SRAS GUIDELINE

SYSTEM RESTART ANCILLARY SERVICES

Incorporating BOUNDARIES OF ELECTRICAL SUB-NETWORKS

PREPARED BY:	AEMO Operations - Systems Capability
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VERSION RELEASE HISTORY

Version	Effective Date	Summary of Changes
1.0	15 December 2017	Initial version of the 'SRAS Guideline' under clause 3.11.7, reflecting the *National Electricity Amendment (System Restart Ancillary Services) Rule 2015 No. 5* (introduced in version 72 of the National Electricity Rules). **Note:** Supersedes the consolidated set of SRAS Guidelines made under National Electricity Rules version 64, clause 3.11.4A and 3.11.4B on 5 September 2014
1.1	9 May 2018	Revised as a consequence of the consultation on the *Power System Model Guidelines*.

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1. INTRODUCTION

1.1. Purpose and scope

(a) This document (**Guideline**) has effect only for the purposes set out in the National Electricity Rules (**NER**). The NER and the National Electricity Law prevail over this Guideline to the extent of any inconsistency.

(b) The Guideline incorporates:

(i) the *SRAS Guideline* made under NER clause 3.11.7(c) to address the matters specified in NER clause 3.11.7(d); and

(ii) AEMO's determination of the boundaries of *electrical sub-networks* under NER clause 3.11.8.

(c) This Guideline is intended to reflect the *system restart standard* (**SRS**) published by the *Reliability Panel* on 15 December 2016, with an effective date of 1 July 2018. It explains how AEMO proposes to procure SRAS in order to meet the SRS for each *electrical sub-network*.

1.2. Application

(a) This Guideline applies to SRAS that AEMO has procured, or seeks to procure, under an SRAS Agreement if the service commencement date under that agreement is on or after 1 July 2018.

(b) The previous version of the SRAS Guidelines published on 5 September 2014 continues to apply to the testing of SRAS procured under an SRAS Agreement entered into before the effective date of this Guideline, until that agreement ends.

1.3. Definitions and interpretation

1.3.1. Glossary

The words, phrases and abbreviations set out below have the meanings set out opposite them when used in this Guideline.

Terms defined in the NER have the same meanings in this Guideline unless otherwise specified in this clause. Those terms are intended to be identified in this Guideline by italicising them, but failure to italicise a defined term does not affect its meaning.

Term	Definition
AEMO	Australian Energy Market Operator Limited
Cold load pickup	*Re-energisation* of *load* where greater than average *load* is initially expected due to both the in-rush of current and the recovery needs of machines that have been off supply for an extended period.
Contract Availability	For the purpose of determining the availability of an SRAS under an SRAS Agreement, includes availability of both SRAS Equipment and SRAS Transmission Components.
Delivery Point	A nominated point on a *transmission system* to which power is to be delivered using SRAS Equipment and SRAS Transmission Components.
Generator Modelling Data	The data to be provided by an SRAS Provider to AEMO under clause 5.2 about each relevant *generating unit*, related *generating system* and other applicable SRAS Equipment.
ITT	An invitation to tender for the provision of SRAS issued by AEMO under clause 6.3.
LBSP	*Local black system procedures* developed by a *Generator* or *Network Service Provider* under NER clause 4.8.12.
NER	National Electricity Rules.

Term	Definition
NSP	*Network Service Provider*
SRAS	*System restart ancillary service*, including a proposed service where the context requires.
SRAS Agreement	An *ancillary services agreement* for the provision of SRAS.
SRAS Equipment	One or more identified *generating units* and other facilities used, or proposed to be used, to provide an SRAS to the Delivery Point, including SRAS Third Party Assets but excluding SRAS Transmission Components.
SRAS Equipment Availability	A parameter for the assessment of the availability of SRAS Equipment, determined in accordance with clause 3.5.2.
SRAS Equipment Reliability	A parameter for the assessment of the reliability of SRAS Equipment, determined in accordance with clause 3.5.3.
SRAS Provider	A *Generator* with whom AEMO contracts to provide SRAS, or who submits or has been invited to submit an expression of interest or offer to provide SRAS to AEMO. **Note:** This modifies the NER definition.
SRAS Test	A physical test of the capability of SRAS Equipment to provide SRAS, conducted in accordance with clause 4.
SRAS Third Party Assets	Facilities and equipment within the SRAS Equipment that are owned or operated by a third party independent of (and not under the direction or control of) the SRAS Provider. **Note:** Examples include parts of a *transmission system* connecting SRAS units that are not co-located within a single *power station* site, or *distribution system* assets between a *power station* and the SRAS Delivery Point. Facilities or equipment operated by a contractor, agent or other person on behalf of the SRAS Provider are not SRAS Third Party Assets.
SRAS Transmission Components	Facilities and equipment forming part of the *transmission system* between (and including) the *transmission network connection point* to which the SRAS Equipment is *connected*, and the *transmission substation* or *switchyard* located at or immediately downstream of the Delivery Point.
SRS	The *system restart standard* determined by the *Reliability Panel* under the NER.
Stabilising Load Blocks	Blocks of *load* connected during the system restart process to assist stable operation of *generation*.
Tender	A tender submitted in response to an ITT.
Test Procedure	A procedure for the conduct of an SRAS Test, that meets the requirements set out in clause 4.1.
TNSP	*Transmission Network Service Provider*
Transmission Component Reliability	A parameter for the assessment of the individual reliability of an SRAS, determined in accordance with clause 3.5.4.
Trip to house load (or TTHL)	An electrical islanding scheme using *generating units* that can disconnect from the *transmission network* following a *major supply disruption* and continue to supply their own auxiliaries or an isolated segment of system *load*.

1.3.2. Interpretation

This Guideline is subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.

2. LEGAL AND REGULATORY FRAMEWORK

2.1. SRAS Procurement Objective

The *SRAS Procurement Objective* is to acquire SRAS to meet the SRS at the lowest cost, as defined in NER clause 3.11.7(a1).

2.2. SRAS Guideline

Clauses 2.4 to 7 of this Guideline comprise the *SRAS Guideline*. The *SRAS Guideline* is designed to meet the *SRAS Procurement Objective* and includes (in accordance with NER clause 3.11.7(d)):

(a) a description of the technical and availability requirements of SRAS (clause 3);

(b) a process for meeting the aggregate reliability of SRAS for each *electrical sub-network* under NER clause 8.8.3(aa)(3) (clause 5.5);

(c) a process for the modelling, assessment and physical testing of SRAS proposed to be provided by an SRAS Provider, including any assumptions to be made by AEMO regarding the state of *transmission elements* during a *major supply disruption* (clause 5, with physical testing of SRAS covered in clause 4);

(d) a process for determining the number and location of SRAS required to be procured for each *electrical sub-network* consistent with the SRS (clause 5.5.3);

(e) guidance to *Registered Participants* on the factors that AEMO must take into account when making a decision to follow a particular type of procurement process to acquire SRAS to meet the *SRAS Procurement Objective* (clause 6);

(f) a process for AEMO to follow for contacting a potential SRAS Provider to negotiate the provision of SRAS without a competitive tender process (clause 6.4); and

(g) a process for a potential SRAS Provider to contact AEMO to offer the provision of SRAS without a competitive tender process, which offer AEMO is in no way obliged to accept (clause 7).

