	• The AEMC role as decision maker is appropriate given its independence and the nature of the decision. • The AEMC role is consistent with the AEMC's current Rule making function.	• As they would be located in the Rules, the reliability parameters could be subject to more frequent review as any person may lodge a Rule change request to amend them at any time, thereby creating uncertainty.
Option 2	• It includes policy guidance from the MCE on the customer value of reliability. • The reliability parameters would be determined in a consistent manner. • The process for amending the reliability parameters is clear and transparent. • The AEMC role as decision maker is appropriate given its independence and the nature of the decision. • The AEMC role is consistent with the AEMC's current Rule making function. • There are no perceptions of conflict of interest as there are for option 1.	• There is a risk that decisions are not made in a timely manner as there is considerable time and process involved in the MCE directing the AEMC to conduct a review and, following conclusion of the review, considering the outcomes of the review and submitting to the AEMC a Rule change request. • It involves the MCE in a detailed area of policy that is not consistent with its more general role in the energy governance framework. There may be potential for increased investment uncertainty under this process. • As they would be located in the Rules, the reliability parameters could be subject to more frequent review as any person may lodge a Rule change request to amend them at any time, thereby creating uncertainty.
Option 3	• It includes policy guidance from the MCE on the customer value of reliability. • The reliability parameters would be determined in a consistent manner. • The process for amending the reliability parameters is clear and transparent. • The AEMC role as decision maker is appropriate given its independence and the nature of the reliability parameter decisions. • The AEMC role is consistent with the AEMC's current Rule making function. • There are no perceptions of conflict of interest as there is for option 1. • It provides for timely decision making, which is a risk for option 2.	• The AEMC would be making a decision outside of its Rule making function. However this would be mitigated by following the standard consultation process. • Depending on the prescribed process for the AEMC to carry out this decision making function there could be the perception that the AEMC has undue responsibility for making important policy and market performance settings. • If the process for making the reliability parameter decisions is set out in the Rules, the prescribed process could be subject to review as any person may lodge a Rule change request to amend them at any time, thereby creating uncertainty.

	Advantages	Disadvantages
	• The reliability parameters would not be located in the Rules, avoiding the possibility of Rule change requests being submitted to amend them more frequently.	

4.4.8 Conclusion

We have concluded that it is appropriate for the MCE to provide high level policy guidance on the community's expectation and valuation of reliability. We have also concluded that the AEMC is best placed to make reliability parameter decisions. They are detailed economic, market framework decisions that are not unlike decisions that are made by the AEMC on a regular basis via its Rule making function. Under this approach, the role of the Reliability Panel would be to provide advice to the AEMC as part of the AEMC's decision making process. AEMO should continue to make reliability operational decisions.

Three indicative options have been explored for how the AEMC could make the reliability parameter decisions. For each of the options considered the MCE would provide high level policy guidance or direction on the community's expectations and valuation of reliability relative to cost. The form of that guidance and the appropriate level of detail would need further consideration.

Regarding options for the AEMC to make the reliability parameter decisions, our preliminary conclusion is that option 3 represents the most appropriate governance arrangements for making such decisions in the future. Our reasons are set out below.

Options 1 and 2 assume that the AEMC would make the decision via the Rule change process under the NEL. The disadvantages with each of options 1 and 2 relate to the main trigger for the Rule change requests. In the first option, the Reliability Panel is the main trigger. While not the decision maker, the Reliability Panel would still have a key role in determining when the AEMC would consider amendments to the reliability parameters through its review function. It can be argued that the Reliability Panel is not best placed to review and initiate such matters as it may be perceived to have a conflict of interest due to its composition. For option 2 the main trigger for the Rule change request is the MCE. The main disadvantage for option 2 is the risk that decisions are not made in a timely manner as the MCE is not resourced to consider detailed issues of this nature on a regular basis. There may also be a perception of increased investment uncertainty under the option 2 process. For each of options 1 and 2, having the reliability parameters in the Rules themselves also creates a risk that they could be subject to more frequent proposals for change.

The third option provides an alternative under which the AEMC would make reliability parameter decisions. The AEMC would make the decision under a prescribed process – whether in the Rules or the NEL. Making a decision other than via a Rule change process is a function outside of the AEMC's main decision making function which is by way of the Rule change process. However, the AEMC does make some decisions under the Rules (such as determining the APC) and the nature of the reliability parameter decisions is similar to decisions that the AEMC makes on a regular basis as part of its Rule making function. So long as the AEMC makes reliability parameter decisions in accordance with an appropriately open and transparent process, making such decisions would be consistent with the AEMC's role and functions as envisaged under the energy governance framework and reflected in the NEL. The third option requires further detailed consideration on how best to implement it. However, on balance we consider it to be preferable to the other options presented.

A Reliability Standard

AEMC Reliability Panel **December 2007**

NEM Reliability Standard – Generation and Bulk Supply[50]

This Reliability Standard for Generation and Bulk Supply was determined by the Reliability Panel (Panel) as part of its Comprehensive Reliability Review (CRR), which it completed on 30 November 2007. This Reliability Standard forms part of the *power system security and reliability standards* and was determined in accordance with clauses 8.8.1(a)(2) and 8.8.3 of the National Electricity Rules (Rules).

Form of the Reliability Standard

The NEM Reliability Standard for Generation and Bulk Supply is an output-based measure expressed in terms of the maximum permissible unserved energy (USE), or the maximum allowable level of electricity at risk of not being supplied to consumers, per financial year. The USE is measured in GWh and should be expressed as a percentage of the annual energy consumption for the associated region or regions.

Level of the Reliability Standard

The maximum permissible unserved energy (USE), or the maximum allowable level of electricity at risk of not being supplied to consumers, is 0.002% of the annual energy consumption for the associated region or regions per financial year.

Compliance with the Reliability Standard

Compliance with this Reliability Standard for Generation and Bulk Transmission should be measured over the long-term using a moving average of the actual observed levels of annual USE for the most recent 10 financial years. Operationally, this Reliability Standard for Generation and Bulk Transmission should be targeted to be achieved in each financial year, for each region and for the NEM as a whole.

Scope of the Reliability Standard

This Reliability Standard for Generation and Bulk Supply includes unserved energy associated with power system reliability incidents that results from:

- a single credible contingency on a generating unit or an inter-regional transmission element, that may occur concurrently with planned generating unit or inter-regional transmission element outages; or
- delays to the construction or commissioning of new generating units or inter-regional transmission network elements, including delays due to industrial action or 'acts of God'.

50 This standard is published in the final report of the Reliability Panel's Comprehensive Reliability Review, available on the AEMC website at www.aemc.gov.au/electricity.php?r=20051215.142656 .

This Reliability Standard for Generation and Bulk Supply excludes unserved energy associated with power system security incidents that results from:

- multiple or non-credible contingencies;
- planned outages of intra-regional transmission or distribution network elements; or
- industrial action or 'acts of God' at existing generating or inter-regional transmission facilities.

B Historical Reliability Projections

The MCE Direction requires the Commission to include in this Second Interim Report a comparison of historical NEM reliability forecasts with outcomes that occurred in the first ten years of the NEM (averages and extremes). The information provided in this appendix is summarised in Section 3.1.

AEMO operates a number of deterministic reliability assessments covering a range of time horizons to inform both AEMO and NEM participants of the current and projected levels of available reserves. These include:

- ESOO – reserve assessment over ten years;
- MTPASA – reserve assessment over two years;
- STPASA – reserve assessment over one week; and
- PDPASA – reliability assessment over two days.

These processes serve two main purposes, that is to inform:

1. NEM participants and potential investors of potential periods of low reserves, which would be expected to correspond to periods of high prices, in order to elicit a market response; and
2. AEMO of potential periods of reserve shortfalls so that AEMO can take action to increase reserves by releasing lack of reserve notices to the market to elicit a market response, speaking to NEM participants (including TNSPs) about rescheduling planned outages, contracting for reserves through the RERT provisions, or by directing participants to make plant available.

AEMO also performs a number of probabilistic reliability assessments. AEMO uses Monte Carlo simulation, which models the probability of various power system events (such as forced outages), to determine the likelihood of a reliability outcome. These include:

- EAAP – energy constrained reliability assessment over two years; enables AEMO and the market to forecast and respond to projected times where there may be energy constraints that would affect reliability; and
- Adhoc Probabilistic Reserve Studies – performed when considered necessary by AEMO to gain a more detailed understanding of expected reliability for a period; usually triggered by MTPASA.

As there is a large amount of data to compare for the deterministic reliability projections, this data has been provided here in this appendix with conclusions summarised in Section 3.1. There is little data to compare for the probabilistic reliability projections, and as such probabilistic reliability projections are discussed only in Section 3.1.

B.1 Electricity Statement of Opportunities

The ESOO is prepared annually by AEMO and provides a ten year projection of the supply demand balance for both summer and winter maximum demand conditions.

The ESOO includes projections of:

- the maximum summer and winter demands under different temperature and economic growth conditions;
- the available installed generation in each region;
- the available demand side response during periods of high demand; and
- the inter-regional transfer capability of the NEM transmission network.

In making a comparison between the ESOO projections and actual reserve outcomes, it is important to understand the purpose of what the ESOO has been developed to achieve.

1. The ESOO is intended as an information resource for investors, to assist assess the future need for and timing of new supply capacity (or demand side). The ESOO is not a reliability forecast, but a projection of reserve adequacy based on confirmed data at a point in time. The ESOO includes only generation that is either installed or confirmed for installation at the time the ESOO is prepared. Thus the ESOO projects the years until reserve shortfall, assuming no new generation enters the market. Periods of low projected reserves in the ESOO indicate likely periods of high prices and, therefore, are expected to encourage investment in additional capacity in the associated regions. Thus it is expected that investors will respond to the ESOO and commit new generation before the projected reserve shortfall eventuates.

2. The ESOO is designed to project the ability of installed generation to satisfy demand under extreme conditions. The ESOO uses 10% POE demand projections to assess the adequacy of projected generation. This approximates the seasonal peak demand which is expected to be exceeded once in 10 years. The table below compares the actual demand with the 10% POE, 50% POE and 90% POE demand forecasts from the 2008 and 2009 ESOO. The table shows that for the three most recent seasonal peaks, actual maximum demand was generally below the 10% POE demand forecast used in the ESOO reserve adequacy projections.

Region	QLD	NSW	Vic	SA	Tas
Winter 2008					
2008 SOO Peak Forecast (10% POE)	8,196	14,140	8,448	2,533	1,809
(50% POE)	8,075	13,770	8,254	2,432	1,786
(90% POE)	7,923	13,400	8,106	2,332	1,766
Actual maximum demand	8,204	14,287	8,037	2,439	1,718
Summer 2008/2009					
2008 SOO Peak Forecast (10% POE)	10,042	14,860	10,525	3,408	1,445

(50% POE)	9,493	14,010	9,937	3,091	1,420
(90% POE)	9,103	13,160	9,422	2,831	1,405
Actual maximum demand	8,699	14,097	10,445	3,318	1,479
Winter 2009					
2009 SOO Peak Forecast (10% POE)	8,726	14,703	8,328	2,730	1,886
(50% POE)	8,606	14,313	8,190	2,580	1,863
(90% POE)	8,434	13,963	8,084	2,460	1,843
Actual maximum demand	7,687	12,981	8,130	2,358	1,677

As it is expected that 9 in 10 years will experience demand peaks lower than the 10% POE demand, generally regions will not experience reserve shortfall as soon as projected by the ESOO.

Hence if the market design is working, and the need for new investment is being appropriately signalled and incentivised, the reserve shortfalls projected in the ESOO should never eventuate. As such there is little value in comparing the projections to actual outcomes. However, there is value in examining whether the ESOO is providing appropriate information, and whether the market is appropriately responding to those signals.

Efficient investment in supply capacity should result in the commissioning of new supply capacity just in time to meet demand.

The lead time for new investment in generation is between about 18 months and 4 years. For the NEM investment signals to be working optimally, the ESOO should ideally show projected time until supply shortfall of between 18 months and 4 years.

Figure 1 below illustrates the years until reserve shortfall projected for each publication of the ESOO. To simplify the chart, Tasmania has not been included because Tasmania is not capacity constrained but rather energy constrained. The ESOO only considers capacity and cannot indicate a reserve shortfall due to energy limitations. As such the ESOO generally projects adequate reserves for the full ESOO outlook period for Tasmania.[51]

51 Except for the 2008 ESOO which was just before the commitment of a major new generator in Tasmania.

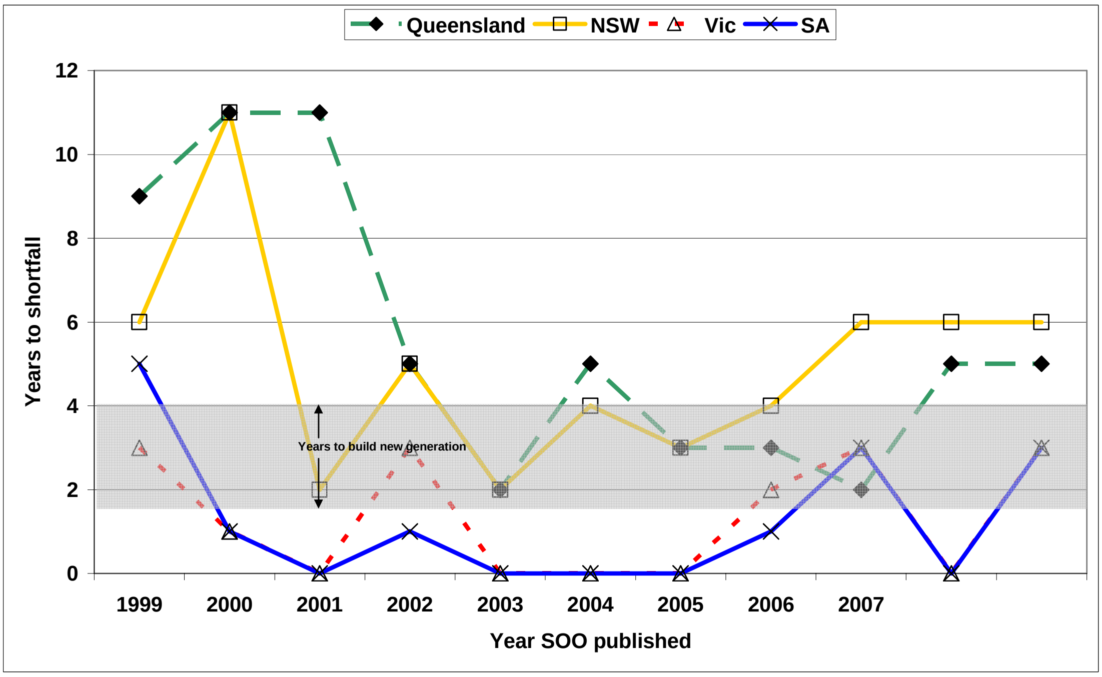

Figure 1 – SOO projected years until reserve shortfall

Figure 1 shows that for New South Wales and Queensland, projected years until reserve shortfall have been in the upper end or have exceeded the optimum range, while for South Australia and Victoria the projected years until reserve shortfall have generally been under the optimum range.

We consider that the projected years until reserve shortfall for Victoria and South Australia have historically been too low. Relative to other regions, Victoria and South Australia entered the NEM with less reserve generation and have had less government intervention to support investment in generation. Victoria and South Australia have also been impacted more by the uncertainty and impact of climate change policy. Although in the 2009 ESOO, the projected years until reserve shortfall for Victoria and South Australia increased to 3 years. This is a result of significant investment in generation and a decrease in demand forecasts due to a decline in economic activity.

As demand continues to rise throughout the ESOO ten year outlook period, significant new investment will be required to maintain adequate reserves in Victoria and South Australia. The level of the MPC is due to increase from $10,000 to $12,500 on 1 July 2010 which will provide greater incentive for investment in generation. The Reliability Panel is also currently reviewing the level of the MPC to apply from 1 July 2012 onwards. The Reliability Panel will recommend a further increase in the level of the MPC if modelling shows that a higher MPC is required to incentive necessary investment to maintain reserves.

The level of MPC is designed to incentive generation in an efficient market. The MPC will not necessarily counter-balance any disincentive to invest caused by uncertainty or transitionary issues with policies outside of the NEM framework. When climate change policy is legislated, providing certainty to investors, the MPC will adjust to provide the incentives necessary to maintain adequate reserves. In the short-term, the Commission is aware that greater reliance may be placed on operational tools such as the RERT.

B.2 Medium-Term PASA

MTPASA calculates projected available reserves at a daily resolution for a two year outlook period. The MTPASA results are updated weekly and are based on the availability information provided by market participants such as generators.

MTPASA has two core purposes. Firstly it informs market participants of periods of potential low reserves. It is expected that periods of low reserves, and hence projected high energy prices, will solicit a market response such as rescheduling planned maintenance outages. Secondly, AEMO monitors MTPASA reserve projections, and will act to increase reserves when the market does not voluntarily respond to low reserve projections. AEMO action could involve issuing lack of reserve notices to the market, talking to market participants about rescheduling outages, contracting for reserves under the RERT provisions, or directing participants to make equipment available.

Like the ESOO, comparing the MTPASA reserve projections to actual reserve outcomes may not provide a meaningful interpretation of whether MTPASA is performing satisfactorily. This is because:

1. MTPASA uses the 10% POE demand and assumes every day over the MTPASA timeframe will endure prevailing conditions resulting in reaching the 10% POE demand, given the precise timing of the underlying condition causing the 10% POE demand cannot be forecast reliably more than one week out. It is not possible to forecast peak demand for a day, two years in advance. MTPASA projections will generally be conservative because it assumes that the 10% POE demand peak could occur on any day. It is thus expected that actual reserve levels will generally be higher than the reserve levels projected in MTPASA.

2. The generator availability submitted to MTPASA is a generator's best estimate of operating capability under the stipulated reference temperatures. Things affecting this estimate are, the temperature on the actual day, binding network constraints limiting generator availability, and unscheduled outages. Generators will actively reschedule planned outages in response to possible supply scarcity flagged by MTPASA.

3. In accordance with the Rules, MTPASA reserve calculations are based upon PASA generator availability whilst STPASA and PDPASA reserve calculations are based upon market availability. Thus if a generating unit was on 24 hour standby then it would be included in the MTPASA reserve calculation but not in the STPASA and PDPASA calculation.

It is generally assumed that an investment decision in new generation capacity would not be affected by the MTPASA results as the lead time for such new generation capacity is likely to exceed the two year projection. Plant upgrades might be influenced.

The following pages contain charts that compare historical MTPASA projections for reserves, demand, and generator availability with actual outcomes.

B.2.1 MTPASA Reserve Projections

The charts on the following pages compare historical MTPASA reserve projections with actual reserve outcomes. The charts include 90 day, 120 day and 365 day ahead forecasts, and include sample data from between the months of November and March for the past 2 years. The charts illustrate MTPASA reserve projections can differ from the actual reserve outcomes by over 1000 MW. For the reasons outlined above, this is not unexpected, and reinforces the point that MTPASA performance cannot be assessed by comparing projections to actual outcomes.

