RELIABILITY PANEL AEMC

REVIEW

Reliability Panel AEMC

FINAL REPORT

Reliability standard and settings review 2018

30 April 2018

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About the Reliability Panel

The Panel is a specialist body within 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 on 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.

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Executive summary

The Reliability Panel (Panel) has completed its review of the reliability standard and reliability settings to apply in the national electricity market (NEM) from 1 July 2020. We are required to assess the reliability standard and settings every four years.[1] The Panel recommends keeping the current reliability standard and reliability settings unchanged as they remain appropriate to support reliability in the NEM.[2]

This final report sets out the Panel's review of and recommendations regarding the:

- **Reliability standard** which expresses the level of reliability sought from the NEM's generation and transmission inter-connector assets.
- **Reliability settings** which protect the long term integrity of the market by limiting the extent to which wholesale prices can rise and fall, to limit market participants' exposure to prices that could threaten the financial viability of a prudent market participant. They are set to allow investment sufficient to achieve the reliability standard.[3] The settings comprise:
  - **The market price cap** which imposes an upper limit on **temporary** high prices in the wholesale market.
  - **The cumulative price threshold** which imposes a limit on **sustained** high prices in the wholesale market.
  - **The administered price cap** which is the 'default' price cap that applies when the cumulative price threshold is exceeded.
  - **The market floor price** which imposes a **negative limit** on prices in the wholesale market.

What is reliability?

Reliability means that the power system has an adequate amount of capacity (including generation, interconnector capacity and demand response) to meet consumer needs. It therefore requires there to be an adequate pattern of investment and disinvestment, and appropriate operational decisions, so that supply and demand are in balance at a particular point in time.[4] To deliver a reliable supply, the level of supply needs to include a buffer, known as reserves, so that supply is greater than expected demand.

1 National Electricity Rules (rules) clause 3.9.3A(d).

2 The Panel recommends that the CPI continues to be the measure used to index the market price cap and the cumulative price threshold, to preserve the real value of those settings over time. This is the purpose of indexation noted in the final determination for the Review of the reliability standard and settings guidelines, 2016 (Guidelines final determination), p. 41. Indexation is discussed in more detail in chapter 5 and Appendix D.

3 The market floor price should be set at a level that does not interfere with generators being able to differentiate themselves according to the value they place on being dispatched by bidding at negative prices during periods of excess generation.

4 AEMC 2018, *Reliability Frameworks Review*, Directions Paper, 17 April 2018, Sydney, p. ii.

This allows actual demand and supply to balance, even in the face of unexpected changes.

Reliability is currently delivered in the NEM through investment, retirement and operational decisions that are underpinned by various market structures.[5] The framework is supplemented by a series of mechanisms that allow the system operator to intervene in the market in specific circumstances.[6] The reliability standard and the reliability settings are key parameters in the market structure.

The scope of this review is limited to the reliability of the power system as provided by generators and interconnectors.[7] In completing this review the Panel is also bound to take into account considerations set out in the National Electricity Rules (the rules) and the Panel's *Review of reliability standard and settings guidelines* (the guidelines).

What is the context for this review?

Energy systems around the world are transforming; and the NEM is no exception. Rapidly evolving technology with declining costs and changing consumer preferences are driving this transformation. The generation mix is shifting and the power system is becoming more decentralised due to factors including increased volumes of variable renewable generation, demand response, storage capacity and customer-connected distributed energy resources.

Elements of the current market design are set to change within the period of time for which the reliability standard and settings have been reviewed, 1 July 2020 - 30 June 2024 (the review period). For instance, the Australian Energy Market Commission (AEMC) has determined that five minute settlement will apply from 1 July 2021.

The Panel has, to the extent appropriate, taken into account in this review the power system transformation, changes to market design such as the introduction of five minute settlement, and the range of government responses and initiatives that have been announced to date.

A key additional factor in the Australian context is the uncertainty over a nationally consistent long-term policy on emissions reduction. The Energy Security Board's proposal of a National Energy Guarantee (Guarantee) – which seeks to integrate energy and climate policy – aims to deliver the certainty and investor confidence needed for long term investment decisions. At the time this report was finalised the detailed design of the Guarantee was not known and the impacts of the Guarantee could therefore not be taken into account for this review.[8]

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5 AEMC 2018, *Reliability Frameworks Review*, Directions Paper, 17 April 2018, Sydney, p. ii.

6 AEMC 2018, *Reliability Frameworks Review*, Directions Paper, 17 April 2018 , Sydney, p. ii.

7 The review does not address the reliability provided by the electricity transmission and distribution networks as this is the responsibility of jurisdictional governments.

8 This issue is further discussed in section 8.3.

The Panel's recommendations

The Panel recommends retaining the current levels of the reliability standard and settings because:

- The current reliability standard and settings are, in our view, achieving their purpose and are likely to continue to do so throughout the review period including with the introduction of five minute settlement from 1 July 2021. The Panel recently found that the NEM performed well in terms of reliability during 2016/17. In 2016/17, at a wholesale level, 0.00036 per cent unserved energy occurred in South Australia from one reliability event, well within the reliability standard.[9]
- The present market price cap and cumulative price threshold have been, and are likely to continue to be effective at limiting market participants' exposure to excessive high prices and maintaining overall market integrity. They are sufficiently high to allow investment in enough generation so that the expected level of unserved energy does not exceed the reliability standard. The Panel has also considered the case for lowering the market price cap and the cumulative price threshold. We have concluded that the potential benefits from lowering these price caps in terms of possible reduced wholesale prices do not outweigh the long term risks associated with having inadequate investment signals to incentivise demand side capacity or marginal new supply so that the total of generation, demand response and transmission interconnection will meet the reliability standard through the review period.[10]
- The Panel considers that providing regulatory stability through no changes will benefit consumers and market participants, given the extent of the current flux and range of uncertainties that impact on market participants' long term decisions, including the current impact of policy uncertainty on investor confidence and the rapid technological change underway in the national electricity market. The Panel also notes the absence of sufficient evidence in support of a change to the price settings.

Table 1 presents the Panel's recommendations.

9 See: https://www.aemc.gov.au/markets-reviews-advice/annual-market-performance-review-2017

10 The Panel notes there are many factors that affect price outcomes in the wholesale market asides from the market price cap and that most consumers are not exposed directly to wholesale prices. Rather, the electricity price most consumers pay is the price they negotiate with their energy retailer. Wholesale market costs comprise one of a number of cost categories that energy retailers seek to recover through residential bills and typically account for 28 – 41 per cent of customers' bills.

Table 1: The Panel's recommendations

Reliability standard/settings	Current and recommended level from 1 July 2020
Reliability standard	A maximum expected unserved energy in a region of 0.002 per cent of the total energy demanded in that region for a given financial year
Market price cap	$14,200/MWh ($2017)[11]
Cumulative price threshold	$212,800 ($2017)[12]
Administered price cap	$300/MWh
Market floor price	-$1,000/MWh

Increased focus on reliability

The Panel acknowledges that there has been considerable public attention and focus on all reliability issues, including the reliability standard itself, and in particular commentary which suggest that the reliability standard should be zero, that is, the reliability standard should provide for zero loss of load.

As system operator, AEMO is required operationally to do all it can to keep the lights on, that is, it is required to target zero loss of load (or 100 per cent reliability). In order to achieve this, AEMO has a number of tools and options available to it under the rules. When these options have been exhausted and the system has or is likely to move into an insecure operating state for more than 30 minutes AEMO would be expected to initiate managed load shedding where this is able to achieve a secure operating state.

While AEMO will try to do all it can to keep the lights on, it cannot always do so, nor can it do so without significant costs to consumers, and this is why we have a non-zero reliability standard. The tools and options available to AEMO to meet a non-zero reliability standard are therefore carefully defined to limit the costs to consumers and the economy more generally.

Setting the level of the reliability standard involves a trade-off between the prices consumers pay for electricity and the cost to consumers of not having electricity there when it is needed. Getting the balance right avoids what some have called 'gold plating' with excess capacity built but not required for years. In making such a trade-off it is

11 See footnote 2 regarding indexation of the market price cap. Applying CPI indexation, the market price cap will be $14,500/MWh for the 2018/19 financial year. For more details see: https://www.aemc.gov.au/news-centre/media-releases/aemc-publishes-schedule-reliability-settings-2018-19

12 See footnote 2 regarding indexation of the cumulative price threshold. Applying CPI indexation, the cumulative price threshold will be $216,900 for the 2018/19 financial year. For more details see: https://www.aemc.gov.au/news-centre/media-releases/aemc-publishes-schedule-reliability-settings-2018-19

important to understand what level of reliability consumers actually value, and the extent to which a higher standard would better match consumer expectations.

The Panel notes that removing the difference between the current standard (99.998 per cent of demand met) and 100 per cent could require additional investment in the NEM measured in the billions of dollars. Based on the outcomes of the modelling conducted by Ernst & Young (EY) for this review the costs of additional generation to increase the (already high levels) of reliability in Victoria to an outcome of having 100 per cent of demand met will cost around $200 million per annum in the state of Victoria alone, increasing wholesale costs by nearly 7 per cent. The Panel also notes that since 2007/08 only 0.23 per cent of supply interruptions (in terms of GWh) were the result of reliability events.[13]

The Panel understands that AEMO has concerns regarding the suitability of the reliability standard, particularly with regard to how it is applied operationally and in extreme conditions, and these have been documented in this report (see sections 3.1.3 and 8.1, and appendix A.6.6). The Panel notes that these issues will be investigated outside of this review; AEMO has raised its concerns in the enhanced Reliability and Emergency Reserve Trader (RERT) rule change request lodged with the AEMC.[14]

Recent and upcoming market developments

The review of the reliability standard and settings is informed by forecasts of market conditions seven years into the future. Development of these long-term forecasts is particularly challenging at this point in time.

In conducting this review, the Panel has considered the significant uncertainty and change underway in the national electricity market, and the attendant implications for reliability over the review period.

If warranted due to the changing market circumstances, for example the adoption of the Guarantee, the AEMC may give the Panel terms of reference for an interim review of the reliability standard and settings, prior to the next scheduled four-yearly review.[15]

13 Security events also represented a small portion of all supply interruptions at 3.20 per cent. Estimates show that the distribution network is responsible for about 96 per cent of supply interruptions.

14 Available at: https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader

15 See section 8.3.

Contents

1 Introduction

This final report has been prepared for the Reliability Panel's (the Panel's) 2018 Reliability standard and settings review (the review). It presents the Panel's findings and recommendations on the reliability standard and reliability settings to apply in the national electricity market (NEM) from 1 July 2020.[16] We are required to review the reliability standard and settings every four years.[17]

The Panel recommends leaving the current reliability standard and reliability settings unchanged.

1.1 The reliability standard and settings review

Reliability of the power system is about having sufficient physical capacity in the system to generate and transport electricity to meet consumer demand.[18] Many factors impact on the power system's overall reliability and the level of reliability a particular customer experiences.

In terms of the physical power system, this review focuses on the reliability provided by electricity generation and inter-regional transmission assets (called "interconnectors"). The review does not address the reliability provided by the electricity transmission and distribution networks as this is the responsibility of jurisdictional governments.[19]

Reliability of the power system, along with energy affordability and meeting our emission reduction obligations, currently features prominently in many policy, political and media announcements and debates. This review centres on one key aspect of the reliability framework: the reliability standard and settings to apply in the NEM from 1 July 2020 until the next review.

The reliability settings are the market price cap, the cumulative price threshold, the administered price cap and the market floor price (Table 2).

The reliability standard expresses the level of reliability sought from the NEM's generation and transmission inter-connector assets. The scope of this review is therefore

16 The next review is due to be completed by 30 April 2022 and will consider settings to apply from 1 July 2024.

17 Rules clause 3.9.3A

18 Unless otherwise stated, references to demand throughout this paper refer to operational demand, (consistent with the approach used previously by the Panel in the *Annual Market Performance Review*). Operational demand consists of electricity used by residential, commercial and large industrial consumers, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units. Demand response activities and embedded generation are not included on the 'supply' (or 'capacity') side with large generating units. Instead these 'behind-the-meter' activities have the effect of reducing total demand. Nevertheless, behind-the-meter activities are relevant to reliability. As reliability relates to the ability to meet customers' demand for electricity, reductions in demand can make it easier to meet the desired level of reliability. For an explanation of scheduled, semi-scheduled and non-scheduled generating units see AEMC, *Demand side obligations to bid into central dispatch, consultation paper*, 2015, Sydney, pp. 2-3

19 The reliability standards for distribution and transmission assets within regions are the responsibility of regional jurisdictions. For example, the NSW Department of Planning and Environment sets the *Transmission Network Design and Reliability Standards for NSW*.

limited to the reliability of the power system as supplied by generators and interconnectors.

The reliability settings protect the long term integrity of the market by limiting the extent to which wholesale prices can rise and fall. They are set at a level so as not to interfere with the price signals needed for efficient investment and operation. They guide investment, retirement and operational decisions in the wholesale electricity market, and thereby support reliability in the NEM.

Table 2: Current reliability standard and reliability settings[20]

Reliability standard	The reliability standard for generation and inter-regional transmission elements in the national electricity market is a maximum expected unserved energy in a region of 0.002 per cent of the total energy demanded in that region for a given financial year.[21]
Market price cap	$14,200/MWh
Cumulative price threshold	$212,800
Administered price cap	$300/MWh
Market floor price	-$1,000/MWh

This four-yearly review allows the Panel to consider whether the current levels of the reliability standard and reliability settings remain suitable for expected market conditions, or whether changes should be made so that these mechanisms continue to meet the requirements of the market, market participants and consumers. Regular review of the reliability parameters allows appropriate price signals for investment as the market environment and market arrangements change, so as to provide a reliable supply of electricity to consumers.

The Panel recognises that it is conducting this review at a time of uncertainty and significant and rapid change in the national electricity market. As required by its terms of reference, the Panel has considered the scale and pace of changes, and uncertainties, in our deliberations (see chapter 8).

20 Under the rules clauses 3.9.4 and 3.14.1, the Commission is required to adjust the market price cap and cumulative price threshold in line with the consumer price index by 28 February each year, to apply from 1 July that year. This table shows the levels that apply in the 2017-2018 financial year. The indexed levels of the market price cap and cumulative price threshold that will apply from 1 July 2018 – 30 June 2019 were published on 20 February 2018 and are available at: https://www.aemc.gov.au/news-centre/media-releases/aemc-publishes-schedule-reliability-settings-2018-19

21 It is important to understand what is meant by the term '*expected unserved energy*' in regards to this review. '*Unserved energy*' means the amount of customer demand that cannot be supplied within a region of the national electricity market due to a shortage of generation or interconnector capacity. The term '*expected*' is important – it means a statistical expectation of a future state; an average across a range of future scenarios, weighted for probability.

1.2 Role of the reliability standard and settings in the NEM

1.2.1 Reliability and security

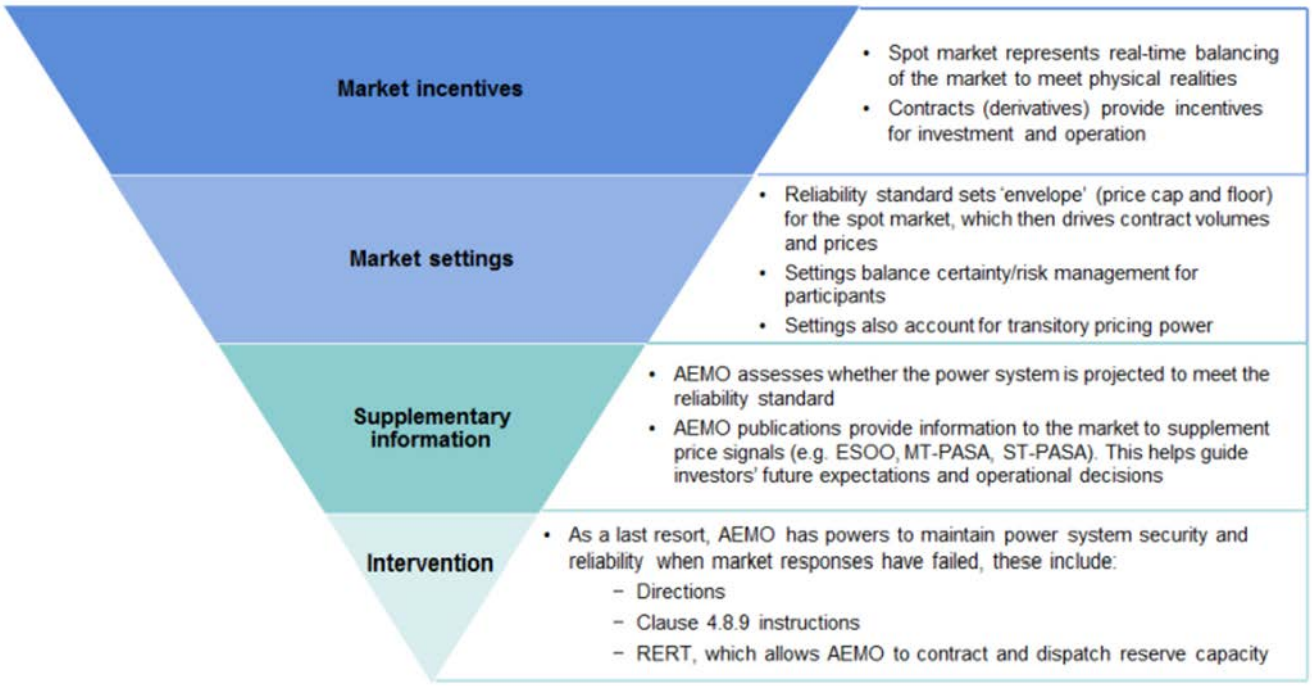
Reliability (as referred to above as having enough generation, demand response and network capacity to supply consumers) is different from security, which refers to being able to operate the system within defined technical limits, even if there is an incident such as the loss of a major transmission line or large generator.

The Panel recognises the related, importance of system security to the power system and the significant work underway on supporting system security.[22] Issues related to system security are being progressed through a range of avenues, including the AEMC's system security work program.[23]

1.2.2 Current reliability frameworks

Figure 1 provides an overview of the existing reliability framework for the NEM. The core objective of the reliability framework is to deliver desired reliability outcomes through market mechanisms to the largest extent possible. The market settings – the reliability standard, market price cap, cumulative price threshold, administered price cap and market floor price—are an integral part of this framework.

Figure 1: Markets and an escalating series of interventions[24]



22 While the two concepts are separate, they are closely related operationally. A reliable power system is also a secure power system. However, the converse is not necessarily true; a power system can be secure even when it is not reliable. For example, the rules allow AEMO to undertake involuntary load shedding, potentially compromising reliability, in order to return the power system to a secure operating state.

23 See the AEMC's website at http://www.aemc.gov.au/Major-Pages/AEMC-work-overview/System-security-review.

24 AEMC, *Reliability Frameworks Review*, Discussion paper, 18 April 2018, Sydney, pp. 19

The wholesale spot market and contract market provide market incentives for investment and operation. Revenue earned in the spot market, in conjunction with participants' contract positions, supports reliability in the short-term since it provides a financial incentive for generators to be available to supply electricity when needed. To manage their exposure to the spot market, participants typically seek to enter contracts which convert uncertain future spot prices into more certain wholesale prices.

The **reliability standard** and **settings** focus on the future performance of the national electricity market. Their purpose is to:

- Establish the level of reliability consumers can expect from key aspects of the physical system (generators and interconnectors), by setting the reliability standard.
- Protect the long term integrity of the market by limiting the extent to which wholesale prices can rise and fall, to limit market participants' exposure to prices that could threaten the financial viability of a prudent market participant.[25]
- Allow for investment sufficient to provide electricity to the agreed reliability standard (efficient investment).

Box 1.1 The reliability standard and settings

The **reliability standard** expresses the level of reliability sought from the NEM's generation and transmission inter-connector assets.

There are four reliability settings.

- The **market price cap** imposes an upper limit on temporary high prices (the maximum bid and therefore settlement price that can apply in the wholesale market) and so limits market participants' exposure. It is set at such a level that prices over the long-term incentivise enough new investment in generation, as well as appropriate operational decisions, to achieve the reliability standard.
- The **cumulative price threshold** imposes a limit on participants' financial exposure to sustained high prices.
- The **administered price cap** is the 'default' price that applies when the cumulative price threshold is exceeded. It also limits participants' financial exposure to sustained high prices while maintaining incentives for participants to supply energy during the period following the cumulative price threshold being exceeded.
- The **market floor price** imposes a negative limit on market prices in any half hour trading interval. This assists in limiting the amount of money a generator can lose in a single half hour, thereby supporting market stability.

AEMO is required by the NER to publish **supplementary information** on matters pertaining to the reliability standard; that is, over and above the information contained

25 Large consumers who buy wholesale are directly protected by the settings. The market settings indirectly protect consumers assuming that retailers will pass through the impact of the price caps in a competitive market.

in contract and spot market prices, including whether the power system is projected to meet the reliability standard. This information is provided in several formats and considers various time-frames. For example, the Medium Term Projected Assessment of System Adequacy provides information on generation adequacy over 2 years, or Electricity Statement of Opportunities addresses generation adequacy over 10 years. This information helps to guide investors' expectations for the future.

Additional supplementary mechanisms exist that allow for interventions to be made in certain limited circumstances when the incentives, settings and information arrangements have not delivered - or will not deliver –the desired outcome. These intervention powers are described in detail in Appendix B, Box B.3.

This review centres on the market settings rather than the intervention components of the framework for delivering reliability in the national electricity market.

1.2.3 Related policy responses

Significant work is underway across the national electricity market related to reliability.

Most recently the COAG Energy Council agreed that the Energy Security Board should progress development of the detailed design of the National Energy Guarantee (see section 8.3).[26]

A key initiative being undertaken by the AEMC is the *Reliability frameworks review*. This examines the broader market and regulatory frameworks that underpin reliability in the national electricity market.[27] A number of recommendations from the Finkel review are within the scope of the Reliability frameworks review, such as:[28]

- the need for a strategic reserve to act as a safety net in exceptional circumstances or replacement to the existing reliability and emergency reserve trader mechanism
- the suitability of a 'day-ahead' market
- a mechanism that facilitates efficient demand response in the wholesale energy market.

On 17 April 2018, a directions paper was published for the Reliability frameworks review. The directions paper considers complementary changes to market design to support the National Energy Guarantee's objective to deliver long-term reliability at least cost.

The Reliability Panel's *Annual market performance review* assesses the performance of the power system in terms of reliability, security and safety. In March 2018, the Panel published its review for the 2016/17 financial year.

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26 COAG Energy Council meeting communique, 20 April 2018, available at: http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/16th%20COAG%20Energy%20Council%20Communique.pdf.

27 See AEMC, *Reliability frameworks review*, EPR0060, https://www.aemc.gov.au/markets-reviews-advice/reliability-frameworks-review.

28 These three recommendations represent three of the four key streams of work for the Reliability frameworks review. The fourth key work stream relates to forecasting and information provision.

Also in March 2018, AEMO provided advice in response to a request from the Federal Energy Minister assessing AGL's plan to replace the energy and capacity currently delivered by the Liddell Power Station following its retirement in 2022.[29]

The Panel is monitoring reliability and other policy developments and initiatives in the sector, and has taken them into account in this review to the extent possible.

1.3 Consultation

On 6 June 2017 the Panel published an issues paper for this review. Submissions on the issues paper closed on 12 July 2017. The Panel received seven submissions and these are available on the AEMC website. Issues raised in submissions have been grouped according to the standard or setting to which they refer and, along with the Panel's response, are detailed in the relevant appendix in this report. They are also summarised in the table in Appendix G.

On 21 November 2017, the Panel published a draft report for this review along with a draft modelling report from EY. The Panel invited submissions from interested parties. Submissions closed on 22 December 2017. Four submissions were received on the draft report and these have been published on the AEMC's website. Issues raised in submissions are detailed in the relevant appendix in this report. They are also summarised in the table in Appendix G.

We also held a public meeting on 7 March 2018 to discuss stakeholder feedback on the draft report, additional modelling outcomes and their implications for the Panel's final report.[30] The presentations from the public meeting are published on the AEMC website.[31]

It was the Panel's intention that our interpretation of the assessment framework, the modelling method, the draft findings and analysis, and our judgements made in relation to the assessment criteria were transparent. We therefore welcomed stakeholder feedback on each of these matters.

The key consultation stages are shown in Table 3.

29 AEMO, Advice to the Commonwealth relating to AGL's proposal to replace Liddell, 16 March 2018. Available at: http://www.aemo.com.au/Media-Centre/AEMOs-liddell-response.

30 The rules require that the Panel follow the rules consultation procedures in carrying out this review. The rules consultation procedures are set out in section 8.9 of the rules.

31 See https://www.aemc.gov.au/markets-reviews-advice/reliability-standard-and-settings-review-2018

Table 3: Review milestones

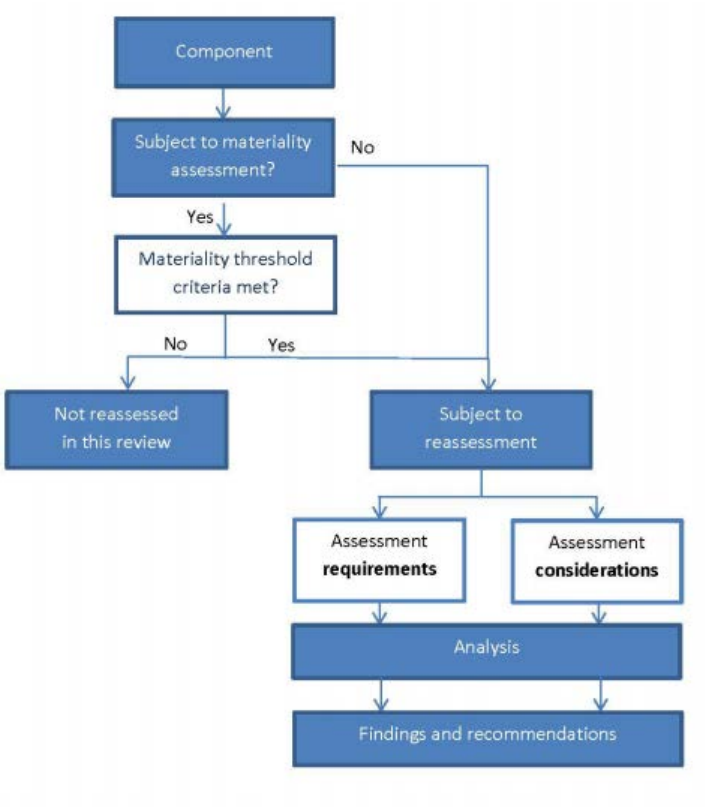
Milestone	Description
Issues paper	An issues paper was published in June 2017 seeking initial stakeholder views on the issues the review will cover and the approaches to the review. Seven submissions were received.
Draft report	A draft report was published in November 2017 seeking stakeholder views on the Panel's proposal to leave the reliability standard and reliability settings for the NEM unchanged from 1 July 2020. Four submissions were received. Stakeholder feedback demonstrated support for retaining the reliability standard at its current level. Stakeholder feedback also revealed diverse views on the appropriate level of the market price cap with support for lowering, retaining and raising its level. Stakeholders also recognised the need for the review to consider the potential impact of five minute settlement and the Guarantee on the reliability settings.
Public meeting	The Panel held a public meeting in March 2018 to discuss stakeholders' feedback on key aspects of the draft report and present additional modelling results. Ten stakeholders and six Panel members attended the meeting.

2 Assessment framework

2.1 Overview

The Panel's assessment framework is based on a series of obligations that are set out in National Electricity Rules (the rules), the review's terms of reference issued by the AEMC, and the Panel's *Review of reliability standard and settings guidelines* (the guidelines).[32] Figure 2 illustrates the assessment process and various assessment criteria that the guidelines have set out for each component (i.e. the standard itself, the market price cap, the cumulative price threshold, the administered price cap and the market floor price).

Figure 2: Assessment process for the reliability standard and settings



The Panel must apply a specific framework when assessing the reliability standard and settings:

- the Panel is guided by the national electricity objective in undertaking the review
- only certain components of the reliability standard and settings are to be reassessed
- the Panel must use specific criteria to assess each component.

32 Reliability Panel, *Review of reliability standard and settings guidelines*, final guidelines (Guidelines), 1 December 2016, Sydney. The guidelines and the terms of reference are available at www.aemc.gov.au

2.2 The national electricity objective

The national electricity objective is the goal (or objective) of the National Electricity Law, the legislation under which the Panel is established. The Panel must be guided by the national electricity objective when it undertakes its assessment and makes recommendations for this review.[33]

The national electricity objective is:

> 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.[34]

The Panel must consider how the outcome of a particular decision would impact on the variables contained in the national electricity objective, where relevant. For this review, the most relevant variables are price and reliability.

The question the Panel is to answer through this review is therefore whether a recommendation to change the reliability standard or (one or more of) the reliability settings would likely promote more efficient investment in and operation and use of electricity services, which would ultimately promote the **long term interests of consumers** *with respect to price and reliability of the supply of electricity, and the reliability of the national electricity system*.[35]

The Panel is to be guided by the following general principles in order to meet the national electricity objective:[36]

- **Allowing efficient price signals while managing price risk:** The Panel will exercise its judgment so as to allow the market to send efficient price signals while limiting price risk exposure for participants.
- **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 to exercise its judgment 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.
- **Providing a stable, predictable and flexible regulatory framework:** The Panel will exercise its judgment to achieve stable outcomes, while reflecting significant changes in market conditions, to support efficient investment and operational decisions by participants.

33 Guidelines p. 2.

34 National Electricity Law section 7.

35 More information about how the Commission and Panel interpret the national electricity objective can be found in Applying the energy objectives, a guide for stakeholders. AEMC, *Applying the energy objectives, a guide for stakeholders*, December 2016, Sydney.

36 Guidelines pp. 2-3.

2.3 Materiality assessments

Not all the components of the reliability standard and settings are automatically subject to review in each review. In 2016 the Panel determined that only certain components would be automatically reviewed every four years.[37] The Panel took this decision to deliver both a stable and flexible regulatory framework for system reliability.

The level of the market price cap and the cumulative price threshold are the only two parameters that are automatically reassessed every four years. As indicated in Figure 3, the levels of the reliability standard, the administered price cap and the market floor price are subject to a materiality assessment. The Panel is only to open these settings for reassessment if it considers the materiality threshold has been met – that is, there may be a material benefit in reassessing it – with reference to the criteria outlined in the guidelines. If the materiality threshold is not met then the reliability standard / setting remains unchanged from its present levels.[38]

The use of the consumer price index (CPI) for the annual indexation of the market price and cumulative price threshold is also subject to a materiality assessment.

The following aspects are not subject to review:[39]

- The measures (or metrics) used to express the reliability standard and each of the settings.
- The application of indexation to the market price cap and cumulative price threshold, and the non-indexation of the market floor price and the administered price cap.

Figure 3: Components of the reliability standard and settings subject to a materiality assessment

	Reliability standard	Market price cap	Cumulative price threshold	Administered price cap	Market floor price
Level	Materiality assessment	Automatically reassessed	Automatically reassessed	Materiality assessment	Materiality assessment
Basis of indexation		Materiality assessment	Materiality assessment		

2.4 Assessment criteria

The criteria the Panel is to apply in undertaking this review can be divided into two categories:

- ***Materiality threshold criteria.*** These are the criteria the Panel has used to assess the reliability standard and the various component settings that are subject to a materiality assessment. Established in the guidelines, they are described and

37 Guidelines pp. 4-9.

38 Guidelines p. 4.

39 Guidelines p. 8.

discussed in the chapters and appendices on those settings subject to a materiality assessment.

- ***Assessment criteria:*** These are the criteria set out in the rules, guidelines and terms of reference that the Panel is to consider when reviewing the level of a reliability standard or setting. In considering these criteria it is useful to differentiate between:
  - ***Assessment requirements*** – a condition that the Panel must meet when undertaking its review.
  - ***Assessment considerations*** – factors or impacts to which the Panel must (or may) have regard.

Table 4 presents the main assessment criteria in each category. These criteria are established in the rules.

Table 4: Assessment criteria

Assessment requirements *- Conditions that must be met -*
Under rules clause 3.9.3A(f), in making a decision on the market price cap and the cumulative price threshold, the Panel may only recommend a market price cap/cumulative price threshold that it considers will: • Allow the reliability standard to be satisfied without use of AEMO's powers to intervene under clauses 3.20.7(a) and 4.8.9(a).[40] • In conjunction with other provisions of the rules, not create risks which threaten the overall integrity of the market. If the Panel is of the view that a decrease in the market price cap/cumulative price threshold may mean the reliability standard is not maintained, the Panel may only recommend such a decrease where it has considered any alternative arrangements necessary to maintain the reliability standard.[41] The Reliability Panel may only recommend a market floor price which the Reliability Panel considers will: • allow the market to clear in most circumstances; and • not create substantial risks which threaten the overall stability and integrity of the market.[42] The Panel must comply with the reliability standard and settings guidelines.[43]

40 AEMO's "intervention powers" are explained in appendix B, Box B.3.

41 Rules clause 3.9.3A(g). The assessment criteria for the market price cap and cumulative price threshold are discussed further in Appendix sections B.2 and C.2.

42 Rules clause 3.9.3A(h). The assessment criteria for the market floor price are discussed further in Appendix section F.2.

43 Rules clause 3.9.3A(e)(1).

Assessment considerations
- Factors that must or may be considered -

Under rules clause 3.9.3A(e), the Panel:

- Must have regard to the potential impact of any proposed change to a reliability setting on: (i) spot prices; (ii) investment in the National Electricity Market; (iii) the reliability of the power system; and (iv) Market Participants.
- Must have regard to any value of customer reliability (VCR) determined by AEMO which the Reliability Panel considers to be relevant.
- Must have regard to the terms of reference provided by the AEMC. Among other things, these state the Panel should 'consider how changing the relevant reliability settings may affect price risk management behaviour, including potential impacts on contract markets, and how this may affect investment outcomes in the NEM.'
- May take into account any other matters specified in the guidelines or which the Panel considers relevant.

2.5 How the Panel made its decision

The Panel's consideration against these assessment criteria was based on analysis of wholesale market modelling findings, stakeholder views, and the experience, knowledge and expertise of its members.

Wholesale market modelling for this review was provided by energy market experts Ernst and Young (EY).[44] The Panel engaged EY to provide advice and modelling assistance to inform the Panel's recommendations on the reliability standard and settings. The Panel requested that EY:

1. Forecast the expected amount of unserved energy over the period 1 July 2020 - 1 July 2024 (the review period) under the current reliability settings, and assess whether the current reliability standard will be met.
2. Estimate the theoretical optimal level at which the market price cap could be set over the review period, through scenarios and sensitivity analysis.
3. Estimate the theoretical optimal level at which the administered price cap could be set over the review period.
4. Analyse how the level of the cumulative price threshold influences the effectiveness of the theoretical optimal market price cap and discuss the implications on the market from changing the cumulative price threshold and the market price cap.

The results of these modelling tasks are discussed in the appendices to this report. The principal assumptions used in the modelling are provided in Appendix H.1. A detailed description of the modelling methodology and modelling outcomes can be found in EY's report.[45]

44 Formerly ROAM Consulting. EY were appointed following a competitive tender process.

45 Available at http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Standard-and-Settings-Review-2018

3 Reliability standard

Recommendation	The reliability standard was not reassessed in this review as there was not sufficient evidence that the materiality threshold for its reassessment was met. The reliability standard will remain a maximum expected unserved energy in a region of 0.002 per cent of the total energy demanded in that region for a given financial year.
Purpose of reliability standard (Appendix sections A.1 and A.2)	Expresses the level of reliability sought from the national electricity market's generation and transmission interconnector assets. It embodies the trade-off between the prices paid for electricity and the cost of not having energy when it is needed. It also guides various decisions made by AEMO in its role as the system operator, including when it can intervene in the market if there is an expectation that the standard will not be met.
Specific assessment criteria – Guidelines (Appendix section A.3)	The level of the reliability standard remains as in the previous review unless the materiality threshold is met. The Panel is to consider factors including but not limited to: • any changes to AEMO's VCR measure • any marked changes in the way consumers use electricity, particularly through the use of new technology, that suggest a large number of consumers may place a lower value on a reliable supply of electricity from the NEM.[46]
Analysis (Appendix section A.6)	Analysis in support of the materiality assessment for the reliability standard is set out below and further detailed in the appendix.

3.1 Key issues

The reliability standard is foundational for the reliability settings. The level of the reliability standard is not automatically reassessed every review cycle, rather, the Panel must apply a materiality test to determine if the reliability standard should be reassessed and if the materiality threshold is not met the standard should remain as previously determined.

The Panel has determined that the materiality threshold for reassessing the level of the reliability standard has not been met at this time for the following key reasons:

- the absence of any change in AEMO's value of customer reliability measure
- changes in the way consumers use electricity do not suggest they are markedly less reliant on grid-supplied electricity
- other factors such as changes in the costs of new entrant generation since 2014 and the benefits of predictability and stability.

46 Guidelines section 3.2.2.

3.1.1 Changes to AEMO's value of customer reliability (VCR) measure

Under the guidelines, the Panel must consider whether there have been any changes to AEMO's VCR measure in determining whether to reassess the reliability standard.

AEMO's national VCR study was released in September 2014, several months after the Panel completed the *2014 Reliability standards and settings review* (16 July 2014). As such its results were not considered in the last review. However, the Panel did consider the implications of AEMO's VCR study for the level of the reliability standard in 2016 when developing the guidelines. The Panel had regard to ROAM's 2014 finding that the level of the current standard was equivalent to a value of customer reliability of approximately $30,000/MWh, which corresponded to AEMO's estimated NEM-wide aggregate of $33,460/MWh.[47] AEMO has not revised its 2014 VCR figure.

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, stakeholders did not present any other measures of the value of customer reliability that may be more appropriate for the Panel to consider.

While EY's modelling has not indicated or produced a value of customer reliability it has helped calculate the cost of changing the reliability standard, see section 3.1.3.

For the above reasons the Panel considers this materiality threshold criterion has not been met.

3.1.2 Changes in the way consumers use electricity

Under the guidelines, the Panel must consider whether there have been any marked changes to the way consumers use electricity, particularly through the use of new technology, that suggest a large number of consumers may place a lower value on a reliable supply of electricity from the NEM.[48]

This requires evidence that would support a **relaxing** of the reliability standard, which would allow for more unserved energy in the future. The Panel acknowledges that current public discourse centres on **tightening** the reliability standard (i.e. less unserved energy), and addresses this under 'other matters'.

The issues paper discussed five trends that could affect the value of customer reliability of particular consumers:

- household appliance use
- non-manufacturing business use
- manufacturing business use
- rooftop solar PV
- new storage technologies.

A summary of the issues paper analysis is presented in Box 2.1.

47 See: ROAM Consulting, *Reliability standard and settings review, report to the AEMC*, May 2014, p. 64, and AEMO, *Value of customer reliability review*, September 2014, p. 2.

48 Guidelines p. 5.

Box 2.1 Issues paper overview - key points on changes in consumer electricity use

- **Household appliance use:** residential consumption is not predicted to increase over the review period, despite increased appliance use, in part due to an increase in the energy efficiency of appliances.
- **Non-manufacturing business use:** (non-price) drivers of electricity consumption by non-manufacturing business use include: population; household disposable income; and heating and cooling needs. While long term forecasts exist for these factors, they may not accurately represent the change in the value of reliability for non-manufacturing business use.
- **Manufacturing business use:** long term drivers of manufacturing electricity use include producer input prices, and state output. While long term forecasts exist for these factors, they may not accurately represent the change in the value of reliability for manufacturing business use.
- **Rooftop solar PV:** Rooftop solar PV penetration is expected to increase over the review period. Rooftop solar PV is expected to decrease observed grid level residential consumption of electricity and non-manufacturing business consumption. However, many existing household PV installations cannot operate unless they are connected to the energised grid. For these consumers, rooftop solar PV would not reduce the value of the reliability of grid sourced energy.
- **New storage technologies:** New technologies, in particular, distributed energy storage, may insulate households and small businesses from the impact of interruptions in supply, and thus reduce the value of reliability for some consumers.

Source: Issues paper, p. 48, based on the *2016 National Electricity Forecasting Report for the national electricity market.*

The Panel considers this criterion in the Guidelines has not been met as a sufficiently large number of household and business consumers are not forecast to adopt rooftop solar PV and battery technology and materially change their usage patterns over the 2020 – 2024 period, in a way that would suggest they have become clearly less reliant on the grid and thus place a lower value on grid-supplied electricity. Nor were clear trends in other factors influencing business electricity use identified. See appendix A.3 for further information.

3.1.3 Other matters

Under the guidelines, the Panel may consider other matters considered relevant to assessing whether the materiality threshold has been met for reassessment of the reliability standard. Other matters considered included:

- Stability and predictability – given the substantial policy uncertainty affecting the national electricity market at present, there is merit in not reassessing the reliability standard to provide a measure of regulatory certainty and stability

- Public discourse regarding the standard – some public commentary about the standard seems to suggest that the standard should in fact be zero unserved energy (i.e. no involuntary load shedding) which would be a tightening of the reliability standard. However, notwithstanding the current level of the standard, EY modelling forecasts the system will provide a level of reliability significantly better than the 0.002 per cent reliability standard in all national electricity market regions, for the review period.
- AEMO's concerns over the suitability of the reliability standard as a statistical expectation.[49] In particular, whether the existing reliability standard is still fit for purpose in an environment with very 'peaky' supply and demand – the Panel notes that a reassessment of the metric for the current reliability standard is outside the scope of this review.[50] This is discussed further in appendix A.6.6.
- Modelling costs of a tighter standard – under base scenario conditions in Victoria (where there is virtually no estimated unserved energy, at 0.000006 per cent, expected in 2020/21), EY modelling indicated that an estimated additional 1,000MW of capacity would be required to be in place in Victoria in 2020/21 to avoid any unserved energy (i.e. an effective zero reliability standard) with the Panel estimating the minimum additional annual wholesale energy cost expected to be recovered from customers to be in the order of $200 million
- Changes in costs of marginal generation – changes in the cost of producing an additional unit of energy to meet otherwise unmet demand are the counter point to the value of customer reliability in the reliability "trade-off" that is embodied in the reliability standard. EY's modelling shows that the marginal generator remains a gas turbine generator with no substantial changes in cost compared to historical levels.

The Panel considered that none of these additional matters provided sufficient evidence that the materiality threshold for a review of the standard was met.

3.2 Conclusion

The Panel does not consider that the materiality threshold for a review of the standard has been met. We acknowledge there are a number of changes and potential changes to market and regulatory frameworks in development that could be relevant to investment decisions and therefore could impact the effect of any revised reliability standard for the near term. However, stability in market frameworks is extremely important in the current environment.

Further, submissions received during the consultation process considered the current level of standard was appropriate and supported keeping the reliability standard at the current level. See appendix section A.4 for detail on stakeholder views with respect to the reliability standard. The Panel will continue to work with AEMO, as appropriate, in relation to the concerns it has raised about the appropriateness of the current reliability

49 AEMO's concerns are described in further detail in its rule change proposal for the *Enhancement to the Reliability and Emergency Reserve Trader rule*. See: https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader

50 For more information, refer to appendix A.6.6

standard as a mechanism to operationally manage reliability in the power system going forward.

The Panel notes that the final decision not to reassess the reliability standard in this review means that from 1 July 2020 the reliability standard would remain unchanged from its current level: a maximum expected unserved energy in a region of 0.002 per cent of the total energy demanded in that region for a given financial year. In other words, the current standard requires that there be sufficient generation and transmission interconnection in a region such at least 99.998 per cent of expected annual demand for electricity in that region will be supplied.[51]

51 Frameworks paper, p. ii.

4 Market price cap and cumulative price threshold

Recommendation	A market price cap of $14,200/MWh ($2017) should apply from 1 July 2020 (indexed annually to CPI). A cumulative price threshold of $212,800 ($2017) should apply from 1 July 2020 (indexed annually to CPI).
Purpose (Appendix sections B.1 and C.1)	**Market price cap**: Seeks to maintain the overall integrity of the NEM by limiting market participants' exposure to **temporary high prices** which could threaten the financial viability of prudent market participants. The market price cap should be set at a level such that prices over the long term incentivise enough new investment in generation so the reliability standard is expected to be met. The market price cap is the maximum bid (and therefore settlement) price that can apply in the wholesale market. **Cumulative price threshold**: Seeks to maintain the overall integrity of the NEM by limiting market participants' exposure to **sustained high prices** which could threaten the financial viability of prudent market participants. The cumulative price cap should be set at a level such that prices over the long term incentivise enough new investment in generation so the reliability standard is expected to be met. The cumulative price threshold caps the total market price that can occur over seven consecutive days.
Specific assessment criteria – rules and Guidelines (Appendix sections B.2 and C.2)	Common to both market price cap and cumulative price threshold:[52] • The Panel may only recommend a MPC [market price cap] or CPT [cumulative price threshold] that it considers will allow the reliability standard to be satisfied without use of AEMO's powers to intervene and, in conjunction with other provisions of the Rules, not create risks which threaten the overall integrity of the market. • If the Panel is of the view that a decrease in the MPC or CPT may mean the reliability standard is not maintained, the Panel may only recommend such a decrease where it has considered any alternative arrangements necessary to maintain the reliability standard. Considerations specific to market price cap:[53] • The MPC should not be used to actively steer the market into a short-run 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. Considerations specific to cumulative price threshold:[54] • The CPT should protect all market participants from prolonged periods

52 Rules clauses 3.9.3A(f) and (g).

53 Guidelines section 3.3.2.

54 Guidelines section 3.4.2.

	of high market prices, with particular consideration to impacts on investment costs and the promotion of market stability. • The CPT should 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.
Analysis (Appendix sections B.4 and C.4)	Analysis in support of the determination of the level of the market price cap and the cumulative price threshold is set out below and further detailed in the respective appendices.

4.1 Maintaining market integrity

The Panel may only propose a market price cap and cumulative price threshold that we consider "will, in conjunction with other provisions of the Rules, not create risks which threaten the overall integrity of the market."[55] Box B.1 in appendix B explains why limiting risk exposure to very high prices benefits market integrity.

The Panel considers that the existing levels of both settings have been effective at limiting market participants' exposure to excessive high prices with the overall market integrity having been maintained. In other words, the Panel considers the current market price cap and cumulative price threshold adequately protect against the creation of risks to overall market integrity and are expected to continue to do so during the review period.

