AEMC

REVIEW

Reliability Panel AEMC

Issues Paper

2026 Reliability Standard and Settings Review

19 June 2025

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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.

Acknowledgement of Country

The AEMC acknowledges and shows respect for the traditional custodians of the many different lands across Australia on which we all live and work. We pay respect to all Elders past and present and the continuing connection of Aboriginal and Torres Strait Islander peoples to Country. The AEMC office is located on the land traditionally owned by the Gadigal people of the Eora nation.

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Summary

1 This issues paper has been prepared for the Reliability Panel's (Panel) 2026 Reliability standard and settings review (RSS review or RSSR). The purpose of this paper is to set out the Panel's approach and issues where we are seeking stakeholder feedback. It is the first step in the extensive consultation we will conduct out throughout this review.

2 Under the National Electricity Rules (NER), the Panel is required to review the reliability standard (standard) and reliability settings (settings) every four years. The Panel's 2026 RSS review will consider whether the level of the standard and settings remain appropriate for expected market conditions from 1 July 2028 to 30 June 2032. We are required to complete the review by 30 April 2026 at the latest.

3 The Panel notes that there is work underway by the National Electricity Market (NEM) NEM Wholesale Market Settings Review Expert Panel (the Expert Panel) to make recommendations on the appropriateness of the market settings after 2030. We are collaborating with the Expert Panel so that both processes align, where necessary.

The Panel aims to balance the incremental cost of new capacity with the value customers place on reliability

4 A reliable power system has adequate capacity (generation, demand response, interconnection, and energy storage capacity) to meet consumer needs. As our system transitions, this requires adequate investment to replace retiring thermal generators and meet increasing demand, as well as effective operational signals so that supply and demand can be maintained in balance in real-time.

5 The core objective of the existing reliability framework in the NEM is to deliver efficient reliability outcomes through market mechanisms to the greatest extent possible. These mechanisms provide strong financial incentives for participants (generators, retailers, aggregators and customers) to make investment, retirement and operational decisions that support reliability in the long-term interests of consumers. AEMO provides information to participants on projections and forecasts relevant to reliability outcomes. AEMO also has a range of tools that it can use to intervene, when needed, to maintain reliability.

6 The standard and settings are key components of the NEM's reliability framework. These elements aim to encourage sufficient investment in generation, storage or demand response capacity to meet consumer demand for energy, while protecting market participants from financial risks that would threaten the overall stability and integrity of the market.

- The **reliability standard** defines an efficient level of reliability, expressed as the level of unserved energy (USE) that represents an efficient economic trade-off between reliability and affordability based on what consumers value.
- The **reliability settings** are set to achieve market outcomes consistent with the standard, by defining a price envelope that provides sufficient revenue to support investment, while also limiting the potential for extreme high, low, and cumulative price impacts. The price settings are the:
  - market price cap (MPC)
  - market floor price (MFP)
  - cumulative price threshold (CPT)
  - administered price cap (APC).

The NEM is rapidly replacing ageing thermal generation with variable renewable energy

7 The physical power system is undergoing a period of significant change. There is a continuing and rapid transformation of the large-scale generation mix through the exit of ageing thermal generators, and the entry of renewable generators, peaking plants and storage. On the consumer side, there is ongoing uptake of distributed energy resources and increasing levels of responsive demand. These changes are, in turn, altering market dynamics and price distributions, with increasing intra-day price variability and more frequent periods of high and low wholesale prices.

8 There have been concerns that the changing generation pattern in a system with high levels of variable renewable energy may lead to extreme reliability risks, and the current reliability standard may not adequately address such risk.

9 The Panel's recent *Review of the form of the reliability standard and APC* [1] did not find evidence of any significant risk of such extreme events. While there is a small risk of infrequent but large USE events well into the future, these remain a small part of the overall reliability risk in the NEM and are not expected to exceed the current level of the reliability standard. Seeking to avoid these risks entirely would likely result in an excessive cost burden and would be inconsistent with the value customers place on reliability.

10 While the NEM continues to provide high levels of reliability, there is some evidence to suggest that reliability pressures are increasing and operational reliability is becoming more challenging for AEMO to manage, even in the absence of extreme events. Historically, reliability issues have almost entirely arisen only on very hot days, as hot weather can affect both consumer usage patterns and the power system's ability to provide supply. More recently, however, reliability issues have also begun to emerge during seasonal 'shoulder' and 'winter' periods. The Panel will consider the level of the standard and settings in light of a transitioning NEM and these emerging reliability pressures.

The Panel's assessment approach is guided by the NER, the NEO and the RSS guidelines

11 In reviewing the standard and settings, the Panel applies the framework outlined in the NER and 2021 guidelines. The 2021 guidelines require the Panel to determine the standard and settings that:

- allow efficient price signals while managing price risk
- deliver a level of reliability consistent with the value placed on that reliability by customers
- provide a predictable and flexible regulatory framework.

12 To recommend changes to the reliability standard and settings, the Panel needs to be satisfied that such changes will, or are likely to, contribute to the achievement of the National Electricity Objective (NEO) and meet the requirements in the 2021 guidelines and the NER. If the Panel recommends a change, this would be progressed through an AEMC rule change.

13 The Panel will consider the appropriateness of the settings in promoting the achievement of jurisdictional emissions reduction targets, in line with the revised NEO, along with the effect on price, security and reliability.

14 Consistent with the 2021 guidelines and recognising that revising market settings can increase

1 See: https://www.aemc.gov.au/market-reviews-advice/review-form-reliability-standard-and-apc

uncertainty, the Panel will only consider a change to the reliability standard or settings where there is a material benefit in doing so. The Panel will only recommend a change if there is a reasonable likelihood that the changes would better contribute to the achievement of the NEO than the existing standard or settings.

The Panel will consider whether the current level of the reliability standard remains fit for purpose for FY2028-2032

15 The Panel will consider the optimal level of the reliability standard.

16 In assessing an efficient level for the standard, the Panel is required to consider the value of customer reliability (VCR) determined by the Australian Energy Regulator (AER) to ensure that the standard strikes a balance between having enough generation and demand response to meet consumer demand in most circumstances while keeping overall costs for consumers as low as possible.[2]

17 The current reliability standard is expressed as the maximum expected amount of energy demand that can be unmet in each NEM region in a year. It is expressed as a proportion of the total energy demanded in a region in a financial year, and is currently set at 0.002% USE.[3] In 2024, the Panel made a recommendation, following extensive modelling and consultation to retain the current form of the standard as it remains fit-for-purpose for the NEM as it transitions to net-zero. Therefore, we will not be considering the form as part of this review.[4]

18 The Panel also notes that there is an interim reliability measure in operation until 30 June 2028. The interim reliability measure specifies a maximum expected unserved energy of 0.0006% of the total energy demanded in a region in a financial year. The interim reliability measure does not bind the Panel in deciding the reliability standard and settings and is not within the scope of this review.

The market price settings define the price envelope that promotes efficient investment

19 The 2026 RSS review will consider if the level of the market prices settings (MPC, MFP, CPT, APC) required to achieve a level of reliability consistent with the standard. In determining the settings, the Panel is required to consider the trade-off between promoting efficient market prices, allowing the market to clear, and not creating risks that threaten the overall integrity of the market.

20 The role and key objectives of each of the price settings are:

- The **market price cap** sets the maximum price that can be reached in the wholesale market for energy and FCAS. The MPC is set, together with the CPT, at a level to provide financial incentives for investment and operational decision-making that are sufficient to achieve the reliability standard.
- The **market floor price** sets a lower limit on wholesale market prices that can be reached in any trading interval. The NER states that the Panel may only recommend an MFP it considers will allow the market to clear in most circumstances. The MFP should be set to reflect the amount that inflexible generators are willing to pay to remain dispatched.
- The **cumulative price threshold** is the maximum cumulative energy and FCAS price that can be reached over a period of seven days, before an administered price period (APP)

2 Clause 3.9.3A(e) of the NER.

3 Clause 3.9.3C(a) of the NER.

4 See: https://www.aemc.gov.au/market-reviews-advice/review-form-reliability-standard-and-apc.

commences and the APC is applied to market prices. The CPT acts to cap risk to market participants while maintaining the effectiveness of the MPC.

- The **administered price cap** is the maximum market price paid to participants that can be reached in any dispatch interval and any trading interval, during an APP. The APC, combined with the CPT, is a mechanism to minimise financial stability risks to the market arising from an extended period of supply scarcity and corresponding high prices. It is set at a level sufficiently high to incentivise generation to make itself available during an APP.

21 The Panel will consider a range of issues to determine efficient levels for each of the market price settings in this RSS review, and we will present our analysis for stakeholder feedback.

Modelling will inform our decision on the reliability standard and settings

22 Modelling of the electricity market informs each RSS review. Modelling provides a quantitative basis for the Panel to identify the efficient levels of the standard and market price settings. This paper introduces the modelling that will inform the Panel's determination on the standard and settings. It proposes a set of principles, describes the Panel's approach to modelling, and identifies a set of specific issues in relation to modelling reliability in a changing NEM. We seek stakeholder feedback on this proposed work.

23 Modelling informing the 2026 RSS review is proposed to include:

- detailed time sequential modelling of price and dispatch outcomes in the markets for energy and FCAS
- assessing the standard and settings on the basis of the cheapest available, marginal new entrant technology options, including storage
- consideration of the value of emissions reduction in line with the revised NEO
- consideration of the development time required to investment and deliver new capacity
- scenarios that will be developed to address the range of possible reliability outcomes and risks to reliability
- sensitivity analysis applied to key assumptions and variables .

24 This paper identifies and discusses issues at a high level to inform stakeholder engagement with the review. In addition, the Panel will publish the details that underpin the modelling throughout the course of the review and will seek independent expert review on our approach.

The Panel is seeking stakeholder feedback by 17 July 2025

25 Given the significance of this review, as well as the interest to date from stakeholders, the Panel will provide several opportunities to engage and participate in the process through different channels. This will include bilateral meetings, public forums and formal submissions. Chapter 1 sets out the relevant milestones for this review.

26 The Panel invites comments in response to this Issues Paper by COB Thursday 17 July 2025.

Full list of consultation questions

Question 1: Large-scale VRE, CER and storage is replacing thermal generation

- What are the implications of this changing generation mix for the reliability outlook for 2028-2032?

Question 2: CER and demand implications

- How is the uptake of distributed resources and the growth of electrification going to impact reliability risk?
- How should the reliability framework manage the uncertainty that these changes create?

Question 3: Impact of government policies on reliability settings

- What implications do emission reduction policies have for the Panel's assessment of the reliability standard and settings?
- What are your views on the impact of State and Commonwealth government energy policies on the reliability settings?

Question 4: NEM Review

- What impact do you consider the NEM review will have on the reliability standard and settings?
- How should this process interact with the ongoing review?

Question 5: The level of the Reliability Standard and consideration on VCR

- Do you consider that there is evidence that a different level of the reliability standard would deliver better overall outcomes for the NEM?
- During the period 2028 - 2032, the level of CER in the NEM is expected to continue increasing. How would that affect the value consumers place on a reliable electricity supply?
- How should the Panel account for the 2024 VCR values as part of this RSS review?

Question 6: Other issues the Panel will consider when recommending the appropriate reliability standard?

- Are there any other issues the Panel should consider for its review of the reliability standard?

Question 7: Consultation questions on the MPC

- How effective is the MPC in allowing for the investment of the least-cost mix of generation and storage to meet the reliability standard as the NEM transitions? And what types of generation is it critical to incentivise?
- What factors or issues regarding spot prices, investment, market participants and/or the predictability and flexibility of the regulatory framework should the Panel pay particular attention to?
- Do you consider that the introduction and continuation of government investment schemes means that changes to the MPC should be considered?
- Do you consider that the emergence of new technologies warrants a change in the MPC in order to enable investment to meet the reliability standard in the most cost-effective way?
- How would you suggest the Panel include the value of emissions reduction as part of this economic assessment?
- Do you consider that the introduction of new markets or system security enablement approaches would mean a change to the MPC is required?

Question 8: Consultation questions on the MFP

- What role, if any, does the MFP have to play in mitigating the risk of MSL events? Does this role include investment as well as operational considerations? Is the MFP set at the right level, and is it in the right form to drive efficient operational dispatch?
- In your view, should the Panel consider a negative cumulative price threshold? If so, what factors should be considered when determining the level of a negative CPT?
- Has the growth of VRE led to 'race-to-the-floor' bidding? If so, how should this inform the level of the MFP?

Question 9: Consultation questions on the CPT

- Should the CPT continue to function as a technology-neutral mechanism in a changing reliability landscape?
- Should the formulation of the calculation of the CPT be considered to better reflect its purpose? Including the separate APP triggers for energy and market ancillary services.
- How is the interaction between the CPT in the Energy and FCAS markets changing and what does this mean for this review?

Question 10: Consultation questions on the APC

- How should the Panel consider setting the APC for technologies such as hydro and utility batteries?

- Has the typical generator SRMC increased significantly since the previous review period? Or are they expected to do so over the period 2028-2032?
- Do you consider that the APC remains at an appropriate level to encourage continued participation during times of extended high input costs and market stress? If not, what would be an appropriate level of the administered price cap, why and what is the evidence supporting your view?
- Is there evidence that the APC is affecting the contract prices and so affecting incentives for new investment?
- Do you consider that the current APC provides sufficient investment signal for new technologies?

Question 11: Consultation questions on the indexation of the market settings

- Are there any specific considerations the Panel should take into account for this review, relating to the indexation of the MPC and CPT?

Question 12: Proposed modelling approach for the 2026 RSSR

- Do stakeholders support the high-level modelling approach outlined above? If not, what changes do you consider the Panel should make to its approach?

Question 13: Proposed method of including emissions implications in the modelling

- Do stakeholders agree with the high-level approach to including emissions in the modelling?
- Are there any further ways we should be considering emissions?

Question 14: Modelling principles, inputs, assumptions and limitations

- Do stakeholders agree with the principles, inputs, assumptions and limitations listed in this section? If not, why?
- Are there any additional principles, inputs, assumptions or limitations that the Panel should consider in this review?

Question 15: Feedback on sensitivities

- Do stakeholders agree with the sensitivities listed above?
- Are there other sensitivities the Panel should consider for this review?

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1 Introduction

Box 1: KEY POINTS IN THIS SECTION

- The Reliability Panel is undertaking a review of the reliability standard and settings in accordance with the 2021 RSS guidelines and the NER.
- For the first time, the RSSR will consider emissions reduction as part of the National Energy Objectives (NEO).
- This review will determine the level of the reliability standard and the corresponding market settings (MPC, CPT, MFP, and APC) that will apply from 1 July 2028 to 30 June 2032.
- The purpose of this paper is to set out the Panel's approach and issues where we are seeking stakeholder feedback.

This issues paper has been prepared for the Reliability Panel's (the Panel) 2026 Reliability standard and settings review. The publication of this paper, along with the accompanying terms of reference issued to the Panel by the Australian Energy Market Commission (AEMC or Commission), formally commences the Panel's review of the reliability standard and settings (RSSR or RSS review).[5] In accordance with the National Electricity Rules (NER), this RSSR, must be completed by 30 April 2026 at the latest.[6]

This chapter outlines the:

- Section 1.1 — Panel's requirements under the NER for the RSSR
- Section 1.2 — purpose and scope of the 2026 RSSR
- Section 1.4 — opportunities for stakeholder comment and input
- Section 1.5 — structure of this issues paper.

1.1 The NER and the RSSR guidelines and outline the requirements for this review

Under the NER, the Panel is required to conduct a review of the reliability standard (standard) and reliability settings (settings) every four years. This four yearly review allows the Panel to assess and consider whether:

- the current form and level of the reliability standard and settings remain suitable for expected and evolving market conditions, or
- changes should be made to ensure these mechanisms continue to meet their intended purpose as well as the requirements of the market, market participants and consumers.

There are a number of factors that the Panel will apply or take into account, these include:

- the requirements in the NER[7]
- the Reliability Standard and Settings Guidelines (2021 guidelines)[8]
- the terms of reference provided by the AEMC.

5 The terms of reference are available on the review's project page.

6 Clause 3.9.3A(d) of the NER.

7 Clause 3.9.3A of the NER.

8 Reliability Panel, *Review of the reliability standard and settings guidelines,* final guidelines,1 July 2021, Sydney.

The RSSR guidelines set out the principles, assessment approach and assumptions that the Panel must apply for its RSS reviews. More detail on the requirements embedded in the guidelines is provided in chapter 5 of this paper which sets out the Panel's assessment approach for this review.

Any recommended changes that the Panel may make in this review must contribute, or be likely to contribute, to the achievement of the NEO, and meet the requirements in the NER and the 2021 guidelines. This is also the first time that an RSS Review will explicitly consider emissions reductions as part of the NEO. The Panel has examined how it will consider the emissions reduction component in its work and has published guidance on our website.[9]

The Panel must also have regard to any terms of reference provided by the AEMC, stakeholder consultation and responses, modelling outcomes and any other factors the Panel considers relevant.

When the Panel undertakes an assessment of the standard and settings in a review, the Panel must set out its conclusions and recommendations as part of its final report, which is subsequently provided to the AEMC.[10] In accordance with the 2021 RSS guidelines, the Panel will only consider a change to the reliability standard or settings where there is a material benefit to doing so. If the review process finds a change in standard and settings that would result in only a minor benefit, the Panel may retain the current settings.[11]

The Panel must submit to the AEMC any rule change proposal that results from a review as soon as practicable after the review itself is completed.[12] Any change to the standard or settings would then be made through an AEMC rule change process.

1.2 Purpose and scope of the 2026 review

1.2.1 This review will consider the reliability standard and settings to apply from 2028 to 2032

The standard and settings are key components of the NEM's reliability framework. These elements aim to encourage sufficient investment in generation, storage and demand response capacity to meet customer demand for energy, while protecting market participants from potential substantial risks that threaten the stability and integrity of the market.

The reliability standard determines the optimal amount of capacity for the NEM balancing economic efficiency and the value customers place on reliability

The reliability standard is an ex-ante standard used to indicate to the market the required level of supply to meet demand on a regional basis. The standard is operationalised by AEMO, including through informing the market if the standard is not being met.

The form and level of the standard is specified in the NER.[13] The reliability standard for the NEM is expressed in terms of the expected unserved energy (USE) in a region and is currently set at a maximum of 0.002% of the total energy demanded in that region for a given financial year. The Panel reviewed this form of the standard in 2024. It found that, based on the extensive modelling and stakeholder consultation, the existing form of the standard continues to be fit for purpose and can adequately capture the changing risk profile as the NEM transitions. In the future, while the nature of reliability risk may change in a number of ways including the small risk of infrequent but

9 AEMC, Reliability Panel Guide to applying emissions reduction component of the National Electricity Objective, Final guidelines, 4 April 2024.
10 Clause 3.9.3B of the NER.
11 Reliability Panel, Review of the reliability standard and settings guidelines, 1 July 2021.
12 Clause 3.9.3A(i) of the NER.
13 Clause 3.9.3C(a) of the NER.

large USE events, the expected value of USE remains an effective way to measure that risk and weigh it against the costs of increased reliability.[14]

The reliability standard in the NEM only applies to USE caused by insufficient generation and inter-regional transmission capacity. Customer interruptions due to outages in the distribution network, e.g. when a tree falls across a distribution network element, are not included as USE for the purpose of assessing the reliability standard. Further detail on the purpose and function of the reliability standard is provided in chapter 3 of this paper.

In 2020, federal and state ministers, on the advice of the Energy Security Board (ESB), endorsed an Interim Reliability Measure (IRM). This was set at 0.006% USE, compared to the reliability standard of 0.002% USE. This measure currently only applies for triggering the Retailer Reliability Obligation (RRO). The IRM trigger for the RRO will come to an end on 1 July 2028, the commencement of the period for which this RSS review applies.

The reliability standard is operationalised through the market settings

The settings are price mechanisms designed to incentivise investment in sufficient generation capacity and demand-side response to deliver the standard, while providing limits that protect market participants from periods of very high or very low prices, both temporary and on a sustained basis. The settings consist of the:

- Market Price Cap (MPC), which places an upper limit on dispatch prices in the wholesale market
- Market Floor Price (MFP), which places a lower limit on dispatch prices in the wholesale market
- Cumulative Price Threshold (CPT), which represents a threshold of cumulative dispatch prices over a period of seven days (2,016 trading intervals) that, when surpassed, triggers an Administered Price Period (APP)
- Administered Price Cap (APC), which is the upper limit on dispatch prices that applies during an APP after a period of sustained high prices caused the CPT to be breached.

Further details on the purpose and functions of the market settings are provided in chapter 4.

Table 1.1: The current reliability standard and settings 1 July 2024 to 30 June 2025

Reliability Standard	0.002% USE
Market Price Cap	$17,500/MWh
Cumulative Price Threshold	$1,573,700/MWh
Administered Price Cao	$600/MWh
Market Floor Price	-$1,000/MWh

Source: AEMC, Schedule of Reliability Settings 2024-25, found here

1.2.2 The reliability standard and settings have a crucial, but specific role

The reliability of the power system is complex. Many factors affect the system's overall reliability and the level of reliability individual customers experience. Reliability is becoming more complex due to the level of uncertainty inherent in the market's transition and the number of concurrent

14 Reliability Panel, Review of the form of the reliability standard and administered price cap, Final report, 27 June 2024.

reviews underway. While, this is important context for the Panel's review, it will make its decision based on the information currently at its disposal.

This review focuses on the reliability of the large-scale generation and transmission system, specifically the reliability provided by power generation, storage, demand response, and interconnectors to meet customer demand. It is limited in that it focuses on the key parameters that affect reliability in the wholesale market—the reliability standard and the four reliability settings. Beyond that, the Panel can choose to make further recommendations on any changes that could improve the efficiency of the NEM's reliability frameworks.

Power outages that customers experience can be planned or unplanned. Planned outages generally occur so that maintenance or construction can be undertaken on generators or network assets in the transmission or distribution networks. An unplanned interruption to the electricity supply to customers can be caused by a number of factors including:

- an incident such as a storm that brings down a major transmission line, making it difficult for the power system to operate within its defined technical limits
- disruptions to, or outages in, the transmission and distribution "poles and wires" within a region, causing difficulties in supplying electricity to homes and/or businesses
- insufficient generation capacity and/or transmission capability between regions to supply and meet demand for electricity at a particular point in time.