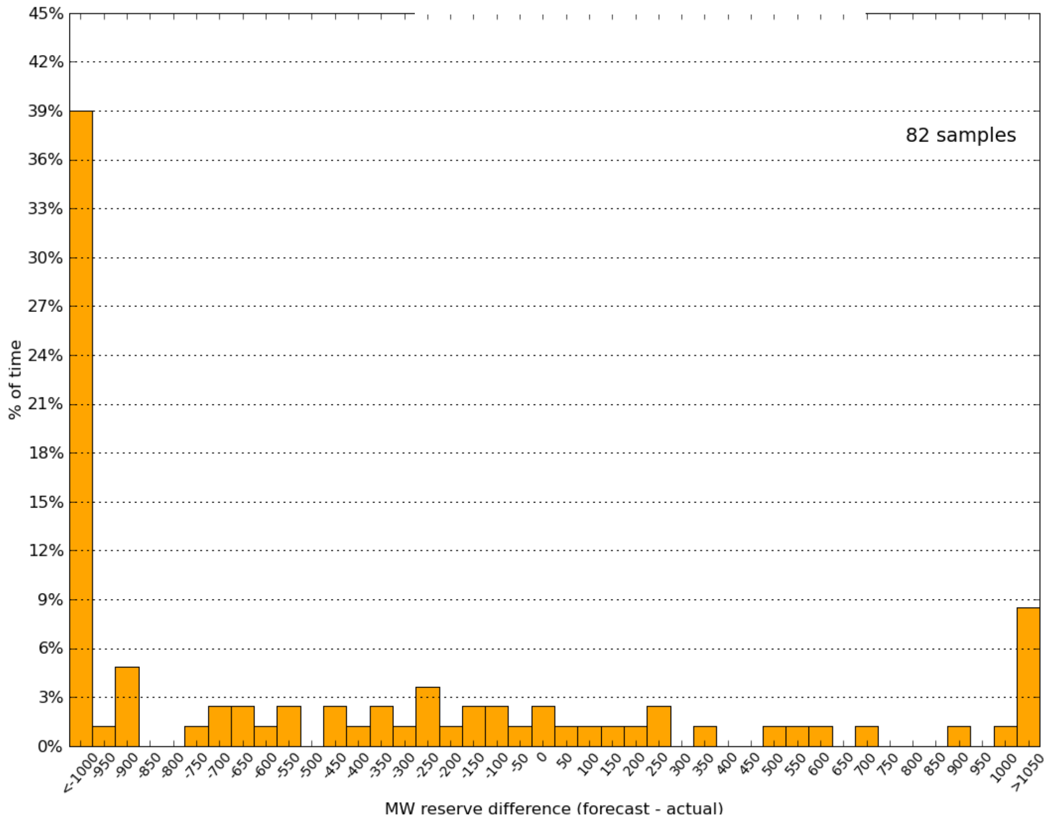

Figure 2 - Victoria 90 day ahead

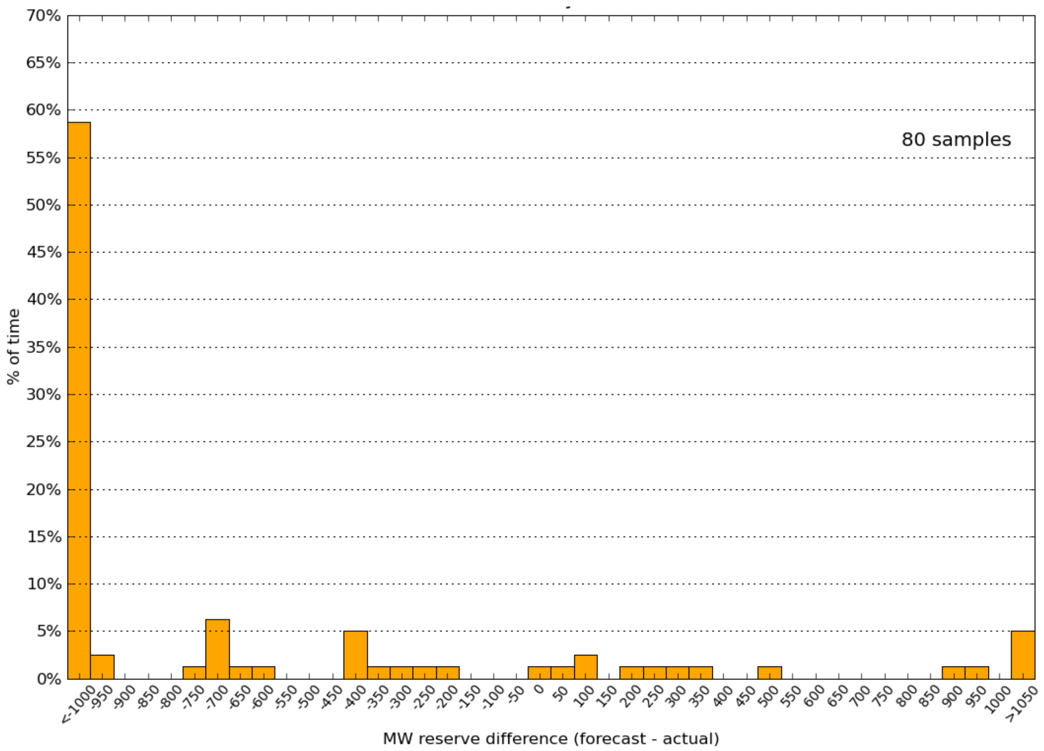

Figure 3 – Victoria 180 day ahead

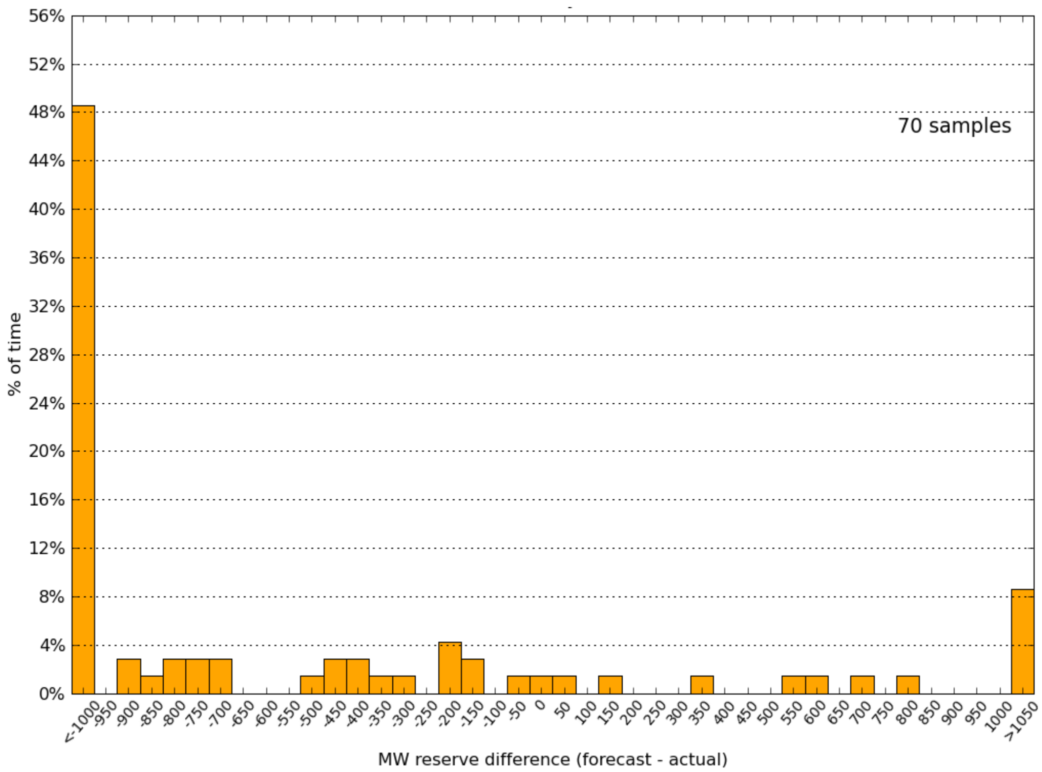

Figure 4 – Victoria 365 day ahead

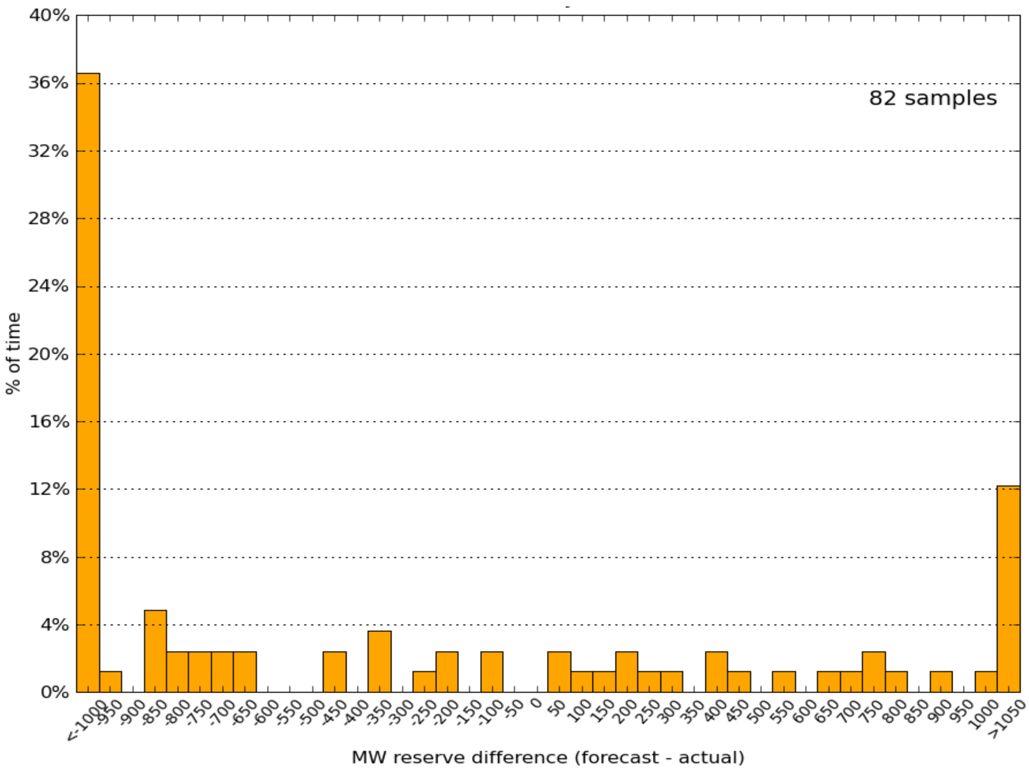

Figure 5 – New South Wales 90 day ahead

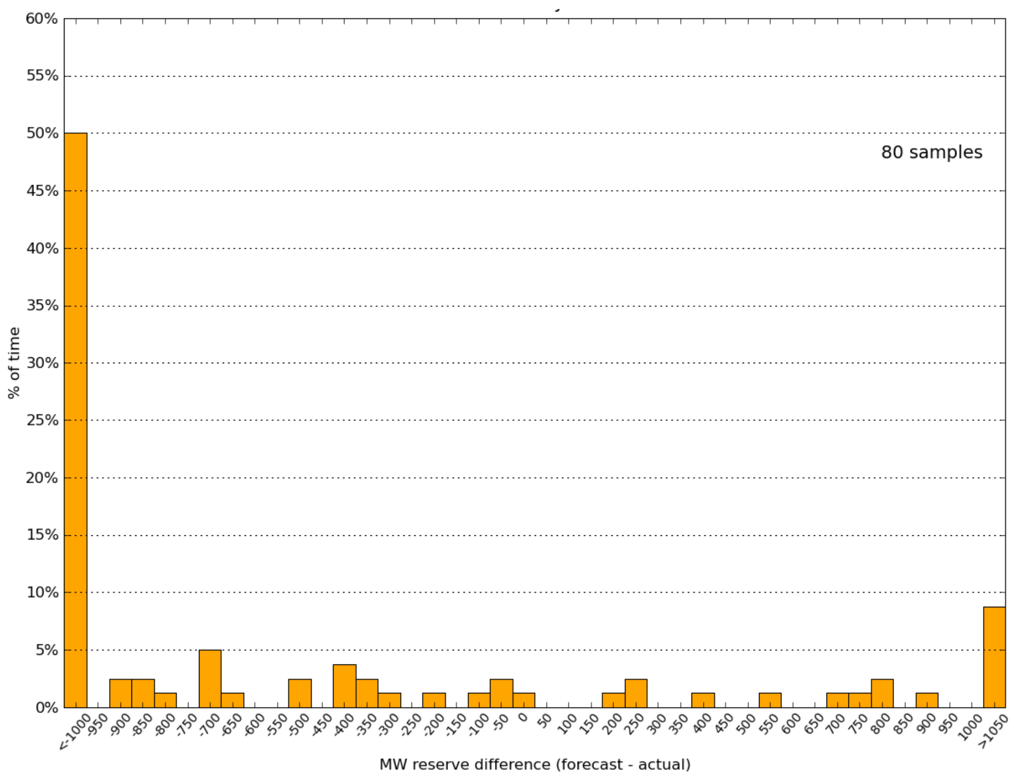

Figure 6 – New South Wales 120 day ahead

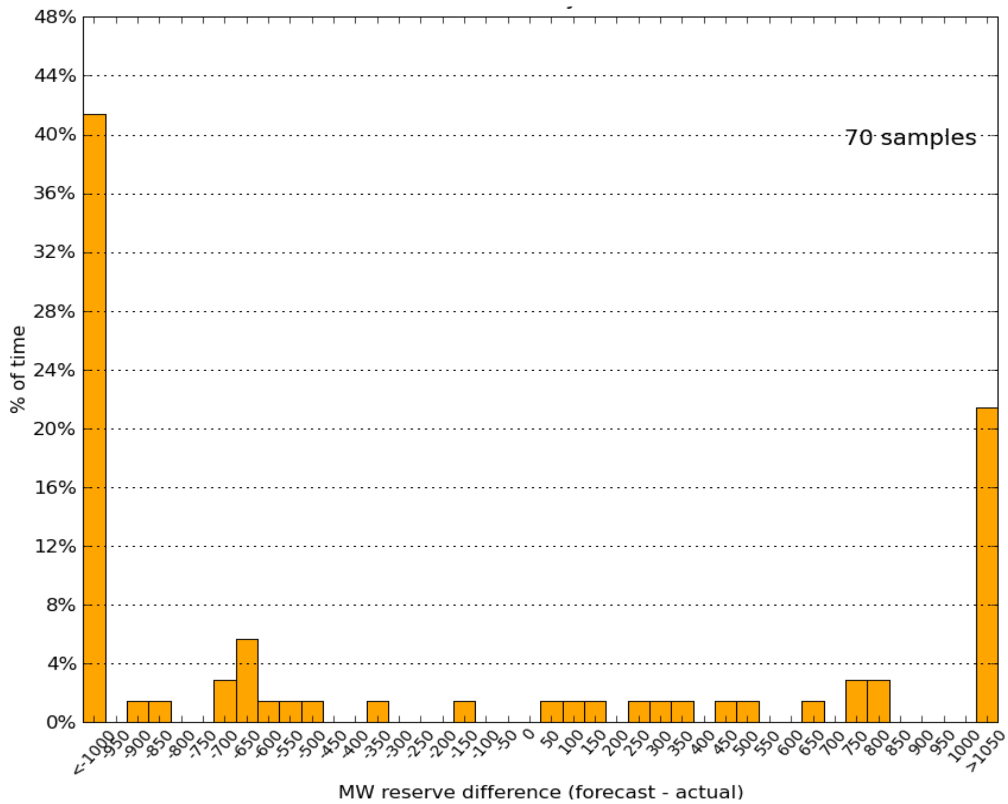

Figure 7 – New South Wales 365 day ahead

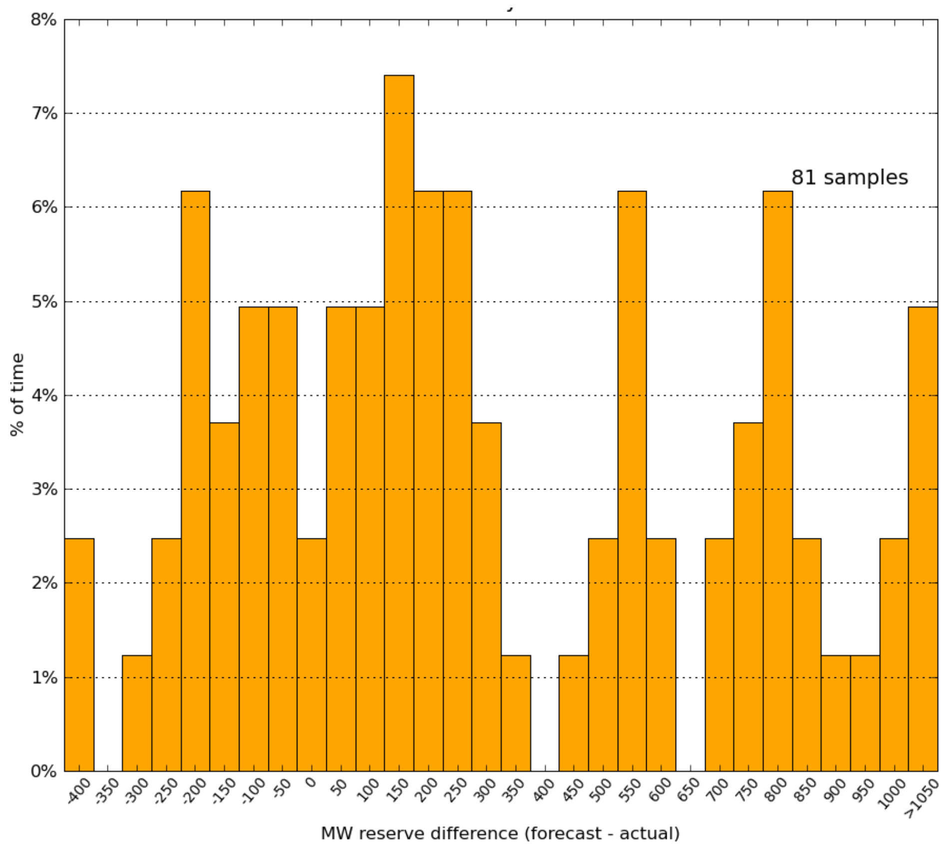

Figure 8 – South Australia 90 day ahead

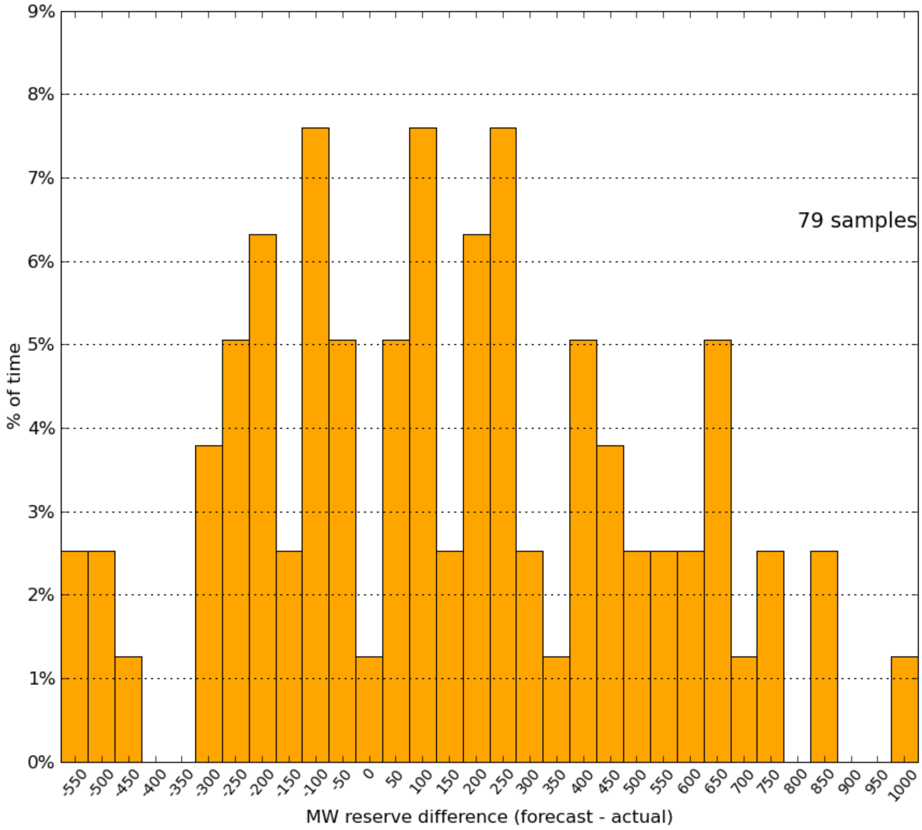

Figure 9 – South Australia 120 day ahead

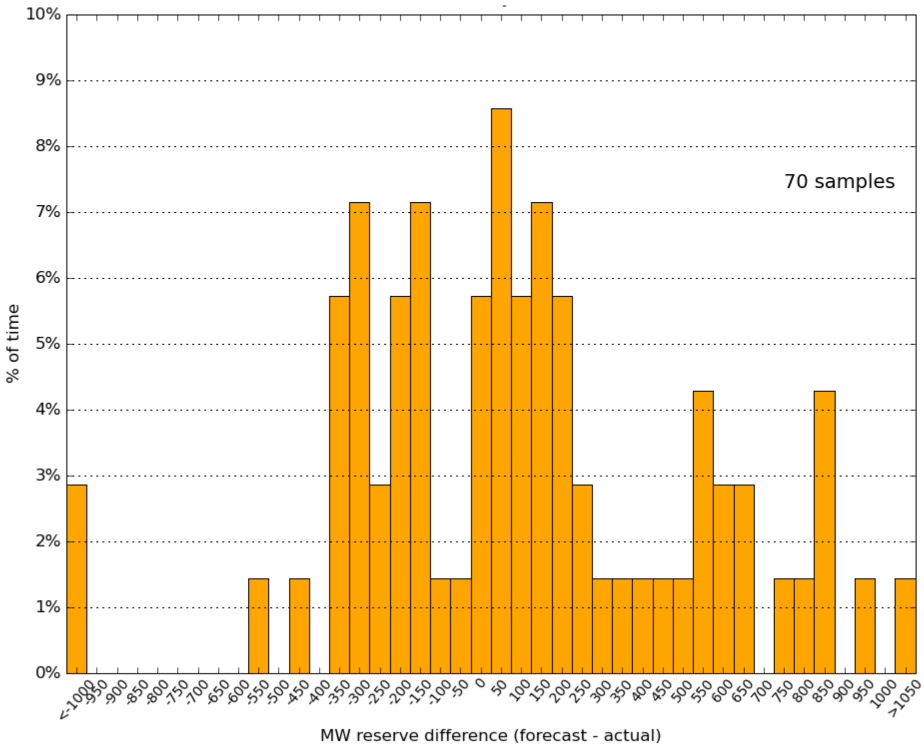

Figure 10 – South Australia 365 day ahead

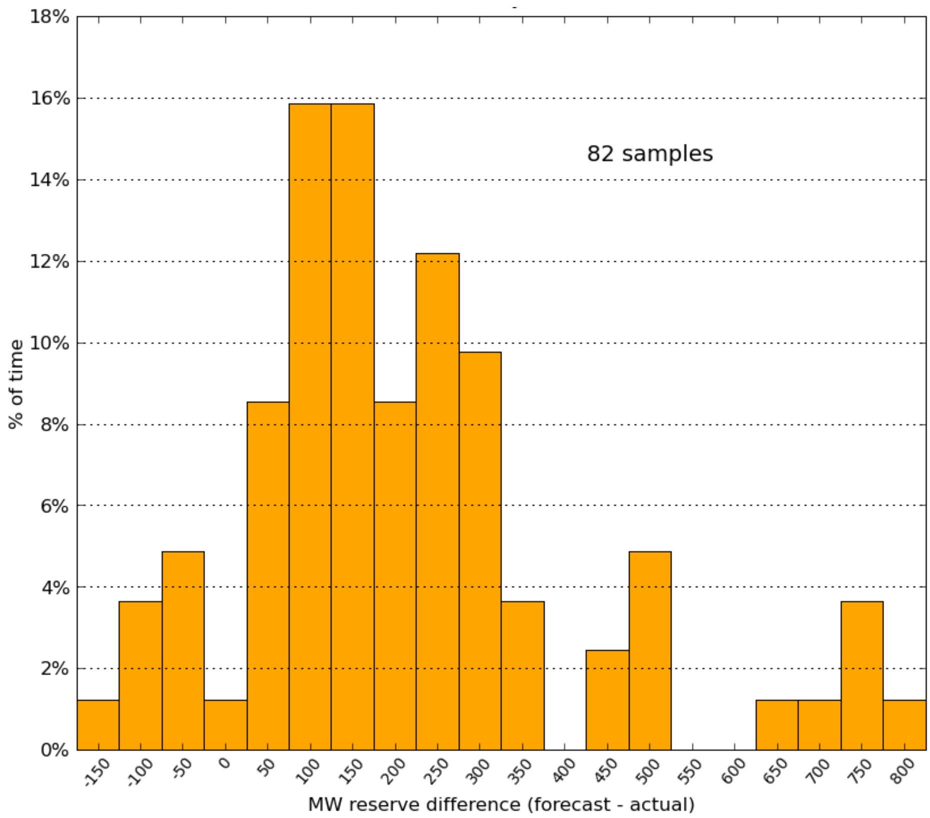

Figure 11 – Tasmania 90 day ahead

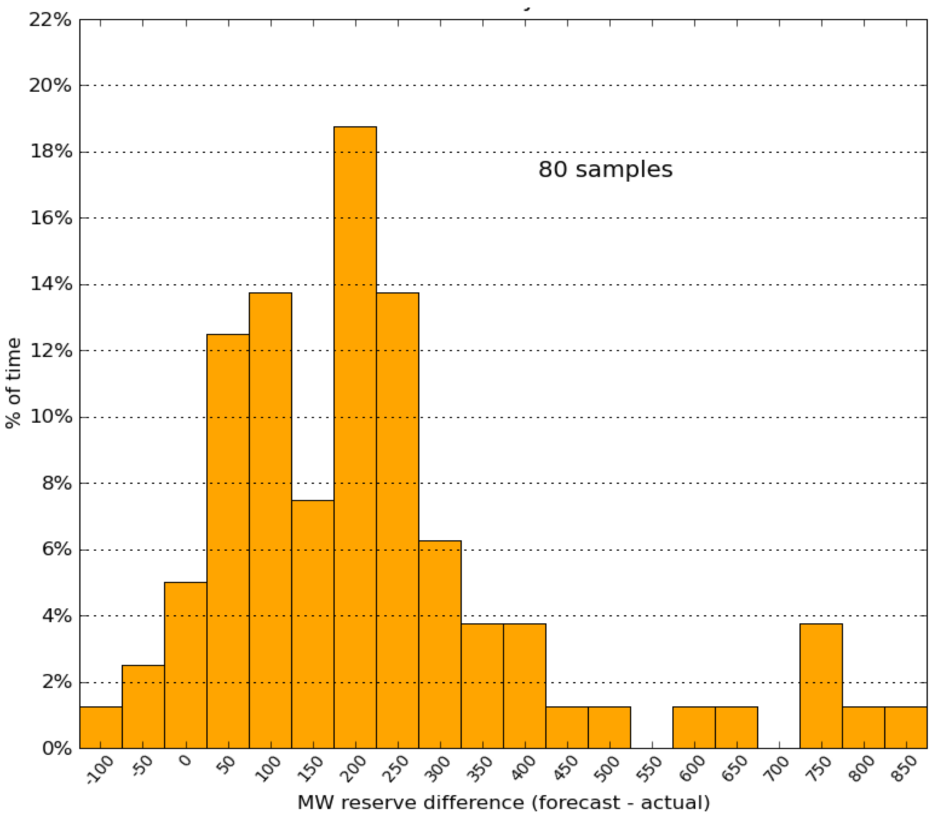

Figure 12 – Tasmania 120 day ahead

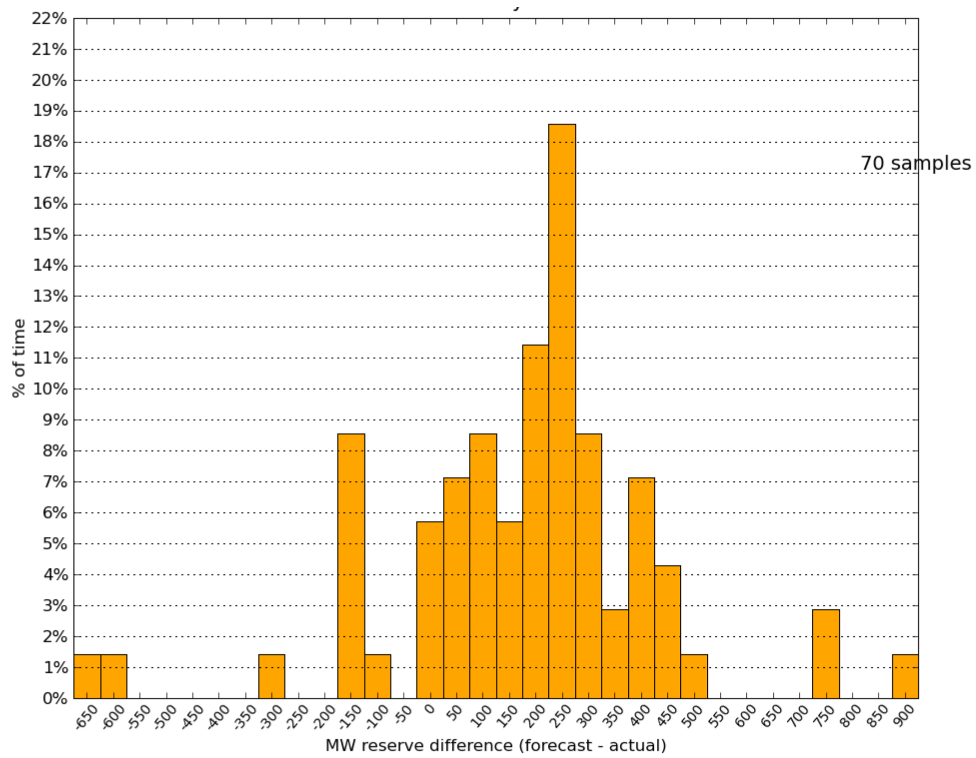

Figure 13 – Tasmania 365 day ahead

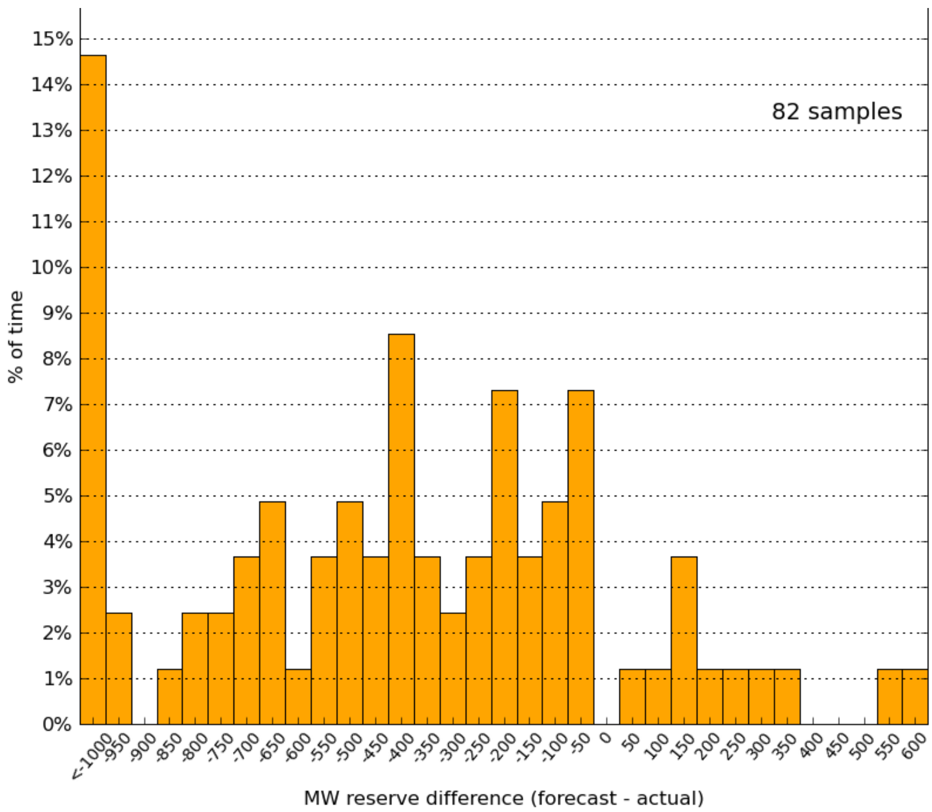

Figure 14 – Queensland 90 day ahead

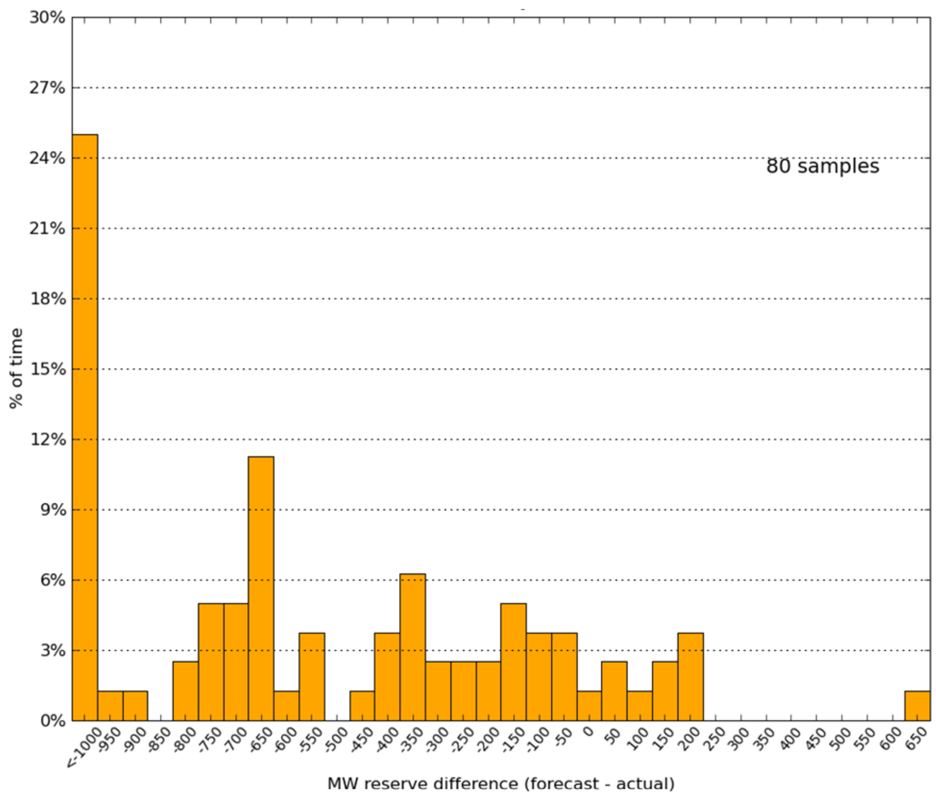

Figure 15 – Queensland 120 day ahead

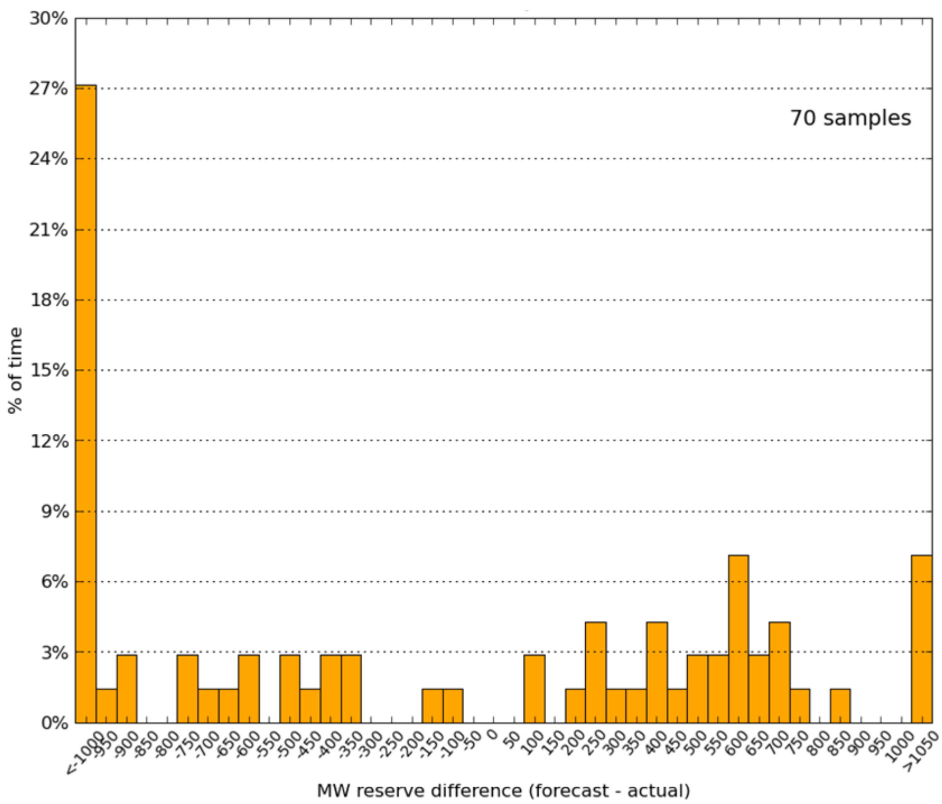

Figure 16 – Queensland 365 day ahead

B.2.2 MTPASA Demand

The following charts illustrate how MTPASA demand projections change over the two year MTPASA time horizon. Each chart shows how the MTPASA demand projections for 13 May 2009 change from the beginning of the outlook period up until real time. The charts also compare the MTPASA demand forecast to the demand forecast used in Dispatch PASA which closely resembles actual demand.

MTPASA demand projections are provided to AEMO on an annual basis by jurisdictional planning bodies (JPB), but are sometimes updated throughout the year which explains some of the variations on the charts.

Note that there was a step change in the demand projection for Victoria of around 500 MW a year out from real time due to revised data from the JPB. Note also that MTPASA demand for 13 May 2009 was higher in all regions than the demand used in dispatch PASA just before real time. This highlights the approximate nature of the demand projections this far ahead of time, and supports the fact that MTPASA uses a very high demand assumption relative to the demand most likely to eventuate.

