Australian Energy Market Commission

AEMC Reliability Panel

Comprehensive Reliability Review

Final Report
December 2007

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy, 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. It is a statutory authority. Our key responsibilities are to consider Rule change proposals, conduct energy market reviews and provide policy advice to the Ministerial Council as requested, or on AEMC initiative.

About the AEMC Reliability Panel

The Panel is a specialist body within the AEMC and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system and advising the AEMC in respect of such matters. The Panel's responsibilities are specified in section 38 of the NEL.

Disclaimer

The views and recommendations set out in this document are those of the Reliability Panel and are not necessarily those of the Australian Energy Market Commission.

Foreword

This Final Report represents the fourth stage in the Reliability Panel's (the Panel's) comprehensive review of the National Electricity Market (NEM) reliability settings. The Comprehensive Reliability Review (CRR) was undertaken to examine those settings that contribute to the reliable supply of electricity to consumers. It has been the first such review of reliability since the inception of the NEM.

By its nature the Review has been comprehensive involving significant input from stakeholders through various submission and consultation processes, as well as substantive research and analysis work. The length of the Review has been elongated to accommodate additional terms of reference including the provision of explicit advice for the Ministerial Council on Energy (MCE) and the Australian Energy Market Commission (AEMC). It would be expected that the future timetable of regular biannual reviews by the Panel of the Reliability Standard and its related settings and mechanisms would be able to be undertaken in a much shorter period, and against the backdrop of extensive information generated through this comprehensive review and the ongoing work of the Panel.

This Final Report is conclusive about certain facets of the mechanisms affecting reliability in the NEM. In particular, it makes recommendations about: improvements to NEM reliability information; the form, level and scope of the Reliability Standard itself; the future of the Reliability Safety Net, commonly referred to as the "Reserve Trader" provisions; and the medium-term settings for VoLL, the Cumulative Price Threshold, and Market Floor Price. The recommendations also create a number of specific work streams for the Panel and NEMMCO relating to guidelines and operational matters affecting reliability including the Minimum Reserve Levels (MRLs) and demand forecasting. The Panel believes that in essence the package of recommendations including proposed Rule amendments represent a prudent, balanced and appropriate set of changes to assist the NEM to achieve levels of reliability consistent with the nature of the Australian electricity market in both design and scope.

A major feature of this Review has been extensive consultation including two public forums. The responses and submissions from stakeholders to the matters raised in the first three phases of the Review (Issues Paper; First Interim Report; Second Interim Report) were crucially important to the Panel in reaching its conclusions for this Final Report. The Panel expresses its appreciation to those stakeholders who provided these responses. Implementing the recommendations will involve further stakeholder consultation including through formal Rule change processes.

The Panel also expresses its appreciation to the work of professional staff from the AEMC secretariat and consulting firm CRA for their contributions to the work and analysis program of the Review. Finally, I would thank my colleague members of the Panel who have participated fully in the deliberations of this important review through their expertise and diligence.

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Contents

Abbreviations

ACCC	Australian Competition and Consumer Commission
AEMC	Australian Energy Market Commission
AMPR	Annual Market Performance Review
ANTS	Annual National Transmission Statement
CAIDI	Customer Average Interruption Duration Index
COAG	Council of Australian Governments
COPD	Cumulative Outage Probability Distribution
CPI	Consumer Price Index
CPT	Cumulative Price Threshold
CRA	CRA International
CRR	Comprehensive Reliability Review
DNSP	Distribution Network Service Provider
DSR	Demand Side Response
EAAP	Energy Adequacy Assessment Projection
ESIPC	Electricity Supply Industry Planning Council of South Australia
FCAS	Frequency Control Ancillary Services
FRC	Full Retail Competition
GELF	Generator Energy Limitation Framework
LOEE	Loss of Energy Expectation
LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
MCE	Ministerial Council on Energy
MPL	Market Price Limit
MRL	Minimum Reserve Level
MTPASA	Medium Term Projected Assessment of System Adequacy
MW	Megawatt
MWh	Megawatt hour
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NEMDE	NEMMCO Dispatch Engine
NGF	National Generators Forum
OCGT	Open-cycle gas turbine
Panel	The Reliability Panel
PASA	Projected Assessment of System Adequacy
POE	Probability of Exceedence
PJM	Pennsylvania New Jersey Maryland

RAS	Reliability Ancillary Service
RERM	See RERT
RERT	Reliability and Emergency Reserve Trader
RNPP	Tasmanian Reliability and Network Planning Panel
Rules	National Electricity Rules
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SRMC	Short Run Marginal Cost
SOO	Statement Of Opportunities
TNSP	Transmission Network Service Provider
USE	Unserved Energy
VCR	Valuation of Customer Reliability
VoLL	Value of Lost Load

Executive Summary

Background, Overview and Context

In December 2005 the Australian Energy Market Commission (AEMC) directed the Reliability Panel (the Panel) to undertake a comprehensive and integrated review of the key standards, mechanisms and parameters (collectively, the reliability settings) for ensuring that the National Electricity Market (NEM) delivers a reliable supply of electricity to consumers. The purpose of this Comprehensive Reliability Review (the Review) was firstly to consider whether there is any need to improve the current reliability settings, and if so, then to determine how best to improve them.

The Review began with the publication of an Issues Paper in May 2006. Stakeholders responded with written submissions, as well as in-person presentations to the Panel at a forum held in July 2006. The Review then entered a research and analysis phase, taking all stakeholders' responses into consideration. The First Interim Report presented the results of that work with a view to further stakeholder consultation before aiming to complete the Final Report and recommendations for July 2007.

However, in June 2007 the Ministerial Council on Energy (MCE) wrote to the AEMC requesting the Panel "review and provide advice on the effectiveness of current market arrangements in managing generation input constraints" in the context of energy shortfalls being forecast by NEMMCO if the prevailing drought conditions remained. The letter also noted "that the current terms of reference [of the CRR] may need to be broadened from its current focus on reliability to consider what, if any, improvements can be made to arrangements, including Reserve Trader, to strengthen the market's ability to manage input constraints."

The AEMC then amended the Panel's Terms of Reference[1] to require the Panel to:

- Provide advice to the AEMC for the MCE by mid-July 2007 on what, if any, improvements can be made to arrangements, including Reserve Trader, to strengthen the market's ability to manage generator input constraints.

- Extend the timetable of the CRR to include a second Interim Report which will seek feedback from stakeholders on the matters raised in that advice before its final report is issued later this year.

The Panel provided the requested advice to the MCE and published a Second Interim Report to seek feedback from stakeholders on issues arising from that advice as well as a number of matters from the broader Review. An exposure draft of potential Rule changes was also issued for consultation, a second public forum for interested stakeholders was held in August 2007 and further submissions were received by the Panel.

This Final Report by the Panel for the Review presents the recommendations, observations, conclusions and proposals developed by the Panel after extensive commentary from stakeholders and analytical work undertaken over the past eighteen months. The issues raised in the Review are complex and the Panel's proposed alterations to the reliability

[1] See Appendix A for the amended Terms of Reference

settings and mechanisms will be subject to formal Rule change proposals and consultation which will emerge during the next year. Any such Rule change proposals would themselves need to satisfy the NEM objective upon consideration by the AEMC. In addition, a number of the recommendations require further action by the particular parties such as the Panel and NEMMCO in the coming months. An overview schematic of the implementation and action work program is found in Executive Summary Figure 1 on page xviii.

In essence, the Panel has made a set of recommendations that it believes are prudent, responsive, and balanced to assist the NEM achieve the appropriate level of reliability into the future. These recommendations address: confirming and clarifying the Reliability Standard in the NEM; adjusting the existing reliability price settings for the medium-term such as VoLL; improving the reliability intervention mechanisms including the 'reserve trader'; increasing the range and quality of information on reliability matters to assist the market particularly for potential energy constraints. In addition, the Panel proposes processes for future reviews of reliability and a number of work streams for the Panel and NEMMCO to improve the operational aspects of the reliability settings.

As the first comprehensive and broad ranging Review covering all the reliability settings since the inception of the NEM, together with an expansion of the Review's Terms of Reference to accommodate additional work for the MCE and AEMC, the Review has been extensive in time and scope. Future regular biannual reviews of the Standard and settings would be expected to be able to be completed in a very much shorter period of time against defined criteria in the Rules.

Why was the Review conducted?

The reliability settings, comprising a reliability standard, market and intervention mechanisms to ensure the standard is met, are crucial for sending appropriate signals for generation investment and end-use demand. The reliability standard itself had not, however, been reviewed since the NEM's inception in 1998, and the various market price and intervention mechanisms have only been reviewed as discrete elements, never as part of a coherent and integrated whole. Furthermore, the nature of supply and demand in the NEM has undergone significant change with, for example, an increasingly peaky demand profile and a shift in the mix of generation plant including increasing contribution from wind generation. Therefore this Review was undertaken at an opportune time to consider holistically all the reliability settings in a comprehensive manner.

The focus of the Review: the NEM reliability settings

The Review's focus is the NEM reliability settings which comprise the following:

- The *reliability standard*, currently set at 0.002% unserved energy (USE) measured "over the long term";
- Three *price mechanisms*, whose purpose is to balance the aim of ensuring the wholesale electricity market meets the reliability standard with the aim of avoiding the creation of unmanageable risks for market participants: a price cap (known as the Value of Lost

Load, or VoLL); a market floor price; and a cap on financial exposure (the cumulative price threshold, or CPT);[2] and

- *Intervention mechanisms* – (the reliability safety net), which comes into effect if the price mechanisms fail – the so-called "reserve trader"; and NEMMCO reliability directions.

How has the NEM performed against the reliability standard to date?

The Panel's view is that the NEM has performed well against the existing reliability standard. Nevertheless there are some exceptions where interruptions to consumers due to problems in the operation of the power system have meant the reliability standard in supply capacity has been breached. Instances where there have been large scale interruptions to supply have included an event involving coincident industrial action and equipment failure in the year 2000, multiple transmission failures leading to blackouts in NSW in 2004, and the recent bushfires that led to blackouts in Victoria in 2007. It is unlikely that incidents such as these would have been prevented by adjusting the reliability standard or by redesigning the reliability mechanisms themselves. In two separate years, reserve capacity has been contracted for under the reserve trader safety net but it has not been dispatched, although the use of the reserve trader provisions must be regarded as a market failure, whether dispatched or not. However, the reliability settings themselves, which are the focus of this Review, have performed satisfactorily to date.

The Panel observes, however, that the NEM's reliability performance has, historically, been bolstered by generation capacity overhang in some regions. This has perhaps made the reliability standard an easier benchmark to perform against than would otherwise have been the case in a system starting with a tighter supply-demand balance.

The Panel's conclusion is that, against the reliability standard, the reliability mechanisms in the NEM have been satisfactory to date.

How is the NEM expected to perform against the reliability standard in the future?

The Panel's analysis suggests that there are risks on the horizon which may affect the timing of generation investment needed to meet the reliability standard in the future, particularly from 2011 onwards, because investor confidence and appetite to invest may be compromised by insufficient underwriting of capital expenditure and by external influences. These concerns raised by many market participants during the review relate to other public policy matters such as the uncertainty about future potential greenhouse measures and their impact on generation investment and demand patterns. The Panel notes that since its Interim reports, significant public policy announcements have been made particularly in reference to carbon, greenhouse emission sand renewable energy. In the next two years, detailed policy arrangements for these areas are expected to be designed and implemented by governments. Future reviews of NEM reliability should be able to take account of these developments.

[2] Currently VoLL, the market floor and the CPT are set at $10,000/MWh, -$1,000/MWh and $150,000 respectively.

The design of the NEM is premised on the effective operation of both spot price trading arrangements under the Rules and of bilateral contracting between generators and consumers. Quantitative modelling indicates that spot prices would be just sufficient to signal the need for new investment in the next three years in the absence of distortions due to the influence of external policy mechanisms such as greenhouse measures or retail price caps. Where such distortions are present they could give rise to delays in the introduction of new generation. Furthermore, qualitative assessment of the contracting environment indicates that the market for contracts is too short-term to underwrite investment, although this is less of a barrier to vertically-integrated participants. In addition, the Panel's analysis has noted the trend of an underlying cost increase for future generation construction.

The analysis in this Review shows that absent any change to the reliability settings there would likely to be an increasing reliance on the safety net – the reserve trader post 2011. However this mechanism was intended as an emergency intervention mechanism only and was not designed neither for regular use nor as a replacement for the underlying market signals to generation and consumption.

Sufficient concerns have also emerged from stakeholders, particularly in light of the issues raised above, that it would appear prudent to strengthen the reliability settings to increase confidence that the reliability standard will continue to be met in a timely manner, with additional generation coming online ahead of a potential breach of that standard in the future, especially for the period beyond 2011. The Panel notes that improving the reliability settings may come at a future cost to consumers.

The Panel's view is that there appear to be risks on the horizon that may impact the NEM achieving the reliability standard in the future if the amount of investment in new generation required to meet expected demand is either delayed in timing or did not occur. The risks which emerged from stakeholder submissions principally relate to external policy factors which create perceptions of uncertainty or potential distortions to the market and the investment environment. The Panel also notes that other risk areas put forward in submissions include the operation of the contract market over the longer term and the relationship of the level of values of the reliability settings (such as VoLL) to underlying costs – such as construction costs. The analysis also shows that in the absence of further market signals, even under ideal conditions, there are risks to achieving the sufficient level of generation investment and demand responses with the reliability settings at their current levels. The Panel therefore believes it prudent and responsible to consider adjustments and incremental improvements to the reliability settings and mechanisms to provide continuing confidence in the NEM's ability to deliver reliability in the long term interests of electricity consumers.

Addressing the risks: adjust the reliability standard?

One possibility is to refine the design of the reliability standard itself. To this end, the Panel has assessed the arguments for and against refining the standard's form, level and/or scope, and has benchmarked it against that of other systems internationally.

The 'raw' results of international comparison are that the reliability standard in the NEM is lower (that is, less reliable) than in very large and highly-meshed power systems such as in the north east of the US but that its level is in line with systems in European countries, from which the Panel concludes that the NEM reliability standard is at the lower end of international practice. But other factors also have to be taken into account: the different

standards used internationally to manage duration and depth of interruption; and the potentially marked effect of overall power system size, characteristics of generators, consumer demand, and level of interconnection. On balance, then, the Panel has reached the view that, given Australia's unique demographics (a small population spread over large distances), the standard for reliability in the NEM is not inappropriate.

As for the *level* of the reliability standard, submissions to the Panel from stakeholders indicated that there is little concern about it and broad support for the 0.002% USE level. The Panel also notes that any tightening of the standard's level would come at a cost which would ultimately be paid for by the consumer.

However, the Panel's analysis has identified concerns about the clarity of understanding of the current reliability standard. Therefore the Panel believes the standard should be specified as 'over the long term' to mean ten years looking backwards, and that it should be targeted to be achieved prospectively on an annual basis, NEM-wide and in each region.

The Panel's conclusion is therefore to confirm the existing NEM-wide reliability standard at 0.002% USE but to more clearly specify its measurement and targeting. In this regard, the Panel is issuing a new version of the formal reliability Standard for the NEM. This is based upon the consultations and analysis work of the Review. (See Appendix D)

Addressing the risks: options

The Panel has considered a suite of possible options for amending the reliability mechanisms. These options fall into three main groups, each of which offers a different balance between market arrangements and central control and therefore offers different allocations of risk and certainty in the management of reliability.

- *Group 1*. This group of options would make no change to the roles of the existing reliability mechanisms and would either:
  - do nothing and rely on the reserve trader, possibly with amendments (discussed below);
  - raise the setting of VoLL and amend the related CPT mechanism level; or
  - facilitate the underwriting of new investment by, in some way, 'forcing' longer-term contracting.
- *Group 2*. These options would introduce additional new mechanisms and revenue streams for plant that provides reserve (e.g. a new reserve ancillary service, or a standing reserve contract).
- *Group 3*. These options would introduce a general payment for availability, payable to all plant (e.g. centralized financial or physical contracting open to all generators).

Group 1 options would require little change to the structure of the NEM. But as already discussed, the 'do nothing' is likely to create an increasing and unhealthy reliance on the safety net that may have unpredictable consequences.

Group 2 and 3 amendments would introduce varying degrees of change to the structure and affect other elements of the market operation. The Panel acknowledges that a number of

stakeholders have put forward submissions arguing for a more fundamental change in the NEM market design (such as capacity payment arrangements or 'reliability options' to either reduce volatility or increase the predictability of generator revenues and wholesale electricity cost profiles).

Group 3 options would require a major reconstruction of the current market design and are matters in the province of the Ministerial Council on Energy (MCE). As part of this review, material and submissions relating to Group 3 options have been raised by some stakeholders. The Panel intends to forward these to the MCE and the AEMC for information.

The Panel's conclusion is to recommend changes which largely reflect Group 1 options in combination with improved information processes to allow for market responses. In addition, analytical and submission material relating to Group 2 and 3 options will be forwarded by the Panel to the relevant policy bodies.

Addressing the risks: vary the level of VoLL and related mechanisms?

Another obvious way to address the reliability risks identified, and be consistent with the NEM design, would be to raise the level of VoLL.

The underlying design of an energy-only market suggests that VoLL should be raised periodically in line with the underlying costs of the market. The level of VoLL has not been altered for five years. In undertaking the Review, the Panel had expressed the early view that prima facie, raising VoLL was not its preferred approach. It sought through the analysis and consultation process to see whether its analysis demonstrated that the case for change was demonstrable, and other alternatives (capable of being implemented within the context of an energy-only market) were not capable of effectively ensuring the likelihood of sustaining reliability at 0.002% USE in the medium-term. These matters and the analysis work is extensively canvassed in Chapter 6 and Appendix E of this Report.

The Panel observes that the analysis of future projections demonstrates that the USE reliability standard would be breached in the medium term at a level of VoLL of $10,000/MWh nominal.

On balance, the Panel has reached the conclusion that raising VoLL in the medium term is the prudent approach given the risks identified and the constraints of an energy-only market. The Panel intends to put forward a Rule change proposal to the AEMC to raise VoLL to $12,500 effective 1 July 2010. The CPT would be similarly raised to $187,500 by explicitly specifying the value of the CPT as 15 times VoLL. These matters will be subject to the formal Rule change process and consultations by the AEMC.

To assist in this process and to allow for further stakeholder input, the Panel intends to release an "Exposure Draft" for consultation with interested stakeholders in the first half of 2008. Following this consultation process, the Panel then intends to make a formal Rule change proposal. The Panel notes that the proposed level of VoLL to apply from 2010 would reflect a similar level of the current level of VoLL (set five years ago) and indexed either for inflation or for cost increases. The Panel is not recommending an automatic indexation of the level of VoLL but rather the ability to review its level in the

context of all the reliability settings every two years, with at least a two year notification period of any proposed change.

The Panel also believes that, to reflect its true nature as a limit on prices in the market, VoLL should be renamed the Market Price Limit (MPL).

In addition, the Panel recommends that the Market Floor Price should remain unchanged at -$1,000/MWh

Conclusions and recommendations reached on related matters

In this Final Report the Panel has made the following conclusions and recommendations:

- That the current safety net or 'Reserve Trader' should be redesigned to become a Reliability and Emergency Reserve Trader (RERT); this mechanism should be retained for a sunset period; and its operation should be reviewed as part of the regular review of the reliability settings. (The Panel issued an exposure draft on this recommendation earlier this year. With the benefit of amendments suggested through stakeholder responses in the Review consultations, and broad support for the proposal, the Panel intends to submit the recommendation, by way of a formal Rule change proposal to the AEMC, in the first quarter 2008. This should allow its consideration ahead of the current expiry date for the existing 'Reserve Trader' of 30 June 2008.) The RERT will provide for both demand-side and generation responses. Furthermore, consultations in the Review have suggested that there may be operational improvements available to NEMMCO in relationship to both the contracting and funding arrangements for the 'reserve trader'. The Panel recommends that NEMMCO undertakes a consultation process with interested stakeholders on these matters in 2008 with a view to implementing any administrative or procedural changes for the operation of the new RERT mechanism.

- That a new Energy Adequacy Assessment Projection (EAAP, an information gathering and dissemination mechanism) be introduced to enable the market to forecast and respond to projected times where there may be energy constraints that would affect reliability. (The Panel issued an exposure draft on this recommendation earlier this year. With the benefit of amendments suggested through stakeholder responses in the Review consultations, and broad support for the proposal, the Panel intends to submit the recommendation, by way of a formal Rule change proposal to the AEMC in the first quarter 2008.)

- That there is a confirmation of NEMMCO's ongoing power to issue Reliability Directions with no sunset date for this power. (The Panel issued an exposure draft on this recommendation earlier this year. With broad support for the proposal from stakeholders, the Panel intends to submit the recommendation, by way of a formal Rule change proposal to the AEMC in the first quarter 2008. This should allow its consideration ahead of the current expiry date for the existing directions powers – being 30 June 2008.)

- That the current annual review of VoLL should be replaced by a Reliability Standards and Mechanisms review of all the reliability settings (i.e. the reliability standard, VoLL(MPL), the CPT, the market floor price, the RERT and any additional reliability

mechanisms) which should take place every two years. With respect to any recommendations from the biannual Review which may suggest changes to VoLL, the market floor price and the CPT, there should be a two year notification period. In essence, this process means an average four-year cycle of potential changes which appears to be a balanced and appropriate time scale.

- That the Panel will request NEMMCO to conduct a review of the level of short term reserves that should be used in the short term PASA.

- That the Panel will request that NEMMCO report to the Panel each November on the accuracy of the most recent Statement of Opportunities (SOO) demand forecasts and on improvements in the forecasting process that will be used to prepare the subsequent SOO.

- That the Panel notes the significant progress being made by jurisdictions and NEMMCO in further improving the demand forecasts for the market. The Panel believes that continuous improvements in the accuracy of demand forecasting would be beneficial for the market and for reliability responses.

- That the Panel should undertake a formal consultation under the Rules for the 'Guidelines for management of electricity supply shortfall events' which was issued by the Panel in 1998. The Panel intends to implement this recommendation in 2008.

- That the Panel should establish a taskforce to look specifically at the methodology and process for calculating Minimum Reserve Levels (MRLs), especially where the MRLs are applied across more than one jurisdiction. This taskforce will comprise of NEMMCO, industry and jurisdictional representation and would be chaired by a member of the Panel. It is intended that this recommendation also be undertaken in 2008.

- That the Panel endorses the action of the AEMC in undertaking a current review of the Administered Price Cap (APC). The Panel also notes that a related Rule change proposal regarding the compensation arrangements for administered prices has been proposed by a market participant which will allow consideration of this matter by the AEMC.

- That the Panel notes that there appear to be potential benefits to medium-term reliability from the development of demand-side and standing reserve arrangements. The Panel notes that the AEMC is currently undertaking a review of demand-side issues relating to the Rules. The Panel intends to provide inputs to that review based upon the submission and analysis work undertaken for this Report. Furthermore, the Panel intends to establish a work program in 2008 relating to "medium-term reserves and reliability" to provide additional analytical material that would be relevant to deliberations by the MCE and AEMC on policy and market development issues respectively.

- That the Panel continue to release its Annual Market Performance Review relating to reliability and security.

Next Steps

Amongst the recommendations above, a number will require changes to the National Electricity Rules. These will be the subject of three Rule change packages to be submitted to the AEMC during 2008.

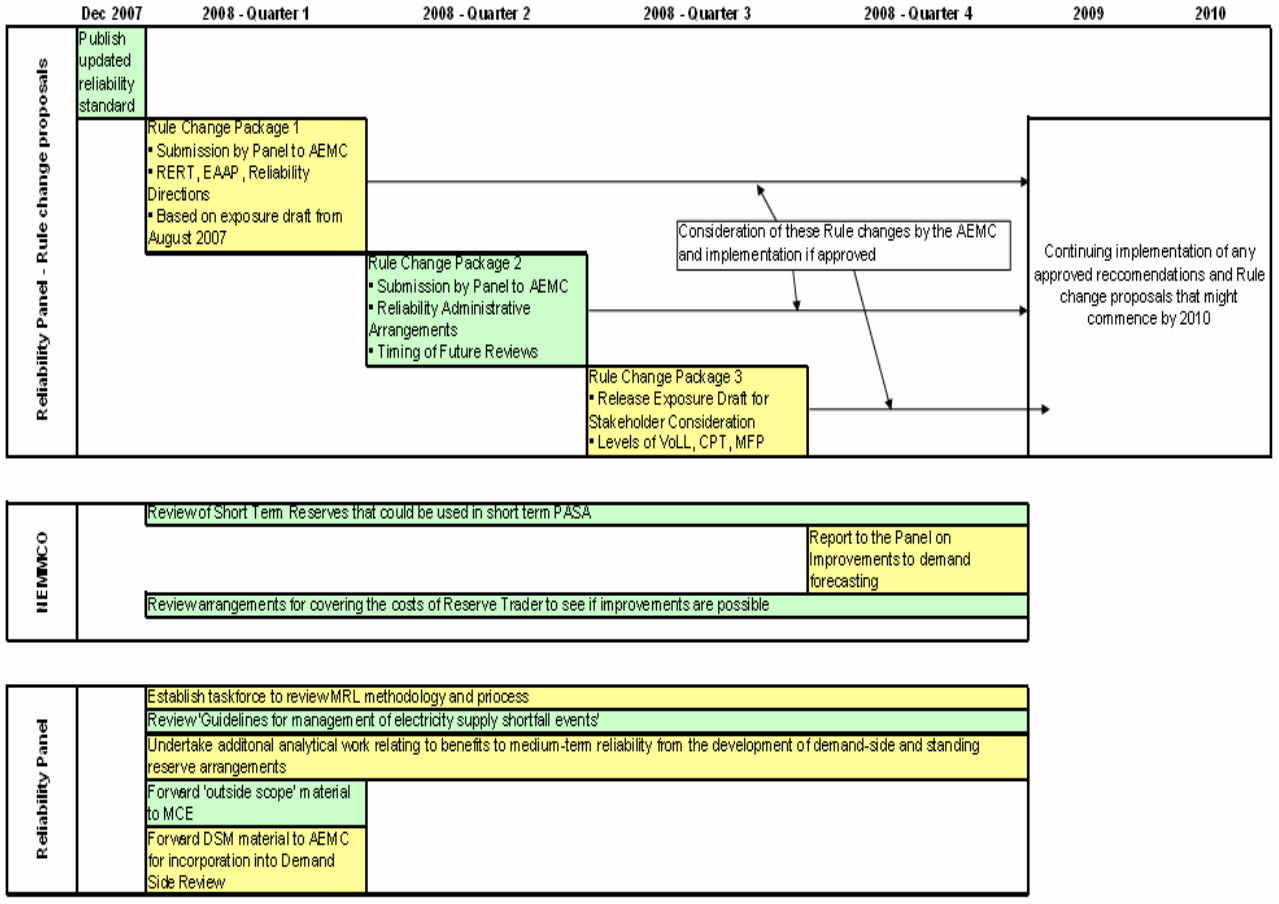
The first of these will be submitted in early January 2008 and will address the re-designed reserve trader (RERT), the new EAAP information mechanism and NEMMCO's power to issue reliability directions. The content of this Rule change has already had extensive consultation through an exposure draft in the Second Interim Report.

The second Rule change package will be submitted in February or March 2008. It will largely be administrative. It will address the name of VoLL (to be changed to the Maximum Price Limit (MPL) and the timing and process of future review of the reliability settings (the cycle of which would commence from 2010.)

The third Rule change package will address the levels of VoLL and the CPT. Due to the impact on the market that a change in the level of VoLL would have, the Panel intends to first issue an exposure draft of its Rule change proposal in order to gain stakeholder feedback prior to submitting the proposal to the AEMC for consideration. The exposure draft would be published by the Panel in April or May 2008 and then subject to consultation, with the aim of submitting the final Rule change proposal to the AEMC in the second half of 2008 to have effect from 1 July 2010.

The Panel would like to thank all stakeholders who made submissions and participated in this important Review. As indicated from the Review recommendations, a further process of consultation relating to each specific area would be expected to occur during 2008. The diagram below indicates the anticipated work streams arising from this Review.

Figure 1 – Implementation and Action Work Program



1 Introduction

This chapter outlines the purpose, scope and key themes of the Comprehensive Reliability Review (the Review) and describes its progress to date. It also outlines the structure of this Final Report.

1.1 The Comprehensive Reliability Review

In December 2005, the Australian Energy Market Commission (the AEMC)[3] directed the Reliability Panel (the Panel)[4] to undertake a comprehensive and integrated review of the key mechanisms, standards and parameters (collectively, the 'reliability settings') for achieving reliability of supply in the National Electricity Market (NEM).

1.1.1 Purpose of the Review

The purpose of the Review is to investigate the effectiveness of the current reliability settings and to consider if, and how, they can be improved for the benefit of consumers.

The reliability settings comprise:

- An explicit reliability standard for generation and bulk transmission (currently set at no more than 0.002% USE and assessed over the long term);
- Price mechanisms designed to ensure that the wholesale spot market delivers capacity to meet the reliability standard: a price cap (known as the Value of Lost Load or VoLL) with a market floor price and a cap on financial exposure (the Cumulative Price Threshold or CPT); and
- An intervention mechanism known as the 'reliability safety net' (sometimes called the reserve trader), should the price mechanisms fail.
- The National Electricity Market Management Company (NEMMCO) also has a power of direction it is able to use at short notice.

As noted in the Executive Summary the Panel was due to submit its final report to the AEMC by 31 March 2007. The AEMC subsequently revised this date to 31 July 2007. This was further revised to 30 November 2007 following a request from the Ministerial Council of Energy for advice from the Panel on ways to manage generation input constraints.[5]

This Final Report presents results of research and analysis carried out in light of stakeholders' submissions to the Issues Paper of May 2006, the First Interim Report of March 2007 and the Second Interim Report of August 2007.

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[3] The AEMC is the national body responsible for making the National Electricity Rules (the Rules) that govern the operation of the NEM. It is also responsible for market development of the NEM. The AEMC's responsibilities are specified in section 29 of the National Electricity Law (NEL).

[4] The Panel is a specialist body within the AEMC and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on the safety, security and reliability of the national electricity system and advising the AEMC in respect of such matters. The Panel's responsibilities are specified in section 38 of the NEL.

[5] See the Terms of Reference (see Appendix A).

