Reliability Panel
AEMC

REVIEW

Reliability Panel AEMC

ISSUES PAPER

System Restart Standard

4 November 2011

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Inquiries

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

E: aemc@aemc.gov.au
T: (02) 8296 7800
F: (02) 8296 7899

Reference: REL0045

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005 to be the rule maker for national energy markets. The AEMC is currently responsible for rules and providing advice to the MCE on matters relevant to the national energy markets. We are an independent, national body. Our key responsibilities are to consider rule change proposals, conduct energy market reviews and provide policy advice to the MCE as requested, or on AEMC's initiative.

About the AEMC Reliability Panel (Panel)

The Panel is a specialist body within the AEMC and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on reliability, security and safety of the national electricity system and advising the AEMC in respect of such matters. The Panel's responsibilities are specified in section 38 of the National Electricity Law.

Reliability Panel members

Neville Henderson, Chairman and AEMC Commissioner

Trevor Armstrong, Executive General Manager, Transmission and System Operations, Ausgrid

Simon Bartlett, Chief Operating Officer, Powerlink

Mark Grenning, Chief Advisor Energy, Rio Tinto

Chris Murphy, Chief Executive Officer, Secure Energy

Andrew Nance, Principal, St Kitts Associates

Tim O'Grady, Head of Public Policy, Origin Energy

Stephen Orr, Director Strategy and Regulation, International Power Australia

Nick Sankey, Head of Utilities Energy and Renewables, Commonwealth Bank

David Swift, Executive General Manager, Australian Energy Market Operator

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1 Introduction

The National Electricity Rules (Rules) require the Reliability Panel (Panel) to determine the System Restart Standard that would apply for the procurement of system restart ancillary services (SRAS). SRAS are ancillary services that provide energy to allow power stations to be restarted and connections to be re-established following a major supply interruption in which power stations are disconnected from the power system. Currently the annual cost of SRAS is of the order of $36.7 million of the whole of the national electricity market (NEM).[1] This Issues Paper commences the Panel's review process to determine the System Restart Standard. The purpose of this paper is to facilitate consultation and seek views on relevant issues.

1.1 Requirement for the review

The Australian Energy Market Commission (AEMC or Commission) made the National Electricity Amendment (System Restart Ancillary Services and pricing under market suspension) Rule and associated Rule determination in 2006. The Rule change related to the arrangements for the standards applying to, the procurement of, and payment for, SRAS.

A requirement introduced by the Rule change is that the Panel is required to determine the System Restart Standard for the acquisition of SRAS. The system restart standard would set out the requirements that are to be met by the Australian Energy Market Operator (AEMO) in acquiring sufficient SRAS to restart large generating units following a major supply interruption. The Rules provided that the Panel is to determine the System Restart Standard 'as soon as practicable'.[2] Until such time as the Panel determined a System Restart Standard, the Rules required AEMO (NEMMCO at the time) to determine an interim system restart standard which would be approved by the Panel.[3] An interim system restart standard has been in place since November 2006.

The Panel acknowledges that, although the Rules allowed the Panel to determine the standard 'as soon as practicable', there has been a reasonable time lag from the time when the requirement was introduced to now. However, the Panel notes that AEMO undertook consultation in establishing the interim standards and that these interim standards had been approved by the Panel (as required by the Rules).[4] In addition, experience from the operation of the interim standard may assist the Panel in developing a meaningful standard. Given these considerations, and the relatively low probability of a 'black system' event occurring and that an event has not occurred in the NEM to date, the Panel did not initiate this work until now.

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1 AEMO, advice to the Reliability Panel, letter from Mr Matt Zema to Mr Neville Henderson, 12 October 2011, p. 2.