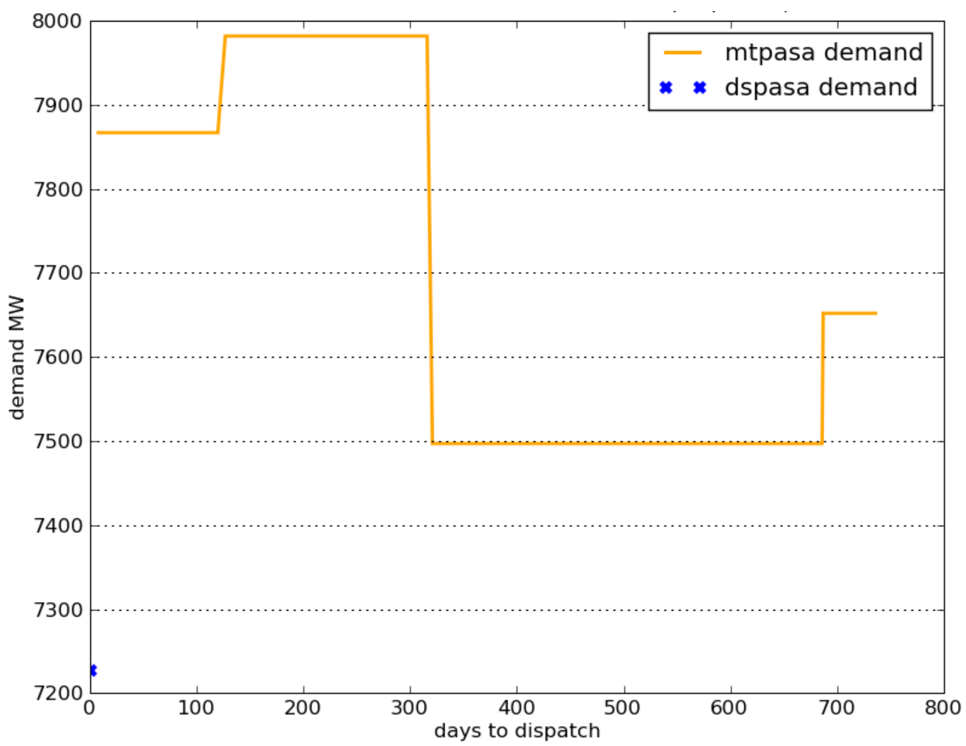

Figure 17 – Victoria

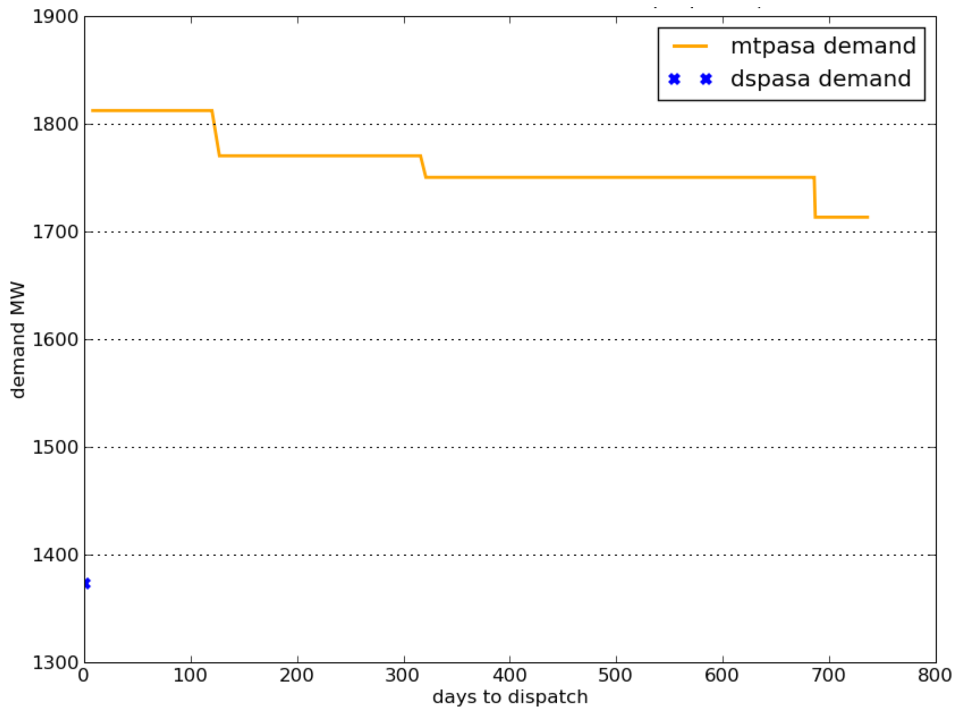

Figure 18 – Tasmania

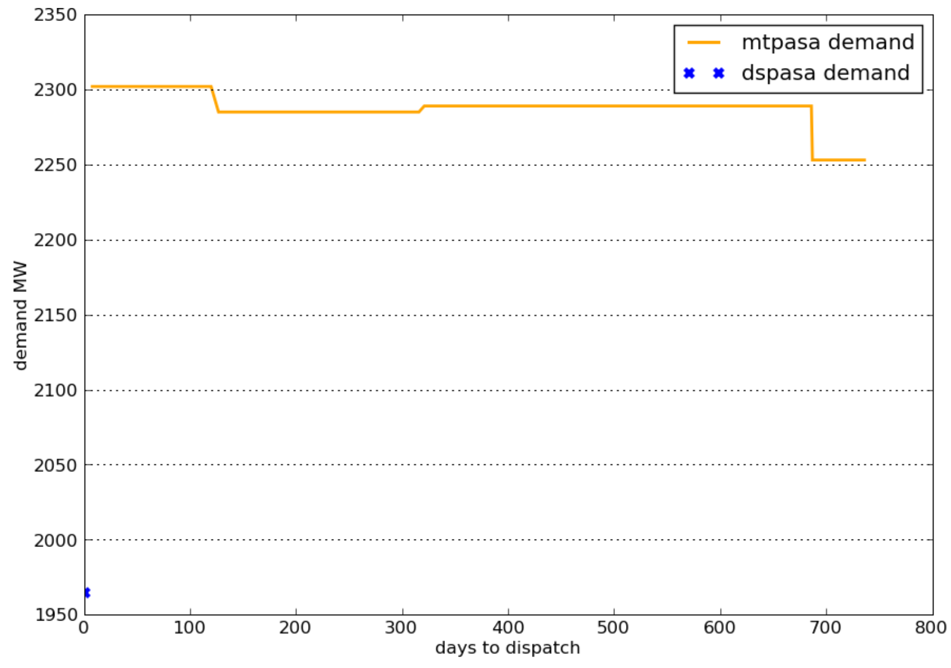

Figure 19 – South Australia

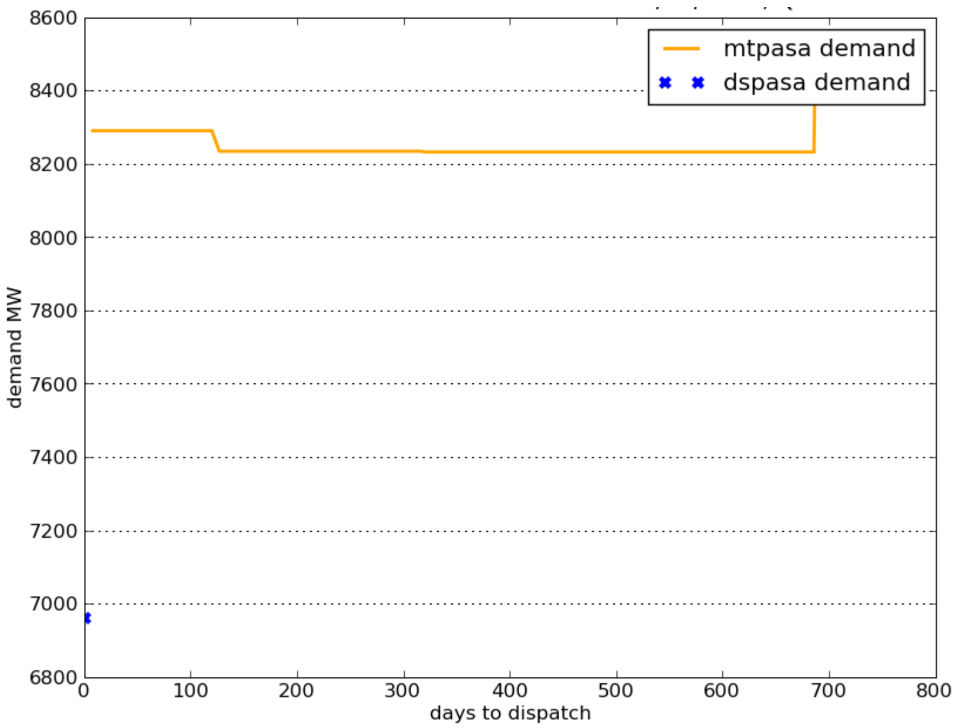

Figure 20 – Queensland

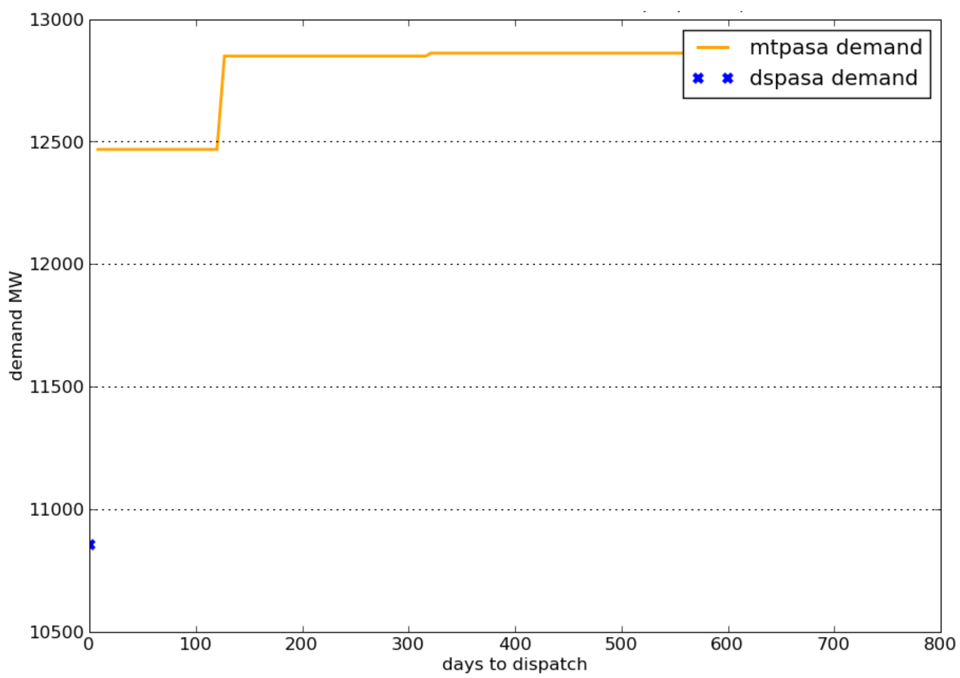

Figure 21 – New South Wales

B.2.3 MTPASA Generator Availability

The charts below show projected generator availability for the 13 May 2009, as projected by MTPASA on each day over the MTPASA timeframe. A spring day was chosen because spring and autum are generally the time when a lot of generators schedule maintenace outages because of lower demand and prices. Hence there is generally a lot of re-scheduling of outages as illustrated by the charts. For Victoria, generator availability varied by over 40%.

This data reinforces the importance of MTPASA in providing useful and meaningful information to the market to assist in the scheduling of outages. It also reinforces the difficulty in interpretting the performance of MTPASA by comparing projections to actuals.

Note that it is constrained generator availability that is presented in these charts. This is the generator capacity available for dispatch after network and weekly energy constraints have been applied.

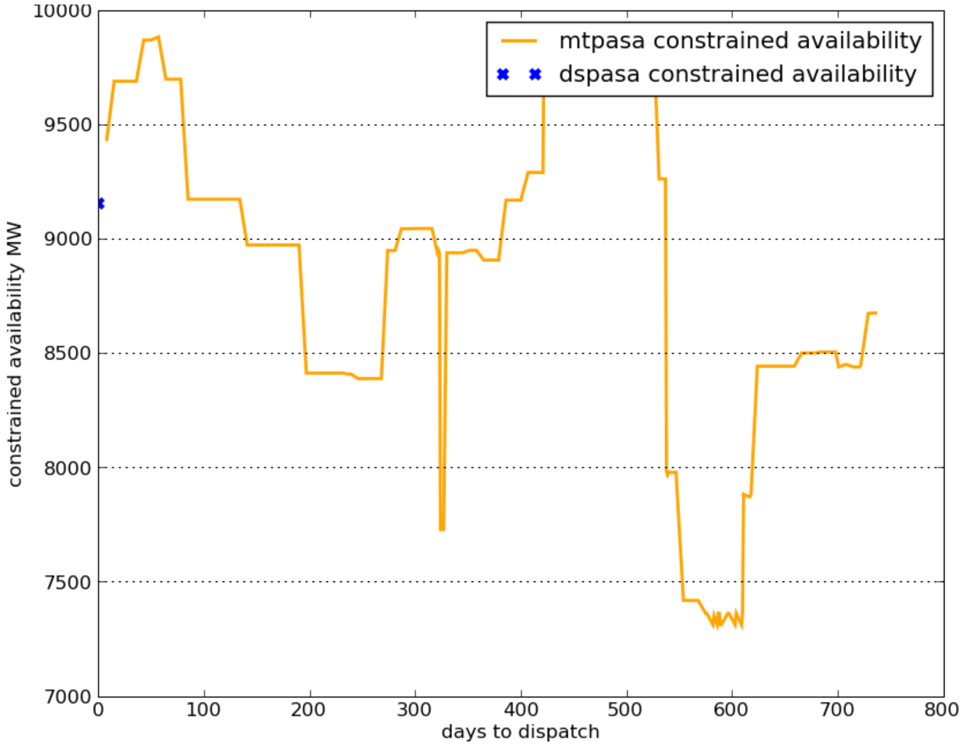

Figure 22 – Victoria

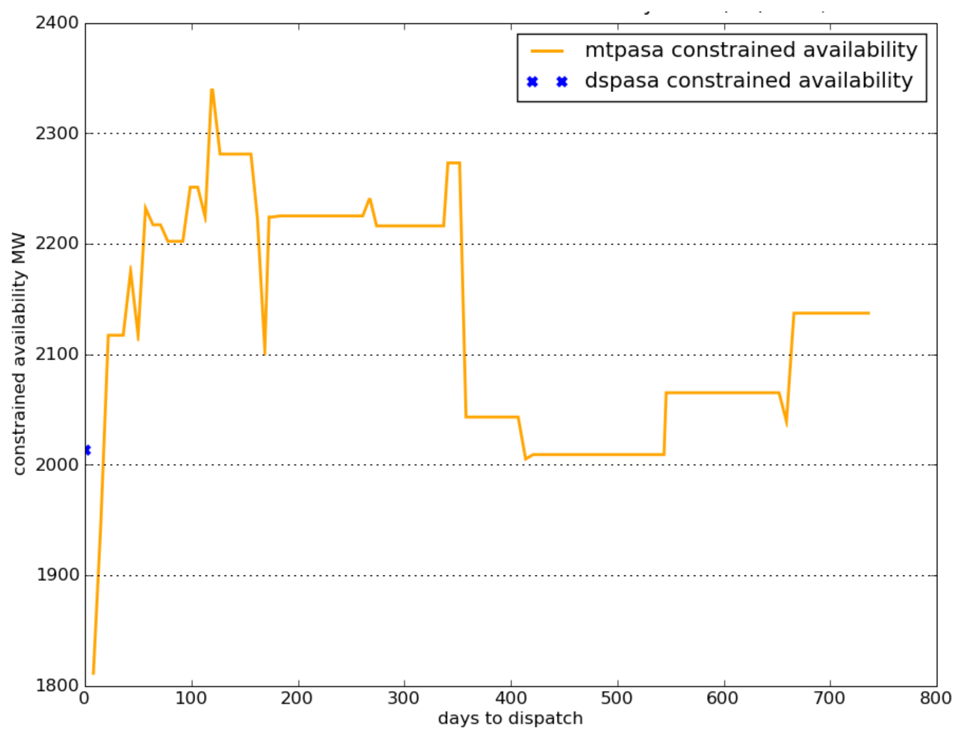

Figure 23 – Tasmania

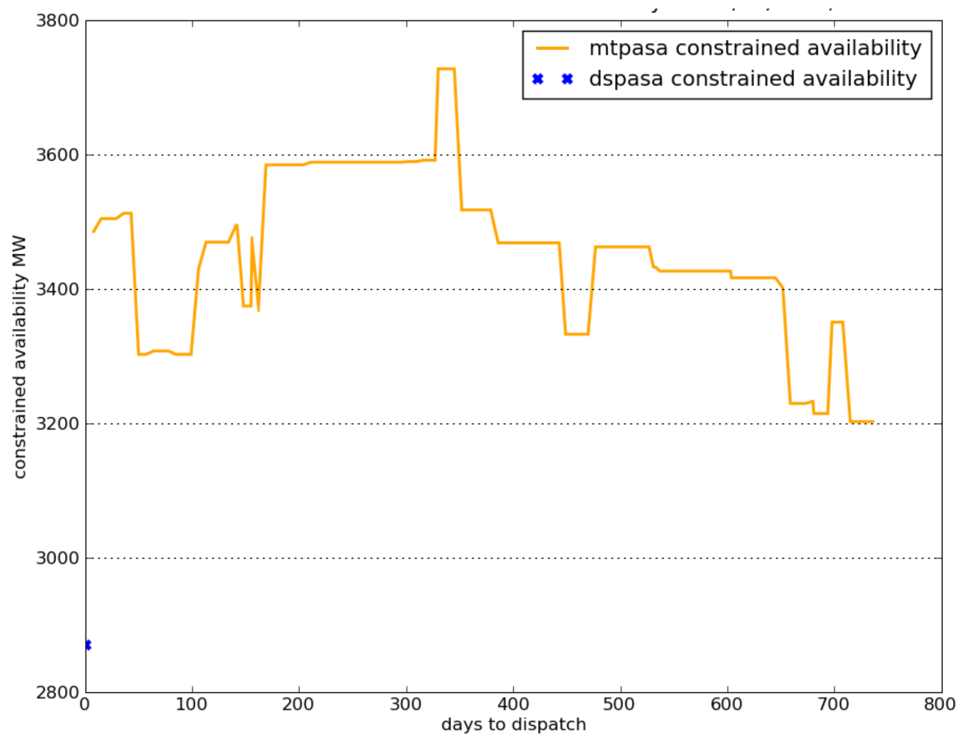

Figure 24 – South Australia

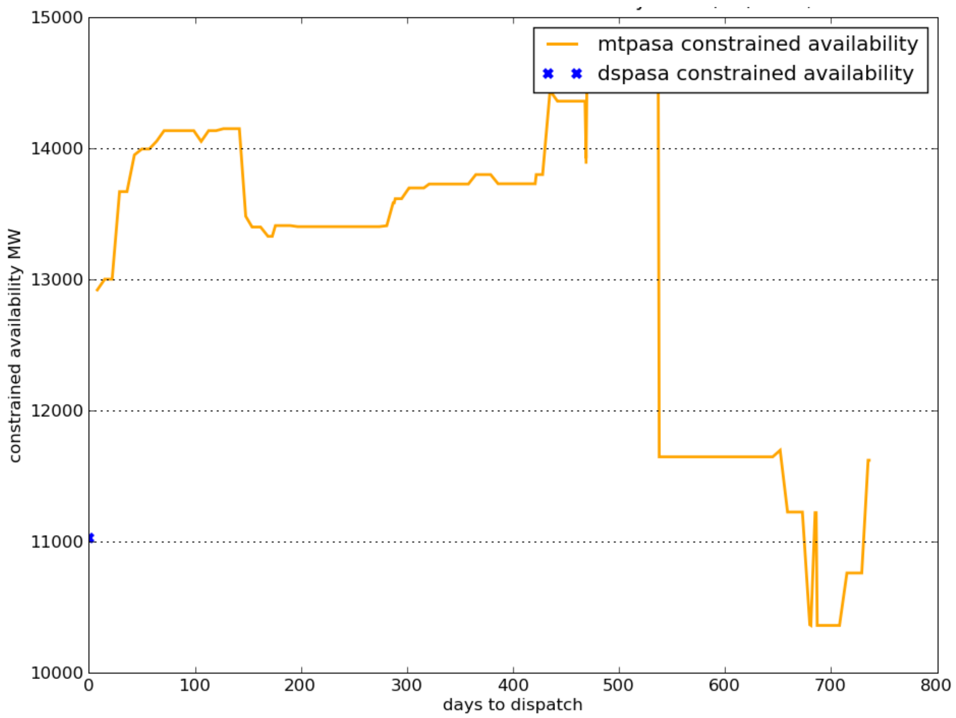

Figure 25 – New South Wales

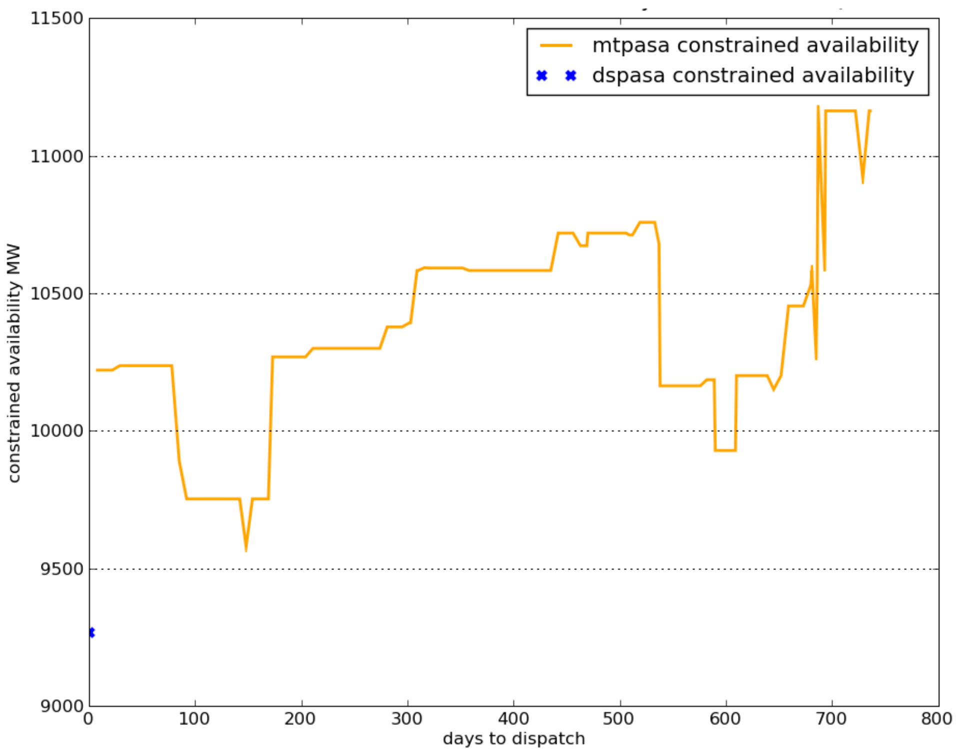

Figure 26 - Queensland

B.2.4 MTPASA Reserve

The charts below show projected reserves for 13 May 2009, as projected by MTPASA on each day of the 2 year MTPASA timeframe.

As was observed for generator availability, this data is quite volatile and is thus difficult to interpret. This volatility is explained by the volatility in the primary two inputs into the reserve calculations, that is generator availability and demand.

