RELIABILITY PANEL AEMC

PANEL DETERMINATION

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DRAFT DETERMINATION

Review of reliability standard and settings guidelines

13 October 2016

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Inquiries

Reliability Panel

c/o Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

E: aemc@aemc.gov.au
T: (02) 8296 7800
F: (02) 8296 7899

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About the Reliability Panel

The Reliability Panel (Panel) is a specialist body established by the Australian Energy Market Commission (AEMC) and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on reliability, security and safety 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. This work is copyright.

Executive summary

The Reliability Panel (Panel) has developed these reliability standard and settings guidelines (the guidelines) in order to inform its approach to its four-yearly reviews of the reliability standard and settings (the review).

The guidelines:

- establish the assessment framework the Panel will use when undertaking each review;
- identify those parts of the reliability frameworks the Panel considers should be re-examined at each review; and
- outline a general approach to the modelling the Panel will use in each review.

Assessment framework

The assessment framework sets out the Panel's general analytical approach when it undertakes each review. This includes consideration of the National Electricity Objective (NEO). These reviews typically involve identifying and making trade-offs between a number of factors.

The guidelines include principles the Panel will use when assessing trade-offs between:

- the price and level of reliability of electricity;
- developing stable and predictable regulatory frameworks that are, nevertheless, capable of adjusting to changing market circumstances; and
- allowing the market to determine efficient price signals while not creating risks that threaten the integrity of the market, by limiting the extent of market participant exposure to periods of prolonged high prices.

The components of the reliability standard and settings

The Panel may consider several different components of the reliability frameworks in each review. These include the level and form of the reliability standard (the standard), and of the reliability settings (the settings):

- Market Price Cap (MPC)
- Cumulative Price Threshold (CPT)
- Market Floor Price (MFP); and
- Administered Price Cap (APC).

The Panel considers that when conducting each review, it should focus on the most important components. These are the components where regular assessment is likely to

provide the greatest market benefit. Focusing our analysis in this way will help minimise the complexity of each review and provide the market with more predictable outcomes.

The guidelines, therefore, describe which components will be open for assessment at each review, those which will only be open for assessment if the Panel considers there is a material benefit in doing so, and those which are not open for assessment. These components, and the approach taken to the assessment of each, are described in the table below.

Reliability components

	Reliability Standard	**Market Price Cap**	**Cumulative Price Threshold**	**Market Floor Price**	**Administered Price Cap**
Form	Closed	Closed	Closed	Closed	Closed
Level	Materiality assessment	Open	Open	Materiality assessment	Materiality assessment
Application of indexation	N/A	Closed (indexation is to apply)	Closed (indexation is to apply)	Closed (indexation is not to be applied)	Closed (indexation is not to be applied)
Form of indexation	N/A	Materiality assessment	Materiality assessment	N/A	N/A

Approach to modelling

Modelling is a key component of the Panel's analysis in each review. The guidelines set out the general approach the Panel will take when it develops modelling, including:

- That modelling will consider the impact of MPC and CPT on capacity retention and retirement decisions, as well as considerations of new capacity investment.
- That a new general approach to modelling should be adopted, which builds on previous approaches. This approach will be technology-neutral and will more accurately reflect market outcomes.
- More sophisticated analysis of interactions between different input variables, including the relationship between weather conditions, demand and intermittent generation dispatch.

Stakeholder consultation

The draft guidelines have been published as a standalone document separate to this draft determination. This draft determination sets out the Panel's analysis that has informed the contents of the draft guidelines. To facilitate consultation, the Panel has included the core contents of the draft guidelines in boxes at the end of the relevant section of this draft determination.

Stakeholders are invited to provide comment on the Panel's general approach and the detailed matters set out in this draft determination and the draft guidelines. Submissions must be received no later than **3 November 2016**.

Reliability Panel Members

Neville Henderson, Chairman and AEMC Commissioner

Trevor Armstrong, Acting Chief Executive Officer, Ausgrid

Lance Balcombe, Chief Executive Officer, TasNetworks

Murray Chapman, Executive Officer Corporate Development, AEMO

Mark Collette, Executive Energy, EnergyAustralia

Royce De Sousa, General Manager - Energy & Sustainability, Visy

Gavin Dufty, Manager Policy and Research, St Vincent de Paul Society, Victoria

Miles George, Managing Director, Infigen Energy Ltd

Chris Murphy, Strategic Advisor, Meridian Energy and General Manager - Energy Market Interfaces, Telstra

Richard Wrightson, General Manager Wholesale Markets, AGL Energy

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1 Introduction

1.1 Reliability standard and settings framework

The National Electricity Rules (NER) set out a framework for the determination of the reliability standard (the standard) and reliability settings (the settings) that apply to the National Electricity Market (NEM). This includes:

- The standard, which is the maximum expected unserved energy (USE) in a region. It is currently set at a level of 0.002% of the total energy demanded in a region for a given financial year.[1]

- The settings, which include:

  - The market price cap (MPC), which is the maximum price that can be reached in any dispatch interval and in any trading interval. It is currently set at $14,000/MWh.[2]

  - The market floor price (MFP), which is the minimum price that can be reached in any dispatch interval and any trading interval. It is currently set at -$1000/MWh.[3]

  - The cumulative price threshold (CPT), which is the maximum total energy price that can be reached in a time period of 336 trading intervals, and the maximum total frequency control ancillary services (FCAS) price that can be reached in a period of 2160 dispatch intervals, before an administered price period (APP) commences and the administered price cap (APC) is applied to market prices.[4] It is currently set at $210,000 for the energy market, and at six times the energy market value for FCAS markets.[5]

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1 NER clause 3.9.3C.

2 NER clause 3.9.4. As per NER Clause 3.9.4 (c), the MPC to apply on and from 1 July of each year is to be calculated by 28 February of each year and published on the AEMC website as part of a schedule of reliability settings. This schedule of reliability settings is available at http://www.aemc.gov.au/getattachment/5e81890c-0a96-43bb-b8c0-9cc9532c4bc5/Schedule-of-Reliability-Settings-(MPC-and-CPT-(4).aspx.

3 NER clause 3.9.6.

4 During an APP, the NEM dispatch engine (a computer program responsible for determining the optimal combination of generators to run in order to meet demand at lowest total cost) continues to dispatch the market based on generators' actual offers. However, for the trading intervals in which it applies, the maximum amount that customers will pay, and that generators will be paid, is capped at $300/MWh.

5 NER clauses 3.14.1 and 3.14.2. As per NER Clause 3.14.1 (d), the CPT to apply on and from 1 July of each year is to be calculated by 28 February of each year and published on the AEMC website as part of a schedule of reliability settings. This schedule of reliability settings is available at http://www.aemc.gov.au/getattachment/5e81890c-0a96-43bb-b8c0-9cc9532c4bc5/Schedule-of-Reliability-Settings-(MPC-and-CPT-(4).aspx.

- The APC, which is the maximum settlement price that applies during an APP. It is currently set at $300/MWh.[6]

1.2 Reliability Panel review of the standard and settings

The NER require the Panel to undertake a review of the reliability standard and settings (the review) every four years.[7] A key outcome of this review may be recommendations to change the standard and settings, if the Panel considers this necessary. If the Panel recommends a change to the standard or settings, it does so by lodging a rule change request to the Australian Energy Market Commission (AEMC). The next review is due to commence in January 2017.

The Panel must undertake the review in accordance with the reliability standard and settings guidelines (the guidelines).[8]

The Panel must also only recommend:

- A value for the MPC or CPT which it considers will:[9]
  - allow the standard to be satisfied without use of the Australian Energy Market Operator's (AEMO) powers to intervene under clauses 3.20.7(a) and 4.8.9(a); and
  - in conjunction with other provisions of the rules, not create risks which threaten the overall integrity of the market.
- A decrease in MPC or CPT that could mean the standard is not maintained, where it has considered any alternative arrangements necessary to maintain the standard.[10]
- A value for the MFP that it considers will:[11]
  - allow the market to clear in most circumstances; and
  - not create substantial risks that threaten the overall stability and integrity of the market.

The Panel must also have regard to any value of customer reliability (VCR) determined by AEMO which the Panel considers to be relevant.[12]

6 NER clause 3.14.1 (a).

7 NER clause 3.9.3A (d)(1).

8 NER clause 3.9.3A(e)(1).

9 NER clause 3.9.3A(f).

10 NER clause 3.9.3A(g).

11 NER clause 3.9.3A(h).

12 NER clause 3.9.3A(e)(4).

1.3 The reliability standard and settings guidelines

The NER require the Panel to develop and publish guidelines that set out the principles and assumptions the Panel will use in conducting the review.[13]

The Panel must develop and amend the guidelines in accordance with the rules consultation procedures.[14] There must be guidelines in force at all times after the date on which the Panel publishes the first guidelines.[15]

These are the first set of guidelines that the Panel has developed, since the requirement to do so was introduced in 2015.[16] The guidelines must be in place by 1 January 2017.[17]

1.4 The purpose of the guidelines

These guidelines set out the general approach that the Panel intends to take to future reviews.

The Panel's overarching goal in producing the guidelines is to provide the market with useful and transparent information about how it intends to undertake each review. The guidelines do not determine the values of the standard and settings. These will be determined in each review. Rather, the guidelines set out the principles that the Panel will apply in undertaking each review.

The structure of the guidelines is broadly divided into three main areas. This determination has been set out to reflect these areas:

- **Assessment framework:** The Panel has developed an assessment framework based on consideration of the NEO. This framework will be used by the Panel when undertaking each review. It sets out how the Panel will consider trade-offs between different priorities when determining the value of the standard and settings.
- **Function of the standard and settings:** The guidelines describe the function of the standard and each setting. These definitions complement and clarify any definitions in the NER.

13 NER clause 3.9.3A(a).

14 NER clause 3.9.3A(b). The rules consultation procedures are set out in NER clause 8.9.

15 NER clause 3.9.3A(c).

16 The requirement for the Panel to develop the guidelines was established in the *Governance Arrangements and Implementation of the Reliability Standard and Settings* rule change, which was made in March 2015.

17 NER clause 11.78.3.

In order to strike a balance between regulatory flexibility and predictability, the guidelines also clarify:

- which components of the standard and settings would be open for assessment in each review;
- which components of the standard and settings are unlikely to require assessment, unless the Panel considers there is a material benefit in doing so; and
- which aspects of the standard and settings are defined in the guidelines and will not be assessed in future reviews.

- **Approach to modelling:** The Panel uses market modelling to inform its review of the standard and settings. The guidelines set out a conceptual framework for how the Panel intends to undertake this modelling. More detailed issues related to the technical design of the model will be addressed in each review.

1.5 2014 Reliability standard and settings review

The Panel conducted its most recent review in 2014. The Panel made the following recommendations in that review:

- **The standard:** the form and level of the standard be maintained as a measure of USE, being 0.002% of the annual energy consumption for the associated region or regions, per financial year.
- **MPC:** no change be made to the real value of the MPC to apply from 1 July 2016. The MPC should continue to be indexed by the Consumer Price Index (CPI), annually.
- **CPT:** no change be made to the real value of the CPT to apply from 1 July 2016. The CPT should continue to be indexed by CPI annually. The Panel also recommended that the AEMC or the Panel (as appropriate) carry out a review of the form of the CPT mechanism prior to the next review.
- **MFP:** no change be made to the value of the MFP. The MFP should continue to be set at -$1,000/MWh from 1 July 2016.
- **Indexation:** no change be made to the measure of indexation of the MPC and CPT, with both settings to continue to be indexed by CPI annually. For MFP, the Panel recommended no change be made to the current approach of non-indexation. The Panel also recommended a review of the current indexation measure occur within two years.
- **VCR:** the AEMC or the Panel (as appropriate) should, in consultation with stakeholders and having regard to any VCR values delivered by AEMO, develop a methodology to derive an appropriate estimate of VCR for use in determining the efficient standard.

The Panel notes that a number of changes have occurred since it made these recommendations in 2014. AEMO has since developed its VCR measure, which the Panel is required to consider when undertaking each review.[18] The Panel has also considered its approach to the CPT and the appropriate form of indexation in sections 4.4and 4.7 of this determination, respectively.

18 NER clause 3.9.3A(e)(4).

2 Assessment framework

This chapter sets out the assessment framework, and considerations therein, that the Panel has applied in developing the guidelines, and that it will apply in reviewing the standard and settings.

2.1 The National Electricity Objective

The Panel is guided by the NEO when developing the guidelines and when undertaking each review. The NEO is:[19]

> "to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system."

The Panel considers that when developing the guidelines and undertaking each review, its key focus is to support efficient investment in and operation of electricity services to maintain the reliability of the supply of electricity and the reliability of the national electricity system. However, the costs of providing a reliable supply of electricity and the value customers place on that reliability is also central to the Panel's considerations.

Reliability: The overarching purpose of each review is to ensure that the market and the rules frameworks can continue to deliver a reliable supply of electricity to consumers, and maintain a reliable power system, in the long term.

The reliability of the power system is directly related to the efficiency of investment and operation of energy services in the NEM. Reliability is maintained when there is efficient investment in supply-side solutions such as generation, or demand-side options, such that the standard is met. Typically, these investments are for large, high capital cost, long lived assets. Efficient investment decisions, therefore, require a regulatory reliability framework that is stable and predictable.

