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ACRONYMS

AEMC	Australian Energy Market Commission
FCAS	Frequency Control Ancillary Services
FCSPS	Frequency Control System Protection Scheme
HT	Hydro Tasmania
MASS	Market Ancillary Service Specification
MNSP	Market Network Service Provider
NEMDE	National Electricity Market Dispatch Engine
NEMMCO	National Electricity Market Management Company (Ltd)
NER	National Electricity Rules
NOCS	Network Operations Control System
OFGSS	Over Frequency Generator Shedding Scheme
TNSP	Transmission Network Service Provider
UFLSS	Under Frequency Load Shedding Scheme

1 INTRODUCTION

Transend Networks wishes to acknowledge the timeliness of the AEMC Reliability Panel's review as per the stated intentions documented in [1] and is pleased to submit its initial comments on proposed changes to the Tasmanian frequency standards.

As the Tasmanian Transmission Network Service Provider (TNSP), Transend Networks does not have a definitive opinion on whether the frequency standards should be altered or not. While it is attuned to arguments both for and against, Transend does not believe it appropriate to express firm views on matters which have no direct impact on its own obligations and statutory requirements, most of which are limited to matters of safety, system security/operations and compliance management in accordance with the National Electricity Rules (NER).

As such, Transend's principal expectations of the Reliability Panel's review are restricted to the following:

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. Anomalies presently exist which could potentially be addressed during the current review, e.g.: definition of Lower FCAS capability utilising a test signal based on a maximum frequency excursion of 51 Hz while dispatch of Lower FCAS for some contingency events requires consideration of operation up to 53 Hz, and application of different stabilisation times for contingency events which essentially have the same impact on power system operations;

b. That any changes to the Tasmanian frequency operating 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, including:

    i. Tasmanian Under Frequency Load Shedding Scheme (UFLSS);

    ii. Tasmanian Over Frequency Generator Shedding Scheme (OFGSS);

    iii. Basslink Frequency Control System Protection Scheme (FCSPS);

c. That change 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.

This document presents a summary of issues identified by Transend which it believes should be taken into account by the AEMC Reliability Panel as part of its review process. Should further information be required on any of the matters raised, Transend can be contacted and will assist wherever practical.

2 AFFECTED CONTROL SCHEMES

2.1 UNDER FREQUENCY LOAD SHEDDING SCHEME (UFLSS)

The Tasmanian UFLSS is divided into seven blocks and currently operates between the range 47.4 Hz to 46.1 Hz. It has been designed to maintain frequency above the lower limit of the "*separation"* and "*multiple contingency event"* bands for severe generation deficit scenarios. This includes loss of Basslink import and subsequent FCSPS failure. The first two blocks include df/dt elements which are intended to trip loads at higher frequencies if the rate of change is high and pre-emptive control action is warranted.

Transend has undertaken preliminary studies to ascertain whether a viable UFLSS can be developed having only a 1 Hz operating band (as per the Alinta Energy submission). "Proof of concept" studies suggest that detailed design investigations are warranted as a workable solution appears probable. Once an initial determination on Tasmania's future frequency standards is made available by the Reliability Panel, additional work is considered necessary to formalise the concept studies into a final, approved design.

The detailed design will need to take account of the following additional issues:

a. Impact of further wind developments in Tasmania. One of the principal considerations is the potential impact of light inertia dispatch scenario's either more severe than presently experienced or at least more regular in their occurrence. Another consideration is the displacement of synchronous generating units that may at present provide FCAS, either via the FCAS markets or in the form of "free rider" control action[1]. As both forms of fast frequency control are expected to decrease with increasing wind injection, the future robustness of the UFLSS design needs to be considered;

b. Various assumptions regarding circuit breaker opening times need to be re-validated especially for blocks one, two and three which may experience higher rates of frequency change than blocks lower in the tripping order. As setting separation is likely to be reduced to no more than 0.2 Hz for the first three blocks, delays in tripping may create significant discrimination issues;

c. It is necessary to confirm that adequate coordination exists between the Basslink FCSPS and UFLSS under a wider range of operating scenario's than was possible during the preliminary studies.

