

AEMC Reliability Panel

**Tasmanian Frequency Operating Standard
Review**

Draft Report

28 August 2008

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy, established the Australian Energy Market Commission (AEMC) in July 2005 to be the Rule maker for national energy markets. The AEMC is currently responsible for Rules and policy advice covering the National Electricity Market. It is a statutory authority. Our key responsibilities are to consider Rule change proposals, conduct energy market reviews and provide policy advice to the Ministerial Council as requested, or on AEMC initiative.

About the AEMC Reliability Panel

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

Disclaimer

The views and recommendations set out in this document are those of the Reliability Panel and are not necessarily those of the Australian Energy Market Commission.

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*Mark Grenning and Geoff Willis declared a potential conflict of interest in the Panel's review of the Tasmanian *frequency operating standards* and did not participate in the decision for the Panel's draft determination.

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Abbreviations

Italicised terms in this report have the same meaning as in Chapter 10 of the National Electricity Rules.

2006 Review	Tasmanian reliability and frequency standards review
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
CCGT	Combined cycle generating turbine
Code	National Gas Code
Commission	see AEMC
FCAS	Frequency Control Ancillary Services (Market Ancillary Services in the Rules)
kV	Kilovolt
L6	Fast FCAS (6 second) lower service
MCE	Ministerial Council on Energy
MNSP	Market Network Service Provider
NECA	National Electricity Code Administrator
NEL	National Electricity Law
NEM	National Electricity Market
NEMMCO	National Electricity Market Management Company
NEO	National Electricity Objective
OCGT	Open cycle generating turbine
OFGSS	Over frequency generator shedding scheme (also known as the OFGTS)
OFGTS	Over frequency generator tripping scheme (also known as the OFGSS)
Panel	Reliability Panel
R6	Fast FCAS (6 second) raise service
Rules	National Electricity Rules
SPS	Special Protection Scheme (the Basslink SPS limits the size of the contingency)
SRMC	Short Run Marginal Cost
TNSP	Transmission Network Service Provider
Transend	Transend Networks Pty Ltd
TRNPP	Tasmanian Reliability and Network Planning Panel
TVPS	Tamar Valley Power Station (the Alinta 210 MW CCGT)
UFLSS	Under frequency load shedding scheme

Executive Summary

In February 2008 the Australian Energy Market Commission (AEMC) provided the Reliability Panel (Panel) with terms of reference requiring it to conduct a review of the Tasmanian *frequency operating standards*. The terms of reference require the Panel to conduct the review in accordance with section 38 of the National Electricity Law (NEL) using the consultation processes in clause 8.8.3 of the Rules.

The Panel must have regard to the national electricity objective^a, which is set out in section 7 of the NEL, when it performs this review of the Tasmanian *frequency operating standards*.

The purpose of the *frequency operating standards* is to define the range of allowable frequencies for the electricity power system under different conditions, including normal operation and various contingencies. Equipment connected to the power system must be capable of operating within the frequency ranges specified in the *frequency operating standards*, while NEMMCO is responsible for managing the frequency to meet the requirements of the *frequency operating standards*.

The purpose of this draft determination is to describe the Panel's proposed changes to the Tasmanian *frequency operating standards* and the Panel's reasoning.

Review context

There has been an interest in diversifying the range of possible electricity generating technologies that can be connected in the Tasmanian region as this would increase the security and reliability of the energy supplies to Tasmania, as well as facilitate competition. However, the existing Tasmanian *frequency operating standards* are not as tight as those standards that apply on the NEM mainland and this has meant that some higher efficiency thermal generating units cannot meet the minimum access standards in terms of frequency ride through^b. In particular, under the existing standards the frequency is able to be as low as 46 Hz, while many thermal generating units are required to trip at 47 Hz and have limits on the times they operate below 48 Hz. While this barrier to entry has been acknowledged, previous reviews of the Tasmanian *frequency operating standards* have not been able to economically or technically justify aligning, even partially, with the NEM mainland standards.

Prior to Tasmania's entry into the NEM, annual reviews of the Tasmanian *frequency operating standards* were performed by the Tasmanian Reliability and Network

^a "The objective of this Law is to 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."

^b The frequency ride through requirements are specified in schedule 5.2.5.3 of the Rules. This schedule operates in conjunction with the *frequency operating standards* that apply in the associated region.

Planning Panel (TRNPP). Following Tasmania joining the NEM in May 2005, the Panel acquired responsibility for the Tasmanian *frequency operating standards* and was required to perform a review within one year. In its 2006 review, the Panel determined that the existing Tasmanian *frequency operating standards* should continue to apply until NEMMCO has gained sufficient experience operating Basslink, and then, once this experience is gained, the Panel would undertake a benefit cost assessment of tightening the standards at a future time. In February 2008 the AEMC provided the Panel with terms of reference for this follow up review. The Panel commenced this review in April 2008.

The Panel received submissions and supplementary submissions from a range of stakeholders and held a well attended stakeholder forum in Hobart on 6 June 2008. As required under the Rules, the Panel also sought NEMMCO's advice on the implications of changes to the standards, and associated matters, proposed by stakeholders. In addition, the AEMC engaged consultants CRA to assist the Panel by performing the economic and technical assessment of the various proposals it received.

Some stakeholders proposed tightening the Tasmanian *frequency operating standards* to allow higher efficiency thermal generators such as single shaft industrial CCGTs or cogeneration steam turbines to operate in Tasmania. Other stakeholders expressed concerns that tightening the frequency standards and allowing large single shaft generating units to operate would significantly increase the FCAS requirements for Tasmania. This may lead to very high costs and could impact on the operation of the Tasmanian power system, as well as inhibiting the development of wind generation projects.

The *frequency operating standards*, as ultimately determined by the Panel, would apply to all market participants once these standards are approved and implemented. The Panel intends, in accordance with its AEMC terms of reference, to make a final determination on the standards to apply before the end of November 2008.

Assessment of changes to the Tasmanian frequency operating standards

The Tasmanian power system differs significantly from that on the NEM mainland in that it:

- is small in terms of the size of the load and installed generating capacity;
- has relatively large load, generator and network contingencies, as a proportion of the total system;
- is predominantly supplied by hydro generating units;
- can have a relatively low inertia, particularly when Tasmania is importing energy via Basslink at a time of low Tasmanian demand;
- experiences shortages of fast acting frequency control ancillary services (FCAS), because of the slow response of hydro generators to frequency disturbances; and

- is more susceptible to hydrological risks.

Importantly in this context any consideration of widening the future range of generation alternatives for Tasmania involves recognising the role of both frequency standards and the relative contingency size for which the frequency standards apply.

The Panel's analysis indicates that there is a need for new and diverse generation for the future security and reliability of the electricity supply in Tasmania. However, higher efficiency thermal generating units cannot connect to the Tasmanian network under the existing Tasmanian *frequency operating standards*. The Panel does note that some small and lower efficiency thermal plant may be available which could meet the existing standards, albeit with comparatively higher capital costs.

Therefore, the Panel considered the range of proposals from stakeholders and performed an initial assessment of the five scenarios in the following Table.

Summary of the Panel's Assessment

Possible Scenarios	A	B	C	D	E
Frequency Operating Standards	Leave unchanged	Minor changes plus mitigation	Tighten standards plus mitigation	Tighten standards	NEM mainland standards
Additional mitigation mechanisms	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Limit contingency size Trip additional load at 47 Hz when unit trips 	<ul style="list-style-type: none"> Limit contingency size Consider FCAS cost recovery mechanisms 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> None
Benefits	<ul style="list-style-type: none"> No additional FCAS costs 	<ul style="list-style-type: none"> No additional FCAS costs No changes to existing UFLSS or Basslink frequency controller 	<ul style="list-style-type: none"> Opens wider options for future generator development Excessive FCAS costs avoided 	<ul style="list-style-type: none"> Opens wider options for future generator development 	<ul style="list-style-type: none"> Consistency with NEM mainland standard
Costs	<ul style="list-style-type: none"> Potential long run impacts from restrictions to the form of new generation developments to meet reliable supply 	<ul style="list-style-type: none"> High costs for additional loads Reduced UFLSS effectiveness 	<ul style="list-style-type: none"> Small increase in R6 FCAS costs 	<ul style="list-style-type: none"> Significant increase in R6 FCAS requirements 	<ul style="list-style-type: none"> Very significant increase in R6 FCAS costs
Feasibility	<ul style="list-style-type: none"> Yes, but future higher efficiency thermal generators unlikely 	<ul style="list-style-type: none"> Voltage stability issues Additional loads need to be independent of the existing UFLSS and near the generating unit Difficulties in applying to future projects 	<ul style="list-style-type: none"> Yes. Must specify how to mitigate contingency with a limit Minor reduction in effectiveness of UFLSS under certain rare situations 	<ul style="list-style-type: none"> R6 FCAS costs very high NEMMCO would need to intervene regularly 	<ul style="list-style-type: none"> Sufficient FCAS not available NEMMCO would need to intervene regularly
National electricity objective	<ul style="list-style-type: none"> Limits future development 	<ul style="list-style-type: none"> Higher UFLSS costs Greater risks during under frequency events Limits future development 	<ul style="list-style-type: none"> Allows for new generation development without substantial costs 	<ul style="list-style-type: none"> Higher FCAS costs Greater intervention to maintain system security 	<ul style="list-style-type: none"> Excessive FCAS costs Not possible to maintain system security

The Panel considers that scenario B is unlikely to advance the national electricity objective because it would be expensive to implement, result in greater risks to supply during low frequency events, would limit future investment in higher efficiency thermal generating units and is likely to create voltage stability issues. The Panel also considers that scenarios D and E would not be likely to advance the national electricity objective given the limits on existing fast FCAS availability in Tasmania. For example, tightening the standard without a generator contingency limit would increase the fast FCAS raise requirement from 95 MW to 307 MW^c. However, scenarios D or E could become more attractive at some stage in the future if the availability of fast FCAS increases and the overall shape of the Tasmanian generation portfolio changes.

Therefore, the Panel is not proposing to pursue scenarios B, D and E as recommendations for the Tasmanian *frequency operating standards*. This left the Panel with the broad choice between leaving the standards unchanged (scenario A) or tightening the standards with a mechanism to mitigate the impact of the size of the largest generator contingency (scenario C).

CRA performed a benefit cost assessment that showed scenario C would be expected to deliver greater benefits than the associated costs, when compared to the no change scenario A. This conclusion is based on:

- a high level assessment showing there are material risks to the security of the electricity supply in Tasmania under some plausible conditions including higher than expected load growth, continued low hydro inflows, a prolonged outage of Basslink, or loss of the ageing Bell Bay generating units;
- the most likely base load generating technology that could be built in Tasmania, at least in the near future, is gas, notwithstanding the significant contribution of wind in the future development of the State's generating portfolio; and
- the benefits of allowing lower capital costs and higher efficiency thermal generating units such as single shaft CCGTs would be expected to exceed the increased FCAS costs associated with the tighter frequency standards.

The Panel proposes to adopt scenario C thereby tightening the Tasmanian *frequency operating standards* but prescribing a contingency limit. This proposal is expected to lead to reduced electricity costs in Tasmania in the long-run by allowing more higher efficiency generating units to connect without imposing materially higher FCAS costs and significantly impacting wind farm penetration, provided the size of the largest generator contingency is limited. Appendix A contains the proposed draft Tasmanian *frequency operating standards*.

^c NEMMCO advice to the Panel on 23 May 2008.