1.1.2 Timing of the Review

This has been an opportune time to review the reliability settings, for several reasons. The reliability standard itself has not been reviewed since the NEM's inception in 1998, and the various market price and intervention mechanisms have only been reviewed as discrete elements, never as part of a coherent and integrated whole. More importantly, the settings needed to be reviewed because over the years the market has evolved with changes evident including an increasingly peaky demand profile. The mix of generation plant has altered to include a growing contribution from peaking and wind generation. The 'Reserve Trader' safety net has been invoked twice now. The overhang of generation capacity with which the market started has been substantially consumed in all regions, and reserve margins are now approaching levels that are low by conventional standards. Significantly, the market narrowly avoided exceeding the Cumulative Price Threshold in June 2007, which would have resulted in Administered Prices. There have been concerns raised by stakeholders on generation constraints arising from drought conditions in several NEM regions. Finally, some investor uncertainty has become evident with regard to building new generation.

1.1.3 Scope of the Review

The continuity of electricity supply to consumers depends on there being (1) an adequate level of generation and bulk transmission network assets available ('reliability'), and (2) the safe and secure operation of the power system ('security'). (These concepts are explained more fully in Chapter 0.) Delivering sufficient investment in generation and bulk transmission and maintaining the technical performance of the power system requires an appropriate market structure, governance arrangements, regulatory settings and technical standards. The reliability settings are an important part of this broad picture.

While the Panel does have some responsibilities that impact on power system security, the focus of this Review is reliability.

The Panel has also sought to be informed as to how reliability may be affected by broader market features and, therefore, the Issues Paper invited comment on this from stakeholders. Schemes aimed at reducing greenhouse gas emissions and other government initiatives, for example renewable energy targets and retail price caps, were raised in submissions by some stakeholders as having a significant impact on future reliability.

The Panel has undertaken an initial assessment of options for changes to market features that lie outside the scope of this Review or are beyond the role of the Panel as defined under the NEL and the Rules, and will forward them to the relevant decision-making body. It will do this after the release of this Final Report.

Other reviews

Due to the complex and interconnected nature of the NEM, reliability cannot be considered in isolation from other elements of the market that are currently under review. For example, changes to transmission regulation or market structure may have an influence on investment strategies, and consequently on reliability. The Panel notes that several other reviews are currently under way which may have some bearing on future market settings, including:

- Some of the energy work program of MCE relating to energy market reforms; and

- The AEMC's Congestion Management Review.

1.1.4 Key themes and questions

Inevitably, any tightening of the reliability settings would result in both costs and benefits for electricity consumers. Changes may also impact on other dimensions of electricity supply such as the security of the power system. These inter-relationships are reflected in the NEM objective, set out in the NEL, which is used as the basis for assessing proposed changes to the Rules. It provides that:

> *The national electricity market objective is to promote efficient investment in, and efficient use of, electricity services for the long-term interests of consumers of electricity with respect to price, quality, reliability and security of supply of electricity and the reliability, safety and security of the national electricity system.*[6]

The Panel's view is that any assessment of the current reliability settings, as well as any actual improvements to them, should be undertaken on a basis consistent with the NEM objective. In this context, the Panel considers that an effective approach to reliability should achieve the following:

- Delivery of a level of supply reliability that meets the broad expectations of consumers, and the value they place on it;
- The maximising of efficiency in investment and use of electricity;
- Clarity in respect of the reliability standard and settings and certainty in respect of how the relevant mechanisms operate; and
- In the event that changes to the reliability settings prove desirable, minimal disruption to the market.

In order to address these key themes, the Panel has approached this Review in terms of the following fundamental questions raised in the Issues Paper of May 2006:

1. Is there now, or is there likely to be in the future, a problem with supply reliability in the NEM?
2. If yes, is there now, or is there likely to be in the future, a problem with the reliability settings?
3. If yes, is it serious enough to cause material dislocation to suppliers and users in the future?
4. If no, what improvements to the operation of the reliability settings should be made?
5. Otherwise, what changes to the reliability settings should be contemplated that would be beneficial?

1.1.5 Progress to date

The Issues Paper (May 2006) described the current reliability standard and mechanisms, and discussed the NEM's performance against the standard to date as well as where there may be scope for improvement.

[6] NEL, s7.

After receiving twenty-three submissions to the Issues Paper from a range of industry stakeholders, the Panel held a Stakeholder Forum on 27 July 2006 in which further views were presented and discussed. Subsequently the Panel also received eight supplementary submissions. Submissions and presentations can be viewed on the AEMC website at www.aemc.gov.au.

To prepare for the First Interim Report a consultancy, Charles River Associates (CRA), was commissioned by the Panel to assist in analysis, which included modelling reliability outcomes for the current market design and for possible alternative design options. The First Interim Report was published on 30 March 2007 with the preliminary results of the CRA analysis presented to give stakeholders further opportunity for comment. Fifteen submissions were received from stakeholders at this stage of consultation.

In June 2007, the MCE requested the Panel to "review and provide advice on the effectiveness of current market arrangements in managing generation input constraints".[7] The AEMC then changed the Panel's terms of reference to incorporate this piece of work for the MCE and extended the publication date of the final report and also extending the timetable of the CRR to include a second Interim Report to specifically deal with the issues arising from the advice to the MCE. The Panel then decided that further stakeholder consultation was necessary and a public forum was held in Melbourne on 13 September 2007. Seven stakeholders made presentations to the Panel. Additionally, a further thirteen submissions were made responding either to issues raised at the forum or to the Second Interim Report.

1.2 Final Report Setting

As discussed, this Report has been informed by an Issues Paper, two Interim Reports, extensive stakeholder consultation through submissions to the those papers and direct feedback at two stakeholders forums. It brings to a closure the Comprehensive Reliability Review.

1.3 Structure of this report

The rest of this Report is organised as follows:

- Chapter 2 is a general introduction to the fundamental design of the NEM and the role of the reliability settings;
- Chapter 3 is an historical examination of the NEM's reliability performance to date;
- Chapter 4 assesses whether the current form, level and scope of the reliability standard are appropriate for the future;
- Chapter 5 assesses the outlook for reliability in the future;
- Chapter 6 provides a discussion of the range of options being considered by the Panel for providing confidence over reliability into the future;

[7] The MCE letter is available on the AEMC's website.

- Chapter 7 outlines the Panel's conclusions about the Reserve Trader provisions in the Rules.
- Chapter 8 discusses other aspects of the NEM on which the Panel has reached conclusions to enhance the market's reliability performance.

The Report also includes five appendices:

- The Review's Terms of Reference (Appendix A).
- A list of all submissions, supplementary submissions and presentations made to the Panel (Appendix B).
- Analysis information on costs and pricing of plant (Appendix C).
- The formal definition of the reliability standard (Appendix D).
- Detailed analysis of the alternative scenarios proposed in Chapter 6 for improving reliability outcomes (Appendix E) which is the consultant's report to the Panel.

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2 A general introduction to the NEM and 'reliability'

This chapter provides a general introduction to the National Electricity Market (NEM), how reliability is defined in the NEM, what mechanisms are used to achieve it, and the reasons why such mechanisms are necessary. The chapter also highlights the relationship between the reliability settings and key themes of this Review.

2.1 What is the NEM?

The NEM is the single interconnected power system stretching from Queensland through New South Wales, the Australian Capital Territory, Victoria, and South Australia to Tasmania. It does not currently include the Northern Territory or Western Australia. The NEM is divided into pricing regions which closely align with State borders (the ACT forms part of the NSW region), and there is an additional region encompassing the Snowy Mountains Hydro Electric Scheme.[8]

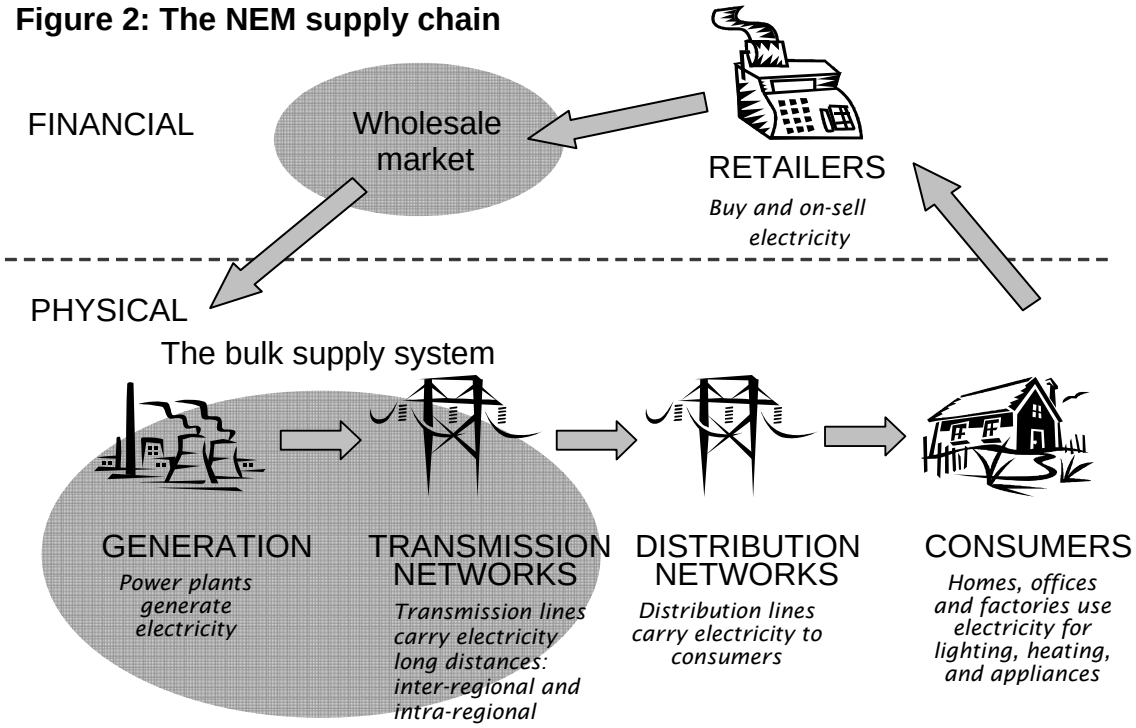
The NEM comprises a number of elements including:

- A *wholesale market* for the sale of electricity by generators to wholesale consumers (typically retailers and large consumers), and which allows trading in contracts between generators, wholesale consumers and merchant traders;
- The physical *power system* used to deliver the electricity from generators via transmission networks (together referred to as the 'bulk supply system') and local distribution networks; and
- *Retail arrangements* whereby retailers on-sell the energy they purchase to end-user consumers such as households and businesses.[9]

[8] The AEMC recently made a Rule change that will abolish the Snowy region on 1 July 2008.

[9] In the context of this Review, the Panel's responsibilities do not extend to the retail sector or certain aspects of the network arrangements. The boundaries with those matters are discussed in Chapter 4 below.

Figure 2: The NEM supply chain



The NEM is a partially-regulated market. That is, generators and retailers operate according to competitive market conditions, whereas owners of 'natural monopoly' assets – transmission networks and distribution networks – are largely regulated. An option for market network service providers also exists for specific network assets to operate under competitive market arrangements. This means that if public or private enterprises are to provide adequate generation capacity to meet demand at all times, there needs to be sufficient financial incentives for them to do so. These incentives are delivered through the operation of a wholesale spot market.

Spot electricity prices are calculated for each region every five minutes (known as a 'dispatch interval'). Six dispatch prices are averaged every half-hour ('trading interval') to determine the regional spot market price used as the basis for settling the market. The wholesale spot price can vary considerably, potentially dramatically, in short periods of time. The degree to which the price moves is important to many stakeholders. A large proportion of suppliers and consumers negotiate financial contracts to manage the financial risk associated with market volatility. Those contracts are private arrangements in that the prices are not visible other than to the participants who are party to the contracts.

All electricity generated is traded via the spot market (this is known as a 'gross pool' arrangement) and dispatched centrally by the National Electricity Market Management Company (NEMMCO) – the market and system operator. NEMMCO also manages the security of the power system and provides ongoing information to market participants about forecast and actual supply and demand. NEMMCO and transmission network companies

also acquire specific technical or ancillary services from generators and consumers to support the operation of the physical power system.

2.2 What is 'reliability'?

Broadly, the reasons why consumers may not receive a continuous, uninterrupted supply of electricity may fall into two categories. The first is technical: action has been taken to ensure that power system equipment is protected from damage or exceeding operating limits that, if left unchecked, may lead to wider interruptions to supply. This is *security*. Ensuring that the power system is operated securely is the responsibility of NEMMCO and the network operators. The second is non-technical: quite simply there is not enough capacity to generate or transport electricity across the networks to meet all consumer demand. This is *reliability*. This second reason is economic to the extent that it must be cost-effective for generators and networks to have enough capacity to meet demand at all times.

Standards for reliability are set in the Rules and by the Panel. In technical terms, the formal definition of reliability includes single credible contingencies[10] but excludes non-credible contingencies, including multiple contingencies, which are classified as security events.[11]

For security or reliability reasons, or a combination of both, some consumers may be without electricity for some of the time. Most commonly, interruption to supply is caused by unforeseeable events such as storm damage to local distribution networks. Such events are, as explained above, security issues (and are therefore outside the scope of this Review). From the consumer's perspective, however, there usually appears to be little if any difference between an interruption caused by a reliability issue and one caused by a security issue. But from a market design perspective, the two causes have very different ramifications: security events – managed through standards applied by NEMMCO and network operators – usually pass quickly, whereas a reliability issue is far more likely to be long term as it may be the symptom of a fundamental problem – a lack of sufficient supply capacity – which will take time to rectify.

There are any number of responses to the question of what degree of reliability is tolerable and how much value is ascribed to increased reliability. One group of consumers may require a higher level of reliability, and therefore would be willing to pay a higher price for reliable supply, from another. For example, businesses are likely to be less tolerant of interruption to supply during office or factory hours, whereas families are likely to be less tolerant of it in the mornings and evening and on weekends. Potentially, each individual consumer may have a unique tolerance threshold and there are millions of consumers in the NEM. Thus, the question as to what degree of reliability is tolerable also raises an issue concerning how differing expectations regarding reliability and the cost of that reliability can be communicated most effectively to suppliers.

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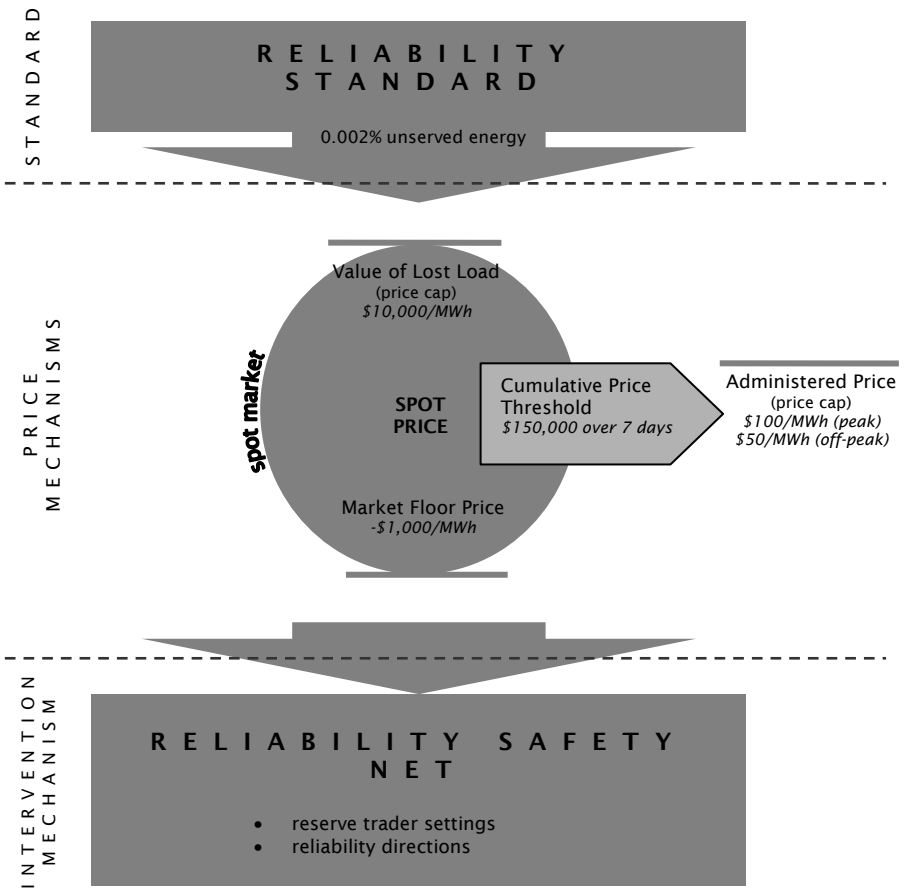
[10] A credible contingency event is defined in clause 4.2.3(b) of the Rules as "a contingency event the occurrence of which NEMMCO considers to be reasonably possible in the surrounding circumstances including the technical envelope." A contingency event is defined as "an event affecting the power system which NEMMCO expects would be likely to involve the failure or removal from operational service of a generating unit or transmission element."

[11] For example, the unserved energy arising from events in NSW on 13 August 2004 was a security event rather than a reliability one.

There is also an important relationship between reliability and security. Security is fundamental to the operation of the power system. However, larger amounts of generation and network capacity generally will make it less likely that interventions will be required to keep the power system secure (although this is subject to how that capacity is distributed throughout the system and how reliable each component is itself).[12] Therefore, the level of reliability tolerated by consumers in respect of a system may impact on the technical risk that the system will be unable to supply electricity.

2.3 What are the NEM's reliability settings?

Figure 3: The NEM reliability settings



2.3.1 The reliability standard

The reliability standard was set at no more than 0.002% unserved energy (USE) 'over the long term' by the Panel at market start in 1998 and has remained unchanged since that time.

[12] There are exceptions. For example, having too much generation on line overnight when demand is low can lead to problems controlling the stability of the power system if most generators have been forced down towards their minimum stable operating level.

The standard describes the minimum acceptable level of bulk electricity supply measured against the total demand of consumers. A number of aspects in the way that the standard should be interpreted remain undefined. For example, the practice to date has been to measure the standard over the long term. Thus, if consumer energy demand was 100,000 MWh over the long term, the standard would require the supply of no less than 99,998 MWh, although the standard does allow for significant variations from year to year providing the long-term average is within the standard. Currently, in order to operationalise the standard, NEMMCO calculates minimum reserve levels (MRLs) for each region. It then compares forecast and actual reserve levels with those minimum levels to manage against the risk that the reserve standard will not be met at the time of dispatch.

2.3.2 Price mechanisms

The level of VoLL, the market floor price and the CPT arrangements are the key price envelope within which the wholesale spot market seeks to balance supply and demand, and deliver capacity to meet the NEM reliability standard with the aim of avoiding unmanageable risks for market participants. VoLL is the market price cap and is currently set at $10,000/MWh. The market price floor is currently set at -$1,000/MWh. These parameters are crucial because they provide key signals for supply and demand-side investment and usage. For example, if the caps are set too high, consumers (either via their retailers or trading directly in the market themselves) can be financially exposed. Set too low and there may be insufficient incentives to invest in new generation capacity to meet future reliability.

The CPT is designed to limit participants' exposure to protracted stress in the wholesale spot market and is currently set at $150,000. This is an explicit risk management mechanism. If the sum of the half-hourly wholesale market spot prices over a rolling seven day period total or exceed this threshold, then NEMMCO must impose an administered price cap such that spot market prices do not exceed $100/MWh during peak times and $50/MWh in off-peak times until the sustained high prices fall away[13]. Some market participants have, however, complained that the CPT does not actually assist in the management of risks. In particular the level of potential administered prices, combined with an open ended compensation regime for generators, means that prudently hedged retailers may suffer increased losses if the CPT is exceeded.[14] This level of concern was heightened when such an event almost occurred in June 2007.

Under the current Rules, the Panel is required to conduct a review of VoLL, the market floor price and the CPT by 30 April each year. In its 2006 and 2007 determinations, the Panel did not alter the level of those parameters mainly on the basis that they would be extensively examined as part of this Review and will be reported on in the CRR Final Report in November.

2.3.3 Intervention mechanisms

The reliability safety net refers to NEMMCO's powers to intervene in the market to address potential shortfalls of supply against the NEM reliability standard. Currently, the trigger for NEMMCO intervention is if reserves appear likely to – or in fact do – fall below the

13 The AEMC has recently initiated consultation on the level of the APC.

14 Energy Retailers Association of Australia submission to the Issues Paper.

minimum reserve levels it periodically sets. NEMMCO can intervene in the market in either or both of two ways:

- By acting as a "Reserve Trader" and purchasing ahead of time the additional reserve generation and/or demand side response (DSR) it forecasts will be needed at the time the market is dispatched to meet the minimum reserve levels. Twice now NEMMCO has contracted for, but has not in fact been required to dispatch, reserve capacity in order to meet forecast summer peak demand.
- By requiring generators to provide additional supply at the actual time of dispatch to meet those minimum reserve levels using its short-term direction power.

In December 2005, the Panel lodged a Rule-change proposal with the AEMC to extend the expiry date of the reliability safety net from 30 June 2006 until 30 June 2008 to allow it time to complete this Review. The AEMC has released a determination accepting that proposal subject to allowing the expiry date to be brought forward on the recommendation of the Panel as an outcome of this Review.[15] In this Review, the Panel will assess whether an intervention mechanism is still required, whether the current reliability safety net mechanism remains appropriate or whether alternative arrangements should be put in place.

2.3.4 Inter-relationship between the reliability settings

The settings outlined above are inter-related. For example, an increase in the level of the reliability standard (i.e. an actual tightening of the standard to a more reliable supply level such as 0.001% USE) is likely to require an increase in the level of VoLL or some other form of generation remuneration, in order to signal the appropriate level of investment to wholesale spot market participants so that the standard can be delivered. Depending on the effectiveness of that pricing signal, it may also mean that NEMMCO intervenes to contract for additional generation or DSR in order to address any potential reliability shortfalls.

2.4 Achieving reliability: why are 'reliability mechanisms' needed?

Although there are some exceptions, in most commodity markets the price for the commodity in question is decided at any moment in time through the buyers (the demand side) and sellers (the supply side) agreeing on a price at which to transact. In effect, consumers signal the value they place on supply – and this provides a price signal to the market, at times when a shortfall in supply is forecast, to drive investment in *new* supply. In such markets, there is no need for a minimum level of supply to be determined by a central body, because it is possible for the consumers themselves to signal clearly at what price they are willing to curtail demand.

The electricity market does not work quite as smoothly as this for several reasons:

- Electricity is a commodity that is not cost effective to store in bulk;
- The provision of electricity is regarded as an 'essential service'; and

[15] National Electricity Amendment (Reliability Safety Net Extension) Rule No. 7 , 18 May 2006, located at the AEMC's website: http://www.aemc.gov.au

- On the whole, consumers of electricity have little direct involvement in the market (i.e. there is an absence of 'demand-side participation').

All these factors, as will be explained below, limit the ability of consumers to send accurate and effective price signals. This distorts the market's functioning and hence its capacity to deliver reliability of its own accord. Consequently, special 'reliability mechanisms' have to be introduced to compensate for this distortion, and such mechanisms have been a feature of the NEM since its inception.

As electricity cannot be cost effectively stored in bulk, it therefore must be generated in a literally 'as it is used' manner. Generally only larger industrial or commercial consumers are equipped with 'time of use' metering that records electricity consumed within each half hour. The majority of (smaller) consumers are metered on a cumulative basis with no record taken of when electricity is used. Retailers generally apply an average load shape to most consumers for the purpose of setting their tariffs and apply a flat tariff which takes account of consumer usage patterns and the actual time-related cost of electricity. In effect, consumers do not see a 'time of use' related price signal.

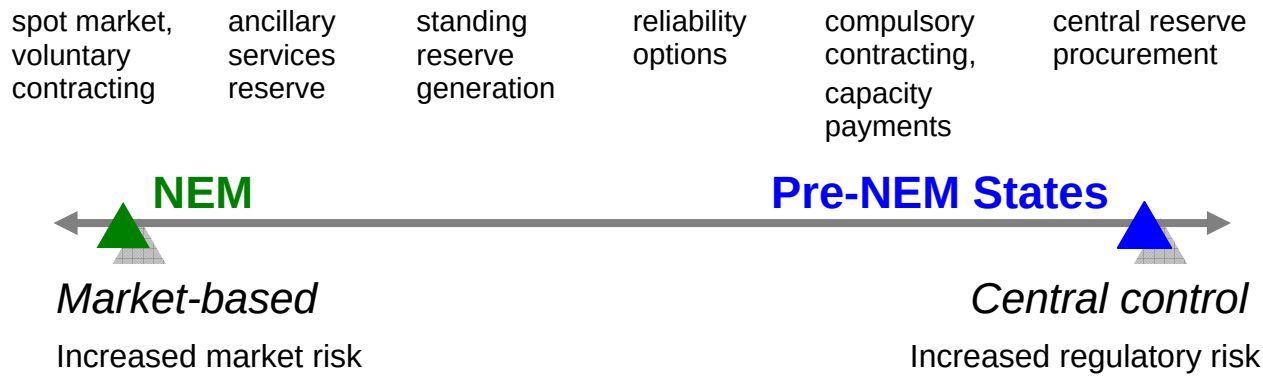
The continued rollout of 'time of use' metering, as recommended by the MCE and COAG, combined with 'time of use' reflective tariffs, may provide more opportunity for demand-side participation.[16] Consumers will send more effective signals to the supply side as to how they value electricity at different times during the day. In effect, consumers will be billed different rates depending upon 'time of use' and can choose when to use electricity based on the different cost of supply during, for example, peak or off-peak periods. Consequently this will, in theory at least, signal exactly what level of reliability consumers require and what they are willing to pay for it. 'Time of use' metering also has the prospect of lowering supply costs overall through encouraging less use of electricity at peak times of the day (when it is expensive) and hence reducing the need for as much investment in infrastructure, particularly peaking plant, which currently only run for perhaps a few hours a year, and network assets. Significantly, there is an increasing trend towards the adoption of 'time of use' metering.

In the absence of wide-scale demand-side participation the price of electricity is predominantly set by the supply side, with some limited DSR from (typically) large users who have the ability to indicate their price sensitivity and curtail load without impacting other consumers (for example, large industrial consumers that have direct connection to the transmission network).

For this reason, and because electricity supply is considered an essential service, it is necessary for electricity systems to have some form of reliability standard to signal the minimum expected level of reliability, and reliability mechanisms within the market design that are aimed at delivering the level of supply capacity needed to meet that standard.

Deciding what mechanisms to use to achieve a particular standard of reliability is a subject of debate worldwide. Options for market design can be considered as sitting on a spectrum which ranges from various forms of centralised control to more market-based mechanisms. This diagram illustrates where the NEM sits on the spectrum:

[16] MCE Communiqué, 27 October 2006 and COAG Communiqué, 10 February 2006.



A fully centrally-controlled solution would see a central body, perhaps a regulated generation company, responsible for ensuring sufficient generation capacity to meet the required level of reliability.

At the other end of the spectrum, a market-based solution would leave the market to decide how much capacity should be provided, with appropriate mechanisms designed to incentivise sufficient capacity to meet the reliability standard in an efficient manner. There would be no safety net mechanism.

There are many options in between these two extremes, with varying degrees of central control, for example, using a central body to contract for additional reserves when there is a perceived risk that the reliability standard will be met (as with the market design at present), to instituting capacity obligations on market participants.

The NEM's position on the spectrum is partly a result of the fact that it is an 'energy-only' market design. This means the market pays for actual electricity served, not for capacity available.

Before one looks at how to go about ensuring a certain level of reliability, a decision must be made as to the level of the reliability standard itself. Clearly all consumers will have a threshold above which they would not want to pay any more for increased reliability. In the absence of a clear price signal from all consumers on a continuous through-time basis, a design feature of the market is for a central body to define a standard that balances the differing needs of all consumers. In the NEM this responsibility falls to the AEMC's Reliability Panel.

3 Reliability performance

In assessing the performance of the reliability settings it is necessary to begin by setting a clear historical perspective on the issue. The purpose of this chapter, therefore, is to examine the NEM's track record on reliability since market start in 1998. This track record is examined through two different indicators: reliability performance to date, and previous projections of capacity shortfall.

The Panel's conclusion is that although reliability outcomes have been affected by a range of factors, and although the overall level of interruptions to consumers due to the operation of the power system has in some instances exceeded the reliability standard, the reliability settings themselves, which are the focus of this Review, have performed adequately to date.

Chapter 4 of this Final Report will assess the ability of the settings to allow the NEM to meet the reliability standard in the future.

3.1 Reliability performance to date

The first part of this section looks at the performance to date of the bulk supply system against the reliability standard, the exact definition of which is given in Section 4.1. The second part reviews the historical adequacy of reserves measured against the minimum reserve levels set by NEMMCO.

3.1.1 Performance against the reliability standard

The Panel's most recent assessment of the NEM's performance against the reliability standard is contained in its draft Annual Market Performance Review (AMPR) 2006-07.[17] In it the Panel reported that for the period since market start in 1998, the long-term averages for unserved energy due to supply shortfall are as follows:

- New South Wales, 0.0001%;
- Queensland, 0%;
- South Australia, 0.0022%; and
- Victoria, 0.0088%.

South Australia and Victoria fell outside the reliability standard in the year 2000, when there was a coincidence of industrial action, high demand, and temporary loss of generating units in Victoria during January and February. In every year since then, both states have met the reliability standard. It is due to the 2000 event alone that their long-term averages remain outside the standard.

The Panel also reported in the AMPR that, with the exception of an incident in NSW on 1 December 2004, there had been sufficient capacity from the energy market to meet consumer demand at all times and in all regions for the sixth consecutive year.

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[17] AMPR 2006-07, p 18 located on the AEMC's website at www.aemc.gov.au.

It is important to note that these long-term averages were based on only eight years' experience, a relatively short span of time in the history of an electricity market of the size and complexity of the NEM. Relying solely on these results to conclude that there is not now, nor will be in the future, a problem with reliability carries the risk that they fail to reflect any 'true' or underlying longer-term trend. Consequently, it is important to supplement these results by considering the adequacy of reserve levels since market start.

3.1.2 Adequacy of reserve levels

The Panel reported in the 2005-06 AMPR that there has been a general reduction in forecast and actual shortfalls in reserves in each region over time such that they have fallen below the NEMMCO-determined minimum reserve levels.[18] The single exception was South Australia during the Moomba crisis of January and February 2004, when the restricted supply of gas led to the unavailability of gas-fired generation. This is shown in Table 1.