As NEMMCO will ultimately be required to approve the UFLSS settings, it is anticipated that both Transend and NEMMCO will work together on a detailed design once a draft determination is available from the Reliability Panel on which to base the investigations.

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[1] Dealing with "free rider" control action is a subject of some debate. The most onerous design criterion is to ignore any such contributions and accept that "some" is likely to be provided in practice (but not guaranteed). Any such contributions act as an additional design safety margin in addition to what may already have been factored in. In an environment where even free rider control action is limited, more serious consideration needs to be given to the specification of design safety margins, as this may be the sum total of what is available in practice.

2.2 OVER FREQUENCY GENERATOR SHEDDING SCHEME (OFGSS)

The Tasmanian Over Frequency Generator Shedding Scheme (OFGSS) was initially designed to primarily manage islanding events on the West Coast and at Strathgordon where significant generation could be instantaneously "stranded" along with a much smaller load. Once Basslink commenced operation, the OFGSS became a backup for the FCSPS, covering its partial or complete failure under export conditions. It now seems certain that the scope of the OFGSS will be expanded to include generators who require negotiated access agreements under NER S5.2.5.3 (noting that the technical intent of the OFGSS does not change).

As with the UFLSS, preliminary "proof of concept" studies have been undertaken by Transend. The key findings from the initial studies were:

a. Discrimination between the FCSPS and OFGSS could be achieved;

b. Any new thermal plants requiring to be tripped above the upper limit of the "*network event*" band would need to be properly coordinated into the OFGSS to ensure that the provisions of NER S5.2.5.3 (d)(2) could be satisfied[2];

c. Coordinated tripping of *multiple* generating units all having trip settings in the immediate vicinity of 52 Hz will be problematic unless sufficient margins can be established, either in terms of a frequency and/or time delay offset.

As with the UFLSS, preliminary results suggested that more detailed design work is warranted and that practical solutions are probable. The initial findings will need to be rigorously tested once a draft determination on future frequency standard is available on which to base such studies.

Detailed design work should consider the following issues:

a. Impact of further wind developments in Tasmania (as for UFLSS);

b. The variation in outcomes depending on the availability of fast lower FCAS from thermal plant which participates in the OFGSS;

c. The size and/or preferred type of margin required between generating unit trip settings to achieve adequate discrimination and thereby prevent gross over tripping (leading to under frequency load shedding);

Issue (c) is considered significant given that the NER is specific on the terms and conditions for negotiating access standards with affected generators. The hypothetical situation of concern is as follows:

a. The Tasmanian frequency standards are modified such that larger frame size thermal units can satisfy at least the minimum access standard (ref NER S5.2.5.3) and therefore commence negotiations for connection;

2 Which basically stipulates that no load shedding can occur following tripping of generating units in response to over frequency conditions.

b. The vast majority of units available from reputable manufacturers will all meet a similar standard. It is foreseeable that the frequency band between 52.0 Hz and 52.5 Hz could become congested with units needing to be tripped due to limited over speed capability;

c. Initial applications will most likely be accommodated however a point will eventually be reached where subsequent applicants are forced to negotiate higher (or more delayed) trip settings, possibly out to or beyond the capability of plant;

d. The result may be that new entrants are not able to negotiate a workable outcome and cannot be connected even after changes to the frequency standards are made.

This situation may not lead to a least cost, maximum benefit solution from a network operation (or market) perspective.

Transend is very mindful of this situation given the relative size of the Tasmanian network and the prospect of several large thermal units being connected in the near future. It should be noted that absolute unit size is not the only consideration, as multiple smaller units all requiring to be tripped in a similar frequency range would create the same basic issue.

Transend believes that the Reliability Panel should consider the issue of "congestion" (in the realms of OFGSS operation) and explore what opportunities may exist to manage such situations via established market processes. A concept to consider is the application of constraint equations to limit the total dispatched output of affected plant to within the capability of the network *at the time*. While Transend acknowledges that this is not strictly related to the current review of the Tasmanian frequency standards, it is believed to be an issue worthy of consideration in parallel.