2.3. Boundaries of electrical sub-networks

Clause 8 of this Guideline comprises AEMO's determination of the boundaries of *electrical sub-networks* under NER clause 3.11.8, which provides that:

(a) for the purpose of acquiring SRAS and determining and implementing the *system restart plan*, the *power system* is to be divided into *electrical sub-networks*; and

(b) AEMO must determine the boundaries of *electrical sub-networks* in accordance with the guidelines determined by the *Reliability Panel* under NER clause 8.8.3(aa)(5).

2.4. System Restart Standard

(a) This Guideline is intended to be consistent with the SRS determined by the *Reliability Panel* on 15 December 2016, effective from 1 July 2018.

(b) The SRS includes a determination of:

  (i) the maximum amount of time within which SRAS are required to restore supply in an *electrical sub-network* to a specified level, under the assumption that supply (other than that provided under an SRAS Agreement acquired by AEMO for that *electrical sub-network*) is not available from any neighbouring *electrical sub-network* (see columns 2 and 3 of Table 1 below);

  (ii) the required aggregate reliability of SRAS for each *electrical sub-network*, being the probability that generation and transmission will be restored to the specified level in the specified timeframe (see column 4 of Table 1 below);

(iii) guidelines for assessing the diversity and determining the strategic location of SRAS; and

(iv) guidelines for determining *electrical sub-networks*.

Table 1 SRS requirements for each *electrical sub-network*

Electrical sub-network	Restoration Supply Level (MW)	Restoration Time (hours)	Required Aggregate Reliability
Queensland North	825	3.5	90%
Queensland South	825	3.0	90%
New South Wales ***North of Sydney**	1500 (*500)	2.0 (*4.0)	90% (*75%)
Victoria	1100	3.0	90%
South Australia	330	2.5	90%
Tasmania	300	2.5	95%

*For New South Wales AEMO shall procure SRAS north of Sydney, sufficient to also independently restart, without drawing power from the *power system*, at least 500 MW of *generation capacity* north of Sydney within four hours of a *major supply disruption* with an aggregate reliability of at least 75%.

2.5. Role of Network Service Providers

(a) NER clause 3.11.9(i) sets out obligations and rights of NSPs in relation to the procurement of SRAS, including the provision of information to AEMO and assistance to prospective SRAS Providers.

(b) This Guideline includes some requirements for NSPs to provide information, advice and assistance to AEMO for some aspects of the procurement and testing process for SRAS. Those requirements:

(i) do not limit the obligations or rights of NSPs under NER clause 3.11.9(i);

(ii) are additional to NSP obligations to develop, review and amend an LBSP; and

(iii) do not cover the development of *system restart plans* under NER clause 4.8.12, but may relate to information that is used in preparing those plans.

3. SRAS DESCRIPTION

3.1. Overview

(a) An SRAS involves the operation of SRAS Equipment capable of starting without drawing power from the *power system* following *a major supply disruption*, and delivering power to a Delivery Point within a nominated timeframe, sufficient to allow supply to be made available to other *generating units*.

(b) AEMO will only procure an SRAS that meets the minimum capability and technical requirements (detailed in clause 3.2 and 3.3). These requirements apply to all SRAS unless specified, e.g. TTHL SRAS.

(c) In addition to these mandatory requirements, AEMO assesses additional parameters to determine the reliability of each individual SRAS (detailed in clause 3.5):

(i) each SRAS Agreement will establish contracted performance levels to be achieved by the SRAS Provider; and

(ii) AEMO uses the assessed individual reliability of each SRAS in determining which SRAS, or combination of SRAS, to procure in order to meet the aggregate reliability requirement for an *electrical sub-network* (as described in clause 3.5), and to assess whether the SRS is being met on an annual basis.

3.2. Capability Requirements

An SRAS must be provided using SRAS Equipment that:

(a) meets the technical requirements detailed in clause 3.3, as evidenced by testing under clause 4; and

(b) where the SRAS is being provided under an *ancillary services contract*, meets the individual contracted performance requirements for the individual reliability parameters detailed in clause 3.5.

3.3. Technical Requirements

SRAS Equipment must meet the following technical requirements, to be demonstrated in accordance with the testing requirements in clause 4:

(a) in the case of TTHL, automatic disconnection of the *generating unit(s)* within the SRAS Equipment from the *power system* using approved tripping schemes[1];

(b) start without drawing energy from the *power system* or, in the case of TTHL, remain in operation after disconnection from the *power system*

(c) operate at zero export load for a specified minimum period;

(d) close onto a *de-energised busbar*[2];

(e) supply a specified level of *generation* output to a Delivery Point;

(f) control *network voltage* within limits to meet minimum requirements specified by AEMO;

(g) control *power system frequency* within limits to meet minimum requirements specified by AEMO; and

(h) operate in a stable manner with no adverse effects on *power system security* during *network* switching and *load* restoration.

3.4. Arrangements with NSPs and others

(a) Each SRAS Provider must have in place documented arrangements with:

(i) the TNSP on whose *transmission system* the Delivery Point is located; and

(ii) the owner or operator of any SRAS Third Party Assets,

sufficient to ensure that the SRAS can be provided and tested in accordance with the requirements of this Guideline and the terms of the SRAS Provider's offer or SRAS Agreement.

3.5. SRAS Individual Reliability

3.5.1. Overview

(a) AEMO uses the following assessment parameters (factors) to determine the individual reliability of an SRAS:

(i) SRAS Equipment Availability (see clause 3.5.2);

(ii) SRAS Equipment Reliability (incorporating start-up performance) (see clause 3.5.3); and

(iii) Transmission Component Reliability (see clause 3.5.4).

[1] The tripping schemes must be able to be activated by sustained excessive high or low *frequency* excursions, and where required by AEMO; *frequency* rate-of-change and/or loss of *synchronisation* or sustained excessive low *voltage* excursions, with all settings specified or approved by AEMO.

[2] The reason for this demonstrated ability is to ensure that there are no interlocks that would prevent closing onto a *de-energised busbar*.

(b) Information reasonably required by AEMO to assist in its determination of individual reliability is to be provided by:

(i) the SRAS Provider in respect of SRAS Equipment (including SRAS Third Party Assets); and

Note: AEMO would generally require this information in an SRAS offer, under an SRAS Agreement, or under clause 7(g) of this Guideline.

(ii) the relevant TNSP in respect of SRAS Transmission Components, as described in clause 3.5.4.

3.5.2. SRAS Equipment Availability

(a) SRAS Equipment Availability is the percentage availability of the SRAS Equipment over a period of 12 months, which may be historical or forecast depending on the context for the assessment.