Efficient operation of energy services includes participants making efficient contracting decisions to manage their wholesale market exposure. Maintaining sufficient incentives for participants to contract with counterparties for the purposes of risk management is fundamental to the design of the NEM and maintains efficient levels of investment to meet consumer demand for energy.

19 NEL s.8.

Price: The standard and settings can directly affect market participants' price exposure to the wholesale market. Ultimately, this could impact the prices paid by end-users. With that in mind, the standard and the setting need to balance:

- incentivising efficient investment and efficient operational decisions, including providing sufficient incentives for participants to manage their exposure to spot prices through contracting; and
- the price faced by various market participants.

Sustained high prices may cause financial distress to market customers and create instability in the market, potentially having detrimental impacts on reliability. The possibility of highly volatile prices may also increase financing costs for market participants, which could lead to higher costs for customers. Finally, prices that are too high may result in inefficient over-investment.

On the other hand, low prices may weaken the financial position of market generators, which could similarly have negative implications for reliability. Sustained low prices can also signal for generators to exit the market or for under-investment in new generation. These, in turn, could negatively impact reliability in the long-term.

Considerations of reliability, efficient investment and efficient prices have been central to the Panel's development of the assessment framework. The core components of this assessment framework are described below.

2.2 The trade-offs inherent in the assessment framework

Determining the standard and the settings requires the Panel to exercise its judgement with regard to a number of factors. The guidelines set out the considerations the Panel will have regard to in exercising its judgement in each review. These judgements were also used to inform both the structure and content of the guidelines.

The Panel has identified three general areas where it needs to exercise its judgement:

- allowing for the market to send efficient price signals while effectively managing price risk for all participants;
- delivering a level of reliability consistent with the value placed on that reliability by customers; and
- providing a stable and predictable regulatory framework that is sufficiently flexible to respond to a changing market and power system.

2.2.1 Allowing efficient price signals while managing price risk

The settings must allow for efficient price signals, while managing the price risk faced by participants.

The settings determine the boundaries of potential market prices. These include the maximum possible spot price in a trading interval (MPC) and the maximum cumulative price in a given period (CPT). Price signals in the form of spot prices and hedge prices are important signals, which guide operational and investment decisions in the market.

These signals include incentives to enter into contractual arrangements with counterparties to hedge risk, as well as to invest in and maintain supply and demand side capacity to reliably meet demand. These prices may also signal when it may be efficient for a generating unit to retire. The actual level of market prices and the signals they send are ultimately determined by competition between market participants.

The Panel considers that the main function of the MPC and CPT is to provide the market with boundaries to the possible prices that can occur within the market. Within these boundaries, there should be sufficient scope for competition between market participants to determine the prices that support efficient investment and operational decisions necessary to meet the standard, over the long-run.

Secondly, the settings determine the maximum potential price risk faced by market participants. By defining price limits, the settings protect market participants from exposure to sustained periods of high prices. Limiting the degree of potential price risk helps manage the cost of financing new investment in energy services, with implications for consumer prices and reliability over the long term.

Limiting the maximum potential price also manages the potential for over investment or inefficient operation of assets. Excessive prices may send overly strong signals, resulting in levels of investment in excess of those needed to meet the standard, or operation of assets in a way that is not productively efficient.[20]

Without these limits, the risk exposures may be so great that the market does not continue to operate efficiently or potentially collapses.

The assessment criteria set out in the draft guidelines reflect the trade-offs the Panel will consider between these two functions of the settings.

2.2.2 Delivering a level of reliability consistent with the value placed on that reliability by customers

The value that customers place on reliability will differ between customer groups, reflecting the way they use electricity. Residential customers using electricity for powering appliances may value reliability differently to large customers who use it to run a smelter or production line. However, in all cases there is a direct trade-off

20 The Panel notes that actual market prices are determined by supply / demand dynamics, the degree of competition in a market and the behaviours of individual market participants. The presence of a high price cap does not automatically result in high market prices. Nor does it automatically result in over-investment, as those investment decisions also factor in a range of complex considerations other than the presence of a market price cap at a particular level.

between the level of reliability and the price that customers are willing to pay for that reliability.

Generally, a more reliable power system will require greater levels of investment in generation and/or demand management capacity. Generators or demand-management providers will invest when they have expectations of higher future prices and profitability.[21] There is, therefore, a direct relationship between higher levels of reliability and higher expected prices for consumers.

The Panel considers that when assessing the trade-offs between reliability and the price of energy, it should consider a number of matters, including:

- **AEMO's VCR**: this is an estimate of the value that all customers place on the reliability of supply from the grid. It is based on a survey of different customer types and represents an average of the different values they place on reliability. The Panel is required to consider any value of reliability developed by AEMO, as it considers relevant.[22]

  The Panel acknowledges that other measures of the value of reliability may be used. However, AEMO's measure represents a standard approach that is broadly understood across the market and is commonly used as a proxy for the customer value of reliability.

- **Other relevant factors:** prices are one variable in the equation that determines generator and demand-side participation in the market. Other variables include the market structure, Opex/Capex costs and financial and physical hedges. Any government policies that interact with the market, such as lower emissions policies, may also be relevant to a generator's or demand-side participant's decision.

As discussed in section 4.2, the Panel considers that the level of the standard should normally remain the same between reviews, unless the Panel considers there may be a material benefit in opening it for reconsideration. Considerations of the trade-offs between reliability levels and the price of energy will be central to the Panel's decision as to whether the level of the standard should be reopened for assessment.

2.2.3 A predictable but flexible regulatory framework

Stable regulatory frameworks allow for efficient investment decisions in long-term assets such as generators. Changes to the settings and standard that are predictable and well justified will enable market participants to make informed decisions that would maintain the reliability of supply. At the same time, regulatory frameworks must be

21 The Panel notes that a host of factors external to the settings and market prices will influence investment decisions, including revenues from government schemes designed to deliver environmental outcomes, such as the renewable energy target and the various state based schemes.

22 NER clause 3.9.3A.

capable of adapting to changing market conditions. The standard and settings will need to change from time to time, to reflect material changes in these conditions.

The Panel has considered the trade-off between stability and flexibility in developing these guidelines. As section 1.4 explains, the guidelines identify which components are open for assessment at each review, those open for assessment only where there is likely to be a material benefit to doing so and those which are not open for assessment. Providing transparent ex-ante information on the matters the Panel will consider when deciding whether to assess these components further supports certainty.

2.2.4 Proposed assessment criteria to be included in the guidelines

The Panel has proposed the following assessment criteria be included in the guidelines.[23]

Box 2.1 Assessment criteria

When undertaking each review of the standard and settings, the Panel will be guided by the following general assessment principles:

1. **Allowing efficient price signals while managing price risk:** The Panel will exercise its judgement to balance allowing for efficient price signals against managing price risk for participants.

   The settings should allow sufficient scope for competition between buyers and sellers in the market to set efficient prices to achieve the standard, over the long-run. The settings should be designed to provide a sufficient range to promote this behaviour in the market.

   The settings should also provide protection from high prices in any given trading interval, and sustained high prices over a defined period, such that market outcomes do not result in inefficient over or under investment, or compromise the sustainability of an efficient market.

2. **Delivering a level of reliability consistent with the value placed on that reliability by customers**: The Panel will have regard to estimates of the value placed on reliability by customers when exercising its judgement as to the level of the standard.

   The settings should be sufficient to support the level of investment necessary to deliver the standard, over the long-run.

   The settings should also deliver a level of reliability that is commensurate with the value that customers place on that reliability as reflected by measures including, but not limited to, the Australian Energy Market Operator's (AEMO) measure of the value of customer reliability (VCR).

23 A copy of the draft guidelines is available at www.aemc.gov.au

3. **Providing a stable, predictable and flexible regulatory framework:** The Panel will exercise its judgement so as to achieve predictable outcomes, while reflecting significant changes in market conditions, to support efficient investment and operational decisions by participants.

3 Matters considered by the Panel

The Panel has considered a number of key market trends and market impacts when developing the guidelines. These matters have been relevant to the Panel's considerations regarding the structure of the guidelines, the definition of the various reliability components and the general approach to modelling. This chapter considers some of these key trends and explains how they have been factored into the Panel's development of the guidelines.

3.1 Market developments

The Panel has identified a number of key market developments that will be relevant to its considerations in each review. The guidelines have been developed in reference to these identified developments; they are particularly relevant to considerations of the form and level of the settings, as well as the general approach to market modelling adopted by the Panel.

The key market developments identified by the Panel include:

- gas market interactions with electricity market reliability;
- changes on the supply side, including changes to the generation mix, impacts on dispatch and the relationship between demand, reserves and price; and
- changes on the demand side, including changes in projections for peak demand and growth of distributed generation and storage.

3.1.1 Gas market interactions with electricity market reliability

Australian gas markets are currently going through a period of significant change. Demand patterns have shifted as liquid natural gas (LNG) trains begin production in Queensland. New market frameworks are being established for the trading of gas and pipeline capacity, including the trading hub at Wallumbilla, the various short term trading markets (STTM) in Sydney, Adelaide and Brisbane; as well as the Victorian declared wholesale gas market (DWGM). These developments are impacting the supply / demand balance in gas markets, with subsequent price impacts.

The relationship between gas markets and electricity markets is also changing. Increases in intermittent generation may increase the need for flexible, gas fired generation units to meet reliability and system security. This is exacerbated by the retirement of large thermal coal units.

Going forward, it is likely that the Panel will need to consider more complex interactions between these markets. The Panel considers that there are a number of general areas for consideration, including:

- **Gas supply:** tightness in supply of gas, or transport capability, can impact electricity market outcomes. These impacts are evidenced through recent events in South Australia. As recently noted by the Australian Energy Regulator (AER), gas fired generators in South Australia were faced with limited gas and transport capacity in July 2016, making scheduling of the limited fuel problematic and helping to drive up market prices.[24]These kinds of outcomes are likely to become more relevant to electricity market reliability in the future if the generation mix changes to include a greater amount of gas generation.[25]

- **Unit commitment and ability to respond to pricing signals:** higher gas prices also mean a higher opportunity cost for generators' gas fuel. This may have reliability consequences if it impacts on the ability of a gas fired generator to respond to price signals in the short term. For example, a gas fired plant in a region experiencing high spot gas prices may on-sell its contracted gas across a monthly or quarterly basis, if it receives a higher price than using that gas for generation. This may render the plant incapable of responding to unexpected high-price market signals to supply in the short term.[26]

The Panel considers that these kinds of interactions will primarily impact the modelling scenarios it uses to inform its review. For example, more complex assumptions may be required in regards to gas fuel costs when modelling gas generator behaviour, potentially drawing on STTM spot price outcomes. Scenarios could also include consideration of high and volatile gas prices. While this may add to the complexity of modelling, it may be necessary given the increased interactions between the two markets.

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24 Although there was no unserved energy in South Australia in July 2016, this is illustrative of the kinds of impacts that tightness in gas supply and transport can have on electricity market outcomes. More information on the July 2016 events in South Australia is available at: AER, *Electricity spot prices above $5000/MWh South Australia, 7 July 2016*, September 2016, p.5.

25 The Panel notes that the AEMC has completed a review of the eastern states gas markets, which included consideration of wholesale gas markets and arrangements for trading of pipeline capacity. Key recommendations included the establishment of hubs for the trading of gas and better information provision for all market participants. The AEMC is also currently progressing work on the Victorian declared wholesale gas market. The COAG Energy Council has announced the formation of the Gas Market Reform Group, which will lead implementation of some of the recommendations made in the AEMC's work and in work undertaken by the Australian Competition and Consumer Commission. The outcomes of the Gas Market Reform Group are likely to have significant impacts on the NEM going forward. More information is available at: www.aemc.gov.au and www.scer.gov.au.

26 Although gas may be physically available in the system at a spot price far in-excess of its contracted value, the gas-plant will face additional carriage or transport charges, and may be physically restricted from returning the plant to generation status any sooner than a week to ten days. For a more detailed description of this issue, see: Oakley Greenwood, *Assessment of approach to modelling of Reliability Settings*, September 2016.

3.1.2 Changes on the supply side

There are a number of changes occurring in the supply side of the electricity market that will need to be accounted for in the Panel's review. These include changes in:

- the generation mix as large thermal units retire and intermittent renewables increases;
- dispatch patterns as intermittency increases; and
- the relationship between demand, price and reserve levels.

Changes in the generation mix as large thermal units retire and intermittent renewables increase

Recent years have seen the retirement, or mothballing, of a number of large thermal units.[27] These units have retired for a number of reasons, including low wholesale prices and the fact that they were nearing the end of their operational life. AEMO has pointed to potential further retirements of thermal capacity in New South Wales and Victoria.[28]

At the same time, the amount of renewable generation in the NEM has increased significantly. Large volumes of new renewable generation is expected to enter the market over coming years, to meet the requirements of the renewable energy target (RET).[29]

These changes in the NEM generation mix have a number of implications for demand patterns and the way in which generation is dispatched. These are discussed in more detail below.

The potential for retirement of thermal units will also need to be considered by the Panel when reviewing the standard and settings, particularly in terms of the function of the MPC. This will also need to be considered in market modelling. This is discussed in further detail in sections 4.3 and Chapter 5.

Changes in the relationship between demand, price and reserve levels

Historically, periods of high prices have been linked to high levels of demand and low reserve levels.