Table 1 – Duration below the minimum reserve levels[19]

	Year	Qld	NSW	VIC	SA
Forecast duration below the threshold (hours)	2005 – 2006	0	0	0	0
	2004 – 2005	17.5	0	0	6
	2003 – 2004	11.5	4.5	17.5	645
	2002 – 2003	2.5	3.5	7	115.5
	2001 – 2002	1	0	0	45.5
	2000 – 2001	188	8	67	716
	1999 – 2000	43	33	145	699
Actual duration below the threshold (hours)	2005 – 2006	0	0	0	1[20]
	2004 – 2005	0	2	0	0
	2003 – 2004	0	1	4	6
	2002 – 2003	0	1	0	0
	2001 – 2002	0	0	0	0
	2000 – 2001	0	0	3	24
	1999 – 2000	5	4	36	88

[18] Reserve levels are not set for the Snowy region as that region contains virtually no load. NEMMCO's methodology for assessing minimum reserve levels has developed since market start. This is discussed in Chapter 5.

[19] AMPR 2005-06, p 27, available on the AEMC website at www.aemc.gov.au.

[20] The one hour of reserve shortfalls was not flagged in market notices, although the reserve data recently supplied by NEMMCO identifies the trading intervals ending 4pm and 4.30pm on 30 December 2005.

The Panel also noted that:

- A shortfall in reserves of 195 MW was forecast for Victoria and South Australia for February 2005, which was partially offset by NEMMCO contracting for 84 MW of reserve capacity;
- A similar shortfall in reserves of 500 MW was forecast for Victoria and South Australia for February 2006, which was partially offset by NEMMCO contracting for 375 MW of reserve capacity; and
- In both cases the forecast shortfall did not eventuate.

It should also be noted that the results included in the table include forecast and actual shortfalls before or during particular 'events'. The reserve trading activity is in reaction to forecasts of low reserve against peak conditions.

3.2 Previous projections of capacity shortfall

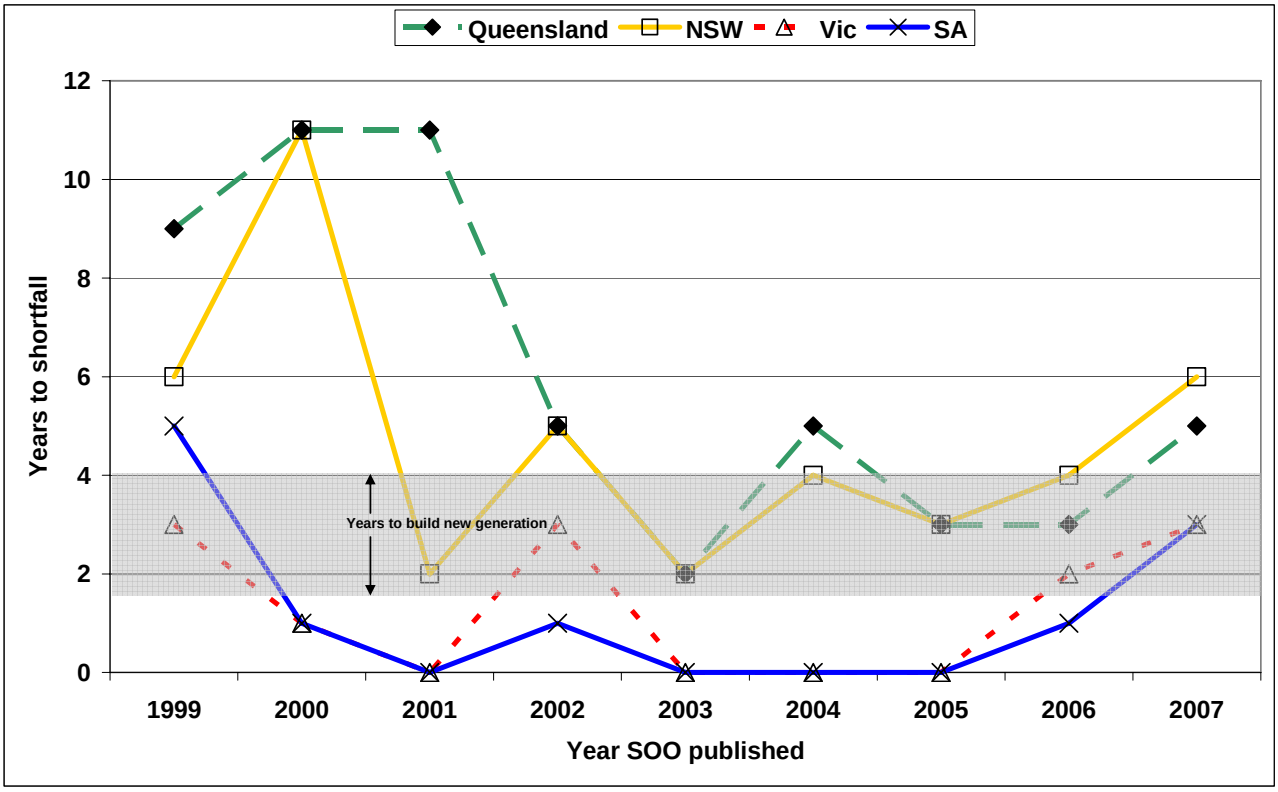
Each year since the start of the NEM, NEMMCO has published a 10-year projection of supply adequacy for each NEM region in its annual Statement of Opportunities (SOO).[21] These projections show the expected level of demand and generation capacity within each region over the 10 year outlook period. The purpose of these projections has been to inform stakeholders of forecast supply and demand conditions, and the likely timing of anticipated shortfalls of capacity to meet growing demand and, therefore, opportunities for investing in new generation or network capability. The SOO also provides additional information to assist investors with their investment decisions.

Figure 4 presents the number of years from each NEMMCO SOO to a projected shortfall of generation capacity for each region (except Tasmania). That is, the number of years from the publication of the SOO until, in the absence of appropriate investment, it was anticipated that the level of reserve generation would not meet the Panel's reliability standard. In particular, the figure shows:

- Considerable spare reserve in Queensland and New South Wales prior to 2001 which has reduced in recent years, converging to between 2 and 5 years' anticipation of when additional capacity will be required. This implies that either new capacity, including additional generation capacity and interconnector refinements, has been built in response to projected shortfalls of generation, or that there have been changes in the estimates of supply and demand leading to revisions to the minimum reserve levels (MRLs) for these regions.
- Shorter time horizons on average before requirement of additional capacity in Victoria and South Australia, including 3 years where the SOO projected a shortfall for the following summer. This implies that responses to anticipated shortfalls are happening closer to the time at which they are forecast to be needed. It should be noted that delays to the commissioning of Basslink and Laverton North power station are considered to have impacted these outcomes.

[21] These long-term projections of supply adequacy are reported in the supply-demand balance chapters of the annual SOO.

Figure 4 SOO projections of time until capacity shortfall



Notes on Figure 4:

- The grey band 'Years to build new generation' is indicative only, but is intended to represent a likely range of time to build new capacity once a project is deemed as 'committed'. To build base load plant such as coal-fired power stations, for example, typically takes more than 3 years from the point at which the project is deemed to be 'committed'. Peaking plant, such as open cycle gas turbines for example, can be built in a shorter period of time.
- The years to shortfall for New South Wales in the 2000 SOO and for Queensland in the 2000 and 2001 SOOs were reported as being beyond the 10 year outlook period (denoted as 11 years for presentation purposes).
- The 2003, 2004 and 2005 SOOs projected a generation shortfall for Victoria and South Australia for the following summers (2003/04, 2004/05 and 2005/06 respectively). NEMMCO subsequently used its Reserve Trader powers for the 2004/05 and 2005/06 summers, although the contracted reserves were, in the event, not required.
- Tasmania is not included in the figure as the SOO did not report on Tasmania until the 2003 SOO and in each year the SOO has not forecast a need for additional capacity within the 10 year outlook period.
- The data has been updated to include the NEMMCO SOO update of 23 November 2007.

The aim of the market design is to incentivise efficient investment in a timely manner. This means that the market mechanisms need to incentivise investment such that minimum reserve margins are not breached, but at the same time, mechanisms should not aim to encourage investment significantly earlier than required as this will come at a cost.

Market design therefore needs to find the right balance with regard to ensuring incentives are presented neither too early nor too late.

The recent forecasts for Victoria and South Australia showed the requirement for new capacity within the year for four of the last six years. The Panel also notes that NEMMCO has contracted for, but not needed to dispatch reserve capacity for those two states. Similarly, over the last 5 years NSW and Queensland have not shown a forecast need for new capacity sooner than 2 years out.

In assessing where to strike the balance, it should be noted that the question of investment too early or too late essentially presents different risks for market participants. Investment too early may result in insufficient return for investors; however, investment too late may result in failure to deliver the desired level of supply reliability.

3.3 What does history say about the outlook for reliability?

Historical analysis suggests that the reliability mechanisms are not always able to protect against the kind of extraordinary or coincident exogenous factors that were observed in South Australia and Victoria in 2000. However it is unlikely that incidents such as these would have been prevented by adjusting the reliability standard or by redesigning the reliability mechanisms themselves. The existing mechanisms also did not bring about sufficient capacity to allay NEMMCO's concerns in 2004 and 2005 that a high load scenario could breach the reliability standard, as a result of which NEMMCO contracted for reserve capacity. The available generation capacity was, in the event, sufficient to meet the demand and the USE standard was not breached.

For these reasons, the Panel's conclusion is that the reliability settings themselves, which are the focus of this Review, have performed satisfactorily to date.[22]

As noted, delays to the commissioning of new generators can impact reliability when the design is only delivering 'just in time' outcomes. From that perspective the Panel considers that some prudence should be adopted when designing the mechanisms such that the reliability standard is not unduly susceptible to ordinary events such as construction delays.

[22] A position supported by the Australian Energy Regulator who in its submission the Second Interim Report state "The AER reiterates its support for the Panel's finding that the NEM has performed well against the existing reliability standard".

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4 The reliability standard

This chapter discusses the Panel's consideration of the NEM's current reliability standard, its appropriateness for the future, and whether or not it should be modified in any way.

The Panel's conclusion is that no fundamental change is needed to the form, level or scope of the reliability standard and that the same standard should be applied to each NEM region. However, the Panel's analysis has identified concerns about the clarity of understanding of the current reliability standard. Therefore the Panel believes that a revised version of the standard should be issued. In particular, the wording of the current standard 'over the long term' is clarified to mean ten years looking backwards, and that it should be targeted to be achieved prospectively on an annual (financial year) basis, NEM-wide and in each region.

The Panel also considers that there is a need to keep a watching brief on the level of the standard, in light of the continuing evolution of the market, as part of the regular reviews of reliability settings which are proposed in Chapter 8 of this report.

The new formal version of the Reliability Standard is included in Appendix D.

A related matter to the standard is the MRLs which are the operationalisation of the standard in the market. The Panel has made recommendations on a process to seek improvements in the management of MRLs in Section 7.5.

4.1 Definition of the current reliability standard

The current NEM reliability standard, determined by the Panel at market start in 1998, is defined as follows:

> 'There should be sufficient generation and bulk transmission capacity so that, over the long term, no more than 0.002% of the annual energy requirements of consumers in any region is at risk of not being supplied; or, the maximum permissible unserved energy (USE) is 0.002%.'

The standard has three main aspects: *form*, *level* and *scope*.

- The *form* of the standard is the method by which reliability is measured. The NEM standard is an output-based measure expressed in terms of 'maximum permissible unserved energy (USE)'. This is also an expression of risk – the maximum allowable level of electricity at risk of not being supplied to consumers in any region.
- The *level* of the standard specifies how much USE is acceptable as a percentage of annual demand. The level is currently set at a maximum of 0.002% of USE per annum over the long term.
- The *scope* 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 and excludes distribution

networks. In terms of events, the standard currently excludes power system security incidents and exogenous incidents such as industrial action and terrorism.[23]

4.2 Form of the standard

As part of this Review the Panel has considered whether reliability in the NEM should be defined using a measure (form) other than unserved energy. It could, for example, be measured in terms of the *frequency of interruptions* to supply (e.g. how many times a year supply fails to meet demand). In its considerations, the Panel has taken into account:

- Comparisons with other countries;
- Views of stakeholders; and
- The results of research and analysis.

4.2.1 Definitions of reliability

Different countries use different measures to define reliability for their respective electricity systems. Comparing the form of the NEM reliability standard with that of other major industrialised countries provides a useful perspective from which to ascertain the appropriateness and effectiveness of USE. 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 – for example, the NEM's unserved energy standard, or the SAIDI index for distribution.[24]

Many jurisdictions comparable to the NEM use the first of the above three measures. This is known either as loss of load expectation (LOLE) or loss of load probability (LOLP):

- LOLE is the expected number of days per year in which available generating capacity is insufficient to serve demand, or the half-hours per year in which capacity is insufficient to serve half-hourly load.
- LOLP is the proportion in % (probability) of days per year, half-hours per year, or events per season, in which available generating capacity is insufficient to serve demand.

LOLP indicates the frequency (events per year) of supply interruptions and not their duration (hours), depth (MW) or energy (MWh). It is possible, for example, due to the different physical characteristics of energy systems, that one system may have a higher frequency of supply interruptions than another, but that these interruptions will last for shorter periods and will not impact as many consumers.

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[23] See Sections 2.2 and 4.4 for further discussion of the standard's scope.

[24] System Average Interruption Duration Index (SAIDI) is defined as the sum of durations of each interruption averaged over the consumer's base. Generally it is measured in minutes.

Indirect standards

The Panel notes that, in some locations, indirect reliability standards are used. These are based on the reserve margin which is the margin by which installed capacity exceeds the expected consumer load as insurance against breakdown of generating plant or unexpectedly high load. However, indirect standards can lead to a reliability level that varies depending upon, for example, the number of generators in service. Hence a standard based upon a reserve margin will not fix the level of reliability.

4.2.2 Stakeholder views

Stakeholders' submissions to the Issues Paper and the two Interim Reports showed that there is general support for retaining the USE form of the reliability standard.[25] Reasons included:

- It has been used since the NEM commenced;
- It is relatively easy to measure;
- It reflects the economic impact on typical end users; and
- It applies equally to each of the NEM regions.

4.2.3 Using a single form of reliability standard

The Panel acknowledges that using any single form of standard has limitations. The ensuing discussion addresses these limitations and considers the relative merits of introducing an alternative, hybrid form of standard.

Limitations of a single-form standard

Measuring reliability through one form alone does not provide perfect information about interruption 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.[26] This is because the current NEM standard measures energy shortfall over the long term. That is, providing the total of unserved energy over the long term does not exceed 0.002% of consumer demand, the NEM's reliability is consistent with, though at the lower end of, international practice, as discussed later in Section 4.3.2.

What the current USE standard cannot capture, however, is 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 used up 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 more frequent. Therefore, a single form of the standard does not capture this information and can affect public expectations and have serious community consequences.

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[25] For example, Macquarie Generation and NEMMCO submissions to the Issues Paper and TRUenergy's submission to the First Interim Report.

[26] That is, the extent of the interruption in terms of the number of people and the geographical areas affected.

Similarly, LOLE and LOLP provide no information about the volume of energy lost due to interruptions, but only provide an estimate on the likelihood of an interruption occurring.

Is a hybrid standard the solution?

Some stakeholders have suggested supplementing the NEM's single USE form with additional parameters, such as LOLE or LOLP, which would indicate the frequency and depth of supply shortfalls[27]. In essence, such additions would create a *hybrid* form of standard.

Hybrid standards are used in several European countries, for example the Netherlands and Italy. A hybrid standard is also being used in Western Australia's new market (which commenced in late 2006), although that standard is currently being reviewed.

Disadvantages of hybrid standards

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 standard to be inadvertently tightened, with an associated cost to the consumer.

The Panel considered the possibility of introducing a hybrid standard in 1998.[28] At the time, the Panel recognised that, in general, energy shortfalls to individual consumers would be managed by rotating the shortfalls. As a result, for all probable incidences of shortfall due to reliability, individual consumers would experience very similar effects regardless of how many others were also affected.

Today the Panel is still of the view that, on balance, introducing multiple forms to the reliability standard would be detrimental because it removes the simplicity offered by a single form, would be difficult to justify on economic grounds, and has the potential to distort or dilute investment signals.

4.2.4 Related issues

Should reliability be a cap or a target?

The Reserve Trader in its current form is used to cap the expected level of USE at 0.002% in each region. It is operated when NEMMCO's projections indicate that a region's reserves are going to fall below the minimum levels determined as being necessary to meet the 0.002% USE standard.

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[27] For example, EnergyAustralia's submission to the First Interim Report.

[28] Reliability Panel Determination on reserve trader and direction guidelines, NECA website (www.neca.com.au), June 1998

Several stakeholder submissions maintained that a USE standard cannot be used as a cap because it is not possible to guarantee that a given level of USE will never be exceeded. Rather, the USE standard should be used as a target for designing and operating the market.

The Panel agrees that the standard should be considered as a target and that the level of USE should be calculated *ex post* to monitor how effectively the standard has been implemented. The Panel has formed a view that the Reserve Trader mechanism should be redesigned to ensure it is not used as a cap, but instead is used as an emergency instrument only. This issue is discussed more fully in Chapter 7.

Target timeframe

The standard's target of 0.002% USE is defined as being 'over the long term'. There are concerns that this timeframe is unclear, for two main reasons:

- It stipulates that the target level of 0.002% USE is an average over a period of time, but it does not stipulate what that period of time is. The definition could be more explicit, for example 'over 10 years'.
- Whether NEMMCO should target 0.002% expected USE every year or whether NEMMCO should attempt to maintain a long term average USE level by, say, increasing the MRLs following a period of USE.

The Panel notes the views of some market participants on the measurement timeframe and cap/target nature of the standard. For example, the Major Energy Users state that:

> "The MEU believes that USE of 0.002% is a standard that must be achieved over a period of time. This means that if USE has been exceeded, there must be positive action to ensure that actual USE is brought back under the target."[29]

However, the Panel believes it would be inappropriate for NEMMCO to attempt to maintain a long-term average USE level by varying the MRL in response to actual incidences of USE, for these reasons:

- A year with a high level of USE would need to be followed by years with very low USE targets, which would require unusually high minimum reserves, and this could be expensive to procure;
- It introduces an arbitrary averaging process that is dependent on the number of years over which the standard is applied;
- It introduces unnecessary complexity for the implementation of the USE standard; and
- Having a higher USE target in one year implies that consumer reliability is less valuable than in other years.

The Panel also notes that assessing the NEM's actual reliability against the 0.002% USE standard is not straightforward because the actual USE is not deterministic but is the result of several random factors including forced plant outages, interconnector outages and extreme load conditions. Therefore, if the actual USE were to exceed the 0.002% standard, this would not necessarily mean that the standard had been implemented inappropriately. It

[29] MEU submission to the First Interim report.

may mean instead that a particularly arduous series of random plant outages had occurred. Applying a moving average to the actual annual levels of USE does assist in identifying trends in the level of reliability but it does not provide a clear explanation of the case of a single very high level of USE. As previously stated, the Panel does support a detailed review of every incidence of USE to determine its cause – whether it was due to random plant outages, or to a systematic problem in the implementation of the reliability standard. Two existing mechanisms for this exist under the Rules. These are the incident reports prepared by NEMMCO under clause 4.8.15 and the Panel's annual reviews under clause 8.8.3.

4.2.5 Panel's conclusion

The Panel's conclusion is that:

1. A revised version of the Reliability Standard should be issued based upon the recommendations of this Review. (This is published in Appendix D).
2. The current form of the standard, being USE, should be retained.
3. A hybrid form of standard should not be adopted, but forecasts of frequency, duration and depth of possible shortfalls that make up the 0.002% USE should be prepared by NEMMCO on a regular basis to provide stakeholders with a gauge as to the possible nature of USE events. This would in effect allow these other measures to be used on an information basis.
4. The reliability standard should be considered retrospectively over a long-term period of looking back at least 10 years.
5. Each incidence of USE caused by a reliability issue should be examined to consider whether, in light of the circumstances, the NEM is achieving the desired long term average USE.
6. The most economically justifiable and straightforward method of targeting 0.002% USE in the long term is simply to target 0.002% USE looking forward each financial year both NEM-wide and within each region.
7. The operationalisation of the standard in MRLs will be explicitly reviewed during 2008. (See Section 7.5.)

4.3 Level of the standard

The level of the standard, currently set at no more than 0.002% USE in any region, has been used in the NEM since market start. As part of this Review, the Panel has considered whether this level of USE continues to be appropriate. In its considerations, the Panel has taken into account:

- The views of stakeholders; and
- Comparisons with other countries.

4.3.1 Stakeholder views

No submissions have been put forward to the Panel to alter the level of the NEM-wide reliability standard.

The Panel understands that, in part, this is because the level of generation and the performance of the bulk transmission network currently contribute a very small fraction of the total loss of supply experienced by consumers. The major sources of such interruptions are related to distribution networks. Local transmission network interruptions and security events also contribute to supply losses.

4.3.2 International comparisons

The Panel's issues paper for the CRR noted that reliability is one element that contributes to continuity of supply to customers. In the context of the NEM and the Panel's responsibilities, reliability is the ability of the interconnected bulk generation/transmission system to provide supply to meet all demand within specified levels of risk. There are a number of ways that those limits can be expressed. Customer output measures include how frequently supply is interrupted (e.g. number of days per year in which any interruptions occur), the cumulative duration of interruptions (e.g. hours per year that any, but not necessarily the same, customer is interrupted and the amount of energy that is not supplied in a period (e.g. the NEM Unserved Energy standard)). Each measure describes a different characteristic of reliability. These measures cannot readily be used in day to day operations as they are all long term measures and only provide information when interruptions occur and hence are not able to be used to assess how "healthy" the situation is. For this reason customer measures are often translated into operational input measures. Operating capacity reserve margin is a common input margin for a power system like the NEM, but other measures can be appropriate for other systems, for example reservoir storage level in a hydro based system which is used in New Zealand.

The relative operating reserve margin from one time to another is a useful indicator of the short term "health" of a particular power system but it is much less useful as benchmark for comparison between power systems. This is because the overall characteristics of demand, generation and network sectors determine what level of customer reliability a given reserve margin will provide. For example, all else being equal, a reserve margin of 15% in a system with a very peaky load characteristic with only a few days of extreme demand generally will provide a higher level of reliability on all customer measures than would be expected in a system with a more uniform demand characteristic where the risk of insufficient capacity is spread over more time. Similarly depending on what allowance is made for interconnectors, a heavily interconnected system may have better reliability than an isolated system. The technology and fuel source for the generation fleet can also affect reliability, for example a predominantly hydro system will often have a high capacity reserve margin because water from different reservoirs is used at different times of the year and when there is low flow little water is available for production from the associated generators. But these generators can provide short term capacity reserve by taking water from small local storages to cover over unexpected production shortages elsewhere in the system and thus these systems have a low risk of short term interruptions typical of a capacity limited system like the NEM. However they are at risk of very infrequent periods of extended shortfall during drought conditions due not to the installed capacity but to water storage capacity.

To compare the reliability of different systems it is therefore important to find a common measure or form of standard and also to take account of the different physical characteristics of the respective power systems. Section 4.2.1 introduced the range of forms that are in general use in different systems. In essence the different forms measure the duration (hours or LOLE), depth (MW), frequency (events per year or LOLP) or accumulated energy (USE) of possible interruptions. Section 4.2.3 also notes that it is not practicable to set targets for more than one of the measures and the importance of aligning the standard with the design of market arrangements in place. What is practicable is to adopt one form of measure as the primary standard and cross check that none of the other measures fall below an acceptable level. Many of the measures used internationally have evolved from pre-market eras where reliability was managed by a utility or a central agency that also made decisions about the amount and timing of generation investment, and LOLE and LOLP were the most common measures, and in many cases have been continued through into market environment. Table 2 provides a summary of the measures and standards employed in a number of power systems around the world.

Table 2 – International comparison of reliability

Country/Region	Characteristics	Level and Form of Reliability Standard	Capacity Reserve Margin	Comment
Australia: NEM	35GW max. demand Multiple generation/load regions with moderate interconnections Moderate-high temperature sensitivity	0.002% USE	Approx 15% over 50% POE forecast of maximum demand	
Australia: Western Australia (SWIS)	4GW max demand Mainly meshed network High temperature sensitivity	0.002% USE subject to n-1 reserve	Highest required to meet USE or n-1.	In practice dominated by n-1 requirement
New Zealand	6.5GW max demand Two main regions (nodal pricing) with internal constraints and moderate interconnection Hydro dominated	1 year in 60	Not relevant	Generally high capacity margin. Reliability dependant on hydro reserves and hence any shortfalls generally extended during drought years

	generation base			
US: PJM	145GW max demand Well meshed with strong interconnections to adjoining systems Moderate (winter) temperature sensitivity	LOLE expressed as 1 day in 10 years may experience capacity shortfall. Depth and duration of shortfall not defined	Approx 15% over 50% POE forecast of maximum demand	Inherently reliable due to size and interconnections
US: New York	34GW max demand	LOLE expressed as 1 day in 10 years may experience capacity shortfall. Depth and duration of shortfall not defined	15-18% (approx) over 50% POE forecast of maximum demand	Generally 15% but significant internal network limitation requires higher reserve at major load centre
Canada: Alberta	Max. demand 10GW Well meshed internal system with moderate interconnection	No specific investment standard	n/a	Authorities anticipate investments will be forthcoming in the market. DSR under contract available to power system operator in the event of shortage
Netherlands	20GW	LOLE expressed as I event in 4 years for a maximum duration of 2 hours		
Ireland	5GW	LOLE expressed as 8 hours per year		
Singapore	6GW Tightly meshed with moderate interconnection	No formal standard	n/a	Government monitoring
UK	60GW Well meshed Moderate interconnections	No formal standard in current market arrangements	n/a	Pre-market (late 1980s) CEGB standard was for LOLE of shortfall event in no more than 9 years per 100 (i.e. similar to the 1 year in 10 employed

				in US)
France	80GW	LOLE max 3 hours per year		

Although LOLE and LOLP are the most common forms of standard, there are a number of variations. Neither LOLE nor LOLP convey any information about the duration or depth of potential shortfalls and, of the systems that use LOLP, only the Netherlands also spelt out the duration of each event. None give standards relating the depth of an individual event. In order to facilitate a comparison between different systems, CRA and NEMMCO have each calculated the LOLP for the NEM. Currently the standard in the NEM of a maximum of 0.002% USE is equivalent to a maximum of approximately 3.5 hours per year. That is, over the long term, on average across the NEM, there is an expectation that in 3.5 hours per year there will be insufficient generation to meet all load in all parts of the NEM. By itself the LOLP gives no indication of the amount of load interrupted and hence how much energy will be lost (whereas the USE standard relates only to the accumulated energy and also provides no information about how much is interrupted at any time or the duration of interruptions). It is important to note that the nature of the NEM transmission system means that each instance of interruption will typically be confined to one or two adjacent regions.

Two significant markets, the UK and Alberta, have no formal standard and rely on the structure of the market design, previous practice and an informal understanding that the respective governments take a keen interest in the level of reliability although it is understood arrangements in Alberta may be reviewed in the near future. This is also the case in Singapore where in practice there is a large reserve margin.

US systems tend to use long term LOLP as the base requirement and translate it to a capacity reserve margin in a similar way to the translation of USE into a capacity reserve margin in the NEM. The review was unable to find information about what level of USE the LOLP and reserve margins deliver.[30] In the large markets in the US, for example in Pennsylvania New Jersey Maryland (PJM), the underlying standard is that for no more than 1 day in 10 years will there be a shortfall in generation requiring interruption to customers. It is notable that the maximum demand of the PJM market is approaching 5 times the size of the NEM and it is therefore inherently more reliable. It also has a more meshed transmission network than the relatively long and linear system of the NEM, again making it inherently more reliable. However, the 1 day in 10 years is a higher basic objective than applies in the NEM where the majority of interruptions are due to distribution, transmission and extreme security related events. The PJM standard for transmission is also higher than for the NEM and as a result interconnections to other regions are more reliable, although in assessing NEM reliability intra-regional transmission failures are not considered.

European systems employ a variety of forms of LOLP but employ a range of levels of standard including 8 hours per year in the relatively small system (5 GW maximum demand) in Ireland, 3 hours per year on the 80GW French system and 1 event per 4 years in Netherlands but with the added limitation of a duration of no more than 2 hours for that event.

[30] Informal discussions suggest that the LOLP meets all policy expectations and thus knowledge of the resultant USE is not needed.

The relatively small and isolated system in the south west of Western Australia employs a hybrid standard that requires no more than 0.002% USE (the same as the NEM) and that there will also be no loss for defined events (generally the loss of a single generating unit). In practice the defined event requirement dominates. This standard is currently under review but its primary purpose is as a planning criterion to set margins for capacity required to be brought to market by market participants under the market rules in WA.

Overall the NEM's reliability level is closer to the level in European countries than to the level in the US. European countries typically have populations closer in size to Australia's, but at the same time they generally have a lower level of interconnection than does the north east of the US. Consequently, the characteristics of demand in European countries are generally quite different, with more sustained winter peaks than Australia's high summer peaks.

4.3.3 Related issues

Should the reliability standard be regional or NEM-wide?

At present, the same level of the reliability standard (0.002% USE) is applied to each region. An alternative would be to determine a different level of USE for each region in order to reflect its unique characteristics, to the extent that this information is available.

The Panel's view is that the same level of USE should continue to apply to each region. This is consistent with the national market approach and it provides equivalent incentives to all participants, irrespective of the region they operate in.

The Panel does note that, in the absence of the use of the reliability safety net, the operation of the market with a single value of VoLL across all regions will not necessarily deliver the same USE in each region. This is because, for a given level of VoLL, the level of generator investment in a region, and hence the expected USE, depends on a number of factors, including the:

- Shape of the region load trace (peakiness);
- Degree of DSR in the region;
- Capital and operating cost of generation options available in the region;
- Availability of generation;
- Degree on interconnection with neighbouring regions; and
- Level of contracting in the financial market.

Therefore, while the approach to the reliability standard may be consistently applied across the NEM regions, the actual reliability achieved in each region may be different.

In addition, the Panel notes that, during this Review, some submissions have raised concerns about the potential impact on future reliability from continuing government ownership[31] in the electricity sector and from the use of retail price caps[32] as part of the NEM.

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31 International Power Australia and Loy Yang submission to the First Interim Report.

32 AGL submission to the Issues Paper.

4.3.4 Panel's conclusion

The Panel confirms the level of the NEM reliability Standard at 0.002% USE. Its determination in not changing the level of the reliability standard at the current time is based on the analysis and consultation work undertaken in the Review. The Panel also notes the following:

- There has been no call from stakeholders in their submissions, particularly those of consumer representative groups, for a change to the standard's level.
- Countries that appear to have more stringent standards generally have characteristics (such as larger system size and high levels of 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.

Nevertheless, the Panel does consider that there is a need to keep a watching brief, through the future reliability reviews, on the level of the standard in light of potential changes to the value that consumers place on reliability.