(b) For these purposes, availability represents the percentage of time over the relevant period for which the SRAS Equipment was (or is expected to be) operationally capable of delivering SRAS at the proposed or contracted levels at the Delivery Point, that is, excluding:

(i) periods of maintenance or service outages of, or affecting, any component of the SRAS Equipment;

(ii) periods during which the SRAS Equipment was otherwise not capable of delivering SRAS at those levels, or taken not to be capable due to failure or non-performance of an SRAS Test when due.

(c) Although outages of SRAS Transmission Components will affect the capability to deliver SRAS at the Delivery Point, these are disregarded in the assessment of SRAS Equipment Availability, to avoid double counting with the Transmission Component Reliability factor when determining individual reliability. Those outages are, however, taken into account in Contract Availability.

(d) During a procurement process and as an ongoing requirement under an SRAS Agreement, an SRAS Provider will be required to inform AEMO of its maintenance schedule, and provide historical maintenance records for the SRAS Equipment covering the period to be assessed.

(e) In assessing SRAS Equipment Availability, AEMO may also rely on any other relevant information available to it as the *NEM* market and system operator.

3.5.3. SRAS Equipment Reliability

(a) SRAS Equipment Reliability represents the probability that all components of the SRAS Equipment required to deliver SRAS will operate without failure. AEMO will determine this as a percentage that combines its evaluation of the following sub-factors:

(i) historical (tested) start-up performance - see paragraph (b);

(ii) single points of failure - see paragraph (c);

(iii) component age and condition – see paragraph (d);

(iv) fuel storage – see paragraph (e);

(v) communications link redundancy – see paragraph (f); and

(vi) previous SRAS experience - see paragraph (g).

(b) Historical start-up performance is assessed as a pass or fail based on the start-up (or TTHL) performance in the most recent SRAS Test. When evaluating start up performance for procurement purposes:

(i) the test must have been conducted within the 6 months prior to the time of assessment, unless AEMO allows a longer period in its absolute discretion; and

(ii) AEMO will not generally procure an SRAS that has failed two attempts to start during the test.

(c) Single points of failure is a measure of the reliability of major components of the SRAS Equipment, taking into account their configuration and substitutability, e.g. alternate *generating units*. Generally, the reliability of individual components that are equally important in the delivery of SRAS will be weighted equally in this assessment.

(d) Component age and condition is a measure of the possibility that a component of SRAS equipment may fail having regard to its age, maintenance or upgrade history. This includes *protection systems* and *control systems*. Generally, the reliability of individual components that are equally important in the delivery of SRAS will be weighted equally in this assessment. Fuel storage is an assessment of redundancy within supply arrangements, for example the availability of alternate sources of fuel to start and operate the SRAS Equipment.

(e) Communications link redundancy is a measure of the reliability of the communications infrastructure used by the SRAS Provider or any operator of SRAS Third Party Assets, to start up and operate the SRAS Equipment after receiving an instruction to do so.

(f) Previous SRAS performance is a measure of proven experience in providing SRAS capability under any previous SRAS Agreement.

3.5.4. Transmission Component Reliability

(a) Transmission Component Reliability is a percentage determined by AEMO based on the relevant TNSP's assessment of the reliability of the SRAS Transmission Components.

(b) For these purposes, a TNSP must give AEMO, on request, the TNSP's engineering assessment of the reliability of nominated SRAS Transmission Components taking into account their:

(i) historical and forecast availability;

(ii) technical characteristics;

(iii) age and condition;

(iv) redundancy.

(c) The TNSP's reliability assessment should include any recommended sensitivity margins the TNSP considers reasonable, having regard to the nature of the components and expected operating conditions.

(d) The TNSP must promptly respond to AEMO's reasonable requests for further information or clarification of information provided under paragraph (b) or (c).

3.5.5. Calculation of individual reliability

The individual reliability of an SRAS is determined by multiplying the assessed percentages of SRAS Equipment Availability, SRAS Equipment Reliability and Transmission Component Reliability.

4. SRAS TESTING

4.1. Test requirements

(a) A test for the purpose of demonstrating SRAS capability during a procurement process or under an SRAS Agreement (SRAS Test) must demonstrate the parameters listed in Appendix A, subject to any variations specified in an applicable SRAS Agreement.

(b) Variations may be agreed, for example, to accommodate testing requirements specific to a particular component of SRAS Equipment or SRAS Third Party Assets, or steps required under clause 4.2(b).

(c) An SRAS Test must be conducted in accordance with the Test Procedure most recently submitted by the SRAS Provider and accepted by AEMO under clause 4.2 prior to the date of the SRAS Test, unless AEMO otherwise agrees.

4.2. Test Procedures

(a) A Test Procedure must:

(i) itemise the steps required to implement the SRAS Test;

(ii) specify how the requirements and evidence set out in Appendix A will be demonstrated and recorded;

(iii) subject to paragraph (b), exactly replicate the process that would occur if AEMO required the relevant SRAS to be provided following a *major supply disruption*;

(iv) provide annotated operating diagrams showing the SRAS Equipment and how the SRAS Equipment is isolated and islanded from local supplies and network connections; and

(v) address any other matters the SRAS Provider considers relevant.

(b) If a Test Procedure does not exactly replicate the process that would occur if AEMO required the relevant SRAS to be provided following a *major supply disruption*, the Test Procedure or accompanying information must:

(i) identify the differences;

(ii) explain why the Test Procedure cannot reasonably replicate that process;

(iii) specify what additional or different steps are required to provide the SRAS following a *major supply disruption*, and who will take those steps; and

(iv) include evidence demonstrating that those steps can be successfully performed with no adverse impact on the delivery of SRAS.

(c) The SRAS Provider must submit its Test Procedure (including any updated Test Procedure) electronically to AEMO together with the written endorsement of:

(i) the owner or operator of any SRAS Third Party Assets within the SRAS Equipment, in respect of the testing of the relevant SRAS Third Party Assets; and

(ii) the TNSP on whose *transmission system* the Delivery Point is located, in respect of the TNSP's facilitation of, or participation in, an SRAS Test,

and, where paragraph (b) applies, the endorsement must extend to any additional or different steps to be taken by the relevant party following a *major supply* disruption.

(d) A Test Procedure is not valid unless AEMO has accepted it. AEMO's review is limited to confirming that the Test Procedure addresses the requirements of paragraphs (a), (b) and (c).

(e) AEMO may reject a Test Procedure if it is not satisfied that the Test Procedure addresses the requirements of paragraphs (a), (b) or (c).

(f) AEMO is taken to have accepted a Test Procedure unless it has notified the SRAS Provider of its rejection:

(i) if submitted with an SRAS offer, at the time of accepting that offer; or

(ii) if submitted at any other time, by the end of the 5th *business day* after submission.

4.3. Testing frequency and timing

4.3.1. Testing for procurement

(a) AEMO will not enter into an SRAS Agreement unless satisfied that the capability to provide the SRAS has been successfully demonstrated by an SRAS Test within the 6 months prior to the intended commencement date of the agreement, evidenced by a test report in accordance with clause 4.4, unless exceptional circumstances apply.