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27 These have been mostly coal fired units, including Munmorah in 2012, Wallerawang and Redbank in 2014, Playford B in 2015 and Northern in 2016. Pelican Point close cycle gas turbine (CCGT) has been subject to reduced commitment since 2013.

28 AEMO, *Electricity statement of opportunities*, August 2016, p.18.

29 AEMO notes that 735MW of wind generation was committed between 1 July 2015 and 30 June 2016, with a further 12,441 MW and 1,724 MW of publicly announced or advanced wind and solar generation, respectively. For more information, see: AEMO, *Electricity statement of opportunities*, August 2016, p.18.

This relationship may change as the NEM shifts to a more intermittent, less dispatchable generation mix. It may be that under this generation mix, large reductions in the availability of intermittent generation may result in low reserve conditions, even during periods of average demand.

This changing relationship between supply, demand and reserve levels may require more sophisticated modelling, particularly in regards to the modelling of intermittent generation. This is discussed in more detail in Chapter 5.

Dispatch patterns reflecting increased intermittency

Increases in intermittent generation may also result in changes to the patterns of dispatch of marginal units.

Historically, the kinds of marginal units (typically open cycle gas turbines (OCGT)) considered by the Panel have been classed as "peaking" units. It has generally been assumed that these units are called on very infrequently, usually only during rare periods of extreme peak demand.

The way in which these units are dispatched may change in the future, primarily driven by a more intermittent generation mix. As noted above, it is possible that low reserve levels could occur during periods of relatively average demand. This could create a need for previously marginal units to be dispatched more frequently.

Changing dispatch patterns may need to be accounted for in any market modelling undertaken by the Panel. This is discussed in Chapter 5.

3.1.3 Changes on the demand side

Demand growth in the NEM has changed significantly in recent years. From 1999 to 2009, the total amount of energy consumed from the grid increased steadily. This was followed by steady annual decreases for the next five years to 2014.[30]

In the last two years, total energy consumed has increased again. However, AEMO projects that total energy demand is expected to remain flat for the next 20 years. This is primarily due to the effects of solar photovoltaic (PV) and increasing energy efficiency of appliances.[31]

Levels of peak demand are also not expected to increase markedly. Increased solar PV and air conditioner use is also expected to shift the intra-day peak demand periods to later in the day.[32]

30 More information is available at www.aemo.com.au and at the industry information section at www.aer.gov.au.

31 AEMO, *2016 National Electricity Forecasting Report*, June 2016.

32 Ibid.

Increased penetration of reverse cycle air conditioning is expected to increase winter peak demand periods, with these becoming comparable to summer peak demand by 2030.[33]

Finally, AEMO has projected that minimum demand periods will begin to occur at midday, when the sun is strongest and overhead. This is due to continued growth in installation of rooftop PV.[34]

The Panel will consider how to account for these changes in demand when reviewing the standard and settings. Market modelling will need to reflect these changes in demand profiles, including both changes in the absolute volumes demanded from the grid, and when that energy is demanded. It will also be necessary to reconsider how distributed energy resources should be treated in market modelling.

It may be necessary to consider how a more engaged demand side may participate in the NEM. As new technologies become more prevalent, parties may become more active in the wholesale market. This may be managed by individual customers, or through third party energy service providers who could aggregate demand or otherwise significantly change demand-side outcomes. Any market modelling will need to consider the increased potential for an active demand side.

Lastly, battery storage will need to be carefully considered going forward. Batteries may change aggregate demand patterns, or may act as generation at specific times. The fact that batteries can be controlled may also mean they need to be considered differently to historic distributed energy resources, such as rooftop PV.

Consideration of a more active demand side will need to be factored into any market modelling done to inform the Panel's analysis, as discussed in Chapter 5.

3.1.4 Developments in system security

There are a number of issues related to power system security that the Panel may need to consider when reviewing the standard and settings, including:

- outcomes of the AEMC's *System Security Market Frameworks* review; and
- impacts in frequency control ancillary services (FCAS) markets from retirement of large thermal units.

AEMC System Security Market Frameworks review

The AEMC and AEMO are currently progressing multiple work programs related to power system security. These projects are looking at what technical or market solutions are required for the NEM to remain secure and able to accommodate changes in the generation mix.

33 Ibid.

34 Ibid.

The AEMC's *System Security Market Frameworks* review is considering a number of issues related to ongoing system security, including the rate at which power system frequency can change and the strength of the power system.[35] This includes a rule change request from AGL, which proposes the introduction of a new non-market ancillary service (NMAS) for the procurement of system inertia.

This work is currently in its early stages and neither AEMO or the AEMC have made any recommendations regarding the appropriate technical or market solutions to deliver improved system security. Any proposed changes that are expected to come into effect during the next review will need to be accounted for in the Panel's considerations. For example, the introduction of a NMAS for inertia could change the patterns of dispatch of large incumbent thermal units, which may need to be accounted for in market modelling. This is discussed in further detail in Chapter 5.

Impacts on Frequency Control Ancillary Service markets

FCAS are services procured by AEMO to manage frequency changes in the power system. FCAS is used to manage minor frequency deviations within dispatch intervals by increasing or decreasing output from generators. It is also used to manage more serious deviations caused by individual contingency events, such as the loss of a single large load or generator.

The MPC and CPT apply in both the market for energy and in the market for FCAS. The MPC for FCAS is applied on the dispatch interval and the CPT is applied over a period of 2160 dispatch intervals, at a level six times that defined in the rules for the energy market.[36]

The Panel notes that supply of sufficient FCAS to maintain the security of the power system is emerging as a significant issue. This reflects the changes in the generation mix, particularly the displacement of large, spinning conventional synchronous generators by non-synchronous, intermittent generators. AEMO has noted that "the market has historically attracted regulation and contingency FCAS from synchronous generation. If this synchronous generation is displaced from dispatch (either permanently or temporarily), the level of FCAS it provides will have to be procured from other sources, which the market has not attracted to date".[37]

The Panel acknowledges that the settings will influence the degree of provision of FCAS, in as much as they incentivise investment in generation that can provide these services. However, it remains the case that when determining the settings, the Panel's primary focus is on reliability and the provision of sufficient investment to meet the

35 For more information on these concepts see: AEMC, *System Security Market Frameworks review - Issues Paper*, July 2016. Available www.aemc.gov.au.

36 This reflects the fact that FCAS is dispatched and settled on the dispatch interval. As there are 6 dispatch intervals per trading interval, the CPT for FCAS is applied over 2016 dispatch intervals (6 DI * 360 = 2160 DI), while the level of the CPT level is also multiplied by 6.

37 AEMO, *Future Power System Security review progress update*, August 2016, p.25.

standard.[38] Issues relating to the adequacy of FCAS services, and the ability of FCAS services to maintain system security, are out of scope of the Panel's work when reviewing the standard and settings.

However, the Panel considers that FCAS markets can and should be reflected in market modelling. For example, to reflect the fact that energy and FCAS markets are co-optimised and have equivalent price caps, market modelling should make marginal units indifferent between providing energy or FCAS. It may also be that market modelling could have minimum levels of FCAS as a constraint, in a similar vein to the potential treatment of inertia requirements.

3.2 Market outcomes

3.2.1 Contract market impacts

The standard and, more directly, the settings, have direct impacts on outcomes in the markets for hedging arrangements.

The level of the MPC sets the maximum possible price that can occur in the spot market. In combination with the CPT, these settings define the degree of potential price risk to which market participants are exposed.

Participants enter into hedging arrangements to manage this risk. These hedging arrangements typically include the various forms of over the counter (OTC) contracts, or exchange traded products.

The costs of these hedging arrangements are directly affected by not only potential price outcomes in the current spot market, but also expected price outcomes. A major factor in determining these potential outcomes, and expected outcomes, is the level of the various settings. By increasing the degree of price risk in the market, a higher MPC would likely increase the demand for hedging contracts from market customers to manage the increased risk.

This increased demand can have varying effects on the price of hedging arrangements and hence the investment signals sent to generators. The first effect may be to increase the derived value of the contract; as the price of the contract is derived from actual and potential spot market outcomes, the price will increase as the degree of the potential risk that it manages increases.

However, a secondary effect may be an increase in the supply of contracts. A higher potential price for contracts will increase incentives for parties to make them available, including by investing in the capacity that is used to back these contracts. In the longer

38 NER clause 3.9.3A(f) requires the Panel to set the MPC by reference to allowing the standard to be met. NER clause 3.9.3A(e) also sets out the matters that the Panel must have regard to when reviewing the standard and settings, which refer solely to impacts on spot prices, investment in the NEM, reliability and market participants. There is no reference in the rules for the Panel to consider impacts on system security when undertaking each review.

term the market can be expected to correct as the additional generation capacity increases market liquidity and places downward pressure on prices.

The Panel acknowledges that factors other than the level of the settings will influence contract markets. However, given the significant impacts of the standard and settings on these markets, they will form part of the Panel's considerations. In particular, the Panel will give some consideration to contracting when considering the level of the MPC and when developing its approach to modelling. This is discussed in more detail in Chapter 5.

It is important to stress, however, that contacting arrangements generally adapt to the situation in the market. As such, the Panel will seek to understand the implications of the standard and settings on the market in light of current contracting arrangements, but the Panel will not determine the standard and settings so that they necessarily satisfy current contracting arrangements. Rather, in a healthy market contracting arrangements will change, as required, in light of any changes to the standard and settings.

3.2.2 Prudential obligations

Qualitatively, a change in the settings will, at some stage in the future, change the prudential requirement and credit limit for both generators and customers operating in the NEM. All else being equal, an increase in the MPC will increase prudential requirements, and vice versa.

3.2.3 Short and long term impacts on customers

In theory, reducing the level of MPC may reduce the ability of generators to earn revenue in the spot market, leading to lower prices for consumers in the short term. However, over the longer term, a lower MPC could dampen investment signals, leading to a shortage of generation capacity.[39] In this event, a lower MPC could result in increased prices to consumers over the longer term.

3.2.4 Impact on demand-side participation

A reduction in MPC may reduce the incentive for participants to engage in demand-side management activities. However, a reduction in DSP can result in a need to increase the MPC to deliver the standard. Therefore, the level of MPC and the quantity of DSP which is provided to the market are closely related.

39 The Panel notes that this does not preclude a lowering of the MPC over time, if the market is still able to reach equilibrium.

4 Components of the reliability standard and settings

The guidelines provide information on the standard and each of the settings. The Panel has divided these up into the following components of the reliability regulatory frameworks, which include the ***form*** and the ***level*** of the:

- reliability standard (the standard);
- market price cap (MPC);
- cumulative price threshold (CPT);
- market floor price (MFP); and
- administered price cap (APC).

This chapter sets out the Panel's assessment of what the form and the level of each component should be, including whether each component will be open for assessment at each review, open for assessment if the Panel considers there is a material benefit in doing so, and those which are not open for assessment. This chapter also summarises the Panel's consideration of the definition of each component, where relevant. These definitions are intended to complement any definitions already provided in the NER. This chapter also discusses whether individual settings should be indexed and, if so, how.

4.1 General approach

The Panel has developed an approach that is designed to balance stability and flexibility in development of the regulatory frameworks for reliability. It does this by establishing for the form and level of each of the components:

- A definition of their purpose.
- The approach taken to each component by the Panel in each review, including whether it is:
  - **Open**, meaning that the form and/or level of the component is open for assessment in each review;
  - **Subject to a materiality assessment**, meaning that the form and/or level of the component will remain the same as in the previous review, unless the Panel considers there may be a material benefit in assessing it during its review; or
  - **Closed**, meaning that the form and/or level of the component will not be open for assessment in the next review.

- Depending on whether the component is open or subject to a materiality assessment, some guidance on the principles the Panel will apply in making its assessment of the component.

In deciding how a component should be addressed in the guidelines, the Panel has considered:

- **Value in reassessing each component:** there are likely to be different benefits associated with assessing different components from one review to the next. Identifying the potential benefits of regular assessment involves consideration of the various factors and inputs relevant to that component.

  For example, a component such as the level of the MPC reflects and incorporates a large set of highly dynamic factors and inputs, including many changes in the generation mix, demand characteristics and fuel costs. As such, it warrants reassessment on a regular basis so that it remains set at a level that effectively reflects any changes in these underlying variables.

  In contrast, a component such as the level of the APC arguably reflects and incorporates a smaller set of relatively static factors and variables. As such, a regular review of the level of the APC may not be as important as with MPC. However, it is possible that these variables can change over time. The Panel should therefore retain the possibility of reassessing this component, on an as needs basis.

- **Value of stability:** the standard and settings inform decision to invest in long term assets. As such, there is value in maintaining stability in the level and form of components wherever appropriate. Stability and predictability of outcomes supports market confidence and reduces perceived regulatory risk, helping to support efficient investment. This value needs to be considered against the value of reassessing each component.

- **Costs of reassessment:** While less material than other considerations, there are costs for the AEMC, the Panel and for stakeholders associated with regularly reopening components for assessment. Clarifying which components are subject to regular assessment helps to reduce these costs and allows for the Panel and stakeholders to focus their resources on the most important issues.

4.2 Reliability standard

The form of the standard is a standard applied to generation and inter-regional transmission elements in the NEM, being the maximum expected USE in a region, as a percentage of the total energy demanded in that region for a given financial year; the level of the standard is currently 0.002%.

