stanwell

18 December 2015

Neville Henderson
Reliability Panel Chair and AEMC Commissioner
Australian Energy Markets Commission
PO Box A2449
Sydney South NSW 1235
Submitted via AEMC website – REL0057

Dear Neville,

RE: Review of the System Restart Standard

Stanwell welcomes the opportunity to provide comment in relation to the Reliability Panel's review of the System Restart Standard (SRS).

Stanwell has been concerned that recent activity in relation to System Restart Ancillary Services (SRAS) has lead to an over-prioritisation of short term cost reductions at the expense of robust, efficient arrangements for the long term benefit of consumers.

We ask that the Reliability Panel consider these recent processes and the fact that the NEM is now significantly less "insured" against an outage when compared to previous periods. Stanwell's vision for the new System Restart Standard is one which is clear and appropriately defined in order to ensure sufficient and efficient provision of SRAS.

SRAS is conceptually similar to an insurance product where the annual cost of SRAS can be equated to the insurance premium and the reduction in the cost of the outage is equated to the payout on the insurance policy[1]. As with insurance policies, the cost of the premium must be reasonable when considering the probability of the event insured and the cost of the event. If the premium is too expensive when compared to the likely payout it may be economically more efficient to "self insure" or forgo insurance, however such action is not possible in relation to SRAS.

System Restart Ancillary Services (SRAS) objective

"The objective for *system restart ancillary services* is to minimise the expected costs of a *major supply disruption*, to the extent appropriate having regard to the *national electricity objective*".

The SRAS objective does not call for "lowest price" but through the link to the national electricity objective where the focus is on "efficient investment" and "long

[1] Unlike typical insurance products, SRAS coverage is defined by the Reliability Panel and AEMO, paid for by generators and consumers equally, benefits generators and consumers differently and does not provide a transparent "payout". In addition, customers are likely to have a range of complementary measures such as business interruption insurance.

term interests", the SRAS objective appears to desire an efficient price over the long term.

Stanwell note however that AEMO will ultimately procure SRAS to meet their *SRAS Procurement Objective* which is to meet the SRS **at the lowest cost**. Accordingly, Stanwell considers that the SRS must be sufficiently clear and comprehensive to ensure that lowest cost procurement remains consistent with the SRAS Objective.

The marginal benefit of procuring SRAS

The first part of the SRAS objective relates to minimising the expected costs of a major supply disruption. A major supply disruption is extremely costly:

- 2007 Victoria, Australia outage, 2200MW, 4.5 hour restoration time, estimated to have cost $500 million[2]
- 2003 Eastern USA, 62000MW, 19 hour restoration time, estimated to have cost $6 billion[3]

The key determinants in the cost of a major supply disruption are the volume of affected load, the value of the affected load and the duration of the outage. Of these three elements, only outage duration is likely to be affected by SRAS procurement strategies.

The length of an outage increases the costs in a non linear fashion. For example, refrigerated stock may be recovered after a short outage but if the outage continues, it will eventually need to be discarded. Similarly, manufacturing processes such as aluminium smelting may be restarted after a certain amount of time but at a critical point the aluminium solidifies causing major costs. Also, the longer the outage continues the more difficult it is to start thermal power stations further extending the duration of the outage.

Regarding restoration time, ROAM have said

> *"International studies have shown that acquiring additional SRAS generation can benefit system restoration by shortening the total restoration time. The acquisition of an additional 50 MW of SRAS reduced the overall restoration time by approximately 33%. (Sun, Liu, & Liu, Black Start Capability Assessment in Power System Restoration, 2011) In another study, the addition of an additional SRAS unit resulted in a 28% reduction in the expected total system restoration time. (Lu, Qin, Liu, Hou, Wang, & Wen, 2013)"*[4]

Accordingly, in the event of an outage the marginal benefit of having procured additional SRAS services is likely to be considerable. At the same time, the likelihood of a major supply disruption is low, but not zero.

By using a widely accepted "power-law" relationship between the probability of large blackouts and the size of blackouts, ROAM developed the following relationship for the NEM.

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[2] Page iv, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014
[3] Page 5, Review of the System Restart Standard, Reliability Panel, 2015
[4] Page 26, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014