2 Clause 8.8.3(a)(5) of the Rules.

3 Clause 11.2.1(b)(3) of the Rules.

4 Clause 11.2.1 of the Rules.

In September 2011, the AEMC provided the Panel with terms of reference to determine the System Restart Standard.[5]

1.2 Current arrangements and advice from AEMO

As outlined above, AEMO determined an interim system restart standard, which has been in place since November 2006 and will continue to apply until the Panel determines a System Restart Standard. Given that AEMO had undertaken consultation to establish the interim standard and it has been in place for a number of years, the Panel considers that the interim standard will form a foundation on which to establish the System Restart Standard. Questions raised for consultation in this Issues Paper have been prepared giving consideration to the interim standard.[6]

The Rules also require that the Panel establish the System Restart Standard on the advice of AEMO.[7] In September 2011, the Panel requested AEMO to provide advice on this matter. AEMO's advice is published on the AEMC's Reliability Panel webpage with this Issues Paper and, where relevant, specific issues raised in AEMO's advice are also discussed in this paper.

The Panel also notes that AEMO initiated consultation on its 'SRAS documents' in September and that AEMO aims to execute new SRAS agreements by the end of June 2012.[8] The Panel expects to work closely with AEMO throughout this review process to ensure that any issues raised in AEMO's consultations are taken into consideration by the Panel where appropriate. At this stage the Panel would expect the final System Restart Standard to take effect after June 2012 so that there would be no uncertainties for AEMO's current round of SRAS procurement and execution of agreements.

1.3 Timetable for the review and consultation process

For this review, the Panel is required to follow the consultation processes set out in clause 8.8.3 of the Rules (and any specific requirements in the terms of reference). The Panel will undertake consultation with stakeholders through seeking comments and submissions on papers and determinations as well as through a public meeting. The key milestones and proposed dates are set out in the following table.

5 The terms of reference for this review is published on the AEMC Reliability Panel's website with this Issues Paper.

6 AEMO's interim system restart standard is available on AEMO's website and it is also included as an attachment to this Issues Paper.

7 Clause 8.8.1(a)(1a) of the Rules.

8 AEMO's SRAS documents are discussed further in section 2.2 below.

Indicative timetable

Stage of review / milestone	Date
Issues Paper published	4 November 2011
Close of submissions on Issues Paper	2 December 2011
Draft System Restart Standard published	24 February 2012
Close of submissions on draft standard	23 March 2012
Public Meeting	11 April 2012
Final System Restart Standard published	25 May 2012

1.4 Submissions to the Issues Paper

The Panel invites comments from interested parties in response to this Issues Paper by 2 December 2011.

Submissions may be lodged online through the AEMC's website www.aemc.gov.au using the link entitled "online lodgement" and reference "**REL0045**". Or, if choosing to make submissions in hard copy, submissions may be posted to:

The Reliability Panel
Australian Energy Market Commission
PO Box A2449
SYDNEY SOUTH NSW 1235

1.5 Structure of the paper

The remainder of this Issues Paper is structured as follows:

Chapter 2 Background - provides background information on SRAS as well as the System Restart Standard and other SRAS guidelines.

Chapter 3 Factors for consideration and key issues - provides a discussion of the key issues the Panel will consider in undertaking its determination. Specific questions for consultation are also outlined.

2 Background

This chapter sets out background information on SRAS requirements and provides a brief overview of the various guidelines and standards under the Rules.

2.1 Black system condition

In the event of a major supply interruption to the NEM such that a black system condition were to occur, most generating units could be expected to shut down. Such a condition would likely cause significant disruption to businesses and the broader community as a whole. In order to ensure costs of a black system event are minimised, provisions need to be in place to provide for the restoration of the power system in a timely, orderly and effective manner.

To restore the power system following a black system event, generating units would need to be progressively restarted and load restored. However, most generating units require a source of electrical power to restore their auxiliary plant and restart. The provision of this emergency starting power is termed 'black start capability'.

Restarting the system in this situation is a highly complex and technical task that requires the coordination of many parties in the NEM, including AEMO, network service providers, generators and customers. Restarting generation units needs to be matched with loads, and the frequency and voltage of the system must be carefully managed to ensure the system is restarted in a stable manner. AEMO and network service providers need to follow specific operating processes and procedures in a coordinated manner. As most generating units require a source of electrical power to restore their auxiliary plant and restart, having some generating units that have black start capability is an important consideration for the NEM.