The first of these factors concerns system security, while the second and third relate to the reliability of the power system.

"Security" relates to operating the power system within defined technical limits, even if there is an incident, such as the loss of a major transmission line or large generator. This RSS review does not consider security-related incidents nor evaluate other factors and processes that impact system reliability, such as the powers of the Australian Energy Market Operator (AEMO) to intervene in the operation of the market.

The Panel has other functions in relation to system reliability (and also system security). For instance, the Panel publishes an annual review of the reliability, security and safety of the NEM, the Annual Market Performance Review (AMPR). The AMPR includes, among other things, data projections from AEMO of forecast USE and whether the reliability standard will be breached, as well as outcomes for the reliability settings for the year reported on. The most recent AMPR final report was published in June 2024.

It is important to recognise that many factors affect the investment environment in the energy sector and investment decisions in the NEM, and thereby reliability in the market. Some of these are internal to the market while others are external. While the standard and the settings are intended to influence investment in the market, they are not the only factors that affect the investment in power system resources needed to achieve the desired level of reliability. Intervention in the market — such as by jurisdictional governments — has been common in the NEM since its inception and will likely continue. The Panel will consider the impacts of these interventions to the extent they impact on the appropriateness of the level of the standards and settings.

1.3 The 2022 RSSR increased the MPC and CPT for the first time since 2010

Since the inception of the NEM the market price settings have mostly remained stable. Other than:

- An increase in the MPC from $10,000/MWh to $12,500/MWh on 1 July 2010.[15] This was to reflect increasing construction costs at the time and was based on modelling of USE outcomes at different price caps.
- Increases in the MPC and CPT based on CPI from 1 July 2012 to maintain the real value of the MPC and CPT, thus maintaining the balance of financial exposure with efficient investment signals.[16]
- An increase in the MPC to $20,300/MWh from 1 July 2025.[17] This was one of a series of recommendations the Panel made in the 2022 RSS review, informed by extensive modelling conducted by IES of the settings required to incentivise investment to meet the reliability standard.

In the 2022 final report, the Panel also recommended:

- Retaining the existing form of the reliability standard. However, the review identified a case for changing the form of the reliability standard to include a 'tail-risk' metric and recommended a subsequent review. The Panel completed this review of the form of the reliability standard in 2024, and recommended retaining the current form.[18]
- Retaining the existing level of the reliability standard. The modelling process for the review identified an efficient reliability standard of 0.0015% expected USE. However, the modelling also provided that the benefit of changing the level of the standard would not be material, so the Panel recommended retaining the existing level of the reliability standard.
- A progressive adjustment in the level of the MPC and CPT to achieve an MPC of $21,500/MWh and a CPT of $2,193,000 ($2021) by the end of the review period. This recommendation was based on the modelling exercise conducted, which determined the market settings required to achieve market entry to meet the reliability standard.
- Increasing the level of the APC from $300/MWh to $500/MWh as it would provide for robust outcomes in future high fuel price periods, prevent undue reliance on compensation processes, improve incentives on storage to participate during an APP, and ensure better management of APP-related customer costs.[19] In December 2023, following the completion of the 2022 RSSR project, the AEMC made a more preferable rule to amend the level of the APC to $600/MWh.[20] The AEMC argued that the $600/MWh level would maintain the intended price signal while accounting for the expected effects of inflation over the rule change period. It would also encourage continued participation by thermal generation and storage during periods of extended high prices, reducing the need for AEMO intervention and the risk of outages for customers over the period to 2028.
- Retaining the existing level of the MFP, -$1,000/MWh. The Panel considered that adjusting the level of the MPC was not warranted, but that future reviews may consider the level of the MFP could be an investment signal for demand response and storage.

Given this increase will not begin to take effect until 1 July 2025, it remains to be seen what impact this has on market entry, particularly the entry of open cycle gas turbine (OCGT) generation.

15 AEMC Reliability Panel, NEM Reliability Settings: VoLL, CPT and Future Reliability Review Rule Change Proposal, December 2008, Sydney.

16 AEMC, Reliability Settings from 1 July 2012, Rule Determination, 16 June 2011.

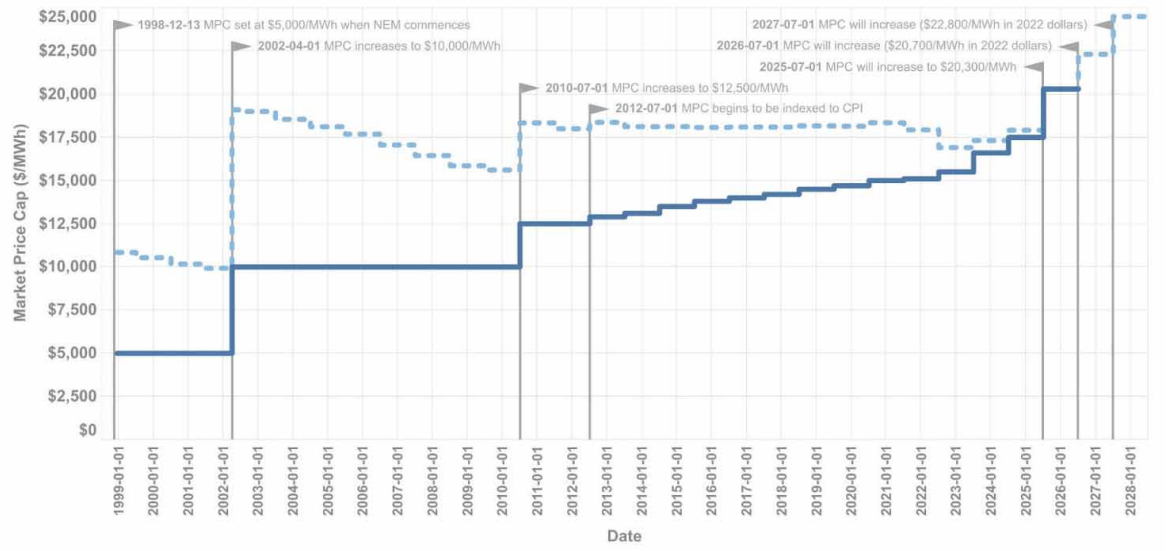
17 AEMC, Amendment of the Market Price Cap, Cumulative Price Threshold and Administered Price Cap, 7 December 2023.

18 Reliability Panel, Review of the form of the reliability standard and administered price cap, Final report, 27 June 2024.

19 In November 2022, following the events of June 2022, the AEMC made a final rule to implement a transitional APC of $600/MWh to be in place until 30 June 2025, at which point the Reliability Panel would make final recommendations in the 2022 RSS review.

20 AEMC, Amendment of the Market Price Cap, Cumulative Price Threshold and Administered Price Cap, Rule determination, 7 December 2023.

Figure 1.1: History of the market price cap in the NEM



Source: WattClarity, Is the price right? A historical exploration into the NEM's price cap, 7 May 2025.

1.4 The Panel is undertaking a thorough consultation process

The Panel will consult with stakeholders by seeking feedback on this issues paper and the subsequent draft report. The Panel will also hold a number of stakeholder meetings, as required. The key dates are shown in Table 1.2.

Table 1.2: Indicative review timetable

Issues Paper published	19 June 2025
Stakeholder submissions on Issues Paper due	17 July 2025
Stakeholder meetings and engagement on the Issues Paper	July-November 2025
Public forum on the Issues Paper	*TBC if required*
Draft report published	27 November 2025
Stakeholder submissions on Draft Report due and engagement	8 January 2026
Final Report published	By 30 March 2026

1.4.1 Making a submission

Stakeholders can help shape the recommendations by participating in this review process. Engaging with stakeholders helps us understand the potential impacts of our recommendations and, in so doing, contributes to well-informed, high quality review recommendations.

1.4.2 How to make a written submission

Due date: Written submissions responding to this consultation paper must be lodged with AEMC by COB, Thursday 17 July 2025.

How to make a submission: From the AEMC's website, www.aemc.gov.au, find the "lodge a submission" function under the "Contact Us" tab, and select the project reference code EPR0094.

Tips for making submissions are available on the AEMC website.[21]

Publication: The AEMC publishes submissions on its website. However, we will not publish parts of a submission that we agree are confidential, or that we consider inappropriate (for example, offensive or defamatory content, or content that is likely to infringe intellectual property rights).

1.4.3 Contact us

To contact us please use the form available on the project page.

1.5 Structure of this issues paper

- Chapter 2 provides context for this review in terms of the capacity mix we expect for the review period, demand conditions, and recent trends in the wholesale spot market.
- Chapter 3 discusses the issues relating to the reliability standard.
- Chapter 4 discusses the issues relating to the market settings.
- Chapter 5 provides our assessment framework for this review.
- Chapter 6 covers the proposed methodology for setting the reliability standard and market settings.

21 See: https://www.aemc.gov.au/our-work/changing-energy-rules-unique-process/making-rule-change-request/submission-tips

2 The NEM is transitioning to a system dominated by variable renewable energy

Box 2: KEY POINTS IN THIS SECTION

- The physical power system is undergoing a period of significant change as the NEM continues to replace ageing thermal generation with variable renewable energy. These changes are altering market dynamics and price distributions, with increasing intra-day price variability and more frequent periods of high and low wholesale prices. In this new market paradigm reliability risks continue to evolve.
- This review is being conducted in a landscape of changing jurisdictional and Commonwealth policies. The policy landscape has significant implications for effectiveness of the reliability settings driving optimal outcomes.

This chapter introduces key changes in the NEM's physical and policy environment that have implications for the long-term reliable delivery of electricity to consumers. Including:

- Section 2.1 — the replacement of ageing coal-fired generation with variable renewable energy
- Section 2.2 — increased demand-side uncertainty driven by rooftop PV, electrification and changing customer behaviour
- Section 2.3 — increasing price volatility in the wholesale market as the generation mix changes, and
- Section 2.4 — continued policy changes and government intervention, which have implications on reliability outcomes.

2.1 Large-scale renewable energy is continuing to replace ageing thermal generation

The physical power system continues to undergo significant changes as the sector transitions to net-zero. There are continuing and rapid transformation of the large-scale generation mix with the ongoing exit of ageing thermal generators, and the entry of variable renewable generation and storage. On the consumer side, there is an ongoing uptake of distributed energy resources and increasing levels of responsive demand. These shifts are changing market dynamics, price outcomes, and more frequency periods of low wholesale prices.

Overall, in recent years there has been:

- steady maximum demand and moderate projected growth
- declining minimum demand driven by the uptake of CER, particularly rooftop PV
- changing consumption patterns
- increasingly ageing thermal generation with decreasing capacity factors
- proposals for increased interconnection between regions
- ongoing reviews of the future wholesale market design
- government policies to incentivise new capacity and increase certainty in the retirement of existing plant (it is noted that some of these schemes terminate in 2030)

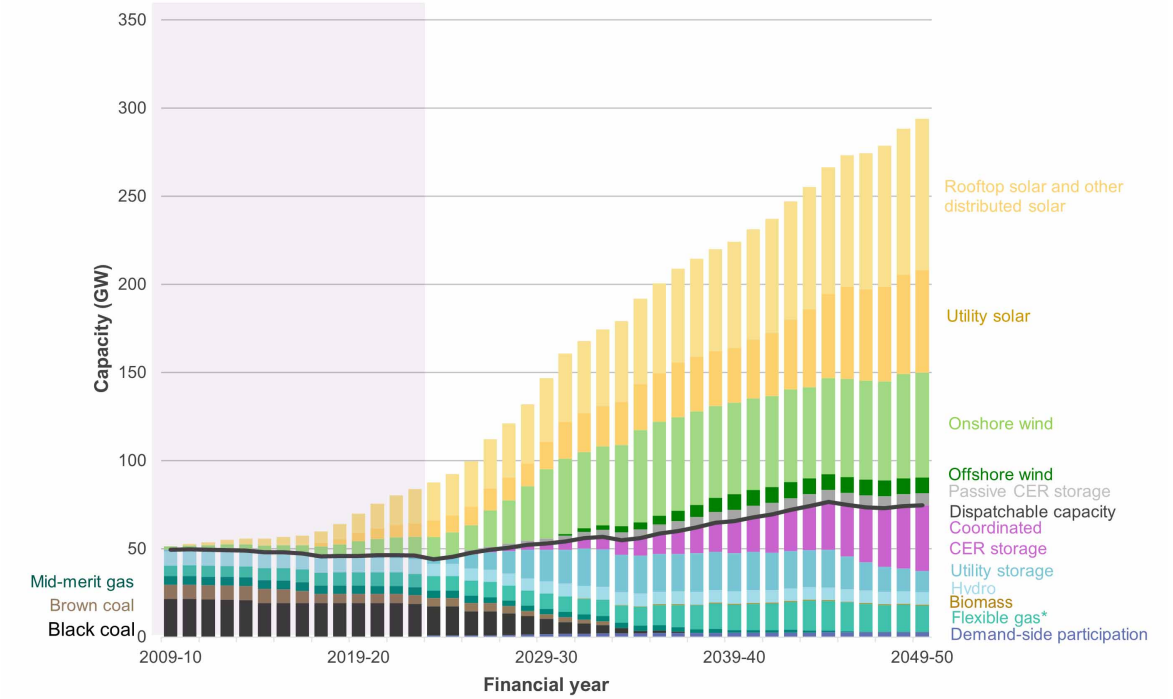
- increasing frequency and severity of extreme weather events, which can pose challenges for reliability, particularly given high penetrations of weather-dependent renewable generation, and
- an ongoing shift of reliability risk away from winter periods.

We have observed many of these changes for a number of years and will continue to see them in the coming decades as the NEM transitions to net-zero. These changes, which affect both the supply and demand side of the wholesale market, involve considerations relevant to the 2026 RSSR to varying degrees.

At the time of the 2022 RSSR, thermal energy represented nearly 37 GW of installed capacity. By the end of 2027/28, the start of the period that this RSSR applies, this capacity is forecast to decline to approximately 28 GW.[22] By the end of the modelling period (2032), the 2024 ISP's Step Change scenario forecasts this will be less than 20 GW, less than 8 GW of which will be coal-fired generation.[23] In the short-term, this decline in coal-fired generation capacity is being driven by the retirement of four units at Eraring, representing 2.88 GW, scheduled for August 2027. Four units at Yallourn, representing 1.45 GW, are scheduled to retire on 1 July 2028.[24]

The bulk energy historically provided by thermal generation is primarily being replaced by the growth of large-scale renewable energy, consumer energy resources and storage. 2.23 GW of solar generation capacity and 2.43 GW of wind are committed to enter over the next three financial years. The ISP's Step Change scenario forecasts more than 24 GW of wind capacity and 13 GW of utility solar by the start of the RSSR period. By the end of the RSSR period in 2032, the ISP forecasts more than 45 GW of wind and 22GW of utility solar will be installed in the NEM. [25]

Figure 2.1: ISP Step Change historical and forecast capacity mix



Source: AEMO, 2024 Integrated System Plan

22 AEMO, Integrated System Plan, 2024.
23 AEMO, Integrated System Plan, 2024.
24 AEMO, Generation Information, April 2025.
25 AEMO, Integrated System Plan, 2024.

This transition from a grid supplied primarily by thermal generation to one dominated by variable renewable energy (VRE) capacity has a number of reliability implications, many of which we are already observing in the NEM. Historically, reliability outcomes were driven by the coincidence of high demand with forced outages of thermal generating units. To a significant degree today, but increasingly in the future, supply shortfalls will primarily arise as a result of low output from weather-dependent generation.

There is a still ongoing shift in the types of roles that generator play in the market that has implications for considering reliability. Generators, historically, either provided baseload, in the case of coal, or peaking energy in the case, primarily, of OCGT plant. Generators now, however, and increasingly as we transition, provide one of three energy services: bulk VRE energy, intraday shaping, and firming services. These services are typically provided by different technologies, and an efficient and reliable system requires a reliability framework that effectively facilitates the delivery of all three.

Question 1: Large-scale VRE, CER and storage is replacing thermal generation

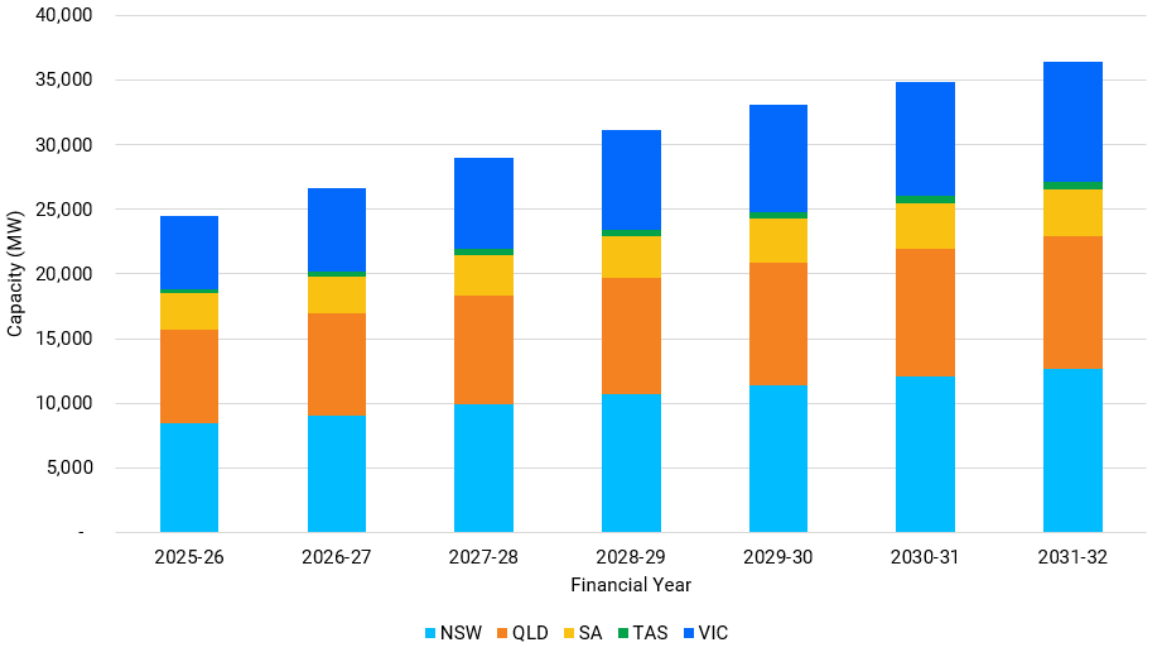
- What are the implications of this changing generation mix for the reliability outlook for 2028-2032?

2.2 Rooftop PV and changing consumer behaviour is increasing uncertainty in long-term demand forecasting

AEMO's draft 2025 Inputs, Assumptions and Scenarios Report (2025 draft IASR) forecasts that by the start of this RSSR period, rooftop PV capacity in the NEM under the Step Change scenario will be nearly 29 GW.[26] This is further forecast to grow to more than 36 GW by 2031/32.

26 AEMO, Draft 2025 Stage 2 Inputs and Assumptions Workbook.

Figure 2.2: Rooftop PV uptake is forecast to increase past 35GW

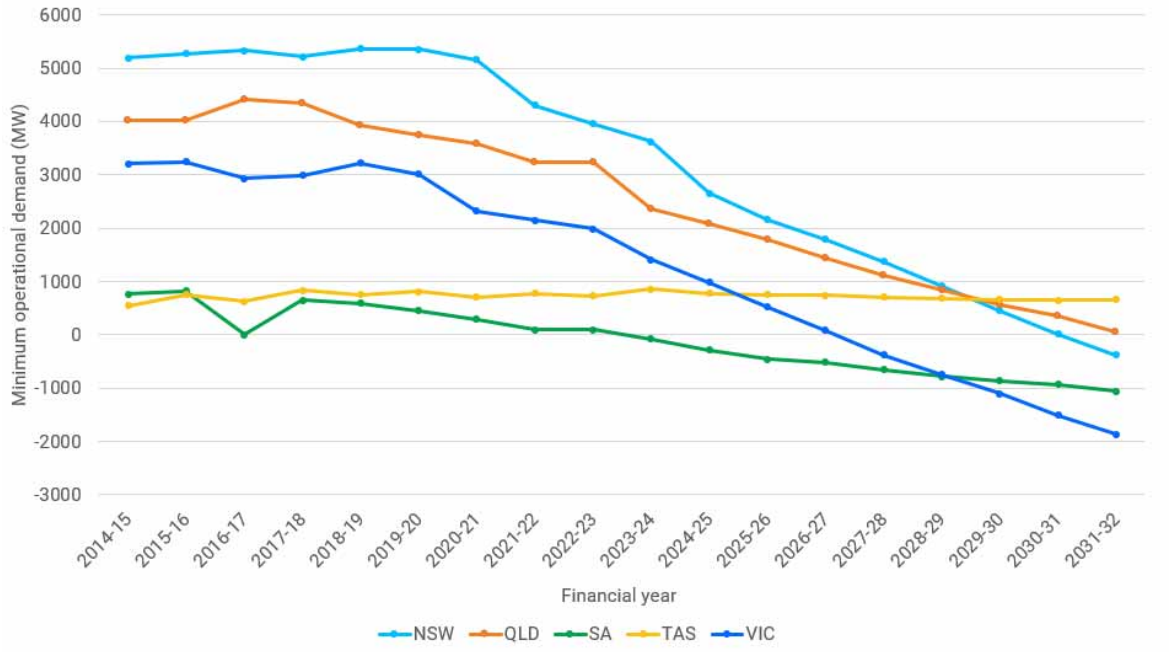


Source: AEMO, Draft 2025 Stage 2 Inputs and Assumptions Workbook

This has a significant impact on minimum operational demand. For example, the 2024 Electricity Statement of Opportunities (2024 ESOO) forecasts minimum operational demand in NSW will be 1.38 GW in 2027/28.[27] This is forecast to further decline, such that by the end of the RSSR period, minimum operational demand will be -376 MW.

