

Reliability Panel AEMC

FINAL REPORT

Reliability Standard and Reliability Settings Review

30 April 2010

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005 to be the rule maker for national energy markets. The AEMC is currently responsible for rules and policy advice covering the National Electricity Market and elements of the natural gas markets. We are an independent, national body. 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 National Electricity Law (NEL).

Disclaimer

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

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Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APC	Administered price cap
CAIDI	Customer Average Interruption Duration Index
CPRS	Carbon Pollution Reduction Scheme
CPT	Cumulative price threshold
CRR	Comprehensive Reliability Review
DWGM	Declared wholesale gas market
ESOO	Electricity Statement of Opportunities
GWh	Gigawatt hour
LOLE	Loss of load expectation
LOLP	Loss of load probability
MCE	Ministerial Council on Energy
MEU	Major Energy Users
MPC	Market price cap
MRL	Minimum reserve levels
MWh	Megawatt hour
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NEO	National electricity objective
NGF	National Generators Forum
NSP	Network service provider
OCGT	Open cycle gas turbine
Panel	Reliability Panel
PASA	Projected Assessment of System Adequacy
PPI	Producer Price Index
RERT	Reliability and emergency reserve trader
Rules	National Electricity Rules

SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
STTM	Short Term Trading Market
ToR	Terms of Reference
USE	Unserved energy
VoLL	Value of Lost Load

Summary

In March 2009, the Australian Energy Market Commission (AEMC) provided the Reliability Panel (Panel) with a Terms of Reference for the Reliability Standard and Reliability Settings Review. The Reliability Standard and Reliability Settings includes the Reliability Standard, the market price cap (MPC, formerly VoLL), the cumulative price threshold (CPT), and the market floor price. The Panel is also required under clause 3.9.3A of the National Electricity Rules (Rules) to undertake a review and report on the Reliability Standard and Reliability Settings that should apply from 1 July 2012.

This Final Report presents the Panel's recommendations on the Review of the Reliability Standard and Reliability Settings. The objectives of this review are to:

- determine whether the existing Reliability Standard is appropriate for current market arrangements given that the existing annual standard was exceeded as a result of the South Australian/Victorian heatwave in January 2009;
- determine the form and level of the Reliability Standard that should apply from 1 July 2012;
- recommend the appropriate Reliability Settings to achieve the Reliability Standard to apply in the National Electricity Market (NEM) from 1 July 2012, given the Reliability Standard chosen,; and
- propose processes for implementing any changes arising from the review.

The Rules provide that the Panel must conduct the review in accordance with the Rules consultation procedures set out in rule 8.9 of the Rules.

Throughout this Review, the Panel has consulted with stakeholders, including through submissions on the Issues Paper and Draft Report, and through two separate public meetings. The submissions and presentations from stakeholders for this consultation are available on the AEMC website.^a

Reliability Standard

In reaching a decision on the form and level of the Reliability Standard, the Panel has considered the views expressed in submissions with respect to the Reliability Standard.

In addition, in the Draft Report the Panel considered the effects of relaxing the Reliability Standard based on the modelling work undertaken by ROAM Consulting (ROAM). ROAM examined the cost savings of relaxing the Reliability Standard.

^a The AEMC website can be found at www.aemc.gov.au.

Most submissions on the Draft Report supported the Panel's proposal that the current level of the Reliability Standard be maintained.^b

The Panel has determined to:

- retain the unserved energy (USE) form of the reliability standard;
- leave the level of the standard at 0.002% USE per annum for each region, and therefore for the NEM as a whole;
- retain the current scope of the reliability standard in terms of excluding system security events, industrial action and 'acts of God';
- retain the current operational approach of targeting to achieve an expectation of no greater than 0.002% USE each year and in each region, and in the NEM as a whole; and
- consider performance against the standard each year with the objective of providing continuous improvement to the processes that monitor and maintain reliability in the NEM, rather than the current practice of measuring compliance with the Reliability Standard over a ten year moving average.

Reliability Settings

The AEMC, on behalf of the Panel, engaged ROAM to undertake modelling work to assist the Panel to assess the Reliability Settings. The aim of the modelling was to assist the Panel to form a recommendation as to the levels of the MPC and the CPT to apply in the NEM. These values would take effect from 1 July 2012 and apply for the 2012/13 and 2013/14 financial years. ROAM was also requested to provide the Panel with advice on the impact of any change on the financial risks faced by market participants.

ROAM's Final Report has been published by the Panel as an accompanying document to this Final Report. The ROAM modelling includes:

- a benchmarking study against the analysis for the Panel's Comprehensive Reliability Review (CRR), published in December 2007;^c
- a description of the modelling assumptions; and

^b The only submission which explicitly did not support maintaining the level of the Reliability Standard was that of the Major Energy Users.

^c The CRR contained analysis performed by Charles River Associates (CRA) on possible changes to the MPC (then called VoLL). In its final CRR report the Panel recommended a rise in the MPC from \$10,000/MWh to \$12,500/MWh, based on the analysis provided by CRA. Further information on the CRR and the associated CRA analysis is available at <http://www.aemc.gov.au/Market-Reviews/Completed/Comprehensive-Reliability-Review.html>.

- the modelling results.

The ROAM modelling considered the values of MPC and CPT that would be expected to be necessary to achieve the Reliability Standard. It is based on determining whether new entry open cycle gas turbines (OCGTs) would be sufficiently profitable at a given level of Reliability Standard and MPC. The expected level of profitability of new entry OCGTs is based on Monte Carlo spot market simulations. ROAM and the Panel considered this approach was consistent with previous assessments of the required MPC and a valid proxy for the operation of NEM, where contract prices are derived from expected spot market outcomes. Following consultation with stakeholders and its own further assessment, the Panel considers that the economics of achieving the Reliability Standard (as modelled) is one of a number of aspects of delivering reliability in the NEM that should be reviewed by the AEMC.

The finding from ROAM is that an increase in the level of the MPC to approximately \$16 000/MWh may be required from 1 July 2012, for two years, in order to meet the Reliability Standard.^d This increase is attributed to:

- increased capital costs for new entrant OCGTs;
- peakier demand; and
- more detailed representation of interconnector capacity assumptions, resulting in reduced inter-regional capabilities at times of high demand.

ROAM also found that the level of the CPT is likely to need to be increased to \$240 000/MWh. ROAM has not recommended a change to the market floor price from the current level of -\$1 000/MWh.

In considering the Reliability Settings, the Panel is required to have regard for the potential impact of any increase in the MPC on spot prices, investment and the reliability of the power system.^e In addition, the Panel has considered the views expressed in submissions.

^d ROAM calculated the MPC value annually on a regional basis. ROAM then calculated a NEM-wide value by weighting these values with the regional annual energy consumption. See section 4.4.2 for more information.

^e This requirement is identified in clause 3.9.4 of the National Electricity Rules.

The Panel recommends that:

- Starting on 1 July 2012, the value of the MPC is increased annually in real terms from \$12 500/MWh according to the change in the Stage 2 (intermediate) Producer Price Index (PPI).
- Starting on 1 July 2012, the value of the CPT is increased from \$187 500/MWh annually according to the same index that is applied to the MPC.
- The Panel maintains an annual review process to determine whether higher increases in the MPC or CPT are necessary, and whether there were any significant changes that occurred to the economics and mechanism for delivering the Reliability Standard.
- The MPC and CPT will continue to be indexed according to this process as long as appropriate, given the Panel annual review process.
- The market floor price is maintained at -\$1 000/MWh.

In making this recommendation, the Panel notes that the current set of Reliability Settings is required to achieve multiple objectives:

- meeting the reliability standard;
- managing the financial risk of market participants; and
- meeting customer's value of reliability.

The Panel considers that, given the way the NEM is developing, the continued ability of the current set of Reliability Settings to achieve each of these objectives is limited. In particular, the Panel is concerned that increases in the MPC may reach a tipping point beyond which the benefits of increasing the MPC and CPT do not offset the costs in terms of market risks.

The Panel considers the AEMC would be best placed to undertake a review of both the mechanism for delivery of the capacity to ensure reliability, and the impact of the risk allocation framework in the NEM on achievement of reliability in the long term.

The Panel notes that it will continue to provide market participants with two years notice of any change to the indexing method, should the annual review process determine that a change is required. Each year the Panel will review the purpose of the index and assess whether the level of the MPC or CPT should deviate from the proposed indexed value. This will be particularly important initially, pending the outcome of the recommended AEMC review of the reliability framework, and to ensure sufficient resources are predicted to meet the Reliability Standard in Victoria and South Australia, which the 2009 ESOO indicates are the first regions at risk.

The Panel notes that the recommended MPC of \$12 500 (to be indexed), which is required to achieve the Reliability Standard of 0.002% USE, is broadly consistent with the Value of Customer Reliability (VCR) of \$13 250 for the residential sector.^f This sector has the lowest VCR value and would, from an economically efficient perspective, generally be the first to be shed if there was insufficient capacity to cover customer demand during a reliability incident. Therefore, the recommended MPC provides a reasonably efficient balance between the cost and the value of reliability of electricity supply at the wholesale level.

Following completion of this Review, the Panel will prepare a Rule change proposal to give effect to the above for submission to the AEMC. The Panel notes that in assessing the Rule change proposal the AEMC will assess the robustness of the proposed index. The Panel considers that in assessing the suitability of this index, the AEMC may wish to examine recent trends in input costs to generation investment.

^f VENCORP, 2008, *Assessment of the Value of Customer Reliability (VCR)*.

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1 Background to this review

1.1 Context of the review

In March 2009, the Australian Energy Market Commission (AEMC) provided the Reliability Panel (Panel) with the Terms of Reference (ToR) for a review entitled “Review of the operational arrangements of the Reliability Settings and Reliability Standard and Settings Review”.¹

In addition, following publication of the AEMC’s *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No.13*,² the Panel is required to undertake a biennial review of the Reliability Standard and Settings. Publication of the first biennial review, which pertains to the Reliability Standard and Reliability Settings to apply from 1 July 2012, must be completed by 30 April 2010.

Those aspects of the ToR pertinent to the Reliability Standard and Settings Review are:

- whether the wording of the standard, as published by the Panel in the Comprehensive Reliability Review (CRR), be changed to give better guidance to the Australian Energy Market Operator (AEMO) as to how to operationalise the standard; and
- test the appropriateness of the Reliability Standard and Settings for the future, including the form and level of the Reliability Standard, the Market Price Cap (MPC, formerly Value of Lost Load, or VoLL), the cumulative price threshold (CPT), and the market floor price.

In respect of the first dot point above, as part of the Panel’s “Review of the Operational Arrangements for the Reliability Standard”,³ the Panel has reviewed the wording of the existing Reliability Standard in consultation with AEMO in order to ensure that the policy intent in the CRR has been clearly implemented. Changes made to the Reliability Standard as a result of that review took effect immediately and should be used by AEMO for its current process to recalculate the medium-term Minimum Reserve Levels (MRLs).

1.2 Consultation process

This review was undertaken in accordance with the Rules consultation procedures outlined in rule 8.9 of the National Electricity Rules (Rules). Given that the outcomes

¹ For ease of reference, the Terms of Reference is included in Appendix A of this Final Report.

² AEMC 2009, *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No.13*, Final Rule Determination, (28 May 2009, Sydney), p.32.

³ For more information about this review, see: www.aemc.gov.au/Market-Reviews/Open/Review-of-Operationalisation-of-the-Reliability-Standards.html.

of this review will have important implications for National Electricity Market (NEM) stakeholders, including generators, retailers, consumers, market customers, network service providers (NSPs), AEMO and the Australian Energy Regulator (AER), stakeholder consultation was a key element of the review.

The following key dates outline the Rules consultation process that led to the delivery of the Panel's Final Report to the AEMC.

Date	Milestone
Friday, 26 June 2009	Publication of Issues Paper
Monday, 13 July 2009	Public forum in Sydney for both the Reliability Standard and Settings Review and Review of Operationalisation of the Reliability Standards
Friday, 14 August 2009	Close of submissions on Issues Paper
Wednesday, 23 December 2009	Publication of Draft Report
Friday, 12 February 2010	Public Meeting in Melbourne
Tuesday, 23 February 2010	Close of submissions on Draft Report
Friday, 30 April 2010	Publication of Final Report

1.3 Consultation on the Issues Paper

The Panel sought stakeholder comments on its Issues Paper which was published on 26 June 2009. In addition, the Panel held a stakeholder forum on this review and the Panel's "Review of the Operational Arrangements for the Reliability Standard" on 13 July 2009.

Submissions on the Issues Paper closed on 14 August 2009. The Panel received submissions from the Major Energy Users (MEU), the National Generators Forum (NGF) and Origin Energy. A copy of these submissions can be found on the AEMC website.⁴

1.4 Consultation on the Draft Report

The Panel published the Draft Report on 23 December 2009 and sought stakeholder comments on the review. Submissions on the Draft Report closed on 23 February 2010. The Panel received sixteen submissions, from:

- AGL Energy;
- Alinta Energy;

⁴ The submissions are available at www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Reliability-Standard-and-Settings.html.

- Australian Energy Market Operator;
- Energy Retailers Association of Australia;
- Energy Users Association of Australia;
- ERM Power;
- Government of South Australian Department for Transport, Energy and Infrastructure;
- Hydro Tasmania;
- International Power Australia;
- Loy Yang Marketing Management Company;
- Macquarie Generation;
- Major Energy Users;
- National Generators Forum;
- Origin Energy;
- Snowy Hydro; and
- TRUenergy.

A copy of these submissions can be found on the AEMC website.⁵

1.5 Public Meeting on the Draft Report

The Panel published the Draft Report in December 2009. The Panel held a second Public Meeting in Melbourne on 12 February 2010 to discuss the results and findings presented in the Draft Report of the Panel’s Review of the Reliability Standard and Settings. There were six presentations given by stakeholders at the Public Forum. A copy of these presentations can be found on the AEMC website.⁶

⁵ The submissions are available at www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Reliability-Standard-and-Settings.html.

⁶ The presentations are available at www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Reliability-Standard-and-Settings.html.

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2 Reliability Standard and Reliability Settings Review

2.1 The need for the Reliability Standard and Reliability Settings Review

The Panel is required under clause 3.9.3A of the Rules to review the Reliability Standard and Reliability Settings every two years. Regularly reviewing the Reliability Settings balances the need for certainty for consumers and investors on the one hand; and the need to maintain appropriate and timely consideration of overall NEM reliability performance. The Reliability Settings, the MPC, CPT and the market floor price, align with the National Electricity Objective (NEO), as they promote the long term interest of consumers and electricity by ensuring that the Reliability Standard is met.

