Australian Energy Market Commission

AEMC Reliability Panel

Comprehensive Reliability Review

Interim Report
March 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.

Foreword

This Interim Report represents the second stage in the Reliability Panel's (the Panel's) comprehensive review of the National Electricity Market (NEM) reliability settings. The Review is designed to ensure that those settings contribute effectively to the reliable supply of electricity to consumers and is the first review of reliability since the inception of the NEM.

This Interim Report is deliberately non-conclusive but canvasses a range of selected options which have emerged during the Panel's analysis to date. The responses of stakeholders are crucially important to the Panel in reaching their conclusions for the Final Report in July 2007.

In this regard the Panel strongly encourages stakeholders to draw on their own NEM experience in providing a detailed rationale for making any improvements or changes to the reliability settings. This should take into account the integrated nature of those settings (which are described in the second section of this Interim Report) and be supported by analysis. The Panel also invites stakeholders to indicate how reliability outcomes may be affected by other broader features of the market.

The Panel has a number of preliminary views about the reliability settings and related matters, and it seeks further stakeholder feedback to contribute to its Final Report and recommendations.

Submissions should be made by 17 May 2007.

The Panel looks forward to receiving your contributions to the next phase of this important Review.

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Commissioner, Australian Energy Market Commission

Other AEMC Reliability Panel Members[1]

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[1] Jim Wellsmore of the Public Interest Advocacy Centre resigned from the Panel in January 2007 but was an active member of the Panel during the development of the Comprehensive Reliability Review up until that time.

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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
COPD	Cumulative Outage Probability Distribution
CPT	Cumulative Price Threshold
CRA	CRA International
DNSP	Distribution Network Service Provider
DSR	Demand Side Response
LOEE	Loss of Energy Expectation
LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
MRL	Minimum reserve level
MW	Megawatt
MWh	Megawatt hour
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
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
Rules	National Electricity Rules
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
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

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 mechanisms, standards 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) is 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. This Interim Report presents the results of that work with a view to further stakeholder consultation before completing the Final Report and recommendations in July 2007.

As well as information and analysis, the Interim Report presents the preliminary observations, provisional conclusions and proposed options developed by the Panel thus far, offered to stakeholders for their consideration and comment. Furthermore, the issues raised in the Review are complex and any proposed alterations to the reliability settings or mechanisms would be subject to formal Rule change proposals which would emerge following the completion of the Final Report of the Review. Obviously, any such Rule change proposals would themselves need to satisfy the NEM objective. The Panel is therefore very keen that whatever final recommendations it makes be fully informed by the views and experience of all NEM stakeholders, and additional analysis.

Stakeholders are urged to provide written submissions on any or all of the matters raised in this report by 17 May 2007. (A complete summary of matters for consultation can be found in Chapter 8.)

Why is this Review being conducted now?

The reliability settings, comprising a reliability standard and market mechanisms to ensure the standard is met, are crucial for sending appropriate signals for generation investment and end-use consumption. The reliability standard has 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 is undergoing 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. It is therefore an opportune time to undertake a holistic review of the reliability settings in a comprehensive manner.

The scope of the Review: reliability and supply capacity

For the consumer, a 'reliable' electricity supply means a continuous, uninterrupted supply of electricity all the way along the supply chain, from generators to transmission networks to distribution networks to the home, office or factory. This is sometimes known as *delivered supply*. But in the Rules, and for the purposes of this Review, 'reliability' has a special, more specific meaning – it is reliability and supply capacity.

'Reliability' pertains to the amount of electricity that *can* be made available to a region at any time if it is needed. This is a question of supply *capacity*, as opposed to *delivered* supply (what consumers experience as reliability across the whole electricity supply and delivery chain). A region's supply capacity is the sum of the electricity that its own generators can produce plus any additional electricity that can be brought to it from interstate via transmission networks. In broad terms, if this total supply capacity is sufficient (with some margin for error) to meet demand, then electricity supply in the region is considered 'reliable'. In technical terms, the formal definition of reliability includes single contingencies but excludes multiple contingencies.

If at any time it looks like capacity will be insufficient to meet demand in the future, then the NEM's market mechanisms are designed to increase supply capacity by stimulating investment in new generation plant and/or regional transmission networks. This fundamentally is the role of the reliability settings.

This Review, then, is *not* about the reliability in distribution networks. It is *only* related to supply capacity from generation and transmission networks that ensure carriage of that capacity throughout the NEM and the reliability mechanisms that affect them. It should be noted that within a jurisdiction there are explicit reliability settings related to transmission that are not part of the NEM reliability standard which is the subject of this review. It should also be noted that the reliability of distribution networks is also the responsibility of State jurisdictions. Understanding the different levels of reliability is important because, from a consumer's perspective, delivered reliability is most related to distribution network performance.

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
- An *intervention mechanism* (the reliability safety net), which comes into effect if the price mechanisms fail – the reserve trader.

In association with this Review and in accordance with its obligations under the Rules (clauses 3.9.4(c) and 9.49.4), the Panel has also reviewed Tasmania's reliability and frequency standards, the level of VoLL for 2006, and the level of VoLL for 2007. The Panel's decisions on the first two matters have already been published in its *Tasmanian Reliability and Frequency Standards Determination* and *Review of VoLL 2006 Final Determination* respectively (available on the AEMC website at www.aemc.gov.au). The Panel's formal draft decision on VoLL for 2007 is published in Appendix 3 of this report.

Preliminary observations, provisional conclusions, proposed options

On the basis of research, analysis and stakeholders' submissions, the Panel has provisionally formed the view that despite the NEM's satisfactory performance against the reliability standard to date, certain risks have been identified that may lead to insufficient or untimely investment in generation to meet demand in the future. The Panel believes these risks can be managed if appropriate steps are taken now. The Panel has therefore developed some possible options to address the risks and encourages stakeholders to consider them carefully and provide comment.

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

The Panel's thinking on these matters is summarised step-by-step in the following points.

1. 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.

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 preliminary conclusion is that, against the reliability standard, the reliability mechanisms in the NEM have been satisfactory to date.

2. 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 relate to other public policy issues such as the uncertainty about future greenhouse measures.

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 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 can give rise to the delayed 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.

If nothing is done to improve this situation, there is likely to be an increasing reliance on the safety net – the reserve trader. However this mechanism was intended as an emergency intervention mechanism only and was not designed for regular use.

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. Therefore the Panel believes that stakeholder feedback is essential before it finalises its recommendations.

The Panel's preliminary 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 and preliminary analysis 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. The Panel therefore believes it is likely to be prudent to consider adjustments or additions to the reliability settings and mechanisms to provide continuing confidence in the NEM's ability to deliver reliability in the long term.

3. 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 it 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 at the present time.

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 preliminary view is therefore to confirm the existing NEM-wide reliability standard at 0.002% but to more clearly specify its measurement and targeting. Furthermore the Panel believes the level of the reliability standard should be reconsidered in three years time as part of the next review of the reliability mechanisms.

The Panel does, however, recognise that no single standard is able to mitigate the unserved energy as well as the depth and duration of potential interruptions and that inevitably there will be regional differences across the NEM due to different load shapes and plant characteristics. This raises the question of the desirability of a hybrid standard – e.g. loss of load probability (LOLP) or loss of load expectation (LOLE) in conjunction with USE – or the desirability of an arrangement under which each jurisdiction could specify a higher capacity reserve level in order to manage regional loss of load expectation via standby reserve paid for by that region's consumers.

The Panel therefore seeks stakeholders' views on introducing either or both of these options.

4. Addressing the risks: raise VoLL?

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, and in any event it has not been altered for five years. However, raising VoLL might have contrary consequences. It could *either* drive participants to longer-term contracts and partly redress compromised investor confidence, *or* it could simply increase financial risk, increase the level of uncertainty and increase the level of volatility experienced by consumers.

On balance, the Panel has formed a preliminary view that raising VoLL at this stage is not the preferred approach and that other options should be considered first. However, given the risks identified, if other options for the reliability mechanisms are not progressed then an increase in the level of VoLL may need to be contemplated in order to provide the necessary market signals for investment.

5. Addressing the risks: other 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 (discussed above); 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, doing nothing is likely to create an increasing and unhealthy reliance on the safety net, and raising VoLL may have unpredictable consequences. Mandatory longer-term contracting, however, is a matter for further consideration by stakeholders.

Group 2 and 3 amendments would introduce varying degrees of change to the structure and affect other elements of the market. Before amendments in Group 2 could be adopted there would need to be a formal Rule change proposal advanced to create the mechanisms. Initial consultation on these options is being canvassed in this report.

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.

The Panel seeks stakeholders' views on the options identified to address the perceived risks. (These are discussed in detail in Chapter 6 of this report.)

6. Operation of the reserve trader

The Panel believes the reliability price mechanisms should be designed so as to avoid undue reliance on the emergency reliability safety net. Two of the options in this report involve removal of the reserve trader. Other options propose retaining a safety net but replacing the current reserve trader arrangements with a back stop that would in effect be a true emergency reserve.

In case the reserve trader is to be retained – and because both the Panel and stakeholders have drawn attention to disadvantages in its current design – the Panel has considered a number of design refinements to reduce any negative consequences should emergency reserve capacity need to be called upon.

The Panel's preliminary view is that: the reserve trader should be redesigned to become an emergency reserve trader; this emergency reserve trader should be retained for a five-year sunset period; and its operation should be reviewed after three years as part of a general review of the reliability settings.

