NETWORK SUPPORT AND CONTROL ANCILLARY SERVICE (NSCAS) DESCRIPTION AND QUANTITY PROCEDURE REVIEW

ISSUES PAPER

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EXECUTIVE SUMMARY

The publication of this Issues Paper commences the first stage of the Rules consultation process conducted by AEMO to consider proposed amendments to the Network Support and Control Ancillary Service (NSCAS) description and quantity procedure under the National Electricity Rules (NER).

The changing context for the NSCAS framework

Network Support and Control Ancillary Services (NSCAS)[1] are non-market ancillary services procured to maintain power system security and reliability of supply of the transmission network[2], or to maintain or increase power transfer capability of the transmission network to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market[3].

Each year AEMO applies the NSCAS description and quantity procedure to identify any NSCAS needs for the coming five-year period. The relevant Transmission Network Service Providers (TNSPs) (or AEMO, in some cases) may then procure the necessary NSCAS[4].

AEMO considers that the current NSCAS description and quantity procedures, developed in 2011[5], need to be updated to better address the requirements for the ongoing transformation of the National Electricity Market (NEM). The changing nature of the NEM power system was explored in detail in AEMO's recently published Renewable Integration Study (RIS) report[6]. The report demonstrated the potential for significant change in the NEM over the coming five years, highlighting the need for flexible market and regulatory frameworks that can adapt swiftly and effectively as the power system evolves.

In particular, the NSCAS procedures need to be adaptive and flexible to allow AEMO to respond to the changing needs of the power system.

The objective of this review is to ensure that the NSCAS description and the NSCAS quantity procedures are:

- Fit for purpose and support AEMO in fulfilling the NSCAS requirements set out in the NER.
- More flexible, where required, to enable AEMO to address emerging system security risks.
- Designed to enable AEMO and TNSPs to prepare the system proactively and avoid problems.

Proposed changes to the NSCAS description and quantity procedure

AEMO has prepared this Issues Paper to facilitate informed debate and feedback by industry about the most efficient way to meet the objectives for NSCAS in the NER.

AEMO is proposing to amend the NSCAS description to make sure the types of NSCAS defined by AEMO are appropriate to allow procurement of the services needed to ensure an operable, secure, and reliable power system, specifically in the context of the transformation of the NEM.

AEMO proposes to redefine the NSCAS types according to the needs that would be primarily addressed – that is, system security and reliability, and constraints alleviation through net market benefit. This flexibility would better accommodate emerging technologies and challenges from novel system phenomena.

[1] The NSCAS definition is in the Chapter 10 Glossary of NER Version 138. The NSCAS definition specifically excludes inertia network services and system strength services from the NSCAS definition.
[2] NER Version 138, Clause 3.11.6 (a1).
[3] NER Version 138, Clause 3.11.6 (a2).
[4] NER Version 138, Clauses 3.11.1 and 3.11.3.
[5] Current documents are at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/network-support-and-control-ancillary-services-procedures-and-guidelines.
[6] See AEMO's Renewable Integration Study Stage 1 Report, April 2020, at https://www.aemo.com.au/energy-systems/Major-publications/Renewable-Integration-Study-RIS.

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AEMO also proposes amending the NSCAS quantity procedure to permit a more appropriate consideration of the needs of the current power system. Error! Reference source not found. summarises t he key proposals, which are to incorporate the ability to restore the network to a secure state within 30 minutes of a critical contingency, forward-looking consideration of increasing power transfer capability, and a more flexible approach to NSCAS modelling assumptions.

Table 1 Summary of the NSCAS quantity procedure proposed amendments

	Summary of existing restrictions and proposed amendments
System security and reliability assessment assumptions	Current: Assess NSCAS needs under system normal plus a credible contingency for the next five years. Proposal: Include in the assessment the ability to restore the network to a secure state within 30 minutes following a credible contingency.
Increase power transfer capability methodology	Current: Assess the net economic benefit of alleviating the top 10 historically binding system normal constraints. Proposal: Allow for flexibility in the methodology such that any appropriate analysis, historical or forward-looking, can be used to determine any constraints inhibiting net economic benefit.
Modelling assumptions	Remove the prescriptive modelling assumptions in the NSCAS Schedule 1 and replace them with high-level modelling principles. Any detailed assumptions can then be included in the annual NSCAS review.

Consultation on the proposed changes

AEMO invites stakeholders to provide views on the proposed options, or suggest alternatives if you consider these would better achieve the relevant objectives. AEMO also asks stakeholders to identify any unintended adverse consequences of the proposed changes.

Stakeholders are invited to submit written responses on the issues and questions identified in this paper by 5.00 pm (Australian Eastern Standard Time) on Tuesday, 7 July 2020, in accordance with the Notice of First Stage of Consultation published with this paper. Submissions should be sent by email to planning@aemo.com.au.

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1. STAKEHOLDER CONSULTATION PROCESS

As required by the National Electricity Rules (NER), AEMO is consulting on the Network Support and Control Ancillary Service (NSCAS) description and quantity procedure in accordance with clause 3.11.4 and the Rules consultation process in rule 8.9.

There is a glossary of terms used in this Issues Paper at Appendix A - Glossary.

AEMO's indicative timeline for this consultation is outlined below. Dates may be adjusted depending on the number and complexity of issues raised in submissions and any meetings with stakeholders.

Deliverable	Indicative date
Issues Paper published	1 June 2020
Submissions due on Issues Paper	7 July 2020
Draft Report published	4 August 2020
Submissions due on Draft Report	18 August 2020
Final Report published	30 September 2020

As part of ongoing joint planning processes between AEMO and the Transmission Network Service Providers (TNSPs), AEMO will consult with TNSPs during its review of the NSCAS procedures.

