AEMC

REVIEW

Reliability Panel AEMC

Final report

Review of the System Restart Standard

11 December 2025

Inquiries

Reliability Panel
Australian Energy Market Commission
Level 15, 60 Castlereagh Street
Sydney NSW 2000

E panel@aemc.gov.au
T (02) 8296 7800

Reference: REL0091

About the Reliability Panel

The Panel forms part of the AEMC's institutional arrangements and is comprised of members who represent a range of participants in the National Electricity Market, including small and large consumers, generators, network businesses, retailers and AEMO. 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 key 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 live and work. The AEMC office is located on the land of the Gadigal people of the Eora nation. We pay respect to all Elders past and present, and to the enduring connection of Aboriginal and Torres Strait Islander peoples to Country.

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Reliability Panel members

Rainer Korte (Chair), Commissioner, AEMC
Sally McMahon (Acting Chair), Commissioner, AEMC
Stewart Bell, Executive General Manager, Operations and Planning, Powerlink Queensland
Suzanne Falvi, Executive General Manager, Corporate Affairs, AGL
Joel Gilmore, General Manager, Regulation and Energy Policy, Iberdrola Australia
Ken Harper, Group Manager, Near-Time Operations, AEMO
Craig Memery, Senior Advisor, Energy and Water Justice, Justice and Equity Centre
Melissa Perrow, General Manager, Energy, Brickworks Limited
Damien Sanford, Chief Executive Officer, Polar Blue
Mark Vincent, Chief Operating Officer, SA Power Networks
Rachele Williams, Director, Plenary Group

Summary

1 The Reliability Panel (Panel) has:

- **determined** a revised system restart **standard** (Standard), to reflect current conditions and to provide flexibility for AEMO to procure black start and restoration support services
- **made** final **recommendations** to strengthen the current system restart regulatory framework and actions by the Australian Energy Market Operator (AEMO) to support improved system restart preparedness, including proposed changes to the rules that would clarify requirements for forward-looking restoration planning and strengthen frameworks to validate this plan.

2 The proposed revisions to the Standard and recommendations for future work are informed by AEMO's System restart technical advice that describes the challenges and opportunities presented by the transitioning power system and stakeholder feedback provided throughout this review.

3 System restart refers to the provision of a capability within the power system to re-energise and restore the system following a major supply disruption or black system event. Black system events are rare, but they can and do occur, and the consequences for our modern societies can be severe. Australia experienced a black system event in South Australia in 2016, when storm damage led to a state-wide blackout that lasted around 8 hours. Another recent example of a black system event is the widespread outage in Spain and Portugal in April 2025, disrupting electricity supply to more than 50 million customers for around 16 hours.

4 Under the National Electricity Rules (NER), the Panel is responsible for determining the Standard, which guides AEMO's procurement of system restart ancillary services (SRAS) necessary to re-energise generation and network elements to restore the power system following a major supply disruption or black system event.

5 This final determination responds to the Australian Energy Market Commission's (AEMC) terms of reference, which requested the Panel undertake two tasks:

1. **Task 1**: review and update the Standard to reflect an up-to-date understanding of the power system.
2. **Task 2**: review the system restart regulatory framework and make recommendations on the appropriateness of the framework in the context of the future power system envisaged in the AEMO integrated system plan.

The Panel's final determination is informed by AEMO's system restart technical advice

6 The final Standard and recommendations are informed by *System restart technical advice (Technical advice)* from AEMO that sets out how system restoration could work in a future power system dominated by renewable and distributed generation technologies. AEMO's *Technical advice*:[1]

- recommended amendments to the Standard to support increased flexibility for AEMO to procure SRAS, including black start and restoration services
- provided commentary on the future of system restart and recommendations for potential changes to strengthen the system restart regulatory framework.

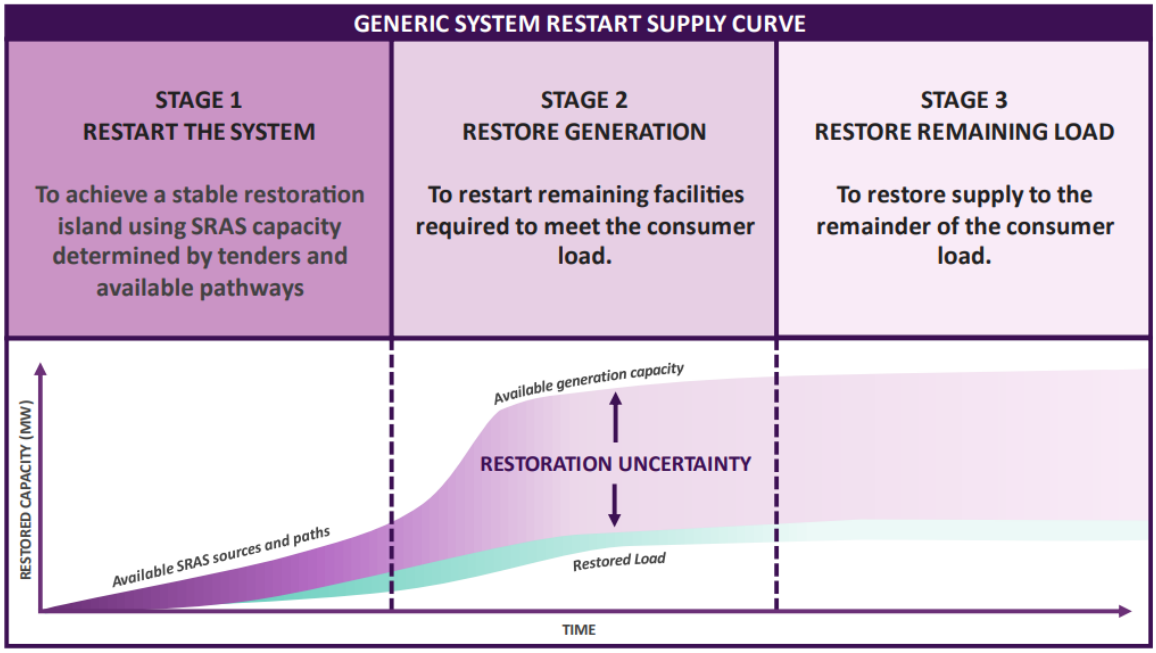
1 AEMO, 2025. System restart technical advice. p.6.

7 AEMO's advice provided an updated description of the conceptual process for restarting the power system, over three stages:

- **Stage 1: Restart** the system by achieving stable restoration islands, using SRAS capacity and available restoration pathways
- **Stage 2: Re-energise** remaining transmission and generation facilities
- **Stage 3: Restore** supply to the remainder of consumer load.

8 The general restoration process can be represented graphically as shown in Figure 1 below.

Figure 1: Conceptualised system restoration process



Source: AEMO,2025. System restart technical advice. p.4.

The Panel sought feedback on its draft standard and recommendations

9 In September 2025, the Panel published a draft determination and draft Standard on the system restart regulatory framework.

10 The Panel's draft Standard sought to provide flexibility for AEMO to procure black start and restoration support services, and was guided by the SRAS Objective and the long-term interest of electricity consumers. The Panel considered that the current system restart regulatory framework, alongside the draft Standard, provided AEMO with sufficient flexibility and guidance to deliver adequate system restart capability through the energy transition. It did not identify a clear need for changes to the regulatory framework, although it wanted to test that with stakeholders.

11 The Panel received 14 submissions in response to the draft determination. Overall, stakeholders supported the draft Standard and draft recommendations related to procurement and investment, and transparency and reporting. However, stakeholders considered the Rules framework with respect to SRAS testing and local black system procedure (LBSP) frameworks could be strengthened to better support effective system restart capability.

12 This feedback has informed the Panel's final Standard and final recommendations.

Task 1 - The revised Standard

13 The Panel has determined a revised final Standard to provide flexibility for AEMO to procure black start and restoration support services

14 Under the NER, the Panel is required to determine, modify as necessary and publish the Standard. The Standard specifies the time, level and reliability of restoring the generation and transmission system following a major supply disruption that results in an uncontrolled full or partial power outage in one or more electrical sub-networks in the NEM.[2] The Standard provides a target for the procurement of SRAS by AEMO.[3] It is a procurement standard rather than an operational standard.

15 The final Standard addresses AEMO's recommendations, responds to stakeholder feedback and seeks to provide improved guidance and flexibility to support future SRAS procurement and planning to meet the needs of the changing power system. We understand the revised Standard will guide AEMO's next SRAS procurement round, which is expected to commence in mid-2026.

16 In considering stakeholder feedback on the draft Standard, the Panel makes the following updates in this final Standard, while retaining all other elements of the draft Standard:

- minor amendments to the wording in the Introduction of the Standard to include a stronger reference to restoration support services
- inclusion of an additional criterion in the Guidelines for Assessing Diversity of Services (Section 9 of the final Standard), for AEMO to identify systemic risks relevant in determining the aggregate reliability of SRAS in an electrical sub-network
- revisions to clarify that AEMO can consider additional SRAS procurement under the guidance from the relevant *jurisdictional system security coordinator* (JSSC) in relation to the strategic location of SRAS for each electrical sub-network and the existence of any sensitive loads.

17 The final Standard retains all other elements from the draft Standard. The revised elements of the final Standard are set out in Table 1.

18 The Panel's determination is guided by the SRAS Objective in the long term interest of electricity consumers

19 The Panel considers that the proposed changes to the revised Standard are in the long-term interests of consumers. In making this final determination the Panel has assessed the trade-off between the benefits of a secure and resilient power system and the costs of achieving this. The Panel has considered the risks and opportunities presented by a changing power system and the potential impact of a prolonged disruption of electricity supply on our modern digitised society. Given this context, the Panel considers that the amendments to the final Standard are important in minimising the potential impact of a major supply disruption or black system event in the NEM.

20 The revised final Standard is expected to deliver benefits for electricity consumers by:

- providing AEMO with increased flexibility around how it plans for the initiation of system restart. This will allow AEMO to consider new ways of initiating restart, including via use of smaller restoration islands or sub-sets of the grid.
- supporting the procurement of additional restoration support services to allow AEMO to address operational challenges throughout the restoration process. This is expected to

2 Chapter 10 of the NER defines a major supply disruption as the unplanned absence of voltage on a part of the transmission system affecting one or more power stations and which leads to the loss of supply to one or more loads. Under Chapter 10 of the NER, when the absence of voltage from a major supply disruption extends to a significant part of the transmission system affecting a significant number of customers, this is referred to as a black system.

3 NER, clause 3.11.7(b)

provide value to electricity consumers through increased assurance over restoration outcomes.

21 The Panel notes that some increase in SRAS expenditure is expected as a result of:

- the procurement of additional new black start and restoration support services to meet the revised Standard
- costs associated with trialling and building new black start SRAS capability to replace the retirement of existing black start capable plant.

22 However, the Panel's economic analysis demonstrates that the value of providing an effective system restart capability exceeds the expected increases in SRAS costs.

23 The final Standard will take effect from 1 July 2027.

24 This timing aligns with that provided by the AEMC in the terms of reference for the Review, allowing sufficient time for AEMO to update the SRAS Guidelines and make arrangements to procure sufficient SRAS, including black start and restoration support services, to meet the revised Standard.

Table 1: Summary of changes to the current Standard

Element of the Standard	Overview of change and rationale
Restoration timeframe	The final Standard includes revised restoration targets for AEMO to procure SRAS to be able to: • form one or more restoration islands within 2 hours, of the major supply disruption. • restore supply to 50% of forecast annual average underlying demand within 8 hours, of the major supply disruption. These changes: • deliver on AEMO's recommendations to provide flexibility for the creation of stable restoration islands and move the target for the restoration of supply further along the restoration curve • reflect that forecast annual average underlying demand is proposed as the reference value for the level of supply restoration as this value is expected to reasonably reflect the level of supply required to be restored to meet customer demand • were supported by stakeholder feedback in response to the Panel's draft Standard.
Aggregate reliability	The final Standard includes revisions such that the aggregate required reliability of SRAS for the formation of restoration islands shall meet or exceed 95% in each electrical sub-network. The aggregate reliability of SRAS for Queensland, New South Wales, South Australia and Victoria is increased from 90% to 95%.[1] The aggregate reliability of SRAS for Tasmania is maintained at 95%. This change is supported by the Panel's economic analysis that shows that it would be economic to raise the aggregate reliability of SRAS in the mainland electrical sub-networks to drive additional procurement of SRAS in South Australia and Victoria, while enhancing reliability requirements in other electrical

Element of the Standard	Overview of change and rationale
	sub-networks. This change was supported by stakeholder feedback in response to the Panel's draft Standard.
Guidelines for the characteristics of restoration islands	The final Standard includes new guidelines on the high level characteristics of a restoration island. These guidelines support AEMO to form a restoration island within 2 hours of a major supply disruption, and are informed by AEMO's technical advice on the minimum attributes of stable restoration islands. Stakeholder feedback to the draft Standard welcomed the inclusion of these guidelines, however called for AEMO to provide further guidance on how these principles are applied in practice. The Panel recognises AEMO will need to consider providing further guidance on these guidelines in consultation with stakeholders, as it considers updates to the SRAS Guideline to reflect the revised Standard following this Review.
Guidelines for AEMO on assessing the diversity of services	The final Standard introduces an additional requirement for AEMO to consider systemic risks associated with common mode of failures, when considering the diversity of SRAS services. This addition supports AEMO in procuring SRAS to minimise the risk of systemic threats, that could present a common mode of failure risk for SRAS procured, ensuring procurement outcomes are resilient to both technical risks and systemic and operational vulnerabilities, and responds to stakeholder feedback to the draft Standard.
Consideration of sensitive loads	The final Standard includes additional guidance for AEMO to consult with the relevant JSSC in relation to the strategic location and number of SRAS for each electrical sub-network, and the existence of any priority or sensitive loads. AEMO would be required to report to the Panel in writing on how it considered any such advice by a JSSC. This change addresses stakeholder concerns in relation to the importance of restoring sensitive loads within critical timeframes, given the potentially significant economic costs, and provides clarity to AEMO in responding to JSSC advice, including consideration of the need for additional SRAS. This proposed approach aligns with the NER framework, including the requirement for: • the Panel to determine the Standard in accordance with the SRAS objective • JSSCs to advise AEMO of the priority of loads, including any sensitive loads in their region.

Note: [1] The Standard also sets specific regional specific requirements for the:

- New South Wales electrical sub-network: AEMO shall procure SRAS sufficient to also independently restart, form and maintain at least one restoration island north of Sydney within two hours of a major supply disruption without drawing power from the power system, with an aggregate reliability of at least 75 per cent.
- Queensland electrical sub-network: AEMO shall procure SRAS sufficient to also independently restart, form and maintain at least one restoration island north of Bundaberg within two hours of a major supply disruption without drawing power from the power system, with an aggregate reliability of at least 80 per cent.

Task 2 - Final recommendations to improve system restart preparedness

25 The Panel has undertaken a review of the regulatory framework and processes related to system

restoration in the NEM, and has set out its consideration of the system restart regulatory framework with respect to:

- **transparency and reporting arrangements**, to assess whether sufficient information is published for market participants to engage effectively in system restart planning
- **procurement and investment**, to assess whether the elements of the existing SRAS procurement arrangements enable AEMO to procure existing and new SRAS technologies
- **testing arrangements**, to assess the flexibility of the current framework to support the consideration of potential new restart pathways
- the **LBSP framework,** to assess whether it supports the provision of quality information to support AEMO's restart planning efforts
- **governance arrangements**, to assess whether the current governance arrangements and requirements for setting the Standard remain fit for purpose for the transition.

26 The Panel's draft determination found the existing Rules framework to be fit for purposes and made recommendations for AEMO to leverage the existing framework to improve system restart preparedness outcomes, in the context of the changing needs of the power system.

27 However, in considering stakeholder feedback, the **Panel recommends that a Rule change request be submitted to the AEMC on the following matters related to the system restart regulatory framework (the Rule change request)**:

- **transparency and reporting:** to clarify the inclusion of system restoration modelling and planning through the *transition plan for system security* (TPSS) and *electricity statement of opportunities* (ESOO).
- **testing arrangements:** to strengthen the system restoration testing framework to support deeper network testing
- **LBSP framework:** to strengthen the framework by clarifying the information provided and provide further effect to energy support arrangements.

28 **The Panel will work to develop the Rule change request,** to be submitted to the AEMC in the first half of 2026, to implement its recommendations for changes to the system restart regulatory framework, as per the scope proposed in Table 2. The Panel is permitted to submit rule changes to the AEMC in accordance with Section 91 of the National Electricity Law (NEL). Stakeholders will have the opportunity for further input on the changes recommended in this final report through the AEMC's usual rule change process.

29 The Panel also maintains its recommendations for AEMO, in relation to other areas of the framework. The final recommendations are set out in Table 2.

Table 2: Recommended actions to improve restart preparedness

Issue	Findings and final recommendations
Transparency and reporting	The Panel considers that transparent forward-looking restoration planning is necessary for signalling new SRAS investment. While the current NER requirements for SRAS reporting are mostly backward looking, the NER framework under the TPSS provides an opportunity for improved transparency and reporting on future system restart needs. The Panel notes that this forward-looking restoration planning is required for:

Issue	Findings and final recommendations

	• participants to consider decisions to invest in the required system restart capability
	• AEMO to substantiate the need for investment in new SRAS capability.
	Stakeholder feedback strongly supported the Panel's draft recommendations to enhance forward-looking transparency, noting this is essential for stimulating investment.
	The Panel recommends the Rule change request consider changes to the rules to put in place explicit provisions for AEMO to report on system restart needs through the TPSS and publish identified opportunities for SRAS investment in the ESOO, or a similar publication.
	The Panel considers this would:
	• provide certainty to market participants around the approach to the delivery of system restart capability through the transition
	• support AEMO in acquiring the appropriate resourcing to carry out this important function for system restart planning.
	The Panel considers that the scope of this Rule change request would require the AEMC to consider how the Rules could seek to support AEMO:
	• in setting out in the TPSS how it plans to deliver system restart capability through the transition to a low- or zero-emissions power system, which includes:
	  • setting out the future system restart needs for the NEM based on future focused restoration modelling that accounts for the contribution of IBR and the expected closure of coal-fired generation over at least a ten year planning horizon.
	  • engagement with the Panel and other relevant stakeholders on the future system restart needs and associated restoration modelling.
	• in reporting on identified SRAS investment opportunities through the ESOO or similar publication.
	The Panel recommends AEMO consider the scope of this recommendation in preparing the 2026 TPSS and ESOO.

Procurement and investment	The Panel notes AEMO's advice that there is a significant risk of insufficient new SRAS sources coming online prior to the possible exit of existing providers. The current NER SRAS procurement framework and the revised Standard provide sufficient flexibility for AEMO to procure sufficient SRAS to meet power system requirements. At the same time, the changes in the revised Standard are intended to deliver increased flexibility to support AEMO's procurement of SRAS including black start and restoration support services as required to meet the changing needs of the power system. Stakeholder feedback broadly supported the Panel's draft recommendations.

Issue	Findings and final recommendations
	The Panel recommends AEMO proactively engage with the market to identify future system restart needs by leveraging flexibility in the existing system restart framework to procure SRAS and meet any identified SRAS gaps in a timely manner. This recommendation remains unchanged from the Panel's draft determination. The Panel welcomes AEMO's recent publication of Statements of Need that seek to award Type 2 contracts to services that demonstrate: • the provision of black start capability using IBR • the capability to support system restoration in a high distributed photovoltaic (PV) environment following a system black event. The Panel encourages AEMO to continue to identify the need for Type 2 transitional service contracts for trialling new SRAS technologies to understand their potential role in system restoration.
Testing arrangements	The Panel considers that testing is crucial to verifying the outcomes of forward-looking restoration planning and associated SRAS procurement, providing confidence in the ability to respond effectively during a black system event. In considering stakeholder feedback to the draft determination, the Panel recommends changes to strengthen these frameworks. **The Panel recommends that the Rule change request consider amending the NER to strengthen elements of the system restart testing arrangements.** The Panel considers the scope of this request would require the AEMC to consider changes to how the Rules operate in relation to: • setting out clear definitions for various types of physical network testing arrangements (e.g. shallow and deep network tests) • determining clear roles for various participants impacted by testing, including specific guidance for AEMO and NSPs • setting out scenarios where deeper network testing is required and guidance on where other testing may be appropriate, and the party or parties responsible for determining the appropriate testing approach • considering whether current compensation arrangements remain appropriate for all types of network testing arrangements, based on the risks and costs associated with each type • considering the need for any real-time visible high-speed monitoring capability to be present throughout the restart pathway prior to conducting deep network testing.
Local black system procedures	The Panel notes AEMO's views that the LBSP process and obligations should be reviewed to ensure AEMO receives accurate, up to date and reliable information for plant to ensure they can be securely energised during restart.

Issue	Findings and final recommendations
	The Panel recognises that the LBSP frameworks are crucial to the provision of information that underpins forward-looking restoration planning. Stakeholders noted in their submission to the Panel's draft determination that the LBSP framework could be strengthened to enable stronger provision of accurate information, clarify the LBSP approval process and give greater effect to energy support arrangements. **The Panel recommends that the Rule change request consider changes to the NER that would strengthen elements of the LBSP framework.** The Panel considers that the scope of this request would require the AEMC to consider: 1. providing clear guidance on the capabilities that are expected to be maintained as part of an LBSP, outside the provision of an SRAS contract 2. establishing a framework that gives greater effect to energy support arrangements, setting out, at minimum, the purpose, the roles of relevant parties and the interaction with system planning. **The Panel also revises its draft recommendation for AEMO to conduct an audit of LBSPs, to recommend that AEMO update the LBSP Guidelines to include clear requirements to notify AEMO when changes are identified on LBSP plant.** The Panel considers that this revised recommendation is a more practical way for AEMO to engage with relevant stakeholders and establish guidance that supports accurate information provision.
Other considerations	The Panel has also considered the following issues raised by stakeholders in feedback to the draft determination: • whether the role for NSPs in system restart planning is clear • how further transparency can be provided on restoration timeframes for consumer load The Panel considers these frameworks remain fit for purpose at this present time, however invite stakeholders to submit a Rule change request if there are any material concerns that can be clearly identified that would warrant a more fulsome investigation of these frameworks.

30 The Panel welcomes the forward-looking preliminary analysis and commentary on system restart needs, published in the 2025 TPSS. The Panel considers the reporting presented on system restart needs to be a strong first step, and aligns with the overall direction of the Panel's recommendation for forward-looking system restart planning and reporting. The Panel encourages AEMO to build upon the analysis in the report, in consultation with the Panel, from 2026.

31 The Panel also recognises the potential opportunity of the Electricity Services Entry Mechanism (ESEM), proposed by the NEM Review Panel, to support co-investment in new SRAS capable equipment. The Panel supports further work to support investment in Essential System Services

through the ESEM, consistent with recommendation 8b in the NEM Review Panel's draft report.[4]

4 NEM Review Panel, National Electricity Market wholesale market settings review - Draft Report, August 2025, p.21.

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Appendices

Tables

Figures

1 The Reliability Panel has made a revised Standard and recommendations

The Reliability Panel (Panel) has been directed by the Australian Energy Market Commission (AEMC) to undertake a review of the System Restart Standard (Standard) in accordance with its responsibilities under the National Electricity Rules (Rules).[5] The AEMC has also requested the Panel make recommendations on the appropriateness of the system restart regulatory framework. The Panel's final findings are set out in this report.

1.1 The AEMC requested the Panel review the Standard and the system restart regulatory framework

On 12 December 2024, the AEMC provided terms of reference to the Panel to initiate a review of the Standard (the Review).[6] The terms of reference require the Panel to consult with as wide a range of stakeholders as possible, including network service providers, generators, consumers, jurisdictional governments and any other relevant bodies.

This final determination responds to the AEMC's terms of reference, which requests the Panel undertake two tasks in this piece of work:

1. **Task 1**: review and update the Standard to reflect an up-to-date understanding of the power system, including consideration of the risks of a major supply disruption and the costs and availability of system restart ancillary services (SRAS), with this Standard to be used in AEMO's upcoming procurement for SRAS.
2. **Task 2**: consider the broader SRAS framework and make recommendations on the appropriateness of the framework in the context of the future power system and the transition underway.

AEMO has identified that it is becoming increasingly challenging to secure the necessary level of SRAS sources at the appropriate level of reliability to meet the current standard across the National Electricity Market (NEM). The associated challenges include an increasing reliance on a limited and shrinking pool of SRAS providers and a scarcity of SRAS capability amongst new transmission-level generation. At the same time, high levels of distribution connected photovoltaic (PV) generation are presenting growing risks to system restoration.

Limited investment in new SRAS sources poses a significant risk to the availability of future SRAS capability. SRAS has historically been provided by large synchronous generating units (coal, gas and hydro power). The physics of the power system is changing as the supply mix transitions from one that is synchronous-based to one that is dominated by inverter based resources (IBR). This requires a rethink of how system restart is delivered.

In light of this, the AEMC considers that the existing framework may need to evolve to provide the appropriate investment signals to support competitive and efficient provision of system restart services in a transitioning system. Given the Panel's responsibility for determining the Standard, the Commission considers it appropriate that the Panel undertake a review of the Standard and the regulatory arrangements related to system restoration.

The terms of reference require the Panel to complete its Review by 30 December 2025. This timing allows AEMO to revise the SRAS Guideline so that it is consistent with the final Standard and

5 NER, clause 8.8.3(a)(5).

6 AEMC, 2024. Review of the system restart standard AEMC Terms of Reference to the Reliability Panel.

incorporates any recommendations the Panel makes in this Review, before AEMO begins the procurement process for SRAS, which must be in place by 1 July 2027.

1.2 What is the system restart standard and framework?

In the NEM, system restart capability is provided by SRAS which re-energise parts of the power system affected by a major supply disruption or black system event. SRAS are procured by AEMO from participants in the NEM in accordance with the Standard.

The Standard sets out several key parameters for power system restoration of the NEM in the event of a major supply disruption, including the restoration time and level of available supply from the restored generation and transmission network.[7]The Standard provides a target for the procurement of SRAS by AEMO. The Standard is a procurement standard rather than an operational standard.

