

27/10/2016

Mr Neville Henderson
Chairman, Reliability Panel
Australian Energy Market Commission
PO Box A2449
Sydney NSW 1235

Lodged online via: www.aemc.gov.au

Dear Mr Henderson,

Review of System Restart Standard – Draft Determination (Reference: REL0057)

TransGrid welcomes the opportunity to respond to the Reliability Panel's Draft Determination of the System Restart Standard published on 25 August 2016.

TransGrid manages and operates the high voltage electricity transmission network connecting generators, distributors and major end users in New South Wales (NSW) and the Australian Capital Territory. TransGrid's network is also interconnected to Queensland and Victoria, and is instrumental to an electricity system that allows for interstate energy trading.

TransGrid considers that the Panel's Determination of the System Restart Standard is an important task, which requires careful consideration of the Standard itself and the associated arrangements to meet the Standard's requirements.

A number of the issues of concern to TransGrid are already raised by the Energy Networks Association (ENA) so are not duplicated here. TransGrid reiterates its support of the ENA submission.

TransGrid has attended the Public Forum (held on the 21 September 2016) and after carefully reviewing the Draft Restart Standard proposed by AEMC, we have detailed our responses and proposed solutions (in Attachment A). TransGrid recognises the gravity of the social and economic impacts of a system restart event, and seeks to ensure that the specific needs of the state of NSW are considered in the Restart Standard. TransGrid's response focuses on four specific areas:

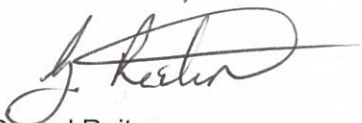
1. Clarity and appropriateness of the determination of subnetworks, taking into account the restoration times associated with restart paths and the network limitations that would exist between the northern and southern NSW network during such an event.
2. Proper consideration of the strategic location of the procured System Restart Ancillary Services (SRAS) taking into account the aggregate reliability and diversity, along with the operational practicality of SRAS location.

3. Economic analysis and consideration of sensitive loads. The potential requirement for a restart source north of Sydney.
4. Further comments which draw on TransGrid's experience to date.

TransGrid considers that recent electricity supply events in South Australia are relevant to this review and this may result in TransGrid providing a supplementary submission to the Panel as part of this review.

We would welcome the opportunity to meet with you and other Panel members to further discuss the issues raised in this submission. In the first instance, please contact me on 02 9620 0850.

Yours faithfully,



Gerard Reiter
Executive General Manager/ Asset Management

Attachment A – Responses to the Draft Determination of the System Restart Standard (SRS)

TransGrid Specific Issues

TransGrid's Response and Proposed Solution

1. Sub-network guidelines

(a) Determination of Sub-Networks

These issues have been raised by TransGrid previously in the submission to the Review of the SRS and are referenced in the Appendix B of the Draft SRS:

"The Panel should give consideration to the technical limitations of the transmission system on a regional basis."

"AEMO define only one sub-network for NSW, however, there are two natural sub-networks in NSW, characterised by slow restart sources in the north and fast restart sources in the south which are constrained by physical limitations of the network to the major load centre in the Sydney area and supply to sensitive loads"

Whilst the Reliability Panel has given guidelines regarding the issues that should be considered in determining sub-networks, these guidelines are largely non-specific, requiring AEMO to "take into account" a number of factors. These factors are given as the number of transmission corridors, the electrical distance between generation centres and the ability of any sub-network to be maintained in a satisfactory operating state.

In the past, this analysis yielded two sub-networks in NSW. A 2013 Issues Paper produced by AEMO into System Restart Ancillary Services contained the following statement:

*"No studies were carried out for New South Wales because combining the existing two electrical sub networks into one was considered to be impractical due to the distances and loads involved."*¹

Since 2013 there has been very little change to the topography of the NSW network, nor much change to the guidelines given by the Reliability Panel. Despite this, NSW now just has one electrical sub-network.

¹ AEMO, "System Restart Ancillary Services Review - Issues and Options Paper", Doc Ref: MARKPER-82-121, 25 January 2013.

“TransGrid considers that it would be appropriate to include a minimum number of services for each sub-network. One suggestion is that this could be one more SRAS than what is required to satisfy the SRS according to AEMO’s assessment.”