Prior to the submissions due date, stakeholders can request a meeting with AEMO to discuss the issues and proposed changes raised in this Issues Paper.

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2. BACKGROUND

This section notes the NER requirements for NSCAS, and the context for AEMO's proposed amendments to the NSCAS description and quantity procedure.

2.1. NER requirements

AEMO is responsible for managing power system security and reliability of supply in the National Electricity Market (NEM). The NSCAS Framework is one of the last-resort tools in place for AEMO to manage this, and is part of the broader joint system planning process between AEMO and TNSPs who are Jurisdictional Planning Bodies.

NSCAS are non-market ancillary services acquired to control active and reactive power flow into or out of an electricity transmission network[7]. AEMO dispatches these services to:

- Maintain power system security and reliability of supply of the transmission network in accordance with the power system security standards and the reliability standard[8]; and
- Maintain or increase power transfer capability of the transmission network to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market[9].

Clause (a)(1)[10] of the NER definition of the NSCAS need explains that NSCAS may be required to keep the network operating within minimum acceptable security and reliability requirements. Clause (a)(2)[11] shows that NSCAS may be required to relieve network constraints where this maximises net economic benefits to the market.

AEMO is required to develop and publish an NSCAS description[12] providing a detailed description of each type of NSCAS, and an NSCAS quantity procedure[13] explaining the determination of the location and quantity of each type of NSCAS required. AEMO may amend the NSCAS description and quantity procedure. When amending the NSCAS description and/or the NSCAS quantity procedure AEMO must comply with the NER consultation procedures[14].

Annually, AEMO must also publish an assessment of any NSCAS gaps in the coming five-year period, and a summary of any NSCAS it has procured in the previous year[15]. An NSCAS gap is defined as any Network Support and Control Ancillary Service need that AEMO forecasts will arise at any time within a planning horizon of at least five years.

When AEMO declares an NSCAS gap, it may ask the relevant TNSP when it will have arrangements in place to address the gap, via connection agreements or network support agreements. In cases where AEMO does not consider that an NSCAS gap will be met where the gap relates to preventing an adverse impact

[7] The NSCAS definition is in the Chapter 10 Glossary of the NER Version 138. The NSCAS definition specifically excludes inertia network services and system strength services from the NSCAS definition.
[8] NER Version 138, Clause 3.11.6 (a1).
[9] NER Version 138, Clause 3.11.6 (a2).
[10] NER Version 138, Chapter 10 Glossary.
[11] NER Version 138, Chapter 10 Glossary.
[12] AEMO. Network Support and Control Ancillary Service (NSCAS) description, published December 2011, at https://aemo.com.au/-/media/files/pdf/0160-0102-pdf.pdf.
[13] AEMO. Network Support and Control Ancillary Service (NSCAS) Quantity Procedure, published December 2011, at https://aemo.com.au/-/media/files/pdf/nscas_quantity_procedure.pdf.
[14] Except for minor and administrative amendments (NER clause 4(e)).
[15] Actionable ISP Rules, to be in effect from 1 July 2020, available via http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/ESB%20Final%20Approved%20ESB%20Recommended%20National%20Electicity%20Amendment%20%28ISP%29%20Rule%202020.pdf. This requirement was previously linked to the release of the National Transmission Network Development Point.

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on power system security and reliability of supply of the transmission network, AEMO may use reasonable endeavours to acquire the necessary NSCAS itself via an ancillary services agreement.

Figure 1 shows a simplified summary of the NSCAS process. The NSCAS framework cannot be used to address inertia and system strength needs, because the NER[16] provide for separate frameworks to address these. The Australian Energy Market Commission (AEMC) is currently conducting a review of system strength frameworks in the NEM.

[16] NER Version 138, Clause 11.100.5 and 11.101.5.