The Standard is part of a broader system restart regulatory framework in the NEM that is designed to support planning for, and coordination during, a major supply disruption. This includes:

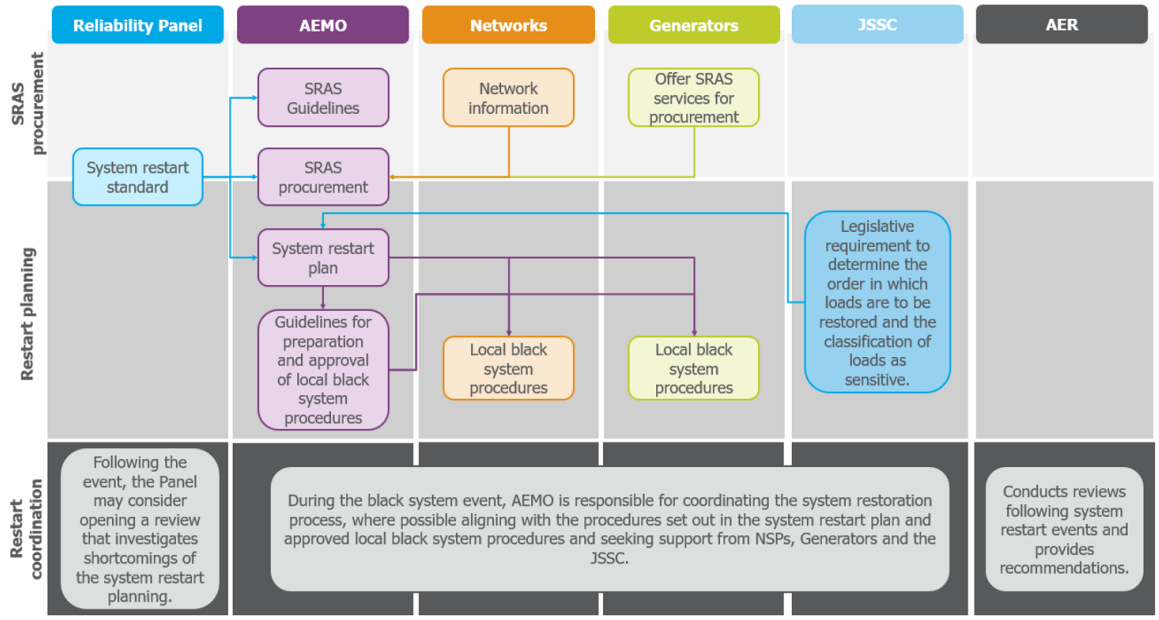
- guiding principles for system restart planning, including definitions for SRAS, and the objectives for procurement and the development of relevant guidelines
- setting out the roles and responsibilities of various market participants and market bodies.

Figure 1.1 provides an overview of the roles and responsibilities of different parties with respect to system restart. The Panel, network service providers, generators and the *Jurisdictional System Security Coordinators* (JSSCs) play a role in supporting AEMO planning for system restoration following a major supply disruption or black system event.[8] The *Australian Energy Regulator* (AER) conducts reviews following system restart events and provides recommendations to bolster system restart planning, in preparation for future events.

7 NER, clause 8.8.3(aa)

8 Under Section 111 of the National Electricity Law (NEL), the JSSC must prepare guidelines in relation to load shedding and restoration of loads (which must specify loads or classes of loads as sensitive loads) for the purpose of enabling AEMO to maintain power system security or for reasons of public safety.

Figure 1.1: Governance arrangements under the system restart regulatory framework



Source: Reliability Panel, 2025.

For further details on the NEM restart framework, refer to Section 4.1 of the Panel's issues paper.

1.3 The Panel's findings are informed by AEMO's technical advice

On 19 June 2025, AEMO published its *System restart technical advice (Technical advice)* to inform this Review. In line with the Review's tasks, the Panel issued a request for technical advice to AEMO to provide: [9]

- general advice to inform an understanding of how system restoration will work under the power system scenarios envisaged in the 2024 Integrated System Plan (ISP)
- specific advice to inform the Panel's determination of a revised Standard, including potential amendments to the form of the Standard and procurement options for SRAS likely to be available in 2027-2032.

AEMO's Technical advice:[10]

- explored restart scenarios with a future technology mix to examine the technical envelope for system restart events and outlines the success criteria for system restoration
- outlined operational restart pathway conditions, processes for reconnecting and re-synchronising sections of the power system, and the short-term challenges and opportunities in providing each
- discussed future investment opportunities in system restart, pathways to support improved confidence in technological capability, and approaches to determining the new Standard, with suggested areas for future policy and regulatory reform.

9 Reliability Panel, 2024. Request for AEMO advice for the Reliability Panel's review of the system restart standard. p. 3.

10 AEMO, 2025. System restart technical advice. p.3.

1.3.1 AEMO recommends the system restart regulatory framework is strengthened to improve system restart preparedness

As part of its advice, AEMO made high level recommendations in relation to how the current regulatory framework may be restricting supply of new sources of SRAS. Specifically, this includes recommendations for the Panel to consider:[11]

- **Procurement and investment** in SRAS, including:
  - options that support adequate investment in SRAS capability, given the current Standard has delivered limited investment in new SRAS sources and the significant risk of insufficient new SRAS sources coming online prior to the possible exit of existing providers.
  - co-investment decisions so that the design of new plant, resources and network assets may include capabilities that can support system restart.
- The **local black system procedure (LBSP) process and obligations** to ensure AEMO receives accurate, up to date and reliable information for plant to ensure they can be securely energised during restart.
- **Testing arrangements** to expand obligations under NER clause 4.3.6 for system restart network testing to involve existing and potential new restart paths with appropriate mechanisms for cost recovery.

1.3.2 AEMO recommends the Standard be revised to provide flexibility to determine the SRAS required to create, maintain, and extend restoration islands

In its technical advice to the Panel, AEMO has set out the process for restarting the power system which can be conceptualised in three stages:[12]

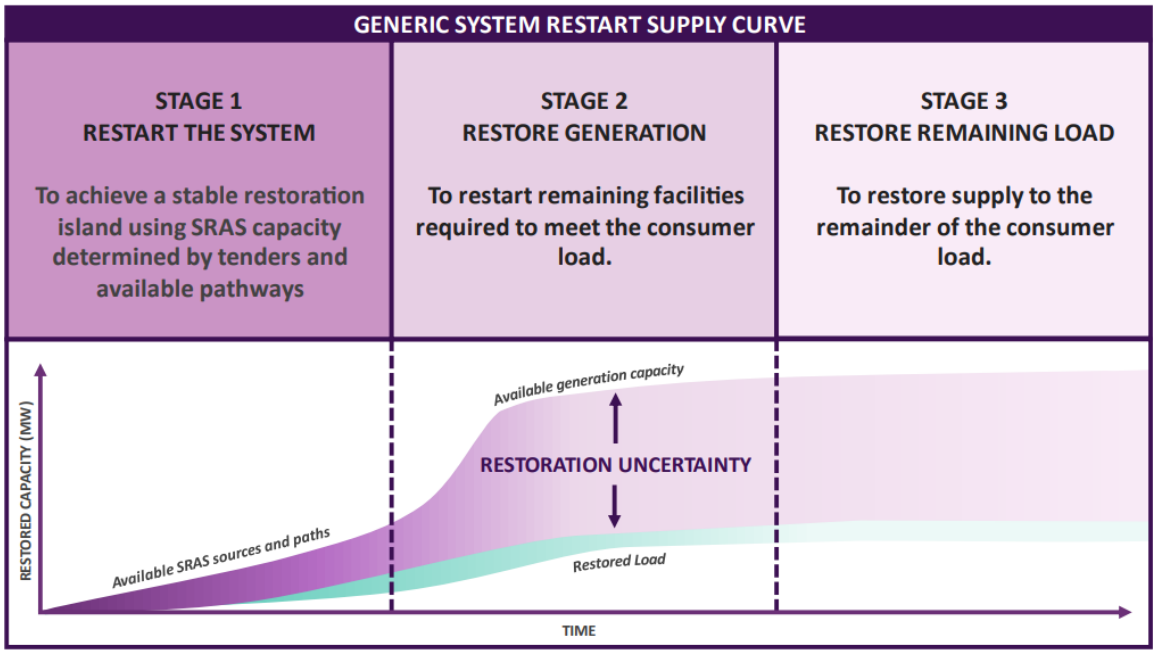
- Stage 1 - Restart the system - achieve a stable restoration island using procured SRAS capacity and available restoration pathways
- Stage 2 - Restoration of generation - restart the remaining facilities that are required to meet consumer load
- Stage 3 - Restore remaining load - restore supply to the remainder of consumer load.

The general restoration process can be represented graphically as shown in Figure 1.2 below.

11 AEMO, 2025. System restart technical advice. p.6.

12 Ibid. p.3-4.

Figure 1.2: Conceptualised system restoration process



Source: AEMO, 2025. System restart technical advice. p.6.

Stages one and two of the restoration process are focused on the restoration of available transmission and generation, whereas stage three is focused on the restoration of remaining consumer load. Despite the different objectives under each stage, AEMO will need to ensure load is brought online throughout the restoration process to meet the generation capacity that is restored.

Key to the commencement of the restoration process (stage one) is the creation of stable restoration islands. AEMO achieves this by:

- initiating the operation of relevant black start capable SRAS units to support energisation of key transmission links to selected generating units
- restarting sufficient stabilising load to maintain these islands.

Stage two of the restoration process is a bridge between the formation of stable restoration islands and the reconnection of remaining consumer load.[13] Once the initial stable restoration is formed at the end of stage one, AEMO focuses on energising sufficient network, generation and other plant that is required to progressively restore consumer load to the remainder of the electrical sub-network. This is achieved by the incremental reconnection of equivalent generation and load blocks.

AEMO's advice recommends that the Standard be revised to provide flexibility in responding to novel restoration risks that may emerge throughout the energy transition. Specifically, AEMO proposes that a revised Standard include a requirement to:[14]

- support the formation of stable restoration islands in stage one of the restoration process.

13 AEMO, 2025. System restart technical advice. p.16.

14 Ibid. p.6.

- restore generation to meet a specified level of demand further along the restoration curve (into stage two). This would allow AEMO to address operational and network risks to the re-energising process and support contracting of restoration support services, such as services to support system security, provide stable load, and value generator flexibility.

1.4 The Panel consulted on the draft Standard and draft recommendations

The Panel published a draft determination for this Review in September 2025. The draft determination set out the Panel's findings in relation to the draft Standard and made draft recommendations on the system restart regulatory framework.

The Panel considered in its draft determination, that the current system restart regulatory framework, alongside the revised draft Standard, provides AEMO sufficient flexibility and guidance to deliver adequate system restart capability through the energy transition. At the time, the Panel did not identify a clear need to revise the regulatory framework. However, the Panel sought stakeholder feedback on the identified issues, including whether stakeholders consider that changes to the NER may be required to support effective and efficient provision of system restart capability.

1.4.1 Stakeholder feedback was supportive of the draft Standard

Broadly, stakeholder feedback was supportive of the draft Standard, with stakeholders proposing relatively minor changes to the draft Standard, including:

- proposed minor amendments to the wording in the introduction of the Standard to include a stronger reference to restoration support services
- consideration of an additional criterion in the guidelines for assessing diversity of services (Section 9 of the final Standard), for AEMO to identify specific systemic risks relevant in determining the aggregate reliability of SRAS in an electrical sub-network
- calls for revisions to clarify how AEMO takes into consideration the guidance from the relevant JSSC in relation to the strategic location of SRAS for each electrical sub-network and the existence of any sensitive loads.

The Panel takes into consideration the feedback from stakeholders in determining the revised final Standard. The Panel determines a final Standard to provide flexibility for AEMO to procure black start and restoration support services, and responds to stakeholder feedback received on the draft Standard.

The revised elements of the final Standard include:

- **restoration timeframes:** For each electrical sub-network, AEMO shall procure SRAS with the capacity and capabilities sufficient to support the achievement of the following targets following a major supply disruption:
  - form one or more restoration islands in an electrical sub-network within 2 hours of the major supply disruption, and
  - use those restoration islands to restore generation and transmission in that electrical sub-network such that supply in that electrical sub-network is restored to be able to meet 50% of forecast average annual underlying demand within 8 hours of the major supply disruption.
- **aggregate reliability:** The aggregate required reliability of SRAS shall meet or exceed 95% in each electrical sub-network (note the aggregate required reliability for each of the mainland NEM regions is set at 90% under the current Standard).

- new **guidelines for the characteristics of restoration islands** that describe the operational features of a restoration island to support AEMO in its planning and procurement of SRAS for stage one of the restoration process.
- **guidelines for AEMO on assessing the diversity of services:** includes an additional requirement for AEMO to consider single point of failure risks associated with systemic risks, when considering the diversity of SRAS services.
- **consideration of sensitive loads:** Additional guidance for AEMO to consult with the relevant JSSC in relation to the strategic location of SRAS for each electrical sub-network and the existence of any sensitive loads. AEMO would also be required to report to the Panel in writing how it has considered any JSSC advice.

1.4.2 Stakeholders called for elements of the system restart regulatory framework to be strengthened

Broadly, stakeholder feedback was supportive of the Panel's draft recommendations related to procurement and investment, and transparency and reporting. However, stakeholders identified potential amendments to the NER arrangements, with respect to, SRAS testing and the LBSP frameworks.

In this final determination, the Panel sets out its consideration of the system restart regulatory framework with respect to:

- **procurement and investment**, to assess whether the elements of the existing SRAS procurement arrangements enable AEMO to procure existing and new SRAS technologies.
- **transparency and reporting arrangements**, to assess whether sufficient information is published for market participants to engage effectively in system restart planning.
- the **LBSP framework,** to assess whether it supports the provision of quality information to support AEMO's restart planning efforts.
- **testing arrangements**, to assess the flexibility of the current framework to support the consideration of potential new restart pathways.
- **the role of the Standard**, to assess whether the current governance arrangements and requirements for setting the Standard remain fit for purpose for the transition.

In considering stakeholder feedback to the draft determination. the **Panel recommends that a Rule change request be submitted to the AEMC on the matters related to the system restart regulatory framework (the Rule change request),** including:

- **reporting and transparency**: to include an explicit requirement for the *transition plan for system security* (TPSS) and *electricity statement of opportunities* (ESOO), or similar publications, to report on system restart needs through the transition.
- **local black system procedures**: to improve the quality of information and more strongly give effect to energy support arrangements
- **testing arrangements**: to support deeper network system restart tests.

The Panel also considered the following issues raised in stakeholder feedback, however, it does not propose any recommendations in relation to these issues at this time:

- whether the role of NSPs needs to be further considered in the context of future restart needs
- how further transparency can be provided on restoration timeframes for consumer load.

1.5 Structure of the determination

The remainder of this determination is structured as follows:

- **Chapter 2:** sets out how the revised Standard meets the assessment criteria used by the Panel for the review of the Standard, including the Panel's consideration of the National Electricity Objective and the SRAS Objective.
- **Chapter 3:** discusses the structure and settings in the final Standard and the Panel's rationale for change
- **Chapter 4:** discusses the Panel's findings in relation to transparency and reporting and procurement and investment
- **Chapter 5:** discusses the Panel's findings in relation to testing arrangements and the LBSP framework
- **Chapter 6:** discusses the Panel's findings of other considerations raised by stakeholders.

2 The revised Standard promotes the NEO

The Panel has determined a revised Standard in accordance with the SRAS objective and the National Electricity Objective (NEO) and NER. This chapter sets out:

- the relevant requirements in the NEL and NER that the Panel needs to consider when determining the Standard
- how the Panel has considered these requirements, including the development of an assessment framework and how this assessment aligns with the relevant requirements in the NER and NEL
- the technical advice from AEMO that informs the Panel's economic assessment.

Box 1: Key points in this section

- The Panel determined that the revised Standard is in the long-term interests of consumers. The Panel's determination contributes to meeting the NEO by managing the trade-off between the benefits of a secure and resilient power system and the costs of achieving this.
- The Panel considers that the additions and amendments to the revised Standard are crucial to help maintain system security in the context of a rapidly transitioning electricity network. This aligns with the technical advice from AEMO which recommended the Panel develop a Standard that provides it with the flexibility to manage the uncertainties introduced to system restart preparedness by a transitioning system.

2.1 The SRAS Objective and NEO guide the determination of the revised Standard

The NER requires the Panel to determine the Standard in accordance with the SRAS Objective set out below:[15]

> The objective for system restart ancillary services is to minimise the expected costs of a major supply disruption, to the extent appropriate having regard to the national electricity objective.

The Panel will consider how the Standard could most efficiently manage and minimise the extent of the costs associated with a major supply disruption, to meet the long term interests of consumers, having regard to the NEO. The NEO is set out in Section 7 of the NEL as follows:

> "to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:
>
> 1. price, quality, safety, reliability and security of supply of electricity; and
> 2. the reliability, safety and security of the national electricity system; and
> 3. the achievement of targets set by a participating jurisdiction—
>   a. for reducing Australia's greenhouse gas emissions; or
>   b. that are likely to contribute to reducing Australia's greenhouse gas emissions."

15 NER, Clause 8.8.3(aa)(1)

In meeting the SRAS Objective, the Panel takes into account various economic factors, including the trade-offs that exist between the cost of procuring restart services against the short term costs of a loss of supply and the longer term costs of economic disruption to electricity customers.[16]

2.2 The Panel has developed an assessment criteria in line with the NEO to guide its determination of the revised Standard

In determining the revised Standard, the Panel has considered the following assessment criteria.

System security

The Panel considers the revised Standard should support the availability of an effective restart capability. Effective restoration capability is a necessary insurance for a major supply disruption event. The revised Standard guides AEMO's procurement of SRAS and supports restoration capability. AEMO's restoration modelling shows that within known capabilities of the system, the revised Standard would guide the successful restart of the system.

Consumer outcomes

The revised Standard would need to support the timely restoration of the power system in line with consumer preferences.[17] The Panel has determined the Standard with a restoration target that is deeper in the restoration process. The Panel considers that this would provide consumers with more certainty of restoration timeframes following a major supply disruption. The Panel considers that the revised Standard meets the SRAS Objective, seeking to minimise the cost of a supply disruption. The Panel expects increases in costs under the revised Standard, however it considers the economic benefits of restoration capability far outweigh the costs of procuring the SRAS.

Economic efficiency

The revised Standard should be supported by a consideration of the expected costs of SRAS and the value of unserved energy from a potential major supply disruption. The Panel's economic analysis shows that the value of providing an effective system restart capability exceeds the expected increase in costs. The Panel also considers that the NER framework supports prudent SRAS investment by bounding the procurement of SRAS capability to the levels set out in the Standard. The Standard acts as a target for SRAS procurement with AEMO procuring SRAS to meet that target at lowest long term cost (SRAS Procurement Objective). The Panel makes further commentary on the assessment of economic efficiency in section 2.4.

Transparency

The Panel considers the revised Standard provides stakeholders with clear guidance on the objectives for SRAS procurement and provides an insight into planning for system restart events. The Panel has also made recommendations, as part of its assessment of the system restart regulatory framework, for AEMO to enhance its reporting of SRAS needs. The Panel considers these recommendations would provide increased transparency to market participants and energy consumers on SRAS planning, future SRAS needs and associated costs.

16 AEMC 2015, System Restart Ancillary Services, Rule Determination, 2 April 2015, p.60.

17 The Panel used the 2024 VCR figures to value unserved energy as part of its assessment of the benefits of establishing an effective restoration plan to re-energise the power system following a major supply disruption. For further information on the Panel's economic assessment methodology, refer to Appendix C of the Review of the System Restart Standard, Draft Determination.

Flexibility

The Panel considers the Standard should be fit for purpose over the long term. On the advice of AEMO, the Panel considers the revised Standard would remain fit for purpose from 2027-2030. The revised Standard provides AEMO with increased flexibility on how it creates stable restoration islands early in the restoration process. This has been achieved by setting a restoration objective deeper into the restoration process and removing the MW level target from the early stages of restoration. The Panel considers these changes provide flexibility to AEMO to consider a broader range of SRAS capabilities. The Panel also considers, following its assessment of the system restart regulatory framework, that the current NER framework provides adequate flexibility to AEMO to engage with the market to seek out the system restart services it needs.

Innovation

The Standard should support (or not restrict) the ability to include new technologies and methods to support system restoration. The revised Standard would support AEMO in considering procurement of additional new restoration support services to meet the revised Standard and incurring capital costs for trialling and building new black start SRAS capability to replace the retirement of existing capability. The Panel considers that this would support AEMO in considering new SRAS technologies and approaches in supporting system restoration. The Panel also supports AEMO's suggestion in its technical advice to consider the use of Type 2 contracts under the Transitional Services Framework to trial new candidate SRAS technologies. The Panel notes AEMO has recently published the Statement of Need to award Type 2 contracts to services that demonstrate the provision of black start capability using IBR, and the capability to support system restoration in a high distributed PV environment following a black system event.

2.3 AEMO's restoration modelling recognises uncertainties in modelling outcomes

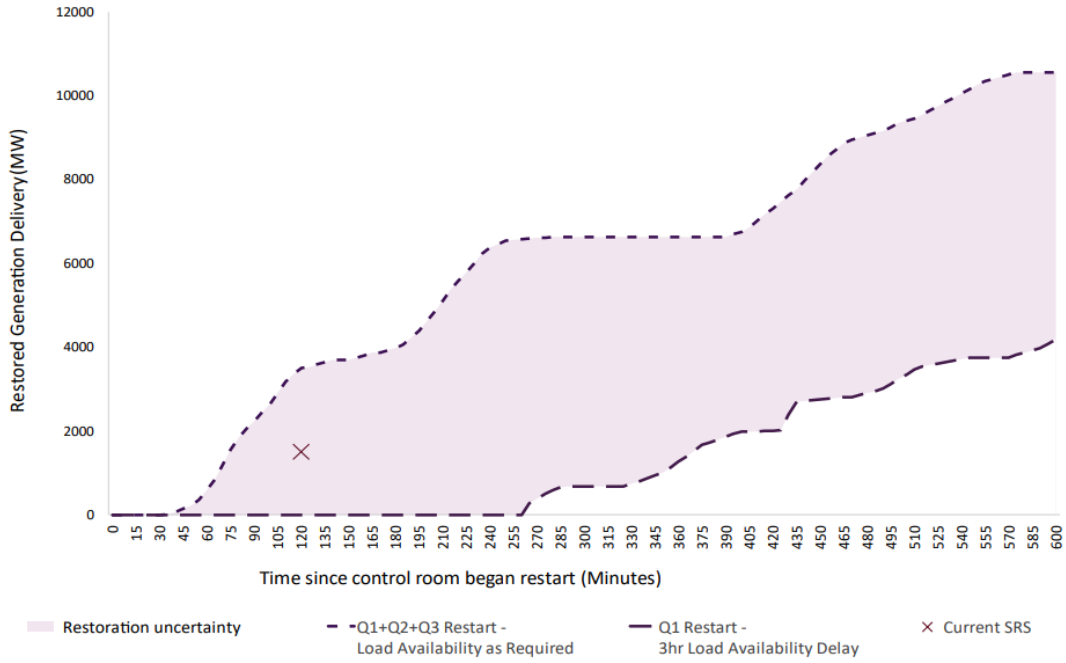
To inform the Panel's determination of the revised Standard, the Panel considered the outcomes of restoration modelling produced by AEMO as part of its technical advice. AEMO's technical advice also provided recommendations to enhance the system restart regulatory framework. This has been considered in Chapters 4-6 of this paper.

AEMO's modelling outputs sought to capture the uncertainty AEMO considers inherent in planning system restart as the system transitions. For this review, AEMO used the latest restart procedures in each electrical sub-network in the NEM to build indicative restoration supply curves to guide the development of a Standard that would remain fit-for-purpose from 2027.[18] With high synchronous generation still expected to be present in 2027, AEMO assumed the existing restart pathways to still be viable, although this will need to be confirmed over time with AEMO's ongoing restart modelling operation.[19]

AEMO highlighted that conducting detailed restart pathway modelling for incremental levels of black start capability, as was done in the 2016 review of the Standard, was not feasible as part of this Review and would have decreasing relevance into the future as the grid changes.[20] An example of the New South Wales restoration curves is provided below.

18 AEMO, 2025. System restart technical advice. p.64.
19 AEMO, 2025. System restart technical advice. p.65.
20 AEMO, 2025. System restart technical advice. p.63.

Figure 2.1: New South Wales restoration curve



Source: AEMO, 2025. System restart technical advice. p.65.

The purple range shows the uncertainty in expected outcomes from known combinations of restart sources and restart scenarios. The curves do not depict deterministic outcomes for a future restart scenario, and therefore, AEMO intends for the Panel to consider the full uncertainty range when determining the Standard.

Box 2: What are restoration supply curves and how are they interpreted?

What are restoration supply curves?

The output of AEMO's restoration modelling included supply curves for each electrical sub-network. These curves provide a representation of a plausible system restart process showing the growth in online generation capacity following a black system event. Restoration modelling outcomes are informed by AEMO's determination of critical re-energisation pathways on the grid, called restart pathways. AEMO noted that finding viable restart pathways through the network is very complex and time-consuming.

To be confident in restart pathways, AEMO undergoes extensive, detailed dynamic modelling of every network element in the pathway (e.g. transformers, protection systems, lines and generators). This complexity in achieving pathway confidence makes it difficult to build supply curves for networks far into the future as differences in single network elements can invalidate pathways.

How are they interpreted?

The supply curves show active power (MW) on the vertical axis and time on the horizontal. The vertical active power (MW) axis represents actual restoring output of generators. The generator names have been excluded for confidentiality and the curves should be interpreted indicatively. Current Standard targets are also plotted for completeness, comparing the exact precision that the current Standard requires against planning uncertainties. Each sub-network depicts a shaded region of uncertainty covering possible scenarios post-black event as well as differing viable

synchronous sources of black start service.

