System Strength Requirements in SA

Introduction

We will be applying the Reguatory Investment Test for Transmission (RIT-T) to an identified system strength requirement in South Australia, with the release of a Project Specification Consultation Report (PSCR) as the first step in this process.

This note provides a summary of the consultation to be undertaken and the background to this need on the network.

What is system strength?

System strength relates to the ability of a power system to withstand changes in generation output and load levels while maintaining stable voltage levels.

When system strength is high, voltage changes less for a change in load or generation than it would if system strength is low. System strength is generally measured by the three-phase fault level, expressed in megavolt-amperes (MVA).

In a system with low system strength:

- generators may be unable to remain connected during disturbances on the power system
- control of system voltage becomes more difficult
- protection systems which control the safe operation of the network may not operate correctly.

This impacts on system security and increases the risk of system instability and supply interruptions to customers and can also lead to constraints in generation output.

System strength is provided locally by sources such as traditional synchronous generators, transmission network lines and transformers, voltage control equipment and synchronous condensers.

Summary

We are applying the Regulatory Investment Test for Transmission (RIT-T) to options that can deliver the efficient level of the system strength services to the South Australian power system, required to maintain power system stability and security during the ongoing clean energy transition.

Publication of a PSCR is the first step in the RIT T process. This PSCR is accompanied by an Expression of Interest (EOI) seeking non-network options from potential System Strength Contractors to address system strength requirements in South Australia (i.e. third party businesses that can provide system strength services to ElectraNet under a network support contract).

The RIT-T will examine network and non-network options to meet the system strength requirements while providing the greatest net economic benefit to the energy market.

Identified need: meeting system strength requirements in South Australia

The Australian Energy Market Operator (AEMO) published a forecast of Inverter Based Resources (IBR) for SA over the next decade in its 2022 System Strength Report[1]. Based on this forecast and using AEMO's guidelines and methodology, a shortfall of Available Fault Level (AFL) to meet the efficient level of system strength has been identified for the Robertstown and Para system strength nodes in South Australia from 2025-26.

National Electricity Rule (NER) S5.1.14 requires us to provide sufficient system strength services to ensure the efficient amount of new inverter-based renewables will remain stable in steady state conditions and remain synchronised following credible contingency events[2].

The identified need for this RIT-T is to ensure that we can provide the efficient level of system strength at all declared system strength nodes (SSNs) in South Australia.

Our best understanding of the identified need at present is to provide an additional 1,133 MVA of AFL at the Robertstown SSN, an additional 537 MVA of AFL at the Para SSN and an additional 66 MVA at the Davenport SSN. This increased requirement is anticipated to arise from December 2025.

There are three distinct needs at separate locations in this RIT-T. However, there is possibly a common solution to all of these and hence this PSCR seeks to address all needs. Subject to submissions, this RIT-T and the needs at separate nodes may be concluded through separate Project Assessment Draft Reports (PADRs).

Credible options

We have identified two credible options to meet the identified need.

The first credible option is to install additional synchronous condensers on the South Australian transmission system. Our preliminary assessment shows we would require three additional synchronous condensers (of similar size to those already installed in South Australia) from 2 December 2025, and the equivalent of up to five synchronous condensers from July 2028 as more IBR connect.

The second credible option is less well defined. We expect that there are non-network solutions that are credible options. However, we do not know the details of those options. In large part the purpose of this PSCR is to identify these.

Non-network solutions may play a significant role in providing these services, if deployed with suitably designed grid forming technology at lower cost than that of synchronous condensers such that any network solution would be commensurately smaller.

Non-network solutions that could help address the identified need

Potential options to provide an efficient level of system strength may be realised by existing or new plant and can include but are not limited to:

- synchronous generators
- synchronous gas units operating in 'synchronous condenser' mode
- conversion of existing synchronous generators to synchronous condensers
- clean fuel (e.g. hydrogen) based synchronous generators
- synchronous condensers (with or without fly wheels)

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[1] AEMO, December 2022, 2022 System Security Reports

[2] AEMC, 21 October 2021, Efficient management of system strength on the power system, rule determination, https://www.aemc.gov.au/rule-changes/efficient-management-system-strength-power-system

- grid forming Battery Energy Storage Systems (BESS)
- grid forming inverter-based renewable generators
- other modifications to existing plant.

We have set out the characteristics that non-network options would need to be capable of to provide required system strength services.

The accompanying EOI provides greater detail and specifies the type and form of information we are seeking from proponents for their solution options to be assessed in the PADR.

The two credible options that would make up the forecast shortfall in AFL and provide an efficient level of system strength are described in Table 1.

We also note that there may be a credible option involving the use of grid forming statcoms. We plan to investigate the technical and commercial feasibility of this option.

Table 1: Summary of credible options

Option	Least cost configurations	Cost ($FY24 ±30%)
Option 1 Synchronous condensers	**By 2 December 2025** Install 2x 125 MVA synchronous condensers in the Adelaide Metropolitan area and 1x 125 MVA synchronous condenser at Robertstown or Bundey ($240M) **By 1 July 2028** Install 1x 125 MVA synchronous condenser in the Adelaide Metropolitan area and 1x 125 MVA synchronous condenser at Robertstown or Bundey ($160M)	$400M
Option 2 Non network solutions	Non-network solutions may provide all or part of the forecast shortfall and if so, any network solution would be commensurately smaller. The assessment of non-network options will depend on responses received to this PSCR and associated EOI. Section 4 of the PSCR and the accompanying EOI provide details on the technical information that the proponents of non-network options need to provide to enable their option to be considered in this RIT-T.	To be estimated based on responses to the EOI

Reliability Corrective Action

We consider this RIT-T to be a ‘reliability corrective action’ as the objective of the relevant investment is to meet the regulatory obligations and service standards contained in clause 11.14, 3.15 and schedule 5.1.14 of the NER.

Submissions and next steps

The purpose of the PSCR is to set out the identified need, present credible options that address the identified need, outline the technical characteristics non-network options would need to provide and allow interested parties to make submissions and provide input to the RIT-T assessment.

We welcome written submissions on the information contained in the PSCR. Submissions will be sought on the options presented, any other credible options available to address the identified need, the classification of this identified need for reliability corrective action and the assessment of materiality of market benefit categories. Submissions will be due on a date to be specified on release of the PSCR.

Submissions may be emailed to consultation@electranet.com.au. Submissions will be published unless a proponent marks its submission (or part of it) as confidential at the time of the submission.

In addition, we are undertaking an EOI for non-network proponents to contribute to meeting system strength needs as set out in this PSCR. Proposals are due by a date to be specified on release of the PSCR. Submissions to the EOI will not be published on our website.

Proponents are welcome to early submissions and/or early engagement with ElectraNet before the stipulated due date above.

The Project Assessment Draft Report (PADR), which is the second stage of the RIT-T process, will include a full options analysis. We currently expect to publish the PADR by December 2024.

13 November 2023