In relation to overall market integrity, the AEMC asked the Panel, as part of its terms of reference for this review, to consider the impact of the level of the reliability settings on the price risk management behaviour including potential impacts on the contracts market and investment outcomes.[56]

The levels of the market price cap and the cumulative price threshold influence the optimal contracting position of a retailer or customer through their impacts on price risk exposure, and thereby influence contract market liquidity.[57] The price caps also limit the 'down side' price risk exposure faced by hedged generators; for each trading interval (the market price cap) and over the period of one week (the cumulative price threshold).

A strong level of participation in the contracts market is important to the overall integrity of the NEM and supports generation investment by providing the stable cash flows needed to underpin financing of high capital cost, long life, generation assets.

- A decrease in the market price cap may:
  - Initially reduce market price volatility making settlements less risky. This may reduce contract incentives and lead to a reduction in contracting, which would

55 Rules, clause 3.9.3A(f).

56 AEMC, Review of the reliability standard and settings - Terms of Reference, p. 6, available at https://www.aemc.gov.au/sites/default/files/content/af27a5fd-c7c1-4771-890d-3f7790c839ee/Reliability-review-2018-Terms-of-Reference-Final.PDF

57 As noted by EY, it is very difficult to assess the impact of changes to the market price cap and cumulative price threshold on the availability of contracts, as there is little data available on the options available for additional contracts under altered price cap. EY report, p. 16.

increase market exposure for generators and may impact financing arrangements.

- On the other hand, an increase in the market price cap may:
  - Stimulate contracting between market participants (driven by increased price risk for uncontracted participants). However, an excessively high market price cap may reduce propensity to contract resulting in increased market risk.

EY explains:

> [A] more volatile market is inherently more risky as the opportunity to extract value is derived from shorter periods of time. The risk of not generating in the short period of time in which significant value is received from the market also makes contracting a higher risk position as the generator has fewer opportunities to recover contract settlements from generating during high price periods. For this reason anecdotal evidence suggests that above a threshold, highly volatile markets result in a reduction in propensity for suppliers to contract as the risk of failing to physically hedge the contractual position becomes too high.[58]

In the Panel's view based on currently available information there is neither a need to lower nor a need to raise the market price cap or the cumulative price threshold in order to avoid the creation of risks that could threaten the overall integrity of the market during the review period.

4.2 Considerations relating to lower market price cap outcomes

The Panel conducted a number of modelling scenarios producing theoretical optimal market price caps for ten different sensitivities. Certain sensitivities produced outcomes indicating the optimal market price cap (and cumulative price threshold) for the review period could be lower than their current levels. These are discussed below, together with a range of relevant considerations.

Other scenarios produced outcomes indicating the optimal levels would be higher – these are discussed in section 4.3.

4.2.1 Outcomes of high cost generation and investment modelling sensitivity

In submissions to this review and the public workshop, consumer representatives argued that lowering the market price cap was in the long term interests of consumers. A lower market price cap would deliver expected unserved energy under, but closer to the reliability standard of 0.002 per cent, the level equivalent to the value consumers place on reliability.

The Panel agrees with the principle that it should consider market price cap outcomes from plausible market price cap modelling scenarios/sensitivities that result in unserved energy under but closer to the reliability standard.

The Panel has considered the outcomes of a number of high cost modelling sensitivities undertaken by EY. EY's primary high cost sensitivity used high assumed costs for

58 EY report, p. 64.

technology and investment to examine the impact of these factors on the theoretical optimal the market price cap. The following 'high cost' assumptions were used for the relevant Victorian sensitivity:

- A high gas price of $18/GJ to represent an upper-bound at the liquid-fuel equivalent price given uncertainty in low-cost natural gas supply for a low utilisation generator.
- Higher capital costs for wind, solar PV and storage.
- A 10 per cent WACC to represent investment uncertainty.
- CCGTs excluded as a candidate marginal new entrant technology due to their inflexibility and the requirement for long-term high volume gas supply.[59]

This sensitivity represents EY's view on a plausible upper bound of generation and investment costs. It suggests a market price cap lower than the current level -- $11,600/MWh under five minute settlement and $12,500/MWh under thirty minute settlement and with no change to the cumulative price threshold– could still allow generation investment sufficient to satisfy the reliability standard.[60] Both values are below the current level of the market price cap.

The outcome of this sensitivity analysis suggests that a market price cap lower than the present one may allow the reliability standard to be satisfied without use of AEMO's powers to intervene. The marginal generator in the sensitivity was found to be an OCGT.

The Panel agrees with EY that the Victorian high cost sensitivity represents a plausible upper bound scenario, and notes that it suggests a market price cap no higher than the present one, and potentially lower, would still be sufficient to deliver capacity such that expected unserved energy is under but close to the reliability standard.

4.2.2 Consumer impacts of a lower market price cap

Residential consumers would not in general experience significantly lower bills with lower market price caps within the range indicated by the modelling results discussed above.

The Panel has forecast the impact of lowering the market price cap to $12,500/MWh on retail residential bills. The analysis suggests that, all else being equal, reducing the market price cap from the present $14,200/MWh to $12,500/MW on annual residential consumer bills to be less than 0.1 per cent under all scenarios. Specifically:

- For EY's base case scenario (with no additional capacity retirements) the reduction on annual consumer bills would be greatest in Southeast Queensland, where the overall effect would be a bill reduction of around $0.06 per annum.

59 See Appendix B for detail.

60 See EY Report, sections 6.2 and 6.7.

- Under the scenario with AEMO's assumption of strong demand and EY's forced outage rates this impact remains less than a $1.40 per annum reduction in consumer bills in the most affected area, led by Southeast Queensland (below 0.1%).[61]

In theory, over any period of time (such as the review period and into the future), a reduction in the market price cap and/or cumulative price threshold, compared to maintaining them (in real terms), will reduce average prices and lead to an increase in the level of unserved energy (as generation capacity retires and is not fully replaced). This is because the wholesale energy market is considered to be workably competitive during the vast majority of dispatch intervals. So that during these workably competitive periods market participants will not be able to influence prices to achieve an outcome significantly above the short run average cost of the marginal generator.

Nevertheless, there will be periods during which transient market power exists and prices can approach or reach the market price cap. It is in these periods that in theory a higher market price cap could allow higher prices to be realised.

Analysis indicates that the number of such periods is extremely limited. For instance, during the twelve months ended 1 March 2018, there were 61 five minute dispatch intervals where the price exceeded $12,500/MWh.[62]

Hence a reduced market price cap would come into play – that is put downward pressure on average wholesale prices – only a small proportion of the year, in the order of 0.06 per cent (61 five minute dispatch intervals based on the year ending 1 March 2018).

Under the Rules the Panel is to have regard to the impact of any proposed changes to the market price cap and cumulative price threshold on spot prices in this review.[63] The Panel recognises that households and businesses are experiencing hardship from rising energy bills.

4.2.3 Market price cap and cumulative price threshold relationship

If the Panel were to reduce the market price cap informed by the outcomes of the Victorian high cost scenario, then the Panel considers that both the market price cap and the cumulative price threshold should be reduced so as to preserve the optimal relationship between the two reliability settings.

The market price cap and the cumulative price threshold share a common purpose. They protect the long term integrity of the market by limiting exposure to high prices. Their impact on new investment in capacity is also connected. The extent to which one cap allows for wholesale revenue sufficient to incentivise new investment depends in part on the level of the other price cap. In recognition of this

61 See Appendix B.4.2.3 for further detail.

62 See Appendix B.4.2.

63 Rules clause 3.9.3A(e)(3)(i).

direct relationship, the Panel considered setting the cumulative price threshold by reference to the level of the market price cap.[64]

By examining a range of market price cap scenarios for this review, we now better understand the relationship between cumulative price threshold and market price cap. A 15:1 relationship appears to maximise the combined efficacy of the market price cap and cumulative price threshold in incentivising market investment.[65]

Retaining the current ratio of cumulative price threshold to market price cap (at approximately 15:1) would suggest that a decrease in market price cap would also require a decrease in cumulative price threshold.

For example, reducing both settings by 5 per cent would achieve the same modelled outcome as solely lowering the market price cap to $12,500/MWh. The 5 per cent reduction would result in a market price cap of $13,000/MWh and a cumulative price threshold of $200,000/MWh and maintain the (optimal) current ratio of 15:1 between the cumulative price threshold and market price cap. Such an approach would be consistent with the requirement in the guidelines for any change to the levels of the market price cap to be gradual.[66]

4.2.4 Modelling limitations and risks

Wholesale market modelling can be immensely useful to decision makers. However no matter how good a model is, as models only approximate reality, they will inevitably have limitations. To use models well, decision makers need to acknowledge the extent, and impact, of a model's limitations when using modelled outcomes to guide decisions.

The market price cap modelling for this review had the following key limitations:[67]

- New entrant generator financial modelling was limited to the four year review period and does not cover the economic life of the assets.
- Modelling of scenarios where the reliability standard was threatened involved retirement of high utilisation thermal generation capacity. Situations with a different generation mix may deliver different market price cap outcomes.
- The modelling assumptions broadly replicate market operation. However, they may not capture real market events and specific generator responses.
- Market price cap outcomes are sensitive to the market price forecast, which are directly attributable to the assumed generator portfolios and associated bidding strategies.
- The majority of modelling assumes a thirty minute basis.

EY also highlighted that other factors critical to investment and project decisions lie outside the scope of the modelling of the theoretical optimal market price cap.[68]

64 Guidelines section 3.4.2.

65 EY Report p.5 and section 6.3.

66 Guidelines section 3.3.2.

67 EY Report p. 3

These relate to the commercial and physical operation of proposed investment and may include, but not be limited to:

- Ability to secure a suitable contract for sale of electricity.
- Ability to secure a fuel source under suitable terms and conditions.
- Technical ability to capture transitory high market price events.
- Connection agreement limitations.
- Risk of competing generation developments.

On the significance of the modelling limitations and these other factors, the Panel notes EY's view that:

> [t]aking into account the modelling limitations and other factors considered in real-world investment and project delivery decision making, the lower MPC outcomes of $11,600/MWh and $12,500/MWh are in line with the present market price cap setting of $14,200/MWh.[69]

4.3 Considerations relating to higher market price cap outcomes

4.3.1 Outcomes of other modelling scenarios

There were several scenarios/sensitivities modelled under which a materially higher market price cap (and cumulative price threshold) would be needed to allow for generation investment to satisfy the reliability standard.[70]

4.3.2 Incentives for demand response

While some stakeholders, for instance Engie, argued for a higher market price cap on the basis that it may provide a greater incentive for demand response, it is not the function of the market price cap to incentivise any particular technologies. Rather than raising the market price cap for this reason, it would be preferable to tailor specific approaches to allow existing price signals to incentivise demand response. As part of the Reliability Frameworks Review, the AEMC is considering developing options that would facilitate demand response in the wholesale energy market.[71]

More generally, EY noted there was insufficient information on the cost of implementing new demand side participation (or pumped storage projects) to comment on the potential for these types of projects to become a marginal source of reducing unserved energy to within the reliability standard.[72] Further information

68 EY Report p. 65

69 EY Report p. 6

70 EY Report pp. 5-6.

71 Information available at: https://www.aemc.gov.au/markets-reviews-advice/reliability-frameworks-review.

72 EY Report, p. 6.

is likely to become available for future reviews in relation to demand response, as outlined in section 8.4.

4.3.3 Historical levels of unserved energy and AEMO interventions

Based on information currently available there does not appear to be a case for raising the market price cap on the basis of historical levels of unserved energy or the number of reliability-related AEMO interventions. It appears unlikely that the present level of the market price cap and cumulative price threshold has interfered with efficient market investment.

While the reliability standard is a forward-looking measure of the *expected* level of unserved energy, it is worthy of note that since the market price cap was last increased in real terms on 1 July 2010, through to June 2017, the amount of unserved energy in each region of the national electricity market has been below the reliability standard of 0.002 per cent.[73]

In 2016/17, at a wholesale level, 0.00036 per cent unserved energy from events that the rules define as reliability events was recorded in South Australia. This is well within the reliability standard. At a wholesale level, there was no other unserved energy recorded due to reliability events for any other region in the NEM. Prior to 2016/17, the last case of any unserved energy occurred in 2008/09.[74]

Several stakeholders asked the Panel to examine the reasons driving the apparent increase in AEMO's interventions in the market, as the market price cap and cumulative price threshold must be set so that the reliability standard can be satisfied without the need for AEMO to issue directions to participants and use the RERT, overriding the outcomes that would have occurred in the market.[75]

The Panel's view is that neither the use of AEMO's directions powers nor the recent use of the RERT indicate a need to raise the market price cap or the cumulative price threshold.

Between 9 October 2016 and 31 March 2018 only three of the 31 instances of the use of AEMO directions powers were initially prompted by a shortfall in capacity.[76] The Panel considers that in each case the expected revenue provided by the market price cap was adequate to provide an incentive for relevant generating units to be made available. Therefore we conclude that these events do not suggest a need to alter the level of the market price cap or the cumulative price threshold.

The Panel also notes the RERT was recently activated twice in Victoria, on 30 November 2017 and 19 January 2018, to maintain the power system in a reliable operating state. In both instances reserves were dispatched for six hours.[77] The Australian Energy Council notes that on both occasions:

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73 Panel, *2017 Annual market performance review*, 20 March 2018, p. xvi - xvii.

74 Panel, *2017 Annual market performance review*, 20 March 2018, p. xvi.

75 Rules clause 3.9.3A(f)(1).

76 These were on 8 February, 9 February and 1 March 2017 in South Australia. See Appendix B.5.

77 AEMO, Market Notice - RERT activated, 30 November 2017.

> AEMO anticipated a high demand peak and dispatched several providers with long notice periods and minimum run times. On each day the demand subsequently fell below AEMO's forecast, and, in hindsight, the dispatch proved unnecessary.[78]

The full details on these RERT activities are not yet public with AEMO obliged to publish a report by mid-2018.

Prior to these two events the RERT had only been procured three times, and had never been dispatched.

4.4 Other matters

4.4.1 Importance of stability and predictability

The Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework. The guidelines direct the Panel to 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.[79]

The Guidelines determination further discusses the value of stability:

> The standard and settings inform decisions 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.[80]

The Panel has considered the value of stability and predictability in the market price cap and cumulative price threshold in the context of the current developments and uncertainties in the national electricity market and the energy sector generally. Market participants and potential investors are factoring into their business models developments including: rapid technological change; the potential introduction of the National Energy Guarantee; five minute settlement; the growth of distributed energy resources; advances in demand response; and government-sponsored generation projects.

Stakeholders who commented on these issues have a range of views on how current market uncertainty impacts on the level of at which the market price cap should be set – see Appendix section B.3.1 for further details.

The Panel recognises the impact that rapid technological change and policy uncertainty are having on consumers, market participants and the broader investment community. Policy uncertainty, in particular regarding the integration of emissions reduction and energy policy, is constraining the investment environment, and potentially raising risk premiums and costs to consumers.

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78 Australian Energy Council, The RERT locker, March 2018, accessed at: https://www.energycouncil.com.au/analysis/the-rert-locker/ on 6 April 2018.

79 Guidelines p. 3.

80 Guidelines determination, p. 20.

The Panel does not wish to unnecessarily exacerbate these negative impacts. We have therefore weighted our decisions in this review in favour of supporting certainty and stability in the national electricity market. The Panel considers there is value for market participants and consumers in maintaining policy stability, where warranted.

4.4.2 Stakeholder comments

Stakeholder views differed on the appropriate level of a market price cap. Several stakeholders argued for a lower market price cap, as outlined earlier. Through the review process several stakeholders supported the current level and one stakeholder argued for a higher market price cap.

Stakeholder views on the cumulative price threshold mirrored those on the market price cap.

See appendix sections B.3 and C.3 for detail on stakeholder views with respect to the market price cap and cumulative price threshold

4.5 Conclusions

The Panel's key conclusions are that the present levels of the market price cap and cumulative price threshold are each sufficiently low to serve the purpose of limiting market participants' exposure to very high prices (temporary and sustained, respectively) and thereby safeguard the overall integrity of the market.

The current level of the settings are also likely to continue to be sufficiently high to allow investment in enough generation so there is not more expected unserved energy than that allowed for by the reliability standard without the use of AEMO's powers to intervene.

The Panel has considered the case for lowering the market price cap alone, and the case for lowering both the market price cap and the cumulative price threshold. Based on the outcomes discussed in sections 4.2.1 and 4.2.3, of the two options if the Panel was to recommend a lowering, the Panel's preference would be to reduce both reliability settings, each by 5 per cent, equating to a market price cap of $13,000/MWh and a cumulative price threshold of $200,000/MWh.

On balance the Panel has concluded that the potential benefits in terms of reduced costs to consumers of lowering the market price cap to $13,000/MWh and the cumulative price threshold to $200,000/MWh do not outweigh the long term risks associated with not having investment signals sufficient to incentivise investment in new capacity to achieve the reliability standard through the review period.

The consumer benefits of a $12,500/MWh market price cap are estimated to be less than 0.1 per cent of residential bills under all scenarios. However, lowering the caps based on the modelling outcomes carries the risk of insufficient price signals for new investment and the reliability standard being exceeded as a result. EY considers that taking into account modelling limitations and uncertain factors associated with investment and project decision making, the lower market price cap and cumulative price threshold modelling outcomes are consistent with the present market price cap and cumulative price threshold settings. The rules establish that the Panel may only recommend a market price cap and cumulative price threshold

that we consider will satisfy the reliability standard for the period of the review without the use of AEMO's intervention powers.

The Panel notes that not all modelling outcomes indicated a lower optimal market price cap and cumulative price threshold. There are several scenarios that could result in the need for a materially higher market price cap to sufficiently incentivise investment to satisfy the reliability standard.

The Panel therefore recommends retaining the present levels of the market price cap and the cumulative price threshold from 1 July 2020 (in real terms) as they are set at levels appropriate to supporting reliability in the NEM.

We consider keeping the settings at their present real levels will promote efficient investment in electricity services for the long term interests of consumers, and thereby further the national electricity objective.

The Panel notes that many factors independent of the market price cap and cumulative price threshold that cannot be factored into market modelling may impact on people's willingness to invest and thereby affect the actual level of unserved energy experienced.

5 CPI indexation of the market price cap and cumulative price threshold

Recommendation	The use of CPI for annual indexation should not be subject to reassessment in this review (i.e. it should continue to be used)[81] because there is not sufficient evidence that the materiality threshold for its reassessment was met.
Purpose of indexation (Appendix section D.1)	To preserve the real values of the market price cap and the cumulative price threshold over time.
Specific assessment criteria – Guidelines (Appendix section D.2)	The annual indexation of the market price cap and cumulative price threshold is not subject to review.[82] The market price cap and cumulative price threshold will continue to be indexed using the CPI, unless the materiality threshold for reassessing this approach is met. The Panel is to 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 changes in the methodology used to calculate the CPI • a more preferable index becomes available and/or there is a change in the designation of the CPI as an official statistic.[83]
Analysis (Appendix section D.4)	Analysis in support of the materiality assessment for the use of CPI indexation for the market price cap and cumulative price threshold is set out below and further detailed in the appendix.

5.1 Key issues

The Panel considered the assessment criteria as follows:

Changes in the basket of goods used to calculate CPI

- In Australia, the CPI measures the changes in the price of a fixed basket of goods and services, acquired by household consumers who live in the eight State and Territory capital cities. The CPI is calculated by the Australian Bureau of Statistics.[84]
- While weights associated with individual good and services categories are adjusted from time to time, there have not been any material changes in the basket of goods and services that make CPI less relevant for the indexation of the settings.[85]

81 Rules clauses 3.9.4(d) and 3.14.1(e) currently require the market price cap and cumulative price threshold to be indexed using CPI. CPI has been used for indexation of these settings from 2012.

82 Guidelines section 3.7.1.

83 Guidelines section 3.7.2.

84 See: Australian Bureau of Statistics (ABS) 2018, Consumer Price Index FAQs, http://www.abs.gov.au/websitedbs/D3310114.nsf/home/Consumer+Price+Index+FAQs, accessed 20 April 2018.

- The impact of any long-term deviations of CPI from the actual cost of generation capacity is mitigated by the fact that reliability settings are reviewed every four years.[86]

Changes in the methodology used to calculate CPI

- The Australian Bureau of Statistics reviewed the CPI in December 2017 and made a range of minor enhancements.[87]
- However, the Panel considers that these CPI enhancements do not make the CPI less relevant for the indexation of the settings.

Changes in the designation of the CPI as an official statistic

- No changes in the designation of the CPI as an official statistic were found.[88]

More preferable index

- Bearing in mind the purpose of indexation as noted above, neither the Panel nor stakeholders have identified a more preferable index.
- While one stakeholders queried the purpose of indexation and suggested that indexation could be used as a "glide path" to reduce the level of the market price cap and cumulative price threshold over time, this is not within the scope of the review.

Further details of the analysis against the assessment criteria are in Appendix section D.4.

Stakeholders made limited comments on indexation, which are discussed in Appendix section D.3. Some stakeholder comments went to the purpose and application of indexation. They were thus out of scope for this review, but could be raised in a future review of the guidelines. One stakeholder supported continued indexation of the MPC and CPT using the CPI.

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85 The CPI is regularly updated to reflect changes in consumer buying habits, or shifts in population distribution and demographics. ABS 2018, Consumer Price Index FAQs, http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Consumer+Price+Index+FAQs#Anchor7, accessed 16 April 2018.

86 Issues paper, p. 58.

87 See: http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6470.0.55.001Main%20Features32017?opendocument&tabname=Summary&prodno=6470.0.55.001&issue=2017&num=&view=, accessed 16 April 2018.

88 "The CPI is an important economic indicator used in formulating monetary policy and in a wide range of business, economic and social analysis and decision-making." ABS, 2018, http://www.abs.gov.au/Ausstats/abs@.nsf/0/CFFA42B90CA68CD2CA25765C0019F281?OpenDocument, accessed 16 April 2018.

5.2 Conclusion

Having considered the assessment criteria and stakeholder comments, there is no evidence to suggest that the materiality threshold for a reassessment of the use of CPI for the annual indexation of the market price cap and cumulative price threshold was met. The Panel notes:

- There has not been a material change in the basket of goods and services used to calculate CPI.
- Changes in the methodology used to calculate CPI have not made the CPI less suitable for the indexation of the settings.
- A more preferable index has not become available and there has not been a change in the use of CPI as an official statistic.
- The continued use of CPI brings stability and predictability, in accordance with the general assessment principles for the Panel's review.[89]

89 Guidelines, p. 3.

6 Administered price cap

Recommendation	An administered price cap of $300/MWh in nominal terms should apply from 1 July 2020.
Purpose of administered price cap (Appendix section E.1)	The administered price cap is the price 'cap' that applies when the cumulative price threshold is exceeded. It seeks to maintain the overall integrity of the NEM by limiting market participants' financial exposure to sustained high prices, while maintaining incentives for participants to supply energy during the period of trading after the cumulative price threshold is exceeded, i.e. an administered price period.
Specific assessment criteria – Guidelines (Appendix sections E.2 and E.3.)	The level remains as in the previous review unless the materiality threshold for its reassessment is met. To assess materiality, the Panel is to consider whether, since the last review, there have been any: • significant changes in the typical short-run marginal costs of generators in the NEM • compensation claims.[90]
Analysis (Appendix sections E.5 and E.6)	Analysis in support of the materiality assessment and determination of the level of the administered price cap is set out below and further detailed in the appendix.

6.1 Key issues

The Panel reviewed the administered price cap in this review as we considered the materiality threshold for its reassessment is met.[91]

To assess the actual level of the administered price cap we considered factors including but not limited to:

- the expected short run marginal costs of high marginal cost, low utilisation generators
- potential impacts on consumers
- fuel price volatility
- the benefits of stability in promoting efficient investment.

The Panel's views were also informed by stakeholder comments and EY's modelling results.

No substantial increase in short run marginal costs

EY's modelling, based on assumptions outlined in Appendix section H.1, confirmed that the highest marginal cost generators in the national electricity market over the review period continue to be OCGTs. EY's assessment of high cost OCGTs concluded that there has not been an increase in the short run marginal costs of these units. At

90 Guidelines section 3.6.2.

91 For more information, refer to appendix E.5

present all 19 OCGT power stations in the national electricity market were assessed to have short run marginal costs under $300/MWh (June $2017).[92]

EY assessed that, based on modelling cost inflation assumptions out to 2024, six of the 19 candidate generators will require a market price higher than the present administered price cap throughout most of the review period. Therefore, if an administered price period were in place and those generators were dispatched during that period, six generators could be candidates for compensation. In regard to magnitude of potential claims, EY notes that this represents less than 2 per cent of dispatchable capacity in the national electricity market.[93] The modelling outcomes also show that administered price periods (and thereby opportunities for compensation claims) are likely to be rare under normal market conditions.

Minimising costs to consumers

The level of the administered price cap affects consumer prices as it is the maximum wholesale price faced by retailers during times of sustained high prices. The administered price cap, currently a fraction (just over 2 per cent) of the market price cap, limits wholesale prices when the cumulative price threshold is exceeded.

There is an inherent asymmetry in the cost impacts of the administered price cap on consumers as opposed to generators; all customer demand is exposed to the administered price cap while only generators whose short run marginal costs exceed the administered price cap are potentially impacted (through the risk of financial loss if their compensation claim is not fully successful).

Given these relative cost impacts, on balance the Panel considers it preferable to allocate this cost risk to a limited pool of high marginal cost generators, given their potential access to compensation, and thereby limit the exposure of all customers to higher sustained prices through a higher administered price cap.

Address fuel price volatility through compensation

The Panel recognises that fuel prices may exceed the $18/GJ assumption used in this review. However, we would consider such price increases to be temporary rather than structural. The Panel proposes to adopt the approach suggested by ERM Power in its submission to the Issues Paper: that volatility in fuel prices during the review period should be addressed through the compensation mechanism.[94]

Promoting stability and predictability

The Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework.[95]

ERM Power and EnergyAustralia both commented that any material benefits potentially derivable from changing the administered price cap are overshadowed by larger uncertainties in the investment environment.[96]

92 EY report, p. 19.

93 For more information, refer to appendix E.6.1.

94 For more information, refer to appendix E.6.3.

95 Guidelines p. 3.

6.2 Conclusion

Following consideration of stakeholder submissions to the issues paper, the Panel's view was that the materiality threshold for the reassessment of the administered price cap was met.

Having conducted this reassessment and following stakeholders' submissions to the draft report, the Panel's final recommendation is to retain the present administered price cap setting of $300/MWh, for the following reasons:

- **No increase in short run marginal cost** – there does not appear to be strong evidence of a substantial, permanent increase since 2008 in the short run marginal costs of low utilisation generators.

- **Minimise costs to consumers** – costs to consumers can be minimised by using the current compensation mechanism for those generators that are dispatched during an administered price period with a short run marginal cost above the administered price cap, rather than exposing all consumers to prices close to the highest short run marginal cost of generators.

- **Address fuel price volatility through compensation** – generators can recoup losses where their short run costs are above the administered price cap due to temporary factors, such as increases in fuel prices, through compensation.

- **Promote predictability and stability** – leaving the administered price cap unchanged provides predictability and stability to the national electricity market, supporting efficient investment.

The Panel concurs with EY's conclusion that a $300/MWh administered price cap:

> …appears to strike a reasonable balance between limiting price risk for customers whilst limiting the risk of need for compensation or direction to relatively few generator suppliers with an SRMC that exceeds this value.[97]

The stakeholders that commented on the administered price cap in this review supported retaining the current level of the administered price cap. See appendix section E.3 for detail on stakeholder views with respect to the administered price cap.

The Panel notes EY's comments on the potential future need of indexation of the administered price cap to address its effective decline in real terms. In 2016 the Panel determined that indexation of the administered price cap should not be considered in this and future four yearly reviews.[98] We consider that factors other than inflation may have a greater impact on the appropriate level of the administered price cap, such as the cost of fuel and the operation and maintenance costs of power generation units in the

96 For more information, refer to appendix E.6.4.

97 EY report, p. 6.

98 Guidelines, section 3.7.1: 'It is confirmed in these guidelines that MPC and CPT are subject to annual indexation and the MFP and APC are not subject to indexation. This will not be opened for reconsideration in future reviews.'

NEM.[99] The administered price cap can be reviewed every four years and as such can be adjusted if the Panel at that time so recommends, given the absence of annual indexation.

99 These factors were suggested in the Guidelines determination, p. 42. The Panel further noted "There is no need to apply minor increases to the levels of these settings [the administered price cap and the market floor price]. 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 failure to maintain their real value is unlikely to impede efficient market function." Guidelines determination, p. 42. That is the function of the administered price cap is to cover the short run marginal cost of the majority of generating units while limiting customers' exposure to prolonged high prices.

7 Market floor price

Recommendation	The market floor price was not subject to reassessment in this review as there was insufficient evidence that the materiality threshold for its reassessment was met. The market floor price will remain unchanged at -$1,000/MWh, from 1 July 2020.
Purpose of market floor price (Appendix section F.1)	Prevents market instability by imposing a negative limit on market prices in any trading interval, while allowing the market to clear during low demand periods. The market floor price should be set at a level that does not interfere with generators being able to differentiate themselves according to the value they place on being dispatched by bidding at negative prices during periods of excess generation.
Specific assessment criteria – rules and Guidelines (Appendix section F.2)	The Panel may only recommend a market floor price which it considers will allow the market to clear in most circumstances and will not create substantial risks which threaten the overall stability and integrity of the market.[100] The level remains as in the previous review unless the materiality threshold for its reassessment is met. The Panel is to consider: • the number and frequency of trading intervals where the market price has been, or has approached, the level of the market floor price • whether there have been significant changes in the generation fleet, such that average generator cycling costs have changed significantly.[101]
Analysis (Appendix section F.4)	Analysis in support of the materiality assessment for the market floor price is set out below and further detailed in the appendix.

7.1 Key issues

At times of excess generation, generators are able to differentiate themselves according to the value they place on being dispatched by bidding negative prices. The generators with the most negative bids are usually dispatched first. The market floor price should be set at a level so that it does not interfere with this efficient outcome.

The Panel considered the following factors to determine whether the materiality threshold for a reassessment of the market floor price was met:

- The number and frequency of trading intervals where the market price has been equal to, or has approached, the level of the market floor price.
- Whether there have been significant changes in the generation fleet, such that average generator cycling costs have changed significantly.
- Promoting stability and predictability.
- The effect of the market floor price on the viability of storage technologies.

100 Rules clause 3.9.3A(h).

101 Guidelines section 3.5.2.

Occurrences where the market price has been, or has approached, the market floor price

The Panel identified that market floor price events (and low price events more generally) related to excess generation occur infrequently in the market.

There has not been a sustained increase in the number of trading intervals with low price events (i.e. prices below -$900/MWh) driven by excess generation. From 2015 to 2017 there were 84 such events, which is fewer than the 139 events observed in the three year period between 2010 and 2012.[102]

Changes in the generation fleet impacting generator cycling costs

At times of low demand and excess generation, generators are able to differentiate themselves according to the value they place on being dispatched by bidding at negative price levels. This allows the market, through the value being placed on being dispatched, to determine which generators remain dispatched during periods of excess generation (to avoid cycling costs) and then what generators are constrained off to maintain demand/supply balance. The market floor price should be set a level so that it does not interfere with this efficient outcome.

Analysis completed by ROAM Consulting (now EY) in 2014, showed that prices could fall sufficiently low, with the market floor price at the same level as it is currently, to give an economic signal to every generator (from the lowest cost to cycle to the highest cost to cycle).

The Panel has found no evidence that changes in the generation fleet are causing a significant change in the range of generator cycling costs. The costs of startup/shutdown for large coal fired generators (which incur the highest costs of startup/shutdown) are a function of their design and will not have moved greatly from the values determined in 2014.[103]

Therefore, the current level of the market floor price does not impede the efficient cycling of generators - it allows thermal generators with different cycling costs to sufficiently differentiate themselves through their negative bids.

Promoting stability and predictability

Under the Guidelines, the Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework. The Panel is to 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.[104]

With present levels of uncertainty in the market, providing stability to market participants may support efficient investment and operational decisions by participants.[105]

102 For more information refer to appendix F.4.1.

103 For more information refer to appendix F.4.2.

104 Guidelines p. 3.

105 For more information refer to appendix F.4.3.

Effect of the market floor price on the viability of storage technologies

During a period where there is excess generation (and prices are negative), storage technologies can charge and so increase the headroom for generation to remain online. The stored energy can be discharged later when there is more demand (and prices are positive) yielding a profit to the owner of the storage device.

The availability of storage can therefore affect the ability of the market to clear during low demand periods and is relevant to the purpose of the market floor price. It can therefore be an important parameter for sending price signals to storage technologies.

To provide value at times of excess generation, storage technologies must be able to offer a cheaper alternative than cycling conventional generation. Consideration of the market floor price should therefore include consideration of cycling costs of conventional generation, costs of operation of storage, and indeed anything that bears on the ability of the market to clear during low demand periods.

At this stage, there is insufficient evidence to indicate the current level of the market floor price is distorting the efficient clearing of market at times of low demand. However, as storage technology continues to mature, we anticipate that consideration of the interplay between storage and cycling of conventional generation will become increasingly important to the setting of the market floor price.[106]

7.2 Conclusion

Following consideration of stakeholder submissions and the analysis summarised above, the Panel considers there was no evidence to suggest that the materiality threshold for a reassessment of the market floor price was met. Market floor price events (and low price events more generally) related to excess generation occur infrequently in the market; over the past eight years a sustained trend has not been observed. Nor is there evidence that changes in the generation fleet are causing a significant change in the range of generator cycling costs.

As a result the present level of the market floor price will be retained from 1 July 2020. See appendix section F.3 for detail on stakeholder views with respect to the market floor price.

106 For more information refer to appendix F.4.3.

8 Recent and upcoming developments

The review of the reliability standard and settings is informed by forecasts of market conditions seven years into the future. Development of these long-term forecasts is particularly challenging at this point in time.

In conducting this review, the Panel has considered the significant uncertainty and change underway in the national electricity market, and the attendant implications for reliability over the review period.

8.1 The current context

8.1.1 Emerging and persistent trends

The emerging and persistent trends in the physical power system and the national electricity market particularly relevant to this review include the following:

- **Continued retirement of thermal generation** – the trend of withdrawal of thermal, scheduled generation from the market has continued since 2012.
- **Increasing penetration of renewable, intermittent generation** - as wind and solar PV form an ever-larger part of the generation mix, their output in certain regions may at times impact price outcomes, and there is more focus on the availability characteristics of different forms of electricity generation and potential impacts on reliability.
- **Emergence of new technologies** - new technologies, including small scale solar PVs, battery storage and demand response, are emerging that:
  - may alter the profile of demand for electricity sourced from the grid
  - may offer new options for supply of energy and demand reductions.
- **Coupling of gas and electricity prices** - increased use of gas as a fuel for power generation is strengthening the connection between the gas and electricity markets. A comprehensive discussion of these trends can be found in the issues paper for this review.

8.1.2 Uncertainty

Uncertainty is another feature of the current investment and market environment. There are a number of drivers of this uncertainty.

The Panel notes the Australian energy sector has suffered from investment uncertainty arising from the sustained absence of national, coordinated policy integrating emissions reduction and energy. This uncertainty has potential impacts on the reliability framework. The Panel notes that the COAG Energy Council has recently agreed for the Energy Security Board to progress development of the detailed design of the National Energy Guarantee (see section 8.3).

There is also uncertainty due to variability in and, in some cases, lack of detailed information on:

- the nature, extent, rate of technological change and the pattern of use of the new technologies
- the absolute and relative costs of generation technologies, and demand-side responses
- the price and availability of gas
- long term weather patterns due to climate change (for instance more frequent, contiguous hotter days).[107]

The pace, scale and fragmentation of government policy announcements and interventions in the market are also contributing to this uncertainty. State governments and the Australian Government are investing in new generation and storage projects such as the 100MW South Australian battery[108], the Queensland Government's 400MW large-scale renewable energy reverse auction with 100MW storage[109], and the proposed Snowy Hydro 2.0.[110] There have been numerous reviews commissioned (such as the Finkel Review), and a range of new regulatory approaches proposed (such as the National Energy Guarantee and the South Australian Energy Minister's intervention powers).[111]

To facilitate the transformation underway in the power system, the AEMC is currently undertaking reviews and has made and is considering rule changes that, if made, would represent substantial changes to the market framework. Most notably, on 28 November 2017 the AEMC made a final rule to change the settlement period for the electricity spot price from 30 minutes to five minutes, starting in 2021.[112] The

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107 The Panel notes that evidence suggests that global climate change is driving an increase in temperatures over time and an increase in the frequency and intensity of extreme events including heat waves (for more information see: *Climate Change in Australia*, https://www.climatechangeinaustralia.gov.au/en/climate-campus/australian-climate-change/australian-trends/).
The impact of these trends on reliability out to 1 July 2024 has been addressed in this review through the use of six recent reference years (capturing gradual temperature increases) and the use of strong demand forecasts (on the demand side) and high outage rates (on the supply side).
The increase in extreme events is expected to continue and worsen post the review period. In the future, higher extreme temperatures may in turn lead to greater levels of demand and higher forced outage rates than have been historically observed. At its next review the Panel will assess whether the modelling approach adopted for this review remains appropriate or whether more extreme sensitivities need to be considered.

108 Neoen, *Hornsdale Power Reserve*, accessed at: https://hornsdalepowerreserve.com.au/ on 18 April 2018.

109 Queensland Government, *Renewables 400,* accessed at https://www.business.qld.gov.au/industries/mining-energy-water/energy/renewable/projects-queensland/renewables-400, 18 April 2018.

110 SnowyHydro, *Snowy 2.0,* accessed at: http://www.snowyhydro.com.au/our-scheme/snowy20/, 18 April 2018.

111 Government of South Australia, *Local powers over national market,* accessed at http://ourenergyplan.sa.gov.au/local-powers.html, 18 April 2018.

112 Sun Metals Pty Ltd submitted a rule change request to reduce the time interval for settlement in the wholesale electricity market from 30 minutes to five minutes. The new rule involves compulsory five minute settlement for generators, scheduled loads and market interconnectors. Demand side

Reliability Frameworks Review is looking at ways to deliver a reliable power system at the lowest cost. It includes consideration of several recommendations from the Finkel Panel's Independent Review into the Future Security of the National Electricity Market that relate to reliability.[113]

In September 2017, AEMO published an updated *Electricity Statement of Opportunities* and provided Ministerial advice on dispatchable capacity.[114] AEMO's views and forecasts have subsequently been augmented in the following documents:

- AEMO's submission to the Reliability Frameworks Review [115]
- Advice to the Commonwealth relating to AGL's proposal to replace Liddell, letter to Minister Frydenberg.[116]
- Proposal for an enhanced reliability and reserve trader (RERT), a rule change request to the AEMC.[117]

8.2 The Panel's approach for this review

The Panel recognises the complex context in which it conducted this review, and adopted the following principles in response to the change and uncertainty in the market:

1. **Model the changing market** – As described in section 2.5, wholesale market modelling for this review informed the Panel's recommendations on the reliability standard and settings. The model the Panel has used is technology-neutral including:
    - Utilising a sophisticated approach to modelling wind and solar assets (large scale and behind the meter).
    - Estimating the contribution to reliability from battery storage.
    - Assessing the market price cap on the basis of the cheapest marginal technology from a range of options.[118]

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participants in the wholesale market, including retailers and large consumers, could choose to be settled on either a five or 30 minute basis. See AEMC, *Five Minute Settlement, final determination*, 28 November 2017, Sydney, available at www.aemc.gov.au.

113 For more information, see: https://www.aemc.gov.au/markets-reviews-advice/reliability-frameworks-review

114 AEMO, *2017 Electricity Market Electricity Statement of Opportunities*, September 2017, Melbourne, and AEMO, *Advice to the Commonwealth Government on dispatchable capacity*, September 2017, Melbourne.

115 Available at: http://www.aemo.com.au/Media-Centre/AEMO-observations---operational-and-market-challenges

116 Available at: http://www.aemo.com.au/Media-Centre/AEMOs-liddell-response.

117 Available at: https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader.

118 Previous reviews assumed the marginal generator was an OCGT. The modelling for this review does not presuppose a single, optimal technology. Instead it provides an optimal mix of technologies as an output of the model. For instance, it assesses the market price cap on the basis of the cheapest marginal technology that can be used to deliver the standard, incorporating not just one, but multiple possible new-entrant technologies (including grid-scale batteries).

- Addressing investment decisions about both new generation and retirements.

2. **Use sensitivity analysis –** The Panel tested the robustness of forecasts through extensive sensitivity and scenario analysis. Sensitivities were applied to test how different assumptions and forecasts impact on reliability, investment and price outcomes. We examined differing levels of demand, technology costs, gas prices, thermal generator outage rates and, to examine the impact of investment uncertainty, different levels of the weighted average cost of capital and asset life.
3. **Only incorporate confirmed policy and projects** - The modelling only incorporates government projects and policies that are certain and will come into effect within the review period. For example, policy changes that have been adopted in legislation and projects with funding committed.[119] For this review, EY has completed modelling which investigates the effects of five minute settlement, refer to section 6.7 of the EY report.
4. **Monitor future developments –** There are future market or policy conditions that may have a material bearing on the effectiveness of the reliability standard and settings recommended by the Panel, including the National Energy Guarantee and the AEMC's *Reliability framework review*.[120] Depending on the significance of the changes, a reassessment of the findings of this review prior to the next four-yearly review might be required– see section 8.3 of this report.
5. **Value stability and predictability** - While the rules require the standard and settings to be reviewed at this time, the Panel remains cognisant of the need to support stability and predictability in the market wherever possible, as noted in the guidelines. This is central to efficient investment over the long term, a key pillar of the national electricity objective.

The model for this review has a sophisticated approach to modelling renewable technologies. In particular the output of a new wind farm is based on the actual observed wind 'resource' at that location. Battery charging and discharging operations are optimised for arbitrage opportunities. Also the model did not focus only on new entrant generation. Retirement is an important driver of reliability and has been incorporated into the model through analysis of the commerciality of existing plants through the review period, and additionally a range of sensitivities that vary the amount of retirement as retirement decisions are typically driven by factors that are highly uncertain. See EY report.

119 Refer to Appendix H which details the principal assumptions.

120 This is a requirement under section 2.5 of the review's Terms of Reference, which can be found at http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Standard-and-Settings-Review-2018. For more information on the *Enhancement to the Reliability and Emergency Reserve Trader* rule change proposed by AEMO refer to the project page: https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader. For more information on the *Reinstatement of Long Notice Reliability and Emergency Reserve Trader* rule change proposed by AEMO refer to the project page: https://www.aemc.gov.au/rule-changes/reinstatement-long-notice-reliability-and-emergency-reserve-trader. For more information on the AEMC's *Reliability frameworks review* refer to the project page: https://www.aemc.gov.au/markets-reviews-advice/reliability-frameworks-review.

8.3 Potential for interim review if Guarantee is adopted

The terms of reference for the review require the final report for the review to:

- outline any future market or policy conditions that are likely to have a significant bearing on the effectiveness of the reliability standard and settings recommended by the Panel
- recommend responses the Panel considers necessary should these conditions arise, such as requiring a reassessment of the findings of the 2018 Review prior to the next four-yearly review.[121]

The Panel considers that the National Energy Guarantee, if adopted, may have a significant bearing on the effectiveness of the reliability standard and settings. Depending on the final design of the Guarantee, the function of the existing reliability standard and settings, as well as their required level, could potentially be affected. The Guarantee is outlined in Box 8.1, below.

On 20 April 2018 the COAG Energy Council noted the high-level design proposal for the Guarantee, and agreed for the Energy Security Board to progress development of the detailed design of the Guarantee.[122]

However, the final detailed design of the Guarantee was not known at the time this final report on the review was completed.

Until detailed Guarantee design elements have been approved by the COAG Energy Council, the Panel cannot assess the optimal level of the reliability standard and settings in light of the Guarantee.

Therefore, the potential impacts of the Guarantee could not be considered in the course of this review.

Consideration of the impacts of the Guarantee could, however, occur in a subsequent review, either the next scheduled four-yearly reliability standard and settings review in 2022 (in respect of settings for the period 2024-2028), or an interim review (which may be in respect of settings for a different period).

The AEMC may instruct the Panel to conduct an interim review of the reliability standard and settings, or any subset of them, prior to the next scheduled review.[123] This would not affect the requirement to conduct the scheduled review in 2022.

An interim review of this kind would not be a formal reliability standard and settings review for the purposes of rules clause 3.9.3A, as those are to be conducted every four years.[124]

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121 Terms of reference section 2.5.

122 COAG Energy Council meeting communique, 20 April 2018, available at: http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/16th%20COAG%20Energy%20Council%20Communique.pdf.

123 Depending on the circumstances, it may be appropriate for such a review to be given a more limited scope, and to be conducted in a shorter timeframe, than the full reliability standard and settings review under rules clause 3.9.3A.

124 Rule 3.9.3A(d) states that "By 30 April of each fourth year (with the first four year period ending in 2014), the Reliability Panel must: (1) conduct the reliability standard and settings review…".

However, considering whether recent developments in the market indicate that the reliability standard or a reliability setting should be adjusted is within the general purview of the Panel under section 38 of the National Electricity Law and rules clause 8.8.1, particularly if the AEMC requests the Panel to consider the issue.[125]

It is open to the Panel to request the AEMC to issue a terms of reference for an interim review. The AEMC would consider but would not be bound by such a request.

In addition, at any time any party (other than the AEMC) may submit a rule change request to the AEMC relating to the rules on the reliability standard and settings, including rules on the review of the standard and settings. A rule change request would be considered under the provisions of the National Electricity Law relating to AEMC rule-making. These provisions require (among other things) at least one round of public consultation and an assessment as to whether the rule would be likely to contribute to the achievement of the national electricity objective.[126]

Box 8.1 The National Energy Guarantee

On 17 October 2017, the Australian Government announced that it had accepted the recommendation of the Energy Security Board for a new National Energy Guarantee to deliver more affordable and reliable electricity while meeting our international emissions reductions commitments.