Source: AEMO, 2025. System restart technical advice. p.63-65.

2.4 The Panel's economic assessment approach seeks to value effective restoration capability

The Panel has undertaken an economic analysis that demonstrates the costs of a prolonged power system outage and the value of effective restoration capability supported by the procurement of SRAS.

The economic assessment builds on the Panel's 2016 approach which was focused on a direct cost benefit analysis of different levels of black start procurement. The 2016 economic assessment approach was based on AEMO restoration modelling outputs that considered incremental levels of black start capability. This supported the Panel developing a robust methodology that could compare marginal costs and benefits of black start SRAS capability to determine the "economically efficient" levels within the Standard.

For each electrical sub-network in the NEM, the Panel conducted two distinct assessments:

- an estimate of the total annualised benefit of an ideal restoration outcome
- assessment of the marginal value of reliability, to inform the aggregate reliability settings in the Standard, similar to the approach undertaken in the 2016 review.

Details of the assessment methodology are set out in Appendix C of the Panel's draft determination,[21] and consideration of the results for the revised Standard are discussed in chapter 3.

2.5 The revised Standard meets the NER requirements

When determining the Standard, the Panel must also consider whether the relevant requirements in the NER have been met. The NER requirements applying to the Panel's determination of the Standard are:

- NER clause 8.8.1(a)(1A) sets out that the Reliability Panel must, on the advice of AEMO, determine the Standard.
- NER clause 8.8.3(aa) which sets out the Standard must:
    1. be reviewed and determined by the Reliability Panel in accordance with the SRAS Objective;
    2. identify the maximum amount of time within which SRAS are required to restore supply in an electrical sub-network to a specified level, under the assumption that supply (other than that provided under a SRAS agreement acquired by AEMO for that electrical sub-network) is not available from any neighbouring electrical sub-network;
    3. include the aggregate required reliability of SRAS for each electrical sub-network;
    4. apply equally across all regions, unless the Reliability Panel varies the system restart standard between electrical sub-networks to the extent necessary:
        a. to reflect any technical system limitations or requirements; or

21 AEMC, Review of the System Restart Standard, Draft Determination, 4 September 2025, pp.73-79.

   b. to reflect any specific economic circumstances in an electrical sub-network, including but not limited to the existence of one or more sensitive loads;
5. specify that a SRAS can only be acquired by AEMO under a SRAS agreement for one electrical sub-network at any one time;
6. include guidelines to be followed by AEMO in determining electrical sub-networks, including the determination of the appropriate number of electrical sub-networks and the characteristics required within an electrical sub-network (such as the amount of generation or load, or electrical distance between generation centres, within an electrical sub-network); and
7. include guidelines specifying the diversity and strategic locations required of SRAS.

As noted, the Panel sought technical advice from AEMO to inform its determination of the revised Standard. This advice can be found on the AEMC's website. The Panel considers the revised Standard aligns with the requirements set out under clause 8.8.3(aa). Chapter 3 provides further detail on the individual elements of the Standard.

3 The system restart Standard

The Panel has determined a revised Standard that responds to recommendations set out in AEMO's Technical advice. This chapter sets out:

- AEMO's recommendations for revisions to the Standard
- stakeholder feedback on the draft Standard
- the elements of the final revised Standard
- proposed arrangements for the implementation of the revised Standard.

In considering stakeholder feedback on the Panel's draft Standard, the Panel makes the following updates to this final Standard, while retaining all other elements of the draft Standard:

- minor amendments to the wording in the introduction of the Standard to include a stronger reference to restoration support services
- inclusion of an additional criterion in the guidelines for assessing diversity of services (Section 9 of the final Standard), for AEMO to identify systemic risks relevant in determining the aggregate reliability of SRAS in an electrical sub-network
- revisions to clarify how AEMO takes into consideration the guidance from the relevant JSSC in relation to the strategic location of SRAS for each electrical sub-network and the existence of any sensitive loads.

The key elements of the revised Standard are set out below in the box below.

Box 3: Key elements of the revised Standard

The key revised elements of the revised Standard are:

1. **Restoration timeframes:** For each electrical sub-network, AEMO shall procure SRAS with the capacity and capabilities sufficient to support the achievement of the following targets following a major supply disruption:
   a. Form one or more restoration islands in an electrical sub-network within 2 hours of the major supply disruption, and
   b. Use those restoration islands to restore generation and transmission in that electrical sub-network equivalent to the capacity to supply 50% of the forecast average annual underlying demand in that electrical sub-network within 8 hours of the major supply disruption.
2. **Aggregate reliability:** Revision such that the aggregate required reliability of SRAS shall meet or exceed 95% in each electrical sub-network.
3. New **guidelines for the characteristics of restoration islands.**
4. **Consideration of sensitive loads:** Additional guidance for AEMO to consult with the relevant JSSC in relation to the strategic location of SRAS for each electrical sub-network and the existence of any sensitive loads.
5. **Guidelines for AEMO on assessing the diversity of services:** Includes an additional requirement for AEMO to consider common modes of failure associated with systemic risks, when considering the diversity of SRAS services.

The primary driver for the restoration level and timeframe settings in the Standard is AEMO's Technical advice on the operational objectives and capabilities for system restoration as set out

further in section 3.1. The proposed change to align the aggregate required reliability levels at 95% is driven by the Panel's economic analysis as set out further in section 3.4.

The revised Standard is expected to deliver benefits for electricity consumers by:

- providing AEMO with increased flexibility around how it plans for the initiation of system restart. This will allow AEMO to consider new ways of initiating restart, including via the use of smaller restoration islands or sub-sets of the grid.
- improved confidence in the effectiveness and reliability of system restart, supported by the proposed increase in the aggregate required reliability of SRAS for the mainland electrical sub-networks.
- supporting the procurement of additional restoration support services to allow AEMO to address operational challenges throughout stage two of the restoration process. This is expected to provide value to electricity consumers through increased certainty over restoration outcomes.

The Panel notes that some increase in SRAS expenditure is expected in the future as a result of:

- the procurement of additional SRAS, including black start and restoration support services, to meet the revised Standard.
- capital costs for trialling and building new black start SRAS capability to replace the retirement of existing capability.

However, the Panel's economic analysis demonstrates that the value of providing an effective system restart capability exceeds the expected increases in SRAS costs. The high level results from this economic analysis demonstrate that:

- the estimated NEM wide annualised total benefit of achieving an ideal restoration is $646m (with sensitivity analysis indicating a range of $80m - $1,600m). This far exceeds the historical average SRAS expenditure of $36m for 2019/20 to 2024/25 and AEMO's expected 2025 SRAS expenditure of $44m.[22]
- the expected cost increases related to AEMO procuring SRAS to meet the revised 95% aggregate required reliability in the mainland electrical sub-networks would be less than the estimated annualised benefit of improved restoration outcomes.
- the impact of these projected SRAS cost increases at a customer level is expected to be minor, noting that historical SRAS costs represent around 0.2% - 0.3% of the value of energy traded in the NEM, or around $1.70 per average NEM customer per year.[23]

The Panel notes that the revised Standard would align the settings for the restoration level, timeframe and aggregate required reliability across each of the electrical sub-networks in the NEM. This would deliver the added benefit of reducing the administrative burden required for AEMO to make changes to the electrical sub-network boundaries in future.[24]

3.1 AEMO recommended changes to the Standard to provide flexibility

The Panel's revised Standard responds to and addresses AEMO's advice to amend the Standard in order to provide AEMO with the flexibility and discretion it needs to procure SRAS and prepare plans to deliver an effective system restart capability for the national electricity system. AEMO's Technical advice included recommendations for amendments to the Standard to provide AEMO

22 AEMO, 2024. Non market ancillary services (NMAS) report 2024-25, p.10.

23 SRAS costs are recovered 50% from market customers and 50% from generators based on energy consumed or sent out - NER cl. 3.15.6A(d),(e).

24 This may include splitting or combining electrical sub-networks or varying the sub-network boundaries in accordance with NER clause 3.11.8.

with increased flexibility to procure SRAS (including black start and restoration services) to deliver an effective system restart capability as the power system transitions. These recommendations are set out in the box below.

Box 4: AEMO's high level advice for the system restart standard

- The Standard should be amended to allow AEMO the flexibility to create and maintain stable restoration islands, along with an option to procure SRAS further along the restoration curve.
- The Standard should include the following:
  - a requirement for AEMO to determine the amount of SRAS to procure to create and maintain stable restoration islands in stage one and extend the islands through stage two of system restoration
  - flexibility for AEMO to determine the quantity of SRAS (both black start and restoration support services) to procure
  - specific ability for AEMO to procure a prudent amount of additional or alternative SRAS to cater for reasonable network risks
  - improved ability to consider services and implementations that support the restoration of smaller islands or sub-sets of the grid.

Source: AEMO, 2025. System restart technical advice. p.6.

The Panel also considered stakeholder feedback received on the draft Standard. At a high level, stakeholders:

- strongly supported the introduction of a dual-target framework for the draft Standard and the increased aggregate reliability levels for mainland NEM regions.[25]
- welcomed the introduction of guidelines for restoration islands and considerations for sensitive loads, however sought further guidance on how these guidelines would be considered in practice.[26]
- suggested expanding the guidelines for the diversity of services (section 9, draft Standard) to consider systemic risks (e.g, cyber threats, network damage) when assessing aggregate reliability.[27]

3.2 Revised target timeframes for the restoration of supply

The revised Standard includes revised target timeframes for the restoration of supply following a major supply disruption. These targets support AEMO's procurement of SRAS, including black start and restoration support services, which deliver the capability to independently re-energise the power system in the event of a major outage.

Box 5: Target timeframes for the restoration of supply

The revised Standard includes revised restoration targets for AEMO to procure SRAS to support the achievement of the following targets in each electrical sub-network following a major supply

25 These include submissions to the draft determination by AEC (p.1); AGL (p.1); AEMO (p.2); CS Energy (p.2); Hydro Tasmania (p.2); Origin Energy (p.1); Powerlink Queensland (p.1); Shell Energy (p.1).

26 These include submissions to the draft determination by AEC (p.2); Shell Energy (p.3).

27 Powerlink, submission to the draft determination, 16 October 2025, p.2.

disruption:

- Form one or more restoration islands within 2 hours of the major supply disruption.
- Use those restoration islands to restore generation and transmission in that electrical sub-network equivalent to the capacity to supply 50% of the forecast average annual underlying demand in that electrical sub-network within 8 hours of the major supply disruption.

These changes:

- deliver on AEMO's recommendations to provide flexibility for the creation of stable restoration islands and move the target for the restoration of supply further along the restoration curve
- are supported by stakeholder feedback on the draft Standard
- reflect that forecast annual average underlying demand is proposed as the reference value for the level of supply restoration as this value is expected to accurately reflect the level of supply required to be restored to meet customer demand.

The targets for the restoration of supply under the existing Standard were set based on defining a target for the initial (stage one) restoration of supply to achieve a minimum level of generation to support the ongoing restoration of the power system.[28] This approach to setting a stage one restoration target in the Standard was based on the definition of SRAS at that time, which was restricted to services with black start capability. However, the definition of SRAS was revised in April 2020 through the *National Electricity Amendment (System restart services, standards and testing) Rule 2020* (*SRAS Rule 2020*). *The SRAS Rule 2020* expanded the definition of SRAS to include restoration support services that support the stable re-energisation of the grid. The capabilities for these restoration support services are defined by AEMO in its SRAS Guideline and include the ability to provide stabilising load and/or control frequency or voltage.[29]

AEMO's advice identified that the current restoration targets in the Standard have acted as a constraint on its efforts to procure restoration support SRAS. The Panel understands that this constraint is related to the current restoration target in the Standard being focused on stage one of the restoration process. While this approach was previously appropriate for the Standard, AEMO has identified that amendments to the Standard are now required to support its procurement of restoration support services required to address emerging operational challenges related to system restoration. These challenges include the availability of stable and consistent load blocks and system security services required to support the operation and restoration of the power system.[30]

The Panel considers that the revised target timeframes for restoration of supply in the revised Standard will better support AEMO to procure the services and capability required to deliver an independent system restart capability to each of the electrical sub-networks in the NEM. This will support quick and effective system restoration which in turn will act to minimise the cost of a major supply disruption.

The two key elements of the revised target restoration timeframes in the revised Standard are:

- a "stage one" requirement for AEMO to have the capability to form a restoration island within 2 hours of a major supply disruption or black system event. This requirement is intended to

28 AEMC Reliability Panel, Review of the System restart standard - Final Determination, 15 December 2016, p.39.

29 AEMO, SRAS Guideline, 8 February 2021, pp.12-13.

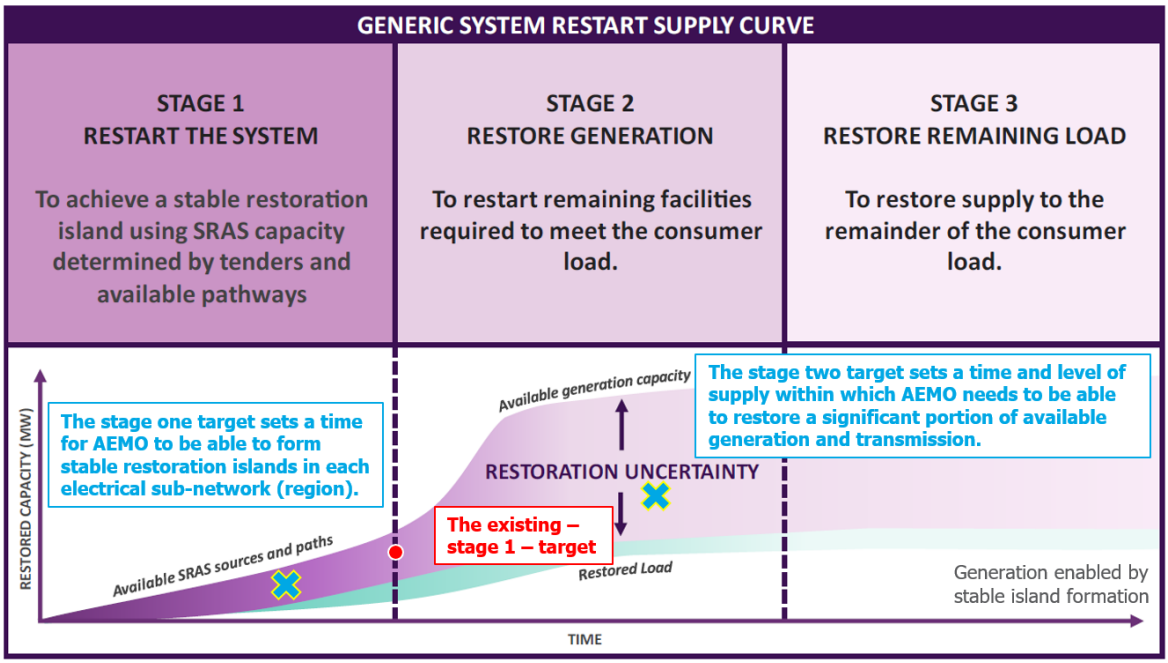
30 AEMO, System restart technical advice, 19 June 2025, p.24.

guide AEMO in its procurement of SRAS with black start capability to support the initial energisation of generation and transmission consistent with stage 1 of the restoration process.

- a "stage two" requirement for AEMO to have the capability to restore supply to 50% of forecast annual average underlying demand within 8 hours of a major supply disruption or black system event. This requirement is intended to provide AEMO a restoration target deeper into stage two of the restoration process in order to support the procurement of restoration support services.

These two restoration targets are depicted below as the green crosses in Figure 3.1.

Figure 3.1: Restoration targets under the revised Standard



The following sub-sections provide further detail on the Panel's considerations with respect to each of these restoration targets.

3.2.1 A requirement for AEMO to be able to quickly form restoration islands to initiate system restart

The revised stage one target in the revised Standard provides AEMO with more discretion around the specific operational objectives for the initial phase of system restoration (as compared to the existing targets in the Standard). This is achieved by not prescribing a quantitative target level for the restoration of supply as part of the stage one target. The stage one target in the revised Standard only includes a time (within 2 hours of the major supply disruption) for AEMO to target the formation of restoration islands in each electrical sub-network to initiate the restoration process. AEMO would determine the specific attributes of restoration islands for each electrical sub-network, informed by new guidelines in the Standard for restoration islands, which are described further in section 3.3.

3.2.2 A requirement for AEMO to be able to substantially restore supply within a reasonable timeframe

The stage two target in the final revised Standard sets a quantitative target for the substantive restoration of supply within a reasonable timeframe. This target is defined in the revised Standard

as 50% of the forecast average annual underlying demand in that electrical sub-network within 8 hours of the major supply disruption. The stage two target is not cumulative of the stage one target; that is, AEMO must target the restoration of equivalent capacity to supply 50% of the forecast average annual underlying demand in that electrical sub-network within 6 hours of meeting the stage one target. As recommended by AEMO, this element of the revised Standard sets the supply restoration target deeper into the restoration process, consistent with AEMO's objective to procure restoration support services to address expected operational challenges associated with system restoration.

The elements of this target can be further broken down to a target level of supply restoration and a target restoration timeframe as described below.

A target level of supply of 50% of forecast average annual underlying demand

The restoration level for the stage two restoration target in the revised Standard is informed by and consistent with the current system restoration capability for each of the electrical sub-networks based on AEMO's restoration modelling outputs.[31] This value represents a target level of supply restoration that will guide AEMO's procurement of restoration support services as required to address operational challenges during the process of meeting this target.

The Panel proposes to represent this supply restoration target as a percentage of forecast average underlying demand to provide an adaptive and forward-looking reference value for the level of supply restoration required to meet customer demand. Importantly, the use of "underlying demand" as the reference value includes the total of electricity consumption defined as operational demand plus rooftop PV generation.[32] This approach is expected to adapt to changes in the power system while reflecting the operational target for restoration to re-energise the power system and restore supply, including that demand met by consumer energy resources, such as rooftop PV.

A target restoration timeframe of 8 hours following the major supply disruption

The timeframe for the stage two restoration target in the draft Standard aligns with AEMO's advice around the importance of restoring supply to transmission and distribution substations within the time window for backup energy supplies for key network sub-stations. As noted by AEMO:[33]

> The process of power system restoration can become significantly harder once certain time thresholds are passed. If supply is not restored to key substations within approximately 10 hours following the major supply disruption, the restoration process will become significantly more difficult.

The Panel considers that the target timeframe of 8 hours following a major supply disruption, for the stage two supply restoration target, provides an appropriate setting to guide AEMO's SRAS procurement and restoration planning activities, with the goal of achieving substantive system restoration prior to the 10 hour threshold for substation backup power supplies. The Panel notes AEMO's advice that extended delays to system restoration may occur if supply is not restored to these network assets before backup power supplies are exhausted.

31 AEMO, System restart technical advice, 19 June 2025, pp.63-71.

32 Definition of "underlying demand" as set out on AEMO's Operational Demand data webpage - https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/operational-demand-data

33 AEMO, System restart technical advice, 19 June 2025, p.18.

3.2.3 Stakeholders strongly support the dual-target framework

In response to the Panel's draft determination, stakeholders expressed stong support for the introduction of the dual-target framework, with most stakeholders supporting the proposed restoration timeframes. AGL viewed the dual target as flexible, expecting the 2-hour target to rely on black start capability, while the 8-hour target may enable broader participation of market-based services such as batteries.[34] AEMO noted that the removal of a specific MW quantity for stage one provides flexibility to form stable restoration islands using a broader mix of technologies, including IBR. AEMO also noted that the two targets also provide increased scope to procure services that support restoration through stage two.[35]

Some stakeholders suggested a deeper target would provide further transparency on restoration timeframes for consumer load. The AEC, CS Energy, and Shell Energy considered that the Standard should include a subsequent restoration target after reaching the 50% supply threshold (e.g., restoring 85% of supply within 10 or 16 hours), to provide enhanced certainty and improved economic outcomes to consumers. Shell Energy suggested that stopping the target at 50% may imply restoration of further load is less important, potentially causing restoration delays beyond that threshold.[36]

The Panel does not propose to amend the restoration level for the stage two restoration target. The Panel is required to determine the Standard on the advice of AEMO.[37] The Panel considers that the target in the revised Standard is informed by and consistent with the current system restoration capability for each of the electrical sub-networks, and supported by AEMO in its submission to the draft determination. However, the Panel notes stakeholders sought further transparency on restoration timeframes for customer load, and has provided further consideration of this in chapter 6.

3.3 New guidelines for restoration islands

The revised Standard includes new guidelines for the characteristics of a restoration island. These guidelines are based on those included in AEMO's advice with minor changes to improve the clarity of messaging and align with AEMO's existing system security obligations.

Box 6: Guidelines for restoration islands in the revised standard

AEMO shall determine the specific operational characteristics for restoration islands, which shall include the following attributes:

- The ability to maintain a satisfactory operating state for the duration of a successful restoration process. This includes:
  - Self-sufficiency, through maintenance of supply-demand balance, and voltage and frequency within acceptable ranges, including tolerance to reasonable changes to the island
  - The availability of sufficient system security capability to support re-energisation of both transmission and distribution systems.

34 AGL, submission to the draft determination, 16 October 2025, p.1.
35 AEMO, submission to the draft determination, 16 October 2025, p.3.
36 Shell Energy, submission to the draft determination, 16 October 2025, p.2.
37 NER, clause 8.8.1(a)(1A).

- The ability to return network and load to service commensurate with the available generation throughout the rest of the restoration process.
- The ability to synchronise with other islands and the main grid.
- Adequate communication systems to facilitate stable operation of islands.

The guidelines for restoration islands are based on the minimum attributes for stable restoration islands included in AEMO's system restart technical advice:[38]

> Minimum attributes of stable restoration islands include:
>
> 1. Self-sufficiency, through maintenance of supply-demand balance, and voltage and frequency within acceptable ranges, including tolerance to reasonable changes to the island.
> 2. The ability to maintain a stable state for the duration of a successful restoration process. This includes ensuring sufficient system security capability to support re-energisation of both transmission and distribution systems.
> 3. The ability to return network and load to service commensurate with the available generation throughout the rest of the restoration process.
> 4. The ability to synchronise with other islands and the main grid.
> 5. Adequate communication systems to facilitate stable operation of islands.

The key difference between AEMO's minimum attributes for stable restoration islands and the guidelines for restoration islands in the revised Standard is the clarification that a restoration island shall have "*The ability to maintain a satisfactory operating state for the duration of a successful restoration process*".[39] As set out by AEMO, this includes having an ability to operate self-sufficiently through balancing supply and demand and maintaining voltage and frequency within an acceptable range, as well as having sufficient system security capability to support the re-energisation of transmission and distribution systems.

The Panel notes that the reference to a restoration island being capable of operating in a satisfactory operating state is consistent with the existing guidelines in the Standard for the determination of electrical sub-networks which includes that:

> "an electrical sub-network should be capable of being maintained in a satisfactory operating state to the extent practicable during the restoration process, and in a secure operating state from a stage in the restoration when it is practicable to do so, as determined by AEMO."

The Panel considers that it is reasonable and appropriate for AEMO to plan for the satisfactory operation of restoration islands, noting that the overall objective for system restoration is to return the power system to a secure operating state, but that this is not likely to be practically achievable early in the restoration process.

The Panel notes that stakeholder feedback welcomed the inclusion of the new guidelines for restoration islands. However, stakeholders called for consultation on the development of technical guidance on how these guidelines would be implemented in practice. Following this review, AEMO

38 AEMO, 2025. System restart technical advice. pp.4,17.

39 The power system requirements for a satisfactory operating state are defined in NER clause 4.2.2.

will need to undertake a process to revise the SRAS Guideline to consider the revised Standard. As part of this process, AEMO will need to consider the new guidelines for restoration islands, and consider how these guidelines will be accounted for during SRAS procurement. AEMO is required to undertake a consultation process, in accordance with the Rules consultation procedure, as part of this process. [40]

3.4 Revisions to aggregate reliability for SRAS

The revised Standard increases the aggregate required reliability of SRAS in the mainland electrical sub-networks from 90% to 95%. This change is supported by the Panel's updated economic assessment which supports increased procurement of SRAS in NSW, Vic and SA based on the value this would provide through increased likelihood of a successful restoration following a major supply disruption. This change was also supported by stakeholders in response to the Panel's draft determination.

The revised Standard maintains the aggregate required reliability of SRAS in Tasmania at 95%.[41]

The results of the Panel's economic assessment are set out in Appendix B of the Panel's draft determination.[42]

Box 7: Aggregate required reliability of SRAS

The revised Standard includes revised requirements for the aggregate reliability of SRAS for the formation of restoration islands to meet or exceed 95% in each electrical sub-network. This element of the revised Standard would result in:

- the aggregate required reliability of SRAS for QLD, NSW, SA and Vic increasing from 90% to 95%.
- the aggregate reliability of SRAS for TAS being maintained at 95%.

This change is supported by the Panel's economic analysis that shows that it would be economic to raise the aggregate reliability of SRAS in the mainland electrical sub-networks to drive additional procurement of SRAS in NSW, SA and Vic. The Panel's economic analysis supports maintaining the aggregate required reliability for SRAS in Tasmania at 95%.

The drafting of this element of the Standard reflects the Panel's understanding that the aggregate required reliability of SRAS is more practically applicable for the stage one restoration target associated with the formation of a restoration island. This approach recognises the increasing complexity of estimating the aggregate reliability for restoration outcomes deeper into the restoration process due to the increasing number of associated power system elements and services.

The aggregate required reliability of SRAS represents the likelihood that the combined procured SRAS for a given electrical sub-network would be able to restore supply to the level requirement within the specified time, based on the combined reliabilities of each of the SRAS sources. As set out in the Standard, AEMO's assessment of the reliability of an individual SRAS is based on:

- the availability of that service,
- where applicable, the expected start-up performance,

40 NER, clause 3.11.7(f).

41 The aggregate required reliability for SRAS in Tasmania was set at 95% through the Panel's 2016 review of the Standard to provide a higher level of restart self-sufficiency than other NEM regions due to Basslink being incapable of supplying power into a de-energised system.