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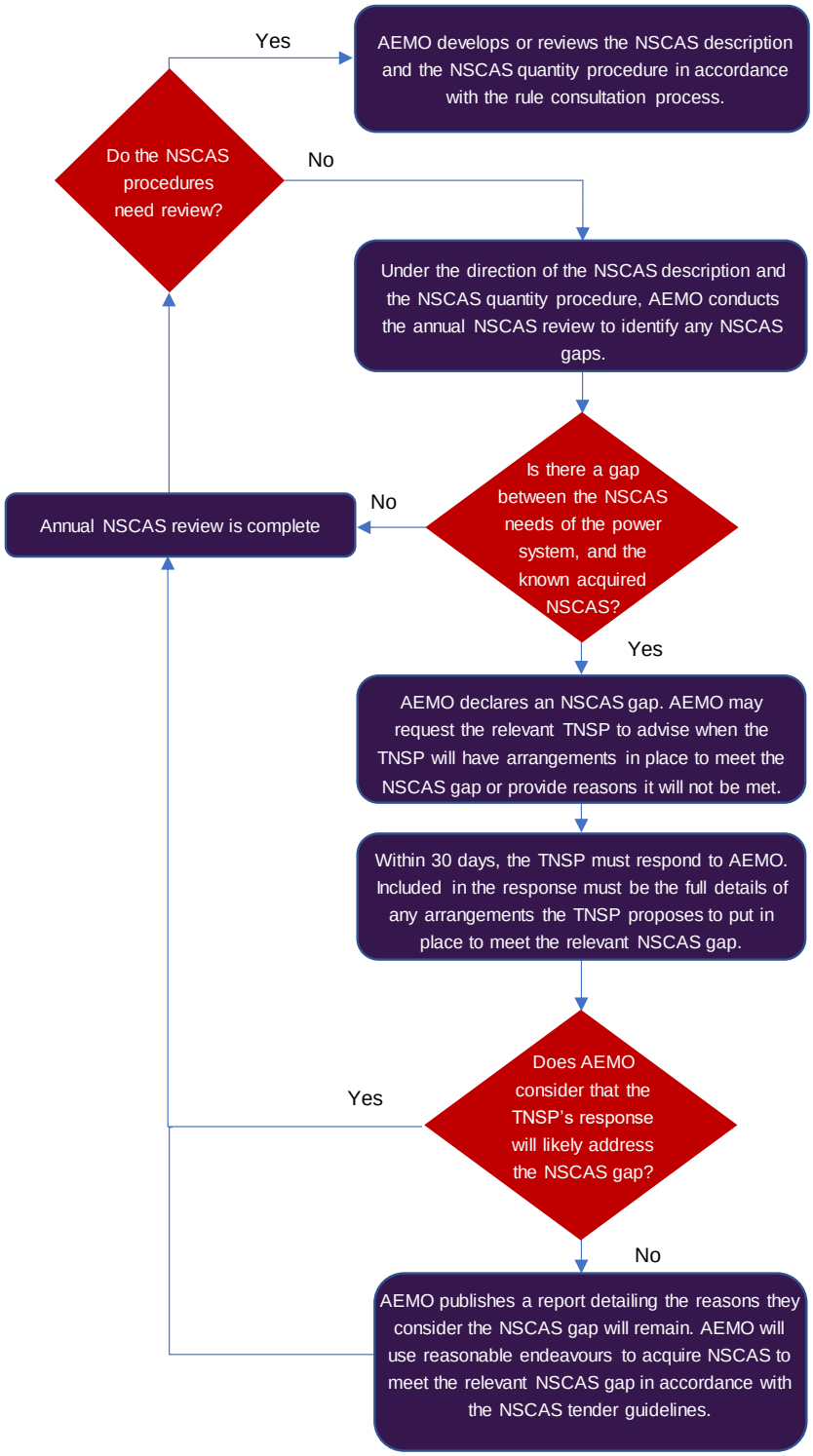
Figure 1 A simplified flow chart of the NSCAS review process



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2.2. Context for this consultation

Since the 2011 release of the current NSCAS description and quantity procedure, the NEM has undergone a significant transformation. The power system is transitioning from being dominated by large thermal power stations to including a multitude of generation sources and technologies of various sizes. Customer demand profiles have also changed rapidly, primarily driven by the introduction of significant distributed energy resources (DER), predominantly distributed solar photovoltaic (PV) systems.

The changing nature of the NEM power system is explored in detail in AEMO's recently published Renewable Integration Study (RIS) report[17]. The report demonstrated the potential for significant change in the NEM over the coming five years, highlighting the need for flexible market and regulatory frameworks that can adapt swiftly and effectively as the power system evolves.

Three known trends in the changing system have the potential to affect the type and way in which NSCAS will be required in the coming years:

- Fewer synchronous machines online and more inverter-based resources online.
- Increasing variability and uncertainty in the NEM.
- Increasing decentralised generation, particularly growth in distributed PV systems.

As the power system's transition continues, additional trends may become evident.

AEMO considers that the known trends, and the potential for additional trends in future, highlight that NSCAS procedures must be adaptive and flexible to allow AEMO to respond to the changing needs of the power system. This section provides detail on each of the three key trends relevant for the proposed NSCAS description and quantity procedure amendments.

2.2.1. Fewer synchronous machines online and more inverter-based resources online

AEMO's Draft 2020 Integrated System Plan (ISP)[18] Central scenario projects that wind and solar generation in the NEM, including utility-scale connections as well as distributed PV systems, will rise from 17 gigawatts (GW) of capacity installed in 2019 to around 27 GW in 2025 and 68 GW in 2040.

Inverters are made up of fast-acting power electronics equipment, with the ability to respond quickly and precisely to changes in frequency, voltage and current levels on the power system. However, these resources are relatively new, and the industry is still collectively learning how to incorporate them into the system. Integration issues could include[19]:

- Fast response times required to arrest step changes in rate of change of frequency in the system.
- The need to understand the effect of high rate of change of frequency (RoCoF) in the system on inverter-based resources.
- Overarching integration of control schemes for the wide variety of newly connected equipment, at the localised network level.

The challenges introduced by the changing system are illustrated in the fact that AEMO has increasingly needed to intervene, through either direction to market participants or instructions to exercise the Reliability and Emergency Reserve Trader (RERT). These intervention events have been more frequent,

[17] See AEMO's Renewable Integration Study Stage 1 Report, April 2020, at https://www.aemo.com.au/energy-systems/Major-publications/Renewable-Integration-Study-RIS.

[18] AEMO, Draft 2020 ISP, December 2019, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf.

[19] System strength-related issues are not considered, because system strength is no longer considered under the NSCAS framework. AEMO's system strength framework and associated documentation is at https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/system-security-market-frameworks-review.

particularly in areas with higher wind and solar generation[20], and NSCAS needs have already been determined which necessitate near-term action to support an efficient transition of the system and ensure system security and reliability.