2.3 BASSLINK FREQUENCY CONTROL SYSTEM PROTECTION SCHEME (FCSPS)

The Basslink FCSPS was designed to facilitate higher power transfers between Tasmania and Victoria than would have otherwise been possible if only governor control systems were available to manage frequency excursions following a trip event. As Basslink is treated as a single credible contingency, Tasmanian frequency must remain within the "*network event*" band after disconnection from the mainland. This is practically achieved by tripping generators or contracted loads depending on the direction of power transfer. Tripping requirements are calculated dynamically and generators / loads are armed / disarmed as required via Transend's NOCS.

As the FCSPS was designed based on the existing frequency standards, the impact of compressing the "*network event*" band needs to be carefully considered. Preliminary studies have suggested that coordination can be achieved between the OFGSS, UFLSS and FCSPS however more rigorous studies across a wider range of operating conditions will be required as part of the detailed design review phase. Issues are similar to those already outlined above:

a. Impact of future wind developments on overall system response characteristics;

b. The appropriateness of safety margins applied during the original FCSPS design and justification of safety margins to be used going forward noting the reduced frequency range now available;

c. A review of whether sufficient load and generation is currently available to the FCSPS to facilitate maximum Basslink transfers under all foreseeable network operating conditions;

It should be noted that it is not Transend's responsibility to source additional generation or load if this is deemed as necessary to relieve constraints on Basslink flow. Transend will however attempt to maximise Basslink flows using the existing volumes of generation and load presently available to the FCSPS.

Initial observations suggest that some redesign of the FCSPS may be required. Again, once a draft determination on future frequency standards is available from the Reliability Panel, detailed investigations will be initiated.

2.4 IMPLEMENTATION OF CHANGE

Transend wishes to highlight that before any changes to the Tasmanian frequency standards can take affect, the following activities will need to be completed:

a. Setting studies for each of the control systems aforementioned;

b. Due diligence and approval by NEMMCO; and

c. Physical application of the settings in the field.

3 OTHER CONSIDERATIONS FOR THE RELIABILITY PANEL

3.1 POTENTIAL MODIFICATIONS TO PROPOSED FREQUENCY STANDARDS

3.1.1 REMOVAL OF DEDICATED LOAD EVENT BAND

Transend Networks has identified a potential opportunity to simplify the Tasmanian frequency standards which it believes the Reliability Panel can consider as part of the current review. The opportunity involves amalgamation of the "*load event*" and "*network event*" bands.

Such a move could achieve the following:

a. Closer alignment of the Tasmanian and mainland frequency standards in terms of the number of separate "bands" defined in each standard;

b. Simplify application of the standard (both in real time operation as well as system planning);

c. Remove the inconsistency whereby the calculation of FCAS lower capabilities is based on a 51 Hz test signal, while some contingency events allow for operation up to 53 Hz (thereby invoking a larger governor response from generators providing an FCAS lower services)[3]. The situation is presently being managed via application of a scaling factor in affected constraint equations[4]. The scaling factors reduce the FCAS requirement down to "match" the service provider capabilities determined in accordance with the Market Ancillary Service Specification [3] using the 51 Hz test signal;

In terms of practical application of the "*load event*" band, Transend's current assessment is as follows:

a. Sufficient Lower FCAS is being dispatched by NEMMCO to manage loss of the largest **single** load block to within the defined 51 Hz limit **should a sudden disconnection of that load block occur**;

b. This requirement by default provides sufficient FCAS to control all foreseeable **switching events** that require lower services, including the deliberate removal of load blocks from the network, as well as step changes in Basslink power transfer resulting from movement in and out of the "no-go" zone;

c. While not obvious in current constraint equations, NEMMCO must also ensure that at least 49 Hz operation is maintained for **switching events** requiring FCAS Raise services, for example when Basslink transfers to the "no-go" zone from import[5];

The issue under consideration by Transend is whether any benefit is derived from continued application of the "*load event*" band in Tasmania, especially if the upper and lower frequency limits for single contingency events are reduced to 52 Hz and 48 Hz respectively (as proposed by other review submissions). Issues identified to date are:

a. It is recognised that some mechanism must exist to prevent large loads being connected radially to the network (most likely proposed by the developer as a cost reduction mechanism)[6] without some form of

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[3] The quoted frequencies relate to the existing Tasmanian frequency standard.