Figure 27 – New South Wales

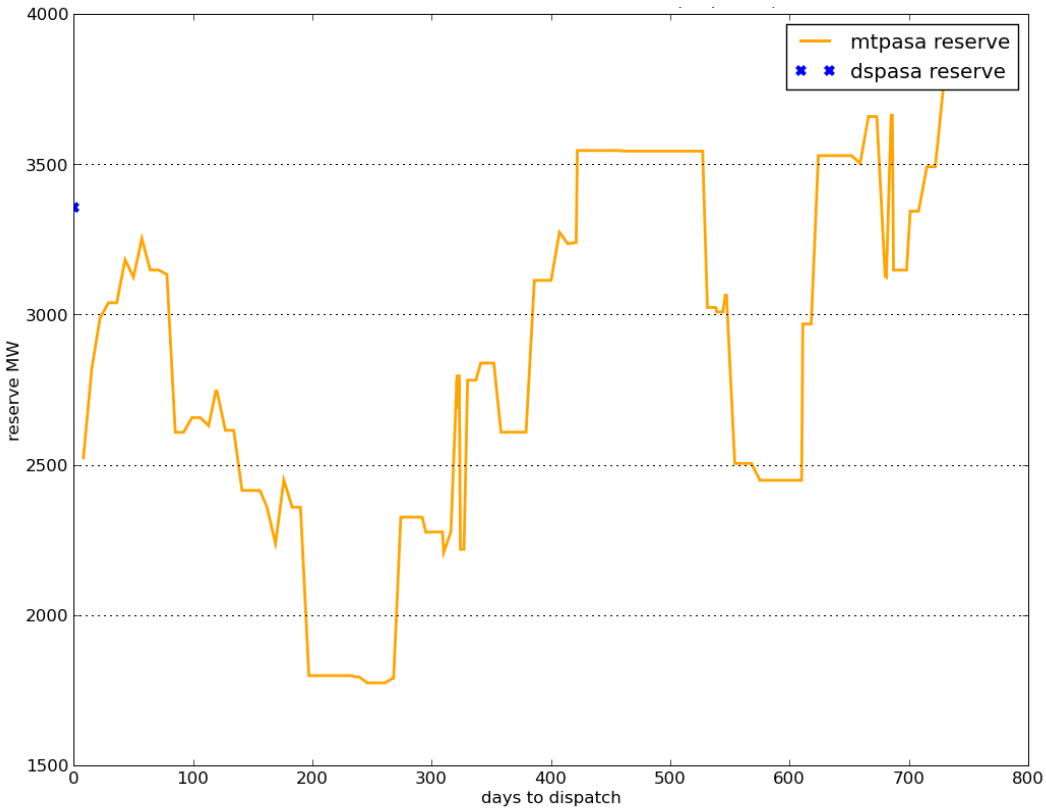

Figure 28 - Victoria

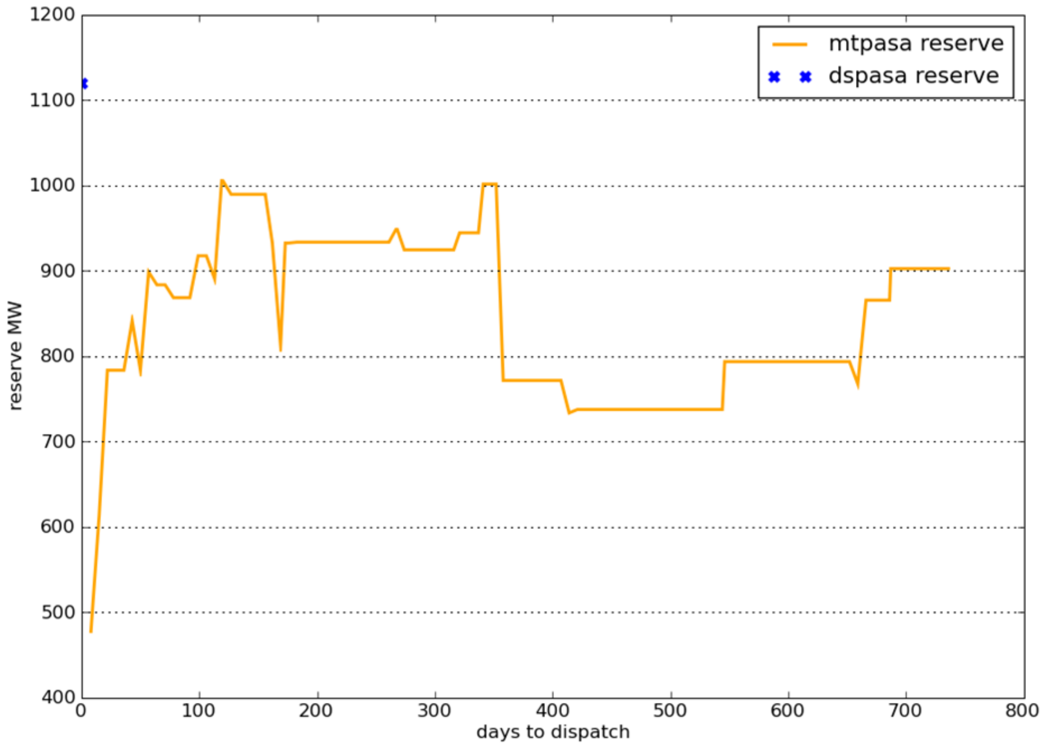

Figure 29 - Tasmania

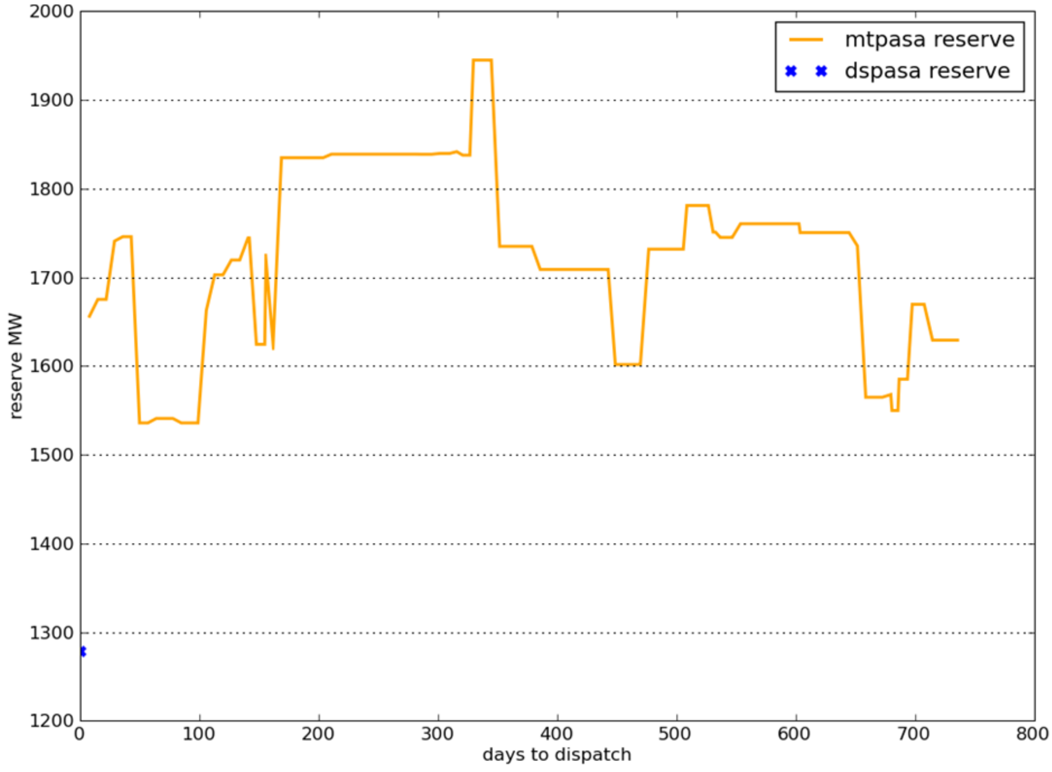

Figure 30 –South Australia

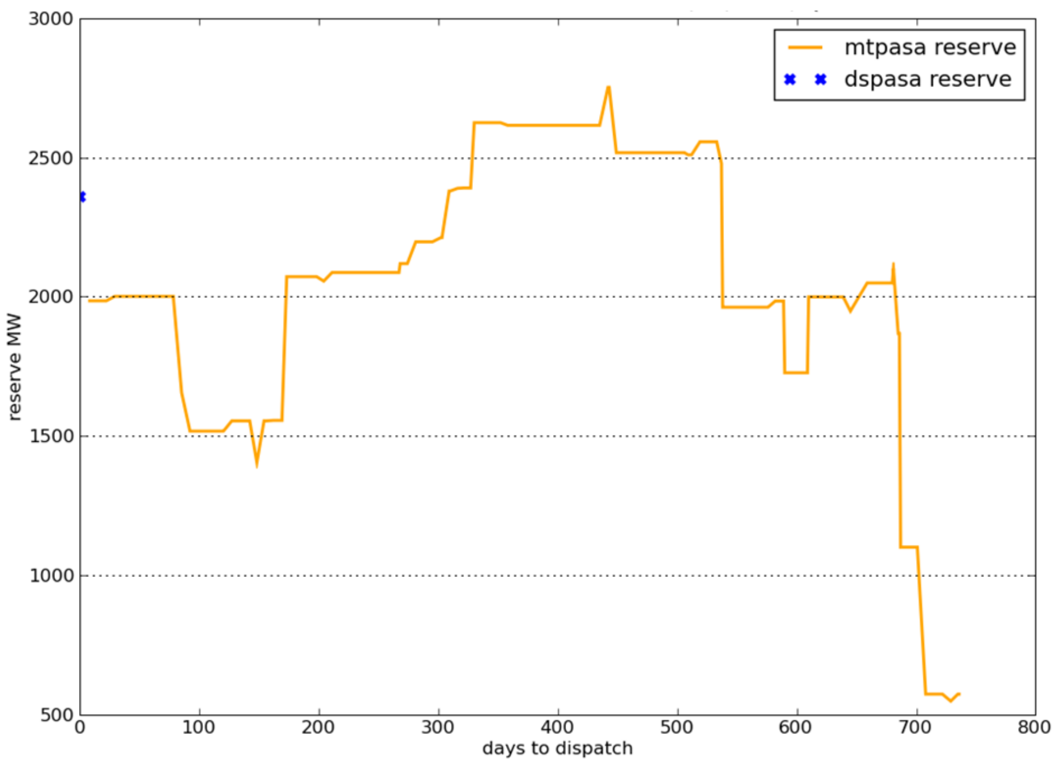

Figure 31 – Queensland

B.3 Short-term PASA and Pre-dispatch PASA

STPASA calculates projected available reserves on a trading interval basis over the upcoming week. The STPASA results are updated every two hours and are based on the generator availability information provided by market participants such as generators.

PDPASA calculates projected available reserves on a trading interval basis like STPASA, but only covers the pre-dispatch period (which is up to 36 hours ahead). PDPASA uses the market data submitted by participants for pre-dispatch, and as such is considered a closer estimate of dispatch.

STPASA and PDPASA are used for similar purposes as MTPASA, but offer higher resolution (half hourly rather than daily), and generally more closely resemble actual power system outcomes.

B.3.1 STPASA Demand Forecast Accuracy

Demand forecasts used in STPASA are based on 50% POE demand, and are modified by input variables such as temperature. As such, STPASA demands more closely resemble actual demands than MTPASA.

The accuracy of STPASA demand forecasts are within AEMO's key performance indicator target range. There is a small over-forecast bias of 0.5% and an almost normal distribution.

The following histograms illustrate the historical performance of the STPASA demand forecasting methodologies. They show the STPASA demand forecast error as percentage of actual demand for all STPASA runs between 13 April 2002 and 14 August 2009.

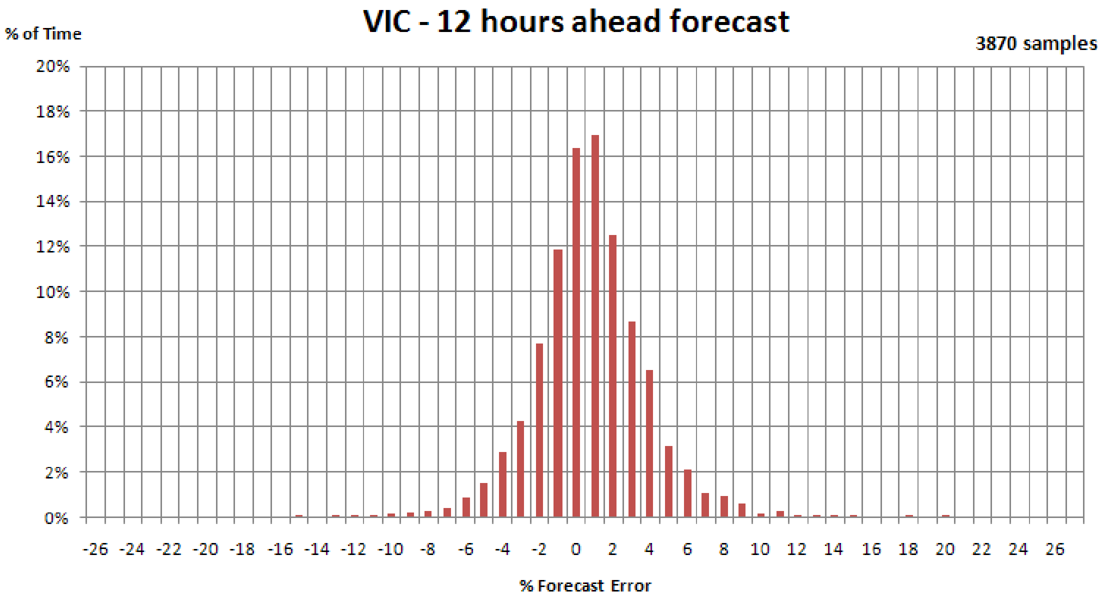

Figure 32 – Victoria 12 hours ahead forecast

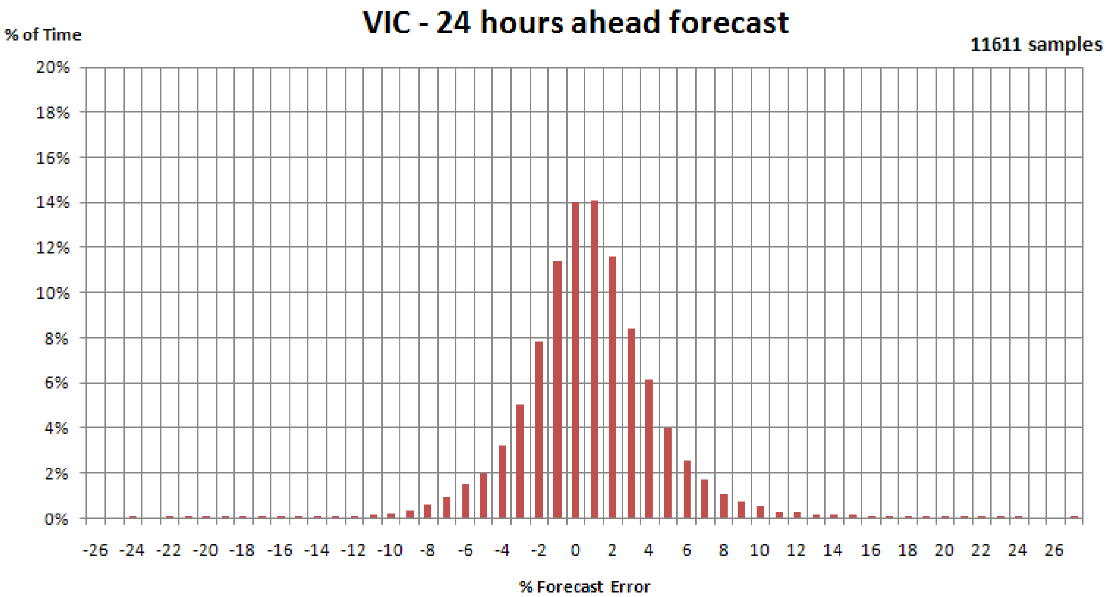

Figure 33 - Victoria 24 hours ahead forecast

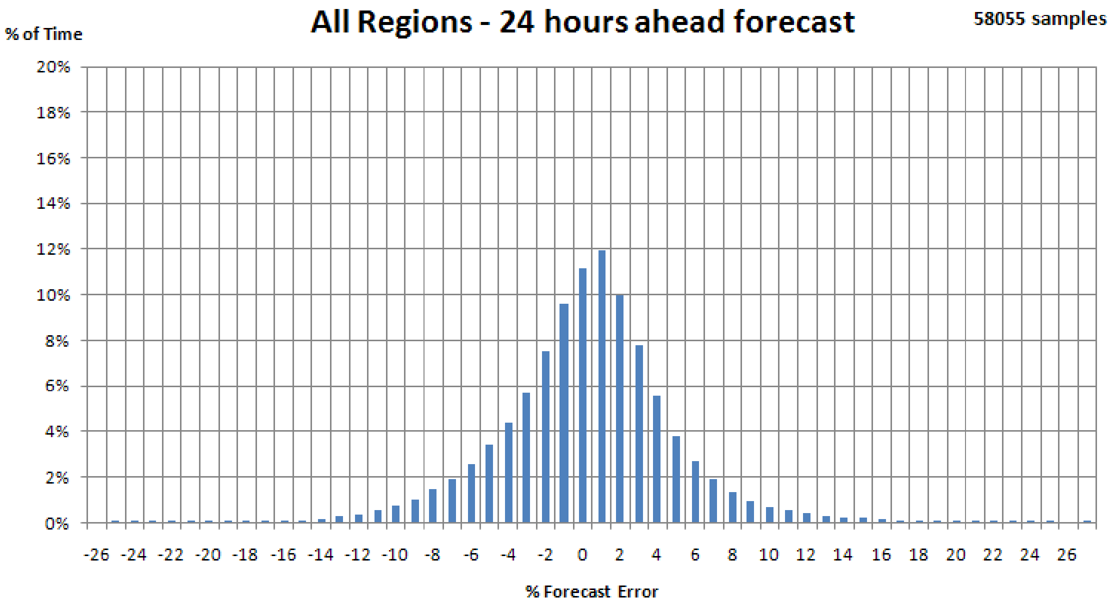

Figure 34 – All regions 24 hour ahead

The following charts illustrate how the STPASA demand projection for 12:30hrs on 13 May 2009 changes over the STPASA timeframe. Note that these forecasts change considerably over the 7-day STPASA period as better information becomes available closer to real time. STPASA demand is based on the average demand expectation (that is the 50% POE demand), and includes inputs variables such as temperature and wind forecasts.

