REPORT

TITLE: **Submission to AEMC Reliability Panel**
Review of Frequency Operating Standards for Tasmania
Response to 28th August Draft Report

TRANSEND INFORMATION

TRIM NUMBER	**D08/76199**
DATE	**3rd October 2008**
REVISION STATUS	**Original Issue**
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JOB/PROJECT NUMBER	**n/a**

EXTERNAL PARTY INFORMATION

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Document History and Status

Revision	Prepared by	Reviewed by	Approved by	Date approved	Revision type
R0	Andrew Halley Stephen Jarvis	Peter Clark	Michael Green	3rd October 2008	Original Issue

Distribution of Copies

Revision	Date of distribution	Quantity/format	Issued to
R0	3/10/2008	1 / E-mail	AEMC Reliability Panel website

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1 INTRODUCTION

Transend Networks has reviewed the AEMC Reliability Panel's Draft Report on proposed changes to the Tasmanian Frequency Operating Standards and is generally satisfied that it addresses the expectations documented by Transend in its initial submission.

The expectations were:

(a) That the Reliability Panel appropriately considers what opportunities may exist to simplify and coordinate the Tasmanian frequency standards to assist with their application in an operational environment;

(b) That any changes to the Tasmanian frequency standards can be practically implemented taking into account the design limitations of frequency dependant control schemes which Transend is either partially or fully responsible for; and

(c) That changes to the frequency standards should not constrain the Tasmanian network to a degree where elements cannot be taken out of service for maintenance, capital works or other such purposes.

The draft report makes clear the conceptual implementation of tighter frequency standards broadly in-keeping with the original Alinta Energy proposal. It is also obvious that a number of additional suggestions from other stakeholders have been recognised and factored into the preliminary recommendations. In Transend's opinion, the result is a workable platform from which to commence a concluding review prior to publication of the Reliability Panel's Final Determination.

Transend is of the view that the proposed standard is technically implementable.

In response to the Draft Report published on 28th August 2008, Transend would like to offer a series of technical observations and comments to both:

(a) Clarify its own interpretations as to the impacts of the proposed standards; and

(b) Outline a number of refinements for consideration by the Reliability Panel as part of its Final Determination now expected late November 2008.

As previously, should further information be required on any of the matters raised, Transend can be contacted and will assist wherever practical.

2 IMPACTS ON TRANSEND SYSTEMS

The three principal control systems operated by Transend that are affected by changes to the Tasmanian Frequency Standards are:

(a) Frequency Control System Protection Scheme (FCSPS);

(b) Under Frequency Load Shedding Scheme (UFLSS); and

(c) Over Frequency Generator Shedding Scheme (OFGSS).

Transend has undertaken system studies to understand what operational impacts result from the proposed changes to the Frequency Standards [5].

2.1 FREQUENCY CONTROL SYSTEM PROTECTION SCHEME

Transend believes that it is possible to modify the settings of the FCSPS to accommodate the proposed changes to the frequency standards.

The anticipated operational impact is that for some dispatch scenarios, an increase in the local Raise FCAS requirement occurs (in Tasmania) which can be managed either via constraint of Basslink import or provision of the additional FCAS to meet the increased need.

Transend has indentified a mechanism[1] (unrelated to the frequency standards) which assists with this issue. Discussions will be pursued in other forums to debate its merits with the affected stakeholders[2].

2.2 UNDER FREQUENCY LOAD SHEDDING SCHEME

Transend believes that it is possible to modify the settings of the UFLSS to accommodate the proposed changes while maintaining a suitably co-ordinated, robust system to manage non-credible contingencies.

There will however be a finite number of systems conditions for which it will not be possible to survive the loss of 60% of dispatched generation. Transend considers that the probability of these unlikely non-credible contingencies coinciding with the unfavourable system conditions which give rise to “black out” conditions, is very small (but still theoretically possible).

2.3 OVER FREQUENCY GENERATOR SHEDDING SCHEME

Transend believes that it is possible to modify the settings of the OFGSS to accommodate the proposed changes to the frequency standards. However, for some islanding events, Transend agrees with the Panel’s view that even with a revised OFGSS design, it will not be possible to form viable islands under all dispatch conditions.