2.2.2. Increasing variability and uncertainty in the NEM

AEMO is increasingly seeing changes to how power stations are operated in the NEM, with resulting impacts on system security and reliability. Observed changes include:

- Increasing uncertainty and complexity affecting power system operation. As the network operates closer to the technical limits, more special protection schemes (SPSs) and Remedial Action Schemes (RASs) are used to manage network limitations. With increasing complexity, comes fragility. A system with multiple complex layers is more vulnerable to breakdown if the complexity is not managed effectively. An example of this is an incident that occurred at Broken Hill on 17 May 2019[21], which included complex interaction between an auto-reclose scheme and an anti-islanding scheme.
- Increasingly variable and uncertain availability of power supply, as shown with faster and larger ramps (changes in supply), driven by increasing penetrations of wind and solar, which are more difficult to predict and are expected to increase in the next few years. The RIS Stage 1 report[22] projects the largest equivalent downward variable renewable energy (VRE) ramp over one hour in the NEM increasing from -1.4 GW in 2019 to -4.5 GW in 2025, where the maximum projected ramp could be as large as -5.8 GW.
- Potential unavailability of some services, such as reactive power support and primary frequency response[23], if traditional power station plants are increasingly unavailable due to lower minimum demand and changing market signals

There are a range of longer-term measures underway to adapt to these emerging challenges, including the Energy Security Board's (ESB's) post-2025 NEM review, a range of ongoing AEMC reviews and rule change processes, and ongoing compliance measures where appropriate. However, in the nearer term, NSCAS needs may be identified to respond to these emerging challenges to ensure system reliability and security.

2.2.3. Increasing decentralised generation, particularly growth in distributed PV systems

Australia has experienced a strong growth in distributed PV systems, increasing from fewer than 100,000 in 2010 to over 2.2 million by the end of 2019[24]. The increase in distributed PV generation has unexpected impacts on the management of operational demand and contingency events on the power system.

The increasing penetration of distributed PV systems and changing electricity consumption practices are leading to record low minimum demands, and at different times of the day. As Figure 2 shows[25], annual minimum demand in the South Australia region decreased from around 800 megawatts (MW) in 2015 to below 500 MW by 2019.

[20] See Chapter 2 of AEMO's Renewable Integration Study Stage 1 Report, April 2020, at https://www.aemo.com.au/energy-systems/Major-publications/Renewable-Integration-Study-RIS.

[21] AEMO, Multiple contingency event at Broken Hill on 17 May 2019, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2019/Multiple-contingency-event-at-Broken-Hill-17-May-2019.pdf

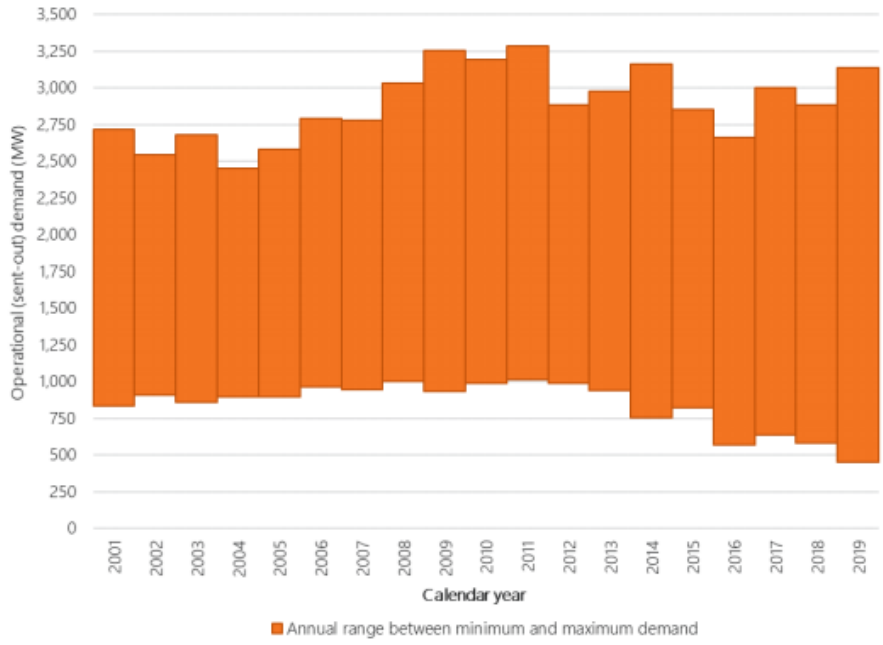
[22] See Chapter 6 and Appendix C of AEMO's Renewable Integration Study Stage 1 Report, April 2020, at https://www.aemo.com.au/energy-systems/Major-publications/Renewable-Integration-Study-RIS.

[23] The changed delivery of primary frequency response is expected to be addressed through the AEMC's rule change covering mandatory primary frequency response, made in March 2020. The substantive elements of the final rule are due to commence on 4 June 2020. Materials about the rule change are accessible via https://www.aemc.gov.au/rule-changes/mandatory-primary-frequency-response.

[24] See http://www.cleanenergyregulator.gov.au/RET/Forms-and-resources/Postcode-data-for-small-scale-installations#Smallscale-installations-byinstallation-year.

[25] AEMO, South Australia Electricity Report 2019, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/SA_Advisory/2019/2019-South-Australian-Electricity-Report.pdf.

Figure 2 South Australia historical annual range of operational (sent-out) demand, 2001-19



Note: analysis excludes black system event in South Australia on 28 September 2016.

The ongoing reduction in operation demand will impact power system operations[26]:

- Reducing the load available to keep synchronous generation online providing essential system services such as voltage control.
- Impacting emergency mechanisms such as emergency frequency control schemes.
- Voltage control challenges may occur in parts of the network experiencing reduced day time demand.