[4] See the Tasmanian constraint equation "F_T+NIL_TL_L6 " as an example.

[5] In the context of this document, import is MW flow *to* Tasmania from Victoria, export is MW flow *from* Tasmania to Victoria.

mitigation which reduces the impact on the network for a single contingency event. At present, Transend and NEMMCO reserve the right to refuse radial connections where the resulting FCAS burden would be excessive and beyond the capability of the network to manage (either all or part of the time). This assumes that the load is **non-scheduled** and is therefore unable to be constrained in some way, i.e.: is "uncontrollable" from a system operations perspective. Practical experience suggests that few large load customers are willing to vary their demands in response to network conditions;

b. Overall quality of power supply must not be degraded as a result of removing the "*load event*" band from the standard, noting that some customers may operate plant and equipment sensitive to frequency variations. The size of the Tasmanian network is a factor as well as the inherent technical limitations that exist when FCAS support is not available via Basslink;

c. There must be some cost associated with adhering to the existing "*load event*" band. This figure is unknown to Transend at the present time hence it is difficult to provide any cost/benefit analysis to justify removal or maintenance of the band from an economic perspective.

Should the "*load event*" band be amalgamated into the "*network event*" band, the following outcomes appear feasible from first assessments (without detailed calculations in support):

a. Transend and NEMMCO retain their right of refusal for radially connected loads who are unwilling or unable to vary their demand in response to network conditions (notably insufficient FCAS) by application of the "*network event*" band. The current proposal tabled by Alinta Energy is to reduce the upper limit of this band from 53 Hz to 52 Hz making such a change more credible. The definition of a "*network event"* may need to be expanded to properly encapsulate what scenario's now apply:

   i. Disconnection of load as a result of a credible single contingency within the interconnected network[7], e.g.: loss of a single transmission or distribution circuit, loss of a transformer, etc;

   ii. Disconnection of the largest single load block as a result of a credible contingency event;

   iii. Deliberate switching of load by a market participant;

   iv. Rapid changes in power flow by a HVDC link to or from 0 MW to facilitate starting, stopping or reversing of its power flow;

   Under most circumstances, items (ii to iv) become redundant *from a frequency control perspective* as scenario (i) will usually set the FCAS requirement in Tasmania. This should simplify FCAS dispatch.

   In a future scenario where a market participant normally supplied via multiple elements (and therefore not normally responsible for setting the FCAS lower requirement) expresses a desire to voluntarily switch load which *would* set the FCAS requirement, then this situation could be managed via the connection agreement, i.e.: "load can only be switched following approval by NEMMCO and is subject to the

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[6] Note that this only becomes an issue for the connection of large generation plant when the defined minimum operating limit is above that which the network could foreseeably control following a single contingency event. Under all other scenario's, provisions exist within the market to maintain power system security via application of dispatch constraints given that large generation plant must be scheduled.

[7] The definition should clarify that credible contingency events include all plant and equipment connected to the network, irrespective of ownership, i.e.: applies as much to privately owned equipment as that owned and operated by the TNSP;

availability of sufficient FCAS". Approval could be given after the appropriate constraint set is activated and sufficient FCAS is procured from the market (most likely on a temporary basis). As such switching events are unlikely to be a regular occurrence, this "manual" control measure may be sufficient. In a small system such as Tasmania, it is possible that voltage control considerations will be more onerous and inherently limit the maximum load block size anyway;

b. Load based events capable of causing under frequency could simply adhere to a minimum operating level corresponding to a "*generation event*", i.e.: 48 Hz as proposed;

c. As there is no requirement to control frequency to some intermediate level dependant on the nature of how the network load variation occurs, the Market Ancillary Service Specification (MASS) could be updated so that the test signal used for calculation of FCAS lower capabilities aligns with the actual frequency attempting to be controlled in practice. This will enable removal of the scaling factors presently inserted into various constraint equations (as discussed previously);