4.2.1 Form of reliability standard

The standard is currently defined as the maximum expected amount of energy that is at risk of not being served in a region, in a financial year.

The form of the standard has remained more or less constant since the market started, aside from some changes in terms of how it is measured over time.[40] However, there are different ways in which overall reliability can be defined and measured.

The Panel has considered the range of different approaches that could be taken to the form of measurement of reliability.[41] Some of these different approaches can be broadly defined as follows:

- How frequently supply is interrupted, for example, the number of days per year in which an interruption occurs. This could include measures such as:
  - Loss of load expectation (LOLE), which 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.
  - Loss of load probability (LOLP), which is the proportion (or probability) of the days per year, half-hours per year, or events per season, in which available generating capacity is insufficient to serve demand.
- The cumulative duration of interruptions, for example, the total number of hours per year that interruption to any (not necessarily the same) consumer occurs, such as the system average interruption duration index (SAIDI) for distribution.
- The amount of energy that is not supplied in a period, for example, the NEM's unserved energy standard.
- Deterministic standards, which define a minimum amount of reserve generation capacity.

The Panel considers that there are strengths and weaknesses associated with each of these approaches. For example:

- A deterministic standard may be relatively simple to implement, but the actual level of reliability it provides is a function of the number of generators actually in service at any given time.

40 At market start, the standard was measured in terms of whether it was met "over the long term". In 2007, the Panel redefined "over the long term" as the preceding ten years. The standard currently refers to a time period of the previous financial year.

41 Including: AEMC Reliability Panel, *Comprehensive Reliability Review Final Determination*, December 2007; AEMC Reliability Panel, *Reliability Standard and Reliability Settings Review 2014*, July 2014.

- Time based measures such as LOLP and LOLE provide information about the frequency of interruptions, but say nothing about actual volumes of energy not served.

- A volumetric measure such as USE, captures the volume of energy lost effectively, but says nothing about the frequency or duration of interruptions to customer supply.

Historically the standard has been a volumetric measure. Given the limitations of each type of measure and the value of stability the Panel's draft position is to retain the form of the standard as USE, and that the form of the standard should not be reassessed at each review.

The NEM is an energy only market, with no separate market to incentivise investment in capacity. The Panel considers that the best way to determine if there has been sufficient capacity investment to meet customer demand is to measure the extent to which all customer demand has been met. A volumetric measure of energy demand met, such as USE, provides an optimal measure of the relative effectiveness of the NEM to meet customer demand.

Another reason is that the standard has been determined as a measure of USE since market start. While maintenance of the status quo has no inherent value, a perception that it may be subject to regular change could create market uncertainty, potentially increasing the cost of investment. In the absence of any clearly identifiable benefit associated with allowing the form of the standard to change, the Panel considers that these costs are not justified.

Finally, the Panel remains satisfied that the form of the standard should remain defined as a probabilistic target for the purposes of system planning, defined as the maximum *expected* unserved energy. This measure of expected unserved energy is very important, as it recognises that there are many factors that may impact on the level of USE in a given year, with very different probabilities attached to each. A measure of reliability like expected USE recognises that in any given year, there is a risk that outlier events could result in the standard not being met.[42]

42 Definition of the standard as a probabilistic target also allows for analysis and modelling that better reflects future outcomes in the market. The Panel typically undertakes a probabilistic assessment of market outcomes that covers a range of different variables including demand levels, power plant availability/outages and other factors. As such, the values of the various settings arrived at by the Panel represent a probabilistic assessment of whether they are able to meet the standard.

Box 4.1 Form of the reliability standard

Function: the standard is a measure applied to generation and inter-regional transmission elements in the National Energy Market (NEM), the purpose of which is to define the maximum expected amount of energy that is at risk of not being served in a region in a given financial year.

Approach: closed. The form of the standard is confirmed in the guidelines as a measure of unserved energy (USE). It will not be opened for reconsideration in future reviews.

4.2.2 Level of reliability standard

The standard is currently set at a level of 0.002% of the total energy demanded in a region for a given year. This value has not changed since market start.

The Panel has considered the level of the standard in previous reviews. In the 2007 *Comprehensive Reliability Review*, it considered that the level of the standard was appropriate for Australia, having undertaken a comparison with international jurisdictions and recommended no change.[43] In the *2014 Review*, the Panel found that the market had performed well against the standard, with only two breaches of the standard since market start.[44] The Panel also considered that the fact no stakeholders had identified a need for change, coupled with analysis undertaken by ROAM, indicated that there was no need to change the level of the standard.[45]

The level of the standard directly influences the level of multiple settings, particularly the MPC and CPT. As such, it is the primary determinant of investment signals in the NEM. As discussed in more detail in sections 4.3 and 4.4, the underpinning predictability of how these components are determined enables efficient investment in the NEM over the long term. The Panel, therefore, considers that stability in the level of the standard is central to delivering stable and predictable outcomes in the entire market.

The Panel has also considered whether the current level of the standard is likely to reflect the VCR. AEMO estimated a VCR in 2014 based on a survey of energy users, which is used across the industry as a common proxy for the true value of reliability. The aggregate NEM-wide VCR calculated by AEMO in 2014 was for $33,460/MWh.[46]

43 AEMC Reliability Panel, *Comprehensive Reliability Review Final Determination*, December 2007.

44 In its most recent annual market performance review, the Panel confirmed that there had been no further breaches of the standard in the 2014/15 reporting period. See AEMC Reliability Panel, *Annual market performance review 2015*, 1 September 2016, p.i.

45 AEMC Reliability Panel, *Reliability Standard and Reliability Settings Review 2014*, July 2014, p.26.

46 The Panel notes that to date, AEMO's VCR has been used for the purposes of network regulatory determinations, to inform the Panel's own consideration of the value of System Restart Ancillary Services for the determination of the System Restart Standard and in a submission to the determination of the System Restart Standard from ROAM Consulting, on behalf of the National Generators Forum. More information is available at:

The Panel acknowledges that other measures of reliability exist and that AEMO's VCR measure only represents an estimation of the true value that customers place on reliability. However, as AEMO's VCR is used across the industry,[47] the Panel considers that it represents a useful tool in assessing the current level of the standard.[48]

It appears that the current level of the standard remains broadly consistent with AEMO's VCR. This is supported by analysis undertaken by ROAM in 2014. In its analysis, ROAM found that the level of the current standard was equivalent to a VCR of around $30,000, which corresponds to AEMO's estimated NEM-wide aggregate VCR of $33,460/MWh.[49] This is reinforced by other more recent analysis by Deloitte Access Economics, which identified an average VCR for each region ranging from $25,050/MWh to $34,510/MWh.[50]

These estimates suggest that the current level of the standard is reasonably close to the optimal value for VCR that is commonly accepted across the NEM. Accordingly, the level of the standard should be subject to a materiality assessment.

When the Panel is considering whether there may be a material benefit in assessing the level of the standard, the following factors will be considered:

- **Whether AEMO has issued a new VCR measure.** The Panel is required to consider any value of VCR estimated by AEMO which it considers to be relevant when undertaking each review. VCR can be used as a tool to calibrate the level of the standard with current understandings of how customers value reliability. As demonstrated above, there is some evidence the current level of the standard aligns reasonably well with VCR measures estimated by AEMO.

  If AEMO were to reassess its VCR measure, this may indicate a material benefit in reassessing the level of the standard.

- **Marked changes in the way consumers use grid supplied electricity.** Currently, the majority of consumers remain grid connected and are largely dependent on a reliable supply of energy from the grid. However, new technologies may change the extent to which consumers rely on the grid. For example, battery storage

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http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Value-of-Customer-Reliability-review ; and http://www.aemc.gov.au/Markets-Reviews-Advice/Review-of-the-System-Restart-Standard.

47 Including in recent regulatory determinations for Jemena, CitiPower, Ausnet and ElectraNet. See: Deloitte Access Economics, *Economic assessment of System Restart Ancillary Services in the NEM*, August 2016, as found on the AEMC website.

48 NER clause 3.9.3A(e)(4) also requires the Panel to consider AEMO's VCR measure when undertaking each review.

49 See: ROAM Consulting, *Final report to AEMC - Reliability standard and settings review*, May 2014, p.64; and AEMO, *Value of Customer Reliability Review*, September 2014, p.2.

50 These ranges were calculated by Deloitte for the purposes of estimating the costs of different lengths of black system events. Deloitte based its values on AEMO's original figures, subject to a number of adjustments to estimate impacts on different customer groups. See: Deloitte Access Economics, *Economic assessment of System Restart Ancillary Services in the NEM*, August 2016, pp. 9, 59.

could provide consumers with uninterruptible power supply solutions, reducing the cost of shorter supply interruptions and, therefore, reducing the value of the reliability of grid supplied electricity.

Significant uptake of this kind of technology or other changes in consumption of electricity from the grid may indicate a material benefit in reassessing the level of the standard.

Box 4.2 Level of the reliability standard

Function: the standard is currently set at 0.002% USE, being the maximum amount of energy that is at risk of not being served in a region in a given financial year.

Approach: materiality assessment. The level of the standard remains as in the previous review, unless the Panel considers that there may be a material benefit in reassessing it.

In making this decision, the Panel will consider factors including but not limited to:

- any changes made to AEMO's VCR measure; and
- any marked changes in the way consumers use electricity, particularly through the use of new technology, that suggests a large number of consumers may place a lower value on a reliable supply of electricity from the NEM.

4.3 Market price cap

The form of the MPC is the maximum market price in any trading interval, measured in $/MWh, and indexed to CPI; the level of the MPC is currently $14,000/MWh.

4.3.1 Form of market price cap

In assessing the form of the MPC, the Panel has considered:

- the unit of measurement of the MPC; and
- whether the level of the MPC should be varied across regions.

The unit of measurement of the market price cap

The Panel considers that the form of the MPC should remain defined in terms of $/MWh. This is the unit of measurement upon which an energy only market is dispatched and settled. The Panel considers that there is no alternative form that could be applied to the MPC.

Whether the market price cap should be varied across regions

In the *Review of the effectiveness of NEM security and reliability arrangements in light of extreme weather events*,[51] the AEMC considered the arguments for and against introducing regional-specific MPCs, and decided against doing so.

The report noted that there would be a range of regulatory and administrative difficulties in implementing regional-specific MPCs. National energy businesses would face greater complexity through exposure to different MPCs in different regions. This would result in a greater need to develop different risk management strategies for each region.[52]

Perceptions of regulatory complexity would also affect investors' willingness to invest, and market participants' ability to obtain competitive finance. To that end, regulatory complexity could, to some extent, counteract the objective of the jurisdictional-specific MPCs by delaying investment in new generation. Furthermore, it could lead to regionally, rather than nationally, focussed generation, with a potential reduction in competition in both the generation and retail sectors in some regions.[53]

Additionally, the Commission identified a range of implementation issues with regional-specific MPCs, including:

- determining how to apportion load-shedding between regions that valued reliability differently;
- determining rules to manage the accumulation of negative settlement residues across interconnectors;
- the requirement that changes be made to AEMO's systems; and
- the need to make a decision as to whether differential MPCs should also apply to ancillary service markets, and how differential MPCs would impact on the cooptimisation of ancillary services between regions with different MPCs.[54]

The Panel continues to agree with the AEMC's conclusions.[55] As such, it proposes to retain a single MPC for the NEM.

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51 AEMC, *Review of the effectiveness of NEM security and reliability arrangements in light of extreme weather events,* Final report, 31 May 2010, Sydney.

52 Ibid p. 90.

53 Ibid.

54 Ibid p. 87.

55 The Panel also considered and decided against regional-specific MPCs as part of the 2014 review. See: AEMC Reliability Panel, *Reliability Standard and Reliability Settings Review 2014*, Final Report, 16 July 2014, p. 43-45.

Box 4.3 Form of the market price cap

Function: the MPC is the maximum market price, measured as a $/MWh value, that can be reached in any dispatch interval and in any trading interval. It is indexed to movements in the Consumer Price Index (CPI).

Approach: closed. The form of the MPC is confirmed in these guidelines as a $/MWh value. It will not be opened for reconsideration in future reviews.

4.3.2 Level of market price cap

The level at which the MPC is set requires a clear understanding of its primary function.

The Panel aims to set MPC such that it allows the market to determine effective price signals for efficient investment and operational decisions. That includes decisions to invest in new capacity, or to retain or retire existing capacity.

In addition to this primary function, MPC plays a role in managing the potential price risk to which participants may be exposed and, therefore, maintaining the integrity of the market.

Primary purpose of the market price cap

The overarching function of the MPC is to allow the market to reach a level of equilibrium. This equilibrium is achieved over the long-run, where market prices support the investment needed to deliver volumes of energy to meet the standard.

When it is set at a level that allows for effective market clearing, the MPC does two things:

- Firstly, it allows the market to achieve and send efficient price signals. These price signals create a degree of price risk in the market, which in turn create incentives for counterparties to enter into contracts to manage risk.
- Secondly, by creating strong incentive for counterparties to enter into risk hedging mechanisms, the MPC supports efficient long term investment decisions. These long term investment decisions include decisions to invest in new capacity, to provide demand-side solutions and to retire capacity.

Consideration of the long-run equilibrium has a number of key implications for how the Panel will assess the level of the MPC in each review.