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[1] If specific DC fault events can be declared non-credible under the definitions of the NER, then additional Basslink import capability can be realised. The issue is related to the delay time associated with FCSPS control actions which may vary from (approx) 220 milliseconds to 630 milliseconds. The impact of delayed FCSPS operation on local FCAS requirements is significant. Operational experience suggests that relatively fast FCSPS operations are by far more typical.

[2] NEMMCO, Basslink, and Hydro Tasmania

The operational impact is that while the bulk of the Tasmanian power system can be protected, activation of the OFGSS and generator over-frequency protection will mean that some islanded portions of the network will not be viable for various dispatch scenarios. Two obvious examples are Strathgordon and the West Coast of Tasmania. In order to comply with the islanded frequency standard, it may be necessary to restart these areas of the network after being disconnected during heavy power transfers into the main network.

2.4 TIMING OF CHANGES TO TRANSEND SYSTEMS

Transend believes that it may take up to six months to reconfigure the UFLSS, OFGSS, and FCSPS to accommodate the proposed changes to the Tasmanian Frequency Operating Standards.

If a final determination is made late November 2008 as per the proposed Reliability Panel timeline, Transend can not commit to having implemented the necessary changes earlier than 1st June 2009.

Transend is mindful that this timing may conflict with the expectations of Tamar Valley Power Station (TVPS). In Transend's opinion, it should still be possible to commission the new CCGT if the proponent can negotiate interim arrangements to mitigate power system security and connection issues.

While Transend will attempt to implement its changes as soon as practicable, it should be recognised that all affected stakeholders (notably Basslink, Hydro Tasmania, and NEMMCO[3]) must implement their respective changes in a coordinated fashion. There is little point in Transend changing its systems if other entities are unable to modify their systems in a complementary time frame.

RECOMMENDATIONS:

- A single entity is nominated to coordinate the timing of changes to all systems, processes and documentation; and
- The transition period for control system setting changes is kept as short as practicable to limit the risk of uncoordinated operation should the various system be called upon during this time.

[3] Transend notes that changes to the Tasmanian Frequency Operating Standards will require various NEMMCO systems and documentation to be appropriately updated, including the Market Ancillary Service Specification (MASS) used to define FCAS trapezium.

3 KEY OBSERVATIONS AND RECOMMENDATIONS

3.1 PRECISE DEFINITION OF A CONTINGENCY LIMIT

The concept of managing FCAS Raise requirements by the application of SPS type arrangements for large generator contingencies is acceptable to Transend. While such schemes complicate operation and analysis of the power system, the benefit from an FCAS perspective is obvious, especially for light inertia dispatch scenarios where FCAS requirements increase rapidly in a non-linear fashion.

The Reliability Panel Draft Report discusses limiting a generator contingency event to 144 MW through such mechanisms. Transend requests that this definition be tightened so as to specify in more specific terms the exact requirements for load shedding services. This would enable a TNSP to methodically assess the adequacy of a proposed scheme against fixed, tangible technical requirements.

The issue which needs to be addressed is the time delay between the loss of generation and the disconnection of contracted load. The volume of FCAS required to manage the event will be a function of this time delay.

Transend believes that the Reliability Panel should clearly specify its intent so as to avoid future interpretation issues. If the intent was to limit the FCAS R6 burden to no more than that required to manage a 144 MW generator contingency (for any given system operating condition), then wording to this effect is considered appropriate within the Frequency Standard.

RECOMMENDATION:

- Consideration should be given to specifying the contingency limit in terms of an equivalent FCAS requirement so that practical design calculations can be performed to assess the adequacy of a proposed load shedding solution[4].

3.2 DYNAMIC CALCULATION OF GENERATOR CONTINGENCY SIZE

The Reliability Panel has asked for comments on the form of the allowed generator contingency size. Transend is of the opinion that a variable contingency size limit, based on variables such as system inertia, system demand and Basslink power transfer, has technical merit and should be explored. However, the development of a robust and equitable technical solution is unlikely to be achievable within the time frame of this review. Transend agrees with the Panel that subsequent to the current review, development work be undertaken to improve the form of the generator contingency size limit.

RECOMMENDATION:

- NEMMCO be tasked with reviewing the form of the generator contingency size limit based on its previously documented work [2].