3.1.2 NOTE FOR GENERATION EVENT BAND

There was an initial temptation to examine the combination of the "*generation event*" and "*network event*" bands as defined in Table 2 (on page 15). This would have allowed frequency to reach a maximum of 52 Hz during the transient recovery process following loss of a large generator. In retrospect, maintaining a marginally lower limit of 51 Hz prevents the remote possibility of inadvertent generator shedding if frequency was to rise above 52 Hz, albeit for only fractions of a second.

In practice, Transend is not aware of any significant issues in controlling frequency overshoot following the loss of a large generating unit. Maintaining the existing 51 Hz limit would therefore seem appropriate.

3.1.3 MODIFICATIONS TO STABILISATION AND RECOVERY TIMES

Two issues have been identified which could be addressed with appropriate changes to the stabilisation and recovery times as proposed by Alinta Energy (which are largely as per the current standard). A third issue must be recognised and carried over from the Reliability Panel determination from May 2006 (and is discussed first):

a. The stabilisation and recovery times associated with the **existing** "*load event"* band allow for operation in the range 49 to 51 Hz for up to 10 minutes. This determination was in response to a submission by Rio Tinto (previously Comalco) to the Tasmanian Reliability Panel which identified that time delays associated with dispatching sufficient regulating FCAS[8] was adversely affecting its business. The proposal by Rio Tinto was specifically discussed and supported by NEMMCO in its advice to the Reliability Panel in January 2006 [4]. The increase in allowable time from 5 minutes to 10 minutes to recover to within the "*normal operating frequency band"* provided NEMMCO with an additional dispatch interval to procure more regulating FCAS (from the market) without breach of the frequency standards in the meantime.

[8] To manage major load changes within their operations…

This change created somewhat of a precedence whereby operation of the network in the range 49 to 51 Hz for up to 10 minutes was deemed as acceptable from a power quality perspective.

If the Reliability Panel consider amalgamation of the "*load event*" and "*network event*" bands, this earlier determination needs to be taken into account. One possible mechanism to achieve this is to maintain the 10 minute recovery period (for restoration to the "*normal operating band"*) and inserting an appropriate 5 minute stabilisation requirement to cater for larger contingency events. Possible options for stabilisation and recovery times for "*network events*" are presented in Table 2;

b. NEMMCO identified in their submission to the Reliability Panel in January 2006 that "*there have been many occasions when the frequency has not recovered to within the normal operating frequency band within the 5 minutes specified in the frequency operating standards and this continues to be the main difficulty with frequency control in Tasmania*".

NEMMCO went on to correctly identify the cause of the issue as (a) the relative size of the largest loads and generating units as a proportion of Tasmanian demand, and (b) the inability of delayed frequency control ancillary services to assist with recovery unless the frequency exceeds the relevant thresholds.

Point (b) is significant as the majority of delayed FCAS available within Tasmania is provided by generators via their governors. For a speed droop governor, a speed error is required to increase or decrease the machine output away from its initial set point. This is the basis of its operating characteristics. A 4% droop setting (which is typical) requires there to be a 4% change in speed to vary the machine output by 100%.

Depending on the number of generating units dispatched and the resulting distribution of system imbalance around the available units not already at operating limits, it is completely foreseeable that steady state frequency errors in the order of 0.15 to 0.4 Hz will result from a significant contingency event. It is only through the provision of regulating FCAS (utilising a secondary control system[9] external to the governor) that the speed error can be reduced back to zero.