Draft Tasmanian frequency operating standards

In addition to increasing the allowable low frequency under extreme conditions from 46 Hz to 47 Hz, the Panel is proposing a number of other smaller changes to further align the standards towards the NEM mainland, including:

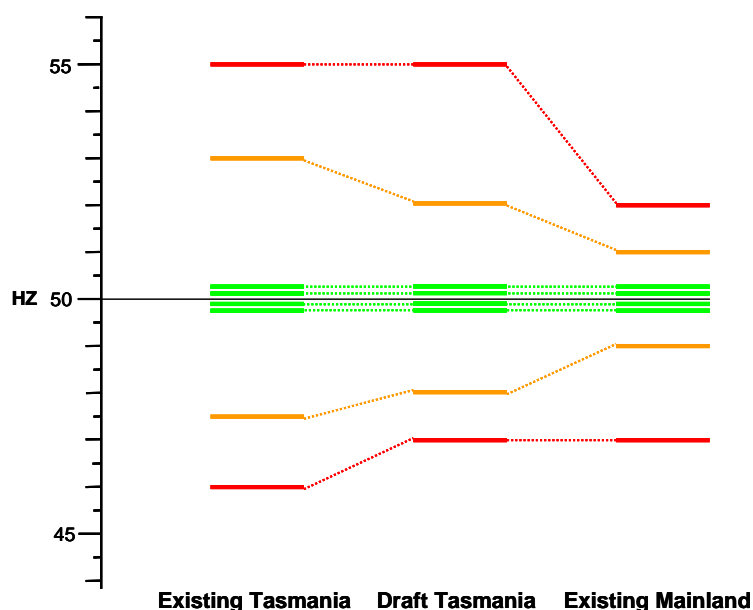
- increasing the lower limit of the load, generator and network event band to 48 Hz, thus requiring the under frequency load shedding scheme (UFLSS) to operate between 48 and 47 Hz^d;
- aligning the upper limit of the *operational tolerance frequency band* for load, generator and network events to 52 Hz, thus allowing efficient thermal generating units to meet the minimum access standards^e;
- aligning the recovery times for load, generator and network events to 10 minutes; and
- reducing the over frequency limit for extreme events under island conditions from 60 Hz to 55 Hz.

The figure below shows the extent that *extreme frequency excursion tolerance limits* (in red), the single contingency *operational frequency tolerance band* (in orange) and the *normal operating frequency bands* (in green) are proposed to be amended from the existing levels to be closer to those that apply on the NEM mainland. The proposed *extreme frequency excursion tolerance limits* align with the NEM mainland for under frequencies, and the proposed over frequency requirements are similar for the minimum access standards. Similarly, the *normal operating frequency bands* already align with the NEM mainland standards. The most significant difference between the proposed Tasmanian standards and those for the NEM mainland are those that apply for single contingencies, which is because the relative supply of fast (six second) FCAS is significantly lower in Tasmania compared to the NEM mainland.

^d The existing UFLSS operates between 47.5 and 46 Hz. NEMMCO and Transend advice that the UFLSS can be modified to operate between 48 and 47 Hz with only a minor reduction in its performance.

^e Further details on the minimum access standards for over frequencies are discussed in chapter 5.

Comparison of the Tasmanian standards (existing and draft) with the NEM Mainland under normal conditions



Mitigating the generating unit contingency size

As discussed above, the feasibility of tightening the Tasmanian *frequency operating standards* at this stage, depends on limiting the size of the generator contingency as the FCAS costs depend on both the *frequency operating standards* and the size of the largest contingency. This could be implemented using a constraint equation in the NEMMCO dispatch process. Where the capacity of a generating unit is larger than the largest allowable generator contingency, the associated generator could operate above the contingency limit by implementing an arrangement that is similar to the Basslink special protection scheme (SPS); that is, by automatically tripping contracted load whenever a new large generating unit trips such that the combined contingency size is limited. However, the ability of a large generating unit to operate up to its full capacity would not necessarily be restricted, provided that contracted load is available to be tripped to limit the size of the resulting contingency. Such an automatic load shedding scheme would need to be approved by NEMMCO and included in the connection agreement with the network service provider.

Form of the mechanism to limit the contingency size

The Panel considers that ideally the size of the contingency should be determined for each dispatch interval following an economic trade off between the benefits of the resulting generation and the costs of the associated FCAS. However, in the absence of this dynamic economic trade off, the Panel is proposing a fixed limit on the contingency size of 144 MW. This contingency size limit equals the existing maximum generator contingency in Tasmania and forms the basis of NEMMCO's advice.

The Panel also considered a variable contingency size limit that depended on variables such as system load and Tasmanian inertia. While the Panel has not

recommended this approach it does seek stakeholder views on this matter in response to its Draft Report.

Including a limit on the generator contingency size in the frequency operating standards

The Panel considers that it has the power to include a limit on the generator contingency within the Tasmanian *frequency operating standards* because such a limit is necessary for the Panel's draft decision to satisfy the national electricity objective. That is, a tightening of the Tasmanian *frequency operating standards* in the absence of a limit on the size of the generator contingency limit would not contribute to the national electricity objective as it would cause economic efficiency costs that are likely to exceed the economic benefits and would be likely to lead to more frequent interventions by NEMMCO in order to maintain power system security.

Future review of the limit on generator contingency size

The Panel would consider reviewing the form of the generator contingency size limit, or its need, in the future following experience with the existing limits or if a new alternative arrangement is developed that efficiently trades off the economic FCAS costs against the contingency size.

Recovering the costs of the increased FCAS requirements

While limiting the contingency size has the effect of significantly lowering the FCAS requirements and the associated costs, the proposed changes to the Tasmanian *frequency operating standards* will themselves result in a small increase in the FCAS requirements, particularly for fast (six second) raise. For example, at a Tasmanian demand of 900 MW, an additional 31 MW^f of fast FCAS raise is typically required if the lower limit of the single contingency *operational frequency tolerance band* is raised from the current 47.5 Hz to the proposed 48 Hz.

Under the existing mechanisms many of the benefits of changing the standards would be captured by new higher efficiency thermal generating units while the costs of the additional FCAS would be recovered from all generators. The Panel notes the potential for possible Rules changes from stakeholders who consider that a different cost allocation arrangement should apply.

Implementation – transitional arrangements

The Panel requests that stakeholders who may need to modify their systems as a result of the proposed changes to the Tasmanian *frequency operating standards* should

^f Draft NEMMCO advice to the Panel, 23 May 2008.

indicate how long they would need and, hence, when the amended standards should take effect.

Publication of the Draft Determination

This draft determination is published on Thursday 28 August. At this time the Panel is also publishing the NEMMCO advice and the CRA report as accompanying documents.

Completion of this review

The completion of this review will follow the indicative timetable below:

- Commence stakeholder consultation Thursday 24 April 2008
- Initial stakeholder comments due Friday 23 May 2008
- Hold Stakeholder Forum in Hobart Friday 6 June 2008
- Publish Draft Decision Thursday 28 August 2008
- Submissions on Draft Decision close Friday 3 October 2008
- Meeting (clause 8.8.3(f)) Thursday 30 October 2008
- Submit Final Report to AEMC Friday 21 November 2008

Submissions on this draft determination

Interested stakeholders are invited to provide comments on the Draft Report outlined in this Paper. Submissions should be received by 5 pm on Friday 3 October 2008. Submissions may be sent electronically to submissions@aemc.gov.au or by mail to:

Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

or by Fax: (02) 8296 7899.

The Panel has indicated that it could hold a meeting with interested stakeholders open to all Registered Participants in Hobart on Thursday 30 October 2008 from 2.00 pm to 4.00 pm. Anyone wishing to attend should contact the Panel at registration@aemc.gov.au by Friday 10 October 2008. Confirmation of the date, time and venue will be made available on the AEMC website.

1 Review Context and Process

1.1 Context of the Review

1.1.1 Purpose of the frequency operating standards

The purpose of the *frequency operating standards* is to define the range of allowable frequencies for the electricity power system under different conditions, including normal operation and various contingencies. Generator, network and end-user equipment must be capable of operating within the range of frequencies defined by the *frequency operating standards*, while NEMMCO is responsible for procuring sufficient ancillary services and ensuring that there are adequate emergency control systems to maintain the frequency within the ranges defined by the *frequency operating standards*.

1.1.2 Tasmanian entry into the NEM

General

Tasmania joined the National Electricity Market (NEM) in May 2005. Prior to Tasmania's entry into the NEM, the Tasmanian Reliability and Network Planning Panel (TRNPP) performed annual reviews of the Tasmanian *frequency operating standards*. The most recent review of the TRNPP was published in March 2006.¹

In recent years, there have only been relatively minor changes to the Tasmanian *frequency operating standards*.

2006 Tasmanian Reliability and Frequency Operating Standards Review

Under clause 8.8.1(a)(2) of the National Electricity Rules (Rules), the Reliability Panel (Panel) of the AEMC is required to determine the reliability and power system *frequency operating standards* for the National Electricity Market (NEM). Tasmania joined the NEM in 2005 and, under clause 9.49.3 of the Rules, the Panel was required to determine reliability and frequency operating standards for Tasmania by the first anniversary of Tasmania joining the NEM (the transition date).

The Tasmanian reliability standard determined by the Panel took effect from when its determination was published and the interconnection date (as defined in clause

¹ The TRNPP's determinations are available on the website of the Office of the Tasmanian Energy Regulator located at <http://www.otter.tas.gov.au>. The TRNPP's *frequency operating standards* determination was originally published on 14 February 2006 to apply from 20 February 2006. The TRNPP published a revised version of its determination on 2 March 2006. The Panel understands that this version rectified minor inconsistencies and that those changes did not affect the date from which the Tasmanian *frequency operating standards* applied (20 February 2006). For clarity, references to the TRNPP's determination are to the revised version.

9.49.1(b) of the Rules). Basslink was commissioned on, and the interconnection date therefore became, 29 April 2006. The Tasmanian *frequency operating standards* determined by the Panel applied from 30 May 2007.

In making its determination in relation to the Tasmanian *frequency operating standards*, the Panel was required under clause 9.49.4 of the Rules to have regard to the existing standards as determined by the TRNPP.

The Panel published its draft determination on the Tasmanian reliability and frequency operating standards for consultation on 24 March 2006. Submissions closed on 26 April 2006 and the Panel held a meeting open to NEM registered participants in relation to the draft determination in Hobart on Friday 21 April, 2006.

The Panel received submissions from the TRNPP, the Tasmanian Department of Infrastructure, Energy & Resources, Hydro Tasmania and Aurora Energy. The Panel considered the submissions, and the discussions at the meeting in Hobart, when finalising this determination on the Tasmanian reliability and frequency operating standards.

On 25 May 2006, the Panel published its final determination on the Tasmanian reliability and frequency standards review (2006 Review). The Panel reached the following conclusion in its 2006 Review:

- that a phased approach to determining the Tasmanian reliability and frequency operating standards was appropriate;
- that the Tasmanian *frequency operating standards* set out in the TRNPP's March 2006 determination would be adopted as the *frequency operating standards* that would apply in Tasmania from 30 May 2007;
- that the opportunities for further alignment of the Tasmanian *frequency operating standards* with the NEM mainland standards would be considered in an additional review to be undertaken with at least 12 months Basslink operational experience; and
- that the additional review following the 2006 Review would require:
 - a full cost benefit analysis of any proposed changes;
 - experience of the Tasmanian market once Basslink commenced its operation;
 - drawing on work to be undertaken by NEMMCO in relation to the Tasmanian automated frequency management schemes; and
 - being conducted in accordance with the principles under the Rules that applied to the 2006 Review.

1.2 Current Review

1.2.1 The desire to consider alignment of the Tasmanian and NEM mainland standards

There has been an interest in diversifying the range of possible electricity generating technologies that can be connected in the Tasmanian region. This has been considered desirable as it would increase the security and reliability of the energy supplies to Tasmania, as well as facilitate competition. However, the Tasmanian *frequency operating standards* are not as tight as the standards that apply on the NEM mainland. This means that higher efficiency thermal generating units cannot currently meet the minimum access standards in terms of the frequency ride through² requirements in the Rules and this has been a significant barrier to entry into the Tasmanian region for these types of generating units.