7. Other improvements

A number of other matters, on which stakeholder feedback is also sought, have arisen from this Review:

Review period

The Panel's preliminary view is that the current annual review of VoLL should be replaced by a comprehensive and holistic review of all the reliability settings (i.e. the reliability standard, VoLL, the CPT, the market floor price, the redesigned emergency safety net and any additional reliability mechanisms) which should take place every 3 to 5 years. This will offer increased certainty for potential investors and consumers, which in turn will benefit reliability.

Demand forecasting

The Panel notes that some stakeholders believe NEMMCO's demand forecasting has systematically been too conservative, resulting in over-utilisation of the emergency reserve trader. The Panel acknowledges NEMMCO's efforts to improve the reliability of its forecasts but has decided to request that NEMMCO report to the Panel each August 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.

Distinguishing between short-term and medium-term reserves

The Panel's preliminary view is that the current practice whereby NEMMCO calculates minimum reserve levels on a medium term basis and then uses those levels to forecast reserve levels in both the short and medium term Projected Assessment of System Adequacy (PASA) is inadequate. The Panel has decided to request NEMMCO to conduct a review of the level of short term reserves that should be used in the short term PASA.

Translating the reserve standard into operational reserves

One option the Panel is considering is contracting for standing reserves on a continual basis. This could be done by institutionalising the reserve trader or by requiring a greater level of reserve than is currently provided by the market.

Aligning the CPT with the overall market design

Given that the CPT will only be exceeded in extreme conditions and that raising it would only add to the financial risks imposed on market participants, the Panel's preliminary conclusion is that the level of the CPT should remain unchanged.

8. Questions for stakeholders

The Panel now seeks stakeholders' comments on the amendments it is considering for improving the reliability settings (a full discussion of which can be found in Chapter 6), and on its preliminary conclusions outlined above. Specifically, stakeholders are asked to give their considered response to the following key questions:

Reliability standard

- Do stakeholders support the retention of the 0.002% USE but expressed with greater definitional clarity?
- Should a hybrid standard (such as LOLP or LOLE in conjunction with USE) be used to measure reliability in the NEM?
- Should the reliability standard be applied on a jurisdictional level or be NEM-wide?

Reliability Mechanisms

- In the context of retaining and only using the existing reliability mechanisms, should VoLL be raised?
- Should the reserve trader be redesigned to become an emergency reserve trader? If so, how?
- What additional mechanisms would be desirable as market features to improve reliability in the future? (E.g. Reserve Ancillary Service or availability payment).
- In order to reflect regional differences in load profiles and plant mix, there could be an addition to the national standard specifying the amount of demand (MW) or duration of interruption that is at risk at anytime in a particular region. Any additional capacity required in a region to meet this standard could be contracted as standby generation or demand side response that is bid into dispatch at VoLL with costs recovered from consumers within that region. Is a Standing Reserve of this form desirable?

Timing of Future Reviews

- How often should the reliability settings be reviewed?

Other Matters

- Are the proposed improvements to information and forecasting appropriate?
- Would it be advantageous to publish long-term contract prices alongside spot prices so as to create a more balanced and accurate understanding of market participants' true financial exposure in extreme conditions?

- Should there be some form of mandatory long-term contracting requirements to give investors the revenue certainty needed to invest in new timely generation?

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 Interim 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 CPT); and
- An intervention mechanism known as the 'reliability safety net', should the price mechanisms fail.[5]

The Panel is required to complete the Review and submit its final report to the AEMC by 31 July 2007.[6] This Interim Report presents the preliminary results of research and analysis carried out in light of stakeholders' submissions to the Issues Paper of May 2006. The Panel encourages stakeholders to comment on the preliminary findings and observations presented in this Interim Report.

Tasmanian reliability standards

A related matter is the setting of the Tasmanian reliability standards which arose due to that State's entry into the NEM in 2005. The Panel published its final determination on this matter on 28 May 2006 (see *Tasmanian Reliability and Frequency Standards Determination*, available on the AEMC website at www.aemc.gov.au).

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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] NEMMCO also has a power of direction it is able to use at short notice.

[6] According to the Terms of Reference (see Appendix 1) 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.

Annual determination on VoLL

The report also presents, in Appendix 3, the Panel's formal draft decision on VoLL for 2007 (an annual obligation under the Rules).

1.1.2 Timing of the Review

This is 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 need to be reviewed because over the years the market has evolved. There is 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 exhausted in all regions, and reserve margins are now approaching minimum levels. 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 2.) 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 to forward to the relevant decision-making body any suggestions concerning 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.

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:

- A review of Australia's energy sector by the Energy Reform Implementation Group (ERIG) – convened by the Council of Australian Governments;
- 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.*[7]

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;
- 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

That Issues Paper 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.

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.

Since then, the Panel and its secretariat have been involved in planning and conducting detailed analysis and research to address the key issues raised. A consultancy, CRA, was commissioned by the Panel to assist in this analysis, which includes modelling reliability outcomes for the current

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[7] NEL, s7.

market design and for possible alternative design options. The preliminary results of this analysis are presented in this Report to give stakeholders further opportunity for comment. Nevertheless, for the preparation of the Panel's Final Report its analysis program is ongoing.

1.2 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;
- Chapter 7 provides a discussion of other improvements being considered by the Panel; and
- Finally chapter 8 summarises the Panel's preliminary views.

The Report also includes a number of appendices:

- The Review's Terms of Reference (Appendix 1);
- Analysis information on costs and pricing of plant (Appendix 2);
- The Panel's formal draft decision on VoLL for 2007 (Appendix 3);
- A list of all submissions, supplementary submissions and presentations made to the Panel (Appendix 4); and
- Detailed analysis of the alternative scenarios proposed in Chapter 6 for improving reliability outcomes (Appendix 5) which is the consultant's report to the Panel.

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.

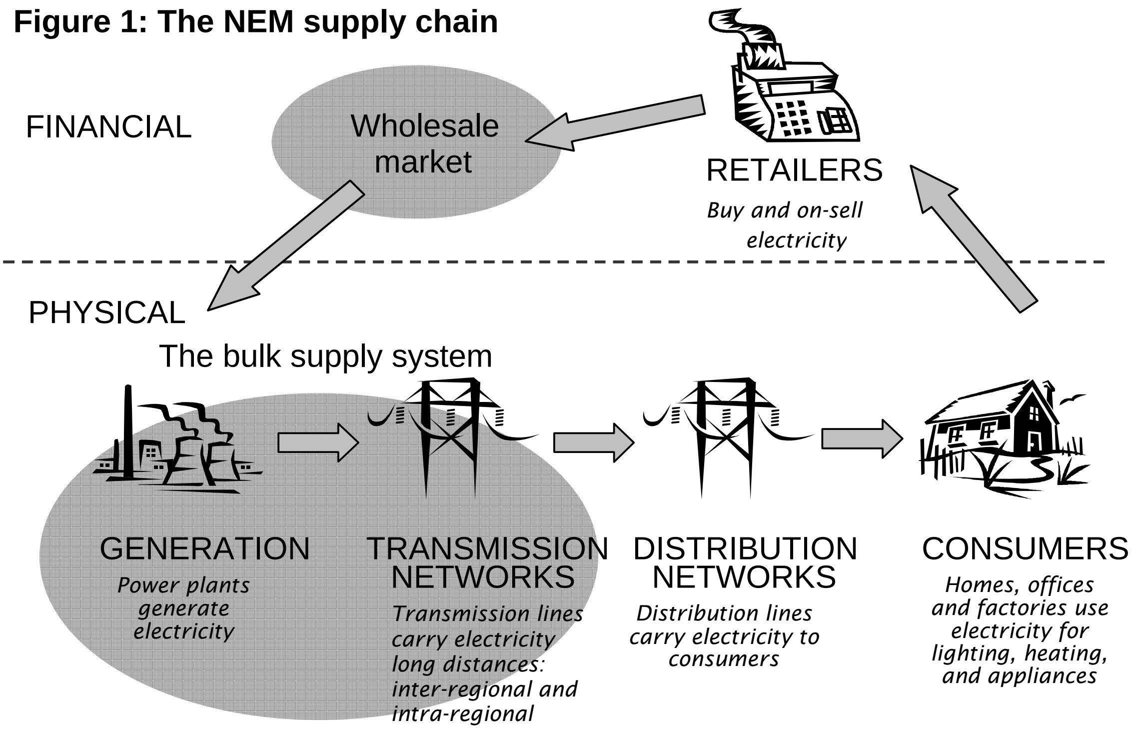
2.1 What is the NEM?

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);
- 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]

Figure 1: The NEM supply chain



[8] There are currently Rule change proposals under consideration by the AEMC that may change the region boundaries within the NEM.

[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.

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 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 associated financial risk. 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 security are set in the Rules and by the Panel. In technical terms, the formal definition of reliability includes single credible contingencies (i.e. events that can credibly be anticipated) but excludes non credible contingencies, including multiple contingencies, which are security events.[10]

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

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

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.