2.2 The requirements under the Rules for reviewing the Reliability Standard and Reliability Settings

By 30 April 2010, the Panel is required under clause 3.9.3A of the Rules to undertake a review and report on the Reliability Standard and Reliability Settings that should apply from 1 July 2012.⁷

2.3 The existing Reliability Standard and the Reliability Settings

2.3.1 Reliability Standard

The Reliability Standard is a measure of the expected amount of energy at risk of not being delivered to consumers due to a lack of available capacity. Currently under the Reliability Standard, the level of expected unserved energy (USE) should not exceed 0.002% of the annual energy consumption per region.

2.3.2 Reliability Settings

The level of the MPC, the market floor price and the CPT are the key price envelopes within which the wholesale spot market seeks to balance supply and demand and deliver capacity to meet the Reliability Standard with the aim of avoiding unmanageable risks for market participants.⁸ The level of the MPC and the market floor price are crucial because they provide key signals for supply and demand-side investment and usage. For example, if the MPC is set too high, Market Customers (retailers or consumers that are directly exposed to the spot price) and generators can be exposed to very large financial risks. However, if set too low, there may be

⁷ An excerpt of the Panel's obligations under the Rules is provided in Appendix B of this Final Report.

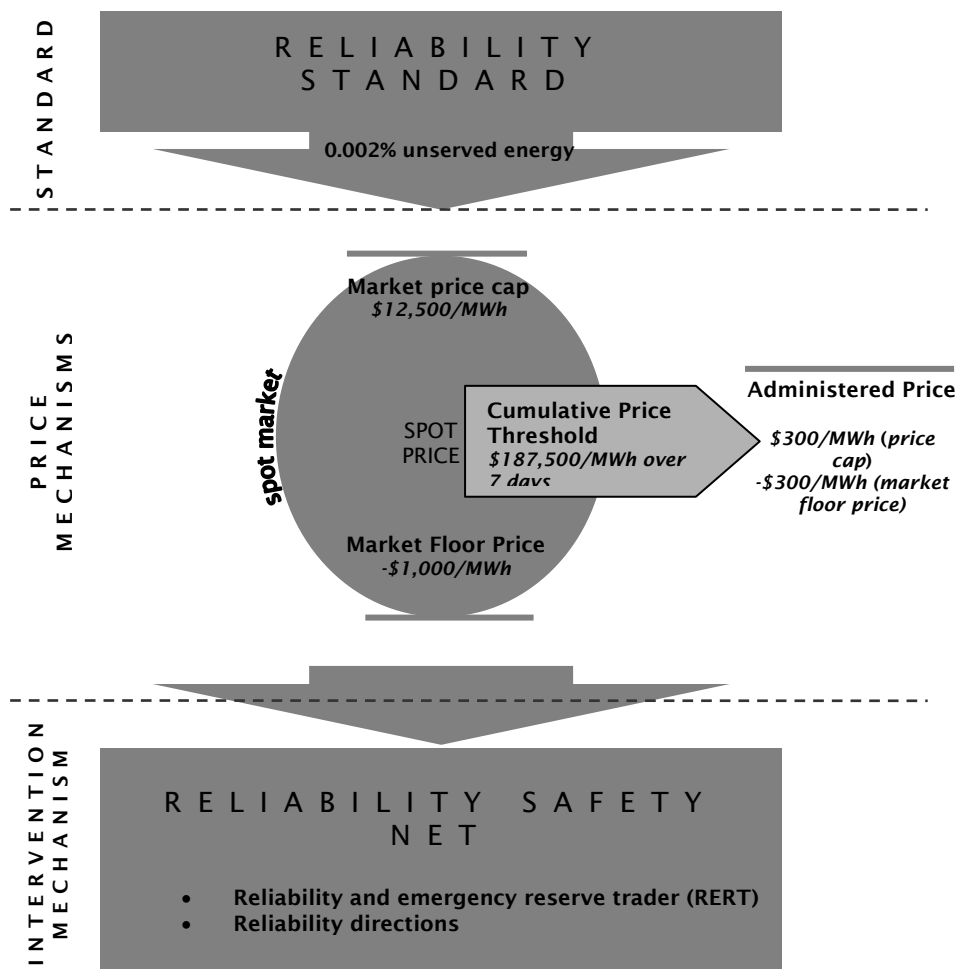
⁸ AEMC Reliability Panel, *NEM Reliability Settings: VoLL, CPT and Future Reliability Review Rule Change Proposal* (December 2008, Sydney), p.1.

insufficient incentives to invest in new generation capacity and demand-side response to meet the Reliability Standard.

The CPT is an explicit risk management mechanism designed to limit participants' exposure to protracted levels of high prices in the wholesale spot market. If the sum of the half-hourly wholesale market spot prices over a rolling seven-day period exceeds the CPT, AEMO must impose the administered price cap (APC). The APC is specified in a schedule that is developed, authorised, published and varied by the AEMC. The APC is currently \$300/MWh for all regions of the NEM, for all time periods.⁹

The NEM Reliability Standard and Reliability Settings as they apply from 1 July 2010 are depicted graphically in Figure 2.1 below.

Figure 2.1 NEM Reliability Standard and Reliability Settings that apply from 1 July 2010



⁹ AEMC 2009, *National Electricity Amendment (NEM Reliability Settings: VoLL, CPT and Future Reliability Review) Rule 2009 No.13*, Final Rule Determination, 2009, Sydney, p.1.

The reliability safety net, which includes the reliability and emergency reserve trader (RERT) and reliability directions are important intervention measures that are available to AEMO to reduce the level of any load shedding. Clause 4.8.9 of the Rules explicitly outlines AEMO's obligations in respect of reliability directions and is not subject to a sunset. Reliability directions are not included in the Panel's assessment of the Reliability Settings for this review. The RERT on the other hand, under clause 3.20.1(a) of the Rules, is subject to a sunset of 30 June 2012. Furthermore, under clause 3.20.9(a) the Panel is required to complete a review of the RERT by 30 June 2011. Given that the Panel must conduct its review of the RERT prior to the commencement date of the outcomes from this review, the RERT is not included in the Panel's assessment of the Reliability Settings.

Within the existing energy only market design framework, the mechanisms that can be adjusted to provide investment signals are limited to the MPC, the CPT and the market floor price.¹⁰ Other mechanisms that deliver investment signals were considered and consulted on as part of the CRR, but were not considered further by the Panel given the high risk of breaching the reliability standard at that time and the constraints of an energy-only market. The Panel notes that new mechanisms were considered during the AEMC's Review of the Effectiveness of Energy Market Frameworks in light of Climate Change, and may also result from other Ministerial Council on Energy (MCE) initiatives.¹¹ The Panel recognises that if new mechanisms arise, the levels of the MPC, the CPT and the market floor price may need to be re-examined at a later stage.¹²

2.4 The reasons for changing the Reliability Settings to apply from 1 July 2010

Since the publication of the CRR, the Commonwealth Government announced plans for a Carbon Pollution Reduction Scheme (CPRS), and an expansion of the existing Mandatory Renewable Energy Target. At the request of the MCE, the AEMC reviewed the implications of the introduction of the CPRS and expanded renewable energy target on the energy market frameworks and the Rules.¹³

In a Rule change proposal¹⁴ to the AEMC, the Panel highlighted the prior intention for the CPRS to be introduced on 1 July 2010. In light of this, the Panel noted that it had sought views from stakeholders on the appropriateness of 1 July 2010 as to the effective date for both the increase in the MPC and the CPT. The Panel noted that responses on this issue had been mixed. Nevertheless, the Panel decided that, taking into account all relevant factors, it was appropriate to propose to raise the MPC and

¹⁰ AEMC Reliability Panel, *NEM Reliability Settings: VoLL, CPT and Future Reliability Review Rule Change Proposal*, (December 2008, Sydney), p.2.

¹¹ Ibid.

¹² Ibid.

¹³ More information on this Review can be found at www.aemc.gov.au/Market-Reviews/Completed/Review-of-Energy-Market-Frameworks-in-light-of-Climate-Change-Policies.html

¹⁴ AEMC Reliability Panel, *NEM Reliability Settings: VoLL, CPT and Future Reliability Review Rule Change Proposal*, (December 2008, Sydney), p.14.

maintain the CPT level relative to the MPC with effect from 1 July 2010.¹⁵ The AEMC concluded in its final Rule determination that the MPC and the CPT be raised at the same date, namely 1 July 2010.¹⁶

The AEMC considered that although other factors may influence the levels of contracting and contract prices, the mechanisms within the existing energy market design framework that can be adjusted to provide investment signals are limited to the MPC, the CPT and the market floor price. The AEMC therefore considered that a given level of NEM reliability – 0.002% USE in the case of the NEM – can best be targeted by raising the MPC, as this would expose retailers to additional risk and create incentives for greater levels of contracting.¹⁷ In respect of the CPT, the AEMC considered that, given its determination to increase the level of the MPC to \$12 500/MWh, failure to increase the absolute level of the CPT would result in an increase in the number of CPT breaches, thereby frustrating the aim of the increase in the MPC. The AEMC considered that the CPT should be set at such a level to protect market participants by limiting their exposure to extreme price events and that it should not act to inhibit or blunt the investment signals given by the MPC. However, the AEMC determined to set the CPT at an absolute level of \$187 500/MWh, rather than “hard wire” a ratio of 15 times VoLL, as proposed by the Panel.¹⁸

The AEMC considered that the Panel’s Rule change proposal was likely to contribute to achievement of the NEO because:

- increasing the MPC to \$12 500/MWh from 1 July 2010 would promote efficient investment and that this will further the long term interests of consumers of electricity in terms of representing an efficient balance between the price and reliability of supply of electricity;¹⁹
- increasing the level of the CPT to an absolute value of \$187 500/MWh would allow for an efficient level of investment in electricity services. This would be in the long term interest of consumers with respect to reliability, while providing an appropriate level of protection to such consumers with respect to the price of electricity through the prevention of extended periods of very high prices that might result in certain extreme circumstances;²⁰ and
- reviewing the Reliability Standard and all the Reliability Settings (i.e. the MPC, CPT, and the market floor price) together would promote the long term interest of consumers as it improved the ability of the NEM to meet the Reliability Standard.²¹

¹⁵ Note that introduction of the CPRS has been delayed beyond 2013.

¹⁶ AEMC Reliability Panel, *NEM Reliability Settings: VoLL, CPT and Future Reliability Review Rule Change Proposal*, (December 2008, Sydney), p.14.

¹⁷ *Ibid*, p.17.

¹⁸ *Ibid*, p.24.

¹⁹ *Ibid*, p.18.

²⁰ *Ibid*, p.24-25.

²¹ *Ibid*, p.30 and p.32.

3 Review of the Reliability Standard

3.1 Background

The Reliability Standard was set at 0.002% unserved energy (USE) by the Panel at market start in 1998. The Reliability Standard describes the minimum acceptable level of bulk electricity supply delivered to consumers in a region measured against the total demand of consumers in that region.

For the purposes of assessing the Reliability Standard, the bulk electricity supply is taken to mean the total generation and demand side capacity within a region, together with the support available from other regions via interconnectors, that can contribute to meeting consumer demand within the region. The Reliability Standard excludes distribution and those transmission components that do not impact on inter-regional transfer capability. Distribution networks are subject to performance standards that are set and monitored by jurisdictional bodies.

The practice to date has been to measure the Reliability Standard over the long term. Thus, if consumer energy demand was 100 000 MWh over the long term, the Reliability Standard would require the supply of no less than 99 998 MWh. Currently, in order to operationalise the Reliability Standard, AEMO calculates MRLs for each region. It then compares forecast and actual reserve levels with the MRLs to manage the risk that the Reliability Standard will not be met at the time of dispatch. Historically, the NEM has performed well against the Reliability Standard.

The current definition of the Reliability Standard, its form, level and compliance are outlined below and are part of the Panel's *Power system security and reliability standards*.

3.1.1 Current form of the Reliability Standard

The NEM Reliability Standard is expressed in terms of the maximum expected level of electricity at risk of not being supplied to consumers, per financial year. The USE is measured in GWh and should be expressed as a percentage of the annual energy consumption for the associated region or regions.

In the CRR²², a number of alternative definitions of reliability were raised, which included the following:²³

- how frequently supply is interrupted – for example, the number of days per year in which an interruption occurs;

²² Further discussion is on page xi of the Final Report of the Panel's "Comprehensive Reliability Review", published December 2007, and on page 9 of the Panel's 2008 Annual Market Performance Review.

²³ See pages 22-26 of the Final Report of the Panel's "Comprehensive Reliability Review", published December 2007.

- 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 Reliability Standard, or the System Average Interruption Duration Index (SAIDI) for distribution.

As part of the CRR, the Panel made an international comparison of reliability standards that showed many international jurisdictions that are 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):²⁴

- 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 percentage (probability) of days per year, half-hours per year, or events per season, in which available generating capacity is insufficient to serve demand.

In its CRR, the Panel noted that there was general support for retaining the USE form of the Reliability Standard from stakeholders. The reasons given were that it:

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

3.1.2 Current level of the Reliability Standard

The expected level of USE is required to be no greater than 0.002% of the annual energy consumption for the associated region or regions per financial year. This has been the level of the Reliability Standard since the start of the NEM.

The Panel considered the level of the Reliability Standard as part of its CRR. At that time, no stakeholder submissions put forward an alternative level for the Reliability Standard. The Panel also made an international comparison of the level of the NEM Reliability Standard with the standard in similar markets.

The Panel concluded in its CRR that the level of the NEM Reliability Standard should remain at 0.002% USE. This was based on the Panel’s view that:

- there had been no call from stakeholders, particularly those of consumer representative groups, for a change to the standard’s level;

²⁴ Ibid.

- 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; and
- any tightening of the level of the standard would likely have a substantial cost in terms of required new investment.

3.1.3 Current performance against the Reliability Standard

Currently performance against the Reliability Standard is measured over the long-term using a moving average of the actual observed levels of annual USE for the most recent ten financial years.²⁵

Operationally, it should be planned to achieve an expected USE that is within the Reliability Standard in each financial year, for each region and for the NEM as a whole.

3.1.4 Current scope of the Reliability Standard

Prior to publication of the CRR, load shedding due to industrial action was included in calculations of USE, which resulted in South Australia and Victoria falling outside the Reliability Standard in 2000.²⁶ The South Australian and Victorian USE for the January 2009 reliability events on an annual energy basis were estimated at 0.0032% and 0.004%²⁷ respectively.²⁸ With the inclusion of USE from industrial action, averages for USE due to capacity adequacy shortfalls for the past ten financial years show that New South Wales and Queensland remain within the Reliability Standard. However, over the same period South Australia (0.0021%) and Victoria (0.0075%) fell outside the Reliability Standard.