(b) The existence of exceptional circumstances will be determined by AEMO in its absolute discretion. By way of example and without limiting AEMO's discretion, such circumstances could arise where:

(i) AEMO considers that the acquisition of the SRAS would best meet the *SRAS Procurement Objective* for the relevant *electrical sub-network*;

(ii) an SRAS Test cannot reasonably be conducted before the SRAS Agreement is entered into; and

(iii) AEMO believes on reasonable grounds that the SRAS Equipment will be capable of providing the SRAS in accordance with the terms of the SRAS Agreement.

4.3.2. Testing of contracted SRAS

(a) An SRAS Agreement will specify the number and frequency of SRAS Tests to be conducted.

(b) An SRAS Test will generally be required by AEMO:

(i) within 20 *business days* after a period of maintenance causing any major component of the SRAS Equipment or SRAS Transmission Components to be out of service for 7 days or more; and

(ii) at one additional date and time per year, to be nominated by AEMO on no less than 5 *business days'* notice to the SRAS Provider, subject to paragraph (c).

(c) In scheduling an SRAS Test under paragraph (b)(ii), AEMO seeks to balance the need for a reasonable level of assurance that the SRAS is 'always ready' against the need to minimise the *power system* and *market* impacts of testing for *Registered Participants*. With that objective, AEMO will:

(i) liaise with the relevant TNSP before the start of each financial year to determine four or more one-week periods in that year during which an SRAS Test would not be expected to disrupt the *supply* of electricity or threaten *power system security*;

(ii) consider any reasonable requests of the SRAS Provider and the TNSP in relation to scheduling;

(iii) use best endeavours to schedule the test to minimise the departure from the *commitment* and *dispatch* of the relevant *generating units* that could reasonably be expected at that time; and

(iv) provide a formal notice of the proposed test date and time to the TNSP not less than 15 *business days* in advance, and for those purposes AEMO and the TNSP are entitled to assume that the most recently accepted Test Procedure will apply.

(d) After nomination of the test date and time by AEMO, the TNSP must make any arrangements necessary to facilitate the SRAS Test with any *Registered Participants* (other than the SRAS Provider) who need to participate in the test, on a confidential basis.

(e) The TNSP, and any other *Registered Participant* required to be involved in an SRAS Test, must not disclose details of the timing of an SRAS Test under paragraph (b)(i)(ii) to the SRAS Provider before AEMO has done so.

(f) Where SRAS Equipment includes multiple alternative *generating units*, any one of which may be used to provide the SRAS, AEMO will specify the *generating unit* to be included in each SRAS Test so that, as far as practicable:

(i) tests after maintenance will include any units that were out of service during that maintenance; and

(ii) otherwise, successive SRAS Tests should rotate through all alternative *generating units*.

4.3.3. General provisions

(a) AEMO may witness any SRAS Test.

(b) SRAS Tests can be performed in conjunction with any planned outages on the *transmission network* (that may require the SRAS Equipment to be offline) if it is safe to do so without adversely impacting *power system security*.

(c) SRAS Agreements will permit AEMO to request an SRAS Test at any other time if AEMO considers the SRAS may not be capable of being provided in accordance with contract requirements.

4.4. Test Report

(a) An SRAS Provider must submit a test report to AEMO after each SRAS Test.

(b) All test reports must:

(i) document the steps of the SRAS Test consistent with the approved SRAS Test procedure;

(ii) document the results, including all relevant evidence specified in Appendix A; and

(iii) if applicable, indicate how and why the approved SRAS Test procedure was not followed in any respect.

(c) In addition, for an SRAS Test conducted under an SRAS Agreement, the test report must:

(i) be provided within 15 *business days*;

(ii) state whether the contracted levels of performance and minimum technical requirements were achieved; and

(iii) state reasons for any failure to establish any required item, the remedial actions taken (or to be taken) to resolve those matters, the results of any remedial actions, and the expected timeframe in which incomplete remedial actions will be completed.

5. SRAS MODELLING AND ASSESSMENT

5.1. Overview

(a) This clause 5 describes the modelling and assessment process AEMO undertakes to determine which SRAS AEMO should acquire in each electrical sub-network in order to meet the SRAS Procurement Objective.

(b) In accordance with the SRS, AEMO must procure sufficient SRAS for each *electrical sub-network* with a specified probability of restoring a specified minimum level of supply (i.e. generation and transmission capacity) within a specified target timeframe. The probability is referred to as the aggregate reliability requirement. The SRS levels, timeframes and aggregate reliability requirements for each *electrical sub-network* are reproduced in Table 1 in clause 2.4.

(c) The remainder of this clause provides guidance on:

(i) the information AEMO needs for its modelling and assessment;

(ii) how AEMO will model the expected contribution of an SRAS to energising the auxiliaries of other *power stations* and rebuilding the *power system* in an *electrical sub-network*;

(iii) how AEMO assesses, from the offers available, which SRAS or combinations of SRAS are expected to meet the SRS requirements;

(iv) how AEMO selects, from the available options to meet the SRS, the SRAS it will acquire for each *electrical sub-network*.

5.2. Information required

(a) For the purposes of AEMO's SRAS modelling and assessment, SRAS Providers must give AEMO:

(i) the applicable SRAS Test evidence detailed in Appendix A;

(ii) the Generator Modelling Data in the form required by the *Power System Model Guidelines*; and

(iii) confirmation that the performance of proposed SRAS Equipment is consistent with the current LBSP, or an explanation of any differences.

(b) If the SRAS Provider is unable to give AEMO all Generator Modelling Data relevant to its offered SRAS, it must apply to AEMO using the appropriate form seeking permission to provide alternative data as detailed in Section 8 of the *Power System Model Guidelines*.

(c) AEMO will endeavour to substitute the missing data, either as proposed by the SRAS Provider or using data or assumptions that AEMO considers to be more reliable. However, AEMO will take into account the reliability of the substituted data in assessing the results of the *power system* studies conducted under clause 5.4.

(d) For the purposes of conducting *power system* studies and assessing aggregate reliability as contemplated in this clause 5, AEMO may request from an NSP, and the NSP must give AEMO on request, any information AEMO reasonably requires to determine the ability of any proposed SRAS to energise *network* paths downstream of a Delivery Point for a proposed SRAS.

(e) AEMO will also consult with *Jurisdictional System Security Coordinators* in relation to any specific requirements relating to the restoration of *Stabilising Load Blocks* or other jurisdictional system security issues to be taken into account in AEMO's modelling and assessment.

5.3. Initial Qualification

Based on the information provided by SRAS Providers, NSPs, and any other relevant information held by AEMO under the NER, AEMO will identify all the proposed services that demonstrate compliance with the SRAS capability requirements in clause 3.2 to AEMO's reasonable satisfaction. Only those services will be further assessed in accordance with the remaining provisions of this clause 5.

