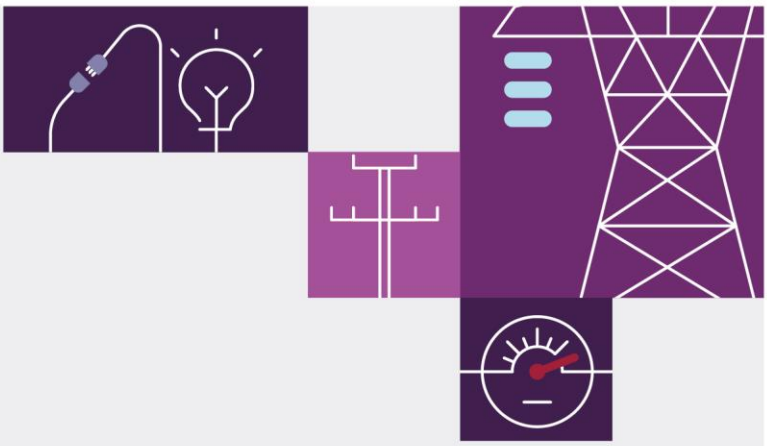
AEMO Request to Revoke Protected Event

April 2023

Destructive wind conditions in South Australia Protected Event

A request to the Reliability Panel



Important notice

Purpose

AEMO has prepared this request for revocation of a protected event under clause 5.20A.5 of the National Electricity Rules, based on information available to AEMO up to the time of submission or as otherwise stated in this document.

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Executive summary

This is a request by AEMO to the Reliability Panel under clause 5.20A.5 of the National Electricity Rules (NER), to revoke a protected event declaration.

The protected event declaration AEMO requests the Reliability Panel to revoke is:

> *The loss of multiple transmission elements causing generation disconnection in the South Australia region during periods where destructive wind conditions are forecast by the Bureau of Meteorology*[1]

Referred to in this submission as the **destructive winds[2] protected event**, this is the only protected event to have been declared in the NEM to date.

AEMO requests that the Reliability Panel revoke the destructive winds protected event, effective 1 October 2023. This date enables the event to be managed under the 'enhancing operational resilience in relation to indistinct events' rule change[3] which took effect in March 2023 and is prior to the expected first synchronous electrical connection of South Australia to New South Wales via Project EnergyConnect (PEC) Stage 1[4]).

Key points

1. The destructive winds protected event was declared by the Reliability Panel in June 2019. It was declared to limit the impact of non-credible contingencies in South Australia that could lead to cascading outages such as those that occurred in the 2016 South Australia black system event[5]. Specifically, the protected event considers the loss of multiple transmission elements causing generation to disconnect in South Australia, which could cause the overload and subsequent trip of the Heywood interconnector (HIC) and a black system event.
2. The protected event was declared only for forecast destructive wind conditions[6]. It defines:
   - The target capabilities of the South Australia Wide Area Protection Scheme (WAPS). This is a scheme designed to reduce the likelihood of HIC tripping following disconnection of up to 500 megawatts (MW) of South Australian generation.

[1] Reliability Panel AEMC, Final report AEMO request for protected event declaration, 20 June 2019, at https://www.aemc.gov.au/sites/default/files/2019-06/Final%20determination%20-%20AEMO%20request%20for%20declaration%20of%20protected%20event.pdf

[2] Table 5 of the published Power System Security Guidelines outlines the wind classification used by the Bureau when publishing severe weather warnings. Destructive winds have wind gusts of 125-164 km/h, or sustained winds of 89-117 km/h or a cyclone category of 2. Full details can be found here - https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715%20Power-System-Security-Guidelines.pdf.

[3] Please see https://www.aemc.gov.au/rule-changes/enhancing-operational-resilience-relation-indistinct-events.

[4] PEC Stage 1 will create a new AC electrical connection between South Australia and New South Wales. The first AC electrical connection is currently planned for October 2023. Once the AC electrical connection is established AEMO will publish a market notice to inform the market of this milestone.

[5] AEMO, Black system South Australia 28 September 2016 – Final Report, March 2017, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Integrated-Final-Report-SA-Black-System-28-September-2016.pdf.