27 AEMO, Electricity Statement of Opportunities, 2024.

Figure 2.3: Historical and forecast minimum operational demand



Source: AEMO, 2024 Electricity Statement of Opportunities
Note: Forecast minimum operational demand is for central scenario, PoE90 demand

This decline in minimum operational demand has a number of implications for the market settings. The primary impact of this phenomenon is to reduce prices during the day, and increase the incidence of very low or MFP events. This not only requires close examination of the function of the MFP, but also impacts the revenue outlook, and therefore investment case, for other technology classes that might contribute to reliability during scarcity periods.

However, electricity consumption overall is still expected to grow in the future.[28] There are two other key drivers of the demand outlook for the NEM, electrification and electric vehicle (EV) uptake. Annual consumption from electrification in 2025 is forecast in the 2024 ESOO to be 1.46 TWh.[29] This is forecast to grow by 2028 to 9.34 TWh. During the RSSR period, this will continue to grow further to 17.35 TWh.

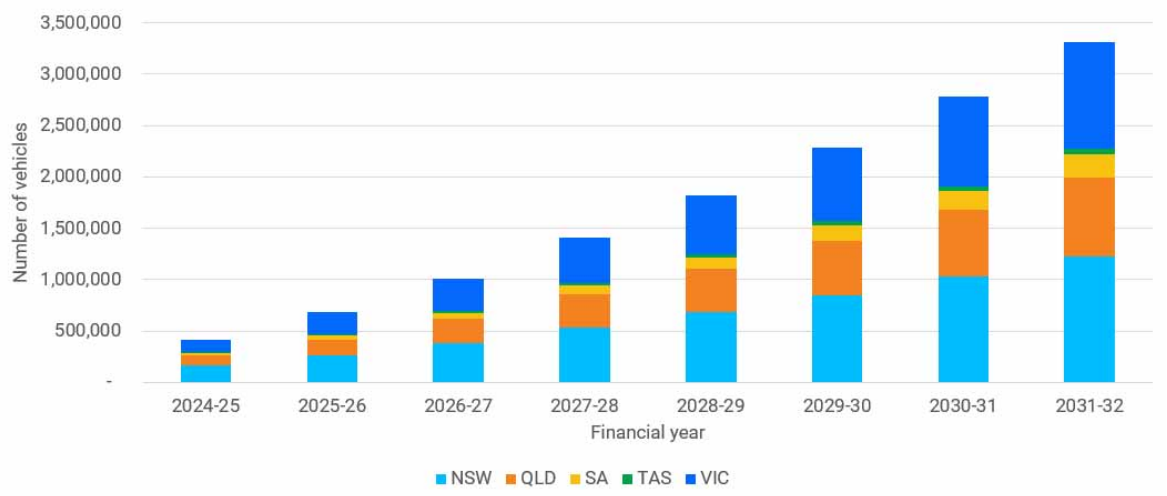
The 2024 ESOO forecasts that in 2024/25, there are 418,612 EVs on the road in the NEM, and that by 2027/28, there will be more than 1.4 million. This number is forecast to more than double by the end of the RSSR period to more than 3.3 million. These vehicles, representing 411 GWh of electricity consumption in 2025, will consume nearly 7,900 GWh by 2031/2032.[30]

28 AEMO, Electricity Statement of Opportunities, 2024.

29 AEMO, Electricity Statement of Opportunities, 2024.

30 Assumptions about the flexibility of charging behaviour and integration into the market represent a major contributing factor to overall demand forecasts, as well as minimum and maximum demand and, by extension, the reliability outlook.

Figure 2.4: EV uptake is forecast to accelerate



Source: AEMO, 2024 Forecasting Assumptions Update Workbook

In addition to increases in the uptake of rooftop solar and EVs, the amount of CER storage in the NEM, both aggregated and non-aggregated, is forecast to increase rapidly.[31] In 2027/28, AEMO's Step Change Scenario forecasts that the NEM will have 3.1 GW of CER storage capacity, of which roughly 700 MW will be aggregated. By 2032, this figure will be 5.8 GW, of which 1.9 GW will be aggregated. This uptake will be supported by subsidy schemes from both State and Commonwealth governments, such as the proposed *Cheaper Home Batteries Program* or the NSW's *Peak Demand Reduction Scheme*.[32] The timely delivery of each of the components of the National CER Roadmap would ensure these resources play an active role in the operation of the market.

These factors all contribute to uncertainty in long-term demand forecasting. This is due to the central role of assumptions as to consumer behaviour during periods with supply scarcity, both in the uptake and operation of these resources, creating a number of challenges for the reliability framework to manage.

Question 2: CER and demand implications

- How is the uptake of distributed resources and the growth of electrification going to impact reliability risk?
- How should the reliability framework manage the uncertainty that these changes create?

2.3 Continued wholesale market volatility could indicate changes in the reliability risk profile

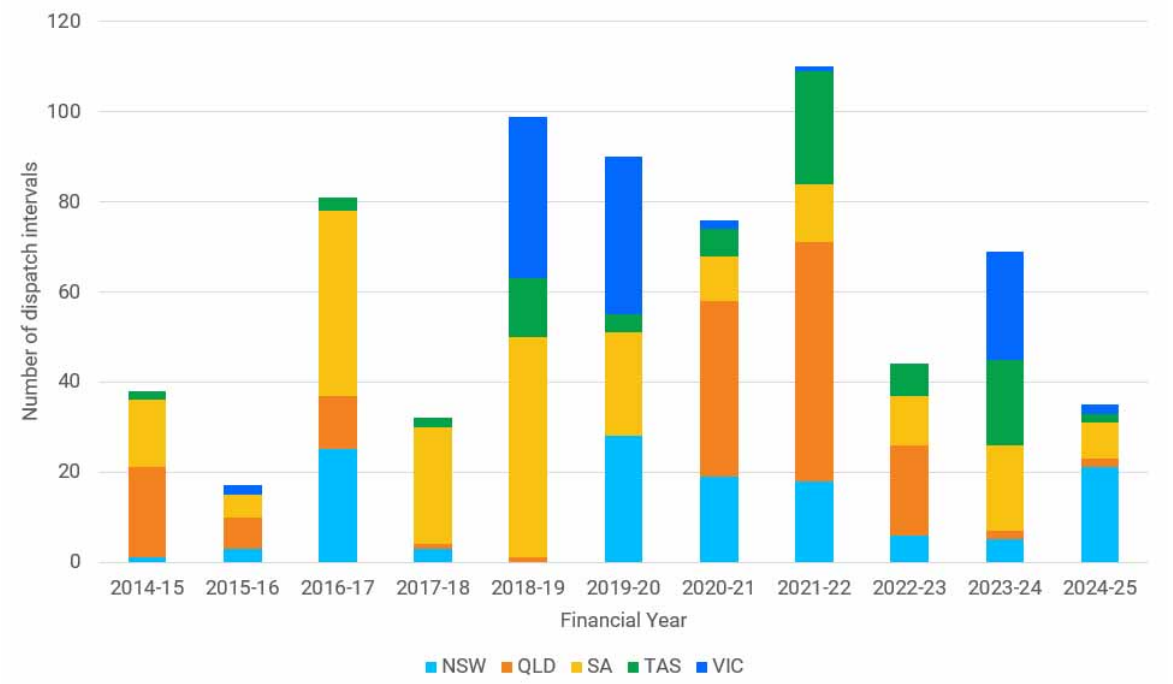
Since the end of 2021/22, the number of both MPC events and MFP events has declined. This has continued on the previous trend, where the number of MPC events declined from 2019 levels in both 2020 and 2021. This trend was disrupted by the June 2022 market suspension following

31 AEMO, Draft Inputs, Assumptions and Scenarios Report, 2025.

32 NSW Government, Peak Demand Reduction Scheme (Amendment No. 3) Rule 2024.

extremely volatile market conditions, it is not clear if, in the absence of this event, the declining incidence of price cap events observed over the previous two years might otherwise have continued. In the three years since 2022, the incidence of MPC events has been lower than any of the four previous years.

Figure 2.5: The number of MPC events has reduced in recent years



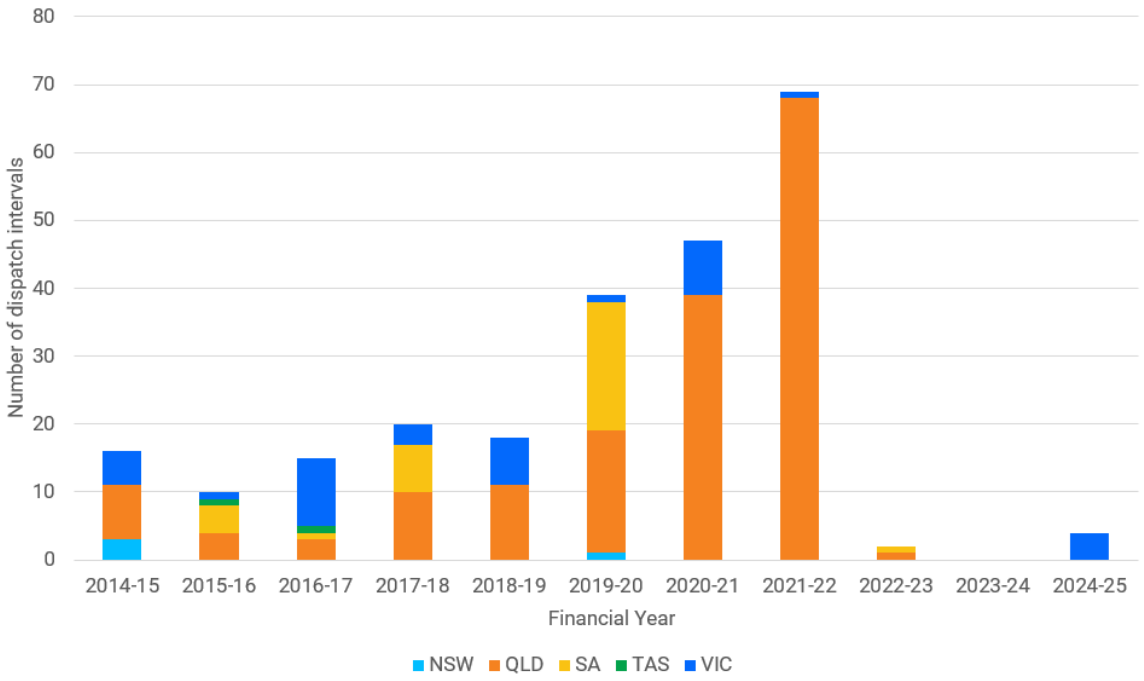
Source: Panel analysis of AEMO data

Since 2016, the number of floor price events has steadily increased, rising from 10 in 2015/16 to 69 in 2021/22. However, since 2022, there have only been six total floor price events in the NEM. The growth in the incidence of MFP events from 2015/16 to 2021/22 is primarily concentrated in Queensland. However, prices within $1/MWh of the MFP are much more common in South Australia. In 2022, there were more than 400 intervals within $1/MWh of the MFP in South Australia. However, since this peak in 2020, the number of very low price intervals has steadily declined, such that in 2023/24, there were only nine dispatch intervals NEM-wide at prices less than -$999/MWh.[33] As of 30 April 2025, there have been just 15.[34]

33 Price intervals less than -$999/MWh have been used as there are a relatively small number of price intervals that reach the floor of -$1,000/MWh.

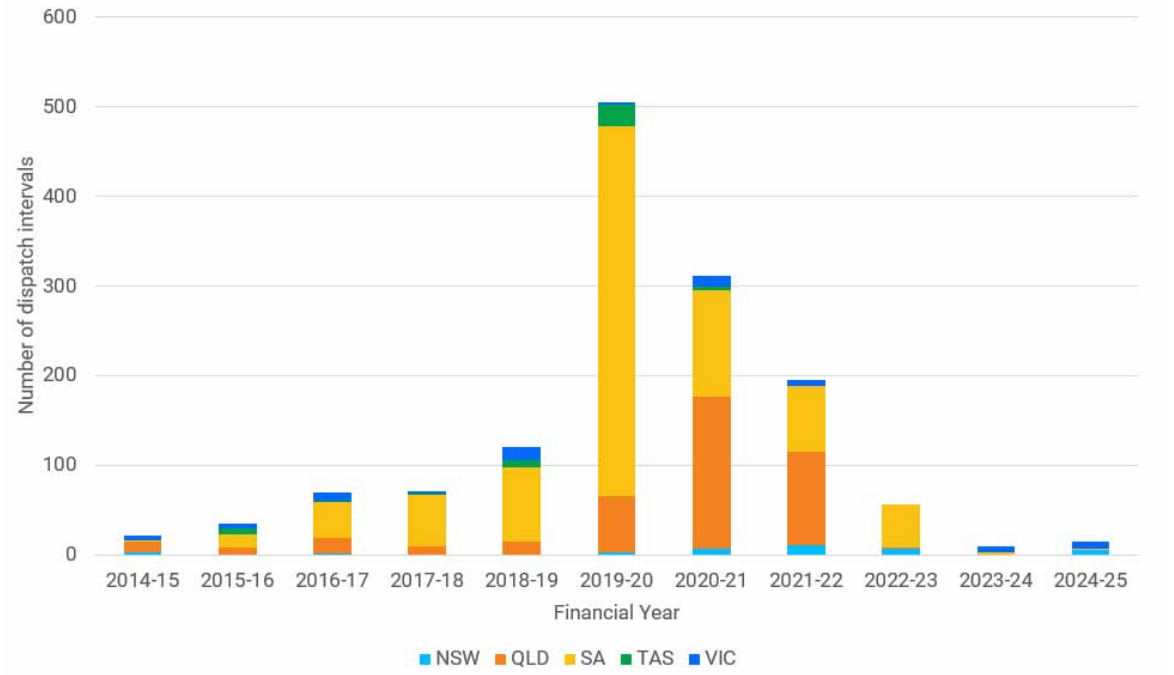
34 This number is not likely to increase significantly in the final two months of FY 2024/25.

Figure 2.6: The number of MFP events has fallen sharply since 2021/22



Source: Panel analysis of AEMO data

Figure 2.7: This decline is less pronounced for prices <-$999/MWh



Source: Panel analysis of AEMO data

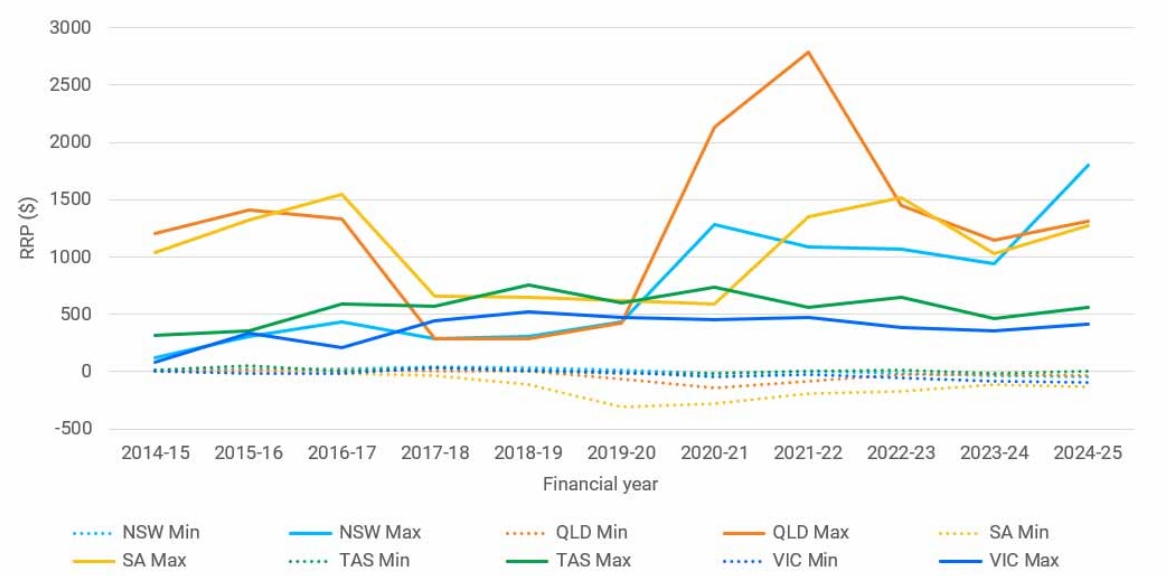
Possible explanations of this sharp decline in the incidence of very low or floor pricing could be:

- That the structure of Power Purchase Agreements (PPAs) is changing. This change would mean that it is no longer in a renewable generators' interest to bid at very negative prices as often to ensure dispatch.
- That the number of inflexible thermal generators is reducing.
- That the introduction of 5 minute settlement had an effect on wholesale market bidding incentives.

Average spot prices and average daily minimum prices both vary significantly between regions and year-on-year. However, there are some observable trends worth noting. Firstly, time-weighted average spot prices have broadly climbed over the last 10 years. This has not been a constant trend, however, and it is worth noting that the peak in average spot prices occurred in 2022, when high commodity prices led to AEMO's suspending the whole market. Since this peak, average spot prices have broadly declined. While prices for the financial year to 30 April 2024 are higher than in 2023/24, this sample includes a full summer of prices and adding the shoulder period and winter prices to that sample may bring the average price down.

Average daily minimum prices have also broadly declined over the last 10 years, though these also vary significantly between regions. Consistent with the trends in the incidence of very low or floor price events, average daily minimum prices were at their lowest in 2020 and 2021, led primarily by South Australia and Queensland. Since 2021, average daily minimums in these states have risen, though they remain significantly negative, and particularly so in South Australia. These effects also influence average daily price spreads - the average of the difference between the maximum and minimum price each day. In South Australia and Queensland, these spreads have varied too much year-on-year to identify meaningful trends, however in the other regions, these have risen steadily over the last 10 years. However, with the exception of a sharp increase on 2023/24 spreads in 2024/25 in New South Wales, average spreads have been level or slightly declined in recent years in the remaining states.

Figure 2.8: The difference between average maximum and minimum prices varies by region, but has trended upwards



Source: Panel analysis of AEMO data

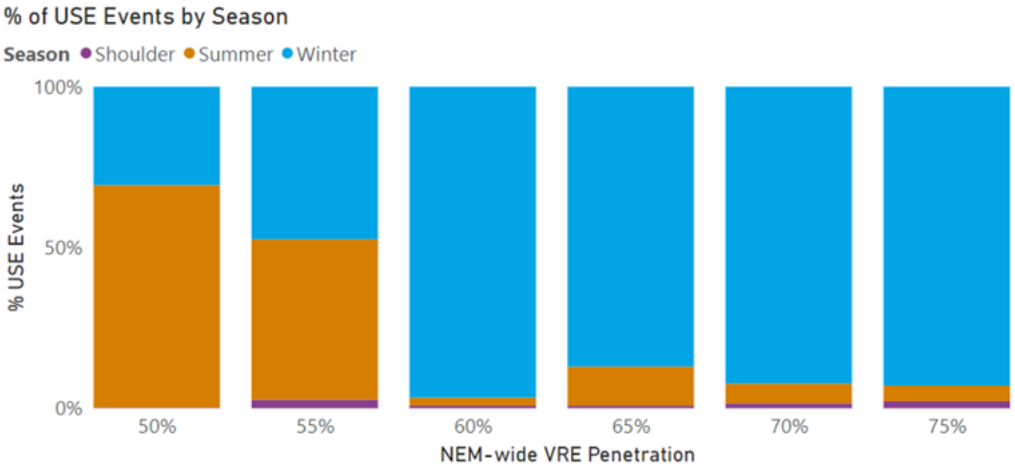
Wholesale price outcomes are often a good indicator of the reliability environment and the balance of supply and demand in the market. These outcomes indicate that since the last RSSR, reliability risk has somewhat dampened. However, this reflects a substantial suite of reforms and jurisdictional and commonwealth support mechanisms that have been incorporated into the market. Some of these will unwind before or during the period under this review. The policy backdrop for this review is discussed further in section 2.4.

2.3.1 The Panel recently confirmed the appropriateness of the form of the reliability standard

In 2024, the Panel concluded a review of the form of the reliability standard and APC and found it remains fit-for-purpose.[35]

The Panel's modelling work in that review demonstrated that the increasing penetration of VRE has two primary implications for the nature of reliability risk in the NEM. Firstly, as VRE penetration increases, reliability risk shifts from summer to winter.[36] This is a result of the weather-dependence of generation in a high-VRE system, and, in particular, lower and more variable solar output during winter months. Secondly, reliability risk is becoming, to a greater degree, a function of weather-dependent generation, rather than periods of high demand. The Panel's modelling work, which stressed the system to create sufficient USE for observation, indicated that reliability events, when they occur, could be longer and deeper than we have seen historically in the NEM.[37]

Figure 2.9: Reliability risk is shifting from Summer to Winter



Source: Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, June 2024

Despite the increasing risk of depth and duration of reliability events in a weather-dependent system when holding reliability constant, the Panel found that the percentage of demand expected USE remains the best metric for both describing reliability risk and for the reliability framework to be operationalised through the market settings. The Panel continues to maintain this position and will therefore not consider the form of the reliability standard for this review.

35 Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, June 2024.
36 Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, June 2024.
37 Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, June 2024.

2.4 Shifting policy continues to have implications for investment certainty and the achievement of desired reliability outcomes

Jurisdictional and Commonwealth energy policy targets and support schemes have an important influence on the reliability outlook. In their modelling for both the Electricity Statement of Opportunities (ESOO) and the ISP, AEMO assumes emissions reduction targets set by Jurisdictional and Commonwealth energy policy targets will be met. This is also reflected in the carbon budgets AEMO includes in their modelling.

Capacity procurement targets that the jurisdictional schemes support are included and assumed to be met in the modelling. This not only impacts reliability modelling, but real-world reliability outcomes. This impact is particularly salient as some of these schemes start or terminate in 2030, which falls in the middle of the RSSR period. These are summarised below:

- Powering Australia Plan[38]
  - 82% renewable generation by 2030
- Capacity Investment Scheme (CIS)[39]
  - 23 GW of additional renewable capacity by 2030
  - 9 GW of renewable dispatchable storage capacity by 2030
- Large-scale Renewable Energy Target (LRET)[40]
  - 33 TWH renewable generation every year until 2030
- NSW Electricity Infrastructure Roadmap[41]
- Long-term energy services agreements (LTESAs)[42]
- Queensland Renewable Energy Target (QRET)[43]
- SA Net renewable energy generation target[44]
  - Net 100% renewable energy generation by 2027
- Tasmanian Renewable Energy Target (TRET)[45]
- Updated Victorian Renewable Energy Target (VRET)[46]
- Victorian Energy Storage Target[47]
- Victorian Offshore Wind Target[48].