The Guarantee will require retailers to contract with, or directly invest in, generation, storage or demand response so that:

- there is a minimum amount of dispatchable energy available to meet consumer and system needs (reliability requirement); and
- the average emissions level of the electricity they sell to consumers supports Australia's international emission reduction commitments, as set by the Commonwealth Government (emissions requirement).[127]

On 15 February 2018 the Energy Security Board published a consultation paper for the draft design of the Guarantee. The consultation paper was prepared to facilitate public consultation on the high-level design of the proposed Guarantee and to seek stakeholder submissions.

125 For example, rules clause 8.8.1(a)(5) provides that one of the functions of the Panel is to "report to the AEMC and participating jurisdictions on overall power system reliability matters concerning the power system and on the matters referred to in clauses 8.8.1(a)(1b) [*i.e. reviewing and making recommendations on the reliability standard and reliability settings under clause 3.9.3A*] … and make recommendations on market changes or changes to the Rules and any other matters which the Reliability Panel considers necessary." See also sections 38(2) and 38(4) of the National Electricity Law, and rules clauses 8.8.1(a)(1) and 8.8.3(b).

126 National Electricity Law Part 7.

127 Energy Security Board, National Energy Guarantee draft design consultation paper, 15 February 2018, p. 10, available at: http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/Energy%20Security%20Board%20National%20Energy%20Guarantee%20-Consultation%20Paper_0.pdf.

The Energy Security Board provided further high-level advice on the design of the Guarantee to the COAG Energy Council in April 2018. On 20 April 2018 the COAG Energy Council published this high-level design document and agreed for the Energy Security Board to progress development of the detailed design of the Guarantee.[128]

8.4 Further information available in future reviews

The Panel notes that there was a limited amount of information available for this review on the use of new technologies such as demand response programs and behind-the-meter batteries, and the potential impact of these new technologies on the value of customer reliability. The following initiatives are expected to result in a greater amount of information being available for future reviews:

- Register of distributed energy resources – rule change request from COAG Energy Council, initiated by the AEMC in March 2018.
- AEMO's demand side participation information guidelines and information portal – the first reports were due by 30 April 2018.[129]
- The review of the value of customer reliability, which is expected to be undertaken by the end of 2019 by either AEMO or the AER (subject to the rule change request from the COAG Energy Council on Establishing values of customer reliability, expected to be initiated by the AEMC in May 2018).
- Improved forecasting tools and methods currently being developed by AEMO.[130]
- Recommendations regarding demand-side forecasting from the AEMC's *Reliability Frameworks Review*; final recommendations are expected later in 2018.

8.5 Recommendations from the 2014 review

The previous review of the reliability standard and settings was conducted by the Panel in 2014. In the 2014 review the Panel made the following recommendations relating to future work:

> AEMC or Panel (as appropriate) to carry out the following work ahead of the next reliability standard and settings review:
>
> – review of the form of the CPT mechanism
>
> – review of the measure of indexation of the MPC and CPT
>
> – develop a methodology to derive an appropriate estimate of VCR for use in determining the efficient reliability standard
>
> – develop a methodology for undertaking future reliability standard and reliability settings reviews.[131]

128 See: http://coagenergycouncil.gov.au/publications/initial-design-guarantee.

129 The guidelines and information on the portal are available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Demand-Side-Participation-Information-Guidelines

130 These developments are outlined in the Commission's Reliability Frameworks Review interim report, 19 December 2017, box 4.2.

The guidelines developed by the Panel in 2016 set out the principles and assumptions that the Panel should apply when it conducts future reviews of the reliability standard and settings. The guidelines address all the Panel's recommendations from 2014.

8.5.1 Review of the form of cumulative price threshold

In the guidelines the Panel considered the form of the cumulative price threshold:

> The Panel considers that changing the timeframe in which the CPT is breached could have a number of impacts, all else being equal:[132]
>
> – 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.
>
> Accordingly, the Panel considers that a time period of 336 trading intervals remains appropriate for breach of the CPT.[133]

8.5.2 Review of the measure of indexation

In the guidelines, the Panel considered the use of CPI as the measure of indexation for the market price and cumulative price threshold:

> The Panel considers that a transparent, universally understood method for indexation remains the preferred approach. Given the detailed analysis previously undertaken by the AEMC,[134] the Panel is satisfied that the CPI continues to be the preferred basis of indexation for the MPC and CPT.[135]

8.5.3 Methodology to derive an appropriate estimate of VCR for use in determining the efficient reliability standard

In 2014 the Panel recommended that:

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131 Panel, *Reliability standard and reliability settings review 2014, final report*, 16 July 2014, p. 122.

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

133 Reliability Panel, *Review of reliability standard and settings guidelines final determination*, December 2016, Sydney (Guidelines Determination), p. 30. Note that this figure will increase to 2,016 trading intervals after the move to five-minute settlement.

134 AEMC, *Reliability settings from 1 July 2012, final determination*, 1 July 2011, Sydney.

135 Guidelines Determination, p. 44.

> the AEMC or the Panel (as appropriate), in consultation with stakeholders and having regard to any VCR values delivered by the Australian Energy Market Operator (AEMO) as part of its national VCR review, develop a methodology to derive an appropriate estimate of VCR for use in determining the efficient reliability standard. This work should take place prior to the next reliability standard and reliability settings review, which is due to commence around 2017.

In the guidelines the Panel made the following statements in response to this recommendation:

> The Panel notes that a number of changes have occurred since it made these recommendations in 2014. For example, AEMO has since developed its VCR measure, which the Panel is required to consider when undertaking each review.[136]
>
> 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.[137]

8.5.4 Methodology for undertaking future reviews

The development of the guidelines addresses this recommendation directly. The guidelines "provide the market with useful and transparent information about how the Panel intends to undertake each review".[138]

136 Guidelines Determination, p. 4.

137 Guidelines Determination, p. 9.

138 Guidelines Determination, p. 3.

Abbreviations and defined terms

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APC	Administered price cap
CCGT	Closed cycle gas turbine
COAG	Council of Australian Governments
CPI	Consumer Price Index
CPT	Cumulative price threshold
Draft report	Panel, *Reliability standard and settings review 2018, draft report*, 27 November 2017
ESOO	AEMO's Electricity Statement of Opportunities
EY	Ernst & Young
EY report	EY, *Reliability Standard and Settings Review 2018, Modelling Report, Final*, April 2018, Brisbane
FCAS	Frequency Control Ancillary Services
GJ	Gigajoules
Guarantee	National Energy Guarantee
Guidelines	*Review of reliability standard and settings guidelines, final guidelines, 2016*
Guidelines determination	*Review of reliability standard and settings guidelines, final determination, 2016*
Issues paper	Panel, *Reliability standard and settings review 2018, issues paper,* 6 June 2017
LOR	Lack of reserve
LRET	National large-scale renewable energy target
MFP	Market floor price
MPC	Market price cap

NEM	National Electricity Market
OCGT	Open cycle gas turbine
Panel	Reliability Panel
PV	Photovoltaic
RERT	AEMO's reliability and emergency reserve trader mechanism under rule 3.20
Review	*Review of reliability standard and settings, 2018*
Review period	1 July 2020 – 1 July 2024
Rules	National Electricity Rules
SRMC	Short run marginal cost
USE	Unserved energy
VCR	Value of customer reliability
VoLL	Value of lost load
VRET	Victorian renewable energy target
WACC	Weighted average cost of capital

Appendix A – Reliability standard

This appendix describes:

A.1. The purpose of the reliability standard.

A.2. What is meant by unserved energy.

A.3. The materiality criteria that the Panel must consider in deciding whether the reliability standard should be reassessed in this review

A.4. Stakeholders' views on the reliability standard.

A.5. The forecast outlook for unserved energy for the review period.

A.6. Information and analysis supplementary to that provided in the main report outlining why the Panel has determined that the materiality threshold for reassessing the level of the reliability standard has not been met at this time.

A.1 Purpose

The broad framework for delivering reliability in the NEM

Investment and operational decisions about electricity generation are made in response to price signals provided by the wholesale electricity market or 'spot market'. These signals in the spot market in turn create signals for participants to enter into contracts, i.e. to *hedge* their exposure to these spot prices. The market rules also establish mechanisms for the market operator to intervene in the market in extreme circumstances when the incentives, settings and information arrangements may not, or do not, deliver the desired reliability outcome.[139]

The reliability standard is a crucial market setting:

> The reliability standard is an expression of the reliability sought from the national electricity market's generation and interconnection assets.[140]

The AEMC's *Reliability frameworks review* elaborates on the purpose and use of the reliability standard:

> What exactly the reliability standard *is* is not entirely tangible. It is not a test against which the market is formally assessed after the fact. Neither is it a regulatory or performance standard that is 'enforced'.
>
> Rather, it is a criterion which bodies such as the Reliability Panel and AEMO use as an input into their decision making. For example, the Reliability Panel uses the 0.002% figure (along with other inputs) to determine what is an appropriate level for the wholesale [market] price cap. It is also the measure which when translated into reserve margins provides operational guidance for AEMO to engage in medium-term intervention. More broadly, AEMO is responsible under the NER [National Electricity Rules] for

139 AEMC, *Reliability Frameworks Review*, Issues paper, 22 August 2017, Sydney (Frameworks paper), pp. i – ii.

140 Reliability Panel, *2018 Review of reliability standard and settings*, Issues paper, June 2017 (Issues paper), p. 10.

> operationalising the reliability standard across the power system in accordance with standards and guidelines.[141]

In summary, the reliability standard expresses the level of reliability sought from the national electricity market's generation and transmission interconnector assets.

The reliability standard also guides various decisions made by AEMO in its role as the system operator. It is AEMO's responsibility to incorporate the reliability standard within its day-to-day operation of the market, and to inform the market of any projection that the reliability standard is expected to not be met. If a market response to a projected expectation that the reliability standard will not be met is not forthcoming, then AEMO may intervene through the intervention mechanisms that are part of the current frameworks.

The reliability standard does not address the reliability provided by the electricity transmission and distribution networks as this is the responsibility of jurisdictional governments.[142]

The level of the reliability standard

This review's issues paper emphasised that setting the level of the reliability standard involves:

> …a trade-off, made on behalf of consumers, between the prices paid for electricity and the cost of not having energy when we need it.
>
> The trade-off is between two sets of costs, both of which are ultimately borne by consumers. On the one hand, are the costs of building, maintaining and operating generation and interconnection assets to provide greater reliability—costs which are ultimately reflected in electricity prices — and on the other hand are the costs to consumers and society generally of not having electricity when it is needed.[143]

Currently:

> [t]he reliability standard for generation and inter-regional transmission elements in the national electricity market is a maximum expected unserved energy (USE) in a region of 0.002% of the total energy demanded in that region for a given financial year.[144]

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141 Frameworks paper, p. 19.

142 The reliability standards for distribution and transmission assets within regions are the responsibility of regional jurisdictions. For example, the NSW Department of Planning and Environment sets the *Transmission Network Design and Reliability Standards for NSW*.

143 This general approach is supported by stakeholders, for example "Origin supports the Panel considering the appropriateness of the reliability standard in a manner that weighs the cost of any additional generation and interconnection capacity against the cost of unserved energy". Origin submission, p. 1.

144 Rules, clause 3.9.3C(a)

In other words, the present reliability standard requires that there be sufficient generation and transmission interconnection in a region such at least 99.998 per cent of expected annual demand for electricity in that region will be supplied.[145]

The AEMC observed that:

> Having the standard set at this level reflects the fact that the most efficient level of reliability is not 0% unserved energy. Such an approach would be inefficient: the cost of the provision of supply of energy at all times would exceed the value placed on it by consumers, given this value is not a constant and varies over time and with the duration and frequency of interruptions.[146]

This review examines whether the Panel should, based on the required considerations and other matters in the guidelines, reassess the reliability standard in this review cycle. Recent public statements regarding the need to tighten the current 0.002 per cent reliability standard (i.e. allow for *less* unserved energy than is currently the case) are among the issues discussed.

A.2 What is unserved energy?

It is important to understand what is meant by the term '*expected unserved energy*' in regards to this review. '*Unserved energy*' means the amount of customer demand that cannot be supplied within a region of the national electricity market due to a shortage of generation or interconnector capacity. The term '*expected*' is important – it means a statistical expectation of a future state; an average across a range of future scenarios, weighted for probability.

For the reliability standard, unserved energy is expressed as a proportion of expected demand that is at risk of not being supplied to consumers (0.002 per cent). In simple terms, the reliability standard requires that there be sufficient generation and transmission interconnection in a region such that at least 99.998 per cent of forecast annual demand for electricity is expected to be supplied.

It should be noted that there can be instances where consumer demand for electricity is not met, which are not deemed unserved energy. For example events such: as two of the largest units in a region tripping simultaneously; measures taken to stabilise the security of the power system; or outages on the transmission or distribution network. Only single credible contingencies are considered in the definition of unserved energy.[147]

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145 Frameworks paper, p. ii.

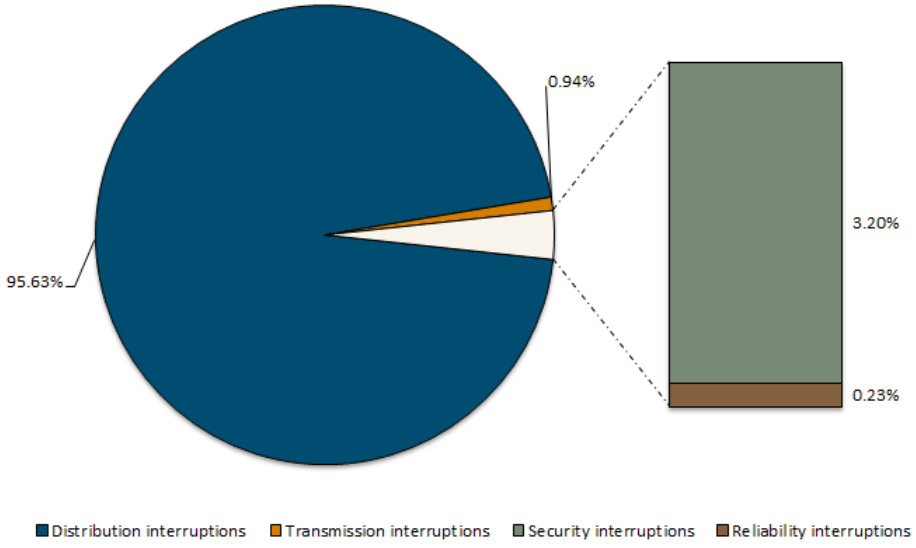
146 Frameworks paper, p. 19.

147 The rules state that for the purposes of the reliability standard 'unserved energy is to: include unserved energy associated with power system reliability incidents: that result from a single credible contingency event on a generation unit or an inter-regional transmission element, that may occur concurrently with generating unit or inter-regional transmission element outages…' clause 3.9.3C(b).
The rules establish that: 'A credible contingency event means a contingency event the occurrence of which AEMO considers to be reasonably possible in the surrounding circumstances including the

In fact, the Panel notes that interruptions to consumer supply relating to the reliability of generators and interconnectors, that is the reliability of the wholesale market, have historically represented a very small proportion of all supply interruptions experienced by customers.

Figure 4 shows the interruptions of supply arising from incidents involving reliability, security, transmission networks and distribution networks from 2007/08 to 2016/17. Over the period, only 0.23 per cent of total supply interruptions (in terms of GWh) were the result of reliability events (brown area of bar chart). Security events also represented a small portion (grey area) of all supply interruptions at 3.20 per cent (green area of bar chart). Estimates show that the distribution network is responsible for about 96 per cent of supply interruptions (blue area of the pie chart).[148]

Figure 4: Sources of supply interruptions in the NEM: 2007/08 to 2016/17[149]



A.3 Criteria – Materiality

The guidelines establish that the reliability standard should not automatically be reviewed every four years. Rather at each review the Panel should apply a materiality test to determine if the reliability standard should be reassessed. The level of the

technical envelope. Without limitation, examples of credible contingency events are likely to include: (1) the unexpected automatic or manual disconnection of, or the unplanned reduction in capacity of, one operating generating unit; or (2) the unexpected disconnection of one major item of transmission plant (e.g. transmission line, transformer or reactive plant) other than as a result of a three phase electrical fault anywhere on the power system.' See rules clause 4.2.3 for a definition of credible contingency event.

148 The distribution network represents the largest infrastructure in the electricity supply chain, with many possible points of failure. Standards relating to distribution networks are set by jurisdictions through various regulatory instruments. Distribution and transmission outages tend to be spread over the year (though higher rates of outages occur at times of peak demand) whereas wholesale reliability issues almost always occur at times of peak stress on the system when demand is high due to extreme weather.

149 AEMC analysis and estimates based on publicly available information from: AEMO's extreme weather event and incident reports and the AER's RIN economic benchmarking spreadsheets.

reliability standard should remain as previously determined unless the Panel considers there may be material benefit in reassessing it.[150]

In making its decision at each review as to whether to reassess the reliability standard, the Panel must consider factors including but not limited to:

- any changes made to AEMO's VCR (value of customer reliability) measure
- 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 national electricity market.[151]

Both these factors relate to the value consumers place on power system reliability. The Panel may consider other matters it deems appropriate including factors associated with the 'other side' of the reliability trade-off; namely, the costs of providing additional generation and interconnection.

A.4 Stakeholder submissions

A.4.1 Submissions on the issues paper

The subject of the reliability standard was addressed by all seven organisations that submitted comments on the issues paper: the Australian Energy Council, Origin, ERM Power, the Public Interest Advocacy Centre (PIAC), EnergyAustralia, Engie and Snowy Hydro.

Five of the submissions supported keeping the reliability standard at its current level.[152] Two submissions did not comment on the current level of the reliability standard but focused on the value of customer reliability materiality criterion (from Origin and the Australian Energy Council). ERM Power supported retaining the reliability standard at its current level and also discussed the second materiality criterion relating to changes in the way consumers used electricity. These views are discussed further below, by stakeholder submission.

Origin

In relation to changes to AEMO's VCR, Origin considered that:

> We agree that for a change to the reliability standard to be considered, there would need to be significant variance between the Panel's VCR and that calculated by AEMO under its 2014 study. We hold this view while noting the inherent limitations of any VCR analysis and the extent to which it can be used to inform the appropriate level of the reliability standard.[153]

Australian Energy Council

On the topic of changes to AEMO's VCR, the Australian Energy Council stated that:

150 Final guidelines, p. 5.

151 Final guidelines, p. 5.

152 These were from: EnergyAustralia, Engie, PIAC, ERM Power and Snowy Hydro.

153 Origin, submission to the issues paper, p. 1.

> Aside from the self-evident age of [AEMO's 2014 VCR review] report, concerns have been raised about the small sample size, exclusion of high-profile customers and inadequacy in capturing low probability but high impact supply interruptions.[154] The Energy Council concurs with those views and… believes it's important to review the value customers place on reliability in light of anticipated technological and market changes, as well as recent reliability issues.[155]

ERM Power

In relation to the materiality threshold criterion regarding changes to consumers' use of electricity (suggesting a decrease in the value consumers place on reliable supply from the grid), ERM Power considered that:

> While some trends are emerging with regard to the way in which consumers use electricity through the introduction of new technology, these trends are only just starting to emerge.[156]

ERM Power does not believe the reliability standard should be changed:

> Currently ERM Power does not believe any change to the reliability standard is warranted.[157]

EnergyAustralia

EnergyAustralia does not consider the threshold for reassessment of the reliability standard has been met:

> We do not consider it likely that the threshold for reassessment has been met at this time, as there have not been significant reliability issues in the market up to this point. We see that the current standard still provides an appropriate balance between providing a reasonable level of reliability without significantly increasing costs to consumers in providing a higher target.[158]

On the topic of providing a stable regulatory framework, EnergyAustralia stated:

> It is likely that stability in regards to this key measure is more beneficial to consumers until such time as the distortionary effects of policy instability are reduced.[159]

EnergyAustralia considers the cost trade-off established by the reliability standard will remain appropriate for the review period, and stability will benefit consumers.

PIAC

PIAC supports keeping the reliability standard at its current level:

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154 Independent Pricing and Regulatory Tribunal of New South Wales, *Electricity transmission reliability standards – An economic assessment*, August 2016, p. 35

155 Australian Energy Council, submission to the issues paper, p. 1.

156 ERM Power, submission to the issues paper, p. 5.

157 ERM Power, submission to the issues paper, p. 5.

158 EnergyAustralia submission to the issues paper, p. 1.

159 EnergyAustralia, submission to the issues paper, p. 2.

> PIAC supports the current reliability standard, and does not see merit in moving away from the value of 0.002% USE at this time. PIAC is of the view that 0.002% USE represents a level of reliability that, given the cost trade-offs of higher reliability and the impact of lower reliability, is consistent with the Panels 2nd general principle:
>
> "Delivering a level of reliability consistent with the value placed on that reliability by customers".[160]

PIAC also provided commentary on the relationship between storage technologies and consumer reliability (see section A.6.2).

Engie

Engie supports keeping the reliability standard at its current level:

> From an economic perspective, the 0.002% unserved energy standard is a pragmatic benchmark that is consistent with the value of customer reliability. According to previous studies by AEMO and the AEMC, it is comparable to electrical systems and markets internationally and should be retained in the NEM.[161]

In relation to stability and predictability, Engie suggests:

> A pragmatic approach is to set the MPC higher than determined by the modelling by adding an uncertainty margin.[162]

Snowy Hydro

Snowy Hydro also supports keeping the reliability standard at its current level:

> …if a combination of these [short term] withdrawn generators return to full service, USE is projected to reduce below the reliability standard in both South Australia and Victoria. We therefore believe that the USE figure should not change.[163]

A.4.2 Submissions on the draft report

Two submissions to the draft report discussed the reliability standard; those from the EUAA and Origin. Both stakeholders agreed with the Panel's recommendation that the current level of the reliability standard should remain unchanged.

EUAA

The EUAA supported the Panel's recommendations on the existing reliability standard.[164]

Origin

160 PIAC, submission to the issues paper, p. 2.

161 Engie, submission to the issues paper, p. 2

162 Engie, submission to the issues paper, pp. 2-3.

163 Snowy Hydro, submission to the issues paper, p. 2. Snowy Hydro is referring to the reductions in unserved energy projected by the *Update: Electricity Statement of Opportunities* published by AEMO in November 2016.

164 EUAA, submission to the draft report, p. 1.

Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[165]

A.4.3 Stakeholder feedback at the public forum

At the public forum stakeholders discussed whether the reliability target for setting the market price cap is zero per cent or 0.002 per cent unserved energy. The Panel members clarified that they do not recommend targeting the achievement of zero per cent unserved energy in setting the market price cap and cumulative price threshold, as this involves unnecessary high costs. Rather, the key metric is that unserved energy is expected to be no greater than 0.002 per cent.

A.5 Modelled forecasts – unserved energy

This section describes:

- why levels of unserved energy have been modelled for this review
- the rationale for the base scenario
- the modelling outcomes regarding unserved energy.

A.5.1 Why levels of unserved energy have been modelled for this review

The Panel commissioned EY to forecast the likely expected unserved energy to 2024 based on the current reliability standard and settings. This was to answer the question (within the limitations of the model): *what is the expected outlook for unserved energy, relative to the reliability standard, from 1 July 2020 – 1 July 2024?*

The Panel has modelled expected unserved energy for the following reasons:

1. **To meet the requirements in the rules:** Under the rules the Panel 'must have regard to the potential impact of any proposed change to a reliability setting on … (iii) the reliability of the power system'.[166] To discharge this requirement the Panel needs to understand what level of reliability the current reliability settings are likely to deliver.
2. **To devise scenarios and sensitivities to determine the required market price cap:** The forecast unserved energy under the current reliability settings influences the modelling approach used for the market price cap. If the EY modelling forecasts unserved energy in excess of the reliability standard for the review period, then this 'base scenario' would have formed the basis for modelling analysis of the required market price cap. If unserved energy is not expected to exceed the reliability standard under the base scenario, as is the case, then alternative plausible scenarios – where the reliability standard is exceeded – are developed to test outcomes related to the reliability settings (primarily the market price cap). Forecasts of unserved energy are essential to the development of realistic scenarios for the purposes of assessing the appropriate level of the market price cap and cumulative price

165 Origin, submission to the draft report, p. 1.

166 Rules, clause 3.9.3A (e)(3).

threshold.[167] As such, these forecasts of unserved energy form key inputs to achieving a key objective of the modelling, which is to determine the appropriate level of the various market settings so as to meet the standard.

A.5.2 Rationale for the base scenario

The initial tasks EY undertook for this review were to forecast the expected amount of unserved energy over the review period under the current reliability settings, and assess whether the current reliability standard of 0.002 per cent USE will be met over the review period given the current reliability settings. Establishing a base scenario is critical to these tasks.

In this review, the purpose of the base scenario is to reflect the most likely outcomes for the national electricity market from 1 July 2020 – 1 July 2024.

EY has sought to deliver a base scenario that reflects the most likely outcomes for the national electricity market by:

- Developing a set of underlying assumptions that reflect the most likely levels, or values, for key drivers of outcomes in the national electricity market (e.g. demand, gas prices, coal prices, new entrant costs). Principal assumptions are outlined in Appendix H.1.
- Utilising a modelling approach that reflects (as far as possible) the operation of the wholesale market and how commercial decisions are made. For instance, one critical aspect of the approach is that the model determines whether any new generation would enter the market (or whether existing plant would retire) based on commercial drivers for net revenue outcomes. In other words, the modelling approach generally assumes that investment decisions are endogenous to the model, rather than an input assumption.

Formulating a base scenario that reflects the most likely outcomes in the national electricity market in the context of the current scale and pace of change, and uncertainty, is necessarily challenging.

The base scenario assumptions were established on the following principles:

- Adopt only those market policy settings that have a high certainty of being implemented.
- Use recognised, publicly available data sources as far as possible, and where appropriate.
- Adopt neutral forecasts in relation to demand and energy consumption in the base scenario and use strong forecasts as sensitivity analyses on the base scenario and/or in separate scenarios.

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167 A clear understanding of expected levels of unserved energy enables EY to determine the level of retirement needed under different scenarios to achieve unserved energy in excess of the standard, such that a new entrant generator (or the deferral of a generator retiring) is required. With regards to this new entrant generator, the market price cap should not prevent the market sending efficient price signals, to support the efficient operation of and investment in electricity services over the long run.

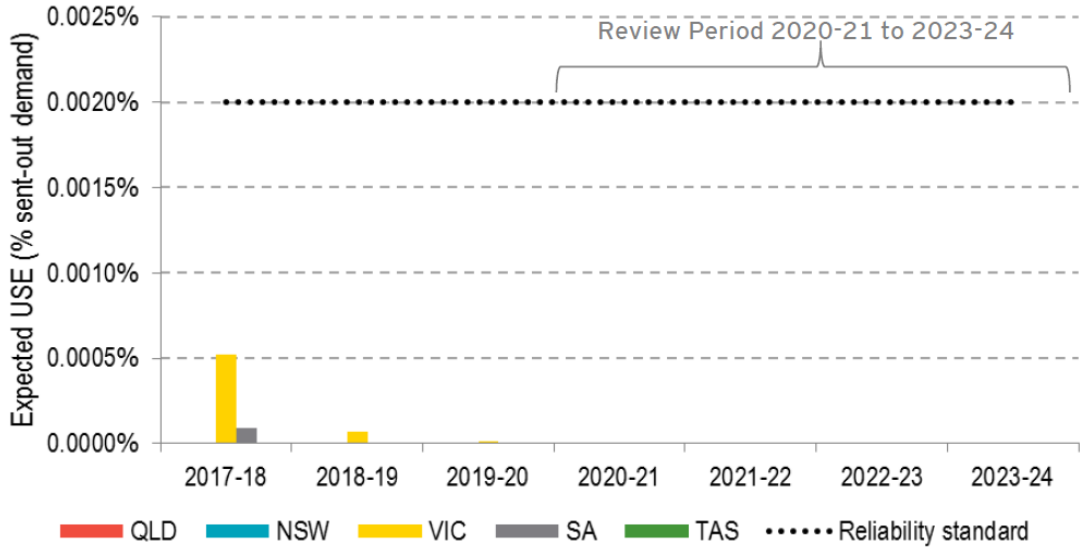
EY has modelled sensitivities to the base scenario to explore outcomes under different possible conditions such as strong demand. (See EY report for further detail).

A.5.3 Overview of unserved energy findings

Expected unserved energy well below the standard

The base scenario modelling conducted by EY (and associated sensitivity analysis) has forecast a level of unserved energy that is well below the expected level of unserved energy defined by the reliability standard.[168] Figure 4 presents the unserved energy modelling outcomes for the base scenario.

Figure 4: Expected unserved energy outcomes for the base scenario from 2017/18 to 2023/24[169]

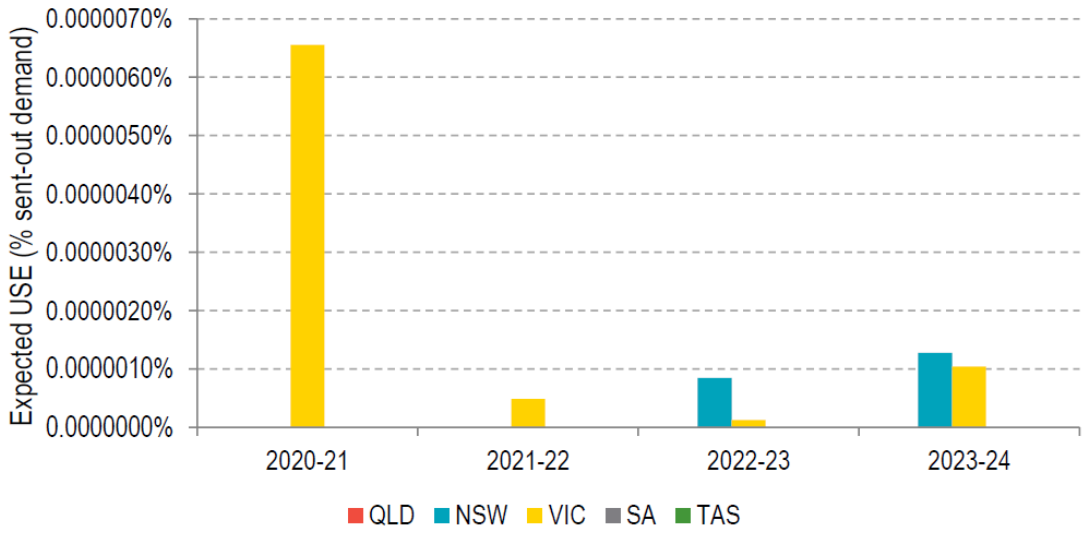


The vertical scale of the above chart obscures the presence of unserved energy over the review period (2020/21 to 2023/24). Expanding the scale and looking at just the review period shows that the highest level of unserved energy under the base scenario is forecast for Victoria in 2020/21 (at around one three hundredth of the standard), decreasing to even lower levels in subsequent years (Figure 5).

168 Forecasting of electricity supply and demand is a complex process the outcomes of which depend on the overall purpose, modelling approach, input data, assumptions, and scenarios and sensitivities tested. The Panel notes that there are other market models that forecast different levels of expected unserved energy.

169 EY Report, p. 29.

Figure 5: Expected unserved energy outcomes for the base scenario from 2020/21 to 2023/24 (expanded vertical scale)[170]



*Note that y-axis scale shows up to approximately 1/300th of the reliability standard of 0.002 per cent.

Expected unserved energy with strong demand and high generator outages rates

To further test the sensitivity of this finding to circumstances such as high demand or higher forced outage rates, EY has run the base scenario varying several key parameters:

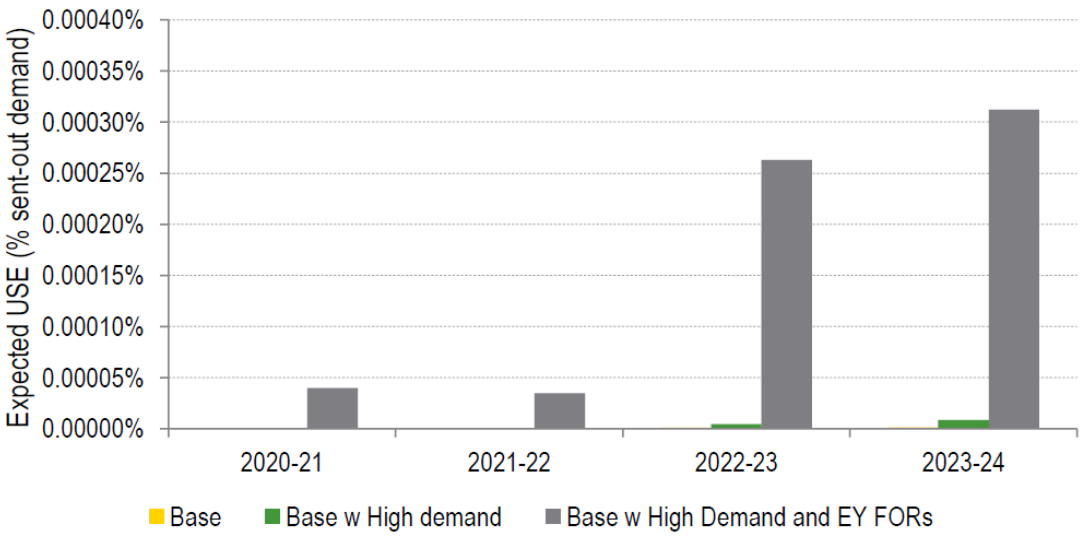
- Demand – using AEMO's most recent strong demand forecast rather than neutral demand.
- Generator outage rates – using EY's own higher generator forced outage rates (significantly higher than the base assumptions for many generators).

Over the review period the level of unserved energy forecast by the base scenario model under these sensitivities remains well below the reliability standard. The highest forecast level of unserved energy under this sensitivity analysis is in New South Wales, where the impact of high demand and EY's forced outage rates is to increase 2023-24 forecast unserved energy to approximately 0.0003 per cent, compared with the reliability standard of 0.002 per cent, or around one seventh of the standard (Figure 6).[171]

170 EY Report, p. 29.

171 Under this base scenario sensitivity, approximately 0.00025 per cent unserved energy is also recorded in New South Wales in 2022-23.

Figure 6: Expected USE outcomes in NSW for the base scenario sensitivities*[172]



*Note that y-axis scale shows up to one fifth of the reliability standard of 0.002 per cent.

Probabilities and timing of expected unserved energy

As shown in Figure 5, the highest level of unserved energy under the base scenario is forecast for Victoria in 2020/21 (at around one three hundredth of the standard). With respect to the probability of *any* expected unserved energy occurring, EY notes that:

> [T]here are only 33 half-hours in which any USE occurs in Victoria in the forecast out of the 42 million modelled. Out of the 2,400 simulations of 2020-21, USE occurred in just 16, and 14 of those were 10% POE peak demand profiles. Furthermore, the 10% POE peak demands are assigned a weighting of 0.3 relative to 0.7 on the 50% POE peak demands, which is less than half. It can be calculated then, that if all the assumptions for the Base Scenario were to eventuate up to 1 July 2021, the probability of **any USE occurring** at all in Victoria in 2020-21 is **0.5%, or one chance in 200**.[173]

EY also discusses the probability of unserved energy occurring *in excess* of the reliability standard with Victoria having the highest probability of any region:

> the probability of **USE being above the reliability standard** in Victoria in 2020-21 is **0.1%, or one chance in 1000**.[174]

The modelling suggests that occurrences of unserved energy will be limited to summer months, predominantly in the late afternoon between 3.30pm and 7.30pm.[175]

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172 EY Report, p. 32.

173 EY Report, p. 30

174 EY Report, p.30.

175 Entirely in January in Victoria in 2020-2021 and predominantly in February in New South Wales in 2023-2024.

The limitations of modelling forecasts

The Panel notes that the above unserved energy findings are forecasts underpinned by modelling assumptions that aim to reflect the likely outlook for the national electricity market over the review period. As such, actual unserved energy outcomes will differ from forecasts. In addition, as described in detail in Box B.3, AEMO has intervention powers under the rules to attempt to address potential shortfalls of reserves which in and of itself will tend to limit actual occurrences of unserved energy.

A.6 Analysis – Materiality

This section describes why the Panel has concluded that the materiality threshold for reassessing the level of the reliability standard has not been met at this time and hence why the reliability standard has not been reassessed in this review. The section outlines the Panel's considerations against each of the materiality criteria (set out in section A.3) and several other factors. The issues covered include:

- changes to AEMO's VCR measure
- changes in consumer electricity use
- stability and predictability
- current public sentiment regarding reliability
- modelling indications of unserved energy MW peak
- AEMO's considerations with regards to the reliability standard
- changes in the cost of marginal generation.

A.6.1 Changes to AEMO's VCR measure

The relevance of AEMO's VCR measure

As discussed in the issues paper:

> To set the reliability standard at an appropriate level, detailed and accurate information about the cost functions of businesses, and the value of reliability for customers, are needed.[176]

In September 2014 AEMO released its *Value of customer reliability review, final report*. The AEMO VCR study provided national level values of customer reliability for the first time.[177] It estimated the value that all customers place on the reliability of supply from the grid, based on a survey of different customer types across all national electricity market states. The report estimated valuations of the cost of outages by customer type and outage length. These values were aggregated to calculate a NEM-wide value of customer reliability of $33,460/MWh.

176 Issues paper, p. 46.

177 Guidelines, final determination, p. 23.

In our 2016 guidelines, the Panel noted that AEMO's VCR is "used across the industry as a common proxy for the true value of reliability".[178] The Panel concluded the existing level of the standard (0.002 per cent unserved energy) remained broadly consistent with AEMO's VCR figure.[179] In developing the guidelines, we had regard to ROAM's 2014 finding that the level of the current standard was equivalent to a value of customer reliability of approximately $30,000/MWh, which corresponded to AEMO's estimated NEM-wide aggregate of $33,460/MWh.[180]

Issues paper

The issues paper for this review noted that AEMO had not reassessed its value of customer reliability measure since its 2014 study. On this basis the Panel did not consider that this materiality threshold trigger has been met.

The issues paper proposed that the Panel would:[181]

- Seek to adjust AEMO's VCR for historic and forecast changes to the consumer price index to the 2020 – 2024 period to reflect that the value of customer reliability is a measure of real, and not nominal, value.
- Assess the value of customer reliability associated with the level of the current reliability standard, existing reliability settings and potential market conditions from 2020 – 2024, as a component of the modelling for the 2018 review.
- As a calibration exercise, compare the value of customer reliability obtained from the modelling for the 2018 review with AEMO's VCR figure.

In the issues paper, the Panel took the view that there would need to be significant variance between AEMO's VCR findings and those calculated from the modelling in order to conclude there would be a material benefit in re-opening assessment of the reliability standard.

Stakeholder views on the issues paper

Two submissions to the issues paper, from Origin and the Australian Energy Council, discussed AEMO's VCR measure.

Origin supported the Panel's conservative approach to considering AEMO's VCR estimate noting:

> We agree that for a change to the reliability standard to be considered, there would need to be significant variance between the Panel's VCR and that calculated by AEMO under its 2014 study. We hold this view while noting the inherent limitations of any VCR analysis and the extent to which it can be used to inform the appropriate level of the reliability standard.[182]

178 Guidelines, final determination, p. 23.

179 Guidelines, final determination, p. 24.

180 See: ROAM Consulting, *Reliability standard and settings review, report to the AEMC*, May 2014, p. 64, and AEMO, *Value of customer reliability review*, September 2014, p. 2.

181 Issues paper, p. 47.

182 Origin, submission to the issues paper, p. 1.

The Australian Energy Council echoed concerns voiced by the Independent Pricing and Regulatory Tribunal (IPART) over the limitations of AEMO's VCR calculation:

> Aside from the self-evident age of [AEMO's 2014 VCR review] report, concerns have been raised about the small sample size, exclusion of high-profile customers and inadequacy in capturing low probability but high impact supply interruptions.[183]

The Australian Energy Council also suggested a review of value of customer reliability is required in light of anticipated technological and market changes, in addition to recent reliability issues.

Analysis

To date, AEMO has not revised its 2014 VCR figure so this criterion for determining whether there may be a material benefit in reassessing the reliability standard has *not* been met.

The publication of a new AEMO VCR study in 2019 could be a trigger for the Panel to consider a future reassessment of the reliability standard at or prior to the next four yearly review, if the study reveals material changes in the value of customer reliability.

The Australian Energy Council commented "it's important to review the value customers place on reliability in light of anticipated technological and market changes, as well as recent reliability issues".[184] AEMO has confirmed that the next VCR study will be completed in 2019 (as part of a five-yearly review cycle).[185]

If in the 2019 VCR study AEMO calculates a value of customer reliability figure that is significantly higher than the current value of customer reliability estimate, it may serve as trigger for the Panel to reassess the reliability standard. The Panel notes Origin's view that there would need to be significant variance between the Panel's value of customer reliability and AEMO's 2014 calculation to warrant changing the reliability standard.

The Australian Energy Council urged caution in drawing conclusions from AEMO's VCR figure highlighting a number of limitations, including "small sample size, exclusion of high profile customers and inadequacy in capturing low probability but high impact supply interruptions".[186] Some of these limitations may be addressed in AEMO's 2019 VCR study.

In the issues paper, the Panel acknowledged that "other measures of reliability exist and that AEMO's VCR measure only represents an estimation of the true value that

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183 Independent Pricing and Regulatory Tribunal of New South Wales, E*lectricity transmission reliability standards – An economic assessment,* August 2016, p. 35

184 Australian Energy Council, submission to the issues paper, p. 1.

185 In its value of customer reliability application guide, AEMO stated that a five year update strikes a balance between the costs involved in undertaking the survey and the consumer insights obtained from updating the values more frequently. AEMO, *Value of customer reliability application guide, final report*, December 2014, p. 24.The intention to undertake a five-yearly review of the value of customer reliability has been confirmed by AEMO staff.

186 Australian Energy Council, submission to the issues paper, p. 1.

customers place on reliability".[187] However, stakeholders did not present any other measures of the value of customer reliability that may be more appropriate for the Panel to consider.

In the issues paper the Panel stated it would compare AEMO's 2014 VCR figure (indexed for increases in CPI) against modelling outputs for the 2018 review as a calibration exercise. Following further discussions with EY since the publication of the issues paper, the Panel has determined that the most feasible and useful output would be to examine the profile of unserved energy and investigate the costs of providing additional levels of reliability (see sections 3.1.3 and A.6.5). It should be noted that the value of customer reliability analysis presented by ROAM in 2014 was a supply cost curve not demand-side value of customer reliability, and was an output of the in depth modelling undertaken for the complete review of the reliability standard.[188]

The Panel notes the AEMC has received a rule change request from the COAG Energy Council that proposes that the AER assumes responsibility for establishing values of customer reliability.[189]

A.6.2 Changes in consumer electricity use suggesting a lowering of the value of customer reliability

The relevance of changes in consumer use of electricity

In deciding whether there may be a material benefit in reassessing the reliability standard, the Panel must also consider whether there have been:

> any **marked changes** to the way consumers use electricity, particularly through the use of new technology, that suggest **a large number of consumers may place a lower value on a reliable supply of electricity** from the NEM [for the period 1 July 2020 - 1 July 2024].[190]

This requires evidence that would support a **relaxing** of the reliability standard, which would allow for **more** unserved energy in the future. The Panel acknowledges that current public discourse centres on **tightening** the reliability standard (i.e. less expected unserved energy), and addresses this issue in section A.6.5.

Issues paper

In the issues paper the Panel had not formed a view regarding the impact of expected changes to consumer use of electricity on the value of customer reliability for the review period. The issues paper discussed five trends that could affect the value of customer reliability of particular consumers:

- household appliance use

187 Issues paper, p. 46.

188 In 2014 ROAM undertook modelling to estimate the minimum total cost of meeting a range of different unserved energy levels (from 0.0004 per cent to 0.0055 per cent for all regions of the NEM) based on new entrant OCGT capacity as the marginal generating unit. The cost being minimised is the total cost of generation, plus the cost (capex) of the new-entrant OCGT capacity plus the cost of unserved energy, valued at the VCR.

189 For more information, refer to the *Establishing values of customer reliability* project page: https://www.aemc.gov.au/rule-changes/establishing-values-of-customer-reliability

190 Issues paper, p. 45. Emphasis added.

- non-manufacturing business use
- manufacturing business use
- rooftop solar PV
- new storage technologies.

based on the *2016 National Electricity Forecasting Report* for the national electricity market.[191]

Stakeholder views on the issues paper

ERM Power considers that:

> While some trends are emerging with regard to the way in which consumers use electricity through the introduction of new technology, these trends are only just starting to emerge. While there are forecasts regarding future adoption, we believe the Panel needs to consider that these forecasts will be subject to revision and may be impacted by other new technologies, changes in the costs of existing technologies or overall prevailing economic conditions.
>
> We believe the Panel should reconsider the impact of integrated solar PV and battery systems on the level of supply reliability required by consumers from the grid as these integrated systems allow consumers to accept a lower level of grid based supply reliability.[192]

ERM Power considers the Panel should recognise the following two factors when deciding whether a reassessment of the reliability standard is likely to yield material benefit:

- There is significant uncertainty regarding forecasts of new technology adoption.
- Some customers install "batteries to allow a continuation of reliable supply following loss of grid supply and integrated battery and solar PV installations are permitted to be installed to achieve this outcome."[193]

The role of batteries was also discussed by PIAC:

> PIAC agrees with the Panel's assessment that many batteries aren't currently able to operate in islanded mode, but notes that:
>
> - as battery products become prevalent and innovative, more are likely to be able to operate in islanded mode; and,
> - in any case, as more batteries are deployed, a great portion of the load on the grid will be interruptible battery charging loads, that have a much lower VCR than average.
>
> At this time, however, the battery and energy services market may not be mature enough for the future wholesale market implications to be fully understood. Considering this, and noting PIAC's preference for an interim review in 2020, PIAC recommends that the Panel asks the AEMC to undertake a

191 Issues paper, p. 48.

192 ERM Power, submission to the issues paper, p. 5.

193 ERM Power, submission to the issues paper, p. 5.

review examining the role of battery energy storage in the reliability and security of the energy market in time for an interim review.[194]

Analysis

The Panel considers that this materiality criterion **has not been met** on the basis of trends and issues related to rooftop solar PV and storage technologies.

Rooftop solar-PV

Intuitively, if a significant number of households and/or businesses had installed rooftop solar PV, then these customers may place a lower value on grid-sourced energy than they did previously, warranting a review of the reliability standard.