4.4 Scope of the standard

The scope of the standard demarcates those aspects of the power system and its performance that are deemed to impact on the NEM's reliability, from those that are not. The scope has two main dimensions, which can be expressed in terms of these questions:

- Which parts of the supply chain should the reliability standard apply to? Currently it applies to generation and bulk transmission capacity only.
- Which *causes* of interruption to supply (or USE) should be taken into account when measuring reliability and which should not, given that supply can be interrupted for numerous reasons? Currently causes are categorised into 'reliability issues', which are taken into account, and 'power system security issues' and 'external factors' (such as industrial action), which are not.

As part of this Review, the Panel has considered whether the current scope of the standard, in both its dimensions, continues to be appropriate.

4.4.1 Scope and the supply chain: what is the definition of 'bulk transmission'?

First, a point of clarification is needed. As mentioned above, the reliability standard applies only to the generation and bulk transmission elements of the supply chain. However, the definition of 'bulk transmission' has caused some confusion, in particular as to whether or not it applies to the transmission network within a region.

For the purpose of measuring reliability, 'bulk transmission' capacity in effect equates to interconnector capability. The reason for this is that the reliability standard is measured on a regional basis, and the standard is met when sufficient generation capacity is available in a region. This capacity is calculated as the sum of local generation available within the region itself and of interstate generation available via an interconnector. Consequently, only constraints in the transmission network that affect interconnector capability are considered when assessing the availability of reserves in a region. When performing the simulations necessary for it to determine the MRLs, NEMMCO generally recasts intra-regional constraints as equivalent inter-regional constraints. As discussed later in Section 7.5, the Panel intends to establish a taskforce to look specifically at the methodology and process for calculating MRLs

The reliability of the transmission network within a region is also assessed using other measures.

The Panel notes that this definition of bulk transmission as it applies to the reliability standard may change as a result of:

- The Congestion Management Review currently being performed by the AEMC;[33] and
- Any future changes associated with the application and form of the Regulatory Test, for example the National Transmission Planner project recently undertaken by the AEMC at the request of the MCE.[34]

4.4.2 Scope and the causes of USE: is the boundary between reliability and security incidents appropriate?

Security events include occasions where there has been a major disturbance beyond the capability of normal protective arrangements to manage, for example, the simultaneous breakdown of two generating units or interruption to transmission lines where normal arrangements assume such events will not be simultaneous. A perennial question for the Panel in considering the standard is whether the 0.002% should incorporate security risks due to severe technical malfunction.

Reliability events

As discussed in Section 2.2, a reliability event occurs when there is insufficient generation available within a region to meet the demand in the region, with the available capacity depending on the outages of the generating units within a region and the interconnector capability under the prevailing system conditions.

Security events

Under clauses 4.2.4 and 4.2.5 of the Rules, NEMMCO must operate the power system in a secure state; that is, the power system will continue to operate following a credible contingency. A credible contingency is defined in clause 4.2.3(b) of the Rules as a "contingency event the occurrence of which NEMMCO considers to be reasonably possible".

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[33] Further information on the Congestion Management Review is available on the AEMC website at http://www.aemc.gov.au/electricity.php?r=20051216.172956

[34] Further information on the National Transmission Planner is available on the AEMC website at http://www.aemc.gov.au/electricity.php?r=20070710.172341

A security incident occurs following a non-credible, usually a multiple contingency, event. Such events can be severe and lead to large quantities of USE. However, as discussed in Section 2.2, it is unlikely that investment in additional generation or bulk transmission would mitigate a security event. Rather such incidents should be reviewed, which may result in changes to operating practices and technical compliance regimes.

Panel's conclusions

After considering this matter the Panel has concluded that the incidence or severity of security incidents would be unlikely to be affected by changes in investment signals. Rather, such matters are better handled through technical operating standards and ensuring compliance with those standards.

While reliability events and security events should be treated separately, the Panel notes that under clause 4.2.3(f) of the Rules NEMMCO can classify a non-credible contingency event as a credible event. This action may affect the network capability if NEMMCO must further constrain network flows in order to maintain the system in a secure operating state, taking into account the reclassified contingency event. This reduction in secure network capability may also reduce the reliability of the power system for the period of time that the non-credible event is reclassified as credible.

The Panel further notes that events such as the Victorian bushfire outages on 16 January 2007 will usually be classified as system security events as they result in line outages and the islanding of the NEM regions.[35] In such cases, the unserved energy that results from these events would not be counted against the 0.002% USE reliability standard.

4.4.3 Scope and the causes of USE: should other sources of USE be taken into account when measuring reliability?

In addition to the reliability and security issues already discussed, supply may also be interrupted by external factors such as industrial action, terrorism, and 'acts of God'.

In the Panel's view, these external sources of USE should not be taken into account when assessing the NEM's performance against the reliability standard. Since the purpose of the standard is to ensure that there is sufficient investment in generation and bulk transmission assets, only those sources of USE that would be mitigated by such additional investments should fall within the standard's scope. USE caused by incidents other than insufficient generation due to random outages of generating units or transmission network elements are best addressed by other mechanisms.

4.4.4 Panel's conclusion

The Panel has concluded that the scope of the reliability standard should not change. That is:

- The standard should extend to generation and bulk transmission capacity only; and

[35] The Victorian event was in fact classified by NEMMCO as a multiple contingency event and hence system security event. See the NEMMCO Power System Incident Report, System Separation and Load Shedding 16 January 2007, June 2007 for further details.

- The standard should not apply to security events and external events such as terrorism, industrial action or 'acts of God'.

Nevertheless, the Panel recommends that all incidents of USE should be reviewed by NEMMCO under clause 4.8.15 of the Rules, 'Review of operating incidents', and reported in the Panel's Annual Market Performance Review. This would include USE caused by:

- Security incidents such as non-credible contingencies, which should be addressed by reviews of operational practices and technical compliance regimes;[36]
- Constraints in local transmission and distribution networks, which should be addressed by changes to the operation or augmentations to these networks;
- Industrial disputes, which should be addressed by the owners of generating units, and not by investment in new generators; and
- Incidents such as terrorism that are mitigated at government level.

The Panel notes that there may be an inconsistency with respect to the treatment of "industrial disputes" in the interpretation of reliability statistics, in that these are excluded for operating plant and included if the plant is under development for a targeted commencement date (that has been reflected in the capacity forecasts). The Panel's conclusion is that despite the apparent inconsistency not to change the current methodology, but rather to report delays in plant commissioning, where relevant, in the Annual Market Performance Review.

4.5 Benefits to Stakeholders

The key benefit to stakeholders arising from the Panel's conclusions in this chapter is the formal definition of the standard which will provide greater certainty going forward as to how the standard will be targeted, which will in turn allow NEMMCO greater ability to ensure the standard is not breached and increase the certainty level for market responses to reliability.

[36] The AEMC recently performed a review into the enforcement of and compliance with technical standards. Further information on this review is available on the AEMC website at http://www.aemc.gov.au/electricity.php?r=20051216.173039

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5 The outlook for reliability

In Chapter 3, the Panel observed that the reliability standard has been met to date, although total interruption of supply to consumers has exceeded the standard due to other 'non reliability' issues such as power system security events. Obviously it is important to consider such issues, but that is beyond the scope of this Review.

The question for this review is: what is the outlook for reliability? This section addresses this question and forecasts the performance of the fundamental market design and the effect on reliability of a number of factors.

The Panel's observations on these matters can be summarised as follows:

- The fundamentals of the market design are sound and, with the current settings, the reliability standard is likely to be met in the near term, provided the fundamentals occur in practice; and
- However, there is increasing risk, in the medium to long term, that reliability may be compromised if reduced investor confidence as a result of uncertainty about other policy settings, or as a result of continued material increases in the costs of constructing new generating plant, created potential delays with new generation investment.

5.1 A conceptual framework for evaluating the NEM design

This section highlights some key features of the design of the NEM, the nature of which affects reliability.

- The NEM is an 'energy-only' market design. This is because the predominant payment to generators is based on the amount of energy they send out, and because wholesale market consumers (e.g. retailers) are charged on the basis of the energy their consumers take from the market. Other market designs include separate charges for availability and provision of reserve.

- The NEM reliability settings are intended to result in market prices that will create incentives for investment such that the reliability standard will be met. This is best seen in clause 3.9.4 where the level of VoLL is set to "allow the standard for reliability established by the Reliability Panel as part of the power system security and reliability standards to be satisfied without use of NEMMCO's powers to intervene…".

- Because peak demand levels occur for only a few hours per year, some generators are only dispatched for those few hours. Therefore the price for energy must be high enough in those few hours to meet the cost of these generators for an entire year.

- Volatile and high prices can create financial risk. Contracts between consumers and generators to hedge the spot price to mitigate that risk are integral to the functioning of the electricity market as a whole. Although this contracting is not governed by the same market Rules, is less obvious from outside the market and attracts less media attention, it is at least as important as the NEM spot market administered by

NEMMCO, in determining the prices paid for wholesale electricity. It is generally held that some 80% or more of total load is covered by contracts.

- For low utilisation plant that forms the reserve against very high demands and against the normal variability of generator output, the most common form of contract is a 'cap contract'. Cap contracts provide a fixed payment or option fee that can be seen as analogous to that of separate payments for availability made in other markets. The difference is that, in the NEM, the amount and price of the option fee is decided between the generators and consumers and is voluntary, whereas a payment through a capacity mechanism would be centrally determined in some way. Also, such contracts are financial instruments, independent of physical dispatch or availability.

- A crucial point for consideration of reliability is that contracts are an integral part of the functioning of the NEM, despite being completely separate from the NEL and Rules. Even where a market participant is both a generator and a retailer (i.e. 'vertically integrated'), the participant underwrites the standing cost and thus provides an implicit option fee or availability payment to its own plant.

A number of matters raised in the preceding dot points have been formed into a useful framework for analysing market designs by Cramton & Stoft.[37] They argue that there are three prerequisites for an effective and robust market:

1. The overall market design should be based around clearly defined reliability objectives to ensure that the settings in the market are consistent with that objective.
2. Market prices should reflect to investors the impact of inadequate capacity. In other words, prices must be allowed to rise to a high enough level that generators have an incentive to build and offer for dispatch sufficient capacity to meet demand, and generators and customers are exposed to a cost that reflects the value of lack of supply to customers if they fail to do this. Cramton & Stoft suggest that a maximum price in the order of $10,000/MWh is needed.
3. Mechanisms should be available to allow customers to be fully insulated from high prices at a reasonable cost. In this way generators face efficient price incentives regarding performance, but customers are able to mitigate the resultant financial risk.

We have used this framework for assessment in the following section.

5.2 Investor revenue expectations

This section discusses a crucially important issue in meeting reliability standards: the financial return required by investors to invest in generation and transmission in a timely manner.

In considering what is an appropriate price to remunerate investors and deliver efficient incentives, well established theory confirms the need for high prices if all payments are based on dispatched energy. But how high? The theory shows that in the event that the marginal 'cost' is set at the operating or short run marginal cost (SRMC) of the marginal

[37] The Convergence of Market Designs for Adequate Generating Capacity 25 April 2006. A White Paper for the Electricity Oversight Board (California), http://web.mit.edu/ceepr/www/2006-007.pdf

plant, the revenue delivered through the spot market will not cover all the costs of all generation. The marginal plant itself must earn more than its SRMC or it would never recover its fixed costs and therefore it would never be economic for an investor to build that plant.

There are two ways by which the revenue from marginal priced markets can be increased towards the revenue necessary to cover costs. The first is to allow, and expect, generators to bid prices for dispatch above their SRMC whenever possible, and to rely on competition and/or price cap to constrain undue exercise of market power and limit financial risk to participants. The second is to introduce another revenue stream, by way of financial contracts or possibly fashioned as an availability payment, that is intended to make-up the shortfall (although this would mean the market is no longer an energy only market).

If there is a price cap, such as VoLL, net revenue for generators will cover fixed and variable costs only if the cap is set sufficiently high, or in the case of a capacity payment, if it is of an adequate quantum. If all generators submit (or are in some way constrained to bid) their SRMC and are dispatched on this basis, the theory indicates that a contractual revenue stream or a capacity payment in a market needs to be equal to the capital cost of peaking plant.[38] Spot prices in the order of the current VoLL of $10,000/MWh or higher are needed to provide adequate revenue to generating capacity that may be required to run only a few hours each year.

Where generators cannot recover costs because of, for example, the effect of a price cap, a limitation on bidding, or inadequate capacity payment, a number of writers have termed the shortfall 'the missing money'. An overview of analysis to demonstrate these conclusions from first principles is shown in Appendix C.

Allowing spot prices to rise to levels to incentivise new plant is one of three pre-requisites of an effective and robust market identified by Cramton & Stoft. Historic spot prices in the NEM show that prices have often reached levels clearly above the SRMC of peaking plant (including up to the $10,000/MWh VoLL level). The question is whether these levels provide the prospect of adequate revenue and hence incentivise timely investment whilst not exposing retailers to excessive risk.

Submissions to the Panel by some privately-owned generators claimed that they have not achieved sufficient revenue to make a commercial return in recent years.[39] On the other hand, consumer representative groups claimed that generators have been exercising their market power in order to achieve inflated profits, and presented an assessment based on analysis of annual reports of government-owned generators.[40] The Panel has reviewed the available information concerning the revenue available to privately owned generators but does not have access to confidential cost data and has consequently not provided an assessment of revenue sufficiency.

Nevertheless, the following sections address a number of factors that have been raised with the Panel and which affect the outlook for reliability. The chapter concludes with an overall assessment for the outlook of reliability should the current mechanisms remain untouched.

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38 This is strictly valid only for systems with an ideal mix of base, intermediate and peak plant.

39 International Power Australia and Loy Yang Marketing submission to the Issues Paper.

40 Major Energy Users submission to the Issues Paper.

5.3 The investment signal

This issue concerns the strength of the investment signal arising from the NEM's energy-only market design. The question is: will investments in generation, on the basis of expected returns from the spot market and/or the availability of the hedge contracts that provide a more certain revenue stream, be sufficiently timely to ensure the reliability standard is met?

5.3.1 Spot and contract prices

A number of submissions[41] to the Issues Paper referred to work carried out by Henney & Bidwell.[42] Arguments were advanced that an energy-only market design, in which prices can be as high and volatile as necessary, is inherently unstable both because of the volatility of demand and because demand is relatively inelastic to price (i.e. spot prices will be volatile because demand does not respond readily to the spot price). It was contended that as a result of this instability, market participants are unable to determine what the appropriate investment response is, and therefore cannot be expected to bring forward an efficient level of investment. The concern is that a volatile spot market does not deliver sufficient revenue certainty for investors, hence there is substantial risk, especially for peaking plant that relies on relatively few high-priced trading intervals to recover its capital costs. Henney & Bidwell also consider that the high prices are likely to be politically unacceptable, and there is some indication that this is also the case in the NEM (see Section 8.2).

This question of spot price volatility should not be considered without looking to the third leg of the conceptual framework; that is, the existence of a financial contract market through which participants can insure themselves against volatility in spot prices. This contracting activity is loosely analogous in the NEM to a capacity payment.

Recent research into the adequacy of the contract market as a risk management tool suggests that the financial contract arrangements in the NEM are working well as short-term risk-management instruments for the bulk of demand, that they are continuing to evolve, and that contracts are available for retailers and existing generators to manage their risks.[43] As such, the contract market provides a more stable investment signal than does the spot market. However, it has been noted that a visible and liquid market for contracts further out than three years does not exist, and hence there is no alternative investment signal for periods beyond this. Moreover, the period beyond three years is crucial for investors in generation assets typically designed to operate for more than 15 years – more likely 20 for the lowest capital plant, and much longer for base load and mid-merit plant.

The question, then, is whether appropriate contracts, i.e. contracts that extend beyond the term available in the contract market that would assist in ensuring timely investment to meet the reliability standard, are available and are being sought?

The following subsections examine the role of contracts in investment decisions and incentives to contract.

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41 For example, the submissions by NewGen Power to the Issues Paper.

42 Alex Henney and Miles Bidwell, POWER UK / ISSUE 122 / APRIL 2004, "Will *NEAT ensure generation adequacy?"*

43 See Independent survey of contract market liquidity in the NEM, report by PWC for the National Generators Forum and Energy Retailers Association of Australia (November 2006), and ERIG discussion paper on financial markets (November 2006).

5.3.2 Will investors be prepared to invest in generation plant given the current lack of visibility over long-term pricing?

Discussions with stakeholders highlighted that the current lack of visibility over longer-term pricing is causing significant uncertainty, which is having an impact on desire to invest and the timeliness of investment in generation.

Potential investors suggested that the lack of long-term contracts discourages investment in stand-alone projects, particularly for base-load plant where capital costs tend to be large, and for peak plant with low utilisation and thus uncertain revenue streams. They noted that in particular, financing may not be possible without greater long-term revenue certainty. This would, in effect, narrow the field of potential investors to vertically integrated businesses, to the extent that these investors use their retail positions as a means to hedge against long-term market price risk. The Panel wishes to better understand if this is the general view and if stakeholders perceive this as a major problem for adequate and timely investment.

The absence of long-term revenue certainty for 'non-hedged' investors raises the risk that they will not invest until near-term market prices are significantly higher than they would otherwise accept on a long-term contract. Hence there is a potential mismatch between, on the one hand, theoretical models that assume there will be new plant built when 'expected' price projections indicate it should, and the real world where investors may apply a higher discount rate to the expected revenue streams to account for the lack of certainty in generation plant. This in turn may impact on the timeliness of investment to meet the reliability standard. On financial grounds investors would be expected to apply discount rates to the different types of plant so that they are indifferent to the difference in returns. In practice, however, many investors will work to policy parameters about certainty of revenue and be concerned about regulatory and market risk into the future which will have the effect of exaggerating the discount rate difference further.

5.3.3 The desire of retailers to purchase long-term contracts needed by generation investors

Retailers prepared to enter into longer-term contracts with generators face risk due to uncertainty about consumer demand and future pricing flexibility.

Full retail competition (FRC) means that consumers are able to switch freely between electricity suppliers. As a result, long-term contracts with all but the larger consumers are generally not achievable. To any retailer prepared to purchase electricity for a lengthy period of time, FRC presents a risk because it is difficult to predict future consumer numbers, especially in light of high consumer churn rates as have been witnessed in Victoria and South Australia in recent years[44] and the impact of regulatory decisions that minimise the consequences for consumers that break contracts.

Retailers are covered by jurisdictional regulatory arrangements which include reviews of the tariffs they can charge to small consumers. In general, these reviews consider the price settings for anywhere between 12 months and 4 years ahead. Hence retailers that are considering contracting for longer periods may run the risk of not being able to recover the

[44] See ERIG Discussion Papers (Market Structures), 17 November 2006 and AEMC, *Review of the Effectiveness of Competition in Gas and Electricity Retail Markets in Victoria: First Draft Report*, October 2007, Sydney..

costs of contracts they entered into ahead of the various reviews. This factor may have consequences for the level of longer-term contracting. The Panel also notes that there has been a parallel debate about certainty relating to investment in energy infrastructure, such as the discussions in network pricing about *ex-post* prudency reviews of regulated network service providers. In the context of considering a package of incentives for efficient regulation of the transmission sector, the AEMC's recent Chapter Six rules confirmed that *ex-post* reviews would not occur.

More significantly, retailers have no financial or regulatory accountability to consumers for reliability of supply, although if it became clear that a retailer had shed load for commercial gain, undoubtedly their reputation would suffer and there could be significant consequences.[45] Nevertheless, in general retailers are not accountable for reliability and suffer at most the opportunity loss of tariff income if there is a shortfall. In the NEM this is partly offset by the fact that the costs of the reserve trader are allocated to retailers if it is invoked. But this is a relatively weak incentive to ensure that adequate capacity is available now, let alone in the future.

In some submissions, some stakeholders have suggested that vertical integration is an alternative means of arranging an effective long-term hedge.[46] For generators, direct access to consumers provides a form of long-term hedge that may not be readily available in the contract market. For retailers, the ownership of generating assets provides a long-term hedge against potentially high prices in the event of under-investment. Control of generation assets by retailers also provides flexibility because it enables generation output to be tailored to suit consumer demand whilst maintaining the ability to offer contracts into the market. Perhaps, then, it is not surprising that much of the capacity currently earmarked for development is being proposed by businesses with some degree of vertical integration.

5.3.4 Acceptability of spot price volatility

Stakeholder submissions also suggested that the energy-only market design, which encourages generators to bid above their SRMC when possible, results in volatile price spikes that are likely to be unacceptable to the community and which will invite regulatory intervention and/or repeated rule amendments, thereby undermining the confidence of consumers and investors.[47] The contention is that spot market price spikes are perceived as a concern, even though the market is designed to allow these prices as a signal for additional capacity, and even though participants have the ability to hedge their exposure to spot prices through financial contracts.

As noted above, the spot price alone should not be viewed as an indication of the market's health, although in an energy-only market with financial contracts, the spot market is the primary reference for the contract market. The spot price should always be considered in conjunction with contract prices, because, at any point, retailers and generators have a choice as to whether they remain exposed to spot prices or whether to hedge with contract cover. Spot prices would only be a concern if generators were applying inappropriate market

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[45] There is in fact a perverse incentive on retailers in that if there is a capacity shortfall and NEMMCO sheds load retailers can move to an over-contracted position and reap a windfall under hedge payments. In this way retailers actually profit from greater shedding and greater contracting.

[46] For example, submission by International Power Australia and Loy Yang Marketing to the Issues Paper.

[47] This is also posited as a failing of energy only market option by Henney and Bidwell as part of the rationale for proposing the Reliability Option concept discussed later in Chapter 6.

power, for example by colluding to withhold financial contracts from the market and at the same time bidding to drive spot prices up. In other words, high spot price spikes should not be the focus *per se*. Rather, the focus should be on whether market participants are persistently applying inappropriate market power across spot and contract markets to the detriment of other participants or consumers. It should also be noted that while artificially high prices may have a financial impact on consumers, artificially low prices due to retailer market power or the (inadvertent) effect of policy initiatives (see Section 5.4) will eventually lead to reduced investment and low reliability, also to the detriment of consumers.

Pricing tension between the interests of buyers and sellers is an essential component of a market and should not be suppressed artificially. Indeed, several authors prominent in the debate about reliability mechanisms all note that a price in the order of $10,000/MWh is an efficient price at which to signal the impact of shortfall.[48]

It is the Panel's view, however, that outside the reliability settings there is scope to improve the communication and presentation of prices in the public arena. This may alleviate the current situation in which a spot price approaching VoLL makes headlines, whereas the fact that a very high percentage of demand was hedged, and therefore not exposed to that price, does not. It may be desirable to introduce a simple means to give equal prominence to spot and to contract prices. A discussion of this is presented in Section 8.2

5.4 Public policy and regulatory factors

This section addresses another significant assumption in models used to forecast future reliability. It is the question of whether the energy-only market is subject to any distortions that may impact market price and thereby distort the signals for new investment. Of most significance in this regard, according to stakeholders, are policy and regulatory factors.

The submissions from stakeholders and discussions with potential generation investors, which are referred to in the following subsections, revealed that the most significant risks to future investment in, and timing of, generation, hence reliability, are perceived to be the uncertainty arising from greenhouse policy and the risk of government intervention. The effect on reliability outcomes of these two factors was generally considered by stakeholders to be of much greater significance than the level of the NEM reliability mechanisms themselves. These policy factors are discussed further below.

5.4.1 Impact of greenhouse gas policies on the generation plant mix

Stakeholders' concerns about policies aimed at reducing greenhouse gases were expressed in terms of:

- The potential distortion to energy prices, and hence market investment, by existing greenhouse related policy mechanisms; and
- The form and scope of future greenhouse related policy initiatives.

[48] William Hogan, October 2005, On an "Energy only" electricity market *design for resource adequacy.* Miles Bidwell (2005), "Reliability options: a market-orientated approach to long-term adequacy", Electricity Journal, 18(5): 11-25.

Existing greenhouse schemes

Greenhouse gas and sustainable development policies can impact on delivered reliability by influencing the generation mix as well as how and when consumers use electricity. For example, government policies on climate change have resulted in legislation that provides additional incentives for renewable generation, such as obligations on retailers to purchase a certain proportion of electricity from renewable sources, with penalties imposed for lack of compliance. Such legislation has the ability to affect the generation mix by increasing the commercial attractiveness of renewable schemes compared to competing forms of generation. Put simply, renewable generators that are receiving an additional revenue stream through legislation or subsidy can afford to sell their electricity at lower prices. This may act to depress spot prices and in effect reduce the signal for other forms of new investment such as peaking plant, which are often relied upon to respond to infrequent spikes in electricity demand, including those caused by the intermittent nature of wind generation. Renewable generation often has high capital cost and low operating cost that is otherwise "uneconomic" in the energy market. It then displaces dispatch from other plant, reducing the probability of investment in that plant type, and indeed may reduce the marginal cost at the same time as raising the average cost.[49]

The resulting impact on the generation mix has potential consequences for reliability. For example, wind generation, by its very nature, cannot be scheduled or readily dispatched in response to increasing demand. As such, as the proportion of wind generation increases, the reserve capacity needed to ensure a certain level of reliability must also be increased. Similarly, other renewable technologies such as hydro or solar, because they rely on the elements rather than a controllable fuel supply, cannot always be dispatched in response to changes in demand.

In recent years there have been a growing number of schemes that provide renewable energy sources with a competitive advantage over more controllable forms of generation. In the Panel's view, an unintended consequence of the increasing number of these schemes, some with increasing greenhouse targets over time, is likely to be an increased risk of failing to meet the reliability standard in the future unless there is careful management of these initiatives. The Panel therefore considers that the design of the reliability mechanisms needs to be reviewed in light of such schemes that impact the generation mix, so that confidence in meeting the reliability standard is not compromised in the future.

Prospective greenhouse schemes

A number of potential investors cited the lack of a consistent climate change policy between different levels of government as a cause of significant uncertainty and risk[50], especially when they are contemplating investing in coal or gas generation. Furthermore, as the debate around climate change has become more active in recent years, it appears that the level of uncertainty about specific future policy initiatives has increased, particularly in regard to the future costs that may be attached to emissions as well as to the penalties or advantages that may be introduced for generation schemes of varying emission intensities.

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[49] A simple example is wind generation. Wind has a very low operating cost and when the wind is blowing displaces thermal plant including at times when thermal plant will be seeking to recover capital costs during peak periods.

[50] For example, submission by the National Generators Forum to the Issues Paper.

This view should not be interpreted as raising concerns with the introduction of policy mechanisms which seek to mitigate greenhouse gas emissions, but rather the concern is that certainty is needed about the nature of these mechanisms in order that long term investment decisions are able to be made.

Recent Developments

The Panel notes that since the publication of its First Interim Report in March 2007, some of the uncertainty surrounding greenhouse policy has begun to be alleviated with the crystallisation of policy intent to pursue additional greenhouse related initiatives such as carbon trading schemes and increased renewable energy targets. Further specification of these initiatives should assist in reducing uncertainty for future investment.

A critical issue for the design, development and execution of the details of such policy initiatives will be to align them with existing mechanisms, including the reliability mechanisms of an energy only spot market design.

The Panel also notes that there have been recent announcements by governments, such as in NSW, that recognise the need for additional generation investment in the first half of the next decade.

5.4.2 Perceptions of policy intervention

The Panel received a number of submissions that put forward the view that here is a perception by some within the private sector that there is an inadequate 'level playing field' or 'competitive neutrality', because it is postulated that what drives government investment is different to what drives investment by private companies.[51] A number of prospective private investors cited recent examples of what they considered non-economic decisions by state governments to invest in generation plant. [52] The Panel has not sought to confirm nor dispel these assertions. However, such perceptions about the unpredictability of future government 'interventions' could create uncertainty and therefore risk (and required return) for investment. The Panel notes that these concerns were also cited in the recent ERIG review:

> *"Private sector operators cited government ownership, and particularly the inherent willingness of government owners of these assets to be guided in their investment decisions by drivers other than purely commercial considerations, such as political factors and/or desires for regional development, as one of the biggest impediments to private investment in the energy sector. Perceptions, strongly held, whether well founded or not, can be real barriers to market entry and timely capacity expansion."* [53]

As part of the submissions referred to above, two reasons have been postulated as to why the perceived risk of government intervention is increasing:

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51 For example, submission by International Power Australia and Loy Yang Marketing to the Issues Paper.

52 Ibid.

53 COAG ERIG Discussion Papers, November 2006, p7. http://www.erig.gov.au/assets/documents/erig/ERIG%5FDiscussion%5FPapers20061117171022%2Epdf

1. There is continuing private sector uncertainty as to governments' intentions for new plant, with government-owned generators progressing their own development plans; and
2. There are increasing signs that the supply-demand balance is tightening, with corresponding nervousness from some in the private sector that governments will react before price signals dictate or will invest in inefficient locations.

In addition to the perceived risk of policy uncertainty is the perceived risk of regulatory change. The view of some stakeholders is that some state governments, with their investments in energy companies and their perceived influence over regulatory decisions, have a conflict of interest.[54] Again, the Panel has not sought to confirm nor dispel the validity of these views but simply note that these matters are outside the scope of the reliability standards and mechanisms.

5.5 Demand-side issues

Competitive markets generally work best with an active demand side that disciplines the supply side by initiating voluntary reductions in demand as price rises. Electricity markets, however, are characterised by relatively low levels of DSR, and this contributes to the instability in price outcomes seen in spot prices, and hence to the volatility in investment returns to generators.

The depth of demand-side response is increasing, albeit slowly. Under ideal conditions there would be a deep enough DSR, there would be no need for a price cap or VoLL, and consumers would choose their own trade-off between price and consumption. As a result, there would be no risk of involuntary reductions in demand and the reliability standard would be redundant. In practice, however, there is not sufficient DSR to make this a reality. The key barriers to DSR are price information to which end users can respond, and the metering to record their response.

The Panel is aware of efforts to facilitate the development of additional DSR, in particular through the roll out of 'smart meters', in accordance with the recommendation of COAG (see Section 2.4). This will allow the development of more price-responsive tariffs, which will signal the times when consumers may choose voluntarily to reduce demand. Increased DSR would improve the NEM's efficiency because the part of the total load that consumers feel need not be supplied at high prices will not eventuate. Price volatility would thus decrease. Furthermore, less total generating capacity would be needed, yet the certainty of revenue, which has been noted earlier as forming a barrier to contracting and investment activity, would improve.

However, the full impact of more active DSR on reliability may not be as straightforward as this. While it offers the prospect of increasing reliability, to the extent that it acts to reduce the relative difference between peak and average demand, it might on the other hand lead to a situation where, for example, consumers may curtail their use of air-conditioning for all but the hottest days, in which case the load profile may actually become peakier.

[54] For example, submission by the National Generators Forum to the Issues Paper.