- Firstly, MPC should not be used to manage the market into the estimated equilibrium at any given point in time.

  Estimations of the level of equilibrium are likely to be inaccurate and could easily be set too low or too high. Moreover, an activist use of MPC is likely to result in volatile MPC values over time, which would undermine the intention of sending

signals for investment in long-term assets. Ultimately, this could result in unpredictable investment or disinvestment signals, potentially requiring further adjustments to the MPC in future to address any capacity shortfalls or excess capacity.

- Secondly, surplus generation capacity at any point in time is not itself evidence of a significant deviation from the long term equilibrium. Significantly lowering the MPC to force disinvestment and reduce this surplus could easily drive levels of USE over the standard, and is also likely to result in the kinds of unpredictable and volatile investment outcomes discussed above.

  Instead, the Panel considers that any signals for disinvestment will be provided through an effectively functioning market. Surplus capacity will be undercut by cheaper competitors and priced out of the market. This will result in efficient, and more gradual disinvestment decisions, which are less likely to destabilise the market or result in breaches of the standard.[56] Importantly, these decisions would be made by market participants themselves.

- Thirdly, the Panel considers that while the level of the MPC should allow the market to clear efficiently, this does not preclude downwards movements in the level of the MPC. In fact, if the market appears to be trending toward a lower equilibrium level over time, this suggests the level of the MPC may also be reduced.

  However, given that stability in the MPC supports efficient investment, any change should occur in a gradual and predictable manner. As discussed above, sudden movements in the MPC could result in unpredictable investment or disinvestment decisions. More gradual changes, likely occurring over several review periods, will provide the market with information, but still rely on and allow the market to determine efficient operational and investment outcomes.

The Panel recognises that this interpretation of the MPC represents something of a departure from previous interpretations. However, we consider that it is the interpretation that best reflects the kinds of significant changes on both the demand and supply side that have been discussed throughout this determination.

Secondary functions of the market price cap

In addition to this primary function of allowing the market to determine an efficient long-run equilibrium, the MPC plays a number of secondary roles in managing market risk. Although these are important, the Panel considers them secondary because other settings, particularly the CPT, play a more significant role.

56 Furthermore, the Panel recognises that the nature of investment in power systems is typically "lumpy", rather than incremental, at the margin. This means that at any given time, efficient investments in response to market prices may result in an apparent oversupply.

These additional roles can be broadly described as follows:

- In conjunction with the CPT, the MPC limits the financial burden that can fall on market participants during periods of high wholesale spots prices.

  As discussed in section 4.4 the Panel considers that the CPT is the primary risk management setting in the NEM, as it determines the total potential price risk that market participants may face. However, the MPC also plays a role in managing price risk by capping the potential spot price that can be achieved in a single trading interval.

- The MPC limits the financial risk of retailers, who package wholesale price risk to provide customers with end use energy products. While retailers should have strong incentives to actively manage this risk, an inability to adjust prices to customers in real time in line with movements in the wholesale spot price can impact on a retailer's financial position and, potentially, force it out of the market.

  Retailer exits can have significant impacts for individual customers and also contributes to higher overall costs, if schemes such as the retailer of last resort are invoked. The failure of a large retailer could also have significant contagion effects, potentially destabilising the market.[57]

- In conjunction with the MFP, limiting price volatility in the wholesale spot market. By limiting volatility, the MPC places a bound on the degree of risk that must be managed through contract markets. This helps to stabilise prices in financial contract markets.

In light of all of these functions, it is appropriate that the value of MPC be reassessed at each review. Chapter 5 discusses some of the relevant considerations.

Box 4.4 Level of the market price cap

Function:

- *Primary function*: the primary purpose of the MPC is to enable the market to achieve and send efficient price signals, to support efficient operation of and investment in electricity services over the long-run.

- *Secondary function*: the secondary purpose of the MPC is to manage participant exposure to price risk.

Approach: open.

When assessing the level of the MPC, the Panel will consider the following principles:

- The MPC should not be used to actively steer the market into a short run

57 There are several mechanisms in the NER designed to limit the risk of financial contagion. See: AEMC 2015, *NEM financial market resilience*, Final report, 6 March 2015, Sydney.

equilibrium position, or to actively drive disinvestment decisions.

- While the MPC may move either up or down over time, these movements should be gradual. These movements should occur over a period of several review periods.
- When setting the MPC, the Panel should give secondary consideration to the MPC's effect on the financial burden faced by participants from high market prices, including price volatility and impacts on retailers.

4.4 Cumulative price threshold

The form of the CPT is a limit on the total market price that can occur over 336 trading intervals (2160 dispatch intervals for FCAS) before an APP is declared. It is measured in Australian dollars, indexed to CPI; the level of the CPT is currently $210,000.

4.4.1 Form of cumulative price threshold

The CPT is currently defined as a price threshold, measured in Australian dollars. Once the cumulative price passes through this limit in the relevant timeframe, an APP is declared and the APC is applied to the settlement price.

The Panel considers that the form of the CPT remains appropriate. As discussed below, the CPT predominantly serves a risk management function, although it also has a role in sending investment signals. The current form, measured in dollars, is appropriate to these functions.

The Panel has given some consideration to the time period over which the CPT applies. As discussed above, this is a time period of 336 trading intervals for energy and 2160 for FCAS.[58] The Panel considers that changing the timeframe in which the CPT is breached could have a number of impacts, all else being equal:[59]

- Shortening the time period would mean that prices would need to be, on average, higher before a breach occurs. However, it could also mean a shorter period of time would pass before the APP concluded and the APC was removed.
- Lengthening the time period would require a lower average price before the APC is applied. Equally, however, an APP could conceivably last for a longer time.

Each of these outcomes would impact on the ability of the market to send signals for efficient investment and operation of energy services, as well as the degree of price risk faced by participants. The Panel considers that these issues are more appropriately considered as part of the determination of the level of the MPC and the CPT.

58 NER clause 3.14.2 sets out the timeframes for breach of the CPT, APP commencement and application of the APC.

59 These comments assume that the level of the CPT remains as currently determined.

Accordingly, the Panel considers that a time period of 336 trading intervals remains appropriate for breach of the CPT.

Box 4.5 Form of the cumulative price threshold

Function: the CPT is the maximum total market price, measured in Australian dollars, that can be reached in a period of 336 trading intervals, before an APP commences and the APC is applied to market prices. Its level is indexed to movements in CPI.

Approach: closed.

4.4.2 Level of cumulative price threshold

In determining an approach to the level of the CPT, the Panel has considered the following:

- the primary and secondary functions of the CPT; and
- the optimal relationship between CPT and the MPC.

Primary function of the cumulative price threshold

The Panel considers the primary function of the CPT is as an explicit risk management mechanism. It is designed to limit participants' financial exposure to the wholesale spot market during prolonged periods of high prices.

This function is central to the efficient functioning of the market. Prolonged periods of high prices can have a number of negative consequences, including:

- The potential for market participants to face unmanageable levels of price risk. If insufficiently hedged, exposure to this price risk could result in sudden market exit. If the failed participant is particularly large, there is a risk of a financial contagion effect, whereby the financial failure of the large participant could trigger a cascading series of failures across the market, leading to significant instability and price impacts for consumers.[60]
- The potential for prolonged high prices will increase the cost of investing in the NEM. As the degree of potential financial risk in the market increases, debtors and equity holders will require higher returns on investments.[61] These higher prices are ultimately passed on to consumers as higher energy prices.

60 There are mechanisms in the NER designed to limit the risk of financial contagion. See: AEMC 2015, *NEM financial market resilience*, Final report, 6 March 2015, Sydney

61 The degree of financial risk relates to the potential exposures of both retailers and generators, in terms of their relative hedging positions. Prolonged high prices could mean that an insufficiently hedged retailer is exposed to higher spot prices for energy purchases. A fully hedged generator could face increased exposure if they are subject to an outage and are unable to generate to meet a

The Panel considers that this risk management function is the primary function of the CPT.

Secondary function of the cumulative price threshold

The CPT also plays a secondary role of maintaining the effectiveness of the market price signals enabled by the level of the MPC. By managing the overall price risk to which participants are exposed, the level of the CPT can either weaken or strengthen those signals.

This secondary function of the CPT was identified by ROAM in its modelling analysis that informed the 2014 review. In that analysis ROAM found that the level of the modelled CPT directly influenced the total revenue that a generator can earn during a high price period:

- If the CPT was set at a higher level, it was breached less frequently and the APC applied less often. This meant that a lower MPC was needed to make it profitable to invest in a generator.
- If the CPT was set at a lower level, it was breached more frequently and the APC applied more often, necessitating a higher level of MPC to achieve the same level of generation capacity.

The Panel considers that the CPT should be set at a level that does not hinder the market price signals for efficient operational decisions and efficient investment in generation capacity and/or demand-side response. This suggests that the CPT should be set at a level that is unlikely to be triggered except in very extreme circumstances.

This dual function of the CPT, and its interaction with the MPC, raises the question of whether the Panel should formalise the relationship between the two.

Nature of the relationship between market price cap and cumulative price threshold

In submissions on the issues paper, two stakeholders expressed differing views on the nature of this relationship. Snowy Hydro suggested that the CPT should remain set at a level of 15 times the MPC, while Engie argued that the CPT and MPC should be determined independently and "decoupled" from each other.[62]

Currently, the NER do not establish any formal relationship between these two components of the reliability setting, other than using the same starting value in the estimation and indexation of each.[63] Because of this common starting value, the MPC and CPT have moved together over time at a ratio of approximately 1:15.

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contracted position. In this case, the generator could be liable for significant difference payments to their counterparty, but will not receive spot market revenue to cover those payments.

62 Issues paper submissions: Engie, p.3; Snowy Hydro. p.2.

63 NER clause 3.9.4 sets out the methodology for the calculation of the MPC. NER clause 3.14.1 sets out the methodology for the calculation of the CPT. Although the NER provides no specific guidance and includes no requirement that these values should be automatically linked to each other, both of these NER clauses that establish the processes for calculation and indexation refer to

As discussed above, the Panel considers that there is a clear relationship between these two components and that they serve complimentary functions. As such, they should be determined in conjunction. For example, they should be modelled simultaneously, as discussed in Chapter 5. The question is, whether this relationship should be formalised. For example, this could be achieved by explicitly defining the 1:15 ratio of the MPC and CPT in either the guidelines or the NER.

Formalising this relationship would help provide predictability to the market, by retaining a consistent ratio between price signals and risk exposure. On the other hand, formalising the relationship could impede the effectiveness of this process because of the differences in the primary function of each; the MPC remains predominantly a setting with a market signalling function, while the CPT is predominantly used for managing aggregate risk. Over time the appropriate balance between the two functions may change.

An appropriate balance can be achieved by considering both together and testing the impact of different ratios.

The Panel has, therefore, determined that when it develops the level of the CPT, it will give consideration to the level of the MPC, with the intention of maintaining the effectiveness of the market signals enabled by that setting. The guidelines will refer to this consideration; however, they will not set out any formalised relationship between the two components.

Overall, the level of CPT will be reassessed at each review.

Box 4.6 Level of the cumulative price threshold

Function:

- *Primary function*: the primary purpose of the CPT is to cap the total price risk to which market participants are exposed, over a given time period.
- *Secondary function*: the secondary purpose of the CPT is to maintain the effectiveness of the MPC, by not hindering the market price signals for efficient operational decisions and efficient investment in generation capacity and/or demand-side response.

Approach: open.

When assessing the level of the MPC the Panel will consider the following principles:

- The CPT should protect all market participants from prolonged periods of high market prices, with particular consideration to impacts on investment

the starting value of both settings as they were prior to July 2012. Those starting values were $12,500/MWh for the MPC and $187,500 for the CPT, representing a ratio of 1:15 between the two values.

costs and the promotion of market stability.

- The CPT should also not impede the ability of the market to determine price signals for efficient operation and investment in energy services.
- The CPT should be determined giving consideration to the level of the MPC.

4.5 Market floor price

The form of the MFP is the minimum market price in any trading interval, measured in $/MWh; the level of the MFP is currently -$1000/MWh.

4.5.1 Form of market floor price

The Panel considers that the form of the MFP should remain defined in terms of $/MWh. This is the unit of measurement upon which an energy only market is dispatched and settled. The Panel considers that there is no alternative form that could be applied to the MFP.

Box 4.7 Form of the market floor price

Function: the MFP serves as the minimum price that can be achieved in any dispatch and trading interval, measured in $/MWh.

Approach: **closed.**

4.5.2 Level of market floor price

The MFP has been set at -$1000/MWh since market start.[64]

The Panel considers that the level of the MFP should remain the same as in previous reviews, unless the Panel considers there may be a material benefit associated in opening it for assessment during a review.

In reaching this conclusion, the Panel has considered the following matters:

- The level of the MFP should be determined by reference to its primary purpose, which is to allow the market to clear during periods of low demand. However, this function should be balanced against the potential risk of price volatility associated with a significantly negative MFP. Given that it has applied since

64 When it originally determined the level of the MFP, the National Electricity Code Administrator (NECA) stated that the MFP should be at a level significantly below the lowest current outcome for dispatch prices at -$1000. This would ensure that the MFP did not interfere with the normal clearing of the market while providing some protection to market participant from extremely high prices. For more information, see: NECA, *National Electricity Code – Capacity Mechanisms Review, VoLL Review and Removal of Zero Floor Price,* 27 September 1999.

market start without any apparent adverse consequences, the Panel considers that the current level of -$1000/MWh strikes the appropriate balance between these two considerations.