The recent and forecast continued significant growth in rooftop solar PV is well documented. The Panel's issues paper highlighted increased penetration of solar PV (and storage) as key emerging market trends.[195] The AEMC in its *Distribution market model, final report* also detailed that it expects there to be "large future demand for distributed energy technologies, such as solar PV, energy storage and electric vehicles".[196]

This expected uptake is driven by a range of factors, including:

- the falling costs of these technologies[197]
- increasing functionality of these technologies[198]
- more sophisticated information and control technologies, and fast, cheap computing platforms[199]
- changing consumer attitudes to electricity supply and prices.[200]

AEMO's most recent forecasts suggest a significant increase in the number, capacity (Figure 7), and proportional share of total generation by rooftop solar PV. EY's base

194 PIAC, submission to the issues paper, p. 5.

195 Issues paper, p. 48.

196 AEMC 2017, *Distribution Market Model final report*, 22 August 2017, Sydney, p. 10.

197 For example, Bloomberg New Energy Finance predicts that battery packs are likely to experience cost declines at a rate of 19 per cent for every doubling of production due to productivity and efficiency improvements. Further, that the costs of inverters have halved from 2016 to 2017 due to the entrance of a number of competitive inverter manufacturers that have traditionally made inverters for solar plants. Source: Bloomberg New Energy Finance, *Economic for some: Grid-scale batteries in Australia*, 3 April 2017.

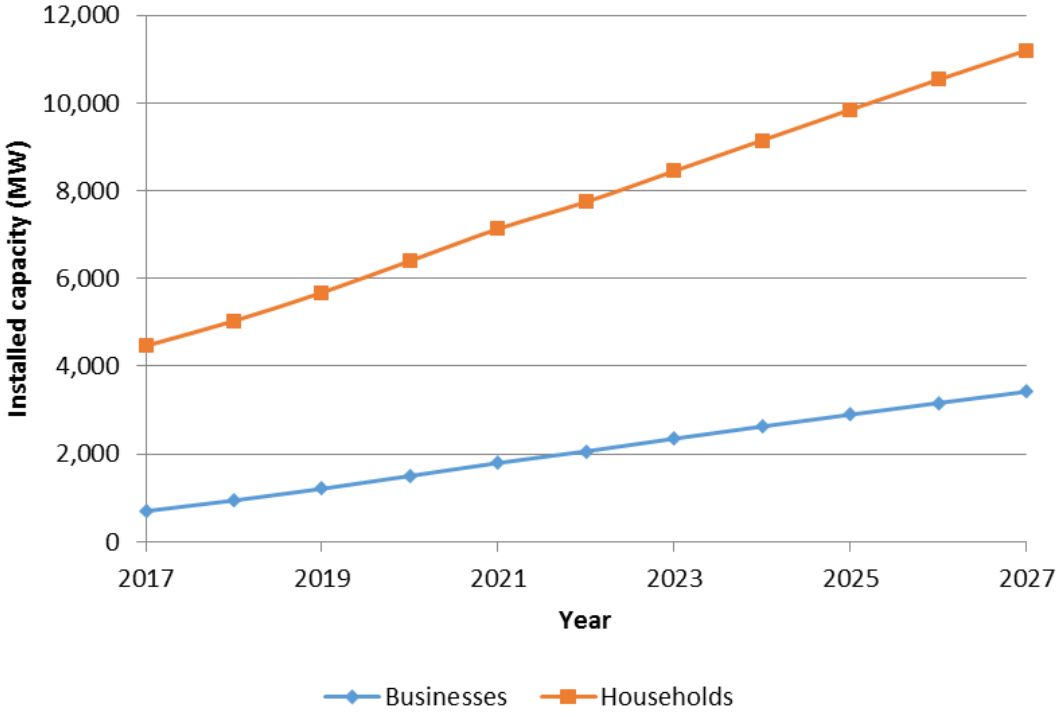
198 For example, the Tesla Powerwall 2 has double the storage capacity compared to the Tesla Powerwall 1 with no change in price thereby halving the KWh cost, with these two models being released less than two years apart. See: http://www.cleanenergyreviews.info/blog/tesla-powerwall-2-solar-battery-review

199 SA Power Networks (SAPN) notes that remote monitoring and control technology is evolving rapidly, and quickly expanding the range of cost effective solutions available. Installation of more intelligent devices such as distribution transformer monitors, SCADA enabled remote-controlled switching devices and advanced meters will help them to manage risk and network performance. See: *SAPN, Distribution Annual Planning Report*, p. 23.

200 The Commission's 2017 Retail energy competition review found that energy consumers have more choices to manage their energy use and are looking to take up new technology options. For example: 20 per cent of consumers now have solar panels; 21 per cent are likely to adopt battery storage in the next two years; and 18 per cent are likely to take up a home energy management system in the next two years.

scenario modelling indicates that rooftop PV would increase as a share of total generation capacity in the national electricity market from 10 per cent to 18 per cent between 2017/18 and 2023/2024.

Figure 7: Installed capacity of PV systems 2017-2027, households and businesses, NEM-wide (AEMO data[201], strong technology uptake forecast[202])



However, notwithstanding this significant change in the way increasing numbers of consumers source at least a proportion of their electricity, many PV installations cannot operate unless they are connected to the energised grid. At a minimum, installing rooftop PV allows consumers to reduce their withdrawals from the grid at certain times, thereby changing the profile of their grid consumption and reducing their electricity bills. However, it does not necessarily allow a customer to sever their connection to the grid.

Furthermore, rooftop PV systems without battery support have highly variable output, which from a reliability perspective means they are not a substitute for an energised grid connection. Hence for most consumers rooftop solar PV may not necessarily reduce the value of the reliability of grid sourced energy, as the reliability of the grid is the main factor that determines whether their PV systems will operate.

201 This chart is based on strong technology growth projections from AEMO's *2017 Electricity Statement of Opportunities*, published in September 2017. The underlying data for this chart and the following chart depicting forecasts of storage technologies remains consistent with AEMO's *2018 Electricity Forecasting Insights – March 2018 Update.*

202 Corresponds to confident consumers in a strong economy.

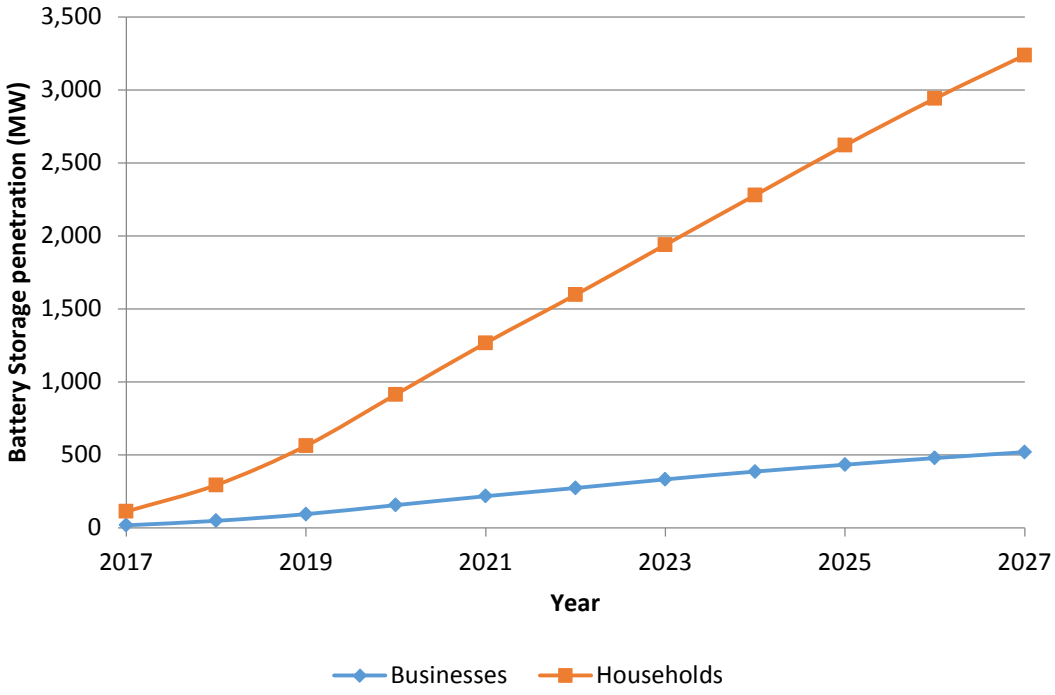
It follows that, at this stage, there is no clear evidence that consumers will place a lower value on a reliable supply of electricity from the national electricity market over the review period as a result of the installation of rooftop solar PV. It is expected that the national 2019 VCR study will examine this issue.

Storage technologies

Installing storage (with rooftop PV) could insulate households and small businesses from the impacts of interruptions in grid supply, and thus reduce the value these consumers place on grid reliability.

Households and businesses are expected to install a significant amount of storage capacity during the review period. Figure 8 shows that forecast growth rates for new storage technologies for households and businesses are high. The chart is based on AEMO's strong battery growth projections from the *2017 Electricity Statement of Opportunities*. Battery storage installations are forecast to reach 5.6 GW by 2036–37, up from a capacity close to zero today.[203]

Figure 8: Forecast uptake of storage technologies by households and businesses, NEM-wide, 2017-2027. (AEMO data, strong technology uptake forecast)



AEMO expects a proportion of new storage to be aggregated and used for price hedging by retailers and provision of ancillary services, further increasing the value streams from innovation and accelerating the rate of uptake.

203 The Panel notes expected uptake of storage technologies varies considerably. For example Bloomberg New Energy Finance forecasts that battery storage capacity in Australia will approach 6GW by as early as 2030. Bloomberg New Energy Finance, *Energy storage forecast, 2017-2030*, 21 November 2017.

Uncertainty in growth rates of rooftop solar PV and storage

ERM Power commented that these trends are still emerging and that growth forecasts are often revised.[204] The impact of changes in technology uptake trends was also highlighted by PIAC; "the battery and energy services market may not be mature enough for the wholesale market implications to be fully understood".[205] The Panel recognises that to date few consumers have installed battery systems.[206]

Battery configuration – ability to operate independently from the grid

PIAC agrees that while significant growth in integrated storage systems is expected, as discussed in relation to rooftop PV "many batteries aren't currently able to operate in islanded mode".[207] That is, they cannot operate unless connected to an energised grid.[208] Hence it may be that only a small number of individuals are likely to place less value on reliable grid supply as a result of the use of storage technologies, especially over the review period.

Future improvements to storage technology may mean these systems can be cost-effectively configured to operate independently from the grid, potentially altering the value some customers place on reliable grid supply.

Noting comments from both PIAC and ERM Power, we consider that the expected uptake of battery systems that can operate independently of an energised grid is unlikely to be sufficiently high such that a large number of consumers place a lower value on reliable supply from the grid during this review period.[209]

We also note that some batteries are primarily used to shift the time of use of electricity. Where this is the case, these systems may have little or no effect on customer reliability outcomes.

Summary

The Panel considers this materiality criterion has not been met. A sufficiently large number of consumers are not forecast to adopt rooftop solar PV and battery technology and materially change their usage patterns over the 1 July 2020 – 1 July

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204 ERM, submission to the issues paper, p. 5.

205 PIAC, submission to the issues paper, p. 5.

206 Unlike solar PV systems, there is no government incentive payment for consumers to disclose their battery purchases. As a result, there is a lack of reliable data on the number of household battery installations in Australia or the combined capacity of those installations. The AEMC is currently examining a rule change request for the creation of a register to capture data on battery deployments, for more information, see: https://www.aemc.gov.au/rule-changes/register-of-distributed-energy-resources

207 A prerequisite for integrated solar and battery systems to operate while disconnected from the energised grid (i.e. islanded) is the presence of isolation equipment. Not all integrated systems have such equipment and therefore cannot operate while islanded.

208 PIAC, submission to the issues paper, p. 5.

209 PIAC noted "as battery products become more prevalent and innovative, more are likely to operate in islanded mode". ERM Power stated "one of the primary considerations for customers installing batteries is to allow a continuation of reliable supply following loss of grid supply and integrated battery and solar PV installations are permitted to be installed to achieve this outcome".

2024 period in a way that would suggest they have become clearly less reliant on the grid and thus will place a lower value on grid-supplied electricity.

Given the need for detailed analysis of the potential impact of these trends on the value for customer reliability, it would be prudent to await greater certainty regarding trends and a detailed study such as the 2019 revised VCR study, or an "interim study" in 2020 as suggested by PIAC, to facilitate actionable analysis of impacts of rooftop solar PV and storage on the level of the reliability standard.[210]

A.6.3 Stability and predictability

In the issues paper, the Panel noted that maintaining consistency in the level of the reliability standard would provide a degree of certainty and predictability for market participants when planning future operations. The Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework.[211]

EnergyAustralia agreed with the Panel on the benefits to consumers of certainty and stability with regards to the reliability standard:

> it is likely that stability in regards to this key measure is more beneficial to consumers until such time as the distortionary effects of policy instability are reduced.[212]

The market price cap, the administered price cap and cumulative price threshold would need to be reviewed in light of a new reliability standard, as well as market developments and forecasts that are considered in any case. Any changes to those settings, as well as to the reliability standard, would create additional uncertainty and unpredictability for consumers and market participants.

Stakeholder feedback on this matter supports the Panel's view that given the substantial policy uncertainty presently affecting the national electricity market, there is merit in not reassessing the reliability standard in order to provide a measure of regulatory certainty and stability.

A.6.4 Current public discourse regarding reliability and costs of changing the standard

Issues such as: the South Australian black out in September 2016; mandatory load shedding (and the threat of it); public concerns about the adverse effect of renewable generation on reliability; and the recent published forecasts of 'supply shortfalls' in AEMO's Electricity Statement of Opportunities and Ministerial advice, have led to increased focus and attention on reliability and the standard through which it is determined and whether any involuntary load shedding is acceptable. Under the current non-zero reliability standard, some load shedding is acceptable.

210 PIAC, submission to the issues paper, p. 5.

211 Guidelines p. 3.

212 EnergyAustralia, submission to the issues paper, p. 2.

As discussed in section A.5.3, notwithstanding that the reliability standard is currently 0.002 per cent, EY modelling forecasts the system will provide a level of reliability significantly better than the 0.002 per cent reliability standard in all national electricity market regions, for the review period

A.6.5 Modelling indications of unserved energy MW peak

The Panel committed in the issues paper to examining the value of customer reliability under the current reliability standard and settings in light of forecast developments in the national electricity market. In its submission to the issues paper, EnergyAustralia suggested improving transparency around the costs associated with higher levels of reliability:

> We also consider that highlighting the potential costs to consumer of embedding a higher reliability standard would be useful in guiding governments and regulators when they seek to intervene to provide a higher level of reliability than set under the standard.[213]

Given public commentary about the reliability standard, the Panel has provided some indicative costs, associated with the reduction of unserved energy to zero in the modelling.

While it is impossible to reduce expected unserved energy to zero in all possible modelled futures, under base scenario conditions in Victoria (where there is virtually no expected unserved energy, at 0.000006 per cent, in 2020/21), EY indicated that an estimated additional 1,000MW of capacity would be required to be in place in Victoria in 2020/21 to avoid any unserved energy under the modelling assumptions (including the impact of forced outages).

If the annual cost (excluding variable operating and maintenance costs) of new generation is in the order of $200,000 / MW (given a WACC of 10 per cent pre-tax real and a capital cost of around $1.5 million per MW, as included in the modelling run by EY), then the minimum additional annual wholesale energy cost expected to be recovered from customers would be in the order of $200 million ($200,000 / MW * 1,000 MW). This is in the context of a Victorian market with current annual demand of around 45 TWh and wholesale energy value of around $3 billion. That is, the additional cost of moving to (close to) zero expected unserved energy under the base scenario would increase wholesale energy costs by nearly 7 per cent in that region, as measured against current market outcomes in Victoria.

EY also modelled an alternative scenario where unserved energy exceeds the reliability standard (0.002 per cent unserved energy) in Victoria through early coal fired generation retirement (scenario 2). Under this scenario, EY indicated there is a peak unserved capacity of approximately 3,000 MW, or three times the amount under the base scenario. This implies a threefold increase in costs to achieve an expected outcome of zero unserved energy compared to the base scenario. That is around $600 million per annum, or a 20 per cent increase in wholesale energy costs, compared to current Victorian wholesale energy costs.

213 EnergyAustralia submission, p. 2

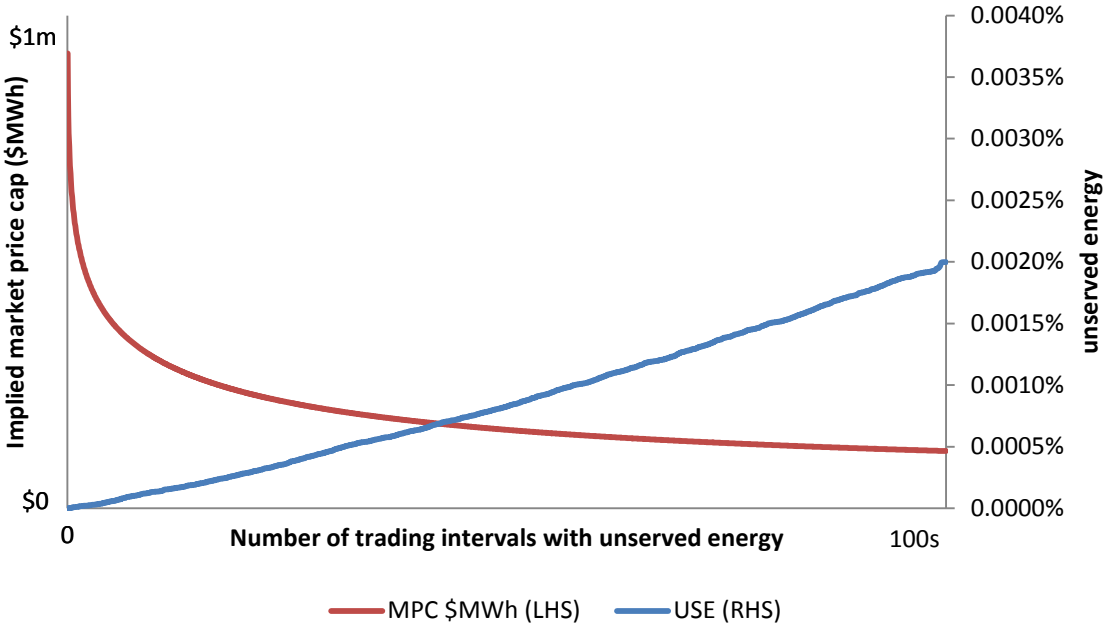
These indicative results for Victoria are summarised in the following table.

	Base scenario	Alt Scenario 2
Peak unserved energy (MW)	≈1,000	≈3,000
Annual cost ($m)	$200	$600
Percentage of current wholesale energy cost (%)	7 per cent	20 per cent

Relationship between the implied market price cap and unserved energy

The previous section estimated the increase in wholesale energy costs associated with the reduction of unserved energy to zero. This analysis is based on the additional expected revenue needed to be captured by a new entrant generator. The Panel would expect that, in terms of the incremental value (and price) that is needed to support such investment, the market price cap would need to be substantially increased. For example, a new entrant generator with a business case that was based on expected operations of two hours a year would need a market price cap in the order of $100,000/MWh. This relationship between annual expected hours of operation and required price is critical in that as we approach zero unserved energy the expected hours of operation for a new entrant decreases, with a proportional required increase in the market price cap. This relationship is highlighted in Figure 9.

Figure 9: Relationship between implied market price cap and unserved energy



It is not clear what the impact of bidding behaviour outcomes would be over the course of a year given a higher market price cap and higher level of generation

capacity. One outcome might be that the impact of the higher market price cap would drive up average prices to an even greater extent than that required to deliver the revenue to support the new entrant generator. Conversely, the additional capacity in the market may result in lower prices at times when demand was more moderate due to the competition between market participants.

However, what we can expect is that, at a minimum, total revenue will increase sufficiently to support the new entrant generation (presumably off the back of supply contracts signed prior to market entry).

A.6.6 AEMO's concerns regarding the reliability standard

On 7 March 2018, AEMO provided the Panel with an overview of its concerns on the appropriateness of the reliability standard for operational purposes. Since this presentation AEMO has also published a number of documents in which these concerns have been detailed further:

- AEMO observations: Operational and market challenges to reliability and security in the NEM.[214].
- Proposal for an enhanced reliability and reserve trader (RERT), a rule change request to the AEMC.[215]
- Advice to the Commonwealth relating to AGL's proposal to replace Liddell, letter to Minister Frydenberg.[216]

As the Panel understands it, AEMO is concerned that, given the reliability standard is defined in the rules as a maximum (i.e. the upper threshold) of expected unserved energy in a given financial year, and is used amongst other purposes to establish the level of economically efficient generation investment in the NEM (via the calculation of the market price cap with reference to statistical forecasts), the occurrence of unserved energy (load shedding) in a given year may be much higher or lower than the expected level.[217] AEMO highlights that 'the actual occurrence of load shedding in a given year over a particular combination of weather events could be much higher than the expected level'.[218] AEMO's conclusion, that there is a high likelihood of some unserved energy occurring (noting that this may not breach the reliability standard), draws on forecast demand conditions with a 10 per cent probability of being exceeded, given current installed capacity and announced retirements.[219]

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214 Available at: http://www.aemo.com.au/Media-Centre/AEMO-observations---operational-and-market-challenges.

215 Available at: https://www.aemc.gov.au/rule-changes/enhancement-reliability-and-emergency-reserve-trader

216 Available at: http://www.aemo.com.au/Media-Centre/AEMOs-liddell-response.

217 AEMO, AEMO observations: operational and market challenges to reliability and security in the NEM, p. 58.

218 AEMO, AEMO observations: Operational and market challenges to reliability and security in the NEM, p. 7.

219 "AEMO's reliability simulations show situations with sufficient resources to meet the reliability standard while simultaneously showing the probability of load shedding during high, but still

As outlined in AEMO's submission to the Reliability Framework Review, in the absence of reserve procurement and any further generation investment in response to market conditions, AEMO expects the reliability standard to be exceeded one year in ten in New South Wales, with some load shedding to occur every four years. The Panel understands that this expectation relates to the period after the closure of the Liddell power plant and it excludes the implementation of AGL's Generation Plan and any other market participant response.

AEMO considers that the reliability standard is more likely to be exceeded during "peaky" demand years (such as years when the 10 per cent probability of exceedance (POE) demand scenarios are borne out in reality) even if, averaged over all scenarios, the expected unserved was less than 0.002 per cent.[220]

In this review the Panel took the generally-accepted approach of modelling unserved energy based on weighted 10 per cent and 50 per cent POE demand forecasts, consistent with statistical distributions. It separately applied this weighting to AEMO's neutral demand forecast as well as AEMO's strong demand forecast to consider the market price cap necessary to incentivise investment to meet the reliability standard.

AEMO believes that if the reliability standard is to be met in all years,[221] then intervention mechanisms additional to those that already exist for AEMO are essential to complement the market price cap during years with extremely high demand.

AEMO also asserts that jurisdictional governments have demonstrated an unwillingness to tolerate reliability-driven load shedding in their regions, even at levels that do not breach the reliability standard.[222] In AEMO's view this is evidenced by the South Australian Government investing in new battery storage peaking generation[223] and the New South Wales Government funding the procurement of reserves through the ARENA/AEMO tender process.[224]

AEMO believes its analysis shows that significant involuntary load shedding could occur during severe but plausible (based on historical observations) supply and demand conditions, potentially with economically efficient reserve options (such as voluntary load shedding/demand response) left on the table if AEMO were not to

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plausible, demand conditions to be an almost certainty. For example, in Sydney, temperatures of 40°C or more could be the catalyst for extreme (1-in-10 year) electricity demand, if these temperatures are experienced towards the end of the day when business demand is still relatively high, residential demand is increasing, and rooftop solar generation is declining.'' AEMO, *AEMO observations: Operational and market challenges to reliability and security in the NEM*, p. 28.

220 AEMO, *Proposal for an enhanced reliability and reserve trader (RERT)*, p 6.

221 The Panel notes that the reliability standard is a maximum level of expected USE and therefore by definition not a regulatory or performance standard. See section A.1 .

222 AEMO, *Proposal for an enhanced reliability and reserve trader (RERT)*, p 6.

223 More information at: https://www.premier.sa.gov.au/index.php/jay-weatherill-news-releases/7198-south-australia-is-taking-charge-of-its-energy-future.

224 More information at: https://aemo.com.au/Media-Centre/AEMO-and-ARENA-demand-response-trial-to-provide-200MW-of-emergency-reserves-for-extreme-peaks.

use its existing intervention powers.[225] AEMO does not consider that load shedding, even within the USE allowed for under the standard, meets most stakeholder expectations and believes that economically efficient options to avoid involuntary load shedding should be pursued to complement the market price cap.

AEMO does note that there will always be extreme scenarios which, if they came to pass, the standard may be exceeded. However in AEMO's view this should only be accepted where all economically efficient reserve options have been exhausted.

AEMO also considers that an alternate or supplementary measure to the current reliability standard may be beneficial for some purposes – such as Loss of Load Probability (LoLP). LoLP shows the probability of any load shedding, does not take into account the magnitude of load shedding, and does not assess whether or not the reliability standard is likely to be met. AEMO is of the view that this alternative measure to the reliability standard may be less sensitive to small changes in the supply-demand balance when USE is near the reliability standard, and so work better in operational timeframes.[226]

A reassessment of the metric for the current reliability standard is outside the scope of this review.[227]

Further the Panel notes that many of these issues have been raised in AEMO's enhanced RERT rule change request to the AEMC, so will be progressed through the AEMC's usual rule change request process.

AEMO also considers that during hot weather, involuntary load shedding poses significant risk of harm to public health and safety. The Panel notes that this review is to be guided by the national electricity objective. Part of the national electricity objective relates to the "safety" of the "supply of electricity" and the "national electricity system". These terms have particular meanings – safety refers to maintaining a "safe" energy system to meet the general requirements for safety of electricity supply, not broader safety considerations that may arise when the system is not supplying electricity. The Panel has set out its views on safety in its Annual Market Performance Review.

AEMO has expressed a desire to continue working with stakeholders including the Panel to progress these issues.

A.6.8 Changes in cost of marginal generation

The Panel committed in the issues paper to consider the materiality of changes in the cost of producing an additional unit of energy to meet otherwise unmet demand. Cost changes are relevant as the costs of marginal generation are the counter point to the value of customer reliability in the reliability "trade-off". If the value customers place on a reliable electricity supply remains constant, then

225 AEMO, Proposal for an enhanced reliability and reserve trader (RERT), p 6.

226 AEMO, *AEMO observations: Operational and market challenges to reliability and security in the NEM*, p. 28-29. AEMO is pursuing this proposal through lodging a rule change request with the AEMC, *Proposal for an enhanced reliability and reserve trader (RERT)*.

227 Reliability Panel, *Final Guidelines*, p. 5.

significant increases in the costs of marginal generator could suggest a loosening of the reliability standard.

In the issues paper the Panel noted that the "costs of new entrant technologies" were of interest.[228] However, EY's modelling results for this review indicate that under all scenarios (including the high demand and high costs scenario) the marginal generation technology is either an OCGT or CCGT unit (see section B.4.1). EY's modelling shows that the marginal generator remains a gas turbine generator with no substantial changes in cost compared to historical levels. For further detail refer to chapter 6 of the EY report.

228 Issues paper, p. 49.

Appendix B – Market price cap

This appendix describes:

B.1. The purpose of the market price cap.

B.2. The assessment criteria the Panel must consider in reassessing the market price cap.

B.3. Stakeholders' views.

B.4. Information and analysis supplementary to that provided in the main report outlining why we have recommended retaining the present level of the market price cap (in real terms) over the review period commencing 1 July 2020.

B.1 Purpose of the market price cap

B.1.1 Purpose

The market price cap is the reliability setting that sets an upper bound on the maximum possible price to which market participants can be exposed in any dispatch interval (and therefore in any trading interval).[229]

Its purpose is to:

> limit market participants' exposure to very high prices and thereby serve to limit risk.[230]

The key object of the market price cap is to safeguard the long term integrity of the national electricity market by limiting market participants' risk exposure to temporary, very high prices.[231] Reflecting this purpose, under the rules the Panel may only recommend a market price cap that in conjunction with other provisions of the rules, we consider will not create risks which threaten the overall integrity of the market[232] (see section B.2).

Box B.1 describes why limiting risk exposure to very high prices benefits market integrity. It should be noted that the actual prices paid by customers served by a retailer is not the actual wholesale market spot prices but will reflect the pricing plan found in their contract with their retailer (which will reflect the average cost the retailer expects to incur over the relevant period for that customer).

229 While the market price cap is in effect the maximum that can be reached in any trading interval (or settlement period) it is defined in the rules as 'a price cap which is to be applied to dispatch prices'. Rules, clause 3.9.4(a).

230 Issues paper, p. 53.

231 The cumulative price setting is the reliability setting that seeks to limit market participants' exposure to very high prices over a sustained period, see chapter 4.

232 Rules, clause 3.9.3A(f).

Box B.1 Why limiting market participants' risk exposure to high prices benefits market integrity

As outlined in the issues paper[233], markets rely on the presence of willing participants. A principal consideration for participants is the risk to which they are exposed in a market. In the absence of market price limits, purchasers of energy (as price takers) could be exposed to potentially unlimited energy cost risk in any dispatch interval. Such an extreme level of risk may make it unlikely that purchasers would be willing to participate in the market.

Similarly, in the absence of a market price cap, generators could be unwilling to provide energy on a "firm" basis – that is, they would not be willing to enter into contracts as by doing so the generator would take on the (limitless) exposure to movements in spot prices. Were the generator to have a technical difficulty limiting generation, or be constrained off at a time of high prices, it would have unlimited financial exposure. In this, admittedly extreme, example a participant could stand to lose its entire business in a matter of hours. Such a level of risk threatens the integrity of the market, because it deters rather than supports use of the market.

Through the price setting process, markets align the costs and risks of consuming a service with the costs and risks of providing that service. A purist economic approach would warn against imposing any constraints on the prices that can occur in a market.

But there is a point at which there are diminishing benefits in increasing market participants' exposure to price risk. Placing some limits on participants' exposure to very high and very low prices to protect the integrity of that market is a feature of markets in many sectors. This is particularly important given the physics of electricity supply systems that require the instantaneous matching of demand and supply which is done through a focus on the supply side.

The market price cap also:

> serves as a proxy "limit" on [customers'] bids – they will not pay more than this amount for energy in any dispatch interval.[234]

Most consumers do not directly face wholesale market prices

While retailers and some large industrial consumers are exposed to variable prices of electricity in the wholesale market, most consumers—for instance small businesses and families—are not directly exposed to spot market prices. Rather, retailers act as intermediaries on behalf of consumers. Retailers purchase electricity on the spot market and manage price risk through participation in the parallel financial contracts market.

233 Issues paper pp. 13-14.

234 Issues paper, p. 53.

The electricity price most consumers pay is the price they negotiate with their energy retailer. Consumers' retail bills reflect a range of costs. Wholesale market costs comprise one of a number of cost components and typically account for 28 – 41 per cent of customers' bills.[235] The other electricity supply chain components are: network costs (comprised of transmission and distribution costs), environmental policy costs and a residual component (represents costs incurred by retailers, retail profit or loss and errors in the estimated value of all other supply chain cost components).

Hence consumers are indirectly affected by conditions and prices in the wholesale spot market through the price they pay to the retailer. Spot market conditions, wholesale contract market conditions, wholesale market risk and importantly, the reliability standard and settings are relevant to all consumers.

Many factors influence wholesale prices

It should be noted that actual price outcomes in the wholesale market, including the average prices, are determined by a range of factors apart from the maximum price set by the market price cap. These factors include bidding behaviour, gas prices and depth of competition in the market.

B.1.2 Considerations in setting the market price cap

The market price cap constrains prices and so is an intervention in the wholesale spot market. As such, setting its level is significant for reliability (and commercial) outcomes in the national electricity market. Hence:

> In setting the market price cap the primary principle observed is that the market price cap should not prevent the market sending efficient price signals, to support the efficient operation of and investment in electricity services over the long run. The process for setting the market price cap assumes that the reliability standard reflects the efficient level of expected unserved energy.[236]

The market price cap needs to be set at a level such that prices over the long term incentivise enough capacity (including generation investment, interconnector capacity and demand response) so the reliability standard is expected to be met.

Reflecting this principle, the Rules require that the Panel only set a market price cap that allows the reliability standard to be satisfied without AEMO using its power to issue directions to market participants or reserve trader powers (see section B.2 for more detail).[237]

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235 AEMC, *2017 Residential Electricity Price Trends, final report,* 18 December 2017, p. x.

236 Issues paper, pp. 53-54. The Panel acknowledges that the guidelines have a slightly different emphasis regarding the role of the market price cap, wherein its primary purpose is presented as facilitating efficient price signals in the market, with a secondary purpose of managing participant exposure to price risk. The characterisation of the settings overall purpose in this discussion places more emphasis on the second function – the management of exposure to high prices – but is nevertheless consistent with the function of the reliability standard and settings..

237 Established under clauses 3.20.7(a) and 4.8.9(a) of the rules.

B.1.3 The trade-off to be made

Setting the level of the market price cap involves making a trade-off on behalf of consumers between:

- **Limiting market participants' exposure to high prices** – the higher the price cap the greater participants' exposure to high prices and therefore price risk, and the risk to long term market integrity.
- **Allowing for efficient price signals –** the lower the market price cap the greater the chance of impeding efficient price signals in the wholesale electricity market for operation and investment – increasing the risk of unserved energy.

Box B.2 explains this trade-off in more detail.

Box B.2 The trade-off to be made in setting the level of the market price cap

To understand the factors the Panel must consider in this review, it is useful to elaborate on the trade-off the Panel is making when setting the level of the market price cap.

Setting the level of the market price cap involves making a trade-off on behalf of consumers between:

- **Market participants' exposure to high prices** – the higher the price cap the greater participants' exposure to high prices and therefore price risk.
- **Inefficient price signals –** the lower the market price cap the greater the chance of impeding efficient price signals for operation and investment – increasing the risk of unserved energy.

If the market price cap were set extremely high, market participants could be exposed to substantial price risk. This could threaten the stability of the market over the long run. While the contract market would act to provide services to minimise this price risk, market participants would remain exposed to some residual financial risk due to the difficulty of exactly matching contract volume with actual wholesale market outcomes.

Equally, the market price cap is a constraint on prices. Its existence prevents prices from rising beyond a certain level. It follows that different levels of the cap may alter the payments for energy in the market. For example, if the cap were set sufficiently low (for instance at $300/MWh) it would prevent the market from sending efficient price signals at times when the marginal cost of energy exceeded $300/MWh. In turn this would feed through to the contract market, potentially reducing the incentive to enter into contracts, decreasing contract market liquidity and, over the long run, reducing incentives for efficient investment in electricity services.

Additionally the level of the market price cap should allow the market price to create incentives for participants to manage price risk; whether it is through the purchase of contracts or even retailers investing in generation (vertical integration).

Finally it is important to note that the market price cap is not a mechanism for putting downward pressure on the prices charged to consumers. Nonetheless the Panel is to have regard to the impact of the market price cap on spot prices and have done so in this review. The Panel recognises that households and businesses are experiencing considerable hardship from high energy bills.

The market price cap is currently set at $14,200/MWh and is indexed to movements in the consumer price index each financial year.

B.2 Criteria – Determination of level

B.2.1 Assessment requirements

Consistent with the purpose of the market price cap, the rules specify that the Panel may only recommend a market price cap that the Panel considers will:

- Allow the reliability standard to be satisfied without AEMO using its power to issue directions to market participants or its reserve trader powers (see Box B.3).[238]
- In conjunction with other provisions of the rules, not create risks which threaten the overall integrity of the market.[239]

The rules also specify that, if the Panel is of the view that a decrease in the market price cap may mean the reliability standard is not maintained, the Panel may only recommend such a decrease where it has considered any alternative arrangements necessary to maintain the reliability standard.[240]

These assessment requirements directly relate to the purpose of the market price cap and the trade-off involved in setting its level.

238 Established under clauses 3.20.7(a) and 4.8.9(a) of the rules. These are explained in Box B.3.

239 Rules, clause 3.9.3A(f).

240 Rules, clause 3.9.3A(g).

Box B.3 AEMO market interventions

AEMO is provided with powers to intervene in the market to address potential shortfalls of the reserve.

Reserve is the level of supply above demand that is forecast to be available for dispatch. Reserve acts as a buffer to help manage unexpected system developments such as the loss of a large generator.

AEMO may take one or more of the following actions when market responses to lack of reserve (LOR) market notices (i.e. notice of an expected shortfall in reserves), or informal negotiations with market participants, are insufficient:

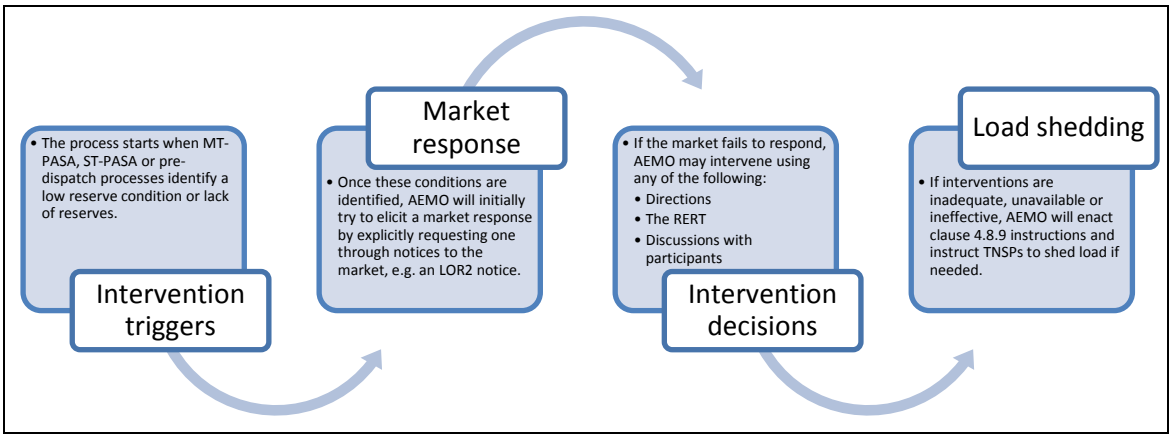
- **Reliability and Emergency Reserve Trader (RERT) contracts** - under clause 3.20.7(a) of the rules, the RERT provisions allow AEMO to contract for ('lock in') reserves ahead of a period where reserves are projected to be insufficient to meet the reserve shortfall (from 3 hours to 10 weeks ahead of time). AEMO is able to dispatch these reserves to manage power system reliability and, where practicable, security.
- **Directions and instructions** - under clause 4.8.9(a) of the rules, AEMO may issue directions and/or clause 4.8.9 instructions to maintain the power system in a secure, satisfactory or reliable operating state. These include:
- Directions, whereby a generator is asked to increase or decrease its output if physically possible and safe to do so. AEMO determines the price that applies when it issues a direction, with that price intended to 'preserve the market signals that would have existed had the intervention action not been taken'.[241]
- Instructing a large energy user, such as an aluminium smelter, to temporarily disconnect its load or reduce demand (a 'clause 4.8.9 instruction'). This only applies to large users who are registered participants.
- Instructing a network service provider to shed and restore load consistent with schedules provided by the relevant state government (also a 'clause 4.8.9 instruction'). The market price cap would apply when involuntary load shedding occurs, whereby load is intentionally shed in different parts of the network at different times.[242]
- Using network support and control ancillary services (such as reactive power management) to the extent that the projected reserve shortfall is affected by a network limitation that can be addressed by such services.

Figure 10 summarises the chain of events that AEMO would typically go through when triggering an intervention.

241 The price that applies when AEMO intervenes in the market is set out in AEMO's Intervention Pricing Methodology (2014), under clause 3.9.3 of the rules.

242 See NER clause 3.9.2(e)(1)

Figure 10: Steps in AEMO market interventions



B.2.2 Assessment considerations

The Panel must have regard to the potential impact of any proposed change to the market price cap on: the reliability of the power system; spot prices; investment in the national electricity market and; market participants.[243]

Additionally, in reviewing the market price cap the Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework.[244] The purpose of this principle is to promote investor certainty. The need for a stable and predictable market framework is not new; it was also discussed in the 2014 Review.[245] However, it is particularly crucial to support efficient investment over this review's time horizon given the rapid change already underway in the physical system and considerable uncertainty in associated policy areas, such as the integration of energy and emissions policy (see section 8.1).

B.3 Stakeholder submissions

B.3.1 Submissions on the issues paper

The subject of the market price cap was addressed in all seven of the submissions received on the issues paper from: the Australian Energy Council, Origin, ERM Power, Public Interest Advocacy Centre (PIAC), EnergyAustralia, Engie and Snowy Hydro.

Three organisations commented on the appropriate level of the market price cap: PIAC suggested it should be lowered, Snowy Hydro supported keeping the cap at its current level, and ERM Power stated it should not be increased. The remaining four submissions discussed factors the Panel should consider in arriving at its decision, including risks to the market from setting the market price cap too low (Engie).

243 Rules clause 3.9.3A(e)

244 Guidelines p. 3.

245 Reliability Panel, Reliability standard and reliability settings review 2014, final report, 16 July 2014, Sydney, p. 42.

PIAC

PIAC suggests that the market price cap 'should be lowered':

> [i]n spite of the Panel's commissioned analysis [in the 2014 review] showing ample opportunity to adjust the price settings downward while remaining within the limit of the Reliability Standard, the Panel decided not to adjust the MPC or CPT downwards…
>
> PIAC considers that, in the context of the above, the Panel's second principle [in the guidelines] "Delivering a level of reliability consistent with the value placed on that reliability by customers" makes clear that, outside of SA [South Australia], the actual level of USE could be much higher than it is and still remain within standard, implying that the MCP and CPT should be lowered.[246]

PIAC also commented on several other matters: [247]

- Role of the MPC – PIAC argues that the 'function of the MPC to manage participant exposure to price risk should be considered paramount' over serving as the chief investment (and disinvestment) signal.[248] PIAC argues that investment and disinvestment decisions are increasingly driven by factors such as such as high fuel prices, over supply, renewable energy incentives, lack of a long-term carbon policy, government investment, and opportunities for additional income from new markets (such as for inertia).
- Demand response – The Panel should consider the role of the market price cap in decisions made by demand response proponents (as well as generators), given policy and market changes supporting increased demand response and the "markedly" lower price signal required compared to new generators. Any demand response procured by AEMO through the RERT should not be considered "AEMO intervention" for the purposes of setting the MPC or CPT.[249]
- New revenue streams – The creation of new markets for energy services such as inertia, and the financial investment signals they provide, suggests consideration should be given to a lowering of the market price cap.[250]
- Regional price caps – The market price cap (and cumulative price threshold) should vary by region.[251]
- Contract market – The contract market is a means to an end and should only be preserved to the extent that it serves the long-term interests of consumers.[252]
- Additional review – The Panel should conduct an interim review in 2020 given the scale and pace of changes underway in the market.[253]

246 PIAC, submission to the issues paper, pp. 2-3.

247 PIAC, submission to the issues paper, pp. 4-6.

248 PIAC, submission to the issues paper, p. 3.

249 PIAC, submission to the issues paper, p. 4.

250 PIAC, submission to the issues paper, p. 3.

251 PIAC, submission to the issues paper, p. 6.

252 PIAC, submission to the issues paper, p. 6.

Snowy Hydro

Snowy Hydro supports the current level of the market price cap:

> There is no evidence to suggest that the MPC at its current levels will not provide the incentives for new investment in the NEM when it is required. All available evidence shows that the MPC has been a signal for new investment which has allowed the reliability standard to be met without AEMO intervention ie. Directions and the use of the RERT.[254]

On the drivers of the rise in market price cap events in South Australia (highlighted in the issues paper), Snowy Hydro points to:

> firm generation retiring as an increasing amount of intermittent generation comes into the market, the need for expensive short-term generation to fill supply gaps, and the absence of national energy policy certainty…
>
> [t]he inclusion of Snowy 2.0 would add firm generation back into the grid and will likely minimise the incidence of market price cap events.[255]

ERM Power

ERM considers the market price cap should not be increased[256] due to uncertain outcomes, heightened risk to market participants and higher prices:

> We believe the Panel needs to consider that changes to increase any of the reliability settings in value may not translate to what the Panel believes would be positive changes in investment outcomes given the current levels of market uncertainty…
>
> An increase in any of these settings would only increase the risk to all participants of operating in the NEM and would lead to further and unnecessary price increase to consumers at a time when many consumers are struggling with significant increases in electricity costs.[257]

In addition, ERM Power:

> [B]elieve[s] the Panel should consider that even at a relatively high gas or liquid fuel price of $30/GJ, which is above the price outcomes observed in the winter of 2016, the equivalent generator marginal cost remains sub $450/MWh, which is well below the current MPC value.[258]

A further argument ERM Power made for not raising the market price cap is that a higher cap would not necessarily avert load shedding events as recently shown on 8 February 2017. ERM Power instead suggests the Panel consider new rules to improve accuracy in AEMO demand and semi-scheduled forecasting.

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253 PIAC, submission to the issues paper, p. 7.

254 Snowy Hydro, submission to the issues paper, p. 4.

255 Snowy Hydro, submission to the issues paper, pp. 4-5.

256 Nor does ERM consider that any of the other reliability settings should be increased.

257 ERM Power, submission to the issues paper, pp. 1-2.

258 ERM Power, submission to the issues paper, p. 3.

Other points ERM Power made against raising the market price cap were that:[259]

- Default bid – while the market price cap acts a default bid, it is possible to observe that price sensitive loads do in fact reduce consumption at prices as low as $5,000/MWh. These loads are not scheduled and their price sensitivity is therefore not visible to the market.
- Contracts – increasing the market price cap may reduce the supply of contracts, as generators may decrease their exposure to the contacts market to avoid unfunded contract for difference payments arising from a rise in a contracted generator risk exposure from unplanned outages.
- Direct demand-price link – a direct relationship between high prices and high demand remains strong in South Australia, based on analysis of the impact of reduced network capability and interconnector outages during 2016 and data from January to June 2017.
- The market price cap, cumulative price threshold and administered price cap should be set together.