Noting this issue and linking it with comments already provided in point (a), Transend considers that there is value in the Reliability Panel investigating the possibility of applying less onerous stabilisation and recovery times for all defined frequency bands as suggested in Table 2. It is noted that this has the potential to impact on time error control. This issue is discussed separately in a proceeding section of this report.

c. The need for a difference in stabilisation times for a "*generation event*" and "*network event*" is questioned once the outer limits are reduced to 48 and 52 Hz. With reference to the current frequency standard, it can be argued that whether a network event or generation event causes the frequency to fall to 47.5 Hz, there should be little practical difference in the stabilisation requirements. Currently, the loss of generation as a result of a "*network event"* requires frequency to recover to 49.0 Hz within 1 minute, while loss of generation which satisfies the specific definition of "*generation event*" requires frequency to only recover to the *normal operating band* within 5 minutes.

[9] Which is AGC (Automatic Generation Control) and is operated by NEMMCO.

Transend would like to see this investigated to ascertain whether such issues are still justified in their existence. Again, a possible option is presented in Table 2;

3.1.4 IMPACTS OF POTENTIAL CHANGES ON ACCUMULATED TIME ERROR

While modifications to the stabilisation and recovery times are considered to have merit from an operational flexibility view point, the trade off is that accumulated time error could theoretically increase. Theoretical impacts are outlined in Table 1, as are the time errors associated with each of the existing frequency standards.

	Potential TAS Standard (Table 2)	Existing TAS Standard	Existing Mainland Standard
Accumulated Time Error Limit	To be determined	15 seconds	5 seconds
Time error that results from operation at maximum frequency limits for maximum defined times[10]			
Load Event	Not defined	12 seconds	3 seconds[11]
Generation Event	18.0 seconds (↑)	15 seconds	
Network Event	18.0 seconds (↑)	7.8 seconds	3.6 seconds
Separation Event	26.4 seconds (↓)	33.6 seconds	7.2 seconds
Multiple Contingency Event	26.4 seconds (↓)	33.6 seconds	12 seconds

Table 1: Accumulated time error (maximum contributions resulting from defined frequency events)

The following should be specifically noted:

a. The numbers provided in Table 1 are based on step changes in frequency from one operating level to another (at the specified times) and are therefore unrealistically onerous. The numbers have been calculated in this way for comparison purposes only so as to show the relative differences between the standards as currently defined;

b. In practice, the accumulated time error for any particular contingency event will be smaller than that indicated given that frequency will recover to intermediate operating levels much faster, i.e.: frequency will not remain at 48 Hz for 5 minutes following loss of a large generator and would most likely recover to above 49.0 Hz within one or two minutes of the event occurring. Even a slow near-linear recovery over the full 5 minutes would still result in a accumulated time error less than that indicated;

Transend would simply like to highlight that the defined accumulated time error limit will need to be reviewed should changes to the stabilisation and recovery times occur.

[10] The times quoted are the additional error that would be added to whatever had already been accumulated prior to the contingency event occurring.

[11] Note that the mainland standard groups both generation and load events into one symmetrical frequency band with limits ±0.5 Hz.

3.1.5 Ongoing application of a separate "island" frequency standard

As part of the Reliability Panels review, Transend believes that there is an opportunity to consider the ongoing need for a separate frequency standard for application to electrical islands *within* Tasmania.

It should be clearly noted that the "*separation event*" band and "*island*" frequency standard are applied differently is Tasmania compared to the rest of the NEM. The inconsistency has caused some confusion in the past and is largely as a result of two "special circumstances" which exist within the Tasmanian network. The two circumstances are:

a. Loss of both Farrell to Sheffield 220 kV circuits which islands the West Coast of Tasmania;

b. Loss of both Gordon to Chapel St 220 kV circuits which islands the small community of Strathgordon;

Other potential scenario's exist where generation and load can become islanded together however these two circumstances are the most widely referenced given the possibility of loosing both circuits simultaneously under various scenario's (albeit non-credible). The intended application of the existing standards was believed to be as follows:

a. The greater portion of the remaining network would be controlled in accordance with the "*separation event*" band, i.e.: the bulk of the remaining Tasmania system after disconnection of the West Coast or Strathgordon;

b. The "island" would adhere to the islanded frequency standards;

Therefore, the "*separation event*" band does not apply when Tasmania is disconnected from the rest of the NEM and the island frequency standard does not apply to Tasmania while disconnected from the NEM. Both points are in contrast to the mainland frequency standard which applies the alternate meanings.