Therefore, in its review in 2006 the Panel indicated that this future review of the Tasmanian *frequency operating standards* would consider the economic benefits of allowing greater diversity and competition within the Tasmanian energy market against the costs of implementing any changes to the standards.

1.2.2 The desire to review the standards

The Tasmanian Jurisdiction³ has indicated that the review of the Tasmanian *frequency operating standards* is important to the future development of the Tasmanian system. It indicated that Tasmania needs to replace the aged Bell Bay thermal plant, help rebuild the hydro energy storage position and help meeting the growing demand, and that a review of the Tasmanian *frequency operating standards* needs to consider the need to bring on the most economic and efficient sources of new generation as well as to facilitate efficient market operations.

Aurora⁴ considers this review of the Tasmanian *frequency operating standards* to be important. Aurora identifies the need to reduce barriers to new entry because of the record low hydro storage levels and to facilitate greater competition in the Tasmanian wholesale electricity market.

Alinta⁵ and Gunns⁶ have also expressed their support for the review of the Tasmanian *frequency operating standards*. In their submissions, Alinta and Gunns indicate that they are proposing to build new generating units that would not be able to connect under the existing Tasmanian *frequency operating standards*.

² The frequency ride through requirements are required in schedule 5.2.5.3 of the Rules. This schedule operates in conjunction with the *frequency operating standards* that apply in the associated region.

³ The Hon. David Llewellyn MP submission, 21 May 2008.

⁴ Aurora Energy submission, 23 May 2008.

⁵ Alinta submission, 24 April 2008.

⁶ Gunns submission, 23 May 2008.

1.2.3 Rules obligations

Clause 8.8.1(a)(2) of the Rules requires the Panel to:

review and, on the advice of NEMMCO, determine the *power system security and reliability standards*;

The *power system security and reliability standards* include the frequency levels for the operation of the power system, which is specified in the *frequency operating standards*.

The Panel is conducting this review in accordance with clause 8.8.3 of the Rules and section 38 of the NEL.

The Panel must also have regard to the national electricity objective (NEO)⁷, which is set out in section 7 of the NEL, when it performs this review of the Tasmanian *frequency operating standards*.

1.2.4 Separate frequency operating standards for NEM mainland

In parallel to this Tasmanian *frequency operating standards* review, the Panel is also conducting a review of the *frequency operating standards* in the mainland of the NEM for periods of supply scarcity during load restoration. The Panel, on the advice of NEMMCO, is not considering changes to the existing arrangements during load restoration in Tasmania due to the increased risk of a cascading failure.

Further information on this review is on the AEMC website⁸.

1.2.5 The AEMC terms of reference

In February 2008 the AEMC provided terms of reference to the Panel requesting it, in accordance with section 38 of the NEL and clause 8.8.3 of the Rules, to undertake a review of the *frequency operating standards* for Tasmania. The AEMC considered that this review is likely to have important implications for NEM stakeholders. The AEMC requested that the Panel plan to involve stakeholders by seeking submissions and holding forums on the Tasmanian *frequency operating standards*. The AEMC requested that the Panel should aim to complete its review by 31 December 2008.

For ease of reference the AEMC terms of reference is reproduced in chapter 3.

⁷ “The objective of this Law is to 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.”

⁸ Further information on the Panel’s review of the NEM mainland *frequency operating standards* during times of scarcity is available at <http://www.aemc.gov.au/electricity.php?r=20080327.122851>.

2 Existing Frequency Control Arrangements in Tasmania

2.1 Purpose of the Tasmanian frequency operating standards

The Rules define the *frequency operating standards* as “the standards which specify the *frequency levels* for the operation of the *power system* as set out in the *power system security and reliability standards*.”⁹

The purpose of *frequency operating standards* are to:

1. give the system operator – in most cases NEMMCO – set limits in which it has an obligation to maintain operation of the power system; and
2. place a requirement on plant and network elements of the power system to meet the *frequency operating standards*.

2.2 Existing Tasmanian frequency operating standards

The *frequency operating standards* in Tasmania have remained relatively unchanged for many years, due mainly to the unique generating characteristics of the Tasmanian power system, which is predominantly hydro based with limited thermal generating capacity. The *frequency operating standards* that currently apply in Tasmania came into effect on 30 May 2007, as a result of the Reliability Panel’s determination in relation to “Tasmanian Reliability and Frequency Standards”.¹⁰ At the time of its review in April 2006, the Panel adopted the *frequency operating standards* determined by the TRNPP with amendments from the Panel through consultation with NEMMCO.¹¹ The following section gives a summary of the current Tasmanian *frequency operating standards*.

For the purposes of the Rules, the *frequency operating standards*, forming part of the *power system security and reliability standards*, that apply in Tasmania are summarised in the following Table 2.1 and Table 2.2.¹²

⁹ The National Electricity Rules, Chapter 10 definitions. Italicised words are also defined in Chapter 10 of the Rules.

¹⁰ For more information see, <http://www.aemc.gov.au/electricity.php?r=20060525.144027>.

¹¹ The TRNPP determinations are available on the website of the Office of the Tasmanian Energy Regulator located at <http://www.otter.tas.gov.au>. The TRNPP’s frequency standards determination was originally published on 14 February 2006 to apply from 20 February 2006. The TRNPP published a revised version of its determination on 2 March 2006. The (National) Panel understands that this version rectified minor error and inconsistencies and that those changes did not affect the date from which the standards applied (20 February 2006). For clarity, references to the TRNPP’s determination are to the revised version.

¹² For more information see, AEMC Panel Review 2006, Tasmanian Reliability and Frequency Standards, 28 May 2006, Sydney, P.p 17-19.

Table 2.1 – Frequency operating standards for any part of the Tasmanian power system

CONDITION	CONTAINMENT	STABILISATION	RECOVERY
Accumulated time error	15 seconds		
No contingency event or load event	49.75 to 50.25 Hz, 49.85 to 50.15 Hz, 99% of the time	49.85 to 50.15 Hz within 5 minutes	
Load event	49.0 to 51.0 Hz	49.85 to 50.15 Hz within 10 minutes	
Generation event	47.5 to 51.0 Hz	49.85 to 50.15 Hz within 5 minutes	
Network event	47.5 to 53.0 Hz	49.0 to 51.0 Hz within 1 minute	49.85 to 50.15 Hz within 5 minutes
Separation event	46 to 55 Hz	47.5 to 51.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes
Multiple contingency event	46 to 55 Hz	47.5 to 51.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes

Table 2.2 – Frequency operating standards that apply to an island within the Tasmanian power system

CONDITION	CONTAINMENT	STABILISATION AND RECOVERY	
No contingency event, or load event	49.0 to 51.0 Hz		
Generation event or network event	47.5 to 53.0 Hz (Note)	49.0 to 51.0 Hz within 5 minutes	
Load event	47.5 to 53.0 Hz (Note)	49.0 to 51.0 Hz within 10 minutes	
The separation event that formed the island	46 to 60 Hz	47.5 to 53.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes
Multiple contingency event including a further separation event	46 to 60 Hz	47.5 to 53.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes

Note Where it is not feasible to schedule sufficient frequency control ancillary service to limit frequency excursions to within this range, operation of the UFLSS or OFGSS is acceptable on the occurrence of a further contingency event.

For the purpose of these *frequency operating standards* and the Rules, a term shown in Column 1 of the Table 2.3 has the corresponding range shown in Column 3 of the table for an island and has the corresponding range shown in Column 2 of the Table otherwise.

Table 2.3 – Frequency inclusion bands for normal and island operation

Column 1	Column 2	Column 3
Term	Normal range (Hz)	Island range (Hz)
<i>normal operating frequency band</i>	49.85 to 50.15	49.0 to 51.0
<i>normal operating frequency excursion band</i>	49.75 to 50.25	49.0 to 51.0
<i>operational frequency tolerance band</i>	47.5 to 53.0	47.5 to 53.0
<i>extreme frequency excursion tolerance limit</i>	46.0 to 55.0	46.0 to 60.0

2.3 Frequency Control Mechanisms

2.3.1 Frequency Control Ancillary Services (FCAS)

Frequency Control Ancillary Services, referred to as Market Ancillary Services in the Rules, are required to maintain appropriate levels of contingency reserve and regulating reserve and can be classified as belonging to one of the following categories:

- *regulation services* are required to maintain frequency within the *frequency operating standards* during typical load and generation variations within a 5-minute Dispatch Interval; and
- six contingency services (defined below) are required to ensure that the frequency remains within the *frequency operating standards*, following credible contingency events as established by the Panel.

The system requirements for each FCAS service are forecast in advance. Pursuant to clause 3.13.4A of the Rules, NEMMCO publishes weekly forecasts of the requirements for each type of *market ancillary service* for each *region* for the following week.

The *frequency operating standards* for containment, stabilisation and recovery as shown in Table 2.1 and Table 2.2 above determine the required amounts of the different FCAS categories. Following a contingency, FCAS are used as follows:¹³

- fast raise or lower FCAS are used for controlling frequency to the containment band;
- slow raise or lower FCAS are used for controlling frequency to the stabilisation band; and

¹³ For more information see: NEMMCO operating procedure – Frequency Control Ancillary Services, Document Number SO_OP3708A, P.p. 6-8.

- delayed raise/lower FCAS are used for controlling frequency to the recovery band.

In the absence of a contingency event requiring large deviation contingency services, the regulating services are the primary frequency control services utilised.

Regulating Service Requirements

Minor variations in frequency around 50 Hz occur continually as a result of normal fluctuations in consumer demand and generating unit performance.

NEMMCO's dispatch engine NEMDE uses forecast demand and establishes a linear path for generating units to follow for each five-minute dispatch interval. However, consumer demand does not vary linearly between dispatch intervals, and the imbalance between generation and demand causes the frequency to vary (even in the absence of contingency events). The regulating raise and lower FCAS are used to correct such frequency variations within each five-minute dispatch interval.

Contingency Service Requirements

The requirement for contingency service is a function of the largest generation output or load blocks on the power system, as well as the system inertia. In most instances, over a dispatch interval the largest generation and load blocks on the power system will be relatively constant, and so the contingency service requirement becomes a simple function of the system demand.

The requirement for FCAS can generally be distributed globally, that is NEMMCO will source the requirement for a service from all interconnected regions in a co-optimised manner using NEMDE. However, for the case of the Tasmanian region, which is only linked to the NEM mainland via Basslink, NEMMCO needs to source a portion of the FCAS requirements locally within the Tasmanian region, which is currently predominantly provided by Hydro Tasmanian generators. Basslink can also transfer FCAS from the mainland; however, there are restrictions on what can be provided by Basslink depending on the margin between its transfer and the transfer limits.

Basslink and FCAS Transfer

Basslink is a high voltage direct current (HVDC) interconnector between the States of Victoria and Tasmania. The interconnector is asynchronous, meaning that the phase and frequency of the alternating current (AC) in both States can be different. The limits of Basslink are 660 MW when exporting (Tasmania to Victoria) and 480 MW when importing (Victoria to Tasmania); however, due to the convertors on the system there is a "no-go" zone between -50 and +50 MW.¹⁴

¹⁴ For further information on the technical capabilities of Basslink see, Basslink submission and AEMC 2007, Dispatch of Scheduled Network Service, Rule Determination, 16 August 2007, Sydney.

The Basslink frequency controller special protection scheme (FCSPS) limits the size of a Basslink contingency to 144 MW under import (equivalent to the largest contingency currently in Tasmania) and 200 MW under export. The FCSPS automatically sheds load or generation in the event that Basslink trips, with the required amounts to be shed calculated automatically and dynamically.