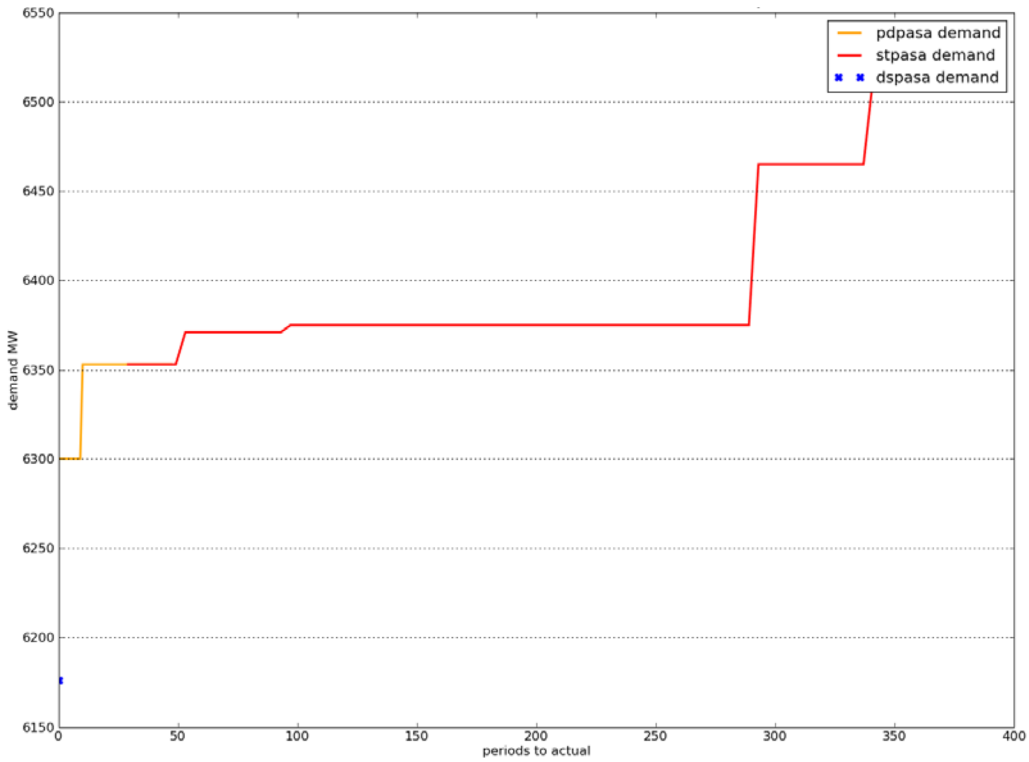

Figure 35 - Queensland

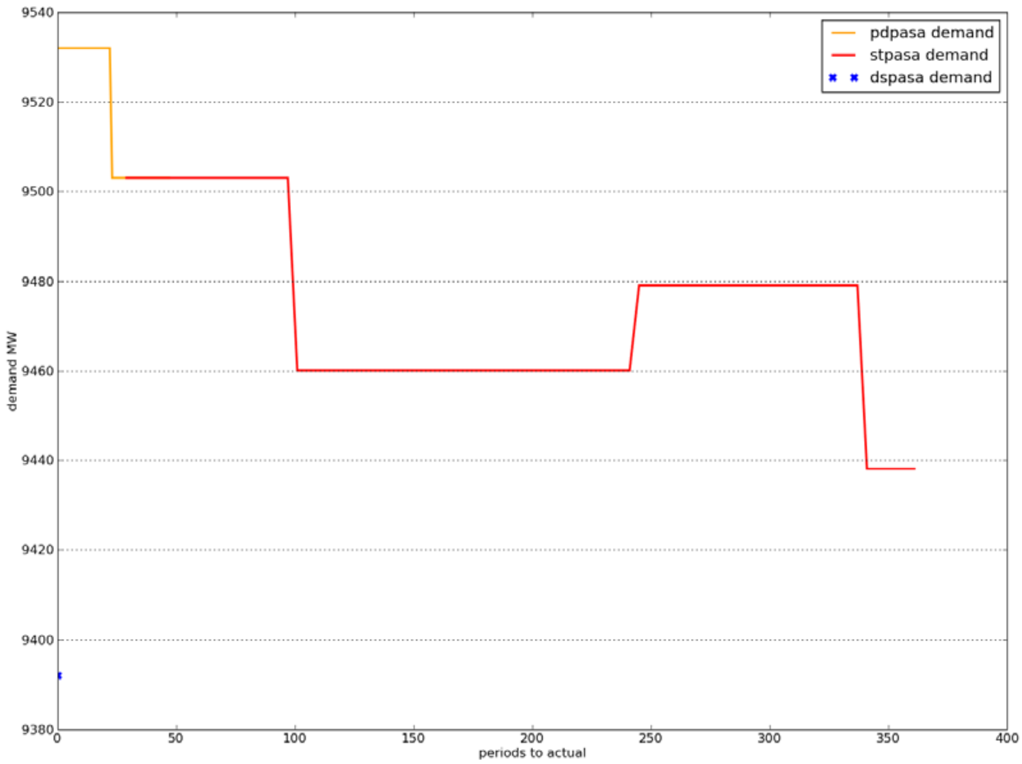

Figure 36 - New South Wales

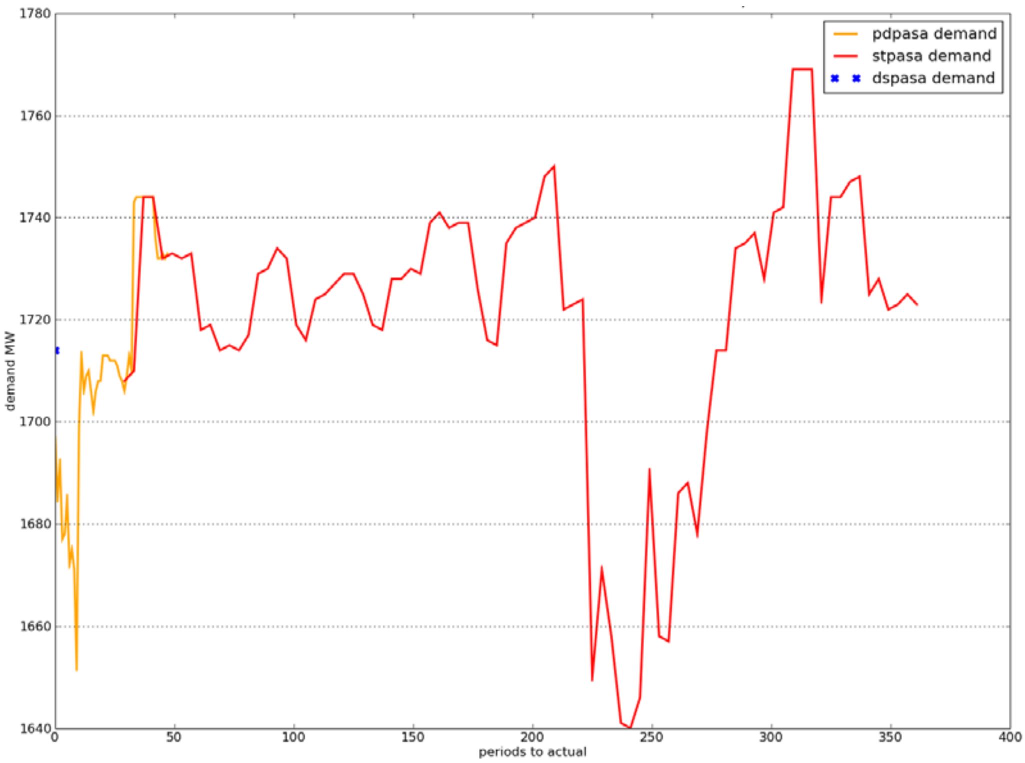

Figure 37 - South Australia

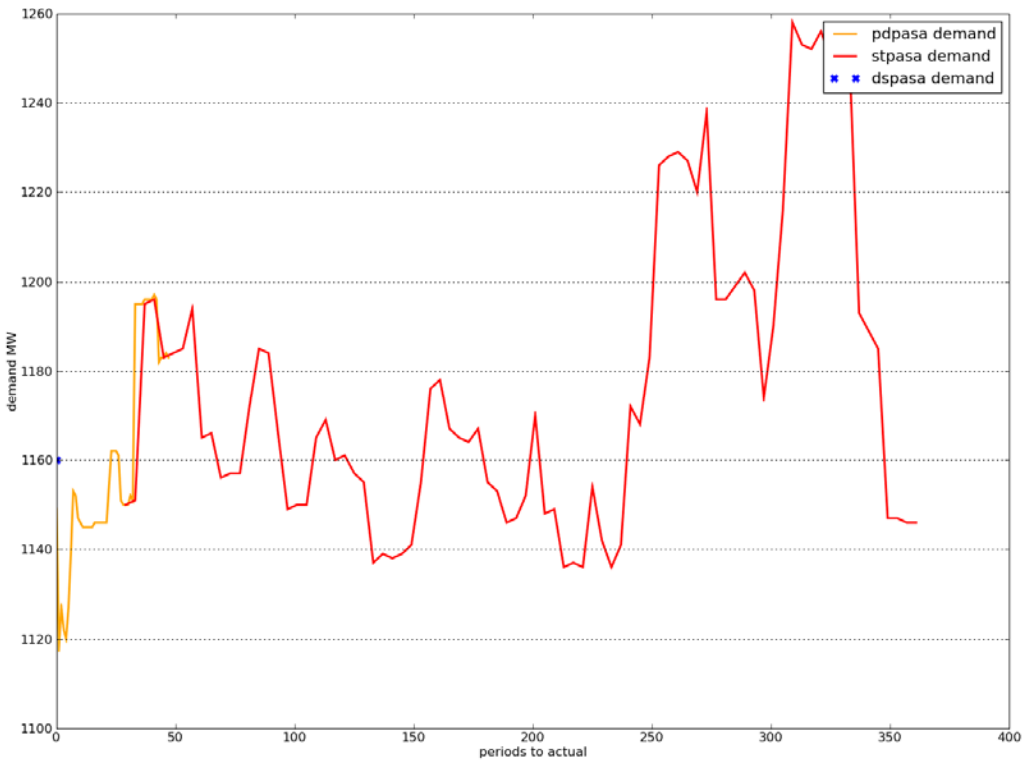

Figure 38 - Tasmania

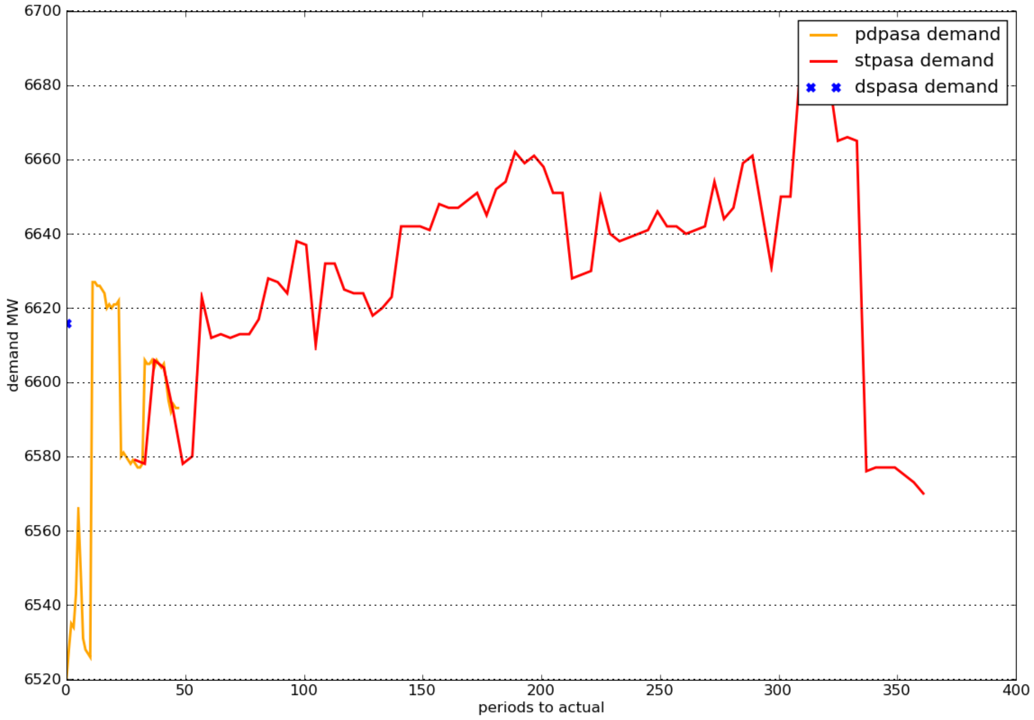

Figure 39 - Victoria

B.3.2 Generator Availability

The following charts illustrate how the STPASA and PDPASA generator availability for 12:30hrs on 13 May 2009 changed over the STPASA and PDPASA timeframes. Note that generator availability changes considerably over the 7-day STPASA period as generators adjust their availability as more information becomes available closer to real time. Note that the figure shows "constrained" generator availability which is the generator availability after network and weekly energy constraints have been applied.

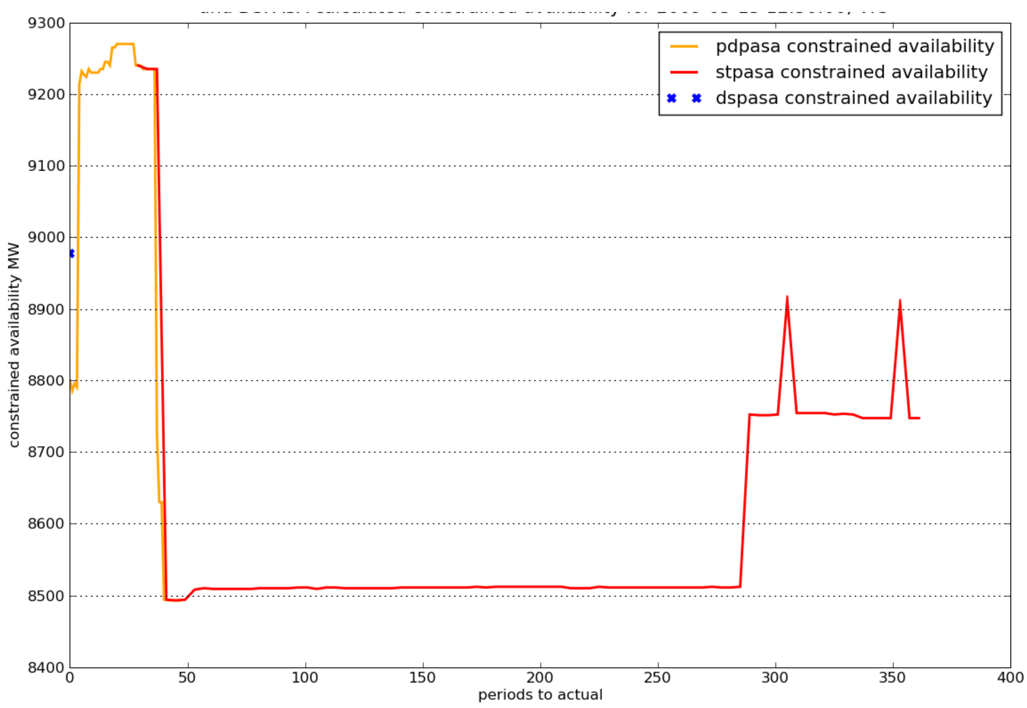

Figure 40 - Victoria

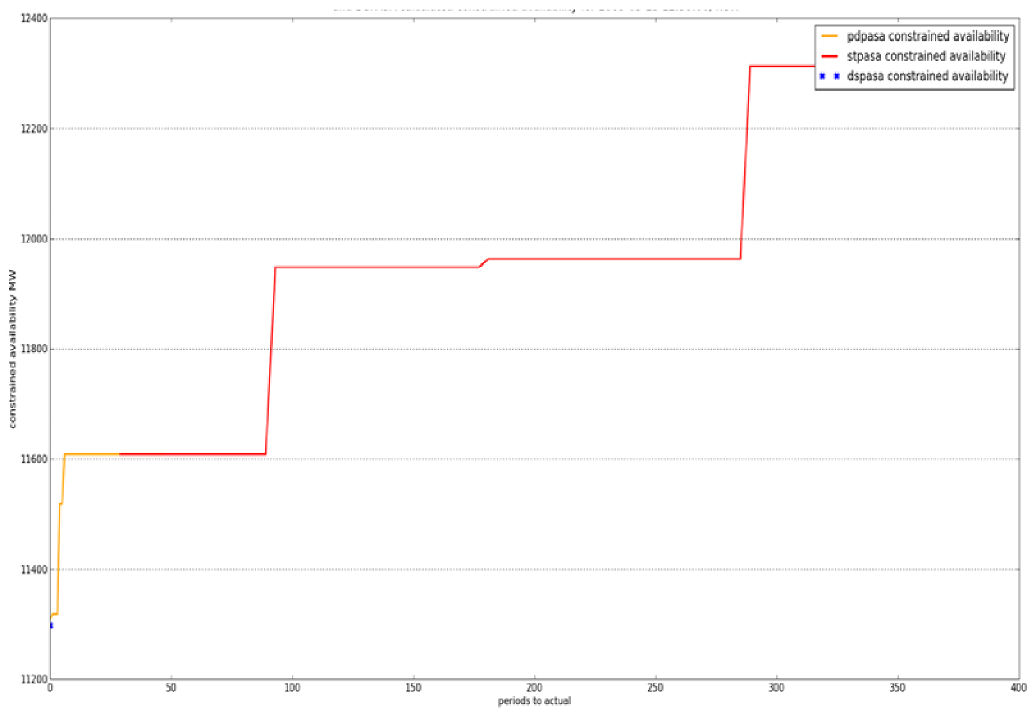

Figure 41 – New South Wales

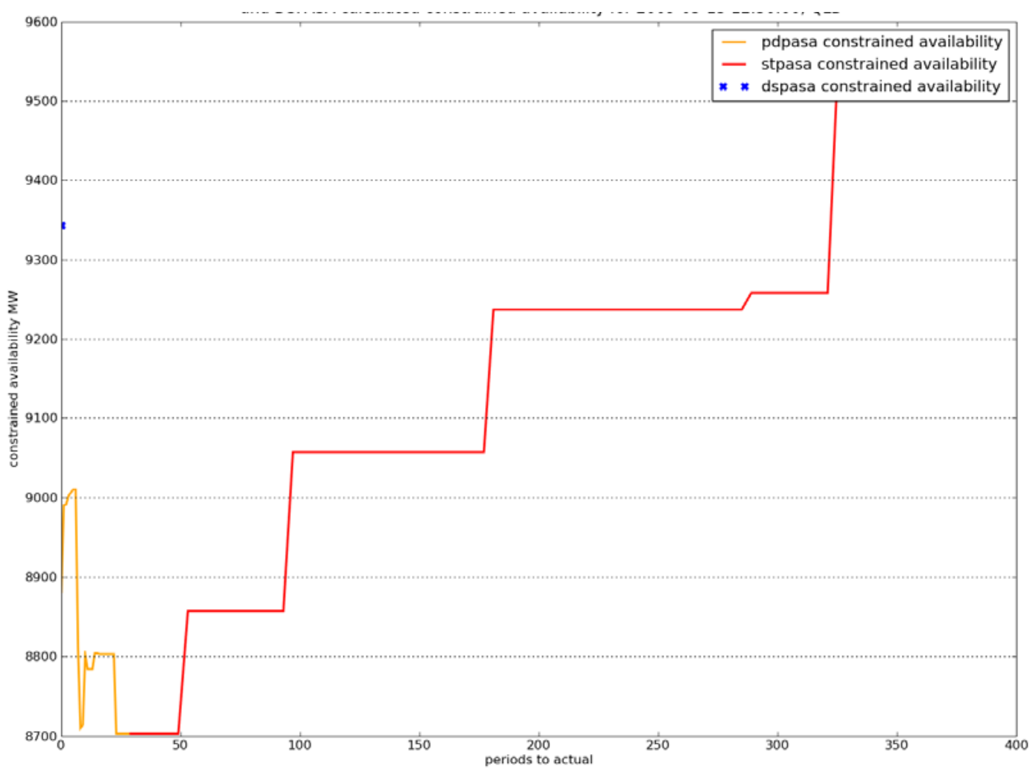

Figure 42 - Queensland

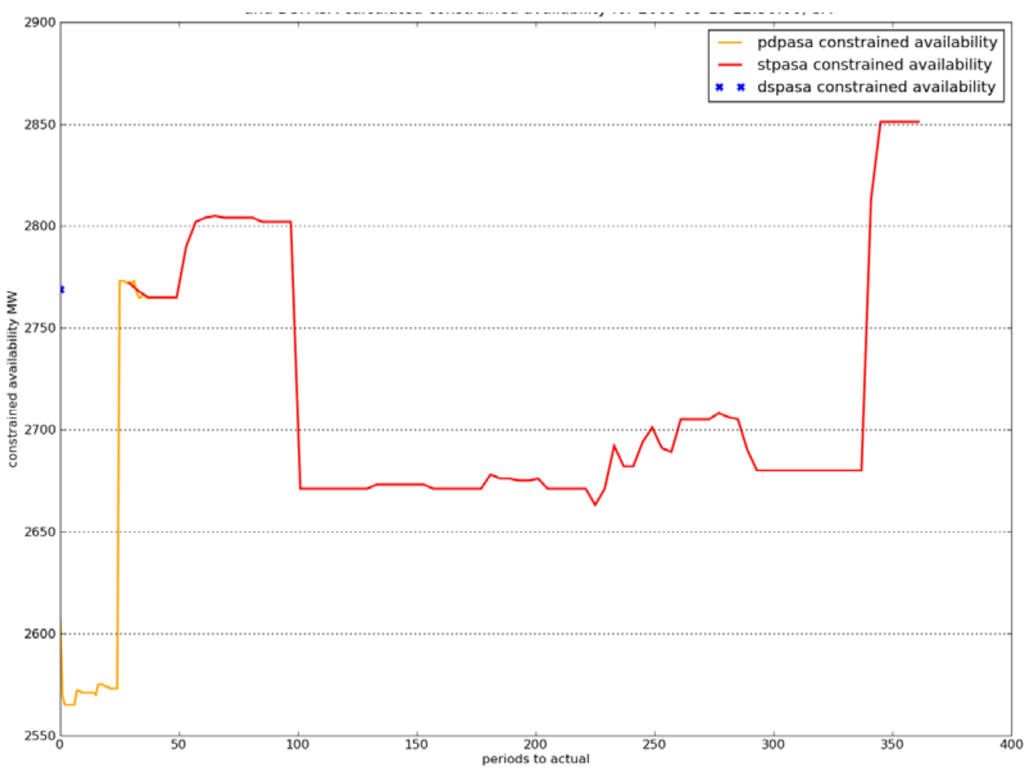

Figure 43 – South Australia

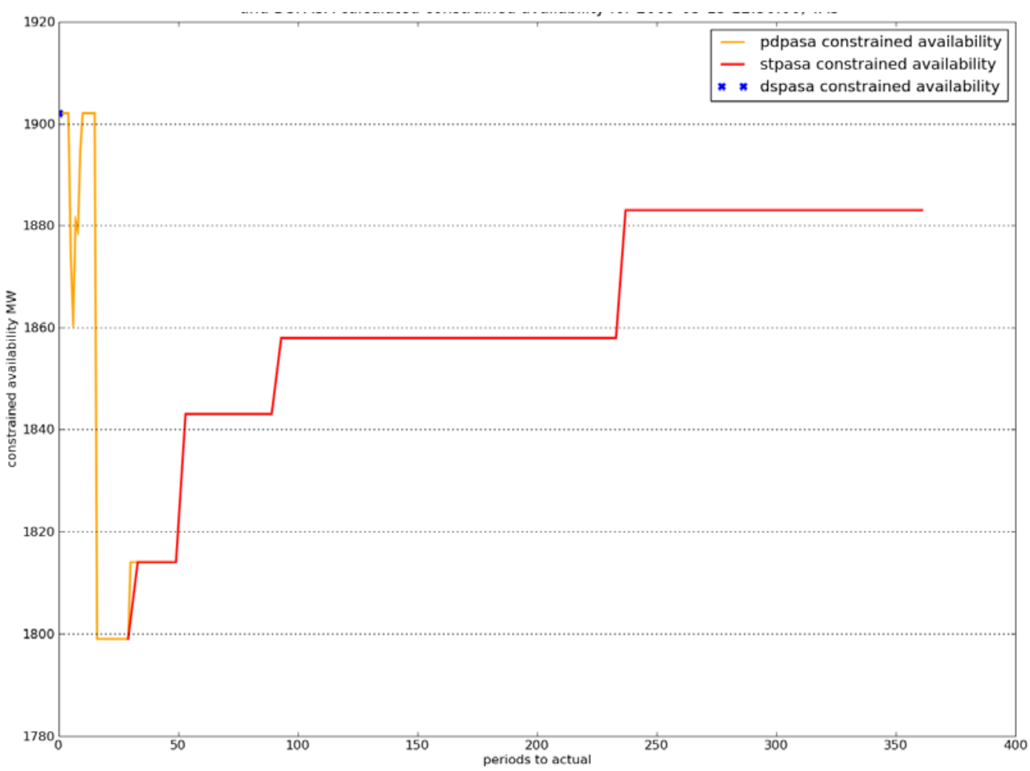

Figure 44 - Tasmania

B.3.3 STPASA Reserve

The charts below show projected reserves for 12:30hrs on 13 May 2009, as projected by STPASA and PDPASA on each day of the 7-day STPASA timeframe.