[6] In this context, "destructive wind conditions" means wind speeds above 140 km/h. See Reliability Panel AEMC, Final report AEMO request for protected event declaration, 20 June 2019, p3, at https://www.aemc.gov.au/sites/default/files/2019-06/Final%20determination%20-%20AEMO%20request%20for%20declaration%20of%20protected%20event.pdf.

- The 250 MW constraint applied to South Australian import via HIC during forecast destructive wind conditions.

3. The defined WAPS target capabilities and the 250 MW HIC constraint may not remain fit for purpose following connection of PEC Stage 1. To change either measure requires the protected event declaration to be revoked.
4. In the 2022 Power System Frequency Risk Review (PSFRR)[7], AEMO noted that it would consider whether the destructive winds protected event could be managed under the new contingency reclassification framework[8] and, if so, recommend revocation of the protected event.
5. AEMO has determined that the new contingency reclassification framework, effective from 9 March 2023, will facilitate the application of appropriate HIC constraints in forecast destructive wind conditions (being abnormal conditions) and that WAPS target capabilities could be implemented by ElectraNet under NER clause S5.1.8.
6. Therefore, consistent with the conditional recommendation in the 2022 PSFRR, AEMO requests that the destructive winds protected event is revoked on 1 October 2023[9].
7. AEMO considers there will be no negative consequences for the power system by ceasing to manage this non-credible contingency event as a protected event after the new contingency reclassification framework comes into effect. In addition, following synchronisation of PEC Stage 1, AEMO considers it will be able to effectively manage this risk, pending the development of import constraints by the transmission network service provider (TNSP).

[7] AEMO, 2022 Power System Frequency Risk Review, July 2022, at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2022/psfrr/2022-final-report---power-system-frequency-risk-review.pdf?la=en.

[8] AEMC, March 2022, at https://www.aemc.gov.au/rule-changes/enhancing-operational-resilience-relation-indistinct-events.

[9] This is prior to the expected date of synchronous electrical connection of South Australia to New South Wales via PEC Stage 1.

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1 Introduction

This is a request by AEMO to the Reliability Panel under National Electricity Rules (NER) clause 5.20A.5 of the), to revoke a protected event declaration.

The protected event declaration AEMO requests the Reliability Panel to revoke is:

> *The loss of multiple transmission elements causing generation disconnection in the South Australia region during periods where destructive wind conditions are forecast by the Bureau of Meteorology*[10]

Referred to in this submission as the **destructive winds protected event**, this is the only protected event to have been declared in the NEM to date.

Revoking a protected event declaration

The Reliability Panel is required to make a determination under NER clause 8.8.4 on a request from AEMO to revoke a protected event. As required by NER clause 5.20A.5, AEMO's request includes:

- Information explaining the nature of the non-credible contingency event.
- The consequences for the power system if the event were to cease to be managed as a protected event.
- Other information AEMO considers reasonably necessary to assist the Reliability Panel to consider the request.

2022 Power System Frequency Risk Review

In the 2022 Power System Frequency Risk Review (PSFRR)[11], AEMO noted that it would consider if the destructive winds protected event could be managed under the new contingency reclassification framework[12] and, if so, determine the applicable reclassification criteria and recommend revocation of the protected event. As part of its considerations, AEMO also needed to work with ElectraNet to assess the necessary modifications to the System Integrity Protection Scheme (SIPS) for the first stage of Project EnergyConnect (PEC). The target capabilities of SIPS are also part of the destructive winds protected event.

As documented in subsequent sections, AEMO has determined that it can manage the risks covered by the existing destructive winds protected event under the updated reclassification framework. AEMO has also determined that following synchronisation of PEC Stage 1, the measures defined in the destructive winds protected event will no longer be fit for purpose. Finally, AEMO has identified that updated measures can be effectively managed under the new contingency reclassification framework and NER clause S5.1.8.

Therefore, consistent with the conditional recommendation in the 2022 PSFRR, AEMO requests that the destructive winds protected event is revoked on 1 October 2023[13].

