SA minimum synchronous generator requirements

Industry update

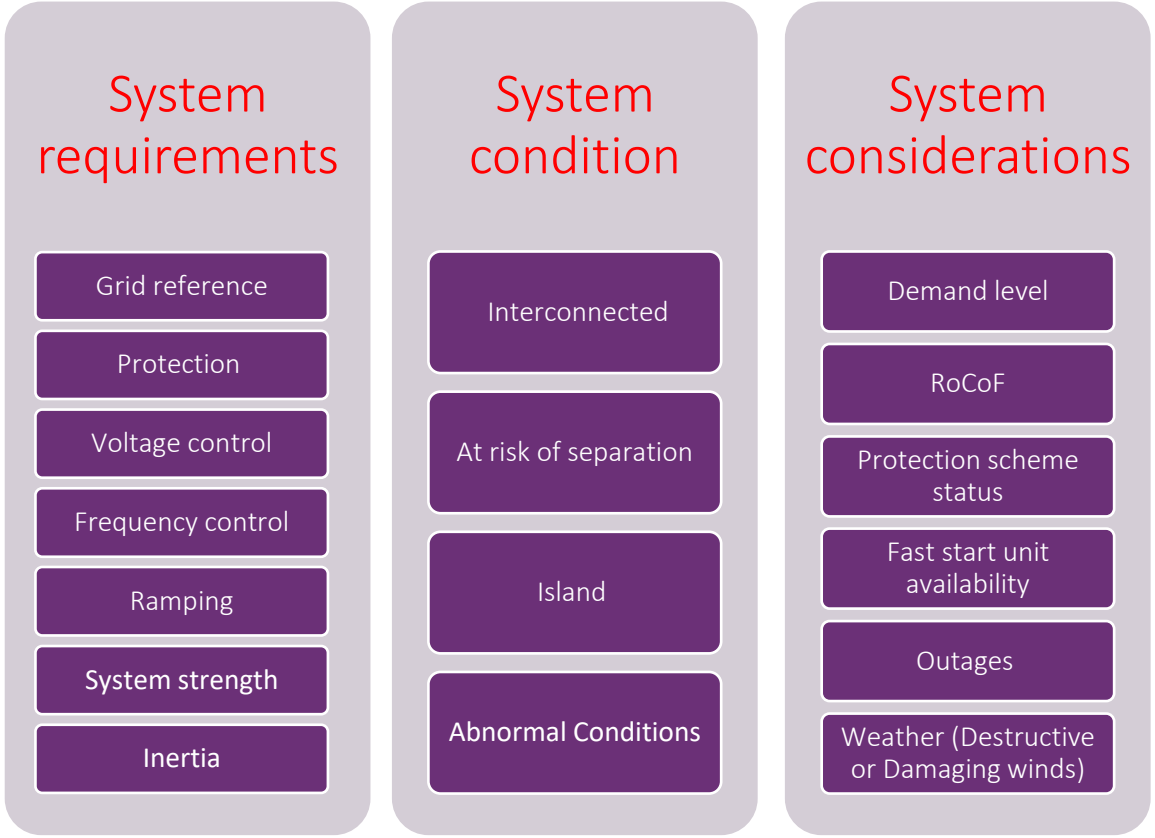
17 August 2023

Synchronous generator requirements

- With four synchronous condensers in operation, the minimum SA synchronous generator requirement was reduced from four to two in Q4 of 2021
- AEMO and ElectraNet have undertaken program of work to reassess the need for this requirement given changing network conditions

Power system operation

- AEMO is required to operate the system in a secure operating state.
- Following a credible contingency event, AEMO is required to re-secure the power system within 30 minutes
  - Fast start units are often required for re-securing the system



Varying levels of system requirements are required from within SA depending on the system condition and specific system considerations at the time.

System Requirements – Consideration for minimum synchronous requirement

System Requirement	Capability
Grid Reference	AEMO investigating requirements.
Protection	One large synchronous generator together with four synchronous condensers are adequate for protection system in an interconnected system.
Voltage Control	Reactive power control in Adelaide currently requires 2 synchronous generators connected to the 275 kV network.
Frequency Control	Frequency control is adequate with an interconnected system.
Ramping	Ramping requirements are met in an interconnected system.
System Strength	Four synchronous condensers are installed to support system strength
Inertia	Four synchronous condensers **with flywheels** are installed to support inertia, currently complemented by contracted Fast Frequency Response.