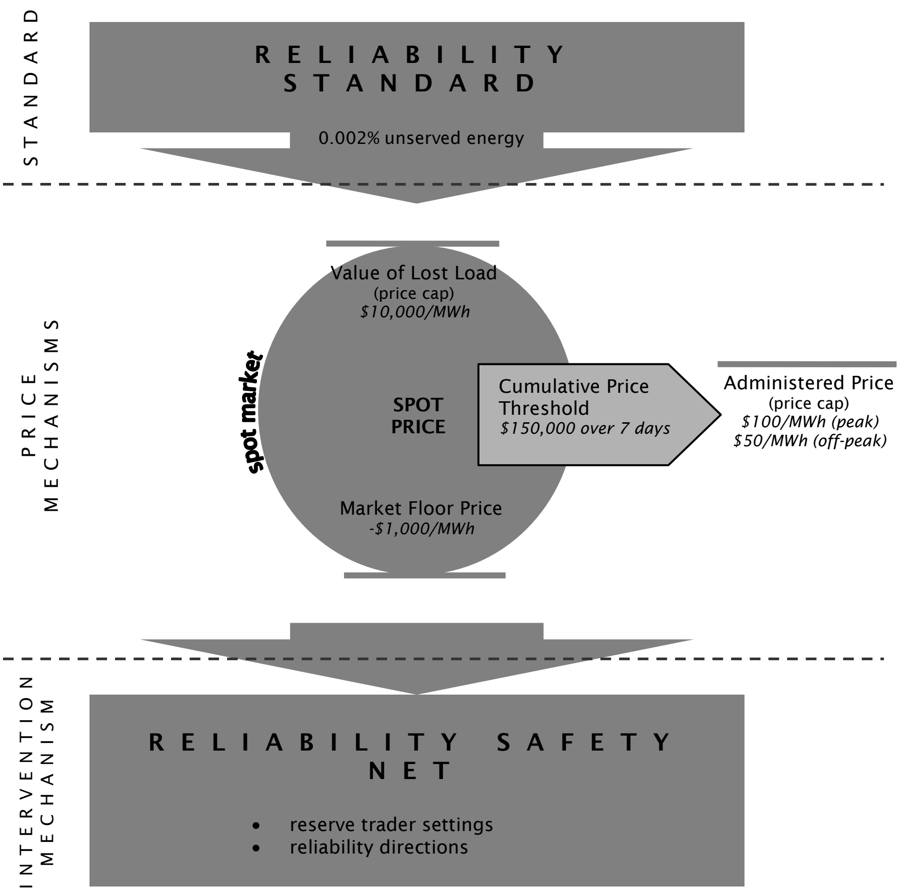
There are any number of responses to the question of what degree of reliability is tolerable. One group of consumers may tolerate a different level of reliability from another. For example, businesses are likely to be less tolerant of interruption to supply during office or factory hours, whereas families 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 can be communicated most effectively to suppliers.

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).[11] 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.

[11] 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.

2.3 What are the NEM's reliability settings?

Figure 2: 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. 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 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 the aim of delivering 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 demand.

The CPT is designed to limit participants' exposure to the wholesale spot market and is currently set at $150,000. This is an explicit risk management mechanism. If the 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.

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 April 2006 determination, 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.

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's intervention is if reserves appear likely to – or in fact do – fall below the 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 (in each of the last two years, NEMMCO has contracted for, but has not in fact been required to dispatch, reserve capacity in order to meet forecast summer peak demand); and/or
- By requiring generators to provide additional supply at the actual time of dispatch to meet those minimum reserve levels using its power of short-term direction.

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.[12] 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, within the constraints of the existing reliability standard, 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.

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

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
- On the whole, consumers of electricity have little 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.

Electricity is a commodity that cannot be cost effectively stored in bulk, and therefore must be generated in a literally 'just in time' 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, should provide more opportunity for demand-side participation.[13] 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. 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

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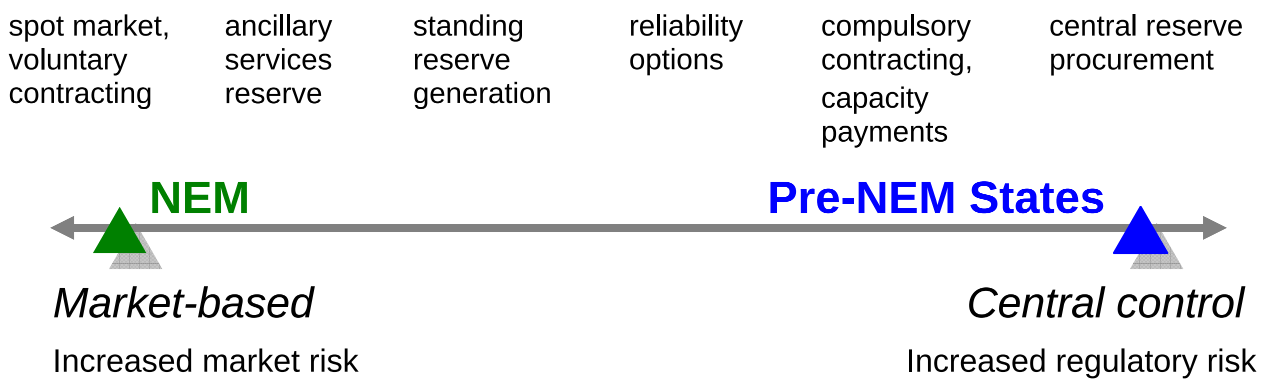
[13] MCE Communiqué, 27 October 2006 and COAG Communiqué, 10 February 2006.

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:



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.

On 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 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 instating 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 getting 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 preliminary 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.

Chapters 4 and 5 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 Annual Market Performance Review (AMPR) 2005-06.[14] 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, 0.0025%; and
- Victoria, 0.0101%.

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 fifth consecutive year.

It is important to note that these long-term averages were based on only seven 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.

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[14] AMPR 2005-06, p 19 located on the AEMC's website at www.aemc.gov.au.

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.[15] The single exception was South Australia during the Moomba crisis of January and February 2004, when the restricted supply of gas lead to the unavailability of gas-fired generation. This is shown in Table 1.

Table 1 – Duration below the minimum reserve levels[16]

	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[17]
	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

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.

[15] 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.

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

[17] 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.

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

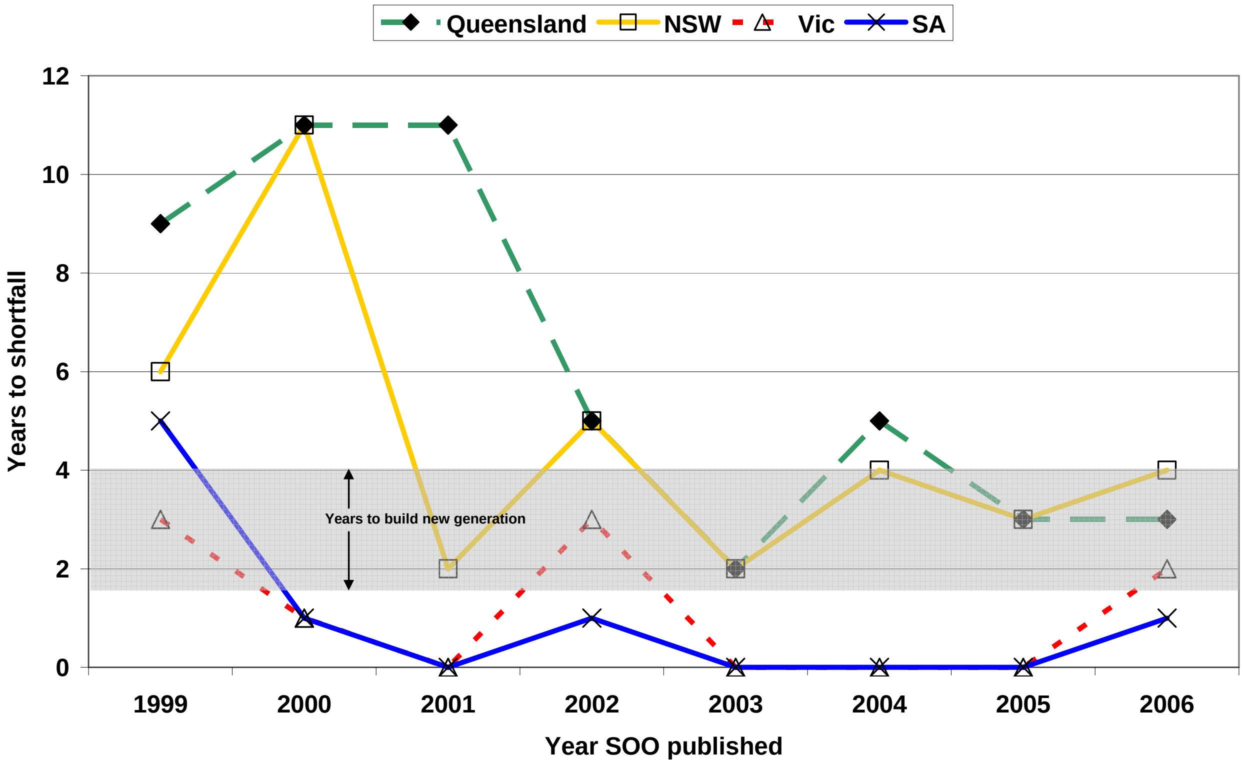
Each year since the start of the NEM the NEMMCO has published a 10-year projection of supply adequacy for each NEM region in its annual Statement of Opportunities (SOO).[18] These projections show the expected level of demand and generation capacity within each region over the 10 year outlook period. The purpose of these projections has been to inform stakeholders of the likely timing of anticipated shortfalls of capacity to meet growing demand and, therefore, opportunities for investing in new generation or network capability. As suggested by its title, the SOO provides additional information to assist investors with their investment decisions.

Figure 3 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 new capacity has been built in response to projected shortfalls of generation some time out. Such responses included additional generation capacity and interconnector refinements but some of the apparent response was due 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 this situation.