In addition to the renewable energy target schemes listed above, there are also a range of relevant CER, electric vehicle, and energy efficiency policies that are relevant to reliability outcomes in the NEM for the reasons discussed above. A more comprehensive list of the relevant policies are available on the AEMC's website.[49]

38 DCCEEW, Powering Australia.
39 DCCEEW, Capacity Investment Scheme.
40 Clean Energy Regulator, Renewable Energy Target.
41 NSW Climate and Energy Action, Electricity Infrastructure Roadmap.
42 NSW EnergyCo, Long-Term Energy Service Agreements.
43 Queensland Treasury, Energy and Climate.
44 SA Government Energy and Mining, Leading the green economy.
45 ReCFIT, Tasmanian Renewable Energy Target.
46 Victoria Energy, Environment and Climate Action, Victorian renewable energy and storage targets.
47 Victoria Energy, Environment and Climate Action, Victorian renewable energy and storage targets.
48 Victoria Energy, Environment and Climate Action, Offshore wind energy.
49 AEMC, Targets statement for greenhouse gas emissions.

Question 3: Impact of government policies on reliability settings

- What implications do emission reduction policies have for the Panel's assessment of the reliability standard and settings?
- What are your views on the impact of State and Commonwealth government energy policies on the reliability settings?

2.4.1 The NEM Review will inform the Panel's view of the future market design and policy landscape

Announced in November 2024, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) commissioned an independent expert panel to perform a review of the NEM wholesale market settings in order to arrive at recommendations for supporting the investment needed (following the conclusion of CIS tenders in 2027).[50] The outcomes of this review may have a significant impact on the reliability outlook for 2028-29 to 2031-32 and, particularly, for any future RSSR period.

The Panel understands that a draft report is expected in the third quarter of 2025 and is working closely with the Expert Panel where relevant. The close collaboration seeks to understand how the direction of the review may impact the reliability outlook and market settings for the 2026 RSSR, given that both reviews are being delivered in parallel.

Question 4: NEM Review

- What impact do you consider the NEM review will have on the reliability standard and settings?
- How should this process interact with the ongoing review?

50 DCCEEW, Capacity Investment Scheme.

3 The reliability standard represents the trade-off between cost and reliability for customers

Box 3: KEY POINTS IN THIS SECTION

- The reliability standard defines the maximum amount of USE that is at risk of being delivered in a year. It forms the bedrock of the NEM's reliability framework by clearly expressing the efficient level of generation and transmission capacity that customers value at a point in time.
- The reliability standard is the key input to determine the market settings (the MPC, MFP, CPT and APC) that define the price envelope that is applied to spot market outcomes.
- The Panel will apply the NEO, the 2021 RSS guidelines when recommending an appropriate level of USE. In line with the revised NEO, we will also consider the effect on jurisdictional emissions reduction targets.
- In setting the standard, the Panel must balance the value customers place on generation capacity and the cost of unserved energy, quantified with the value of customer reliability.

Under the 2021 guidelines for the 2026 RSSR, the Panel can consider both the form and the level of the standard. However, the Panel will not considering alternative forms of the standard, given its recent review on the form of the reliability standard.[51]

The aim of this chapter is to seek stakeholder feedback on issues relevant to reviewing and assessing the current level of the reliability standard. This chapter:

- Section 3.1 — outlines the purpose and role of the standard and trade-offs the Panel considers when considering the optimal outcome for consumers
- Section 3.2 — sets out the assessment criteria the Panel will apply
- Section 3.3 — outlines how the Panel will assess the level of the reliability standard
- Section 3.4 — outlines further issues the Panel will consider.

3.1 The Reliability Standard defines the maximum amount of energy that is at risk of not being served in a given year

The 2021 guidelines set out the function of the reliability standard. It states that the standard is:[52]

- a measure applied to generation and inter-regional transmission elements in the NEM, the purpose of which is to define the maximum expected amount of energy that is at risk of not being served in a region in a given financial year, and
- currently set as a percentage of USE.

This section builds on the introduction to the reliability standard in chapter 1, The rest of this section further details the role of the standard within the market framework, as well as the trade-offs involved in setting the optimal level.

51 Reliability Panel, Review of the form of the reliability standard and administered price cap, Final Report, 27 June 2024.

52 Reliability Panel, Review of the reliability standard and settings guidelines, Final guidelines, 1 July 2021 p.5.

3.1.1 The role of the reliability standard in the NEM

The standard provides a clear, actionable expression of the economically efficient level of generation and transmission capacity sought for the NEM.

In the NEM, the standard is an ex-ante standard that indicates to the market the required level of supply to meet demand on a regional basis. It is not a regulatory or performance standard that is "enforced." Rather, it indicates the efficient level of reliability for the purposes of informing the market under the NEM reliability frameworks described in appendix A.

The standard is based on an economic trade-off made on behalf of consumers as to the appropriate level of reliability and is a key input to the various market settings, that is, the MPC, MFP, CPT, and APC that define the price envelope that applies to spot market outcomes. Further discussion on the market price settings is provided in chapter 4.

AEMO is responsible for operationalising the standard through its forecasting processes, modelling and projecting whether the market will deliver adequate levels of capacity to meet the standard. It does this across a number of time frames, from years ahead up to real-time, through the various ESOO reports, projected assessment of system adequacy (PASA) and pre-dispatch processes.[53]

3.2 Assessment criteria the Panel must consider when setting the standard

The NER and the 2021 guidelines set out specific requirements for what the Panel should consider, and the assessment criteria that the Panel must take into account when reviewing the standard, in addition to those presented in chapter 5. The Panel will apply these assessment criteria in its consideration of the level of the standard in this 2026 RSS review.

In the time since the RSS guidelines were last revised by the Panel, the emissions reduction component was included in the NEO. As such, when determining the optimal level of the standard we will consider both:

- the guidance on applying the emissions reduction component of the NEO, and
- the assessment criteria in the 2021 RSS guidelines.

The NER requires that the Panel (among other things):

- must have regard to any VCR determined by the AER, which the Panel considers to be relevant, and
- may take into account any other matters specified in the guidelines or which the Panel considers relevant

Requiring the Panel to consider the VCR determined by the AER ensures that the standard is set to strike a balance between having enough generation and demand response to meet customer demand in most circumstances and keeping costs as low as possible for customers.

3.2.1 The Panel will consider emissions reduction when considering the optimal setting to best promote the NEO

The Panel applies the NEO in its work in accordance with the NER and as specified in the terms of reference from the AEMC. The 2026 RSS review will be the first iteration of the project in which the

53 Additional information on how AEMO operationalises the reliability standard in its forecasting and market functions is available here.

Panel will be required to take into account the achievement of jurisdictional emissions' reduction targets in line with the revised NEO.[54]

We will consider the effect of our recommendation on emission reduction targets based on the following guidance:

- the MCE statement about the interim value of greenhouse gas emission reduction
- the AEMC's guide How the national energy objectives shape our decisions, with an updated appendix on applying the emissions component, including guidance on when and how the AEMC may undertake a quantitative assessment of emissions impacts
- the AEMC's targets statement, listing government targets for reducing emissions and targets that are likely to contribute to reducing emissions.

Chapter 6 provides more details on how the Panel intends to incorporate the value of emissions reduction into the modelling.

3.2.2 The Panel will apply the RSS guidelines

The guidelines further state that the Panel will consider other factors, including but not limited to:

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

The Panel will consider the requirements under the 2021 guidelines and other factors, such as modelling and stakeholder outcomes, when considering whether to recommend any change.[55]

3.3 Assessing the level of the reliability standard

Overall, the reliability experience in the NEM has shown that the current level of the reliability standard has been an appropriate reliability target in the NEM to date. However, given the transition taking place within the energy sector, the Panel will consider any information that a different standard will, or is likely to, contribute more effectively to the achievement of the NEO.

The Panel will consider the need for any change to the level of the reliability standard based on an assessment of the issues outlined below, outcomes from the modelling it will undertake for the review, and feedback from and consultation with stakeholders. The objective of which is to help the Panel to make this trade-off, by providing information about the net costs and benefits of achieving higher levels of reliability. As there are limitations to any modelling approach, the Panel also considers a range of qualitative issues, such as the benefit of regulatory predictability and transparency in determining the level of the standard.

3.3.1 The Panel must balance the value customers place on incremental capacity and the cost of unserved energy when determining the optimal reliability level

The standard balances the value that consumers place on the reliable supply of electricity against the costs required to deliver this level of reliability. In setting an efficient level for the standard for the NEM, a trade-off is made between two sets of costs:

54 NEL section 7(c), as inserted by the Statutes Amendment (National Energy Laws) (Emissions Reduction Objectives) Act 2023 (SA). For the Panel, this change took effect in November 2023, under NEL Schedule 3 clause 39.

55 As previously indicated, even if the Panel considers and recommends a change, it will need to submit a rule change to the AEMC. The AEMC rule change process under the NER will need to be followed before any change is made.

- **Cost of additional capacity**. Higher levels of reliability require more investment in power generation, demand side participation, storage, transmission capacity and/or load curtailment, and so lead to a higher cost per unit of energy supplied.
- **Cost of unserved energy**. When there is not enough capacity to supply consumer demand, supply will be interrupted, which also imposes the consumer cost of not having energy when needed. The value that customers place on avoiding supply interruption is known as the value of customer reliability.

The efficient level of the standard corresponds to the point, and level of USE, at which the incremental cost of additional power system resources exceeds the savings to customers from the reduction in USE achieved by an incremental investment in these resources. This is the level of reliability that minimises the total societal cost of electricity.

Consideration of the VCR used to assess the level of the standard

The Panel is required to give regard to the AER's VCR in identifying the efficient level of reliability expressed in the standard.[56] In setting the level of the standard, the guidelines also require the Panel to consider any marked or forecast changes in the way consumers use electricity, particularly through the use of new technology, that suggest many consumers may place a lower or higher value on a reliable supply of electricity from the NEM.

The VCR does not perfectly capture consumers' preferences given different market types, climates or individual preferences

VCR is not a perfect indicator of the value that each individual customer places on reliability.[57] Different VCR values are set for residential versus business customers, and for different climate zones where these are linked to volumetric energy consumption. However, this still does not capture all variation in the value customers place on reliability including differences between individuals, or the value consumers may place on reliability on a very hot day compared to a mild day, and nor does it capture how these preferences change over time.

The Panel notes a range of factors that suggest significant number of consumers may place a higher or lower value of a reliable supply of electricity than indicated by the AER's VCR. These factors are not exhaustive but could include:

- the trend of increased production of electricity from rooftop solar PV may have wide-ranging effects on how consumers value reliability
- longer term trends in changes to the way consumers use electricity such as the increased work from home arrangements since the COVID-19 pandemic
- changing end use consumer technologies including the electrification of transport, cooking and hot water heating
- potential uptake of flexible demand response loads such as hydrogen electrolysers, data centres or electrification of transport
- customers perception and lived experiences based on media coverage of outages unrelated resource inadequacy
- Australia's changing industrial structure and the decline of large industrial loads and growth of small to medium size enterprises and expected increase in data centre load.

56 Clause 3.9.3A(e) of the NER.

57 Reliability Panel, The Reliability Standard: Current Considerations, March 2020, p.36.

The AER released new values of customer reliability in 2024

On 18 December 2024 the AER published a final report on the 2024 VCR values.[58] They seek to reflect the value that different types of customers place on a reliable electricity supply and were last updated in 2019.

The updated values follow the AER's final determination on the 2024 methodology, published on 30 August 2024. For the 2024 VCR update, the same survey-based methodology was used as in 2019, but more detailed data inputs based on meter readings were used for individual customers. This change allowed the AER to use more detailed and accurate residential consumption data to calculate the VCR, now and into the future.

The Panel is seeking stakeholder guidance on how best to interpret significantly different VCR values for this review

Given the high degree of uncertainty surrounding how these factors' impact on VCR, the Panel will likely consider sensitivity cases around the AER's VCR in its modelling to identify the efficient level for the standard. Moreover, the Panel is seeking stakeholder views on how to best interpret recent VCR values that have strongly diverged from the previous 2019 values. In aggregate, the NEM-wide VCR has decreased by 39% in real terms with more volatile changes depending on customer segment. A summary of the NEM-wide results is shown in Table 3.1 below:

Table 3.1: NEM-wide VCR values by NEM-jurisdiction

NEM Region	2024 VCR ($/kWh)	2019 VCR (2024$/kWh)	Change ($/kWh)	Change (%)
NSW	30.93	50.77	-19.84	-39%
VIC	35.78	49.68	-13.90	-28%
QLD	25.75	48.25	-22.50	-47%
SA	33.32	52.11	-18.79	-36%
TAS	18.99	38.76	-19.77	-51%
NEM	30.00	49.41	-19.41	-39%

Source: AER, Value of customer reliability — final report, December 2024

While the NEM-wide results show a decrease, it is important to note that the NEM-wide residential customer values increased by 43% from $29.02 in 2019 to $41.48 in 2024. However, business customer values have decreased by 33% to 56%, and for large business customers, the changes range from 214% to -90%. Summaries of the NEM-wide results for residential, business and very large customers are shown in the tables below.

Table 3.2: Residential VCR values by NEM-jurisdiction

NEM Region	2024 VCR ($/kWh)	2019 VCR (2024$/kWh)	Change ($/kWh)	Change (%)
NSW	38.53	31.16	7.37	24%
VIC	49.23	25.84	23.39	91%
QLD	36.09	28.64	7.45	26%

58 See: https://www.aer.gov.au/industry/registers/resources/reviews/values-customer-reliability-2024/final-report

NEM Region	2024 VCR ($/kWh)	2019 VCR (2024$/kWh)	Change ($/kWh)	Change (%)
SA	48.52	36.53	11.99	33%
TAS	35.69	20.45	15.24	75%
NEM	41.48	29.02	12.46	43%

Source: Ibid., p.5.

Table 3.3: Business customer VCR values by customer segment

Customer Segment	2024 VCR ($/kWh)	2019 VCR (2024$/kWh)	Change ($/kWh)	Change (%)
Agriculture	22.25	45.65	-23.49	-51%
Commercial	34.39	44.52	-10.13	-23%
Industrial	33.49	63.79	-30.30	-47%

Source: Ibid.

Table 3.4: Very large business customer VCR values by customer segment

Customer Segment	2024 VCR ($/kWh)	2019 VCR (2024$/kWh)	Change ($/kWh)	Change (%)
Services	33.10	10.54	22.56	214%
Industrial	12.22	117.99	-105.77	-90%
Mines	10.63	35.16	-24.53	-70%
Metals	5.38	19.86	-14.48	-73%

Source: Ibid., p.6.

The Panel understands that changes to customers' willingness to pay, changed reliability outcomes and sampling changes could explain the significant divergence from the 2019 values

The results from the 2024 VCR review significantly diverge from the 2019 values. Although there is considerable uncertainty surrounding the specific reasons for such a dramatic change, the AER attributes:

- the almost universal increase in residential VCR values to a higher willingness for customers to pay to avoid outages, lower consumption lost during those outages and frequency of outages
- the significant decline in business VCR to businesses' lower willingness to pay for reliability as a proportion of their electricity bills
- the significant decline in very large business VCR (other than the services sector) due to the different composition of survey respondents compared to 2019,[59] as well as higher consumption and lower outage costs reported by survey respondents.

The Panel welcomes stakeholder input on how to interpret the revised VCR values and approaches to defining sensitivity cases to address uncertainty in the VCR.

59 Only 20% of the respondents in the 2024 sample were also in the 2019 sample.

Question 5: The level of the Reliability Standard and consideration on VCR

- Do you consider that there is evidence that a different level of the reliability standard would deliver better overall outcomes for the NEM?
- During the period 2028 - 2032, the level of CER in the NEM is expected to continue increasing. How would that affect the value consumers place on a reliable electricity supply?
- How should the Panel account for the 2024 VCR values as part of this RSS review?

3.4 Further issues for the Panel to consider

In addition to the assessment criteria outlined in the guidelines and in the NER, there are a number of changes in the NEM, as outlined in chapter 2 that the Panel consider are relevant to take into account when reviewing the reliability standard.

The cost of new entrant dispatchable generation has changed since the previous review

The cost of marginal generation is likely to have changed since the 2022 review (especially in the context of the wide-ranging supply chain constraints affecting the energy industry and the continued reduction in the costs of batteries). Of interest is the cost of new entrant technologies, particularly those that are capable of minimising the quantity of USE. This restricts the analysis to:

- dispatchable generation (including from batteries) that is sufficiently flexible to meet demand at times when there would otherwise be USE and
- variable generation that has output that correlates with dispatch intervals where there would otherwise be USE.

It is noted that the increased role of battery storage to act as the marginal generator highlights the difficulty of calculating the short-run marginal cost of batteries.

Ensuring that new capacity is delivered prior to the retirement of thermal generation remains the focus of jurisdictions

The challenge of delivering new capacity prior to the forecast exit of thermal generation capacity has been the focus of reforms and work in recent years. The Panel notes that as many of the large synchronous thermal generation fleet (coal generators) reach the end of their life, the probability of major, enduring outages at critical facilities may become greater. This may lead to a longer tailed distribution of USE outcomes (e.g., USE periods of several hours or more). This trend may also be strengthened by the advent of large penetrations of renewables, which also lead to a longer-tailed distribution (i.e., driven by periods of prolonged low levels of wind or solar generation).

Increasing CER continues to transform the relationship between customers and the NEM, especially with respect to reliability outcomes

The continued increase in the amount of CER is influencing the way that consumers interact with the NEM while also creating new financial opportunities for service providers. The uptake of rooftop PV has exceeded the forecast step change scenario in AEMO's 2024 ESOO, while there is also expected to be an increase in the uptake of home battery systems, EV's and other technologies.

Large-scale investment is required to ensure the NEM remains secure and reliable over the longer term

The Panel notes that large amounts of investment in additional capacity will be necessary to ensure that the NEM remains secure and reliable throughout the transition to a net-zero electricity system. However, there exists some investment uncertainty that is inhibiting further investment in generation capacity, which the Panel considers important to consider. This is from:

- growing regulatory risk from government policies and ongoing reforms
- negative price periods are increasing due to curtailment during times with network congestion or due to low demand, and
- increasing difficulty in contracting due to high levels of volatility and unpredictability of captured wholesale electricity prices due to high and
- uncertainty surrounding the future of gas supply and prices.

Question 6: Other issues the Panel will consider when recommending the appropriate reliability standard?

- Are there any other issues the Panel should consider for its review of the reliability standard?

4 The market settings are derived from the standard and set the price envelope for the spot market

Box 4: KEY POINTS IN THIS SECTION

- The market price settings, derived from the reliability standard, define the envelope from which an efficient level of investment should be delivered.
- The MPC places an upper limit on wholesale market outcomes and should be set at the minimum level that delivers the required level of investment.
- The MFP sets a lower limit on the wholesale market outcomes in a trading interval that signal over supply and seeks to ensure that market is able to clear in low demand periods.
- The CPT acts to reduce the impact of high prices over a sustained period, balancing the effectiveness of market price signals and the risks faced by market participants.
- The APC is the maximum price paid to market participants during an administered price period and seeks to manage the risks faced by market participants during periods of sustained high prices and ensure that the market revenue earned during that period is sufficient to cover their operating costs.
- The Panel is seeking stakeholder feedback on the effectiveness of these market settings in a market undergoing a fundamental transition to variable renewable energy.

This chapter outlines the issues and criteria relevant to the Panel's consideration of the market price settings to apply from 1 July 2028 to 30 June 2032. We are seeking stakeholder views on the effectiveness of the settings and our proposed underlying modelling methodology.

This chapter sets out the Panel's assessment of the appropriateness of:

- Section 4.1 — market price cap
- Section 4.2 — market floor price
- Section 4.3 — cumulative price threshold
- Section 4.4 — administered price cap
- Section 4.5 — indexation of market settings.

Consistent with the assessment approach set out in chapter 5 and the RSS guidelines, the Panel will only recommend changes to individual market price settings where there is a material benefit in doing so.[60]

4.1 The market price cap places an upper limit on wholesale market outcomes in a trading interval

The MPC places an upper limit on wholesale market prices that can be reached in any trading interval. The MPC, is a reflection of the marginal value of energy needed to support investment in capacity to meet the reliability standard. The MPC for the 2025-26 financial year is set at $20,300/MWh.[61]

60 Stakeholders should also note that even if the Panel considers and recommends a change, the Panel will need to submit a rule change to the AEMC. The AEMC rule change process under the NER will need to be followed before any change is made.

61 Under NER clause 3.9.4, the Commission is required to adjust the MPC in line with CPI by 28 February each year.

4.1.1 The MPC plays a critical role in promoting investment in the right mix of capacity and maintaining dispatch efficiency

The MPC sets the maximum price, measured as a $/MWh value, that can be reached in the wholesale market for energy and FCAS. As per the 2021 guidelines, this cap on prices serves two functions:

- to enable the market to achieve and send efficient price signals, to support the efficient operation of, and investment in, electricity services over the long run, and
- to manage participant exposure to price risk.

4.1.2 The Panel will aim to set the optimal level of the MPC that encourages sufficient investment to meet the reliability standard

The Panel is required to consider the tension between the cost of providing new capacity and the value consumers place on reliability when determining an efficient level for the MPC.

A very high MPC creates strong financial incentives for investment, but market participants, both on the supply and demand sides, could be exposed to substantial price risk. Therefore, the level of the MPC should be set high enough to send sufficiently strong financial signals and provide incentives for participants to manage spot market risk, whether financially through contract markets or physically with generation assets or demand response.