It would appear that the current process lacks objectivity. Yet there appears to be tacit acknowledgement of this in the Draft Standard, indicated by the divergence from the process proposed in the procurement of an additional SRAS source north of Sydney. The reason for this given in the Executive Summary (pg. iii) is “... The large distance between these generating units and the generation in the south of the sub-network”. This would seem to intimate that a second sub-network is required in NSW, to which the economic analysis could then be applied and an appropriate SRAS source procured.

Reiterating that all of the factors to be considered are technical factors (i.e. there is no requirement to consider the economic circumstances or any other factors pertaining to the sub-network), it should be possible to make this process more prescriptive and, in so doing, more transparent.

It is noted that within the current Rules (clause 3.11.8) there is the following requirement:

- a) AEMO must determine the boundaries of the *electrical sub-networks* in accordance with the guidelines determined by the *Reliability Panel* under clause 8.8.3(aa)(5), and must *publish* a report setting out how it has complied with these guidelines.
- b) AEMO must comply with the *Rules consultation procedures* in determining the boundaries of the *electrical sub-networks*.

The Draft Determination (section 7.6) acknowledges that any changes to sub-networks will have implications. In the event of any such changes, the Panel would have TransGrid’s full support for any further review that was deemed necessary.

Proposal: AEMO’s report to include a detailed description of its methodology for the application of the guidelines for determining the number of sub-networks. This report should demonstrate compliance with the Rules clause 3.11.8(b).

(b) Assumption of 100% Availability of Transmission Network

“maintaining system security during restoration - including that the approach for ensuring system security during the restoration needs to be clear and explicit”

The assumption used in determining the Draft Standard is that the transmission network will be 100% available in the event of a restart. This contradicts with the DGA Report² (pg. 67) which states that: “The blackouts reviewed... were all initiated by unexpected transmission events”. It therefore appears that there is no sound historical basis for this assumption. Preliminary investigation from the recent SA blackout has indicated that there is also no sound basis for the same assumption in this instance either; in fact significant reduction in transmission availability should be expected.

It is appreciated that, once 100% network availability is no longer assumed, the whole problem gets a lot more complex. Looking at transmission network failure modes, extremely strong winds or intense bushfires can cause multiple tower collapses within the same easement. Therefore whether it is a double-circuit tower or two single-circuit towers in the same easement, there is a high probability of both failing concurrently. The “value” of a restart source is therefore proportional to the number of “corridors” joining the source (generation concentration and diversity) to the rest of the network (or a major demand centre); if there is a single corridor, then this is less valuable than two corridors, which in turn is less valuable than multiple corridors. This “value” (i.e. how likely it is that this source will actually be of some practical use in restoring consumer demand) needs to be considered in the procurement process.

Proposal: *AEMO to consider and consult with TNSPs on the avenues for quantifying this restart “value” and managing the risk of 100% availability of transmission network during the process of system restoration, as a part of its procurement of SRAS.*

(c) Restoration Times

The proposed restoration times under the draft standard are considerably less onerous than under the existing standard. TransGrid is concerned that in the absence of the additional requirement for an SRAS source north of Sydney, the draft standard could be met by using a single source south of Sydney, without any other power station auxiliaries being energised. However, in reality the voltage and transient stability limitations of the network would severely inhibit a timely restoration of thermal generating sources in northern NSW.

Proposal: *Since this is essentially a sub-network issue, the Reliability Panel to include in its guidelines, the requirement for AEMO to consider specific network limitations (thermal, voltage and transient stability limits) in its determination of sub-networks.*

² DGA Consulting, “International Comparison of Major Blackouts and Restoration”, 5 May 2016.

2. Proper Consideration of the strategic SRAS Location

(a) Aggregate Reliability of SRAS

This issue has been raised by TransGrid previously in the submission to the Review of the SRS reference in the Appendix B of the Draft SRS:

“The implementation of these diversity requirements should also be demonstrated during the procurement of SRAS.”