Nevertheless, it is anticipated that the more DSR there is, the less central management of reliability there will need to be. When, and to what extent, will only be learned from experience.

The Panel has given some consideration to the concept of a standing demand side reserve similar to that proposed by Energy Response.[55] The Panel's modelling indicates there may be a role for medium-term demand side responses as an alternative for generation responses, as the level of USE achieved is very similar. The standing reserve concept itself is discussed in Sections 6.2.2 and 6.3.

The Panel notes that AEMC has recently commenced a "Review of Demand Side Participation in the National Electricity Market". The Panel intends to forward all material submitted to it that relates to demand side matters to the AEMC for consideration in that context.

5.6 Will the reliability standard continue to be achieved with the current reliability mechanisms?

The design of the NEM is premised on the effective operation of spot market arrangements and bilateral contracting between generators and consumers. In order to consider the design's ability to deliver adequate revenue to cover generator costs, the Panel has taken into account quantitative modelling carried out by NEMMCO and the Electricity Supply Industry Planning Council of South Australia (ESIPC) and has commissioned modelling by CRA (the detailed report is attached as Appendix E). In each case, future demand projections and forecast bidding patterns of existing generators were used to evaluate expected future spot prices and investments and hence expected outcomes for reliability.

All three sets of modelling suggest that NEM spot prices can, in principle, provide revenue over the long term sufficient to support investment to meet the reliability standard. However, this will not necessarily be delivered from the current level of VoLL once rising costs are taken into account, and further, this 'in principle' capability will only be translated into practice if two key conditions are met:

1. Investments are made consistent with expected returns from spot prices (even though spot prices are expected to be highly volatile and revenue from peak generators especially can be expected to vary significantly from year to year); or hedge contracts of sufficient size and duration are agreed between generators and consumers that will provide a more certain revenue stream with which to underwrite investments; and
2. Energy market prices must not be subject to distortion by external factors such as investments that are not undertaken in response to market price signals, but are undertaken through intervention.

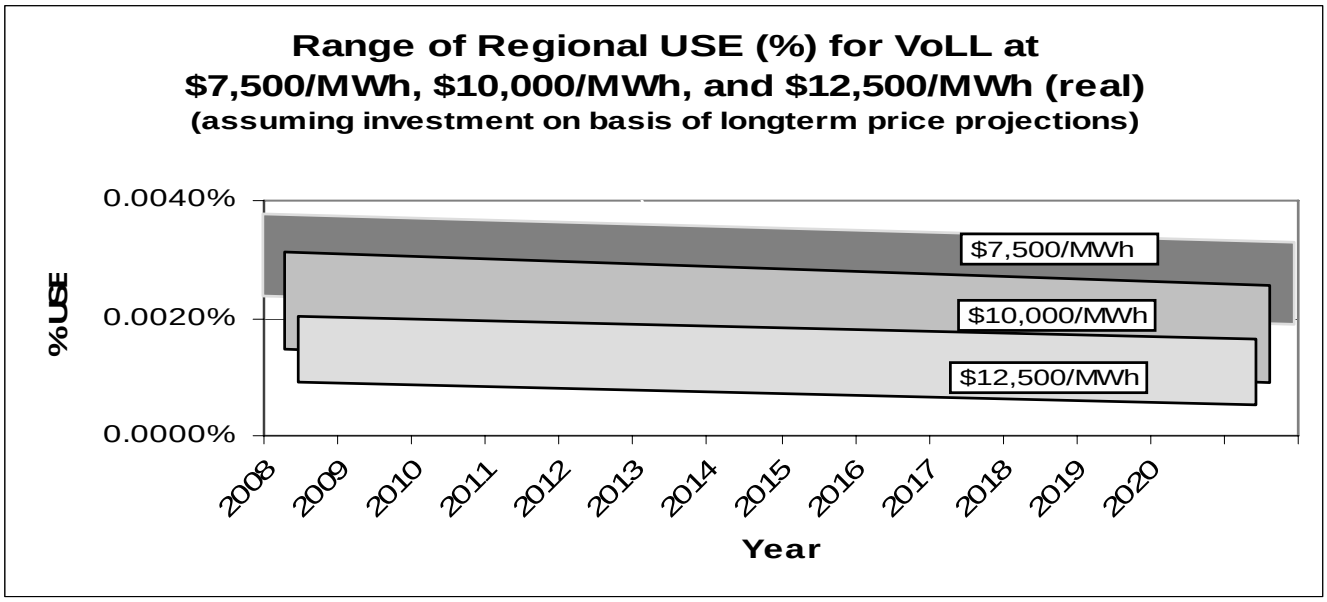
The analysis shows that as the system grows in size the reserve margin necessary to maintain the USE at approximately the reliability standard falls slightly. It should be noted that the analysis undertaken: is with a real value of VoLL at the existing level[56]; is under ideal market

[55] Energy Response supplementary submission to the Second Interim Report.

[56] This analysis was reworked for the modelling Appendix E of this Final Report using a nominal VoLL.

conditions; implies that the level of VoLL is increased in absolute terms in line with increases in the cost of plant over time; and assumes that the long term underwriting of investment discussed above occurs. It should also be noted that these projections do not include quantification of the impact of future public policy settings such as greenhouse. This relationship is illustrated in Figure 5.

Figure 5[57]



Within the bands the individual regional results reflect modelling decisions about the relative timing and size of investments in the different regions and the timing of augmentations of transmission capacity.

However, the results from the modelling tell only part of the story. On the basis of observed prices and views expressed to the Panel, there is a growing concern that there is a risk that neither of the key conditions about (inadvertent) distortion of prices due to policy settings and willingness to commit for longer term underwriting through longer term contracts (or confidence about longer term liquidity) may be met in the future.

Furthermore, qualitative assessment of the contracting environment indicates that the duration of contracts may be inadequate to underwrite investment, although this is less of a barrier, but still of concern, to vertically-integrated participants. Stakeholders have also indicated that a lack of long-term hedge contracts produces significant uncertainty for investors (see Section 5.3.2), and as such investors may not invest on the basis of expected returns from a volatile spot market because revenue from one year to the next may vary significantly.

Discussions with potential investors (see Section 5.4) are consistent with other reviews in that there are barriers to investment emerging from:

- Increasing uncertainty about future greenhouse policies and the future cost of carbon emissions; and

[57] Prepared as part of the analysis by CRA for the First Interim Report.

- A perceived risk that other government policies may distort market prices.

The Panel recognises that, in the absence of long-term contracts or some other mechanism that will provide increased revenue certainty, these risks may drive investors to discount expected revenues with a consequent delay in the timeliness of investment. Sensitivity analysis undertaken by CRA suggests that a small increase to the rate of return required by investors may jeopardise the reliability standard being met. In addition, there have been recent increases in the costs of construction of new generating plant, and there is an expectation of continued increases in those costs over coming years. Given all these factors, the Panel considers there is a genuine risk that investments may not be made early enough to sustain the reliability standard in the long term and achieve it every year without additional incremental development of the reliability mechanisms.

5.7 Conclusion

In summary, the Panel has considered the submissions made to it and has had regard for the information an analysis from NEMMCO, ESPIC and CRA (Appendix E).

The Panel's view is that there appear to be risks on the horizon that may impact the NEM achieving the reliability standard in the future if the amount of investment in new generation required to meet expected demand is either delayed in timing or did not occur. The risks which emerged from stakeholder submissions principally relate to external policy factors which create perceptions of uncertainty or potential distortions to the market and the investment environment, and the increasing cost of constructing new generating plant. The Panel also notes that other risk areas put forward in submissions include the operation of the contract market over the longer term and the relationship of the level of values of the reliability settings (such as VoLL) to underlying costs – such as construction costs. The analysis also shows that in the absence of further market signals, even under ideal conditions, there are risks to achieving the sufficient level of generation investment and demand responses with the reliability settings at their current levels.

The Panel observes that the analysis of future projections demonstrates that the USE reliability standard would be breached in the medium term at a level of VoLL of $10,000/MWh nominal.

The Panel therefore believes it prudent and responsible to consider adjustments and incremental improvements to the reliability settings and mechanisms to provide continuing confidence in the NEM's ability to deliver reliability in the long term interests of electricity consumers. The Panel does not believe that the reliability mechanisms should be fundamentally changed given the energy-only market design of the NEM nor does it believe that the levels of the mechanisms should be substantially changed to manage uncertainty in the policy environment. Rather, as increasing certainty of policies such as greenhouse are given, their effect on reliability should be assessed and appropriate responses or amendments made to the mechanisms if necessary.

The next chapter explores some options for changing or enhancing the mechanisms considered by the Panel.

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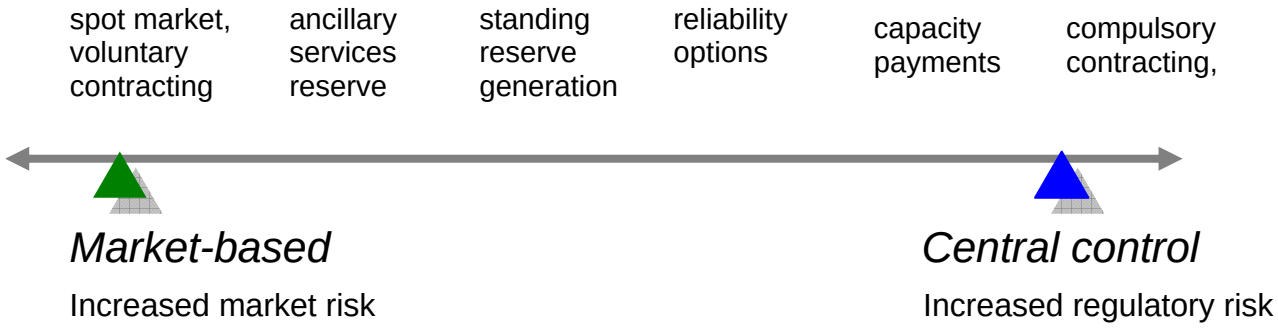
6 Options for changes to the reliability mechanisms

The role of the reliability settings in the NEM has been outlined in Chapter 0 and the performance of the NEM against those settings summarised in Chapter 3. Chapter 5 described the risks that may prevent the reliability standard being met in the future and concluded that some changes to the reliability settings in the NEM is prudent and necessary. This chapter discusses options for changing, amending or augmenting the reliability mechanisms to reduce this risk and assesses the viability and potential impacts of each option.

The Panel has reached the conclusion that, in the context of an energy-only market design, the reliability uncertainties in the market projected in its analysis warrant enhancements to the existing mechanisms. This approach is recommended rather than suggesting the adoption of mechanisms that would be inconsistent with the NEM market design. In addition, the Panel is recommending substantial improvements in reliability information to enable market responses and the re-design of the Reserve Trader provisions discussed later in Chapter 7. In adjusting the existing mechanisms, the Panel is proposing to recommend an increase in VoLL to $12,500, effective 1 July 2010 with commensurate adjustments to the CPT (which are discussed in Chapter 8).

6.1 The spectrum of design options

In considering options for change it is useful to begin by reviewing the general differences between market-based designs and centrally-controlled designs, including the different distribution of financial and policy risks inherent in these designs. The following are examples of designs that sit across the spectrum from totally free markets to those that involve progressively more central direction.



In all systems along the spectrum, reliability and security are interwoven and are affected by decisions across a wide time scale. Decisions to build new generating capacity must be taken years in advance in the investment phase. Lead times may precede the emergence of actual market signals. Investment and operating reserve levels are effectively decided well in advance of their actual projected requirement. Close to the time the electricity is required by consumers, decisions must be made in the dispatch process about which generators will be used and what are the safe operating limits for the power system at that time. Except where explicit control of the amount of capacity is exercised by a central authority, the overall arrangement may also include a safety net.

These different arrangements treat reliability (and security) of supply either as an indirect outcome of a market mechanism for buying and selling electricity or as a matter to be managed directly. Direct management can be through market incentives that specifically target reliability, or through explicit central control of the amount of capacity built and made available at any time.

Table 3 presents a summary of the major reliability-related characteristics of different market designs. It ranges from a highly-disaggregated market structure with a high level of decentralised decision making to a single vertically-integrated utility that owns and operates its generation fleet through central management.

The table also indicates the designs that best describe the industry structure and market arrangements in a range of power systems at different times. Arrangements in Australian states prior to reform in the 1990s were amongst the most centrally managed. Pre-reform US markets, although relatively centrally managed, had more features of a disaggregated arrangement than pre-reform Australian arrangements. The NEM, however, is significantly more decentralised than post-reform US markets. Paradoxically, while some US markets are debating whether to move further towards market mechanisms to create additional incentives, in Australia there is increasing interest, as evident from some submissions to the Panel's Issues Paper[58], in considering a move towards more centralised management (for example, central contracting of standby generation or alternative revenue streams reflecting the level of capacity presented to the market).

Nevertheless such a fundamental change to the NEM design is not part of the terms of reference of this Review and is a matter for policy makers. This Review has therefore considered the potential for application of options which are generally based on the existing energy-only market design.

[58] For example, submissions from NewGen Power and Major Energy Users to the Issues Paper.

Table 3 – Reliability related characteristics of different market designs

Market/Central Management	INDIRECT MARKET INCENTIVES		DIRECT MARKET INCENTIVES FOR RELIABILITY		CENTRAL MANAGEMENT OF RELIABILITY		
INVESTMENT PLANNING	Disaggregated	Disaggregated	Disaggregated	Disaggregated	Central setting of system capacity requirement. Pooled capacity assurance Pooled energy market with voluntary decentralised hedging	Central setting of system and participant obligation Decentralised acquisition of capacity and energy	Central setting of participant obligation Centralised acquisition
GENERATION OWNERSHIP	Disaggregated	Disaggregated	Disaggregated	Disaggregated	Disaggregated	Disaggregated	Centralised owner or PPA holder
ASSURANCE OF CAPACITY ADEQUACY	None (providing shortfall protocol in place)	None (providing shortfall protocol in place)	Minimum set centrally as trigger for safety net	Reserves purchased by system operator	All capacity remunerated by system operator (physical or financial arrangements)	Centrally managed	Centrally managed
DAILY UNIT COMMITMENT	Disaggregated – Notified to system operator	Disaggregated – Notified to system operator	Disaggregated – Notified to system operator	Disaggregated – Notified to system operator			Centrally controlled
REAL TIME DISPATCH	Disaggregated - Notified to system operator with override ability	Centrally controlled	Centrally controlled	Centrally controlled	Centrally controlled	Centrally controlled	Centrally controlled
MARKET SAFETY NET	No formal mechanism but close oversight from government with implied threat of intervention	No formal mechanism but close oversight from government with implied threat of intervention	Reserve Trader	Reserve Trader			Not applicable
EXAMPLE		Alberta, UK	NEM		Post reform/emerging US markets	Pre-reform US	Pre-reform Australian State Utility

The NEM falls in the group that provides direct market incentives and mechanisms and has an explicit safety net.

The reliability standard, VoLL, the CPT and administered price cap, the reserve trader and also the market floor price can all be described as reliability mechanisms. Two key questions for this Review, for which stakeholder feedback was sought, were therefore:

1. Is it appropriate to rely so much on mechanisms which include a safety net?
2. Is there a better combination of mechanisms in design or level? (For example, a standing reserve generation or demand-side resource has been discussed as a better safety net than the reserve trader.)

What follows in the next section are the options the Panel has considered to answer these questions. Quantitative analysis of these options is presented in Appendix E and reproduced in Table 5 at the end of this chapter.

6.2 Options considered by the Panel

The options considered by the Panel fall into five option categories across three broad groups, represented by the examples below. There are a broad range of implementations of market design principles that fall into the categories identified below, and the examples are illustrative only. Option A alternatives involve only minor adjustments to the current settings in the NEM, through to Option E which would represent significant changes, not only to arrangements for managing reliability, but also the trading arrangements in the NEM.

The groupings also broadly represent different positions on the design spectrum between market-based design (Group 1) and centrally controlled design (Group 3). However, the correlation is not exact. For example, mandatory long-term contracting is essentially a 'central control' mechanism, but it is included in Group 1 because it involves very little change to the NEM's current design.

GROUP 1 **Incremental change to existing mechanisms**	**GROUP 2** **Targeted reliability reserve mechanisms**		**GROUP 3** **General reserve mechanisms**	
Option A	***Option B***	***Option C***	***Option D***	***Option E***
• Increase VoLL • Mandatory long-term contracting	• Reliability Ancillary Service	• Standing reserve	• Financial (Reliability Option / capacity option)	• Availability payment

The options are also divided into groups based on the effect each group would have on how capacity and reserves are managed and remunerated. In Group 1, there would be continued

reliance on the energy-only market and the interaction between spot and contract trading arrangements. In Group 2, additional payments, or in some cases additional certainty about payments, would be offered to plant that explicitly provides reserve capability. In Group 3, some of the revenue currently derived from the energy price would be restructured into a payment, either under some form of contract with NEMMCO or via a new payment for availability (an 'availability payment') to be established under the Rules.

Group 3 options would require a major reconstruction of the current market design and are matters, in the first instance, for the Ministerial Council on Energy (MCE). As part of this review, material and submissions relating to group 3 options have been raised by some stakeholders. The Panel intends to forward these to the MCE and the AEMC for information.

A description of the various options is covered in the following sub-sections.

6.2.1 Group 1 Options – Incremental change to existing mechanisms

The Panel considered two viable possibilities for incremental change, within the current structure of revenue streams in the NEM: a potential increase in the level of VoLL; and the introduction of mandatory long-term contracting.

Increase VoLL

One option to increase confidence in reliability would be to alter the level of VoLL, with the intention of driving participants (especially those not vertically integrated) to enter into longer-term contracts to underwrite new investments as well as to provide a wholesale price envelope for the medium-term that is reflective of costs and targeted to achieving NEM reliability at 0.002% USE. This matter is further discussed in Section 6.3.

Introduce mandatory long-term contracting

The importance of contracts in the NEM has been discussed in Section 5.3. This section also noted the barriers to contracting perceived by investors. Based on this information, it is reasonable to assume that if contracts of commercially-acceptable duration and price were available to underwrite investments in low utilisation plant, there would be no shortage of investment.

The option to increase VoLL would likely encourage long-term contracting. The Reliability Options approach (discussed in Section 6.2.3) would itself centralise the contracting activity within NEMMCO and effectively mandate that NEMMCO would seek a sufficient amount of contracts. These contracts may have attractions for investors with regard to providing defined revenue streams or for some users in terms of the potential to reduce volatility and increase forward price predictability. However, the contracts in these options remain voluntary and are cap contracts. A significant percentage of revenue to most plant would still be derived from the pool operated by NEMMCO with voluntary energy contracts at negotiated prices.

An alternative form of central involvement considered in the Review would be to mandate a minimum level of contracting as a percentage of demand. This would essentially force the level and type of contracting that was envisaged by the NEM design in the first place.

The Panel is aware that suggestions to mandate contracting activity tend to be poorly received by market participants and this was evidenced by submissions to the Review.[59] Mandating contracts means that retailers' contracting policies are underwritten by a physical obligation rather than by a commercial setting. However, while mandatory contracting would require little change to current arrangements per se, it would significantly alter the commercial arrangements in the market, inevitably require new Rules to define each retailer's obligation, and may reduce innovation about future contract forms. Compliance mechanisms would also need to be enhanced and an enforcement mechanism such as a penalty or default arrangement created. The Rules would also need to recognise net exposure and to account for owned generation and DSR.

6.2.2 Group 2 Options – Additional targeted reliability reserve mechanisms

The Panel considered two options that would involve substantially greater changes to the NEM's current design: the introduction of a Reliability Ancillary Service and a Standing Reserve.

Reliability Ancillary Service (RAS)

The RAS was postulated as a possible mechanism that could be developed to 'firm up' payments to low utilisation plant that provides reserve.

A RAS would operate in a similar way to the existing Frequency Control Ancillary Services (FCAS) arrangements. The FCAS arrangements, used to manage the effects of sudden disturbances to system frequency, are for fast-acting reserves that can respond in timeframes of five minutes or less. A RAS would operate in a similar way but would target slower-acting plant, for example, it would target generation or demand response available at, say, 30 minutes' notice and that could sustain output for a nominated time.[60] In the same way that some plant can provide FCAS in different time periods, some plant would also be capable of providing both FCAS and 30-minute reserve. Box 1 provides a more detailed description of the concept.

Box 1

Outline of the Operational Design of a possible Reserve Ancillary Service

Key characteristics of the RAS are that it would offer real time pricing of reserve and be paid to any resource that can provide reserve capability at the time. As a result, prices for reserve would reflect prevailing conditions; that is they would be expected to be volatile and rise to a high level as the supply-demand balance tightens. However, it would provide reserve plant with a more certain revenue stream than the energy market alone. Real time calculation of prices and payments to the most efficient combination of resources available at any time would increase the efficiency of the arrangement.

The format for generator bids for production of energy and FCAS would be extended to include bids for RAS.

[59] For example, the EUAA's submission to the First Interim Report.

[60] Although RAS would operate on a 30-minute basis, for the purposes of assessing the impact on reliability it would have a very similar impact on annual revenue as does making a capacity contract payment to reserve plant at the marginal value of capacity for the year.

Capability to increase output within a defined RAS response period of, say, 30 minutes, which could be sustained for a further defined period of, say, 12 hours, would be treated as RAS. The amount of RAS available at any time would thus be limited by the difference between current dispatch level and total availability and any limitations on the ability to ramp to the available capacity within the RAS response period.

Optionally the bidding format could be extended further to allow bidding of RAS availability higher than the availability for energy dispatch in the next 5 minute dispatch period. For example, this may be appropriate where short recall maintenance could be cancelled or for units not on line at the time. Units bidding under existing fast start arrangements in the market would be accounted as available for RAS to the extent that their fast start profiles allowed generation within the RAS response period and production could be maintained.

No change would be made to the current arrangement for bidding capacity to the different FCAS services (which require responses within 6 seconds, 60 seconds and 5 minutes). Generation plant with the requisite characteristics would be entitled to continue to offer FCAS as well as RAS capability.

NEMMCO's dispatch engine (NEMDE) would be enhanced to require it to jointly schedule RAS, FCAS and energy in the optimum manner. As a result, dispatch outcomes for generators would include targets for services of energy, FCAS and RAS.

The price for each service would be the marginal price for each service (i.e. "shadow price" of the relevant constraint within NEMDE).

In a simple case where RAS availability of a generating unit was the same as the availability for energy and no FCAS was offered from the unit, capacity that was not dispatched for energy would be selected for RAS if the unused capacity was offered at a price less than the price of unused capacity of other units until the full quota of RAS was filled.

A RAS would interact with current energy market hedging arrangements; therefore further work would be needed to develop its detailed design. A RAS would amend the structure of reliability mechanisms because it would increase the frequency of payments to plant that provides reserve, and reduce the volatility of revenue paid to reserve plant. Depending on the final settings, a RAS could result in an increase in overall revenue to marginal plant and a corresponding increase in consumer cost, or it could maintain the same total cost to consumers but increase the certainty of revenue streams to plant.

The amount of reserve needed to meet the reliability standard would be determined by NEMMCO. Depending on the detailed design of the scheme, this amount would be up to the current capacity reserve margin used by NEMMCO. In all cases, however, it would primarily affect peak plant and thus create a difference between peak and base load. Indirectly this would provide a market mechanism to redress the effect of uncertainty of revenue available to low utilisation plant (discussed in Section 5.3.2). However, it would not recognise the contribution of high load factor plant to the capacity available to the market at any time.

Standing reserve

The second mechanism in the Group 2 options involves a range of ways to introduce contracts for a standing level of reserve over several years. Decoupling the timing of purchases of energy from reserve in this way inevitably risks introducing inefficiencies because plant that is reserve capacity at one point can rapidly move to providing energy. The volume of reserve would be set centrally and the price determined from a tender or auction process. Depending on how the contracts operated, the mechanisms could be viewed either as:

- a longer-term contract variation of a RAS; or
- Shifting the role of the reserve trader contracts for physical capacity from that of a safety net, to that used in the event the market mechanisms do not result in sufficient capacity to satisfy NEMMCO that the reliability standard will be met.

It is notable that the NEM moved from contract-based FCAS to the current real-time ancillary services in 2001, on the grounds that a spot price would be more efficient. However, a key difference between FCAS and energy reserve plant is that FCAS is not generally the key driver for investment; hence the materiality of the payment stream would be far greater in the case of reserves.

In each case, the volume of reserve sought under contract would be decided centrally, and there would be discretion as to how much reserve is likely to be required. Such arrangements may have the potential to replace all reserve currently provided by the market.

As the discussion of adequacy of revenue in Section 5.2 illustrated, maintaining reserves in an energy-only market such as the NEM is dependent on plant being paid at the high prices for short periods so that peaking plant is remunerated in order to avoid the risk of 'missing money'. Hence the design of the RAS or a standby capacity payment should not ignore the impact of these mechanisms on existing plant. For example, a RAS payment could not be treated as a substitute for revenue at the peak of the price distribution curve.

The effect on the market of additional contracting would be to lower USE and increase total costs by the cost of the contracting. As the standby plant would not be permitted to operate other than at VoLL, and only as a substitute for physical shedding of customer load, market prices and revenues to all other plant would be largely unaffected.

To illustrate the effect, standby reserve generation was added in the modelling as follows:

- 140 MW in Queensland;
- 360 MW in NSW;
- 150 MW in Victoria;
- 40 MW in South Australia.

No additional capacity was added in Tasmania. This is because peaking capacity is less likely to be of concern in its predominantly hydro system and because any additional thermal capacity that is required would be for longer-term energy production and addressed separately.

The total cost of plant would be a standing charge of $71,000/MW/year (the annualised cost of the plant capital), amounting to almost $50M per annum across the market as a whole. To the extent that lower-cost plant or demand-side response could be employed, the cost would be lower. Operating costs would also need to be met, but these would be relatively small compared to the standing charge. With standby capacity in these locations, USE would fall by approximately 0.0003%.[61]

In practice, the improvement in USE would be highly dependent on the amount and location of standby plant. It would also be a way to implement a hybrid reserve standard to manage depth or duration of outage risk as discussed in Section 4.2.3.

6.2.3 Group 3 Options – General reserve and capacity mechanisms

Each of the targeted reliability reserve mechanisms discussed in the previous sub-section would only direct payments to parties providing reserve (as distinct from those that contribute to the overall capacity available). Consequently, parties that provide no or little reserve would continue to rely only on revenue from the dispatch for energy to recover both their capital and operating costs. The third group of options considered by the Panel would make a general payment for capacity presented to the market regardless of whether it also received payment for dispatch. This group of options can be characterised as introducing purely reserve payments.

Two forms of general payment have been considered in the context of this Review:

1. *Facilitated central financial hedge arrangement*. Under this arrangement, NEMMCO would enter into contracts with owners of generating capacity and possibly demand-side capacity and would recover its costs from the market. NEMMCO would nominate the volume of capacity required and some, but not all, elements of the price to be paid. The financial hedges would create a strong incentive for the contracted parties to offer plant for dispatch and then to generate if called or face significant financial penalties. Variations on this arrangement have been developed internationally, such as the Reliability Options model recently proposed by Bidwell[62] for New England, and the Capacity Tickets model used in New Zealand. In the Reliability Options model, the market operator nominates the volume of capacity required and a strike price for central two-way contracts; generators make offers of the option fee they require; and an auction is held to ensure an efficient price.
2. *Central payment.* Under this arrangement, a simple central payment would be made for all capacity up to a level NEMMCO nominates as being sufficient to provide the level of reserve to meet the reserve standards.

Some NEM stakeholders have recommended consideration of the Reliability Options model.[63] This model is also currently under consideration or adoption in parts of the US.

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61 See the modelling Appendix 5 to the First Interim Report available at the AEMC's website at: http://www.aemc.gov.au/pdfs/reviews/Comprehensive%20Reliability%20Review/aemcdocs/002CRR%20Interim%20Report%20-%20Appendix%205.pdf.

62 Miles Bidwell (2005), "Reliability options: a market-orientated approach to long-term adequacy", Electricity Journal, 18(5): 11-25.

63 MEU submission to the First Interim Report.

For these reasons, modelling has been undertaken for this Review on the Reliability Options model.

Reliability/Capacity Options model

In summary, this approach would require NEMMCO and generators to enter into financial contracts. Generators would receive an option fee for entering a one-way hedge contract with NEMMCO, and NEMMCO would run a tender or auction for sufficient capacity to meet peak demand plus reserve. The strike price in the hedge would be set by NEMMCO at just above the highest expected marginal cost of peaking plant before the tender or auction took place. Customers would pay any net costs incurred by NEMMCO. In addition, generators and retailers would be free to enter bilateral energy contracts.

For the purposes of analysis to assess the possible performance of Reliability Options, the following assumptions were made:

- The option fee for the one-way hedges will settle to its theoretical level of the annualised capital cost of peaking plant, assumed to be open-cycle gas turbine (OCGT) plant at $71,000/MW/per year. All generators up to the capacity required to provide reserve equal to the level NEMMCO considers necessary to meet the reliability standard will have entered into reliability options. There would be no surplus capacity.
- NEMMCO would set the strike price of the reliability options at $300/MWh.
- Generators and retailers will enter bilateral contracts at $35/MWh.
- VoLL would be set at $3,000/MWh.[64]
- Generators would receive revenue from the spot market, which will be far less volatile and operate at lower prices, plus the option fee payable under the Reliability Option contracts.

No allowance for penalty payments under the Reliability Option was included in this analysis. The Panel notes that this would, however, be a significant driver for performance and could alter the commercial position for under-performing plant.

The results of the modelling are in Appendix E of this report.

Bidwell notes that a penalty payment for non-performance would be a likely feature of the Reliability Option contract. Such a payment would be set administratively to incentivise performance. Parties proposing to bid for Reliability Options would need to know this penalty in advance. Hence generators would still be exposed to incentives to perform, and these could replicate the conditions of a fully contracted NEM if the penalty were set to the order of the current VoLL.

In all cases, NEMMCO's costs would need to be funded. It would be possible to give a number of years' notice of the amount required, and, although it would not be hedgeable, it would be known for budgeting purposes and for setting tariffs. In all cases, it would be possible to make an administrative determination to charge different amounts to consumers

[64] Note that the level of VoLL will be much less of an issue because generators will be in receipt of income from the reliability option fee and there will be an incentive to cap bids at $300/MWh to ensure dispatch at times when price may be high.

in peak and off-peak periods (which, of course, if taken to the limit, would restore the 5-minute pricing regime of the current NEM design).

The Group 3 options are founded on a view that, providing the costs of production are met separately, there is no difference between plant that is used to produce energy and plant that is in reserve in the contribution to reliably meeting total demand. Therefore they should be remunerated equally.