5.4. Power System Studies

5.4.1. Objectives

(a) AEMO will conduct *power system* studies in relation to the proposed SRAS to:

(i) verify the capacity of the proposed SRAS to start and supply auxiliaries of other *power stations*, facilitating a rebuild of the *power system*;

(ii) determine which other *power stations* can be *energised* subsequent to the SRAS rebuilding sections of the *power system*;

(iii) determine the preferred paths to allow *energisation* of the required sections of the *power system*;

(iv) confirm ability to restore Stabilising Load Blocks;

(v) confirm each electrical sub-network is capable of being maintained in a *satisfactory operating state* to the extent practicable during the restoration process, and in a *secure operating state* from a stage in the restoration when it is practicable to do so;

(vi) determine potential changes to operating modes and *control system* settings of the SRAS Equipment; and

(vii) determine necessary changes to the settings of protective relays for the SRAS Equipment and *transmission network* in the *energisation* path.

(b) AEMO will not generally conduct *power system* studies in respect of a proposed SRAS if:

(i) AEMO has previously conducted studies for that proposed SRAS with identical restoration paths substantially as contemplated by clause 5.4.2; and

(ii) AEMO considers there have been no material changes to the SRAS Equipment or the relevant parts of the *power system* since those last studies.

5.4.2. Studies required

The following studies are envisaged:

(a) Steady-state studies to:

(i) confirm appropriateness of initial operating point including required *transformer* tap settings;

(ii) establish correct initial conditions for dynamic analysis; and

(iii) confirm *voltage* variations are maintained within the operational limits for all steps of the *system restart plan* applicable to the relevant *electrical sub-network*.

(b) Transient *load-generation* balance studies of:

(i) adequacy of speed governors, and appropriateness of control modes;

(ii) adequacy of *voltage* and *reactive power control system*;

(iii) *power station* auxiliary motor starting; and

(iv) cold load pickup (*loads* other than those associated with *power station* auxiliaries).

(c) Transient over*voltage* studies of:

(i) component *energisation*, e.g. *transmission line, transformer*, static and dynamic reactive power support devices;

(ii) harmonic resonance; and

(iii) surge arrester duty.

(d) *Network* fault studies to:

(i) verify integrity of the restoration path for *credible contingency events*;

(ii) verify appropriateness of protective relays settings during *contingency events*; and

(iii) verify appropriateness of the settings applied to excitation system control and associated limiters.

5.4.3. Performance assessment requirements

(a) The *power system* studies will be based on modelling of the SRAS Equipment, its *control systems* and *protection systems*, and relevant *network elements* including *transmission lines, loads, protection systems*, dynamic and static *reactive support* plant and *transformers*, under *black system* conditions.

(b) In conducting the *power system* studies, AEMO assumes that all *network elements* will be capable of operating within their technical limits, subject to any operating restrictions applicable in a *black system* condition and identified by AEMO's *power system* modelling.

Note: The failure of a relevant major *transmission element* is taken into account in AEMO's assessment of individual and aggregate reliability of SRAS procured for an *electrical sub-network*.

(c) AEMO's assessment will be subject to general principles for maintaining *power system security* that require the *power system* to be operated in a *satisfactory operating state* to the extent practicable during the restoration process, and in a *secure operating state* from a stage in the restoration when it is practicable to do so. However, the criteria for the permissible *frequency* range will be in accordance with the *frequency operating standards* for island systems.

(d) The supply *voltage* should remain between ± 10% of normal *voltage* during the restoration process. However, the *voltage* must at all times remain within any applicable limits set by the TNSP.

(e) A *credible contingency event* will be assumed in system restoration studies. For all *contingency events* it is expected that all equipment is secure against damage.

(f) *Generating units* are expected to adhere to their registered *performance standards*. For the purposes of SRAS assessment only, AEMO may accept limited non-compliance with the *performance standards* to allow for *black system* conditions and to ensure maximum utilisation of the technical capability of the *generating unit* during *power system* restoration.

5.5. Aggregate Reliability

5.5.1. Overview

(a) The aggregate reliability of SRAS for each electrical sub-network specified in the SRS represents the probability that generation and transmission will be restored to the MW specified level in the specified timeframe for that electrical sub-network (see Table 1).

(b) AEMO determines the aggregate reliability of SRAS services available for each electrical sub-network considering:

(i) the individual reliability of each selected SRAS (see clause 3.5);

(ii) electrical, geographical and fuel source diversity between the selected SRAS (see clause 5.5.2); and

(iii) strategic location of SRAS (see clause 5.5.3).

(c) AEMO's assessment of each of the above factors is described in the following sub-clauses.

5.5.2. Diversity

In accordance with the guidelines in the SRS for assessing diversity of services, AEMO considers the following factors when determining aggregate reliability for the *electrical sub-network*, accounting for *transmission system* reliability:

(a) Electrical: any single points of failure in the *transmission system* affecting all the procured SRAS in the *electrical sub-network* such as:

(i) a single transmission line from the Delivery Point to the immediate point in the transmission system; or

(ii) a single transmission corridor that connects all the procured SRAS with the remainder of the electrical sub-network.

(b) Geographical: geographical proximity of two or more SRAS sources, such that a natural disaster or other foreseeable location-specific event affecting one of them is likely to also affect the other.

(c) Fuel Source: the risk of failure or shortage of energy or fuel supply from the same cause impacting two or more SRAS services within an electrical sub-network.

5.5.3. Additional principles for electrical diversity

In assessing single points of failure in a *transmission network*, AEMO will apply the following principles and assumptions:

(a) a single point of failure within the *transmission network* is generally considered to exist where a *credible contingency event* can impact the ability of more than one SRAS to energise the auxiliaries of other *power stations*;

(b) the failure of any single major *transmission element* is considered a *credible contingency event*, irrespective of the cause;

(c) the failure of a *transmission* corridor that is considered generally susceptible to interruption due to a single event, e.g. *transmission lines* vulnerable to lightning, will be treated as a *credible contingency event*; and

(d) except in relation to vulnerable lines, *contingency events* that are normally non-credible (including multiple *credible contingency events*), will not be taken into account in determining potential single points of failure.

5.5.4. Diversity objective

(a) In its selection of SRAS for an *electrical sub-network*, AEMO seeks diversity in each of the factors in the SRS, where this can reasonably be achieved while meeting the other requirements of the SRS.

(b) Where diversity in all three factors cannot reasonably be achieved, AEMO will seek diversity in at least two factors if possible.

(c) The SRS aggregate reliability requirement for an *electrical sub-network* may not be met if diversity can only be achieved in one factor.

5.5.5. Strategic Location of SRAS

An SRAS will be assessed as having a strategic location if it can relatively quickly establish a path to the *transmission network* and other *generating units*, or facilitate pick-up of *Stabilising Load Blocks*. Relevant considerations include, without limitation:

(a) there is a relatively short physical distance between the SRAS Equipment and other generation centres within an electrical sub-network that will assist in meeting the overall SRS requirements; and

(b) there are few potential constraints or technical limitations in the *transmission network* between the SRAS Equipment and areas of the *transmission network* that need to be re-energised most quickly to maximise the restoration of *generation* and *transmission* in an *electrical sub-network.*

5.6. Selection of SRAS

(a) Based on the modelling and assessment process, AEMO will identify each service or combination of services that meets the SRS requirements for each *electrical sub-network*.