The current Reliability Panel review has the opportunity to review the ongoing application of the islanded frequency standard in Tasmania as well as clarify the use of the "*separation event*" band. While application of the standard for the two circumstances given above can be described with some clarity, it is not as clear how the standard would be applied in other less obvious circumstances, e.g.: Tasmania splitting into two roughly equivalent islands as a result of a north / south network separation at Palmerston switchyard. Which parts of the standard apply to the northern section of the network and which apply to the south?

Whether the island standard is required at all is another potential consideration. If frequency cannot be retained within the "*multiple contingency event*" limits, could it be appropriate to simply rely on protection systems to "take the island black", with a "best endeavours approach[12]" adopted if the island can be re-energised and operated independently prior to resynchronisation back into the main network?

This issue is raised given ongoing uncertainties with application of the existing standard as well as the observation that the island frequency standards proposed by Alinta Energy are not vastly dissimilar to those proposed for the case of interconnected operation.

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[12] Best endeavours could be interpreted as: "maintaining operation in accordance with the frequency standard as far as practically possible utilising what generation and FCAS sources may be available, but ultimately not outside the multiple contingency band limits".

3.2 RESULTING MODIFIED FREQUENCY STANDARD FOR CONSIDERATION

The modified Tasmanian frequency standard for an intact network that would result if all considerations documented by Transend are adopted is provided in Table 2.

Accumulated Time Error	To be determined		
Condition	**Containment**	**Stabilisation**	**Recovery**
No contingency or load event	49.85 to 50.15 Hz, 99% of time 49.75 to 50.25 Hz, remainder	49.85 to 50.15 Hz within 5 minutes	
Generation Event	48.0 Hz to 51.0 Hz	49.0 Hz to 51.0 Hz within 5 minutes	49.85 to 50.15 Hz within 10 minutes
Network Event or Load Event	48.0 Hz to 52.0 Hz	49.0 Hz to 51.0 Hz within 5 minutes	49.85 to 50.15 Hz within 10 minutes
Separation Event	47.0 Hz to 55.0 Hz	48.0 Hz to 52.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes
Multiple Contingency Event	47.0 Hz to 55.0 Hz	48.0 Hz to 52.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes

Table 2: Potential modifications to proposed Tasmanian frequency standard (intact network)

As a result of a contingency event (either credible or non-credible) that results in the Tasmanian network forming electrical islands, the frequency standard applicable to each island *as soon as it is formed* could be as shown in Table 3. Whether the islanded standard is required at all has also been raised for consideration.

Accumulated Time Error	No specification		
Condition	**Containment**	**Stabilisation**	**Recovery**
Initial operation in response to separation event	47.0 Hz to 60.0 Hz	48.0 Hz to 52.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes
No contingency event	49.0 Hz to 51.0 Hz		
Generation Event	48.0 Hz to 52.0 Hz (Note 1)	49.0 Hz to 51.0 Hz within 10 minutes	
Network Event or Load Event	48.0 Hz to 52.0 Hz (Note 1)	49.0 Hz to 51.0 Hz within 10 minutes	
Multiple Contingency Event and/or Next Separation Event	47.0 Hz to 60.0 Hz	48.0 Hz to 52.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes

Table 3: Tasmanian frequency standards for defined viable islands

Note 1:

Where it is not feasible to schedule sufficient FCAS to limit frequency excursions to within the stated limits, operation of the UFLSS or OFGSS is acceptable on occurrence of a further contingency event.

3.3 FCAS ISSUES TO CONSIDER AS PART OF STANDARDS REVIEW

A number of issues have been identified by Transend in respect to the availability and procurement of FCAS to support the proposed changes in frequency standard. Other issues outlined below may not be directly related to the proposed changes but are seen as valid considerations as part of the broader issue of frequency control in Tasmania.

