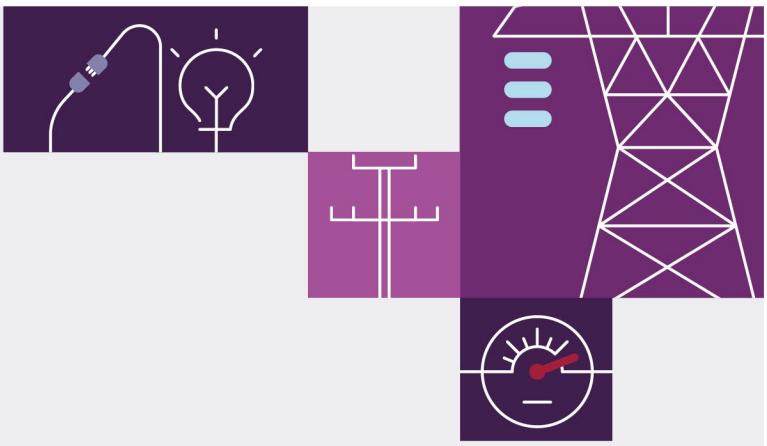
AEMO Request to Revoke Protected Event – Additional information

June 2023

Destructive wind conditions in South Australia Protected Event

A submission to the Reliability Panel



Important notice

Purpose

AEMO has prepared this document to provide additional information to the Reliability Panel relating to AEMO's request for revocation of a protected event under clause 5.20A.5 of the National Electricity Rules. The information and views expressed in this document are current as at the time of submission.

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Purpose

This document contains additional information to support AEMO's request to the Reliability Panel under clause 5.20A.5 of the National Electricity Rules (NER), to revoke the existing SA destructive winds protected event declaration. This additional information is provided in response to requests from the AEMC on behalf of the Reliability Panel. It supplements (but does not vary or supersede) the contents of AEMO's original request, submitted to the Panel on 11 April 2023.

Summary of existing protected event actions and effects

The existing South Australia (SA) destructive winds protected event allows AEMO to take steps to actively manage the risk that, during periods of forecast destructive wind conditions in SA, the loss of multiple transmission elements could cause up to 500 MW of generation to disconnect in SA. If this risk were not managed, it could lead to tripping of the Heywood interconnector (HIC), leading to SA islanding and potentially an SA black system. The protected event presently allows AEMO to constrain HIC flows to a maximum of 250 MW import to SA. At this level, a loss of 500 MW of generation in SA would not cause HIC to trip (HIC flows would increase to approximately 750 MW, but the interconnector would remain in service).

As regards frequency, the protected events framework in conjunction with the frequency operating standard (FOS) would allow frequency to fall to levels as low as 47 Hz, However, the existing actions AEMO takes under the SA protected event to avoid SA separation mean that this additional allowance is not required. If SA islanding is avoided, system frequency would be expected to remain above 49 Hz, with no activation of under-frequency load shedding (UFLS).

System security and actions to be taken under indistinct events framework

AEMO's proposal to manage the SA destructive winds protected event under the revised NER reclassification framework (following the indistinct events rule[1]) has no material impact on the actions that AEMO will take or the level of system security that AEMO will maintain when managing this risk. Management of this risk under the reclassification framework would (during periods of forecast destructive wind conditions in SA):

- Require AEMO to put in place suitable controls to avoid SA islanding for the loss of up to 500 MW of generation in SA caused by multiple network events (being a contingency that is assumed to be reasonably possible when destructive winds are forecast).
- Require AEMO to meet the FOS for a 'network event' (generation event resulting from a network event) with NEM frequency allowed to reach a minimum of 49 Hz, which would avoid UFLS.

Finally, AEMO does not envisage any circumstances under which reclassification of this abnormal condition risk as a credible contingency event would necessitate any additional controls (such as regional FCAS, additional synchronous generation dispatch requirements or directions) in order to maintain power system security.

[1] National Electricity Amendment (Enhancing operational resilience in relation to indistinct events) Rule 2022 No. 1

Wide Area Protection Scheme (WAPS) operation

To further mitigate against the risk of an SA black system, the protected event included provisions for an upgrade to the existing System Integrity Protection Scheme (SIPS) in the form of the WAPS. Specifically the WAPS will further reduce the risk that multiple network events cause up to 500 MW loss of generation in SA and lead to SA separation, and potential SA black system[2]. The scheme will be implemented to reduce this risk with Heywood in service and will also mitigate this risk with Project Energy Connect (PEC) stage 1 in service, with the modifications outlined in the next section. The WAPS has been designed by ElectraNet to accurately detect conditions that are approaching loss of synchronism between South Australia and Victoria using phasor point measurement unit data. The scheme has three stages of response which will trigger when power system conditions exceed the relevant WAPS settings:

- Stage 1 (Lowest trigger level) – The scheme will inject active power from Battery Electrical Storage Sites within SA in order to reduce interconnector flows into SA and avoid interconnector tripping.
- Stage 2 (Higher trigger level) – The scheme will shed loads at pre-determined locations to reduce interconnector flows into SA and avoid interconnector tripping.
- Stage 3 (Highest trigger level) – Where the WAPS detects a loss of synchronism at South East Substation it will immediately trip both Heywood – South East 275 kV lines (islanding SA from the NEM).