Following publication of the CRR, the scope of the Reliability Standard was amended to exclude USE associated with “power system incidents that results from industrial actions or ‘acts of God’ at existing generating or inter-regional transmission facilities”.²⁹ When the USE resulting from the industrial action in South Australia and Victoria in the 1999/2000 and 2000/2001 financial years is excluded, the

²⁵ Section 3.3.6 of this report discusses the changes that the Panel is making to these arrangements.

²⁶ The failure of South Australia and Victoria to meet the Reliability Standard in 2000 is attributable to a coincidence of industrial action, high demand and temporary unavailability of generating units in Victoria. Due to this single event, Victoria’s long term averages remain outside the Standard. See AEMC Reliability Panel 2008, *Annual Market Performance Review – Final Report*, December 2008, p.9.

²⁷ Note that the security event in Victoria on 30 January 2009 due to the unplanned outages of the South Morang to Keilor and South Morang to Sydenham 500 kV lines is not included in the total USE for Victoria, but has been estimated at 0.006% on an annual energy basis.

²⁸ NEMMCO, *Power System Incident Report – Actual Lack of Reserve (LOR3) in Victoria and South Australia Regions on 29-30 January 2009*, May 2009, p.4.

²⁹ The Reliability Standard as published in the AEMC Reliability Panel’s Power system security and reliability standards review is reproduced in Appendix C.

recalculated USE values for the past ten financial years for South Australia (0.00051%) and Victoria (0.00044%) remain within the Reliability Standard.³⁰ New South Wales and Queensland also remain within the Reliability Standard and since Tasmania joined the NEM in May 2005, it has not experienced a breach of the Reliability Standard.

3.2 Consultation on the Reliability Standard

3.2.1 Issues Paper

In its Issues Paper the Panel sought comments from stakeholders on the Reliability Standard. In particular, the Panel asked:

- Is the current form of the Reliability Standard appropriate for current and projected market arrangements or should it be replaced by another form such as LOLE or LOLP?
- If the current form of the Reliability Standard is considered acceptable, is:
 - the level considered appropriate?
 - the current practice of judging compliance over a long term (10 year) timeframe appropriate?
 - the operational practice of planning to achieve expected USE each financial year that is within the Standard appropriate?

Submissions on the Issue Paper closed on 14 August 2009 and the Panel received submissions from the NGF, Origin Energy and the MEU.

3.2.2 Draft Report

In the Draft Report the Panel sought stakeholder feedback on the advice it obtained from ROAM Consulting. That is, whether:

- tightening the Reliability Standard is expected to provide benefits to customers that would outweigh the cost of the required additional generator investment; or
- relaxing the Reliability Standard is expected to reduce the cost of generator investment by more than the reduction to the benefits to customers.

Submissions on the Draft Report closed on 23 February 2010. The Panel received sixteen submissions as listed in Section 1.4. Most submissions supported the Panel's draft recommendations for the Reliability Standard.

³⁰ This assumes USE in South Australia and Victoria for the 2008/2009 financial year of 0.0032% and 0.004% respectively, with no further USE observed through to 30 June 2009.

3.3 Issues raised by stakeholders

3.3.1 The entity to determine the Reliability Standard

In its submission on the Issues Paper, the NGF questioned whether the Panel was the right entity to determine the form of the Reliability Standard. The NGF suggested that this core policy decision may better be made by the MCE.³¹

In its submission on the Draft Report, LYMMCO considered that the Panel was the appropriate body to undertake any economic analysis when considering changes to the reliability standard.³²

3.3.1.1 Panel's view

At present, the Panel is the organisation that is currently required to determine the Reliability Standard, in accordance with the Rules.³³

The Panel noted the concerns of the NGF and referred them to the “Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events”. This review is being undertaken by the AEMC at the direction of the MCE.³⁴

3.3.2 Scope of the Reliability Standard

In its submission on the Issues Paper, the MEU considered that consumers are not concerned with the reason for a lack of supply, rather they are concerned with the overall level of reliability. Therefore, the MEU considered that all sources of supply interruption should be counted against the Reliability Standard, including industrial action and multiple contingencies.³⁵

In its submission on the Draft Report, LYMMCO supported the Panel's position, below, but noted that while such interruptions to supply should not be included in the Reliability Standard, any changes to the Reliability Standard and Settings should be cognisant of the implications of these events.³⁶

³¹ NGF submission, “Reliability Standards and Settings Review (REL0034)” (Issues Paper submission), 14 August 2009, p.1.

³² Loy Yang Management Marketing Company (LYMMCO) submission, “Reliability Standards and Settings Review” (Draft Report submission), 23 February 2010, p.3.

³³ Clause 3.9.3A requires the conduct a review of the Reliability Standard every two years.

³⁴ Further information on the “Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events” is available on the AEMC's website at <http://www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Effectiveness-of-NEM-Security-and-Reliability-Arrangements-in-light-of-Extreme-Weather-Events.html>

³⁵ MEU submission, “Review of the Operational Arrangements for the Reliability Standard (REL0035) and Review of the Reliability Standard and Settings (REL0034)” (Issues Paper submission), August 2009, p.37.

³⁶ LYMMCO, Draft Report submission, p.3.

AEMO considered that the Reliability Standard should be used as a target for forecasting without making adjustments for recent events and that the current exclusions of system security interruptions should be maintained.³⁷

3.3.2.1 Panel's view

The Panel agrees with the MEU that the cause of supply interruptions does not directly affect the impact on individual consumers. However, the different links in the supply chain (from generators to consumers) operate differently and their performances are regulated with different mechanisms. This is summarised in the table below.

Link in supply chain	Type of market	Causes of customer lack of supply	Management of unreliability
Generation (plus bulk transmission)	Competitive wholesale market	Lack of generation and bulk transmission network	Reliability Settings (MPC and CPT), plus AEMO interventions as a safety net
Transmission networks	Regulated monopoly	System security events and local network reliability issues	Economic regulation of transmission network service provider
Distribution networks ³⁸	Regulated monopoly	Local network security and reliability issues	Economic regulation of distribution network service provider

Therefore, the Panel considers that the Reliability Standard that applies to the operation of the competitive wholesale market should only consider unserved energy that can be managed by adjusting the Reliability Settings.³⁹ That is, the level of investment in new capacity in the NEM, and hence the resulting reliability, is regulated through the process of setting the MPC and the CPT.

In addition, the Panel considers that unserved energy due to industrial action and "acts of God" should not be included against the Reliability Standard. The implications of including such unserved energy would require the Panel to raise the level of the MPC and CPT to target the Reliability Standard based on its view of the likely level of industrial action. This would lead to increased price volatility and costs to consumers. In the same way, AEMO would need to increase the MRLs to

³⁷ AEMO submission, "Reliability Standards and Settings Review" (Draft Report submission), p.2.

³⁸ Some large customers connect directly to the transmission network and are, therefore, unaffected by interruptions in the distribution network.

³⁹ The Reliability Settings are the MPC, the CPT and the market floor price.

allow for possible industrial action, which would lead to increased market interventions.

Similarly, the Panel also considers that increasing the MPC and CPT is not the appropriate mechanism to manage the unserved energy caused by system security events such as multiple contingencies. The Panel considers that such incidents are better managed through operating procedures, technical compliance programs and the economic regulation of the networks.

At present, the Panel is the entity responsible for reviewing the Reliability Settings for the wholesale market, and recommending changes, as required. The Panel is not currently responsible for the reliability standards for transmission and distribution networks.⁴⁰

The process for determining the Reliability Settings is discussed in Chapter 4.

3.3.3 Form of the Reliability Standard

A number of submissions on the Issues Paper were supportive of the Reliability Standard being an output based form and expressed in terms of a targeted permissible level of USE in each region.⁴¹

The MEU, in its Issues Paper submission, supported the Reliability Standard being in the form of a USE standard but considers that there should be a composite form of Reliability Standard that also considered the frequency and duration of the supply interruptions.⁴² The MEU suggested that frequency and duration of the supply interruptions should be measured using indices such as SAIDI and the System Average Interruption Frequency Index (SAIFI).

3.3.3.1 Panel's view

In its CRR the Panel acknowledged that one form alone does not provide perfect information about interruption to supply and, in particular, the USE standard provides no information about the frequency of supply interruptions nor about the depth of any single interruption. However, at that time the Panel considered that introducing a hybrid reliability standard is likely to create conflicting objectives that cannot readily be incorporated into the energy only market design. For instance,

⁴⁰ Clause 8.8.1(b) explicitly forbids the Panel from monitoring, reviewing or reporting on the performance of the market in terms of the reliability of distribution networks.

⁴¹ Origin Energy submission "Reliability Standards and Settings Review (REL0034)" (Issues Paper submission, 21 August 2009, p.1; AEMO, Draft Report submission, p.2; AGL submission, "Reliability Standards and Settings Review" (Draft Report submission), p.1; LYMMCO, Draft Report submission, p.2; NGF submission, "Reliability Standards and Settings Review" (Draft Report submission), p.8; Snowy Hydro submission, "Reliability Standards and Settings Review" (Draft Report submission), p.1.

⁴² MEU, Issues Paper submission, p.40.

introducing parameters to limit the frequency or depth of individual events may unavoidably affect the cumulative, long-term energy shortfall.⁴³

Since the start of the NEM there have been very few instances of USE caused by reliability incidents.⁴⁴ Measures such as SAIDI and SAIFI are more applicable to distribution networks where there are many small localised outages, making it meaningful to consider these statistical indices. In addition, the Panel notes that the interruptions to individual customers that occur during reliability incidents are generally rotated between affected customers – rolling blackouts. This means that the interruptions to individual customers are of the same length, thus fixing the value of the Customer Average Interruption Duration Index (CAIDI) index.⁴⁵

3.3.3.2 Panel's final recommendation

The Panel remains of the view that the form of the Reliability Standard should continue to be based on a USE limit. In addition, the Panel considers that adding other dimensions to the standard, such as SAIDI and SAIFI, would add to the complexity of its implementation without adding sufficient value to participants.

The Panel does, however, see value in AEMO calculating and publishing the expected distribution of reliability outcomes on a regional basis, which could be determined from the Monte Carlo simulations used to determine the MRLs. AEMO could then estimate other reliability statistics such as LOLE and LOLP from this distribution of possible reliability outcomes. Through the publication of the distribution of reliability outcomes and other reliability statistics stakeholders would be able to gain a fuller appreciation of the possible market outcomes for a given supply/demand situation, i.e. whilst the expected USE may be 0.002%, there is the potential for higher or lower levels of USE for a given level of installed capacity in the market.

3.3.4 Level of the Reliability Standard

Most submissions supported the Panel's draft recommendation to maintain the level of the Reliability Standard.⁴⁶ For some, this was because they did not consider there

⁴³ AEMC Reliability Panel 2007, *Comprehensive Reliability Review, Final Report*, December 2007, Sydney, p.23.

⁴⁴ Since the start of the NEM there were 3 days in 1999/2000 when there was USE in Victoria and SA, 1 day in 2004/05 in NSW and 2 days in 2008/09 in Victoria and South Australia. This ignores the USE due to industrial action in the early 2000s.

⁴⁵ The Customer Average Interruption Duration Index (CAIDI) is the sum of the duration of each sustained customer interruption (in minutes) divided by the total number of sustained customer interruptions. The CAIDI index is one of the indices that are usually used to report the reliability of distribution networks.

⁴⁶ AEMO, Draft Report submission, p.3; AGL, Draft Report submission, p.1; Alinta Energy, "AEMC – Reliability Panel – Draft Report on the Reliability Standards and Settings Review" (Draft Report submission), 23 February 2010, p.4; Hydro Tasmania, "Reliability Standards and Settings Review" (Draft Report submission) 23 February 2010, p.1; International Power, "Submission to the AEMC Reliability Standards and Settings Review" (Draft Report submission), 23 February 2010. p.5; LYMMCO Draft Report submission, p.3; Macquarie Generation, "Reliability Standards and Settings

was any rationale to change the level of the Reliability Standard from its current level of 0.002% USE.⁴⁷

The NGF, in its Issues Paper submission, considered that the definition of the Reliability Standard should be improved to “better manage the tension between the economic and political consequences” of the current standard, however the NGF was not specific on how this could be achieved. The Panel believes that it considered this tension when undertaking both the CRR and this current review.⁴⁸

The MEU considered that the cost of meeting the Reliability Standard should also be considered when determining the Reliability Settings and that the Panel had not considered the economic costs to consumers of relaxing the Reliability Standard.⁴⁹ The Panel considers that this cost needs to be considered when determining the level of the Reliability Standard. The MEU also suggested that there would only be a small impact on consumers overall reliability from relaxing the level of the Reliability Standard from 0.002% to 0.004% USE.⁵⁰ This is based on the MEU’s comparison of the 0.002% USE with the stated reliability of 99.25% and 98% for transmission and distribution networks respectively.

3.3.4.1 Panel’s view

The Panel notes that the MEUs approach is not an appropriate comparison of reliability statistics. The 0.002% USE for the Reliability Standard relates to situations (actual or possible) where demand in a region exceeds supply and customer load cannot be fully met. However, the transmission and distribution statistics relate to outages of individual network elements, leading to reduced network capability, but usually without any loss of supply.

Implications of the level of the Reliability Standard

Currently the level of the Reliability Standard is set at 0.002% USE per annum. This is equivalent to:

- a system wide outage of 10.5 minutes at an average level of system demand;
- an outage of approximately 18% of the demand for 1 hour at an average level of system demand;

Review” (Draft Report submission), 23 February 2010, p.1; NGF, “Reliability Standards and Settings Review” (Draft Report submission), 25 February 2010, p.8; Origin Energy, “REL0034 - Reliability Standards and Settings Review – Draft Report” (Draft Report submission), 24 February 2010, p.1; Snowy Hydro, Draft Report submission, p.1.

⁴⁷ Origin Energy, Issues Paper submission, p.1; AEMO, Draft Report submission, p.3 Alinta Energy, Draft Report submission, pp.4-5; LYMMCO, Draft Report submission, p.3.

⁴⁸ NGF, Issues Paper submission, p.1.

⁴⁹ MEU, Issues Paper submission “Review of the Operational Arrangements for the Reliability Standard (REL0035) and Review of the Reliability Standard and Settings (REL0034)”, August 2009, p.19; MEU, Draft Report submissions, p.15.

⁵⁰ MEU, Issues Paper submission, p.19.