As per Reliability Panel's invitation to "*identify any important factors that should be considered in the Panel's review of the standards*…", Transend has prepared a list of issues which it believes are significant and should be addressed during the process.

a. Tightening of the standard will reduce the maximum size of credible contingency events that can be controlled under certain operating conditions, notably during periods when Basslink is unable to transfer FCAS from mainland sources. Availability of sufficient Fast Raise and Lower FCAS is likely to be a dominant issue. Considerations in the proposed cost benefit analysis should therefore include:
   i. The expected changes in FCAS requirements for existing and possible future single credible contingency events;
   ii. Direct impacts on existing market participants within Tasmania;
      - Industrial customers already operating on radial connections;
      - Basslink, notably its ability to be reversed and the need for local FCAS in Tasmania to compliment the FCSPS for Basslink contingency events;
      - Existing generators which may be forced away from preferred operating targets to provide the additional FCAS;
      - Potential for increases in FCAS costs and the impact this may have on distribution network service providers (in particular) who may have limited opportunity to offset price rises with FCAS earnings;
   iii. The amount of time that operating constraints may bind, noting that Fast FCAS requirements are strongly influenced by both Tasmanian system inertia and load demand which are both variables in the time domain;
      - Impact on Basslink transfers if more global FCAS is required to support Tasmanian contingencies;
      - Consideration as to whether 1 MW of Basslink spare transfer capacity equates to 1 MW of available FCAS? Given that Basslink is able to vary its power transfer very rapidly in response to frequency deviations, the availability of 1 MW could be worth up to 2 MW in the FCAS domain (see Ref [3] and apply FCAS capability test as defined). The correct definition of capabilities will be important in a constrained market;
   iv. What opportunities exist to increase the volumes of Fast Raise and Lower FCAS capability within Tasmania?

- What can be achieved by encouraging the introduction of thermal plant which is typically very good at providing such services? What are the intentions of Alinta Energy and what capability could be available from this plant as a relevant current example (especially provision of fast lower FCAS);
- Is there a meaningful way of undertaking a risk/benefit analysis to assess this issue, i.e.: risk of changing standard on premise of increased FCAS capability that does not eventuate?
- Is the voluntary nature of the FCAS markets problematic even when it is recognised that a registered generator can eventually be directed by NEMMCO if necessary?
- What reliance will be placed on market forces to correct for any initial shortfalls in FCAS? As an example, no loads are currently registered to provide FCAS Raise services even though demand side response is a perfectly acceptable mechanism of doing so.

b. Tightening of the frequency standards will likely result in a reduction in FCAS capability as provided by generator governor systems. As the allowable speed error is reduced, the induced change in machine output will also reduce. What is the magnitude of this reduction and is it significant to network operations?

c. Robustness of existing market systems to manage potential constraint conditions:

   i. Probability of increased human intervention to manage system security?

   ii. Increased probability of FCAS constraint violations with new standards?

   iii. Are existing techniques used to manage such situations optimal or should alternatives be explored?

d. Compensation to Market Network Service Providers (MNSP's) for the transport of FCAS;

e. Obligations on MNSP's (via the Rules) to provide and maintain frequency control capability on asynchronous interconnectors.

4 REFERENCES

[1] Australian Energy Market Commission, AEMC Reliability Panel; "*Tasmanian Reliability and Frequency Standards – Determination*", 28th May 2006;

[2] NECA Reliability Panel; "*Frequency Operating Standards – Determination*", September 2001;

[3] NEMMCO; "*Market Ancillary Service Specification – Version 1.5*", 27th February 2004;

[4] NEMMCO; "*Reliability and Frequency Operating Standards for Tasmania – NEMMCO's Advice to the Reliability Panel*", 24th January 2006;

[5] Hill Michael, Transend Networks; "*Frequency Standards Development – Final Report to Alinta Power*", 10th December 2007;