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

Figure 3 SOO projections of time until capacity shortfall



Notes on Figure 3:

- 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 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 requiring new capacity within the year for four of the last six years, and the fact that NEMMCO has contracted for, but not needed to dispatch reserve capacity for those two states, would suggest that capacity in those states has been delivered in a literally 'just in time' manner. This raises the question of whether this situation has been too tight.

Similarly, over the last 5 years NSW and Queensland have not shown a forecast need for new capacity sooner than 2 years out. This raises the question of whether achievement of supply reliability is as efficient as for Victoria and South Australia. Of course the difference between these two groups of states could be the difference in the involvement of state governments in the provision of generating plant.

In assessing where to strike the balance, it should be noted that the question of investment too early or too late essentially presents an asymmetric risk for consumers. Investment too early may result in some additional cost to consumers; however, investment too late may result in failure to deliver the desired level of supply reliability. This means more disruption to consumers through loss of electricity supply than desired. With electricity considered as an essential service, doubtless many would perceive an increased failure to supply electricity as a greater evil. Therefore aiming for a 'just in time' approach to delivery of required capacity may not be prudent, considering the plethora of risks that can cause delays to the commissioning of major new power plants.

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. 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. 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. For that reason, the Panel's preliminary conclusion is that the reliability settings themselves, which are the focus of this Review, have performed satisfactorily.

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 susceptible to ordinary events such as construction delays.

4 The reliability standard

This chapter discusses 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 preliminary conclusion is that no change is needed to the form, level or scope of the 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 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 also considers that there is a need to keep a watching brief on the level of the standard in light of potential changes to the value that consumers place on reliability.

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.[19]

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;

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

- 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.[20]

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.

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 showed that there is general support for retaining the USE form of the reliability standard.[21] 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

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[20] 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.

[21] For example, Macquarie Generation and NEMMCO submissions.

- 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 information 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.[22] 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.

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. 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

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

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.[23] 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 and would be difficult to justify on economic grounds.

However, if a hybrid standard were introduced into the NEM on policy grounds, the Panel believes it would be necessary to make supplementary arrangements or a major change to the market design. Supplementary arrangements could be in the form of additional standby generation plant at locations (or regions) particularly susceptible to unacceptably frequent or deep interruptions. Potentially, the costs for such plant could be allocated only to consumers in those regions or locations.

4.2.4 Panel's preliminary conclusion

The Panel's preliminary view is that:

1. The current form of the standard, being USE, should be retained; and
2. 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 the Panel 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.

In order to reflect regional differences in load profiles and plant mix, there could be an addition to the national standard specifying the amount of demand (MW) or duration of interruption that is at risk at anytime in a particular region. Any additional capacity required in a region to meet this standard could be contracted as standby generation or demand side response that is bid into dispatch at VoLL with costs recovered from consumers within that region. The Panel is seeking the views of stakeholders on this option.

4.2.5 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.

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 preliminary view that the reserve trader mechanism should be redesigned to

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

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 6.

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's view is that:

- The reliability standard should be considered retrospectively over a long-term period of looking back at least 10 years; but
- 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.

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.

In conclusion, the Panel considers that 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 year both NEM-wide and within each region.

The Panel 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 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.

4.3 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 negligible fraction of the total loss of supply experienced by consumers. The major source 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, but are at risk of very infrequent periods of extended shortfall during drought conditions due not to the installed capacity but 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 measure of form as the primary standard and cross check that none of the other measures fall below an acceptable level. Many of the measure used internationally have evolved from pr-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 Calculated to be equivalent to approx 3.5 hours	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 generation base	1year in 60	Not relevant	Generally high capacity margin. Reliability dependant on hydro reserves and hence any shortfalls generally extended during drought years
US: PJM	145GW max demand	LOLE expressed as 1 day in 10 years may experience capacity	Approx 15% over 50% POE forecast of	Inherently reliable due to size and

	Well meshed with strong interconnections to adjoining systems Moderate (winter) temperature sensitivity	shortfall. Depth and duration of shortfall not defined	maximum demand	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.[24] 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 in 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 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.

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.

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

4.3.3 Panel's preliminary conclusion

The Panel does not see a convincing argument for changing the level of the reliability standard at the current time, for these reasons:

- 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 on the level of the standard in light of potential changes to the value that consumers place on reliability.

4.3.4 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;
- Bidding behaviour of generators;
- 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.

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.

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;[25]
- The Energy Reform Implementation Group (ERIG) review;[26] and
- Any future changes associated with the application and form of the Regulatory Test.

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

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

[26] Further information on the ERIG review is available at http://www.erig.gov.au/.

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".

A security incident occurs following a non-credible or 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 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 preliminary 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 notes that the recent multiple contingency event in Victoria on 16 January 2007 may be classified as a system security event as it resulted in line outages and the islanding of the Victorian and South Australian regions. If that is the case, the unserved energy that resulted from this event 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 preliminary 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

- 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 and multiple contingencies, which should be addressed by reviews of operational practices and technical compliance regimes;[27]
- Constraints in local transmission and distribution networks, which should be addressed by changes to the operation or augmentations to these networks;
- Industrial action, 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.

[27] 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

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 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 NEM's design. 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 spot trading administered by NEMMCO, in determining the prices paid for wholesale electricity. In fact, 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 fulfils a very similar role in the NEM 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 design 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.[28] 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 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 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 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).

[28] 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

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.[29] 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 2.

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 hit 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.[30] 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.[31] 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.

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[32] to the Issues Paper referred to work carried out by Henney & Bidwell.[33] 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

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

[30] International Power Australia and Loy Yang Marketing submission.

[31] Major Energy Users submission.

[32] For example, the submissions by NewGen Power.

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

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 7.1.1).

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 the NEM equivalent of 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.[34] 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.

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 peak plant compared to base plant. This in

[34] 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).

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.[35]

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 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.[36] 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.[37] 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.

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[35] See ERIG Discussion Papers (Market Structures), 17 November 2006.

[36] 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.

[37] For example, submission by International Power Australia and Loy Yang Marketing.

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.[38] 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 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 whether market participants are 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.[39]

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 proposal for this is presented in section 7.1.1 to seek feedback from stakeholders.

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 to be of much greater significance than the

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[38] 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.

[39] 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.

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
- Uncertainty about future greenhouse related policy.

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 that of investment in that plant type, and indeed may reduce the marginal cost at the same time as raising the average cost.[40]

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. 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[41], 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 yet has failed to result in a unified response, it appears that the level of uncertainty has increased, particularly in regard to the future costs that

[40] 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.
[41] For example, submission by the National Generators Forum.

may be attached to emissions as well as to the penalties or advantages that may be introduced for generation schemes of varying emission intensities.

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 be made.

The Panel seeks feedback from stakeholders about the issues raised above and their implications for future reliability.

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.[42] A number of prospective private investors cited recent examples of what they considered non-economic decisions by state governments to invest in generation plant.[43] 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."* [44]

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

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.[45] Again, the Panel has not sought to confirm nor dispel the validity of these views.

The Panel seeks feedback from stakeholders about the issues raised above and their implications for future reliability.

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[42] For example, submission by International Power Australia and Loy Yang Marketing.
[43] Ibid.
[44] COAG ERIG Discussion Papers, November 2006, p7.
http://www.erig.gov.au/assets/documents/erig/ERIG%5FDiscussion%5FPapers20061117171022%2Epdf
[45] For example, submission by the National Generators Forum.

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 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.

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 learnt from experience.

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 5). 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. The peaking plant sector therefore reduces as a fraction of the total capacity but retains a similar profitability. It should be noted that the analysis undertaken: is with a real value of VoLL at the existing level; is under ideal market 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. These relationships are illustrated in Figure 4 and Table 3.

Figure 4[46]

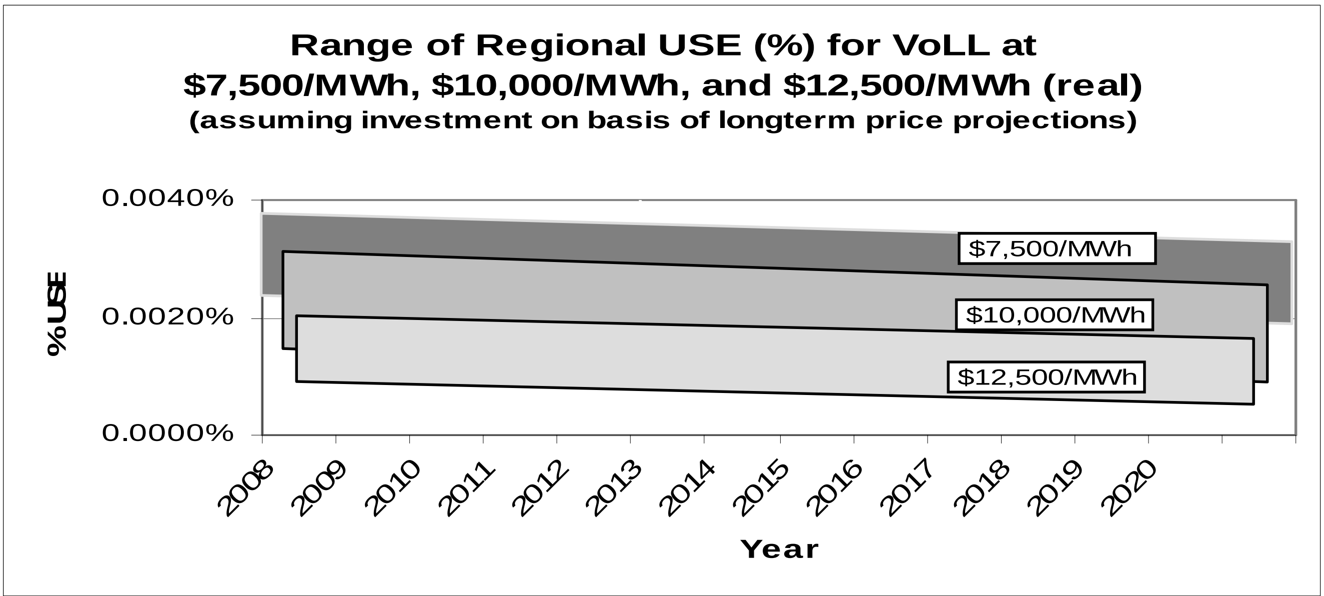


Table 3 – Summary of Status Quo Scenarios – Sensitivity to VoLL

	$7,500/MWh (real)	$10,000/MWh (real)	$12,5000/MWh (real)
USE(long term average)*	0.0022%	0.0018%	0.0015%
Peak Generation: Utilisation Factor (%) for new entrant OCGT	9.2%	9.1%	9.0%
NEM Peak Generation (NEM wide average): Annual Average Price ($/MWh) received by new entrant OCGT	170	188	202

[46] Prepared as part of the analysis by CRA.