Furthermore, the Basslink frequency controller modulates flow across the interconnector to level out frequency disturbances between the NEM mainland and Tasmania. This has the effect of allowing the transfer of FCAS between both sides of the interconnector and significantly smoothes frequency deviations in Tasmania. The optimal dispatch of energy and FCAS over Basslink is determined by NEMDE, based on energy and FCAS bids and offers. However, FCAS transfer is limited by the margins between actual transfer and transfer limits - being maximum export, maximum import and the no-go zone (± 50 MW).

2.3.2 Under Frequency Load Shedding Scheme (UFLSS)

The Under Frequency Load Shedding Scheme (UFLSS) is an emergency control system that automatically sheds system load during the low frequency periods that accompany multiple supply contingencies such as generating unit or Basslink trips.

The Tasmanian UFLSS currently includes seven load blocks that are available for tripping in the frequency range 47.5 Hz to 46.0 Hz, where 46 Hz is presently the bottom *extreme frequency excursion tolerance limit*. The Tasmanian UFLSS has been designed to maintain the system frequency above 46.5 Hz, with the 0.5 Hz safety margin to account for modelling and other uncertainties, for an agreed set of plausible multiple contingencies.

2.3.3 Over Frequency Generator Shedding Scheme (OFGSS)

The Over Frequency Generator Shedding Scheme (OFGSS) is an emergency control system that automatically sheds generators during the high frequency periods that accompany multiple supply contingencies such as load or Basslink trips.

The main requirement of the OFGSS is to maintain frequency should a separation (Island operation) occur between north and south Tasmania as a result of the tripping of transmission circuits. The scheme only trips generation, so it will operate on whichever area was exporting at the time of the trip, to maintain potential high frequencies within the Tasmanian frequency standard for island formation and operation.¹⁵

The OFGSS operates in parallel with the Tasmanian special protection schemes and has become a backup for the FCSPS since Basslink commenced operation in May 2006 to cover its partial or complete failure under export conditions.¹⁶

¹⁵ http://nemmco.com.au/powersystemops/so_op3151v013.pdf

¹⁶ Transend submission, p.6.

2.3.4 Island operation

Island operation occurs when a part of the Tasmanian power system that includes scheduled generation, networks and load, loses all of its network connections with other parts of the power system. During contingencies of this nature, the UFLSS and OFGSS schemes are instrumental in managing frequency deviations and bringing frequencies back to the normal operating band as quickly as possible.

3 Assessment Criteria for the Review

This chapter presents an overview of the assessment criteria for the Panel's review of the Tasmanian *frequency operating standards*.

3.1 National electricity objective and terms of Reference

As discussed in Chapter 1 of this draft determination, when the Panel assessed changes to the Tasmanian *frequency operating standards* it considered the extent the changes are consistent with the NEO.

3.1.1 The national electricity objective

The NEO is set out in section 7 of the NEL¹⁷:

“The objective of this Law is to 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.”

3.1.2 Terms of reference

The terms of reference are as follows:

**Reliability Panel
Review of Frequency Operating Standards for Tasmania
AEMC Terms of Reference (18 March 2008)**

Introduction

As part of its Comprehensive Reliability Review, the Commission published on 25 May 2006 the final determination by the Reliability Panel (Panel) on the *frequency operating standards* applicable in Tasmania from 29 May 2007. In this final determination, the Panel foreshadowed that it would revisit the Tasmanian *frequency operating standards* after at least 12 months operation of Basslink and has included this in its work program for 2008.

¹⁷ National Electricity (South Australia) Act 1996.

Scope of the Frequency Operating Standards Review

Clause 8.8.1(a)(2) of the National Electricity Rules requires the Reliability Panel to:
review and, on the advice of NEMMCO, determine the *power system security and reliability standards*;

The *power system security and reliability standards* sets out the frequency levels for the operation of the power system, which is specified in the *frequency operating standards*.

This review will be conducted in accordance with clause 8.8.3 of the National Electricity Rules.

Therefore, the AEMC requests the Panel, in accordance with section 38 of the NEL and clause 8.8.3 of the National Electricity Rules, to undertake a review of the *frequency operating standards* for Tasmania.

Process

This review is likely to have important implications for NEM stakeholders. Consistent with its philosophy of engaging with those parties, the AEMC requests the Panel to plan to involve stakeholders by seeking submissions and holding forums on the Tasmanian *frequency operating standards*.

Timing

Recognising the extensive work program within the Panel, the Panel should aim to complete its review by 31 December 2008.

3.2 Stakeholder Views

The Panel received a large number of submissions, supplementary submissions and presentations. A list of the submissions provided to the Panel is provided in Appendix B of this draft report.

A summary of the issues raised in these submissions is provided in Appendix C of this draft report.

4 Economic assessment of options

4.1 Broad overview of the scenarios proposed by stakeholders

The Panel considered the range of scenarios that were proposed by stakeholders and compared them against making no changes to the Tasmanian *frequency operating standards* and no other specific changes. The Panel then reduced this range of scenarios down to those where it would perform a more comprehensive benefit cost assessment. Other stakeholders such as Transend and Hydro Tasmania also recommended a number of more detailed amendments that have the potential to improve the operation of the standards. These changes are discussed in chapter 5 of this Draft Determination.

Importantly in this context any consideration of widening the future range of generation alternatives for Tasmania involves recognising the role of both frequency standards and the relative contingency size for which the frequency standards apply.

The Panel considered the following scenarios that range from no change to complete alignment with the NEM mainland *frequency operating standards*:

- A no change to the existing arrangements;
- B minor changes to the Tasmanian *frequency operating standards* but additional mitigation to allow higher efficiency generating units to operate;
- C tightening the Tasmanian *frequency operating standards* but with mitigation to limit the size of the largest contingency;
- D tightening the Tasmanian *frequency operating standards* but without mitigation; and
- E complete alignment of the Tasmanian frequency operating standards with the equivalent NEM mainland frequency operating standards.

4.2 Summary of benefits and costs for each scenario

4.2.1 Scenario – A: No change to the existing arrangements

Any change to the existing Tasmanian *frequency operating standards* and associated arrangements needs to be compared to consequences of no change. Under this option:

- the Tasmanian *frequency operating standards* would not be changed; and
- there would be no need to make changes to the existing UFLSS, OGFSS, Basslink SPS and the Basslink frequency controller.

However, a higher efficiency thermal generating unit, such as a single shaft industrial CCGT, would not be able to meet the minimum access standards as they apply in Tasmania.

This scenario is not consistent with a long term objective of introducing greater diversity of generating technologies into Tasmania. However, it is necessary to demonstrate that any changes to the existing Tasmanian *frequency operating standards* and associated arrangements would advance the NEO.

4.2.2 Scenario – B: Minimal change to the frequency operating standards with mitigation

Tightening the Tasmanian *frequency operating standards* and allowing a higher efficiency thermal generating unit to operate is likely to cause FCAS shortages, with associated high prices and possible interventions, and would require changes to many of the existing frequency control schemes in Tasmania.

Therefore, Hydro Tasmania proposed a set of arrangements that would allow a new higher efficiency generating unit to connect in Tasmania without the need for tightening the under frequency aspects of the Tasmanian *frequency operating standards*. The aim of these arrangements is to avoid the need to find large quantities of FCAS and make changes to many of the existing Tasmanian frequency control schemes. The arrangements proposed by Hydro Tasmania are to:

- limit the size of the contingency caused by the Tamar Valley Power Station (TVPS) tripping to 140 MW by requiring the generator to contract with 70 MW of load to be also tripped;
- allow the TVPS to trip at 47 Hz, but require additional load equal to the size of the generating unit to be included in the UFLSS, which would also be set to trip at 47 Hz to leave the energy balance no worse off; and
- allowing the TVPS to participate in the OFGSS, thus allowing it to trip for frequencies above 52 Hz.

The arrangements proposed by Hydro Tasmania have the benefits of not requiring changes to the Tasmanian *frequency operating standards*, and the associated issues with FCAS and the need to redesign some existing Tasmanian frequency control schemes. However, the advice from NEMMCO and Transend identifies some significant implementation issues with these arrangements. In particular:

- the tripping of up to 210 MW of load in addition to the existing 60% of load that participates in the Tasmanian UFLSS during a multiple contingency event is likely to cause voltage instability, thus reducing the effectiveness of the UFLSS;
- the difficulty in finding, and the high associated costs, of the additional loads to be included in the UFLSS;
- the new higher efficiency thermal generating unit would not meet the minimum access standards for low frequency continuous operation; and

- it would be virtually impossible to connect any similar generating units in the future.

Operation of the UFLSS

The primary purpose of the Tasmanian UFLSS is to progressively disconnect large blocks of load in emergency low frequency conditions in an attempt for the remaining generation to recover the frequency. The existing scheme has been designed to be able to operate under a set of plausible non-credible contingencies that have been agreed with NEMMCO, although no scheme can successfully manage every set of extreme simultaneous contingencies. However, the submission from Transend identifies a number of possible scenarios where allowing a large generating unit and additional load to trip at 47 Hz is likely to cause voltage instability, which could then lead to an extensive blackout of the system.

Transend and NEMMCO also indicate that it may be very difficult to identify a further 210 MW of load that could be shed, given that the load could not already be included in the existing UFLSS or Basslink SPS¹⁸. Transend indicated that additional load would need to be made available from a large number of small feeders, each with a peak rating less than 10 MW, at an under frequency relay cost of approximately \$200,000 per feeder, meaning that the cost of the under frequency relays could easily be more than \$16m¹⁹. Transend also indicated that it may be difficult to find the additional load while still being able to discriminate with the supply to critical loads (such as hospitals and emergency services). This would especially be the case if all the associated loads need to be in the vicinity of the new generating unit to minimise the risk of overloading the network.

While severe under frequency events are rare, the Panel considers that a significant reduction in the effectiveness of the UFLSS would not be in the long term interests of consumers as the associated economic costs and social impacts would be too high. The Panel also considers that the arrangements proposed by Hydro Tasmania would not be good regulatory practice as they only apply to the connection of a single higher efficiency generating unit and could not be readily applied to new generating units in the future.

Therefore, the Panel did not consider the arrangements proposed by Hydro Tasmania further in its assessment.

¹⁸ For the arrangement to be effective the full 210 MW of load would need to be available at 47 Hz and would, therefore, need to be independent of the Basslink SPS as a severe under frequency would be likely to involve a Basslink trip, and hence the SPS would have already operated.

¹⁹ The \$16m is based on each feeder having a peak capacity of 5 MW, but only being able to reliably provide half this load at times of light load. This is also assuming that all the higher capacity feeders in the vicinity of the TVPS have already been included in the existing UFLSS.

4.2.3 Scenario – C: Changes to tighten the frequency operating standards with mitigation of generator contingency size

The Tasmanian *frequency operating standards* currently provide a barrier to the entry to higher efficiency thermal generating units, such as single shaft industrial CCGTs. In particular, such generating units generally must trip for frequencies below about 47 Hz, while the existing standards allow frequencies down to 46 Hz under extreme system conditions.

Therefore, a number of stakeholders including Alinta and Gunns have proposed tightening aspects of the standards. Under this option:

- the Tasmanian *frequency operating standards* would tighten the lower limit of the *operational frequency tolerance band* from 47.5 Hz to 48 Hz;
- the Tasmanian *frequency operating standards* would tighten the lower limit of the *extreme frequency excursion tolerance limit* from 46 Hz to 47 Hz;
- the Tasmanian *frequency operating standards* would align the upper limit of the *operational frequency tolerance band* to 52 Hz;
- the existing UFLSS, OGFSS and the Basslink frequency controller would need to be redesigned to operate correctly to the new standard and co-ordinate correctly with other control systems such as the Basslink SPS; and
- single shaft industrial CCGT generating units would be expected to be able to meet the minimum access standards as they apply in Tasmania.