- a system wide outage of approximately 7 minutes at peak demand;⁵¹ or
- approximately 12% of the demand for 1 hour at peak demand.

Another important consideration of reliability in the NEM is that the level of USE is randomly distributed. The current specification of the Reliability Standard is in terms of an expected level of USE in a given year. This means that when a level of 0.002% USE is targeted it is possible to have actual USE outcomes of more than 0.002%, with a low probability of several times 0.002% actually occurring.⁵² Therefore, to achieve a very low probability of exceeding 0.002% USE it would be necessary to target a level of expected USE that is significantly less than 0.002%.

Implications of relaxing the Reliability Standard

The Panel agrees with the NGF and the MEU that the setting of the level of the Reliability Standard should take into account the economic costs associated with meeting that level of the standard. Therefore, to inform the debate, the Panel sought advice on the costs of changing the Reliability Standard from ROAM Consulting (ROAM). ROAM Consulting:

- has performed the market simulation studies necessary for the Panel to review the Reliability Settings;⁵³ and
- is recalculating the MRLs for AEMO.⁵⁴

ROAM advised the Panel on the costs saving of a change to the Reliability Standard.⁵⁵ Figure 7.8 of the ROAM report shows that a reduction of the generation capacity across the NEM of approximately 750 MW would be expected to increase the expected level of USE from 0.002% to 0.003%. If this reduction in generation capacity was provided by reducing the number of open-cycle gas turbines (OCGT) then the capital cost savings would be approximately \$675m, in 2012/13 in 2009 dollars . This represents annual cost savings of approximately \$53m.⁵⁶

A reduction in the installed OCGT capacity of 750 MW would be implemented over time under the existing NEM market arrangements by reducing the level of the MPC,

⁵¹ The peak demand across the NEM is approximately 1.5 times the average demand, although this varies from region to region.

⁵² The ROAM analysis discussed in Chapter 4 of this review shows that for a hot summer (10% POE) the level of USE usually exceeds 0.002% when the target is 0.002%.

⁵³ The ROAM Consulting studies are discussed in Chapter 4 of this report and ROAM Consulting's report to the Panel is published as an accompanying document.

⁵⁴ The minimum reserve levels and the process to calculate them is discussed in the Panel's "Review of the Operational Arrangements for the Reliability Standards". Details of this review are available on the AEMC website at <http://www.aemc.gov.au/Market-Reviews/Open/Review-of-Operationalisation-of-the-Reliability-Standards.html>.

⁵⁵ ROAM Consulting Report, *Reliability Standard and Setting Review*, 8 November 2009, Section 6.5.

⁵⁶ The Panel notes that the Draft Report contained an estimated value of \$75m for indicative purposes. This value was recalculated for the Final Report using a capital cost of \$900/KW and a WACC of 6.81%.

thus reducing the signal for new peaking generator investment. There may also be other cost savings associated with a lower MPC including lower contracting risk premiums.

The Panel considers that the estimated annual cost saving of \$53m is likely to be an over-estimate due to the arbitrary process used to select the generation to be removed. A more optimised selection of generation to be removed would need to consider its location (including its region and impact on congestion) and the average regional forced outage rate compared with the individual generator forced outage rates of the selected generators.

Changing the Reliability Standard in 2012/13 from 0.002% to 0.003% USE would lead to an additional expected 2.27 GWh of USE. This cost to consumers could be valued at \$36.4m using an MPC of \$16 000/MWh.

Implications of tightening the Reliability Standard

The relationship between the level of the Reliability Standard and the level of installed generator capacity is not linear. Consequently, tightening the level of the Reliability Standard from 0.002% to 0.001% USE would require significantly more than 750 MW of additional generation capacity across the NEM.

To implement a tightening of the Reliability Standard would require the MPC to be raised to a level that is sufficient to encourage the required additional generator investment. Such an increase in the MPC is likely to result in higher spot price volatility and thus increase risk premiums in the electricity contract market.

3.3.4.2 Panel's final recommendation

The Panel did not receive any compelling evidence to consider changing the level of the Reliability Standard in the submissions to this review. Similarly, when undertaking its CRR, the Panel concluded that there was not a case to change the level of the standard.

The Panel considers there is no case for changing the Reliability Standard at this time. As discussed above, given the limitations of the approach to estimating the change in generation capacity (and hence the cost saving from relaxing the Reliability Standard), the costs of meeting the Reliability Standard and the benefits to customers appear to be broadly balanced at the current level.

3.3.5 Applying the Reliability Standard operationally

The MEU, in its submission on the Issues Paper, considered that the Reliability Standard should be targeted over the long-term rather than each year. The MEU considered that a "more aggressive" level of USE may be required to achieve the long-term average. The MEU considered that achievement of an aggressive level of

USE could be made more viable by the implementation of a program of allowing voluntary curtailment rather than consistently seeking supply side options.⁵⁷

In its submission on the Draft Report, Macquarie Generation noted that forecasts of demand and supply conditions are based on a probability distribution, where a low probability event can contribute significantly to single year results. Macquarie Generation considered that the AEMC should not adjust the Reliability Settings for future years based on the occurrence of a single low probability, high impact event.⁵⁸

3.3.5.1 Panel's view

Unserviced energy due to a reliability event occurs when the demand in a region (or regions) exceeds the available generation in that region (or regions), including generation capacity available from adjacent regions. The level of USE that actually occurs on any given occasion will depend on the inherent system conditions that occur, including:

- the ambient temperatures over the period in question, and the resulting impact on demand;
- the pattern of random forced generator outages; and
- availability of the transmission network, particularly interconnector outages.

Unfortunately, AEMO and the other market participants do not get accurate forewarning of the system conditions, so it is not possible to plan to deliver a given level of USE. In fact, even if the actual temperature conditions and random plant outages were known sufficiently well enough in advance, then it still may not be possible to achieve a given level of USE due to insufficient investment in new generation and transmission, and the random nature of generator failure.

Operationally, the Reliability Standard is currently targeted to be achieved in each financial year, for each region and for the NEM as a whole. That is, AEMO aims to have sufficient reserves in advance of a given period, usually the summer, so that the expected USE will be within the 0.002% USE standard. The actual USE that results will depend on the system conditions that end up occurring.

The alternative proposed by the MEU would involve targeting different levels of USE each year in an attempt to produce a long-term average. Presumably this would mean:

- targeting greater levels of USE following years where less than 0.002% USE occurred; or
- targeting very low levels of USE following years where greater than 0.002% USE occurred.

⁵⁷ MEU, Issues paper submission, August 2009, p.41.

⁵⁸ Macquarie Generation, Draft Report submission, p.1.

Targeting varying levels of USE from one year to the next would require AEMO to recalculate MRLs and hence change the threshold for intervention through directions, instructions or the RERT. Similarly, the Panel would need to consider adjusting the MPC and CPT in order to target a variable USE standard. The Panel's position was supported by the submission from Macquarie Generation.⁵⁹

3.3.5.2 Panel's final recommendation

The Panel considers that adjusting the MRLs, MPC and CPT in response to the effects of random weather patterns and plant outages would:

- introduce an arbitrary methodology, adjusting the MRLs, MPC and CPT, for achieving the long-term average USE;
- increase investment uncertainty for generators and customers as the energy prices vary with the changing MPC and CPT; and
- introduce an inter-temporal equity issue in relation to the cost of achieving the Reliability Standard, as it would vary from year to year in response to random events.

The Panel is also concerned that in most years there is little or no USE and then every few years a material level of USE occurs due to higher than average temperature conditions combined with plant outages. If the MRLs are reduced following a few years of low USE then it is likely that very high levels of USE would result if higher than average temperatures occur.

Therefore, the Panel recommends that the most appropriate approach to achieving 0.002% USE over the long term is to target 0.002% USE each year. This approach values reliability equally each year and provides the greatest certainty for generators, retailers and market customers.

3.3.6 Compliance with the Reliability Standard

The NGF considered that targeting 0.002% USE each year while monitoring the performance over ten years is inconsistent.⁶⁰ Similarly, Origin Energy considered that it is confusing that the Reliability Standard is specified as an annual amount of electricity at risk, but compliance is measured over the long-term (i.e. ten years).⁶¹

Macquarie Generation stated that compliance with the Reliability Standard over the previous ten year period should act as a guide, rather than a hard target, to avoid adjusting the Reliability Settings to influence investment to correct for events that took place up to ten years earlier.⁶²

⁵⁹ Macquarie Generation, Draft Report submission, p.1.

⁶⁰ NGF, Issues Paper submission, p.2.

⁶¹ Origin Energy, Issues Paper submission, p.1.

⁶² Macquarie Generation, Draft Report submission, p.1.

In its Draft Report submission, LYMMCO considered that changing from a ten year rolling average to an annual measure may lead to increased emphasis on breaching the Reliability Standard when the performance of the NEM, in terms of reliability, is unchanged. LYMMCO considered that annual assessment in the context of a five or ten year rolling average would better inform stakeholders.⁶³

3.3.6.1 Panel's view

Compliance following the CRR

Prior to the completion of the CRR, the Reliability Standard was expressed as a target of 0.002% USE defined as being “over the long term”. The Panel was concerned that this timeframe was unclear and proposed that the definition could be more explicit, for example “over 10 years”.⁶⁴ To this end, the Panel amended the Reliability Standard such that:

Compliance with this Reliability Standard for Generation and Bulk Transmission should be measured over the long-term using a moving average of the actual observed levels of annual USE for the most recent 10 financial years.⁶⁵

This amendment to the Reliability Standard was made in an attempt to smooth out the year to year variability in the levels of USE. That is, in some years the level of USE may exceed 0.002% even though the outlook from the Projected Assessment of System Adequacy (PASA) showed sufficient medium-term reserves.

Issues with defining a criterion for compliance with the Reliability Standard

The difficulty with defining a criterion for compliance with the Reliability Standard is that:

- looking forward, the projected level of USE for a given set of system conditions is not a single value but a distribution ranging from 0% USE to several times the 0.002% USE standard;
- the distribution of possible USE outcomes for a given year is dependant on complicated interactions between a number of factors including the uncertainty of demand in each region, generation and network capacity and planned and random outages of both generation and network elements;

⁶³ LYMMCO, Draft Report submission, p.4.

⁶⁴ AEMC Reliability Panel 2007, *Comprehensive Reliability Review, Final Report*, December 2007, Sydney, p.25.

⁶⁵ The “NEM Reliability Standard – Generation and Bulk Supply” is included as Appendix D of the Final Report for the CRR, which was published in December 2007. The Reliability Standard is also available on the AEMC website at <http://www.aemc.gov.au/Panels-and-Committees/Reliability-Panel/Guidelines-and-standards.html>.

The characteristics of the underlying distribution of possible USE outcomes for a given year can be estimated using Monte Carlo simulations.⁶⁶ The accuracy of the estimate of this distribution depends on the quality of the Monte Carlo simulations and associated assumptions.

The underlying distribution of possible USE outcomes varies from year to year as the network is augmented, demand grows, generating units are commissioned and/or retired, the penetration of intermittent generation increases and the reliability of the generating units changes over time.

It is not possible to measure compliance with the Reliability Standard in a meaningful manner, because of the random nature of USE outcome for a given year. That is, for a given year only a single actual USE value is recorded for each region. When an actual level of USE varies from the Reliability Standard of 0.002%, this does not necessarily mean that the processes in the NEM to ensure reliability are inherently flawed, rather it may be an outlier from the distribution of possible USE values. When the actual level of USE:

- exceeds the 0.002% Reliability Standard, the year in question may include arduous events, such as extreme temperatures and large generating unit forced outages at the time of the peak demand; or
- is less than the 0.002% Reliability Standard, it may simply be due to system conditions that are not particularly arduous, such as mild temperatures and no large generating unit forced outages at the time of the peak demand.

Considering the USE as a moving average over the past ten financial years has the effect of smoothing out some of the statistical variation from year to year. However, this approach has a number of problems, including:

- more than ten years of data would be required to give a statistically meaningful estimate of compliance with the Reliability Standard;
- the underlying distribution of possible USE outcomes varies from year to year, as demonstrated by AEMO's need to re-assess the MRLs every few years. Therefore, it is not statistically meaningful to use the moving average as a measure of compliance; and
- a ten year delay in measuring compliance is not satisfactory if its purpose is to promote continuous improvement of the processes for meeting the Reliability Standard.

⁶⁶ AEMO uses this approach when it calculates the MRLs. The methodology used is discussed in the Panel's "Review of the Operational Arrangements for the Reliability Standards". Information on this review is available at <http://www.aemc.gov.au/Market-Reviews/Open/Review-of-Operationalisation-of-the-Reliability-Standards.html>.

3.3.6.2 Panel's final recommendation

The Panel does not believe that measuring the effectiveness of the Reliability Standard would be meaningful. This is because it is not appropriate to assign significant meaning to individual historical outcomes or to the average of a number of outcomes over a long period of time.

The Panel considers that it is much more appropriate to review the reliability of the NEM each year, in particular following periods where there has been one or more incidents that have resulted in USE. Where the level of USE in a year approaches or exceeds 0.002% it is important for stakeholders to understand whether the resultant USE was consistent with the anticipated performance of the NEM, i.e. consistent with the projected distribution of USE for the year in question. Factors that would warrant investigation include variations from assumed:

- outage rates or hot weather capacity reductions for generation and interconnectors; and
- demand levels and the demand characteristics.

Armed with these investigations the NEM institutions can then identify potential improvements to the processes that monitor and maintain reliability, as appropriate.

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

The Panel notes the load shedding events on 29 and 30 January 2009, resulted in levels of USE that exceeded 0.002% in both Victoria and South Australia. This load shedding was for both reliability and system security purposes. There were reliability incidents on the afternoon of both 29 and 30 January and there was a system security event in the evening of 30 January. Following these events AEMO undertook reviews of the circumstances that led to the load shedding on these days. In addition, the MCE requested the AEMC to “review energy market frameworks in light of the impact on electricity supplies of the extreme heat wave of 29-31 January 2009”.⁶⁷ This led to the AEMC’s “Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events”⁶⁸ and shaped the terms of reference for the Panel’s “Review of the Operational Arrangements for the Reliability Standards”.⁶⁹

⁶⁷ MCE, 18th *Communiqué*, Canberra, 6 February 2009.

⁶⁸ Further information on the AEMC’s review is available on its website at <http://www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Effectiveness-of-NEM-Security-and-Reliability-Arrangements-in-light-of-Extreme-Weather-Events.html>.

⁶⁹ Further information on the Panel’s review is available on its website at <http://www.aemc.gov.au/Market-Reviews/Open/Review-of-Operationalisation-of-the-Reliability-Standards.html>.