[10] Reliability Panel AEMC, Final report AEMO request for protected event declaration, 20 June 2019, at https://www.aemc.gov.au/sites/default/files/2019-06/Final%20determination%20-%20AEMO%20request%20for%20declaration%20of%20protected%20event.pdf

[11] AEMO, 2022 Power System Frequency Risk Review, July 2022, at https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2022/psfrr/2022-final-report---power-system-frequency-risk-review.pdf?la=en.

[12] AEMC, March 2022, at https://www.aemc.gov.au/rule-changes/enhancing-operational-resilience-relation-indistinct-events.

[13] Which is prior to the expected date of synchronous electrical connection of South Australia to New South Wales via PEC Stage 1.

2 Background

2.1 Non-credible contingency

The destructive winds protected event was declared in June 2019, to minimise the risk of cascading failure resulting from future non-credible contingency events similar to the 2016 South Australia black system event[14]. The non-credible contingency and subsequent sequence of events leading to the 2016 black system are illustrated in Figure 1 below.

Figure 1 Sequence of events leading to the 2016 South Australia black system

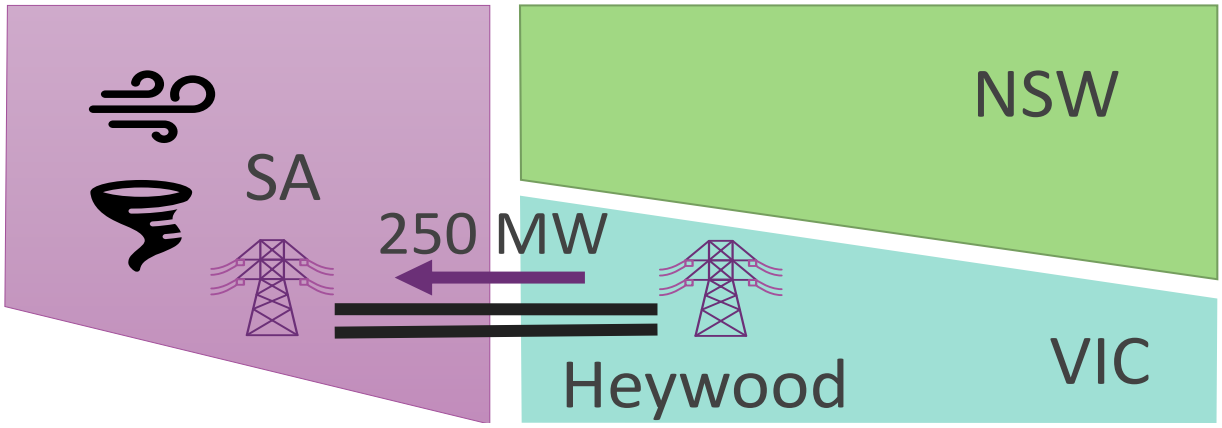
2.2 Destructive winds protected event

2.2.1 Initial implementation

Heywood Interconnector constraint

The destructive winds protected event defines a constrain t of 250 MW to be applied to South Australian import over Heywood interconnector (HIC) during forecast destructive wind conditions. This was considered an effective level to significantly lower the risk of loss of multiple generating units causing HIC to trip (resulting in South Australia islanding).

Figure 2 Simplified diagram of South Australian connection to the rest of the NEM via the Heywood interconnector, with 250 MW constraint during destructive winds



[14] AEMO, Black system South Australia 28 September 2016 – Final Report, March 2017, see https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Integrated-Final-Report-SA-Black-System-28-September-2016.pdf.