However, the advice from NEMMCO, and reinforced by many stakeholder submissions including Transend and Hydro Tasmania, is that simply tightening the Tasmanian *frequency operating standards*, thus allowing a new large higher efficiency thermal generating unit to connect and operate, would require dramatically more FCAS (particularly the six second raise service). This increase in FCAS requirements would be likely to lead to:

- very high FCAS prices under many system conditions;
- significant limitations to the dispatch of energy across Basslink; and
- FCAS shortages under many conditions that could lead to NEMMCO constraining the dispatch in Tasmania.

The NEMMCO advice indicates that, in the case of a new 210 MW generating unit, most of this additional FCAS is due to the increase in the maximum generator contingency from the existing 144 MW. For example at system load of 900 MW, the NEMMCO advice indicates that typical FCAS requirements would be:

<u>Tasmanian frequency operating standards</u>	<u>Contingency size</u>	<u>Required six second raise</u>
existing	144 MW	95 MW
tighten	210 MW	307 MW
tighten (with mitigation)	144 MW	126 MW

Under the typical light load conditions considered by NEMMCO, simply tightening the standard would increase the R6 raise requirement by 212 MW but tightening the standard in the presence of a mechanism to limit the generator contingency size to the existing 144 MW limits the increase in the R6 raise requirement to 31 MW. The FCAS requirements at higher loads are less dramatic and reduce as the system inertia increases, while the FCAS availability increases with the generally higher levels of generation running.

The Panel decided that this scenario where the Tasmanian *frequency operating standards* were tightened but there is a mechanism to limit the size of the largest contingency should be included in its full benefit cost assessment.

The Panel discusses how a mechanism to limit the size of the largest contingency could be implemented in section 4.4 below.

4.2.4 Scenario – D: Changes to tighten the standards

The Panel considered the scenario of simply tightening the Tasmanian *frequency operating standards*, as proposed by Alinta and Gunns. However, as discussed above, the advice from NEMMCO and others is that this would require dramatically more FCAS (particular the six second raise service), and that this increase is mainly due to the increase in contingency size associated with a large new generating unit.

Therefore, the Panel considers that this scenario (simply tightening the Tasmanian *frequency operating standards* and allowing higher efficient generating units to connect without a contingency size limit) would be unlikely to advance the NEO. This is because the FCAS costs would be a significant impost on the Tasmanian region. The analysis described in section 4.3.3 shows that these costs would be higher than those for scenario C, without any material benefits over that scenario.

4.2.5 Scenario – E: Complete alignment with the NEM mainland frequency operating standards

Aligning the Tasmanian *frequency operating standards* with those that apply on the NEM mainland would be significantly more difficult, and costly, than scenario D due to the very large quantities of FCAS that would be required. Such large quantities of FCAS are unlikely to be available at a reasonable cost in Tasmania for the foreseeable future. Therefore, the Panel did not consider aligning the Tasmanian *frequency operating standards* with those for the NEM mainland as appropriate.

4.3 Benefit cost assessment of Scenarios A and C

4.3.1 Scenarios

The Panel notes that the following matters were relevant in its detailed benefit cost assessment of scenarios A and C.

Scenario A (no change) is characterised by:

- no change to the existing arrangements, including no change to the Tasmanian *frequency operating standards*; and
- only generating units that comply with the existing standards would meet the minimum access standards.

Scenario C (tightening the standards with mitigation) is characterised by:

- the opportunity for higher efficiency thermal generating units to be deployed which would be expected to be able to meet the minimum access standards as they apply in Tasmania by tightening the under and over frequency contingency bands and limits;
- modifying the existing UFLSS, OGFSS and the Basslink frequency controller to operate correctly with the amended standard and coordinate correctly with other control systems such as the Basslink SPS;
- a mechanism to mitigate the impact of the increase in contingency size, by including an explicit limit; and
- an increase in the FCAS requirements.

The Panel engaged CRA to assist its review of the Tasmanian *frequency operating standards*, in particular the benefit cost assessment of the scenarios considered by the Panel. The CRA report is published as an accompanying document to this Draft Determination.

4.3.2 Tasmanian energy outlook

Several stakeholders commented on the long term sustainability of the Tasmanian electricity supply in Tasmania. The CRA analysis indicates that on the basis of high level analysis, under most plausible conditions there is a case for additional base load capacity. There may only be sufficient generating capability provided that:

- energy consumption in Tasmania does not exceed the most recent medium economic growth projection published by NEMMCO²⁰;

²⁰ The NEMMCO “2008 Energy and demand projection” was published in July 2008 and is available on the NEMMCO website at <http://www.nemmco.com.au/about/410-0100.pdf>.

- Basslink energy imports approximately balance exports;
- hydro inflows return to their long-term average equivalent to 9,000 GWh per annum; and
- the existing Bell Bay Power Station continues to produce approximately 1,100 GWh per annum.

If the energy forecasts are exceeded, the hydro inflows are below their long-term average or the ongoing operation of Bell Bay Power Station is not possible, then Tasmania would be relying heavily on net Basslink imports and wind farm generation. This risk is quite significant given the:

- age of the Bell Bay Power Station and its uncertain long term future;
- fact that hydro inflows have been approximately equivalent to 2,000 GWh per annum below their long term average for the past two years, with no current sign of this changing;
- energy available from a 130 MW wind farm is approximately 400 GWh per annum²¹; and
- large impact that a prolonged Basslink outage would have on electricity security in Tasmania.

While a prolonged outage of Basslink would be unlikely, its impact could be significant in the presence of an ongoing drought.

The Panel concludes that, while the electricity supply in Tasmania appears to be sufficient given the present circumstances, there appears to be potential risks to that supply if any one of the conditions above are not met. Therefore, the Panel considers there is a credible probability that a proponent for a new base load generation will be forthcoming. The Panel also notes that the most likely fuel sources for this new generation are gas and wind. To this end the Panel notes the TVPS and Gunns gas powered projects and the various potential wind farm projects discussed in submissions to the review.

4.3.3 Opportunities for new gas generator technology development in Tasmania

The proponents of a new gas powered generating unit are broadly faced with a choice between:

1. robust aero derivative gas turbines, either in open cycle operation or as part of combined cycle generator; and
2. large single shaft industrial combined cycle gas turbines.

²¹ This estimate of the output of a wind farm is based on an average utilisation of 35%.

Robust aero derivative gas turbines can operate under the existing Tasmanian *frequency operating standards*²² however, compared to a single shaft industrial combined cycle gas turbines, suffer from several disadvantages including:

- a capital cost approximately 12% higher than those for a single shaft CCGT²³;
- a short run marginal cost (SRMC) approximately 3% higher than those for a single shaft CCGT²⁴;
- increased maintenance requirements.

As discussed above, the consequences of allowing single shaft industrial CCGTs to connect in the Tasmanian power system is that the cost of six second raise FCAS would rise, particularly at times of light load and higher Basslink imports. This would increase the FCAS prices and could in some instances, in the absence of any mitigation, lead to an FCAS shortage that would require intervention by NEMMCO. The Panel does note that the FCAS requirements can be dramatically reduced by limiting the size of the largest generator contingency under light conditions, although tightening the standard itself does marginally increase the FCAS requirement.

The CRA benefit cost assessment shows that the lower capital and running costs of single shaft industrial CCGTs outweigh the increased FCAS cost where there is a contingency limit. This result is generally consistent with the market modelling results produced by ROAM Consulting²⁵.

Therefore, the Panel considers that improving the opportunity for further generation development in Tasmania to promote reliable and secure supplies warrants a set of standards which allow for a wider choice of generation technologies. However, the economic and technical case is dependant on the size of the largest generating contingency being limited in some manner to prevent shortages of FCAS at times of lighter load.

4.3.4 Assessment of scenario C against the national electricity objective

Under the NEO the Panel is required to assess the proposed change to the Tasmanian *frequency operating standards* in terms of the long term impacts on consumers of electricity in terms of:

- (a) price, quality, safety, reliability and security of supply of electricity; and

²² Some stakeholders, including Alinta, asserted aero derivative gas turbines could not be configured for combined cycle operation because the associated steam turbine would not meet the minimum access standards. The Panel did not pursue this point because of other disadvantages of aero derivative generating units.

²³ These indicative capital cost and SRMC comparisons are based on Hydro Tasmania's presentation to the Panel on 30 July 2008, which is available on the AEMC website.

²⁴ *ibid.*

²⁵ The ROAM analysis is contained in the supplementary submission from Alinta, dated 29 July 2008.

(b) the reliability, safety and security of the national electricity system.

Scenario C consists of tightening the Tasmanian *frequency operating standards* and imposing a limit on the size of the generator contingency size²⁶.

The advice from NEMMCO and Transend shows that it may not be practical to change the standards without mitigating the impact on the FCAS requirements, with associated high costs and regular NEMMCO interventions. In addition, CRA's analysis shows that the economic case for tightening the Tasmanian *frequency operating standards* strongly depends on limiting the contingency size to mitigate the resulting high FCAS costs.

The Panel also notes the concern, raised by Hydro Tasmania and Roaring40s, that tightening the Tasmanian *frequency operating standards* may become a barrier to a large penetration of wind generators in Tasmania. The Panel considers that scenario C does not increase the FCAS requirements excessively, compared to scenario D without a limit on the generator contingency size, and is therefore unlikely to have a significant detrimental impact on wind penetration.

Therefore, the Panel considers that scenario C would be likely to advance the national electricity objective for the following reasons:

- the tighter standard would allow higher efficiency thermal generating units to operate in Tasmania which would be expected to lower average energy costs for consumers in the long term;
- allowing higher efficiency thermal generating units to operate will increase the diversity of supply in Tasmania and would be likely to improve reliability and security of supply;
- the limit on the generator contingency size would reduce the FCAS costs, compared to no contingency limit, and hence the long term prices to consumers; and
- the tighter standard, in the presence of a limit on the generator contingency size, would not materially affect NEMMCO's ability to maintain power system security compared to the existing arrangements.

4.4 Mechanism to mitigate the size of the largest contingency

4.4.1 Form of the mechanism to limit the generator contingency size

As discussed above, the feasibility of tightening the Tasmanian *frequency operating standards*, at this stage, depends on limiting the size of the generator contingency as the FCAS costs depend on both the *frequency operating standards* and the size of the largest contingency.

²⁶ The increase in the contingency size in the case of the TVPS, if there were no limits in the standards, would move Tasmania from 144 MW to 210 MW.

A limit on the generator contingency size could be implemented using a constraint equation in the NEMMCO dispatch process. Where the capacity of a generating unit is larger than the largest allowable generator contingency the associated generator could operate above the contingency limit by implementing an arrangement that is similar to the Basslink special protection scheme (SPS), that is by automatically tripping contracted load whenever the new large generating unit trips such that the combined contingency size is limited. That is, the ability of a large generation unit to operate up to its full capacity is not necessarily restricted, provided contracted load is available to be tripped to limit the size of the resulting contingency. Such an automatic load shedding scheme would need to be approved by NEMMCO and included in the connection agreement with the associated network service provider.

The Panel considers that ideally the size of the contingency should be determined dynamically following an economic trade off between the benefits of the resulting generation and the costs of the associated FCAS. However, in the absence of this dynamic economic trade off, the Panel is proposing that a fixed limit on the contingency size of 144 MW. This contingency size limit equals the existing maximum generator contingency in Tasmania and forms the basis of NEMMCO's advice.

The Panel also considered a variable contingency size limit that depended on variables such as system load and Tasmanian inertia, for example, a contingency limit of say 15% of the Tasmanian demand²⁷. The Panel notes that a disadvantage of a fixed limit of 144 MW is that at periods of high load, and higher FCAS availability, this may be overly restrictive on the operation of the higher efficiency generating unit, and thus is likely to be less efficient. However, the Panel notes that a variable contingency limit would still be arbitrary to some degree and may not necessarily reflect the economic trade off between contingency size and FCAS costs.