42 AEMC, Review of the System Restart Standard, Draft Determination, 4 September 2025. pp.65-72.

- where applicable, the reliability of the network components between the SRAS source and the first location on a shared network from which the SRAS can energise or support the energisation of other generation.

A higher value for the aggregate reliability provides an economic benefit to NEM consumers through an increased likelihood of an effective and timely restoration of the power system following a major supply disruption. However, there are also costs of increasing the aggregate required reliability, as the predominant way of increasing the aggregate reliability of SRAS in an electrical sub-network is through the procurement of additional SRAS. Therefore, the aggregate reliability of SRAS represents the Panel's assessment of the economic trade-off between the benefits of the likelihood of effective restart versus the costs of delivering this capability.

An example of the relationship between individual SRAS reliability and the aggregate reliability of an SRAS portfolio based on the number of SRAS units is set out below in Table 3.1.

Table 3.1: Aggregate reliability of SRAS example

No. of black start SRAS	Indicative Aggregate reliability of SRAS portfolio	Calculation
1	80%	= 1 – (1 – 0.8)
2	96%	= 1 – (1 – 0.8)× (1 – 0.8)
3	99%	= 1 – (1 – 0.8) × (1 – 0.8) × (1 – 0.8)

Note: This example assumes an individual SRAS reliability of 80% which is broadly consistent with historically documented reliabilities for SRAS, which range between 72% and 83%.[43]

This element of the Panel's final determination is supported by the Panel's economic assessment of the marginal costs and benefits of black start SRAS as set out in Appendix B of the Panel's draft determination.[44] The high level findings from this economic assessment are:

- that the current level of black start SRAS procurement for QLD and Tasmania is consistent with the economically optimal range of black start SRAS procurement.
- that the marginal annualised benefits of increased black start SRAS procurement in NSW, SA and Vic would be expected to exceed the marginal annualised costs of this additional procurement.

An overview of the high level findings with respect to the economic level of black start SRAS procurement is set out below:

Table 3.2: Economically optimal level of black start SRAS

Electrical sub-network	Current No. of black start SRAS units procured	Current aggregate required reliability	Economically optimal range for black start SRAS procurement	Proposed required aggregate reliability
QLD	3	90%	1-3	95%
NSW	2	90%	1-3	95%
Vic	2	90%	1-3	95%

43 Reliability Panel, Review of the System Restart Standard - Final Determination, 15 December 2016, p.54.

44 AEMC, Review of the System Restart Standard, Draft Determination, 4 September 2025, pp.65-72

Electrical sub-network	Current No. of black start SRAS units procured	Current aggregate required reliability	Economically optimal range for black start SRAS procurement	Proposed required aggregate reliability
SA	2	90%	1-3	95%
Tas	2	95%	2	95%

Source: Current SRAS procurement levels based on values published in AEMO's *Non Market Ancillary Services (NMAS) report 2024-25*.

In a general sense, the proposed increase to the aggregate required reliability for SRAS in the mainland electrical sub-networks is expected to lead to an increase in the number of black start SRAS sprocured in NSW, Vic and SA. At the same time, the Panel's analysis indicates that the 95% aggregate required reliability value would likely be met by historic SRAS procurement levels in QLD and Tasmania.[45]

While it is not practical to accurately predict the actual cost of meeting the proposed revised aggregate required reliability, the historical unit costs of SRAS provide a guide as to the scale of costs as a result of the procurement of additional black start SRAS in NSW, Vic and SA. The estimated total and unit cost for SRAS in 2024-25 are set out below in Table 3.3.

Table 3.3: SRAS costs FY 2024-25

Electrical sub-network	No of SRAS	Actual total SRAS costs	Approximate SRAS unit cost
QLD	3	$ 9,400,083	$ 3.1 M
NSW	2	$ 12,925,543	$ 6.5 M
VIC	2	$ 8,699,106	$ 4.4 M
SA	2	$ 4,277,319	$ 2.1 M
TAS	2	$ 7,437,680	$ 3.7 M
TOTAL NEM	11	$ 42,739,730	N/A

Source: AEMO, Non Market Ancillary Services (NMAS) report 2024-25, p.9.

The Panel's economic analysis shows that the estimated annualised benefits from the increased likelihood of effective restoration exceed the expected increased costs due to the proposed increased aggregate required reliability. The results from this analysis are included in Appendix B of the Panel's draft determination.[46]

AEMO, Shell Energy, HydroTas and CS Energy supported the Panel's draft determination to increase the aggregate required reliability to 95% across all mainland electrical sub-networks. CS Energy noted the increased reliability target is likely to improve the effectiveness of system restart and that benefits will outweigh costs to electricity consumers.[47]

45 The Panel notes that actual SRAS procurement outcomes would be subject to the specific operational characteristics of SRAS offered and AEMO's assessment of the related power system requirements.

46 AEMC, Review of the System Restart Standard, Draft Determination, 4 September 2025. pp.65-72.

47 CS Energy, submission to the draft determination, 16 October 2025, p.2.

AEMO supports the Panel's economic analysis that demonstrates an increase to the aggregate reliability, noting the increased target is a "prudent and efficient" measure.[48] However, AEMO noted that the revised target may not result in the procurement of additional SRAS, particularly in NSW and QLD, where sub-regional targets also contribute to the aggregate reliability totals.[49] The Panel notes the feedback from AEMO, however considers that while the increased aggregate reliability metric may not presently drive an increase in the number of SRAS procured in NSW, the target would support the procurement of additional SRAS services if the reliability of currently procured services declines.

3.5 The revised Standard maintains the existing special restoration requirements for QLD and NSW

The revised Standard retains the current special geographic requirements for NSW and QLD electrical sub-networks while aligning the drafting with the revised concept of forming a "restoration island" as the stage one restoration target.

Box 8: Applicability of the Standard in electrical sub-networks

The revised Standard maintains additional requirements, similar to the existing additional requirements, that:

- for the New South Wales electrical sub-network, AEMO shall procure SRAS, sufficient to also independently restart, form and maintain at least one restoration island north of Sydney within two hours of a major supply disruption without drawing power from the power system, with an aggregate reliability of at least 75 per cent.
- for the Queensland electrical sub-network, AEMO shall procure SRAS, sufficient to also independently restart, form and maintain at least one restoration island north of Bundaberg within two hours of a major supply disruption without drawing power from the power system, with an aggregate reliability of at least 80 per cent.

The additional regional requirements for QLD and NSW were previously determined to provide value to consumers in the QLD and NSW regions and reflect the network topography and geography of the respective electrical sub-networks. The value of SRAS in the respective network locations is based on potential restoration delays associated with the absence of a restoration source in these areas of the power system, based on the size and layout of the transmission network.[50] As the Panel noted in its 2016 determination:[51]

> a delay to supplying the auxiliaries of the New South Wales generators north of Sydney would significantly delay the restoration of the sub-network, due to the large distance between these generating units and the generation in the south of the sub-network.

The Panel understands that the reasons for the existing additional restoration requirements in NSW and QLD continue to be valid and true, therefore these requirements are maintained in the revised Standard.

48 AEMO, submission to the draft determination, 16 October 2025, p.6.

49 Ibid.

50 The rationale for the QLD locational requirement is set out in the Panel's 2021 determination for the system restart standard. The rationale for the NSW locational requirement is set out in the Panel's 2016 determination for the system restart standard.

51 Reliability Panel, Review of the System Restart Standard - Final Determination, 15 December 2016, p.v.

The drafting for these additional requirements in the revised Standard removes reference to a specific MW level of supply restoration and instead require AEMO to form at least one restoration island, north of Sydney in NSW and north of Bundaberg in QLD (respectively) within 2 hours of a major supply disruption. This maintains the existing specific geographic requirement, while providing AEMO with greater flexibility as to the specific operational characteristics required for initiating restoration in each of these locations.

The AEC, CS Energy and Shell Energy queried the rationale for the significantly lower required aggregate reliability levels (75% north of Sydney, 80% north of Bundaberg) compared to the overall 95% target, suggesting this risks higher economic losses for consumers in those geographical regions.

The Panel wishes to clarify that the inclusion of regional-specific requirements is designed to ensure the availability of black start capability within these sub-regions. This would enable these sub-regions to be restored earlier in the process and be ready to support energisation of larger load centres across the electrical sub-network. Should the aggregate reliability target for specific regions in NSW and QLD be adjusted to meet the target aggregate reliability for the broader electrical sub-network, there could be a lack of black start SRAS sources across the remainder of the electrical sub-network. This is because AEMO would meet the aggregate reliability requirements by only procuring SRAS sources from the specific sub-regions.

3.6 Guidelines for assessing the diversity of services

The revised Standard introduces a requirement for AEMO to consider systemic risks when assessing the diversity of services. The NER sets out a requirement for the Panel to include guidelines for specifying the diversity and strategic location required of SRAS. These guidelines are relevant to AEMO in determining the aggregate reliability of SRAS in an electrical sub-network. The current Standard provides guidance to ensure AEMO considers single point of failure risks related to electrical, geographical and energy source characteristics of SRAS. The revised guidelines are set out in the Box below.

> In determining the aggregate reliability of SRAS in each electrical sub-network, AEMO shall assess diversity of the following characteristics across the procured SRAS sources to account for common modes of electrical or physical failure:
>
> - **Electrical** characteristics;
> - **Geographical** characteristics, including the potential impact of geographical events such as natural disasters;
> - **Energy sources** or fuel utilised by services, where applicable; and
> - **Systemic risks** that services may be exposed to.
>
> In accounting for electrical diversity, AEMO needs to consider the failure of any single significant transmission element, such as a single line or corridor that is downstream of the first transmission substation in the restoration path.

The drafting of these guidelines in the final standard has been streamlined to more directly reflect the underlying intention of this element of the standard.

The revised guidance in the final standard is underpinned by a proposal from Powerlink, which recommended the Panel expand the guidelines for assessing the diversity of services to include systemic risks associated with:

- cyber security threats

- failure of common supporting systems, such as communication networks and control system platforms
- industrial action or workforce disruptions.

Powerlink considers that "incorporating these considerations will help ensure that SRAS procurement outcomes are resilient not only to physical and technical risks, but also to systemic and operational vulnerabilities".[52]

The Panel supports Powerlink's rationale in its submission; however, the Panel considers there are a range of systemic threats that could present a common mode of failure risk for SRAS, and that these risks may change over time. Therefore, the Panel's final determination sets out a requirement for AEMO to consider such risks; whilst providing flexibility for AEMO in determining specific risks it would need to consider as it undertakes SRAS procurement. Further, AEMO is required to consult with stakeholders in identifying systemic risks, as part of any update to the SRAS Guidelines.[53]

3.7 Consideration of sensitive loads

The Panel has considered the impact on sensitive loads in making its final determination for a revised Standard. In the context of stakeholder concern highlighting the risks of significant commercial impacts to aluminium smelters following major supply disruptions, the Panel's draft determination was for AEMO to consult with JSSCs on the strategic location of SRAS and the implications for priority and sensitive loads.

While stakeholders welcomed the inclusion of this guidance, some stakeholders sought clarity on how the advice from JSSCs are considered in practice, by AEMO.

In considering this feedback, the Panel makes a minor amendment to the advice that JSSCs may also advise on the **number of SRAS** in each electrical sub-network. This advice could support AEMO in considering whether to procure an additional SRAS, to support the energisation of a sensitive load within its critical timeframes,[54] if it can be done relatively economically.

The revised guidance is set out in the box below.

Box 9: Consideration of sensitive loads

The final Standard includes an additional requirement for AEMO to consult with JSSCs in each region in relation to the strategic location, number of SRAS and the system restart implications for priority loads and sensitive loads, within the respective electrical sub-network.

The revised guidance for this requirement is:

> AEMO must consult with the relevant jurisdictional system security coordinator (JSSC) in relation to the strategic location and number of SRAS for each electrical sub-network. . The JSSC may provide advice to AEMO in relation to the strategic location of SRAS, based on its assessment of the implications for priority loads and any sensitive loads, and the existence of any related energy support arrangements. AEMO must consider any such advice when determining the strategic locations of SRAS, and report to the Panel in writing how it has considered the advice.

52 Powerlink, submission to the draft determination, 16 October 2025, p.2.

53 NER, clause 3.11.7(f)

54 Some sensitive loads require re-energisation within a 'critical timeframe', to prevent significant damage that could result in a total loss of the facility.

This change addresses stakeholder concerns in relation to the importance of restoring sensitive loads within critical timeframes given the potentially significant economic costs. The proposed approach is intended to align with the NER framework, including the requirement for:

- the Panel to determine the standard in accordance with the SRAS Objective
- JSSCs to advise AEMO of the priority of loads including any sensitive loads in their region.
- the roles and responsibilities for AEMO to procure SRAS in accordance with the Standard.

The revised guidance extends on the guidance from the Panel's draft Standard for JSSCs to also consider "the number of SRAS", and whether additional SRAS may be advisable to support re-energisation of sensitive loads in the respective region.

The following sub-sections summarise stakeholder submissions to the issues paper with respect to how sensitive loads are incorporated into the system restart arrangements and the Panel's considerations supporting its draft determination.

3.7.1 Summary of stakeholder submissions with respect to consideration of sensitive loads

The Panel received stakeholder feedback in relation to the consideration of sensitive loads to the Panel's issues paper and draft determination. In developing its guidance, the Panel considered stakeholder feedback from both papers.

Stakeholder feedback to the draft determination welcomed the guidance in the draft Standard, however AEMO called for improved clarity

Stakeholders welcome the inclusion of guidance requiring AEMO to consult with the relevant JSSCs regarding the strategic location of SRAS, including sensitive loads. [55]

However, AEMO noted that "while this is an improvement on the current arrangements, the proposed drafting remains somewhat ambiguous".[56] AEMO goes on to note that JSSCs already have functions under the NER and NEL to advise AEMO of any designated sensitive loads. While more specific advice about related limitations and capabilities of sensitive and priority loads in their regions may be useful, further clarification is required to the extent to which AEMO is required or expected to implement a JSSC's advice on strategic location.[57]

AEMO recommends that in addition to the guidance in the draft standard, "the Panel consult directly with JSSCs to determine the necessity to procure more SRAS for this purpose".[58] AEMO considers that this would provide "greater clarity and ensure that restoration planning reflects the real-world consequences of supply disruptions for sensitive loads."[59]

Stakeholder feedback to the Panel's issues paper expressed the economic risks borne by sensitive loads during black system events

The Panel notes concerns expressed by Tomago Aluminium Company (TAC) and The Australian Aluminium Council around appropriately accounting for and integrating key sensitive loads, such as aluminium smelters, through the system restart framework and planning arrangements, including the system restart standard. The Aluminium Council noted that:[60]

55 These include submissions to the draft determination from AEC (p.1); AEMO (p.7); CS Energy (p.2); EUAA (p.3); Powerlink (p.3); Shell Energy (p.3).
56 AEMO, submission to the draft determination, 16 October 2025, p.7.
57 Ibid.
58 Ibid.
59 Ibid.
60 Australian Aluminium Council, submission to the Issues paper, 30 January 2025, p.3.

> after around 75 minutes without electricity, aluminium begins to "freeze" in the pots, which can force plant/line interruption and potentially freezing cells with a restart which can take months to complete at significant cost. For example, following a prolonged power outage at Portland Aluminium Smelter in 2016, it took more than 6 months to restore the capacity of the smelter.
>
> [...]
>
> While smelters are usually identified as sensitive loads, the timeframes for restoration of energy do not currently reflect either the impact of delayed restoration nor does it reflect the role smelters could have in system restart efforts.
>
> It is imperative that the regulatory framework supports the development and implementation of technologies capable of restarting the network infrastructure in emergency events to mitigate this risk.

TAC also expressed concerns in relation to the risks posed to the operation of its aluminium smelter at Tomago in NSW following a major supply disruption under the current system restart plans.[61]

> the existing regulatory framework does not currently provide viable system restart plans to ensure that power is restored within a critical timeframe to avoid total business loss of our operations due to potline freeze. TAC is identified as a sensitive load in the NEM and has been independently acknowledged as a significant economic risk and liability to the Australian economy should it be impacted by a prolonged power outage.

TAC proposed a number of actions to address its concerns and reduce the risk posed to its operations from delayed restoration of supply following a major supply disruption. The TAC proposals included that:[62]

- System restart plans should account for actual critical timeframes needed to restore each unique sensitive load to avoid catastrophic business loss.
- Sensitive loads are appropriately consulted to improve restart modelling, including:
  - technical suggestions for restoring sensitive loads within critical timeframes during system black events, and
  - determining the economic benefit to the NEM from leveraging sensitive loads to help bring nearby generators back into operation following a system black event.
- Integration of TAC at the beginning of system restart in system restart plans could save our operation and may also provide significant advantages to help expedite and secure the system restart effort and should be reflected in the System Restart Standard to be a requirement of future system restart ancillary services.
- The Reliability Panel should also assess whether additional regulatory frameworks may need to be reviewed to provide for the development of technical solutions that are necessary to restore sensitive loads within their critical timeframes. For example, this may include the need for additional resourcing and funding for TransGrid to upgrade infrastructure that serves sensitive loads.

61 Tomago Aluminium Company, Submission to the Issues paper, 30 January, 2025, p1.

62 Tomago Aluminium Company, Submission to the Issues paper, 30 January, 2025, p3.

- Techno-economic modelling and scenario analysis should explicitly consider the costs and implications to the broader Australian economy for not successfully restoring sensitive loads.

The Panel's considerations with respect to sensitive loads

The Panel acknowledges the concerns expressed by TAC and The Australian Aluminium Council with respect to the significant economic role of aluminium smelters within the Australian economy and the potentially significant risks posed to these businesses in the event of a delayed restoration of supply following a major supply disruption.

While the Panel notes stakeholder support for the guidance for considering sensitive loads in the draft determination, it also acknowledges AEMO's need for further clarity on how the advice from JSSC's is considered in practice.

In response to these concerns, the Panel revises its draft determination to:

- continue to include the additional requirements in the Standard for AEMO to consult with JSSCs in relation to the strategic location of SRAS and the existence of any sensitive loads and/or related energy support agreements.
- report to the Panel on how it considered the advice of JSSCs, including where applicable, the rationale for additional procurement of SRAS.

This final determination is informed by the NER requirements for the Panel's determination of the Standard guided by the SRAS Objective and the NEO.

The Panel's consideration of sensitive loads is guided by the NER and the NEO

The Panel notes that the NER sets out how the Panel shall determine the Standard, including authorisation for the Panel to vary the standard:[63]

> to reflect any specific economic circumstances in an *electrical sub-network*, including but not limited to the existence of one or more *sensitive loads*;

At the same time, the Panel is required under the NER to determine the system restart standard in accordance with the SRAS Objective.[64]

In applying the SRAS Objective and having regard to the NEO, the Panel interprets that it must consider the "efficient operation and use of, electricity services for the long term interests of consumers of electricity". As such, the Panel's assessment of the potential costs associated with a major supply disruption and the costs and benefits of procuring SRAS to minimise these costs is contextualised by the long term interests of all consumers of electricity.

The revised Standard does not include specific supply restoration targets to accommodate sensitive loads

Guided by the SRAS Objective, the Panel does not consider it appropriate to set out specific supply restoration targets in the Standard to account for and prioritise the restoration of sensitive loads.

The Panel notes that in the event that an individual customer or customers require an increased level of protection from major supply disruptions over and above that provided to them under the Standard, they may make standalone arrangements for the provision of such a service, either

63 NER cl. 8.8.3(aa)(4)(B)
64 NER cl. 8.8.3(aa)(1)

through onsite backup generation or by entering into a contract with a third party for energy support. The NER contemplate the existence of such an "energy support arrangement" which is defined as:

> **energy support arrangement**
>
> A contractual arrangement between a *Generator*, *Integrated Resource Provider* or *Network Service Provider* on the one hand, and a customer or *participating jurisdiction* on the other, under which *facilities* not subject to an *ancillary services agreement* for the provision of *SRASs* are used to assist *supply* to a customer during a *major supply disruption* affecting that customer, or customers generally in the *participating jurisdictions*, as the case may be.

Further, the NER requires that local black system procedures must appropriately incorporate any relevant energy support arrangement to which a Generator, Integrated Resource Provider or Network Service Provider may be party.[65]

The revised Standard would require AEMO to consult with JSSCs in relation to the impact of SRAS procurement on priority and sensitive loads

While the revised Standard does not include specific restoration targets to accommodate sensitive loads, the Panel does support improved consideration of the impacts on sensitive loads throughout the SRAS procurement process. The Panel considers that JSSCs are well placed to advise AEMO of the impact of SRAS procurement on priority and sensitive loads to inform AEMO's consideration of the strategic location and number of SRAS.

The Panel considers that requiring AEMO to consult with JSSCs in relation to the strategic location and number of SRAS, and impact on priority and sensitive loads, aligns with the JSSC's responsibilities under the NER to provide AEMO with information relating to sensitive loads and the priority of load shedding.[66]

The Panel's final recommendation revises its guidance in the draft determination to provide clarity to AEMO in considering the need for additional SRAS procurement in response to the advice of JSSC.

The revised guidance expands on AEMO's consultation requirement with JSSCs. It requires AEMO to also consider any JSSC advice on the quantity of SRAS, alongside the strategic location of SRAS and impact on priority and sensitive loads, in each electrical sub-network.

The Panel considers the expanded consultation requirements supports AEMO's response to the advice of JSSCs, including consideration of the need for additional SRAS to support energisation of sensitive or priority loads in the electrical sub-network. However, the Panel also notes that AEMO is required to consider the procurement of additional SRAS in accordance with the SRAS Procurement Objective.

The Panel notes the suggestion from AEMO for the Panel to consult with JSSCs in determining any additional SRAS procurement to support energisation of sensitive loads. However, the Panel considers AEMO is best placed to consider the range of region-specific, technical and commercial considerations to be made on the basis of the advice from JSSCs, in deciding specific procurement requirements.

The revised Standard maintains the requirement in the draft standard for AEMO to consider any advice provided by a JSSC, and to advise the Panel in writing as to how it has considered this

65 NER cl.4.8.12(f)(2)

66 NER cl. 4.3.2(f)

advice. In setting this out in the revised Standard, the Panel recognises the need for clarity around how AEMO is to act in response to any such advice from a JSSC, while at the same time allowing AEMO to exercise its judgement on SRAS procurement decisions and the strategic location and number of SRAS.

The Panel notes that due to the sensitive nature of any such advice from the JSSCs and AEMO, it would not be appropriate for the specific details to be made publicly available. As such, the revised Standard does not require publication of the advice.

3.8 Arrangements for implementation of the revised Standard

The revised Standard will take effect on 1 July 2027. This timing will allow a period of 18 months from this publication to the date the new Standard takes effect. This aligns with the timing provided by the AEMC in the terms of reference for the Review and allows sufficient time for AEMO to update the SRAS Guideline and make arrangements to procure sufficient SRAS, including black start and restoration support services, to meet the revised Standard.

4 The Panel supports future-focused restoration planning to identify SRAS opportunities

In this Chapter, the Panel has set out the findings and recommendations from its analysis of the system restart regulatory framework with respect to:

- **transparency and reporting arrangements**, to assess whether sufficient information is published for market participants to engage effectively in system restart planning (see Section 4.1-4.2 for further discussion).
- **procurement and investment**, to assess whether the elements of the existing SRAS procurement arrangements enable AEMO to procure existing and new SRAS technologies (see Section 4.3-4.6 for further discussion).

As set out in chapter 3, the Panel has determined a revised Standard that provides AEMO with greater flexibility in planning for system restoration and procurement of SRAS. In the context of this revised Standard and the transitioning nature of the power system, the Panel finds:

- SRAS gaps need to be identified and published based on forward-looking restoration modelling and planning, to provide clear signals to market participants to consider investment in the required SRAS capabilities.
- the current NER framework provides AEMO with sufficient flexibility and guidance to procure SRAS capabilities that meet identified future SRAS gaps, over planning timeframes.

The Panel makes the following recommendations in relation to these findings.

Recommendation 1: Transparency and reporting

The Panel recommends that a Rule change request be submitted to the AEMC on various matters related to system restart.

The Panel recommends that the Rule change request consider changes to the Rules to put in place explicit provisions for AEMO report on system restart needs through the TPSS and publish identified opportunities for SRAS investment in the ESOO, or a similar publication. The Panel considers that the scope of this Rule change request would require the AEMC to consider how the Rules could seek to support AEMO:

1. in setting out in the TPSS how it plans to deliver system restart capability through the transition to a low- or zero-emissions power system, including:
   a. setting out the future system restart needs for the NEM based on future focused restoration modelling that accounts for the contribution of IBR and the expected closure of coal-fired generation over the ten year planning horizon set out in the TPSS.
   b. engagement with the Panel and other relevant stakeholders, on the future system restart needs and associated restoration modelling.
2. in reporting on identified SRAS investment opportunities through theESOO or similar publication.

Panel also recommends AEMO to consider the scope of this Rule change recommendation in preparing the 2026 TPSS and ESOO.

Recommendation 2: Procurement and investment

The Panel recommends AEMO proactively engage with the market to identify future system restart needs by leveraging flexibility in the existing system restart framework to procure SRAS and meet any identified SRAS gaps in a timely manner.

4.1 The Panel recommends forward-looking restoration planning requirements to identify future SRAS needs

The provision of transparency on the future needs for SRAS is central to stimulating investment in new system restart capability. To date, the approach to SRAS reporting has generally been backward-looking, and the Panel considers that transparent, forward-looking planning by AEMO is critical to identifying and meeting future system restart needs for the NEM.

The Panel's draft determination included draft recommendations for AEMO to report on future system restart needs and investment opportunities through the TPSS and the ESOO (or similar publication) from 2026. Stakeholders strongly advocated support for the Panel's draft recommendations, viewing this as essential for stimulating investment.

Given the strong support for this topic area, the Panel makes a final recommendation for the NER to be amended to clarify the inclusion of publishing:

- the outcomes of system restoration modelling and planning through the TPSS
- identified opportunities for investment in SRAS capability in the ESOO.