Black start capability is commonly provided in the following ways:[9]

- inherent black start sources - generating units that can start without being connected to external power supplies such as some hydro generating units and some gas turbines;
- combination system restart sources - large generating units which can be started from a nearby small power station such as thermal power stations with adjacent black start gas turbine generating units; and
- trip to house load schemes (or islanding schemes) - large generating units that can disconnect from the transmission network and continue to supply their own auxiliaries or an isolated segment of system load.

9 As discussed in the final Rule determination for the National Electricity Amendment (System Restart Ancillary Services and pricing under market suspension) Rule 2006 and related Rule change proposal.

SRAS refers to these services that enable other generators to start up, which would then allow power to be progressively restored to the whole system in accordance with local system black procedures and AEMO's system restoration plans. The System Restart Standard sets the 'benchmark' for the requirements and procurement of SRAS, which specifically relates to the service which allows energy to be supplied (and a connection to be established) sufficient to initiate the process of restarting the power system following a major disruption. The System Restart Standard does not define or specify the operational procedures to be followed by AEMO or market participants in the event of a black system condition.

2.2 System Restart Standard and other guidelines

Under the Rules, AEMO is responsible for procuring sufficient SRAS for the NEM.[10] The System Restart Standard, which the Panel is required to determine, would provide the benchmark that defines what services AEMO should procure.[11] In essence, the System Restart Standard should set out the SRAS requirements for the market to efficiently minimise expected economic costs of a major supply interruption. The System Restart Standard would provide consistency and clarity in the definition of SRAS in a way which achieves the right balance between having sufficient guidance on the services to be procured and allowing AEMO appropriate discretion to carry out its functions. (The specific requirements of the System Restart Standard are discussed in detail in Chapter 3.)

To this end, AEMO is required to develop and publish a number of guidelines in relation to specific areas defined under the System Restart Standard.[12] These guidelines would likely be more detailed than the System Restart Standard and take into consideration specification implementation and operational issues. To clarify the provisions of the System Restart Standard and the other guidelines and determinations that AEMO is required to publish, the specific provisions include:

- the System Restart Standard is to set out guidelines on the required reliability of primary restart services and secondary restart services, and AEMO is to develop the SRAS description that identifies whether a service is a primary or secondary restart service and the technical and availability requirements of each service (SRAS description);[13]

10 Clause 3.11.4A(b) of the Rules.

11 The specific requirements of the System Restart Standards as defined under the Rules are discussed in Chapter 3 below.

12 Detailed discussion of the content of the System Restart Standard is discussed in Chapter 3.

13 Clause 8.8.3(aa)(4) and clause 3.11.4A(d) of the Rules. Primary and secondary restart services are defined in the Rules with respect to the reliability requirements of these services as set out in the System Restart Standard (or interim standard). In AEMO's interim standards, primary services are required to be assessed by AEMO to be likely to perform on more than 90% of the occasions the service is called upon and secondary services more than 60% of the occasions (AEMO 2006, op cit, pp. 9-10).