As described above, the WAPS will be more effective than the existing SIPS at mitigating the risk of a 500 MW generation loss in SA causing separation and SA region black event however, additional measures are required during destructive wind conditions. As such (and in line with the existing protected event declaration) AEMO will continue to constrain interconnector flows between SA and other NEM regions during destructive wind conditions to further mitigate the risk.

PEC Stage 1

As part of PEC, ElectraNet will upgrade the WAPS to account for the PEC Stage 1 connection. A separate control scheme will also be designed to directly intertrip PEC stage 1 following a non-credible loss of HIC.

Revocation of the protected event declaration will allow the upgrade to WAPS and PEC Stage 1 inter-trip scheme to proceed as planned and be managed by ElectraNet under NER S5.1.8.

South Australia Interconnector Remedial Action Scheme (SAIT RAS)

ElectraNet will further upgrade the WAPS to account for the PEC Stage 2 connection. The SAIT RAS is designed to prevent cascaded tripping of an interconnector due to the non-credible loss of the other interconnector. SAIT RAS will also include functionality to take remedial actions to reduce the impact of the non-credible loss of 500 MW of generation in SA

Under AEMO's proposal the SAIT RAS implementation (upgrading WAPS) will proceed as planned and be managed by ElectraNet under NER S5.1.8.

[2] See section 5.2.3 of the 2018 Power System Frequency Risk review for a summary of AEMO's assessment of SIPS performance and the recommended improvements to the scheme - https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/PSFRR/2018_Power_System_Frequency_Risk_Review-Final_Report.pdf

Indicative limit updates

The following table summarises the indicative changes to HIC and PEC limits that AEMO would apply during periods of forecast destructive wind conditions. The table includes the anticipated constraints which would apply to maintain HIC and PEC within their satisfactory limits after a 500 MW loss of generation within SA. The limits applicable with PEC Stage 1 are subject to finalisation at the time of preparing this document. PEC Stage 2 limits are yet to be determined.

	HIC current approach	**HIC indistinct events framework**	**HIC + PEC-1**	**HIC + PEC-1 (PEC-1 out of service)**	**HIC + PEC-2**
HIC limit	250 MW	250 MW	430 MW	250 MW	TBC
PEC-1 limit	N/A	N/A	70 MW	Out of service	TBC
PEC-2 limit	N/A	N/A	N/A	N/A	TBC
SIPS / WAPS / SAIT RAS	Defined as an EFCS under NER 4.3.2(h)	Managed under NER S5.1.8	Managed under NER S5.1.8	Managed under NER S5.1.8	Managed under NER S5.1.8

Reporting of reclassification of non-credible contingency events

In line with the requirements of NER clause 4.2.3A(i), every six months AEMO will publish a report covering its reasons for all decisions to reclassify non-credible contingency events as credible. These reports include

- An explanation of how *AEMO* applied the *reclassification criteria* for each reclassification decision;
- AEMO's appraisal of:
  - The appropriateness and effectiveness of the *reclassification criteria* and the measures implemented to maintain *power system security* as a result of reclassification decisions; and

  - Any need to review and amend the *reclassification criteria* before the next review under clause 4 4.2.3B(b); and
- AEMO's analysis of reclassification trends during the relevant period.

This reporting covers all types of reclassifications including reclassification due to invoking a protected event or due to abnormal conditions (such as destructive or damaging winds). AEMO will report on reclassifications due to actual/forecast destructive winds in SA in these six monthly reports[3].

In addition, if the circumstances of any individual reclassification decision result in AEMO taking different management actions to those anticipated in the reclassification criteria, AEMO is required under NER 4.2.3A(j) to report separately on that decision as soon as reasonably practicable. That said, in the context of this particular risk AEMO does not presently expect different actions to be taken on an ad hoc basis. Any limit revisions (up or down) to manage this risk are more likely to occur in a planned way, as described below.

Reporting of updates to limits in relation to destructive winds causing a 500 MW loss of generation in SA

AEMO will continue to apply appropriate constraints to manage the risk that destructive winds may cause up to 500 MW loss of generation in SA, to maintain power system security by minimising consequential SA islanding and a potential SA black system. From time to time the limits applied/controls used by AEMO may need to be updated (due to system, generation or risk changes). AEMO will report any updates to the limits applied (and risk management methods used) to mitigate against this risk in the General Power System Risk Review (GPSRR). The annual GPSRR is the appropriate vehicle for this reporting, as AEMO considers this a priority risk with the potential to cause cascading outages and major supply disruptions (aligning with the requirements of NER clause 5.20A.1). Should any updates to limits or management actions be required in a more expedited timeframe, outside the annual GPSRR reporting timeframes, revisions would occur in accordance with NER 4.2.3B through the reclassification criteria, after consultation with affected participants.

AEMO's approach to managing power system security

As the independent power system and market operator for the NEM, AEMO will respond to abnormal power system conditions by taking operational actions that are reasonably practicable and within the limits of its NER authority to maintain the power system in a secure operating state, while minimising the impact of those actions on market outcomes as far as possible.

[3] Examples of AEMO's existing reclassification report and the information they include can be found here - https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-events-and-reports/power-system-reclassification-events