Specifically, the scope of the Rule change would consider amendments to the provisions under the framework for AEMO's publication of the TPSS, under NER clause 5.20.8, and the statement of opportunities, under NER clause 3.13.3A, or as otherwise determined by the AEMC, to:

- set out in the TPSS how it plans to deliver system restart capability through the transition to a low- or zero-emissions power system, including:
  - setting out the future system restart needs for the NEM based on future focused restoration modelling that accounts for the contribution of IBR and the expected closure of coal-fired generation over the ten year planning horizon set out in the TPSS.
  - engagement with the Panel on the future system restart needs and associated restoration modelling.
- report on identified SRAS investment opportunities through the ESOO or similar publication.

The Panel considers this would:

- provide certainty to market participants around the approach to the delivery of system restart capability through the transition
- support AEMO in acquiring the appropriate resourcing to carry out this important function for system restart planning.

The Panel also recommends AEMO consider the scope of the Rule recommendations in preparing the 2026 TPSS and 2026 ESOO.

4.1.1 Transparent future-focused restoration planning is necessary for signalling new SRAS investment

The process for restoring the system is at a transition point. The supply mix is rapidly changing, with synchronous generation being rapidly displaced by IBR, including wind, solar and batteries. There are also significant changes to the network topography, including the changing location of

generation sources, the introduction of new transmission infrastructure, the increasing penetration of CER, and the emergence of new large load sources. This gives rise to fundamental changes in the process for restarting the power system, following a black system event. These changes require stronger planning obligations on AEMO to establish a forward-looking blueprint for system restart requirements as the NEM continues to transition.

The current approach to SRAS planning could be enhanced to achieve these outcomes. The NER currently requires AEMO to develop a confidential system restart plan and report on the SRAS procured in a backward-looking report. AEMO is required to publish annually, the non-market ancillary service (NMAS) report, which reports for the previous period, on the process followed to acquire SRAS, the costs of procuring SRAS, and whether AEMO has been unable to meet the Standard, along with the reasons for this. The Panel considers that this planning function does not sufficiently address the need to attract future investment, as it does not set out a forward-looking strategy for future SRAS needs.

The Panel notes the strong stakeholder support for the Panel's draft determination, which highlighted the critical need for transparent, forward-looking restoration planning to identify future system restart needs. Therefore, the Panel makes a new final recommendation that seeks to set out explicit requirements in the NER for AEMO to report on system restart needs through the transition.

The Panel maintains that AEMO still sets out in the 2026 TPSS how it plans to deliver system restart capability during the transition to a low- or zero-emissions power system, and that this shall include:

- publication of interactive future-focused restoration modelling that accounts for the contribution of IBR and expected closure of coal-fired generation
- engagement with the Panel on this restoration modelling approach and draft modelling results prior to publication.

The Panel also maintains that AEMO publish identified opportunities for SRAS investment that are identified through the restoration modelling and planning that is completed through the TPSS, in the 2026 ESOO.

The Panel's considerations for maintaining these recommendations is set out in the sub-sections below.

4.1.2 Stakeholders strongly supported the need for transparent future-focused restoration planning to be set out in the TPSS and ESOO

Stakeholders strongly advocated support for the Panel's draft recommendations to enhance forward-looking transparency and reporting through the TPSS and the ESOO. However, AEMO expressed concerns about the practicalities of conducting detailed restoration modelling.

Stakeholder feedback on forward-looking modelling in the TPSS

The Australian Energy Council (AEC), Shell Energy, Alinta Energy, AusNet, CS Energy, Hydro Tasmania and Energy Australia supported the recommendation for forward-looking SRAS modelling to align with the planning horizons. The AEC noted that it "strongly endorses the Reliability Panel's recommendations on the future-focused modelling for system restoration as part of the Transitional Plan for System Security".[67] While Hydro Tasmania supported the Panel's

67 AEC, submission to the draft determination, 16 October 2025, p.2.

draft recommendations, it suggested that the Panel consider setting out a 10-15+ year planning horizon for AEMO, aligning with the 'end state' objective.[68]

Alinta Energy, Shell Energy, Energy Australia, AusNet, and CS Energy encouraged the Panel to consider whether wider stakeholder consultation should be included (beyond just the Panel) for AEMO when setting out system restoration needs in the TPSS. AusNet recommended that "AEMO be required to consult directly with Transmission Network Service Providers (TNSPs) when planning for SRAS".[69]

AEMO supports "the Panel's draft recommendations to enhance forward-looking reporting as a more effective means of driving accountability and investment in SRAS capability."[70] AEMO notes in its submission that it "is already considering some level of reporting on this subject in the 2025 TPSS, and this process will inform how, and through which publications, AEMO can best report going forward"[71] However, AEMO has expressed concern about the practicalities of conducting future-focused restoration modelling to achieve the outputs set out by the Panel in section 4.2.4 of the draft determination. AEMO expressed that the Panel should not "prescribe methods for undertaking this work" and that "future-focused restoration modelling may not be feasible – particularly constructing and modelling restart paths in the way this has been done for current SRAS tender assessments" given uncertainty around the future network configuration.[72]

AEMO also highlighted the potential cost and resourcing implications that additional reporting expectations could impose on AEMO and TNSPs.[73] This concern was also shared by the EUAA, who called for "appropriate funding to be allocated for technical engineering modelling that reflects the real world today and the future status of the grid".[74]

Stakeholder feedback on reporting in the ESOO, or similar publication

EnergyAustralia and CS Energy supported the Panel's draft recommendation for SRAS opportunities to be published in the ESOO, with EnergyAustralia noting "we support including SRAS opportunities in the ESOO as this will enhance investment signals".[75] EnergyAustralia and CS energy called for the ESOO to include specific locational breakdowns, projections of SRAS shortfall or surplus by sub-region, and clear opportunities for new capacity investment.[76] [77] AEMO encouraged the Panel to leave the specific report open for publication, allowing it to decide, noting "AEMO is...comfortable with a reporting recommendation on potential SRAS investment, without suggesting any specific publication".[78]

68 HydroTas, submission to the draft determination, 16 October 2025, p.3.
69 AusNet, submission to the draft determination, 16 October 2025, p.2.
70 AEMO, submission to the draft determination, 16 October 2025, p.13.
71 Ibid.
72 Ibid.
73 Ibid.
74 EUAA, submission to the draft determination, 16 October 2025, p.5.
75 EnergyAustralia, submission to the draft determination, 16 October 2025, p.3.
76 EnergyAustralia, submission to the draft determination, 16 October 2025, p.3.
77 CS Energy, submission to the draft determination, 16 October 2025, p.2.
78 AEMO, submission to the draft determination, 16 October 2025. p.13.

4.2 The Panel recommends that the NER include an explicit requirement for forward looking reporting on system restart needs through the transition

In considering stakeholder feedback to the draft determination, the Panel expands on its draft recommendations to recommend that the NER be amended to clarify the inclusion of:

- system restoration modelling and planning through the TPSS
- identified SRAS investment opportunities in the ESOO, or similar publications.

The Panel welcomes the forward-looking preliminary analysis and commentary on system restart needs, published in the 2025 TPSS. The Panel considers the reporting presented on system restart to be a strong first step, and aligns with the overall direction of the Panel's recommendation for forward-looking system restart planning and reporting.

However, the Panel considers that clarifying the inclusion of system restart considerations in the NER framework for the TPSS and ESOO, or similar publication, would provide certainty around the approach to planning for the delivery of system restart capability during the transition, and provide a means to acquire the necessary resourcing to undertake this important task.

The Panel encourages AEMO to build upon the analysis in the 2025 TPSS, in consultation with the Panel, from 2026.

4.2.1 Explicit NER requirements for system restart reporting provide planning certainty

The Panel considers that enhanced reporting on future system restoration needs is consistent with the NER requirements for AEMO to set out in the TPSS how it plans to maintain power system security through the transition to a low- or zero-emissions power system.[79]

However, the recommendation for clarifying the inclusion of system restoration modelling and planning through the TPSS, responds to strong stakeholder support that calls for transparent forward planning requirements. The Panel considers that this planning need should be appropriately resourced and an explicit NER obligation would support AEMO in acquiring the appropriate funding to carry out the intended planning work.

Further, the Panel recognises that AEMO must outline in the transition plan how it will manage system security, which includes system restart. However, the improving security frameworks Rule change, which set out the requirements of the TPSS, excluded system restart considerations within its original scope.[80]

Therefore, the Panel considers that an explicit NER requirement would clarify the need for future-focused restoration planning and support AEMO in acquiring adequate resources to undertake this modelling need.

The Panel also notes stakeholders encouraged the Panel to consider whether wider stakeholder consultation should be included (beyond just the Panel) for AEMO when setting out system restoration needs in the TPSS. The Panel considers that the scope of the Rule change should consider the need for a stakeholder consultation process, noting there are key interactions between AEMO, NSPs and other generation facilities through LBSP, when establishing system restart plans.

79 NER, clause 5.20.8.

80 AEMC, Improving security frameworks for the energy transition, Rule determination, 28 March 2024, p.87.

4.2.2 The TPSS framework should support planning for system restart needs to a low- or zero-emissions power system

The Panel considers the scope of the Rule change would consider amendments to the provisions under the framework for AEMO's publication of the TPSS, under NER clause 5.20.8 to set out in the TPSS how it plans to deliver system restart capability through the transition to a low- or zero-emissions power system, including:

- setting out the future system restart needs for the NEM based on future focused restoration modelling that accounts for the contribution of IBR and the expected closure of coal-fired generation over at least a ten year planning horizon..
- engagement with the Panel on the future system restart needs and associated restoration modelling.

The Panel considers AEMO is best placed to determine specific modelling requirements

The Panel acknowledges the concerns expressed by AEMO regarding the practicality of power system modelling in meeting the objectives outlined in Section 4.2.4 of the draft determination. The Panel wishes to clarify that AEMO is best placed to determine fit for purpose modelling that supports the identification of system restart needs over future planning horizons.

The Panel agrees that detailed electromagnetic transient (EMT) modelling is not feasible over all planning time horizons, particularly due to uncertainties associated with specific capabilities within the system in the future. However, the Panel still considers that enhanced forward-looking reporting would need to be underpinned by future-focused restoration modelling.

The Panel suggests forward-looking restoration planning should align with the 10-year planning horizon set out in the TPSS

The Panel suggests that forward-looking SRAS reporting in the TPSS should aim to identify SRAS needs over at-least a 10-year outlook. The Panel considers that long-term restoration planning should support industry understanding of system restoration needs for a future power system with limited thermal coal availability, which aligns with the Panel's proposal for at least a 10-year planning horizon. The Panel considers that restoration planning should align with the existing planning horizons and be consistent with AEMO's reporting of other transitional system security services.

The Panel recommends, the TPSS would aim to provide, over at least a 10-year outlook:

- a description of how AEMO plans to meet the Standard in each electrical sub-network
- identifying upcoming SRAS risks in each electrical sub-network
- supporting its findings by publishing results from future-focused restoration modelling.

The Panel recommends AEMO identify options to procure SRAS that meets identified SRAS needs, which includes:

- specific details of the required capabilities or new entrant resources that could participate in meeting identified regional risks. These findings should also be set out in the ESOO or a similar publication (see section 4.2.3).
- doutcomes from existing trials of any type 2 contracting undertaken in relation to system restart..

The Panel considers that this enhanced reporting on system restart on future system restoration needs is consistent with the NER requirements for AEMO to set out in the TPSS how it plans to maintain power system security through the transition to a low- or zero-emissions power system.[81]

The Panel welcomes the progressive steps to report on system restart needs in the 2025 transition plan for system security

AEMO published the 2025 TPSS on 1 December 2025.

The TPSS highlights that existing system restart pathways could become unviable after coal and other large synchronous plant retire and are likely to require redesign to support a high VRE and IBR power system. AEMO calls for strong collaboration across industry to develop new approaches and procedures to restart each NEM region for when coal stations have decommitted or exited. This would include physical testing of restart pathways without soon-to-retire plant, at least a year ahead of retirements, and other transition points that impact system restart.[82]

The report provides commentary and preliminary results of forward-looking analysis on system restart needs as the system transitions. This includes:[83]

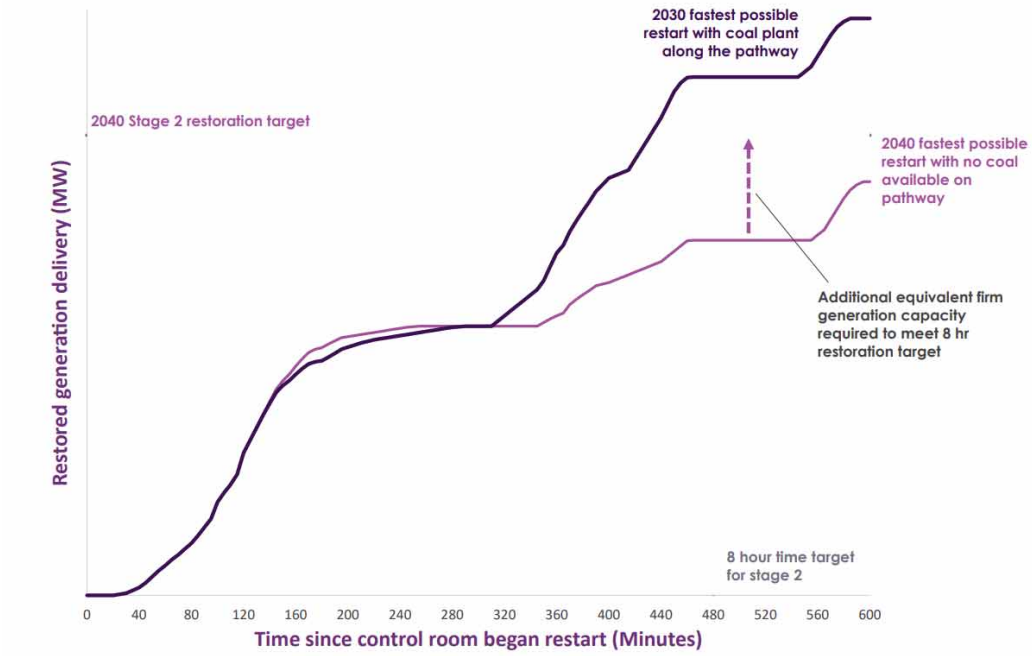
- an overview of upcoming work, including finalisation of this Review, AEMO's update of the SRAS Guideline, finalising AEMO's market engagement on type 2 contracts related to system restart, and preparation for the SRAS procurement round. AEMO highlights that its upcoming procurement round will be focused on the procurement of both black start and restoration support services.
- a call for new black start investment from new hydro or gas generation (100 MVA+) highlighting that:
  - at least two black-start SRAS services may need to be procured in each region from 2027 through to 2030, with the ability to procure more to meet the SRS in each region if required
  - at least three black start SRAS services may be needed per region from 2030 onwards, depending on factors such as development of new methodologies, evolving technical frameworks, and demonstration of new technology restart capabilities.
- preliminary forward-looking analysis on restoration needs under the revised Standard, highlighting the equivalent level of firm generation capacity to meet the revised Standard in each region by 2040, based on publicly announced exits.

81 NER, clause 5.20.8.

82 AEMO, 2025 Transition Plan for System Security, 1 December 2025, p.103.

83 AEMO, 2025 Transition Plan for System Security, 1 December 2025, pp.104-106.

Figure 4.1: AEMO's illustrative approach to forward analysis of the NEM's ability to meet the Stage 2 restoration target in the Standard



Source: Figure 14, AEMO, 2025 Transition Plan for System Security, 1 December 2025, p.107.

The Panel encourages AEMO to continue to refine and develop these modelling outputs as they provide a valuable outlook of the system restart need, providing signals for new entrants to meet future gaps in capability. The Panel notes that AEMO intends to extend this preliminary analysis in 2026 by:

- exploring the application of a probabilistic approach to SRAS modelling to include more variable generation sources in the restart planning process to meet the Stage 2 restoration target
- signalling the locations within each region that are most suitable for black start capability

The Panel looks forward to collaborating with AEMO on the outcomes of forward-looking restoration modelling and key actions ahead of the next iteration of the TPSS. As mentioned above, the Panel still considers that in spite of the material included in the 2025 TPSS, clarifying the inclusion of system restart considerations in the NER framework for the TPSS and ESOO, or similar publication, would provide certainty around the approach to planning for the delivery of system restart capability during the transition, and provide a means to acquire the necessary resourcing to undertake this important task.

Future focused restoration planning should be developed in consultation with relevant stakeholders

The Panel maintains its recommendation for AEMO to engage with it to provide feedback on the preliminary modelling outcomes, prior to AEMO's publication of the results and findings in the TPSS.

As previously noted in the Panel's response to AEMO's 2024 TPSS, the Panel considers that AEMO's next priority is to understand the future resources required for the modelling of the grid. The Panel suggests that this engagement include:

- seeking input from the Panel on the proposed forward-looking restoration modelling approach, scope and forecast horizon.
- presenting draft forward-looking modelling results to the Panel for feedback prior to publication.
- responding to any written commentary provided by the Panel in relation to the forward-looking restoration modelling.

The AEMC should also give consideration to whether other stakeholders should be involved in future focused restoration planning. The Panel considers this could include requirements for both TNSPs and DNSPs to provide the necessary information to AEMO in considering future system restart needs.

4.2.3 The NER should support reporting of identified SRAS investment opportunities in the appropriate publication

In addition to reporting in the TPSS, the Panel recommends that AEMO report on SRAS investment opportunities through the ESOO or similar publication. The Panel notes this is supported by stakeholder feedback.

The Panel considers the ESOO an appropriate publication for reporting of identified SRAS opportunities, however suggests the AEMC also consider the merits of other publications

The ESOO provides technical and market data for the NEM over a 10-year period to inform the planning and decision-making of market participants, new investors, and jurisdictional bodies.[84]. Information AEMO must currently report on in the ESOO includes:

- projections of aggregate MW demand and energy requirements for each region
- capabilities of existing, proposed, and planned generating and bidirectional units
- planned plant retirements
- a summary of network capabilities and constraints
- proposed network developments (committed and non-committed)
- operational assumptions made by AEMO.

Currently, the ESOO does not set out an explicit requirement for AEMO to publish identified opportunities for investment in SRAS capability. While AEMO is comfortable with a reporting recommendation on potential SRAS investment, it requests that the Panel does not specify the publication.[85]

In considering the feedback from AEMO, the Panel considers that the AEMC should also investigate whether other publications that may be more appropriate in publishing investment opportunities related to SRAS capabilities.

The Panel proposes AEMO include relevant details regarding the identified investment opportunities for SRAS capabilities

The Panel considers AEMO could take the ESOO further by reporting on SRAS procurement opportunities.

The Panel recommends that the ESOO, or any similar publication the AEMC considers appropriate, consider amendments to the NER requirements to reflect the SRAS findings in the TPSS in line with the current ESOO publication cycle, or publication cycle of the similar publication, to include:

84 NER, clause 3.13.3A

85 AEMO, submission to the draft determination, 16 October 2025, p.13.

- a description of any SRAS gap, including a list of SRAS providers forecast to close
- the opportunities available for SRAS procurement and the location these services are required
- ways in which costs can be minimised and how this will be assessed.

The Panel considers this would be beneficial, as it goes beyond procurement for trialling that would be set out in the TPSS and sending investment signals for procuring restart services with known capabilities.

4.2.4 The Panel's recommendations for enhanced forward-looking restart planning aligns with international best practice

The Panel recognises the extensive reform to the system restart regulatory framework undertaken by the UK. On 1 April 2021, the UK government introduced a legally binding target for a new Electricity System Restoration Standard (ESRS). The new ESRS requires NESO to have sufficient capability and arrangements in place to restore 100% of Great Britain's electricity demand within 5 days. It was implemented regionally, with an interim target of 60% of regional demand to be restored within 24 hours.[86]

The ESRS is underpinned by a robust assurance framework that establishes a baseline level of testing and exercising of restoration capabilities, across the power sector. The assurance framework requires NESO to set out in a public report:[87]

- a forward looking strategy for the provision of electricity system restoration for:
  - the upcoming regulatory year
  - two regulatory years after that
  - subsequent regulatory years.
- the restoration approach to ensure that the ESRS is capable of being complied with at all times during a regulatory year including the identification of technologies and approaches for the provision of restoration services;
- a description of how the licensee (NESO) will monitor its ability to comply with the ESRS at all times during a regulatory year
- ex-ante modelling of restoration times for the subsequent regulatory year using credible projections of the required transmission system data, as well as ex-post modelling of restoration times using actual transmission system data from the previous regulatory year
- sufficient details of the methodology, assumptions and data used in any restoration modelling, to reflect the capabilities of the transmission system during the subsequent regulatory year to allow participants to assess and provide comment on how well the operator is representing the capabilities of the transmission system within the modelling.

The Office of Gas and Electricity Markets (OFGEM) is responsible for monitoring the assurance framework on an annual basis, providing the necessary assurance and confidence that the restoration process can be carried out across each region as intended.[88]

For further information on the system restart arrangements in the UK refer to Appendix G of the draft determination.[89]

86 UK Government, 2021. Introducing a new electricity system restoration standard.

87 Independent System Operator and Planner, Electricity System Operator, Licence Conditions. p.97-98.

88 UK Government, 2021. Introducing a new electricity system restoration standard.

89 AEMC, Review of the System Restart Standard, Draft Determination, 4 September 2025,pp.93-98.

4.3 Forward-looking restoration planning is required to substantiate the need for investment in new SRAS capability

Stakeholders broadly supported the Panel's draft recommendation for AEMO to leverage flexibility in the existing framework and proactively engage with the market. Stakeholders, however, called for stronger contract certainty and encouraged the Panel to express the urgency of action, noting lead times for commissioning new SRAS capability.

4.3.1 AEMO sought guidance on the application of SRAS contracts to support investment in new-build black start capable generation

AEMO is required to procure sufficient SRAS to meet the Standard, in accordance with the SRAS Procurement Objective, which is defined in the NER as:

> AEMO must use reasonable endeavours to acquire SRASs to meet the system restart standard at the lowest long-term cost.

Shell Energy, Alinta Energy and AEMO noted the SRAS Procurement Objective remains fit for purpose and provides AEMO with sufficient flexibility in specification and procurement. AEMO noted that the SRAS Procurement Objective "provides a clear and balanced framework for procurement decisions, ensuring that restoration capability is delivered efficiently while allowing for flexibility in contract design and investment support."[90]

However, AEMO sought clarification on whether SRAS contracts could be used to fund capital expenditure. This includes whether it would be appropriate for SRAS contracts to be part of the primary business case for investment in a new power station or that SRAS contracts would only be appropriate as support for balance of plant upgrades required to deliver a black start capability.

Stakeholders called for stronger contract certainty with Alinta Energy, Origin Energy, and Energy Australia emphasising that AEMO must procure SRAS using longer-term contracts (beyond 3 years) to provide investment certainty and attract capital for new technologies, aligning with the "lowest long-term cost" objective. Tesla similarly noted that short contract durations are a major barrier to developers investing in the balance of plant required for SRAS capability.

4.3.2 The NER provides AEMO with substantial discretion around SRAS procurement in accordance with the SRAS procurement objective

As outlined in section 4.4, the NER grants AEMO substantial discretion regarding SRAS procurement, in line with the SRAS Procurement Objective.

AEMO may follow "any procurement process" for the acquisition of SRAS, which allows for AEMO to negotiate with any party and determine any contract terms (or length) that it considers is appropriate.[91] As such, the NER does not limit AEMO's ability to enter into contracts for the procurement of SRAS, as is necessary to meet the Standard, such that it can be demonstrated that the SRAS procurement approach has the lowest long-term cost.

The Panel considers that AEMO is best placed to make a judgement on what SRAS procurement is appropriate and consistent with the requirements under the NER. The NER provides AEMO with the discretion to cover any types of costs through an SRAS contract – including expenses relating to capital works required for new equipment and capability.

90 AEMO, submission to the draft determination, 16 October 2025, p.19.

91 NER, clause 3.11.9(a)

Forward-looking restoration planning is an important element in substantiating whether investment in new SRAS capable plant is necessary, as it is this planning that will identify any SRAS gaps over planning timeframes. The Panel considers this would:

- provide sufficient lead time for AEMO to engage with the market participants to identify options to meet the identified gaps
- provide sufficient lead time for AEMO to seek information related to the cost and timing of implementing each identified option
- determine the lowest long term cost approach to meeting identified SRAS gaps.

The Panel encourages AEMO to engage SRAS providers with longer duration contracts, however, recognises there are trade-offs involved in determining the appropriate contract length. The Panel considers AEMO is best placed to negotiate with potential SRAS providers in relation to the appropriate contract duration required to support investment in the required capability.

4.4 The Panel recommends AEMO leverage the flexibility in the existing system restart framework to procure SRAS to meet future SRAS gaps

The Panel considers:

- The revised Standard provides AEMO flexibility to procure additional SRAS, over the current Standard, to meet a deeper restoration target. This includes consideration for additional black start SRAS capability through the increased aggregate reliability requirements in several NEM regions.[92]
- The current framework provides AEMO with discretion in how it defines and procures SRAS, giving AEMO the flexibility to determine the technical and commercial arrangements related to SRAS procurement.

4.4.1 The revised Standard provides AEMO with greater flexibility around how it determines the system restart requirements to unlock its procurement of SRAS

The Panel considers that the final Standard addresses AEMO's recommendations for changes and inclusions to provide AEMO the flexibility to create and maintain stable restoration islands, along with an option to procure SRAS further along the restoration curve. The revised Standard is expected to deliver benefits for electricity consumers by:

- providing AEMO with increased flexibility around how it plans for the initiation of system restart. This will allow AEMO to consider new ways of initiating restart, including via the use of smaller restoration islands or sub-sets of the grid.
- supporting the procurement of additional restoration support services to address operational challenges throughout stage two of the restoration process. This is expected to provide value to electricity consumers through increased certainty over the restoration outcome.
- supporting AEMO's consideration of additional black start capability to improve the reliability of restoration outcomes for each electrical sub-network.