NEM Peak Generation (NEM wide average revenue:cost ratio for new entrant OCGT)	1.25	1.38	1.48
Base Generation (new entrant coal): Utilisation Factor (%)	90%	90%	90%
Base Generation: Annual Average Price ($/MWh) received by new entrant coal	33.2	35.0	36.4

*Average outcomes over 2008-2017. Weighted average of 10% and 50% POE cases using a 30% and 70% weight, respectively.

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 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
- 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. As such, 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.

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 5).

The Panel's preliminary 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. As noted earlier in this section, the risks which emerged from stakeholder submissions and preliminary analysis principally relate to external policy factors which create perceptions of uncertainty or potential distortions to the market and the investment environment. The Panel also noted that other risk areas put forward in submissions included 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.

The Panel therefore believes it is likely to be prudent to consider adjustments or additions to the reliability settings and mechanisms to provide continuing confidence in the NEM's ability to deliver the reliability standard in the long term and seeks stakeholder feedback in this regard.

The Panel will consider the views of stakeholders and undertake further analysis of these matters before coming to a concluded view on the risks involved and the need or type of amendments to the reliability settings to address them.

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

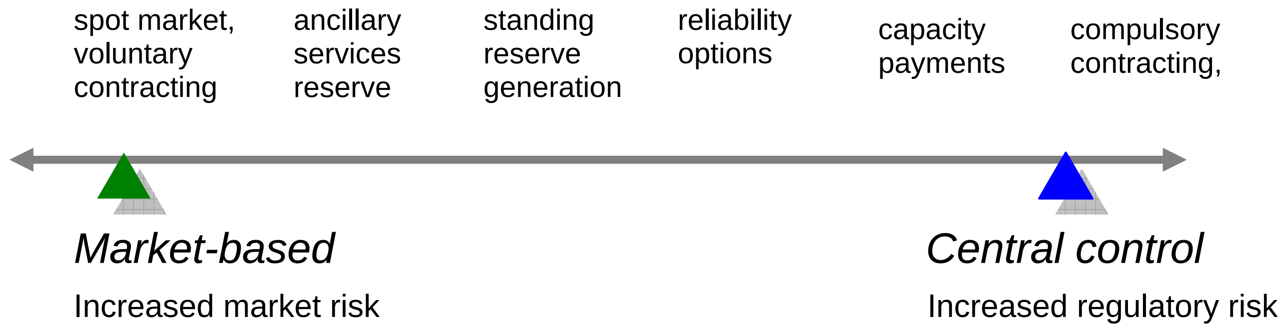
6 Options for changes to the reliability mechanisms

The role of the reliability settings in the NEM has been outlined in Chapter 2 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 change to the NEM is necessary. This chapter discusses options for changing the reliability mechanisms to reduce this risk and assesses the viability and potential impacts of each option.

The Panel has reached no preliminary conclusions about implementing a particular option. Instead it wants to receive stakeholders' views on them and is continuing its analysis program to further assess them.

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, different designs look to different ownership structures. Where relevant, investment and operating reserve levels must be decided in advance. 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 4 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[47], 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 considered options which are generally based on the existing energy-only market design.

[47] For example, submissions from NewGen Power and Major Energy Users,

Table 4 – 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 is sought, are 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 5 and summarised in section 6.2.4.

6.2 Options

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 • Increase VoLL • Mandatory long-term contracting	***Option B*** • Reliability Ancillary Service	***Option C*** • Standing reserve	***Option D*** • Financial (Reliability Option / capacity option)	***Option E*** • 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.

How each option would work is described in the following sections.

6.2.1 Group 1 – Incremental change to existing mechanisms

There are two possibilities here, neither of which would change the structure of revenue streams:

- Increase VoLL; and
- Introduce 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.

The sensitivity of unserved energy and of financial returns has been analysed by raising and lowering VoLL from the base case study. The results 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 assumes that an increase in VoLL will not affect the discount rate applied by investors.

The Panel's analysis suggests 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 has doubts as to whether raising VoLL will address the risks that investors are exposed to in the absence of long-term contracts.

The Panel also notes the views put by many submissions regarding concerns for consumers about a potential increase in the volatility in the wholesale prices.

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. In any case, a change to the level of VoLL is unlikely to alter the appetite of retailers to enter into longer-term contracts.

The analysis also indicates that raising VoLL would increase the standard deviation of revenue. This, together with the views of current and potential investors, has led the Panel to seriously doubt that raising VoLL in the current circumstances would actually help deliver reliability.

Before reaching a conclusion, it is worth asking if the current situation reflects simply the fact that the market is still in transition as surplus capacity in different regions and transitionary pricing arrangements are wound back. Would an increase in VoLL to adjust for changing costs and risks, for example, necessarily result in increased contracts, in line with the design assumptions, and also accelerate the emergence of deeper DSR that would make the level of VoLL less of an issue?

Should the risks of distortion of energy-market outcomes and the potential effect on reliability due to external policies and practices be highlighted and taken into account in the design of any schemes in order to allow the rational design of the energy market to move to maturity?

The Panel's preliminary view, on balance, is that a simple increase in VoLL is not the preferred option to address the future risks identified. Nevertheless given these risks, if other options for the reliability mechanisms are not progressed then an increase in the level of VoLL may need to be contemplated in order to provide the necessary market signals for investment.

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 discussed above was developed to encourage long-term contracting. The Reliability Options discussed later as part of Option D proposes to centralise the contracting activity within NEMMCO and effectively mandate that NEMMCO would seek a sufficient amount of contracts. These contracts are likely to be an attractive proposition for investors but they remain voluntary and are cap contracts. However 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 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. Mandating contracts means that retailers' contracting policies are underwritten by a physical obligation rather than solely by a commercial driver. On the positive side, it would leave some of the existing mechanisms of the NEM intact. It would also circumvent any 'distortions' to contracting incentives resulting from external influences such as the effect of greenhouse policy.

However, while mandatory contracting would require little change to current arrangements, it would inevitably require new Rules to define each retailer's obligation and it may reduce innovation about contract form. Compliance mechanisms would 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.

The Panel's preliminary view is that mandatory contracting is problematic, distortionary and restrictive and is therefore inappropriate.

Accordingly, the Panel has examined two further groups of options that represent changes in design of the market mechanisms.

6.2.2 Group 2 – Targeted reliability reserve mechanisms

This section examines the two options that involve substantive changes to the NEM's design: the introduction of a Reliability Ancillary Service and a Standing Reserve.

Reliability Ancillary Service

The Reliability Ancillary Service (RAS) is a possible mechanism that could be developed to 'firm up' payments to low utilisation plant that provides reserve.

The 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. The RAS would operate in a similar way but would target slower-acting plant, for example, it would target generation or demand response at, say, 30 minutes' notice and sustain output for a nominated time (yet to be decided).[48] 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.

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.

[48] 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.

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.

The RAS would interact with current energy market hedging arrangements; therefore further work would be needed to develop its detailed design. The RAS would amend the structure of reliability mechanisms because it would transfer to plant that provides reserve to the RAS payments that would otherwise be paid infrequently, and reduce the volatility of revenue paid to reserve plant. Depending on the final settings, the 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 option involves a range of mechanisms 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 the RAS; or
- Shifting the role of the reserve trader contracts for physical capacity from that of a safety net, used only 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 is 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. These arrangements 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 needed to remunerate peak plant in order to avoid the risk of 'missing money'. Hence the design of the RAS and 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 unlikely 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%.

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 – General reserve mechanisms

Each of the targeted reliability reserve mechanisms discussed in the previous section would only direct payments to parties providing reserve. Consequently, parties that provide no or little reserve would continue to rely 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 described 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[49] 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.

A number of NEM stakeholders have indicated a preference for the Reliability Options model. This model is also currently under consideration in parts of the US. For these reasons, modelling has been undertaken for this Review on the Reliability Options model only.

Reliability/Capacity Options model

In summary, this approach requires 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 variable 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, the following assumptions have been 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.[50]
- 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 has been included in this analysis. It would, however, be a significant driver for performance and could alter the commercial position for under-performing plant.

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.

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

[50] 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 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 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).

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 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.

6.2.4 Summary of Options

Table 5 represents a summary of the quantitative analysis of the options and the status quo taken from Appendix 5. To facilitate comparisons, the analysis has been designed so that the options each deliver the same USE as an increase in VoLL in the current design to $12,500/MWh, assuming the key conditions about investment behaviour and distortions to price discussed in section 5.6 are met.