3.4 Amendments to the Reliability Standard

Appendix C of this report contains the Reliability Standard that has been amended to reflect the Panel's recommendations above.

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4 Review of the Reliability Settings

4.1 Background

The level of the MPC, the market floor price and the CPT form the key price envelope within which the wholesale spot market is expected to deliver the capacity required to achieve the NEM Reliability Standard. These settings provide important signals to participants concerning both supply-side and demand-side investment and usage. Briefly, if the MPC and CPT are set too high, market participants (predominantly retailers) can be financially exposed and end-use consumers may be paying for reliability at a price that is higher than they value it. If the MPC and CPT are set too low, there may be insufficient incentive to invest in new generation capacity.

The purpose of the Panel's review is to ascertain the levels of the existing NEM Reliability Settings. The Panel notes that changes to the market framework, in respect of what Reliability Settings are available in the NEM, are not included in the scope of this review.

On 19 March 2010 the Panel received a letter from the AEMC, requesting the Panel to consult with AEMO on the gas market settings and to consider the interactions between the electricity and gas markets, and the implications of gas market settings when undertaking the biennial review of the electricity market settings.⁷⁰ This request is as a result of the AEMC Review of the Energy Market Frameworks in light of Climate Change Policies which found that co-optimisation of electricity and gas market settings to the maximum extent possible would support the efficient operation of these markets.

The Panel has consulted with AEMO on this issue. AEMO's advice can be found in Appendix E. This advice states that if the scarcity price for each market is set at an appropriate level, then arbitrage between the gas and electricity markets should appropriately allocate scarce resources. In particular, with regard to electricity, if the relative gas scarcity price is below the electricity scarcity price then any issues that are created by the different markets will not compromise electricity reliability. The Panel considers that the proposed Reliability Settings below are appropriate and therefore does not consider that there is a need to adjust these settings as a result of interactions with the gas market.

⁷⁰ A copy of the letter can be found in Appendix D.

4.2 Consultation on the Reliability Settings

4.2.1 Issues Paper

In its Issues Paper, the Panel sought comments from stakeholders on the Reliability Settings. In particular, the Panel asked:

- Given the Reliability Standard that stakeholders consider appropriate, what are the levels of the Reliability Settings (consisting of the market price cap, market floor price and cumulative price threshold) required to deliver that Reliability Standard?

Submissions on the Issues Paper closed on 14 August 2009 and the Panel received submissions from the NGF, Origin Energy and the MEU.

4.2.2 Draft Report

In the Draft Report, the Panel sought views from stakeholders on a number of key issues:

- the approach used in ROAMs modelling, which assumes that new entry OCGTs derive all their income from the spot market, or alternative approaches that are quantifiable and traceable;
- the assumed value of the OCGT forced outage rate (FOR), which was 3% for new entrant peaking generators; and
- the approach used to combine the individual regional MPC values into a single NEM wide value. This could be either the average of the individual regional values, or the maximum value of the regional MPC values.

The Panel also sought views on the impacts and issues relating to a substantial increase to the MPC, including:

- Investment is currently occurring at an MPC of \$10 000/MWh;
- Increased prudential requirements;
- Transient market power;
- Additional demand side response;
- Additional risk premiums for retailers; and
- Additional risks for generators.

Submissions on the Draft Report closed on 23 February 2010. The Panel received sixteen submissions as listed in Section 1.4.

4.3 Process for determining the Reliability Settings

4.3.1 Engagement of ROAM consulting

The AEMC, on behalf of the Panel, engaged ROAM Consulting (ROAM) to undertake the modelling work to assist the Panel to assess the Reliability Settings. The aim of the modelling is to assist in forming a recommendation as to the levels of the MPC and the CPT to apply in the NEM. These values would take effect from 1 July 2012 and apply for the 2012/13 and 2013/14 financial years. ROAM was also requested to provide the Panel with advice on the impact of any change on the financial risks faced by market participants.

4.3.2 Methodology to determine the Reliability Settings

The approach used by ROAM to determine the Reliability Settings, in particular the MPC, has been to:

- adjust the level of generator capacity using advanced and/or announced projects so that there is sufficient capacity to achieve the Reliability Standard in each region in each year of the modelling period from 2012 to 2020; then
- adjust the level of the MPC so that a new entrant open cycle gas turbine (OCGT) is marginally profitable, that is, would recover sufficient expected income to cover its annualised capital and fixed operating costs, plus a return on its investment.

ROAM used its in-house electricity market forecasting package 2-4-C to perform the market simulations to determine the Reliability Settings. 2-4-C uses time sequential Monte Carlo simulations to match as closely as possible the operation of AEMO's Market Dispatch Engine (NEMDE).

ROAM developed a model of the NEM that includes:

- the existing and committed generation;
- forced and planned generator unit outages;
- regional load traces based on historical load traces that are scaled to match demand and energy projections; and
- represents network constraints.

ROAM has modelled the temperature dependence of the maximum demand projections in the AEMO Electricity Statement of Opportunities (ESOO) by considering load traces that are based on the 10% and 50% probability of exceedence

(POE) demand levels.⁷¹ ROAM performed market simulations using both the 10% and 50% POE demand traces then weighted the results to form an overall expected result.

The Panel published the accompanying report “Reliability Standard and Setting Review” which was prepared by ROAM. The Panel published the ROAM analysis with its Draft Report in December 2009. In January, ROAM advised the Panel that its analysis contained an error. The Panel published a revised ROAM report on 15 January 2010.

4.3.3 Benchmarking with previous studies

Previous modelling for determining the level of the MPC and CPT was undertaken by Charles Rivers Associates International (CRA) as part of the 2007 Comprehensive Reliability Review (CRR).⁷² At that time, the decision was made to increase the MPC from \$10 000 to \$12 500/MWh and the CPT from \$150 000 to \$187 500 effective from 1 July 2010.

Given this review of the Reliability Settings was undertaken by a different consultancy, ROAM undertook benchmarking studies to ensure continuity of the results. ROAM used the same input data as CRA when performing the modelling work for the benchmarking study. That is, the following sources of data were utilised:

- NEMMCO 2007 Statement of Opportunities;
- 2007 NEMMCO Energy and Demand Projections;
- 2007 ACIL Tasman Report to NEMMCO *Fuel Resource, new entry and generation costs in the NEM*, March 2007; and
- initial installed capacity as per the CRA Input Assumptions and Results report.

ROAM’s methodology was to review the model outputs in order to closely align the USE levels achieved with the Reliability Standard. This was necessary to obtain a level of USE in line with the Reliability Standard that accurately determined the MPC required to achieve profitability for the marginal generator. Through this process ROAM determined that the MPC necessary to achieve the Reliability Standard was as low as \$12 500/MWh in 2010-11 and \$15 000/MWh in 2011-12, which is in close alignment with the value of \$12 500/MWh determined by CRA.⁷³

⁷¹ The 10% POE case represents an unusual weather year resulting in demand levels that are expected to be exceeded only one year in ten. By contrast, the 50% POE case represents a typical weather year where the demand would be expected to be exceeded this level one year in two.

⁷² For further information see, *CRR Final Report Modelling Appendix E*, at: www.aemc.gov.au/Market-Reviews/Completed/Comprehensive-Reliability-Review.html.

⁷³ In coming to this determination, ROAM made an assumption that new entry Open Cycle Gas Turbine (OCGT) generation was 100% reliable, that is, the assumed forced outage rate was 0%.

4.3.4 Assumptions for the Reliability Standard and Settings review

The modelling assumptions utilised for the Reliability Standard and Settings review are consistent with those used in AEMO's recalculation of the minimum reserve levels (MRLs) and the national transmission statement (NTS).⁷⁴ The assumptions for each modelling input is provided below.

4.3.4.1 New entry based on spot market outcomes

The ROAM modelling assumes that the new entry OCGTs derive all their income from the spot market. Therefore, a new entry OCGT is regarded as profitable when its expected spot market income exceeds its annualised capital and fixed operating costs, plus a return on its investment.

For its Draft Report the Panel noted that new entry in the NEM occurs for a variety of reasons, depending on the circumstances of the proponent. In most instances the entry would be financed through cap contracts or by a vertically integrated generator retailer. However, ROAM and the Panel considered the approach of considering spot market revenues was consistent with previous assessments of the required MPC and a valid proxy for the entry of the new entry extreme peaking plant. The Panel considered this view was reasonable because the value of contracts is derived from the outcomes expected in the spot market. The Panel also considered that the approach is also both quantifiable and traceable. Following consultation with stakeholders and its own further assessment, the Panel considers that the economics of achieving the Reliability Standard (as modelled) is one of a number of aspects of delivering reliability in the NEM that should be reviewed by the AEMC.

4.3.4.2 Load traces

The time sequential Monte Carlo simulations performed by ROAM require load traces to represent the demands in each region. ROAM uses load traces that are:

- based on the actual regional demands that occurred in each region in the 2008/09 financial year, and
- scaled to match the load forecasts in the AEMO 2009 ESOO.

4.3.4.3 Transmission network

- The transmission network model is based on five interconnected regions;
- The transmission network model has been applied as per the 2009 NTS constraints "workbook" provided by AEMO, which incorporates all intra- and inter-regional constraints and thus meets n-1 contingency standards such that load shedding will not occur for any credible transmission contingency.

⁷⁴ The National Transmission Statement was prepared by AEMO in accordance with clause 11.27 of the National Electricity Rules.

4.3.4.4 Generators

- Existing and committed generating capacity has been taken from the 2009 ESOO;
- The values of the forced outage rates (FORs) utilised in the modelling are consistent with those used by AEMO in its MRL recalculations and the NTS;
- The 2009 ACIL Tasman report to AEMO “Fuel Resources, new entrant and generation costs in the NEM”, April 2009 has been used for capital cost forecasts for new entry generation, and variable operating, maintenance and fuel costs for generation. This is of significance for assessing the MPC needed for new entry peaking generation to be marginally profitable.

4.3.4.5 Intermittent generation

- Sufficient renewable generation was installed to meet the expanded 20% renewable energy target by 2020;
- Wind traces have been generated for each existing and committed wind farm (scheduled, semi-scheduled and non-scheduled), with all trace data modelled at the half-hourly level;
- All other relevant information is provided in the 2009 NTS consultation Final Report.

4.3.4.6 Generator bidding assumptions

- ROAM considers that applying a carbon price uplift to historical (current) bids is not necessarily an accurate representation of the bidding strategy of plant under an emissions trading regime, particularly for high carbon prices.
- ROAM did not use Cournot modelling of generator bidding because it involves a large number of assumptions that are of little importance to the study of reliability. Therefore, ROAM considers it more appropriate to instead construct generator bids by using a bid analyser process.

4.3.4.7 New entrant generation

The ROAM modelling assumes that the last new entry generation necessary to just meet the Reliability Standard will be OCGTs. To achieve this, it was necessary in some circumstances to first remove some existing generation.⁷⁵ That is, the MPC is set at the level where a new entrant OCGT would recover its expected annualised capital costs with a utilisation commensurate with 0.002% USE per annum.

⁷⁵ For more information see ROAM Consulting, *Reliability Standard and Settings Review*, p.9.

In summary:

- New entrant peaking generators consistent with a balanced portfolio of new entrant plant types are assumed to be open cycle gas turbines;
- Capacity is offered to the market at the MPC; and
- The FOR of new entrant peaking generation is assumed to be 3%.

4.3.4.8 OCGT forced outage rates

The generator FORs used in the modelling for the AEMO NTS were determined using the methodology developed by the Forced Outage Data Working Group (FODWG).⁷⁶ ROAM used the same FORs for its advice to the Panel for this review.⁷⁷

A value of 27.88% for the FOR has been used for OCGTs, including existing and future units. This is consistent with the AEMO NTS. However, when assessing the profitability of the new entrant peaking generators ROAM has assumed a FOR of 3%, based on the availability for OCGTs presented in Table 32 of the ACIL Tasman report. This approach was adopted because:

- new entrant OCGTs will generally have a high level of availability;
- older OCGTs may have lower levels of availability, or in practice not be able to be available, or choose to be available immediately when required, so it is appropriate to assume a lower level of availability; and
- forced outages for peaking generators that are derived from historical performance can overstate the unreliability that can be expected in practice,⁷⁸ and thus indicate the need for an excessive increase to the MPC.

Further reasoning on the assumed OCGT FORs is available in the ROAM report.

4.4 Results from the ROAM Studies

The Panel has published the “Reliability Standard and Setting Review” report by ROAM as an accompanying document.⁷⁹ The modelling in the ROAM report indicates that from 1 July 2012 it may be necessary to consider raising:

⁷⁶ Further information on the FODWG is available on the AEMO website at www.aemo.com.au/electricityops/fodwg.html.

⁷⁷ Table A.3 of the ROAM report shows the FORs used for the ROAM modelling for each generator type.

⁷⁸ “CASOM 16: Are Reliability Measures Unreliable? Part 1” by Robert Richwine, available at www.worldenergy.org/documents/casom16_may03.pdf.

⁷⁹ The ROAM report is available on the AEMC website at www.aemc.gov.au/Market-Reviews/Open/Review-of-the-Reliability-Standard-and-Settings.html.

- the MPC from \$12 500/MWh effective from 1 July 2010 to approximately \$16 000/MWh; and
- the CPT from \$187 500/MWh effective from 1 July 2010 to approximately \$240 000/MWh.

4.4.1 Explanation of the possible need to raise the MPC

The main reasons why the ROAM modelling shows that a further increase to approximately \$16 000/MWh, effective from 1 July 2012, may be required are:

- increased capital costs for new entrant open cycle gas turbines;
- peakier demand; and
- more detailed representation of interconnector capacity assumptions, resulting in reduced inter-regional capabilities at times of high demand.

In addition, the Panel notes that the CRA analysis performed as part of the CRR indicated that:

- the MPC should be raised from \$10 000/MWh to \$12 500/MWh from 1 July 2010; and
- it would be likely that further increases to the MPC after 1 July 2012 may be necessary.

Figures 10 and 11 of the CRR show the expected levels of USE for MPC levels of \$12 500/MWh and \$15 000/MWh respectively.⁸⁰ The figures show that the analysis performed at this time indicated a likely need to raise the MPC in approximately 2012.

The level of capital costs for new entrant open cycle gas turbines

In April 2009 AEMO published an updated ACIL Tasman report “Fuel Resources, new entrant and generation costs in the NEM”. Compared with the data in the corresponding 2007 ACIL Tasman Report, this report showed that the forecast 2012/13 capital costs of new entrant open cycle gas turbines in the 2009 report:

- was approximately 21% above the 2007 report; and
- were forecast to fall in real terms until the end of the forecasting period in 2016/17.⁸¹

⁸⁰ Figures 10 and 11 are on page 67 of the final report for the CRR, published in December 2007. These figures are extracted from page 22 of the accompanying CRA report on its modelling.