The Panel seeks stakeholders' views on the form of the contingency size limit.

4.4.2 Including a limit on the generator contingency size in the frequency operating standards

The Panel considers that including a limit on the generator contingency within the Tasmanian *frequency operating standards* is necessary for the Panel's draft decision to satisfy the NEO. Tightening of the Tasmanian *frequency operating standards* in the absence of a limit on the size of the generator contingency limit would cause costs that are likely to exceed the benefits and would be likely to lead to regular interventions by NEMMCO in order to maintain power system security.

4.4.3 Future review of the limit on generator contingency size

The Panel considers that a limit on the generator contingency size is warranted in the absence of a mechanism to more accurately trade off between the contingency size

²⁷ 15% is approximately the ratio between a typical low load of 960 MW and the existing contingency limit of 144 MW.

and the associated FCAS costs. However, the Panel would subsequently consider removing this limitation on the contingency size if a more efficient alternative arrangement is implemented.

The Panel notes that this generator contingency limit can only be removed from the Tasmanian *frequency operating standards* following a review by the Panel in accordance with clause 8.8.3 of the Rules.

4.5 Recovering the costs of the increased FCAS requirements

While limiting the contingency size has the effect of significantly lowering the FCAS requirements and the associated costs, compared to tightening the standard without a contingency limit, the proposed changes to the Tasmanian *frequency operating standards* will nevertheless result in a small increase in the FCAS requirements, particularly those for six second raise. For example, at a Tasmanian demand of 900 MW, an additional 31 MW six second raise FCAS is typically required if the lower limit of the single contingency *operational frequency tolerance band* is raised from the current 47.5 Hz to the proposed 48 Hz.

Under the existing mechanisms in the Rules many of the benefits of changing the Tasmanian *frequency operating standards* would be captured by the new higher efficiency generating unit, while the costs of the additional FCAS would be recovered from all generators.

The Panel considers that the following two alternative cost recovery mechanisms could also be explored:

- calculating the cost of the additional FCAS required to meet the tighter Tasmanian *frequency operating standards* and recovering this from the new higher efficiency thermal generating unit; or
- requiring the higher efficiency thermal generating unit to contract with an amount of additional FCAS that NEMMCO would take into account when procuring sufficient FCAS.

Both these cost recovery options are a form of “runway pricing” where the costs of the additional FCAS is recovered from the party that caused the additional need. However both options have difficulties. The first cost recovery option requires an independent entity, such as NEMMCO, to calculate the additional requirements for each trading interval. The second cost recovery option has the disadvantage that the actual additional requirement varies with the system load.

The Panel notes the potential for possible Rules changes from stakeholders that consider an alternative arrangement, such as a form of “runway pricing”, should apply. The implementation of any alternative cost recovery mechanisms could only occur through a formal Rule change process and consideration by the AEMC.

4.6 Implementation – transitional arrangements

The Panel requests that stakeholders who may need to modify their systems as a result of the proposed changes to the Tasmanian *frequency operating standards* should indicate how long they would need and, hence, when the amended standards should take effect.

5 Development of the Draft Tasmanian Frequency Operating Standards

5.1 Draft Tasmanian Frequency Operating Standards

The Panel has considered the benefit cost assessment prepared by its consultant (CRA), the information provided in the various submissions and its own analysis, and is proposing to amend the Tasmanian *frequency operating standards* to the draft standards presented in this chapter, provided that the size of the generator contingency is limited to 144 MW.

Tables 5.1 and 5.2 present a summary of the Draft Tasmanian *frequency operating standards* that would apply under interconnected and island conditions. Table 5.3 presents the values of the terms specifically used in the Rules. A full description of the Draft Tasmanian *frequency operating standards* is presented in Appendix A.

Table 5.1 Draft Tasmanian Frequency Operating Standards – interconnected system

Condition	Containment	Stabilisation	Recovery
Accumulated time error	15 seconds		
Normal	49.75 to 50.25 Hz, 49.85 to 50.15 Hz 99% of the time	49.85 to 50.15 Hz within 5 mins	
Load and generation event	48.0 to 52.0 Hz	49.85 to 50.15 Hz within 10 mins	
Network event	48.0 to 52.0 Hz	49.85 to 50.15 Hz within 10 mins	
Separation event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 mins	49.85 to 50.15 Hz within 10 mins
Multiple contingency event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 mins	49.85 to 50.15 Hz within 10 mins

Table 5.2 Draft Tasmanian Frequency Operating Standards – island operation

Condition	Containment	Stabilisation	Recovery
Normal	49.0 to 51.0 Hz		
Load and generation event	48.0 to 52.0 Hz	49.0 to 51.0 Hz within 10 mins	
Network event	48.0 to 52.0 Hz	49.0 to 51.0 Hz within 10 mins	
Separation event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 mins	49.0 to 51.0 Hz within 10 mins
Multiple contingency event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 mins	49.0 to 51.0 Hz within 10 mins

Table 5.3 Draft Tasmanian Frequency Operating Standards – Rule terms

Term	Normal range (Hz)	Island range (Hz)
<i>normal operating frequency band</i>	49.85 to 50.15	49.0 to 51.0
<i>normal operating frequency excursion band</i>	49.75 to 50.25	49.0 to 51.0
<i>operational frequency tolerance band</i>	48.0 to 52.0	48.0 to 52.0
<i>extreme frequency excursion tolerance limit</i>	47.0 to 55.0	47.0 to 55.0

5.2 Draft Amendments to the Tasmanian Frequency Operating Standards

In developing the Draft Tasmanian *frequency operating standards*, presented above and in Appendix A, the Panel has considered each aspect of the existing standards and is proposing a number of amendments.

5.2.1 Normal operating bands

The normal operating band, also referred to in the Rules as the *normal operating frequency band* and *normal operating frequency excursion band*, specifies the allowable frequency deviations in the absence of a contingency that occur due to the natural variation of the system load, small generator non-conformances or forecasting errors. NEMMCO procures sufficient regulating FCAS to ensure that the frequency remains within the normal operating band in the absence of a contingency.

Neither the NEMMCO advice²⁸ nor any of the submissions proposes or supports a change to the normal operating frequency bands. The Panel also notes that the existing normal operating frequency bands are the same as those that apply on the NEM mainland for interconnected conditions, although the normal bands for island conditions are 49.5 to 50.5 Hz on the NEM mainland.

Therefore, the Panel is proposing no change to the normal operating bands for either interconnected operation or island operation.

5.2.2 Under frequency bands

As discussed in Chapter 4, the Panel is proposing that the Tasmanian *frequency operating standards* be amended so that higher efficiency thermal generating units can be connected and operated in Tasmania. The greatest barriers to the connection of such generating units are the requirements to operate for the relatively low frequencies currently allowed under the Tasmanian *frequency operating standards*. To reduce these barriers the Panel is proposing that the lower limits of the *extreme frequency excursion tolerance limit* and the *operational frequency tolerance band* be increased.

Extreme frequency excursion tolerance limit

Higher efficiency thermal generating units are less tolerant to low frequencies than the existing generating units in Tasmania and are generally required to trip at approximately 47 Hz.

Therefore, the Panel is proposing raising the lower limits of the separation event and multiple contingency event bands, and the *extreme frequency excursion tolerance limit*, to 47 Hz from the current value of 46 Hz.

Operational frequency tolerance band

If the lower limit of the *extreme frequency excursion tolerance limit* is raised to 47 Hz then it is necessary to raise the *operational frequency tolerance band* to allow sufficient margin for the Tasmanian UFLS to operate without a single credible contingency causing unintended load shedding.

At present the Tasmanian UFLSS operates from 47.5 Hz down to 46 Hz. However, NEMMCO and Transend advise that they consider that the operation of the UFLSS could be compressed to 1 Hz, thus operating from 48 Hz down to 47 Hz²⁹. In addition, higher efficiency thermal generating units are generally required to minimise the periods of operation below 48 Hz to prevent significant loss of life of the plant, to reduce excessive maintenance and risks of catastrophic failure.

²⁸ The advice received from NEMMCO in accordance with clause 8.8.1(a)(2) of the Rules, and published on the AEMC website.

²⁹ Reference Transend (23 May 2008) and NEMMCO advice on UFLSS.

Therefore, the Panel is proposing that the lowest allowable frequency for a single credible contingency should be 48 Hz. This has been achieved in the draft Tasmanian *frequency operating standards* by raising the lower limit of the generator and network event bands, and the lower limit of the *operational frequency tolerance band*, to 48 Hz from the current value of 47.5 Hz³⁰.

5.2.3 Over frequency bands

Higher efficiency thermal generating units are also less tolerant to high frequencies than the existing generating units in Tasmania and are generally required to trip at approximately 52 Hz.

However, under schedule S5.2.5.3(c)(5) and (6) of the Rules, a generating unit can meet the minimum access standards for over frequency ride through requirements if it has a protection system to trip the unit if the frequency exceeds a level agreed with NEMMCO. Under schedule S5.2.5.3(c)(5) NEMMCO can choose any tripping frequency above the upper bound of the *normal operating frequency band*, but NEMMCO would not normally allow a generator to trip below the upper limit of the *operational frequency tolerance band* because the generating unit could be exposed to this frequency for a single credible load or network event³¹.

Therefore, the Panel is proposing:

- no change to the upper limit of the *extreme frequency excursion tolerance limit* of 55 Hz³²; and
- an upper limit for the *operational frequency tolerance band* of 52 Hz³³.

The Panel considers that aligning the upper limit of the *operational frequency tolerance band* for load, generator and network events to 52 Hz, would allow higher efficiency thermal generating units to meet the minimum access standards in respect to the frequency ride through requirements in schedule 5.2.5.3 of the Rules³⁴.

³⁰ The lower limit of the load event band is currently set to 49 Hz, however, the Panel recommends that this limit be made equal to the limits for the generator and network event bands.

³¹ Refer to the NEMMCO submission to the and/or Rule change. NEMMCO may make an exception if the unit needed to trip at a frequency that was not significantly below the upper limit of the *operational frequency tolerance band* and the size of the resulting contingency was small, but this would be a matter for NEMMCO when it coordinates the operation of the OFGSS.

³² The Panel is recommending that the same *operational frequency tolerance band* and *extreme frequency excursion tolerance limit* apply for both interconnected and island conditions.

³³ The Panel is recommending that the same *operational frequency tolerance bands* apply for load, generator and network events.

³⁴ Gunns indicated that its cogeneration plant would trip at 51.6 Hz, causing a 60 MW contingency. In principle, this also meets the minimum access standards in schedule 5.2.5.3(c)(5) of the Rules as NEMMCO could accept a tripping frequency as low as 51.0 Hz, the normal operating band for island operation, however there would be a risk that the Gunns unit would trip for a large single load or network event. NEMMCO's advice is that the alternative of lowering the upper limit of the single contingency band below 52 Hz would not be practical because of the impact on the FCAS lower requirements. The Panel expects that NEMMCO would only accept a generating unit tripping

The Panel also acknowledges that it may be impossible to design the OGFSS to manage an island condition where there is a large imbalance between the generation and load within the island. Under these conditions, the Panel considers that it is in the long term interests of consumers to allow the affected generating units to self protect at frequencies above 55 Hz, or as agreed with NEMMCO, rather than risk damage and prolong outages of these generating units.

5.2.4 Load, generator and network events

At present the Tasmanian *frequency operating standards* have separate frequency bands for load, generator and network events. However, Transend identified the potential to simplify the standards³⁵. Transend summarised its recommended changes in Tables 2 and 3 of its submission of 23 May 2008.