[4] Note that this would be just one consideration is determining the adequacy of a proposed solution. Voltage control in the region of load & generator shedding will also need to be considered given that there is potential for the two control actions to be physically remote from each other.

3.3 APPLICATION OF A 144 MW LIMIT FOR DIFFERENT CONTINGENCY TYPES

Within the Reliability Panel Draft Report, Appendix A Part B point (h) uses the term "largest single generator event…". This has been defined as "*a synchronisation of a generating unit of more than 50 MW or a credible contingency event in respect of either a single generating unit or a transmission element solely providing connection to a single generating unit…".*

Two issues are raised for consideration by the Reliability Panel:

(a) The use of the term *single generating unit*. This issue is addressed separately in Section 3.7 of this submission. Pre-emptively, the term *generating system* is used in its place for further discussions; and,

(b) The 144 MW limit will not apply to multiple generating units NOT part of a *single generating system* which are radially connected to the network.

The implications of this definition are:

Advantages	Disadvantages
Planned or unplanned network outages which result in multiple generating units being radially connected to the main transmission network are not affected by the 144 MW limit as the definition excludes *Network Events*. (N-1) FCAS constraint equations are enabled such that sufficient FCAS is procured from the market to manage whatever power transfers eventuate from each NEMDE solution during such operating conditions. Where insufficient FCAS is available, manual intervention by NEMMCO is necessary to maintain power system security.	There would appear to be no limitation imposed on the connection of multiple generating units to single transmission elements so long as they do not constitute a *single generating system*.

Table 1: Application of 144 MW generator contingency limit

There are existing situations in the Tasmanian power system where the *network event* has the potential to set the FCAS raise requirement. While historically, these events have been rare, the existing water storage situation and possible future generation developments could result in *network events* more regularly setting the raise requirement. This would reduce the value of capping the generator contingency size, and still result in NEMMCO needing to manually intervene to maintain power system security.

The issue raised by Transend, for consideration only, is whether this outcome was intended by the Reliability Panel and whether the issue of limiting FCAS requirements has been completely solved by the current proposal.

Transend offers the following questions for discussion:

(a) Should the 144 MW contingency limit also apply to *network events* which disconnect generation?

(b) How could planned and unplanned network outages be managed without significantly constraining generation more than currently required?

3.4 CO-ORDINATION OF OVER FREQUENCY GENERATOR TRIP SETTINGS

Transend is of the view that setting the upper limit of the *operational frequency tolerance band* to 52 Hz will require it to develop what is being termed the Over Frequency Co-ordination Scheme (OFCS). The scheme will consist of two principle components:

(a) The Tasmanian Over Frequency Generator Shedding Scheme (OFGSS), which is a Transend asset and designed to maintain power system frequency within the limits specified by the frequency standard following non-credible contingency events; and

(b) Over-speed protection settings on generating units as negotiated under the provisions of NER S5.2.5.3 (Generating unit response to frequency disturbances).

The need for definitive coordination between the two components will increase as more generators (likely to be thermal and wind based) request trip settings in the range 52 to 53 Hz (expected). Transend is mindful of the requirements of NER S5.2.5.3(d)(2) which states that a consideration in negotiating an access standard is that "*the frequency would be unlikely to fall below the lower bound of the operational frequency tolerance band as a result of over frequency tripping of generating units*".

The risk of "under shooting" is now considered higher given that the upper limit of the *operational frequency tolerance band* has been decreased by 1 Hz (53 Hz to 52 Hz) and the lower limit increased from 47.5 Hz to 48 Hz.

In principle, the OFCS will take account of OFGSS and existing over-speed settings (for generators already connected to the network) and use this as a basis for determining acceptable trip settings for new entrants. This will occur as part of the connection agreement process.

The conceptual arrangement is shown in Figure 1.