Network protection

- SA interconnected
  - ElectraNet completed required protection system work.
  - one large synchronous generator together with four synchronous condensers are adequate for protection system.
- SA island
  - ElectraNet completed required protection system work.
  - ElectraNet updated protection settings for islanded operation.

Voltage control

- One large 275 kV connected synchronous generator and minimum number of reactive power control devices in Adelaide metropolitan area are required for voltage control
  - Key reactive power control devices (Cherry Gardens reactor, Para SVCs, Torrens Island BESS) are expected to be ready for operation by end of September 2023
- ElectraNet is progressing a voltage control RIT-T* to ensure sufficient voltage control capability is provided in the Adelaide Metropolitan region.
- Consistent with the latest limits advice, AEMO is investigating voltage control needs in SA through the 2023 NSCAS process.

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

Voltage control

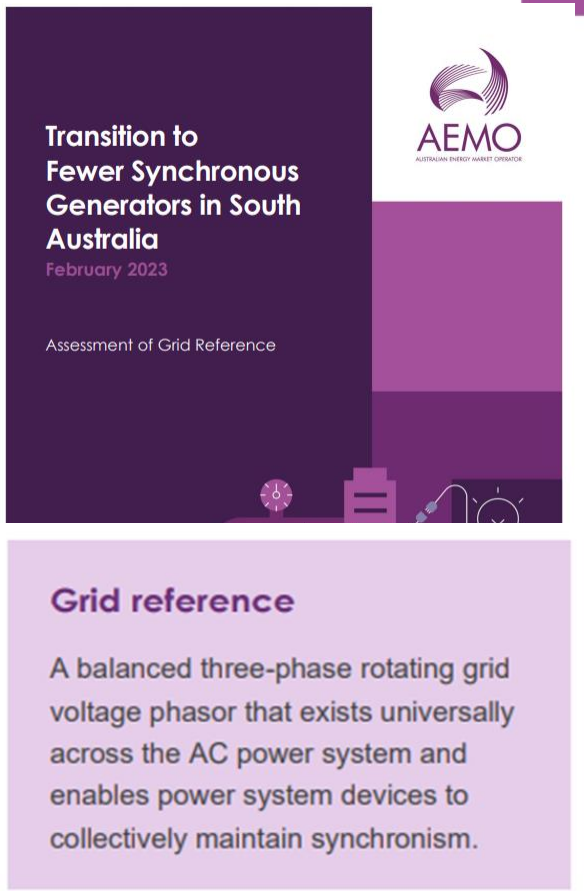
- A number of system conditions are to be met for allowing a minimum of one large 275 kV synchronous generator operation
  - Appropriate fast start unit options available to meet N-1 and N-1-1 requirements
  - Operational demand will need to be in excess of 600 MW
  - The network must be in a normal operating state i.e. not at risk of islanding, no abnormal operating conditions, and not in an island state
  - Sufficient reactive power control devices are online in Metro area

Given the above restrictions AEMO will be operating SA with two large synchronous generators as a minimum

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

Grid reference

- AEMO studies identify in theory that the four synchronous condensers and appropriate BESS can provide adequate grid reference in SA.
  - This means grid-following inverter-based resources can ‘latch-on’ to the voltage waveform supplied by the synchronous condensers and BESS.
- Consultation with national and international organizations supported AEMO findings.
- To be confident that power system security can be maintained in the absence of synchronous generation, AEMO will be seeking additional evidence of successful operation, such as an appropriately scaled system testing.



https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/congestion-information/sa-transition-to-fewer-synch-gen-grid-reference.pdf

Next steps

- AEMO report on network support and control ancillary services published later this year.
- AEMO is reviewing existing South Australia generator combinations to ensure they adequately cover voltage control requirements. Any changes will be communicated in advance of implementation.

For more information visit

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