The rapid increase in distributed PV penetration has further had unexpected impacts on AEMO's ability to securely operate the South Australia region; for example, the effective contingency size being increased during a contingency event by the potential mass disconnection of this distributed generation, and the impact on daytime generation prices, both of which significantly change the conditions under which the system must be securely planned and operated.

The NSCAS quantity procedure currently prevents AEMO from considering rapid changes to minimum demand. The current procedure specifies that minimum demand studies be conducted using actual minimum regional demand over the past 12 months to determine the reactive power absorption requirements over the next five years. The procedure also specifies that the minimum regional demand is assumed to stay constant over the planning horizon, particularly when determining voltage control ancillary service needs.

Taken together, these requirements prevent AEMO from modelling changes over the planning horizon such as the rapid demand declines witnessed in South Australia since 2015.

[26] See Appendix A4.2 of AEMO's Renewable Integration Study Stage 1 Report, April 2020, at https://www.aemo.com.au/energy-systems/Major-publications/Renewable-Integration-Study-RIS.

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3. NSCAS DESCRIPTION AND QUANTITY PROCEDURE REVIEW

AEMO considers that the existing NSCAS quantity procedure and description need to be updated to adapt to the changing power system. As outlined in Section 2.2, these changes include a decrease in synchronous machines online, an increase in inverter-based resources, an increase in complexity and variability, and an increase in decentralised generation.

To adapt to these and other power system operability needs, AEMO is reviewing the NSCAS description and the NSCAS quantity procedure, to ensure these are:

- Fit for purpose and support AEMO in fulfilling the NSCAS requirements set out in the NER.
- More flexible, where required, to enable AEMO to address emerging system security risks.
- Designed to enable AEMO and TNSPs to prepare the system proactively and avoid problems.

Following the update of the NSCAS description and quantity procedure, it is expected that the documents will facilitate appropriate planning for future scenarios together with near-term transmission and generation investments. This should assist AEMO and TNSPs in identifying and addressing any necessary, economic solutions to network issues in a proactive and timely manner, and mitigate use of directions and constraints being applied at a cost, until economic solutions can be realised.

This issues paper begins the consultation for the review of the NSCAS description and quantity procedure and is intended to seek industry input to inform AEMO.

The purpose of the review is to:

1. Develop the NSCAS description such that it fulfils the NER requirement to be a "detailed description of each type" of NSCAS, while still being flexible enough to allow NSCAS to be used to address emerging challenges.
2. Develop the NSCAS quantity procedure such that it meets the NER requirement to specify how the location and quantity of NSCAS required will be determined, while allowing investigation of a variety of relevant and localised challenges.

During the review, AEMO will continue to work closely with TNSPs to ensure transparency, including through sharing NSCAS review assumptions and modelling methodologies.

This review will complement other ongoing sector reviews and reforms underway by AEMO, the AEMC, and the ESB.

This review is limited to the NSCAS description and quantity procedure. AEMO, in this consultation, does not consider amending the NSCAS tender guidelines and the NSCAS dispatch procedure. AEMO will review the need to update these procedures after the consultation on the NSCAS description and quantity procedure, and based on feedback received as part of the NSCAS consultation. In this review, AEMO does not currently propose any changes to the NSCAS rules.

Section 3.1 details the proposed amendments to the NSCAS description, and Section 0 details the proposed the amendments to the NSCAS quantity procedure.

3.1. NSCAS description amendments

The NSCAS description must provide a detailed description of each type of NSCAS. As discussed in Section 2.2, the power system is undergoing significant changes. AEMO considers that the NSCAS description is not sufficiently responsive to the changing power system and so is proposing changes to allow timely procurement of any services needed to ensure an operable, secure, and reliable power system.

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Section 3.1.1 summarises the current NSCAS description, Section 3.1.2 considers the limitations of the current categorisations of NSCAS types, and Section 0 proposes two options for amending the NSCAS description.

3.1.1. Current NSCAS description

The current NSCAS description[27] defines three NSCAS types, each matching a different physical service. Error! Reference source not found. lists the current NSCAS types, detailed definitions, and examples of e quipment that might provide each service.

Table 2 Current NSCAS types, descriptions and examples

NSCAS type and description	Examples
Network Loading Ancillary Service (NLAS) NLAS are services that are able to control the power flow into or out of a transmission network in order to: • Maintain power flow in transmission lines within the capacity ratings following a credible contingency event; and • Maintain or increase the power transfer capability of that transmission network by allowing increased loading on transmission network components, to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market.	• Fast runback of generators • Standby generation that can be brought online rapidly • Load reduction • Phase shifting transformers • Series and shunt compensation • Controlled series compensation
Voltage Control Ancillary Service (VCAS) VCAS has the ability to control the power flow into or out of the transmission network in order to: • Maintain the transmission network within the voltage limits, and voltage stability; and • Maintain or increase the power transfer capability of that transmission network by improving voltage control and voltage stability, to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market.	• Generators operation in synchronous condenser mode • Excess reactive power from generators • Capacitor banks and reactors • Static VAr compensators • HVAC and HCDC transmission lines • Demand side management
Transient and Oscillatory Stability Ancillary Service (TOSAS) TOSAS is the capability to control the power flow into or out of the transmission network in order to: • Maintain the transmission network within its transient or oscillatory stability limits; and • Maintain or increase the power transfer capability of that transmission network by improving transient or oscillatory stability to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market.	• Generators running generating plant with properly designed PSS • Generators operating in synchronous condenser mode • Synchronous condensers • Braking resistors • Series compensation • Static VAr compensators

3.1.2. Limitations of current NSCAS description

NSCAS is typically deployed as a last-resort tool to ensure security and reliability of the power system, using services which can be delivered relatively quickly and prevent the need for more drastic operational measures such as issuing directions.