Wide Area Protection Scheme

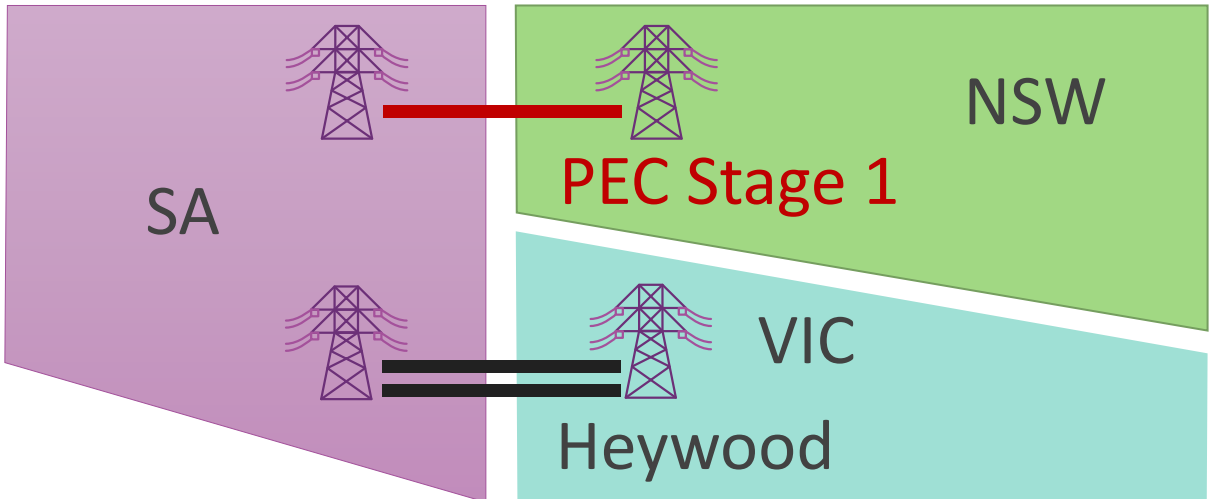
In addition to the HIC constraint, a remedial action scheme – the SIPS - is in place to further lower the risk that trip of South Australian generation will cause HIC to trip. SIPS works by detecting a power swing on HIC, and if the power swing exceeds certain thresholds, it triggers power injection from participating batteries in South Australia, and/or sheds load in South Australia, to reduce the flow on HIC to prevent it from becoming unstable and tripping.

The destructive winds protected event provided for SIPS to be upgraded to a more effective scheme and defines target capabilities for the upgrade of SIPS. Upgrades to SIPS have been designed and are in the process of being implemented by ElectraNet. The upgraded scheme will be called the Wide Area Protection Scheme (WAPS)[15] and is planned to be enabled in 2023.

2.2.2 Impact of Project EnergyConnect Stage 1 on the destructive winds protected event

PEC Stage 1 will create a second alternating current (AC) interconnection corridor between South Australia and the rest of the NEM. Stage 1 will be a single circuit connection from South Australia to New South Wales, with a second circuit constructed later as part of PEC Stage 2.

Figure 3 Simplified diagram of South Australian connection to rest of NEM via HIC and PEC Stage 1



PEC Stage 1 will modify power flows in ways not accounted for by the WAPS target capabilities or the 250 MW HIC constraint defined in the destructive winds protected event. It is unlikely that either the HIC constraint or WAPS target capabilities, as currently expressed in the destructive winds protected event, will remain fit for purpose following connection of PEC Stage 1[16].

ElectraNet, in collaboration with AEMO, is currently assessing the changes to WAPS that will be required to remain effective following connection of PEC Stage 1.

[15] WAPS will improve on SIPS by using a more sophisticated and accurate method of detecting impending unstable power swings on HIC, increasing the available battery response, and sizing its response according to the severity of the incident to avoid tripping excessive load.

[16] As an example, the destructive winds protected event does not include any provision to limit flow on PEC Stage 1 during destructive wind conditions

2.3 2022 PSFRR recommendations

In the 2022 PSFRR AEMO recommended that as part of PEC Stage 1 delivery:

- WAPS is modified to account for the change in network topology.
- The existing 250 MW HIC constraint applied during forecast destructive wind conditions is replaced by a 430 MW constraint on HIC South Australian import and a 70 MW constraint on PEC Stage 1 South Australian import:
  - This recommendation was based on preliminary studies by ElectraNet. These found a trip of 500 MW of generation at maximum South Australian import could cause thermal overload of PEC Stage 1. This could cause trip of PEC Stage 1, and cascading trip of HIC, islanding South Australia.
  - ElectraNet is completing detailed studies to provide AEMO with updated advice on suitable limits to be applied to Heywood and PEC Stage 1 during destructive wind conditions based on the satisfactory limit of Heywood and PEC interconnectors. AEMO intends to continue to apply the existing 250 MW HIC constraint until ElectraNet provide updated limits advice to AEMO. AEMO considers that destructive wind conditions are likely to continue to be managed under the indistinct events framework post WAPS commissioning as, similar to the SIPS scheme, the WAPS scheme is unlikely to be 100% effective at preventing SA islanding and black system events.
- AEMO consider whether the existing protected event could be managed under the new NER contingency reclassification framework (which applies from March 2023), and, if so, determine the applicable reclassification criteria and recommend revocation of the protected event.

In addition:

- AEMO, the Australian Energy Market Commission (AEMC) and the Reliability Panel have confirmed that altering the WAPS target capabilities and the HIC constraint to account for PEC stage 1 requires revocation of the destructive winds protected event, as both are defined in the existing declaration.

3 Assessment of NER frameworks

3.1 Updated contingency reclassification framework

As per the 2022 PSFRR recommendations, AEMO considered whether the HIC import constraint element of the destructive winds protected event could be managed under the under the new contingency reclassification framework (effective 9 March 2023) and, if so, determine the applicable reclassification criteria.

In summary, AEMO's assessment is:

- The AEMC 'enhancing operational resilience in relation to indistinct events rule' aims to ensure that "AEMO is able to take action to mitigate any credible threats to the power system, even if the assets at risk and impacts cannot be explicitly identified ('indistinct events')"[17].
- As required by the rule, AEMO has consulted on, and recently finalised, updated contingency reclassification criteria in the the Power System Security Guidelines[18] to reflect the revised framework.
- For widespread risks managed under the new contingency reclassification framework, AEMO will take measures it considers reasonable to manage a risk in all circumstances, including one or more of:
  - Constraining the dispatch of scheduled plant.
  - limiting interconnector flows.
  - Issuing directions or NER clause 4.8.9 instructions for the purpose of managing system strength, voltage, frequency or inertia requirements.
  - Procuring additional market ancillary services.
  - Reconfiguring the network (including sacrificial switching).
  - Recalling planned network outages.
  - Recalling planned generation outages.
  - Maximising reactive power reserves.
  - Activating contingency plans.
  - Implementing temporary limits in SCADA systems.
  - Distributed photovoltaics (DPV) curtailment.
  - Pre-contingent and/or post-contingent load shedding.
- The updated reclassification criteria for abnormal conditions include criteria for "severe winds", which includes "destructive winds" and AEMO can take any of the actions listed above (including "limiting interconnector flows") to manage risks arising from destructive wind conditions.

[17] AEMC, March 2022, at https://www.aemc.gov.au/rule-changes/enhancing-operational-resilience-relation-indistinct-events.

[18] AEMO, Power System Security Guidelines, at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/Procedures/SO_OP_3715 Power-System-Security-Guidelines.pdf.

AEMO concludes that South Australian import limits can be implemented during destructive wind conditions using the updated contingency reclassification framework. HIC limits applied for any given severe wind conditions should be based on AEMO's risk assessment, informed by asset owners as well as prior experience. In the absence of contrary information, AEMO will consider the analysis conducted for the destructive winds protected event to set an appropriate limit.

Following revocation of the destructive winds protected event, the existing 250 MW South Australian import constraint can be implemented during destructive wind conditions using the updated contingency reclassification criteria, until updated limits advice is provided to AEMO by ElectraNet. In addition, appropriate constraints for the network topology post PEC Stage 1[19] can be implemented under these reclassification criteria.

AEMO also notes that the contingency reclassification framework and protected event rule changes were both initiated in response to the 2016 South Australian black system event. AEMO considers the destructive winds protected event, as currently declared, is better aligned with the modified contingency reclassification framework, which considers power system security during temporary 'abnormal conditions' and now recognises 'indistinct events' where the specific assets at risk and impacts cannot be explicitly identified.

Therefore, using the updated reclassification criteria to manage the risk of destructive winds causing trip of multiple South Australian generators aligns well with the purpose of the rule change.