Extremely high market prices may encourage retailers to increase their contract coverage but may impose additional risks on generators. Retailers could increase their contract coverage provided generators offer additional contracts, however without new capacity or a change to their risk appetite generators may not be willing to increase their contract exposure. Such an outcome may produce less efficient outcomes over the long term.[62]

Conversely, if the MPC were set too low, it could reduce energy market revenues and potentially reduce the efficacy of market price signals particularly if the MPC is less than the price needed to support a marginal new entrant. This situation would reduce the incentives for efficient investment in electricity services resulting in an increase in unserved energy and, therefore, market costs.

Importantly, given the role of the MPC is to support the financial requirements of the marginal unit required to meet the reliability standard, the Panel will carefully consider the effect of any jurisdictional support mechanism and ensure that the overall objective is not compromised.[63] As per our obligations under the NER and the guidelines, the Panel cannot recommend reducing the MPC without being satisfied that satisfactory reliability outcomes would continue to be delivered, either through the market or with out-of-market support.

The Panel considers that the appropriate selection of the MPC to manage this trade-off is to select the lowest level of the MPC below the VCR that results in the reliability standard being achieved, subject to the other considerations discussed in the balance of this chapter.[64]

62 Loads may be able to manage this risk through the contract market, but may still be exposed to some residual financial risk, given that it is difficult to exactly match contracting volume with actual market outcomes.

63 Depending on their specific design, support mechanisms can crowd out revenues for new entrants who do not receive support thereby requiring maintaining the level, or increasing, the level of the MPC to make sure any investment is additional.

64 The Panel is required to also take into account the AER's estimate of VCR when setting the MPC, which sets the upper bound for possible MPC values, as a value above this would allow for energy prices to exceed customers' value of energy.

4.1.3 The NER and the guidelines set out the factors the Panel must consider when setting the MPC

The NER and the guidelines set out a number of assessment criteria that the Panel must take into account when reviewing the MPC. The Panel will apply these assessment criteria in its review of the MPC.

The NER states that the Panel can only recommend an MPC that the Panel considers will, among other things:

- allow the reliability standard to be satisfied without the use of AEMO's powers to intervene, and
- not create risks that threaten the overall integrity of the market.

These requirements mean that if the Panel considers that a decrease in the MPC may prevent the reliability standard from being maintained, it may only recommend such a decrease after considering any alternative arrangements necessary to maintain the reliability standard.[65]

The guidelines further state that the Panel will consider the following principles in its review of the MPC:

- 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. Any such movements should occur over a period of several review periods.
- When setting the MPC, consideration should be given to the MPC's effect on the financial burden faced by participants from high market prices, including price volatility and impacts on retailers.

Stakeholders should note that the MPC is not intended to be a tool for placing downward pressure on consumer costs by constraining high prices. It is not necessarily the case that a lower MPC will lead to lower average consumer costs. **Similarly, a higher MPC may not necessarily lead to higher consumer costs**. The relationship between the MPC and consumer costs is determined by a myriad of factors, including investment and dispatch decisions, the cost of any unserved energy, fuel prices and competition in dispatch. The Panel does consider the effect of the market settings on end-use customer costs, but it is important to note that using the MPC as a tool to steer consumer costs would likely distort investment decisions in the long term, leading to inefficient outcomes, increased costs and more frequent market intervention.

4.1.4 Further issues the Panel will consider

In addition to the assessment criteria outlined in the guidelines and in the NER, there are a number of changes in the NEM that the Panel consider relevant to take into account when reviewing the MPC. A number of the issues raised in chapter 2 have implications for the setting of the MPC. Chapter 6 also provides more details on potential practical issues associated with modelling to inform the setting of the level of the MPC.

Further issues for the Panel's consideration in setting the MPC include:

- The Panel considers, given the increasing investment in new technologies, that the MPC should allow for investment in the lowest cost plant necessary to meet the reliability standard and, as such, will need to examine whether the current level of the MPC allows the wholesale market to send the right price signals for all technology types. Furthermore, the Panel's

65 Clause 3.9.3A(g) of the NER.

proposed approach will include consideration of emissions reduction targets alongside the other limbs of the NEO.

- The rapid uptake of CER, including remotely controllable load, has emerged as a potential driver for a shift in consumer load profiles and a potential trigger to re-examine the relationship between the market price cap and customers in the wholesale market.[66]
- The potential introduction of new markets and enablement approaches for security services should be accommodated in the co-optimised dispatch process, but this could affect the supply-demand balance during normal operation.
- The jurisdictional investment schemes and whether they will distort price signals based on the reliability settings by driving additional investments into the market.

Question 7: Consultation questions on the MPC

- How effective is the MPC in allowing for the investment of the least-cost mix of generation and storage to meet the reliability standard as the NEM transitions? And what types of generation is it critical to incentivise?
- What factors or issues regarding spot prices, investment, market participants and/or the predictability and flexibility of the regulatory framework should the Panel pay particular attention to?
- Do you consider that the introduction and continuation of government investment schemes means that changes to the MPC should be considered?
- Do you consider that the emergence of new technologies warrants a change in the MPC in order to enable investment to meet the reliability standard in the most cost-effective way?
- How would you suggest the Panel include the value of emissions reduction as part of this economic assessment?
- Do you consider that the introduction of new markets or system security enablement approaches would mean a change to the MPC is required?

4.2 The market floor price sets a lower limit on the wholesale market outcomes in a trading interval

The MFP sets a lower limit on wholesale market prices that can be reached in any trading interval. The value of the MFP is specified in the NER and is currently set at -$1,000/MWh.[67]

4.2.1 The MFP aims to ensure the market is capable of efficient clearing without intervention during low demand periods.

In general, low price events are expected at times when there is a surplus of generation relative to demand. During such periods, negative prices assist power system operations by creating an incentive to reduce generation and potentially increase demand.

Negative bids reflect the amount a generator is willing to pay to remain dispatched to a certain level. Some participants have less flexible generators with high start costs, minimum generation levels or technical unit commitment constraints, such as minimum run-time requirements. To

66 Customers that don't have demand-side response have not historically been active participants in the wholesale market and so could not alter their consumption to avoid high prices.

67 NER clause 3.9.6(b)

manage characteristics such as these, and to minimise their overall operating costs, these participants offer their minimum load capability at negative prices to ensure they continue to operate during over supply periods. In contrast, highly flexible generation, which can start or cease generation easily and at a low cost, will reduce generation and decommit if necessary in response to negative pricing, thereby reducing the over supply in those periods. Network congestion may also see participants offer their capacity at significantly negative prices as they seek to be dispatched in preference to other participants behind the constraint.

As identified by the ACCC when the negative market floor price was first introduced, negative wholesale market prices also provide an incentive for demand side participation by paying demand to consume energy.

The purpose of the MFP is to allow the market to clear efficiently during low demand periods without market intervention, by imposing a lower limit on the total potential volatility of market prices.

4.2.2 The level of the MFP seeks to allow the market to clear in most circumstances while limiting undue risks on market participants

In setting the MFP, the Panel is making a similar trade-off on behalf of market participants and consumers as it makes when setting the MPC. This involves :

- The MFP being sufficiently low to allow less flexible generators with different cycling costs to appropriately reflect those unloading values and differentiate themselves through their negative bids. A low MFP theoretically, provides scope to facilitate the communication of the commitment decisions from participants into the dispatch process and enables the market to clear efficiently without intervention from the operator. If the MFP were set too high, generators with cycling costs in excess of the costs incurred by being dispatched at the MFP would be unable to express their willingness to incur these cycling costs through their bids. This could lead to inefficient rationing of overabundant, less flexible generation and higher wholesale prices.
- Not creating substantial risks that threaten the overall stability and integrity of the market. An extremely low MFP would expose less flexible thermal generators to increased negative price risk given their unit commitment constraints.[68] This would increase the cost of inflexibility and affect the financial viability of these generators and more frequent cycling may also pose a reliability risk if generators fail to restart.

4.2.3 The guidelines set out the factors the Panel must consider when setting the MFP

Both the NER and the guidelines set out a number of assessment criteria that the Panel must take into account when reviewing the MFP. The Panel will apply these assessment criteria in its review of the MFP.

The NER states that the Panel may only recommend an MFP it considers will:[69]

- allow the market to clear in most circumstances
- not create substantial risks that threaten the overall stability and integrity of the market.

These requirements mean that if the Panel is of the view that a change in the level of the MFP will prevent the market from clearing in most circumstances, the Panel may only recommend such a

68 Note: As relatively inflexible thermal generation continue to retire the salience of this concern will likely diminish.

69 NER clause 3.9.3A(h).

change where it has considered alternative arrangements necessary to allow the market to clear in most circumstances.

The guidelines further state that the Panel will consider the following principles in its review of the MPC:

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

4.2.4 Further issues the Panel will consider

In addition to the assessment criteria outlined in the guidelines and in the NER, there are a number of changes in the NEM that the Panel consider relevant to take into account when reviewing the MFP. These include:

- Increasing frequency of Minimum System Load (MSL) events. The uptake of rooftop solar is resulting in very low operational demand during the day. Negative prices should facilitate efficient market clearing when demand is low, however prices are still set by participants' bids. This raises the question of the extent to which the MFP has a role to play in mitigating the risk of MSL events. This applies over both operational and investment timeframes. It is unclear whether the MFP can provide sufficient incentive for investment in dispatchable load in the same way the MPC does for generation. As part of this review, the Panel may provide commentary on options to set the price at the floor when demand is insufficient to meet the generation to keep the grid stable. This work would help the Panel to determine if further work on this issue is required beyond the current review.
- There is currently no market setting that limits market participants' exposure to sustained negative prices. As the frequency of MFP and low price events is increasing, it may be time to consider whether it would be appropriate to introduce an equivalent of the CPT for negative prices. As with the existing CPT, a negative CPT would seek to limit market participants' exposure to prolonged negative prices, that could threaten their financial viability.
- It is often in a VRE generator's interest to bid at the floor behind a constraint with an expectation that the clearing price will be higher than the short run marginal cost of the generator. The extent of this phenomenon should inform considerations of the appropriate level of the floor.
- Historically, the absence of markets for some system services required to ensure secure dispatch that are provided by synchronous generators as a by-product to energy has meant that the provision of these services have not been compensated explicitly. As such, these synchronous generators have been required to make self-commitment decisions based on the energy price alone. This current structure means that the MFP is an important factor in the provision of system services provided by-products. However, as new markets and compensation frameworks for system services are implemented in the future, these services will be valued separately from energy, allowing generators to make commitment decisions and to be compensated for their commitment in a way that represents the value to the market.

Question 8: Consultation questions on the MFP

- What role, if any, does the MFP have to play in mitigating the risk of MSL events? Does this role include investment as well as operational considerations? Is the MFP set at the right level, and is it in the right form to drive efficient operational dispatch?
- In your view, should the Panel consider a negative cumulative price threshold? If so, what factors should be considered when determining the level of a negative CPT?
- Has the growth of VRE led to 'race-to-the-floor' bidding? If so, how should this inform the level of the MFP?

4.3 The cumulative price threshold acts to reduce the incidence of high prices over a sustained period

The CPT is the maximum total energy price and total frequency control ancillary services (FCAS) price that can be reached over a period of seven days, before an APC commences and the APC is applied to market prices.[70] The CPT is currently $1,573,700/MWh. From 1 July 2025 to 30 June 2026, the CPT will be $1,823,600/MWh.

4.3.1 The CPT aims to balance the effectiveness of investment signals sent by the MPC and risks for market participants

The CPT acts to reduce the incidence of high prices over a sustained period. The 2021 Guidelines state that the CPT has two purposes:

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

4.3.2 The CPT and MPC are inherently linked and must be co-optimised to minimise distorting investment signals

The CPT is set in tandem with the MPC. Changes in the CPT have direct effects on the balance between participants' exposure to extreme prices in the market and the amount of revenue that participants earn. The CPT is therefore an important parameter for providing sufficient revenue to incentive sufficient new entry to achieve the reliability standard.

A higher CPT means that an APP is less likely to occur. This may increase the level of price risk faced by consumers but also increases the revenue that generators can potentially receive. It also affects the contract market by affecting the exposure period and potentially the value of cap and hedge contracts. As a result, a higher CPT can increase the effectiveness of price signals as an investment signal by increasing the potential wholesale and contract revenue earned by participants.

A lower CPT increases the chances of an APP occurring. This reduces market participants' exposure to sustained high prices but in turn also reduces the revenue that generators can receive. A lower CPT would reduce the effectiveness of price signals in the market by reducing the

70 NER clause 3.14.1.

potential revenue earned by participants potentially impacting on USE and achievement of the reliability standard.

Limiting participant exposure to sustained high prices may also alter incentives for participants to manage price risk, which may, in turn, affect investment outcomes. The level of the CPT is, therefore, important for the contract market and the efficient management of investment risk, supporting the achievement of the reliability standard.

The level of the CPT may also affect investment decisions regarding the duration of storage for grid-scale battery storage. A lower CPT may reduce the length of consecutive high prices supporting investment in shorter-duration storage. Conversely, a higher CPT could incentivise investment in longer-duration storage.

The form of the accumulation mechanism may also affect the efficacy of the CPT and its influence on participants short and long term behaviour. Submissions to previous reviews have suggested that a simple accumulation of 5 minute prices over a period may result in the CPT being triggered without there being significant high prices. For example a sustained period of prices in the order of $750/MWh would currently be sufficient to trigger the CPT. If the purpose of the CPT is to manage reliability events, typically related to periods of significant market stress, then having the CPT triggered by higher average prices may not be consistent with that outcome. An alternative formulation of the calculation of the CPT may better reflect the intention of the measure and be more supportive of delivering reliability, a market that operates efficiently, and provide appropriate investment signals for energy services.

4.3.3 The guidelines set out the factors the Panel must consider when setting the CPT

The guidelines and the NER set out assessment criteria that the Panel must consider when reviewing the CPT. The Panel will apply these criteria in its review of the CPT.

The NER states that the Panel can only recommend a CPT that the Panel considers will, among other things:[71]

- allow the reliability standard to be satisfied without use of AEMO's powers to intervene
- not create risks that threaten the overall integrity of the market.

In addition, the guidelines provide that when assessing the level of the CPT, the Panel will consider the following principles that the CPT should

- protect all market participants from prolonged periods of high market prices, with particular consideration to impacts on investment costs and the promotion of market stability
- not impede the ability of the market to determine price signals for efficient operation and investment in energy services
- be determined by giving consideration to the level of the MPC.

These requirements mean that if the Panel is of the view that a decrease in the CPT may mean that the reliability standard is not maintained, then the Panel may only recommend such a decrease where it has considered any alternative arrangements necessary to do so.

4.3.4 Further issues the Panel will consider

In undertaking its review of the CPT, there are a number of issues arising in the NEM, in addition to those above, that the Panel considers relevant to take into account when reviewing the CPT. These are:

71 NER clause 3.9.3A(f).

- In the Panel's Review of the Form of the Reliability Standard and APC, modelling results indicated that as VRE penetration increases while holding total reliability outcomes constant, reliability events, when they occur, are becoming longer and deeper.[72] This impact, particularly in terms of duration, may require a CPT that reflects the market's need for longer-duration technologies that can respond to sustained periods of scarcity. The trade-off between the MPC and the CPT means that while maintaining the same expected reliability outcome, the market settings can provide different incentives to different technology types. This allows the Panel to consider the nature of reliability risk in the RSSR period, which informs the appropriate formulation and level of the CPT.
- Traditionally, both energy and FCAS were provided by large, synchronous plant in tandem and sustained high prices in the energy could be linked to high prices in FCAS markets, and vice versa. As such, modelling for previous RSS reviews has focused on the energy price as a useful proxy for capturing the dynamics of the FCAS as well. However, as the NEM continues to evolve, energy and FCAS are increasingly being provided by separate plant types, which could cause sustained high prices in each market type to no longer be coincident. Given the significant increase in the new technologies, particularly battery storage, that can provide strong frequency response, FCAS prices may play an increasingly important role in setting the efficient level and form of the CPT.[73]

Question 9: Consultation questions on the CPT

- Should the CPT continue to function as a technology-neutral mechanism in a changing reliability landscape?
- Should the formulation of the calculation of the CPT be considered to better reflect its purpose? Including the separate APP triggers for energy and market ancillary services.
- How is the interaction between the CPT in the Energy and FCAS markets changing and what does this mean for this review?

4.4 The administered price cap is the maximum price paid to market participants during an administered price period

The APC is the maximum settlement price that applies during an APP after a set of sustained high dispatch prices exceeds the CPT.[74] The value of the APC is currently set at $600/MWh.[75] The Panel recently confirmed the form of the APC, as such it will not be reconsidered as part of this review, the Panel will only consider if the level of the APC is fit for purpose for this review period.[76]

4.4.1 The APC seeks to minimise financial risks related to extended periods of high prices

The APC is the maximum market price paid to participants, measured as a $/MWh value, that can be reached in any dispatch interval and any trading interval, during an APP. The APC, combined with the CPT, acts to minimise financial stability risks to the market arising from an extended period of supply scarcity and corresponding high prices.

72 Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, 2024.
73 AEMO, Energy Explained: Big Batteries.
74 Clause 3.14.1 of the NER.
75 Clause 3.14.1(a) of the NER.
76 Reliability Panel, Review of the Form of the Reliability Standard and APC, Final report, 2024.

During an APP, the spot market continues to be the primary mechanism for procuring services and the administered pricing compensation framework is designed so that a participant is indifferent between participating in the market during the APP, even though there is an APC in place. Specifically, these arrangements are intended to maintain the incentive for market participants to supply services notwithstanding the application of the APC.

The APC also acts as the administered floor price, which is set at the negative of the APC value and represents the lower threshold that can be reached in any dispatch interval and any trading interval during an APP.

4.4.2 The APC seeks to balance the reliability risks from generator decommitment and financial risks for market participants

Given the role and purpose of the APC it needs to be set at a sufficient level to encourage continued participation during times of extended high input costs, reducing the need for AEMO intervention and the risk of outages for consumers. Setting its value requires the Panel to make a trade off that involves balancing a number of competing objectives, namely having a sufficiently:

- low APC to mitigate the risk of a systemic financial collapse of the electricity industry during an extreme market event
- high APC to incentivise market participants to supply electricity during administered price events
- high APC to minimise compensation claims by market participants following an application of the administered price cap.

An APP occurs following an extended period of high prices and is likely to occur under conditions of generation supply scarcity. Having an APC that is too low may discourage high cost generators from bidding into the market during an APP. This would reduce available generation and potentially require intervention by AEMO and delay return to normal market operations.

If the APC 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.[77] However, this is an expensive and time-consuming process. As such, the Panel considers that ensuring that the APC is sufficiently high to minimise the likelihood of triggering a compensation claim is highly desirable.

Conversely, an APC that is too high may unnecessarily contribute to the financial distress of energy purchasers and risk contributing to financial instability in the market in response to extreme market events.

4.4.3 The guidelines set out the factors the Panel must consider when setting the APC

Both the NER and the guidelines set out a number of assessment criteria that the Panel must take into account when reviewing the APC. The Panel will apply these assessment criteria in its review of the APC. The Panel will also consider factors including, but not limited to whether there have been:

- significant changes in the typical short-run marginal costs of generators in the NEM
- any compensation claims since the last review.

77 Clause 3.14.6 of the NER.

4.4.4 Further issues the Panel will consider

In addition to the assessment criteria outlined in the guidelines and in the NER, the NEM's transition could also have implications for the appropriate setting of the APC. Other issues of specific relevance to the Panel's consideration of the APC include:

- Consideration must be given to the cost of the different technologies that may play an increasing role during APPs in the future, and whether the APC provides both sufficient incentives for investment in these technologies and incentives to operate them efficiently to meet demand during APP periods. This may have implications for the existing approach because storage technologies such as hydro or utility-scale batteries do not have a well-defined SRMC. One option is to consider setting the APC with regard to an estimate of the opportunity cost of storage. The AEMC recently completed a review into the electricity compensation framework that similarly considered the treatment of opportunity costs of storage.[78]
- Historically, gas generators and particularly OCGTs have played an important role in helping to meet demand during times of scarcity. For gas-fired generators, fuel costs account for most of their SRMC. Since the commencement of LNG exports in 2015 the domestic gas price has become increasingly linked to the international prices for LNG. This has led to greater volatility and a higher overall average gas price which has increased dramatically in recent times. The Panel may consider whether a fixed level for the APC remains appropriate given increasing volatility in gas, and other fuel prices.

Question 10: Consultation questions on the APC

- How should the Panel consider setting the APC for technologies such as hydro and utility batteries?
- Has the typical generator SRMC increased significantly since the previous review period? Or are they expected to do so over the period 2028-2032?
- Do you consider that the APC remains at an appropriate level to encourage continued participation during times of extended high input costs and market stress? If not, what would be an appropriate level of the administered price cap, why and what is the evidence supporting your view?
- Is there evidence that the APC is affecting the contract prices and so affecting incentives for new investment?
- Do you consider that the current APC provides sufficient investment signal for new technologies?

4.5 Only the MPC and CPT are currently subject to annual indexation

Currently the MPC and the CPT are subject to indexation. The MFP and the APC are not subject to indexation.

As per the requirements in the rules, the AEMC has inflated the nominal value of the MPC and CPT each year based on historical inflation beginning in 2012.[79] The AEMC has undertaken this

78 See: https://www.aemc.gov.au/market-reviews-advice/review-electricity-compensation-frameworks.

79 National Electricity Amendment (Reliability Settings from 1 July 2012) Rule 2011 No. 5.

indexation in reference to the consumer price index (CPI), which is a measure of the changes in prices faced by consumers in the broader economy.

The application of indexation (using the CPI) for the MPC and CPT is prescribed in the NER.[80] The NER does not prescribe indexation for the MFP and APC, which retain their nominal values. The Panel decided against recommending annual indexing for the APC in the Review of the form of the standard. As such it will not be reconsidered as part of this review.

In accordance with the 2021 guidelines, the indexation approach to MPC and CPT will continue to be based on the CPI, unless the Reliability Panel considers that there may be a material benefit in reassessing and changing this approach.

The Reliability Panel will consider the following factors in its assessment which include, but are not limited to, whether:

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

Question 11: Consultation questions on the indexation of the market settings

- Are there any specific considerations the Panel should take into account for this review, relating to the indexation of the MPC and CPT?