- Also relevant to the Panel's consideration is the role the MFP plays in a number of other market outcomes, such as strategic negative re-bidding to maximise constrained dispatch, and the relationship with negative bidding by generators receiving a secondary source of revenue from the renewable energy target (RET).

The Panel also notes advice from Oakley Greenwood that:[65]

- the current level of the MFP is such that it normally allows the market to clear during low demand periods; and

- there are a number of cost assumption sensitivities that may limit the usefulness of modelling the MFP, suggesting that MFP may be more effectively set by reference to pragmatic considerations, including whether affected stakeholders can demonstrate that the current level is ineffective.

Market floor price as a market clearing price

The NER require the Panel to set the MFP at a level that allows the market to clear and does not create substantial risks that threaten the overall stability and integrity of the market.[66]

The Panel interprets this to mean that the MFP should be set at a level that allows the market to clear at times of very low demand.

During low demand periods, there may be multiple generators competing to remain dispatched in order to avoid costs associated with cycling units, or to be able to access later high prices. However, the total amount of all these generators' energy, running at minimum generation, may exceed total demand at a given point in time.

A key constraint for market operation is that supply should be exactly equal to demand at all times. Some kind of rationing device is, therefore, needed to determine which of these generators should remain dispatched and which should be shut down in order to maintain the supply / demand balance. This could be achieved through a regulatory solution, or by requiring generators to compete for the right to remain dispatched.

Negative prices during periods of low demand provide this rationing function. In effect, generators are forced to reveal the value they place on remaining dispatched, through their negatively priced dispatch offers. This results in an efficient allocation of a scarce resource; in this case, the right to remain dispatched. This is a more efficient outcome than a regulatory solution, as costs and risk are borne solely by the generators best placed to do so.

65 Oakley Greenwood, *Assessment of approach to modelling,* September 2016, p.13.

66 NER clause 3.9.3A(h).

The MFP should, therefore, be set at a level sufficiently low so as to allow for effective competition between generators to reveal the value they place on being dispatched. If the MFP is set at a level that is too high (ie too close to zero), it may not allow for efficient outcomes; more generators than efficient would be happy to pay the floor price as a penalty, thus weakening the rationing function and requiring AEMO to intervene.

However, the Panel notes that a lower (more negative) level of MFP increases the range and, therefore, potential volatility of market prices. This may increase the cost of investing in and operating these kinds of units. The level of the MFP will have some impact on the efficiency of investment and operation of energy services, although less significant than the level of the MPC and CPT.

The Panel, therefore, considers that review of the level of the MFP should be subject to a materiality assessment at each review. This means that, absent any indication that this value should be reassessed, the level of MFP would remain at -$1,000/MWh.

When the Panel decides whether to reassess the level of the MFP, it will consider factors such as whether:

- there have been significant changes in the generation fleet, such that average generator cycling costs have changed significantly; and
- prices in the NEM spot market have shown an increasing incidence of approaching, or being set at, the MFP.

Other factors relevant to the market floor price

The MFP interacts with a number of other market outcomes, including:

- disorderly bidding, where the MFP forms the lowest possible negative price at which constrained-off generators rebid capacity, in order to maximise dispatch; and
- the ability of generators with alternative revenue streams to rebid capacity at negative prices to maintain dispatch.

The Panel acknowledges these potential interactions with the MFP. However, in both cases, the interaction with the MFP is a function of there being a market floor price, rather than the specific level of the floor price. As such, any issues should be addressed through policy measures other than changing the level of the MFP.

Changes to the level of the MFP would not affect outcomes where generators are rebidding dispatch. In these instances, there is a disconnect between offer and dispatch price; generators' sole incentive is to offer energy at prices as low as possible to maximise the volume of energy dispatched. Changing the level of MFP would not change these incentives, with generators simply rebidding their capacity to the new level. In any case, the Panel considers that issues related to disorderly bidding are

appropriately addressed through policy mechanisms that reconnect dispatch pricing with dispatch offers.

More generally, the Panel considers that these issues fall outside of the scope of the matters that the Panel is able to consider when determining the MFP. The MFP is designed to allow the market to clear efficiently during low demand periods, while not creating any instability. It follows that the competitiveness (or otherwise) of dispatch outcomes during normal market operation, and any associated inefficiencies, are outside of the scope of the matters that the Panel should consider when determining the level of the MFP.

Modelling of the market floor price

As part of their general advice on modelling of the settings, Oakley Greenwood were asked to comment on the MFP.[67]

Oakley Greenwood advised that MFP has traditionally been of less relevance for assessment of reliability than may be expected in the future, as commitment of generating units at low demand and low system inertia begins to interact with capacity available to meet low reserve periods.

However, they also advised that the current level of MFP at $-1,000/MWh has been successful at signalling short term excess capacity without creating adverse financial risk to market participants thus avoiding the need for AEMO to direct participants.

Oakley Greenwood also cautioned against overly relying in economic modelling to determine the level of the MFP, suggesting that such an assessment is likely to be problematic given the variability of relevant costs and increasing uncertainty in the market. For example, generator costs for operation at very low output or cycling on and off are highly variable, as well as being linked to costs to provide frequency control and voltage control capability. In terms of future uncertainty, intermittent generation capability (particularly wind) may become relevant to the operation of units at low demand periods.

Generally, they advised that modelling can inform assessments of different levels of MFP, but that the results of such modelling would be sensitive to the factors listed above. Accordingly, Oakley Greenwood recommended that the level of MFP should be based on pragmatic considerations, and that MFP should only be changed if affected stakeholders can demonstrate that the current level results in inefficient outcomes.

The Panel agreed with Oakley Greenwood's assessment and recommended approach to any future assessment of the level of MFP.

67 Oakley Greenwood, *Assessment of Approach to Market Modelling*, September 2016, p.13.

Box 4.8 Level of the market floor price

Function: the purpose of the MFP is to allow the market to clear during low demand periods, while preventing market instability by imposing negative limit on the total potential volatility of market prices.

Approach: materiality assessment. The level of the MFP remains as in the previous review, unless the Panel considers that there may be a material benefit in reassessing it.

In making this decision, the Panel will consider factors including, but not limited to:

- the number and frequency of trading intervals where the market price has been, or has approached, the level of the MFP; and
- whether there have been significant changes in the generation fleet, such that average generator cycling costs have changed significantly.

4.6 Administered price cap

The form of the APC is the maximum settlement price in any trading interval during an administered price period, measured in $/MWh; the level of the APC is currently $300/MWh. Historically, the APC has been reviewed and determined by the AEMC. The Panel now has responsibility for assessing the APC.[68]

4.6.1 Form of administered price cap

The APC is the price cap that applies to dispatch prices following the commencement and during an APP. While dispatch, projected assessment of system adequacy and other related functions continue on the basis of the dispatch determined by the National Electricity Market Dispatch Engine (NEMDE), payments to participants are capped at the APC.

The Panel considers that the form of the APC should remain defined in terms of $/MWh. This is the unit of measurement upon which an energy only market is dispatched and settled, and which continues be applied during an APP. The Panel considers that there is no alternative form that could be applied to the APC.

68 This responsibility was conferred on the Panel as part of the 2015 *Governance Arrangements and Implementation of the Reliability Standard and Settings* rule change, where APC was included in the settings.

Box 4.9 Form of the administered price cap

Function: the APC is the maximum market price paid to participants, measured as a $/MWh value, that can be reached in any dispatch interval and any trading interval, during an APP.

Approach: closed.

4.6.2 Level of administered price cap

The level of the APC has previously been determined by the AEMC at $300/MWh, most recently in 2008.[69] In that assessment, the AEMC considered that the level of the APC should be determined so as to balance three objectives:

- mitigating the risk of a systemic financial collapse of the electricity industry during an extreme market event;
- minimising the incentives for market participants to not supply electricity during administered price events; and
- minimising compensation claims by market participants following an application of the APC.[70]

In determining the appropriate level of the APC, the AEMC considered the likely short run marginal costs (SRMC) of NEM generators. The AEMC's analysis found only four generators with SMRC costs over $300/MWh in the NEM. These generators were typically small in size, meaning that their total capacity was small relative to the total installed capacity in the NEM.

Given this estimated distribution of SRMC costs, the AEMC considered that an APC of $300/MWh struck an appropriate balance between these three criteria. Lower values, while minimising financial exposure and mitigating the risk of financial collapse, would have resulted in lower incentives for participants to supply energy and also increased the probability of compensation claims. Higher values would have had the inverse effect.

The Panel is satisfied that the analysis undertaken by the AEMC in 2008 remains correct. There has only been one compensation claim since the review was completed, which indicates that the level of the APC remains appropriate. Stakeholders have also not indicated a need to change the value of the APC.

The Panel, therefore, considers that the level of the APC should be subject to materiality assessment at each review. This means that, absent any indication that this value should be reassessed, the level of APC would remain at $300/MWh.

69 AEMC, *Determination of Schedule for the Administered Price Cap*, May 2008.

70 Clause 3.14.6 of the NER allow participants to claim compensation for direct and opportunity costs incurred due to operating during an administered price period.

When the Panel considers whether to reassess the level of the APC, it will consider factors including but not limited to:

- increases in the number of generators with SRMCs above $300/MWh;
- significant decreases in the SRMCs of generators; and
- the incidence of compensation claims.

Box 4.10 Level of the administered price cap

Function: the function of the APC is to cap participant exposure to high prices during an APP, while maintaining incentives for participants to supply energy.

Approach: materiality assessment. The level of the APC remains as in the previous review, unless the Panel considers that there may be a material benefit in reassessing it.

In making this decision, the Panel will consider factors including but not limited to:

- any significant changes in the typical SRMCs of generators in the NEM; and
- whether there have been any compensation claims since the last review.

4.7 Indexation

Indexation means that the value of a reliability setting would be updated annually in accordance with some pre-determined measure, without the Panel having to review and reset the value of that setting. The MPC and CPT have been indexed to CPI since 2012.[71] The APC and the MFP are not currently indexed. In considering whether individual settings should be indexed and, if so, how, the Panel's considered the primary purpose of each setting.

4.7.1 Application of indexation to settings

Indexation should continue to be applied to the market price cap and cumulative price threshold

The Panel considers the MPC and CPT should remain indexed. These boundaries allow the market to determine price signals for efficient operation of and investment in energy services. Indexing these components maintains their value in real terms and reduces the risk that they will impede the ability of the market to determine efficient prices.

71 AEMC, *Reliability Settings from 1 July 2012 - final determination,* July 2011.

The AEMC has previously considered the indexation of these settings. In the 2011 *Reliability Settings from 1 July 2012* rule change, the AEMC concluded that linking the MPC and CPT to an indexation method on an annual basis was beneficial for the following reasons:[72]

- It would send an explicit signal to the market that the intention in the NER is to preserve the real values of the settings over time. This would provide a consistent basis to inform investment decisions.[73]

- It was likely to significantly improve the predictability of changes to those values. This would help to minimise the level and frequency of intervention in the settings, leading to strong and clear price signals and a more stable environment for investment.[74]

- It would introduce a degree of administrative efficiency by implementing a relatively automated process to affect incremental increases to the MPC and CPT. This would avoid the need to undertake a formal rule change process to implement any such changes.[75]

As discussed above, the levels of the CPT and MPC are set, at least in part, by reference to their impact on the ability of the market to determine price signals for efficient operation of and investment in electricity services. These components should reflect the long-run market equilibrium between reliability and market price. They should not act to constrain or impede the market's ability to clear and determine this long-run equilibrium.

The Panel, therefore, agrees with the above. For this reason, both the CPT and the MPC should remain indexed.

Indexation should not be applied to the market floor price and administered price cap

The Panel considers that indexation is not required to allow the MFP and APC to continue to meet their objectives.

The AEMC and the Panel have previously considered whether to apply indexation to both of these components.

In regards to the MPF, in the *2014 review*, the Panel considered that the MFP differs from the MPC and CPT in that it does not significantly influence investment signals. It is not set to enable recovery of asset costs. Instead, the MFP operates at times of very

72 Importantly the Commission also noted that indexation did not represent a substitute or alternative to reviewing the settings on a periodic basis. As such, indexation is designed solely to maintain the real value of the settings.

73 AEMC, *Reliability Settings from 1 July 2012 - final determination,* July 2011, p. 11.

74 Ibid.

75 Ibid.

low demand and excess generation, and provides a signal to offload generation.[76] On that basis, the Panel determined that indexation would have minimal impact on the effective functioning of the MFP.[77]

In regards to the APC, the AEMC considered that factors other than a general inflation indicator (such as measured by CPI) would have greater impact on the appropriate level of the APC. These included, for example, the cost of fuel and the operation and maintenance costs of power generation units in the NEM.[78] Nonetheless, to ensure that the APC reflected the requirement of the NEM on a timely basis, the AEMC anticipated that it would review the APC schedule periodically.[79]

The Panel is satisfied that both of these arguments remain valid.

There is no need to apply minor increases to the levels of these settings. Given the primary function of both of these settings is not related to market price signalling, it is less important that they remain calibrated to movements in the cost of investing in and operating generation assets. This is because setting their value in nominal terms is unlikely to impede efficient market function.