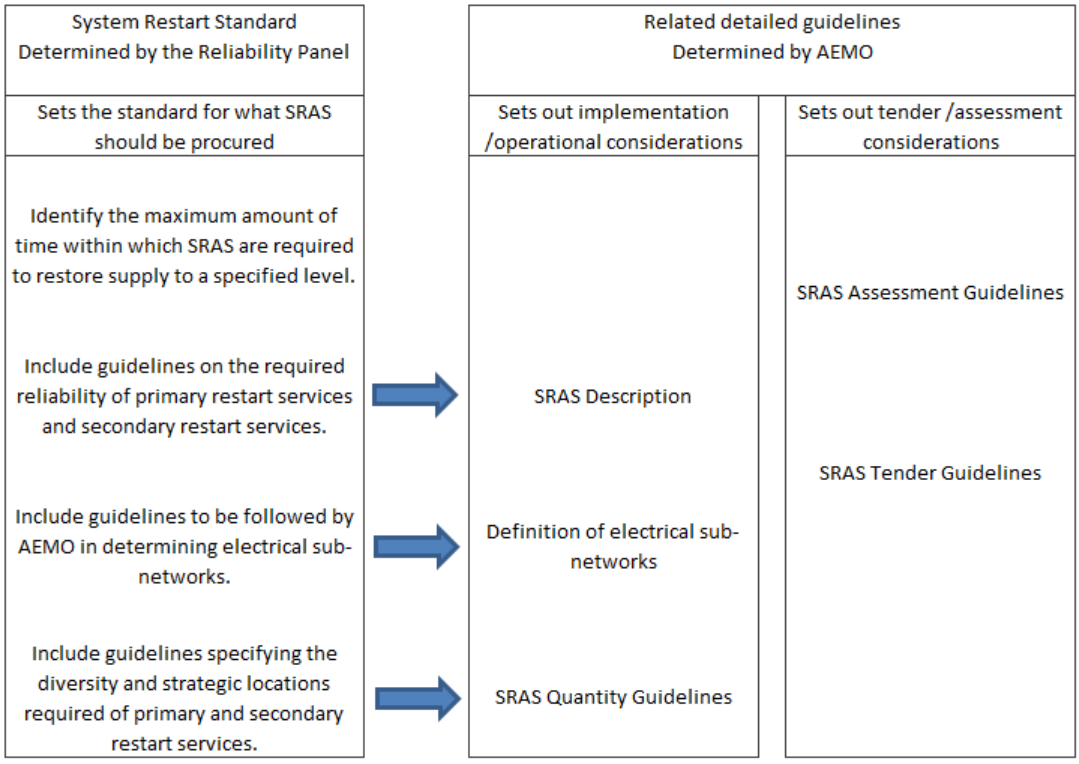
- the System Restart Standard is to set out guidelines for determining electrical sub-networks, and AEMO is required to determine the boundaries of the electrical sub-networks;[14] and

- the System Restart Standard is to set out guidelines specifying the diversity and strategic locations required for SRAS, and AEMO is required to develop and publish the procedure for determining the number, type and location of SRAS for each electrical sub-network (SRAS quantity guidelines).[15]

In addition, AEMO is also required to develop and publish guidelines for undertaking modelling and assessment of the technical capabilities and physical testing of SRAS (SRAS guidelines);[16] and determine and publish ancillary services tender guidelines.[17]

The relationship between the System Restart Standard and AEMO's determinations and guidelines are demonstrated in the following diagram.

Figure 2.1 System Restart Standard and AEMO's guidelines



14 Clause 8.8.3(aa)(5) and clause 3.11.4B(b).

15 Clause 8.8.3(aa)(6) and clause 3.11.4A(f).

16 Clause 3.11.4A(e) of the Rules.

17 Under clause 3.11.5(b) of the Rules, AEMO must determine and publish tender guidelines in respect of non-market ancillary services. The Rules provides that AEMO may publish separate guidelines for network control ancillary services and system restart ancillary services, which AEMO has elected to do.

2.3 Related reviews

The Panel notes that September 2011 AEMO commenced consultation on its 'SRAS documents'.[18] AEMO's SRAS documents have been developed in reference to the interim system restart standard.[19] As discussed above, the Panel will work closely with AEMO to ensure that any relevant issues raised in AEMO's consultation process are taken into consideration in the Panel's determination of the System Restart Standard. As noted above, at this stage the Panel would expect the final System Restart Standard to take effect after June 2012 so that there would be no uncertainties for AEMO's current round of SRAS procurement and execution of agreements.

18 AEMO's SRAS documents refer to the guidelines and determinations AEMO is required to develop and publish as discussed in section 2.2.

19 The Rules requirement for AEMO to have established interim system restart standards are discussed above in sections 1.1 and 1.2.

3 Factors for consideration & key issues

This chapter sets out the specific requirements of the System Restart Standard under the Rules, and discusses the key issues and the factors that the Panel will take into consideration in its decision making process.

3.1 Requirements under the Rules

Under the Rules, the System Restart Standard must:[20]

- be consistent with the SRAS objective;[21]
- apply equally across all regions, unless the Panel varies the System Restart Standard between electrical sub-networks to the extent necessary:
  - to reflect any technical system limitations or requirements; or
  - if the benefits of adopting the System Restart Standard would be outweighed by the costs of implementing such a standard;
- identify the maximum amount of time within which SRAS are required to restore supply to a specified level;
- include guidelines on the required reliability of primary restart services and secondary restart services;[22]
- include guidelines to be followed by AEMO in determining electrical sub-networks, including the determination of the appropriate number of electrical sub-networks and the characteristics required within an electrical sub-network (such as the amount of generation or load, or electrical distance between generation centres, within an electrical sub-network); and
- include guidelines specifying the diversity and strategic locations required of primary restart services and secondary restart services.