TransGrid broadly supports the use of the suggested Aggregate Reliability approach proposed in Section 6 of the Draft Standard. Clarity is sought as to the point at which aggregation stops. For example, where a gas turbine is used to start a large coal-fired unit, is the reliability used that of the SRAS provider (in this case the GT), or does it also factor in the probability of the coal generator failing to start? Since the latter is the only thing that is of ultimate value in the network restoration process, this would be a more valuable metric.

Proposal: *Clarify the second paragraph of Section 4 to explain this requirement. Possible wording might be “The reliability of any individual SRAS will incorporate the expected start-up performance and availability of that service and any other services dependent on this source e.g. a large coal-fired generator”.*

(b) Operational Practicality of SRAS

Section 6 of the Draft Standard (“Use of SRAS in neighbouring electrical sub-networks”) clarifies that a service can only be used for one electrical sub-network at a time. However, it stops short of specifying that the service must be located with that sub-network. TransGrid believes that this matter should be clarified, specifically requiring that the source must be located in the sub-network (or at least on its immediate boundary, such is the case with Murray power station supplying VIC or NSW).

A situation could arise where a NSW source can be located at some distance into the neighbouring network. This can lead to significant practicality issues: extended restoration times, careful management of load segments to be restored at each substation, control system volts within limits, etc., are to name just a few. Based on simulation exercises that TransGrid has conducted, the time taken to provide supplies to southern NSW generation (and so allow the normal NSW restoration to proceed) was anticipated to be in the region of 60-90 minutes from a source located some 150km into Victoria. Such a setback would mean that thermal power stations in the north of Sydney may then be performing a “cold” start, with considerably longer start-up and run-up periods.

TransGrid believes that a restart source in an adjacent network is technically infeasible and offers the following two scenarios to clarify this position:

Scenario 1. A NSW shutdown, with the “contagion” progressing into the VIC network by a distance of around 150km, but other VIC generation (Latrobe Valley etc.) operating satisfactorily

and most load still connected. The NSW-VIC interconnector is therefore black.

In this situation, the operationally-sound approach would be to rebuild the VIC network back up to the interconnector (synchronising generation along the way as required, but without requiring any to black start). Then the NSW network could be energised from the NSW-VIC interconnector. So in this scenario the SRAS source in VIC is superfluous.

Scenario 2. A total shutdown involving NSW and VIC occurring overnight, the VIC transmission network operator would be expected to initiate the restart for both VIC and NSW concurrently. The complexity of such an operation would require considerable care and attention. It would not be reasonable to expect one VIC transmission operator to dedicate time and effort into restarting NSW when VIC is in an equally difficult situation. The 60-90 minutes estimated by TransGrid studies could therefore be expected to blow out considerably further.

These scenarios are technical in nature and must be considered for SRAS to be effective. Regardless of the price offered, such a source is of little practical value and should be considered as not fit for purpose.

Proposal: *Clarify Section 6 of the Draft Standard to accommodate this. Possible wording might be "A system restart ancillary service can only be acquired by AEMO under a system restart ancillary services agreement provided that it is electrically and operationally within the boundary of that electrical sub-network".*

3. Economic Analysis taking proper consideration of Sensitive Loads

(a) Use of Economic Analysis to determine SRAS requirement

This issue have been raised by TransGrid previously in the submission to the Review of the SRS reference in the Appendix B of the Draft SRS:

"The Panel should give consideration to whether the Standard should outline expectations for restoration of sensitive and

TransGrid is not opposed to this approach in principle, but has some concerns regarding its derivation and application. The use of Value of Customer Reliability (VCR) as the metric for determining the economic circumstances of a sub-network and hence the value of an SRAS source is a major digression from past practice and so requires further explanation if the required level of stakeholder confidence is to be achieved. Further, the VCR appropriate for a system wide blackout is likely to be significantly different to that has been derived by AEMO. Specific observations are:

- > The analysis is complex and difficult to understand;
- > It claims to consider all relevant aspects, so obviates the requirement to consider sensitive loads

critical loads within the appropriate timeframe.”

(para 6.3.5);

> However, Table 5 in Appendix B of the Deloitte report (“Direct Connect VCR for each duration bracket”) appears to show little impact for the loss of a sensitive and economically important load such as Tomago smelter, anticipated to occur in the 3-6 hrs bracket.