ERM Power considered the Panel should set a "high bar" for changing the market price cap:

> The Panel's task in reviewing the reliability settings during this review is challenging. Any changes to any of the settings should be based on an assessment that the change will result in positive benefit to the NEM from a consumer's perspective.[260]

Origin

Origin did not comment on the appropriate level of the future market price cap but offered views on matters the Panel should consider. Origin noted the (limited) potential of the MPC to impact on investment in the current environment:

> While the level of the MPC is important in providing an efficient price signal for future investment there are a number of other important factors. For example the lack of a sound and coherent policy framework continues to be the primary issue dampening investor confidence, and if addressed would have a more significant impact in ensuring ongoing reliability compared to any changes to the reliability settings.[261]

Origin also suggested the Panel examine the reasons for AEMO's increased use of its intervention powers. Origin does 'not believe it should be assumed that AEMO's interventions are indicative of the MPC or other reliability settings being set at an inappropriate level'.[262]

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259 ERM Power, submission to the issues paper, pp. 2, 5-6

260 ERM Power, submission to the issues paper, p. 5.

261 Origin, submission to the issues paper, p. 2. See also Origin's opening comment on page 1 of its submission.

262 Origin, submission to the issues paper, p. 1.

More generally, Origin notes that the Panel's decision necessarily will be based on judgement, informed by quantitative and qualitative evidence.[263]

Australian Energy Council[264]

The Australian Energy Council's submission to the issues paper also discusses AEMO's use of its intervention powers. In contrast to Origin, the Australian Energy Council's view is the recent increase in the use of these powers necessitates a review of the market price cap (and the cumulative price threshold).[265]

The Australian Energy Council also supports a modelling approach that examines the impacts of recent changes in the market on the level of the market price cap. It suggests that the growth in renewable generation and thermal retirement will require a higher market price cap in order for the reliability standard to be met.[266]

Engie

Engie requests that we consider the risks of setting the market price too low:

> The MPC needs to be set at a sufficiently high level to underpin an active demand response sector and to encourage unsophisticated commercial players to contract and not 'ride spot' on the back of oversupplied intermittent generation.
>
> In this context the risk of setting the MPC too low is likely to result in under contracting, and hence underinvestment, possibly leading to market failure. These risks are considered far more detrimental to the market stability and efficacy of the market than if the MPC is set too high which would result in a small amount of excess capacity being built.
>
> A fundamental principle in setting the MPC should be to ensure that the cap is 'out of the way', and the market (supply and demand) can respond below it.[267]

On the current investment environment, Engie comments:

> [I]nvestment in the National Energy Market has been seriously compromised by policy interventions and therefore risk (and hence WACC) has increased at the same time as payback periods have been severely shortened across all technology types. This doesn't impact just new entrants but any investments related to existing plant, especially when considering refurbishment of plant.[268]

Engie's view is that uncertainties and risk should be incorporated into the modelling and lists a number of issues the modelling should address. These include: plant life and WACC "from an investors' perspective" (ie economic life); a flattening of the shape of demand over time; complexity and cost of gas arrangements; transmission risks and

263 Origin, submission to the issues paper, p. 2.

264 The Australian Energy Council is a peak industry body that represents 21 major electricity and downstream natural gas businesses operating in competitive wholesale and retail energy markets.

265 Refer to section 4.5

266 Australian Energy Council, submission to the issues paper, p. 2.

267 Engie, submission to the issues paper, p. 2.

268 Engie, submission to the issues paper, p. 3.

costs; levels and impacts of variability of wind and solar generators; and the changing role of thermal plant.[269]

Also regarding the modelling method for setting the market price cap, Engie states:

> As a matter of principle, the modelling should minimise the use of 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).[270]

EnergyAustralia

EnergyAustralia commented on the factors the Panel should consider in reviewing the level of the cap. The Panel should:

> be seeking to strike the right balance between providing incentives to invest in the market while not having extreme outcomes from exposure to the price cap.[271]

In relation to raising the market price cap, EnergyAustralia stated that:

> Any significant increase [in the market price cap] has the potential outcome of causing extreme financial stress to retailers that are exposed to the spot price, or generators that are unable to defend hedging positions. A cause of concern would be that if growing volatility is experienced due to the continued penetration of intermittent generation, without corresponding levels of storage, participants are likely to suffer increased exposure to the price cap as the market transitions. Obviously, this exposure would be exacerbated by a higher MPC setting.[272]

On lowering the market price cap, EnergyAustralia commented:

> Any reduction in the MPC [market price cap] should be considered against the possibility that it would reduce incentives to invest in adding generation capacity to the market. Combined with government interventions in this sector, such a reduction may impact on the market's ability to respond to market signals and meet the reliability standard.[273]

The submission also calls for a market price cap that supports the effective operation of the contract market; 'the setting of the MPC should also be such that it continues to drive a strong level of participation in financial markets to minimise exposure to the spot price.'[274]

EnergyAustralia notes that the market price cap should be set so as to allow investment sufficient to deliver the reliability standard without AEMO interventions and also notes

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269 Engie, submission to the issues paper, p. 2.

270 Engie, submission to the issues paper, p. 5-6. Engie also stated that it :'believes that the use of the cap defender approach is highly distortionary, misprices generation output or demand side response and therefore must not be used as a technique for the MPC determination.'

271 EnergyAustralia, submission to the issues paper, p. 2.

272 EnergyAustralia, submission to the issues paper, pp. 2-3.

273 EnergyAustralia, submission to the issues paper, p. 3.

274 EnergyAustralia, submission to the issues paper, p. 2.

in this regard notes the occurrence of multiple directions from AEMO in the last twelve months. Akin to Origin's views, EnergyAustralia considers many of the recent interventions relate to system security issues and as such do not indicate concerns in the effective functioning of the market price cap.[275]

On the broader market environment, EnergyAustralia considers that:

> With the level of change being considered in the market at present it would be difficult to confidently assess the impact of changing the standard and settings.[276]

B.3.2 Stakeholder submissions on the draft report

The subject of the market price cap was addressed in all four of the submissions received on the draft report: Origin, Engie, EUAA and PIAC.

Origin supported the Panel's recommendation to maintain the current level of the market price cap. Engie considered there was evidence supporting an increase in the level of the market price cap. The EUAA and PIAC both argued that the market price cap should be decreased.

Origin

Origin supports the Panel's market price cap draft recommendation:

> Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[277]

Engie

Engie disagrees with the Panel's assessment of modelling scenarios:

> The draft report proceeds to dismiss higher settings and E&Y modelling results on the basis that these scenarios are unlikely and would serve to increase cost to consumers.[278]

EUAA

The EUAA does not agree with the Panel's market price cap recommendation:

> [The EUAA] does not support the Panel's recommendation on the market price cap.[279]

The EUAA expressed concern regarding the Panel's 'stability' argument:

> The draft report provides no supporting analysis that "stability" is materially better than a change.[280]

275 EnergyAustralia, submission to the issues paper, p. 2.

276 EnergyAustralia, submission to the issues paper, p. 1.

277 Origin, submission to the draft report, p. 1.

278 Engie, submission to the draft report, p. 3.

279 EUAA, submission to the draft report, p. 1.

280 EUAA, submission to the draft report, p. 8.

> "Stability" in the MPC is not in the long-term interests of consumers – a lower MPC is.[281]

The EUAA considers the market price cap's role as investment signal has diminished:

> In the recent years, deployment of new generation capacity has almost entirely been driven by the RET, CEFC, State Government and Territory reverse auctions and investors' view of risk e.g. carbon and gas fuel supply.
>
> The level of MPC is not a major factor (if a factor at all) in the new generation build and indeed the NEM is moving away from being a market relying on 'market' signals.[282]

The EUAA contends that a lower market price cap would better protect consumers from extreme prices:

> While the current MPC is not needed for new investment, its role in mitigating the risks of consumers being exposed to excessive prices still remains. The draft paper agrees with this role for the current MPC level, so presumably a lower MPC would achieve the role of consumer protection even better.[283]

PIAC

PIAC considered the Panel's market price cap recommendation needed to be supported by greater evidence:

> PIAC is deeply concerned about the dearth of evidence behind the panel's draft recommendations, and that these fail to promote the long term interests of consumers.[284]

PIAC was not satisfied with the Panel's consideration of the issues it raised in its submission to the issues paper in relation to lowering the market price cap:

> PIAC is disappointed to note that many of the points made in PIAC's submission to the issues paper have been acknowledged, but not meaningfully addressed.[285]

B.3.3 Stakeholder feedback at the public forum

The public forum focussed exclusively on the market price cap and the cumulative price threshold in response to stakeholders' comments to the draft report.[286] In the forum the following issues were raised in relation to the level of the market price cap.[287] In summary, consumer advocates argued that:

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281 EUAA, submission to the draft report, p. 3.

282 EUAA, submission to the draft report, p. 2.

283 EUAA, submission to the draft report, p. 2-3.

284 PIAC, submission to the draft report, p. 1.

285 PIAC, submission to the draft report, p. 1.

286 The slides presented at the public forum are available on the project page: https://www.aemc.gov.au/markets-reviews-advice/reliability-standard-and-settings-review-2018

287 Refer to Appendix G for a full summary of the issues discussed at the public meeting.

- Since the current level of the market price cap is higher than the level necessary to ensure that the reliability standard is met, the market price cap should be reduced.
- The market price cap is no longer a key driver of investment, and its primary purpose is consumer protection.
- The current market price cap contributes to high electricity prices.
- Consumers are paying twice: through taxes (the cost of government interventions) and high electricity bills.
- The market price cap had been set too high by past Panel reviews.
- Five minute settlement outcomes are a reason to consider a reduction in the market price cap.

Generators stated:

- The market price cap is relevant for investment decision-making. For instance, the value of power purchase agreements is driven by revenue expectations which in turn depend on the level of the market price cap.
- A higher market price cap incentivises capacity investment, which over time puts downward pressure on prices.
- The current market price cap should be retained.

B.4 Analysis – Determination of level

This section presents information and analysis supplementary to that provided in the main report regarding why the Panel recommends leaving the current market price cap unchanged from 1 July 2020.[288] It addresses:

- Considerations relating to lower market price outcomes including:
  - outcomes of the high cost generation and high cost investment modelling sensitivity.
  - interaction between the market price cap and consumer prices.
- Considerations relating to higher market price outcomes including:
  - outcomes of other modelling scenarios.
  - historical levels of unserved energy.
  - AEMO interventions.

Considerations relating to lower market price cap outcomes

B.4.1 Outcomes of the high cost generation and investment modelling sensitivity

This section details the modelling approach underpinning the market price cap outcomes of $11,600/MWh under five minute settlement and $12,500/MWh under

288 Note that information regarding the relationship between the market price cap and cumulative price threshold is presented in Appendix C – Cumulative Price Threshold.

thirty minute settlement. For greater detail refer to the EY Report (sections 3, 6 and 7).

B.4.1.1 Overview of the market price cap modelling approach

The Panel commissioned EY to estimate the theoretical optimal market price cap for the period 1 July 2020 – 1 July 2024. Given the extent of uncertainty and change in the market, we sought modelling outcomes for a range of circumstances (with varying degrees of likelihood) that could arise in the future. This was to allow the Panel to form judgements about the circumstances under which certain levels of the market price cap may be needed; to limit exposure to excessive high prices while allowing for investment sufficient to meet the reliability standard.

To examine the potential market price cap needed from 1 July 2020, EY in consultation with the Panel:

- Chose two scenarios of the many potential 'futures' for the NEM considered to be plausible ways in which expected unserved energy in a region could exceed 0.002 per cent.
- Chose a number of factors to modify to examine the sensitivity within each scenario of the market price cap level to those factors.
- Examined through market modelling the market price cap required to allow new investment in generation sufficient to reduce expected unserved energy back below the standard, for each scenario and sensitivity.

Devise scenarios

As the forecast level of unserved energy for each region over the review period is well below the reliability standard (see appendix section A.5) scenarios were needed to examine the theoretical optimal market price cap.

Of the many potential 'futures' for the national electricity market during the review period, EY and the Panel chose two scenarios, which were considered to be plausible ways in which unserved energy in a region could be expected to exceed the reliability standard of 0.002 per cent.

These scenarios were used to examine the market price cap needed to allow investment sufficient to reduce expected unserved energy back below the standard. One scenario was in South Australia and the other in Victoria.[289]

The modelling examined the market price cap(s) needed in each region in the event that:

- thermal plant retired earlier than expected
- renewable technologies accounted for a considerable proportion of the generation mix
- demand was strong

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289 The EY report states that: 'these are the two regions where the most plausible scenarios could be devised to threaten the reliability standard. This is mainly due to the thermal power stations in these regions being older than in other regions and are hence more likely to retire earlier than currently expected.' See EY Report, p. 36 regarding exploratory studies conducted for NSW and Queensland.

- coal plants experienced high outage rates.

To generate expected unserved energy above 0.002 per cent, the following assumptions were applied to EY's baseline or base case forecast for each region:[290]

Scenario 1: South Australia	► AEMO high demand forecast[291] ► EY's coal outage rates[292] ► Early retirement of 1,040 MW of thermal capacity in South Australia
Scenario 2: Victoria	► AEMO high demand forecast ► EY's coal outage rates ► VRET 5150 MW scheme[293] ► Early retirement of 2,600 MW of thermal capacity in Victoria

Introduce candidate new entrant generators to reduce unserved energy below 0.002 per cent

The methodology then involved finding, for each plausible scenario with expected unserved energy over 0.002 per cent (i.e. more unserved energy than allowed by the reliability standard), the marginal (lowest cost) technology that could be installed to bring unserved energy back below 0.002 per cent.[294]

The modelling utilised a technology-neutral approach, in that a range of technologies were considered as the potential new entrant to reduce unserved energy below 0.002 per cent, and potentially set the theoretical optimal market price cap outcome. The technologies that were considered are as follows:

- Solar PV (Fixed flat plate)
- Solar PV (Single-axis tracking)
- Solar PV (Dual-axis tracking)
- Solar Thermal
- Wind
- OCGT
- CCGT
- Coal
- Nuclear
- Large-scale storage, including batteries and pumped hydro.

While both demand side participation and pumped storage projects have the potential to reduce unserved energy, EY considered that there is 'insufficient information on the cost of implementing new demand side participation or pumped storage projects to

290 Forecast unserved energy in the base case for each region was well below the reliability standard. EY Report, p. 36.

291 From Strong scenario in AEMO's 2017 ESOO. This includes higher demand, rooftop PV, EV and behind-the-meter battery uptake compared to the Neutral scenario (as used in the base scenario in this Review). For details, see EY Report, Appendix A.

292 EY analysed historical availability of NEM coal generators to estimate an upper bound for its forced outage rates. For details, see EY Report, Appendix A.

293 Involves 700 MW of renewable capacity in addition to the LRET installed in Victoria in each year in the Period (Source: https://www.energy.vic.gov.au/renewable-energy/victorias-renewable-energy-targets).

294 EY report, p. 11.

comment on the potential for these types of projects to become a marginal source of reducing USE [unserved energy] to within the reliability standard'.[295] See section 8.4 for commentary on future sources of information.

Identify the minimum market price cap

The optimal market price cap for each scenario is the lowest market price cap that achieves net positive revenue for any existing generator and for the new entrant investment, by the end of the review period. The methodology to determine the theoretical optimal market price cap involved finding for each plausible scenario the marginal (lowest cost) technology that could be installed to bring unserved energy below 0.002 per cent.[296]

Apply sensitivities

As part of the process, EY in consultation with the Panel chose a number of factors to modify within each scenario to examine the sensitivity of the theoretical optimal market price cap to those factors.

B.4.1.2 The high technology and investment cost sensitivity

The sensitivity that resulted in the market price cap outcome of $12,500/MWh examined the market price cap needed for the Victorian scenario in the event of high investment and high technology costs, while maintaining the cumulative price threshold at its current level.

With unserved energy exceeding 0.002 per cent due to the factors applied to the Victorian scenario (outlined previously), the modelling assessed the market price cap needed to reduce unserved energy below 0.002 per cent given the following 'high cost' assumptions:

- A high gas price of $18/GJ to represent an upper-bound at the liquid-fuel equivalent price given uncertainty in low-cost natural gas supply for a low utilisation generator.
- Higher capital costs for wind, solar PV and storage.
- A 10 per cent WACC to represent investment uncertainty.
- CCGTs excluded as a candidate marginal new entrant technology due to their inflexibility and the requirement for long-term high volume gas supply.

Market price cap results

Table 5 presents the market price cap results for the scenarios and sensitivities, including the Victorian 'high costs/high' scenario resulting in a market price cap of $12,500/MWh. A number of other sensitivities were applied. The basis of these sensitivities explained in section 6 of the EY Report. These outcomes were with the present cumulative price threshold and administered price cap settings.

295 EY report, p. 66.

296 EY report, p. 11.

Notwithstanding the falling cost of battery storage, EY's modelling found OCGTs to be the marginal new entrant technology to meet the reliability standard for most scenarios and sensitivities for the period 1 July 2020 – 1 July 2024, as shown in Table 5.[297]

Table 5: Market price cap outcomes[298]*

MPC scenario	Sensitivity		Theoretical optimal MPC ($/MWh)	Marginal new entrant technology (achieved capacity factor)
MPC Scenario 1 (SA)	Base costs		$1,500	CCGT (70%)
	High costs	High	$8,900	OCGT (3.5%)
		Cap defender	$9,000	OCGT (2.1%)
		12% WACC	$21,000	OCGT (3.5%)
		Half lifetime	>$50,000	OCGT (3.5%)
MPC Scenario 2 (Victoria)	Base costs		$1,500	CCGT (70%)
	High costs	High	$12,500	OCGT (6.3%)
		Cap defender	$21,000	OCGT (2.0%)
		12% WACC	$37,000	OCGT (6.3%)
		Half lifetime	>$50,000	OCGT (6.3%)

*With the present settings for the cumulative price threshold ($212,800) and administered price cap ($270).

As shown in the table above, the market price cap outcomes for the Victorian scenario were higher than the South Australian outcomes and so Victoria became the NEM region setting the market price cap for the purposes of the modelling and the Panel's considerations. The Victorian results were higher than those in South Australia as there are relatively fewer high price periods compared to the modelled South Australian prices in the other market price cap scenarios. This requires a higher market price cap, in order for the marginal generator to recover necessary revenue from a smaller number of high price periods.[299]

The Panel notes EY's views that the lowest market price cap under the base costs scenarios ($1,500) may only be sufficient where the marginal generator (in this case, a CCGT unit) can achieve a relatively high capacity factor and if gas fuel is available for a fixed price, at high volumes, over a long period of time.[300]

297 See discussion in the EY report regarding assumptions in relation to CCGTs, pp. 40-41.

298 EY report, p. 42. These modeling results have been revised since EY's draft report. Stakeholders were briefed on the revised results at the March 2018 public forum. For further detail, refer to the presentation given at the public forum (slide 18), available at the project page: https://www.aemc.gov.au/markets-reviews-advice/reliability-standard-and-settings-review-2018

299 For an explanation of how market incentives work, and how the reliability settings impact on them, see AEMC 2017, *Reliability Frameworks Review, Issues paper*, 22 August 2017, Sydney, particularly sections 2.2 and 6.

300 EY Report, pp.5- 6.

The principal modelling assumptions are presented in Appendix H.1, and the modelling method is detailed in the EY Report.

B.4.1.3 Impact of five minute settlement

On 28 November 2017 the AEMC made a final rule to change the settlement period for the electricity spot price from 30 minutes to five minutes, starting on 1 July 2021. Five minute settlement will be in effect for three of the four years considered by the Panel in this review. As such, the Panel tasked EY to investigate the effect of five minute settlement on the market price cap outcomes for the Victorian high cost generation and investment sensitivity.

The results show that the theoretical optimal market price cap in the five-minute modelling is lower than in the 30-minute modelling ($11,600/MWh compared to $12,500/MWh).[301] EY comments that:

> The results show that the theoretical optimal MPC in the five-minute modelling is lower than in the 30-minute modelling, but still relatively close to the present MPC at $14,200/MWh. The five-minute modelling produced a very similar overall expected amount of unserved energy (USE) to the 30-minute modelling in MPC Scenario 2. Consistent with this, the five-minute modelling also resulted in a similar number of hours with prices at the MPC. However, due in part to the interactions of generator bidding and ramp rate limitations, the five-minute modelling resulted in a higher incidence of prices between $200/MWh and $250/MWh compared to the 30-minute modelling. These periods provide the new entrant OCGT with higher market revenue compared with the 30-minute modelling, putting downward pressure on the theoretical optimal MPC.[302]

EY concludes:

> The outcomes presented show that moving to five-minute settlement may not make a substantial impact on the theoretical optimal reliability settings within the bounds of uncertainty associated with the assumptions and modelling limitations.[303]

In light of PIAC's concern that the market price cap has historically been set too high, and that the wholesale market is effectively being 'gold plated',[304] a key issue in considering any change to the market price cap is what impact such a change could have on consumer prices. The Panel has undertaken analysis to illustrate potential impacts, discussed in the next section.

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301 EY report, p. 58.

302 EY report, p. 58.

303 EY report, p. 62.

304 PIAC, submission to the issues paper, p. 2. PIAC argued that the the market price cap in 2014 was expected to deliver a much higher level of reliability than consumers are prepared to pay for.

B.4.2 Theoretical interaction between the market price cap and consumer prices

A material change in the market price cap will directly impact on both extreme and average wholesale electricity prices with a decrease in market price cap leading to lower prices and an increase in market price cap leading to higher prices.

This impact is a natural outcome of the NEM market structure, which can be argued to be workably competitive for the vast majority of dispatch intervals so that the ability to significantly increase prices above the marginal cost of the marginal generator is low. Noting that there may be transient market power in subcomponents of the dispatch order such as base load, shoulder or peaking plant due to limitations on available plant in those categories at certain times or when inter-regional constraints are in force.

Similarly, during periods of supply shortages it can be expected that generators with available capacity will have significant temporary market power which will be reflected in prices at or near the market price cap. This is a logical and necessary characteristic of the design of the NEM whereby generators in order to earn a return on and of capital invested must be able to achieve prices above marginal cost.

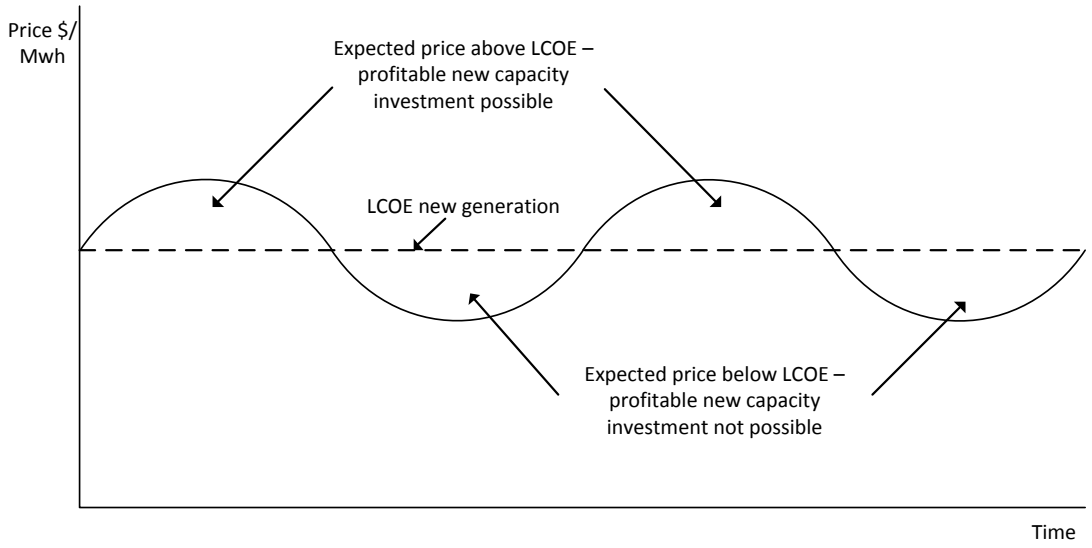
B.4.2.1 Impact on investment

New generation investment becomes economic when the expected price outcomes and future revenue from operating a new generator provide a neutral or positive project net present value (that is where the expected revenue is greater than or equal to the levelised cost of energy (LCOE) of the proposed generation project).

For investment in a non-base load dispatchable generator, the expected revenue stream will be determined by the number of dispatch intervals with prices greater than the unit's short run marginal cost as generating at such prices is a profit maximising strategy.

In terms of reducing investment risk through entering into an electricity off-take agreement, in an efficient market with no information asymmetry both parties have the same information on expected prices and demand and therefore should arrive at the same estimate of the future expected value of electricity supply (this is the basis of the fair value calculation underpinning cap contracts). Where this value is sufficient to support new investment, then generators can be expected to invest in new capacity and potentially underpin that investment with some form of electricity off-take agreement.

The entry of new capacity into the market can be expected to increase competition and decrease prices thereby foreclosing the opportunity for additional profitable new generation investment and limiting the likelihood of significant over capacity being developed. This is illustrated in the following graphic.



B.4.2.2 Analysis of historic market prices

An indication of the number of high price events and the potential impact of changing the market price cap can be gained from analysis of the NEM five-minute price outcomes for the twelve months ended 28 February 2018.

This period encompasses some 105,120 dispatch intervals (DIs). The following table shows the number of dispatch intervals with prices above certain levels calculated as the sum of the DIs in each region with prices above the threshold.

Price > ($/MWh)	# DIs	% of DIs*
12,500	61	0.06%
10,000	107	0.10%
1,000	153	0.15%
500	235	0.22%

* The percentage of DIs overstates the impact as the numerator in the calculation is based on the sum or all DIs above the price threshold while the denominator is simply the number of DIs in a year.

The above table highlights how few dispatch intervals exhibit high prices. For example, there were only 61 dispatch intervals across the entire NEM with prices above $12,500/MWh over the twelve months to 28 February 2018. Over this period the average NEM wide wholesale energy price (based on five-minute prices) was $93.07/MWh.

If the market price cap had been set at $12,500/MWh over this period, and assuming that this simply capped the price in dispatch intervals where the price was actually greater than this level and had no other price impact (which is consistent with the market being workably competitive), then over this 12 month period the total wholesale market revenue would decrease by some $19 million resulting in a 0.1% decrease in average prices or some ten cents per MWh.

B.4.2.3 Forward-looking analysis of lower market price cap on consumer bills

EY calculated the impact of lowering the market price cap—from its present level of $14,200/MWh to $12,500/MWh—on average annual time-weighted wholesale prices. The impact on time-weighted annual average regional wholesale market prices over the review period was estimated to be less than $0.25/MWh under all scenarios.[305]

The Panel has calculated that a $0.25/MWh reduction in wholesale costs would result in a decrease in annual residential consumer bills for a representative household by $1.40 in South East Queensland and $1.17 in New South Wales.[306]

Considerations relating to higher market price cap outcomes

B.4.3 Outcomes of other modelling scenarios

The Panel has also examined the outcomes of and assumptions underpinning the other scenarios. We consider that the Victorian and South Australian high costs scenarios with a 12 per cent WACC and half lifetime (resulting in marginal price caps >$50,000) to be outside the bounds of sensitivities informing how to set the market price cap for this review.

B.4.4 Levels of unserved energy – historical and expected

While the reliability standard is a forward-looking measure that expresses the *expected* level of unserved energy, it is worthy of note that for each financial year since the market price cap was last increased in real terms on 1 July 2010, through to June 2017, the amount of unserved energy in each region of the national electricity market has been below the reliability standard.[307]

In 2016/17, at a wholesale level, 0.00036 per cent unserved energy from events that the rules define as reliability events was recorded in South Australia. This is well within the reliability standard. At a wholesale level, there was no other unserved energy recorded due to reliability events for any other region in the NEM. Unserved energy above the reliability standard last occurred in the NEM in 2008/09.[308]

The Panel expects that with the settings at their current levels, based on the modelling forecasts unserved energy outcomes will continue to be below the reliability standard throughout the review period in all regions of the national electricity market.[309] The outcomes of the EY modelling that support this view are presented in appendix section A.5.

305 EY *Reliability Standard and Settings Review 2018 – Modelling Report*, March 2018, p. 63.

306 Based on 100 per cent of the change in wholesale market prices flows through to consumers' bills, and given that annual bill values are a function of regional retail price and customer energy consumption.

307 Panel, *2017 Annual market performance review*, 20 March 2018, p. xvi.

308 Panel, *2017 Annual market performance review*, 20 March 2018, p. xvi.

309 Based on the outcomes of the modelling conducted by EY.

The level of unserved energy under circumstances such as high demand and/or higher generator forced outage rates is still forecast to be well below the reliability standard throughout the review period (also outlined in Appendix A.5).[310]

Snowy Hydro shares this view of future unserved energy levels, commenting that:

> There is no evidence to suggest that the MPC at its current levels will not provide the incentives for new investment in the NEM when it is required.[311]

B.4.5 AEMO interventions

As outlined previously, clause 3.9.3A(f) of the rules state that the market price cap must be set so that the reliability standard can be satisfied without the need for AEMO to intervene (i.e., to issue directions to participants and use the RERT), overriding the outcomes that would have occurred in the market.

Some stakeholders asked that the Panel examine recent AEMO interventions in our review of the market price cap. In its submission to the issues paper, EnergyAustralia stated that:

> In terms of the MPC and CPT we note that multiple directions from AEMO have occurred in the last 12 months. The MPC and CPT are both meant to drive outcomes that allow the reliability standard to be met without such interventions, and it would be useful that reassessment of the MPC and CPT takes into account ongoing and increasing use by AEMO of directions. However, we also see that some of the directions are primarily due to system security concerns and less so due to a lack of generation within specific regions. This includes directions for synchronous generation to run in place of wind, in order to maintain system strength. We consider that such intervention does not necessarily point to the MPC and CPT not functioning as intended.[312]

Origin also commented on this issue, stating that:

> The Australian Energy Market Operator (AEMO) has used its powers of direction to intervene in the market on a number of occasions. We agree that the MPC and other reliability settings should allow for the meeting of the reliability standard without a reliance on AEMO using its directions or reserve trading powers. However, Origin would suggest that the Panel use this review as an opportunity to examine recent instances where AEMO has used these powers and determine the underlying motivation for doing so. We do not believe it should be assumed that AEMO's interventions are indicative of the MPC or other reliability settings being set at an inappropriate level. This is particularly

310 The Panel notes that the reliability standard allows for up to 0.002 per cent expected unserved energy in a region. Also, the unserved energy findings are forecasts underpinned by modelling assumptions that aim to reflect the likely outlook for the NEM over the review period. As such, actual unserved energy outcomes will differ from forecasts. In addition, AEMO has intervention powers under the rules to address potential shortfalls of reserves which in and of itself will tend to limit actual occurrences of unserved energy.

311 Snowy Hydro, submission to the issues paper, p. 4.

312 EnergyAustralia, submission to the issues paper, p. 2.

> the case where AEMO's powers of direction are used to maintain system security.[313]

Engie was concerned with the costs associated with AEMO interventions:

> To make a meaningful comparison between alternative settings, the Reliability Panel needs to assess the impact of interventions on the market, investments (existing and prospective) and prices to customers. Cost of interventions and/or load shedding is quite material. According to the Energy Security Board 12/17 report, interventions are costing tens of millions of dollars due to compensation and inefficient dispatch.[314]

The Australian Energy Council stated that:

> Since 1st December 2016, AEMO has issued directions to generators seven times, and for the coming 2017-18 summer, AEMO is seeking expressions of interest for the supply of reserve contracts as a Long Notice Reliability and Emergency Reserve Trader ("RERT"). While the protracted government policy uncertainty is a contributor to this situation, AEMO's actions suggest that the market price cap and cumulative price threshold need review, particularly as the market price cap has been at the same level in real terms since July 2012.[315]

Between 9 October 2016 and 31 March 2018 there have been 31 interventions, each of which involved one or more directions.

As noted by both EnergyAustralia and Origin Energy, many of these interventions have been for system security concerns and are unrelated to the reliability of the system. We note that:

- 24 of the interventions related to a requirement for synchronous generation in South Australia.
- Four of the interventions (i.e. on 1 December 2016 in Victoria and South Australia, on 10 February 2017 in New South Wales and on 28-29 March 2017 in Queensland) were for other system security reasons that are unrelated to reliability.[316]

It follows that only three of the interventions relate to system reliability, and so are of consequence to the setting of the market price cap and/or cumulative price threshold. This is not to diminish the significance of these three events. The Panel has considered these interventions and whether they have any consequences for the setting of the market price cap (and cumulative price threshold). Table 6 summarises our analysis.

313 Origin Energy, submission to the issues paper, p. 2.

314 Engie, submission to the draft report, p. 3.

315 Australian Energy Council, submission to the issues paper, p. 1.

316 The intervention on 28-29 March 2017 required a direction to a generator in northern Queensland to maintain security in the event of a separation of northern Queensland. Clause 3.9.7 of the rules establishes that in the event of such a separation, the generator's offer would not affect the determination of the dispatch price. It follows that altering the market price cap and cumulative price threshold would not change the incentives to generators of providing energy under these circumstances.

The Panel considers that these events do not suggest a need to alter the level of the market price cap (and/or cumulative price threshold). These events are discussed in detail following the table below, with references to stakeholder comments as available.

Table 6: Panel's analysis of reliability directions

Direction	Panel's analysis
8 February 2017 South Australia[317]	The key observation made by ERM Power in its submission to this review's issues paper is that adequate generation capacity was available on 8 February, but not ultimately committed in time because of forecasts of wind and demand suggested that capacity would not be required.[318] The Panel notes ERM's views that a higher market price cap would not have altered this outcome. Given the commentary regarding forecasting it appears that the load shedding on 8 February was not the result of inadequate remuneration for available generation.
9 February 2017 South Australia	The Panel notes adequate generation capacity was potentially available. The Panel considers that the expected revenue provided by the market price cap was adequate to provide an incentive for the unit to be made available.
1 March 2017 South Australia	A key question in this case is why generation capacity was not made available without the need for a direction, and whether a higher market price cap would have avoided the need for a direction. The Panel considers that the expected revenue provided by the market price cap was adequate to provide an incentive for the unit to be made available.

The Panel notes that it is AEMO's role to determine how each event is defined.

AEMO intervention on 8 February 2017 (South Australia)

The Panel recognises that the direction issued by AEMO on 8 February 2017 was to maintain the system in a secure operating state. However the 8 February 2017 load shedding event was a reliability incident. The Panel notes that if stress on the system stemming from reliability incidents is not alleviated early enough it will often result in directions being issued for system security.

Our review in this section draws heavily on the material published in AEMO's system event report for this intervention.[319]

Early February of 2017 saw the NEM experience an extended heatwave. On 8 February 2017, AEMO issued a direction to ElectraNet to interrupt supply to 100 MW of customer load in South Australia. Key details are as follows:

317 This direction was issued by AEMO to maintain the system in a secure operating state. However it has been included here as the 8 February 2017 load shedding event was a reliability incident. The Panel notes that if stress on the system stemming from reliability incidents is not alleviated early enough it will often result in directions being issued for system security.

318 ERM Power, submission to the issues paper, pp. 3-4.

319 AEMO, *System Event Report – South Australia – 8 February 2017*, 2017

- At 1500 hours, pre-dispatch Projected Assessment of System Adequacy (PD PASA) indicated a forecast LOR 1 for the South Australian region from 1630 to 1900 hours.
- At 1725 a constraint managing the flow on Murraylink was violated. Murraylink's flow exceeded its limit of 78 MW by over 100 MW. The power system was therefore not in a secure operating state.
- At 1803 hours, AEMO declared an LOR3 condition for the South Australia region and issued a direction to ElectraNet to reduce load by 100 MW to reduce the flow on Murraylink and restore system security.
- At 1820 hours, the market price cap was applied in South Australia from the dispatch interval ending 1825 hours.
- At 1830 hours, AEMO advised ElectraNet to start restoring load.
- At 1850 hours, the market price cap pricing was removed and at 1900 hours the LOR3 condition was cancelled.

The Panel has considered whether this intervention event suggests a need to alter the market price cap and/or cumulative price threshold.

ERM Power's view is that the 8 February load shedding event was not due to a shortfall in investment generation and thus would not have been solved had the market price cap been higher:

> In assessing the events in South Australia on 8 February 2017, with regard to considering the potential for USE events in the future, we believe the Panel needs to consider that additional generation remained available for commitment, based on sufficient notice being provided, should AEMO have indicated to the market or determined this additional generation was required. A higher level of MPC or CPT would in all likelihood not have changed this outcome…
>
> The Panel should also consider that the AEMO, Market Event Report, indicated that the 16:00 predispatch revision indicated a higher level of output from wind farms located in South Australia and a lower level of forecast demand for South Australia. Combined, these errors totalled approximately 250 MW when compared to actual outcomes. Had AEMO's forecasts been more accurate at the 16:00 revision, this involuntary load shedding event may well have been avoided as the LOR2 notice would have been issued one hour earlier than actually occurred [providing sufficient time for the available 240MW capacity second Pelican Point generator unit to return to service].
>
> Currently, the rules do not set requirements regarding the bounds of accuracy for AEMO's demand and semi-scheduled generator forecasts; this is an area the Panel may consider as part of this review due to the impact of AEMO forecasts on supply reliability and market intervention.[320]

The key observation made by ERM Power is that adequate generation capacity was available on 8 February, but not ultimately committed in time because of forecasts of wind and demand suggested that capacity would not be required. Given commentary regarding forecasting, it appears that the load shedding on 8 February was not the result of inadequate remuneration for available generation. It follows that this event

320 ERM Power, submission to the issues paper, pp.3-4.

does not lead the Panel to believe that there is a need to reconsider the level of the market price cap.[321]

AEMO intervention on 9 February 2017 (South Australia)

Our review in this section draws heavily on the material published in AEMO's system event report for these interventions.[322]

The day following the 8 February 2017 intervention, another intervention occurred in South Australia. AEMO issued a direction to Pelican Point to synchronise and dispatch at minimum load. Key details are as follows:

- From 2130 hours on 8 February until 1505 hours on 9 February, all PDPASA runs forecast LOR2 conditions in South Australia between 1700 hours and 1830 hours on 9 February.
- At 1505 hours, AEMO issued a direction to Engie to synchronise and dispatch GT12 at Pelican Point power station to its minimum load of 160 MW.
- At the same time, AEMO issued counter-action instructions to two other gas-fired generators in South Australia, i.e.: Mintaro gas turbine was instructed to reduce output from 69 MW to its minimum load of 30 MW, and two of the Dry Creek units were instructed to reduce output from a combined output of 75 MW to their combined minimum load of 10 MW. The aim of this counter-action was to minimise the market impact of the direction, as required by clauses 3.8.1(b) and 4.8.9(h)(3) of the rules.
- The reduction in generation due to the counter-action was 158 MW, which was close to the 160 MW of generation directed on at Pelican Point. But the advantage of the configuration of the system achieved by the direction was that it made more capacity available to meet increasing demand, alleviating the LOR2 condition.
- AEMO cancelled the LOR2 condition at 1600 hours, and the direction was cancelled at 1900 hours. The direction remained in place during this period because of the minimum run time of 4 hours for Pelican Point's GT12.

The Panel has considered whether this intervention event suggests a need to alter the market price cap.

Once again, the Panel notes that adequate generation capacity was available. The question is why that generation capacity was not made available without the need for a direction, and specifically whether a higher market price cap would have avoided the need for a direction.

The Panel considers that this is not the case, and considers that the expected revenue provided by the market price cap is adequate to provide an incentive for the unit to be made available.

321 Over the course of the entire day, prices were at (or near) the market price cap for 2 hours and 25 minutes. At no point was the cumulative price threshold triggered, nor was it close to being triggered – the level of the cumulative price threshold was not relevant to the event.

322 AEMO, *NEM Event – Direction to South Australian Generator – 9 February 2017*, 2017.

AEMO intervention on 1 March 2017 (South Australia)

This section draws its information from market notices published on 1 March 2017, as well as analysis of actual generation outcomes from the MMS database.

On 1 March 2017 in response to high temperatures in South Australia and a lack of declared availability, AEMO forecast an LOR2 condition for the evening peak and issued a direction to a generator. Key details are as follows:

- Direction was issued at 1639 hours to meet possible LOR2 conditions from 1730 to 1830 hours.
- LOR 1 condition ceased at 1825 hours, and the LOR 2 condition never eventuated because of higher than expected wind output.
- The direction ended at 1925 hours.

The Panel has considered whether this intervention event suggests a need to alter the market price cap, noting that in this circumstance that no LOR2 condition ever eventuated.

A question is why generation capacity was not made available without the need for a direction, and whether a higher market price cap would have avoided the need for a direction.

The Panel considers that the expected revenue provided by the market price cap was adequate to provide an incentive for the unit to be made available.

Dispatch of the RERT in summer 2017/18

The Panel also notes the RERT was activated twice in Victoria, on 30 November 2017 and 19 January 2018, to maintain the power system in a reliable operating state. In both instances reserves were dispatched for six hours.[323] The full details on these RERT activities are not yet public with AEMO obliged to publish a report by mid-2018. The Australian Energy Council notes that on both occasions "AEMO anticipated a high demand peak and dispatched several providers with long notice periods and minimum run times. On each day the demand subsequently fell below AEMO's forecast, and, in hindsight, the dispatch proved unnecessary."[324] Prior to these events the RERT had only been procured three times, and had never been dispatched.

323 AEMO, Market Notice - RERT activated, 30 November 2017.

324 Australian Energy Council, The RERT locker, March 2018, accessed at: https://www.energycouncil.com.au/analysis/the-rert-locker/ on 6 April 2018.

Appendix C – Cumulative price threshold

This appendix describes:

C.1. The purpose of the cumulative price threshold.

C.2. The assessment criteria the Panel must consider in reassessing the level of the cumulative price threshold.

C.3. Stakeholders' views.

C.4. Information and analysis supplementary to that provided in the report outlining why we have recommended retaining the present level of the cumulative price threshold (in real terms) over the review period commencing 1 July 2020.

C.1 Purpose

The cumulative price threshold limits market participants' financial exposure to the wholesale spot market during prolonged periods of high prices.[325] It limits the total market price that can occur over a period of seven consecutive days, currently 336 trading intervals, before an administered pricing period is declared and the administered price cap applies.[326]

The cumulative price threshold can be triggered in different ways. For example, it could be triggered after many days of sustained high but not extreme prices (in the order of $625/MWh). It can also be breached in just a few hours if prices are at or close to the market price cap (currently $14,200/MWh). The cumulative price threshold is indexed to the consumer price index and is currently $212,800.[327]

325 Together with the administered price cap (see chapter 8), the cumulative price threshold also limits the risk of financial contagion across participants in the national electricity market. If market participants are insufficiently hedged, exposure to high 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. There are several mechanisms in the rules designed to limit the risk of financial contagion. See: AEMC, *NEM financial market resilience, final report*, 6 March 2015, Sydney.

326 Rules, clause 3.14.2(c)(1) (note that this will change to 2,016 trading intervals when five-minute settlement commences in 2021). An administered price period is triggered where the cumulative price threshold is reached at any point over a seven day period. Once an administered price period is triggered, the administered price cap applies. In addition, an administered price period in relation to ancillary service markets will apply where the cumulative price threshold for market ancillary service exceeds six times the cumulative price threshold.

327 The cumulative price threshold is also relevant to FCAS markets. For FCAS markets, an administered pricing period is declared after 2,016 dispatch intervals, if the cumulative price is six times the cumulative price threshold reflecting the five minute settlement period applicable to FCAS markets. Rules, clause 3.14.2(c)(1A).

C.2 Criteria – Determination of level

C.2.1 Assessment requirements

In accordance with the rules the Panel may only recommend a cumulative price threshold that it considers will:[328]

- Allow the reliability standard to be satisfied without AEMO using its directions or reserve trader powers.[329]
- In conjunction with other provisions of the rules, not create risks which threaten the overall integrity of the market.

The rules also specify that if the Panel is of the view that a decrease in the cumulative price threshold may mean the reliability standard is not maintained, the Panel may only recommend such a decrease where it has considered any alternative arrangements necessary to maintain the reliability standard.[330]

C.2.2 Assessment considerations

The Panel must have regard to the potential impact of any proposed change to the cumulative price threshold on: the reliability of the power system; spot prices; investment in the national electricity market; and market participants.[331]

The guidelines establish the following principles for assessing the cumulative price threshold:

- The cumulative price threshold should protect all market participants from prolonged periods of high market prices, with particular consideration to the impacts on investment costs and the promotion of market stability.
- The cumulative price threshold should not impede the ability of the market to determine price signals for efficient operation and investment in energy services.

The cumulative price threshold should be determined giving consideration to the level of the market price cap.[332]

C.3 Stakeholder submissions

C.3.1 Submissions on the issues paper

Six submissions on the issues paper discussed the consumer price threshold.[333] Snowy Hydro, ERM Power and EnergyAustralia stated that current level of the cumulative price threshold should be retained. Engie and the Australian Energy Council supported the review of the cumulative price threshold. PIAC commented that the level of the cumulative price threshold should be lowered.

328 Rules, clause 3.9.3A(f).

329 Established under clauses 3.20.7(a) and 4.8.9(a) of the rules.

330 Rules, clause 3.9.3A(g).

331 Rules clause 3.9.3A(e)

332 Guidelines, p. 7.

333 The cumulative price threshold was not discussed by Origin.

Snowy Hydro

Snowy Hydro considered that the current level of the cumulative price threshold was appropriate:

> The cumulative price threshold provides a safety net for the NEM to ensure the financial stability of the market. Since market start the CPT has only been activated on 5 occasions which provides a clear indication that it is set at the right level.[334]

Snowy Hydro also stated that the current relationship between the cumulative price threshold and the market price cap should be maintained:

> The CPT should remain at 15 times MPC.[335]

ERM Power

ERM Power stated that the level of the cumulative price threshold should not be increased:

> Any increase … would potentially lead to poor outcomes for consumers…[and] would only increase the risk to all participants of operating in the NEM.[336]
>
> Currently ERM Power has not observed any trends in market outcomes or increased costs for the provision of generating plant and equipment that would suggest a change … is warranted.[337]

ERM Power emphasised that a higher market price cap or cumulative price threshold would not have prevented the involuntary load shedding in South Australia on 8 February 2017.