3.2 Key issues for consideration

In order to determine a System Restart Standard that meets the requirements of the Rules, the Panel's consideration will include the key issues discussed as follows. Specific questions are also outlined for consideration during this consultation process. The Panel considers that the System Restart Standard could be based on the interim

20 Clause 8.8.3(aa) of the Rules.

21 Clause 3.11.4A(a) of the Rules; discussed in section 3.2.1 below.

22 The System Restart Standard would define which services would be considered primary and which secondary.

standard with any amendments, additions or clarifications as identified through this review process.

3.2.1 Consistency with the SRAS objective

As set out in clause 3.11.4A(a), the SRAS objective states:

> "The objective for system restart ancillary service is to minimise the expected economic costs to the market in the long term and in the short term, of a major supply disruption, taking into account the cost of supplying system restart ancillary services, consistent with the national electricity objective"

The Panel understands that the SRAS objective is to provide guidance on all aspects of decision making regarding SRAS including the services to procure, how much to procure and for what purpose.[23] As required by the Rules, in developing the System Restart Standard, the Panel will consider its consistency with the SRAS objective.

Question 1 How to achieve consistency with the SRAS objective?

How can we measure the value provided to the market by SRAS? What factors affect the costs of SRAS and how can these costs be minimised?

3.2.2 Consistency across regions and sub-networks

As the System Restart Standard should be reflective of the overall requirements of SRAS for the NEM, generally speaking it should apply equally to all regions and electrical sub-networks. However, to account for any economic or technical reasons, the Rules allow the standard to be varied across electrical sub-networks. The Panel notes that, in the interim system restart standard, AEMO considered that it did not have authority to vary the interim standard across electrical sub-networks and as such the interim standard applies uniformly across all NEM regions.[24]

Question 2 Should the standard be varied across regions and sub-networks?

Are there any reasons that the System Restart Standard should be varied for any electrical sub-networks? Is so, which sub-networks and for what reason?

23 Refer to section 5.1, p. 13 of the AEMC's Rule determination: National Electricity Amendment (System Restart Ancillary Services and pricing under market suspension) Rule 2006.

24 AEMO, Interim Restart Standard, 2006, p. 4.

3.2.3 Time to restore supply

The Rules set out that the System Restart Standard must identify the maximum amount of time within which SRAS are required to restore supply to a specified level following a major supply interruption. The Panel notes that in practice this timeframe would be affected by a number of factors including the location of a supply interruption and the nature of the disruption itself, as well as the types of ancillary services that may be available. Taking this into account, the Panel considers that the timeframes set out in the System Restart Standard could be considered 'target timeframes'. As outlined above, the generator providing the system restart ancillary service plays the critical role in initiating system restoration. To achieve the System Restart Standard requires plans and procedures which can use that SRAS and restore the system to the level, and within the timeframe, specified in the standard. AEMO conducts analysis to confirm that each SRAS acquired can feasibly play their part in meeting the System Restart Standard by modelling restarting from system black under two scenarios. To determine a restoration timeframe that would apply generally, the Panel would likely need to consider a target that would be realistically achievable.

Question 3 What are the assumptions that should apply to determining a restoration timeframe?

What are the key factors that affect the time in which supply could be restored following a major supply interruption? What would be a reasonable target timeframe?