⁸¹ Table 7.2 of the ROAM report shows a comparison of the capital costs of open cycle gas turbines in the 2007 and 2009 ACIL Tasman reports “Fuel Resources, new entrant and generation costs in the NEM”.

ACIL Tasman also published a report in 2008 which reviewed the fuel and capital costs for new generators. This report showed that the forecast capital costs for OCGT plant decreased by 14% in actual costs between 2008/09 and 2012/13.⁸²

In its Draft Report the Panel noted the importance of the assumed capital costs when determining the level of the MPC. The Panel also noted that the future capital costs of new OCGTs will depend on a number of factors including the extent:

- of the recovery from the recent global financial crisis;
- of global demand for gas turbines at any given time, including increases in demand as existing coal generators are replaced by gas powered generators under a carbon constrained future; and⁸³
- to which alternative manufacturers enter the market.

Peakier demand

A peakier demand trace means that the number of hours that a new entrant OCGT can run and recover its capital cost is reduced for a given level of the USE Reliability Standard, thus the level of the MPC would need to be higher.

In its Draft Report the Panel noted that the AEMO 2009 ESOO predicts that NEM-wide energy demand growth is forecast to grow at 1.9% per annum over the next 10 years while the peak demand is forecast to grow at 2.5%. The ESOO also shows that the differential growth between energy and maximum demand varies between the respective NEM regions.

In addition, the increased penetration of wind generators will make the demand seen by the scheduled generators appear more peaky. This is because at times of high demand there will be increased uncertainty as to the contribution made by intermittent wind generators.

Interconnector capacity assumptions

The level of interconnector capacity determines the level at which capacity can be shared between regions when attempting to meet the demand during periods of scarcity. Therefore, if a lower set of interconnector capacities is modelled then there will be a greater reliance on generation capacity from within each region and a higher level of MPC may be required to meet the Reliability Standard.

⁸² ACIL Tasman, 2008, *Fuel and Capital costs in the NEM: Greenfield cost data for the calculation of the 2009/10 BCRI*, p.65, www.qca.org.au/files/ER-NEP910-ACIL-BRCI0910-FinalReport-1008.PDF.

⁸³ A greater reliance on gas powered generation is expected to lead to increased demand for OCGTs, both directly and because combined cycle gas turbines contain one or more OCGTs. This increased demand is likely to translate to increased OCGT capital costs.

In its analysis for the 2007 CRR, CRA assumed that interconnector capability would be augmented where indicative analysis showed “further capacity would be commercially viable”.⁸⁴

In contrast ROAM assumed for its modelling that the transmission network model has been applied as per the 2009 NTS constraints “workbook” provided by AEMO, which incorporates all intra- and inter-regional constraints.

4.4.2 Calculating a single weighted MPC

The ROAM modelling considered the level of MPC required for new entrant OCGTs to be marginally profitable in each region. The ROAM modelling shows different values of MPC would be required for each region because of the unique characteristics of the regions, including the load shape, the mix of generation and the degree of inter-regional interconnection. However, under the current design a single MPC value applies in all regions of the NEM.

ROAM calculated an MPC value that is the average of the individual regional values, weighted with the regional annual energy consumption. This approach will be expected to deliver sufficient investment across the NEM as a whole but may be expected to deliver insufficient investment in the regions that appear to require a higher MPC value. However, the reliability of these regions will tend to be supported by the investment in the other regions.

4.4.3 The level of the cumulative price threshold

Another finding from ROAM is that the level of the CPT is likely to need to be increased to \$240 000/MWh. This level of CPT appears to retain the current ratio of 15:1 between the CPT and the MPC that currently applies in the NEM.

ROAM’s modelling of the required level of MPC assumed no CPT restrictions on MPC events, and as such, is conservative in its assessment of a recommended level of the MPC.

Correspondingly, ROAM’s modelling shows that a lower level of CPT would dampen the investment signals from the spot market and would, therefore, require a greater increase to the level of MPC necessary to meet the Reliability Standard.

4.4.4 The level of the market floor price

ROAM does not recommend a change to the market floor price from the current level of -\$1 000/MWh.

⁸⁴ Page 15 of the CRA report for the Panel’s CRR, available at www.aemc.gov.au/Market-Reviews/Completed/Comprehensive-Reliability-Review.html.

4.5 Issues raised by stakeholders

4.5.1 Market Price Cap

In their submissions on the Issues Paper, the NGF and Origin Energy supported regular reviews of the Reliability Settings due to the changes in climate change policies.⁸⁵ The Panel notes that under the current Rules the Reliability Settings are reviewed every two years.

The majority of submissions on the Draft Report did not support an increase in the level of the MPC⁸⁶ because they considered:

- the key driver for generation investment is not the forecast spot price, instead investors rely on certainty through the contract market;
- it is likely that market volatility will increase. This would lead to higher costs and risks for market participants. For example, higher price volatility is likely to increase the contract prices for retailers and generators as the risk premiums would increase. This is likely to be passed through to consumers;
- sufficient investment in capacity is already occurring under the current MPC;
- the prudential risks faced by market participants will also increase;
- it may lead to an increase in the extent of transient market power when the opportunities arise; and
- that the increased spot price will encourage additional demand-side participation.

4.5.1.1 Panel's considerations

The Panel's considerations on these key issues are set out below.

The key driver for generation investment is the contract market

Some participants consider that investment in electricity generation is driven by a number of factors, including forecast contract prices, forecast demand growth, cost and availability of project finance. While the forward contract price may be expected to correlate with the forecast spot market price, uncertainty over forecasts and regulatory stability may mean that the correlation is not strong.

⁸⁵ NGF Issues Paper submission, 14 August 2009, p. 2; Origin Energy Issues Paper submission, 21 August 2009, p. 2.

⁸⁶ EUAA, Draft Report submission, p.3; ERM, Draft Report submission, p.1; Hydro Tasmania, Draft Report submission, p.1; International Power, Draft Report submission, p.5; LYMMCO, Draft Report submission, p.14; Macquarie Generation, Draft Report submission, p.6; MEU, Draft Report submission, p.22; Origin Energy, Draft Report submission, p.1; and Snowy Hydro, Draft Report submission, p.1.

ROAMs modelling for the Panel assumed that investment in the extreme peaking generator will occur if the forecast spot market prices are sufficient. The Panel notes that these participants do not consider that the forecast spot market price provides sufficient revenue certainty and therefore do not consider it to be the key driver for investment.

Increased wholesale market price volatility

The Panel notes the possibility that an increased MPC may mean that the spot market prices become more volatile. This price volatility occurs primarily at times of high demand, as a result of the inelastic nature of demand and the supply side response. The volatility increases as the MPC increases. Higher price volatility is likely to lead to an increase in costs and risks for market participants. For example, participants may have higher prudential costs or difficulty obtaining finance and these costs would be expected to be passed on to consumers to the extent allowable under retail price regulation.

The Panel notes that the market design effectively requires that costs increase as a result of increased MPC. The MPC is determined at a level which reflects the value of reliability to customers.

Investment is currently occurring at an MPC of \$10 000/MWh

In recent years there has mainly been investment in peaking generating capacity in all regions of the NEM. The Panel notes that AEMO 2009 ESOO shows that there is sufficient generation capacity to meet the Reliability Standard up to 2011/12 in South Australia, 2012/13 in Victoria, 2013/14 in Queensland and 2013/14 in New South Wales.

While the Reliability Standard assessment is for the period from 1 July 2012, the Panel notes that the AEMO 2009 ESOO suggests two states, South Australia and Victoria, are currently at risk of not meeting the Reliability Standard at this point (or a year later). It is arguable whether the Reliability Settings for 2012 would influence decisions for installing capacity at this time, as these decisions would have been made some time ago, given the lead times for installation.

Increased prudential requirements

The Panel notes that the prudential requirements required by market customers will be likely to increase as a result of increase in the level of the MPC. This is an additional burden for market customers and may, in the extreme, become a barrier to entry into the market.

Transient market power

A significant increase in the MPC may reduce the opportunities to exercise transient market power in a competitive market. That is, in the short-term, the possibility of higher prices may increase the level of contracting in the energy market, thus reducing the incentive to exercise transient market power. In the long-term the potential of higher prices is likely to encourage increased generator and demand side investments, thus increasing competition at times of high spot prices. If the market is not fully competitive, an increase in the MPC may increase the potential for higher spot prices and hence the financial impact at times when market participants exercise transient market power.

The likelihood of high prices during periods of scarcity is a natural outworking of the energy only market and, therefore, necessary to encourage sufficient investment.

The Panel notes the regulatory framework provides for the AER to monitor, investigate and enforce compliance with the bidding and rebidding requirements of the NER and for the ACCC to ensure compliance with competition law.

Additional demand side response

ROAM's modelling for the Panel assumed that the most efficient investment to meet the Reliability Standard is in OCGT capacity. This is the cheapest available supply side option currently available.

The Panel considers that a substantial increase to the level of the MPC may make more demand side options economically viable. If this is the case, the price would be capped below the higher MPC when the demand side options are dispatched, thus the MPC may not need to be increased by as much as the increase indicated by the ROAM analysis.

To analyse this further the Panel would need to form a view of the level of the MPC which is likely to attract significant levels of DSP capacity, thus making DSP the most efficient investment to meet the Reliability Standard. The Panel would then need to find the level that balances the need for additional supply-side option (i.e. generators) with the demand-side options that are likely to present to the market.

Additional risk premiums for retailers and higher prices for consumers

A significant increase in the MPC increases the threat of higher spot prices. This will be likely to lead to higher risk premiums on energy contracts and hence higher prices to market customers. In the case of retailers, these higher contracting prices will generally be passed onto the individual customers through higher retail tariffs. The Panel notes that this is a necessity of the market design.

Additional risks for generators

A significant increase in the MPC will also increase risks to generators trading in the NEM. In particular, generators may be less willing to contract their capacity as they

would be exposed to increased risks at times of high prices should their physical generation not be available due to plant failure, network congestion or network outages.

This may eventually lead to generators being less willing to contract, or to invest in further capacity due to the perceived increase in the risks. Conversely, it may lead other generators to consider additional capacity to act as a physical hedge for their existing portfolio of generating units.

4.5.2 Cumulative Price Threshold

The NGF considered that the CPT does not necessarily protect participants from extreme events.⁸⁷ It considered that the Review should note that the CPT, however, does provide protection from financial risk and that the AEMC has recently rejected a Rule change proposal on this issue.⁸⁸

In its Issues Paper submission, the MEU considered that the need for the CPT, and hence the administered price cap (APC), demonstrated that the MPC is set too high. It considered that if the MPC was lower and another mechanism was used to meet reliability then the CPT may perhaps not be needed at all.⁸⁹

In Draft Report submissions, a number of participants considered that the Panel should reconfirm the objective of the CPT⁹⁰ and that the value of the CPT should then be derived from this objective.⁹¹

AGL and Snowy Hydro considered that the CPT should be increased, in line with the change to the MPC, in order to maintain the CPT as the 15 times multiple of the MPC.⁹² However, International Power and the MEU considered that the CPT should not be increased simply in response to an increase in the MPC.⁹³ They considered that changing the CPT was unlikely to influence future investment, but may add to the risk faced by participants.

⁸⁷ NGF, Issues paper submission, p.2.

⁸⁸ The NGF submitted the Rule change proposal "Contingency Administered Price Cap Following a Physical Trigger Event". On 4 June 2009 the AEMC determined not to make this Rule. Further information on the assessment of this Rule change proposal is available at www.aemc.gov.au/Electricity/Rule-changes/Completed/Contingency-Administered-Price-Cap-Following-a-Physical-Trigger-Event.html.

⁸⁹ MEU submission "Review of the Operational Arrangements for the Reliability Standard (REL0035) and Review of the Reliability Standard and Settings (REL0034)", August 2009, p. 38.

⁹⁰ ERAA, Draft Report submission, p.2; Hydro Tasmania, Draft Report submission, p.1; NGF, Draft Report submission, p.7; TRUenergy, Draft Report submission, p.2.

⁹¹ ERAA, Draft Report submission, p.2; NGF, Draft Report submission, p.7; TRUenergy, Draft Report submission, p.2.

⁹² AGL, Draft Report submission, p.3; Snowy Hydro, Draft Report submission, p.5.

⁹³ International Power, Draft Report submission, p.6; MEU, Draft Report submission, p.38.

4.5.2.1 Panel's view

The CPT is an explicit risk management mechanism. Originally it was designed to replace the force majeure provisions in the National Electricity Code, the CPT was only intended to be breached in the event of a market failure, where supply failed to meet demand, or where, due to the unique nature of electricity, supply and/or demand were unable to respond to market signals.⁹⁴

The Panel considers that the CPT is designed to limit participants' financial exposure to the wholesale spot market during prolonged periods of high prices, while not hindering investment. This means that the CPT should ideally be set at a level that is unlikely to be triggered except in extreme circumstances. The Panel's recommendation for the level of the CPT and its reasoning are set out below.

The Panel disagrees with the MEU that the CPT is needed because the MPC is too high. In an energy only market the MPC needs to be high enough to encourage sufficient investment. The CPT provides a safety net to mitigate participants' financial risks, as described above, should a period of high prices extend beyond what is necessary to provide a strong investment signal. Under market designs other than an energy only market, a CPT may not be required but this is outside the scope of the Panel's review.

4.5.3 Market Floor Price

Few submissions commented on the level of the market floor price. Those that did considered that there was no justification for a change to the level.⁹⁵ Snowy Hydro considered that the level of the market floor price should be sufficiently negative to differentiate between all different generation technologies and minimum operating levels.⁹⁶

4.5.3.1 Panel's view

In the Draft Report, the Panel agreed with submissions to the Issues Paper and considered that there is no evidence that shows a need to change the level of the market floor price for the period from 2012/13 onwards.

4.6 The Panel's final recommendation

The Panel recommends that:

- Starting on 1 July 2012 the value of the MPC is increased annually in real terms from \$12 500/MWh according to the change in the Stage 2 (intermediate) Producer Price Index (PPI).

⁹⁴ NECA Reliability Panel, *VoLL and the cumulative price threshold – Issues Paper*, December 2003, p.40.

⁹⁵ AGL, Draft Report submission, p.4; International Power, Draft Report submission, p.5; NGF, Draft Report submission, p.8; Snowy Hydro, Draft Report submission, p.4.