As discussed in chapter 3, the Panel recognises that some increase in SRAS expenditure is expected in the future as a result of:

- the procurement of additional new restoration support services to meet the final Standard

92 The final Standard increases the aggregate reliability from 90% to 95% in NSW, Qld, SA and Vic. This could drive the procurement of an additional black start SRAS source in these regions. For further information refer to Chapter 3.

- capital costs for trialling and building new black start SRAS capability to replace the retirement of existing capability.

However, the Panel notes that the Standard is part of the broader restart framework in the NER that balances the provision of flexibility for AEMO to consider technical and commercial decisions for SRAS procurement with prudent SRAS expenditure. This is explored in the sub-sections below.

4.4.2 The NER provides AEMO with sufficient flexibility and discretion to support the specification and procurement of SRAS

The elements of the NER that support AEMO's consideration of technical specification and commercial procurement of SRAS include:

- Chapter 10 definition of SRAS, which enables AEMO to procure black start capability and define any other capability it considers necessary for SRAS as a restoration support service.
- The SRAS Objective and SRAS Procurement Objective which guide the Panel's determination of a Standard and AEMO's obligations in meeting that Standard at lowest long-term cost.[93]

The Panel notes the NER provides AEMO with discretion around the technical specification and commercial procurement of SRAS. This includes flexibility in:

- defining the types of services it requires for system restart
- AEMO is not restricted in the procurement approach it uses to meet the SRAS Procurement Objective.

These elements set out the governance arrangements that balance the flexibility provided to AEMO to operationalise system restart planning, with guidance that supports prudent investment in SRAS.

The SRAS definition provides AEMO with discretion to consider a broader range of technologies to support system restoration

Chapter 10 of the NER defines SRAS as:

> A service provided by *plant* or *facilities* with:
>
> (a) *black start capability*; or
>
> (b) the capabilities described in the *SRAS Guideline* to supply one or more services to sustain the stable *energisation of generation* and transmission,
>
> sufficient to facilitate the restoration and maintenance of *power system security* and the restart of *production units* following a *major supply disruption*.

While black start capability is defined under Chapter 10 of the NER, part (b) of the definition of SRAS provides AEMO with the discretion to define the services it considers necessary to sustain the stable energisation of generation and transmission. AEMO defines these services as restoration support services in the SRAS Guidelines.[94]

The Panel considers the SRAS definition appropriately encompasses the range of current and future technologies that would be required for system restoration. The definition provides AEMO with the flexibility to adapt to the needs of the transitioning system restart by amending the services it considers as restoration support services to include services such as those provided by, Battery Energy Storage System (BESS) and IBR that could support the restoration process.

93 NER, clauses 3.11.7(a1) and 8.8.3(aa)(1)

94 The current restoration support services are defined in Section 3.4 of AEMO's 2021 SRAS Guideline.

The Panel notes stakeholder feedback from its issues paper that the requirements for IBR to participate in SRAS provision is currently not clear.[9596] The Panel considers that AEMO is able to provide further clarity to market participants on specific technical requirements for the services it requires for SRAS through the SRAS Guideline. The NER requires AEMO to consult with registered participants and other persons who have identified themselves as having interest in the SRAS Guideline.[97]The Panel encourages AEMO to engage directly with market participants to inform the technical specifications it sets out in the SRAS Guideline.

The Panel also notes the changes that were made to the SRAS definition under the *SRAS Rule 2020*. This rule was made in response to a rule change request from AEMO which requested:

- the definition of SRAS is amended to refer to both black start capability and system restoration support services
- AEMO to define restoration support services in the SRAS Guideline
- the definition of black start capability is amended to allow for this capability to be provided by both generating units and other facilities.

The Panel notes the Commission's rationale for the expanded definition of SRAS to:[98]

- allow emerging technologies, such as batteries with 'grid-forming' inverters, or plant combinations (e.g. an asynchronous generator combined with a battery storage system) to be procured by AEMO to provide black start capability in the future
- increase competition for the provision of black start capability from an expanded range of facilities, reducing the costs of these services for consumers
- allow AEMO to procure system restoration support services, providing for the capability to support the grid during a restart process to be valued under the NER and available when required
- provide AEMO with the flexibility to define the specifics of system restoration support services in the SRAS guideline, allowing AEMO to determine what capability is needed to support system restoration at any given time and within different electrical sub-networks, and to revise these services as required to adapt to changing system conditions.

The Panel notes the feedback in AEMO's submission that sought to clarify that NSPs should not be treated as SRAS providers for network functionality that is already considered part of their regulated obligations.[99] The Panel wishes to clarify that NSPs are not considered providers of SRAS. This aligns with the Commission's commentary in the 2020 SRAS Rule, which noted the "definition of SRAS...does not include services provided by NSPs".[100] The Commission noted that NSPs would generally already provide the types of services that might be defined as system restoration support services, as part of their normal operations, and that this would already form part of their prescribed transmission services.[101]

95 Ausgrid submission to the Review of the System Restart Standard Issues Paper, p.7.
96 EnergyAustralia submission to the Review of the System Restart Standard Issues Paper, p.2.
97 NER, clause 3.11.7(f).
98 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.43.
99 AEMO, submission to the draft determination, 16 October 2025, p.12.
100 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.48.
101 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.47.

The SRAS procurement objective supports AEMO in considering a range of commercial arrangements including establishing long term contracts and investing in the development of new SRAS capability

The Panel considers the NER framework provides AEMO with considerable flexibility to procure SRAS through commercial arrangements based on any procurement process that it considers will meet the SRAS procurement objective.[102] While AEMO is required to set out its proposed SRAS procurement processes in the SRAS guideline, it has discretion and flexibility under the NER around the specifics of any procurement process it considers is fit for purpose.[103]

AEMO is not restricted in the procurement approach it uses to meet the SRAS Procurement Objective. If AEMO proposes to acquire an SRAS:[104]

> AEMO must enter into an ancillary services agreement with a prospective SRAS provider following the completion of **any procurement process to acquire SRAS** which AEMO is satisfied will enable it to meet the SRAS Procurement Objective.

This includes provisions for AEMO to contract both registered and non-registered market participants for the provision of SRAS, provided that SRAS are only provided once the person becomes a registered participant.[105] AEMO's SRAS procurement may also utilise any competitive or non-competitive process to acquire SRAS, including processes to enter direct negotiations and invite potential SRAS providers to contact AEMO directly to offer SRAS.[106]

At the same time, AEMO has discretion to determine the contract length for SRAS ancillary services agreements as required to maintain existing capability and support investment in new SRAS capable plant.

The primary restriction on AEMO's procurement of SRAS is the SRAS Procurement Objective, which requires AEMO to use reasonable endeavours to acquire SRASs to meet the Standard at the lowest long term cost..:[107]

AEMO is required to provide guidance to Registered Participants on how it will achieve the SRAS Procurement Objective in AEMO's SRAS Guideline.[108]The Panel considers that the NER provisions for AEMO to develop the SRAS Guidelines provide AEMO flexibility in its approach to procuring SRAS, enabling AEMO to:

- determine a procurement approach AEMO sees fit in acquiring SRAS and set out this process in the SRAS Guideline[109]
- set out its process to negotiate the provision of SRASs without a competitive tender process[110]
- set out its process for a potential SRAS provider to contact AEMO to offer the provision of SRASs without a competitive tender process, which offer AEMO is in no way obliged to accept.[111]

The Panel also notes that the Commission considered and amended the SRAS Procurement Objective through the determination of the *SRAS rule 2020.* This rule amended the SRAS

102 NER cl.3.11.9(a)
103 NER cl.3.11.7(d)(5)
104 NER, clause 3.11.9(a)
105 NER cl. 3.11.9(b) and 3.11.9(c).
106 NER cl. 3.11.7(6) and 3.11.7(7).
107 NER, clause 3.11.7(a1)
108 NER, clause 3.11.7(d)(5A)
109 NER, clause 3.11.9(a) and 3.11.7(d)(5).
110 NER, clause 3.11.7(d)(6)
111 NER, clause 3.11.7(d)(7)

procurement objective through the addition of "lowest long term cost" to provide AEMO with greater flexibility to consider entering into longer term SRAS contracts or paying for capital works, if this would result in lower long term costs. This change was intended to support investment in new SRAS capability through long-term contracts as required to meet future system restart requirements.[112]

4.5 The Panel encourages AEMO to continue using Type 2 contracts to understand the contribution of new technologies to system restoration

The Panel supports AEMO with its plans to undertake a program of priority technology trials for system restart, which include the use of Type 2 contracts under the NEM's Transitional Services Arrangements.[113] This aligns with stakeholder views which encouraged AEMO to utilise Type 2 transitional contracts to trial new technologies such IBR and BESS for participation in system restart.

The Panel welcomes AEMO's recent publication of Statements of Needs that seek to award Type 2 contracts to services that demonstrate:[114]

- the provision of black start capability using IBR
- the capability to support system restoration in a high distributed PV environment following a system black event.

The Panel considers that these trials will help enhance the understanding of IBR behaviour and the capabilities to support re-energisation during high distributed PV conditions, during stage one and stage two of system restart process. This would help improve understanding of technologies that have not previously been demonstrated for supporting system restart in the NEM, and support AEMO in forward looking restoration planning and identifying options for future SRAS procurement.

The Panel notes that Type 2 contracts under the Transitional Services Framework can be used in specific circumstances:

- Type 2 contracts can only be used to trial either new technologies or the new application of existing technologies.
- Any existing technology must not have been used to manage system security before 28 March 2024. This does not preclude assets if they are providing security services in a way that is distinct from their previous services.
- Type 2 contracts have a maximum duration of 10 years and must not extend past 1 December 2039. The entire transitional service framework sunsets on 1 December 2039.

4.6 The Panel supports further work to support investment in essential system services through the electricity entry mechanism

The Reliability Panel recognises the potential opportunity provided by the Electricity Services Entry Mechanism (ESEM), proposed by the NEM Review Panel, to support co-investment in new SRAS-capable equipment.

112 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.68

113 "Type 2 contracts" are contracts for services pursuant to NER, clause 3.11.11(b)(2).

114 AEMO, 2025. Transitional services - type 2 services.

The ESEM is designed to facilitate the entry of new energy services into the market. This includes provisions for co-investment in essential security services (ESS). The NEM Review Panel considers system restart services to be an ESS.[115]

The Reliability Panel supports further work to support investment in Essential System Services through the ESEM, consistent with recommendation 8b in the NEM Review Panel's draft report, which states.[116]

> Where cost-effective, projects facilitated through the ESEM should also be able to provide Essential System Services. The ESEM administrator should coordinate with transmission network service providers (TNSPs). This should take the form of secondary contracting for the specific elements of the project that relate to providing ESS.

The ESEM has the potential to support the provision of new SRAS capability that AEMO advises will be required to make up for the expected retirement of existing black start capable generation. This support could be in the form of:

- targeted co-investment in SRAS capability to meet specific system needs as identified in advance by AEMO.
- a generalised requirement for ESEM beneficiaries to have the capability to provide at least one type of SRAS, this could include the capability to provide a black start or restoration support service as determined and specified by AEMO.[117]

Stakeholders, including Tesla and AEMO, both support the Panel's consideration of the opportunity to support co-investment in SRAS-capable equipment through the ESEM.

115 NEM Review Panel, National Electricity Market wholesale market settings review - Draft Report, August 2025, p.33.

116 Ibid. p.21.

117 For reference, AEMO proposed a similar general technical performance standard for SRAS capability in its 2020 SRAS rule change request, further detail on this is set out on page 5 of the AEMC Final Determination - System restart ancillary services, standards and testing Rule 2020, published 2 April 2020.

5 The Panel recommends changes to physical network testing and local black system procedure arrangements

In this Chapter, the Panel has set out the findings and recommendations from its analysis of the system restart regulatory framework with respect to:

- **testing arrangements**, to assess the flexibility of the current framework to support physical testing of potential new restart pathways (see section 5.1 for further discussion).
- the **local black system procedure** (**LBSP) framework,** to assess whether it supports the provision of quality information to support AEMO's restart planning efforts (see section 5.2 for further discussion).

In the draft determination, the Panel considered that:

- the current **SRAS testing arrangements** under the NER provide sufficient flexibility for AEMO to undertake physical SRAS tests and compensate involved parties accordingly, and invited stakeholder views on potential changes to the framework that could better support more extensive SRAS testing.
- the current NER **LBSP framework** is sufficiently strong and flexible to support AEMO in obtaining the information it requires from relevant market participants.

However, stakeholders disagreed with the Panel's findings that the Rules frameworks are fit for purpose, with respect to SRAS testing and LBSP frameworks. Stakeholders consider amendments to the NER to strengthen the:

- testing arrangements to better support deeper system restart testing, which stakeholders consider crucial in supporting the development and verification of changes to existing, or new, restart pathways
- LBSP framework to improve the provision for accurate and timely information, provide additional clarity in the LBSP approval process and consider a framework that would give greater effect to energy support arrangements.

The Panel is recommending that a Rule change request be submitted to the AEMC on various matters related to system restart. In considering stakeholder feedback, the Panel considers that this Rule change request includes consideration of matters relating to testing arrangements and the LBSP framework, as per the following recommendations.

Recommendation 3: Testing arrangements

The Panel recommends that the Rule change request consider amending the NER to strengthen elements of the system restart testing arrangements.

The Panel considers the scope of this request would require the AEMC to consider changes to how the rules operate in relation to:

- setting out clear definitions for various types of physical network testing arrangements (e.g. shallow and deep network tests)
- determining clear roles for various participants impacted by testing, including specific guidance for AEMO and NSPs

- setting out scenarios where deeper network testing is required and guidance on where other testing may be appropriate, and the party or parties responsible for determining the appropriate testing approach
- considering whether current compensation arrangements remain appropriate for all types of network testing arrangements, based on the risks and costs associated with each type
- considering the need for any real-time visible high-speed monitoring capability to be present throughout the restart pathway prior to conducting deep network testing.

Recommendation 4: Local black system procedure framework

1. **The Panel recommends that the Rule change request consider changes to the NER that would strengthen elements of the LBSP framework.** The Panel considers that the scope of this request require the AEMC to consider:
   - providing clear guidance on the capabilities that are expected to be maintained as part of an LBSP, outside the provision of an SRAS contract
   - establishing a framework that gives greater effect to energy support arrangements, setting out, at minimum, the purpose, the roles of relevant parties and the interaction with system planning.
2. **The Panel recommends AEMO update the LBSP Guidelines to include clear requirements to notify AEMO when changes are identified on LBSP plant.**

5.1 The Panel recommends changes to testing arrangements in the NER

Power system operators worldwide rely on a combination of computer-based, deterministic models and physical tests to demonstrate confidence in their restart plans.[118]

In its technical advice, AEMO noted that the current restart pathways in the NEM have remained unchanged for a considerable period of time. In developing these pathways, extensive network testing and detailed modelling were conducted, which provides a high level of confidence in the respective pathways functioning in the event of an actual black system event.[119]

As the energy transition in the NEM accelerates, a range of new technology sources, including IBR generation, BESS and DER are entering the system, alongside significant changes to the network topography, including new transmission infrastructure, thermal coal generation exits and changes in load availability. Given these changes to the power system, there may be diminished confidence levels in existing restart pathways, and new pathways may need to be considered and developed.

These changes highlight an important need to review whether the existing arrangements for testing remain fit for purpose in the NEM. In light of stakeholder feedback to the Panel's draft determination, the Panel recommends that a Rule change proposal is submitted to the AEMC that considers, at minimum, the following scope:

- set out clear definitions for various types of network testing arrangements (e.g. shallow and deep network tests)

118 ISON, 2025. International system restoration review. p.4

119 AEMO, 2025. System restart technical advice. p.60.

- determine clear roles for various participants impacted by testing, including specific guidance for AEMO and NSPs
- set out scenarios where deeper network testing is required and guidance on where other testing may be appropriate, and the party or parties responsible for determining the appropriate testing approach
- consider whether current compensation arrangements remain appropriate for all types of network testing arrangements, based on the risks and costs associated with each type
- consider the need for any real-time visible high-speed monitoring capability to be present throughout the restart pathway prior to conducting deep network testing.

5.1.1 Deep network testing is required when considering substantive changes to existing restart pathways

AEMO considers that there is a strong need for a dedicated ongoing program of deeper testing of new and existing restart paths. In particular, this would include testing the interaction between different technologies in the early stages of a restart event. AEMO set out some key tests that could include:[120]

- the ability of BESS to restart nearby network and other generation plant
- the restoration of select IBR from traditional black start providers, and the impact on the stable restoration island, including the nearby network
- the ability to use existing high voltage direct current (HVDC) interconnectors as an SRAS resource
- the ability of renewable energy zones (REZs) to form an independent restoration island.

In an international review of system restoration conducted by International System Operator Network (ISON),[121] survey responses from operators globally indicated that physical testing was considered the "ultimate proof" of restart capability. The report noted that operators expressed a desire to regularly perform physical network tests beyond the initial system restart service, including the next-start generator and load pickup, to confirm the validity of the units procured and their restart plans. However, only ERCOT (Texas, USA) and Energinet (Denmark) have been able to routinely perform network-based testing beyond the initial black start plant, with others struggling to secure the necessary outages to facilitate this procedure, meaning such network and load testing may need to be indefinitely postponed.[122]

The Panel recognises that there is a trade-off between the benefits of deeper network testing, with the cost and risk involved in such tests. The Panel notes that the development of deeper restoration tests is complex and would take extensive planning and coordination to execute.

In its submission to the Panel's draft determination, AusNet expands on the trade-offs associated with foregoing deep network testing, noting that they "require all parties to accept the risks and commit to the planning and effort required to conduct meaningful deep network tests".[123] Table 5.1 sets out these considerations.

120 AEMO, 2025. System restart technical advice. p.60.

121 AEMO is one of six founding members of the ISON, formed in 2024. The network also includes CAISO (California), EirGrid (Ireland), Energinet(Denmark), ERCOT (Texas) and NESO (UK) and collectively focuses on real-world, practical solutions to enable the operation of reliable, secure, high renewable power systems

122 ISON, 2025. International system restoration review. p.4.

123 AusNet, submission to the draft determination, 16 October 2025, p.4.

Table 5.1: Risks associated with foregoing deep network system restart testing

Risks of undertaking deep network tests	Risks of not undertaking deep network tests
• Potential damage to transmission assets (e.g. transformers could be damaged if they do not have adequate over-voltage protection). • Operational complexity and coordination challenges. • Cost implications for generations (e.g. units may need to be offline for extended periods).	• Increased risk of restart failure due to invalidated pathways. • Reduced confidence in restoration modelling and system readiness. • Limited ability to identify and resolve latent issues in restart pathways.

Source: AusNet, submission to the draft determination, 16 October 2025, p.4

5.1.2 The flexibility provided in the existing NER testing frameworks has not translated into consistent practice

The Panel considered in the draft determination that the current Rules framework pertaining to system restart testing obligations under clause 4.3.6 provides sufficient discretion for AEMO to:

- establish testing procedures to test deeper into existing restart pathways, so long as this testing procedure is supported by impacted test participants
- carry out tests of potential new restart pathways, subject to consultation with relevant participants impacted.

While stakeholders agreed with the Panel's draft determination finding, that the NER currently provides flexibility for deep network tests to be conducted in the NEM, stakeholders highlighted that this flexibility "has not translated into consistent practice".[124] In its submission to the draft determination, AusNet acknowledged that a deep network test is currently being planned in Victoria, however, noted:[125]

> ...coordination challenges such as aligning parties, ensuring readiness and selecting the lowest-impacting timing have contributed to delays, underscoring the delicate trade-offs that must be managed. This experience reinforces the point that flexibility alone is not enough to ensure deep network testing occurs when it is needed.

AEMO supports this sentiment, noting that "system restart tests are already extremely difficult to achieve, given the very narrow windows for sufficiently benign conditions to minimise market disruption".[126] AEMO goes on to note that "if a single piece of critical equipment has not been maintained or is not operating to standard, a programmed test could easily be delayed for a full year".[127]

The Panel understands that AEMO conducts SRAS tests annually as a requirement of the SRAS provider's contractual obligations, [128] AusNet highlighted that these tests are shallow in nature,

124 AusNet, submission to the issues paper, 30 January 2025, p.4
125 Ibid.
126 AEMO, submission to the draft determination, 16 October 2025. p. 17.
127 Ibid.
128 AEMO, NMAS annual report 2024-25, October 2025, p.9.

only assessing the SRAS provider's ability to re-energise the bus at the relevant black start site, rather than deeper tests of the restart pathway.[129]

5.1.3 The Panel's recommendation considers stakeholder proposals in determining the scope of its Rule change request to revise the existing testing framework

Both AEMO and AusNet proposed changes to the system restart testing framework.

AusNet called for AEMO to amend its protocols to mandate deep network testing arrangements and identified three changes that could support more extensive SRAS testing:[130]

- clearer definitions for shallow and deep network testing
- agreed defined scenarios where deep network testing is required, including when a new restart pathway is established or a material change occurs to an SRAS unit on a restart pathway.
- mandatory requirements for real-time visible high-speed monitoring capability to be in place for all relevant equipment within the restart pathway prior to conducting deep network testing to ensure that testing yields meaningful insights and enables accurate validation of system behaviour against models.

However, AEMO called for further strengthening of the system restart testing frameworks, under NER clause 4.3.6 to enable deep network tests to occur.

Physical testing of restoration pathways and procured SRAS capability is an important aspect of system restart planning. The Panel recognises physical testing supports AEMO in establishing confidence in its system restart plans. The Panel however, recognises there are significant technical risks and commercial considerations when considering extensive system restart tests. Therefore, a balance must be struck between the benefits of improved confidence in the restart plans and the cost of risks undertaken to establish this.

The Panel considers merit in the proposals set out by AEMO and AusNet with respect to enabling deeper restart testing. The Panel agrees with AEMO that further strength may be required in the NER to give effect to deeper network tests, noting such tests have not been performed in the NEM for some time. The Panel considers that testing arrangements should not be limited to existing pathways, but rather align with AEMO's planning functions and support it in testing potential new restart pathways. The Panel also welcomes AusNet's proposal, providing a constructive basis upon which a potential framework for deeper network testing can be established within the Rules.

The current testing framework establishes cost recovery arrangements for direct costs incurred. The Panel recognises these arrangements remain fit for purpose when considering the costs associated with establishing deeper network testing requirements.

In considering stakeholder feedback, the Panel is recommending that the scope of the Rule change would consider amendments to the provisions under the framework for system restart test obligations, under NER clause 4.3.6, or as otherwise determined by the AEMC, to:

- set out clear definitions for various types of network testing arrangements (e.g. shallow and deep network tests)
- set out scenarios where deeper network testing is required and guidance on where other testing may be appropriate, and the party or parties responsible for determining the appropriate testing approach

129 AusNet, submission to the issues paper, 30 January 2025, p.2.

130 AusNet, submission to the draft determination, 16 October 2025, p.3.

- determine clear roles for various participants impacted by testing, including specific guidance for AEMO and NSPs
- consider whether current compensation arrangements remain appropriate for all types of network testing arrangements, based on the risks and costs associated with each type
- consider the need for any real-time visible high-speed monitoring capability to be present throughout the restart pathway prior to conducting deep network testing.

The following sub-sections set out specific enhancements proposed by AusNet and AEMO, under each element of the Panel's recommended scope.

AusNet proposed definitions for deep and shallow network testing arrangements

In its submission, AusNet proposed potential definitions for shallow and deep network testing as set out below:

Box 10: Proposed definitions for physical testing as proposed by AusNet

Shallow network testing definition

A basic startup test where SRAS units must be capable of operating in a stable manner, supplying their own auxiliaries or running at zero export load for 30 minutes.

Deep network testing definition

A comprehensive test that involves at least one of the below tests as agreed between AEMO and the relevant TNSP(s):

- Line energising test:
  - A test to verify the SRAS unit's ability to energise lines along the cranking path.
  - The SRAS unit must demonstrate the ability to energise enough transmission to deliver its output to required loads as specified in the System Restart Plan.
- Load carrying test [1]:
  - A test to verify the SRAS unit's ability to supply a pre-arranged load.
  - The SRAS unit must demonstrate the ability to supply the required load while maintaining voltage and frequency for at least 30 minutes.
- Next-start resource test:
  - A test to verify the SRAS unit's ability to start the next unit in the restoration sequence.
  - The SRAS unit must demonstrate the ability to start the next SRAS unit's largest required motor while maintaining voltage and frequency stability for at least 30 minutes.

Source: AusNet, submission to the draft determination, 16 October 2025, p.3.
Note: [1] Deep network testing is also conducted in other international jurisdictions, including Denmark, where Energinet serves as the transmission system operator.

AusNet and AEMO recommend deep network tests to occur under prescribed scenarios

AusNet proposes deep network tests should be performed under three scenarios:[131]

- a new restart pathway is established or proposed, noting it is essential to test any new restart pathway to ensure it is viable.
- a material change occurs to a SRAS unit, noting the restart capability of the unit should be verified following the implementation of this change.

131 AusNet, submission to the draft determination, 16 October 2025, pp.4-5.

- more than 10 years have elapsed since the last deep network test in the region, noting this cycle offers a practical starting point, balancing system assurance with the financial and logistical realities of conducting full-path validation under realistic conditions.

AEMO considers that the current framework requires it to have a system restart plan in place before requiring it to test the effectiveness of that plan. However, AEMO suggests that in future, testing of the system may need to be completed before a system restart plan is finalised.

AEMO recommends that deep network tests are also considered during the planning of new restart pathways. AEMO called for amendments to the following NER clause:

- 4.3.6(b) - to allow the conduct of system restart tests to confirm the feasibility of **potential** system restart paths to inform the development of a system restart plan

AEMO considered that the role of NSPs in testing should be clarified

AEMO highlighted the important role NSPs play during system restart testing and sought further clarity on the implication of testing costs on NSPs. In the 2020 SRAS Rule, AEMO sought to clarify that restart path tests are part of the functions of AEMO and NSPs under the NER, and therefore subject to the liability and cost recovery regimes in the national energy legislation.[132]

AEMO calls for amendments to the following NER clause:

- 4.3.6(l) - to clarify that the provision also does not prevent recovery of NSP testing costs through determinations made under chapter 6 or 6A.