80 NER cl 3.9.4 (d); and NER cl 3.14.1 (e).

5 The Panel's assessment will be guided by the NEO

Box 5: KEY POINTS IN THIS SECTION

- The assessment framework that the Panel must apply to considerations of the reliability standard and market settings is provided in the NER.
- The Panel is also guided by the requirements in the 2021 reliability standard and settings guideline.
- The Panel will only recommend changes if these represent a material benefit in achieving the NEO. Including if the proposed changes promote the efficient, secure and reliable delivery of jurisdictional emissions reduction targets.
- If the Panel recommends any changes, they will need to submit a rule change request to the AEMC so that the Commission can review and implement these changes.

The Panel will apply a specific framework when reviewing the reliability standard and settings, which is outlined in the 2021 guidelines. This specific framework includes:[81]

- the general assessment principles in the guidelines to contribute to the achievement of the NEO, including the function of the standard and settings
- the overarching assessment criteria and considerations set out in the NER.

The Panel will apply this assessment framework when considering the reliability standard and settings, including both the form and the level.

The remainder of this chapter outlines the general assessment principles and the overarching assessment criteria in the NER. The function and criteria used to review the reliability standard and setting is noted in CHAPTERS X and Y respectively.

5.1 The general assessment principles are set out in the RSSR guidelines

The 2021 guidelines state that when undertaking a review of each of the reliability standard and settings, the Panel will be guided by the NEO and the assessment principles set out below (**General Assessment Principles**).

The NEO is:[82]

> [T]o 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; and
>
> c. the achievement of targets set by a particular jurisdiction—
>
> i. for reducing Australia's greenhouse gas emissions; or
>
> ii. that are likely to contribute to reducing Australia's greenhouse gas emissions.

81 AEMC Reliability Panel, Final guidelines - review of the standards and settings guidelines, 1 July 2021.

82 National Electricity Law, s.8 as contained in National Electricity (South Australia) Act 1996 (SA).

The General Assessment Principles set out in the 2021 guidelines are:

1. **Allowing efficient price signals while managing price risk:** The Reliability Panel will exercise its judgement to balance allowing for efficient price signals against managing wholesale price risk for participants. The settings should:
   a. allow sufficient scope for competition between buyers and sellers in the market to set efficient prices to achieve the standard, over the long run,
   b. be designed to provide a sufficient range to promote this behaviour in the market, and
   c. also provide protection from uncapped prices in any given trading interval, and sustained high prices over a defined period, such that wholesale market outcomes do not result in inefficient over-investment, overly high financing costs or excessive price risk for all participants.
2. **Delivering a level of reliability consistent with the value placed on that reliability by customers:** The Reliability Panel will have regard to estimates of the value customers place on reliability when exercising its judgement as to the level of the standard. The settings should be sufficient to support the level of investment necessary to deliver the reliability standard, over the long run.
3. **Providing a predictable and flexible regulatory framework:** The Reliability Panel will exercise its judgement to achieve predictable outcomes recognising the importance of stability for market participants to invest, while taking into account changing market conditions, to support efficient investment and operational decisions by participants. The assessment principle, approach and supporting criteria informs the materiality assessment that the Panel will apply in its consideration of the form and level of reliability standard and settings.

For any recommended changes to the reliability standard and settings, the Panel would need to be satisfied that such changes will, or are likely to, contribute to the achievement of the NEO and meet the requirements in the 2021 guidelines and the NER. If the Panel recommended a change, this would need to be progressed through an AEMC rule change process (see chapter 1).

5.1.1 The Panel will consider emissions reduction in making its recommendations

In September 2023, the NEO were amended to explicitly include an emissions reduction objective. This is the first time that an RSS Review has been required to consider emissions reductions.[83] To the extent that the Panel considers the level of the reliability standard or any of the market settings will meaningfully impact carbon emissions, we will consider this cost in our analysis based on the AER's value of emissions reduction.[84] Further details on how emissions are considered in the methodology are provided in chapter 6.

5.2 The review will consider a range of other factors

There are a number of other requirements in the Rules that relate to the assessment of the standard and each of the settings. These requirements and criteria are included in the guidelines and collectively inform the materiality assessment for the Panel to assess the standard and each of the settings. This section details the Panel's approach for assessing the reliability standard and settings, and provides the Panel's approach for any recommendations for change.

83 AEMC, Reliability Panel Guide to applying emissions reduction component of the National Electricity Objective, Final guidelines, 4 April 2024.
84 AER, Valuing emissions reduction - Final guidance, May 2024.

5.2.1 The rules outline other factors this review must consider

When undertaking each review, there are a number of requirements in the NER that the Panel must follow. These include:

- complying with the reliability standard and settings guidelines
- having regard to any terms of reference provided by the AEMC
- having regard to the potential impact of any proposed change to a reliability setting on:
  - spot prices
  - investment in the National Electricity Market (NEM)
  - the reliability of the power system, and
  - market Participants.
- having regard to any value of customer reliability determined by the AER which the Panel considers relevant, and
- any other matters specified in the guidelines or which the Panel considers relevant.

As noted, there are a range of NER specific requirements that apply to the reliability standard and each of the reliability settings. These are outlined in the guidelines, and are discussed in chapter 3 and chapter 4.

5.3 The Panel will make recommendations to the AEMC

In addition to the General Assessment Principles and NER Assessment Criteria outlined above, there are a number of equally important steps that must take place for a change to the standard or settings, which ensure that stakeholders have the opportunity to understand and respond to any such change. The Panel considers this ensures the regulatory process remains predictable while balancing the need for the market to be flexible to changing market conditions.

In addition, to improve predictability and flexibility in its review, and to best incorporate new information about how the NEM is changing, the Panel will only change the level or form of the reliability standard or settings where there would be a material benefit in doing so. The analysis undertaken in this review will determine the most efficient level of the reliability standard and corresponding market price settings. These will be compared to the status quo, as the Panel will only recommend changes that would result in a material benefit. This ensures that predictability in the reliability standard and settings, an important feature of the market for participants and new investors, is maintained.

If the Panel recommends that a change to the reliability standard and settings would result in a material benefit, it will need to submit a rule change request to the AEMC to implement these changes. The Commission would then consider these proposed changes through the usual rule change process, allowing further opportunities for stakeholder input and consultation above those already incorporated into this review's process.

6 Detailed market modelling informs each RSSR

Box 6: KEY POINTS IN THIS SECTION

- The Panel will carry out detailed modelling to provide key evidence to inform the Panel's decision on the reliability standards and settings. We will engage an external third party to provide quality assurance of the modelling methodology, results and insights.
- The modelling will comprise two broad phases:
  a. time-sequential market modelling to determine the efficient level of the reliability standard
  b. optimisation and scenario modelling to determine the appropriate settings to achieve this standard.
- The high-level principles, inputs, assumptions and limitations to modelling are in line with the requirements in the NER and 2021 guidelines. We will continue to publish the details that underpin the modelling throughout the course of the 2026 RSSR.
- We will consider the value of emissions reduction in our modelling and decision-making.
- We will also run several sensitivities to ensure the results and the Panel's final decisions are robust.

Detailed modelling of the electricity market informs each RSSR. Modelling provides a quantitative basis for the Panel to identify efficient levels for the standard and market price settings.

This chapter introduces and outlines issues relevant to the Panel's approach to modelling to inform the 2026 RSSR. Specifically this chapter:

- Section 6.1 — introduces the modelling task required to inform the Panel's determination on the standard and settings
- Section 6.2 — proposes a set of principles, inputs and assumptions that underpin the Panel's high-level approach to modelling for the RSSR
- Section 6.3 — outlines the sensitivities that will be run for stakeholder feedback.

The Panel will publish the details that underpin the modelling throughout the course of the 2026 RSSR. The Panel intends to provide transparency on modelling methods and assumptions by publishing a more detailed methodology paper that will provide details on the scenarios and specific parameters and assumptions used in the modelling. In addition, the draft and final reports will include detailed modelling results.

6.1 Introducing the modelling task

The modelling required to inform the Panel's determination on efficient levels for the standard and settings needs to meet the requirements of Clause 3.9.3A(e)(3) of the NER and 2021 guidelines. This section provides a high-level description of the modelling task we will carry out.

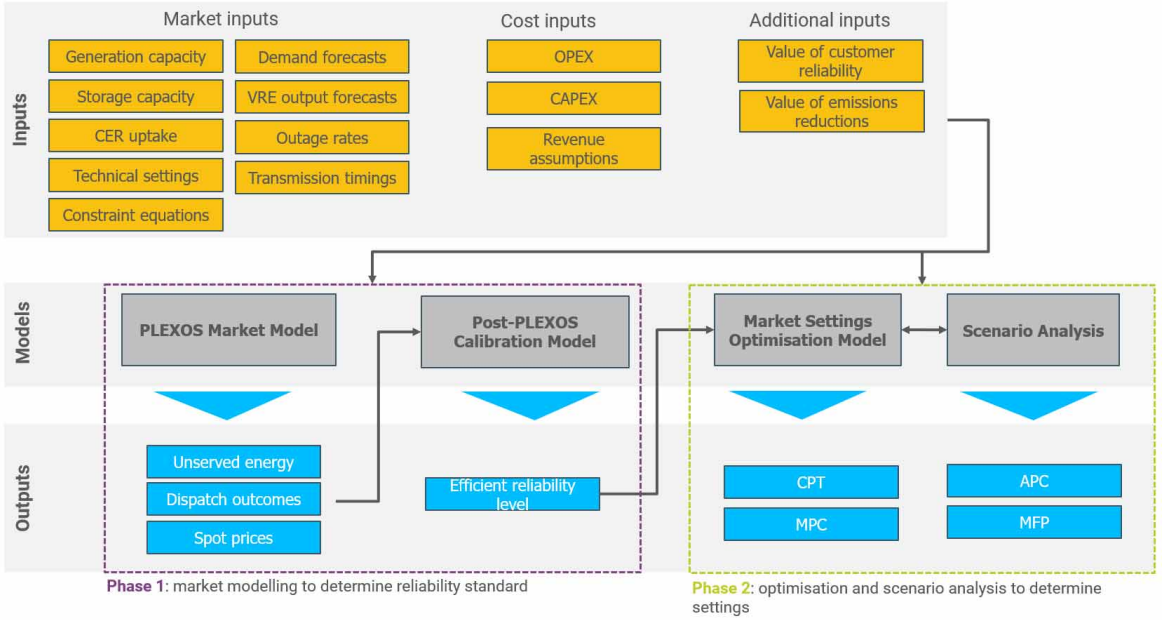
There are two broad phases of modelling required for this review:

1. The first phase is to determine an efficient reliability standard through a combination of time-sequential market modelling using the optimisation software PLEXOS and through post-simulation scenario analysis.
2. Once an efficient reliability level has been derived, the second phase of modelling can begin. This phase uses optimisation methods and further scenario analysis to determine the

appropriate market settings, in particular the MPC and CPT, that will provide market signals to support the level of investment needed for that level of reliability.

The high-level modelling approach is illustrated in Figure 6.1 below.

Figure 6.1: Overview of proposed modelling approach



Source: AEMC

6.1.1 Modelling the efficient level of the reliability standard

An efficient reliability standard delivers a level of reliability consistent with the value placed on that reliability by customers. As outlined in chapter 3, modelling informing this efficient level requires an assessment and comparison of costs:

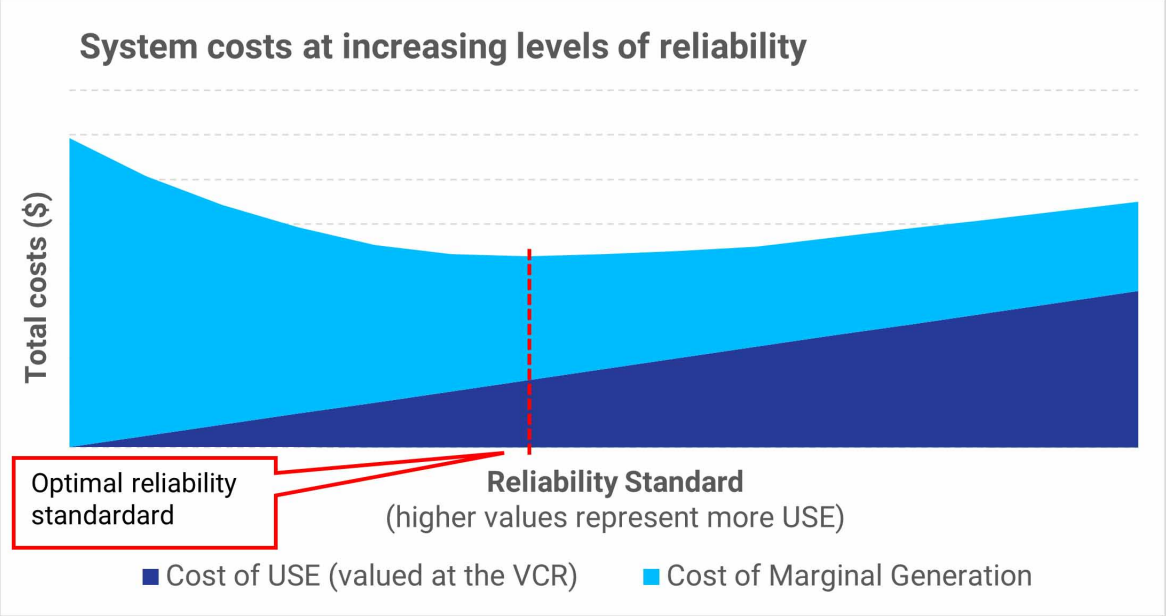
- to consumers from USE arising from range of different reliability events
- of procuring additional power system resources (both supply side generation, storage and demand response) to address this USE.

The modelling task in the first phase of work is to identify a level of reliability, under the current form of the reliability standard, which has the lowest total costs by balancing the delivery of a reliable electricity supply while maintaining reasonable costs for consumers. This efficient level occurs when the incremental cost of procuring additional power system resources to achieve a more reliable system is higher than the value consumers place on that additional reliability. This concept is described graphically in Figure 6.2 below, which shows an increasing reliability standard on the X axis (where a higher standard represents more USE, or less reliability), and the total system cost on the Y axis.

The total system cost comprises of the cost of:

- USE which is valued using the VCR and increases at a constant rate as the reliability standard increases (becomes less tight)
- generation, which decreases sharply when moving away from a system that is 100% reliable and then tapers out, since a perfectly reliable system would require more generation assets than a less reliable system.

Figure 6.2: Conceptual representation of the optimal level of the reliability standard



Source: AEMC, illustrative only

High level approach to modelling the level of the reliability standard

The modelling approach we will take to identify an efficient reliability standard is, at a conceptual level, the same as that developed by Intelligent Energy Systems and described in the 2022 RSSR. However, we have made changes to account for changing market conditions and improved modelling techniques developed for the Panel's Form of the Standard review. This high-level methodology is as follows:

- set up a market model using the most up-to-date market and generator information from AEMO and other sources such as CSIRO
- modify this model by removing firm capacity such that it produces a level of USE that is below the reliability standard (i.e. more USE than the existing standard)
- run this model over the review period (2028-29 to 2031-32) to generate a time-sequential profile of USE and dispatch outcomes for different weather reference years and outage samples
- iteratively add generator capacity of different technology types to produce higher levels of reliability (this may be done in a post-processing excel model, rather than through additional PLEXOS simulations)

There are several methodological improvements we have identified compared to the 2022 RSSR which we may implement, including using a:

- much larger set of weather reference years in the PLEXOS modelling to produce a greater sample of USE outcomes with greater variability.
- post-processing excel model alongside the market model to generate additional USE and dispatch outcomes; this will be used to reduce the extensive run time of running hundreds of PLEXOS models and will allow us to generate a much greater number of cost points with which to set the level of the standard.

As with all modelling there are many assumptions and limitations that we must be aware of. These are described in more detail in section 6.2.3.

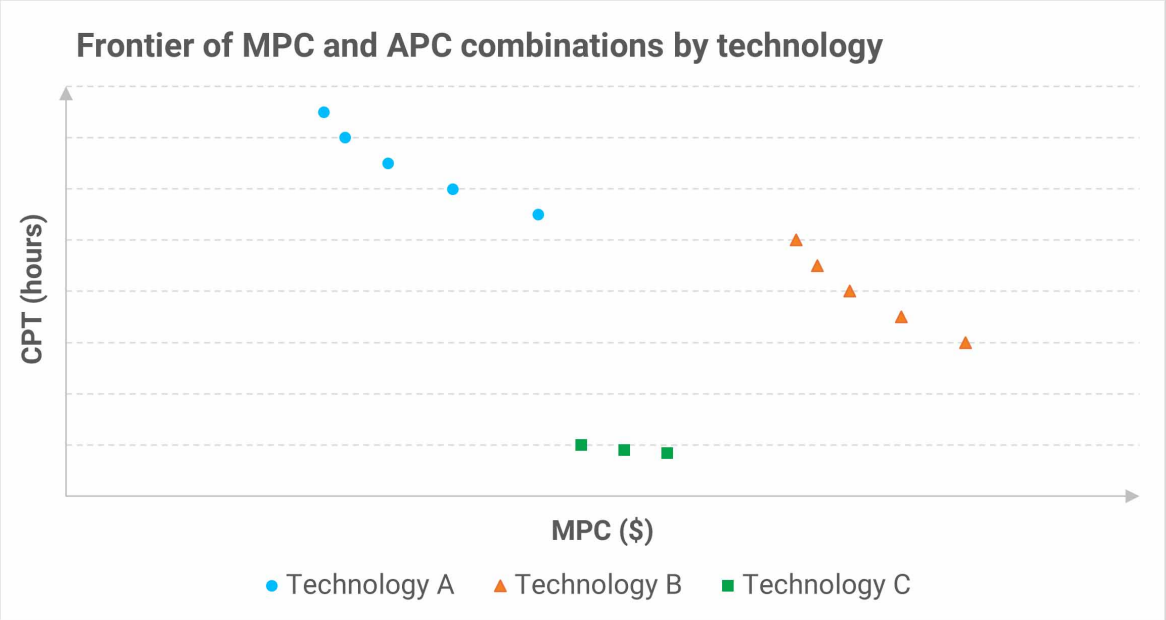
6.1.2 Modelling informing the market price settings

As introduced in chapter 4, the market price settings set incentives for investment in sufficient generation capacity, energy storage, and demand-side response to deliver the reliability standard, while also providing limits that protect market participants from temporary or sustained periods of very high or very low prices.

There is a significant amount of modelling and scenario analysis that informs these settings. Each individual setting requires detailed modelling and the interactions between settings must also be considered. The settings that most influence investment decisions that support reliability are the MPC and CPT. These settings are informed by an optimisation model which sets these values such that there is sufficient market revenue to recover the capital and operating costs of the lowest cost new entrant power system resource.

There will be various combinations of these settings depending on the choice of marginal entrant and the preference for a relatively higher MPC or CPT. These combinations of settings may form a 'frontier' (a curve where all values represent a combination of the MPC and CPT) such as that shown in the illustrative Figure 6.3 below, where each dot represents an optimal CPT and MPC combination to support investment to reach the reliability standard for different technology types.

Figure 6.3: Conceptual frontier of optimal MPC and CPT settings



Source: AEMC
Note: Illustrative only

The Panel will determine the most appropriate MPC and CPT combination based on the frontier produced by the modelling and taking into account the most appropriate technology type or mix of technologies.

The MFP and APC require additional analysis as these interact with the market differently and provide different incentives.

High level approach to modelling the settings

The modelling to determine the most appropriate price settings requires a set of inputs including:

- the efficient level of reliability defined by the modelling in phase one
- a time-sequential profile of USE and dispatch outcomes from the modelling in phase 1 for scenarios that are slightly below the efficient level of reliability level
- a candidate set of new entrant power system resources that may enter the market including associated costs and technical characteristics
- relevant demand forecast and variable renewable generation traces over the investment time horizon
- forecasts of demand side technology uptake including EVs, solar PV and active demand side response
- information relating to other factors that influence the generation mix over the assessment time horizon including jurisdictional reliability and renewable energy schemes, end of life generator retirements, actionable ISP projects and REZ development areas and timelines.

A grid-search (or similar) optimisation model is run with the inputs above to determine the optimal reliability settings, whose objective function is to minimise the total system whilst still ensuring that new entrant power system resources can recover enough revenue to cover their capital and operating costs.

As with the modelling to determine the most efficient level of reliability, the modelling in this phase also includes a number of assumptions and limitations, which are detailed in the following section.

Question 12: Proposed modelling approach for the 2026 RSSR

- Do stakeholders support the high-level modelling approach outlined above? If not, what changes do you consider the Panel should make to its approach?