(b) From the identified list and using the offers submitted by SRAS Providers, AEMO will select and seek to procure the service or combination of services that meets those SRS requirements at the lowest cost.

(c) If, using reasonable endeavours, AEMO is unable to acquire sufficient services to meet the SRS requirements, or to procure the lowest cost option, AEMO will acquire the service or combination of services that meets the *SRAS Procurement Objective* as closely as possible.

6. PROCUREMENT PROCESSES

6.1. Procurement options

(a) AEMO may procure SRAS for an *electrical sub-network* where AEMO considers the applicable SRS is not being met, or is unlikely to be met from a given date, for example due to:

(i) expiry or termination of an SRAS Agreement; or

(ii) material and sustained changes in the performance or reliability of SRAS Equipment, or in the *transmission system*; or

(iii) expected unavailability of an existing SRAS for an extended period.

(b) AEMO may procure SRAS using one or a combination of two processes:

(i) open competitive tender; or

(ii) direct request for offer.

(c) If AEMO is procuring SRAS for multiple *electrical sub-networks* in the same timeframe, different procurement processes can apply in different *electrical sub-networks*.

(d) Clause 6.2 describes the matters AEMO will consider in determining which procurement process to use, and clauses 6.3 and 6.4 describe the minimum requirements of each type of process.

6.2. Considerations for determining process

(a) For the purposes of this clause 6, 'competing SRAS Providers' are SRAS Providers that are not related bodies corporate within the meaning of the *Corporations Act 2001* (Cth) or, in relation to an SRAS Provider that is not a body corporate within the meaning of that Act, does not have an equivalent association with another SRAS Provider.

(b) AEMO will procure SRAS for an *electrical sub-network* using an appropriate competitive tender process, if AEMO considers (subject to paragraph (c)):

(i) the available SRAS from competing SRAS Providers is likely to exceed the level required to meet the SRS for that *electrical sub-network*; or

(ii) having regard to the need for the procurement process, any specific requirements necessary to meet the SRS could be provided by more than one competing SRAS Provider.

(c) AEMO will directly request one or more SRAS Providers to make an offer to provide SRAS for an *electrical sub-network*, if AEMO considers:

(i) neither of the conditions in paragraph (b) applies;

(ii) there is insufficient time to conduct a competitive tender for a replacement SRAS to cover an actual or anticipated temporary shortfall; or

(iii) the SRS cannot be met unless AEMO acquires SRAS from specified SRAS Equipment owned by that SRAS Provider(s).

6.3. Open competitive tender minimum requirements

(a) A competitive tender must be open to any prospective SRAS Provider able to meet the technical and reliability requirements in clause 2.4 of this Guideline for one or more relevant *electrical sub-networks*.

(b) AEMO must publish an invitation to tender (ITT) for SRAS on its website.

(c) In any ITT, AEMO must specify the tender process steps and timelines, and the information to be submitted in or with a tender offer, including:

(i) forms for the submission of technical information or prices;

(ii) the period within which an SRAS Test must have been conducted prior to the date of the offer, or may be conducted after the offer if applicable;

(iii) the proposed duration of the SRAS Agreement (see clause 6.5);

(iv) any information that may be required from a *Network Service Provider* or other third party;

(v) the minimum validity period of the offer;

(vi) any applicable exclusions or modifications to the Generator Modelling Data that may apply to particular types of SRAS; and

(vii) any criteria or principles that AEMO proposes to apply to the evaluation of offers, in addition to those specified in this Guideline.

(d) As soon as reasonably practicable after publication of an ITT, AEMO must notify those potential SRAS Providers that, to the best of AEMO's knowledge, would be capable of providing SRAS for a relevant *electrical sub-network* in accordance with the requirements of this Guideline.

6.4. Direct request for offer process

(a) If AEMO decides to procure SRAS for an *electrical sub-network* by directly requesting offers, AEMO must issue a request to all potential SRAS Providers that, to the best of AEMO's knowledge, would:

(i) be capable of providing SRAS for that *electrical sub-network* in accordance with the requirements of this Guideline; and

(ii) assist in meeting the SRS given the need to be met by the procurement process.

(b) The request must specify the offer process and timelines, and the information to be submitted in or with an offer, including the matters in paragraphs (i) to (vii) of clause 6.3(c).

6.5. Form of SRAS Agreement

(a) AEMO will maintain a form of SRAS Agreement on its website.[3]

(b) At the time of making an offer to AEMO for SRAS under any procurement process, an SRAS Provider must notify AEMO of any changes it proposes to the terms of the published agreement.

(c) AEMO is entitled to propose and negotiate any changes to the form of agreement that it considers appropriate in relation to an offer or tender for SRAS.

6.6. Disputes

A dispute concerning any aspect of a tender or negotiation for the provision of SRAS (other than price) must be dealt with in accordance with NER rule 8.2.

[3] Current location: http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Ancillary-services/System-restart-ancillary-services-guidelines

7. UNSOLICITED SRAS OFFERS

(a) In this clause 7, the term *Generator* is taken to include a person who intends to become registered as a *Generator*.

(b) A *Generator* may at any time submit to AEMO an expression of interest or offer to provide SRAS for one or more *electrical sub-networks*.

(c) AEMO may develop and publish, on the SRAS page of its website, a form for the submission of expressions of interest or offers under this clause.

(d) If no form is published, a *Generator* must identify the proposed SRAS Equipment and include in its expression of interest or offer sufficient information to allow AEMO to model the performance of the proposed SRAS through *power system* studies and assess its capability to meet the requirements in Appendix A.

(e) An expression of interest or offer is valid for the period specified by the *Generator* in its submission. If no period is specified, AEMO must assume it remains valid for two years.

(f) Information submitted under this clause is *confidential information.*

(g) AEMO:

(i) may at any time request further information from a *Generator* to assess the capability of an SRAS proposed under this clause;

(ii) may, but is not obliged to, accept any offer to provide SRAS, subject to the requirements of clause 6; and

(iii) must, before commencing a procurement process under clause 6, notify any *Generators* who have submitted expressions of interest or offers for proposed SRAS that AEMO considers technically capable of meeting the requirement for which SRAS is to be procured.

8. BOUNDARIES OF ELECTRICAL SUB-NETWORKS

The boundaries of *electrical sub-networks* in accordance with the requirements of SRS effective until 1 July 2018 are described in Table 2 and shown geographically on the maps in Appendix B.