AEMO's interim system restart standards specify that SRAS should be procured for each electrical sub-network sufficient to:[25]

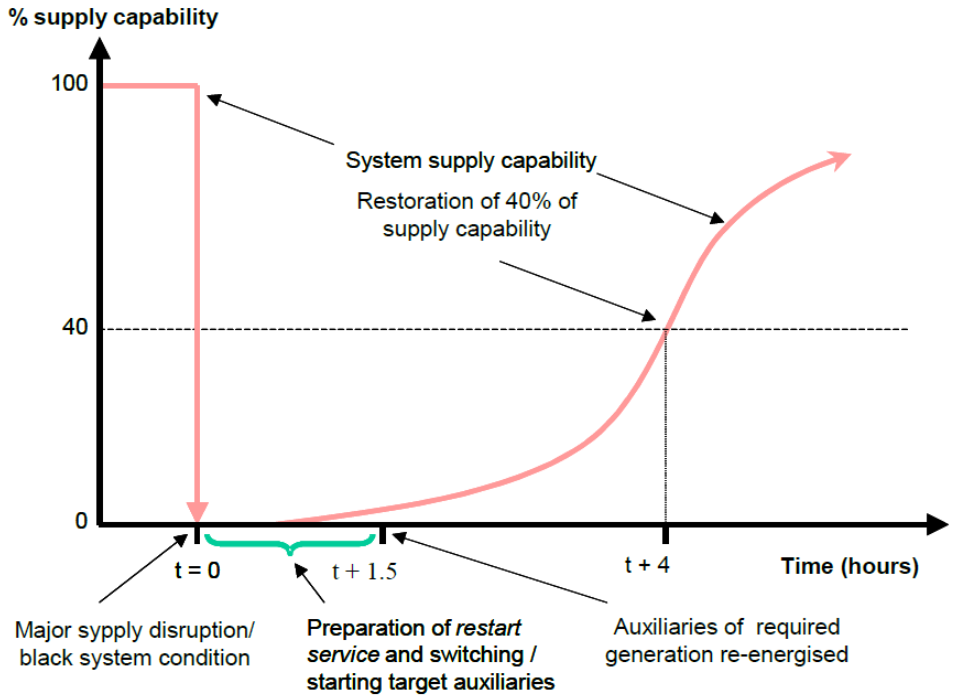
"• Re-supply and energise the auxiliaries of power stations within 1.5 hours of a major supply interruption occurring such that there would be sufficient capacity to meet 40% of the peak demand in the affected electrical sub-network; and

• Restore generation and transmission within the affected electrical sub-network such that 40% of the electrical sub-network's peak demand could be supplied within four hours of a major supply interruption occurring."

These restoration milestones are represented in the following figure.

25 AEMO 2006, op cit, p. 5.

Figure 3.1 Interim standard restoration milestones[26]



The Panel has been advised that some stakeholders have noted that the restoration timeframe in the interim standard may not be achievable particularly for thermal generating units. The Panel notes that AEMO has also raised this issue in its advice to the Panel on this matter and AEMO notes that:[27]

> "... the purpose of the interim system restart standard is to guide the acquisition of system restart ancillary services ... If the timeframes relating to the restoration of supply capability were extended, a potential outcome may be that fewer system restart ancillary service tenders need to be selected in the procurement process to meet the 'relaxed' standard and actually extending the restoration times achieved following a major supply disruption."

However, AEMO further notes that some jurisdictions consider the restoration timeframes too long as generating plant in their jurisdictions could potentially respond more quickly.[28]

26 AEMO 2006, op cit, p. 5.

27 AEMO 2011, op cit, p. 2.

28 ibid

Question 4 What is the appropriate target timeframe to restore supply?

Are the timeframes and supply capability targets set out in the interim system restart standard appropriate? Does this target timeframe allow efficient and economical SRAS to be procured? Is the use of a percentage of peak demand the appropriate measure?

3.2.4 Required reliability of primary and secondary services

The System Restart Standard must include guidelines on the reliability of primary and secondary restart services. In determining appropriate reliability thresholds, the Panel will take into consideration whether numerical reliability thresholds could be practically established and to what extent they would be reflective of the SRAS objective. The Panel notes that the interim system restart standard has set standards of 90 per cent and 60 per cent for primary and secondary services respectively.[29] The interim system restart standards also allow a combination of services to be considered.[30]

Question 5 What should be the guidelines for reliability of primary and secondary restart services?

What factors affect the reliability of restart services? Are the current definitions in the interim system restart standard acceptable (a primary service would be likely to be perform on more than 90 per cent of the time; and a secondary service would be likely to perform 60 per cent of the time)?