3.2 WAPS modifications under NER clause S5.1.8

AEMO has considered whether modifications to WAPS and South Australian import constraints appropriate for PEC Stage 1 (and future material power system changes) require the declaration of a new protected event, or could be applied under other frameworks provided for in the NER.

NER clause S5.1.8 includes the following provisions regarding non-credible contingency events and emergency control schemes:

1. Network service providers (NSPs) must plan their network considering non-credible contingency events.
2. Where the consequences of such events are likely to be severe disruption, the NSP must, in consultation with AEMO, install, maintain or upgrade emergency controls (subject to NER requirements regarding economic justification).

Modifying WAPS to remain effective following PEC Stage 1 synchronisation aligns with these obligations.

Following the revocation of the destructive winds protected event, AEMO will also revoke the Protected Event Emergency Frequency Control Scheme (EFCS) for WAPS, and ongoing management (including settings, changes and reviews) will be managed by ElectraNet under NER clause S5.1.8.

3.3 Limitations of protected events framework in a time of rapid transition

Following connection of PEC Stage 1 and revocation of the destructive winds protected event, AEMO could recommend a new protected event to implement the necessary updates to South Australian import limits during destructive winds, and modification of WAPS, rather than implementing these measures using the contingency reclassification framework and NER clause S5.1.8 as outlined above.

[19] ElectraNet to provide AEMO with updated limits advice to apply during destructive winds and post PEC Stage 1's connection.

However, AEMO considers that declaring a replacement protected event would have the following negative consequences:

1. As the power system rapidly changes, successive protected event modifications would be required to change the WAPS design, settings and/or interconnector limits. Each change would be an administratively intensive and lengthy process.

   AEMO understands that under the current NER, each change would require the Reliability Panel to revoke the previous protected event and declare a new protected event following a recommendation in a General Power System Risk Review (GPSRR) and associated AEMO requests.

2. Given the sequence of steps required to implement a new protected event noted above, and the consultation requirements for each associated process, it is unlikely this could be achieved before expected PEC Stage 1 synchronisation, or that any future control scheme modifications required to operate efficiently for system changes could be implemented in a timely way.

3. Applying the protected event alone may have the potential to limit actions AEMO can take to effectively manage particular risks, compared to the reclassification framework which allows a broader set of actions to be taken, where appropriate.

As the required measures can be efficiently implemented using other frameworks, AEMO does not intend to recommend an updated protected event to replace the existing destructive winds protected event.

4 Request to revoke protected event

Consistent with the conditional recommendation in the 2022 PSFRR, AEMO requests that the destructive winds protected event is revoked on 1 October 2023[20].

4.1 Management of non-credible contingency risk following protected event revocation

Following revocation of the destructive winds protected event, AEMO proposes the non-credible contingency risk presently covered by the protected event be managed as follows:

1. During periods for which destructive wind conditions are forecast in South Australia, under the updated contingency reclassification framework, AEMO will limit Heywood interconnector flow towards South Australia to a level that will be likely to reduce the risk of transmission faults causing up to a 500 MW generation disconnection and subsequent islanding and black system events.
2. During forecast destructive wind conditions, AEMO intends to continue to apply the existing 250 MW constraint to South Australian import via HIC using the updated contingency reclassification framework, until updated limits advice is provided to AEMO by ElectraNet.
3. ElectraNet will modify WAPS as needed so that it remains effective for the network topology that includes PEC Stage 1. This includes any changes to WAPS deemed necessary, including decommissioning the scheme if future information, network changes or power system conditions render it no longer needed.

4.2 Consequences for the power system of ceasing to the manage non-credible contingency as a protected event

There will be no negative consequences for the power system by ceasing to manage the non-credible contingency as a protected event following synchronisation of PEC Stage 1. The non-credible contingency risk will continue to be managed by WAPS and constraints, which will be updated as appropriate for the new network topology under NER clause S5.1.8 and the contingency reclassification framework respectively.

4.3 Reliability Panel consultation process

The Reliability Panel may consider whether it wishes to follow the standard process or expedited process for consultation on this revocation request under the Rules consultation procedures[21].