As was observed for generator availability, this data is quite volatile and is thus difficult to interpret. This volatility is explained by the volatility in the primary two inputs into the reserve calculations: generator availability and demand.

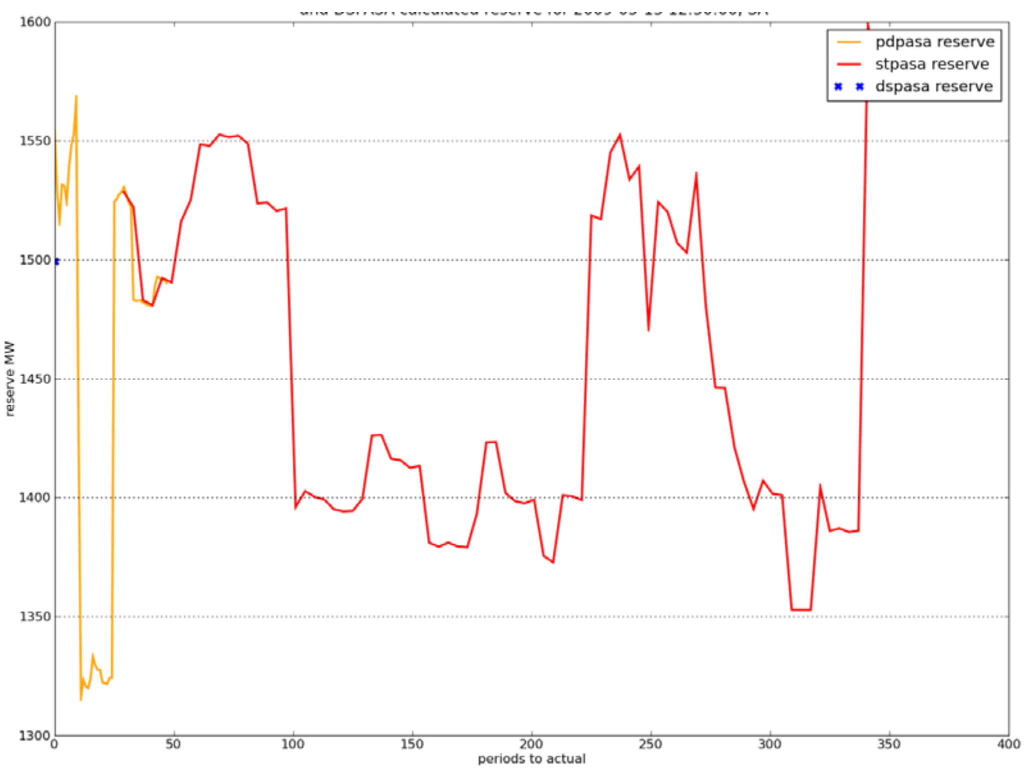

Figure 45 – South Australia

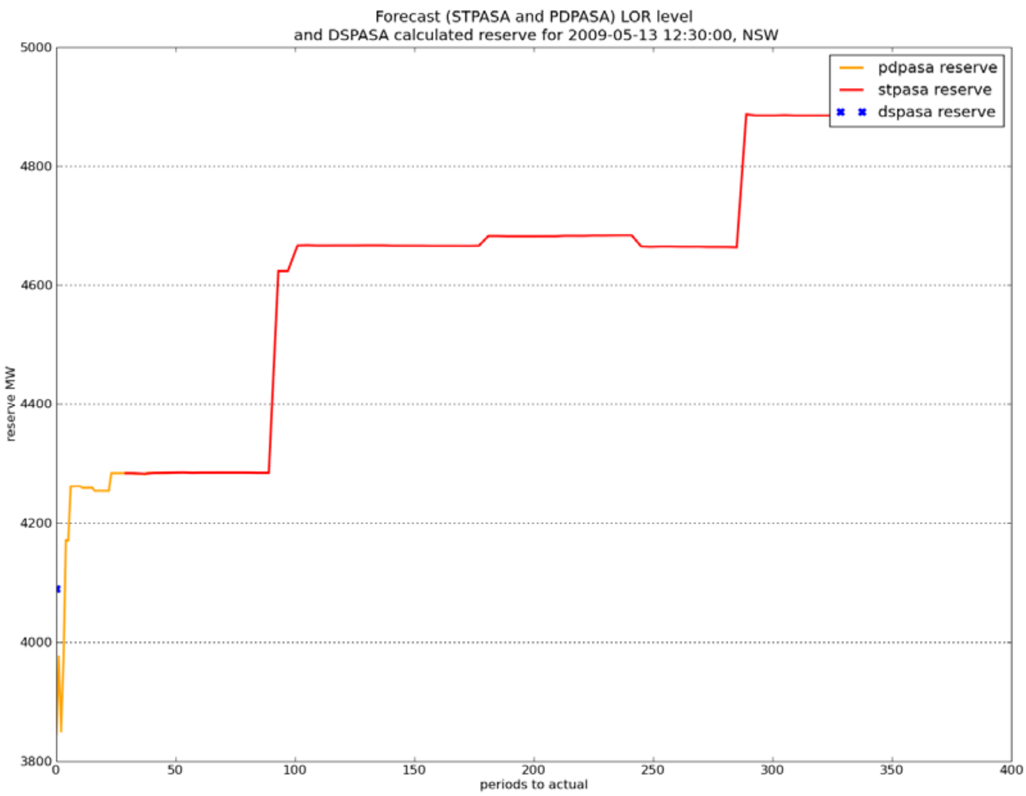

Figure 46 – New South Wales

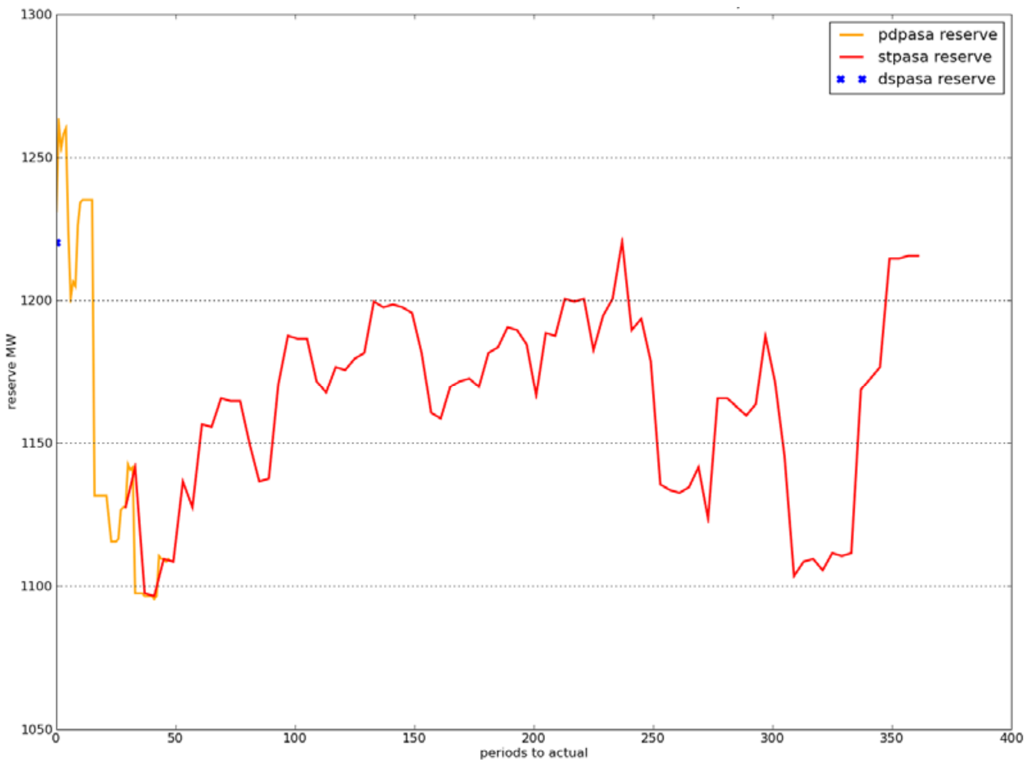

Figure 47 - Tasmania

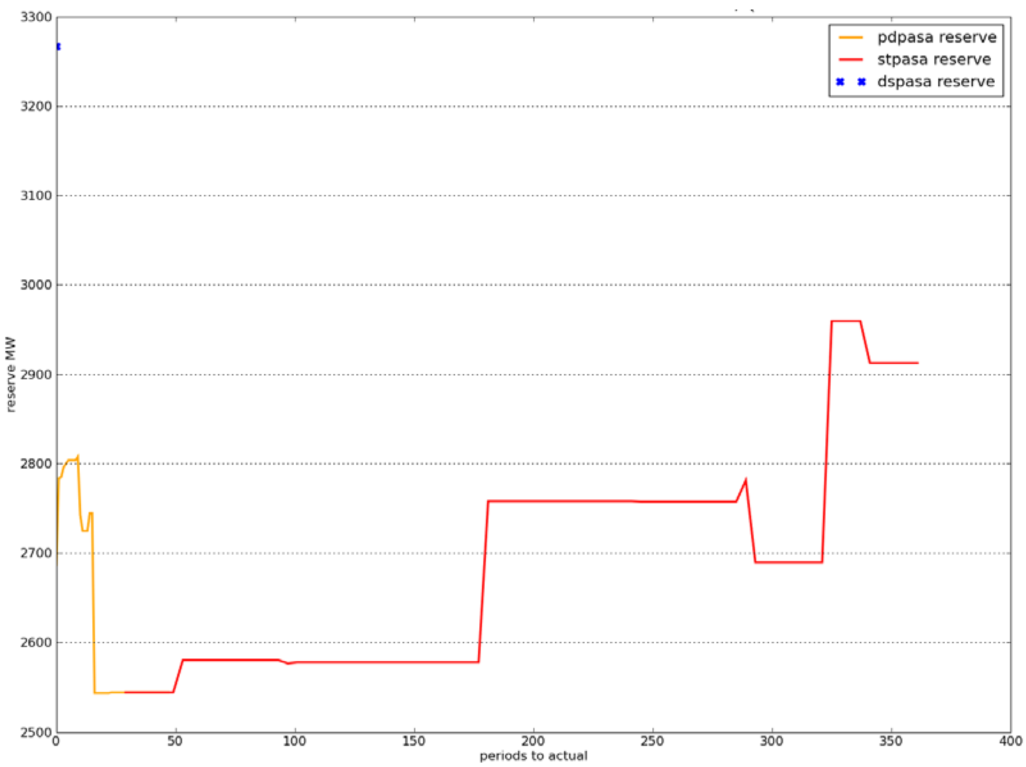

Figure 48 - Queensland

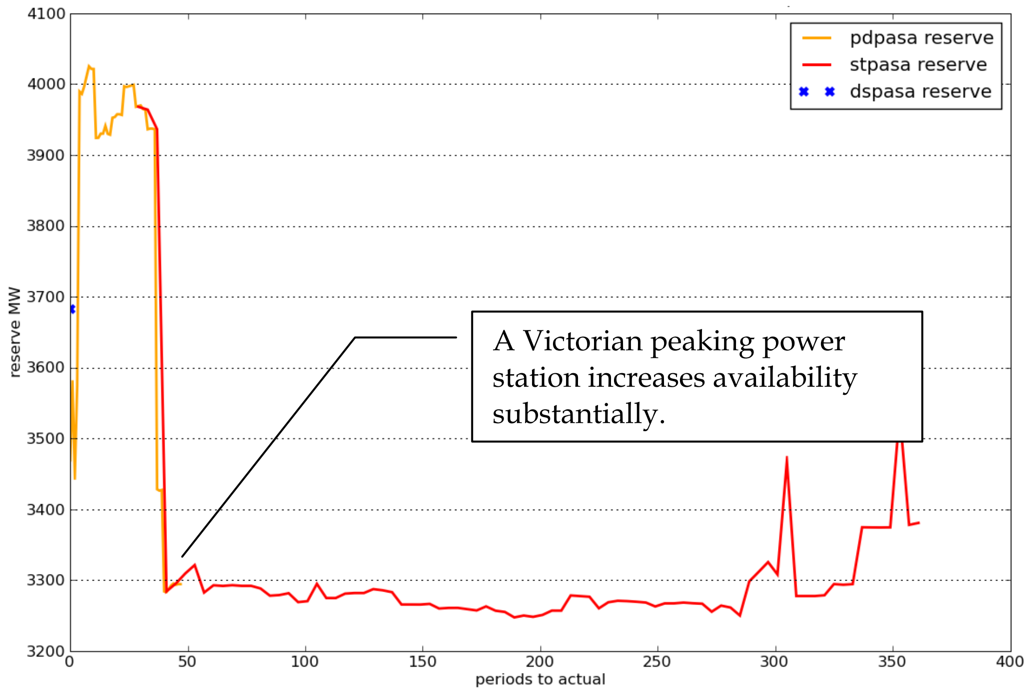

Figure 49 - Victoria

B.4 Case Study of 29 January 2009

Assessing the performance of reserve projections (particularly MTPASA) is of limited value because the purpose of these projections is to promote changes in the availability of the NEM generators, loads, and networks. Hence if the projections succeed in adjusting offers of availability, then the accuracy of the original projections will degrade.

A better measure of the usefulness of the supply adequacy projections would be to investigate when these projections failed to signal a need to adjust offers of availability.

As a starting point, the load shedding event of 29 January 2009 was chosen as a case study to assess how the various reserve projections signalled the potential for a supply shortfall.

Temperature forecast for Melbourne by the Bureau of Meteorology were below those that occurred between 28 and 30 January.

Date	Forecast Maximum Temperature	Actual Maximum Temperature
27 January	38	36.4
28 January	41	43.4
29 January	40	44.3
30 January	40	45.1

Historically the 10% POE temperature used by AEMO for Melbourne was 32.9 degrees Celsius, this figure is no longer used, but is a useful comparison against the temperatures recorded.

MTPASA made the following projections for 29 January 2009, on 26 August 2009 and 20 January 2009. Note that the demand forecasts did not vary significantly, but generator availability reduced significantly between August and real time.

Region	MTPASA run	Demand MW	Gen capacity MW	Reserve Shortfall MW
Vic	26 Aug	10,525	10,012	168
	20 Jan	10,525	9,994	186
	Actual	10,463	9,567	*
SA	26 Aug	3,408	3,478	0
	20 Jan	3,408	3,347	11
	Actual	3,199	3,163	*

STPASA made the following projections for Victoria for 12:30pm on 29 January 2009 at various points ahead of real time. Forecast reserves for 29th January were higher than actual reserves on the day. This was largely due to inaccuracies in the demand forecast (note that AEMO is addressing this issue through changes to the demand forecasting methodology to better respond to extreme weather events[52]).

NEMMCO did not forecast lack of reserve conditions for January 29th 2009 but did forecast a lack of reserve level 1 condition for both Victoria and South Australia on 28th January for 30th January.

STPASA run	Max Temp *C	Demand MW	Gen availability MW	Basslink availability MW	NSW to VIC MW	Forecast reserve MW
23 Jan 1400	36.1	8,816	9,722	594	205	2,081
26 Jan 1400	39.9	9,192	9,843	594	237	1,899
27 Jan 1400	40.1	9,576	9,843	594	311	1,469
28 Jan 1400	43.2	10,096	10,279	594	300	1,441
Actual	44.3	10,463	9,567	478	489	Actual 84

PDPASA made the following projections for Victoria for 12:30pm on 29 January 2009 at various points ahead of real time. Twelve hours ahead, PDPASA projected reserves in Victoria to be over 1000 MW. By real time reserves had reduced to 84 MW. This was due to higher demand than was forecast, and reduced generator availability due to thermal limitations on generator capacity.

[52] See Appendix E for more information.

PDPASA run	Max temp *C	Demand MW	Gen Availability MW	Basslink Availability MW	NSW to VIC MW	Forecast Reserve MW
29 Jan 0000	43.2	10,126	10,226	594	328	1,170
29 Jan 0600	43.2	10,149	10,131	594	416	
29 Jan 1000	43.2	10,294	9,894	594	365	631
29 Jan 1100	43.2	10,296	9,755	594	418	531
29 Jan 1200	43.2	10,279	9,738	478	428	492
Actual	44.3	10,463	9,567	478	489	Actual 84

The 29 January case study demonstrates that projections of generator availability are quite inaccurate even close to real time. AEMO is currently sourcing more detailed data on availability information submitted by generators.

AEMO made the decision not to procure reserves (under the RERT provisions) for the 2008/09 summer period in August 2008. MTPASA results at the time showed a reserve shortfall of 168 MW for Victoria and no shortfall in South Australia. Probabilistic studies showed average USE in the two regions of less than 0.002%.

Actual USE on 29 and 30 January is estimated to total 1.88 GWh in Victoria and 0.42 GWh in South Australia. Studies conducted indicated that under an extreme 10% POE demand there was a 28% chance that Victoria and a 50% chance that South Australia would exceed these USE values.

The actual USE that occurred due to shortages of reserve in January 2009 were not inconsistent with the results of the studies.

B.5 Energy Adequacy Assessment Projection (EAAP)

The EAAP[53] is an information gathering and dissemination mechanism that was introduced to enable the market to forecast and respond to projected times where there may be energy constraints that would affect reliability. An example of such an energy constraint would be a drought that limits the generation from hydro generating units and thermal generating units that rely on cooling water from inland reservoirs.

AEMO is required to publish the first EAAP by 31 March 2010 and publish subsequent EAAPs every three months thereafter. The EAAP will provide projected levels of USE for each region for a two year period with a monthly resolution.

The purpose of the EAAP results will be to inform stakeholders, including market participants, of periods of low energy availability. It is anticipated that periods of energy scarcity, and hence projected high energy prices, will solicit a market

[53] Rule 3.7C describes the requirements for the EAAP.

response such as rescheduling maintenance or reallocating scarce resources such as water for cooling or hydro generation.

Currently AEMO produces quarterly drought reports which study the potential impact of drought on the generating capacity of both hydroelectric and coal-fired plants operating in the NEM. The quarterly drought reports will be replaced by the EAAP from March 2010.

C MCE Direction

RECEIVED

11 MAY 2009

MCE

Ministerial Council on Energy

CHAIR
The Hon Martin Ferguson AM MP
Minister for Resources and Energy
Telephone: (02) 6277 7930 Facsimile: (02) 6273 0434

Dr John Tamblyn
Chairman
Australian Energy Market Commission
PO Box H166
AUSTRALIA SQUARE NSW 1215

11/5.

28 APR 2009

Dear Dr ~~Tamblyn~~ John,

AEMC REVIEW OF THE EFFECTIVENESS OF NEM SECURITY AND RELIABILITY ARRANGEMENTS IN LIGHT OF EXTREME WEATHER EVENTS

At its 6 February 2009 meeting, the Ministerial Council on Energy (MCE) considered the challenges faced by the National Electricity Market (NEM) in light of extreme weather events.

As reflected in the meeting communiqué, the MCE agreed to direct the Australian Energy Market Commission (AEMC) to conduct a review of the effectiveness of NEM security and reliability arrangements.

I am writing on behalf of the MCE to outline the Terms of Reference for this task.

MCE direction to the AEMC

Section 41 of the National Electricity Law (NEL) enables the MCE to direct the AEMC to review any matter relating to the NEM or any other market for electricity.

Pursuant to section 41 of the NEL, the MCE directs the AEMC to conduct a review of the effectiveness of National Electricity Market (NEM) security and reliability arrangements in light of recent extreme weather events. In identifying options for addressing issues raised by these events, the AEMC shall have regard for the need for actions to be proportionate, as well as the value of stability and predictability in the energy market regime.

The AEMC's review is to provide advice in relation to the generation and transmission elements of the power system. While matters relating to the performance standards of distribution networks are the responsibility of jurisdictions, the MCE appreciates any advice the AEMC can provide to ensure network security and reliability. This review should be consistent with, and draw on, a number of reviews and rule change proposals being progressed by the AEMC and the Reliability Panel.