6.1.3 Considering the value of emissions reduction

In the 2026 RSSR, in contrast to previous RSSR's, we must consider the value of emissions reductions in our analysis and recommendations alongside the primary considerations of reliability and cost. This consideration will be applied primarily in the first phase of modelling and is described below:

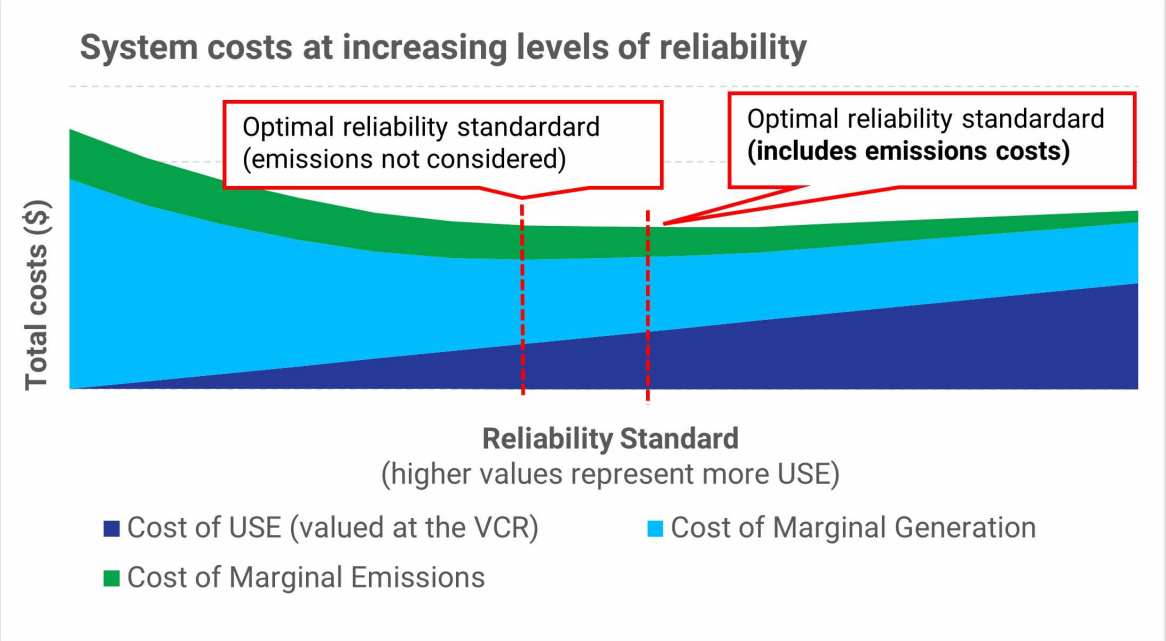
Considering emissions when determining the reliability standard

The cost of marginal emissions will be taken into account when building out the system cost curve. This is dependent on the marginal technology assumed to enter for increasing levels of reliability, as thermal generators produce emissions whereas storage and demand response do not produce any emissions. The choice of technology to base the reliability standard will be primarily based on cost, however the Panel may consider other factors as well.

The figure below shows the impact of including emissions in the total system cost on the optimal level of the reliability standard. In general, including the costs of emissions will lead to a less strict reliability standard, since the cost of emissions is higher at lower levels of USE when more generation is required. The value of emissions reduction is also increasing over time. All else being equal, this will lead to a reliability standard which is less and less strict towards the end of

the modelled horizon. The Panel will take into account this dynamic when determining the most appropriate reliability standard.

Figure 6.4: Setting the reliability standard when considering emissions



Source: AEMC, illustrative only
Note: This chart assumes that the marginal entrant is an emitting technology

Considering emissions when determining the market settings

The value of emissions will impact the modelling of the reliability settings to the extent that the value of emissions influences the level of the reliability standard (as above), and to the extent that it impacts total system costs in the optimisation approach. We will not include costs of emissions on operating or capital costs of generation and storage assets as these costs are not borne by these assets. When determining the most appropriate technology type to base the reliability settings on the Panel will consider emissions implications alongside the primary consideration of reliability and cost.

Question 13: Proposed method of including emissions implications in the modelling

- Do stakeholders agree with the high-level approach to including emissions in the modelling?
- Are there any further ways we should be considering emissions?

6.2 Modelling principles, assumptions and limitations

This section presents a set of principles that inform the Panel's modelling for the 2026 RSSR and details the key assumptions and limitations that pertain to the modelling exercise.

6.2.1 Modelling principles

These principles for modelling satisfy the NER, the NEO and 2021 guideline requirements:

- detailed time sequential modelling of USE and dispatch outcomes will be conducted

- modelling will consider a range of technology options, whilst taking the value of emissions into account
- scenarios will be defined to cover the range of reliability risks relevant to the period covered by the 2026 RSSR
- uncertainty will be addressed through sensitivity analysis and extended weather modelling.

The Panel's proposed modelling approach that satisfies these principles is described below.

Detailed time sequential modelling of unserved energy and dispatch outcomes will be conducted

The Panel considers detailed time sequential modelling of price and dispatch outcomes is required to inform the reliability standard and settings. Detailed time sequential modelling is required to appropriately reflect the nature of unserved energy over the investment time horizon, and is particularly important to assess the role and risks associated with reliance on energy limited storage resources, coupled with variable renewable generation, for reliability outcomes.

Modelling will consider a range of technology options, whilst taking the value of emissions into account

The Panel intends to perform modelling that considers a range of technology options when setting an efficient reliability standard and settings. Given the rapid changes in technology costs and the emergence of new technologies this review will include generation technologies such as Open Cycle Gas Turbines (OCGTs), storage options such as grid-scale Lithium-Ion batteries and demand response.

Additionally, since the NEO was amended in September 2023 to explicitly include an emissions reduction objective, we will also consider the cost of emissions in our analysis where they might meaningfully impact results.

Scenarios will be defined to cover the range of reliability risks relevant to the period covered by the 2026 RSSR

The power system reliability risk profile is changing. A more diverse range of risks are emerging/have emerged which are relevant to the efficient reliability standard and settings. Weather-driven reliability risks are changing due to higher penetrations of variable renewable generation, and climate change is increasing the frequency and/or severity of some extreme weather events[85]. Furthermore, as firm thermal capacity exists the system, a risk profile based on the failure of a small number of large base load units is no longer as prominent. Modelling this changing risk profile is important to reveal the range of different shapes (frequency, duration, depth) of USE relevant to determining the form and level of the reliability standard and associated market price settings. The Panel will identify scenarios for this purpose.

Uncertainty will be addressed through sensitivity analysis and extended weather modelling

A key challenge for modelling to inform the 2026 RSSR is to manage and understand uncertainty. The Panel notes that the standard and settings are informed by forecasts of market conditions seven years into the future in the context of a rapidly changing power system:

- with increasing penetrations of variable renewable resources
- changing load patterns and energy use characteristics
- increasing significance of energy limited storage.

85 Australian Climate Service, available at: https://www.acs.gov.au/pages/climate-future

We will assess sensitivities to understand uncertainty in outcomes associated with each scenario. Sensitivity analysis will allow the Panel to understand how outcomes change given assumptions or other parameters where material uncertainty on the true or forecast value.

The modelling work for the Panel's review of the Form of the Reliability Standard also revealed that weather plays an extremely important role in determining USE outcomes. Using modelling techniques developed for that review, the Panel will run the market model through a significant number of weather reference years to produce a greater sample of outcomes which are also more variable and may more closely reflect changing weather conditions due to climate change.

6.2.2 Key inputs

The base case modelling will directly leverage AEMOs published documents and PLEXOS models including the:

- 2024 Integrated System Plan (ISP)[86]
- 2024 Electricity Statement of Opportunities (ESOO)[87]
- 2025 ESOO (when it is released in August 2025)
- 2025 Inputs Assumptions and Scenarios Report (IASR)[88].

We will also rely upon documents published by the AER, including the 2024 Values of Customer Reliability (VCR)[89] and the Value of Emissions Reductions (VER)[90]

The key inputs that come from these documents and other sources are summarised in Table 6.1 below:

Table 6.1: Modelling inputs

Input	Description or source	Additional details
Generation and storage build	From AEMO's 2025 ESOO	These dates will be cross-checked with AEMO's Generation Information publication
Generation and storage new entrants	Generic new entrants and policy-based new entrants from AEMO's 2024 ISP Step Change scenario	Note that in order to generate sufficient USE to study, some new build generation and storage assets may be excluded in the initial modelling
Generation and storage retirement	From AEMO's 2025 IASR and AEMO's 'Expected Closure Year' publication	Note that the AEMO's expected retirement dates as published in the IASR may be different to those published in the latest 'Expected Closure Year'

86 2024 Integrated System Plan (ISP), available at: https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp

87 NEM Electricity Statement of Opportunities (ESOO), available at: https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/nem-electricity-statement-of-opportunities-esoo

88 Draft 2025 Inputs Assumptions and Scenarios Consultation, available at: https://aemo.com.au/consultations/current-and-closed-consultations/2025-iasr

89 Values of Customer Reliability 2024, available at: https://www.aer.gov.au/industry/registers/resources/reviews/values-customer-reliability-2024

90 Valuing emissions reduction - Final guidance and explanatory statement - May 2024, available at: https://www.aer.gov.au/documents/aer-valuing-emissions-reduction-final-guidance-and-explanatory-statement-may-2024

Input	Description or source	Additional details
		publication. We will outline where we have applied judgement in updating the closure dates in the model, which will depend on timing and materiality to the results.
Transmission upgrade timings	From AEMO's 2025 IASR	
CER forecasts, including Virtual Power Plants (VPPs)	From AEMO's 2025 IASR	
Demand side participation (DSP)	From AEMO's 2025 IASR	
Technical settings including outage and maintenance rates for generation, storage and transmission	From AEMO's 2025 IASR	We will run the model over different Monte-Carlo samples of outage rates
Bidding behaviour	SRMC bidding will be applied to variable renewable energy generators and hydro generators. Bidding behaviour for coal and gas will be based on historical bidding data and dispatch outcomes. Battery bidding will be calibrated to ensure that batteries operate realistically.	We will also consider other methods for generating reasonable dispatch outcomes and prices such as applying a price uplift based on reserve margins
Constraint equations	Constraint representation is taken directly from AEMO's 2025 ESOO PLEXOS model	
Demand forecasts	From AEMO's 2025 ESOO	We will use AEMO's PoE10 and PoE50 demand traces
VRE output forecasts	From AEMOs' 2025 ESOO, extended through AEMC's additional weather reference year work	An additional 85 years of VRE output traces have been produced by the AEMC
Hydro inflows	From AEMO's 2025 ESOO	
Generation and storage cost data	From AEMO's 2025 IASR	Originally taken from CSIRO's GenCost report
Value of customer reliability	From AER's VCR report	
Value of emissions reduction	From AER's VER report	

6.2.3 Key assumptions and limitations

The Panel is aware of the following limitations of the modelling in addressing the scope of work and broader objectives of the RSSR. These limitations and the assumptions used to address them are summarised in Table 6.2 below.

Table 6.2: Modelling assumptions and limitations

Area	Assumption / limitation	Description
Modelling inputs	The base case inputs are sourced from AEMO's Step Change scenario using the ESOO and ISP	Base case assumptions regarding demand, generation mix, demand-side participation, transmissions timing and other critical generator and market components are taken from AEMO's Step Change scenario. These assumptions may change in the future, and could potentially lead to very different reliability outcomes and hence reliability settings.
	Weather reference years are based on historical data and do not take into account climate change	We have extended the set of weather years in the model from AEMO's default 13 years to an additional 84 years, which represents a much larger statistical sample. However, climate change is likely to impact weather both in terms of short-term outcomes and longer-term trends, and as such we are unable to fully capture this uncertainty in the modelling.
General Approach	The modelling framework only considers total system costs	The modelling framework only considers total system costs and revenues for the marginal new entrant. Broader issues outside of the modelling scope including regulatory stability, market integrity and financial risks, contract market implications, new entrant revenue predictability, and investment price signals are not fully captured in the modelling exercise.
	All marginal new entrant technologies except storage are assumed to operate only around times of USE	The modelling assumes that the reliability settings should be high enough such that new entrants will earn enough revenue to cover their costs if they operate only during days when there is unserved energy. This assumption also simplifies the modelling task as revenues need only be calculated for a small number of periods. This assumption does not hold for storage, since batteries have a much lower start-up cost than traditional peaking generators and are likely to participate in the market regardless of whether there is USE or not.
	Spot prices may not be explicitly modelled through PLEXOS	Energy prices are used as an input into both phases of the modelling to calculate: 1. revenues for periods outside of MPC, CPT, MFP and APC events 2. total system cost As future spot prices are heavily dependent on market and bidding dynamics which are increasingly uncertain in the future, spot price modelling is becoming increasingly complex. In light of this increasing uncertainty, we may take a different approach to modelling spot prices and revenues, either by:

Area	Assumption / limitation	Description
		1. assuming that revenues outside of periods of USE will be similar to historical revenues, or 2. simplifying the approach to generating spot prices by using a statistical approach to predict spot prices from variables such as reserve margins We will run a number of tests on the two approaches above, as well as modelling spot prices directly in PLEXOS to determine which approach works best. This will then be tested with stakeholders in the Draft Report. Note that there is also an implicit assumption that marginal new entrants (excluding storage) will not materially impact the spot price in periods outside of USE.
	The impact of changing reliability settings on existing generators is not modelled	Significant changes to the reliability settings are likely to shift revenue outcomes and supply and demand dynamics modelled in the market modelling step. The impacts of this on existing and committed generators are out of scope.
	Modelled revenues are based on spot markets only	The revenue condition considered in both the market and optimisation model steps do not account for underlying contracts and other portfolio dynamics which can be significant in the context of generator bidding and new entrant investment. The revenues are also only assessed over the Review Period only which is significantly shorter than the investment decision horizons of new entrant plants.
	FCAS and other ancillary service revenues will be based on simplified modelling	Ancillary services costs and revenues will be estimated using historical data and applying forward assumption. While this was a substantial portion of early battery projects, it is generally accepted that revenues from FCAS streams will decline over time, and a reduction assumption will be applied.
	The value of emissions will be taken into account in the modelling	In both phases of the modelling we will consider the value of emissions where appropriate. In the first stage of the modelling (where the appropriate level of the reliability standard is set) we will include the value of emissions in the calculation of the total system costs.
Market Modelling	The number of samples is limited	The optimal reliability settings are highly dependent on the USE distributions. There is a risk the outcomes based on the number of samples run may not have reached convergence, however the higher number of weather reference year samples has ameliorated this issue somewhat.
	Bidding behaviour may	Bidding dynamics in the model are based on SRMC and historical bidding behaviour at the generator level. This does not

Area	Assumption / limitation	Description
	change in the future	take into account portfolio dynamics or changing bidding behaviour as the NEM transitions.
	Modelling is done at a 30min time step	The market modelling is carried out at 30-minute resolution whereas there may be ramp rate implications for a system that is increasingly supplied from variable renewable energy sources. Sensitivity analysis in the 2022 RSSR revealed that moving from a 30min time step to a 5min time step leads to far higher computational costs but a low material impact on results, therefore we consider the 30min interval to be appropriate.
	PLEXOS modelling has a perfect foresight assumption	The nature of the PLEXOS optimisation software is such that the model has perfect foresight, i.e demand and other variables in the future is already known in the model. To alleviate some impacts of this perfect foresight, storage assets will be de-rated either by setting minimum and maximum states of charge, setting a minimum arbitrage spread, or by other methods such as those identified by AEMO in Appendix A4 of the 2024 ISP.
Optimisation Modelling	Inter-regional pain sharing impacts are not included	The optimisation model assumes that when one region has unserved energy, there is no ability to import more energy from neighbouring regions. Analysis of the modelled USE outcomes in the 2022 RSSR found less than 0.2% of all USE intervals where the interconnections into the region experiencing USE was not at the import limit. This is consistent with the definition of USE as defined in AEMO's ESOO modelling methodology and implies each region must build its own new entrant capacity to address its own reliability gap. Pain sharing can potentially impact the USE distribution but would also be limited by network constraints across two neighbouring regions.

Question 14: Modelling principles, inputs, assumptions and limitations

- Do stakeholders agree with the principles, inputs, assumptions and limitations listed in this section? If not, why?
- Are there any additional principles, inputs, assumptions or limitations that the Panel should consider in this review?

6.3 Sensitivities

This section describes the modelling sensitivities that the Panel is considering running to ensure that results are robust.

The initial list of sensitivities considered by the Panel is detailed below. These will be run over all phases of the modelling.

Generation costs

The build costs of new entrant technologies play a major role in the setting of the reliability standard and market settings, so we will run sensitivities on these including costs due to supply chain delays. The main source will be the CSIRO Gencost Report but additional literature reviews may also consider wider supply chain issues.

New entrants

The reliability standard and settings are based on incentivising a marginal new entrant technology. We will use several different new entrant technology types including gas turbines of different sizes and fuels and different size and capacity batteries. We may also consider demand-side participation.

Weather

We will use our newly internally developed set of 85 historical weather reference years for existing and sampled proposed projects to ensure our results are robust and consider a range in weather outcomes. While it is expected that most runs would not produce USE and the standard is determined from the average, individual runs may provide insight to the potential range of outcomes when they occur.

Value of customer reliability

The VCR is the key input that determines the cost of USE. We will run sensitivities on this value, including using the residential and industrial VCR level. Together with the alternate costs and technology values, these will add to the definition of an envelope of reliability and cost outcomes.

Generator outages

We propose to follow previous work on the Panel's review of the form of the standard[91] which showed that generator reliability was less important than weather variability. A Monte Carlo forced outage simulation approach would require a very large number of random draws to provide confidence in the outcomes. A de-rating approach is also not seen as appropriate as it would potentially result in additional depth of USE events without revealing any contextual probability for reliability. Given these considerations, we may run a smaller subset of Monte-Carlo outage samples, though we may increase the number of samples if it is found that they are material to results.

Value of emissions reduction

We will run sensitivity analysis on the value of emissions reduction to understand how significantly this impacts the level of the reliability standard and the subsequent reliability settings. The base case values will be taken from AER's value of emissions publication, but we will run sensitivities varying both the values in absolute terms and also how they change over time.

Question 15: Feedback on sensitivities

- Do stakeholders agree with the sensitivities listed above?
- Are there other sensitivities the Panel should consider for this review?

91 Review of the form of the reliability standard and APC, available at: https://www.aemc.gov.au/market-reviews-advice/review-form-reliability-standard-and-apc

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
Commission	See AEMC
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEO	National electricity objective
NERL	National Energy Retail Law
NERO	National energy retail objective
NGL	National Gas Law
NGO	National gas objective

A Reliability in the NEM

The term reliability has a distinct meaning in the NEM and is delivered through a framework that has the reliability standard (standard) and market price settings (settings) at its core.This appendix provides background and context for the 2022 RSS review and introduces and discusses:

- power system reliability in the NEM
- the current NEM framework for delivering reliability of which the standard and settings are an important part, and
- reliability outcomes to date in the NEM.

A.1 What is power system reliability in the NEM?

As outlined chapter 3, a reliable power system has an adequate amount of capacity (generation, demand response and interconnector capacity) to meet customer needs. This requires adequate investment in capacity, including sufficient investment to cover generator retirements, as well as an appropriate operational framework so that supply and demand can be maintained in balance at any particular point in time.

The core objective of the existing reliability framework in the NEM is to deliver efficient reliability outcomes through market mechanisms to the largest extent possible.[92] These mechanisms provide strong financial incentives for participants (generators, retailers, aggregators and customers) to make investment, retirement and operational decisions that support reliability. In addition, AEMO provides information to participants on projections and forecasts relevant to reliability outcomes and also has tools that it can use to intervene, when needed, to maintain reliability.

A.1.1 Power system reliability is distinct from power system security

Power system reliability in the NEM is distinct from power system security but both involve 'keeping the lights on'. To achieve this, the power system overall needs to be:

- Reliable- have enough capacity (generation and networks) to supply customers, and
- Secure - able to operate within defined technical limits, even if there is an incident such as the loss of a major transmission line or large generator.

While "security" relates to the stability of the power system in terms of its ability to withstand disturbances, "reliability" of the power system is about having sufficient resources to generate and transport electricity to meet customer demand.

While these two concepts are often described seperately they are closely related.

- A reliable power system is one that has a high likelihood of fully servicing the electricity needs of customers.
- A secure operating state is one where the power system is in, or will return, to a satisfactory operating state following a credible disturbance.[93]

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. The NER allows AEMO to

92 Reliability Panel, Information Paper: The reliability standard, current considerations, 12 March 2020, Sydney.

93 Clause 4.2.4(a) of the NER. A satisfactory operating state is defined in Clause 4.2.2 of the NER. The power system is in a satisfactory operating state when all vital technical parameters (such as voltage, frequency, and equipment loads) are within their design limits and ratings

undertake involuntary load shedding, in order to return the power system to a secure operating state. The NER therefore empowers AEMO to sacrifice reliability outcomes to maintain the power system in a secure state.

As noted in Chapter one, the Panel is required to focus on the reliability of the power system when conducting the RSS review. Specifically, the level of reliability provided by power generation and inter-regional transmission assets.[94]

A.1.2 Reliability events and the definition of unserved energy in the NEM

If there is an event or incident its classification as a system security or reliability event generally depends on the cause of the event. The NER defines the circumstances in which unserved energy (USE) is counted for the purposes of assessing reliability. Clause 3.9.3C of the NER specifies that USE for the purposes of the reliability standard includes energy demanded but not supplied due to power system reliability incidents resulting from:

- A single credible contingency event on a generating unit or an inter-regional transmission element that may occur concurrently with generating unit or inter-regional transmission element outages,[95] and
- Delays to the construction or commissioning of new generating units or inter-regional transmission elements, including delays due to industrial action or acts of God (such as extreme weather events).

USE *excludes* energy demanded but not supplied due to power system security incidents resulting from:

- Multiple contingency events, protected events or non-credible contingency events on a generating unit or an inter-regional transmission element,[96] that may occur concurrently with generating unit or inter-regional transmission element outages,
- Outages of transmission network or distribution network elements that do not significantly impact the ability to transfer power into the region where the USE occurred, and
- Industrial action or acts of God at existing generating facilities or inter-regional transmission facilities.

The NER provides some additional guidance on what should be considered to be a 'power system reliability incident'. Clause 3.9.3C(c) of the NER specifies that a "power system reliability incident" is an incident that AEMO considers would have been avoided only if additional active energy had been available to the relevant region or regions from generation, demand response or inter-regional transmission elements.[97]

The loss of customer load due to multiple contingency events, radial transmission line outages, industrial action or acts of God at existing generation or inter-regional transmission facilities are therefore not included. As an example, load shedding in Queensland following the fire at the Callide Power station and associated loss of transmission lines is not included as USE for the

94 Clause 3.9.3C of the NER.

95 Clause 4.2.3(a) of the NER defines a contingency event an event affecting the power system which AEMO expects would be likely to involve the failure or removal from operational service of one or more generating units and/or transmission elements. (b) A credible contingency event is one the occurrence of which AEMO considers to be reasonably possible in the surrounding circumstances including the technical envelope.

96 Clause 4.2.3(f) of the NER defines a protected event as a non-credible contingency event that the Reliability Panel has declared to be a protected event under clause 8.8.4, where that declaration has come into effect and has not been revoked. Protected events are a category of non-credible contingency event

97 The Panel acknowledges the complex relationship between a 'reliability' incident and a 'security' incident. For example, if a reliability incident such as a shortfall in available capacity in a region is not addressed through an action like manual load shedding, this would result in the power system being in an insecure operating state. This in turn could trigger a security incident following a contingency which may result in a major supply disruption such as operation of the automatic load shedding scheme or even a system black. As such, while these events are classified separately, the Panel notes that both may result in loss of supply and therefore are more or less indistinguishable for consumers.

purposes of assessing the reliability standard as it occurred as a result of a multiple non-credible contingency event.