Table 5 – Summary of the results of Appendix 5

	Status Quo		Alternative Market Design		
	$10,000/MWh (Real)	$12,500/MWh (Real)	RAS	Standing Reserve	Reliability Options
USE	0.0018%	0.0015%	0.0015%	0.0015%	0.0015%
NEM Average Energy Price	31	32	32 (Excludes RAS cost)	31 (Excludes Contract Costs)	20 (Excludes Reliability Option Costs)
NEM Peak Generation (NEM-wide Average): Annual Average Price Received $/MWh	188	201	193	187	50 (Excludes Reliability Option Fees)
NEM Peak Generation NEM-wide Average Revenue:Cost Ratio	1.38	1.48	1.51	1.37	0.95
NEM Peak Generation NEM-wide Standard Deviation of Average Revenue:Cost Ratio	0.41	0.46	0.39	0.39	0.05
NEM Base Generation NEM-wide Standard Deviation of Average Revenue:Cost Ratio	0.19	0.22	0.19	0.19	0.01
Base Generation: Annual Average Price ($/MWh)	35.2	36.4	35.5	35.5	Approx 35 *

* The price will be dominated by the effect of contract. For the analysis we have assumed 100% of demand is contracted and that all generators will bid at SRMC. In practice it is unlikely there will be a perfect match and some uncontracted capacity will be present. As a result average price could be above or below contract strike price.

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 6.

Do nothing

A "do nothing" approach is possible. However, the likely result of adopting this approach is that there would be a progressive decline in market based investments and thus increasing reliance on the reserve trader. The analysis in Chapter 5 demonstrates this would be likely in the near future. The reserve trader is a mechanism that has not been designed for, and is not well suited to, regular use.

If the "do nothing" option was followed the Panel would want to see amendments to the design of the reserve trader to improve its operation. Although it would be 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. The changes are discussed in section 7.2.1.

More broadly, based on its analysis to date, the Panel considers that making no changes to the reliability settings is not the most prudent policy position.

Incremental change to existing mechanisms

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 would require that investors and retailers respond by entering into contracts of sufficient length so as to underwrite new investment and manage the consequent increase in the level of financial risk. There is also considerable uncertainty about the overall effect of raising VoLL and, because it places even greater emphasis on the integrity of the price signals, it assumes less rather than more price distortion due to external policy effects. There is also consumer concern about increasing the potential volatility of the wholesale market prices.

Mandatory Contracting

Mandatory contracting would 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 is 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 general, the Panel's preliminary view is that the form of contract could evolve over time, but that flexibility and the opportunity for innovation would decline.

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.

Reliability Ancillary Service (RAS)

The RAS option uses 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 the RAS would remain susceptible to external influences that affect spot prices now, such as greenhouse mechanisms. Overall, the RAS would offer some improvement, but how much improvement would be a matter for the market to decide.

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. 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 will be needed. A standby reserve arrangement can deliver this.

What it may do, however, is insert an additional, counter-productive mechanism 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 to be used only when the market incentives do not deliver. A standby contract arrangement would see a contracted level of reserve sit between these two layers. This would not necessarily mean that the safety net could be removed (although this is 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. 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.

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 therefore represent a more extensive change to the market arrangements. Their effect would be to increase certainty about revenue. They 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 market design options presented, 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 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, and also in settlement, however, there would be no need to change its dispatch processes or software.

Table 6 provides a summary of the different options.

The Panel is seeking direct feedback and views from participants on the various options presented in order to make substantial recommendations as part of its Final Report.

Table 6 – 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 but uncertain	Some 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	Significantly greater certainty as total capacity centrally determined	Significantly 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	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 (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

6.4 Transitional arrangements

In practice, all but the simplest option will require significant time to implement. The more changes that are required to NEMMCO's and participants' IT systems, and the greater the change to trading arrangements, the more time that will be required.

Other than changes to the level of VoLL or to the detailed operation of the reserve trader, a transition period in the order of 3 to 5 years would be expected. Accordingly, the Panel expects that there would be a continuing reliance on the reserve trader in the interim, regardless of whether it is amended or removed as a result of recommendations in this Review. The Panel considers that any improvements to the reserve trader should be considered during the transition period. The Panel therefore seeks feedback from stakeholders on ways to improve the reserve trader provisions, and whether the provisions should be removed at the end of the transition period, or remain a permanent feature of the reliability settings.

7 Other issues and improvements

Chapter 6 discussed a range of options for improving the NEM's principal reliability mechanisms. This chapter discusses other aspects of the NEM. On some of these matters the Panel also offers recommendations, to enhance the market's reliability performance. Issues are grouped under the following headings:

- Price mechanisms;
- Intervention mechanism;
- Operational issues; and
- Review period.

7.1 Price mechanisms

7.1.1 Correcting misconceptions about market prices

Skyrocketing 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)[51]. The political unacceptability of high spot prices generally is discussed by Henney and Bidwell[52] and by PWC[53].

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 seeks feedback on whether, wherever possible, long-term contract prices 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.

The Panel recognises the inherent difficulties with such information disclosure but is seeking feedback from stakeholders as to either the desirability and workability of publishing such data, or suggestions for additional information opportunities to improve understanding of market prices.

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[51] AAP, 19 January 2007; Power Industry News, Edition 525, 22 January 2007, p.10.
[52] Alex Henney and Miles Bidwell, POWER UK / ISSUE 122 / APRIL 2004, "Will *NEAT ensure generation adequacy?"*
[53] 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).

7.1.2 Treatment of the CPT

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.[54]

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.[55]

The CPT was established as part of the changes to the level of VoLL in the NEM. NECA had conducted a review of capacity mechanisms in parallel to the Reliability Panel's review of VoLL and a 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 the event 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.[56]

The Panel is considering 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 originally set 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.[57] Since then, however, the cost of OCGTs has increased (from approximately $50,000 to $75,000/MW) and the value of VoLL has

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

[55] Supplementary commentary from AGL subsequent to their submission.

[56] Ibid.

[57] 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.

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.

Taking the above into account, the Panel believes that the current level of CPT remains consistent with the philosophy that underpinned its creation, 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 preliminary conclusion is that the level of the CPT should remain unchanged.

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 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 preliminary conclusion therefore is that the CPT should not be augmented with physical triggers.

The Panel also notes that there may be ambiguity in the way the administered price cap applies and recommends that the AEMC review the level of the administered prices and the periods over which they apply.[58]

7.2 Intervention mechanism

7.2.1 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.[59]

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 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. The key issues are as follows:

- Whether, because the NEM can provide the same service more efficiently than NEMMCO, the reserve trader arrangements contribute to the market objective.

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58 Specifically, in the definition of peak and off-peak times and also whether these definitions refer to NEM time or local time.

59 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

- 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 response. As an alternative, longer-term contracts for reserve plant may be more effective and predictable. Such plant would need to be outside the market and priced at VoLL to avoid distorting market prices.
- 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.

The Panel's view is that the NEM's reliability settings should be designed to avoid undue reliance on safety net mechanisms. Even if market amendments were ultimately introduced that removed the reserve trader (as discussed in Chapter 6), the Panel believes that the time to process and implement the amendments is such that the current reserve trader mechanism needs to be improved. The Panel considers that the following refinements may have merit:

- To avoid the risk of loads 'double dipping', parties providing capacity to the reserve trader could be required to enter into a binding undertaking to the effect that they are not double dipping.[60] Parties would then be subject to legal action in the event they were subsequently found to have breached this undertaking.
- NEMMCO's costs could be apportioned in a manner that recognises prudent preparations by each retailer, for example by contracting and demand-side arrangements. The Panel is aware that acquiring the necessary information for this, such as contract details, may be regarded as intrusive. Arrangements to apportion costs could be developed similarly to those in the current Rules concerning mandatory restriction contracts. The Panel also notes that, in the event the reserve trader is called upon, NEMMCO may in fact make a surplus as it receives

[60] Some stakeholders expressed concern that some loads were suspected of providing DSR to NEMMCO but at the time same time contracting their load with a retailer.

the spot market revenue from dispatch of reserve trader plant. Thus, any changes to cost allocation would also be expected to be reflected in changes to the distribution of surplus.

- NEMMCO could be authorised to maintain a fund for expected reserve trading expenses, to the extent that funding of any NEMMCO shortfall cannot be hedged or budgeted for by retailers and that those costs cannot be passed on to consumers. Appropriate arrangements for carrying forward under-spending and over-spending would serve to reduce the risk to retailers.
- The reserve levels that trigger use of the reserve trader could be reviewed separately. (The methodology for doing so is discussed in the next section.)

7.2.2 Calculation of reserve margins

NEMMCO operationalises the NEM reliability standard by estimating the MRLs required in each region to meet it. 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.

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 October 2006.[61]

As discussed in section 7.3, there is some concern that NEMMCO's calculation of reserve margins is too conservative. A consequence of this has been that in two separate years NEMMCO has contracted for reserve but not been required to dispatch it. 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.[62] 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.[63]

Despite the concerns expressed above, submissions to the Issues Paper indicate that stakeholders generally accept that NEMMCO is still the most suitable entity to calculate MRLs and that its methodology is appropriate.

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[61] NEMMCO's MRL analysis is available on its website at http://www.nemmco.com.au/powersystemops/240-0020.htm.

[62] 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.

[63] 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.

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.[64]

7.2.3 'Share the pain' guidelines

The South Australian region is unique in the NEM because it 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.[65] 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%.[66] TRUenergy argues that under the 'share the pain' rule it is not possible to achieve an optimal reserve allocation.