The Panel acknowledges that both the level of the MFP and the APC may need to be reassessed from time to time, to determine whether they continue to meet their main objectives. These periodic reviews will be sufficient to ensure that both components continue to function effectively, removing the need for any form of indexation.

4.7.2 Form of indexation to be applied to the market price cap and cumulative price threshold

The Panel has considered what form of indexation should be applied to the CPT and MPC. In making its assessment, the Panel has considered the trade-offs between specificity, stability and transparency. For this reason, the Panel considers that CPI remains the appropriate mechanism for indexation.

The AEMC has previously considered what form of indexation should be applied to the MPC and CPT. It determined that the CPI was a marginally more preferable indexation method than a stage 2 producer price index (PPI), being a less volatile index (its components being less exposed to exchange rate fluctuations) and representing an indexation method that was commonly used in business decision-making.[80]

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76 As noted in section 4.5, the Panel acknowledges that the MFP may have a minor impact on investment and operational price signals, by setting the lower bound on potential price volatility in the market. However, the Panel considers that this impact is minor and secondary to the primary purpose of the MFP, which is to allow the market to clear at times of low demand.

77 Reliability Panel, *2014 review of the reliability standard and settings*, 2014

78 See section 4.6 for a more detailed description of the factors relevant to the level of the APC.

79 AEMC, *Determination of Schedule for the Administered Price Cap*, May 2008.

80 AEMC, *Reliability Settings from 1 July 2012 - Final determination*, July 2011.

In making its recommendation, the AEMC considered that an indexation method should:

- be based on the supply side costs of meeting the standard;
- follow similar economic trends to those parameters used in setting the MPC and CPT, particularly the capital cost of new entrant OCGT plant;
- be independently verifiable; and
- be amenable to forecasting.

Given these principles, the AEMC considered the merits of developing a bespoke index that would more accurately reflect movements in the prices relevant to investment in an OCGT unit. However, the AEMC decided against a bespoke index on the basis that:[81]

- there was little or no industry consensus on a single model of the capital costs of a new OCGT plant on which to base such an index;
- any administrative efficiency that might have been gained with indexation would likely be lost in the effort required to construct and maintain the index over the long term;
- while an OCGT plant is considered to be the marginal plant in the current generation mix, this could change to another type of plant in the future, requiring a new index to be constructed; and
- a specifically tailored index that incorporated a high proportion of raw materials or imported components would be a very volatile measure.

The Panel considers this reasoning remains correct. In particular, the Panel considers that there are significant issues related to the complexity of a bespoke approach. This could contribute to market uncertainty, increasing investment and operational costs, with flow on impacts for consumers. Furthermore, any assumption regarding the nature of the marginal unit would not align with the proposed approach to assessment of the MPC, as discussed in section 5.3.

The Panel considers that a transparent, universally understood method for indexation remains the preferred approach. Given the detailed analysis previously undertaken by the AEMC, the Panel is satisfied that the CPI continues to be the preferred basis of indexation for the MPC and CPT.

The Panel, therefore, considers that indexation of the MPC and CPT should be subject to materiality assessment at each review. This means that, absent any indication that this approach should be reassessed, the MPC and CPT would continue to be annually indexed to CPI.

81 Ibid.

When the Panel considers whether to reassess indexation of the settings to CPI, it will consider whether:

- there have been material changes in the basket of goods used to calculate the CPI that make it less relevant for indexation of the settings;
- there have been other changes in the methodology used to calculate the CPI; and
- a more preferable index becomes available and/or there is a change in the designation of the CPI as an official statistic.

Box 4.11 Indexation

Application of indexation to settings

Function: MPC and CPT are subject to indexation.

MFP and APC are not subject to indexation.

Approach: closed. It is confirmed in these guidelines that MPC and CPT are subject to annual indexation. The MFP and APC are not subject to indexation. This will not be opened for reconsideration in future reviews.

Form of indexation applied to the MPC and the CPT

Function: MPC and CPT are subject to annual indexation to movements in the CPI.

Approach: materiality assessment. Indexation approach to MPC and CPT will continue to be based on the CPI, unless the Panel considers that there may be a material benefit in reassessing this approach.

In making this decision, the Panel will consider factors including but not limited to whether:

- there have been material changes in the basket of goods used to calculate the CPI that make it less relevant for indexation of the settings;
- there have been other changes in the methodology used to calculate the CPI; and
- a more preferable index becomes available and/or there is a change in the designation of the CPI as an official statistic.

5 Approach to modelling

Modelling forms a key input into the Panel's assessment of the standard and settings. It allows the Panel and stakeholders to understand the impact of different levels of the standard and settings. It can also be helpful in assessing the potential impacts of potential future developments, such as changes in the generation fleet, or changes in demand. As such, modelling provides quantitative rigor to inform the Panel's decisions.

Modelling is an important and powerful tool, but it is only one of the inputs into the Panel's decisions regarding the standard and settings.

The Panel also acknowledges the relative benefits and trade-offs that must be made when developing models. More complex models can consider a wider range of variables, helping to develop a better understanding of potential future trends. However, more complex models also depend on more assumptions and, as such, may give a false sense of accuracy. The more complex a model is, the more difficult it may be to interpret its results. Lastly, more complex models are typically more time consuming and costly to develop.

The Panel considers that the guidelines can help manage these issues related to modelling. By setting out the high level approach that will be taken to modelling, the guidelines define the purpose and limitations of what modelling will be used for in future reviews. The specific details of how the model will operate will be determined at each review.

5.1 Approach to modelling in 2014 review

ROAM Consulting (now EY) were engaged to provide modelling advice to assist the Panel in the *2014 Review*.[82]

The market simulation modelling undertaken by ROAM was primarily focused on assessing the level of MPC needed to deliver sufficient investment in new capacity to meet the standard. To do this, ROAM considered the revenues that a theoretical OCGT generator could earn, if it offered its capacity into the market in different ways.

ROAM's market modelling considered two assumed approaches as to how the marginal generator in the model would offer capacity:

- The Cap Defender approach, which assumed that the marginal generator was fully contracted and offered its capacity at $300/MWh; that is, the generator was dispatched every time the market model delivered a price outcome above $300.

82 ROAM Consulting, *Reliability Standard and Settings Review*, 31 May 2014. Available at: http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Standard-and-Settings-Review-2014.

- The Extreme Peaker approach, which assumed that the marginal generator only offered its capacity in as an alternative to USE, with this capacity offered only at the level of the MPC; that is, the generator was dispatched only if the market model delivered a price outcome at MPC.

Importantly, both of these approaches assume that the marginal generator is an OCGT unit.

The model was then divided into a number of different stages that considered the MPC levels, reliability levels, the level of the standard and the MFP.

5.2 Oakley Greenwood's analysis of 2014 modelling

The Panel engaged Oakley Greenwood to analyse ROAM's modelling for the *2014 Review*.[83]

In undertaking this assessment Oakley Greenwood were asked to consider key trends in the market from 2014 out to 2022, with a view to identifying any gaps in the previous modelling.[84] Oakley Greenwood were asked to pay particular attention to the Extreme Peaker and Cap Defender approaches. They were then asked to identify what changes might be made to this modelling for future reviews.

5.2.1 Limits of the Extreme Peaker and Cap Defender models

Oakley Greenwood identified the following limitations of the Extreme Peaker model:

- The assumption that new entrant technology will be an OCGT forecloses the opportunity for new, lower cost technologies to enter as the marginal unit in the model.

- Limiting the marginal generator to offering at the MPC at all times also forces it to participate as a substitute for unserved energy. This may not accurately reflect actual bidding strategies, where generators are likely to offer energy at prices ranging from their SRMC toward MPC. Given key trends including increased intermittency and resultant changes in dispatch, marginal capacity may also be dispatched at other times and at lower prices.

- As a result, Oakley Greenwood found that the Extreme Peaker approach was likely to overstate the MPC needed to support new investment.

83 Oakley Greenwood, *Assessment of approach to market modelling*, September 2016.

84 The Panel notes that this is not a criticism of ROAM's modelling, but rather an acknowledgment that significant market changes since 2014 require a reassessment of the approach taken to that modelling.

Oakley Greenwood identified the following limitations of the Cap Defender model:

- Although the Cap Defender approach appears more commercially realistic, it is limited in that the new investment plant is never marginal and cannot set the spot price in the market. It, therefore, relies on other players setting the price to recover its fixed costs. While this may be tenable for an incumbent, Oakley Greenwood suggested that it was not realistic for a new entrant.

- Furthermore, within certain practical limitations (such as liquidity), contracting approaches adapt to market conditions. The Cap Defender approach relies on one type of contract as the basis for estimating the appropriate levels of MPC. This runs the risk of having unintended consequences on the behaviours of market participants, since generators could adopt different contracting approaches than that assumed in the model.

- The Cap Defender approach is more influenced by the growing disconnect between high demand and high prices with low available capacity. As such, the cap defender approach would result in greater modelled price volatility. This, in turn, could distort the conclusions drawn from the model about the appropriate level of MPC.

- Oakley Greenwood found that the Cap Defender approach was likely to underestimate the MPC needed to support new investment.

5.2.2 Oakley Greenwood's proposed changes

In light of the perceived limitations of the modelling used for the *2014 Review,* Oakley Greenwood made the following key recommendations for future modelling:

- **Consideration of equilibrium:** Analysis will increasingly need to focus on assessing the long-term supply and demand equilibrium, rather than only the conditions for additional investment. Assessment of equilibrium will be important in a market where capacity withdrawal is as important as investment and where there is a general transition in generation and demand technologies.

- **Changes in correlation between peak demand, available capacity and price:** Evolving generation and demand-side factors are reducing the correlation between demand, available capacity and spot price (due to changing characteristics of technology and intermittency). These changes will need to be considered throughout the modelling. In particular, future modelling should identify the marginal technology and costs at the margin as an output of the model. This is a departure from the past approach, which assumed a particular technology (OCGT) as the marginal generator.

- **Assessment of Extreme Peaker and Cap Defender**: Both the Extreme Peaker and Cap Defender approaches employed in the 2014 analysis require amendment. It is recommended that a new technology-neutral equilibrium approach be adopted for future modelling. This approach would:

- be similar to the 2014 Extreme Peaker approach, modified to allow the modelling to identify the marginal generator based on cost and operating characteristics;

- the modelling would retain ROAM's game theory approach to generator's bidding behaviour; and

- recognise the commercial drivers underpinning the 2014 Cap Defender but allow market behaviours to signal future contract prices through bidding behaviours.

- **New scenarios to reflect changes in dispatch patterns:** More sophisticated modelling, for example through scenario analysis, is required to more robustly account for:

  - the growing disconnect between demand, available capacity and price; and

  - the increased significance of atmospheric conditions on both the supply side (ie availability of a number of renewable resources) and the demand side (ie on-site consumption from rooftop solar PV, and air conditioner use).

5.3 Modelling in future reviews

The Panel considers that Oakley Greenwood's recommendations are sensible and likely to result in more effective modelling.

However, in developing these guidelines, we consider that the detailed development of the model in future reviews should not be constrained or limited in its ability to consider all relevant factors.

The guidelines, therefore, seek to identify the matters that will be considered in the modelling, rather than ruling things out. This is intended to provide the market with a clear indication of the Panel's general approach, while avoiding inadvertently preventing the consideration of key issues that may not be identified until modelling actually commences.

This section sets out:

- the Panel's general approach to modelling;

- the form of modelling used; and

- relevant inputs and scenarios.

5.3.1 General approach to modelling

Historically, the modelling used by the Panel has focused on investment in new marginal capacity, considering that investment in new capacity is the primary

mechanism through which the standard will be met. This underlying focus remained appropriate in a world of increasing demand (particularly peak demand) and a relative shortage of generation supply capacity.

However, as discussed in section 3.1.3, these underlying conditions have changed. Demand has been falling, or relatively static, for some time. As a result, the market is, on average, in a relative position of oversupply.[85] The generation mix is also changing, with a number of significant retirements of large thermal units, increased investment in intermittent generation and the advent of new technologies, such as solar residential PV and storage.

These changing conditions have led the Panel to reconsider the underlying rationale for setting the MPC and CPT. As discussed in section 4.3 the Panel considers that the primary purpose of the MPC (and a secondary purpose of the CPT) is to allow the market to find the long-run equilibrium between reliability and price.

The Panel considers this should be reflected in the general approach to modelling. In particular, this will involve moving the focus of modelling away from new investment. Instead, the model should be able to also consider the impacts of the standard and settings on generation retention and retirement. This approach would allow for a more realistic reflection of current, and potential future, market conditions and would allow for an assessment of the long-run equilibrium.

This general change in the focus of modelling is reflected throughout some of the more detailed changes that are discussed throughout the rest of this section.

5.3.2 The form of modelling used

Noting the issues identified by Oakley Greenwood, the Panel considers the guidelines should set out a number of principles to guide its general approach to modelling. These principles should help to deliver modelling that more accurately and effectively reflects some of the key changes currently underway in the market. In general, the Panel considers that the new approach to modelling should include the following characteristics.