> In assessing the events in South Australia on 8 February 2017, with regard to considering the potential for USE events in the future… A higher level of MPC or CPT would in all likelihood not have changed this outcome.[338]

ERM Power noted that the cumulative price threshold is rarely reached:

> Historically, the CPT has triggered infrequently in the energy market and looking forward there is no evidence to suggest an increase in the frequency for CPT events.[339]

ERM Power believes the market price cap, cumulative price threshold and administered price cap should all be reviewed together:

> The APC is also interrelated to the MPC and CPT and these three setting should be reviewed together.[340]

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334 Snowy Hydro, submission to the issues paper, p. 5.

335 Snowy Hydro, submission to the issues paper, p. 3.

336 ERM Power, submission to the issues paper, p. 2.

337 ERM Power, submission to the issues paper, p. 6.

338 ERM Power, submission to the issues paper, p. 3.

339 ERM Power, submission to the issues paper, p. 6.

340 ERM Power, submission to the issues paper, p. 7.

EnergyAustralia

EnergyAustralia supports the current relationship between the level of the cumulative price threshold and the market price cap:

> It does appear to us that the relationship between the CPT and MPC acts to allow suitable investment signals while preventing unmanageable long term prices impacting participants and consumers.[341]

EnergyAustralia emphasised the importance of stability in setting the level of the cumulative price threshold:

> Similar to the reliability standard we consider that any reassessment needs to factor in that stability is both important for consumer outcomes while also providing an appropriate investment environment.[342]

EnergyAustralia also commented that while multiple [AEMO] directions have occurred in the last 12 months, some were driven by system security concerns and 'considers[s] that such intervention does not necessarily point to the MPC and CPT not functioning as intended'.[343]

Engie

Engie considered the cumulative price threshold should be decoupled from the market price cap and reviewed separately:

> The CPT should be set with reference to the level of risk the market can manage in aggregate and not simply as a function of the MPC. ENGIE continues to suggest that the settings of the MPC and CPT should be decoupled.[344]

Australian Energy Council

The Australian Energy Council supports a review of the cumulative price threshold:

> The Energy Council recommends the Reliability Panel… assesses the market price cap and cumulative price threshold in light of AEMO's recent use of generator directions, and its expected use of the RERT provisions.[345]

PIAC

PIAC recommends that different levels of the cumulative price threshold should be set for different regions:

> PIAC strongly recommends that the Reliability Panel consider setting different MPC's and CPT's in different regions.[346]

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341 EnergyAustralia, submission to the issues paper, p. 3.

342 EnergyAustralia, submission to the issues paper, p. 2.

343 EnergyAustralia, submission to the issues paper, p. 2.

344 Engie, submission to the issues paper, p. 4.

345 Australian Energy Council, submission to the issues paper, p. 2.

346 PIAC, submission to the issues paper, p. 8. Not that this proposal is outside the scope of this review as per the review guidelines.

Further, PIAC notes:

> Outside of SA, the actual level of USE could be much higher than it is and still remain within standard, implying that the MCP and CPT should be lowered.[347]

C.3.2 Submissions on the draft report

Two submissions to the review's draft report discussed the cumulative price threshold; those from the EUAA and Origin.

EUAA

The EUAA stated:

> We do not support the Panel's recommendation on the market price cap (MPC), and, by implication, the cumulative price threshold (CPT).[348]

Origin

Origin supports the Panel's recommendation:

> Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[349]

C.4 Analysis – Determination of level

This review has revealed that setting the level of the market price cap and the cumulative price threshold together is important for efficient market outcomes. Modelling conducted for the review has provided evidence for an optimal ratio, from a market outcomes perspective, between the two settings of approximately 15:1.

The market price cap and the cumulative price threshold collectively seek to limit market participants' exposure to high prices, temporarily and over a sustained period of time respectively. As caps on the prices that can apply in the wholesale market, it is their combined impact on potential generator revenue that should be considered in relation to allowing for efficient investment.

The Panel recognises the importance of considering the impacts of the market price cap on the appropriate level of the cumulative price threshold. On the basis that the Panel is recommending not to change the market price cap, we also recommend retaining the current level of the cumulative price threshold.

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347 PIAC submission to the issues paper, p. 5.

348 EUAA, submission to the draft report, p. 1. The Panel's consideration of the issues raised by the EUAA in relation to the market price cap and cumulative price threshold is presented in section A.6.

349 Origin, submission to the draft report, p. 1.

C.4.1 Historical approaches

Table 7 shows that, since its introduction to the national electricity market, the cumulative price threshold has been approximately 15 times the value of the market price cap (previously named the Value of Lost Load).[350] This approximate ratio of 15:1 has since been a working assumption rather than a formal requirement (see Box C.1).

Table 7: Historical market price cap and cumulative price threshold values

Year	Market price cap ($/MWh)	Cumulative price threshold ($)	Ratio (CPT : MPC)
1998	5,000	-	-
1999	10,000	-	-
2002	10,000	150,000	15:1
2010	12,500	187,500	15:1
2011	12,500	187,500	15:1
2012[351]	12,900	193,900	~ 15:1
2013	13,100	197,100	~ 15:1
2014	13,500	201,900	15.6:1
2015	13,800	207,000	15:1
2016	14,000	210,100	~ 15:1
2017	14,200	212,800	~ 15:1

In submissions to this review there was stakeholder support for examining the levels of the market price cap and the cumulative price threshold jointly. ERMPower and Snowy Hydro both commented on an interconnected assessment. Engie's view appears to be that an assumed relationship should not be the basis of determining the level of the cumulative price threshold: 'the CPT should be set with reference to the level of risk the market can manage *in aggregate* and not simply as a function of the MPC'.[352]

350 Before the cumulative price threshold was established, the administered price cap would be triggered by the occurrence of "force majeure events". NECA, *Administered price arrangements and force majeure*, April 1998.

351 The Reliability Panel recommended in the 2010 review of the Reliability Standard and Settings that the market price cap and cumulative price threshold were to be subject to indexation starting from 1 July 2012.

352 Engie, submission to the issues paper, p. 4, emphasis added.

Box C.1 Overview of historical levels of the cumulative price threshold

The cumulative price threshold was first set at $150,000 in December 2000.[353] At this level, the cumulative price threshold was 15 times the value of lost load of $10,000 determined by the ACCC (although the latter came into effect in 2002 after a two-year transitional period).[354] The cumulative price threshold of $150,000 meant that the administered price cap would apply after 7.5 hours of prices at the value of lost load. This approximate ratio of 15:1 has since been a working assumption rather than a formal requirement.

In 2008, the Panel lodged a rule change proposal that sought to formally define cumulative price threshold in the rules as 15 times the prevailing level of the market price cap (amongst other things).[355] The Panel argued that this ratio would allow for an efficient level of investment in electricity services, which is in the long term interest of consumers with respect to reliability, while providing an appropriate level of protection to such consumers through the prevention of extended periods of very high prices.

In its final determination, the AEMC deemed that while the cumulative price threshold should be increased in line with the Panel's proposal to an absolute level of $187,500 (equivalent to 15 times the market price cap at the time), the cumulative price threshold should not be "hard wired" to a ratio of 15 times the market price cap as the cumulative price threshold might be perceived as being consequential or subordinate to the market price cap.

The AEMC considered that to define a constant ratio between the two variables would require more evidence that such a relationship is robust for all levels of the market price cap and cumulative price threshold. In addition, it reasoned that not formalising a ratio would ensure that, in future, the appropriate value of the cumulative price threshold would be considered in its own right rather than as a matter ancillary to the appropriate level of the market price cap. Nonetheless, both the market price cap and cumulative price threshold have been adjusted in line with the consumer price index since 2012, and the ratio between the two has remained roughly the same since.

C.4.2 Impacts of the market price cap on the cumulative price threshold

Modelling the Panel commissioned for this review has analysed how the market price cap impacts on the cumulative price threshold, and how the level of the cumulative price threshold influences the effectiveness of the theoretical optimal market price cap.

353 See AEMC, *Comprehensive Reliability Review, Final Report*, 2007 and Australian Competition and Consumer Commission, *Determination Applications for Authorisation* VoLL, Capacity Mechanisms and Price Floor, 2000, p. iii.

354 The transitional period was 'to allow market participants sufficient lead-time to put in place the necessary arrangements to accommodate the increase in risk from a doubling of the VoLL (previously $5,000/MWh). Australian Competition and Consumer Commission, Determination Applications for Authorisation VoLL, Capacity Mechanisms and Price Floor, 2000, piii.

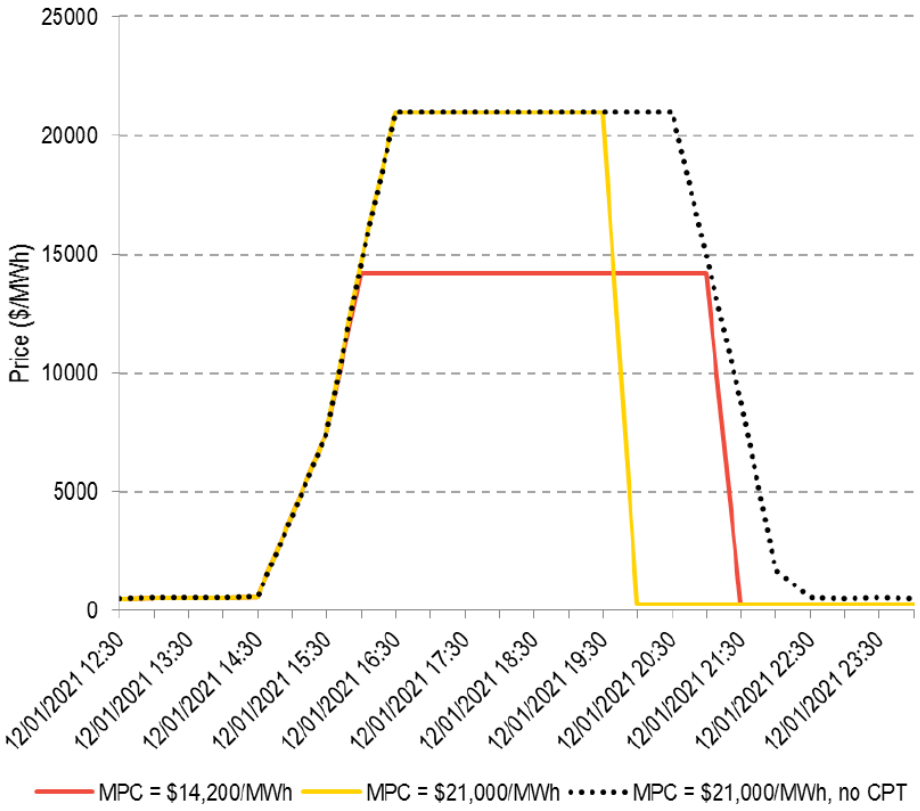
355 AEMC Rule change: NEM Reliability Settings – VoLL , CPT and Future Reliability Review, Final Determination (link).

EY's report states that:

> To explore the role of the CPT in the reliability setting analysis, EY explored varying the CPT to assess the relative impact on the theoretical optimal MPC. EY's analysis suggests that the efficacy of the MPC to efficiently incentivise market investment reduces if the MPC is increased while keeping the CPT the same. It follows that an alternative to reducing the MPC alone is to reduce both the MPC and CPT provided the CPT is not reduced too much in proportion to the corresponding change in the MPC.[356]

To illustrate, Figure 11 (reproduced from the EY report) shows the market price outcomes for Victoria for a single 12-hour period.[357]

Figure 11: Price outcomes for Victoria in a single 12-hour period modelled in MPC Scenario 2, under different reliability settings[358]



356 EY report, p. 6.

357 Modelled in the market price cap Scenario 2 (Victoria), under different reliability settings.

358 EY report, p. 47.

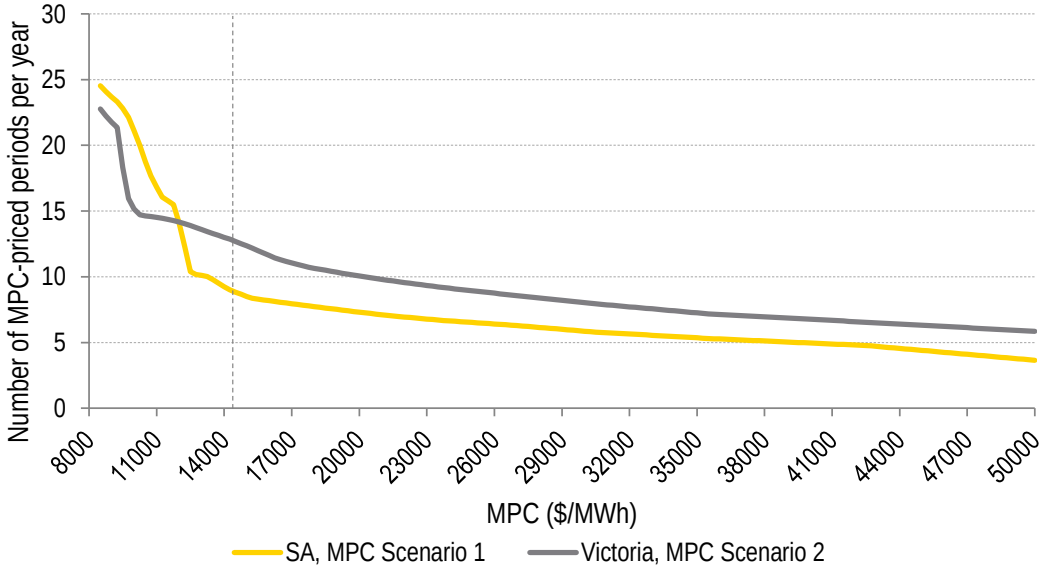
The chart shows that:

> when the MPC is increased from $14,200/MWh to $21,000/MWh, CPT is triggered four trading intervals earlier resulting in the price being set at $270/MWh instead of the MPC. In other words, the number of MPC-priced periods is reduced from 11 to 7 during this particular 12-hour period. As a result, the average price received by the marginal OCGT during this particular 12-hour period is only marginally higher in the case with the higher MPC.[359]

The reduction in the number of market price cap-priced periods, and the application of the administered price cap in their place, means fewer high price periods from which peaking / low capacity generators can recover revenue, significantly raising the level of the market price needed to deliver a certain revenue requirement.

Figure 12 is reproduced from the EY report and highlights the impact of a constant cumulative price threshold on the required level of market price cap.

Figure 12: Number of MPC-priced periods in SA for MPC Scenario 1 and Victoria for MPC Scenario 2 (with present settings for the CPT and APC, and for 10% POE demands only)[360]



EY assessed how increasing the cumulative price threshold in 5 per cent increments affected the theoretical market price cap for each scenario and sensitivity modelled. Table 8 presents those results.

359 EY report, p. 47.

360 EY report, p. 48.

Table 8: Exploring reductions in the theoretical optimal MPCs for each High cost sensitivity with increased CPTs if the MPC is higher than the current setting of $14,200/MWh[361]

MPC scenario	CPT	Theoretical optimal MPC, with different CPTs			
		High	Cap defender	12% WACC	Half lifetime
MPC Scenario 1 (SA retirements)	Current ($212,800)	$8,900	$9,000	$21,000	>$50,000
	+5%			$17,000	$37,000
	+10%			$15,000	$30,000
	+15%			$14,000	$24,000
	+20%				$22,000
	+25%				$19,000
MPC Scenario 2 (Victoria retirements)	Current ($212,800)	$12,500	$21,000	$37,000	>$50,000
	+5%		$19,000	$30,000	$47,000
	+10%		$17,000	$26,000	$37,000
	+15%		$16,000	$23,000	$33,000
	+20%		$15,000	$21,000	$30,000
	+25%		$14,000	$20,000	$27,000

EY concluded that:

> The results show that the value of the CPT can have a material impact on the MPC required to achieve the reliability standard, especially for very high MPCs, where the CPT can be triggered more often.[362]

C.4.3 Panel observations

The Panel recognises the importance of EY's outcomes for understanding how the level of the cumulative price threshold influences the effectiveness of the theoretical optimal market price cap, and therefore for setting the market price cap and the cumulative price threshold.

Optimal ratio

With respect to setting the ratio of the market price cap to the cumulative price threshold, EY comments that:

> The modelling suggests that maintaining near to the current ratio of 15 between CPT and MPC delivers a fair balance between limiting customer exposure to

361 EY report, p. 50.

362 EY report, p. 50

> sustained high price events and sufficiently incentivising new entrant investment to maintain expected USE within the reliability standard.[363]

As outlined in chapter 4, the Panel is recommending to leave the market price cap unchanged from its current level in real terms for the review period. On that basis, and given the current 15:1 ratio of the market price cap to the cumulative price threshold, the Panel recommends to leave the current level of the level of cumulative price threshold unchanged in real terms for the review period.

Market integrity

This section discusses for the cumulative price threshold in isolation, and the market price cap and the cumulative price threshold considered jointly, the rules requirement on the Panel to only recommend a market price cap and cumulative price threshold that it considers will '[i]n conjunction with other provisions of the rules, not create risks which threaten the overall integrity of the market.'[364]

Prudential requirements

In relation to increasing the cumulative price threshold, the Panel notes EY's comments that increasing the cumulative price threshold may increase prudential requirements, increasing barriers to entry:

> A material matter is the setting of prudential requirements for market customers. Increasing the CPT may lead to a call for increasing credit support under the participant prudential settings. This may place customers under financial pressure, increase barrier to entry and reduce efficiency in the market…increasing the CPT could trigger an increase in credit support placing a financial burden on market customers.[365]

Impacts on the contracts market

In coming to a conclusion on the levels of the market price cap and cumulative price threshold, the terms of reference for this review require the Panel to consider:

> [H]ow changing the relevant reliability settings may affect price risk management behaviour, including potential impacts on contract markets, and how this may affect investment outcomes in the NEM.[366]

In the terms of reference the AEMC articulated the key considerations as follows:

> Secondary contract markets are a key method used by [market] participants to manage their exposure to price risk in the NEM. These contracts may include over-the-counter type products, as well as exchange traded products. The reliability settings, particularly the MPC, will influence prices and liquidity in contract markets. A higher MPC creates additional price risk in the market. This may increase the demand for, and price of, risk management tools including contracts, depending on the strength of this signal compared to other factors

363 EY report, p. 6

364 Rules clause 3.9.3A(f).

365 EY report, p. 64.

366 Terms of reference are issued to the Panel by the Australian Energy Market Commission. AEMC, *Review of the reliability standard and settings - Terms of Reference*, 2017, p. 4.

> relevant to the market generally. High contract prices for generators support investment in the NEM, as they provide the stable cash flows needed to underpin the high cost assets that supply consumer demand for energy.[367]

EY also notes that:

> A change in the CPT may affect the optimal contracting position that a retailer or customer would seek to manage their risk…. There is an inherent link between the MPC and the CPT. The MPC places an upper bound on the price risk exposure of uncontracted electricity purchases for each trading interval. The CPT adds a time limit (i.e., one week) to that level of exposure.[368]

The market price cap and cumulative price threshold may also impact on the liquidity in the contract market. As noted by EY, it is very difficult to assess the impact of changes to the market price cap and cumulative price threshold on the availability of contracts, as there is little data available on the options available for additional contracts under an altered price cap.[369]

EY modelling indicates that the theoretically optimal level of contracting for electricity customers is not affected by changes to the cumulative price threshold at least over the limited range of values considered (i.e. plus or minus 20 per cent cumulative price threshold change):

> EY explored the potential impact on settlements for an uncontracted load and various levels of contracting under alternative CPT settings. For the case studies analysed EY found that the optimal level of contracting did not change with changes in the CPT up to ±20%.[370]

This suggests that within the limits of the levels examined, there would not be significant changes in the contracting position and price risk management behaviour from changes to the cumulative price threshold.

The Panel considers that maintaining the cumulative price threshold (and market price cap) at the current level would have no material impact on liquidity in the contract market as the optimal level of contracting would not change.

367 AEMC, *Review of the reliability standard and settings - Terms of Reference*, 2017, p. 4.

368 EY Report, p. 15.

369 EY Report, pp. 15-16.

370 EY Report, p. 6.

Appendix D – CPI indexation of the market price cap and cumulative price threshold

This appendix describes:

D.1. The purpose of the CPI indexation.

D.2. The materiality threshold criteria that must be considered in deciding whether CPI should be used for the annual indexation of the market price cap and cumulative price threshold.

D.3. Stakeholders' views.

D.4. Information supplementary to that provided in the main report regarding why the Panel has determined that the materiality threshold for reassessing the use of CPI for the purposes of annual indexation has not been met at this time.

D.1 Purpose of annual CPI indexation

The purpose of the annual CPI indexation of the market price cap and cumulative price threshold is to:

> preserve the real values of the market price cap and the cumulative price threshold over time.[371]

That is, the indexation is not intended as a mechanism for gradually changing those settings over time (a "glide path"), but to maintain them. |

D.2 Criteria – Materiality

The guidelines establish that:

- The application of indexation to the market price cap and cumulative price threshold is not subject to review.
- At each review the use of CPI as the measure of indexation for the market price cap and cumulative price threshold is subject to a materiality assessment. The Panel will continue to use CPI to adjust both settings unless it considers there may be a material benefit in reassessing this approach.[372]

In making its decision, the Panel must 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.
- Whether there have been changes in the methodology used to calculate the CPI.
- Whether a more preferable index has become available and/or there is a change in the designation of the CPI as an official statistic.
- Any other relevant matter.[373]

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371 AEMC 2011, *Reliability Settings from 1 July 2012*, Rule Determination, 16 June 2011, Sydney p. i. This is reiterated in s. 4.7.1 of the Guidelines Determination.

372 Guidelines, p 8 - 9.

373 Guidelines, p.8.

If the Panel decides that the materiality threshold for reassessing the use of CPI for indexation has been met, then the Panel would apply the provisions in the rules regarding its review.

D.3 Stakeholder submissions

D.3.1 Submissions on the issues paper

The subject of CPI indexation was addressed in two of the seven submissions received on the issues paper: PIAC and Snowy Hydro.[374] The comments provided by PIAC and Snowy Hydro fall outside the scope of this review for the reason discussed below.

PIAC recommends the application of indexation should be reviewed as part of this review:

> The question the Panel is to answer through this review is therefore whether a recommendation to change the reliability standard or (one or more of) the reliability settings would likely promote more efficient investment in and operation and use of electricity services, which would ultimately promote the long term interests of consumers with respect to price and reliability of supply of electricity and the reliability of the national electricity system.
>
> PIAC considers that leaving the application of indexation out of scope for the review limits the Panel's capacity to fully answer that question as posed.[375]

Snowy Hydro recommends indexing the market floor price:

> It is appropriate for the MFP to have an analogous methodology to that applied to the MPC. Snowy Hydro strongly recommends indexing the MFP to a lower value in line with the indexation of the MPC.[376]

We consider that both stakeholder comments are not within the scope of this review as established in the guidelines. The Panel notes that:

> [the] MPC and CPT are subject to annual indexation and the MFP and APC are not subject to indexation. This will not be opened for reconsideration in future reviews.[377]

The Panel considered the purpose and application of indexation in the 2016 guidelines.

In this review stakeholders did not suggest any alternative indices that could be used in place of CPI for either the market price cap or cumulative price threshold.

D.3.2 Submissions on the draft report

One submission to the draft report, from Origin, mentioned indexation.

Origin supports the continued CPI indexation of the market price cap and cumulative price threshold:

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374 Five of the seven organisations commenting on the issues paper did not address CPI indexation. They were Origin, the Australian Energy Council, EnergyAustralia, Engie and ERM Power.

375 PIAC, submission to the issues paper, p. 7. These views were shared by the EUAA in its discussion at the public forum in March 2018.

376 Snowy Hydro, submission to the issues paper, p. 1.

377 Guidelines, p. 9

> Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[378]

D.3.3 Stakeholder discussion at the public forum

At the public forum, PIAC and the EUAA discussed the purpose and application of indexation. They considered indexation should not apply to the market price cap and cumulative price threshold. If the Panel were to recommend a gradual decrease in the either market price cap or cumulative price threshold, PIAC and EUAA considered that the effect of such a decrease would be counteracted by the continued indexation of the settings.

D.3.4 Stakeholder feedback following the public forum

An ECA representative stated (by email, noting it was not an ECA submission) that it is unclear on what basis the Panel interpreted indexation to only refer to an index of price movements and believes it is appropriate to make a decision on indexation absent the data on the operation of the settings.

The ECA representative also argued the indexation of the market price cap should cease. According to the ECA representative, this is the classic approach to adjustment down.

The Panel notes that the purpose of indexation is to preserve the real values of the market price cap and the cumulative price threshold over time – see section D.1. Furthermore, the application of indexation to the market price cap and cumulative price threshold is not subject to review (see section D.2). Therefore, the Panel is not able to address these concerns within the context of this review.

D.4 Analysis – Materiality

In the issues paper the Panel held the preliminary view that both the market price cap and cumulative price threshold should continue to be adjusted using the same index and that both should remain indexed to CPI.

The Panel provided the following reasons to support this view:

- the continuing use of the CPI within business and for investment decisions and modelling
- the continued degree of stability and predictability of the CPI
- the impact of any long-term deviations of CPI from the actual cost of generation capacity is mitigated by the fact that reliability settings are reviewed every four years.[379]

The required matters for consideration in the guidelines are addressed below.

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378 Origin, submission to the draft report, p. 1.

379 Issues paper, p. 58.

D.4.1 Any changes in the basket of goods used to calculate CPI

While weights associated with individual good and services categories are adjusted from time to time, there have not been any material changes in the basket of goods and services that make CPI less relevant for the indexation of the settings.[380]

D.4.2 Any changes in the methodology used to calculate CPI

A minor review of CPI was conducted in December 2017.[381] This review resulted in the following enhancements to CPI:[382]

- updated geographical coverage
- changes to data sources and methodologies in deriving weights for the following CPI expenditure classes: 'New dwelling purchase by owner–occupiers', 'Insurance', and 'Other financial services'
- changes to the method used to estimate the upper level substitution bias.

The Panel considers that these CPI enhancements do not make the CPI less relevant for the indexation of the reliability settings.

D.4.3 Any preferable index or changes in the designation of CPI as an official statistic

Bearing in mind the purpose of indexation as noted above, neither the Panel nor stakeholders have identified a more preferable index.

There has not been a change in the designation of CPI as an official statistic.[383]

380 The CPI is regularly updated to reflect changes in consumer buying habits, or shifts in population distribution and demographics. Australian Bureau of Statistics (ABS). 2018, Consumer Price Index FAQs, http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Consumer+Price+Index+FAQs#Anchor7, accessed 16 April 2018.

381 "The ABS conducts a major review of the CPI approximately every six years to take advantage of data from the updated Household Expenditure Survey (HES). The most recent update occurred in the December 2017 quarter." ABS, 2018, Consumer Price Index FAQs, http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Consumer+Price+Index+FAQs#Anchor7, accessed 16 April 2018.

382 ABS, 2018, Enhancements implemented in the 17th series CPI and SLCIS, http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6470.0.55.001Main%20Features32017?opendocument&tabname=Summary&prodno=6470.0.55.001&issue=2017&num=&view=, accessed 16 April 2018.

383 "The CPI is an important economic indicator used in formulating monetary policy and in a wide range of business, economic and social analysis and decision-making." ABS, 2018, http://www.abs.gov.au/Ausstats/abs@.nsf/0/CFFA42B90CA68CD2CA25765C0019F281?OpenDocument, accessed 16 April 2018.

Appendix E – Administered price cap

This appendix describes:

E.1. The purpose of the administered price cap.

E.2. The criteria for assessing the administered price cap in this review.

E.3. Stakeholders' views.

E.4. Why we consider the administered price cap should be reassessed in this review (i.e. our materiality assessment).

E.5. Information and analysis supplementary to that provided in the main report outlining why we have recommended retaining the present level of the administered price cap from 1 July 2020.

E.1 Purpose

The administered price cap is one of the reliability settings intended to limit market participants' exposure to *sustained* high prices. It is the maximum settlement price that can apply when the total of all settlement prices over seven consecutive days exceeds the cumulative price threshold ($212,800 in 2017/18).

The purpose of the administered price cap is to:

> …cap participant exposure to the potential of what could otherwise be high prices during an administered price period, while maintaining incentives for participants to supply energy [during that period].[384]

The administered price cap is currently set at $300/MWh.[385]

E.2 Criteria – Materiality

The guidelines establish that the level of the administered price cap should be subject to a materiality assessment at each review to determine whether it should be reassessed. Unless the Panel considers there may be material benefit in reassessing the administered price cap, its level should remain as previously determined.[386] In making its decision the Panel must consider factors including but not limited to:

1. Significant changes in the typical short-run marginal costs of generators in the national electricity market.
2. Compensation claims since the last review.[387]

E.3 Criteria – Determination of level

If the Panel decides to reassess the level of the administered price cap, the criteria we would apply are the considerations established in the rules and the framework the

384 Guidelines, p. 8. The administered price cap also sets the limit for the administered floor price which is set at negative of the value of the administered price cap. Rules clause 3.14.1(b).

385 Rules clause 3.14.1(a). The same administered price cap will apply in relation to ancillary service markets where the sum of the ancillary service prices in the previous 2,016 dispatch intervals exceeds six times the cumulative price threshold in the national electricity market.

386 Final guidelines, p. 8.

387 Final guidelines, p. 8.

AEMC used in the last determination on the administered price cap (conducted in 2008).

There are no specific provisions in the rules on requirements that *must be met* in determining the level of the administered price cap. As with the other reliability settings, the Panel *must have regard to* the potential impact of any proposed change on spot prices, investment in the national electricity market, the reliability of the power system and market participants.[388]

The AEMC's 2008 determination on the level of the administered price cap offers additional guidance on assessment considerations. When the administered price cap was last reviewed in 2008, taking submissions and the national electricity objective into account, the AEMC formed the view that the level of the administered price cap should 'strike a balance' between a number of competing objectives. The administrated price cap was to be set:

- sufficiently low to ensure overall market integrity
- sufficiently high so that the expected frequency and magnitude of compensation claims are kept to the minimum
- sufficiently high so as not to distort the incentive for supplying electricity during an extreme market event when the administered price cap is triggered.[389]

The AEMC's particular concern regarding the risk of systemic financial collapse was the potential financial failure of a generator (depending on their hedging contract positions) in the event that it breaks down, resulting in exposure to periods of sustained high prices. The financial failure of a generator would also affect market customers who were counterparties to agreements with the generators, as they would face full spot prices for large components of their loads.[390]

The AEMC considered the above three criteria met the national electricity objective.[391]

388 Rules clause 3.9.3A (e)(3)

389 AEMC 2008, *Clarification of Schedule for the Administered Price Cap, Final Report*, 30 April 2008, Sydney, p. vii, p. 7.

390 AEMC 2008, *Clarification of Schedule for the Administered Price Cap, Final Report*, 30 April 2008, Sydney, p. 4.

391 AEMC 2008, *Clarification of Schedule for the Administered Price Cap, Final Report*, 30 April 2008, Sydney, p. 8.

E.4 Stakeholder submissions

E.4.1 Submissions on the issues paper

Three submissions to the issues paper discussed the administered price cap; those from EnergyAustralia, ERM Power and Snowy Hydro.[392]

EnergyAustralia and ERM Power outline several issues the Panel should consider when it applies the materiality threshold criteria, and argued for a stable policy environment. More generally, EnergyAustralia and Snowy Hydro consider the Panel should keep the administered price cap at its current level. ERM Power is against raising its level.

EnergyAustralia

In relation to changes to the short run marginal cost of generators, EnergyAustralia considered that:

> In determining whether the materiality threshold has been met for a reassessment of the administered price, a key issue is whether this price is appropriate given current gas prices and the effect on costs for gas peaking plant. During the transition from the previous high levels of baseload coal generation, there is likely to be a greater reliance on gas powered generation and higher volatility. This may see gas generators exposed to longer periods of administered pricing.[393]

At the same time, EnergyAustralia discussed several other matters, arguing for keeping all the settings at their existing levels. These matters were that:

> …the current standard and settings strike a good match between providing the correct price incentives in the market for new generation, while not creating unmanageable risk of exposure to extreme prices.[394]

And:

> With the level of change being considered in the market at present it would be difficult to confidently assess the impact of changing the standard and settings.[395]

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392 Four of the seven organisations commenting on the issues paper did not address the level of the administered price cap. They were Origin, Engie, the Australian Energy Council and the Public Interest Advocacy Centre.

393 EnergyAustralia, submission to the issues paper, p. 3.

394 EnergyAustralia, submission to the issues paper, p. 1.

395 EnergyAustralia, submission to the issues paper, p. 1.

Finally, EnergyAustralia considered that:

> [A]ny reassessment needs to factor in that stability is both important for consumer outcomes while also providing an appropriate investment environment.[396]

ERM Power

In relation to the criteria regarding compensation claims, ERM Power comments that:

> In assessing the potential for the lodgement of compensation claims under this provision of the rules into the future, the Panel should consider that only a small component of this claim was associated with the participant's marginal cost of production and due to a significant level of controversy regarding the claim, rules changes occurred to more clearly detail the areas that may be claimed following the processing of the claim.[397]

Regarding changes to short run marginal costs criteria, ERM Power noted:

> We believe that in assessing the appropriate value for the APC the Panel should consider if a structural increase in normal marginal costs has occurred for the higher cost generators in the NEM...
>
> In assessing this, we believe it would be beneficial for the Panel to refer to an independent assessment of the marginal costs for generators such as that used by AEMO for modelling in the National Transmission Network Development Plan.[398]

ERM Power does not support an increase to any of the reliability settings:

> In this current world of uncertainty, ERM Power does not support an increase to any of the NEM Reliability Settings and believes any increase to the Market Price Cap (MPC), Cumulative Price Threshold (CPT) or Administered Price Cap (APC) would potentially lead to poor outcomes for consumers. An increase in any of these settings would only increase the risk to all participants of operating in the NEM and would lead to further and unnecessary price increase[s] to consumers at a time when many consumers are struggling with significant increases in electricity costs.[399]

Snowy Hydro

Snowy Hydro supports keeping the administered price cap at its current level:

> Snowy Hydro submits that…[t]he CPT should remain at 15 times MPC and the APC set at $300/MWh.[400]

396 EnergyAustralia, submission to the issues paper, p. 2.

397 ERM Power, submission to the issues paper, p. 7, emphasis added.

398 ERM Power, submission to the issues paper, p. 7.

399 ERM Power, submission to the issues paper, p. 2.

400 Snowy Hydro, submission to the issues paper, p. 3.

E.4.2 Stakeholder submissions on the draft report

Two submissions to the draft report discussed the administered price cap; those from the EUAA and Origin. Both submissions agreed with the Panel's draft recommendation that the present level of the administered price cap should be retained from 1 July 2020.

EUAA

The EUAA stated:

> The EUAA supported the Panel's recommendations on the existing reliability standard, the administered price cap and the market floor price.[401]

Origin

Origin also supports the Panel's recommendation:

> Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[402]

E.5 Analysis – Materiality

This section details the reasons why the Panel considered that there could be material benefit in reassessing the administered price cap in this review. It sets out and discusses each of the materiality assessment criteria in turn.

E.5.1 Changes in short-run marginal costs of generators in the NEM

The relevance of short-run marginal costs

Considering changes in the typical short-run marginal costs of generators in the national electricity market is fundamental to evaluating whether the materiality threshold for a reassessment of the administered price cap is met. As discussed in the issues paper:

> An administered price period is associated with an extended period of high prices. High prices are connected to a tightening of the supply demand balance as increasingly high cost generation capacity is dispatched to satisfy demand. Having an administered price cap that is too low will discourage high-cost generators from bidding into the market potentially resulting in high cost generators choosing to not make a unit commitment decision. This would reduce available generation and potentially delay removal of the administered price period and return to normal market operations.[403]

The purpose of the administered price cap is to limit market participants' exposure to sustained high prices; it becomes the cap on prices while an administered price period is in effect. It should therefore be sufficiently low so as to maintain the overall financial integrity of the national electricity market during an extreme market event. At the same

401 EUAA, submission to the draft report, p. 1.

402 Origin, submission to the draft report, p. 1.

403 Issues paper, p. 67.

time, it should be set sufficiently high so as to incentivise market participants to supply electricity during administered price events.[404]

For a generator to be willing to continue generating, the administered price cap need only be set at the level sufficient to cover the marginal cost faced by that generator. The level of the cumulative price threshold is set so as to balance the reduction in risk of market participants' exposure to extreme prices over prolonged periods while still allowing peaking generators to have a reasonable expectation of recovering their capital investment in the period prior to the cumulative price threshold binding.[405]

This means that the level of the administered price cap need only cover the marginal cost faced by the generator in order for the generator to be left financially whole and willing to generate.

It should be noted that the administered price cap serves only as a default value; generators can claim for compensation for the short run marginal costs that are incurred above the administered price cap.

Drivers of change to short-run marginal costs

As outlined in the issues paper, the short run marginal cost of generation generally includes:

- the incremental cost of the fuel required to produce one more MWh
- any non-fuel variable operating and maintenance costs (such as water, chemicals and ash disposal) and bringing forward of maintenance.

The marginal generation technology will vary over time and as such the nature of the short run costs will also vary. For example, if the marginal generator was considered to be a battery, the short run costs would include electricity purchased for storage, the round trip efficiency impact, and any cyclic costs associated with a charge/discharge cycle for the battery technology chosen.

Additionally, even where the marginal technology remains unchanged, changes to fuel costs and variable operating and maintenance costs can affect a generator's short run marginal costs.

Issues paper

In the issues paper the Panel supported a reassessment of the administered price cap given the potential for changes in the short run marginal costs of generation technology. Our view was based on the potential cost effects of underlying inflation and fuel price increases since 2008, the year when administered price cap was last reviewed.[406]

We highlighted the following factors as important when setting the optimal level of the administered price cap for this review period:

- The impact of gas supply uncertainty and future price volatility on gas turbine short-run marginal costs.

404 Issues paper, p. 67. The objective of minimizing compensation claims is discussed in the subsequent section.

405 This is discussed in more detail in section 7.1 of the Issues paper.

406 Issues Paper, pp. 68 – 69.

- Whether the marginal generation will remain an OCGT.

Stakeholder feedback and Panel outcomes

Stakeholder feedback on the issues paper supports the view that the materiality threshold criteria on significant changes to short run marginal costs has been reached.

ERM Power proposed that the Panel should commission an independent assessment of changes to short run marginal costs, focused on identifying structural – versus temporary – increases in normal marginal costs for higher cost generators.[407]

EnergyAustralia's comments confirm the potential import of current and future gas prices increases on the marginal costs of peaking gas plants:

> In determining whether the materiality threshold has been met for a reassessment of the administered price, a key issue is whether this price is appropriate given current gas prices and the effect on costs for gas peaking plant.[408]

No stakeholders disputed the possibility (outlined in the issues paper) of changes to typical short run marginal generator costs – of approximately 20 per cent or to between $350 and $400/MWh since 2008 – due solely to increases in the underlying inflation based on changes in the consumer price index.

After considering the potential for significant changes in the typical short run marginal cost of generators in the national electricity market, the Panel's view is that this materiality threshold criterion for reassessing the administered price cap is met.

E.5.2 Compensation claims since the last review

The relevance of compensation claims

In deciding whether the materiality threshold for reassessing the administered price cap is met, the Panel must also consider compensation claims since the last review.

As discussed in the issues paper:

> If the administered price cap is too low and a high cost generator is nevertheless dispatched, it has the option of pursuing a compensation claim to ensure it recovers all eligible costs. However, this is likely to be an expensive and time consuming process. As such, ensuring that the administered price cap is sufficiently high to minimise the likelihood of triggering a compensation claim is highly desirable.[409]

One of the competing objectives in setting the administered price cap is to have it sufficiently high so as to reduce the likelihood of compensation claims by market participants following the application of an administered price cap.

Issues paper

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407 ERM Power ,submission to the issues paper, p. 7.

408 EnergyAustralia, submission to the issues paper, p. 3.

409 Issues paper, pp. 67-68.

The issues paper outlined that while there has only been one compensation claim pursuant to the application of the administered price cap (the Synergen power claim in 2010)[410], the success of the claim shows that by 2010 there were at least some generators in the NEM with a short run marginal cost materially higher than the administered price cap.[411]

Stakeholder views and Panel outcomes

The Panel notes that ERM Power suggested that care be taken in assessing the significance of the Synergen claim in regards to short run marginal costs, as 'only a small component of this claim was associated with the participant's marginal cost of production' as demonstrated by the subsequent rule change.[412]

The expert panel report to the AEMC assessing the Synergen compensation claim noted that the elements included were the direct costs incurred less spot market income where direct costs were comprised of fuel costs, variable operating and maintenance costs, and any ancillary service costs levied against the generator.[413] This approach remains consistent with the current approach to assessing compensation as outlined in the AEMC's revised compensation guideline.

As such, the Panel considers that the success of the Synergen compensation claim does support the potential materiality of reassessing the administered price cap.

E.5.3 Materiality – conclusion

The Panel reviewed the administered price cap in this review as we considered the materiality threshold for its reassessment has been met.

E.6 Analysis – Determination of level

This section details why the Panel has determined to retain the current level of the administered price cap from 1 July 2020. It provides an overview of the Panel's approach and rationale, and then describes each reason in detail.

Approach to the APC

The Panel commissioned EY to estimate the theoretical optimal level at which the administered price cap could be set over the review period**.** EY undertook analysis of the short run marginal cost of existing generators in the national electricity market. This assessment determined that six of 19 candidate generators (low capacity gas turbine

410 This claim was successful as it was found that the legitimate costs incurred by Synergen Power had exceeded the amount received under the administered price cap and that compensation in the amount of $130,486.94 was payable. See http://www.aemc.gov.au/Markets-Reviews-Advice/Compensation-claim-from-Synergen-Power

411 Note that under the rules compensation is only payable to certain types of entities. For example, it is payable to scheduled and non-scheduled generators and scheduled network service providers to maintain the incentive for these parties to supply energy during an administered price period (rules clause 3.14.6(c)). It is not currently payable to entities that provide demand reductions.

412 ERM Power, submission to the issues paper, p. 7.

413 Expert panel recommendations to the AEMC, *Assessment of Synergen's claim for compensation*. 18 August 2010, Section 5.

and liquid or dual fuel generators with relatively high short run marginal costs) will require a wholesale market price higher than the present administered price cap in order to recover their short run marginal cost throughout most of the review period. A further seven generators present short run marginal costs relatively close to the administered price cap. EY concludes retaining the current administered price setting of $300/MWh.[414]

Key reasons

The Panel recommends retaining the current administered price cap of $300/MWh for the review period, for the following key reasons:

- **No increase in short run marginal cost** – based on the assumptions used, there does not appear to be strong evidence of a substantial, permanent increase since 2008 in the short run marginal costs of low utilisation generators.
- **Minimise costs to consumers** – costs to consumers can be minimised by using the compensation mechanism for those generators that are dispatched during an administered price period with a short run marginal cost above the administered price cap, rather than exposing all consumers to prices close to the highest short run marginal cost of generators.
- **Address fuel price volatility through compensation** – generators can recoup the real costs of temporary increases in fuel prices through compensation.
- **Promote predictability and stability** – leaving the administered price cap unchanged provides predictability and stability to the national electricity market, promoting efficient investment.

The Panel considers that in the current context retaining a $300/MWh administered price cap reflects an appropriate trade-off between competing objectives, as explained in the following sections.

E.6.1 No substantial increase in short run marginal costs

From an economic perspective, an increase in the level of the administered price cap may be warranted if there was evidence of a significant increase in the typical short run marginal cost of the marginal generation technology.

The Panel signalled the potential for an increase in the short run marginal cost of OCGTs in the issues paper.[415] However, this is not borne out by the EY assessment for high cost OCGTs based on the assumptions used. EYs modelling confirmed that the

414 EY report, p. 7.

415 The Panel notes that based on EY's modeling the marginal generation technology for the review period was an OCGT unit. With regards to new technologies, the Panel recognises that if prices are capped by the administered price cap for a sustained period, this may limit potential arbitrage opportunities for batteries. Batteries would only be able to sell electricity back to the grid at prices up to $300/MWh. Should this situation arise during the review period the Panel considers that given the relatively low number of grid-scale batteries in the system, the current compensation framework should be sufficient to allow batteries to recover any lost revenue. Beyond the review period, if grid-scale batteries become more prevalent, this may suggest a need to reconsider the level of the administered price cap, noting that batteries would act as both a load and generation source depending on charge/discharge status.

highest marginal cost generators in the national electricity market continue to be OCGTs. There are currently 19 OCGT power stations in the national electricity market with the highest marginal costs, being those that potentially use liquid fuel and/or any particularly low efficiency gas-fuelled generator.[416] At present, all of these generators were assessed to have short run marginal costs under $300/MWh (June $2017).[417] By comparison, in 2008 the short run marginal cost of the six highest cost generators ranged from $258 – $307 ($2008/09).[418]

While the underlying assumptions regarding fuel prices differ, the Panel considers both sets of assumptions are appropriate for their respective periods of interest. The 2008 calculations appear to be based on a delivered liquid fuel price of $30/GJ[419], while EY based its assumptions on a delivered liquid fuel equivalent fuel price of $18/GJ, as provided by the Panel. This $18/GJ price is based on Australia's Institute of Petroleum's published average diesel wholesale price.[420] The lower current fuel price reflects the decline in traded oil prices to a recent range of USD50 to USD60 per barrel from around USD100 in 2008, reflecting the impact of the US shale gas and oil revolution that has dramatically increased world oil supplies in recent years.

The Panel considers that the expected magnitude and frequency of compensation claims with a nominal value $300/MWh (non-inflation indexed) administered price cap for the review period is reasonable, given the need to strike a balance with other competing objectives.

EY assessed that, based on modelling cost inflation assumptions out to 2024, six of the 19 candidate generators will require a market price higher than the present administered price cap throughout most of the period.[421] Therefore, if an administered price period were in place and those generators were dispatched during that period, six generators could be candidates for compensation.[422] In regards to magnitude of potential claims, EY notes that this represents less than 2 per cent of dispatchable capacity in the national electricity market. The Panel notes EY's results that a further

416 The Panel notes that it is not only high gas prices but also the potentially high cost of 'as needs' shipping, that may mean it is more economical for some peaking generators to use liquid fuel.

417 EY report, p. 19.

418 AEMC 2008, *Clarification of Schedule for the Administered Price Cap, Final Report*, 30 April 2008, Sydney, pp. 9-10.