In the context of extreme weather related events such as droughts, heatwaves, storms, floods and bushfires, the AEMC is directed to:

- examine the current arrangements for maintaining the security and reliability of supply to end users of electricity and provide a risk assessment of the capability of those arrangements to maintain adequate, secure and reliable supplies,
- provide advice on the effectiveness of, and options for cost-effective improvements, to current security and reliability arrangements, and, if appropriate,

- identify any cost-effective changes to the market frameworks that may be available to mitigate the frequency and severity of threats to the security and reliability of the power system.

The MCE considers that any recommendations arising from the review should also identify, where applicable, possible benefits or lessons for the broader energy market framework.

The MCE does not anticipate that this review will result in a fundamental revision of the electricity market design.

Timing and process

The AEMC is to report by 29 May 2009 on measures that are currently under consideration that would improve system reliability and security and any further cost-effective measures that could be taken in the short term that would impact on system reliability for the summer of 2009-10.

The AEMC is to report by 30 October 2009 on any cost-effective changes that could be made to energy market frameworks that would improve system reliability in the longer term and contribute to the more effective management of system reliability during future extreme weather events.

Copies of both of these reports are to be provided to the Australian Energy Regulator and the National Electricity Market Management Company/Australian Energy Market Operator. The MCE will determine whether the reports are to be published.

Yours sincerely

Martin Ferguson

D Revised MCE Direction

MCE

Ministerial Council on Energy

CHAIR
The Hon Martin Ferguson AM MP
Minister for Resources and Energy
Telephone: (02) 6277 7930 Facsimile: (02) 6273 0434

RECEIVED
18 AUG 2009

Min ID: B09/1833

Dr John Tamblyn
Chairman
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

14 AUG 2009

Dear ~~Dr Tamblyn~~ John,

The Ministerial Council on Energy (MCE) considered matters related to the Australian Energy Market Commission (AEMC) review of the effectiveness of National Electricity Market (NEM) security and reliability arrangements in the light of extreme weather events ("the review") at its meeting of 10 July 2009.

The MCE agreed to commission the review in February 2009 following the impact of the 29-31 January 2009 heat wave events on electricity supplies, particularly in Victoria and South Australia.

The MCE communiqué of 6 February 2009 noted that matters that the review would consider included whether the level of the NEM market price cap (MPC), formerly called the Value of Lost Load or VoLL, should be raised to ensure adequate levels of generation to reduce the risk of loss of supply during heat wave events.

The MCE notes the Interim Report of 29 May 2009 for the review, as required by the terms of reference, reported on measures that are currently under consideration that would improve system reliability and security, and further measures that could be taken in the short term that would impact on system reliability for the summer of 2009-10.

The Interim Report noted the proposed increase in the MPC to $12,500 per MWh from 1 July 2010, the periodic two yearly reviews of MPC and other reliability settings to be undertaken in future by the NEM Reliability Panel (including the *Review of the Operationalisation of the Reliability Standards* and the *Review of Reliability Standards and Settings* commissioned by the AEMC on 3 March 2009), and the proposal published by the Reliability Panel on 1 May 2009 for improved flexibility for the Reliability and Emergency Reserve Trader (RERT) and short term reserve contracts in the NEM.

The terms of reference for the review require that the final report for the review be published by 30 October 2009, and report on any cost-effective changes that could be made to energy market frameworks that would improve system reliability and contribute to the more effective management of system reliability during future extreme weather events.

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Community Expectations of Supply Reliability

Substantial load shedding of the kind which occurred in the Victorian and South Australian regions on 29-30 January 2009 had significant economic and social impacts due to the simultaneous and widespread loss of electricity-dependent services. This has highlighted community concerns about supply reliability, and whether the current level of the MPC reflects the true value of lost load.

NEM Rules, including those for setting the level of the MPC, are made by the AEMC on the basis that the Rule will or is likely to contribute to the achievement of the National Electricity Objective (NEO). The NEO promotes efficient investment in electricity services for the long term interest of consumers with respect to two criteria:

(i) price, quality, safety, reliability, and security of supply; and
(ii) the reliability, safety and security of the national electricity system.

When considering the impacts of Rule changes on affordable prices for electricity and security of supply, it is possible for these objectives to conflict. The National Electricity Law (NEL) provides for the AEMC's Rule making activities to weight any aspect of the NEO as appropriate, having regard to any relevant MCE statement of policy principles.

To date, the MCE has not provided any policy advice to the AEMC or the Reliability Panel as to how potentially conflicting objectives in the NEO should be balanced when reviewing reliability related market parameters.

The AEMC's Comprehensive Reliability Review (CRR), as published on 21 December 2007, and subsequent related work on incremental adjustments to the reliability settings, have taken into account expectations of public willingness to accept electricity price increases in return for greater security and reliability of supply. The AEMC has also noted industry concerns about the economic costs of the inherent volatility of pricing in the NEM under the current market design.

The recent load shedding events, and the risk identified in the 2008 NEM Statement of Opportunities of insufficient generation to meet minimum reserve levels in the combined Victorian and South Australian regions in the period up to the summer of 2010-11 indicate investment in generation and transmission infrastructure in these regions may not be occurring in a timely manner. While factors outside of the NEM framework may be influencing investment decisions, the current Reliability Panel review of the effectiveness of the NEM reliability settings and incentives is timely.

In that context, a number of energy market policy matters will require consideration by the MCE, including whether:

- the NEM reliability standard, which was set at the commencement of the NEM in 1998, and subsequent interpretations of the price component of the NEM reliability settings, conform with contemporary public expectations of supply reliability;

- the MCE should provide related policy advice to the AEMC on the relative weighting of price and reliability objectives in the NEO in the determination of the reliability settings in the NEM; or

- vary the terms of reference for the extreme weather events review to include provision for the AEMC to recommend changes to the NEL or NER that would strengthen the processes for determining the NEM reliability settings and MPC.

To be able to further consider these policy matters the MCE will require, among other things, detailed information on the potential costs that would be associated with a range of reliability levels in the NEM.

MCE Direction to the AEMC

As provided for under Section 41 of the National Electricity Law, the MCE therefore directs the AEMC to provide a second interim report for the review, with the following information, supported by analysis by the Australian Energy Market Operator (AEMO) and relevant economic modelling:

(i) a comparison of historical NEM reliability forecasts with outcomes that occurred in the first ten years of the NEM (averages and extremes);

(ii) the expected distribution of reliability outcomes, particularly the frequency of extreme load shedding events, that are implicit in forecasts of average levels of reliability in the NEM;

(iii) an analysis of the reliance that may be placed on NEM reliability forecasting methods, taking into account the outcome of (i) and (ii), sensitivity analysis and other relevant considerations;

(iv) modelling projections of the price-reliability trade-offs of a phased increase in the NEM MPC to:

a) an interim level of $20,000 per MWh;

b) the current value of customer reliability in the study by CRA International dated 12 August 2008 for VENCorp; and

c) any other level that the AEMC decides is relevant to the MCE's consideration.

The AEMC is also requested to advise on:

(i) whether the NEM Reliability Standard has been interpreted to date either as a maximum which cannot be exceeded, or as a mean which is not be exceeded over a number of years;

(ii) the appropriate specification and interpretation of the NEM Reliability Standard in future;

(iii) the appropriate roles for the MCE, the AEMC, AEMO, and the Reliability Panel in policy decision-making on reliability standards; and

(iv) the feasibility of mechanisms for recognising differences in jurisdictional expectations regarding the price-reliability trade-off and delivery outcomes consistent with those expectations.

Timing and Process

The AEMC is to provide a briefing on the second interim report to the 4 December 2009 meeting of the MCE and a full written report by 18 December 2009.

The timing for the final report of the review is extended to 30 April 2010. The final report will have regard to any policy guidance given by the MCE following its consideration of the second interim report.

Copies of the second interim report are to be provided to the Australian Energy Market Operator and the Australian Energy Regulator. The MCE will determine whether the second interim report is to be published.

Yours sincerely

Martin Ferguson

E Measures being undertaken by AEMO to improve the effectiveness of operational responses during extreme weather events

AEMC Review into Effectiveness of NEM Security & Reliability Arrangements in light of Extreme Weather Events

Measures being undertaken by AEMO to improve effectiveness of operational responses during extreme weather events

The following initiatives are being undertaken by AEMO to improve its planning and operational processes to respond to the challenges of extreme weather events.

Extreme Temperatures

The measures being undertaken here are:

- A review with TNSPs to identify the normal ambient temperature rating of transmission equipment in order to identify at what point extreme temperatures are likely to significantly increase the risk of the failure of transmission equipment. This has been discussed with the TNSPs through the Power System Security Working Group (PSSWG) established by the NEMOC. All TNSPs have indicated that they have not identified any systematic issues in this area. This issue will be periodically reviewed by the PSSWG to see if there are any emerging issues.
- A more structured process is being developed to increase operational resources on days when peak ambient temperatures in a region are expected to exceed the reference temperatures established in the E-SOO. An outline of such arrangements is set out in the Appendix A. This process is expected to be in place by summer 2009.
- AEMO will implement a process to remind operators of scheduled generating units and scheduled network service elements to review forecasts of availability on days when peak ambient temperatures in a region are expected to exceed the reference temperatures established in the E-SOO. This process is expected to be in place by summer 2009.
- AEMO is commencing a major project to improve the accuracy of its demand forecasts in STPASA and Pre-dispatch. This project will place a special emphasis on improvements in accuracy of forecasts for very high demand days which are normally associated with periods of extreme temperatures (either high or low).

- AEMO will work with TNSPs to address the issue of volatility of dynamically calculated equipment ratings which was noted to be an issue during extreme temperature events in late January 2009. Work is currently underway with SP AusNet to address identified issues. This work is expected to be completed shortly.
- To address the possibility that shortfall of reserves may occur at short notice if ambient temperatures significantly exceed 10% POE conditions AEMO will be implementing the short notice RERT process in accordance with principles currently being developed by the AEMC through the current Rule Change process. The final design will depend upon progress with the current Rule change consultation, but the arrangements are expected to be in place for summer 2009/2010.
- Ex-VENCorp (now Transmission Services within AEMO) has made a number of recommendations following investigation of the extreme temperature events of late January 2009, which are summarised in Appendix B.
- AEMO will explicitly study an extreme weather scenario as part of the 2009 calculation of minimum reserve levels (MRLs) used in PASA. In the past we have focussed on explicitly modelling only 50% POE and 10% POE demand traces in the market simulations and then weighted those outcomes to form an expected MRL. The 2009 recalculation will include explicit modelling of a 5%POE demand condition (thought to be equivalent to the conditions which occurred in Vic and SA last summer). This scenario will also consider the plant de-rating which actually occurred under those extreme temperatures.

  AEMO are yet to decide how the 5% study result will be used. It might be combined with 10%, 50% and 90% POE results to form an expect view if we are confident in the weighting factor to apply; alternatively it might be used as a sensitivity study, to illustrate how much more USE is likely in 5% POE years.
- AEMO will also explicitly account for thermal limitations on wind farms as part of the 2009 calculation of MRLs. AEMO has data from existing wind farms that describe the protection schemes settings designed to protect against overloads under high ambient temperatures. This data will be used in the MRL studies to estimate the extent of output reduction likely to occur due to extreme temperatures. The approach we intend to explore is using actual wind and temperature data to develop half-hourly wind generation profiles which reflect both the wind observed historically and the impact of historical temperatures on wind farm outputs.

Bushfires

The measures being undertaken in this area are:

- AEMO has developed more a structured process to assess the risks of individual bushfire threats to transmission easements to determine whether or not additional precautions through the mechanism of reclassification of contingency events is appropriate.
- A more structured process is being developed to increase operational resources on days when extreme bushfire conditions are forecast throughout a region. An outline of such arrangements is set out in the Appendix A. This process is expected to be in place by summer 2009.
- Ex-VENCorp (now Transmission Services within AEMO) is reviewing the extreme bushfire events of late January 2009.
- Ex-VENCorp (now Transmission Services within AEMO) will be reviewing the options available to reduce the impact of bushfires on Victorian transmission assets (Minister requested review). The scope of review is being developed.

Lightning

AEMO is developing a more structured process to assess the risks of individual lightning threats to transmission easements to determine whether or not additional precautions through the mechanism of reclassification of contingency events is appropriate. This process is now in place and will be subject to periodic review to identify any opportunities for improvement.

Storms

AEMO is developing a more structured process to assess the risks and threats to transmission easements due to a cyclone to determine whether or not additional precautions through the mechanism of reclassification of contingency events are appropriate. This process is now in place and will be subject to periodic review to identify any opportunities for improvement.

Drought

AEMO has developed a quarterly review process to anticipate the impact of a number of rainfall scenarios (including a drought scenario) on energy capability and hence reliability over the coming two year period. In early 2010 this process will be superseded by a comprehensive process known as the Energy Adequacy Assessment Projection (EAAP).

Impact on Victorian Electricity Transmission Planning

Ex-VENCorp (now Transmission Services within AEMO) will be conducting a longer term review into the impact of extreme weather on Victorian electricity transmission planning. The high level scope of this review is detailed in Appendix C.

Extreme Wind Forecasting

Phase "A" Forecasting enhancements:

- **SCADA-based Extreme Events Alarming System**. The Extreme Events Alarming System would consist of an input collector coupled to a generalised calculation engine driving a trigger point that produced an output alarm file. Many instances of inputs, calculations driving several trigger points can be configured.

Phase "B" Forecasting enhancements:

- **Daily Pattern Identification.** The AWEFS vendor has supplied a report indicating that for Australian wind farms a significant improvement in forecasting can be made by taking account of the sea breeze that follows a daily pattern. The basic steps are:
  - Weather classification, to identify if the "sea breeze" effect is likely; and
  - For each site correct the wind speed in the numerical weather prediction
- **Extreme Events Prediction Advanced Alarming Evaluation study.** Three competing options for future event prediction, with focus on ramp forecasting, would be compared. A recommendations report and an integration design would be provided as part of this study. The options to be evaluated are:
  - CSIRO approach, which estimates the level of extremes based on a variability index;
  - Overspeed approach, which contrasts one forecast with previous forecasts and looks at changes within a forecast; and
  - Advanced ramp prediction approach proposed by Energy and Meteo systems (EMSYS), which forecasts which ramps could occur.
- **Ensembles Study**. Ensemble numerical weather predictions are emerging as a significant step forward in wind energy prediction, allowing for increased understanding of the confidence of weather forecasts and corresponding energy output predictions, and increased likelihood of detection of extreme weather events. A recommendations report and a technical design would be provided as part of this study.

APPENDIX A – Resourcing of NEM Control Room in Emergency Situations

All the actions taken during a major event will encompass the following activities in an approximate order of priority:

(1) Maintain power system security by:

- (1.1) ensuring that system remains secure except for periods immediately following a contingency or reclassification
- (1.2) undertake reclassification of non-credible contingences as required in procedures
- (1.3) restore system to secure operating state following a contingency or reclassification
- (1.4) issue load shed instructions as required to maintain or restore power system security

(2) Minimise amount of unserved energy by:

- (2.1) maximising supply by ensuring interconnectors and generating units operating at maximum capability and dispatching reserve contracts subject to (1) above
- (2.2) restoring load as soon as practical subject to (1) above

(3) Implement special market mechanisms (e.g. intervention pricing , VoLL setting, administered pricing and mandatory restrictions)

(4) Ensure the Market, Responsible Officers (ROs) , CEO and Corporate Communications Manager are kept aware of current state of the event

(5) Forecast supply demand balance (and expected level of load shedding) for current day and at least the next day

(6) As far as possible maintain normal operations in unaffected regions

(7) Identify which credible contingencies are likely to be the most significant in their impact and determine a general plan for the action that would be required to restore back to a secure operating state after each of these contingencies

(8) Communicate to the Market, ROs, CEO and Corporate Communications Managers the results of the analysis for (5) and (7) above.

(9) Track potential risks (i.e. those which are possible but not immediate risks) in order to provide further information on level of risk. For instance if there is a fire in the area of but not yet threatening a transmission easement; then it would be desirable for this to be recognised and a preliminary assessment be made of the likely impact of reclassification of a contingency loss of multiple lines in the easement if the fire was to approach the easement; and also the likely impact of actions to restore PSS if the multiple lines then tripped.

Under emergency conditions, the immediate issues under activities 1, 2, 3, 4, and 6 are likely to command the full attention of normal on-line staff and probably any additional staff immediately called in to assist in the control rooms. There is thus a potential risk that insufficient resources will be allocated to the important but less urgent activities (5, 7, 8 and 9 above)

To ensure that these activities remain adequately resourced, a separate temporary team reporting to the on-line Power System Operations (PSO) Manager will be established to carry out these functions and provide information as required to Senior Manager/PSO and AEMO’s Responsible Officer.

APPENDIX B –
VenCorp (now AEMO) Investigation into Extreme Temperature Events

Actions underway

As part of the review of the extreme temperature events of late January 2009, four specific recommendations were identified as possible immediate improvements to business processes, and for which work has commenced.

The recommendations were:

- for AEMO and SP AusNet to review the settings of the MLS relay at WMTS to ensure that the infrastructure supporting the underground rail loop is exempt from the MLS;
- for AEMO and SP AusNet to investigate the failure of MLS facilities at FBTS and GTS;
- to review the supply / demand balance forecasting methodology, to ensure it reflects high ambient temperature limitations on Basslink and generators output; and
- to provide generic mobile and email addresses for all organisations required to respond to extreme weather events; and to incorporate additional information into the key media message suite which advises people on how they can reduce their electricity consumption

In addition, a number of other recommendations were identified for longer term review and investigation and which required immediate commencement. These recommendations were:

- for SP AusNet to investigate possible options for monitoring of CVTs with a single phase removed from service;
- for SP AusNet to investigate operational practices for removing a failed CVT from service when monitoring systems are in place;
- for SP AusNet to further investigate the failure of the 500kV CVT to identify whether the failure was related to a single CVT, a batch of CVT or related to the type of CVT;
- for SP AusNet to provide advice on the ambient temperature conditions to which the CVT was rated, and the impact of high ambient temperatures on an unbalanced CVT and the voltage gradient in a CVT with reduced capacitance;
- for SP AusNet to provide advice on the feasibility and cost of protection of critical assets within terminal stations from collateral damage by explosions;
- for AEMO and SP AusNet to review the process for changes to the MLS scheme to ensure that any change is confirmed as implemented;
- for AEMO to further investigate the capability of Basslink interconnector with the asset owner such that its transfer limit constraints are fully understood, documented and highlighted; and

- for AEMO to review the inputs into the planning processes for the Victorian electricity transmission network (refer Appendix C for details)

APPENDIX C –
AEMO Review of Impact of Extreme Weather on Victorian Electricity Transmission Planning

Following the extreme weather events of 29-30 January 2009, it is prudent that AEMO Transmission Services review its impact on Victorian electricity planning functions.

It is important to note that there is no consideration by AEMO to move away from an economic cost-benefit approach to planning, however, some of the fundamental inputs will be subject to review, as well as additional information which could be provided in documents such as the Victorian Annual Planning Report.

The areas that AEMO will consider in particular relate to the following inputs into our cost-benefit approach:

- Probability of plant outages at extreme temperatures. Probability of plant failures is a key input to the market benefits test, however, limited information is available on probabilities of some plant failures, and whether there is any increase in probability during extreme temperatures.
- Probability of non-credible contingencies. Presently, events such as an outage of a double circuit tower, or two single circuits on the one easement, are classified as non-credible, and therefore the probability of both occurring is extremely small. However, given recent experience, a review of this probability is warranted, particularly for lines in particular easements which are at risk from bushfires.
- Probability of combined events – does the planning process properly account for multiple events across the system driven by extreme temperatures, bushfires or other extreme or unusual circumstances?
- The relationship between asset parameters such as age/condition and failure frequency.
- Review of temperature standards – that is, is there evidence to suggest that we can expect the 1 in a 100 extreme temperatures that Victoria experienced in January 2009 to be more frequent?
- Review the weighting of 10%, 50%, 90% POE as part of our probabilistic planning. This is also an area where information can be provided about line loadings and demand at risk for, say, 1% POE events.
- Special control schemes for non-credible contingencies. There is ongoing work through the Operations Planning Working Group (chaired by AEMO) into options for control schemes which deal with non-credible contingencies. For instance, such a scheme could allow for high power flow along an easement threatened by bushfire to continue, but allow controlled tripping of selected load if the contingency did actually occur – this would avoid reducing power flows prior to a contingency occurring, which may lead to load shedding.

The events also raise issues regarding asset management, including:

- Ratings of transmission assets and generation plants (including wind farms) at extreme temperatures. It is clear that the performance of generation plant and some transmission elements were affected during these events, noting that the AEMO E-SOO assumes generation capacities for Victorian generators at a 42 degrees Celsius reference temperature.

- The width of existing easements, and the management of vegetation along easements.
- Given the explosive failure of a CVT at South Morang on 30 January 2009, which damaged adjacent equipment and led to the loss another 500kV line, a review into the protection of critical assets within terminal stations may be warranted (e.g. blast walls