⁹⁶ Snowy Hydro, Draft Report submission, p.4.

- Starting on 1 July 2012 the value of the CPT is increased from \$187 500/MWh annually according to the same index that is applied to the MPC.
- The Panel maintains the annual review process to determine whether higher increases in the MPC or CPT are necessary, and whether there were any significant changes that occurred to the economics and mechanism for delivering the Reliability Standard.
- The MPC and CPT will continue to be indexed according to this process as long as appropriate, given the Panel annual review process.
- The market floor price is maintained at -\$1 000/MWh.

However, in making this recommendation, the Panel notes that the current set of Reliability Settings is required to achieve multiple objectives. These are:

- Meeting the Reliability Standard;
- Managing the financial risk of market participants; and
- Meeting customer's value of reliability.

The Panel considers that the ability of the current set of Reliability Settings to achieve each of these objectives is limited. The Panel recommends that the AEMC perform a comprehensive review of both the mechanism for delivery of the capacity to ensure reliability, and the impact of the risk allocation framework in the NEM on achievement of reliability in the long term.

In particular, the Panel is concerned that increases in the MPC may reach a tipping point beyond which the benefits of increasing the MPC and CPT do not offset the costs in terms of market risks. In particular, the Panel cites increasing prudential risk, increasing price volatility risk to consumers and increasing outage and congestion risk, where some generating capacity may not be able to be dispatched due to limitations on the transfer capability of the network at various times. This risk can be difficult for generators and retailers to manage.

4.6.1 The Panel's reasoning

The Panel notes that under the current framework for management of reliability in the NEM, the modelling undertaken by ROAM demonstrates a prime facie case for an increase in the MPC to at least \$16 000/MWh from July 2012. The specific terms of reference framing this modelling may influence the results.

Within these modelling constraints and the reliability framework that drives them, the commentary by both ROAM and in independent review of the modelling⁹⁷

⁹⁷ The AEMC instigated an independent review of the ROAM analysis for the Reliability Standard and Settings Review and the Review of the Effectiveness of NEM Security and Reliability Arrangements in light of Extreme Weather Events (Extreme Weather Review). This independent review will be submitted to the MCE as part of the final report on the Extreme Weather Review.

suggests that the truncation of potential MPC events by the CPT means that the theoretical MPC should in fact be higher than \$16 000/MWh from July 2012.

However, the Panel considers that the current reliability framework may be reaching the point where it is no longer adequate to achieve the multiple objectives of meeting the Reliability Standard, managing financial risk and meeting consumers' value of reliability. In particular:

1. Increasing prudential risks may prove a barrier to entry or a source of premature exit for retailers;
2. Increasing the MPC would increase the risks of physical delivery by generators, including risks caused by transmission constraints, which may reduce generators' propensity to contract, and reduce contract liquidity; and
3. The increased risk of price volatility to retailers and generators. This increase in volatility is likely to increase contract risk premium. This additional cost is likely to be passed through to consumers.

The Panel believes that under the current framework, these risk factors may cause the market to approach a "tipping point" beyond which the reliability value of increases in the MPC are offset by the changed behaviour of participants in response to increased financial risk.

The Panel also notes that there are a number of factors that bring the efficacy of the current reliability framework, and specifically the 'single lever' of MPC/CPT, into question. These include:

- Investment appears to be occurring at a level that meets the Reliability Standard. The AEMO 2009 ESOO shows that there is sufficient generation capacity to meet the Reliability Standard up to 2011/12 in South Australia, 2012/13 in Victoria, 2013/14 in Queensland and 2013/14 in New South Wales. In addition, in their modelling, ROAM needed to remove capacity in order to achieve the Reliability Standard. This indicates that plant appeared to be profitable, despite the modelling assumptions.
- There have been significant changes in the market structure from that in place at NEM formation, including significant vertical integration.
- The use of a uniform Reliability Standard across all NEM regions means that the cost of ensuring reliability in the region with the worst reliability is spread across market participants in all NEM regions.

Consequently, the Panel recommends that the AEMC perform a comprehensive review of both the mechanism for delivery of the capacity to ensure reliability, and the impact of the risk allocation framework in the NEM on achievement of reliability in the long term.

In this context, and while this comprehensive review is performed, the Panel does not consider that there is sufficient evidence that target reliability will not be delivered in the 2012/13 and 2013/14 period to offset the impact of the increased

risks created by significant real changes to the MPC or CPT. Further, if there is doubt over the suitability of the market framework, there is the possibility that other factors and additional issues/risks may need to be addressed in the reliability modelling. These include:

- The potential for the extreme peaking generator to earn other revenue from the market;
- The potential for contractual arrangements to impact the income of the extreme peaking generator; and
- The impact on the extreme generator if it is part of a portfolio of generation. This may change the investment dynamics for building this generator.

While investors will have already anticipated the MPC increase on 1 July 2010, the full impacts of this increase are not yet known; in particular, whether there will be material impacts on prudential risks.

The Panel notes that the recommended MPC of \$12 500 (to be indexed), is broadly consistent with the Value of Customer Reliability (VCR) of \$13 250 for the residential sector.⁹⁸ This sector has the lowest VCR value and would, from an economically efficient perspective, generally be the first to be shed if there was insufficient capacity to cover customer demand during a reliability incident. The recommended MPC provides an efficient balance between the cost and the value of reliability of electricity supply at the wholesale level.

4.6.2 Why is the Panel recommending that the MPC and CPT be indexed?

While the Panel is not currently recommending a substantial real increase in the level of the MPC and CPT, the Panel notes that there is potential for the capital expenditure to increase over the period to 2012/13 above the increase forecast in the 2009 ACIL Tasman report. The Panel considers that if the MPC and CPT are fixed for too long a period, that the real value will erode and therefore there is a need to index both the MPC and the CPT.

The Panel recommends that a suitable index should:

- follow similar economics to those used in setting the MPC and CPT; that is, it should be based on the supply side costs of meeting the Reliability Standard;
- be independently verifiable; and
- be amenable to forecasting. This is important in providing some certainty to investors on the likely changes to the MPC and CPT.

⁹⁸ VENCORP, 2008, *Assessment of the Value of Customer Reliability (VCR)*.

4.6.3 How will the MPC and CPT be indexed?

The Panel considers that the Stage 2 (intermediate) Producer Price Index will adequately fulfil the criteria identified above. The PPI provides a summary measure of the movements in the prices of commodities over time. The PPI uses a “stage of production” framework, which means that commodities are categorised on a sequential basis along the production chain, from preliminary (stage 1) to final (stage 3). The Panel considers that the Stage 2 PPI provides a good reflection of the costs associated with meeting reliability and avoids being too general, such as the CPI-type index, or too specific, such as a commodity specific index (i.e. steel).

Subsequent to the completion of this Review, the Panel will prepare a Rule change proposal to give effect to the above, for submission to the AEMC. The Panel notes that in assessing this Rule change proposal the AEMC will assess the robustness of this index and may determine to use an alternative indexing mechanism.

The Panel acknowledges that the costs of capital equipment for generators can be variable and this variability is strongly influenced by international demand. The Panel considers that in assessing the suitability of this index, the AEMC may wish to examine recent trends in input costs to generation investment, such as capital costs.

4.6.4 How will the index be used?

The Panel recommends that the change to the MPC and CPT will be assessed annually based on the change in the PPI. In preparing the Rule change proposal the Panel will further analyse the detail required in order to apply such an index.

The Panel recommends this process continue indefinitely with no sunset. However, the Panel proposes to maintain the annual process to review the performance of the market. In doing this, the Panel will review the purpose of the index and assess whether the level of the MPC or CPT should deviate from the proposed indexed value. This will be particularly important initially, pending the outcome of the recommended AEMC review of the reliability framework, and to ensure sufficient resources are predicted to meet the Reliability Standard in Victoria and South Australia, which the 2009 ESOO indicates are the first regions at risk.

The Panel will then advise the market of the change to the MPC and the CPT. The level of the MPC and CPT will also be rounded to the nearest \$100. Where the annual change in PPI is less than zero, there should be no reduction in the nominal value of the MPC and CPT. The Panel considers that the change to the levels should be an administrative step, with no interpretation required.

The Panel recommends that the first change to the level of the MPC and CPT, starting on 1 July 2012, should be escalated by the PPI measured over the previous year. The same indexing methodology will be used for the CPT. In the process for reaching a recommendation on the level of the MPC (i.e. \$12 500) and CPT (i.e. \$187 500) to apply in 2010/11 and 2011/12, the Panel took into account the change in the real value until 1 July 2012. Following this, the MPC and CPT should then be indexed annually from 1 July.

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A Terms of Reference

[Reproduced below]

Reliability Panel Review of the operational arrangements of the reliability settings and Reliability standard and settings review AEMC Terms of Reference (3 March 2009)

Introduction

The Reliability Panel (Panel) made a number of recommendations in relation to the operationalisation of the bulk supply reliability standard in the final report of its Comprehensive Reliability Review (CRR), which was published in December 2007. The Panel also forecast in the CRR a number of other initiatives and reviews it would undertake as a response to issues raised during consultations. The Panel is also required to undertake periodic reviews of reliability matters.

The Panel's indicative work program in 2009 and 2010 foreshadowed a number of the issues subject to these terms of reference. Therefore, the terms of reference align a range of related matters.

Scope of the reviews

The Panel is requested to review the operationalisation of the reliability standard including:

- the methodology and process used by NEMMCO for calculating the minimum reserve levels (MRLs), especially where the MRLs apply across more than one jurisdiction;
- the MRLs and associated arrangements and standards to be used in the short-term reserve assessment of reliability;
- the current "Guidelines for management of electricity supply shortfall events" (sometimes referred to as 'share the pain' guidelines) that were issued by the Panel in September 1998;
- the need and possible design of a short-term version of the RERT that could be used in a critical emergency;
- whether the wording of the standard as published by the Panel in the CRR could be clarified to give better guidance to NEMMCO as to how to operationalise the standard; and
- whether the Rules should be amended to clarify the requirement for market participants to inform NEMMCO, via dispatch bids or offers, of their actual capability under the prevailing or forecast temperature conditions.

In addition, the Panel is also requested to commence a 'Reliability standard and settings review' as proposed by the Panel in its Rule change proposal "NEM Reliability Settings: VoLL, CPT and Future Reliability Review". Although a final determination is yet to be made on this Rule change proposal, it is considered

desirable that this review be commenced now to test the appropriateness of the future standard and settings. Furthermore, under the existing Rules, the Panel would have been required to review VoLL by 30 April 2010.

Process

The recent unserved energy events in Victoria and South Australia have highlighted the need for close scrutiny of the way the reliability standard is put into operation in the NEM, and also the appropriateness of the reliability standard and settings.

Therefore, these reviews are 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 at least one forum for these reviews.

The Panel is requested to consider the national electricity objective (NEO) contained in section 7 of the National Electricity Law (NEL) when it considers issues raised in these reviews and when making associated recommendations.

Timing

Recognising the extensive work program within the Panel, the Panel should aim to complete its review into the operationalisation of the reliability standard by the end of December 2009 and the reliability standard and settings review by the end of April 2010.

Clearly, these Panel reviews will also assist the AEMC in responding to the MCE directed review into the energy market frameworks in light of the impact on electricity supplies of the extreme heat wave of 29-31 January 2009, which was identified in the MCE's 6 February 2009 Communiqué.

Notwithstanding the end dates for these reviews and given the desirability of implementing any appropriate changes in a timely manner for the summer of 2009/10, the Panel should consider the possibility of making necessary changes to guidelines or proposing Rule changes before the completion of these reviews.

B The Panel's obligations under the National Electricity Rules to review the Reliability Standard and settings

3.9.3A Reliability standard and reliability settings review

- (a) By 30 April of each second year (commencing 2010) the *Reliability Panel* must conduct a review in accordance with the *Rules consultation procedures* on the *reliability standard* and *reliability settings* set out in paragraph (b) of this clause and *publish* a report on the *reliability standard* and *reliability settings* that it recommends should apply from 1 July in the year commencing 2 years after the year in which the review is conducted.
- (b) In conducting a review in accordance with this clause 3.9.3A the *Reliability Panel* must review the following:
 - (1) the *reliability standard*;
 - (2) the *market price cap*;
 - (3) the *cumulative price threshold*; and
 - (4) the *market floor price*.

3.9.4 Market price cap

- (a) The *market price cap* is a price limit which is to be applied to *dispatch prices*.
- (b) The value of the *market price cap* is \$10,000/MWh prior to 1 July 2010. Effective from 1 July 2010, the value of the *market price cap* is \$12,500/MWh.
- (c) In conducting a review of the *market price cap* in accordance with clause 3.9.3A, the *Reliability Panel* must have regard to the potential impact of any proposed increase in the *market price cap* on:
 - (1) *spot prices*;
 - (2) investment in the *National Electricity Market*; and
 - (3) the *reliability* of the *power system*.
- (c1) The *market price cap* recommended by the *Reliability Panel* in a review under clause 3.9.3A must be a level which the *Reliability Panel* considers will:
 - (1) allow the *reliability standard* to be satisfied without use of NEMMCO's powers to intervene under clauses 3.20.7(a) and 4.8.9(a);
 - (2) in conjunction with other provisions of the *Rules*, not create risks which threaten the overall integrity of the *market*; and
 - (3) take into account any other matters the *Reliability Panel* considers relevant.
- (c2) A report of the *Reliability Panel* under clause 3.9.3A must set out the conclusions of its review and the recommendation in relation to the level of the *market price cap* along with supporting information including:
 - (1) details of all relevant market conditions and circumstances on which the recommendation is based; and

- (2) an assessment of whether the level of the *market price cap* together with the operation of the *cumulative price threshold* has achieved the objectives set out in clauses 3.9.4(c1)(1) and (2).
- (d) In its review of the *market price cap* under clause 3.9.3A, the *Reliability Panel* may only recommend a change to the *market price cap* from 1 July in the year commencing 2 years after the year in which the review is being conducted where:
 - (1) in the *Reliability Panel's* opinion, it is highly probable that the relevant *market* conditions and circumstances on which the recommendation for that year are based as stated in the report of the *Reliability Panel* under clause 3.9.3A will eventuate; and
 - (2) the *Reliability Panel* has given due consideration to the impact of the change to the *market price cap* on *Market Participants* and, in the event of a recommended decrease in the *market price cap*, any alternative arrangements considered necessary to ensure that the *reliability standard* is maintained.

...