The Panel acknowledges this issue but notes that:

- It is the role of NEMMCO to determine the quantity of load to be shed during a given system incident; and
- It is the role of each jurisdiction to determine which loads within its region should be disconnected when loads are reduced for security or reliability reasons.

7.2.4 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 Issues Paper, 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.

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[64] 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).

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

[66] TRUenergy supplementary submission

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 of the allowable short-term minimum reserve levels should be undertaken. To this end, the Panel intends to raise with NEMMCO the desirability of undertaking a review of the level of short-term reserves that should be used in short-term PASA.

7.3 Operational issues

7.3.1 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 powers too often and may be too pessimistic when coordinating plant maintenance outages. 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. The combined cost of these interventions was $5.4m, which was passed on to consumers.

The Panel recognises, however, that NEMMCO is taking steps to continue to improve its demand forecasting. In late 2004, NEMMCO engaged KEMA Consulting[67] to independently review its process for preparing the SOO's load forecasts (see also section 7.2.2). NEMMCO is evaluating KEMA's recommendations as part of its continual improvement processes.[68]

On balance, the Panel acknowledges NEMMCO's continuous improvement processes and has decided to recommend that NEMMCO report to the Panel in August 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.

7.4 The review period for VoLL and the other reliability settings

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 determines 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,

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

[68] Further information is provided in section 3.8.3 of the 2006 SOO.

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.

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. 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, three 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.

The Panel's preliminary conclusion is that VoLL should be reviewed less frequently and in conjunction with a regular and integrated review of all the reliability settings.

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.

Accordingly, the Panel proposes to recommend the replacement of the current annual review of VoLL with a comprehensive and holistic review of all the reliability settings (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 three to five years. The Panel believes that this will offer increased certainty for consumers and potential investors, which in turn will benefit reliability.

8 Matters for consultation

This chapter provides a summary of all the issues raised in this report about which the Panel seeks stakeholders' feedback.

8.1 Reliability performance to date

(full discussion in Chapter 3)

The reliability settings performance to date.
Although various factors have affected reliability outcomes, 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 Panel's preliminary view is that the reliability settings themselves have performed adequately to date.**

Historical analysis suggests that the reliability mechanisms are not always able to protect against extraordinary or coincident exogenous factors as were observed in SA and Victoria in 2000. The existing mechanisms also did not bring about sufficient capacity to prevent NEMMCO contracting for reserve capacity in 2004 and 2005. This was due to the fact that NEMMCO deemed that, during those years, a high load scenario could have caused the reliability standard to be breached and deemed it necessary to take action.

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 to ensure the reliability standard is not susceptible to ordinary events such as construction delays.

8.2 Reliability settings

(full discussion in Chapter 4)

1. The current form and level of the reliability standard, being USE of no more than 0.002%, should be retained.
2. The current scope of the reliability standard should not be changed.
3. The most economically justifiable and straightforward method of targeting 0.002% USE in the long term is simply to target 0.002% USE annually NEM-wide and within each region.
4. The form, level and scope of the reliability standard should be reconsidered within the next 3 years as part of a review of the overall package of reliability settings.
5. A hybrid form of standard should not be adopted. Instead, the Panel should regularly prepare forecasts of frequency, duration and depth of possible shortfalls that make up the 0.002% USE, to provide jurisdictions, consumers and industry with a gauge as to the possible nature of USE events.
6. The potential to add to the standard of demand or duration parameters for each jurisdictional region to provide for the fact that a single reliability standard may have different impacts for each region. The jurisdictions would then contract for additional reserve plant to meet these augmented standards.

8.3 Outlook for reliability in the future: provisional conclusion

(full discussion in Chapter 5)

The Panel has concluded that while the basic format of the energy-only market appears able to allow the market to deliver revenue streams over the longer term that would sustain sufficient investment to meet the reliability standard, it is less clear that the external environment in which the market operates will allow the market to function freely enough to succeed.

The Panel's preliminary conclusion is that there are risks on the horizon that may impact reliability in the future by affecting the timing of generation development to match expected demand, hence it may be prudent to adjust the reliability mechanisms to provide continuing confidence that the reliability standard will be met into the future.

8.4 Securing reliability in the future: draft alternatives

(full discussion in Chapter 6)

The Panel has as a result considered a number of alternatives and now seeks comment on these:

Alternative 1: Retaining the status quo pending resolution of certainty about the perceived policy risks discussed in Chapter 5. For the reasons discussed in section 6.3, the Panel highlights this comes with a risk that there will be greater reliance on the reserve trader, possibly in a redesigned form.

Alternative 2: Retaining all elements of the existing reliability settings but increasing VoLL to increase the probability that investment in peaking plant will be commercially viable. The Panel recognises that there may be counteracting influences associated with increased risk of exposure and volatility.

Alternative 3: Introducing one of the options for reliability mechanisms discussed in Chapter 6 without changing the fundamental energy-only philosophy. Within this alternative two options appear more attractive than others.

Alternative 3A: Introduce an additional ancillary service spot market for reserves (the RAS discussed in section 6.2.2) as an extension of the existing FCAS market and, at the same time, lower VoLL in recognition of the payment for reserve. Preliminary analysis suggests a VoLL of approximately $7,500/MWh would allow the same total revenue to be paid. The distribution of revenue between existing generators may also be affected but further analysis is required to gauge the impact. The ancillary service market would be a spot market against which it would be possible to hedge the payment but only a limited number of peak generators would be likely to provide such reserve at times when the reserve price was high.

Alternative 3B: Contract for reserve on a continuous basis as discussed in section 6.2.2. There are a number of means by which this can be achieved. It can be designed by institutionalising the reserve trader as an insurance, for use only if the capacity delivered by the market is inadequate. In this case, no change to other market settings would be warranted. Alternatively, the contract can be for a greater level of reserve to replace some of the reserve currently provided by the market. In this case the contract would operate as part of the ordinary market operations; hence there would be a case for lowering VoLL as less capacity would then be sought from market responses.

8.5 Other matters: draft recommendations

(full discussion in Chapter 7)

Regional reserve levels

The Panel seeks stakeholders' views on each regional jurisdiction specifying a higher capacity reserve level, in order to manage regional loss of load expectation, via standby reserve paid for by that region's consumers.

Reserve trader

The Panel's preliminary view is that: the reserve trader should be redesigned. The redesigned emergency reserve trader should be retained for a five year sunset period and that its operation should be reviewed after three years.

Review period

The Panel's preliminary view is that the current annual review of VoLL should be replaced by a comprehensive and holistic review every 3-5 years of all the reliability settings (the reliability standard, VoLL, CPT, the market floor price, and the redesigned emergency safety net). This will offer increased certainty for potential investors and consumers, which in turn will benefit reliability.

Demand forecasting

The Panel notes that some stakeholders believe NEMMCO's demand forecasting has systematically been too conservative, resulting in over-utilisation of the emergency reserve trader. The Panel acknowledges NEMMCO's efforts to improve the reliability of its forecasts but has decided to request that NEMMCO report to the Panel each August 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.

Distinguishing between short-term and medium-term reserves

The Panel's preliminary view is that the current practice whereby NEMMCO calculates minimum reserve levels on a medium term basis and then uses those levels to forecast reserve levels in both the short and medium term PASA is inadequate. The Panel has decided to request NEMMCO to conduct a review of the level of short term reserves that should be used in the short term PASA.

Translating the reserve standard into operational reserves

One option the Panel is considering is contracting for standing reserves on a continual basis. This could be done by institutionalising the reserve trader or by requiring a greater level of reserve than is currently provided by the market.

Aligning the CPT with the overall market design

Given that the CPT will only be exceeded in extreme conditions, and that raising it would only add to the financial risks imposed on market participants, the Panel's preliminary conclusion is that the level of the CPT should remain unchanged.

Appendix 1 Terms of reference

Introduction

In accordance with the National Electricity Rules (Rules) clauses 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 clause 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 per cent 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 (clause 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:

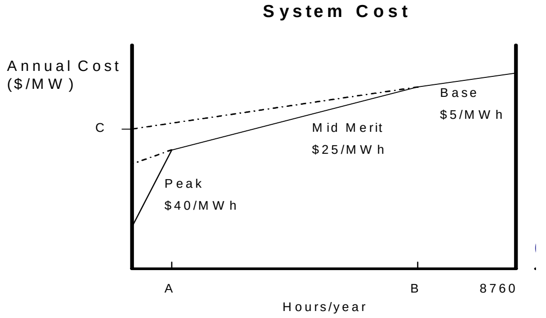
10. Utilise a lead consultant engaged and provided by the AEMC to assist in the preparation of scoping and issues papers, draft and final review documents, the undertaking of research and analysis and carriage of the review generally;

11. Provide the AEMC with a detailed project plan and budget by 24 February 2006; and

12. Brief the AEMC on progress in relation to the comprehensive reliability review from time to time as appropriate.

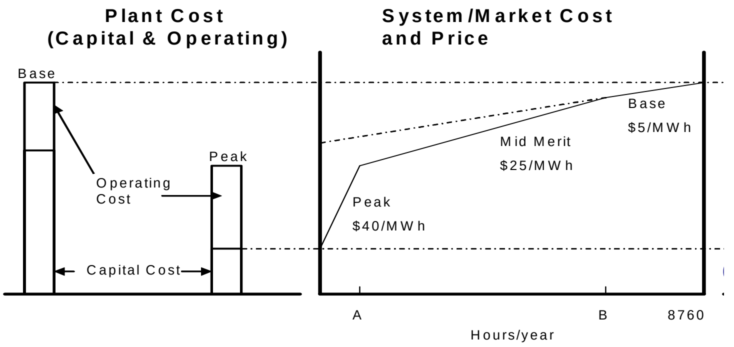
Appendix 2 Analysis information on costs and pricing

This was provided by CRA and the secretariat.