A.2 Current framework for delivering reliability in the NEM

A reliability framework requires a trade-off between the prices paid for electricity and the cost of not having energy when it is needed. The need to balance these costs illustrates that the most efficient level of reliability is not having zero percent USE. Such an approach would be inefficient as the cost of supplying energy would exceed the value placed on it by customers. As introduced in Chapter one, the level of the standard is based on the level of USE that represents an efficient economic trade-off between reliability and affordability based on what customers value.

A.2.1 Market incentives

Market incentives are the foundation of the current NEM reliability framework. Prices in the spot and contract markets provide signals for generation and demand-side resources to be built and dispatched, as well as provide information about the balance of supply and demand across different places and times. As the expected supply/demand balance tightens, spot and contract prices will rise, within the price envelope defined by the market price settings. A rise in market prices affects operational decisions and provides the incentive for entry and increased production, addressing any potential reliability problems as or before they arise.

Spot market

The NEM utilises a gross pool (mandatory participation) energy-only market design. Generators sell all the electricity they produce through the wholesale market for electricity, which matches supply to demand on a five-minute basis.[98] From market participant bids and offers to consume or supply electricity at certain prices, the national electricity market dispatch engine (NEMDE) determines the lowest cost combination of scheduled generation or demand to meet customer load, given the physical limitations of the power system. AEMO then issues dispatch instructions and wholesale market prices are determined from the generator offers or demand bids to supply the last MW of customer load in the NEM.[99]

The pricing framework for the NEM allows for price variability within an envelope established by the settings. The market price settings therefore act to limit the prices that generators receive for supplying electricity and the revenue potential from investment decisions. The level of the market price settings therefore need to carefully balance the reliability benefits of efficient wholesale market price signals with the financial risks faces by market participants.This trade off, and related considerations, are discussed in more detail in chapter 6.

Contract market

Reliability outcomes in the NEM are facilitated by financial contracting for risk management.[100] The contracts, or financial derivatives, market supports reliability in the NEM by providing a means for retailers and generators to manage their exposure to spot prices, by allowing participants to trade uncertain and variable spot market prices for fixed prices for a specific period (e.g., a month, quarter, year or longer). Contract markets create incentives for reliability including on:

98 NEM market design includes 10 markets for frequency control ancillary services (FCAS) that regulate frequency by balancing supply and demand for electricity on sub five-minute timescales.

99 This framework is underpinned by the economic principle that the most efficient investment decisions are made if market participants can make their own decisions in response to marginal prices. As such, the market price provides the signals needed for investors to make informed investment and divestment decisions.

100 While the financial markets this contracting occurs through are not part of the formal wholesale electricity market operated by AEMO, contract markets are still a critical element of the NEM reliability framework.

- operational timescales - generators who have sold contracts are incentivised to be available when needed (i.e. when spot prices are high), in order to be dispatched to at least the volume of those contracts so the revenues earned in the spot market fund payouts on their contract positions. This incentive to 'turn up' is heightened during high price/tight demand supply periods, which is precisely when the system most values the generator's output.
- investment timescales - forward contracting lowers the cost of financing investment in generation capacity, which lowers the cost of achieving and maintaining system reliability. Contracts provide generators with a steadier stream of revenue than the spot market. A steadier stream of revenue reduces the risks to parties providing funding to generators, such as debt and equity holders. This lowers the overall cost of capital required to finance the project and lowers the cost of the new generation capacity.

Prices in the contract market also reveal participant expectations regarding the value of, and risk associated with, additional resource investments. Price signals in the contract market therefore complement those in the spot market in signalling the value of new entrant investment to support reliability outcomes.

A.2.2 AEMO information and intervention processes

A key role for the reliability standard is to guide various decisions made by AEMO in its role as the system operator. AEMO is responsible for operationalising the reliability standard through its forecasting and operational processes. AEMO's Reliability Standard Implementation Guidelines set out how AEMO implements the reliability standard.[101] AEMO uses the reliability standard in several core ways including to:

- Publish forecasts regarding reliability and its components to inform market participants, network service providers and potential investors, over ten year, two year and six day outlooks,[102] and
- Monitor demand and generation capacity and, if necessary, initiate action in relation to a relevant AEMO intervention event to maintain the reliability of supply and power system security where practicable.

Information processes

AEMO is required by the NER to publish various materials which provide information to market participants – and any other interested parties – on matters pertaining to the reliability standard; that is, over and above the information contained in contract and spot market prices. This information is an important part of the existing reliability framework and helps guide and inform market participants' expectations of the future, enabling more efficient investment and operational decisions.

The purpose of this information is to inform the market of prevailing and forecast conditions, particularly when reserves may be running low, in order to elicit a market response. For example, the electricity statement of opportunities (ESOO) identifies potential shortages of generation over a 10-year forecast time horizon to prompt the market to make new investments to alleviate any forecast reliability problems. AEMO also publishes relevant information through its Projected Assessment of System Adequacy (PASA) and pre-dispatch processes.[103]

101 AEMO, Reliability Standard Implementation Guidelines, December 2020.
102 AEMO, Reliability Standard Implementation Guidelines, December 2020, pp. 8-22.
103 Clauses 3.7.2(f)(6) and 3.7.3(h)(5) of the NER.

In operational timescales, AEMO issues lack of reserve (LOR) notices to inform the market when supply scarcity conditions apply. AEMO declares LOR conditions when it determines there is a non-remote probability of unserved energy due to a shortfall of available capacity reserves at a given time in the assessment horizon.[104] LOR notices are either LOR1, LOR2, and LOR3 in order of increasing supply scarcity.[105]

Intervention mechanisms

As effective as information processes can be in delivering the desired reliability outcomes through market incentives, they do not always elicit the outcomes needed. If the market fails to respond to the information AEMO publishes, AEMO may have no other choice but to intervene in the market more directly.

AEMO therefore has various 'last resort' intervention powers that enable it to deal with actual or potential shortages of varying degrees of severity. Under the NER, these intervention mechanisms include the following:

- AEMO has reliability and emergency reserve trader (RERT) obligations. These allow AEMO to contract for reserves ahead of a period where reserves are projected to be insufficient to meet the reliability standard. AEMO can dispatch/activate these reserves to manage power system reliability and, where practicable, security.[106]
- In addition, if there is a risk to the secure or reliable operation of the power system, AEMO can use directions or instructions under NER clause 4.8.9 to:
  - Direct a generator to increase its output, if this is possible and can be done safely.
  - Direct a large energy user, such as an industrial plant, to temporarily disconnect its load or reduce demand.

If there continues to be a shortfall in supply, even after these measures have been implemented, AEMO may require involuntary load shedding as a last resort to maintain the power system in a secure state. It does this by instructing a transmission network service provider to arrange for the interruption of customer load.

These intervention mechanisms provide an important ultimate safety net when there is insufficient generation capacity to maintain adequate reserves above demand, to minimise the adverse impacts on customers of involuntary load shedding. Although AEMO would be expected to do all that it necessarily can to avoid load shedding using the above intervention mechanisms, there will be times when involuntary load shedding will be unavoidable because the level of investment and operational decisions are being driven by a reliability standard that is non-zero.

A.3 NEM Reliability to date

The NEM has historically enjoyed a very high level of reliability. However, reliability issues sometimes occur when the balance of supply and demand in a region is tight. The increase in variable renewable generation is seeing the power system supply and demand balance continue to become more sensitive to weather conditions than has historically been the case.

104 In the NEM, reserves are made available by the market as part of usual operation of the power system and expectations of future price outcomes in the energy market. Reserves refer to the amount of spare capacity available given amount of generation, demand and demand response at any point in time, and can be 'In market' from generators that are available to run, but because available capacity is greater than demand, are not called on to run, and 'Out of market' from the emergency reserves that AEMO procures through the reliability and emergency reserve trader (RERT) mechanism to be in standby

105 Clause 4.8.4 of the NER - additional information is available in AEMO's reserve level declaration guidelines, available here.

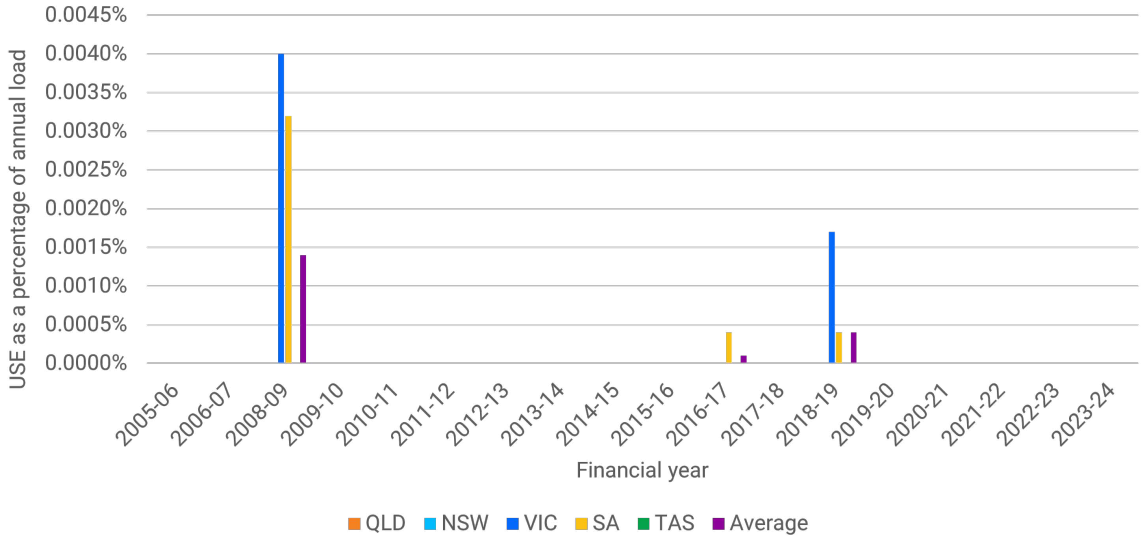
106 Clause 3.20.3 of the NER.

This section provides a summary of NEM reliability performance as context for the issues addressed in the main body of the document.

A.3.1 Unserved energy in the NEM

Over the past 17 years, reliability events in the NEM due to a lack of available capacity have been very rare. That is, there have been very low levels of actual USE across all NEM regions. The reliability standard has only been breached on an ex-post basis in 2008/09 in South Australian and Victoria, which was as a consequence of extreme weather conditions and reduced availability of Victorian generators and the Basslink interconnector.[107] The figure below shows actual USE levels across the NEM regions since 2005/06, illustrating the high level of reliability which has been provided by the NEM to date.

Figure A.1: USE is rare in the NEM and even less frequently breaches the reliability standard



Source: Panel analysis of AEMO data
Note: Reliability standard is 0.002% USE

In addition to the low level of unserved energy in the NEM to date, AEMO's 2024 Electricity Statement of Opportunities (ESOO) report forecasts no breaches of the reliability standard until 2032/33 under the sensitivity that includes actionable and anticipated developments, which is beyond the period relevant to this review.[108] This ESOO report however forecasts USE for New South Wales in 2033/34 will exceed the reliability standard, if further investment in new capacity or demand reduction was not forthcoming by that time.[109]

A.3.2 Reserve levels and lack of reserve notices

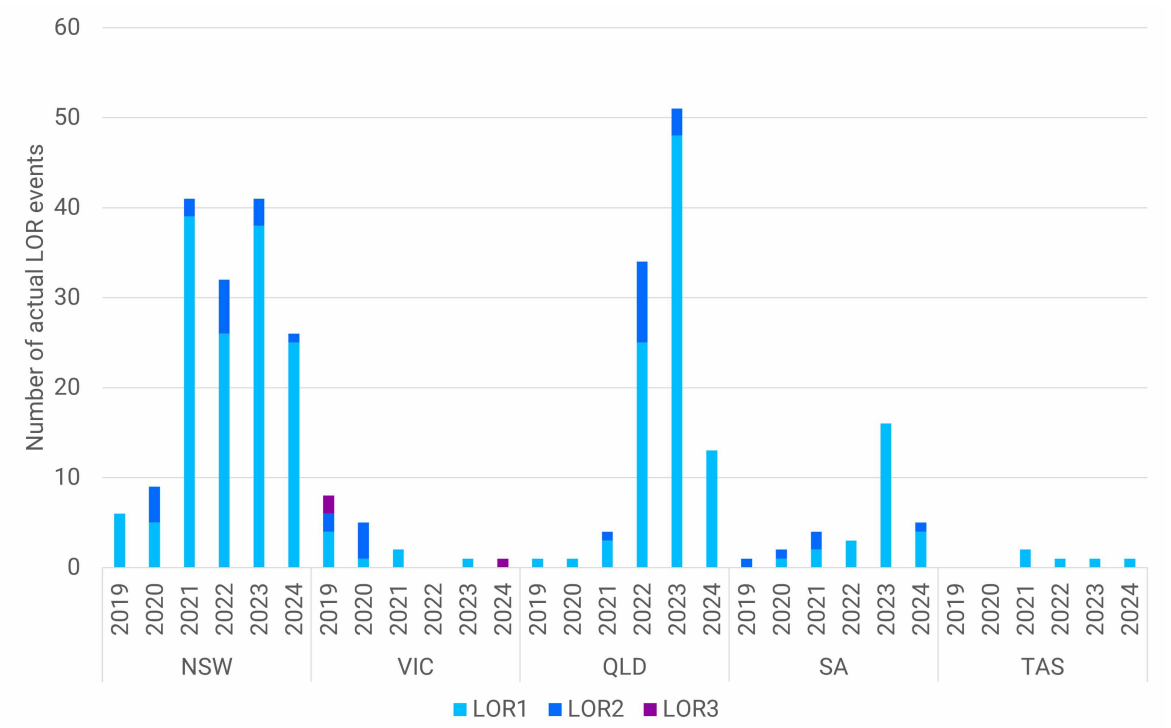
While the NEM continues to provide high levels of reliability, there is some evidence to suggest that reliability pressures may be increasing.

The 2022 RSSR Issues Paper noted a record number of lack of reserve (LOR) notices issued in recent years despite unserved energy levels being low and AEMO's ESOO indicative reliability

107 Reliability Panel, Annual Market Performance Review, May 2021, Sydney, p. 54.
108 AEMO, 2024 Electricity Statement of Opportunities, August 2024, p. 7.
109 AEMO, 2024 Electricity Statement of Opportunities, August 2024, p. 7

forecast showing expected USE levels below the reliability standard.[110] In all regions except Victoria, the upwards trend in LOR notices has continued.[111] The figure below shows LOR notices have occurred most often in Queensland and New South Wales, with Queensland in particular experiencing a sharp increase in LOR notices. While none of these regions have experienced any USE in the last two years, these LOR notices show that supply and demand conditions have been tighter, more often than in the past.

Figure A.2: LOR notices have continued to increase, particularly in Queensland and New South Wales



Source: Panel analysis of AEMO data

A.3.3 Reliability directions and RERT

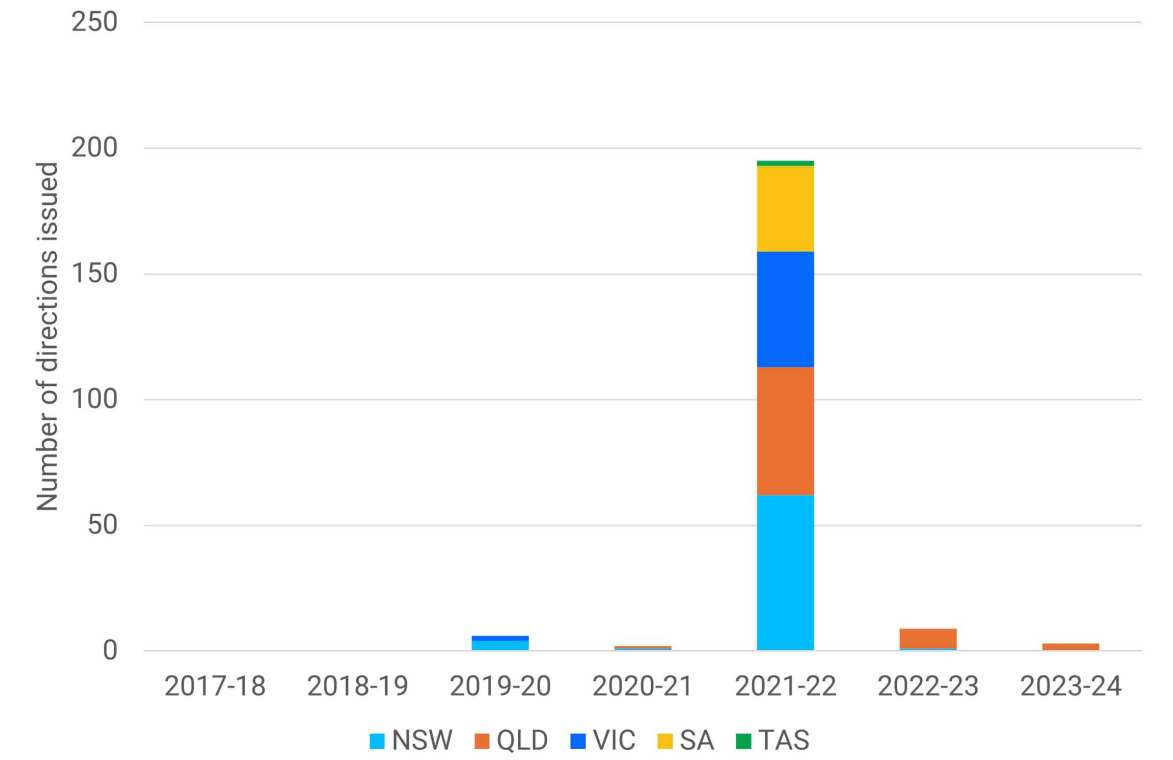
As outlined, AEMO is able to direct for reliability and dispatch the RERT in order to maintain the power system in a reliable state. AEMO issued RERT for the first time in South Australia in 2016/17. Since then, until 2021/22, AEMO issued reliability directions or activated RERT in only two other financial years, and never more than six times. However, in 2021/22, AEMO issued reliability directions or activated RERT 195 times. However, this is an extraordinary outlier that reflects the volatile market conditions and subsequent administered pricing period of June 2022, and the number of reliability directions and RERT activations returned to pre-2021/22 levels in 2022/23.[112]

110 Reliability Panel, 2022 Reliability Standard and Settings Review, Issues paper, 27 January 2022, p. 17.

111 LOR notices by region and financial year is on Slide 32 in the 2023 Annual Market Performance Update.

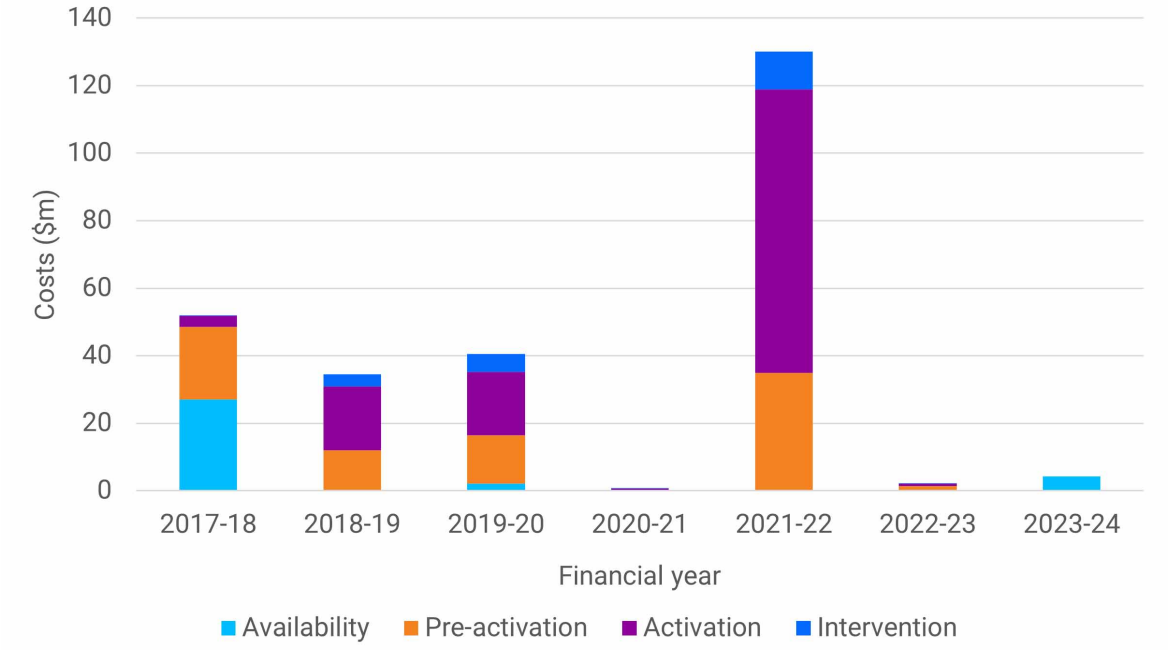
112 RERT costs and the number of RERT issues by region and financial year is on Slide 33 in the 2023 Annual Market Performance Update.

Figure A.3: 2021/22 is an outlier in the number of reliability directions issued by AEMO



Source: Panel analysis of AEMO data

Figure A.4: RERT activation costs in particular rose sharply in 2021/22



Source: Panel analysis of AEMO data

Stakeholders should however note that RERT will not be a consideration for the Panel in the 2026 RSSR as it may only recommend an MPC and CPT that will allow the reliability standard to be satisfied without the use of AEMO's powers to intervene through reliability directions and RERT.[113]

The Reliability Panel's Annual Market Performance Update published in June 2024 provides more detail on reliability outcomes over the period 2022/23.[114]

113 Clause 3.9.3A(f) of the NER.

114 AEMC, Annual Market Performance Review, market update, 27 June 2024.