Availability payment

Another potential option that would see revenue to all plant via a traditional capacity payment, where plant is rewarded for presenting capacity at a centrally determined price, has not been assessed in this Review.

6.3 Assessment of options

All the options discussed offer different degrees of certainty as to whether a market will meet its reliability requirements. As we move along the spectrum from Option A to Option E:

- The extent to which market forces create incentives for participants to set the level of reserves decreases;
- The reliance on central authorities to set the level of reserves increases;
- And, correspondingly, the certainty that sufficient reserves will exist to meet the reliability standard increases.

Unavoidably, the different options also affect energy trading arrangements. Each option therefore has its advantages and disadvantages. A summary of the options is found at the end of this section in Table 4 at the end of this Chapter.

Table 6 of modelling Appendix E represents a summary of the quantitative analysis of the options and the status quo, and the impact on USE of each of the options. That table is reproduced at the end of this Chapter as Table 5 of this Report.

Do nothing

A "do nothing" approach while possible is not the recommendation of the Panel. Based on its analysis and consultations, the Panel considers that making no changes to the reliability settings is not the most prudent policy position.

The Panel notes that the likely result of adopting a "do nothing" approach would be a progressive decline in market based investments and thus an increasing reliance on the reserve trader. The analysis in Chapter 5 and Appendix E demonstrates this would be a likely in the period from 2011. As noted earlier, the reserve trader is an intervention mechanism that has not been designed for, and is not well suited to, regular use as a baseline mechanism for ensuring reliability.

The Panel is also proposing amendments to the design of the reserve trader to improve its operation. Although these would be even more important if there were to be increased

reliance on the reserve trader, the Panel has concluded that such changes would be beneficial in any event. Those changes are discussed in Chapter 7.

Mandatory Contracting

Mandatory contracting may increase certainty about revenues because it would be clear that demand up to an amount specified in the Rules would need to be covered by contracts. Mandatory contracting would force participants to enter contracts but would still rely on the incentives created by those contracts to deliver the capacity needed to deliver reliability. For the purposes of this Review, it assumed that the form of contracts would be one or more of the common forms used in the market already or that parties could present different forms for endorsement by a central authority. In seeking feedback from stakeholders, the Panel also suggested that the form of contract could evolve over time, but that flexibility and the opportunity for innovation would decline.

The Panel also notes that there was no market support for mandatory contracting with the EUAA stating that it "is likely to be problematic, distortionary and restrictive".[65]

Mandatory contracting would involve significantly increased compliance costs. Implementation costs, on the other hand, would be relatively low compared to any arrangements which might change dispatch or the settlement systems between NEMMCO and participants. While mandatory contracting may increase certainty, the linkage of contract prices to spot market outcomes may result in insufficient revenue to secure investment, despite contract tenor.

The Panel's conclusion is that mandatory contracting is problematic, distortionary and unreasonably restrictive and is therefore inappropriate to recommend in this Review.

Reliability Ancillary Service (RAS)

A RAS option would use real-time market-pricing principles that are very similar to the current energy-pricing arrangements for spot trading in the NEM. The level of reserve acquired by the RAS would be set centrally but priced in a spot market. The design would increase the certainty of revenue streams for reserve plant and indirectly increase the probability of merchant investments. It would not create incentives for long-term contracting, but it would address, to some extent, the underlying problem identified in Chapter 5; namely, the lack of long-term underwriting of new investment. However, it would address this problem only to the extent that an increased certainty of revenue would reduce the need for investors to have as much of their investment underwritten, thereby implicitly reducing the discount factor that they apply when analysing new investment in peak plant. The price of a RAS would remain susceptible to external influences that affect spot prices now, such as greenhouse mechanisms.

Overall, while the RAS may offer some contribution to improving reliability, the Panel believes that it would be a complex mechanism that would deliver limited benefits. Analysis by the Panel has indicated that revenue earned from a RAS would not provide sufficient incentive to encourage new generation. A RAS would also be open to 'gaming' in the market, and determining a workable mechanism to marry the temporal effects and co-

[65] EUAA Submission to the First Interim Report

optimisation was problematic. As this means the RAS would have little real effect on reliability, the Panel does not recommend its introduction to the market.

Standing reserve

A standby reserve arrangement would be similar to a long-term reserve trader. Plant under a standby reserve contract would be prevented from participating in the market until dispatched by NEMMCO, and then only at VoLL. Net costs incurred by NEMMCO would be met by consumers.

To date, when NEMMCO has entered into reserve trader arrangements it has typically resulted in contracts being awarded to demand-response facilities, either through reductions in consumer demand or through standby generation that would not otherwise have been used. Assuming that, over time, the backlog of such under-utilised demand-response facilities was drawn into the market through a range of network and other arrangements, standby reserve would need to be met by new investment created specifically for that purpose. If the standby facility is to be more than a safety net for temporary failure of the market to elicit new investment, then long-term underwriting would be needed. In the Review it was suggested that a medium to longer term standby reserve or a demand side reserve arrangement might be capable of delivering such an outcome.

The Panel notes that such arrangements might also insert a multi-layered and duplicative arrangement for delivering reliability in the NEM. Currently there are two layers: the combination of spot and contract trading arrangements based around the Rules, and the reserve trader as a safety net intervention to be used only when the market incentives do not deliver. A standby contract arrangement would see a contracted level of reserves sit between these two layers. This would not necessarily mean that the safety net could be removed (although this may be a possibility). If the amounts under standby contract are to be stable and long term, then the amount under contract would need to be set conservatively.

Market incentives would be relied upon to deliver most of the capacity. These incentives would be a function of VoLL, certainty of revenue and the standby contract amount. Depending on the detail of the design and, in particular the level of VoLL, the market incentives would no longer be relied upon to deliver all capacity, as they are expected to now. There is a risk, however, that if the settings do not encourage the delivery of capacity through market incentives, 'missing money' may inadvertently be designed into the NEM operation. Accordingly, standby contracts should not be seen as a substitute for part of the existing arrangements but as a true 'insurance' against the failure of those arrangements to work. A standing reserve in and of itself would also not deliver the 'missing money' to market participants to encourage investment.

The analysis work and the modelling undertaken for the Panel suggests that the standing reserve concept (either demand-side, generation or a combination thereof) may be capable of making a contribution to reliability in the future.[66] The Panel is not recommending the adoption of a standing reserve mechanism as a fundamental change to the current market design at present. This would require consideration of, and decisions by, policy makers to

[66] A position supported by the Electricity Supply Industry Planning Council in its submission to the Second Interim Report who state "[ESIPC] considers that there is a strong argument for the existence of a standard contract for reserve capacity".

implement. However, the Panel intends to provide information and analysis gathered in this Review to the AEMC in relation to the potential to develop medium-term demand-side reserves (as discussed in Section 5.5.) Additionally, the Panel intends to include further analytical work on the concept of standing reserves in reference to reliability in its forward work program, and make the information available to policy makers and the AEMC during the next year. The Panel believes that investing in further work in this area is appropriate ahead of the next reliability review period.

Reliability/Capacity Options model

The Reliability/Capacity Options model is one of a group of alternatives that provide a centrally-sourced revenue stream to all generators and that explicitly replaces some of the revenue that is currently derived through a combination of spot and contract settlements. These alternatives would therefore represent a very much more extensive change to the existing market arrangements and current energy-only market design. Their effect would be to increase certainty about revenue. In concept, these would also significantly increase certainty about reliability because NEMMCO (or another nominated body) would be charged with entering into contracts for the full capacity needed to cover demand and reserve margin. The form of contracts would of course need to be uniform, and thus flexibility and the opportunity for innovation would be reduced. Significant change to risk profiles and existing contract arrangements would also be required.

Of all the options reviewed by the Panel, the Reliability/Capacity Options model would represent the most significant shift in trading arrangements. Consequently, making the transition to the Reliability/Capacity Options model would result in higher indirect and transition costs to participants than would any of the other options discussed in this paper. NEMMCO too would incur costs in establishing and conducting the tender or auction to acquire the Reliability/Capacity Options. These approaches, if adopted would move the NEM towards a form of capacity market which while having the attraction of predictability may result in higher average prices for consumers in the medium term.

In the Panel's view, the options in Group 3 represent a fundamental change to the existing NEM market design and would require major policy changes by governments in relation to the design of the market. A number of stakeholders have expressed support for one or more of these options as a potential response to volatility and as a facilitator of future capacity in the market. The Panel has undertaken to forward all relevant submissions on these matters to the MCE for its information and consideration.

Increase VoLL

Retaining the existing arrangements and raising VoLL in response to rising costs and increased uncertainty about prices would compensate investors who are adopting a higher discount rate when assessing investments. This option is consistent with the basic design of the NEM and would be least disruptive to existing systems and to participants' understanding of the market. However, to be successful, it will require that investors, retailers and consumers respond including by entering into contracts of sufficient length so as to encourage new and timely investment as well as manage the consequent increase in the overall level of financial risk. Future movements in the level of VoLL should be contemplated in an incremental manner and against clear evidence that the existing price signal is insufficient. In addition, an incremental approach to movements in the level of VoLL on realistic time cycles, as opposed to more substantial, yet less frequent movements

would assist in addressing consumer concerns about increasing the potential volatility of the wholesale market prices.

The sensitivity of unserved energy and of financial returns has been analysed by raising and lowering VoLL from a base-line case study. The results of the modelling to the First Interim Report[67] show that, in the base case, the USE changes by just under 0.0005% over the long term (i.e. from the current standard of 0.002% unserved energy +/- 0.0005%) for each $2,500/MWh change in VoLL, with an increase in VoLL leading to an increase in forecast reliability. However, this modelling assumed that an increase in VoLL will not affect the discount rate applied by investors.

The Panel's analysis suggested that raising VoLL will increase the average revenue that generators can expect over the long-term for a given level of reliability. However, the Panel notes that raising VoLL will need to be accompanied by a market response that increases the scope of long-term contracts.

There were a number of submissions who called for a substantial increase in VoLL. For example TRUenergy in its submission to the First Interim Report suggested $30,000/MWh and in a submission to the Second Interim Report "continued to support a large increase in the market price cap".[68]

A number of submissions called for VoLL to be increased by indexation, either annually or at less frequent intervals in order that VoLL increase as costs increase.[69] A number of submissions, such as Origin Energy's submission to the Second Interim Report, recommended the status quo and VoLL to remain at $10,000/MWh.[70]

The Panel also notes the views put by some submissions regarding concerns for consumers about a potential increase in the volatility in the wholesale prices.[71] Some of these submissions also argued for more fundamental changes to the energy-only market design. For example, the Major Energy Users "is convinced that the current level of VoLL is too high, and that an alternative mechanism is required to allow market forces to operate but also to ensure that equity is an outcome of the market."[72]

Submissions to the Panel were divided on whether an increase in VoLL would result in more or less contracting activity. In theory, an increase in VoLL would expose retailers to additional risk and create incentives for greater levels of contracting and DSR. However, a number of participants suggested that raising the level of VoLL would also increase the risk of exposure faced by generators as a result of forced outages and, as such, may prompt investors to contract less and apply a higher discount factor to compensate for the increased risk.[73] These comments need to be considered in the context of the size and timing of any potential change to the level of VoLL.

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67 Available at: http://www.aemc.gov.au/pdfs/reviews/Comprehensive%20Reliability%20Review/aemcdocs/002CRR%20Interim%20Report%20-%20Appendix%205.pdf

68 TRUenergy submission to the Second Interim Report.

69 For example, the Electricity Supply Industry Planning Council submission to the Second Interim Report.

70 Origin Energy submission to the Second Interim Report.

71 EUAA submission to the First Interim Report.

72 MEU submission to the Second Interim Report.

73 EnergyAustralia submission to the First Interim Report

The Panel undertook further and more detailed analysis in relation to VoLL for this Final Report (Appendix E) that examines the impact that raising VoLL would have on USE. The scenarios examined included nominal VoLL levels of the current $10,000/MWh, increases of $2,500/MWh up to $20,000/MWh as well as two additional cases of $5,000/MWh and $30,000/MWh.

Figures 9, 10 and 11 of modelling Appendix E, specifically the plots of USE under VoLL scenarios of $10,000/MWh (i.e. the status quo), $12,500/MWh are $15,000/MWh, are reproduced below.

Figure 9: Annual USE by Region (VoLL $10,000/MWh nominal)

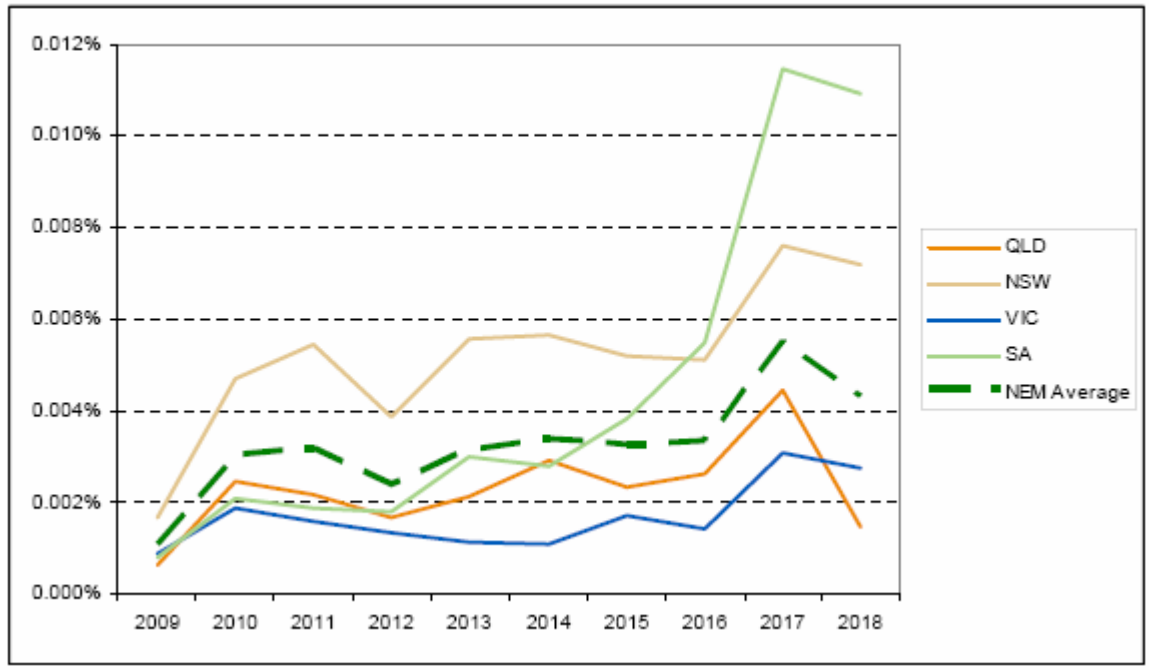


Figure 10: Annual USE by Region (VoLL $12,500/MWh nominal)

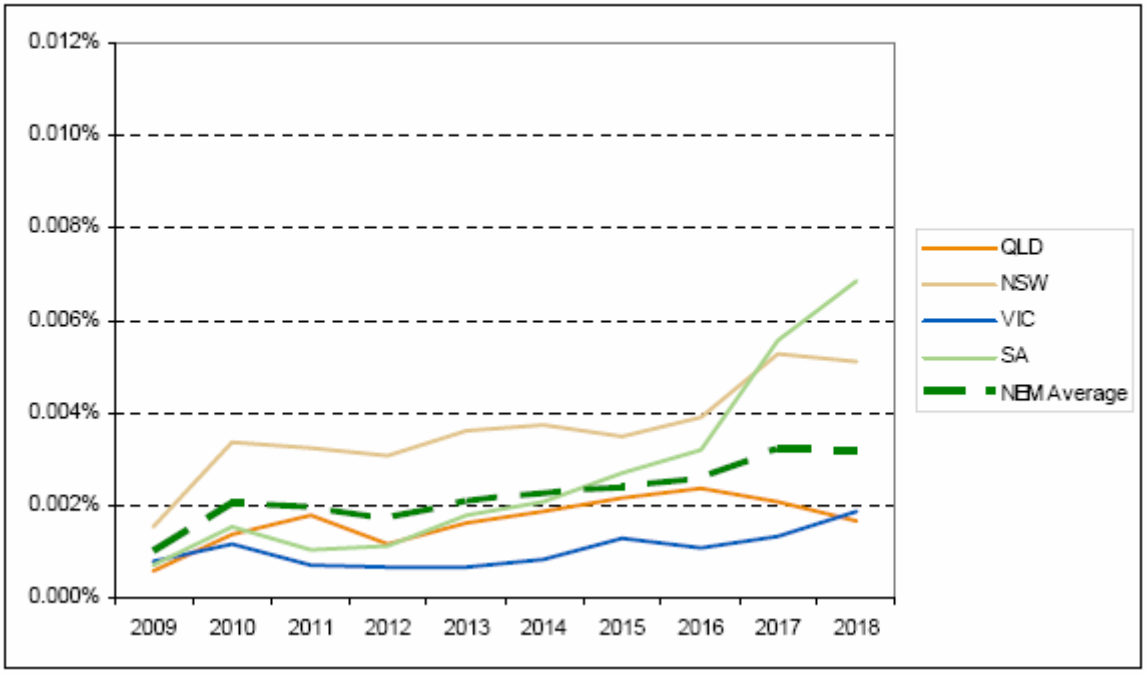
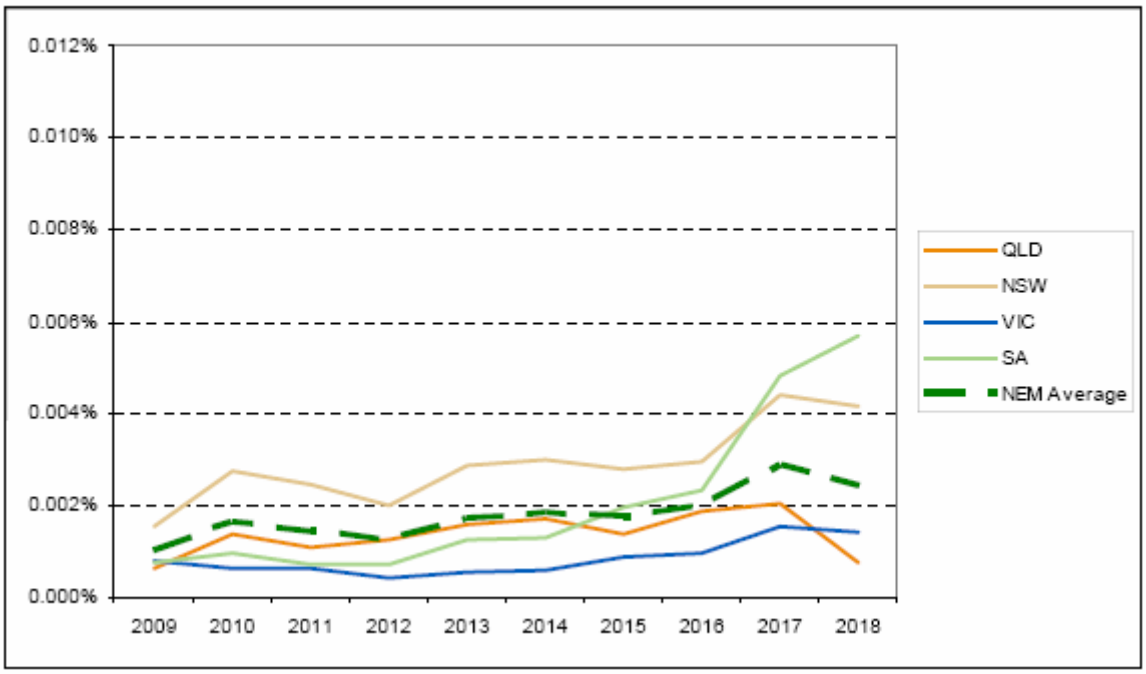


Figure 11: Annual USE by Region (VoLL $15,000/MWh nominal)



As CRA note in the appendix "In the analysis for the interim report we noted that considerable care should be taken in interpreting regional results and this caution also applies to the results reported here. In particular the timing of peaks and troughs for any single region and the relativity between regions at any given times should be regarded as indicative only." However the extensive modelling of Appendix E does indicate that raising VoLL would decrease the incidence of USE, and that leaving VoLL at its current level would result in a breach of the Reliability Standard sometime between 2010 and 2014, particularly when considering the conservative nature of the modelling in that it assumes a near ideal

market setting and does not allow for material increases in the costs of constructing new generating plant. Figure 21 of the modelling also indicates that USE increases in when VoLL is kept stable but capital costs increase, noting that an increase in capital costs of new generating plant has been a feature of the NEM in recent years, and is a feature which could continue in future years.

In considering its conclusion, the Panel also took into account whether the current situation reflected the fact that the market is still in transition as surplus capacity in different regions and transitionary pricing arrangements are wound back. It also considered whether an increase in VoLL to adjust for changing costs and risks might be likely to result in increased contracts and investment, in line with the market design assumptions, and also whether it may accelerate the emergence of deeper DSR.

6.4 Conclusion

The Panel has concluded that the prudent option is to adjust the existing price mechanism as a medium-term signal for investment and demand. It is proposing to recommend an increase in VoLL from the existing level of $10,000/MWh to $12,500/MWh to be effective from 1 July 2010. This is justified in light of the Panel's analysis which was undertaken against a conservative case of the construction costs of new generating plant and minimal market distortions and that clearly indicates a very likely breach NEM-wide and in a number of regions of the reliability standard after 2011.

Furthermore, the Panel believes that as there is a real risk on the horizon of breaching the standard, an incremental adjustment to the level of VoLL is warranted. The Panel notes there are risks relating to the future cost of generation construction and development as well as the implementation of other energy related public policy initiatives that would suggest that the time frame for its recommendation is appropriate. A higher level of VoLL should encourage investment in new generation and provide greater incentives for customers to participate in demand side responses.

The Panel has further concluded that embedding an annual indexation of VoLL in the Rules is not an appropriate feature because annual movements which produce dollar values for VoLL that are uneven are likely to produce unnecessary complexity in the trading market. In addition, the nature of selecting a single indexation measure itself (for example CPI-based or a construction cost index) is problematic. However, the Panel notes the support for the concept of indexation expressed in some submissions.[74] So as the level of VoLL is to be reviewed periodically, the Panel intends that assessing the relative indexed levels of VoLL would form part of the reference analysis for future considerations of the level of VoLL. This approach means that rather than an automatic increase that may not be required for reliability purposes, the level of VoLL can be assessed in the context of the regular review of the reliability standard and other settings.

[74] For example Macquarie Generation submission to the First Interim Report and South Australian Government submission to the Second Interim Report.

Table 4 – Final summary of the different options

	Status quo NEM	Targeted Reserve Mechanisms		General Reserve	Mechanisms
	Change VoLL	**Ancillary Service**	**Standing Reserve**	**Financial (Reliability Option/Capacity Options)**	**Availability Payment**
Impact on reliability	On balance increase against projections	Marginal improvement but extent dependant on investor response to increased certainty (but no change in contract duration)	Greater certainty - actual level depends on volume of standby or DSR	Greater certainty as total capacity centrally determined	Greater certainty as total capacity centrally determined and acquired
Investment for Reserve Plant	Stronger incentive but counteracted greater Willingness To Invest barrier	Improved due to increased certainty of revenue, but unlikely to affect contract duration.	Significantly improved due to certainty of revenue under contract	Significantly improved	Significantly improved
Operation	Increases operational risk but arguable if any material change in behaviour	Neutral or improved incentive to present reserve	Neutral	Potentially neutral if penalty set to EOM value but decreased if not	Neutral if penalty set to EOM value but decreased if not (difficult to make neutral)
Impact on existing generation investors	Increased revenue - reflect increasing plant costs (CPI), further increase dependant on level of DSR and industry structure	Increased for peak plant, little change for base, overall increased if VoLL unchanged or increased	No change - assuming standby is not designed to replace existing signals	Assume neutral overall if no change in reserve requirement but much increased certainty (assume any current contract premium reflected in price of Reliability Option)	Assume neutral overall if no change in reserve requirement but much increased certainty (assume any current contract premium reflected in capacity price)
Impact on customer price	Increased in line with change to generator revenue	Increased in line with changes to generation revenue	Increased to fund costs of standby plant and DSR	Neutral overall - in line with changes to generator revenue	Neutral overall - in line with changes to generator revenue
NEMMCO Implementation Cost	Very Low	Significant as requires settlement and dispatch changes.	Low - some impact on settlement system	Moderate - NEMMCO administration and settlement costs increase	Moderate - Does not affect dispatch systems. Potentially significant increase in settlement and compliance costs
Participant transition cost and disruption	Low	Moderate as will impact current cap contract environment	Low	High - Significant change	High - Significant change
Market Design (command/control) impact	No change	Minor (slight increase in central control)	Minor (slight increase in central control)	Significant change (central control of volume of reserve and facilitation of market)	Very significant (central control of price and volume of capacity)
Price volatility	Potentially increased	Moderate reduction	Moderate reduction	Significant reduction	Significant reduction

Table 5[75]

Summary of results for alternative designs and varying levels of VoLL

	Nominal VoLL Scenarios							Alternative Market Design		
	$5,000/MWh Nominal VoLL	$10,000/MWh Nominal VoLL	$12,500/MWh Nominal VoLL	$15,000/MWh Nominal VoLL	$17,500/MWh Nominal VoLL	$20,000/MWh Nominal VoLL	$30,000/MWh Nominal VoLL	RAS	Standing Reserve	Reliability Options
USE (max/min trendline)	0.0014% - 0.0085%	0.0004% - 0.0055%	0.0003% - 0.0032%	0.0002% - 0.0029%	0.0002% - 0.0025%	0.0007% - 0.0022%	0.0019% - 0.0021%	0.0014% - 0.0027%	0.0014% - 0.0027%	0.0018% - 0.002%
NEM Average Price (TW $/MWh)	42.28	43.98	43.46	43.54	43.41	43.66	46.32	41.42	40.12	27.69 Excludes separate Reliability Option Fee
Peak Generation: Utilisation Factor (%) for new entrant OCGT	n/a	10.63%	10.67%	10.61%	10.51%	10.47%	6.75%	10.11%	8.83%	2.27%
NEM Peak Generation (NEM wide average): Annual Average Price ($/MWh) received by new entrant OCGT	n/a	140.70	135.76	139.85	136.65	138.83	237.72	136.00	149.70	67.30
NEM Peak Generation (NEM wide average revenue:cost ratio for new entrant OCGT	n/a	1.00	0.99	1.00	1.00	1.00	1.06	1.29	0.99	0.90
Base Generation (new entrant coal): Utilisation Factor (%)	92.28%	93.57%	92.84	92.86%	92.87%	92.83%	93.11%	92.73%	93.38%	93.16%
Base Generation: Annual Average Price ($/MWh) received by new entrant coal	42.64	42.80	44.70	44.75	44.55	45.18	46.16	41.89	40.00	28.00 Excludes Option Fee (Assumes 100% energy contracts at $35/MWh)

[75] This table is reproduced from Table 6 of the CRA modelling Appendix E

7 Information Processes and Intervention Mechanisms

This chapter outlines the Panel's conclusions about further incremental changes to existing, and additions to the, reliability mechanisms.

The first of these is a new information gathering and dissemination mechanism to enable the market to forecast and respond to times where there may be energy constraints – the Energy Adequacy Assessment Projection (EAAP).

This chapter then looks at the current reliability safety net or "Reserve Trader" provisions in the Rules. It begins with an outline of the Reserve Trader as it exists currently, explains the Panel's reasoning in recommending the retention of the mechanism, although redesigned as a Reliability Emergency Reserve Mechanism (RERT). It then details the characteristics proposed for the RERT including a sunset period.

Next, it considers NEMMCO's power to issue reliability directions under clause 4.8.9 of the Rules and concludes that this power should be extended indefinitely with no sunset date.

Lastly, it makes some recommendations about the minimum reserve level methodology that NEMMCO uses to calculate the need to intervene with the Reserve Trader (and in future, the RERT).

7.1 Interim reports and context

In its First Interim Report on its Comprehensive Reliability Review, published in March 2007, the Reliability Panel indicated that it has provisionally formed the view that, notwithstanding the satisfactory performance of the NEM against the reliability standard to date, certain risks have been identified that may lead to insufficient or delayed investment in generation to meet demand and ensure reliability in the future. The Panel believed these risks can be managed and sought stakeholder feedback on the possible options that might address these risks.

Following the publication of the Panel's First Interim Report, there had been growing concern that the drought in south eastern Australia was having an increasing impact on energy availability in the NEM. Energy constraints, other than the short-term gas constraints experienced in South Australia, have not been experienced on the Australian mainland since the start of the NEM. The NEM design is predicated upon the key factor for long-term reliability being capacity of the bulk supply system, so the impact of energy constraints is a new phenomenon. The MCE subsequently requested advice from the Panel through the AEMC on these matters which was provided ahead of issuing the Panel's Second Interim Report in August 2007.

In that advice, and in the Second Interim Report, it was noted that it was uncertain how well the market would operate in terms of reliability with the presence of relatively widespread potential energy constraints. Furthermore it was noted that this would add to the risks on the horizon that had already been identified in the Panel's first Interim Report. The Panel proposed the following strategies to assist in managing these reliability risks:

- Improving the information available to the market participants and stakeholders to facilitate a better understanding of when and where energy constraints could potentially impact reliability (the EAAP);
- Allowing the market participants and other stakeholders to respond to that information; and
- Examining the future of the present reliability safety net (covered in Section 7.3); and
- Evaluating the future of NEMMCO's reliability directions power (which will sunset under the present Rules in June 2008).

The Panel considered that these risks, and in particular the risks associated with the drought, are material and that a timely and appropriate response was warranted. Therefore, the Panel addressed them in detail in an exposure draft contained in Appendix C of its Second Interim Report. In preparing this exposure draft, the Panel also had the benefit of the significant stakeholder consultation and detailed analytical work which has been already been undertaken as part of this Comprehensive Reliability Review. The Panel explicitly sought feedback on all aspects of the exposure draft covering the EAAP, the RERT (titled the RERM in that document), and NEMMCO's reliability directions power. The Panel has taken into account all feedback received on these issues and intends to submit a Rule change proposal to the AEMC in January 2008. The balance of this chapter therefore covers the final recommendations fro the Panel relating to these initiatives.

7.2 Improved information and market response

As discussed in Chapter 3, to date the NEM has been very reliable, with the greatest risk to the ongoing reliability being whether the market delivers sufficient new generating capacity in a timely manner.

To aid the market to deliver this capacity, the NEM market information systems provide projections of capacity reserves and, in situations when capacity reserves have been projected to be below those necessary to meet the reliability standards, NEMMCO has contracted for reserves in the affected region(s), as discussed in Section 2.3.3.