3.2.5 AEMO's determination of electrical sub-networks

The System Restart Standard must include guidelines to be followed by AEMO in determining electrical sub-networks. The Panel notes that determination of electrical sub-networks will require analysis of the relevant physical characteristics of the NEM. The Panel also notes that the interim system restart standard sets out that electrical sub-networks will be determined by taking into account, but not limited by, the following factors:[31]

- the number and strength of transmission corridors connecting an area to the remainder of the power system;
- the electrical distance (length of transmission lines) between generation centres;

29 That is, a primary service would be assessed by AEMO to be likely to perform on more than 90 per cent of the occasions the service is called upon to deliver the service (and correspondingly, 60 per cent of the time for secondary restart services). AEMO 2006, op cit, p. 9.

30 ibid, p. 10.

31 AEMO 2006, op cit, p. 12.

- a significant quantity of generation in an area, of the order of 1000 MW or more; and

- a significant quantity of load in an area, of the order of 1000 MW or more.

The number of sub-networks determined will directly impact the number of services which need to be contracted. Allowing sub-networks to overlap, or generators in adjacent regions to offer restart services in more than one sub-network could potentially reduce the number of services required..

Question 6 What factors should be taken into consideration in setting the guidelines for electrical sub-networks?

Are the factors as identified in AEMO's interim system restart standard for setting guidelines for electrical sub-networks clear and sufficient? Should any other factors be taken into consideration? Would it be appropriate to consider whether electrical sub-networks can overlap and, if so, what benefits would this provide?

3.2.6 Strategic location and diversity of required services

The System Restart Standard must set out guidelines specifying the strategic locations and diversity required of primary and secondary restart services. The Panel notes that the SRAS procured will need to have a certain level of independence, which may be achieved through ensuring diversity in both the type of SRAS, and the location of the services, procured. The interim system restart standard sets out the requirement to consider diversity in terms of electrical, technological and geographical requirements.[32] In considering the strategic location of the services, the interim system restart standard sets out guidelines that consider the complexity of the relevant parts of the network, flexibility in re-configuring the relevant parts of the network, and the simplicity in establishing a path between the service and the target generating unit.[33]

Question 7 What factors should be taken into consideration in setting the guidelines for the strategic location and diversity of restart services?

What are the different types of SRAS available in the NEM? When diversity of SRAS is being considered what are the factors that are relevant (such as diversity in fuel, electrical, technological and geographical requirements)? Are the factors as identified in AEMO's interim system restart standard clear and sufficient?

32 The Panel understands that 'diversity' in the interim standards includes fuel diversity.

33 AEMO 2006, op cit, pp. 14-15.

3.2.7 Other factors

In developing the System Restart Standard, the Panel may need to make various assumptions. For example, AEMO notes that in developing the interim standards, it made several assumptions relating to the extent of disruption to the power system and it considered two scenarios:[34]

- total shutdown of the power system in all electrical sub-networks without any infrastructure damage; and
- as per above and, in addition, damage to either one SRAS plant or a significant transmission facility within the particular electrical sub-network being assessed.

AEMO notes that it may be timely to review these scenarios. Other scenarios may also be considered such as potential islands to be established.[35]

Question 8 Assumptions and scenarios of extent of power system disruption

Are the scenarios used by AEMO in developing the interim standards still valid and/or should other scenarios be considered by the Panel in developing the System Restart Standard? Would specific scenarios help to demonstrate potential costs and benefits of SRAS?

As discussed above, the Rules set out the specific aspects that the System Restart Standard must include. In this review process, the Panel will consider whether any other relevant information should be included.

Question 9 Are there any other issues that should be included in the System Restart Standard?

In addition to the specific requirements outlined in the Rules, are there any other relevant issues that should be included in the System Restart Standard?

34 AEMO 2011, op cit, pp. 2-3.

35 ibid, p. 3.

A AEMO's interim system restart standards

AEMO's interim system restart standard is available on the AEMO website and also on the AEMC's website with this Issues Paper.

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
Commission	See AEMC
NEM	national electricity market
Panel	Reliability Panel
Rules	National Electricity Rules
SRAS	system restart ancillary services