[20] Which is prior to the expected date of synchronous electrical connection of South Australia to New South Wales via Project EnergyConnect (PEC) Stage 1.

[21] See NER clause 8.8.4(b), and 8.9.1(d)

The Reliability Panel may follow the expedited process if it considers that the request for revocation of the protected event is a “non-material proposal”, which is defined as:

> *a Proposal that, if implemented, will be unlikely to have a significant effect on the NEM or on the activities of the Registered Participants to which the Proposal relates*

AEMO considers that the request to revoke the destructive winds protected event meets the criteria for a non-material proposal, as it will have no negative consequences, and therefore requests the Reliability Panel to consider the expedited process if it is able to do so.

Following an expedited process, in AEMO’s view, will maximise the likelihood of implementing the necessary changes prior to synchronisation of PEC Stage 1. This will ensure that South Australian imports are not unnecessarily constrained and WAPS operation remains fit for purpose.

A1. Project EnergyConnect topology

Figure 4 PEC Stage 1 topology

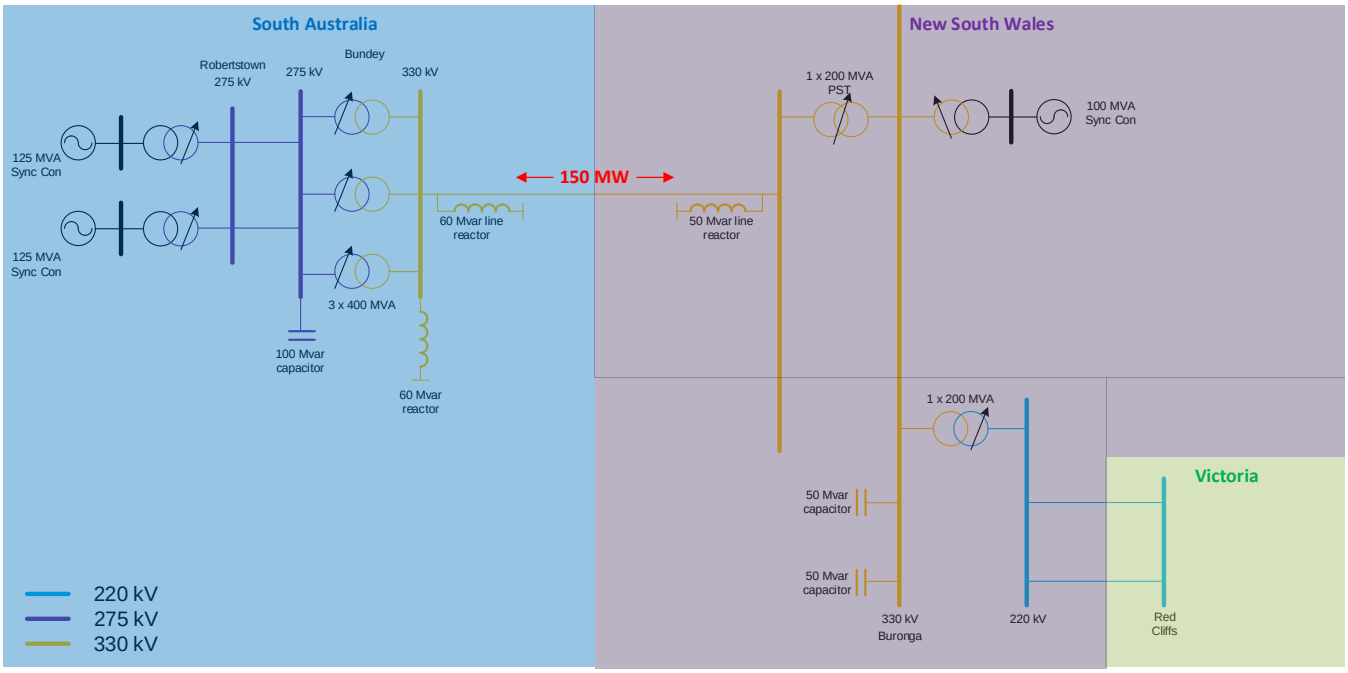


Figure 5 PEC Stage 2 topology