The limitation of the current NSCAS procedure is that it is not flexible enough to encompass the variety of services that may be needed to deliver a secure and reliable power system in the context of declining minimum demand, changing power plant operation, increasing penetration of inverter-based resources

[27] AEMO. Network Support and Control Ancillary Service (NSCAS) description, published December 2011, at https://aemo.com.au/-/media/files/pdf/0160-0102-pdf.pdf.

and more. AEMO is keen to ensure that the amended NSCAS description is sufficiently broad and flexible to meet the challenges of the future.

3.1.3. Options to amend the NSCAS types

AEMO seeks views on the approach to classification of service types and whether the NSCAS types in the current NSCAS description should be updated, and if so, in what way.

Given the emerging challenges discussed in Section 2.2 and the limitations with the existing NSCAS description noted in Section 3.1.2, AEMO considers that NSCAS types and detailed descriptions should be updated. An update proposal is provided in the following for feedback.

Proposal – Classify by NSCAS need

AEMO proposes to move away from classifying NSCAS types according to electrical phenomena, and instead classify the types according to which of the two NSCAS needs the service would primarily address. Table 3Error! Reference source not found. lists the proposed NSCAS types, detailed definitions, and e xamples of equipment that might provide each service.

Table 3 Proposed NSCAS types with descriptions and examples

NSCAS type and description	Examples
System Security and Reliability Ancillary Service System Security and Reliability Ancillary Service is a non-market ancillary service primarily procured in order to assist AEMO to operate the NEM within the System Security and Reliability Standards. This service will exclude any services excluded by the rules that have existing frameworks.	• SVCs, synchronous condensers, and reactors to manage network voltages that cannot be kept within secure limits • Fast frequency response of batteries to increase operating reserve • Controllable DER to reduce the size of contingencies under fault conditions • Fast runback of generators • Standby generation that can be brought online rapidly • Load reduction • Phase shifting transformers • Generators operation in synchronous condenser mode • Excess reactive power from generators
Constraints Alleviation through Net Market Benefits Ancillary Service Constraints alleviation through Net Market Benefits Ancillary Service is a non-market ancillary service primarily acquired to increase the power transfer capability of the transmission network, to maximise the present value of net economic benefit to all those who produce, consume or transport electricity in the market. The identification of top binding current and/or projected top binding future constraints would be assessed to determine if there is an identified need to alleviate these constraints.	• SVCs, synchronous condensers, and braking resistors for management of transient stability • Reactive plant (capacitor banks, reactors, and static VAr compensators) to increase voltage collapse limits • Fast runback schemes of generation units, line uprating, or special battery schemes to manage network loading • Generators running generating plant with properly designed PSS • Generators operating in synchronous condenser mode • Other services which could relieve existing constraints and deliver a net market benefit

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Questions for consultation

1. **In Section 2.2, AEMO discusses the changing context for the NSCAS framework. Do you think these changes justify a change to the NSCAS description? Are there any other relevant changes AEMO should be considering in this NSCAS review? Please specify.**
2. **What are your views on the options presented for describing the types of NSCAS, and if you have a preference, what is the reason? Do you have suggestions for alternative options that should be investigated? Please specify.**
3. **In your preferred option, how would you define the detailed description differently from the descriptions provided above?**
4. **Do you know of any potential NSCAS services that are not included in Table 3Error! R eference source not found. (please specify)?**
5. **Are there any NSCAS types that AEMO should be exploring in addition to those mentioned above? Please include examples.**

3.2. NSCAS quantity procedure amendments

The NSCAS quantity procedure must explain how the location and quantity of each type of NSCAS required is determined. The current description[28] was developed in 2011 in accordance with NER Clause 3.11.4.

As for the NSCAS description, AEMO considers that the NSCAS quantity procedure needs to be amended to be responsive to the changing power system. At present, the quantity procedure limits AEMO from considering important emerging power system issues and projections when identifying NSCAS needs.

Section 3.2.1 discusses the proposed changes to the system outages and constraints which may be considered as part of assessment of NSCAS needs, and Section 0 outlines AEMO's proposed amendments to the modelling inputs and assumptions for calculating NSCAS shortfalls.

Additional to any changes discussed in Sections 3.2.1 and 0, the quantity procedure will be aligned with the changes to the NSCAS description options following the results of the consultation, and a draft version will be provided as part of AEMO's second round of consultation.

3.2.1. Outages and Constraints

This section details AEMO's proposed changes to the outages and contingencies considered during the NSCAS assessments for each type of NSCAS.

Catering for system security

AEMO has power system security responsibilities and obligations set out in Chapter 4 of the NER which includes AEMO's responsibility following a contingency, to return the power system to a secure state within 30 minutes. Some of AEMO's system security responsibilities listed in chapter 4.3.1 of the NER include:

- *to assess the availability and adequacy, including the dynamic response, of* contingency capacity reserves *and* reactive power reserves *in accordance with the* power system security standards *and to ensure that appropriate levels of* contingency capacity reserves *and* reactive power reserves *are available:*
  - *(1) to ensure the* power system *is, and is maintained, in a* satisfactory operating state*; and*

[28] AEMO. Network Support and Control Ancillary Service (NSCAS) Quantity Procedure, published December 2011, at https://aemo.com.au/-/media/files/pdf/nscas_quantity_procedure.pdf.