However, the Panel is concerned that the current market arrangements do not explicitly address the generation input constraints of the type (energy rather than installed capacity) being witnessed within the present drought. Therefore, the Panel is proposing the following enhancement to the NEM market information systems to better manage the potential impacts of energy constraints on reliability in the NEM through the introduction of the EAAP:

- Each quarter NEMMCO should publish a two year outlook of the impact of generation input constraints on reliability, to supplement the existing capacity-based projected assessment of system adequacy (MTPASA).

These quarterly EAAP projections of the impact of generation input constraints would be expected to operate in a similar manner to the projections of capacity produced by the two year outlook MTPASA. That is, periods of projected energy shortage would be expected to coincide with high energy prices which should encourage market responses. Such responses could include a market participant that indicates that it intends to reallocate energy from

periods of projected excess energy capability to periods of shortage, or the releasing of additional energy or water allocations, possibly in consultation with a jurisdiction. The quarterly two year outlooks would be expected to facilitate changes to the behaviour of existing generators and to the allocations of existing water and fuel resources as well as demand-side responses. The aim of this increased information availability is to provide the opportunity for market reaction to develop within the NEM based upon more comprehensive information.

The Panel also noted some concerns regarding the nature and scope of "generator models" to provide information for the EAAP. Based upon the submissions, the Panel's final version of the EAAP has adjusted the basis and methodology for these to be less intrusive as well as minimise commercial and operational risks.

The process and methodology for gathering and disseminating the information for the EAAP is briefly described as follows:

- The Panel will develop guidelines containing the parameters for scenarios which will guide the input data to be provided by participants. The specifics of the scenarios will be determined by NEMMCO following those guidelines.
- The Panel considers that as a matter of principle, changes to the input requirements from participants should minimise the level of practicable intrusion and additional costs of information provision, and limit the exposure of the commercial positions of the participants to that essential to inform the market of the generic energy constraints projected.
- The EAAP inputs are additional to the inputs that NEMMCO already receives for reserve adequacy projections. Thus the timeframes for MT PASA and EAAP inputs will be aligned.
- The nature of energy constraints can vary considerably between generating plants, and a 'one size fits all' approach to the modelling of the energy characteristics of generating plant is unlikely to be sufficiently flexible to deliver robust results.
- Each Scheduled Generator would be required to lodge with NEMMCO a 'Generator Energy Limitation Framework' (GELF) that NEMMCO can use in its assessments of energy adequacy. The nature of GELFs could be tailored by the participant to suit the technology of the generating plant, and the types of agreements the generator has with its fuel suppliers, jurisdictional water authorities or other relevant factors. Once defined, the GELF would require specific inputs in order to operate, and the participant must be under an obligation to provide those inputs (as described below) to suit its defined GELF. The Panel would need to consider the merits of making GELFs publicly available in the interests of transparency as is the case with the current ANTS modelling process.
- Once the GELF is defined for a particular generating plant, the Generator will be obliged to provide input parameters with the exact combination of inputs determined by the tailored GELF, so that some inputs may not be applicable to some generating plants. Some of these inputs will be confidential.
- The inputs will be provided for each scenario and for 24 future months from the start of the next modelling period.

- Inputs for each tailored GELF may include: maximum annual energy; forecast monthly energy; minimum and maximum monthly energies; dependencies between months; pumping strategies for energy storage; and anything else appropriate for each generator circumstance.
- NEMMCO would then publish monthly energy shortfalls for each region for each scenario based on 10% and 50% POE demand forecasts.
- Projected shortfalls would be published using each participant's preferred energy usage pattern and also when monthly energy allocations are optimised by NEMMCO. The difference between the two outputs would represent the 'gap' between current participants' preferences and the minimum USE outcome.
- There could be an update to the EAAP process if there is a material change in circumstances in the market.
- The EAAP will not be used as a trigger for intervention purposes.

For it to be able to prepare these projections, NEMMCO will need to be given additional powers to collect data from market participants under the National Electricity Rules (Rules) and other entities under the National Electricity Law (NEL). Therefore, these powers were included in the exposure draft of the necessary changes to the Rules for consultation upon as part of the Second Interim Report. As previously indicated, the panel will submit a formal Rule change proposal to the AEMC to give effect to the EAAP. The Panel will also raise matters relating to the NEL with the MCE.

In its Second Interim Report the Panel raised the prospect of NEMMCO incorporating a ten year outlook of the impact of generation input constraints on reliability into its annual Statement of Opportunities (SOO). However submissions and presentations have persuaded the Panel that any changes are superfluous as generation input constraints can already be managed and covered within the current SOO/ANTS process. The Panel has also concluded that a 10-year forward assessment is likely to be meaningless, since prediction of energy capability, particularly that affected by weather and water inflows, on a 10-year forward basis would be unrealistic.

7.3 Intervention mechanism

7.3.1 Operation of the Reserve Trader

Clause 3.12.1 of the Rules provides for a reliability safety net by conveying on NEMMCO Reserve Trader powers to contract for reserves if it projects low reserve conditions. The Panel has published guidelines governing how NEMMCO should exercise these Reserve Trader powers.[76]

The Reserve Trader provisions are due to expire by 30 June 2008 unless extended by a Rule change or terminated earlier by the AEMC (having regard to advice from the Panel). Furthermore, under the Rules, the Panel must recommend whether or not the reliability

[76] The revised guidelines governing NEMMCO's intervention powers were prepared by the Panel under clause 8.8.1(a)(4) of the Rules and are available on the AEMC website at: http://www.aemc.gov.au/electricity.php?r=20060525.143043

safety net should be removed prior to 30 June 2008. The Panel's review of the reliability safety net is incorporated in this Comprehensive Reliability Review.

Both the design of the Reserve Trader mechanism and the manner in which it is implemented have given rise to considerable dissatisfaction amongst stakeholders and have therefore been carefully reviewed by the Panel. Some of the key issues covered included:

- Whether, because the NEM can provide the same service more efficiently than NEMMCO, the Reserve Trader arrangements contribute to the market objective.
- The Reserve Trader was only ever intended as a temporary mechanism and its use should be seen as a market failure. Such a failure should trigger a major review of the market trading arrangements and market sustainability.
- In the event of NEMMCO activating the Reserve Trader provisions, there is no guarantee that the required capacity or DSR will be available.
- The current short-term Reserve Trader does not induce new supply into the market, because it is invoked only months before the perceived shortfall and therefore relies primarily on demand responses.
- Interventions should be treated as exceptional and subject to external scrutiny. In 2001, for example, NEMMCO directed a power station to defer a unit outage by two days. The benefit in terms of avoiding a very low risk of shortfall was far outweighed by the resulting NEM-wide compensation cost of $23m.
- Retailers argue that the current Reserve Trader mechanism creates an unhedgeable and unpredictable levy upon them. To date, however, these costs have been low.
- The current reliability safety net provisions impede the NEM from delivering efficient market-based responses to supply shortfalls and result in inefficiencies being passed on as costs to consumers. In particular, the Reserve Trader interferes with the efforts of retailers to contract DSR. This reduces the ability of the market to respond on its own, because retailers have relationships with consumers and are thus better placed to negotiate DSR contracts than is NEMMCO.
- The names and plants of tenderers of DSR should be published so that the market can advise NEMMCO whether the capacity is in fact already available to the market by other means.
- Some stakeholders argue that energy-only markets without active DSR tend to have "boom-bust cycles", that an energy-only market is unlikely to provide the necessary long-term signals to build new base and intermediate load generation, and that intervention is therefore essential and inevitable.[77]

7.3.2 Future of the present reliability safety net

The present reliability safety net provisions in the Rules allow NEMMCO to contract for capacity reserves (the Reserve Trader) when a shortfall of reserve is projected. These reserves can be dispatched by NEMMCO when customer loads would otherwise be shed. Under guidelines prepared by the Panel in accordance with the Rules, distortion to the market is minimised by only allowing NEMMCO to enter into Reserve Trader contracts within six months of a project shortfall.

[77] NewGen Power submission to the Issues Paper.

On balance, the Panel has reached the conclusion that, although the Reserve Trader provisions are a market distortion which would not be necessary under ideal conditions, the prevailing market conditions are such that a revised form of the provisions needs to be maintained for a defined period of time. Ideally, in the longer-term, the market should be able to operate without the need for a distortionary intervention mechanism.

As discussed in Chapter 1, the Panel observed that the NEM's reliability performance has, historically, been bolstered by generation capacity overhang in some regions. This has perhaps made the reliability standard of 0.002% USE an easier benchmark to perform against than would otherwise have been the case in a system starting with a tighter supply-demand balance. The performance of the market in the sort of tighter supply-demand conditions that is likely to be experienced over the next few years has never been tested. Therefore, the Panel considers that the removal of a key safety net provision such as the Reserve Trader would not be prudent at this stage.

Nevertheless, the Panel acknowledges, and agrees with, the views of several market participants (for example International Power Australia and Loy Yang Marketing Management Company Limited[78]) that the enablement of the Reserve Trader should be viewed as a failure of the market to deliver reliability.

The Panel also acknowledged the support of some market participants and stakeholders for retaining the Reserve Trader including the South Australian Government who state that:

> "Given the (SA) Planning Council's modelling and the fact that Reserve Trader has had to be implemented over the last two summers in Victoria and South Australia due to forecast shortfalls in reserve margins, the State Government considers there is a strong case for its retention, albeit with enhancements deigned to promote broader capacity options than just demand side responses."

In its submission to the Issues Paper, Major Energy Users stated that:

> "The $2.7m [average of the two years] contracted by NEMMCO each year of 04/05 and 05/06 to secure adequate supplies needs to be considered in light of the $6.7Bn traded through the NEM spot market for power supplies in 2006."

In its Second Interim Report the Panel concluded that although it is a market distortion, on balance the costs are minimal when compared to the costs in the market overall and that if better specified, the mechanism could be less of a distortion.

Therefore the Panel recommends that, on balance, a redesigned Reserve Trader (the Reliability Emergency Reserve Trader (RERT)) should be implemented for the short-term to assist maintaining the future reliability of the NEM. (In the Second Interim Report and Exposure draft this mechanism was called the "Reliability and Emergency Reserve Mechanism or RERM. Following consultation the Panel believes the RERT title more accurately reflects the nature of the intervention mechanism.)

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78 International Power Australia and Loy Yang submission to the First Interim Report.

As noted above, there have been some issues raised by participants concerning the operation of the current Reserve Trader mechanism. These concerns include potential "double dipping" by parties providing Reserve Trader cover, and the arguably conservative forecasting of demand leading to the enacting of the Reserve Trader when perhaps it is not needed. Consequently, the Panel is recommending a revised Reserve Trader scheme to operate for up to four years.

The "double dipping" issue had been addressed to some extent by the Panel in proposed guidelines for the redesigned Reserve Trader, the RERT. Prospective providers of capacity under the RERT will be required to give undertakings that the capacity is not contracted to another entity, such as a market participant. The Panel has acknowledged NEMMCO's efforts to improve the reliability of its forecasts[79], including the improvements in the demand forecasts for 2007, and has proposed that NEMMCO report to the Panel each year (this is discussed further in Section 8.3.1) on the accuracy of the most recent SOO demand forecasts, and on improvements in the forecasting process that will be used to prepare the subsequent SOO. These improvements will also assist both the potential for market responses for reliability and also the operation of the RERT.

7.3.3 The Reliability and Emergency Reserve Trader (RERT)

The proposed RERT incorporates incremental improvements in the design of the existing Reserve Trader and has been designed to impose minimal distortion on the operation of the NEM while increasing NEMMCO's flexibility when contracting for reserves.

Under the current Reserve Trader arrangements, NEMMCO is only able to contract for capacity reserves up to six months in advance of a projected shortfall. The consequence of this short lead-time is that there are only a limited number of potential sources of reserve capacity available. The Panel anticipates that extending this timeframe will increase the range of entities willing to offer reserve contracts, increasing competition and hence reducing the procurement cost, although the Panel is mindful that allowing NEMMCO to procure reserves too far in advance of the projected shortfall may distort investment in new generating plant. On balance, the Panel is recommending that under the proposed RERT, NEMMCO would be able to contract for reserves for up to nine months in advance of a period where the reserves are projected to be insufficient to meet the reliability standards. While this is a modest increase in time period, combined with the next feature – recontracting – the RERT should be able to secure a wider range of generation and demand responses.

NEMMCO currently only has one opportunity to tender and enter into contracts under the Reserve Trader. This rigid tendering and contracting timetable may mean that NEMMCO is restricted from entering into the most efficient reserve contracts. Under the proposed RERT, NEMMCO would be able to contract further in advance of a projected reserve shortfall and it would therefore be desirable to allow NEMMCO to undertake multiple rounds of tendering and contracting when selecting the optimal portfolio of reserve contracts to cover a projected shortfall. Such a rolling tendering process would also allow NEMMCO's reserve contracting to be informed by the updated quarterly projections of the impact of generation input

[79] Acknowledging also that many inputs used by NEMMCO in its forecasts are prepared by Jurisdictional Planning bodies.

constraints, and the associated market responses. NEMMCO will also be able to negotiate with a previous tenderer if a projected shortfall arises at short notice. This would be more efficient than relying on directions later.

Like the current Reserve Trader, the proposed RERT would operate on a regional basis. That is, NEMMCO would only contract for reserves in the region, or regions, projected to be in a reserve shortfall. In addition, NEMMCO would continue to be required to consult with the Jurisdictions from the affected regions before entering into reserve contracts. Also, NEMMCO would recover its costs from Market Customers in the affected regions on a basis that is agreed with the associated Jurisdictions. The Panel seeks further feedback from stakeholders as to equitable cost recovery arising from reserve shortfalls in importing regions which could be consequent on actions potentially taken in exporting regions.

The Panel is recommending that the proposed RERT have a sunset in four years, and that prior to this date, the Panel be required to review the operation of the RERT, including whether the RERT should be retained beyond its sunset. The Panel is recommending that this review be completed within three years of the operation of the RERT as part of the next review of reliability settings. The Panel is further recommending that the RERT could be removed prior to the four year sunset if its review were to so recommend that step to the AEMC.

Under the current arrangements, the Reserve Trader's operating costs are recovered from Market Customers (in affected regions) at the end of the reserve contract period. The Energy Retailers Association of Australia (ERAA) expressed concern that the cost of the current Reserve Trader varies from year to year, and that a more stable long-term arrangement should make costs recovery less of an issue for its members.[80] An alternative arrangement that attempts to address the ERAA's concerns is to spread the costs over a number of years by recovering the costs of the RERT from a fund that is administered by NEMMCO. However, the Panel considers that such a fund, applied to a mechanism with an explicit sunset date, would be problematic to administer and that the costs arising from the use of the RERT should be recovered as needed.

Nevertheless as part of its recommendations, the Panel will request that NEMMCO examine the arrangements for covering the cost of Reserve Trader, in consultation with stakeholders, and see if any improvements are possible at an operational level. In addition, this examination will also cover NEMMCO considering further improvements to the nature and form of RERT contracts to facilitate participation including by demand-side responses.

The power that enables NEMMCO to operate the current Reserve Trader is provided in the Rules, and in a set of guidelines prepared by the Panel in accordance with clause 8.8.1(a)(3) of the Rules.

To enable consultation on the RERT, the Panel developed an exposure draft of a proposed Rule change and associated revised guidelines for NEMMCO. This exposure draft was published as an Appendix of the Second Interim Report and feedback was sought from stakeholders on all aspects of the exposure draft. The exposure draft, which included a proposed Rule, also included the Panel's recommendation that the need for, and

[80] ERAA submission to the First Interim Report.

effectiveness of, the proposed RERT mechanism be reviewed after three years and contain a sunset provision.

Detailed responses were received and the version of the proposed Rule which the Panel intends to submit to the AEMC in January 2008 has benefited from suggestions made through submissions. The Panel acknowledges that the MCE received its advice that it would proceed with a recommendation to create a re-designed reserve trader and that a range of stakeholders supported the proposal in their submissions including EnergyAustralia, the ERAA and TRUenergy. The latter, despite an opposition to the Reserve Trader in general, stated "If the Reserve Trader is to continue, we believe that several of the alterations proposed will be beneficial".[81]

The Panel also notes that repeated or increasing use of the RERT would be a lead indicator for accelerating Panel reviews of reliability.

7.4 The Reliability Directions Power

Another consideration the Panel has had to address as part of its analysis of mechanisms to maintain power system reliability is the power of NEMMCO to issue reliability directions under clause 4.8.9(a) of the Rules. This is an urgent issue as the power is due to expire at 30 June 2008. This matter was explicitly raised in the Second Interim Report and the exposure draft rule proposal. The overwhelming view of stakeholders supported by the Panel's analysis is that these directions powers are a necessary part of the overall reliability settings for the market.

It is the Panel's recommendation that this power should be retained by NEMMCO and that the current derogation time limits on the directions power should be replaced with an explicit Rule. This matter will also be included in the proposed Rule change package to be submitted to the AEMC in January 2008.

7.5 Calculation of reserve margins

NEMMCO operationalises the NEM reliability standard by estimating the MRLs required in each region to meet it and enabling the Reserve Trader (and the RERT if adopted) if a shortfall is forecast. NEMMCO determines the MRLs using Monte Carlo simulations of the operation of the NEM including:

- Forecasts of maximum demands and annual energy consumption by region;
- Historical regional load traces adjusted for forecasts and, in some cases, for diversity;
- Price-sensitive demand-side response;
- NEM generating units, including committed new developments;
- Random generator failures based on a survey of historical forced outage rates; and
- Network constraints.

[81] EnergyAustralia, ERAA and TRUenergy submissions to the Second Interim Report.

NEMMCO reviews its analysis of MRLs whenever there is a material change to the NEM power system, such as an augmentation to an interconnector or the addition of a new large generating unit. In recent years, NEMMCO has reviewed its calculations every 1 to 2 years, with the most recent assessment being published in November 2007.[82]

During the Review the issue of whether NEMMCO's calculation of reserve margins may be too conservative was raised. A perceived consequence of this has been that in two separate years NEMMCO has contracted for reserve but not been required to dispatch it, although the Panel notes that reserve margins allow for unexpected generator failure and not dispatching contracted reserves can also be a consequence of the conditions not arising for their need. The cost of the reserve was then passed on to consumers.

In October 2004, NEMMCO engaged KEMA Consulting to independently review the methodology and assumptions it used in its 2003/04 determination of MRLs.[83] KEMA found that NEMMCO's approach 'is as good or better than typical international practice'. The most substantial recommendations made by KEMA relate to the representation of generator outages. Consequently NEMMCO and the National Generator Forum formed a joint working group, the Forced Outage Data Working Group, to address this issue.[84]

Despite the concerns expressed above, submissions to the Issues Paper and Interim Reports indicate that stakeholders generally accept that NEMMCO is still the most suitable entity to calculate MRLs and that its methodology is appropriate. The Panel also agrees with this viewpoint.

The Panel agrees that NEMMCO should continue to calculate the MRLs because it already performs similar analysis in the SOO and ANTS and has the appropriate knowledge, skills and information. The Panel also agrees that NEMMCO's approach is appropriate and consistent with international best practice.

The Panel also considers that approval of the MRLs should remain the responsibility of NEMMCO and not the Panel. Under the NEL, the Panel's role is to monitor, review, report and give advice on reliability in the NEM, whereas NEMMCO has a more direct operational role and has existing responsibilities for maintaining system reliability and security.[85]

Nevertheless the Panel acknowledges that the process for operationalising and calculating the MRLs is complex, particularly in an environment where the supply-demand balance is much tighter than the earlier history of the NEM. The Panel notes the concerns raised by some stakeholders, particularly the South Australian Government who stated "that the Rules should require guidelines to be issued to provide NEMMCO with clarity on the

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82 NEMMCO's MRL analysis is available on its website at http://www.nemmco.com.au/powersystemops/240-0024.htm.

83 The KEMA report "Review of Methodology and Assumptions Used in NEMMCO 2003/04 Minimum Reserve Level Assessment, 11 January 2005 is available on the NEMMCO website at: http://www.nemmco.com.au/powersystemops/240-0009.htm.

84 The Forced Outage Data Working Group Terms of Reference, formed in conjunction with the NGF, is available on the NEMMCO website at http://www.nemmco.com.au/powersystemops/240-0021.pdf.

85 Section 38(2) of the NEL defines the functions and power of the Panel. The role of approving the MRLs could be conferred on the Panel under section 38(2)(c) but this would generally be inconsistent with the functions and powers prescribed in sections 38(2)(a) and 38(2)(b).

methodology for calculating MRLs, and require NEMMCO to undertake a transparent consultation process prior to changing the methodology for establishing reserve levels".[86]

Therefore, given its advisory and monitoring role, the Panel will establish a taskforce in 2008 to look specifically at the methodology and process for calculating MRLs, especially where the MRLs are applied across more than one jurisdiction. This taskforce will comprise of NEMMCO, industry and jurisdictional representation and will be chaired by a member of the Panel.

7.6 Benefits to Stakeholders

The key benefits gained by stakeholders from the EAAP, RERT, NEMMCO's extended power to issue Reliability directions and seeking improvements in MRL calculating methodology are:

- Lower levels of USE through greater market information leading to improved market response;
- Lower levels of USE through improved responses by NEMMCO to forecast capacity shortfalls;
- Improvements in the form and nature of reliability interventions; and
- Reduced pressure in the medium-term on more substantive tightening of other reliability settings.

[86] South Australian Government submission to the Second Interim Report.

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8 Other Recommendations and Conclusions

This chapter discusses other aspects of the NEM and reliability on which the Panel has reached conclusions to enhance the market's reliability performance. Issues are grouped under the following headings:

- Reliability Price Mechanisms other than VoLL (the CPT, MFP and APC);
- Misconceptions about market prices;
- Operational and Administrative issues; and
- Future Reliability Reviews.

Where relevant these recommended changes will be included in two further Rule change proposals to the AEMC. These Rule change proposals are expected to be submitted in the second and third quarters of 2008 and will include an exposure draft consultation process by the Panel in reference to the proposed price mechanism changes.

8.1 Price mechanisms

8.1.1 Treatment of the CPT

The CPT was established as part of the changes to the level of VoLL in the NEM. The CPT is an explicit risk management mechanism designed to limit participants' financial exposure to the wholesale spot market during prolonged periods of high prices. It is also designed not to hinder investment in that the CPT is set at a level that is unlikely to be triggered except in very extreme circumstances.

Currently, CPT is set at $150,000. This means that if, over a rolling 7-day period (336 half-hour trading intervals), the cumulative sum of the wholesale market spot prices equals or exceeds this threshold, then NEMMCO is required to impose an administered price cap such that spot market prices do not exceed $100/MWh during peak times and $50/MWh in off-peak times. This price cap remains in place until the sustained high prices falls away.[87]

A number of criticisms of the current CPT mechanism have been raised with the Panel including:

- It rewards participants who do not appropriately manage their hedge positions;
- The administered price cap is set at a level that would interfere with normal contracts, harming prudent retailers; and
- It would expose retailers to an unhedgeable risk during an administered price period because they are required to pay their share of the compensation to generators whose costs exceed the administered price.[88]

[87] Due to the nature of the CPT, this may take up to 7 days.

[88] Supplementary commentary from AGL subsequent to their submission to the Issues Paper.

In 2002 NECA had conducted a review of capacity mechanisms in parallel to the Reliability Panel's review of VoLL and an earlier proposed increase of VoLL to $20,000/MWh was to be accompanied by the introduction of the CPT and an increase in the value of the administered price cap (APC) to $300/MWh during peak times and $150/MWh during off-peak times. At the time the CPT was to be set to $300,000. Modelling had shown that this level of the trigger was equivalent to the force majuere provision then in place and would allow an OCGT to make a reasonable return from an extreme event before the CPT was triggered.

In 2002, the ACCC did not allow VoLL to increase to $20,000/MWh due to participant concerns and instead substituted a value of $10,000/MWh. It also reduced the CPT to $150,000. NECA also failed to increase the APC. This has left the situation where the CPT is considered to low by many participants and concerns that, if triggered, the APC would interfere with prudent retailer contracts.[89]

The Panel considered key issues, both of which have been raised in stakeholders' submissions:

- Is the current level of the CPT appropriate?
- Should the CPT financial threshold be augmented with physical triggers?

Is the current level of the CPT appropriate?

The CPT was first set in the NEM at $75,000 per MW which allowed an OCGT to recover 3 years of capital costs from an extreme event before the CPT was triggered.[90] Since then, however, the cost of OCGTs has increased (from approximately $50,000 to $75,000/MW) and the value of VoLL has increased (from $5,000 to $10,000/MWh). However, the CPT level remains unchanged, which in effect has halved the ratio between the CPT and VoLL. The overall impact of these changes is that, if the CPT were triggered, less of the capital cost of an OCGT would be recovered during a single event. Notwithstanding this, the CPT level has not been exceeded since the NEM commenced, even in periods of high prices. By way of example, the Victorian price spikes on 16 January 2007 resulted in a rolling seven-day price of only ~$91,000, meaning that another similarly priced day in the six days to 22 January would have triggered the APC. The closest the CPT has been to being breached was in June 2007 in NSW when the rolling seven-day price reached ~$135,000.

The Panel notes that the events of June 2007 caused considerable financial stress to some market participants as NEMMCO's prudential requirements increased as a direct result of those high prices. One retailer exited the market in these circumstances. A major increase in the CPT may exacerbate this position.

The modelling undertaken by the Panel indicates that any lowering of the CPT would result in an increase in the number incidences where the USE would be exceeded, while an increase would not result in any reduction in USE.

Taking the above into account, the Panel believes that the current relative level of CPT (that is, 15 times VoLL) remains consistent with the philosophy that underpinned its creation,

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89 Ibid.

90 During a 30-minute trading period a generator delivers 0.5 MWh for each MW of its output. Therefore, for an accumulated price of $150,000, a generator receives $75,000 for each MW it produced.

namely to act as a financial safety net without hindering investment. Given that the CPT would only be exceeded in extreme conditions, and that raising it would only add to the financial risks imposed on market participants, the Panel's conclusion is that the level of the CPT, relative to VoLL, should remain unchanged. Thus given the Panel's recommendation to incrementally increase its level to $12,500/MWh from 1 July 2010, the Panel is therefore recommending that the CPT be defined in the Rules as 15 times VoLL. If these recommendations were accepted, and the level of VoLL were to move to $12,500/MWh, then the CPT would be reset to $187,500 at 1 July 2010.

Should the CPT financial threshold be augmented with physical triggers?

The CPT does not distinguish between 'market failure' events (including events that the reliability mechanisms were not intended to address) and normal high price outcomes.

The Panel notes the views of some market participants such as the ERAA who argue for a physical trigger to the CPT.[91] However the Panel is concerned that the introduction of physical triggers may lead to administered prices being applied (or not applied) arbitrarily. Furthermore, it is the Panel's view that because the risk to participants is a financial one, only the existing financial triggers should apply. The Panel's conclusion therefore is that the CPT should not be augmented with physical triggers.

8.1.2 The Administered Price Cap

The Panel notes that the APC is currently the subject of consultation with stakeholders under an active review by the AEMC, as was recommended by the Panel in its Second Interim Report. The Panel also notes that a market participant has lodged a Rule change proposal with the AEMC relating to the compensation regime should administered prices be triggered.

8.1.3 The Market Floor Price

The Panel's modelling states that "the level at which it is set is unrelated to investment signals" implying its setting will have little or no effect on USE. There being no stakeholder calls for a change in the level of the market floor price and following modelling analysis, the Panel proposes to leave it unchanged at -$1,000.

8.2 Addressing misconceptions about market prices

Increasing spot prices due to low reserves or system security events make sensational news and cause community discomfort. For example, the Victorian blackout on 16 January this year prompted reports that 'the spot market price had soared to $10,000 during the crisis' (AAP) and headlines such as 'Spot Prices Soar' (Power Industry News)[92]. The political

[91] ERAA submission to the Second Interim Report.

[92] AAP, 19 January 2007; Power Industry News, Edition 525, 22 January 2007, p.10.

unacceptability of high spot prices generally is discussed by Henney and Bidwell[93] and by PWC[94].

Spot prices are indeed volatile, but it is simplistic to assume that market participants – generators and retailers – are fully directly exposed to them. In fact, most load is heavily hedged, sometimes up to or even over 100%, through financial contracting. The public focus on spot prices therefore has the potential to create a false impression and exaggerate the true financial risks of participating in the NEM.

Contributing to this misconception is the fact that spot prices have greater 'visibility' than long-term contract prices. Spot prices are easily accessible on NEMMCO's website and in its SOO, and are regularly published by third parties such as NEM-Watch. In contrast, although information about long-term contract prices is published, it is perhaps not so readily available and it is certainly not receiving adequate recognition from politicians and the media.

The Panel therefore observes that, wherever possible and despite the inherent difficulties with such information disclosure, long-term contract prices, such as those traded on the SFE, should be published alongside spot prices so as to create a more balanced and accurate understanding of market participants' true financial exposure in extreme conditions. While only indirectly related to reliability itself, such an improvement in the comprehension of the overall market would assist with the future development and understanding of the reliability settings, particularly the price mechanisms.

8.3 Operational and Administrative issues

8.3.1 Demand forecasting

The operationalisation of the reliability standard depends on accurate projections of the maximum demand. If the projections are too high, NEMMCO will tend to intervene with its Reserve Trader or reliability directions powers too often. If the projections are too low, there is an increased risk of USE due to inaction by NEMMCO to avoid untimely generator maintenance.

The Panel notes the concern, shared by many stakeholders, that demand forecasts have been systematically too conservative, particularly at the 10% POE demand levels that underpin Reserve Trader intervention, and that consequently NEMMCO intervenes too often using the Reserve Trader at great cost to consumers. For example, in the summers of 2004/05 and 2005/06, NEMMCO contracted for reserves but ultimately did not need to dispatch them.[95] The combined cost of these interventions was $5.4m, which was passed on to consumers. As discussed in Section 7.3.2 the Panel notes this amount is small compared to the overall value of the market.

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93 Alex Henney and Miles Bidwell, POWER UK / ISSUE 122 / APRIL 2004, "Will *NEAT ensure generation adequacy?"*

94 Independent survey of contract market liquidity in the NEM, report by PWC for the National Generators Forum and Energy Retailers Association of Australia (November 2006).

95 As discussed in Section 7.5 there may be other reasons for the non dispatch of contracted reserves.

The Panel recognises, however, that NEMMCO is taking steps to continue to improve its demand forecasting. In late 2004, NEMMCO engaged KEMA Consulting[96] to independently review its process for preparing the SOO's load forecasts (see also Section 7.5). NEMMCO is evaluating KEMA's recommendations as part of its continual improvement processes.[97] Similarly, the demand forecasting methodologies utilised by the Jurisdictional Planning bodies, which feed into NEMMCO's forecasts, are also the subject of continual improvement processes.