AEMO considered this change would expand testing arrangements to support testing of potential new pathways to support AEMO's system restart planning efforts.

The Commission previously considered the roles and responsibilities of NSPs in system restart testing in the 2020 SRAS Rule. AEMO's Rule change request sought to clarify the role of NSPs in system restart testing and the process for NSPs to recover costs following a test.[133] The revised testing framework determined by the Commission set out a clear role for NSPs to support the design of test programs and establish communication protocols to be followed during a system restart test.[134] In relation to NSP cost recovery, the Commission considered "the efficient costs NSPs incur in association with [system restart] testing are expected to be recovered through charges for prescribed transmission services"[135]

However, the Panel considers that deeper network testing may require varied obligations on NSPs. This could include more extensive communication and monitoring capabilities and increased costs associated with a larger quantity of equipment used during such tests. The Panel also considers that the role of DNSPs in relation to system restart testing is growing. DNSPs will continue to play a strong role in acquiring sources of clean load to support stabilisation of the system during daylight re-energisation processes.

AusNet called for mandatory real-time high-speed monitoring capability to be installed ahead of any testing

AusNet also highlighted the importance of real-time high-speed monitoring capability to ensure that testing yields meaningful insights and enables accurate validation of system behaviour against models.[136] AusNet considers that while Supervisory Control and Data Acquisition (SCADA)

132 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.74.
133 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.6.
134 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.71-72.
135 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020, p.90.
136 AusNet, submission to the draft determination, 16 October 2025, p.5.

systems are available, they typically provide data at four-second intervals, which is insufficient resolution to detect fast-acting phenomena that may be important when studying systems under restart conditions (e.g. resonance oscillations or transient instability).[137]

Stakeholders consider existing cost recovery arrangements may not be fit for purpose for deep network testing

The NER establishes a compensation framework to allow participants to claim compensation for any direct costs incurred as a result of being instructed to participate in a test. The framework sought to provide equity between participants with and without SRAS agreements. In making the Rule, the Commission did not consider that it is pragmatic or economically efficient to compensate generators for opportunity costs (particularly lost market revenue) resulting from participation in restart path testing.[138]

However, Shell Energy and Hydro Tasmania support reviewing the cost recovery framework for testing to appropriately consider the economic risks of participating in deeper network testing arrangements. Hydro Tasmania noted that "compensating generators based upon an opportunity costs basis may be appropriate for certain generation types and under certain SRAS testing conditions".[139]

5.2 The Panel is recommending changes to the local black system procedure framework in response to stakeholder feedback

The system restart plan, and thereby SRAS procurement needs, are informed by local black system procedures (LBSPs) that each generator, integrated resource provider (IRP) and network service provider (NSP) in the NEM is required to develop and provide to AEMO.[140] The LBSP includes all procedures, requirements and relevant performance of plant (including generation and network assets) during their restart. The LBSP information underpins system restart modelling and could go toward supporting the identification of gaps in restoration pathways and identifying opportunities for market participants to provide services to fill those gaps.

The current NER framework requires AEMO to develop and publish a LBSP guideline in consultation with registered Generators, IRPs and NSPs.[141] LBSPs must set out:

- the information AEMO requires to understand the likely condition and capabilities of a plant following a major supply disruption
- actions that the relevant participant must undertake following a major supply disruption, prior to the energisation or synchronisation to the grid
- any relevant energy support arrangements to which relevant participants may be a party.[142]

The NER also outlines a process for AEMO to review and approve LBSPs submitted by registered Generators, IRPs, and NSPs.

In its technical advice, AEMO noted that due to the importance of LBSPs to the system restart plan, it is critical that accurate and comprehensive LBSPs are provided for all plant and network providers.[143]Changes to LBSPs may have downstream impacts on the system restart pathways

137 Ibid.
138 AEMC, System restart services, standards and testing, Rule determination, 2 April 2020. p.100.
139 Hydro Tasmania, submission to the draft determination, 16 October 2025, p.4.
140 NER, clause 4.8.12(d)
141 NER, clause 4.8.12(e)
142 NER, clause 4.8.12(f)
143 AEMO, 2025. System restart technical advice. p.58.

and impact the ability for the system restart plan to meet the Standard, and may require AEMO to consider procurement of further SRAS services.

The Panel made a draft recommendation for AEMO to conduct an audit of LBSPs, prioritising the audit of LBSPs that are contained within existing system restart pathways, before the revised Standard becomes enforceable on 1 July 2027.

However, stakeholder feedback to the Panel's draft determination expressed concern about the implementation of the draft recommendation and outlined a range of issues with the current framework. Stakeholders called for the Panel to reconsider its draft recommendation and consider whether the framework requires strengthening. The concerns raised by stakeholders were related to:

- the provision of accurate up-to-date and reliable information for plant to ensure they can be securely energised during restart
- the services that may be expected to be maintained within a plant's LBSP
- energy support arrangements and how they are considered in system restart plans.

In considering stakeholder feedback, the Panel recommends a Rule change request consider strengthening elements of the LBSP framework.

The Panel considers the scope of this request requires the AEMC to consider changes to the NER to:

1. provide clear guidance on the capabilities that are expected to be maintained as part of an LBSP, outside the provision of an SRAS contract
2. establish a framework that gives greater effect to energy support arrangements, setting out, at minimum, the purpose, the roles of relevant parties and the interaction with system planning.

The Panel also revises its draft recommendation for AEMO to conduct an audit of LBSPs, to recommend that AEMO update the LBSP Guidelines to include clear requirements to notify AEMO when changes are identified on LBSP plant.

5.2.1 The Panel considers that the NER could better clarify the services that are required to be maintained as part of the LBSP

The Panel recognises LBSPs form important inputs into AEMO's system restart modelling and planning. The Panel considers LBSP information would be useful in identifying options for SRAS procurement when SRAS gaps are identified.

Stakeholders called for clarity in the services that are required to be provided as part of an LBSP

Stakeholder submissions expressed mixed views on the capabilities that should be provided as part of an LBSP, versus those that should be compensated for through an SRAS contract or other means of cost recovery.

AEMO is concerned that the current LBSP framework incentivises participants to underestimate the capabilities of its facility, thereby requiring AEMO to procure the capability. In its submission, AEMO clarifies that restoration support services cannot compensate for diminished capacity or delayed restoration capabilities. This is because delays in the return to service time for synchronous plant reduces both the system security contribution (i.e. provision of voltage control, frequency control, etc) and the power generation capacity along the restart path, which cannot fully be restored through restoration support services.[144] AEMO requests that the Panel carefully

144 AEMO, submission to the draft determination, 16 October 2025. p.16.

consider whether the SRAS framework may disincentivise participants from maintaining existing capabilities that would assist in restoration, further eroding declared LBSP capabilities, unless AEMO procures them as restoration support services.[145]

However, Shell Energy expressed concern that the LBSP framework could be interpreted in the opposite way, as providing an incentive for AEMO to require the plant to provide services that may not be appropriately compensated for through an SRAS contract. The NER provides for AEMO to approve LBSPs, taking into account the LBSP guidelines and relevant components of the system restart plan.[146] Under NER clause 4.8.12(h):

> AEMO may request amendments to local black system procedures, including, without limitation, imposing conditions in respect of any energy support arrangement as AEMO reasonably considers necessary to ensure the integrity of the system restart plan. When requesting amendments to the local black system procedures, AEMO must provide reasons for those requested amendments.

Shell Energy and the EUAA are concerned that this NER clause leaves it open to AEMO to determine what "reasonably" can mean in this context and this exposes participants to the risk of providing capabilities that they are not appropriately compensated for. To make this clarification, Shell Energy and the EUAA proposed a new NER clause 4.8.12(g) as follows:

> (3) services to be provided under a system restart or system restart support services agreement.
>
> AEMO must not require the provision of a service under the local black system procedure which is not supplied in accordance with a system restart or system restart support services agreement or registered generator performance standard.

Conversely, AEMO argues that while it has the capability to request changes to LBSPs, it is limited in the circumstances in which it can make an amendment request, to when:[147]

- AEMO has actual knowledge of a capability or limitation that may not be accurately reflected in the LBSP (for example from an ancillary services contract or previous power system incident);
- AEMO is able to identify arrangements in the LBSP that could reasonably be varied if necessary for a viable system restart plan.

Stakeholders noted that energy support arrangements could be better integrated in the NER

In the event that an individual customer or customers require an increased level of protection from major supply disruptions over and above that provided to them under the Standard, they may make standalone arrangements for the provision of such a service, either through onsite backup generation or by entering into a contract with a third party for energy support. The NER contemplates the existence of such an "energy support arrangement" which is defined as:

> **energy support arrangement**
>
> A contractual arrangement between a *Generator*, *Integrated Resource Provider* or *Network Service Provider* on the one hand, and a customer or *participating jurisdiction* on the other, under which *facilities* not subject to an *ancillary services agreement* for the provision of

145 Ibid.

146 NER, clause 4.8.12(g).

147 AEMO, submission to the draft determination, 16 October 2025. p.15.

> *SRASs* are used to assist *supply* to a customer during a *major supply disruption* affecting that customer, or customers generally in the *participating jurisdictions*, as the case may be.

The NER requires that LBSPs must appropriately incorporate any relevant energy support arrangement to which a Generator, Integrated Resource Provider or Network Service Provider may be party.[148]

However, Shell Energy, EUAA and Energy Australia are concerned that the current NER arrangements may not support customers entering into energy support arrangements with other market participants, with the EUAA highlighting that "the current provisions around an energy support agreement do not require AEMO to include energy support agreements in the overall sub-region restart plan".[149]Further, Shell Energy highlighted that AEMO could potentially negate any energy support arrangements if it considers the arrangement calls into question the integrity of the system restart plan. [150] [151]

This causes concerns for some large load providers, such as aluminium smelters. These loads may depend on energy support arrangements to provide an increased level of protection against major supply disruption, as they are exposed to significant economic damage in the event of a delayed restoration of supply following a major supply disruption.

The EUAA highlights that large loads are critical to restoration, noting the ability of large loads to support the coordinated provision of stable load sources throughout the restoration process.[152] Large loads typically have predictable ramp-rates and can act as a dampener for frequency and voltage fluctuations, allowing the coordination of large scale generation to energise, and for smaller loads to be reconnected earlier in the process. [153]

Energy Australia highlighted that "LBSP templates should ensure that a generator is not prevented from entering into energy support agreements with other market participants".[154] Shell and the EUAA, however, call for the Panel to consider updates to the NER to include an addition to clause 4.8.12 of the NER to ensure that an energy support agreement **must** be considered by AEMO when developing a sub-region system restart plan.

> 4.8.12(c1) must take into account and give effect to any energy support arrangement as set out in a local black start system procedures as detailed in accordance with clause 4.8.12(f).

AEMO also recommended that the Panel consider a proposal to **extend the LBSP provisions in the NER to major customer loads**, if AEMO requires this information to develop a system restart plan, noting the LBSP guidelines currently permit this, but there is no NER obligation.[155]

The Panel recommends a Rule change to investigate changes to the LBSP framework to establish clarity

The Panel considers that stakeholders raise material concerns regarding the LBSP framework, in relation to:

- the ambiguity of the capabilities set out in LBSPs that are required to be compensated

148 NER cl.4.8.12(f)(2)
149 EUAA, submission to the draft determination, 16 October 2025, p.3.
150 Shell Energy, submission to the draft determination, 16 October 2025, p.3.
151 NER, clause 4.8.12(h).
152 EUAA, submission to the draft determination, p.2.
153 Ibid.
154 Energy Australia, submission to the draft determination, 16 October 2025, p.3.
155 AEMO, submission to the draft determination, 16 October 2025, p.15.

- incentives for participants in entering energy support arrangements.

The Panel considers that the current LBSP framework does not currently outline a process for validating LBSP information. The Panel's draft recommendation sought to provide a process for LBSPs information to be validated through an extensive review process. However, the Panel notes the feedback from AEMO regarding the practicality of implementing this recommendation and has decided to remove this recommendation.

The Panel considers the LBSP framework is designed to support AEMO's understanding of the capabilities of plant under system restart conditions. The LBSP should:

- be used to inform system restart planning, including identifying the appropriate system restart path and informing the appropriate SRAS providers along potential restart pathways that minimise the cost of SRAS procured to meet the Standard.
- not incur substantive additional costs for participants, beyond what would be reasonably expected to be provided.
- provide sufficient time for AEMO to respond to revisions to LBSPs, through SRAS procurement or changes to the system restart plan, or both.

Furthermore, the Panel notes stakeholder feedback that highlights the potential for energy support arrangements to provide an increased level of protection from major supply disruptions beyond that provided under the Standard. However, the Panel recognises that this potential has not been delivered through the current NER arrangements.

In considering stakeholder feedback on the LBSP framework, the Panel recommends the scope of its Rule change request in relation to the LBSP framework consider:

- providing clear guidance on the services that are expected to be maintained as part of an LBSP, outside the provision of an SRAS contract
- developing a framework that more strongly recognises the existence of energy support arrangements, including clear guidance on their purpose, the roles of relevant parties and their interaction with system restart planning.

5.2.2 The Panel recommends AEMO update its LBSP Guidelines

In its submission, AEMO highlights that "LBSPs are critical inputs to the development of system restart plans and SRAS procurement".[156] AEMO highlights that it is important that LBSP information is accurate and up to date, noting this would promote "improved coordination, effective use of plant, advance identification of issues and workarounds to minimise restoration setbacks, and identification of gaps and SRAS opportunities".[157]

AEMO recommended stronger NER obligations for LBSPs to ensure LBSPs are kept up to date and accurate

AEMO highlighted that the existing NER requirements regarding LBSPs are "procedural only" and [158]is concerned that the reliance placed on LBSPs creates fundamental weaknesses in developing a system restart plan. AEMO noted the NER does not provide explicit obligations for:[159]

- facilities to conform with its LBSP in the event of a black system

156 AEMO, submission to the draft determination, 16 October 2025. p. 14.
157 Ibid.
158 AEMO, submission to the draft determination, 16 October 2025. p.14.
159 Ibid.

- the provision of accurate LBSP information, which is regularly reviewed with AEMO notified of any updates.

AEMO notes that the LBSP Guidelines permit the use of assumptions and appropriate disclaimers to encourage full disclosure of capabilities. [160] However, this has not translated to consistent practice, with AEMO noting that participants have previously "omitted or understated helpful restoration capabilities".[161]

The current LBSP Guidelines recommend, but do not obligate, participants to review its LBSP(s) at least once every two years, and sets out a process for participants to notify AEMO of any updates to these procedures. In a review of LBSPs conducted by AEMO between 2020 and 2022, AEMO noted that a "significant number of generating systems" under 30MW have outstanding LBSPs.[162]

AEMO recommended the Panel consider establishing stronger obligations within the NER for relevant participants to ensure LBSPs are kept up to date and reflect the best information and estimates reasonably available to the participant.[163]

Participants are subject to tier one civil penalties for non-compliance against the LBSP Guidelines

The Panel notes AEMO's concerns in relation to the provision of information; however, maintains its position that the current LBSP framework:

- provides sufficient flexibility for AEMO to determine and seek out the information it requires through the development of the LBSP guidelines.
- imposes significant civil penalties (Tier 1) for non-compliance against this reporting obligation.

The Panel notes that NER clause 4.8.12(d) imposes significant civil penalties (Tier 1) for any provider that is required to submit an LBSP and is non-compliant with this reporting obligation:

> Each Generator, Integrated Resource Provider and Network Service Provider must develop local black system procedures in accordance with the guidelines referred to in clause 4.8.12(e). The Registered Participant's local black system procedures must be consistent with any ancillary services agreement to provide SRASs to which that Registered Participant is a party. On request from AEMO, or as a result of a significant change of circumstances, a Registered Participant must review, and amend if appropriate, its local black system procedures.
>
> Note: This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

Under NER clause 4.8.12(e) AEMO is required to maintain an LBSP Guideline for the preparation of the LBSP, in consultation with generators, IRPs and NSPs. The requirements for an LBSP are set out in NER clause 4.8.12(f):

> Local black system procedures must:
>
> (1) provide sufficient information to enable AEMO to understand the likely condition and capabilities of plant following any major supply disruption such that AEMO is able to

160 AEMO, submission to the draft determination, 16 October 2025. p.15.
161 Ibid.
162 Ibid.
163 Ibid.

> effectively co-ordinate the safe implementation of the system restart plan;
>
> (1A) include any action the Generator, Integrated Resource Provider or Network Service Provider must take following any major supply disruption prior to *energisation* or *synchronisation*; and
>
> (2) appropriately incorporate any relevant energy support arrangements to which a Generator, Integrated Resource Provider or Network Service Provider may be party.

The Panel considers, as per NER clause 4.8.12(f)(1A), the participant **must** set out in advance, in its LBSP, any action it needs to take, following a major supply disruption to support early restoration efforts. Should a facility fail to conform with the actions set out in its LBSP on the day of a black system event, it would be subject to the relevant tier 1 penalties under the National Electricity (South Australia) Regulations clause 6(1) and Schedule (1). Facilities that undergo significant changes in circumstances are required to review and amend, as required, the relevant LBSP in accordance with the LBSP Guidelines. The facility provider would then be required to submit the LBSP for approval in accordance with NER clause 4.8.12(g).

The Panel notes AEMO's concern that it has "no practical means of verifying [the] accuracy [of LBSPs] or confirming whether they are regularly reviewed by the equipment operators"[164] However, the Panel notes that Section 4 of the current LBSP Guidelines sets out a clear responsibility for all Generators and NSPs to:[165]

- ensure "that the information in its LBSP reflects the current performance and capabilities of its plant at all times"
- review LBSPs when there are significant changes to plant and, routinely at regular intervals (two years is suggested), even when there are no material changes.

The Panel considers that the current LBSP Guidelines are outdated and recommends an update

The Panel notes the LBSP Guideline was last updated on 12 December 2019 and recommends that AEMO update the LBSP Guideline, in consultation with Generators, IRPs and NSPs to:

- align the Guidelines with updates to the NER framework to include requirements for Integrated Resource Providers
- clarify the processes AEMO will follow in the event it identifies non-compliance with the requirements of this Guideline, in consultation with the AER.

The Panel considers that these changes would help emphasise to participants the significance of maintaining updated LBSPs and emphasise the significant penalties imposed by the NER for non-compliant outcomes. Furthermore, the Panel considers that the inclusion of requirements for IRPs may provide stronger signals to smaller plants to submit LBSP procedures, noting that the consultation process outlined in the NER would require AEMO to engage with IRPs.

The Panel considers that, should AEMO identify other avenues to strengthen obligations on participants, it has the power within the framework to enact this through an update to the LBSP Guideline. These changes are subject to consultation with Generators, NSPs and IRPs.[166] The Panel notes that any participant that does not comply with the requirements set out in the NER or LBSP Guideline, is subject to the relevant tier 1 penalties.

164 AEMO, submission to the draft determination, 16 October 2025. p. 15.

165 AEMO, Local Black System Procedure Guidelines, Section 4.

166 NER, clause 4.8.12(e).

6 Other considerations

In this Chapter, the Panel has set out the findings and recommendations from its analysis of the system restart regulatory framework with respect to:

- **the role of the Standard**, to assess whether the current governance arrangements and requirements for setting the Standard remain fit for purpose for the transition
- **other considerations** that have been raised in stakeholder feedback to the Panel's draft determination, that has not been discussed in previous Chapters.

In the draft determination, the Panel considered the:

- Standard is an effective instrument in guiding AEMO's procurement of SRAS and supporting system restart planning
- current roles for the Panel in setting the Standard and AEMO in procuring to meet the Standard remain appropriate.

Stakeholder feedback did not provide further commentary on the role of the Standard, while some stakeholders considered that the roles and responsibilities for the Panel and AEMO in relation to the Standard remain appropriate.

Stakeholder feedback made other considerations, including:

- whether the role of networks should be more clearly set out, including seeking clarity in their role in system restart planning and as providers of system restart services.
- whether stronger provisions for enhanced certainty on timeframes for the restoration of consumer load should be established.
- while most stakeholders support the assumption for the Standard to be set such that each region is capable of independent energisation, Hydro Tasmania encouraged the removal of the NER assumption, arguing this constraint impedes the procurement of least-cost SRAS.

The Panel notes stakeholder feedback in relation to these issues, however considers that these frameworks remain fit for purpose at the present time. The Panel invites stakeholders to submit a Rule change request if they have any material concerns that warrant a more fulsome investigation of these frameworks. The following sub-sections set out issues raised and the Panel's consideration of these concerns.

6.1 The Panel's considerations of the role of NSPs in the context of future restart needs

While stakeholders supported the current roles for the Panel and AEMO, stakeholders considered that the role of networks should be more clearly set out. This includes seeking clarity in their role in system restart planning and as providers of system restart services.

AGL, AusNet and AEMO called for greater clarity in the role of NSPs. AGL noted that while NSPs are currently involved in planning and coordination, their role "should not extend to areas that impact competitively procured services".[167] AEMO suggests that the NER could more explicitly set out the responsibility for NSPs to plan and maintain transmission to support future restart capability.

167 AGL, submission to the draft determination, 16 October 2025, p.2.

AusNet recommends that AEMO be required to consult directly with TNSPs when planning for SRAS. This includes developing the restart plan and forward-looking modelling. AusNet notes that:[168]

> TNSPs bring critical insights from their deep network knowledge and operational experience. Early and formal involvement would support more efficient planning and ensure SRAS strategies reflect the practical realities of the transmission network and its constraints.

The Rules currently prescribe roles for NSPs, under NER clause 4.3.4(a1) to facilitate testing of SRAS, comply with the SRAS Guideline, and take all reasonable steps to facilitate the effective deployment of SRAS.

Chapter 5 (network planning standards) and Chapter 6A (economic regulation of transmission services) make reference to prescribed transmission services which includes the services NSPs must provide under the NER relating to shared transmission services, including those "necessary to ensure the integrity of a transmission network, including through the maintenance of power system security and assisting in the planning of the power system".

While AEMO identified areas in the Rules to improve the clarity on the role of NSPs, other stakeholders asked for greater clarity on the role of NSPs in the SRAS framework but they did not provide any specific examples or further explanation of what exactly this could mean.

The Panel considers that the current NER framework is currently clear on obligations for NSPs and fit for purpose. The Panel does not consider there to be a strong material need for further clarity in these frameworks at this time.

However, as noted in Chapters 5 and 6 of this determination, the Panel will include within the scope of its Rule change request, for the AEMC to investigate the role of NSPs with respect to:

- **transparency and reporting**, which includes consideration of NSP engagement in forward-looking restoration planning.
- **testing arrangements**, which includes consideration of:
  - the function of TNSPs and DNSPs in designing and exercising deep network test programs
  - whether the current arrangements to recover costs through charges for prescribed transmission services costs remain appropriate.

In developing its Rule change request to the AEMC, the Panel proposes to work with AEMO and other stakeholders, including NSPs to better understand the issues raised.

6.2 The Panel does not recommend any further changes to the framework underpinning the Standard

The Panel maintains its position from the draft determination, that:

- the Standard is an effective instrument in guiding AEMO's procurement of SRAS and supporting system restart planning
- the current roles for the Panel in setting the Standard and AEMO in procuring SRAS to meet the Standard remain appropriate.

168 AusNet, submission to the draft determination, 16 October 2025, p.2.

While stakeholders did not explicitly discuss the role of the Standard, stakeholders agreed with the Panel that the roles for AEMO and the Panel in relation to the Standard remain appropriate.[169] However, stakeholders provided feedback in relation to:

- whether stronger provisions for enhanced certainty on timeframes for the restoration of consumer load should be established
- whether the assumption for the Standard to be set such that each region is capable of independent energisation, remains appropriate

6.2.1 The Panel considers that the role of the Standard in specifying targets for the restoration of transmission and generation remains appropriate

The Panel recognises that under the current framework, the Standard:[170]

- sets a target that is focused on restoring a level of supply within a specified period of time
- assumes that supply is not available from any neighbouring region, in the event of a black system event.

The Panel is currently limited to determining a Standard to guide SRAS procurement to enable the restoration of all available generation and transmission. While this objective would require AEMO to consider how it brings online an equivalent quantity of load, a supply Standard provides limited transparency on the level of planning related to restoring all customer load.

Shell Energy, HydroTas and Energy Australia noted that the Standard should seek to provide enhanced certainty to consumers on timeframes associated with the restoration of consumer load. However, AEMO highlighted it does not support a formal load restoration standard and outlines in its submission the realities of the complexity of such modelling and, that the revised Standard acts as a strong balance in providing improved transparency around potential load restoration timeframes.[171]

The Panel recognises the merit of providing improved clarity regarding restoration load timeframes. However, the Panel also recognises the complexities in undertaking the appropriate modelling to provide a view on load restoration timeframes. While the Panel notes the UK's ESRS arrangements, which set out requirements for the restoration of load, the Panel considers implementing such a framework:

- requires a significant shift to the existing system restart regulatory framework
- leads to increased costs related to system restart including costs associated with regulatory reform, implementation, extensive and more frequent modelling, testing and additional procurement of SRAS
- presents operational challenges, noting current levels of visibility in distribution grids are low, and there would need to be a significant uplift in communication abilities to provide certainty in load restoration times, particularly in remote areas of the grid.

Therefore, the Panel does not propose this issue is considered in a Rule change proposal at this time. However, the Panel notes this issue was raised as part of the 2016 review of the system restart standard. At the time, the Panel made a recommendation for AEMO and NSPs to provide further transparency to JSSCs in relation to load restoration timeframes, however the Panel notes

169 These include submissions to the draft determination from AEMO (p.18); EnergyAustralia (p.3); Shell Energy (p.6).

170 NER, clause 8.8.3(aa)(2).

171 AEMO, submission to the draft determination, 16 October 2025, p.18.

no further actions have been taken on this recommendation to date.[172] In line with the Panel's 2016 recommendation, the Panel encourages AEMO and NSPs to consider how it could provide improved transparency on restoration timeframes for consumer load to the relevant bodies.