Proposal: *For such a vital metric, a greater degree of clarity in its derivation and application is required to help ensure robust outcomes. Its effective use is pivotal to the function of the Reliability Panel. Therefore it is proposed that the Reliability Panel conduct regular reviews of VCR for each sub-network, to ensure that any changes to economic circumstances etc. are adequately reflected in the VCR figure applied.*

4. Further comments – issues with the Draft System Restart Standards

(a) Reference to “Supply” rather than “Load”

This issue have been raised by TransGrid previously in the submission to the Review of the SRS reference in the Appendix B of the Draft SRS:

“Implementation of the regional network restoration plans - including the need for meaningful and timely consultation with the TNSPs to review and revise the regional network restoration plans, and transition from one SRAS process to another - including that sufficient time is allowed for the revision of the plans, procedures and training of

The Executive Summary points out that *“the Standard does not specify the level of load (consumer consumption) that needs to be restored”*, referring to the Rules as the reason for this. TransGrid would contend that this is not a sound approach. By referring to the restoration of supply rather than load allows a disassociation from the ultimate outcome. A central aspect of the role of the Reliability Panel (and indeed the National Electricity Objective NEO) is customer load. Describing this as *“a procurement standard rather than an operational standard”* undermines the value of this standard to stakeholders. Although sect. 3.2.1 claims that *“In formulating the Draft Standard the Panel has considered the timings and expectations for the restoration of load on a regional basis”*, the outcome appears to be a considerable reduction in what was previously considered appropriate.

Acceptance of a standard that consciously avoids mentioning load is inappropriate. It is acknowledged that estimating load restoration times is difficult, but this can be determined from simulation studies with distributors and from knowledge of the power system transmission limitations that would apply during a restart. Since load restoration is the ultimate objective, its omission from the standard is not acceptable.

It is also noted that AEMO’s recent commentary on the derivation of the restoration curves³ indicates that *“Approximately five minutes is allowed to energise one transformer or one branch leading away*

³ AEMO, “System Restart: Restoration Curves & Generator Reliability – Information Sources and Methodology”, October 2016

operating staff prior to any change of the SRAS providers."

from the black start generator". This five minute window does not accurately reflect the time taken to assess the security of the power system, obtain stabilising load from the distribution network, or to coordinate the necessary telephone calls.

Proposal: *AEMO to work with TNSPs, DNSPs and Generators to establish realistic load restoration timeframes for different restart scenarios. These timeframes to be advised to the Reliability Panel, who will determine whether the outcome predicted is acceptable. This will form the basis of an "agreed" version for promulgation to JSSC / Energy Ministers and will include advice on the time it will take to restore sensitive and other key loads. (Note this proposal goes considerably further than that proposed under para 7.3)*

(b) System Risk

Section 2.1.3 discusses the causes of major supply disruptions, citing equipment failure or human error as initiating events. However, throughout Australia historically one of the major causes of system faults has been extreme weather events (demonstrated by the recent SA blackout), which is not mentioned. Changes in weather patterns are expected to lead to an increase in both frequency and magnitude of severe weather events, but this does not appear to have been factored into the analysis. Three factors point towards an *ongoing increase* in system risk:

- i. An increasing number of automated control schemes being used to push power systems closer to the edge of their operating envelope;
- ii. An ever-increasing amount of asynchronous generation; and
- iii. Anticipated changes to weather patterns, meaning a higher frequency of serious weather events.

Proposal: *The Reliability Panel to continually review "system risk" and report on current risk level and anticipated future trend.*

(c) Substation Batteries

Sect 7.1 proposes a review of the current standard for substation batteries, particularly from the perspective of maintaining a substation in a controllable state following an extended period of disconnection.

Proposal: *TransGrid supports this proposal and would be happy to assist the Panel in developing a standard to achieve this.*

(d) Reliable Communication Networks

Section 7.2 raises an important issue on how communication networks will behave under system black conditions and how essential communications will be maintained. This is a very important issue that has not been fully addressed by a number of key stakeholders.

Certainly a communications failure would be extremely detrimental to network restoration, so the only way to ensure that this does not happen is to develop and implement a communication standard.

Proposal: *The Panel to produce a standard for communications that will function independent of the transmission network and grid supplies.*