

SA minimum synchronous generator requirements

Update

June 2023



Approach to minimum units

- With four synchronous condensers in operation, the minimum SA synchronous generator requirement has been reduced from four to two in Q4 of 2021
- Technical assessment required before further reducing the minimum units
 - Grid reference
 - Ramping and reserve
 - Frequency control including emergency frequency control schemes (UFLS, OFGS, SIPS)
 - Transmission and distribution protection adequacy, as per S5.1.9(c)
 - Adequate voltage control (including compliance with S5.1.8 and AS61000.3.7)
 - Revision to impacted limit advice

Grid reference

- The SA power system currently requires at least one large synchronous generator for grid reference.
- Results of power system analysis suggest a synchronous generator may not be required for grid reference
 - This means grid-following inverter based resources can ‘latch-on’ to the voltage waveform supplied by the synchronous condensers
- To be confident that power system security can be maintained in the absence of synchronous generation, appropriately scaled system tests will be required to demonstrate the concept of ‘grid reference’.

Ramping

- AEMO's analysis confirms a continuous minimum two-unit requirement in SA is not required to manage ramping events.
 - Two units may be required when SA is at a risk of island or an island under certain conditions.
- Aside from this, there are challenges managing increasingly large wind and solar ramping events.
- AEMO intends to explore mechanisms to mitigate risks associated with ramping events (e.g. constraining IBR when needed and/ or contracting fast start units)

Frequency control

- No material impact on system frequency if the SA synchronous generator requirement moves from two to one unit when SA is interconnected
 - During an island, reliance is on Fast Frequency Response (FFR) and availability of fast start units to synchronise within 30 mins
- Emergency frequency control schemes
 - The existing SA Regulation 88A constraints limit flow on the Heywood interconnector based on inertia and load. The reduction to a minimum of one unit has negligible impact on the effectiveness of UFLS and OFGS
 - ElectraNet has highlighted there could be an impact on the performance of System Integrity Protection Scheme (SIPS) with increased short-term risk prior to WAPS implementation in 2023

Network protection adequacy

- Heywood interconnector in service, combined with the worst network outage (line or transformer):
 - Distribution system protection is presently adequate with one synchronous generator online and 3 synchronous condensers operational
 - Transmission system protection is presently adequate with one synchronous generator online and 4 synchronous condensers operational (ElectraNet recently completed protection system work)
- SA islanded, one synchronous generator online and 4 synchronous condensers operational, combined with the worst network outage:
 - ElectraNet is undertaking a review of protection adequacy

Voltage control

- A minimum number of reactive power control devices are required to be online together with one large 275 kV connected synchronous generator in the Adelaide Metropolitan region
 - Required minimum number of reactive power control devices are expected to be ready for operation by end of September 2023
- A minimum of two large 275 kV connected synchronous units are required online during low demand conditions
 - Current analysis suggesting that one large 275 kV connected synchronous unit operation is possible for operation demand higher than 600 MW when SA is interconnected to the rest of the NEM regions
- ElectraNet is progressing a voltage control RIT-T* to ensure sufficient voltage control capability is provided in the Adelaide Metropolitan region.

* <https://www.electranet.com.au/wp-content/uploads/ritt/PSCR-EC.11645-Transmission-Network-Voltage-Control.pdf>

Current status of the work

Tasks / Assessment	ElectraNet	AEMO
Voltage Control	Complete	Work ongoing to ensure appropriate outage contingency plans are defined
Protection system changes	Complete	-
Transient stability	Complete	Complete
System strength	Complete	Complete
Power system damping	Complete	Due-diligence ongoing

Next steps

- ElectraNet and AEMO continue to assess technical requirements
- AEMO will update constraints and operating procedures once all technical assessment is complete
- AEMO will advise market at least 2 weeks prior to implementation of limits



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