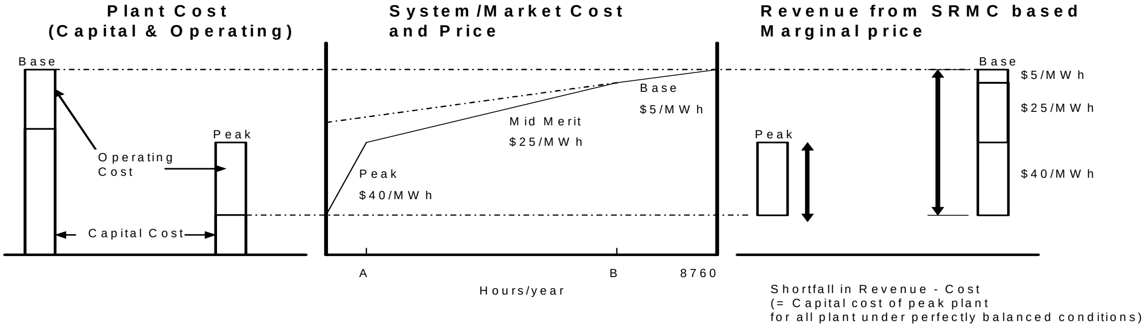
Consider a system with base plant with an operating cost (SRMC) of $5/MWh, mid merit plant with SRMC of $25/MWh and peak plant with SRMC of $40/MWh. Assume that the base plant runs 8760 hours per year, the mid merit plant for "B" hours per year and the peak plant for "A" hours per year.

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.

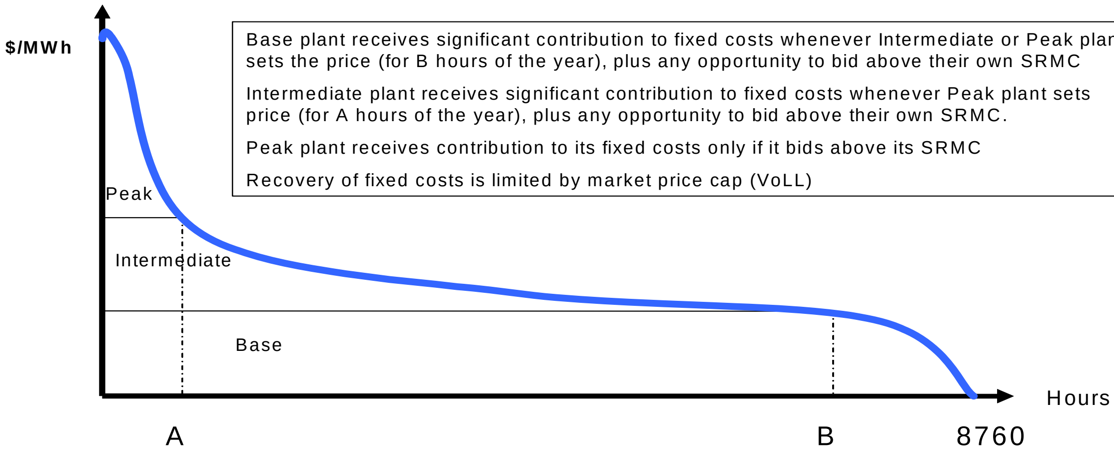
Revenue adequacy in market requires that each generator be able to recover its capital and operating cost.



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

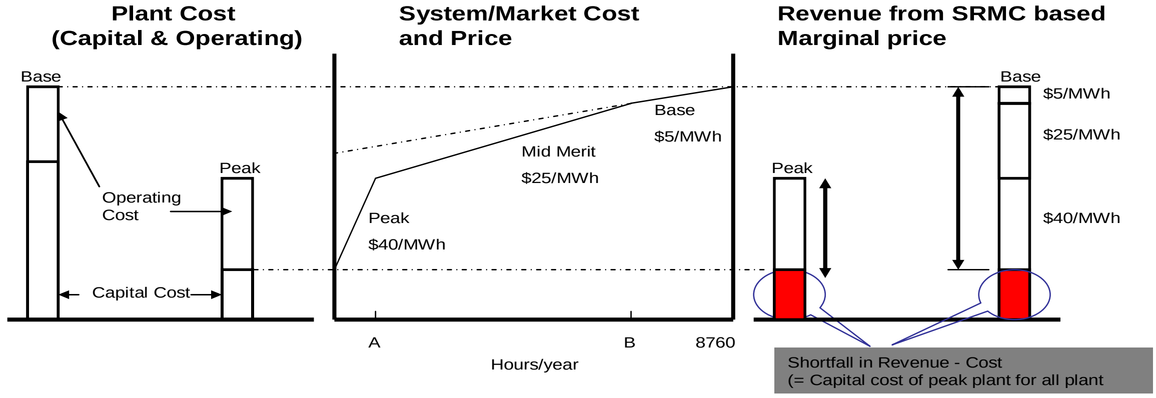


Base plant receives significant contribution to fixed costs whenever Intermediate or Peak plant sets the price (for B hours of the year), plus any opportunity to bid above their own SRMC

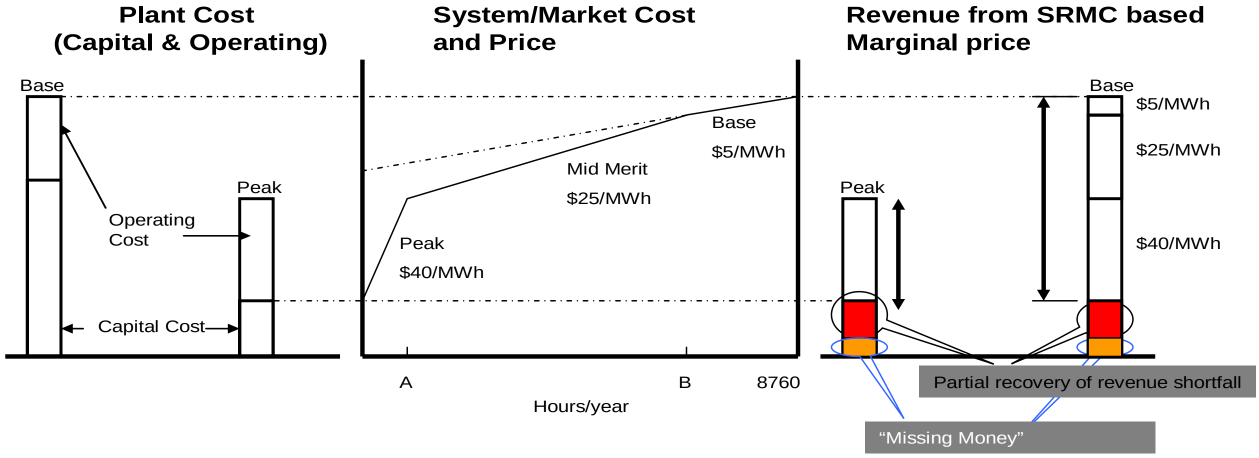
Intermediate plant receives significant contribution to fixed costs whenever Peak plant sets price (for A hours of the year), plus any opportunity to bid above their own SRMC.

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]

Appendix 3 Draft Decision – 2007 VoLL

Requirement

This appendix presents the Draft Determination by the Reliability panel (the Panel) for the 2007 review of the Value of Lost Load (VoLL), the market floor price and the Cumulative Price Threshold (CPT). Under the clauses 3.9.4 and 3.9.6 of the National Electricity Rules (the Rules), the Panel is required to conduct such a review by 30 April each year.

Current settings

VoLL is currently set at $10,000/MWh and the market floor price is set at -$1,000/MWh. The CPT is the cap for the cumulative price over a rolling 7-day, 336 trading interval, period and is currently set at $150,000/MWh. The cumulative price exceeds this threshold then administered prices are invoked. The administered prices are set by the AEMC (previously by NECA) and are currently at $100/MWh for peak periods and $50/MWh for off-peak periods.

Context – Comprehensive Reliability Review

This 2007 review is taking place under the umbrella of the Panel's major initiative to review wholesale market reliability arrangements, the comprehensive reliability review (CRR). The terms of reference for the CRR were provided to the Panel by the AEMC in December 2005.

As part of the CRR the Panel is completing a detailed assessment of the performance of the National Electricity Market, in particular the role of VoLL and the CPT in meeting the reliability standard of not more than 0.002% USE.[69]

Draft Determination – 2007 VoLL Review

In the context of the CRR review of the reliability mechanisms in the NEM, the Draft Determination of the Panel is to leave VoLL unchanged at $10,000/MWh, the market floor price unchanged at -$1,000/MWh and the CPT unchanged at $150,000/MWh.

This Draft Determination does not constrain the Panel from changing VoLL as part of its CRR recommendations.

Consultation

The Panel invites comment from stakeholders on this draft determination by 19 April 2007. This comment can form part of a stakeholders submission to the CRR.

[69] More information on this analysis is provided in the main-body of this report. The reliability standard is defined in Chapter 3 of the main-body of this report.

Appendix 4 Submissions, supplementary submissions and presentations

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

Submissions and supplementary submissions

- 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

Appendix 5 Quantitative analysis of reliability and reliability mechanisms

See attached paper by CRA.