6.2.2 The Panel considers it appropriate to determine a Standard that ensures each electrical sub-network is capable of independent energisation following a black system event

The NER requires that the Panel determine the Standard to support independent restoration of each under the assumption that supply is not available from any neighbouring electrical sub-networks.[173]

The Panel recognises that this assumption delivers a layer of redundancy for system restoration capability for the mainland NEM regions, due to the low probability of a NEM-wide black system event. At the same time, this assumption drives an increased need for SRAS procurement along with associated costs.

Hydro Tasmania, strongly encouraged the removal of the NER assumption that restoration cannot rely on neighbouring sub-networks, arguing this artificial constraint impedes the procurement of least-cost SRAS. This concern was not shared by Shell Energy, which noted support for retaining the current NER requirement that SRAS only be acquired for a single electrical sub-network at a time, ensuring confidence in the simultaneous restart of multiple electrical sub-regions.[174]

The Panel is not recommending changes to the Rules to remove this assumption, noting:

- it remains appropriate that each electrical sub-network is capable of independent re-energisation
- AEMO is able to procure services in adjacent networks, so long as that service is only used for one electrical sub-network at a time
- AEMO can also consider the design of electrical sub-networks to better recognise the location of available SRAS.

172 See Appendix D.1.1 of the Panel's draft determination, which reviewed actions taken following the previous recommendations related to the system restart regulatory framework

173 other than that provided under a SRAS agreement acquired by AEMO for that electrical sub-network) ref. NER cl. 8.8.3(aa)(2)

174 Shell Energy, submission to the draft determination, 16 October 2025, p.6.

A Restoration targets and restoration curves

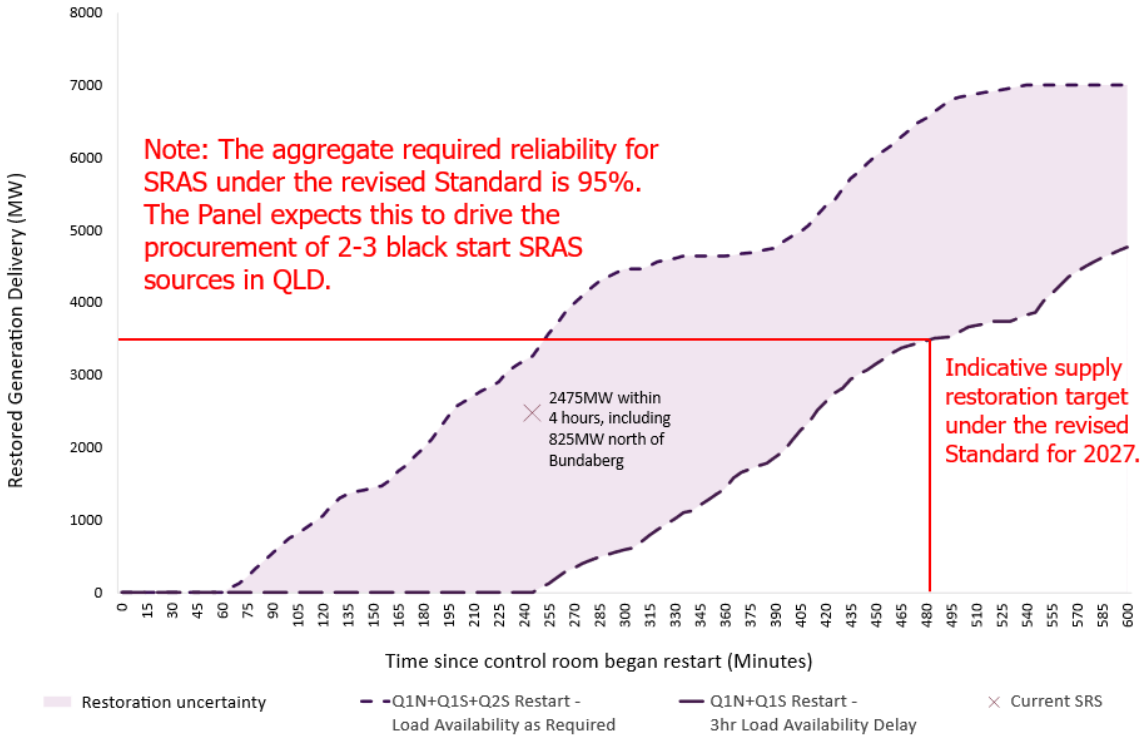
This appendix displays indicative representations of the proposed restoration targets under the revised Standard overlaid on AEMO's latest restoration curves for each electrical sub-network as included in its system restart technical advice.

For reference the quantitative restoration target under the revised Standard is

> For each electrical sub-network, AEMO shall procure SRAS to support the achievement of the following targets, following a major supply disruption:
>
> 1. Form one or more restoration islands, as described in section 5, in an electrical sub-network within 2 hours, and
> 2. Use those restoration islands to restore generation and transmission in that electrical sub-network equivalent to the capacity to supply 50% of the forecast average annual underlying demand in that electrical sub-network within 8 hours.

A.1 Queensland

Figure A.1: Final standard - Restoration level and time for QLD

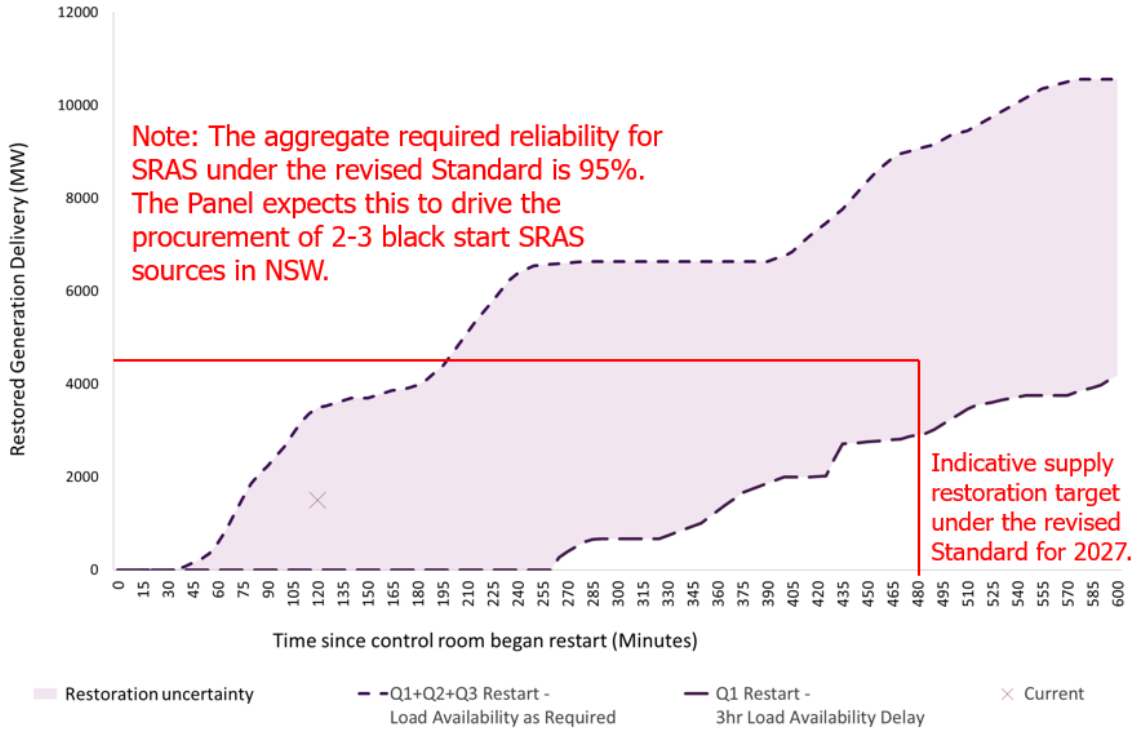


Source: Restoration curve based on summation of the Nth and Sth Queensland restoration curves included in AEMO's *System restart technical advice*, 19 June 2025, pp.66-67.

Note: Indicative restoration level based on 50% of forecast annual average underlying demand in QLD for 2027 which is 3,597MW. (Ref AEMO 2024 ISP Demand forecast, OPSO_PVLITE 2023 Reference year)

A.2 New South Wales

Figure A.2: Final standard - Restoration level and time for NSW

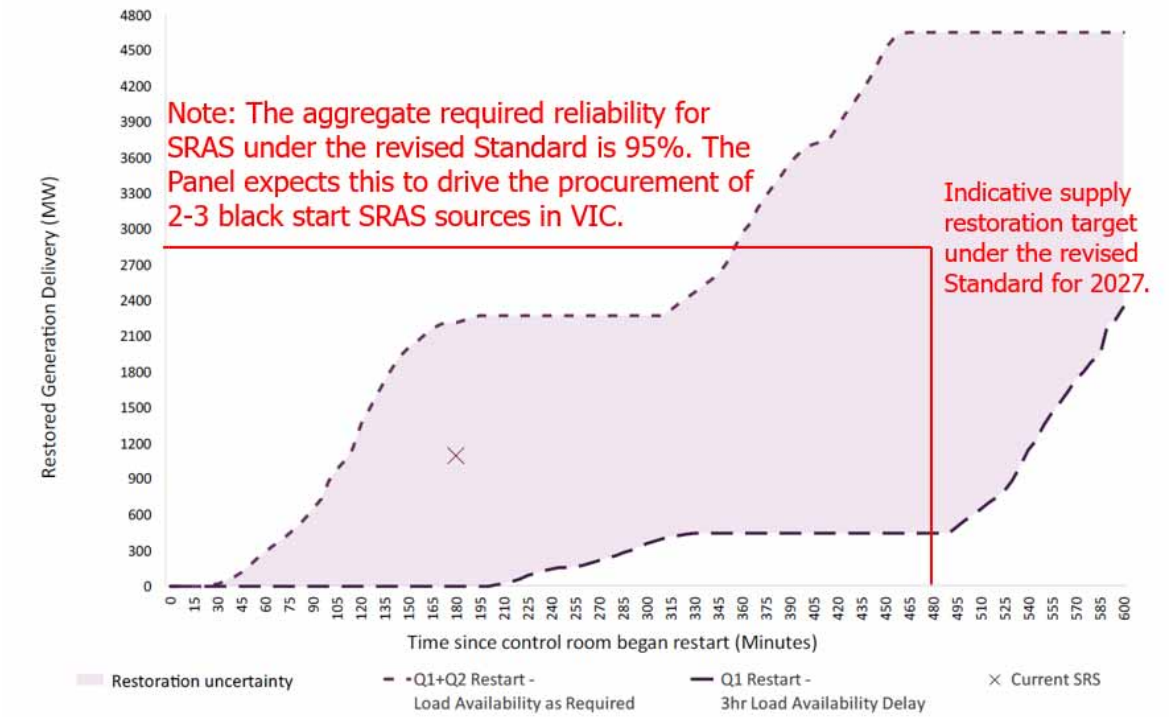


Source: Restoration curve from AEMO's *System restart technical advice*, 19 June 2025, p.65.

Note: Indicative restoration level based on 50% of forecast annual average underlying demand in NSW for 2027 which is 4,499MW. (Ref AEMO 2024 ISP Demand forecast, OPSO_PVLITE 2023 Reference year)

A.3 Victoria

Figure A.3: Final standard - Restoration level and time for Vic

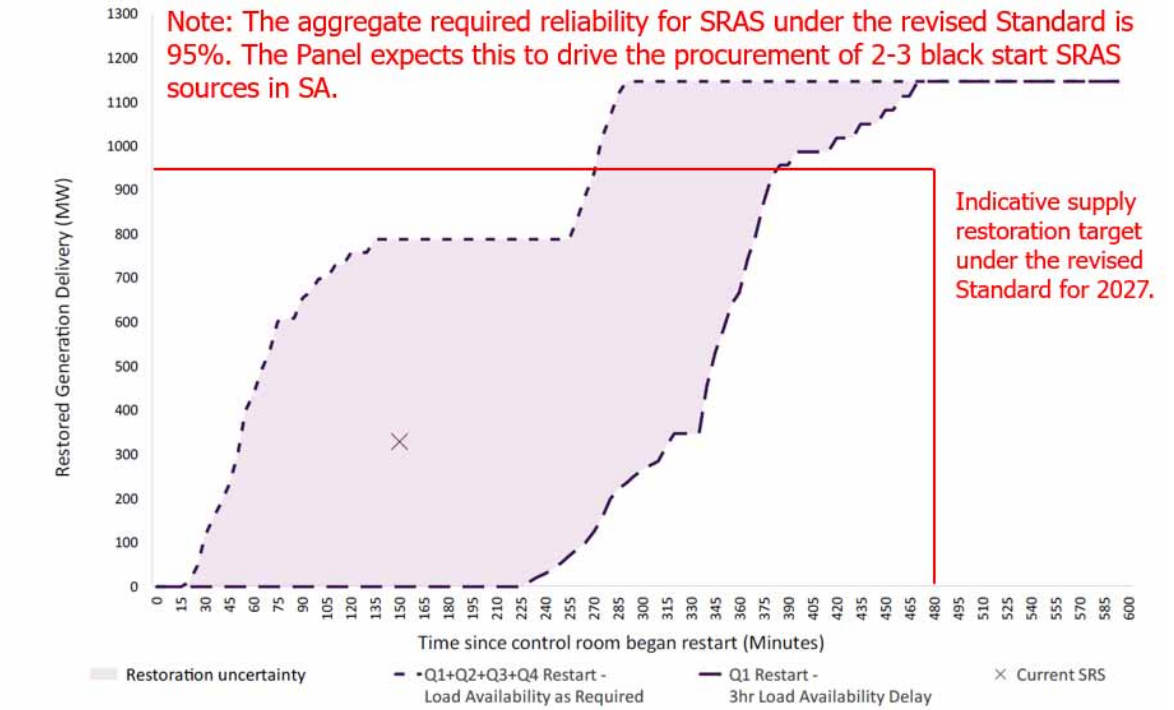


Source: Restoration curve from AEMO's *System restart technical advice*, 19 June 2025, p.68.

Note: Indicative restoration level based on 50% of forecast annual average underlying demand in VIC for 2027 which is 2,859 MW.(Ref AEMO 2024 ISP Demand forecast, OPSO_PVLITE 2023 Reference year)

A.4 South Australia

Figure A.4: Final standard - Restoration level and time for SA

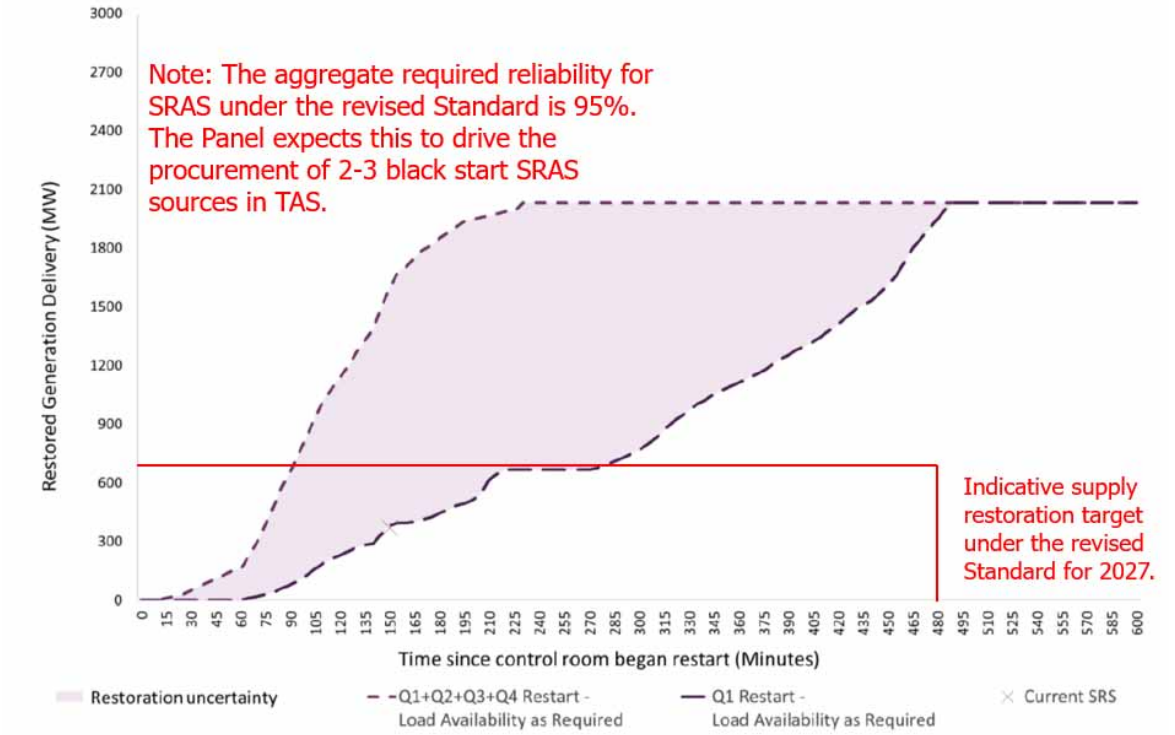


Source: Restoration curve from AEMO's *System restart technical advice*, 19 June 2025, p.66.

Note: Indicative restoration level based on 50% of forecast annual average underlying demand in SA for 2027 which is 948MW.(Ref AEMO 2024 ISP Demand forecast, OPSO_PVLITE 2023 Reference year)

A.5 Tasmania

Figure A.5: Final standard - Restoration level and time for Tasmania



Source: Restoration curve from AEMO's *System restart technical advice*, 19 June 2025, p.7.

Note: Indicative restoration level based on 50% of forecast annual average underlying demand in TAS for 2027 which is 654MW.(Ref AEMO 2024 ISP Demand forecast, OPSO_PVLITE 2023 Reference year)

Glossary

Black system event	A black system event is an event that results in the power system, including generation, transmission and distribution being de-energised as the result of a cascading outage following a significant contingency event.
Busbar	A busbar is an electrical conductor in the transmission system that is maintained at a specific voltage. It is capable of carrying a high current and is normally used to make a common connection between several circuits within the transmission system. The rules define busbar as 'a common connection point in a power station switchyard or a transmission network substation'.
Cascading outage	The occurrence of a succession of outages, each of which is initiated by conditions (e.g. instability or overloading) arising or made worse as a result of the event preceding it.
Contingency events	These are events that affect the power system's operation, such as the failure or removal from operational service of a generating unit or transmission element. There are several categories of contingency event, as described below: • credible contingency event is a contingency event whose occurrence is considered "reasonably possible" in the circumstances. For example: the unexpected disconnection or unplanned reduction in capacity of one operating generating unit; or the unexpected disconnection of one major item of transmission plant • non-credible contingency event is a contingency event whose occurrence is not considered "reasonably possible" in the circumstances. Typically a non-credible contingency event involves simultaneous multiple disruptions, such as the failure of several generating units at the same time.
Directions	Under s. 116 of the NEL, AEMO may issue directions. Section 116 directions may include directions as issued under clause 4.8.9 of the NER (e.g. directing a scheduled generator to increase output) or clause 4.8.9 instructions (e.g. instructing a network service provider to load shed). AEMO directs or instructs participants to take action to maintain or re-establish the power system to a secure operating state, a

	satisfactory operating state, or a reliable operating state.
Distribution network	The apparatus, equipment, plant and buildings (including the connection assets) used to convey and control the conveyance of electricity to consumers from the network and which is not a transmission network.
Distribution network service provider (DNSP)	A person who engages in the activity of owning, controlling, or operating a distribution network.
Frequency control ancillary services (FCAS)	Those ancillary services concerned with balancing, over short intervals, the power supplied by generators with the power consumed by loads (throughout the power system). Imbalances cause the frequency to deviate from 50 Hz.
Interconnector	A transmission line or group of transmission lines that connect the transmission networks in adjacent regions.
Jurisdictional planning body	The transmission network service provider responsible for planning a NEM jurisdiction's transmission network.
Load	A connection point (or defined set of connection points) at which electrical power is delivered, or the amount of electrical power delivered at a defined instant at a connection point (or aggregated over a defined set of connection points).
Load event	In the context of frequency control ancillary services, a load event: involves a disconnection or a sudden reduction in the amount of power consumed at a connection point and results in an overall excess of supply.
Load shedding	Reducing or disconnecting load from the power system either by automatic control systems or under instructions from AEMO. Load shedding will cause interruptions to some energy consumers' supplies.
Medium term projected assessment of system (MT PASA) (also see ST PASA)	A comprehensive programme of information collection, analysis and disclosure of medium-term power system reliability prospects. This assessment covers a period of 24 months and enables market participants to make decisions concerning supply, demand and outages. It must be issued weekly by AEMO.
Ministerial Council on Energy (MCE)	The MCE is the national policy and governance body for the Australian energy market, including for electricity and gas, as outlined in the COAG Australian Energy Market Agreement of 30 June 2004.

National Electricity Code	The National Electricity Code was replaced by the National Electricity Rules on 1 July 2005.
National electricity market (NEM)	The NEM is a wholesale exchange for the supply of electricity to retailers and consumers. It commenced on 13 December 1998, and now includes Queensland, New South Wales, Australian Capital Territory, Victoria, South Australia, and Tasmania.
National Electricity Law (NEL)	The NEL is contained in a schedule to the National Electricity (South Australia) Act 1996. The NEL is applied as law in each participating jurisdiction of the NEM by the application statutes.
National Electricity Rules (NER)	The NER came into effect on 1 July 2005, replacing the National Electricity Code.
Network	The apparatus, equipment and buildings used to convey and control the conveyance of electricity. This applies to both transmission and distribution networks.
Network capability	The capability of a network or part of a network to transfer electricity from one location to another.
Network control ancillary services (NCAS)	Ancillary services concerned with maintaining and extending the operational efficiency and capability of the network within secure operating limits.
Network event	In the context of frequency control ancillary services, the tripping of a network resulting in a generation event or load event.
Network service providers	An entity that operates as either a transmission network service provider (TNSP) or a distribution network service provider (DNSP).
Network services	The services (provided by a TNSP or DNSP) associated with conveying electricity and which also include entry, exit, and use-of-system services.
Operating state	The operating state of the power system is defined as satisfactory, secure or reliable, as described below. The power system is in a **satisfactory** operating state when: • it is operating within its technical limits (i.e. frequency, voltage, current etc are within the relevant standards and ratings) • the severity of any potential fault is within the capability of circuit breakers to disconnect the faulted circuit or equipment. The power system is in a **secure** operating state when: • it is in a satisfactory operating state

	• it will return to a satisfactory operating state following a single credible contingency event. The power system is in a **reliable** operating state when: • AEMO has not disconnected, and does not expect to disconnect, any points of load connection under NER clause 4.8.9 • no load shedding is occurring or expected to occur anywhere on the power system under NER clause 4.8.9 • in AEMO's reasonable opinion the levels of short term and medium term capacity reserves available to the power system are at least equal to the required levels determined in accordance with the power system security and reliability standards.
Participant	An entity that participates in the national electricity market.
Plant capability	The maximum MW output which an item of electrical equipment is capable of achieving for a given period.
Power system reliability	The measure of the power system's ability to supply adequate power to satisfy demand, allowing for unplanned losses of generation capacity.
Power system security	The safe scheduling, operation and control of the power system on a continuous basis.
Probability of exceedance (POE)	POE relates to the weather/temperature dependence of the maximum demand in a region. A detailed description is given in the AEMO ESOO.
Reliable operating state	Refer to operating state.
Reliability of supply	The likelihood of having sufficient capacity (generation or demand-side response) to meet demand (the consumer load).
Satisfactory operating state	Refer to operating state.
Scheduled load	A market load which has been classified by AEMO as a scheduled load at the market customer's request. A market customer may submit dispatch bids in relation to scheduled loads.
Secure operating state	Refer to operating state.
Separation event	In the context of frequency control ancillary services, this describes the electrical separation of one or more NEM regions from the others, thereby preventing frequency control ancillary services being transferred from one region to another.
Spot market	Wholesale trading in electricity is conducted as a spot market. The spot market allows instantaneous

	matching of supply against demand. The spot market trades from an electricity pool, and is effectively a set of rules and procedures (not a physical location) managed by AEMO (in conjunction with market participants and regulatory agencies) that are set out in the NER.
Supply-demand balance	A calculation of the reserve margin for a given set of demand conditions, which is used to minimise reserve deficits by making use of available interconnector capabilities.
Technical envelope	The power system's technical boundary limits for achieving and maintaining a secure operating state for a given demand and power system scenario.
Transmission network	The high-voltage transmission assets that transport electricity between generators and distribution networks. Transmission networks do not include connection assets, which form part of a transmission system.
Transmission network service provider (TNSP)	An entity that owns operates and/or controls a transmission network.
Unserved energy (USE)	The amount of energy that is required (or demanded) by consumers but which is not supplied due to a shortage of generation or interconnection capacity. Unserved energy does not include interruptions to consumer supply that are caused by outages of local transmission or distribution elements that do not significantly impact the ability to transfer power into a region.

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BESS	Battery energy storage system
CER	Consumer energy resources
Commission	See AEMC
DER	Distributed energy resources
ESOO	Electricity statement of opportunities
FFR	Fast frequency response
GPSRR	General power system risk review
HVDC	High voltage direct current
IBR	Inverter based resources
ISON	International System Operator Network
ISP	Integrated System Plan
LBSP	Local black system procedure
MCE	Ministerial Council on Energy
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National electricity objective
NERL	National Energy Retail Law
NERO	National energy retail objective
NESO	National Energy system operator (UK)
NGL	National Gas Law
NGO	National gas objective
NMAS	Non-market ancillary service
OFGEM	Office of Gas and Electricity Markets (UK)
Panel	Reliability Panel
PV	Photo-voltaic
SRAS	System restart ancillary service
SWIS	South-west interconnected system (WA)
TPSS	Transition plan for system security
REZ	Renewable energy zone
VRE	Variable renewable energy
WEM	Wholesale electricity market (WA)