Technological neutrality of the marginal unit

Historically, modelling has assumed that the marginal unit has been an OCGT generator. This input assumption may no longer be valid, given changes in technology costs and the emergence of new solutions such as battery storage.[86]

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85 There may be temporary or local situations in which supply is tight, as evidenced by recent outcomes in South Australia where relative tightness in demand and supply contributed to high prices. Generally, however, the Panel considers that in contrast to historical outcomes, the NEM is in a relative position of over-supply in most regions.

86 The technology of the marginal generator may also be affected by changes to how the market operates. For example, the AEMC is assessing a rule change request that proposes to change settlement in the spot market from the current 30-minute interval to a five-minute interval. Such a

Accordingly, the Panel considers that the nature of the marginal unit should be an output of the modelling, rather than an input assumption. This will allow for the model to identify the MPC that will deliver the standard using the most efficient mix of technologies, rather than being constrained by an MPC needed to support a specific type of marginal generator.

This approach also allows for the modelling to consider retirement and the most efficient form of generation to replace that retired capacity. As such, it provides a way to consider potential reductions in the MPC, in a way that maintains the ability of the market to trend toward long-term equilibrium.

Marginal cost restriction

A key issue with the Extreme Peaker model is that it constrains the ability of the marginal generator to offer its capacity at a price other than the MPC. This does not reflect the likely behaviour of a marginal generator, and would tend to overestimate the MPC required to meet the standard.

The Panel, therefore, considers that future modelling should relax this constraint and allow for more flexible assumed bidding behaviour by the marginal generator. This is particularly important given the potential changes in dispatch that may follow from more intermittent generation and increasing dispatch of marginal units to meet supply shortfalls even when demand is below its peak levels.

Assumptions regarding contracting

A key issue with the Cap Defender model is the required assumptions regarding generator contracting strategies. Making any assumptions about generator behaviour could be problematic, given that there are a range of potential bidding strategies that generators could adopt, which may themselves be based on generator expectations of what strategies their competitors will adopt.

The Panel, therefore, considers that future modelling will not have assumptions regarding contracting behaviour as a central part of their approach. However, the modelling may use contracting assumptions for the purposes of specific scenarios.

5.3.3 Inputs and scenarios

Range of inputs and assumptions to be considered in the modelling

The guidelines note that modelling will use various inputs and assumptions. These inputs and assumptions include, but are not limited to:

- average and peak demand projections for each region;
- expected load profiles;

change may favour fast-response technologies such as batteries. See: AEMC, *Five Minute Settlement*, consultation paper, 19 May 2016, Sydney.

- government mandated schemes for encouraging renewable energy technologies;
- sectoral or economy wide mechanisms designed to address climate change, such as a sectoral emissions intensity trading scheme or an emissions trading scheme;
- gas price trajectories;
- costs for marginal generating units;
- demand-side participation quantities and price thresholds;
- expected changes in the large scale generation fleet, particularly thermal unit retirement; and
- growth rates for small scale distributed generation, particularly rooftop PV and battery storage.[87]

Scenario assessment

Scenarios are typically used in modelling to explore particular concepts, changes or issues. They may involve changing a number of input variables, or potentially introducing new variables, to assess the kinds of general outcomes that may occur.

Scenarios can be incorporated into the model either:

- deterministically - a specific set of assumptions are used to assess a situation different to the baseline used in the model; or
- stochastically - a range of assumptions and corresponding possibilities are used as inputs into the model, which uses Monte Carlo simulations to identify a probability-based set of potential outcomes.

The Panel will use both approaches, as appropriate, in conducting scenario assessments.

The guidelines note that modelling will use various scenarios, as appropriate for each review. These may include, but are not limited to:

- high and low capital cost assumptions for marginal plant;
- alternative MPC / CPT ratios;
- high and low peak demand and average demand growth forecasts;
- changes in load profiles, including withdrawal of large industrial loads;
- different emission reduction and renewable target settings;

87 To the extent possible, the Panel will consider how the usage of such technologies would change over the period in question.

- high and low gas price projections;
- potential changes in the level of demand-side participation;
- different projections in the price of distributed energy and emerging technologies, including solar PV and battery storage;
- different timelines for retirement of large scale generators;
- the effects of any new system security requirements, including changes to dispatch of generating units to address issues related to rate of change of system frequency; and[88]
- different timelines for exit of large customers.

Box 5.1 Modelling

In developing modelling for the purposes of informing its assessment of the standard and settings, the Panel will consider the following general principles:

- the model should consider how a long term equilibrium between price and reliability can be achieved in the market;
- in considering long term equilibrium, the modelling should consider both new investment and the potential for retirement of capacity.

When designing the specifics of the model, the Panel will consider the following principles regarding the assumed generator behaviour included in the model:

- the model should be technology-neutral and assess MPC on the basis of the cheapest available marginal technology that can be used to deliver the standard;
- assumed generator behaviours should be modelled in reality and the modelled generators should be allowed to offer their capacity in a way that reflects reasonable behaviour; and
- the model should not make assumptions regarding the contracting behaviour of any modelled generators.

The range of inputs to be used in the model may include but are not limited to :

- average and peak demand projections for each region;
- expected load profiles;

88 The Panel notes that work being undertaken by the AEMC and AEMO in regards to system security is still in its early stages. These maters will be reconsidered at the next review, when the Panel understands work on these issues will be further progressed.

- government mandated schemes for encouraging renewable energy technologies;
- sectoral or economy wide mechanisms designed to address climate change, such as a sectoral emissions intensity trading scheme or an emissions trading scheme;
- gas price trajectories;
- costs for marginal generating units;
- demand-side participation quantities and price thresholds;
- expected changes in the large scale generation fleet, particularly thermal unit retirement; and
- growth rates for small scale distributed generation, particularly rooftop PV and battery storage.[89]

The scenarios to be used in the model may include but are not limited to:

- high and low capital cost assumptions for marginal plant;
- alternative MPC / CPT ratios;
- high and low peak demand and average demand growth forecasts;
- changes in load profiles, including withdrawal of large industrial loads;
- different emission reduction and renewable target settings;
- high and low gas price projections;
- potential changes in the level of demand-side participation;
- different projections in the price of distributed energy and emerging technologies, including solar PV and battery storage;
- different timelines for retirement of large scale generators; and
- different timelines for exit of large customers.

89 To the extent possible, the Panel will consider how the usage of such technologies would change over the period in question.

Abbreviations

AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APC	Administered Price Cap
APP	administered price period
CCGT	close cycle gas turbine
CPI	Consumer Price Index
CPT	Cumulative Price Threshold
DWGM	declared wholesale gas market
FCAS	frequency control ancillary services
LNG	liquid natural gas
LOLE	Loss of load expectation
LOLP	Loss of load probability
MFP	Market Floor Price
MPC	Market Price Cap
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NEO	National Electricity Objective
NER	The National Electricity Rules
OCGT	open cycle gas turbines
OTC	over the counter
Panel	Reliability Panel
PPI	producer price index
PV	photovoltaic

RET	renewable energy target
SAIDI	system average interruption duration index
SRMC	short run marginal costs
STTM	short term trading markets
the guidelines	reliability standard and settings guidelines
the review	reviews of the reliability standard and settings
the settings	reliability settings
the standard	reliability standard
USE	expected unserved energy
VCR	value of customer reliability

A Responses to submissions on the issues paper

Assessment Framework

Stakeholder	Issue	Panel response
Engie, p.2	Suggests certain changes to the wording of the trade-offs: • Maintaining stable and consistent regulatory frameworks, while allowing sufficient flexibility to account for changes in the market. • Sending effective price signals to drive which support and don't impede efficient investment, while maintaining adequate protection for market participants from sustained high prices. • Delivering, creating and maintaining an environment to support an acceptable level of reliability, at a price that matches the value that consumers place on reliability. The first dot point can be addressed by allowing a sufficient upward tolerance of the reliability parameters so that they do not need to be adjusted on a regular basis as they are under the current arrangements.	The Panel has retained the wording to the trade-offs and believes that it is necessary to attain an efficient level of investment and deliver the proposed standard of reliability rather than strive to achieve them. As section 4.3.2 explains, the approach to the MPC aims to allow the market to approach long-term equilibrium. This approach lends itself to gradual adjustments to the MPC and other settings.
Snowy Hydro, p.1	The AEMC should consider the acceptable transitional period for the USE. What really matters is that in the long-run, the standard and settings send the appropriate signals for new investment or the retention of existing assets.	The Panel agrees that the focus of the standard and settings should be related to long term equilibrium outcomes, including facilitating market determination of appropriate levels of investment in new and retention of existing assets.

Matters to be considered in guidelines

Stakeholder	Issue	Panel response
AGL, p.2	The Panel might consider embedding further detail in relation to the purposes of the settings directly into the NER.	The Panel provided detail on the purposes of the settings in the guidelines. The purposes of individual settings can change over time. Thus, rather than require a rule change in order to change any definitions, it is more appropriate to capture these definitions in the guidelines.
AGL, p.2	The guidelines could go further by acknowledging that the market does not distinguish between the level and quality of generation in the market, ie whether generation is intermittent or dispatchable.	The Panel's assessment of the standard and settings will utilise a technology-neutral approach. The modelling that underpins the next review will explore all kinds of technology within the generation mix, including intermittent and dispatchable generation. This modelling will seek to identify the lowest cost combination of generation and demand-response to achieve the standard.
Snowy Hydro, p.2, Engie, p.3	Snowy Hydro suggests that the CPT should remain at 15 times the level of the MPC. Snowy Hydro's own analysis suggests that a smaller ratio would significantly increase the trading days that are subjected to the APC and would, therefore, send the wrong signals to stakeholders about the sustainability of the market. Engie suggests that the MPC and the CPT should be decoupled as the CPT should be set by reference to the amount of risk the market can manage in aggregate, not simply as a function of the MPC.	As set out in sections 4.4.0 and 4.4.2, the Panel considers the MPC and CPT to serve complimentary but different functions. Over time, the appropriate balance between their functions may change. Accordingly, an appropriate balance between predictability and flexibility can be achieved by considering the MPC and CPT together and testing the impact of different ratios.
Engie, p.2	It is important to consider the function of parameters such as the MPC and the CPT prior to determining the methodology to quantify or set them.	Sections 4.3.1 and 4.3.2 set out the functions of the MPC and CPT, which inform how these settings should be determined in future reviews.
Engie, p.2	Does not agree with the view that the MPC has reached its limited to incentivise a market response. The MPC does not only create generator and retailer responses but also demand-side responses (ie it impacts both decisions to actively participate in the market and decisions to actively contract directly with generation).	As discussed in section 4.3.2, the Panel considers that the function of the MPC is to allow the market to determine prices that provide signals for efficient operational and investment outcomes in order to trend toward equilibrium in the long term.

Engie, p.3	The risks of setting the MPC too low are far more detrimental to the market stability than if the MPC is set too high as the absence of an MPC is likely to facilitate an active demand response sector where unsophisticated commercial players will be encouraged to contract. A pragmatic approach would be to set the MPC higher than determined by the modelling to ensure that it is out of the way and the market can respond underneath it.	The Panel does not agree with Engie's comments. Depending on the situation in the market, the risks of setting the MPC too high can be equally as great as setting the MPC too low. Section 4.3.2 explains that the Panel does not intend to use the MPC to manipulate the market into a particular outcome in the short term. Rather, it sees the role of the MPC setting a boundary price within which the market can trend towards equilibrium in the long term.

Approach to modelling

Stakeholder	Issue	Panel response
Engie, p.3	The modelling should not incorporate subjective assumptions regarding offer/bid behaviour or dispatch. To be sustainable, the cap contracts need to be valued at the expected value of a cap using the modelling output (without cap contracts in place). Cap contracts may serve to smooth the costs/revenues to counterparties but should not be used to change the behaviours in the modelling.	As discussed in section 5.3.2, the Panel considers that market modelling should not make assumptions regarding the contracting behaviour of participants. Nevertheless, the Panel may seek to understand the impact of certain contracting behaviours on what settings would be expected to achieve the standard. It would do so through scenario testing.
Engie, p.3	Believes that the use of the Cap Defender approach is distortionary, misprices generation output or demand-side response and, therefore, should not be used as a technique for the determination of the MPC.	The Panel accepts Oakley Greenwood's assessment that the Cap Defender approach is more likely to result in an under-estimate of the required MPC. However, the detailed development of the model in future reviews should not be constrained or limited in its ability to consider all relevant factors, including the potential to use the Cap Defender approach.
Engie, p.3	Proposes augmenting inputs, assumptions and scenarios to include: plant life and the cost of capital from an investors' perspective, the costliness of gas supply arrangements, and transmission risks and costs.	The Panel considers that the details of modelling should be decided at the commencement of each review. However, the Panel generally agrees that modelling should consider gas prices and that debt and equity costs are also likely to form an input into modelling. Transmission risks and costs have typically been considered in modelling through assessment of random outages.
AGL, p.1	The VCR as an input into modelling should be treated with caution given the difficulties in determining an accurate measure of the VCR taking into account the various customer classes.	The NER require the Panel to consider any value of VCR developed by AEMO when reviewing the standard and settings, to the extent that it considers appropriate. The Panel may include consideration of AEMO's VCR through its modelling. In doing so, it will consider any issues related to the accuracy of the measure.
Snowy Hydro, p.2	Market modelling is important but should be only one of a number of inputs used by the Panel to inform its determination of the standard and settings.	The Panel agrees with Snowy Hydro's comments, as reflected in Chapter 5.