419 ACIL Tasman, *Fuel Resource, New Entry and generation costs in the NEM, Report 2 – Data and documentation*, 6 June 2007, p45. The report states: '[w]e have assumed a $30/GJ price for petroleum products (constant in real terms) for each of the stations above which is reasonably consistent with the assumed international oil price of US$80/bbl in the long-term (roughly $1.20/litre of product).'

420 EY report, p. 18.

421 In the modelling study, the APC is kept consistent with today's nominal value of $300/MWh. As EY's market projections are in real terms, with a base of 1 July 2017, EY de-escalates the value such that it can be applied in real terms. Using an assumed CPI of 2.5%, the adjusted APC values are as follows: $278 (2020-21), $271 (2021-22), $264 (2022-23), and $258 (2023-34), in June 2017/$MWh, levels lower than the short run marginal cost of six candidate generators.

422 In 2008 the Commission determined in favour of the administered price cap that was below the estimated short run marginal cost of four generators' with a total capacity of 177 MW in 2008/09. AEMC 2008, *Clarification of Schedule for the Administered Price Cap, Final Report*, 30 April 2008, Sydney, pp. 9 - 10.

seven generators require a market price very close to the administered price cap by 2023-24.[423]

However, the modelling outcomes show that administered price periods (and thereby opportunities for compensation claims) are likely to be rare under normal market conditions. In all the iterations modelled for the most likely (base) scenario, EY forecasts the cumulative price threshold will be exceeded only four times during the review period, and states:

> Under normal market conditions, the CPT has a very low probability of being breached and therefore the application of the APC is highly unlikely.[424]

This is broadly consistent with historical experience whereby administered price periods are uncommon; there have only been five such periods since the inception of the national electricity market.

EY notes that, should the assumptions underpinning the market price cap scenarios be borne out in reality (for instance, high demand, significant thermal retirement and high technology costs), then the administered price cap could apply about 15 trading intervals per year in each of the modelled regions.[425] EY also highlights the administered price period is only likely to occur in one region at any point in time and therefore the relative impact on the market is contained to customers and generators in that region.[426]

The Panel notes that this frequency of administered price periods reflects the potential upper bound of compensation, given the assumptions and also given the potential for claims depends on the particular generators dispatched. We do not consider this upper bound unreasonable in light of the other objectives that need to be balanced in setting the level of the administered price cap.

E.6.2 Minimising cost to consumers

The Panel recognises that minimising costs to consumers should carry particular weight in this review given, as articulated by ERM Power, 'many consumers are struggling with significant increases in electricity costs'.[427] Under the rules the Panel must consider the impact of any changes to the administered price cap on spot prices, and thereby the potential impacts on consumers.

The level of the administered price cap affects consumer prices as it is the maximum wholesale price faced by retailers during times of sustained high prices. The

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423 Progressively more generators require a price that is close to or exceeds the administered price cap throughout the Period. This is an outcome of all assumptions being held constant in real terms, while the present administered price cap is defined as nominal and thus declines in real terms.

424 EY report, p. 21.

425 EY report, p. 21. If the MPC is increased or decreased (but the CPT kept the same), the number of APC-capped periods also increases or decreases, respectively. These scenarios speak to the point made by EnergyAustralia about gas peaking plants exposed to longer periods of administered pricing. EnergyAustralia, submission to the issues paper, p. 3.

426 The administered price cap can be applied to neighbouring regions if they are exporting electricity into the region where the administered price period applies. EY report, pp. 20-21.

427 ERM Power, submission to the issues paper, p. 2.

administered price cap, currently a fraction (just over 2 per cent) of the market price cap, limits wholesale prices.

Additionally, there is an inherent asymmetry in the cost impacts of the administered price cap on consumers as opposed to generators; all customer demand is exposed to the administered price cap while only generators whose short run marginal costs exceed the administered price cap are potentially impacted (through the risk of financial loss if their compensation claim is not successful). EY articulates the disproportionate impact of the level of the administered price cap on consumers as follows:

> [c]ompensation is based on only the extent to which the APC prevents a generator from receiving at least its SRMC from the wholesale market. However, all customer demand is exposed to the wholesale electricity market price. As such, the potential amount of compensation claimed will always be considerably less than the additional amount paid to the market if the APC was increased to cover the SRMC of all generators.[428]

Given these relative cost impacts, on balance the Panel considers it preferable to lessen customer exposure to extended high price periods by retaining the current administered price cap and requiring generators to lodge compensations claims for real costs incurred (as needed).

The Panel recognises the importance of setting the cap high enough so as to incentivise continued supply during an administered price period. We note EY's view that given the relatively low impact of the administered price cap on generators, retaining the administrative price cap's current level is unlikely to compromise the incentives to offer generation into the market.

E.6.3 Address fuel price volatility through compensation

The Panel proposes that volatility in fuel prices during the review period should be addressed through the compensation mechanism. EnergyAustralia reiterated that we should assess the impacts of higher gas prices on the costs of gas peaking plant in setting the administered price cap.

The Panel recognises that fuel prices may exceed the $18/GJ assumption used in this review. However, we would consider such price increases to be temporary rather than structural. On this basis we propose to adopt the approach proposed by ERM Power:

> [T]here may be from time to time some level of short term volatility in marginal cost for these generators, in which case the APC should remain at its current level and the existing compensation provisions should be used to cover any short-term volatility in marginal costs.[429]

428 EY report, p. 21.

429 ERM Power, submission to the issues paper, p. 7.

E.6.4 Promoting stability and predictability

Stability in market frameworks is important for promoting efficient investment in electricity services in the current environment.

The Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework.[430] In EnergyAustralia's view, the Panel's reassessment should 'factor in' the importance of stability for consumer outcomes and investment.[431] ERM Power and EnergyAustralia both commented that any material benefits potentially derivable from changing the administered price cap are overshadowed by larger uncertainties in the investment environment. The Panel has not received sufficient evidence that changing the administered price cap would advance the national electricity objective.

430 Final guidelines p. 3.

431 EnergyAustralia, submission to the issues paper, p. 2.

Appendix F – Market floor price

This appendix describes:

F.1. The purpose of the market floor price.

F.2. The materiality threshold criteria the Panel must consider in deciding whether the market floor price should be reassessed in this review.

F.3. Stakeholders' views.

F.4. Information and analysis supplementary to that provided in the main report outlining why the Panel has determined that the materiality threshold for reassessing the level of the market floor price has not been met at this time..

F.1 Purpose

The market floor price serves as the minimum acceptable bid price, and therefore the minimum settlement price, and is currently -$1,000 /MWh. The issues paper states that:

> [i]ts purpose is to prevent market instability by imposing a negative limit on the total potential volatility of market prices. The market floor price bears on the clearing of supply and demand at times of low demand and excess generation.[432]

During low demand periods there may be multiple generators competing to remain online (i.e. dispatched).[433] Generators are able to differentiate themselves according to the value they place on being dispatched by bidding at negative price levels. This allows the market to determine which generators should be turned off to maintain demand/supply balance. The market floor price should be set a level so that it does not interfere with this efficient outcome.

432 Reliability Panel, *Reliability standard and reliability settings review 2018*, Issues paper, 6 June 2017, p. 17.

433 Thermal generation units (such as coal and gas generators) incur significant costs when they are operated (cycled) at varying load levels in response to system demand, including on/off and low load.

F.2 Criteria – Materiality

The guidelines establish that at each review the level of the market floor price should be subject to a materiality assessment. The level of the market floor price should remain as previously determined unless the Panel considers the materiality threshold for its reassessment is met.[434]

In making its decision, the Panel must consider factors including but not limited to:

- The number and frequency of trading intervals where the market price has been equal to, or has approached, the level of the market floor price.
- Whether there have been significant changes in the generation fleet, such that average generator cycling costs have changed significantly.[435]

F.3 Stakeholder submissions

F.3.1 Submissions on the issues paper

The subject of the market floor price was addressed in four of the seven submissions received on the issues paper: ERM Power, EnergyAustralia, Engie and Snowy Hydro.[36] None of the four submissions commented on whether either of the two materiality threshold criteria had been met. Instead they outlined their support (or not) for the current level of the market floor price and reasons for their views. Two stakeholders (ERM Power and EnergyAustralia) supported the current level. Engie supported reviewing the market floor price but did not offer a view on a preferred level. Snowy Hydro argued for a lowering of the market floor price.

Reasons given for retaining the current market floor price

ERM Power

In relation to retaining the market floor price at its present level, ERM Power considers that:

> The Market Price Floor (MPF) which is currently set at -$1,000 is sufficiently low for its intended purpose and ERM Power has not observed any changes in the market that would warrant a change to the value of the MPF and therefore does not support any change to its current value.[436]

ERM Power argues there is insufficient evidence at this time to justify altering the level of the market floor price. However, ERM Power does not indicate what market change(s) it would have deemed sufficient.

ERM Power also supports the view the Panel offered in the issues paper; that there may be merit in retaining the current market floor price level to provide regulatory certainty.

A further argument put forward by ERM Power for retaining the current market floor price relates to the compromised effectiveness of the reliability settings given current levels of uncertainty in the market and the provision of 'off-market subsidies, such as

434 Guidelines, pp. 7 - 8.

435 Guidelines, p. 8.

436 ERM Power, submission to the issues paper, p. 7.

the Renewable Energy Target'. ERM Power warns that altering the level of any of the reliability settings may not translate to what the Panel expects would be positive changes in investment outcomes, given the current levels of market uncertainty.[437]

EnergyAustralia

EnergyAustralia supports retaining the reliability standard and all the reliability settings at their present levels:

> the current standard and settings strike a good match between providing the correct price incentives in the market for new generation, while not creating unmanageable risk of exposure to extreme prices.[438]

EnergyAustralia's view is that the current level of the market floor price does not expose participants to unmanageable risk from low (negative) prices.

EnergyAustralia shares ERM Power's view that accurately assessing the potential impacts of changes to the reliability settings at present is difficult. Energy Australia states with the extent of change 'being considered in the market at present it would be difficult to confidently assess the impact of changing the standard and settings'.[439] The submission also promotes the importance of policy stability for consumer outcomes and investment.[440]

Reasons given for reviewing the market floor price

Engie

Engie supports a review of the market floor price but does not offer a view on whether it should be raised or lowered. Engie states that:

> The impact of the current arrangements is that the burden of reducing output falls on conventional plant and yet this plant is also relied upon to provide market services such as inertia and system strength.
>
> …generators providing a range of system services are being financially penalised and are likely to reduce the number of available plants.[441]

Engie considers that to 'maintain equity between participants, technological neutrality and economic efficiency' arrangements for dealing with excess generation need to be examined.[442] Arrangements of concern include:

- That semi-dispatchable wind is curtailed in dispatch only in the event of network constraints.
- Pricing policies (such as subsidies and fixed feed-in tariffs) for renewable technologies.

437 ERM Power, submission to the issues paper, p. 7.

438 EnergyAustralia, submission to the issues paper, p. 1.

439 EnergyAustralia, submission to the issues paper, p. 1.

440 EnergyAustralia, submission to the issues paper, p. 2.

441 Engie, submission to the issues paper, p. 5.

442 Engie, submission to the issues paper, pp. 4-5.

- The absence of financial recognition for the provision of system security services.[443]

Reasons given for lowering the market floor price

Snowy Hydro

Snowy Hydro supports a lowering of the market floor price, for a range of reasons. Snowy Hydro argues that:

> … increased intermittent generation will require the MFP to be progressively negative so as to allow economic cycling.
>
> The large potential hourly variation of wind means firm generators will be required to more frequently cycle for short intervals.[444]

Snowy Hydro appears to be arguing that the market floor price should be lower (ie. more negative) to allow more efficient signalling of the cost of cycling given increased cycling frequency.[445] Other reasons given for a lowering of the market floor price include:

- Setting the market floor price low enough to ensure that thermal plant stays on line to provide ancillary services such as system inertia.[446]
- To avoid generation being constrained off and as a result not being able to sell hedge products given the indexation of the market price cap in line with rises in the CPI.[447]

Snowy Hydro also proposes the Panel set the market floor price using a new method that:

> entail[s] assessing what level the MFP has to be to encourage new entrant technologies that could alleviate excess generation. These technologies may be pump storage, storage batteries etc. The concept is that the MFP has to be sufficiently low to provide an appropriate pricing signal to these new entrant technologies.[448]

Snowy Hydro is proposing the Panel align the methodology for setting the market floor price with that of the market price cap, that is, a move away from a cycling cost approach to assessing what level of market floor price is required to encourage investment in new technologies (loads) that would ensure excess generation is absorbed. Snowy Hydro also suggests that the market floor price should in the future be

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443 Engie also states that "Battery storage technologies may assist to further *hinder the operation of the NEM* during excess generation periods depending on the price signals and control arrangements for storage technology." p. 5, emphasis added.

444 Snowy Hydro submission to the issues paper, p. 6.

445 Snowy Hydro submission to the issues paper, p. 5. Earlier on the same page, Snowy Hydro provides an excerpt of the one hour cycling costs for the 2014 Review and states it 'believes ROAM's analysis, which indicates that the current MFP is approximately at the right level, continues to be appropriate.'

446 Snowy Hydro submission to the issues paper, p. 7.

447 Snowy Hydro submission to the issues paper, pp. 6 - 8.

448 Snowy Hydro submission to the issues paper, p. 7.

indexed in a manner similar to the market price cap. The reasons given are increased intermittent generation and the static level of the market floor price level since its inception.[449]

F.3.2 Submissions on the draft report

Two submissions to the draft report discussed the market floor price; those from the EUAA and Origin. Both submissions agreed with the Panel's recommendation that the current level of the market floor price should remain unchanged.

EUAA

The EUAA stated:

> The EUAA supported the Panel's recommendations on the existing reliability standard, the administered price cap and the market floor price.[450]

Origin

Origin also supports the Panel's recommendation:

> Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI.[451]

F.4 Analysis – Materiality

This section details the Panel's consideration of the criteria we have to apply to determine if there may be material benefit in reassessing the market floor price for this review (see section F.2). It examines:

- Occurrences where the market price has been, or has approached the market floor price
- Changes in the generation fleet impacting generator cycling costs
- Other issues including policy stability and uncertainty, and the effect of the market floor price on the viability of storage technologies.

F.4.1 Occurrences where the market price has been, or has approached, the market floor price

Analysis of the occurrence of low price events is fundamental to evaluating if the materiality threshold for the reassessment of the level of the market floor price is met. As mentioned earlier:

> The market floor price…limits market participant's exposure to very low, negative prices and total market price volatility so as to prevent market

449 Snowy Hydro submission to the issues paper, p. 1.

450 EUAA, submission to the draft report, p. 1.

451 Origin, submission to the draft report, p. 1.

instability. In setting the market floor price, the principle to be observed is that it should not interfere with efficient outcomes being achieved.[452]

Examining the recent incidence (and trends) of negative price events can indicate the extent to which the current negative bound of the floor price allowed generators to sufficiently differentiate themselves according to the value they place on remaining dispatched.[453]

From an economic perspective a greater incidence of trading intervals in which the market floor price is reached could imply the need to lower (make more negative) the market floor price to satisfy the principle of not interfering with the efficient operation of the market.

The market floor price influences a number of important behaviours in the national electricity market. These include:

- Strategic re-bidding[454], where the market floor price forms the lowest possible negative price at which constrained-off generators rebid capacity, in order to maximise dispatch.[455]
- The ability of generators with alternative revenue streams (for example, renewable energy certificates or hedge contracts) to rebid capacity at negative prices to maintain dispatch.

The Panel acknowledges these two interactions with the market floor price. However in both cases the interaction with the market floor price is a function of there being a market floor price per se rather than its specific level. Any such issues should be addressed through policy measures rather than changing the level of the market floor price.

Issues paper

The position presented in the issues paper was there has not been a sustained increase in the low price events (lower than -$900/MWh) over recent years. Therefore we proposed there was insufficient evidence to indicate that the existing level of the market

452 Issues paper, p. 72.

453 Issues paper, p. 72.

454 Strategic re-bidding is observed when generators attempt to maximize dispatch following a price spike event leading to excess generation supply. It arises from the misalignment of operational dispatch and settlement. A recent example of strategic re-bidding in the national electricity market occurred on 8 November 2016 during the trading interval ending 3.30pm, following a trip of three generators at the Braemar 2 Power Station in New South Wales. In the first dispatch interval, the price reached the market price cap. In the second and third dispatch intervals prices returned to normal levels as generation started to come online in response to the price. In the fourth and fifth dispatch intervals prices approached zero as generators attempted to maximise dispatch. In the sixth dispatch interval, the price fell to the market floor price as further generation entered the market. The trading price in New South Wales for the trading interval was $2,191/MWh.

455 While a dispatch price is determined for each five minute dispatch interval, settlement - the transfer of money for electricity supplied to the market and consumed by end users - is calculated on a 30 minute basis (i.e. for each trading interval). The settlement price is the time-weighted average of the six dispatch prices that occurred during any given trading interval. Participants are settled on the basis of the half hourly settlement price and their aggregate production or consumption during the respective half hour.

floor price had interfered with efficient market outcomes. The study in the issues paper of low price events revealed that since 2012 there has been:

- No sustained trend in the total number of low price events.[456]
- An increasing proportion of low price events occurring in the same trading interval as a high price event (>$12,000/MWh), such that in 2016 over 40 per cent of trading intervals with a low price event occurred in conjunction with a high price event.[457]

Setting aside low price events occurring in the same trading interval as a high price event —on the basis that they are likely to reflect strategic re-bidding— the key findings were that:

- There has been no sustained increasing trend in the number of low price events driven by an excess of generation.
- Low price events appear more evenly dispersed throughout the year in 2016 than they were in 2012, suggesting that low price events are isolated events from which the market quickly returns to normal.[458]

Stakeholder views on the issues paper

None of the four submissions to the issues paper commented explicitly on the number of low price events. However, ERM Power concurred with the view that there were no changes in the market that warranted a change to the market floor price. On the question of whether the market floor price should be raised (for instance given the current incidence of low price events) EnergyAustralia considered the current level did not expose market participants to unmanageable risk, an argument against raising it. Neither Engie nor Snowy Hydro commented on the incidence or frequency of low price events.

Analysis

Market prices at or approaching the market floor price have been analysed to examine the clearing of excess generation. The conclusions set out in the issues paper were based on data available up to 7 March 2017. We have updated this analysis to include outcomes up to 12 April 2018, but our conclusions remain unchanged.

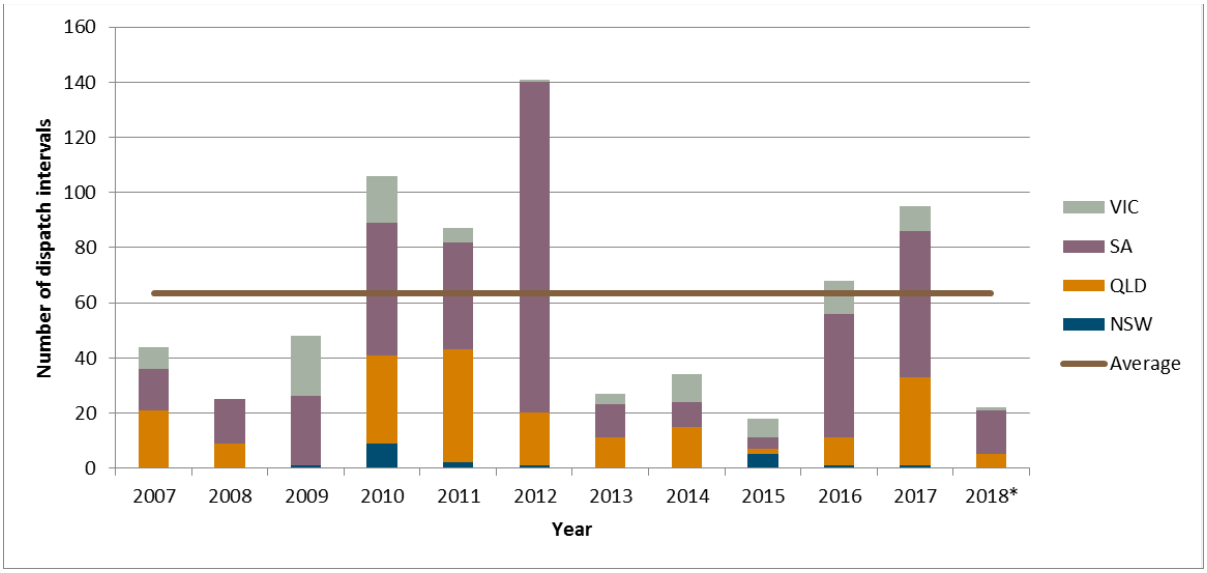
The Panel considers that there has not been a *sustained* increase (i.e. over a number of years) in the number of dispatch intervals with low price events (less than -$900/MWh). shows that the number of low price events in 2016 and 2017 has been higher than in the period from 2013 to 2015 but markedly lower than in the years 2010 and 2012.

456 Issues paper, p. 75.

457 Issues paper, pp. 75-76.

458 Issues paper, pp. 76 - 77.

Figure 13: Low price events in the national electricity market (2007- 12 April 2018)[459]



The materiality criteria focus on examining low prices during *trading intervals*. In the past eight years, there has not been a clear and sustained increase in either of the following:

- **The number of trading intervals that include a low price event** (see Table 9 below, second row) – while noting that levels in 2017 were the highest over the period.
- **The number of trading intervals with low price events driven by excess generation** (see Table 9, fourth row) – there has not been a sustained increase over time in the number of low price events that occur in a trading interval unaccompanied by a high price event. From 2015 to 2017 there were 84 such events, which is well short of the 139 events seen between 2010 and 2012.[460]

Table 9: Low and high price events in the national electricity market
(1 January 2010 – 12 April 2018)[461]

No. of trading intervals	2010	2011	2012	2013	2014	2015	2016	2017	2018*
With a high price event	7	35	18	72	57	108	114	119	17
With a low price event	50	43	50	16	19	11	40	62	17
With a low and high price event	0	3	1	5	6	4	18	7	0
With a low price event without a high price event	50	40	49	11	13	7	22	55	17

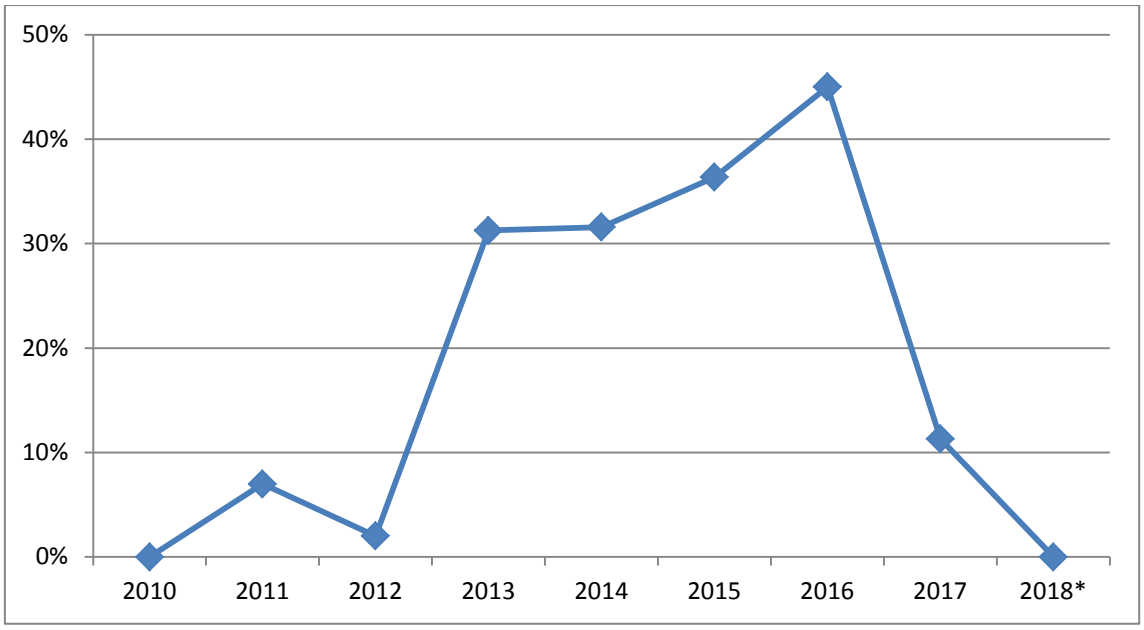
459 Asterisk (*) denotes year to date.

460 These conclusions are based on data for the period 1 January 2010 to 12 April 2018.

461 Asterisk (*) denotes year to date.

Figure 14 presents the proportion of trading intervals containing both a low price event and a high price event, from 1 January 2010 to 12 April 2018. This proportion fell in 2017 compared to 2016 suggesting that recent low price events are generally occurring because of excess generation, rather than generators responding to high prices. This does not alter our conclusions, but is worthy of note.

Figure 14: Share of low price trading intervals that include a high dispatch interval price (1 January 2010- 12 April 2018)[462]



F.4.2 Changes in the generation fleet impacting generator cycling costs

Cycling costs, negative bids and market efficiency

The Panel is to consider whether there have been changes in the generation fleet that have significantly altered average generator cycling costs. This materiality threshold relates to the principle of setting the market floor price at a level that should not interfere with achievement of efficient market outcomes.

Thermal units incur considerable costs when they are required to cease generation or are operated at varying levels ('cycled') in response to system demand.[463] By allowing generators to bid at negative price levels, the market determines which generators remain dispatched in periods of excess generation (to avoid cycling costs) and which

462 Asterisk (*) denotes year to date.

463 As stated in the issues paper, the incremental costs attributed to cycling fall into the following categories: increases in maintenance and overhaul capital expenditures; forced outage effects, including forced outage time, replacement energy, and capacity; cost of increased unit heat rate, long-term efficiency and efficiency at low/variable loads; cost of start-up fuels, auxiliary power, chemicals; and additional manpower required for unit start-up. APTECH Engineering Services, 'The Cost of Cycling Coal Fired Power Plants', Coal power magazine, Winter 2006, accessed at http://www.pserc.cornell.edu/empire/100_coalpowerwintermag16-20.pdf. Hydro, solar and wind generators have negligible cycling costs

should be turned off to maintain demand/supply balance. Generators use negative bids to differentiate themselves according to the value they place on being dispatched and avoiding cycling.

If the market floor price was not at a sufficiently low level to allow thermal generators with different cycling costs to differentiate themselves through their negative bids, a more negative market floor price would in theory reduce distortion and enable the market to clear without intervention for a larger proportion of time.

In relation to changes in the generation fleet, the issues paper explained that:

> A significant change in the nature of the generation fleet such that *the range of generator cycling costs had decreased* could result from the retirement of ageing thermal units. Generators would be able to use bids to differentiate themselves (according to the value they place on being dispatched), over a narrower price range. Holding all other factors constant, this would imply the need to raise (make less negative) the market floor price so that participants do not bear unnecessary risk; tightening the price envelope and reducing potential volatility.[464]

Issues paper

Based on the analysis presented in the issues paper, the Panel concluded that the cycling costs have not materially changed since the 2014 Review. Key points discussed were:

- Adoption of cycling costs from 2012 for the 2018 Review was recommended by Oakley Greenwood and actioned by AEMO in the *2016 National Transmission Development Network Plan*.
- The future withdrawal over time of the ageing thermal generators may narrow the range of generator cycling costs in the national electricity market.
- It is possible that the per cycle cost of some conventional thermal units may increase due to more frequent cycling given the growth in intermittent renewable technologies.

Stakeholder views on the issues paper

Snowy Hydro was the only stakeholder to discuss cycling costs in response to the issues paper. Snowy Hydro considers that the analysis for the 2014 Review of the cost requirements of for each cycling class for one hour cycling 'continue to be appropriate'.[465] However a lower market floor price is needed given the high penetration of intermittent renewable generation, particularly wind in South Australia. Snowy Hydro states:

> At times of high wind, intermittent technologies continue to run even if there is excess generation. South Australia, which is sourcing almost half of its electricity from intermittent generation, was the state which achieved the highest

464 Issues paper, p. 74.

465 Snowy Hydro, submission to the issues paper, p. 5.

> frequency of low price events in 2016. A lower market floor would be required to allow more efficient signaling of the cost of cycling. We note that the MFP has been -$1,000/MWh since December 2000 despite significant changes in the energy market.
>
> The increased intermittent generation will require the MFP to be progressively negative so as to allow economic cycling….The large potential hourly variation of wind means firm generators will be required to more frequently cycle for short intervals.

Snowy Hydro's key argument for a lower market floor price is that the market floor price needs to be lowered to allow for stronger market signals to ensure the market allows sufficient scope for generators to differentiate themselves; and thus both allow high cycling cost generators to be dispatched and signal the value of new load such as storage.

Analysis

The ROAM report for the 2014 Review expressed the efficiency principle relating to the level of the market floor price this way:

> The efficient operation of the market allows generators with the highest cycling costs to continue to operate during periods of low demand.[466]

For the 2014 Review, which reassessed the level of the market price cap, ROAM found that the generators with the highest cycling costs for startup/shutdown would still be incentivised to cycle if the price floor of -$1000/MWh was sustained for one hour (rather than solely for a five minute interval).[467] That is it makes economic sense for these high cycling cost generators to incur the costs associated with cycling rather than remain generating and pay a price of -$1,000/MWh for an hour.

Table 10 from ROAM's final report shows the range of market floor price required within each cycling class for one hour cycling to be beneficial.[468] The table shows the negative prices that would need to be reached for different generator classes such that these generators, from an economic standpoint, would prefer to cycle rather than pay the spot price for an hour. At the time the Panel concluded that with a market floor price of -$1000/MWh prices could already fall low enough to provide an economic signal to every generator (from the lowest cost to cycle to the highest cost to cycle).

466 ROAM consulting, R*eliability Standard and Settings Review, Modelling approach*, Final report, report to the AEMC, Brisbane, 2014, p. 12.

467 ROAM consulting, R*eliability Standard and Settings Review, Modelling approach*, Final report, report to the AEMC, Brisbane, 2014, pp. 65-69.

468 The ROAM table was reproduced in the Snowy Hydro submission to the issues paper.

Table 10: Market floor price requirement for 1 hour cycling

Cycling Class	Minimum MFP	Maximum MFP
Small sub-critical coal	-594	-299
Large sub-critical coal	-758	-342
Supercritical coal	-674	-444
CCGT	-240	-81

The Panel has considered whether cycling costs have changed significantly since 2014 and has found no evidence that changes in the generation fleet are causing a significant change in the range of generator cycling costs.

The costs of startup/shutdown for large coal fired generators (which incur the highest costs of startup/shutdown) are a function of their design and will not have moved greatly from the values determined in 2014. More frequent cycling is unlikely to increase the cost per cycle (although it would increase the total costs associated with cycling). Gas fired plants have a lower cost of cycling and their owners may prefer a less negative floor price for competitive advantage, such that the ability of market prices to send economic signals is diminished.

A further reason provided by Snowy Hydro for lowering the market floor price is that conventional plant needs to cycle for shorter periods due to the growth of intermittent renewable technologies. The argument appears to be that a lower (more negative) price floor would better reflect the economic costs of shorter shutdown periods. As outlined above, the costs associated with paying the current market floor price are expected to exceed the costs of any plant to shut down for an hour. A shut down period of less than one hour in duration (say 30 minutes) is not possible for large coal fired units, the technology with the highest cycling costs, as the shutdown and startup procedures would then overlap in time. Even one hour is likely to be less than the achievable cycle time for hot starts of large units. Hence, it is practically impossible to incentivise large coal fired units to cycle for shorter periods than one hour.

The optimal operation of the market requires that generators with the smallest negative breakeven points should cycle off first, thus reducing the need for others with much more negative breakeven points to cycle. This should be the desired efficient market outcome. The case for adopting a lower market floor price is therefore not justified as the current level of the market floor price does not impede the efficient cycling of generators; it allows thermal generators with different cycling costs to sufficiently differentiate themselves through their negative bids.

This analysis addresses the concern raised by Snowy Hydro that the market floor price should be set low enough to ensure that thermal plant can stay on line to ensure they can provide important ancillary services such as system inertia.

7.4.3 Other matters

The Panel has considered the following additional matters in assessing whether a review of the market floor price could yield material benefit at this time:

- stability and predictability
- the effect of the market floor price on the viability of storage technologies.

The Panel also notes that Snowy Hydro and Engie raised several matters which are being addressed by the AEMC and/or are outside the scope of this review. These include:

- The absence of financial recognition for the provision of system security services.
- Non-scheduled and semi-scheduled status of renewable generation.
- Pricing policies (such as subsidies and fixed feed-in tariffs) for renewable technologies.
- Changing the methodology from a cost of cycling approach to a method analogous to the market price cap to provide appropriate price signals to new entrant (storage) technologies.[469]

Stability and predictability

The guidelines stipulate that in making its decision, the Panel is to be guided by the principle of providing a stable, predictable and flexible regulatory framework.[470]

With present levels of uncertainty in the market, providing stability to market participants may support efficient investment and operational decisions by participants. This was a view supported by ERM Power and EnergyAustralia. EnergyAustralia stated that:

> Stability is more beneficial to consumers until such time as the distortionary effects of policy instability are reduced.[471]

Several stakeholders also commented that any material benefits potentially derivable from reassessing the settings including the market floor price are overshadowed by larger uncertainties in the investment environment. For example, EnergyAustralia notes that:

> [M]ultiple factors, other than price, are creating large distortions in the appropriate signals that are impeding the effectiveness of the standards and settings to drive investment.
>
> With the level of change being considered in the market at present it would be difficult to confidently assess the impact of changing the standard and settings.[472]

469 Engie also states that 'Battery storage technologies may assist to further *hinder the operation of the NEM* during excess generation periods depending on the price signals and control arrangements for storage technology.' Engie, submission to the issues paper, p. 5.

470 Guidelines Determination, section 2.

471 EnergyAustralia, submission to the issues paper, p. 2.

Origin observes that 'adjustment to the reliability standard and settings cannot be effectively and efficiently used as a means of addressing some of the underlying issues facing the market'.[473]

A number of stakeholders support the Panel setting a high standard for the strength of evidence before reassessing the market floor price.

The adequacy of the overall market and regulatory frameworks in supporting a reliable supply of electricity as the power system transforms to include more variable, intermittent generation and demand-side innovation, is being examined in the AEMC's Reliability frameworks review.

The effect of the market floor price on the viability of storage technologies

Storage can affect the market's ability to clear during times of low demand

Since the last review of the reliability settings, there have been significant changes in the national electricity market. Among these is the emergence of a range of energy storage technologies which are decreasing in cost.

Storage devices can be valuable at times when there is excess generation. During a period where there is excess generation (and prices are negative), storage technologies can charge and so increase the headroom for generation to remain online. The stored energy can be discharged later when there is more demand (and prices are positive) yielding a profit to the owner of the storage device.

The availability of storage can therefore affect the ability of the market to clear during low demand periods. It follows that the availability, cost, and financial viability of storage are relevant to the setting of the market floor price, given that the stated purpose of the market floor price is to:

> … allow the market to clear during low demand periods, while preventing market instability by imposing a negative limit on the total potential volatility of market prices.[474]

Consideration of storage in the setting of the market floor price

Storage technologies are very different from other forms of generation. They do not produce energy – indeed they are net consumers of energy – but rather shift its availability from one-time period to another. As a result, storage does not have any single unit cost of producing energy – the cost depends on the price of energy at the time of charging.

The market floor price is therefore an important parameter for sending price signals to storage technologies. In the same way that a *higher* market price cap increases the profitability of conventional generators, a *lower* market floor price can increase the profitability of storage technologies.

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472 EnergyAustralia, submission to the issues paper, p. 1.

473 Origin submission to the Issues Paper, p. 1.

474 Guidelines, p. 8.

To provide value at times of excess generation, storage technologies must be able to offer a cheaper alternative than cycling conventional generation. Consideration of the market floor price should therefore include consideration of cycling costs of conventional generation, costs of operation of storage, and indeed anything that bears on the ability of the market to clear during low demand periods.

At this stage, as indicated by the analysis, there is no evidence that the current level of the market floor price is distorting the efficient clearing of market at times of low demand. However, as storage technology continues to mature we anticipate that consideration of the interplay between storage and cycling of conventional generation will become increasingly important to the setting of the market floor price.

Appendix G – Summary of stakeholders' comments

G.1 Summary of comments on the issues paper

Stakeholder	Issue raised	Panel response	Ref.
Stakeholder comments: Modelling			
Australian Energy Council (AEC), p.2	• The modelling should take into account past and anticipated market changes including: further retirement of coal fired generation; increasing intermittent generation; recommendations of the Finkel Review; behind the meter battery storage; wholesale market design changes including an inertia ancillary services market and five minute settlement; higher gas prices and demand interaction.	Noted and addressed. The modelling commissioned by the Panel has addressed anticipated market changes including future retirement, increasing intermittent generation and behind the meter battery storage. The Panel regards modelling future rule changes and some policy developments as problematic. Our approach to addressing potential and future policy changes is outlined in chapter 8. In relation to ancillary markets, the interaction between the energy and ancillary markets was not considered for this review. Revenue from ancillary services markets has not been modelled for the review as the reliability settings are primarily driven by outcomes in the energy market, due to its relative size compared to the ancillary services market. (The revenue generators currently earn for providing ancillary services is small compared to revenue from electricity sales. In 2015, the total value of FCAS in the NEM was $112 million, being 1.4 per cent of the $8.3 billion traded on the energy market in the NEM.)	1.
EnergyAustralia, p.3	• Modelling should consider in particular, outcomes at peak demand times, times of	Noted and addressed. The modelling commissioned by the Panel addresses the factors	2.

Stakeholder	Issue raised	Panel response	Ref.
	network constraints or supply shortages. • EnergyAustralia agrees that the modelling should consider the "growing disconnect between reserve, demand and price and the increasing penetration of intermittent energy resources".	raised by EnergyAustralia, for example it has run sensitivities and scenarios using high demand forecasts, it models network constraints and has run sensitivities in relation to generator outages.	
EnergyAustralia, p.4	• Modelling future changes to the NEM and related impacts on financial markets should be done in a transparent manner.	Noted and addressed. The EY report articulates the modelling approach used to address potential changes in the NEM and financial market impacts.	3.
Engie, p. 5	• The cap defender approach is highly distortionary and misprices generation output. • Modelling should model caps at their expected value based on a model without cap contracts in place • Modelling should assume that cap contracts may serve to smooth costs and revenues but should not assume that contracts change behaviour.	Noted and addressed. The Panel has not used the cap defender approach in this review. In regards to the modelling approach to cap contracts, cap contracts (and all other contracts) affect participant behaviour and the incentive to exercise short-term market power.	4.
ERM Power, p.8	• ERM believes that the Panel should publish its cost input assumptions used in the modelling prior to the commencement of the modelling. Achieving agreement on those key assumptions would be a good way to avoid some of the disagreements that would arise with regards to the modelling outcomes.	Noted. The Panel considered and agreed to the assumptions prior to the modelling commencing. Stakeholders were given an opportunity to provide input on the assumptions through the first round of consultation.	5.

Stakeholder	Issue raised	Panel response	Ref.
ERM Power, p.8	• Modelling should consider the Finkel review recommendation requiring intermittent generators to provide controllable output.	Noted. The Generator Reliability Obligation was not considered in the modelling as the recommendation is not at the stage of an agreed, detailed policy. This is being considered through the AEMC's Reliability Frameworks Review.	6.
ERM Power, p.8	• The value of retirement should not exceed the value placed on new investment.	Noted. No direct relationship has been established in advance between the value of retirement and the value of new investment. Rather, the modelling approach used is to calculate the revenue required for every generator individually (both for existing and new entrant investment) based on assumed capital and operating costs.	7.
ERM Power, p.2, 5	• A NEM-wide approach should be taken to assessing the potential changes in the relationship between high price events and demand, and the individual causes of past events should be analysed on a case-by-case basis. • It should be acknowledged that demand response is occurring well below the MPC.	Noted and addressed. The modelling results enabled a NEM-wide view of the relationship between high price events and demand. The EY report outlines how demand-side participation (both non-disclosed and disclosed) has been incorporated into the model, including in relation to the MPC.	8.
ERM Power, p.3	• A number of gas-fired intermediate and peaking duty generators have dual fuel (both gas & liquid) capability.	Noted and addressed. The Panel considered dual-fuel plants in relation to the level of the APC and fuel prices used for the MPC scenarios.	9.

Stakeholder	Issue raised	Panel response	Ref.
Public Interest Advocacy Centre, p.6	• The Panel should undertake an interim review in 2020 in light of extensive market developments between now and the end of the review period in 2024.	Noted. The modelling approach addresses emerging trends and uncertainties in the market. Additionally, the Panel recognises there are policy developments currently being considered that could impact on the required reliability settings. Additionally, AEMO (or the AER) is scheduled to review the VCR in 2019. Appropriate responses to these developments are discussed in chapter 8. While the Panel can see benefits in an interim review prior to 2022, we also note it may introduce additional uncertainty to entities seeking to make investment decisions, offsetting some of the potential benefits.	10.
Snowy Hydro, p.7, 8	• The modelling should take into account: increasing levels of intermittent output; higher gas prices; interaction between prices and demand; removal of firm generation; increased penetration of batteries behind the meter and; possible wholesale market design changes (inertia ancillary services market).	Noted and addressed. See Panel comment #1.	11.
Stakeholder comments: Reliability standard			
EnergyAustralia (p.1,2), Engie	• Support for the reliability standard to be kept at current level.	Noted and addressed. The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, and so the final recommendation is to retain the reliability standard at its	1.

Stakeholder	Issue raised	Panel response	Ref.
		current level.	
Australian Energy Council (AEC), p.1	• Concerns with AEMO's VCR report: self-evident age of the report, the small sample size, exclusion of high-profile customers and inadequacy in capturing low probability but high impact supply interruptions. • AEC believes that the VCR needs to be reviewed in light of technology and market changes, as well as reliability issues.	Noted. The Panel notes AEC's concerns with the VCR report. However, it considers that AEMO or the AER, rather than the Panel, would be best placed to conduct a review of VCR. Stakeholders did not present any other measures of VCR that may be more appropriate for the Panel to consider. See Appendix section A.6.1.	2.
EnergyAustralia, p.1,2	• Does not consider it likely that threshold for reassessment has been met. • Stability is more beneficial to consumers until such time as the distortionary effects of policy instability are reduced. • Considers that highlighting the potential costs to consumers of embedding a higher reliability standard would be useful in guiding governments and regulators when they seek to intervene.	Noted and addressed. The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, on the basis of factors including stability and the costs of a higher reliability standard. See Appendix section A.6.	3..
Engie, p.2	• Supports keeping the reliability standard at its current level. • Economically the standard is a pragmatic benchmark. However if there is not a consensus policy direction then a trading arrangement other than the Energy Only	Noted and addressed. The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, and so the final recommendation is for the reliability standard to remain at its current level.	4.

Stakeholder	Issue raised	Panel response	Ref.
	Market will be needed.		
ERM Power, p.3, 4	• Do not believe change in reliability standard is warranted at this time. • The changes in how consumers use electricity in regards to new technology are only just starting to emerge, so any forecasts of changes in customer reliance on the grid may be subject to significant revision. • Regarding VCR: There are significant levels of demand management, either via consumption reduction or behind the meter generation, which are readily observable at times where a RRP exceeds values as low as $5,000/MWh. This indicates that some consumers are prepared to accept lower supply reliability from the grid in return for lower cost outcomes. Also, regional VCRs were not a fixed value but reduced with the length of a supply interruption, suggesting VCR may not be a static number but decrease as the level of unserved energy (USE) increases. • Note that primary consideration for customers installing batteries is to allow a continuation of reliable supply following the loss of grid supply, and integrated battery and solar PV installations are permitted to be installed to achieve this outcome (contrary to what is stated in the Issues Paper that behind the	Noted and addressed (points 1 -3). The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, and so the final recommendation is for the reliability standard to remain at its current level. See Appendix section A.6 for discussion of points two and three. The Panel considers that the expected uptake of battery systems that can operate independently of an energised grid is unlikely to be sufficiently high such that a large number of consumers place a lower value on reliable supply from the grid during this review period. See Appendix section A.6 for a detailed discussion.	5.

Stakeholder	Issue raised	Panel response	Ref.
	meter batteries still rely on grid supply).		
Origin, p.1	• Origin supports the Panel considering the appropriateness of the reliability standard in a manner that weighs the cost of any additional generation and interconnection capacity against the cost of unserved energy. • They agree with the Issues Paper that for a change to the reliability standard to be considered, there would need to be significant variance between the Panel's VCR and that calculated by AEMO under its 2014 study.	Noted. As the Panel is not proposing to review the reliability standard, the points raised by Origin cannot be actioned. See Appendix section A.6.	6.
Public Interest Advocacy Centre, p.2	• PIAC supports current reliability standard and does not see merit in moving away from the value of 0.002% USE at this time. • PIAC agrees with the Panel's assessment that many batteries aren't currently able to operate in islanded mode, but that this may change with technology innovation and more deployment.	Noted and addressed. The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, and so the final recommendation is for the reliability standard to remain at its current level. In regards to batteries, see Appendix section A.6.	7.
Snowy Hydro, p.2	• Believe USE figure should not change, especially in the event of short-term withdrawal generators returning to market.	Noted and addressed. The Panel considers that the materiality threshold for reassessing the level of the reliability standard has not been met, and so the final recommendation is for the reliability standard to remain at its current level.	8.

Stakeholder	Issue raised	Panel response	Ref.
Stakeholder comments: Market price cap			
Australian Energy Council (AEC), p.1	• The MPC should be reviewed in light of the recent increase in use of AEMO directions powers. AEC notes that since 1st Dec 2016, AEMO has issued generator directions seven times. AEMO is also seeking expressions for the supply of reserve contracts as a Long Notice Reliability and Emergency Reserve Trader. • Supports a modelling approach that examines the impacts of recent changes in the market on the level of the market price cap.	Noted and addressed. In the past year AEMO has issued five interventions relating to the scarcity of energy or FCAS. As part of its review, the Panel has considered these interventions and whether they have any consequences for recommended setting of the MPC and the CPT. See Appendix section B.4. The modelling approach addresses emerging trends and uncertainties in the market. See section 2.5.	1.
EnergyAustralia, p.2	• There is an inherent stability benefit from not changing the MPC. • The recent history of AEMO directions should be examined. However, as many of them relate to system security, they do not necessarily indicate that the MPC are working as intended. • The MPC should be set at a level that ensures a strong level of participation in financial markets. It should also be set to ensure sufficient investment in generation capacity. • The MPC should be set to provide suitable investment signals while preventing unmanageable long term prices.	Noted and addressed. The Panel recognises setting the level of the MPC involves making a trade-off between protecting market participants' exposure to high prices and allowing for efficient price signals in the wholesale market. Also, the level of the market price cap should allow the market price to create incentives for participants to manage price risk. The Panel has recognised the benefits of stability in recommending no change to the MPC, and has considered the relevance of recent AEMO interventions (Appendix section B.4) and potential impacts on the contract market (section 4.1).	2.
Engie	• The MPC should be set with reference to:	Noted and addressed. See EY's modelling report on methodology used for market price cap analysis and the assumptions	3.