(2) *to arrest the impacts of a range of significant multiple* contingency events *(affecting up to 60% of the total* power system load*) or* protected events *to allow a prompt restoration or recovery of* power system security*, taking into account under*-frequency *initiated* load shedding *capability provided under* connection agreements*, by* emergency frequency control schemes *or otherwise*[29].

- *to utilise resources and services provided or procured, such as* ancillary services*… to maintain or restore the* satisfactory operating state *of the* power system[30].

Since an NSCAS need is defined as the location and quantity of each type of NSCAS required to maintain power system security and reliability of supply of the transmission network in accordance with the power system security and reliability standard, AEMO needs to be able to assess, where necessary, AEMO's system security obligations.

The current NSCAS quantity procedure restricts the NSCAS assessment to system normal arrangements catering for a single credible contingency[31]. AEMO proposes to include the ability to restore the system to a secure state within 30 minutes of the first credible contingency, which includes consideration of the impact of a second credible contingency.

There is an expectation under the rules that AEMO should take all reasonable actions to operate the power system in a secure operating state and, following a contingency event, to return the power system to a secure operating state as soon as practicable, and at most within 30 minutes. AEMO is finding it increasingly difficult to return the system to a secure state, and AEMO and TNSPs are increasingly operating the transmission network closer to the network limits in real time. There is naturally risk associated with this approach.

For example, if an unplanned outage occurs on the transmission network, AEMO is required to return the network to a secure state by catering for the loss of the next worse credible contingency. AEMO should take all reasonable actions to return the system to a secure state within 30 minutes. In some instances, this may require significant co-ordination between numerous generators and/or TNSPs to reduce generation and accommodate switching to radial subnetworks, of which may take longer than 30 minutes.

AEMO anticipates that evolving the NSCAS quantity procedure approach will reduce the number of interventions and market directions required overall.

Questions for consultation

6. **In Section 2.2, AEMO discusses the changing context for the NSCAS framework. Do you think these changes justify a change to the NSCAS quantity procedure? Are there any other relevant changes that AEMO should be considering in this NSCAS quantity procedure review not already captured? Please specify.**
7. **AEMO proposes to include in the NSCAS assessment the ability to return the network to a secure state within 30 minutes following a contingency. Do you have any comments on this proposal?**

Reducing limitation on assessment of services to increase power transfer capability of the network

The current quantity procedure states that NSCAS needs relating to increasing power transfer capability of the transmission network may only be assessed for system normal constraints using historical information,

[29] NER Version 138, Clause 4.3.1(k)
[30] NER Version 138, Clause 4.3.1(o)
[31] AEMO. Network Support and Control Ancillary Service (NSCAS) Quantity Procedure, published December 2011, at https://aemo.com.au/-/media/files/pdf/nscas_quantity_procedure.pdf (Page 14).

rather than forward-looking projections. However, the power system is no longer static and historical information no longer appropriate as the sole basis on which to identify future needs and procure essential NSCAS.

System security and reliability needs are assessed on an appropriately comprehensive approach that also considers future needs. Accordingly, AEMO proposes to amend the procedure to allow a comprehensive assessment of NSCAS requirements that may be justified to increase power transfer capability of the network.

For example, this assessment should also consider changes to the power system expected within the NSCAS planning horizon of at least five years (including, but not limited to, new infrastructure such as planned transmission network augmentations, committed and anticipated development of VRE, and reactive plant, and control schemes).

Questions

8. **The current NSCAS description and quantity procedure say that system normal constraints should be assessed for determining net market benefit. AEMO proposes to include any relevant constraints. Which constraints should AEMO consider when assessing the NSCAS needs to increase power transfer capability?**
9. **AEMO proposes to amend the NSCAS procedures to allow flexibility in the methodology to use not only historical analysis, but also a forward-looking projection. Which AEMO forecasting methodology would be appropriate when assessing the forward-looking NSCAS projections?**

3.2.2. Modelling assumptions

The current quantity procedure is specific about exact planning assumptions AEMO should make when modelling any NSCAS shortfalls each year. These specifications are outdated, given the significant market and power system changes since the procedure was released in 2011. For example, the current procedure requires that minimum demand may not be projected to change from the previous year's actual figures, and that generation and demand projections from a medium economic scenario must be applied.

AEMO is proposing to remove the prescriptive modelling specification for the NSCAS studies – that is, Schedule 1 of the current NSCAS quantity procedure – and instead include a set of higher-level modelling principles which will guide industry on the nature of the analysis. This will also allow AEMO the flexibility to adapt the modelling to the current system and environment as well as incorporate localised requirements where appropriate.

One of the intentions of the NSCAS quantity procedure is to ensure transparency. AEMO therefore recommends that high level assumptions are still discussed in the NSCAS quantity procedure, but that the detailed assumptions, where necessary, can be captured in the appendices of the NSCAS review. AEMO has provided (in Section 4) a draft set of high-level modelling assumptions for consultation.

Questions

10. **What NSCAS assumptions would be pertinent to include in the NSCAS quantity procedure? Please provide justification.**
11. **Section 4 contains the proposed schedule 1, to replace the existing schedule 1 of the current NSCAS quantity procedure. What assumptions should be included or excluded in this section?**

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4. DRAFTING FOR PROPOSED CHANGES

The drafting for the amended NSCAS description and quantity procedure will be informed by the results of the consultation on this Issues Paper. A draft description and quantity procedure will be provided in the Draft Report for further consultation

However, to help stakeholders and other interested parties respond to this Issues Paper, AEMO proposes the following assumptions could be included in a schedule of the draft NSCAS quantity procedure, as discussed in Section 0.