Table 2 Boundaries of electrical sub-networks

Electrical Sub-Network	Cut-Set across transmission corridors connecting Electrical Sub-Networks	Approximate Generation and Load
Queensland North Calvale – Halys 275 kV lines (8810 & 8811) South Pine – Palmwoods 275 kV line (808) South Pine – Woolooga 275 kV line (807) South Pine – Palmwoods 110 kV lines (745 & 746) Refer to Appendix B.1	One 275 kV double circuit in one transmission corridor, and two single 275kV circuits in another transmission corridor connecting Qld North and Qld South. One weak, low capacity 110 kV parallel system. Loss of western 275 kV corridor with high southerly transfers can result in the loss of the 275 kV eastern corridor. The major generation centre in QLD North electrical sub-network is in Central Qld.	Generation: 6,000 MW Load: 3,150 MW
Queensland South (*as above for the cut set with QLD North*) QNI Bulli Creek –Dumaresq 330 kV lines (8L & 8M)	One 330 kV double circuit transmission corridor A DC Directlink[4] between Qld South and NSW (i.e.: Terranora – Mudgeeraba). These transmission corridors link Qld South and NSW.	Generation:6,715 MW Load: 6,500 MW

[4] These links (direct current) requires stable Alternative Current sources at both ends of the convertor stations for power transfer.

Directlink Terranora – Mudgeeraba 132 kV DC lines (DC1, DC2 & DC3) Refer to Appendix B.1	The major generation centre in Qld South electrical sub-network is in South West Qld.	
New South Wales (*as above for the cut set with QLD South*) Murray–Dederang 330 kV lines (67, 68) Wodonga–Jindera 330 kV line (060) Buronga–Redcliffs 220 kV line (0X1) Refer to Appendix B.2	One 330 kV double circuit transmission corridor, One 330 kV single circuit transmission corridor One weak 220 kV single circuit transmission corridor connection between Redcliffs and Buronga. The major generation centres in NSW electrical sub-network are in Hunter Valley and Snowy Mountains area.	Generation: 16,000 MW Load: 14,050 MW
Victoria (*as above for the cut set with NSW*) Heywood – South-East 275 kV lines (1 & 2) Murraylink Basslink Refer to Appendix B.3	One 275 kV double circuit transmission corridor A DC Murraylink[4] between Vic and SA. A DC Basslink[4] between Vic and Tas The major generation centre in Vic electrical sub-network is in Latrobe Valley.	Generation: 12,000 MW Load: 9,775 MW
South Australia (*as above for the cut set with Vic*) Refer to Appendix **B.4**	One 275 kV double circuit transmission corridor A DC Murraylink[4] between Vic and SA. The major generation centre in SA electrical sub-network is in Adelaide.	Generation: 4,575 MW Load: 3,050 MW
Tasmania Basslink Refer to Appendix B.5	A DC Basslink[4] between Vic and Tas. Electrical distance is not an applicable factor for a DC link. There are multiple generation centres in Tas electrical sub-network.	Generation: 2,860 MW Load: 1,750 MW