When developing the draft Tasmanian *frequency operating standards*, the Panel has considered the recommendations from Transend, and the NEMMCO advice, and in some cases made further simplifications.

Amalgamating the load event and the network event bands

Currently the load and network event bands are 49 to 51 Hz and 47.5 to 53 Hz respectively.

Transend propose that the upper limits of both bands be amended to 52 Hz for simplicity and to remove an inconsistency in the calculation of FCAS lower³⁶. Tightening the network event band to 52 Hz would be necessary to align with the *operational frequency tolerance band* while increasing the upper limit of the load event band to 52 Hz reduces the fast FCAS lower requirements. Transend also notes that the *market ancillary service specification*³⁷ could be updated for Tasmania so that the test signal used for calculating the FCAS lower capability aligns with the actual frequency limit being controlled to.

The Panel considers that aligning the lower limit of the load event band to 48 Hz would have no material affect as the primary requirement following a load event is to manage the over frequency.

Therefore the Panel agrees with Transend and is proposing combining the load event and the network bands in the draft Tasmanian *frequency operating standards*.

following a single load or network event if it caused only a small contingency and it could be effectively integrated into the OFGSS.

³⁵ Transend submission of 23 May 2008.

³⁶ See section 3.1.1 of the Transend submission of 23 May 2008.

³⁷ Has the meaning given in clause 3.11.2(b) of the Rules.

Upper limit of the generator event band

Transend discusses the possibility of raising the upper limit of the generator event band from 51 Hz to 52 Hz and it concludes that leaving the limit at 51 Hz would be appropriate because the remote possibility of an over frequency to 52 Hz may cause inadvertent over frequency tripping of some generating units.

The Panel notes that the upper limit of the load and generator events bands are identical in the NEM mainland *frequency operating standards*³⁸, and it considers that the risk of a single generator event causing another generating unit to inadvertently trip on over frequency to be remote, given that NEMMCO would be procuring sufficient FCAS to limit the frequency to 52 Hz for a generator event.

Therefore, the Panel is proposing to align the upper limit of the generator event band to 52 Hz to align with the *operational frequency tolerance band* and the load and network event limits. The Panel considers this would provide simplicity and better align with the NEM mainland, without introducing a material additional risk.

Lower limits of the load, generator and network events

Currently the lower limit of the generator and network event bands is 47.5 Hz and the lower limit of the load event band is 49 Hz. The Panel notes that the lower limit of the generator and network event bands need to be raised to 48 Hz to align with the *operational frequency tolerance band*.

The Panel also considers that the lower limit of the load event band should be lowered to 48 Hz to align with the generator and network event bands. The Panel considers that this would have little or no effect on the FCAS raise requirements and would simplify the standards, without introducing a material risk to system security. In making this proposal the Panel notes that the lower limit of the load and generator events on the NEM mainland are equal.

5.2.5 Stabilisation and recovery values

Load, generator and network events

Currently the recovery time for generator and network events is 5 minutes while the recovery time for load events is 10 minutes. This difference was introduced by the TRNPP in its last review of the Tasmanian *frequency operating standards* in 2006³⁹, and was adopted by the Panel in its initial review in 2006. The TRNPP stated that:

³⁸ The NECA determination on the NEM mainland *frequency operating standards* is available on the AEMC website.

³⁹ TRNPP 2006 review, available on the website of the Office of the Tasmanian Energy Regulator located at <http://www.otter.tas.gov.au>.

“The stabilisation and recovery time for a load event has been increased from 5 to 10 minutes. This addresses a problem experienced by a major customer due to the 5 minute dispatch interval in the NEM where it was being asked to delay restoration until sufficient ancillary services had been dispatched in the following interval to avoid excessive frequency excursions when the load is switched back in.”⁴⁰

Transend indicated in its submission that 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.” Transend notes that this set a precedence whereby operation in the range 49 to 51 Hz for up to 10 minutes was deemed acceptable from a power quality perspective. Therefore, Transend also considers that the recovery times for generation and network events could be extended to 10 minutes if both the bands are tightened to 48 Hz to 52 Hz.

Transend also considers that a stabilisation requirement of 49 to 51 Hz within 5 minutes should apply following a single contingency event. The Panel has not included this requirement in its draft Tasmanian *frequency operating standards*, for simplicity, because the single event bands have been tightened (48 to 52 Hz) and the frequency must in any case be within the *normal operating frequency band* within 10 minutes. The Panel would welcome comments from stakeholders on this decision.

Multiple contingencies and separation events

Neither the NEMMCO advice nor any of the submissions propose or support a change to the stabilisation and recovery bands and times, other than consequential changes due to changes to the containment bands for normal and the single event bands.

Therefore, the Panel is proposing no change to the stabilisation and recovery bands and times, other than aligning them to the amended *normal operating frequency bands* and the *operational frequency tolerance bands*.

5.3 Accumulated time error

The existing accumulated time error is 15 seconds and it applies whenever the Tasmanian power system is intact.

⁴⁰ Submission made to the Panel by the TRNPP in April 2006 as part of the Panel’s initial review of the Tasmanian frequency operating standards, published in May 2006.

Transend⁴¹ advised that the existing accumulated time error can be exceeded following separation or multiple contingency events, which is consistent with the advice from NEMMCO.

The Panel considers that the value of the accumulated time error should continue to be 15 seconds. In addition, the Panel notes that this value may be difficult to achieve following separation or multiple contingency events and, given that the accumulated time error is not critical for system security, is proposing to relax the requirement so that it only applies during normal operation and following single contingency events.

The Panel seeks feedback from stakeholders on the specification of the accumulated time error in the Tasmanian *frequency operating standards*.

⁴¹ Transend submission of 23 May 2008.

A Draft Tasmanian Frequency Operating Standards

The Panel is proposing to amend, in accordance with clause 8.8.3 of the Rules and section 38 of the NEL, the Tasmanian *frequency operating standards* to those contained in this Appendix.

Part A Summary of the Standards

The *Tasmanian frequency operating standards* set out in Part B are summarised in the following tables for convenience. To the extent of any inconsistency between these tables and Part B below, Part B prevails.

The following table applies to any part of the Tasmanian *power system*, other than an *island*:

Draft Tasmanian Frequency Operating Standards – interconnected system

CONDITION	CONTAINMENT	STABILISATION	RECOVERY
Accumulated time error (other than multiple contingency events)	15 seconds		
Normal	49.75 to 50.25 Hz, 49.85 to 50.15 Hz 99% of the time	49.85 to 50.15 Hz within 5 minutes	
Load and generation event	48.0 to 52.0 Hz	49.85 to 50.15 Hz within 10 minutes	
Network event	48.0 to 52.0 Hz	49.85 to 50.15 Hz within 10 minutes	
Separation event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes
Multiple contingency event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 minutes	49.85 to 50.15 Hz within 10 minutes

The following table applies to an *island* within the Tasmanian *power system*:

Draft Tasmanian Frequency Operating Standards – island operation

CONDITION	CONTAINMENT	STABILISATION	RECOVERY
Normal	49.0 to 51.0 Hz		
Load and generation event	48.0 to 52.0 Hz	49.0 to 51.0 Hz within 10 minutes	
Network event	48.0 to 52.0 Hz	49.0 to 51.0 Hz within 10 minutes	
Separation event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes
Multiple contingency event	47.0 to 55.0 Hz	48.0 to 52.0 Hz within 2 minutes	49.0 to 51.0 Hz within 10 minutes

Part B The Frequency Operating Standards

For the purposes of the *Rules*, the *frequency operating standards*, forming part of the *power system security and reliability standards*, that apply in Tasmania are:

- (a) except in an island or following a multiple contingency event, the accumulated time error should not exceed 15 seconds;
- (b) except as a result of a contingency or a load event, system frequency should not exceed the applicable *normal operating frequency excursion band* and should not exceed the applicable *normal operating frequency band* for more than five minutes on any occasion and for not more than 1% of the time over any 30 day period;
- (c) as a result of a generation event, system frequency should not exceed the applicable generation change band and should not exceed the applicable *normal operating frequency band* for more than 10 minutes;
- (d) as a result of a load event, system frequency should not exceed the load change band and should not exceed the applicable *normal operating frequency band* for more than 10 minutes;
- (e) as a result of any network event, system frequency should not exceed the applicable *operational frequency tolerance band* and should not exceed the applicable load change band for more than one minute or the applicable *normal operating frequency band* for more than 10 minutes;
- (f) as a result of any separation event, system frequency should not exceed the applicable island separation band and should not exceed the applicable load change band for more than two minutes or the applicable *normal operating frequency band* for more than 10 minutes;
- (g) as a result of any multiple contingency event, system frequency should not exceed the applicable *extreme frequency excursion tolerance limits* and should not

exceed the applicable load change band for more than two minutes while there is no contingency event or the applicable *normal operating frequency band* for more than 10 minutes while there is no contingency event; and

- (h) the size of the largest single generator event is limited to 144 MW, which can be implemented for a generating unit with a capacity that is greater than 144 MW by the automatic tripping of load.

Part C Application of Rules Terms

For the purposes of these *frequency operating standards* and the *Rules*, a term shown in Column 1 of the following table has the corresponding range shown in Column 3 of the table for an *island* and has the corresponding range shown in Column 2 of the Table otherwise.

Draft Tasmanian Frequency Operating Standards – Rule terms

Column 1	Column 2	Column 3
Term	Normal range (Hz)	Island range (Hz)
<i>normal operating frequency band</i>	49.85 to 50.15	49.0 to 51.0
<i>normal operating frequency excursion band</i>	49.75 to 50.25	49.0 to 51.0
<i>operational frequency tolerance band</i>	48.0 to 52.0	48.0 to 52.0
<i>extreme frequency excursion tolerance limit</i>	47.0 to 55.0	47.0 to 55.0

Part D Definitions

Words and phrases shown in italics in this document have the meaning given to the in the following table:

Draft Tasmanian Frequency Operating Standards – Glossary

Term	Reference	Meaning
Accumulated time error		Accumulated time error means, in respect of a measurement of system frequency that NEMMCO uses for controlling system frequency, the integral over time of the difference between 20 milliseconds and the inverse of that system frequency, starting from a time published by NEMMCO
Rules		The Rules means National Electricity Rules

Connection point	Glossary - NER	The agreed point of supply established between Network Service Provider(s) and another Registered Participant, Non-Registered Customer or franchise customer.
Contingency event	Clause 4.2.3(a) - NER	A “contingency event” means an event affecting the power system which NEMMCO expects would be likely to involve the failure or removal from operational service of a generating unit or transmission element.
Credible contingency event	Clause 4.2.3(b), Schedule 5.1 - NER	<p>A “credible contingency event ” means a contingency event the occurrence of which NEMMCO considers to be reasonably possible in the surrounding circumstances including the technical envelope. Without limitation, examples of credible contingency events are likely to include:</p> <ul style="list-style-type: none"> • the unexpected automatic or manual disconnection of, or the unplanned reduction in capacity of, one operating generating unit; or • the unexpected disconnection of one major item of transmission plant (e.g. transmission line, transformer or reactive plant) other than as a result of a three phase electrical fault anywhere on the power system.
Extreme frequency excursion tolerance limits	Glossary - NER	In relation to the frequency of the power system, means the limits so described and specified in the power system security and reliability standards.
Generating unit	Glossary - NER	The actual generator of electricity and all the related equipment essential to its functioning as a single entity.
Generation	Glossary - NER	The production of electrical power by converting another form of energy in a generating unit.
Generation change band		means the frequency range of 47.5 to 53.0 Hz in respect of an island and the frequency range of 47.5 to 51.0 Hz otherwise.