Schedule 1: Assumptions for NSCAS need assessments

These are the modelling assumptions made when determining the required NSCAS. Some of the assumptions are applicable to the assessments of all NSCAS types and the others are only applicable to certain types.

Inputs and assumptions associated with generation

- AEMO will include newly committed generation within the area of study according to the latest information available on AEMO's Generation Information page[32] at the start of the NSCAS review.
- AEMO will use the outcomes of AEMO's Integrated System Plan (ISP) and Electricity Statement of Opportunities (ESOO) to inform assumptions about future generator operation for use in the NSCAS studies, including situations where generator performance may be expected to differ from existing performance standards.
- Generator technologies and economic drivers are evolving, and NSCAS studies will use the Inputs and Assumptions (including the latest CSIRO GenCost Report[33] or any replacements) applied in the ISP and ESOO to inform analysis on potential NSCAS needs. An example of this would be the adaption of coal generators to switching off during low price and/or any other relevant conditions.
- Generators are required to notify AEMO three years ahead of their retirement. Announced retirements will be considered in the NSCAS review in the three-year period. AEMO will use the outcomes of the ISP and ESOO to inform a study of the potential future need for NSCAS for the potential risk of a generator exiting in the 3-5 year period. This will use announced retirement dates and risks identified in the ISP.

Inputs and assumptions with interconnector transfers

- Interconnector transfers will be assumed at transfer levels appropriate to the given study bound by the maximum transfer limits.
- If committed projects (network or non-network) will lead to an increase in interconnector transfer limits, then the revised interconnector limits will be assumed in the modelling.

Inputs and assumptions associated with loads and demand

- Plausible demand levels will be sourced from the best available demand forecasts at the time of assessment. NSCAS studies will be conducted at various demand levels appropriate to the issue assessed.

[32] AEMO, NEM Generation Information, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information.

[33] AEMO and CSIRO. GenCost 2019-20: Preliminary results for stakeholder review, published December 2019, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/Inputs-Assumptions-Methodologies/2019/CSIRO-GenCost2019-20_DraftforReview.pdf.

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- Loads will be modelled in a manner consistent with the type of study to be performed for determining the NSCAS need.

Other inputs and assumptions

- Committed transmission network augmentations are modelled in determining NSCAS. Projects that are well advanced but not yet committed, which may come within the NSCAS review periods, may be included in an NSCAS assessment, as a sensitivity.
- AEMO will consider network support agreements that will be active during the study period.
- Relevant control schemes are enabled as appropriate in the assessment of the NSCAS needs.

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5. SUMMARY OF MATTERS FOR CONSULTATION

AEMO invites stakeholders to provide feedback on whether the outlined proposed changes to the NSCAS description and the NSCAS quantity procedure are appropriate for use in managing power system security and reliability. The questions below can be used as a guide.

Stakeholders are invited to submit written responses on the issues and questions identified in this paper by 5.00 pm (Australian Eastern Standard Time) on Tuesday, 7 July 2020, in accordance with the Notice of First Stage of Consultation published with this paper. Submissions should be sent by email to planning@aemo.com.au.

Questions for consultation

1. **In Section 2.2, AEMO discusses the changing context for the NSCAS framework. Do you think these changes justify a change to the NSCAS description? Are there any other relevant changes AEMO should be considering in this NSCAS review? Please specify.**
2. **What are your views on the options presented for describing the types of NSCAS, and if you have a preference, what is the reason? Do you have suggestions for alternative options that should be investigated? Please specify.**
3. **In your preferred option, how would you define the detailed description differently from the descriptions provided above?**
4. **Do you know of any potential NSCAS services that are not included in Table 3?Error! R eference source not found. Please specify.**
5. **Are there any NSCAS types that AEMO should be exploring in addition to those mentioned above, please include examples?**
6. **In Section 2.2, AEMO discusses the changing context for the NSCAS framework. Do you think these changes justify a change to the NSCAS quantity procedure? Are there any other relevant changes that AEMO should be considering in this NSCAS quantity procedure review not already captured? Please specify.**
7. **AEMO proposes to include in the NSCAS assessment the ability to return the network to a secure state within 30 minutes following a contingency. Do you have any comments on this proposal?**
8. **The current NSCAS description and quantity procedure say that system normal constraints should be assessed for determining net market benefit. AEMO proposes to include any relevant constraints. Which constraints should AEMO consider when assessing the NSCAS needs to increase power transfer capability?**
9. **AEMO proposes to amend the NSCAS procedures to allow flexibility in the methodology to use not only historical analysis, but also a forward-looking projection. Which AEMO forecasting methodology would be appropriate when assessing the forward-looking NSCAS projections?**
10. **What NSCAS assumptions would be pertinent to include in the NSCAS quantity procedure? Please provide justification.**
11. **Section 4 contains the proposed schedule 1, to replace the existing schedule 1 of the current NSCAS quantity procedure. What assumptions should be included or excluded in this section?**

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APPENDIX A - GLOSSARY

Term or acronym	Meaning
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
DER	Distributed energy resource
ESB	Energy Security Board
GPS	Generator performance standard
GW	Gigawatt
ISP	Integrate System Plan
MW	Megawatt
NER	National Electricity Rules
NEM	National Electricity Market
NLAS	Network Loading Ancillary Services
NSCAS	Network Support and Control Ancillary Services
NTNDP	National Transmission Network Development Plan
PSS	Power system stabiliser
PV	Photovoltaic
RAS	Remedial action scheme
SPS	Special protection scheme
TNSP	Transmission Network Service Provider
TOSAS	Transient and Oscillatory Stability Ancillary Services
VCAS	Voltage Control Ancillary Services

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