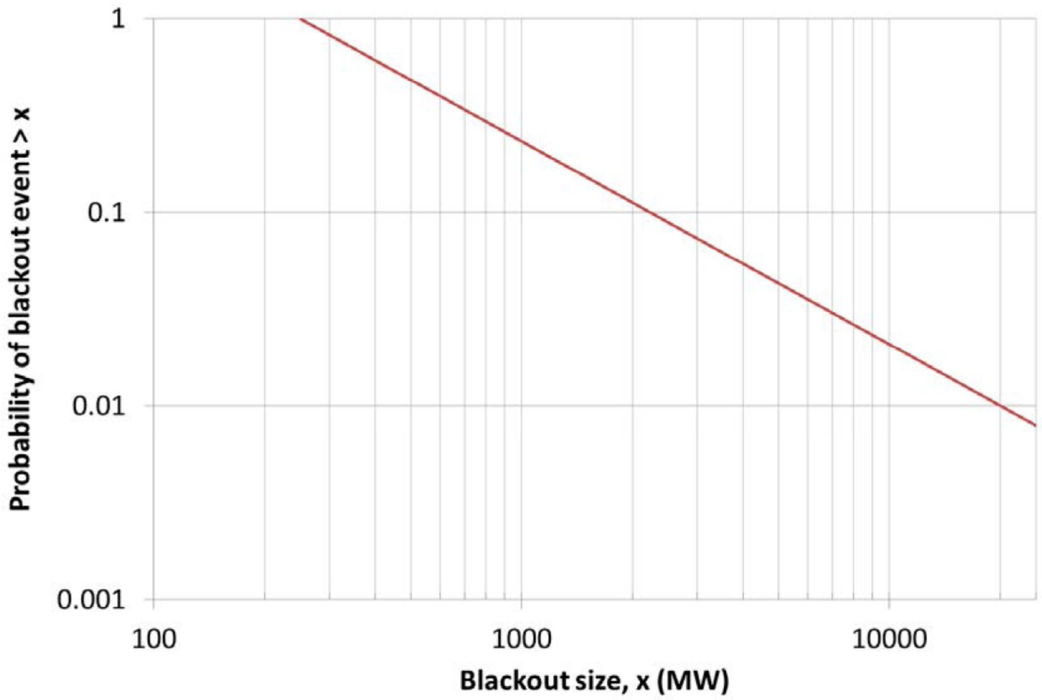

Figure 1: Probability of a blackout being greater than a particular size in the NEM[5]

ROAM also translated the power-law probability results into a "return period" calculation which refers to the number of years between events, on average. The results are shown below and include a comparison with the NEM's observed outage history.

Blackout Size	Estimated Return Period (Years)	Observed Return Period (Years)
≥ 500 MW	1.6	1.25
≥ 1,000 MW	2.7	2.5
≥ 1,800 MW	4.5	5
≥ 5,000 MW	12.1	N/A
≥ 10,000 MW	24.6	N/A
≥ 15,000 MW	37.3	N/A
≥ 20,000 MW	50.3	N/A
≥ 25,000 MW	63.4	N/A

Figure 2: Estimated return period of NEM blackouts, compared with actual data[6]

To work out an appropriate level for SRAS premiums, ROAM's approach of an "annual risk-cost" could be used. This represents the annualised economic value of mitigating a particular sized outage.

ROAM defines this as follows:

[5] Page 18, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014

[6] Page 19, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014

4.2 RISK-COST CALCULATIONS

The annual risk-cost to the market for each scenario investigated can be calculated taking into considering the size and probability of the hypothesised event.

Equation (8) estimates the annualised risk-cost of a blackout.

$$\text{Annualised blackout risk-cost} = V \times E \times P \quad (8)$$

where:

E is the amount of unserved energy during the blackout. This is equal to the integral of the size of the blackout in MW over the duration of the blackout,

P is the probability of the blackout occurring in a given year (see equation (7)), and

V is the Value of Customer reliability in $/MWh. ROAM proposes to the use a Value of Customer reliability of $50,000/MWh[5] for the cost calculations, which is consistent with AEMO's estimates.

Figure 3: Risk-cost calculation[7]

In reference 5, ROAM points out that the Value of Customer reliability may only be enough to cover the direct costs of unserved energy. ROAM state that the total $500m cost of the Victorian outage is equivalent to $70,000/MWh in 2007 dollars[8].

Alternatively, a value of customer reliability value for a particular subnetwork or region could be developed based on the customer profile in the region and AEMO's calculation of the value of customer reliability in each customer segment repeated below.

RESIDENTIAL CUSTOMERS

State	National Electricity Market	New South Wales	Victoria	Queensland	South Australia	Tasmania
VCR ($/kWh)	25.95	26.53	24.76	25.42	26.88	28.58

BUSINESS CUSTOMERS

Sector	Agriculture	Commercial	Industrial
Weighted Average VCR ($/kWh)	47.67	44.72	44.06

DIRECTLY-CONNECTED CUSTOMERS

Sector	Sector-wide weighted average	Metals	Wood, pulp and paper	Mining
Weighted Average VCR ($/kWh)	6.05	5.29	1.44	14.96

Figure 4: AEMO's Value of customer reliability[9]

With the calculated information on the annualised risk-cost combined with the cost of SRAS services, an optimal level of SRAS could then be obtained based on a principle of: if the cost of the additional SRAS service exceeds the annualised risk cost, then it should not be obtained.

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[7] Page 32, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014

[8] Page 32, Review of System Restart Ancillary Services (SRAS) Requirements in the NEM, ROAM, 2014

[9] Page 2, Value of customer reliability fact sheet, AEMO, November 2015

Working with the Reliability Panel's definition of the optimal level of SRAS[10], Stanwell considers it could be better defined as "where the marginal *annualised risk-cost* of procuring an additional service is approximately equal to the marginal cost of procuring that service".