Stakeholder	Issue raised	Panel response	Ref.
	- a 'two-sided market' and should not be set as a mechanistic derivative of VCR; - impact on demand response; - plant life and WACC; - changing load/demand shape; - gas supply arrangements; - transmission risks and non-firm transmission rights; - intermittent and dispatchable generation; - storage; and - the capital cost of existing plant (that may require refurbishment) and not just new entrant plant.	underpinning the market price cap scenarios.	
Engie	• A lower MPC will result in less contracting by reducing demand for contracts.	Noted. The Panel's recommendation is that the MPC remain unchanged. The impact of changes to the MPC and CPT on contracting is discussed in Chapter 4.	4.
Engie	• The MPC should be set at the level determined from modelling plus an uncertainty margin	Noted. See section 4.2.4 and EY's modelling report for detail on how uncertainty has been considered in the modelling approach. The Panel considered the level of the market price cap in the context of an uncertainty margin through WACC of 10 per cent and 12 per cent, and reduced asset life of plant, but is proposing not to recommend an increase to the market price cap.	5.
ERM Power, p.3,4	• A higher MPC would not have avoided the involuntary load shedding event in SA on 8 Feb 2017. ERM believes that according to AEMO's report on the matter, this should be dealt with	Noted and discussed in Appendix section B.4.	6.

Stakeholder	Issue raised	Panel response	Ref.
	by improving the quality of AEMO's forecast.		
ERM Power, p.3	• ERM notes that a number of the gas fired intermediate and peaking duty generators in the NEM have dual fuel (both gas and liquid) capability. In assessing the impact of gas prices and secure gas supplies on electricity price outcomes, ERM considers that even at a relatively high gas or liquid fuel price of $30/GJ, which is above the price outcomes observed in the winter of 2016, the equivalent generator marginal cost remains sub $450/MWh, which is well below the current MPC value.	Noted. A number of cost sensitivities were considered in the market price cap modelling scenarios and with high gas price also used ($18/GJ). The $18/GJ price is based on Australia's Institute of Petroleum's published average diesel wholesale price (see Appendix section E.5.1). The Panel also notes that the market price cap is set at a sufficiently high level such that generators have the potential to recover their capital costs not just marginal operating costs.	7.
ERM Power, p.5	• While the MPC acts a default bid, ERM believes that it is possible to observe that price sensitive loads do in fact reduce consumption at prices as low as $5000/MWh. These loads are not scheduled and their price sensitivity is therefore not visible to the market.	Noted. While both demand side participation and pumped storage projects have the potential to reduce unserved energy, EY considered that there is 'insufficient information on the cost of implementing new demand side participation or pumped storage projects to comment on the potential for these types of projects to become a marginal source of reducing USE to within the reliability standard' (EY report, p. 66).	8.
ERM Power, p.6	• ERM challenges the Issues Paper claim that increasing the MPC may increase generators' incentives to contract. ERM believes that increasing the MPC may reduce the supply of contracts, as generators may decrease their exposure to the contacts market to avoid unfunded CFD payments arising from a rise in a	Noted and examined. See contracts discussion in section 4.1.	9.

Stakeholder	Issue raised	Panel response	Ref.
	contracted generator risk exposure from unplanned outages.		
ERM Power, p.7	• ERM believes that the MPC, CPT and APC need to be set together.	Noted and addressed. The optimal market price cap has been examined as has the impact of various administered price cap levels on the market price cap. See section 4.2.3 and Appendix E of this report and section 6.3 of the EY report.	10.
Origin, p.2	• The task of determining the MPC is more challenging than in previous reviews. While the MPC is important in providing efficient price signals for future investment, other important factors such as the lack of a sound and coherent policy framework, continues to be the primary issue dampening investor confidence. The Panel should be cognisant that changing the MPC and other settings cannot effectively and efficiently be used as a means of addressing some of the underlying issues facing the market. • The Panel should examine recent instances of when AEMO has used its intervention powers and the reasons for AEMO doing so. It should not be assumed that AEMO's intervention is due to reliability issues.	Noted. See section 4.4.1. The Panel is recommending leaving the MPC unchanged in part in recognition of the need for stability. AEMO interventions: noted and addressed. See Appendix section B.4.	11.
Public Interest Advocacy Centre, p.1,2	• PIAC believes that 2014 modelling showed that the current MPC delivered a far smaller USE than 0.002% in all states except SA, and that	Noted. See section 4.2. The Panel notes the actual level of generation capacity in the market at any point in time reflects historical investment in long life assets,	12.

Stakeholder	Issue raised	Panel response	Ref.
	therefore, the MPC and CPT has not been lowered sufficiently in the past. PIAC believes that the wholesale market is being ' "gold plated" with a much higher level of reliability than consumers are prepared to pay for'.	together with the impact of the investment signal sent by the reliability settings and other policies such as feed in tariffs for roof top solar PV and Large-scale Generation Certificates (LGC or LREC). The settings are not intended to be a tool for signalling generation to leave the market (Guidelines section 3.3.2). Critically, the MPC is a maximum setting for prices. In circumstances where there is excess generation capacity in the market, it would be expected that average whole market prices would be lower than where there is a tighter supply demand balance irrespective of the level of the MPC.	
Public Interest Advocacy Centre, p.3	• The MPC is no longer setting signals for new investment, particularly in light of other factors such as "fuel prices, renewable energy incentives, and the lack of long term carbon policy". • The MPC should focus more on managing the risk exposure of market participants, particularly in light of strategic bidding behaviour and gaming by generators.	Noted. The Panel notes that in almost all circumstances, the MPC does have a marginal impact on investment and capacity and notes the broader uncertainty in the market. The Panel has focused on the role the MPC serves in managing risk exposure. The use of strategic bidding and wider market issues are beyond the scope of this review and being addressed through other work streams.	13.
Public Interest Advocacy Centre, p.4	• Demand response is viable at a price level that is much lower than the MPC. • Setting the MPC or CPT to incentivise new generation would appear to be misguided. The price of DR should be considered as an alternative to capacity.	Noted. See comment 8. The guidelines require the MPC/CPT to be set so as to allow for sufficient investment through price signals in the market, not to incentivise investment.	14.

Stakeholder	Issue raised	Panel response	Ref.
Public Interest Advocacy Centre, p.4	• Any demand response procured by AEMO through the RERT should not be considered "AEMO intervention" for the purposes of setting the MPC or CPT.	The Panel disagrees. The AEMC is required to set the standard, based on a recommendation from the Panel. The Panel's recommendation is required to consider the RERT as an AEMO intervention (rules clause 3.9.3(f)(1)).	15.
Public Interest Advocacy Centre, p.4	• The creation of new markets (including markets for ancillary services) means that potential capacity can recover costs through means other than the energy market. This should be reflected in the valuation of the MPC and CPT.	Noted. The modelling for this review has not incorporated revenue from existing and future ancillary service markets. The EY report explains: 'The revenue generators currently earn for providing ancillary services is small compared to revenue from electricity sales. In 2015, the total value of FCAS in the NEM was $112 million, being 1.4 per cent of the $8.3 billion traded on the energy market in the NEM. The 2018 Review tasks are focussed on the reliability settings in the NEM. These settings are primarily driven by outcomes in the energy market due to its relative size. For this reason the interaction between the energy and ancillary markets are not considered for this Review. ' EY report, section 7.1.1.	16.
Public Interest Advocacy Centre, p.6	• MPC and CPT should vary by region. This will incentivise investment in generation capacity in particular regions.	Noted. The Guidelines state that only the level of the MPC and CPT is to be examined in this review. Consideration of varying the MPC/CPT by region is outside the scope of this review. See Guidelines pp. 6 - 7, and Guidelines determination, pp. 26 - 27.	17
Public Interest Advocacy Centre, p.6	• The contract market is a means to an end. It should only be preserved to the extent that it	Noted. Assessment of the impacts on the contract market has been	18.

Stakeholder	Issue raised	Panel response	Ref.
	serves the long-term interests of consumers.	undertaken subsequent to the modelling to ascertain the theoretical optimal MPC.	
Public Interest Advocacy Centre, p.6	• The indexation of the MPC and CPT is supported except when there are reasons to believe that the MPC and CPT should decrease over time. The indexation of the MPC and CPT appears to create a kind of ratchet effect leading only to ever higher settings for the MPC and CPT.	Noted. See Appendix D. The application of indexation per se to the MPC is not subject to review (Guidelines section 3.1).	19.
Snowy Hydro, p.1	• Snowy supports the current framework for determining the MPC. • The MPC should continue to be indexed to CPI.	Noted. The Panel's recommendation is to continue indexing MPC using CPI.	20.
Snowy Hydro, p.4	• There is no evidence that the MPC at current level is not providing sufficient incentives for new investment. Available evidence shows that the MPC has been a signal for new investment and has allowed the reliability standard to be met without AEMO intervention (i.e. Directions and the use of the RERT).	Noted and addressed. The Panel is recommending to leave the MPC unchanged.	21.
Stakeholder comments: Cumulative price threshold			
Australian Energy Council (AEC), p.1	• The CPT should be reviewed in light of the recent increase in use of AEMO directions powers. AEC notes that since 1st Dec 2016, AEMO has issued generator directions 7 times.	Noted and addressed. The Panel has examined the reasons for AEMO's interventions and whether they indicate a need for changing the MPC or CPT. See	1.

Stakeholder	Issue raised	Panel response	Ref.
	AEMO is also seeking expressions for the supply of reserve contracts as a Long Notice Reliability and Emergency Reserve Trader	Appendix section B.4.	
EnergyAustralia, p.2	• There is an inherent stability benefit from not changing the CPT.	Noted and addressed. See section 4.4.1. The Panel is recommending to leave the CPT unchanged.	2.
EnergyAustralia, p.2	• The recent history of AEMO directions should be examined. However, as many of them relate to system security, they do not necessarily indicate that the CPT is working as intended. • The CPT should be set to provide suitable investment signals while preventing unmanageable long term prices.	Noted and addressed. See comment (1) in relation to the Panel's examination of AEMO interventions. The Panel considers retaining the current CPT will provide suitable investment signals while preventing unmanageable long term prices.	3.
Engie, p.4	• The MPC and CPT should be decoupled. CPT should be set with reference to the risk tolerance of the market as a whole.	Noted. The Panel has considered the EY modelling outcomes that shows the MPC and CPT are inherently linked and should be set together – see Appendix section C.4.	4.
Engie, p.4	• The CPT should be set to ensure that it does not undermine the MPC or truncate "peaking plant" revenue during "extreme events"	Noted and addressed. The Panel has considered the influence of the MPC on the CPT, and their combined impacts on revenue; see Appendix section C.4.	5.
ERM Power, p.3,4	• A higher CPT would not have avoided the involuntary load shedding event in SA on 8 Feb	Noted and addressed.	6.

Stakeholder	Issue raised	Panel response	Ref.
	2017. ERM believes that according to AEMO's report on the matter, this should be dealt with by improving the quality of AEMO's forecast. The presence of spare capacity in the form of Pelican Point reinforces this belief.	The Panel has examined the reasons for AEMO's interventions and whether they indicate a need for changing the MPC or CPT, including the 8 February event. See Appendix section B.4.	
ERM Power, p.6	• There is little reason to increase the CPT. Historically; the CPT has not been triggered particularly often in the energy market.	Noted and addressed. The Panel is recommending to leave the CPT unchanged.	7.
ERM Power, p.6	• The recent increase in the CPT being triggered in FCAS markets in SA reflects a set of temporary and local circumstances. There is no reason to increase the CPT at present.	Noted and addressed. The Panel is recommending to leave the CPT unchanged.	8.
ERM Power, p.7	• ERM believes that the MPC, CPT and APC need to be set together.	Noted and addressed. The Panel has considered the level of the MPC in relation to the CPT and also examined how varying the APC affects the optimal MPC. See Appendix section C.4 and the EY report section 6.3.1.	9.
Snowy Hydro, p.1	• Snowy supports the current framework for determining the CPT. • The CPT should remain at 15 times MPC.	Noted and addressed. The Panel is recommending to leave the CPT unchanged at approximately 15 times the MPC.	10.
Snowy Hydro, p.3	• The CPT has only been activated on 5 occasions which provides a clear indication that it is set at the right level.	Noted and addressed. The Panel is recommending to leave the CPT unchanged at	11

Stakeholder	Issue raised	Panel response	Ref.
		approximately 15 times the MPC.	
Stakeholder comments: Administered price cap			
EnergyAustralia, p.3	• As part of materiality assessment a key issue is whether the APC is appropriate given current gas prices and the effect on costs for gas peaking plant. During the transition from the previous high levels of baseload coal generation, there is likely to be a greater reliance on gas powered generation and higher volatility. This may see gas generators exposed to longer periods of administered pricing.	Noted and addressed. In supporting a reassessment of the APC, the Panel factored in the potential for changes in gas prices and availability to impact on the costs of gas peaking plant. The assessment of the APC then considered the short run marginal costs over the review period of high marginal cost, low utilisation generators. The MPC scenarios examined the frequency of CPT events, and the impact of increases to the MPC on generators' exposure to periods of administered pricing. See Appendix E.	1.
ERM Power, p.2,7	• Does not support an increase to any of NEM reliability settings as this may lead to poor outcomes for consumers. • In assessing the potential for the lodgement of compensation claims under this provision of the rules into the future, the Panel should consider that only a small component of the one past claim was associated with the participant's marginal cost of production. Also, due to a significant level of controversy regarding the claim, rules changes occurred to more clearly detail the areas that may be claimed. • Would support a review of the APC if there is	Noted and (largely) addressed in Appendix E. The Panel: • made a final recommendation that the level of the APC remains unchanged • addressed ERM Power's comments on the need to assess structural changes in marginal costs • assessed the MPC, CPT and APC together • differed from ERM Power, on its views regarding the marginal costs associated with the Synergen compensation	2.

Stakeholder	Issue raised	Panel response	Ref.
	evidence of a structural increase in normal marginal costs has occurred for the higher cost generators in the NEM. • In that the CPT and APC work together to limit participants' financial exposure to the wholesale spot market during prolonged periods of high prices, that the APC is also interrelated to the MPC and CPT and these three setting should be reviewed together.	claim.	
Snowy Hydro, p.5	• Supportive of leaving the administered price cap at current level	Noted and addressed. The Panel's final recommendation is that the APC remain at its current level.	3.
Stakeholder comments: Market price floor			
EnergyAustralia, p.3	• Does not consider there is likely to be material benefit in reassessing the market price floor.	Noted. The Panel agrees that the materiality threshold for a reassessment of the level of the market price floor has not been met.	1.
Engie, p.5	• The Panel should initiate a review of the whole market arrangement dealing with excess generation.	Noted. The Panel notes this could be addressed in the AEMC's current Reliability Frameworks Review.	2.
Engie, p.5	• Pricing policies (such as subsidies and fixed feed-in tariffs) for renewable technologies are	Noted. The Panel considers these policy issues are outside the scope of the	3.

Stakeholder	Issue raised	Panel response	Ref.
	inequitable for conventional plant.	2018 Review.	
Engie, p.5	• Non-responsiveness of wind generation to wholesale spot prices and the fact that output is only curtailed in the event of network constraints contributes to the 'burden of reducing generation fall[ing]… on conventional plant'.	Noted. The AEMC has recently considered two rule changes (from Snowy and Engie) on altering the threshold for scheduling generation and requiring load to be scheduled. The AEMC published a final determination in September 2017, that there was no benefit at the moment from imposing the cost associated with altering the requirements for market participants to participate in the central dispatch process (ERC0203).	4.
Engie, p.5, Snowy Hydro, p. 6	• Absence of financial recognition for the provision of system security services provided by thermal plants threatens their commercial viability and power system security.	Noted. The Panel notes these issues are being addressed in the AEMC's system security work program.	5.
ERM Power, p.2,7	• ERM has not observed any changes in the market that would warrant a change to the floor price. Therefore ERM does not support any change to the current MFP value. • ERM notes that changes to the value of any of the reliability settings may not translate to what the Panel believes would be positive changes in investment outcomes given the current levels of market uncertainty. ERM states investment signals have also been muted by off market subsidies, such as the	Noted. The Panel considers that the materiality threshold for a reassessment of the level of the market price floor has not been met.	6.

Stakeholder	Issue raised	Panel response	Ref.
	Renewable Energy Target.		
Snowy Hydro, p.6,7	• Support use of an analogous methodology to that applied to the MPC for the determination of MFP. This would entail assessing what level the MFP has to be to encourage new entrant technologies that could alleviate excess generation. These technologies may be pump storage, storage batteries etc.	Noted. The Panel is not aware of any evidence that the current level of the market floor price impedes the efficient entry of storage technology, based on the infrequent incidence of low price events. Additionally, using the market floor price to incentivise particular technologies to enter the market represents a change in the approach to and potentially the function of the market floor price outlined in the guidelines. The guidelines state that the level of the reliability settings, and not their purpose or form, is to be subject to review. [475]	7.
Snowy Hydro, p.6,7	• To avoid generation being constrained off and as a result not being able to sell hedge products, the market floor price will need be lower if the market price cap was to continue to increase due to CPI.	Noted. The Panel's analysis of the market price cap in this review has examined the impact of increases to the cap in line with the CPI.	8.
Stakeholder comments: other issues			
ERM Power, p.1	• General comment that perceptions of difficulty in achieving reliable supply to consumers have occurred before, generally driven by forecasts of ever increasing peak demand which failed to	Noted. The modelling for the review has considered both strong and neutral demand forecasts.	1.

475 Guidelines , p. 5. However, given the rapidly increasing role of storage in the NEM, it is possible that future versions of the Guidelines may reconsider the relationship between the market floor price and storage technologies.

Stakeholder	Issue raised	Panel response	Ref.
	materialise. • The Panel should consider both the potential negative and positive aspects of changes in the settings, as this is a challenging time to be reviewing the settings.	The Panel acknowledges the significant uncertainty and the change underway in the national electricity market and as required by the rules has considered the impacts of the changes to the settings on: • spot prices • investment in the NEM • the reliability of the power system, and • market participants.	

G.2 Summary of comments on the draft report

Stakeholder	Issue raised	Panel response	Ref.
Engie, p.3	• The draft report proceeds to dismiss higher settings and E&Y modelling results on the basis that these scenarios are unlikely and would serve to increase cost to consumers. • To make a meaningful comparison between alternative settings, the Reliability Panel needs to assess the impact of interventions on the market, investments (existing and prospective) and prices to customers. Cost of interventions and/or load shedding is quite material. According to the Energy Security Board 12/17 report, interventions are costing tens of millions of dollars due to compensation and inefficient dispatch. • It is important to minimise the need for on-going invention in the market instead of using interventions to manage the "top end" issues in the market and facilitate investment. • It could be suggested that the MPC should be increased to make it consistent with the reliability standard under most scenarios considered.	Noted and addressed in chapter 4. The Panel notes the MPC modelling results have been revised since EY's draft report. In particular, the revised MPC results associated with the Victorian high cost scenario were lower than those originally presented in the draft report, for some sensitivities. The Panel considers the current level of the MPC remains consistent with the reliability standard under most scenarios examined. The Panel has considered recent AEMO interventions related to the reliability of the system in Appendix section B.4. The Panel is required to set the MPC and CPT at levels that allow the reliability standard to be satisfied without use of AEMO's powers to intervene (rules clause 3.9.3A(f)).	1.
Energy Users Association of Australia (EUAA), p.1,2	• While the EUAA supports the Panel's recommendations on the existing reliability standard, the administered price cap and the market floor price, the EUAA does not support the Panel's recommendation on the market price cap, and, by implication, the cumulative price threshold. • In the recent years, deployment of new generation capacity	Noted. The Panel accepts that a variety of factors have driven recent investment in new capacity. Considerations relating to a lower MPC/CPT are discussed in section 4.2. The purpose of the market price cap is discussed in Appendix section B.1.	2.

Stakeholder	Issue raised	Panel response	Ref.
	has almost entirely been driven by the RET, CEFC, State Government and Territory reverse auctions and investors' view of risk e.g. carbon and gas fuel supply. • The level of MPC is not a major factor (if a factor at all) in the new generation build and indeed the NEM is moving away from being a market relying on 'market' signals. • Essentially, the more the NEM moves towards a capacity market the less is the need for an MPC anywhere near the current level.		
Energy Users Association of Australia, p.2,8	• The Panel acknowledges that there is a lot of change going on in the NEM and for that reason supports the "stability", "certainty" and "predictability" that comes from leaving the MPC unchanged. Given the materiality test applied by the Panel, the draft report provides no supporting analysis that "stability" is materially better than a change. It seems the Panel has placed the onus of proof on those who advocate change rather than applying its own test to its own analysis and conclusions. Where it does apply the materiality test the arguments are more qualitative that quantitative. • The EUAA contends that MPC stability in the current and expected market for 2020-2024 is not in the long-term interests of consumers. The EUAA notes that the only submissions to the Issues Paper supporting the concept of stability in the MPC came from generators. There were no submissions from consumers supporting the Panel's approach. • While the current MPC is not needed for new investment, its role in mitigating the risks of consumers being exposed to	The guidelines require the Panel to be guided by the objective of "providing a stable, predictable and flexible regulatory framework" (Guidelines p. 3). This is discussed in section 4.4.1. Potential impacts on consumers of lowering the MPC/CPT are discussed in section 4.2.2. As discussed in section 4.5, on balance the Panel has concluded that the potential benefits in terms of reduced costs to consumers of lowering the market price cap do not outweigh the long term risks associated with not having investment signals sufficient to incentivise investment in new capacity to achieve the reliability standard through the review period.	3.

Stakeholder	Issue raised	Panel response	Ref.
	excessive prices still remains. The draft paper agrees with this role for the current MPC level, so presumably a lower MPC would achieve the role of consumer protection even better. • "Stability" in the MPC is not in the long-term interests of consumers – a lower MPC is.		
Origin, p.1	• Origin supports the Panel's draft determination to leave the current reliability standard and settings unchanged over the period 2020-24, with the market price cap and cumulative price threshold indexed to CPI. • While there is renewed focus on reliability given the tighter demand/supply balance in recent years, it is not clear that a change in the standard and settings is key to driving greater levels of investment at this time.	Noted. The Panel is recommending no changes to the reliability standard and settings at this time.	4.
Public Interest Advocacy Centre (PIAC), p.1	• PIAC is disappointed to note that many of the points made in PIAC's submission to the issues paper have been acknowledged, but not meaningfully addressed, in the draft report. • PIAC is deeply concerned about the dearth of evidence behind the panel's draft recommendations, and that these fail to promote the long term interests of consumers.	As requested, the project team met with PIAC on 16 January 2018 to discuss the issues PIAC had raised in relation to the review and provide further detail as to how these had been considered and addressed by the Panel. PIAC also attended the public meeting. In terms of how the Panel makes its decisions on the settings, see section 2.5.	5.

G.3 Summary of stakeholder discussion at the public meeting

On 7 March the Reliability Panel held a public meeting to discuss stakeholders' feedback on key aspects of the draft report and present additional modelling results. The meeting focused on the Panel's proposal to keep the market price cap and cumulative price threshold at their current levels. The Panel's modelling of five minute settlement and its implications for the review's final recommendations on these price settings was also discussed at the meeting.

Issue	Comments	Report references
Role of the market price cap	• Public Interest Advocacy Centre (PIAC) together with Energy Users Association of Australia (EUAA) argued that the market price cap now has a more limited role, in that (in their view) it is no longer a key driver of investment. PIAC and EUAA suggested that since the level of reliability that has been achieved is well within the reliability standard, the market price cap could be reduced. Furthermore, PIAC argued that the market price cap had been set too high by past Panel reviews. • On the other hand, generation businesses argued that the market price cap is relevant for investment decision-making. A higher market price cap incentivises capacity investment, which over time puts downward pressure on prices. It was also argued that a change in wholesale prices manifests in a change in retail prices. • Generation businesses argued that the market price cap has the same purpose today as it did 10 years ago. The market price cap signals the need for investments. For instance, the value of power purchase agreements is driven by revenue, expectations which in turn depend on the level of the market price cap. • The representative of Energy Consumers Australia (ECA) (via email, noting that this was not an ECA submission) argued that the market price cap is not set to encourage investment. If there was total confidence in the wholesale market there would be no market price cap. According to the ECA representative, the market price cap only exists to provide protection to consumers and works to dampen investment signals relative to market with no price cap. The lower the market price cap the lower the likely investment and the higher the possible unserved energy. The argument made by the ECA representative (and echoed by other consumer advocates) is that the current level of the	Considerations relating to lowering the MPC/CPT are discussed in section 4.2. As discussed in section 4.5, on balance the Panel has concluded that the potential benefits in terms of reduced costs to consumers of lowering the market price cap do not outweigh the long term risks associated with not having investment signals sufficient to incentivise investment in new capacity to achieve the reliability standard through the review period. The purpose of the market price cap is discussed in Appendix section B.1.

Issue	Comments	Report references
	market price cap is clearly higher than the level necessary to ensure that the reliability standard is met. The ECA representative also argued that if additional investment only exists to support occasional peaks, this results in higher average prices for consumers. • The Panel reiterated that an excessively high market price cap will deliver reliability far in excess of the reliability standard while an excessively low market price cap will result in a breach of the reliability standard. The Panel's aim is to ensure that the reliability standard is expected to be met, with the level of reliability not being far in excess of the standard. • S&C Electric Company argued that arbitrage is very difficult to do for batteries, and is unlikely to enable batteries to sufficiently recover costs. EY confirmed that batteries may need a higher market price cap to be viable.	
Connections between the market price cap and the actual prices paid by consumers	• Consumer groups argued that the market price cap contributes to high electricity prices. Other stakeholders disagreed stating that the market price cap working well is a different issue to having continual higher prices - lowering the market price cap would not deliver lower wholesale market prices. • Consumer groups argued that consumers are paying twice: through taxes (the cost of government interventions) and electricity bills. According to their views, there is a need to rethink the value of customer reliability (97 per cent of blackouts are due to distribution network outages). There is also a need to consider more precisely the primary purpose of the market price cap – which they argued was consumer protection. • EUAA suggested doing a quantitative assessment of the market price cap impact on retail prices.	The potential impact of a lower market price cap on consumer electricity bills is discussed in section 4.2. The purpose of the market price cap is discussed in Appendix section B.1. The value of customer reliability will be reassessed in 2019 by AEMO or the AER; see Appendix section A.6.
Contract markets	• ERM Power commented that the determination to be made by the Panel in this review will apply in two years' time, thus, retailers will have time to respond. The argument of retailers not responding fast is of limited relevance. It was also added that if generators see more risk (e.g., face a higher market price cap), they will seek higher cost hedge contracts. Indicatively, a 10 per cent change in the market price cap would cause generators to reconsider investment and hedging strategies. • The market price cap does materially impact the level of prudential requirements. ERM Power also noted that decreasing the market price cap could reduce the volume of power	Impacts on contract markets are discussed in section 4.1 and Appendix section C.4.3.

Issue	Comments	Report references
	hedged or might increase it from a retail competition perspective.	
Modelling assumptions	• EUAA considered that modelling assumptions are very conservative, particularly in regards to demand response. EUAA suggested the use of scenarios incorporating different levels of demand response would have been useful. EY noted the lack of publicly available information on demand response (cost, MW availability and duration). • EUAA argued that five minute settlement modelling outcomes are a reason to consider a reduction to the market price cap. • PIAC acknowledged that EY assumptions regarding the contribution of behind-the-meter storage to peak demand seemed reasonable (70 per cent of installed battery capacity available at times of peak demand).	Modelling assumptions are outlined in Appendix section H.1 and in the EY report. Considerations relating to a lower market price cap are discussed in section 4.2.
Regulatory stability and other issues that impact on market integrity	• Stakeholders acknowledged the increasing role of government investments into the energy sector. • EUAA and PIAC stated that the only submissions to the draft report that supported regulatory stability were from generators. According to EUAA and PIAC, stability does have importance, but certainty (i.e predictability) is what stakeholders and consumers prefer. It was agreed by all stakeholders that the market would value predictability more than stability. • EUAA and PIAC stressed that the system now is hyper-reliable and existing generators experience unbalanced rewards due to market power. They argue there is more to be gained by reducing the market price cap than continuing to increase it at CPI. They see government interventions as the biggest risk at the moment. • Stakeholders discussed whether the reliability target for setting a market price cap is 0 per cent or 0.002 per cent unserved energy. The Panel members clarified that they do not target to achieve 0 per cent unserved energy, as this involves unnecessary high costs. • Consumer groups also see value in conducting an interim report on the reliability standard and settings, after the current review is concluded but before the 2022 review, once there is more clarity around current uncertainties in the market, such as the finer details of the national energy guarantee.	Stability and predictability are guiding principles for the review, as discussed in section 4.4.1. Considerations relating to a lower market price cap are discussed in section 4.2, and indexation is discussed in chapter 5. The purpose of the reliability standard is discussed in Appendix section A.1. The potential for an interim report is discussed in section 8.3.
Indexation of the	• The ECA representative noted (by email, noting it was not an ECA submission) that it is	Indexation is discussed in chapter 5

Issue	Comments	Report references
market price cap and the cumulative price threshold	unclear on which basis the Panel interpreted indexation to only refer to an index of price movements and on which basis the Panel believes it is appropriate to make a decision on indexation absent the data on the operation of the settings. • The ECA representative also argued the indexation of the market price cap should cease. It should get no higher in nominal terms. According to the ECA representative, this is the classic approach to adjustment down. • PIAC and the EUAA discussed the purpose and application of indexation. They considered indexation should not apply to the market price cap and cumulative price threshold. If the Panel were to recommend a gradual decrease in the either market price cap or cumulative price threshold, PIAC and EUAA considered that the effect of such a decrease would be counteracted by the continued indexation of the settings.	and Appendix D.
AEMO interventions	• Stakeholders suggested the Panel should consider the costs of market interventions in recommending a level for the market price cap but were not sure how this could be done.	The Panel is required to set the MPC and CPT at levels that allow the reliability standard to be satisfied without use of AEMO's powers to intervene (rules clause 3.9.3A(f)). AEMO's historical interventions are discussed in Appendix section B.4.

List of attendees

1. Luke Middleton - Hydro Tasmania (dial in)
2. David Calder - Origin Energy
3. Meng Goh- AGL Energy Limited
4. Jill Cainey- S & C Electric Company
5. Joanne Bright- Department of Environment and Energy
6. Ron Logan- ERM Power
7. Craig Memery- PIAC

8. Mark Grenning – EUAA
9. David Evans – Flow Power (dial in)
10. David Havyatt– Energy Consumers Australia (dial in)

Appendix H – Modelling

H.1 Summary of principal assumptions

This section summarises the principal assumptions of the wholesale market modelling undertaken for this review:

- For the base scenario including sensitivities.
- For the market price cap modelling including sensitivities.

Base scenario

Table 11 presents the key market assumptions for the base scenario for this review, which forecast the likely market outlook to 1 July 2024.

Table 11: Base scenario assumptions[476]

Assumption	Description	Source
Assumptions affecting demand / energy consumption		
Electricity consumption	Annual forecasts of energy and seasonal peak demand by NEM region	AEMO, 2017 ESOO Neutral scenario
Rooftop PV	Annual energy forecast from rooftop PV generation	AEMO, 2017 ESOO Neutral scenario
Electric vehicles and behind-the-meter storage	Annual energy forecast for electric vehicles and behind-the-meter battery storage	AEMO, 2017 ESOO Neutral scenario
Demand-side participation	DSP has a significant role in preventing unserved energy	AEMO, 2017 ESOO
Assumptions regarding market policies		
Drivers of large-scale renewable capacity	The present legislated LRET target of 33,000 GWh is met by 2020, plus additional drivers from GreenPower and state Government renewable energy auctions.	Present legislated LRET target and additional drivers.
Emissions reduction	No explicit or implicit policy to reduce emissions from the electricity sector (aside from the LRET).	As agreed in consultation with the Panel.
Assumptions affecting generation supply		
Non-renewable generator developments	The committed and likely changes to generator capacity, including large-scale storage, are taken into account.	Based on public announcements, and agreed in consultation with the Panel.

476 EY report p. 24-25.

Assumption	Description	Source
Outage rates - generators	Outages are in two categories: Forced outage rates depict the probability of different types of generators experiencing an unplanned full or partial outage. Planned outages are specified as an average number of days a generator is unavailable due to planned maintenance every year.	AEMO, 2017 ESOO
Fuel prices	The price for natural gas and coal is a key influence on market prices, influencing the short-run costs and bidding strategies of thermal generators.	AEMO, 2016 NTNDP
Network constraint equations	AEMO publishes a data set of network constraint equations annually. These are used to constrain generation at particular times to ensure the system is operated in a secure state with respect to transmission network limitations.	AEMO 2015 constraints data set
Technology capital costs	Capital costs for new entrant generators of different types are used to assess the economic viability for new capacity.	AEMO, 2016 NTNDP, except: Adjustments for large-scale wind and solar PV CSIRO/Jacobs Neutral trajectory (from 2016 AEMO NEFR) for large-scale storage
Technology parameters	These parameters include heat rates, economic lifetime, annual energy expectations (wind and solar) and loss factors	AEMO, 2016 NTNDP EY annual energy expectations Loss factors for 2017-18 from AEMO
WACC	The WACC is used to evaluate the annualised repayments of capital costs for each generator. 8% pre-tax real was used.	IPART Review of Regulated Retail prices, adjusted by EY in consultation with the Panel

A number of sensitivities to the base scenario were simulated to explore the impact of different assumptions on the unserved energy forecast. Table 12 lists the sensitivities modelled, including where assumptions departed from the base scenario and the reason for varying those factors.

Table 12: Base scenario sensitivities[477]

Sensitivity	Assumptions that differ from Base Scenario	Motivation
Base w High Demand	Uses AEMO's high demand scenario (from the 2017 ESOO Strong scenario).	Explores the impact of high demand and to compare with AEMO's modelled high demand in the 2017 ESOO report.
Base w HighD and EY FORs	Uses AEMO's high demand scenario (from the 2017 ESOO Strong scenario) and EY's upper bound of full FORs[478] for existing coal generators.	To explore the impact of EY's upper bound FORs in isolation to other assumptions.

477 EY report, p. 26.

478 For more details see EY report, Appendix A

Market price cap modelling

Table 13 outlines the assumptions made for the two market price cap scenarios to drive expected unserved energy over 0.002 per cent.

Table 13: Overview of market price cap scenarios[479]

Scenario	Assumptions differing from the Base Scenario
MPC Scenario 1	► AEMO high demand forecast[480] ► EY's coal outage rates[481] ► Early retirement of 1,040 MW of thermal capacity in South Australia
MPC Scenario 2	► AEMO high demand forecast ► EY's coal outage rates ► VRET 5150 MW scheme[482] ► Early retirement of 2,600 MW of thermal capacity in Victoria

Table 14 summarises the different assumptions used in the sensitivities for the market price cap outcomes. The base costs are used in the base scenario as well as both market price cap scenarios. The high costs sensitivities are only used for the market price cap scenarios.

Table 14: Assumptions that differ between the Base costs and High costs sensitivities[483]

Assumption	Base costs	High costs			
		High	Cap defender	12% WACC	Half lifetime
WACC (pre-tax real)	8%	10%	10%	12%	10%
Economic lifetime for OCGTs	30	30	30	30	15
Bidding strategy of marginal OCGT*	SRMC	SRMC	$270/MWh#	SRMC	SRMC
Capital costs** – wind and solar PV	EY market research	2016 NTNDP			
Capital costs** - Storage	CSIRO/Jacobs Neutral	CSIRO/Jacobs Strong			
Gas fuel price	2016 NTNDP	$18/GJ			
Include CCGTs as potential new entrant	Yes	No			

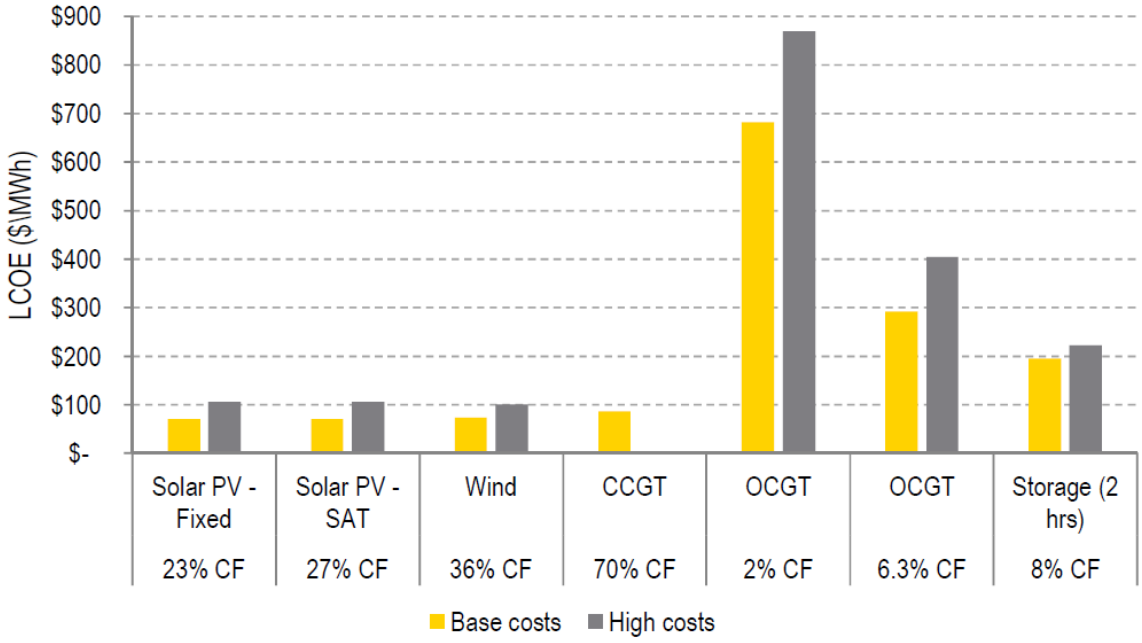
* This is equivalent to the cap defender strategy employed in the 2014 Review.
** The same capital costs for OCGTs and CCGTs were used in the Base and High costs sensitivities as these are considered stable and more certain for the Period than with the other technologies.

479 EY report p. 37.
480 From Strong scenario in AEMO's 2017 ESOO. This includes higher demand, rooftop PV, EV and behind-the-meter battery uptake compared to the Neutral scenario.
481 EY analysed historical availability of national electricity market coal generators to estimate an upper bound for their forced outage rates.
482 Involves 700 MW of renewable capacity in addition to the LRET installed in Victoria in each year in the Period (Source: https://www.energy.vic.gov.au/renewable-energy/victorias-renewable-energy-targets).
483 EY report, p. 38.

As described above the nominal $300/MWh APC is estimated to be $270/MWh in real terms for the purpose of the modelling. This estimate is equally applied to the $300/MWh cap contract on the basis that this standard contract is also effectively nominal.

Figure 15 presents the levelised cost of energy (LCOEs) for the key contending generator technologies.

Figure 15: LCOEs for key technologies using the Base costs and High costs assumptions (SAT = single access tracking)[484]



H.2 Comparison with 2017 ESOO

In September 2017 AEMO published the 2017 Electricity Market Electricity Statement of Opportunities (ESOO). As required under clause 3.13.3(q) of the rules, the ESOO includes projections of aggregate demand and energy requirements for each region, generating capabilities of existing and planned units, anticipated plant retirements and operational and economic information. In the ESOO, AEMO also provides forecasts of unserved energy for the regions of the NEM for a 10-year period from 2017-18 to 2026-27.

The unserved energy forecasts presented in the ESOO were significantly different to the unserved energy outcomes forecasted by EY in the base scenario (and associated sensitivities) for this review. EY notes:

> AEMO's 2017 ESOO presents a higher forecast unserved energy in New South Wales in 2022-23 compared to EY's modelling when applying AEMO's ESOO modelling data sets. The magnitude of this forecast difference is 43 MWh out of 348 MWh. When implementing EY's half-hourly profiles for demand, wind,

484 EY report, p. 39.

solar, behind-the-meter battery storage and electric vehicles the difference increased to 328 MWh.[485]

The Panel engaged EY to explore the reasons for these different forecasts. EY concluded that the majority of the differences in unserved energy forecasts are due to the following factors:

- "EY's half-hourly modelling of wind, solar and rooftop PV uses different source data and data preparation techniques to AEMO. In particular EY use different data sets that describe the characteristics of wind generation in different regions. This difference in wind resource data means AEMO and EY have different wind generation profiles. The contribution of this assumption to the differing USE levels was approximately 25%.
- "EY's modelling assumes a much greater contribution to peak demand from behind-the-meter storage which might be expected in the Period as a result of changing electricity tariff structures that reward peak demand reduction. This assumption results in lower peaks in the demand to be met by scheduled generators in the NEM, compared to AEMO. The estimated impact of this assumption for NSW in 2022-23 is approximately 63% of the difference of forecast USE levels.
- "EY's dispatch modelling software differs from AEMO's and as a result, some aspects of the modelling approach are not the same. The contribution of applying alternative dispatch modelling software on the USE levels was assumed to contribute to the remaining difference, being approximately 12%."[486]

The Panel acknowledges that forecasting of electricity supply and demand is a complex process the outcomes of which depend on the overall purpose, modelling approach, input data, assumptions, and scenarios and sensitivities tested.

Differences between the rationales for the scenarios used in this review and the ESOO scenarios

In addition to modelling differences, the scenarios used in this review and those used in the ESSO serve different purposes.

In effect, the September 2017 ESOO presents three base scenarios, covering the period from 2017–18 to 2026–27. The scale and distribution of new generation capacity is the crucial difference between each of the three ESOO scenarios. The following table summarises each scenario and its underpinning rationale as stated in the ESOO.

485 EY report, p. 109

486 EY report, p. 109

Table 15: ESOO scenarios summary

ESOO scenario	Description	Rationale
Scenario 1 Committed capacity	This first scenario relates to the requirement in the rules to provide information about 'generating units for *which formal commitments have been made for construction or installation'* (rule 3.13.3(q)(2)). The scenario 'incorporates all existing generation in the NEM and new generation that meet AEMO's commitment criteria'[487] The forecast is based on AEMO's definition of committed new generation projects. AEMO's commitment criteria are set out in the table below. Committed projects are those that meet all five of the commitment criteria.	Required under the rules.
Scenario 2 Concentrated renewables	This scenario 'assumes potential additional development after 2020 are geographically concentrated particularly in Victoria, driven by the Victorian Renewable Energy Target (VRET).'[488] According to the ESOO: '[t]he Concentrated renewables pathway's goal is to deliver renewable capacity from the federal Largescale Renewable Energy Target (LRET) and the VRET[out to 2025] only.' The scenario includes capacity 'built beyond AEMO's commitment criteria' to meet the targets but the model does not assess whether any of this new entrant capacity is commercially viable.	'[M]odelling renewable generation builds to meet proposed and existing renewable targets in the NEM' and 'to capture **a broad range of possibilities** that could occur in the NEM in the next 10 years.' [489]
Scenario 3 Dispersed renewables	This scenario focuses on examining capacity under a national renewables target. It: 'includes the LRET as above, but further assumes any additional renewable capacity incentivised from 2021 onwards is driven through nationally set (or at least co-ordinated) targets, rather than state-based schemes. No such national target currently exists. For modelling purposes, this pathway targeted 45% renewables by 2029–30, a mid-point of the proposed outcomes announced by the Queensland and Victorian governments.' [490] The forecast includes capacity 'built beyond AEMO's commitment criteria' to meet the targets but the model does not assess whether any of this new entrant capacity is commercially viable.	

While both EY's modelling for the Panel's review and the ESOO forecast unserved energy for the national electricity market for the period 1 July 2020 – 1 July 2024, the rationale for the Panel's base scenario differs fundamentally from the rationales for the ESOO scenarios. Put simply, the scenarios in the Panel's review and those in the ESOO have different purposes; they are not seeking to examine comparable 'futures'.

In contrast to the Panel's review, none of the three ESOO scenarios seek to reflect the **likely outcomes** for the national electricity market in the review period. Rather, in relation to new capacity AEMO either seeks to forecast unserved energy outcomes, should only very well progressed generation projects proceed (scenario 1), or forecasts

487 AEMO, *ESOO*, September 2017, p. 7

488 AEMO, *ESOO*, September 2017, p. 7

489 ESOO p. 6, 7, emphasis added. Both Scenario 2 and Scenario 3 are not required by the rules.

490 AEMO, *ESOO*, September 2017, p. 10

and compares the unserved energy outcomes under **'a broad range of possibilities' regarding policies on renewable targets** (scenarios 2 and 3).

The generation project commitment criteria used by AEMO are outlined below.

Table 16: Generation project commitment criteria[491]

Category	Criteria
Site	The project proponent has purchased/settled/acquired (or commenced legal proceedings to purchase/settle/acquire) land for the construction of the project.
Major components	Contracts for the supply and construction of major plant or equipment components (such as generating units, turbines, boilers, transmission towers, conductors, and terminal station equipment) have been finalised and executed, including any provisions for cancellation payments.
Planning consents/construction and connection approvals/EIS	The proponent has obtained all required planning consents, construction approvals, connection contracts (including Generator Performance Standard agreement from AEMO in the form of the 534A letter), and licences, including completion and acceptance of any necessary environmental impact statements.
Finance	The financing arrangements for the proposal, including any debt plans, must have been concluded and contracts executed.
Final construction date set	Construction of the proposal must either have commenced or a firm commencement date must have been set.

Further information on this matter is provided in Appendix D of EY's report including a comparison of the unserved energy forecasts by EY for this review, and AEMO in the ESOO.

491 AEMO's commitment criteria are presented in the "Background Information" worksheet at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information