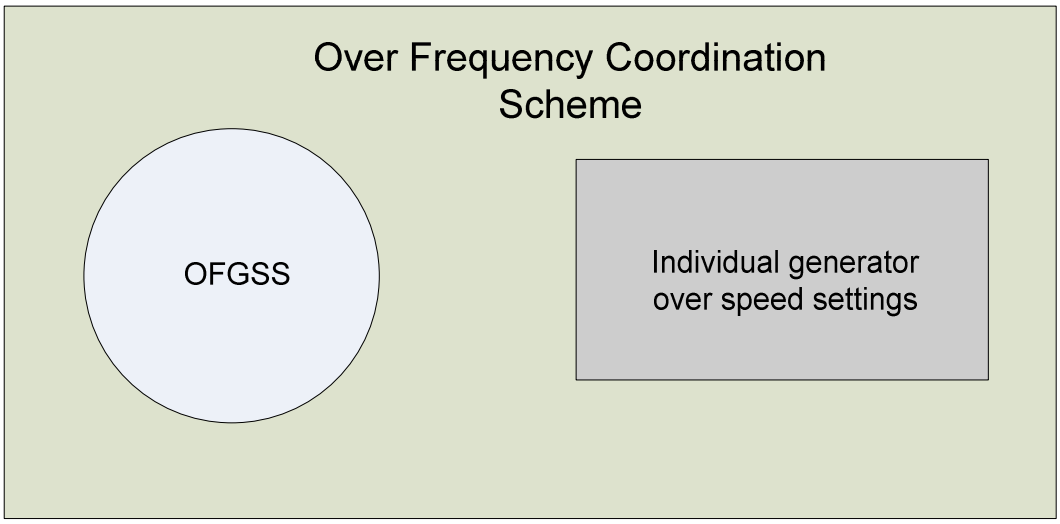

Figure 1: Conceptual arrangement of Over Frequency Coordination Scheme

3.5 CONTINGENCY LIMIT FOR SYSTEM LOADS

The focus of the Reliability Panel Draft Report has been very much on the loss of generation and the resulting Raise FCAS requirements (and associated issues).

Given that the Reliability Panel has adopted the approach of setting a maximum contingency size for generator events, it would also seem appropriate to give consideration to a maximum contingency size for loss of network load. While it is acknowledged that provision of R6 is generally more of an issue than L6, managing over frequency events can also be difficult for various system operating conditions (especially for light load scenarios having low dispatched inertia)[5].

Such a specification would also be extremely useful for network planning and design purposes as it sets a clear constraint in both directions.

While this is not a significant issue for the current Tasmanian network, Transend believes that its relevance will increase if more low inertia generators are connected to the system. Consideration of the maximum load that may be disconnected for a single credible contingency may be a topic for consideration in a future review.

3.6 ACCUMULATED TIME ERROR

Although raised as an issue in our original submission, Transend has no particular concerns with the pragmatic approach adopted by the Reliability Panel in regards to time error. Management of a ±15 second deviation for credible contingency events is consistent with existing arrangements.

3.7 DEFINITION ISSUES

Transend has reviewed Part D of Attachment A in the Reliability Panel Draft Report and offers the following comments:

(a) Generation Event

The definition is stated in terms of a "*single generating unit*". Transend suggest that there would be benefit in defining a generation event in terms of a "*single generating system*" so that installations involving multiple generating units that are operated essentially as a single entity are adequately captured by the definition. Wind farms and some CCGT installations will fall into this category.

(b) Network Event

Transend's understanding is that since a load event is not specifically excluded from the definition, it would become part of a network event. Transend believes that the definition of a network event should explicitly *exclude* load events so that a separate load event definition is still applicable. A separate definition is required so as to capture scenarios including Basslink reversals and the deliberate switching of customer load blocks.

[5] R6 and L6 are equivalent to Fast Raise and Fast Lower FCAS which are both assessed over a 6 second time frame.

4 CONCLUSION

Transend is of the opinion that it could modify its systems to accommodate the proposed changes to the Tasmanian Frequency Operating Standards without an unacceptable increase in operational risk.

5 REFERENCES

[1] AEMC Reliability Panel; "*Tasmanian Frequency Operating Standard Review - Draft Report – 28th August 2008*"

[2] Brian Spalding (NEMMCO); "*NEMMCO Final Advice on Tasmanian Frequency Operating Standards*", 26th August 2008

[3] Michael Green (Transend submission to first round consultation); "*Review of Frequency Operating Standards for Tasmania*", 23rd May 2008

[4] Michael Green (Transend supplementary submission to first round consultation); "*Review of Frequency Operating Standards for Tasmania – Supplementary Submission*", 7th August 2008

[5] Andrew Robbie (PSC); "*Tasmanian Under Frequency Load Shedding and Over Frequency Generator Shedding Specification*", October 2008.