The marginal cost of procuring SRAS

The second part of the SRAS Objective relates to the national electricity objective which is "promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to -

(a) price, quality, safety, reliability and security of supply of electricity; and
(b) the reliability, safety and security of the national electricity system"

When related to the objective of minimising the expected costs of a major supply disruption, the most important aspects of the national electricity objective appear to be

- efficient investment in electricity services
- the long term interests of consumers which relate to price, reliability and security of supply

At its peak in 2013-14, SRAS cost a total of $55 million[11]. This is an order of magnitude less than the 2007 Victorian outage which cost $500 million. It seems likely that, in general, the cost of an event will dwarf the cost of procuring SRAS.

Definition of sub-networks

The System Restart Standard must provide guidance to AEMO in its determination of sub-network boundaries. The current Standard requires AEMO to take into account

- the number and strength of transmission corridors connecting an area to the remainder of the system
- the electrical distance (length of transmission lines) between generation centres
- the quantity of generation in an area, which should be in the order of 1000MW or more
- the quantity of load in an area, which should be in the order of 1000MW or more

Under the current guidelines, AEMO has defined six sub-networks, including one sub-network which represents all of NSW, over 13,000 MW of load.

An alternative approach to defining sub-networks could be based on the cost of unserved demand for a notional length outage (say 4 hours). This could be calculated based on the composition of loads in the area and AEMO's segmentation of the value of reliability amongst different customer groups. The NEM could be divided into sub-networks based on a maximum cost of unserved demand during a notional length outage (say $0.5bn).

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[10] where the marginal benefit of procuring an additional service is approximately equal to the marginal cost of procuring that service
[11] Page 18, Review of the System Restart Standard, Reliability Panel, 2015

As SRAS is procured on a sub-network basis, appropriately sizing the sub-networks would ensure that customers are adequately insured for an outage, based on the value they place on reliability.

Maximum amount of time within which SRAS services are required

The System Restart Standard must identify the maximum amount of time within which system restart ancillary services are required to restore supply in an electrical sub-network to a specified level.

If Stanwell's suggestion of a probabilistic determination of sub-network boundaries was adopted, the maximum amount of time during which SRAS services are required could be the length of the notional length outage used in determining the size of the sub-networks.

Recognising AEMO's requirement to procure SRAS on a lowest cost basis, Stanwell supports the retention of multiple interim guidelines as to the required provision of system restart services.

Aggregate SRAS reliability

The reliability of a SRAS service is the probability that the service will be available when requested. This is expressed as the reliability of an individual service. The aggregate reliability is the combined reliability of all the SRAS procured in a single sub-network.

For the consumers and generators to have confidence in the Standard, the aggregate SRAS reliability in a sub-network should be close to 100%. A combination of SRAS services can be used to achieve the aggregate reliability with confidence.

The System Restart Standard has also historically required diversity of electrical, technical, geographical and fuel sources which is likely to require multiple SRAS providers which in turn enhances aggregate reliability. We support the retention of such requirements going forward.

Importance of SRAS given renewables targets

Setting an appropriate System Restart Standard has become even more important with the increasing penetration of renewables. Recent experience in South Australia demonstrates that on the edge of the network (South Australia or Far North Queensland) a decreasing proportion of base load generation can lead to frequency and voltage instability. The recent outage in South Australia, Deloitte's recent work for the Energy Supply Association of Australia and AEMO's recent renewable energy roadshow all demonstrate the increasing problems which the Panel must ensure the Standard adequately insures for.

Current climate for the provision of SRAS

AEMO has reduced the number of SRAS services acquired from 20 in 2012-2015 to 10 in 2015-2018. Stanwell understands that at least two of the generators that failed to secure an SRAS contract have taken steps to disable their capability to provide the service. This includes cancelling maintenance plans and no longer holding the fuel which is required to provide the service. While these are commercial decisions by the generators, it demonstrates that the NEM is significantly less “insured” when compared to 2012-2015.

Stanwell also understands that the revenue received for the provision of SRAS has not been enough to incentivise a private developer to include provision for the service when building a new power station. This includes the gas fired power stations built over the last 10 years in QLD and new wind farms. Stanwell understands that wind farms are able to be built with certain system stability and system restart capabilities but that current SRAS and frequency market revenues do not justify the investment.

This information is included in order to make clear that the SRS needs to frame a market which provides sufficient future support for SRAS development as baseload generators with SRAS capability retire.

Further work by Reliability Panel

The Panel intends to undertake additional analysis of the issues in order to inform its determination of an appropriate Standard. This includes comparisons to other jurisdictions, a study of the technical capability of the power system to meet any amendments to the Standard and economic analysis of the costs of any potential black system event.

Stanwell supports this analysis. We also suggest the Reliability Panel investigate probabilistic approaches to determining the optimal amount of SRAS. This could be in line with the work conducted by ROAM on an annualised risk-cost approach. By considering probabilistic approaches, the Panel would be approaching the problem as an insurer would when determining the amount of cash to set aside to fund unknown future insurance pay outs.

Thank you for your consideration of Stanwell’s response to the Issues Paper. If you would like to discuss any aspect of this submission, please contact Jennifer Tarr on 07 3228 4546.

Regards

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