3.9.6 Market floor price

- (a) The *market floor price* is a price floor which is to be applied to *dispatch prices*.
- (b) The value of the *market floor price* is \$-1,000/MWh.
- (c) **[Deleted]**
- (d) The *market floor price* recommended by the *Reliability Panel* in a review under clause 3.9.3A must be a level which the *Reliability Panel* considers will:
 - (1) allow the *market* to clear in most circumstances;
 - (2) not create substantial risks which threaten the overall stability and integrity of the *market*; and
 - (3) take into account any other matters the *Reliability Panel* considers relevant.
- (e) A report of the *Reliability Panel* under clause 3.9.3A must set out the conclusions of its review and the recommendation in relation to the level of the *market floor price* along with supporting information including details of all relevant *market* conditions and circumstances on which the recommendation is based.

...

3.14.1 Cumulative price threshold and administered price cap

- (a) In conjunction with each *participating jurisdiction*, and after consulting *Market Participants* in accordance with the *Rules consultation procedures*, the *AEMC* must develop, authorise and *publish* and may vary from time to time a schedule to specify an *administered price cap* for each *region* to apply to *spot prices* and *market ancillary service prices* and to be used as described in this rule 3.14.
- (b) The *administered floor price* for each *region* to apply to *spot prices* and to be used as described in clause 3.14.2 will be the negative of the value of the *administered price cap*.
- (c) The *cumulative price threshold* is \$150,000 prior to 1 July 2010. Effective from 1 July 2010, the *cumulative price threshold* is \$187,500.

C NEM Reliability Standard – Generation and Bulk Supply

This Reliability Standard for Generation and Bulk Supply⁹⁹ was determined by the Reliability Panel (Panel) as part of its “Review of the Reliability Standard and Settings”, which completed in April 2010. This Reliability Standard forms part of the *power system security and reliability standards* and was determined in accordance with clauses 8.8.1(a)(2) and 8.8.3 of the National Electricity Rules (Rules).

Form of the Reliability Standard

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

Level of the Reliability Standard

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

Performance Against the Reliability Standard

Performance against this Reliability Standard for Generation and Bulk Transmission should be considered using the actual observed levels of annual USE for the most recent financial year. Plant performance and demand characteristics that occurred in that financial year should be assessed to determine whether there are any underlying changes occurring.

Operational Implementation of the Reliability Standard

Operationally, it should be planned to achieve an expected USE that is within this Reliability Standard for Generation and Bulk Transmission in each financial year and for each region, which means that it should also be achieved for the NEM as a whole.

⁹⁹ This version of the Reliability Standard takes effect on 1 July 2012. The “NEM Reliability Standard – Generation and Bulk Supply – December 2009” is contained in Appendix D of the Review of the Reliability Standard and Settings, December 2009, and is available on the AEMC website.

Scope of the Reliability Standard

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

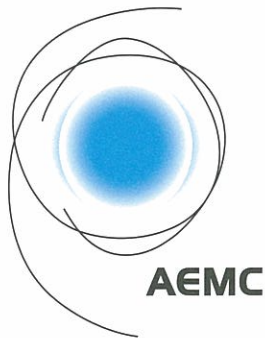
- a single credible contingency on a generating unit or an inter-regional transmission element, that may occur concurrently with generating unit or inter-regional transmission element outages; or
- delays to the construction or commissioning of new generating units or inter-regional transmission network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

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

- multiple or non-credible contingencies;
- outages of transmission or distribution network elements that do not significantly impact the ability to transfer power into the region where the USE occurred; or
- industrial action or 'acts of God' at existing generating or inter-regional transmission facilities.

D Consideration of gas market settings when reviewing electricity market settings

On 19 March 2010 the Panel received a letter from the AEMC, requesting the Panel to consult with AEMO on the gas market settings and to consider the interactions between the electricity and gas markets, and the implications of gas market settings when undertaking the biennial review of the electricity market settings. The letter is contained in the following pages.



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Mr Neville Henderson
Chairman
Reliability Panel
PO Box A2449
Sydney South NSW 1235

19 March 2010

Our ref: EMO0001

Dear Mr Henderson

Reliability Panel to consider gas market settings when it reviews electricity market settings

I am writing to request the Reliability Panel to consider the interactions between the electricity and gas markets, and the implications of gas market settings, when it undertakes its biennial reviews of electricity market settings. Given the Panel's current Review of the Reliability Standard and Settings, to be completed by April 2010, it will be timely to consider these issues in that context.

The AEMC's Review of Energy Market Frameworks in light of Climate Change Policies found that the energy market frameworks are sufficiently resilient to deal with the convergence of the electricity and gas markets, noting that there is now a single market operator (AEMO) and a single rule maker (the AEMC) overseeing both markets. However, the Commission found that co-optimisation of electricity and gas market settings to the maximum extent possible would support the efficient operation of these markets. Recognising this, the Commission considers that existing and future reviews of the market settings in the electricity and gas markets should take into account the likely impacts on the other market.

The Ministerial Council on Energy's response to the Commission's Review, dated December 2009, supported this conclusion, recognising "the need to ensure a level of harmonisation, where appropriate, between the operation of gas and electricity markets. Accordingly, it supports the recommendations that the Reliability Panel and AEMO take into account the interactions between the two sectors."¹

The Panel has obligations under the National Electricity Rules to review the electricity market settings every two years, and is currently undertaking such a review. Accordingly, the Commission requests that the Panel take into account gas market settings and the

¹ MCE 2009, Review of Energy Market Frameworks in light of Climate Change Policies: MCE Response, December 2009, p.12.

Neville Henderson
Reliability Panel

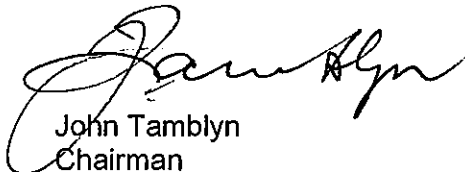
19 March 2010

impact of any change in electricity market settings on both the electricity and gas markets as part of the Panel's current Review of the Reliability Standard and Settings.

The Panel is requested to consult with AEMO on the gas market settings as part of its consideration of this further issue. AEMO's participation as a member of the Reliability Panel should help to facilitate this process. The Commission will also write to AEMO to request its cooperation with the Panel's current and future reviews on the electricity market settings.

If you require clarification of any of the matters discussed above, please contact Cheryl Lo on (02) 8296 7800.

Yours sincerely



John Tamblyn
Chairman

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E Consistency of settings between electricity and gas markets¹⁰⁰

The information in this appendix was provided by AEMO as discussed in section 4.1. The table at the end of this appendix summarises the current parameters and review arrangements for the three relevant markets, being the Short Term Trading Market (STTM), the NEM and the Victorian Declared Wholesale Gas Market (DWGM).

Setting the MPC

When determining market settings within a specific market, the key circumstances to consider are:

- Investment revenue adequacy to meet reliability standards;
- Value of Customer Reliability of those customers likely to suffer shortfall; and
- Market tolerance of financial risk and provision of credit support.

Quantification of these circumstances are very different in each market and thus consistency across markets would not be expected unless it were the objective of the reviewer.

The main concern of inconsistent market settings is that at times of stress, operational decision making of potential arbitrage players will be skewed against the respective market supply/demand conditions. These arbitrage players would include:

- Gas Fired Generators (GFG), whose marginal cost of fuel consumption would equal the gas price whilst the value of production would equal the electricity price;
- Gas market participants who have sources of supply that can be injected into either the DWGM or the STTM.

Their behaviour could be skewed for example when:

- If the gas price cap is “higher” than the electricity cap, then GFGs without alternative fuel may shutdown even if electricity is scarcer than gas;
- If the electricity cap is “higher” than the gas cap, then GFGs may attempt to operate even when gas is scarcer than electricity;
- As the DWGM cap is higher than the STTM cap, then joint gas market participants may choose to transfer gas to the DWGM even when it is scarcer in an STTM hub.

¹⁰⁰ This advice was provided by AEMO in response to a request from the Reliability Panel.

Comparing Gas prices to Electricity prices

Ideally, in conditions where both markets were operating at their MPC, a GFG would be indifferent to operation, i.e. the electricity MPC would equal the product of the gas cap and the GFGs heat rate. Heat rates vary from about 7.5GJ/MWh for efficient combined cycle gas turbines (CCGT) up to about 13GJ/MWh for older open cycle gas turbines (OCGT).

In practice, OCGTs in the NEM mostly invest in alternative fuel supply and CCGTs mostly do not, therefore the CCGT heat rate would be most relevant. This approach suggests that the NEM MPC is about twice the DWGM MPC and about four times the STTM MPC.

Different Settlement intervals

The differences in respective settlement pricing intervals are not relevant to determining equivalent MPCs. The key issue is that the marginal supply/demand conditions would equate at that moment when

- a GFG considering production or
- a gas injector was considering arbitraging gas between markets.

This could hold even with different pricing intervals as long as each pricing interval was sufficiently short such that the marginal conditions of that energy did not materially change throughout the interval.

Cumulative Price Threshold (CPT)

Whilst the concept of CPT exists in each market, their levels are quite different. Whilst the NEM's CPT equates to 7.5 hours of MPC, the STTM CPT must equate to greater than 24 hours of MPC because that is the minimum pricing interval.

This does not necessarily mean the CPTs are inconsistent. For example, in a situation where both markets are in tight conditions over, say, a 2 day period, the marginal value of electricity may be high only for a few hours each day whereas for gas it would be expected to stay continuously high due to linepack storage.

However in practice it would be impossible to arrange CPT equivalence as there is no certainty that the high prices will occur simultaneously and over the same period. It should be accepted that the CPTs are likely to be triggered asymmetrically, and deal with the impacts of this.

Administered Price Cap (APC)

Using the above heat rates the APCs of all markets appear roughly consistent.

However this provides no comfort because the CPTs will not be triggered simultaneously, one market will be subject to the very low Administered Price Cap

(APC), with another possibly pricing at its MPC, being more than an order of magnitude higher.

This distortion could be addressed through joint triggering, i.e. when one market triggers the CPT, multiple markets become subject to the APC. However the operational benefits of equivalent price capping may be less than the costs of market disruption caused by applying the APC more widely.

Supporting the APC in electricity are specific compensation arrangements¹⁰¹ aimed at encouraging a generator with marginal costs in excess of the APC to continue to operate. For example, if, during NEM APC, a Victorian GFG were facing an DWGM price of \$800/GJ, it could still enter a bid price of $\$800/\text{GJ} \times 7.5\text{GJ}/\text{MWh} = \$6\,000/\text{MWh}$, and, if dispatched by the NEM dispatch engine, could be eligible for compensation payments for its fuel cost of $\$6\,000 - \$300 = \$5\,700/\text{MWh}$.

Thus an assessment of the CPT/APC compatibility might consider whether these compensation arrangements adequately address the disincentive for GFGs to run during NEM APC, noting limitations to the compensation arrangements, such as:

- Risk to the generator of insufficient compensation (payments are determined ex-post);
- Lack of any provision of economic profit, thus the GFG has no positive incentive to provide;
- Partial self-funding of the compensation by a vertically integrated GFG/Retailer.

The DWGM and STTM also have APC compensation arrangements, which might similarly address the situation of gas transfers from an uncapped to capped market.

The situation where a gas market has APC but the NEM does not and therefore a GFG wishes to operate even though the gas supply is tighter than electricity does not appear to be addressed by a market or compensation mechanism. It is likely that AEMO would have to intervene to prohibit the GFG from operating, but may not be able to do this in an efficient manner. This would appear to be an area deserving of consideration.

Process to converge arrangements

As can be seen in the table, the market setting review timings do not coincide and are split between AEMO, the Reliability Panel and AEMC.

¹⁰¹ NER 3.14.6

However Rule 492 (Review of Market Parameters) of the NGM (Short-term Trading Market) Rules states:

“(4) If:

- (a) any corresponding value in respect of another Australian gas market or the national electricity market is reviewed; and
- (b) the review finds that value should be changed,

AEMO must, after consultation with interested parties, determine whether to conduct a review under this rule earlier than would otherwise be required under subrule (1), and must publish that determination.”

This implies that the NGM parameters are intended to be reactive to changes in other market parameters. There is no equivalent contemplation in the NER or DWGM rules.

However successive reactive reviews would result in circularity, with price settings unable to break out of pre-existing levels. This could perhaps be avoided by combining the market settings reviews into the one joint review. Ideally this would be done by one body, or, if necessary, a joint exercise between the organisations carried out simultaneously.

Ultimately, the recommendations need to be promoted as Rule Changes under the respective National Gas and National Electricity Laws, and if there were to be a synchronised process, two Rule Changes would need to be proposed simultaneously. There is no provision to enter a “dual-fuel” Rule Change into Gas and Electricity at once.

As the Market Objective in each law is similar, it may be possible to propose the respective Rule changes with the economic costs and benefits combined across both markets. This would reduce the risk of the Rule Change being considered separately in one market from another. A legal opinion on that matter might be sought.

Comparison of Gas and Electricity Market Settings

Market	Settlement Pricing Interval	Market Price Cap (MPC)	Cumulative Price Threshold (CPT)	Administered Price Cap (APC)	Last Reviewed	Reviewing Agency	Next Review
NEM	30 minutes	\$12 500/MWh (from 1/7/10)	\$187 500/MWh (equivalent to 15 intervals of MPC) measured over 7 days	\$300/MWh	<i>MPC & CPT Dec 08 (rule made May 09). Current review to complete 30/4/10 & to apply for 1/7/12-30/6/14. APC May 08</i>	<i>MPC & CPT Reliability Panel APC AEMC</i>	<i>MPC & CPT Biennial: Next due by 30/4/12¹⁰² APC AEMC discretion</i>
STTM	Daily	\$400/GJ	110% ¹⁰³ of Market price cap (i.e. \$440/GJ) measured over 7 days	\$40/GJ	June 09	AEMO	By 31/12/12 to apply 1/7/14, then at least five-yearly ¹⁰⁴
DWGM	4 Hourly ¹⁰⁵	\$800/GJ	\$3,700/GJ accumulated over 35 settlement intervals	\$40/GJ	2007/08	None ¹⁰⁶	None identified

¹⁰² NER 3.9.3A.

¹⁰³ NGR (STTM) Rules definition of “Cumulative Price Threshold”.

¹⁰⁴ NGR (STTM) Rule 492.

¹⁰⁵ The Victorian gas day incorporates four 4 hour and one 8 hour pricing intervals. A single gas day ex-ante dispatch and price is initially published, but variations from the dispatched supply and demand volumes are priced upon these shorter deviation intervals.

¹⁰⁶ Previously VENCORP, this obligation has been removed. Both AEMO and AEMC have legislative obligations in market development.