On balance, the Panel acknowledges NEMMCO's continuous improvement processes, including the improvements in the demand forecasts for 2007, and has decided to recommend that NEMMCO report to the Panel in November each year on:

- The accuracy of the most recent SOO demand forecasts; and
- Any improvements that have been incorporated into the process used to prepare the SOO forecasts.

8.3.2 'Share the pain' guidelines

The South Australian region is unique in the NEM because the reliability standard is operationalised by NEMMCO using MRLs for the combined Victorian and South Australian regions. South Australia accrues unserved energy (USE) in two different situations:

- When there is a shortfall of generation in South Australia alone and the Victoria to South Australia interconnector is at its transfer limit; and
- When there is a shortfall of generation in the South Australian and Victorian regions combined and the Snowy to Victoria interconnector is at its transfer limit.

In the first scenario, load is shed in South Australia alone. In the second scenario, load is shed in Victoria and South Australia proportionate to demand in each region; that is, in accordance with the 'share the pain' rule.[98] Taken together, this means South Australia is in double jeopardy of having to shed load and accrue USE.

This has potential implications for the 'share the pain' guidelines. Arguably, because South Australia is at greater risk of accruing USE than Victoria, whenever the second scenario arises Victoria should be required to 'share *more* of the pain'. As TRUenergy's submission notes: if NEMMCO is targeting 0.002% USE in the South Australian region and there are two scenarios where USE can occur in that region, then the reliability for Victoria would be expected to be less than 0.002%.[99] TRUenergy argues that under the 'share the pain' rule it is not possible to achieve an optimal reserve allocation.

TRUenergy state that "the current conservative reserve allocations are due to limitations imposed by the 'Guidelines for management of electricity of electricity supply shortfall

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96 KEMA (June 2005). 'Review of the process for preparing the SOO load forecasts.' http://www.nemmco.com.au/nemgeneral/419-0012.pdf.

97 Further information is provided in Section 3.8.3 of the 2006 SOO.

98 In accordance with the Reliability Panel "Guidelines for management of electricity supply shortfall events", published by NECA in September 1998.

99 TRUenergy supplementary submission to the Issues Paper.

events' issued by the Reliability Panel in September 1998". [100] Early in 2008, Panel will initiate consultation on these guidelines with stakeholders, which in any case have not changed in 9 years, and implement amendments to them if appropriate.

8.3.3 Short and medium capacity reserves

At present NEMMCO calculates MRLs on a medium-term basis. NEMMCO then uses these medium-term MRLs to assess the adequacy of forecast reserve levels in both the medium-term (months or years) and the short-term (hours or days).

As discussed in the First Interim Report, an alternative would be for NEMMCO to calculate short-term MRLs as well, to better reflect the prevailing demand conditions that apply in the short-term.

The Panel's view is that the short-term reserve requirements are likely to be lower than those in the medium-term because more information is available on the system conditions, including the maximum demand and generator availability. Therefore, the Panel considers that a review by NEMMCO of the allowable short-term minimum reserve levels should be undertaken. To this end, the Panel will seek to have NEMMCO undertake this review of the level of short-term reserves that should be used in short-term PASA during 2008.

8.3.4 Renaming VoLL to Market Price Limit

As noted earlier, the price at which customers would rather have interrupted supply is variable across customer classes, and indeed individual customers, as well as being variable across season, day of the week and time of day. Accordingly the Panel believes that the use of the term VoLL to describe what is clearly a market price cap is misleading as a true VoLL would be based on a theoretical price at which customers would rather have interrupted supply than pay the market price for electricity as opposed to a level of VoLL in reference to projections of meeting a USE reliability standard. For this reason the Panel recommends changing the name from VoLL to the Market Price Limit (MPL). The would also bring the titles of the two terms which define the wholes price ranges in the NEM into alignment – the Market Price Limit and the Market Floor Price.

8.4 Future Reliability Reviews and Reporting

Currently, the only arrangement in place for regularly reviewing any of the reliability settings is the Panel's annual review of VoLL.

For the VoLL review, the Panel recommends by April each year the level of VoLL as it will apply from July two years hence; in other words, it is a rolling three-year schedule. As part of the same review the Panel may also decide, in unusual circumstances, to amend the level it set the previous year; in this case, the re-set level would not of course take effect until July *one* year later. In effect, this gives market participants 26 months' advance notice of changes to VoLL, except in unusual circumstances in which case there may be 14 months' notice. It should be noted that any recommendation by the Panel would then be the subject of a Rule change proposal to the AEMC.

[100] TRUenergy submission to the Second Interim Report.

There are two key issues here:

- Should there be longer-term certainty about the level of VoLL?
- Should all the reliability settings be reviewed on a regular and integrated basis?

Should there be longer-term certainty about the level of VoLL?

The NEM objective is directed to the long-term interests of consumers. Consumers have a direct interest in the future settings which influence price.

Investors seek as much certainty as possible about potential returns on their investments. Certainty is affected by how often VoLL changes and how long the notification period for such changes is.

Advance notice of any change to VoLL is necessary so that market participants can adjust their risk management arrangements accordingly and make any other necessary adjustments to trading conditions such as the level of contracting that might be appropriate for a material change. The volatility of revenue for investors in peak plants will be more affected by changes in the level of VoLL than will revenue for investors in base load plants.

Suggestions have been made that, for example, the level of VoLL should be adjusted only on request from a market participant to the Panel (followed by the necessary Rule change proposal to the AEMC if the Panel agrees with the market participant), or that it should be fixed for a longer period of, say, two years.

The central issue here, for consumers and investors, is the trade-off between certainty and opportunity. Fixing the level of VoLL for too long risks inefficiencies if the level is higher than needed, and it risks greater use of the market safety net if the level is too low.

Should all the reliability settings be reviewed on a regular basis?

The second issue concerns whether or not there should be a regular review of all the reliability settings. The Panel's view is that all the settings have an effect (though not necessarily an equal one) on USE and so should all be reviewed together. This will also mean that any adjustments to the settings, to ensure the reliability standard is met, will be more effective.

The Panel's conclusion covered in the Interim Reports was that VoLL should be reviewed less frequently than every year, and that it was more appropriate to review its level in conjunction with a regular and integrated review of all the reliability settings.

Accordingly, the Panel proposes to recommend in its second Rule change package to the AEMC in early 2008 that the current annual review of VoLL be replaced with a Reliability Standards and Settings Review (covering the reliability standard, VoLL, CPT, the market floor price, and any other safety net, emergency reserve or reliability mechanism) which is to take place every two years. Any change to the settings would occur two years later at which time the two yearly review cycle would reset. The Panel raised these matters in its Interim Reports. It acknowledges the overwhelming response from stakeholders in support of an integrated reliability review process not undertaken annually. Based upon feedback from stakeholders and further analysis, the Panel believes the "two plus two" concept represents

an appropriate balance between certainty for consumers and investors on one hand; and the need to maintain appropriate and timely vigilance in relation to overall NEM reliability performance.

As the first comprehensive and broad ranging Review covering all the reliability settings since the inception of the NEM, together with an expansion of the Review's Terms of Reference to accommodate additional work for the MCE and AEMC, this Review has been extensive in time and scope. The Panel believes that the future regular biannual reviews of the Standard and settings would be expected to be able to be completed in a very much shorter period of time against defined criteria in the Rules. In addition, the Panel will manage its work program against the two-yearly cycle to enable ongoing information collection that would facilitate a shorter period to undertake the review.

The Panel also recognises the support from stakeholders for the release of the Annual Market Performance Report (AMPR) relating to reliability and security. The Panel recommends that this important information document continue. In the past two years the Panel has made progressive improvements to the range and scope of the information included in the AMPR. The Panel will continue to develop the report in line with stakeholder feedback and suggestions.

8.5 Conclusion, timing and the way forward

In essence, the Panel has made a set of recommendations that it believes are prudent, responsive, and balanced to assist the NEM achieve the appropriate level of reliability into the future. These recommendations address: confirming and clarifying the Reliability Standard in the NEM; adjusting the existing reliability price settings for the medium-term such as VoLL; improving the reliability intervention mechanisms including the 'reserve trader'; increasing the range and quality of information on reliability matters to assist the market particularly for potential energy constraints. In addition, the Panel proposes processes for future reviews of reliability and a number of work streams for the Panel and NEMMCO to improve the operational aspects of the reliability settings.

As the first comprehensive and broad ranging Review covering all the reliability settings since the inception of the NEM, together with an expansion of the Review's Terms of Reference to accommodate additional work for the MCE and AEMC, the Review has been extensive in time and scope. Future regular biannual reviews of the Standard and settings would be expected to be able to be completed in a very much shorter period of time against defined criteria in the Rules.

The conclusions and recommendations in this Report will be implemented by three Rule change packages to the AEMC, as well as a number of separate pieces of action that the Panel will incorporate into its work program in 2008. The timetable for all work streams, summarised in Figure 1 on page xviii, arising from this Review are as follows:

8.5.1 Rule Changes

Rule Change Package 1 will be submitted in early January 2008 and will address the re-designed reserve trader (RERT), the new EAAP information mechanism and NEMMCO's

power to issue reliability directions. The content of this Rule change has already had extensive consultation through an exposure draft in the Second Interim Report.

Rule Change Package 2 will be submitted in quarter 2 of 2008. It will largely be administrative. It will address the name of VoLL (to be changed to the Maximum Price Limit (MPL)) and the timing and process of future review of the reliability settings (the cycle of which would commence from 2010.)

Rule Change Package 3 will address the levels of VoLL and the CPT. Due to the impact on the market that a change in the level of VoLL would have, the Panel intends to first issue an exposure draft of its Rule change proposal in order to gain stakeholder feedback prior to submitting the proposal to the AEMC for consideration. The exposure draft would be published by the Panel in April or May 2008 and then subject to consultation, with the aim of submitting the final Rule change proposal to the AEMC in the second half of 2008 to have effect from 1 July 2010.

8.5.2 NEMMCO Actions

NEMMCO will initiate two reviews. The first will be to examine the level of short term reserves that should be used in the short term PASA. The second review will look at the arrangements for recovering the costs of Reserve Trader and see if any improvement is possible.

NEMMCO will also report to the Panel in November each year on the accuracy of the most recent SOO demand forecasts and on improvements in the forecasting process that will be used to prepare the subsequent SOO.

8.5.3 Additional Reliability Panel work streams

In quarter 1 of 2008, the Panel will establish a taskforce to look specifically at the methodology and process for calculating Minimum Reserve Levels (MRLs), especially where the MRLs are applied across more than one jurisdiction. This taskforce will comprise of NEMMCO, industry and jurisdictional representation and would be chaired by a member of the Panel.

Also in quarter 1 of 2008, the Panel should undertake a formal consultation under the Rules for the 'Guidelines for management of electricity supply shortfall events' which was issued by the Panel in 1998.

The Panel will also undertake additional work relating to the benefits to medium-term reliability from the development of demand-side and standing reserve arrangements.

The Panel has also undertaken to forward all out-of-scope submissions received relating to additional reliability mechanisms to the MCE and AEMC for further consideration. Similarly, all submitted material relating to demand-side issues will be forwarded to the AEMC for consideration in its Review of Demand Side Participation in the National Electricity Market, currently in progress.

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Appendix A Terms of reference (amended 22 June 2007)

Introduction

In accordance with the National Electricity Rules (Rules) cl. 8.8.3(b) and (c), the AEMC requests the Reliability Panel to undertake, in a comprehensive and integrated process, the reviews required by the Rules in relation to the following key National Electricity Market (NEM) standards and parameters:

- the NEM reliability standard;
- the Tasmanian reliability and frequency standards;
- the level of Value of Lost Load (VoLL), market floor price and cumulative price threshold (CPT); and
- whether the reliability safety net should be allowed to expire or alternative arrangements put in place.

The AEMC strongly supports the view of the Panel, as customer and industry representatives, that the subject matter of those reviews are closely inter-related and that it is appropriate that they be considered together. This more comprehensive approach will enable the Panel to address the clear need to provide NEM stakeholders with greater medium-term certainty in relation to these fundamental market signals.

The AEMC advises the panel of the terms of reference set out below including a requirement that the Panel complete its reviews and provide its report to the AEMC by 31 March 2007.

Scope

NEM reliability standard

In accordance with Rules cl. 8.8.1(2), the Panel must review and, on the advice of NEMMCO, determine the NEM reliability standards. The reliability standard is the relationship between the minimum acceptable level of bulk electricity supply measured against the total demand of electricity customers. The standard was set at .002% unserved energy (USE) by the Panel at market start in 1998 and it is appropriate to review that standard now.

The Panel is requested to examine:

1. the appropriateness of the standard including consideration of:
    a. the effectiveness of equivalent standards internationally;
    b. the effectiveness of the standard domestically;
    c. the appropriate form, level and degree of precision for the standard in the future; and

d. the scope of the standard in terms of the boundary with system security events and the boundaries of application of the standard across electricity infrastructure;

2. the interpretation of the standard into minimum reserve requirements including consideration of whether the contingency, short term and medium term capacity reserve standards should be explicitly defined; and

3. the application of minimum reserve levels in the market.

Tasmanian reliability and frequency standards

The Rules require that the Panel determine the Tasmanian reliability and frequency standards on the advice of NEMMCO and that, in making that determination, take into account the following principles:

- the Panel must have regard to the existing Tasmanian standards;
- the Panel must consider the costs and benefits of any changes;
- the Panel must consider the size and characteristics of the Tasmanian power system;
- the standards may differ from the mainland standards; and
- the standards must be less stringent for islands in Tasmania (cl. 9.49.4).

The Tasmanian Reliability and Network Planning Panel (RNPP) is currently reviewing the Tasmanian capacity reserve and frequency standards. The RNPP released a position paper in August 2005 and received a number of submissions in response. It is expected to make its decision by the end of February 2006.

The Panel is requested to:

4. Review the RNPP's position paper and submissions received in response as part of reaching its own determination by no later than 30 April 2006; and

5. Take into consideration that determination when undertaking the main body of the comprehensive integrated review.

VoLL, market floor price and CPT

The level of VoLL, the market floor price and the CPT arrangements provide the key price envelope within which the market must deliver to the NEM reliability standard. As established, these parameters provide the key signals for supply and demand-side investment. The Rules currently require the Panel to review the parameters by 30 April each year and that, in setting VoLL, do so at a level which the Panel considers will:

- Allow the reliability standard to be met without the use of NEMMCO's intervention powers (to dispatch contracted reserves or direct Registered Participants);
- Not create risks which threaten the overall integrity of the market; and
- Take into account any other matters the Panel considers relevant.

The Panel is requested to:

6. Complete its next review of VoLL, the market floor price and CPT by 30 April 2006 (VoLL 2006 review);

7. Undertake the 30 April 2007 review of those parameters (VoLL 2007 review) as part of the main body of the comprehensive reliability review;

8. In undertaking the VoLL 2007 review:

   - Consider whether VoLL, the market floor price and CPT are the most appropriate mechanisms for providing adequate investment signals and managing price volatility;
   - If the Panel considers that they remain appropriate mechanisms, determine the values of those parameters appropriate for the future medium-term including how often they should be assessed in the future;
   - If the Panel considers that they are no longer appropriate, consider appropriate alternative mechanisms.

Reliability safety net

The reliability safety net comprises the ability of NEMMCO to take actions to address any potential shortfalls by the market to deliver against the NEM reliability standard. At present, the Rules put a sunset date of 30 June 2006 on NEMMCO's powers in this regard and require the Panel to, by that date, review whether the reliability safety net should be allowed to expire or alternative arrangements be put in place.

The Panel is requested to:

9. Consider as a priority how the Panel can meet its obligation under the Rules to address the issue by 30 June 2006 while also addressing the matter as part of the comprehensive review.

Process

Consultation

The comprehensive review is likely to have important implications for NEM stakeholders. Consistent with its philosophy of engaging with those parties, the AEMC requests the Panel to plan to involve stakeholders by seeking submissions and holding forums on the main review issues paper and on each of its draft decisions.

In giving notice to Registered Participants of the Tasmanian reliability and frequency reviews, as required by Rules 8.8.3(d), the Panel is directed that the notice must be given at least four weeks prior to the meeting referred to in Rules 8.8.3(f).

The Panel is also directed that its report on the Tasmanian reliability and frequency reviews must be provided to the AEMC no later than eight weeks after the meeting referred to in Rules 8.8.3(f).

Resourcing, planning and communication

The Panel is requested to:

- utilise a lead consultant engaged and provided by the AEMC to assist in the preparation of scoping and issues papers, draft and final review documents, the undertaking of research and analysis and carriage of the review generally;

- provide the AEMC with a detailed project plan and budget by 24 February 2006; and
- brief the AEMC on progress in relation to the comprehensive reliability review from time to time as appropriate.

Addendum to Terms of Reference – 21 June 2007

The AEMC requests the Reliability Panel to include an additional component in the comprehensive reliability review to incorporate the request of the MCE to provide advice on the effectiveness of current market arrangements in managing generation input constraints and energy shortfalls.

The Panel is requested to:

- Provide advice to the AEMC for the MCE by mid-July 2007 on what, if any, improvements can be made to arrangements, including reserve trader, to strengthen the market's ability to manage generator input constraints.
- Extend the timetable of the comprehensive reliability review to include a second interim report which will seek feedback from stakeholders on the above advice before its final report is issued.

Revised Timetable for the Comprehensive Reliability Review

The AEMC requests the Reliability Panel incorporate the following key dates in its work program:

- By mid-July 2007 – advice to the AEMC for the MCE
- By 31 August 2007 – second Interim Report of CRR, including an exposure draft of the Panel's proposed changes (if any) to the reserve trader mechanism.
- By 30 November 2007 – final report of CRR.

Appendix B Submissions, supplementary submissions and presentations

Listed below are all submissions, supplementary submissions, presentations made to the Panel as stakeholder feedback after the release of the Issues Paper, and submissions to the Interim Report. All these are available from the AEMC's website at www.aemc.gov.au.

Submissions and supplementary submissions to the Issues Paper

- AGL Energy
- Country Energy
- Electricity Supply Industry Planning Council
- Energy Response
- Energy Retailers Association Of Australia
- EnergyAustralia
- Enertrade
- Hydro Tasmania
- International Power Australia And Loy Yang Marketing
- Macquarie Generation
- National Generators Forum
- National Generators Forum Attachment 1
- National Generators Forum Attachment 2
- NEMMCO
- NewGen Power (revised On 3 August With A Correction To Table 3)
- Queensland Government
- TransGrid
- TRUenergy
- VENCorp
- Energy Users Association Of Australia
- Energy Users Association Of Australia Attachment 1

- Major Energy Users
- Total Environment Centre
- Electricity Supply Industry Planning Council Supplementary Submission
- Electricity Supply Industry Planning Council Supplementary Submission Appendices
- Energy Response Supplementary Submission
- Paul Simshauser (CEO NewGen Power) Supplementary Submission
- Powerlink Supplementary Submission
- Major Energy Users Supplementary Submission
- Commonwealth Minister for Industry, Tourism and Resources
- NSW Minster for Energy
- SA Department Of Transport Energy And Infrastructure
- TRUenergy Supplementary Submission
- Electricity Supply Industry Planning Council Supplementary Submission
- SA Department Of Transport Energy And Infrastructure Supplementary Submission

Presentations to the Stakeholder Forum – 27 July 2006

- Chairman's Introduction
- Electricity Supply Industry Planning Council
- Energy Users Association Of Australia – McLennan Magasanik Associates
- National Generators Forum
- NewGen Power
- Energy Response
- Enertrade
- Major Energy Users
- Loy Yang Marketing

Submissions to the First Interim Report

- Institute Of Public Affairs (Attachment Added - 6th June 2007)
- Australian Energy Regulator
- NEMMCO
- Energy Australia
- Enertrade
- Energy Retailers Association Of Australia
- National Generators Forum
- Energy Users Association Of Australia
- Energy Response
- International Power Australia And Loy Yang Marketing
- Macquarie Generation
- Major Energy Users
- TRUenergy
- EEE Limited
- Government Of South Australia

Presentations to the Stakeholder Forum – 13 September 2007

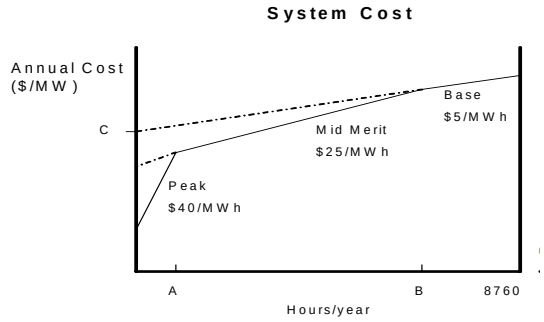
- Chairman's Introduction
- NEMMCO
- Major Energy Users
- Energy Action Group
- Electricity Supply Industry Planning Council
- Energy Retailers Association Of Australia
- National Generators Forum
- TRUenergy

Submissions to the Second Interim Report

- South Australian Jurisdiction
- Energy Response
- NEMMCO
- Australian Energy Regulator
- TRUenergy
- Energy Retailers Association Of Australia
- Origin Energy
- Electricity Supply Industry Planning Council
- Major Energy Users
- International Power Australia And LYMMCo
- Energy Australia
- Macquarie Generation
- National Generators Forum
- Energy Response - Supplementary

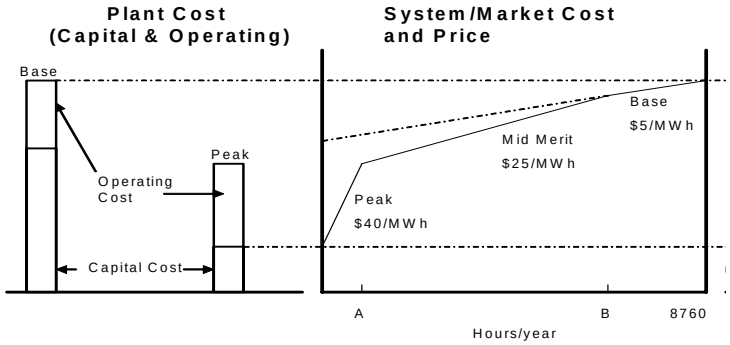
Appendix C Analysis information on costs and pricing

This was provided by CRA and the secretariat.



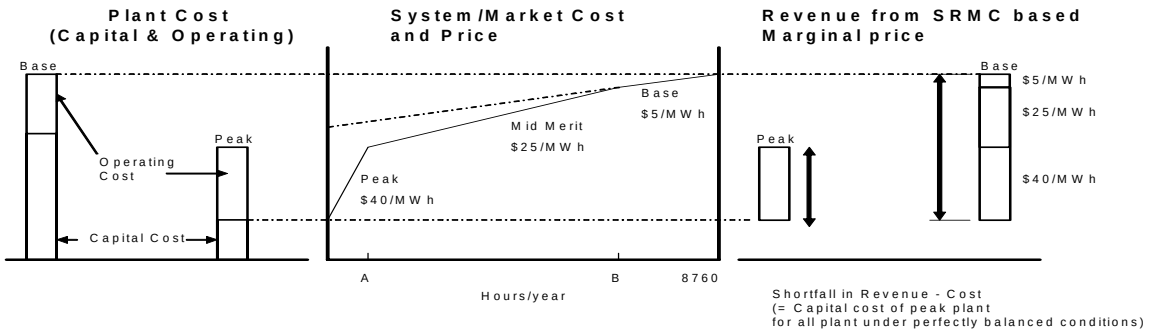
Consider a system with base plant with an operating cost (SRMC) of $5/MWh, mid merit plant with SRMC of $25/MWh and peak plant with SRMC of $40/MWh. Assume that the base plant runs 8760 hours per year, the mid merit plant for "B" hours per year and the peak plant for "A" hours per year.

The total cost to build and run these plants will comprise capital and operating costs. With each plant having a capital cost that is incurred regardless of hours of running, for example point C on the diagram represents the capital cost of the base plant.



The bars to the left in the diagram above shows the make up of total cost for base and peak plant by projecting the capital and operating costs incurred for operation during the year.

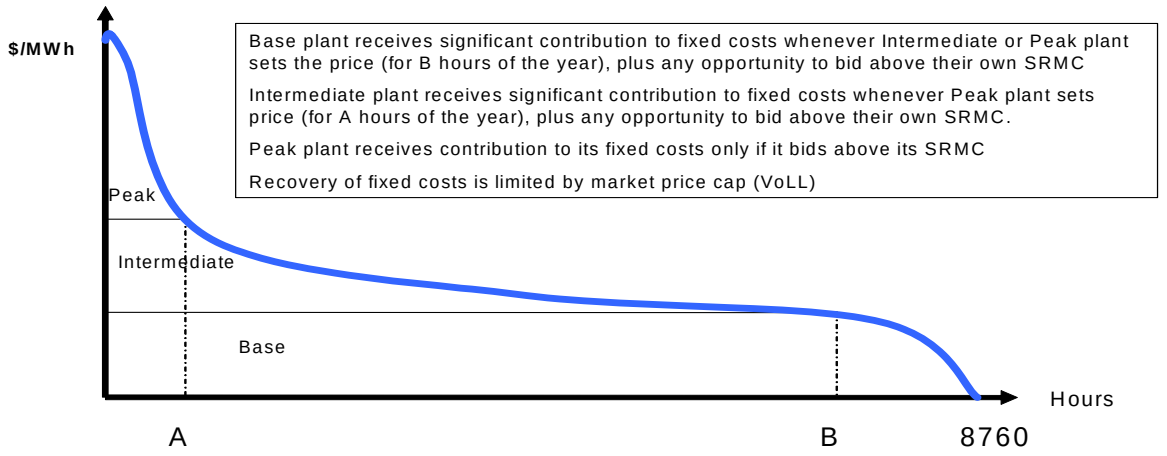
Revenue adequacy in market requires that each generator be able to recover its capital and operating cost.



The right hand side of the diagram constructs the revenue that base and peak plant in the system will receive IF price in the market is based on the SRMC of plant at the margin at all times. A similar construction can be made for the mid merit plant but this has been omitted for simplicity.

In this system the marginal price would then be $40/MWh for "A" hours when all plants were operating, $25/MWh for "B-A" hours when the mid merit and base plant were operating and $5/MWh when only the base plant was operating (i.e for 8760 – B hours).

Recovery of Fixed Costs by Peak, Intermediate and Baseload Plant

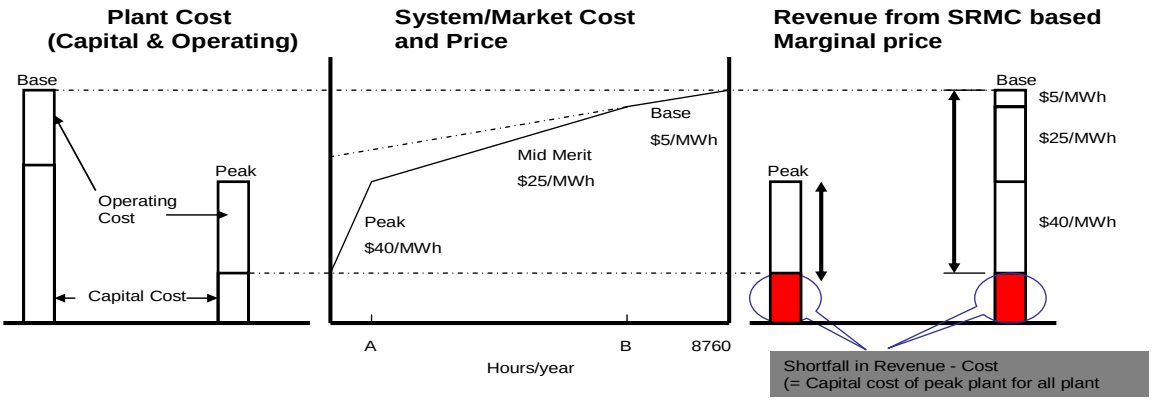


Base plant receives significant contribution to fixed costs whenever Intermediate or Peak plant sets the price (for B hours of the year), plus any opportunity to bid above their own SRMC

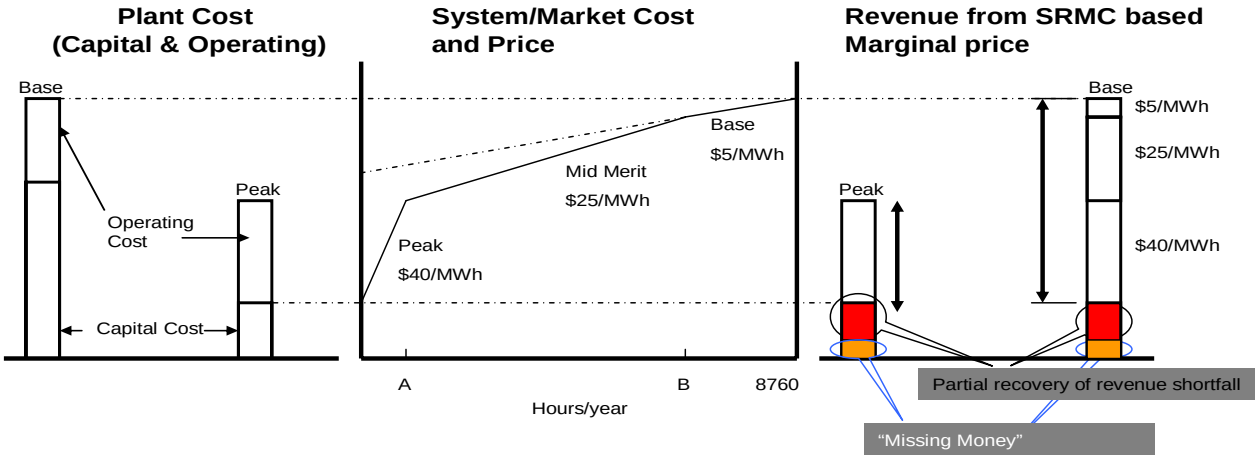
Intermediate plant receives significant contribution to fixed costs whenever Peak plant sets price (for A hours of the year), plus any opportunity to bid above their own SRMC.

Peak plant receives contribution to its fixed costs only if it bids above its SRMC

Recovery of fixed costs is limited by market price cap (VoLL)



If the market price is always set by the SRMC of the marginal generator,
there is a shortfall equal to the capital cost of the peak plant.



If market prices are permitted to rise above SRMC but
capped at a level that prevents the shortfall from being fully covered then there is "missing money"
[Full recovery requires that market price cap no less than [Peak plant Fixed Cost + Peak plant Operating cost per hour*A) / A]

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Appendix D The Reliability Standard

AEMC Reliability Panel

NEM Reliability Standard – Generation and Bulk Supply – December 2007

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'.

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.