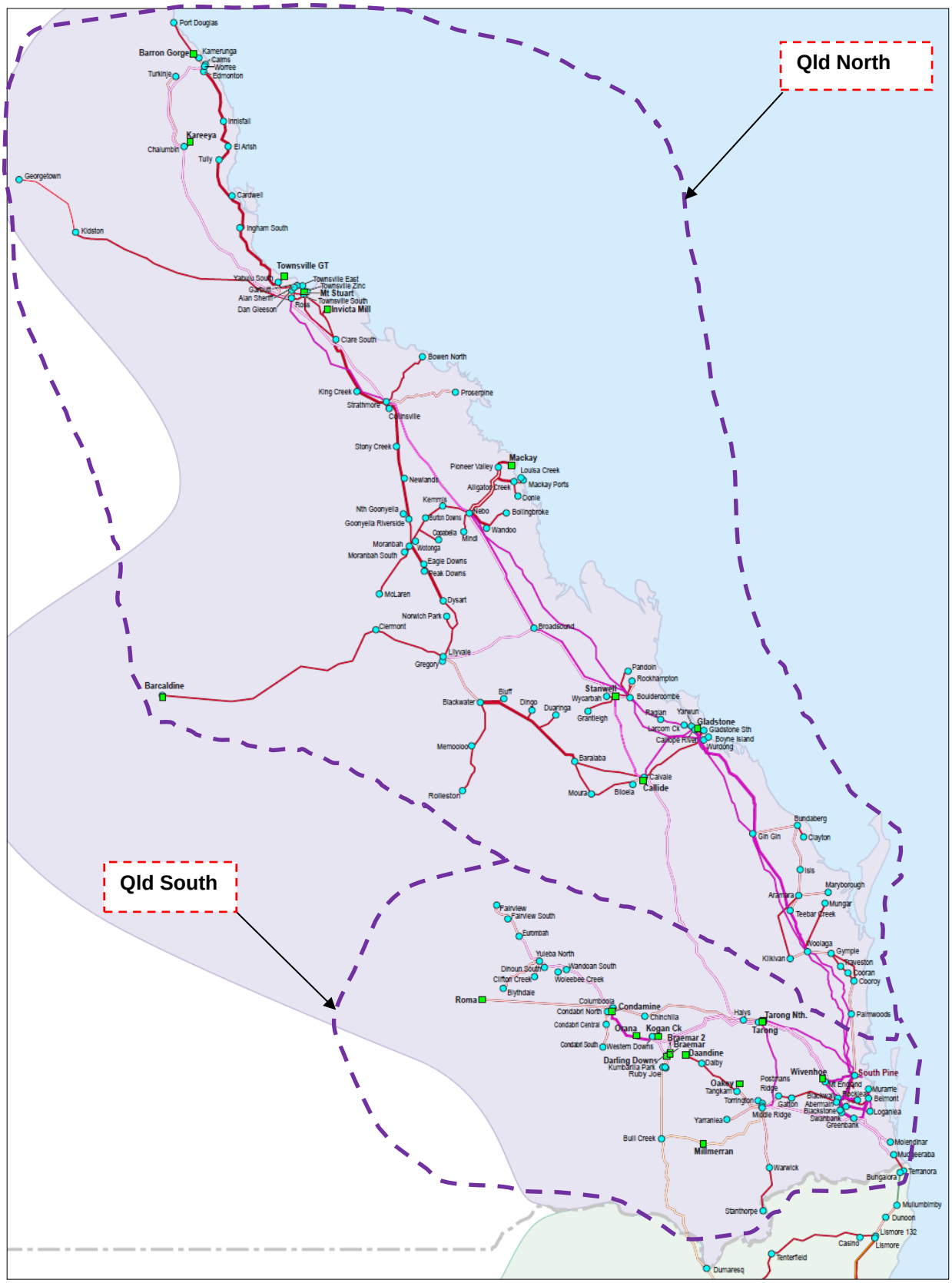
APPENDIX A. SRAS TEST REQUIREMENTS

Item	Assessment	Capability	Test	Evidence Required
1	Isolate SRAS test unit	SRAS to operate as an electrical island for the duration of test (excluding item 7).	SRAS to be electrically isolated from all sources of supply not associated with the unit	1. Documentation showing all the isolation points at zero volts by measurement. This includes alternating current supplies to battery chargers etc.
2a	Start (non-TTHL)	Start without external supply.	Start using same procedure or process as would be used for a system restart.	2. Provide data showing output trends of SRAS unit (as a minimum, continuous recordings of generator MW, Voltage, Frequency over the duration of the test)
2b	Trip to House Load	Trip to house load from at least 80% of its registered capacity (as registered with AEMO).	Demonstrate trip operation of TTHL relay to disconnect SRAS from power system. SRAS to then remain operational at house load.	3. Provide data output trends of SRAS unit (as a minimum, continuous recordings of generator MW, Voltage, Frequency over the course of the test)
3	Zero Export	Operate in a stable manner at zero export load.	Run at zero export load for at least 30 minutes.	4. Frequency and voltage trends (or other equivalent trends) to demonstrate the SRAS operated in a stable manner at zero export load for at least 30 minutes.
4	Voltage Control	Control SRAS voltage.	Change SRAS output voltage by 5% above and below nominal output voltage and hold each change for 5 minutes (measured at generator terminals or other agreed point). Can be done concurrently with item 3.	5. Provide output voltage trend for the duration of the SRAS test.
5	Frequency Control	Control SRAS frequency.	Change SRAS output frequency by 0.5 Hz above and below 50 Hz and hold each change for 5 minutes (measured at generator terminals or other agreed point). Can be done concurrently with item 3.	6. Provide output frequency trend for the duration of the SRAS test.
6	Energise De-energised Busbar	Close onto a de-energised busbar.	SRAS to close onto a de-energised busbar (or other de-energised electrical equipment agreed by AEMO).	7. Provide voltage trend of for the busbar for the duration of the SRAS test.
7	Output Capability	SRAS to supply specified capability.	Synchronise to the network and demonstrate capability to ramp to the	8. Provide SRAS output trend for the duration of the SRAS test.

Item	Assessment	Capability	Test	Evidence Required
			specified capability within the specified timeframe.	
8	Timeframes	Provide SRAS in specified timeframe	Timeframes demonstrate ability to provide SRAS in accordance with the SRAS agreement	Record the time at the following milestones over the duration of the SRAS test: • Start of the SRAS test.(item 2 start) • Time at stable operation (item 2 end) - ready to energise a de-energised busbar. • Time of commencement of the zero export load ability (start item 3). • Times of completion of the zero export load ability (end item 3). • Time of connection to isolated busbar (item 6). • Time commenced loading for capability test (item 7 start). • Time at contracted capability (item 7 end).
9	Regular diesel generator (if part of SRAS Equipment)	Start up and operate for minimum period	Periodic operation of diesel generator independent of full SRAS Test (monthly unless otherwise agreed), with evidence to be provided with Test Report.	Maintenance records or time-stamped data trends

APPENDIX B. MAPS OF ELECTRICAL SUB-NETWORKS

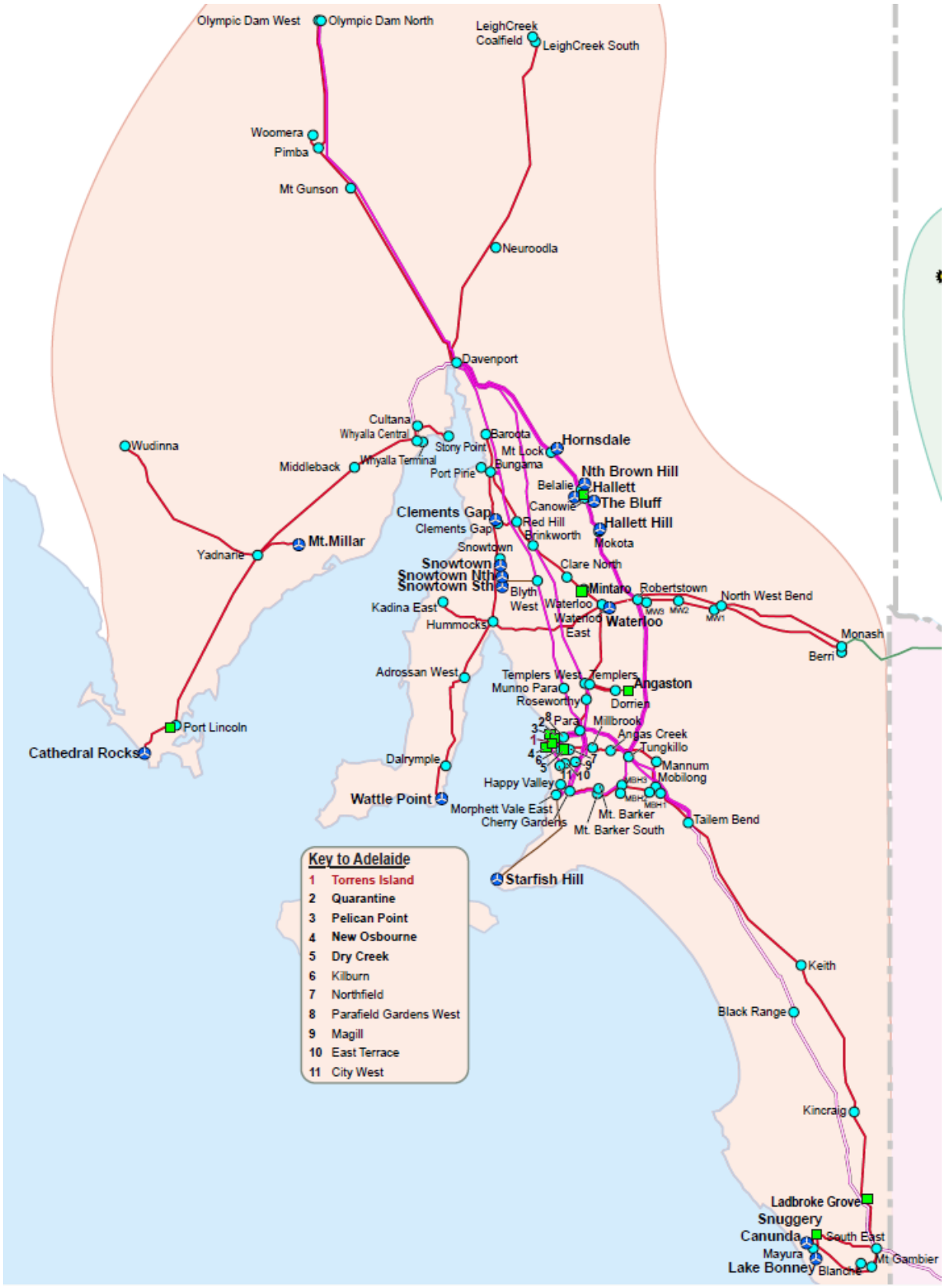
B.1 Queensland North and South



B.2 New South Wales (actual regional boundary shaded in light green)

B.3 Victoria (actual regional boundary shaded in light pink)

B.4 South Australia (actual regional boundary shaded in light orange)



B.5 Tasmania (actual regional boundary shaded in light green)