Generation event		means 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, not arising from a network event, a separation event or a part of a multiple contingency event.
Interconnector	Glossary - NER	A transmission line or group of transmission lines that connects the transmission networks in adjacent regions.
Island		means a part of the Tasmanian <i>power system</i> that includes <i>scheduled generation, networks and load</i> for which all of its alternating current network connections with other parts of the <i>power system</i> have been disconnected
Island separation band		means the extreme frequency excursion tolerance limits
Load	Glossary - NER	A connection point or defined set of connection points at which electrical power is delivered to a person or to another network or the amount of electrical power delivered at a defined instant at a connection point, or aggregated over a defined set of connection points
Load change band		means the frequency range of 47.5 to 53.0 Hz in respect of an island and the frequency range of 49.0 to 51.0 Hz otherwise.
Load event		means an either an identifiable increase or decrease of more than 20 MW of customer load (whether at a connection point or otherwise), or a rapid change of flow by a high voltage direct current interconnector to or from 0 MW for the purpose of starting, stopping or reversing its power flow, not arising from a network event, a generation event, a separation event or a part of a multiple contingency event
Market network service provider	Glossary - NER	A Network Service Provider who has classified any of its network services as a market network service in accordance with Chapter 2 and who is also registered by NEMMCO as a Market Network Service Provider under Chapter 2.

Multiple contingency event		means either a contingency event other than a credible contingency event, a sequence of credible contingency events within a period of 5 minutes, or a further separation event in an island
National grid	Glossary - NER	The sum of all connected transmission and distribution systems within the participating jurisdictions
NEMMCO	Glossary - NER	National Electricity Market Management Company Limited A.C.N. 072 010 327.
Network	Glossary - NER	The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity to customers (whether wholesale or retail) excluding any connection assets. In relation to a Network Service Provider, a network owned, operated or controlled by that Network Service Provider
Network event		means a credible contingency event other than a generation event, a separation event or a part of a multiple contingency event
Normal operating frequency band	Glossary - NER	In relation to the frequency of the power system, means the range 49.9 Hz to 50.1 Hz or such other range so specified in the power system security and reliability standards.
Normal operating frequency excursion band	Glossary - NER	In relation to the frequency of the power system, means the range specified as being acceptable for infrequent and momentary excursions of frequency outside the normal operating frequency band, being the range of 49.75 Hz to 50.25 Hz or such other range so specified in the power system security and reliability standards.
Operational frequency tolerance band	Glossary - NER	The range of frequency within which the power system is to be operated to cater for the occurrence of a contingency event as specified in the power system security and reliability standards.
Power system	Glossary - NER	The electricity power system of the national grid including associated generation and transmission and distribution networks for the supply of electricity, operated as an integrated arrangement.

Power system security and reliability standards	Glossary - NER	The standards governing power system security and reliability of the power system which are approved by the Reliability Panel on the advice of NEMMCO. They may include but are not limited to standards for the frequency of the power system in operation, contingency capacity reserves (including guidelines for assessing requirements and utilisation), short term capacity reserves, medium term capacity reserves and system restart.
Publish	Glossary - NER	Make available to Registered Participants electronically.
Separation event		means a credible contingency event in relation to a transmission element that forms an island.
Synchronisation	Glossary - NER	The act of synchronising a generating unit or a scheduled network service to the power system.
System frequency		means the frequency of a part of the power system, including the frequency of an island.
Technical envelope	NER Clause 4.2.5	means the technical boundary limits of the power system for achieving and maintaining a secure operating state of the power system for a given demand and power system scenario.
Transmission line	Glossary NER	A power line that is part of a transmission network.
Transmission element	Glossary - NER	A single identifiable major component of a transmission system involving: (a) an individual transmission circuit or a phase of that circuit; (b) a major item of transmission plant necessary for the functioning of a particular transmission circuit or connection point (such as a transformer or a circuit breaker).

Transmission network	Glossary - NER	<p>A network within any participating jurisdiction operating at nominal voltages of 220 kV and above plus:</p> <p>any part of a network that operates at nominal voltages between 66 kV and 220 kV that operates in parallel to and provides support to the high voltage transmission network;</p> <p>any part of a network that operates at nominal voltages between 66 kV and 220 kV that is not referred to in paragraph (a) but is deemed by the AER to be part of the transmission network.</p>
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B Initial Stakeholder Comments

This Appendix summarises the initial stakeholder comments that were received and considered by the Panel prior to it preparing its Draft Determination

B.1 Submissions

Entity	Dated	Comment
Alinta	24 April 2008	Letter Submission (revised 21 May 2008) extract from submission (revised 5 June 2008)
Basslink	23 April 2008	
Department of Infrastructure, Energy and Resources	28 September 2007	Prepared by ETAC and supplied by the Jurisdiction
Aurora	23 May 2008	
Gunns	23 May 2008	
Hydro Tasmania	23 May 2008	Letter Submission
Roaring40s	23 May 2008	
Transend	23 May 2008	Letter Submission
TRUenergy	23 May 2008	
National Generators Forum	28 May 2008	
David Llewellyn	21 May 2008	Tasmanian Minister
Transend	25 July 2008	Presentation to ETAC
Alinta	24 July 2008	
Alinta	29 July 2008	
Alinta	30 July 2008	Presentation to the Panel
Alinta	25 July 2008	ROAM report (Stage 1)
Alinta	29 July 2008	ROAM report (Stage 2)
Hydro Tasmania	1 August 2008	Letter Responses to the Panel Proposal Confidential Information

Entity	Dated	Comment
Hydro Tasmania	30 July 2008	Presentation to the Panel
Roaring 40s	4 August 2008	Letter Submission
Hydro Tasmania	6 August 2008	Presentation to the Panel
Transend	7 August 2008	Letter Submission
Alinta	7 August 2008	
Hydro Tasmania	7 August 2008	

B.2 Presentations at stakeholder forum in Hobart on 6 June 2008

- Chairman of the Reliability Panel
- Office of Energy Planning and Conservation - Tony Van De Vusse
- Transend Presentation
- Gunns Presentation
- Hydro Tasmania Presentation
- Roaring 40s Presentation
- Basslink Presentation

C Initial Stakeholder Comments - Benefit Cost Assessment

This Appendix summarises the views raised by stakeholders in their initial comments prior to the Panel making this Draft Determination.

C.1 How the Review will or is likely to contribute to the achievement of the national electricity objective

This section summarises the comments from stakeholders on how the review could achieve the NEO e.g.:

- by “creating and applying a market environment and rules that promote efficient investment adequate to meet the current and prospective demand, the efficient dispatch of generation, and continuing high standards of security and performance”;⁴²
- “a package of frequency standards and a rule change or alternative mechanism as another way for new entrant generators to meet minimum access standards under the Rules” which “minimises costs, maximises benefits”;⁴³
- avoid aligning the Tasmanian *frequency operating standards* with the mainland *frequency operating standards* in the NEM for the sole reason of consistency;⁴⁴ and
- “the Reliability Panel undertake a thorough assessment of the potential costs of tightening the standards, to ensure they are set at a level which maximises the net benefits to consumers over the long term”.⁴⁵

C.2 The expected benefits and costs of the Review and the potential impacts of the Review on those likely to be affected

This section presents, in accordance with clause 9.49.4(a)(2) of the Rules, the Panel’s explanation of the expected benefits and costs of the Review to the existing Tasmanian *frequency operating standards*. This includes the potential impacts of the Review on those likely to be affected.

Below are some stakeholder comments on the expected benefits of tightening the Tasmanian *frequency operating standards*:

- lower electricity prices for consumers;⁴⁶
- it would be beneficial if generator competition is encouraged;⁴⁷

⁴² The Hon David Llewellyn MP submission, 21 May 2008, p.1.

⁴³ Hydro Tasmania submission, 23 May 2008, p.2.

⁴⁴ TRUenergy submission, 23 May 2008, p.1.

⁴⁵ NGF submission, 28 May 2008, p.2.

⁴⁶ Alinta submission, 24 April 2008, p.2.

- future demand could be met;⁴⁸
- other market benefits of thermal plant;⁴⁹
- provides voltage support for the power system;⁵⁰
- system inertia provided by the new thermal entry;⁵¹
- incremental benefit of facilitating connection of additional renewable technologies in Tasmania should be considered;⁵²
- improvements in long term security and reliability benefits through improved plant mix and greater fuel diversity in Tasmania;⁵³ and
- additional capacity from the new plant.⁵⁴

Below are some stakeholder comments on the expected costs of tightening the Tasmanian *frequency operating standards*:

- cost to consumers should be minimal;⁵⁵
- experiences in similar overseas systems have concluded that the compliance costs to wider frequency band operation outweighs the cost of a tighter *frequency operating standard*;⁵⁶
- comparisons should be made between the increased cost of FCAS in operating to a tighter band and the cost of plant compliance and increased energy cost;⁵⁷
- an evaluation should be undertaken on the forecast combined energy reserve cost, with and without a new standard;⁵⁸
- the reliability costs of thermal units should be considered;⁵⁹

⁴⁷ Aurora Energy submission, 23 May 2008, p.3; TRUenergy submission, 23 May 2008, p.2; NGF submission, 28 May 2008, p.2; Alinta supplementary submission, 24 July 2008, p.11.

⁴⁸ Aurora Energy submission, 23 May 2008, p.3.

⁴⁹ Aurora Energy submission, 23 May 2008, p.3.

⁵⁰ Aurora Energy submission, 23 May 2008, p.3.

⁵¹ Aurora Energy submission, 23 May 2008, p.4; Roam Consulting report in Alinta supplementary submission, , 24 July 2008, p.II.

⁵² Roaring 40s submission, 23 May 2008, p.4.

⁵³ NGF submission, 28 May 2008, p.2.

⁵⁴ Roam Consulting report in Alinta supplementary submission, 24 July 2008, p.II.

⁵⁵ Aurora Energy submission, 23 May 2008, p.3.

⁵⁶ Gunns submission, 23 May 2008, p.6.

⁵⁷ Gunns submission, 23 May 2008, p.6.

⁵⁸ Gunns submission, 23 May 2008, p.6.

⁵⁹ Gunns submission, 23 May 2008, p.6.

- FCAS costs in lost water from inefficient machines to supply FCAS should be based on the water opportunity cost and costs of the new FCAS supply should be determined;⁶⁰
- the current and 210W contingency should be considered to determine the viability and costs of any proposed change following the commissioning of the Alinta plant;⁶¹
- the cost of installing CCGT plant designed for the existing Tasmanian system is low compared with the costs in accommodating less suitable plant;⁶²
- the total costs of contingency services could more than double with a tighter *frequency operating standard*;⁶³
- lower cost alternative mechanisms such as a Rule change or out-of-market arrangements as opposed to changing the Tasmanian *frequency operating standards* should be considered;⁶⁴
- potential increases in FCAS costs may have an impact on distribution network service providers and may limit their opportunities to offset price rises with FCAS earnings;⁶⁵
- likely increases in costs to both existing customers and generators in Tasmania if the Tasmanian *frequency operating standards* were aligned with the NEM for the sole reason of consistency;⁶⁶
- the FCAS raise cost to generators in Tasmania will increase;⁶⁷
- the cost of lower services to customers will increase;⁶⁸
- the cost of entry to less frequency sensitive entrants will increase;⁶⁹
- the cost for wind resources will increase;⁷⁰

⁶⁰ Hydro Tasmania submission, 23 May 2008, p.10, and Roaring40s submission, 4 August 2008, p1.

⁶¹ Hydro Tasmania submission, 23 May 2008, p.10.

⁶² Roaring 40s submission, 23 May 2008, p.2.

⁶³ Roaring 40s submission, 23 May 2008, p.4.

⁶⁴ Roaring 40s submission, 23 May 2008, p.4.

⁶⁵ Transend submission, 23 May 2008, p.16.

⁶⁶ TRUenergy submission, 23 May 2008, p.1.

⁶⁷ TRUenergy submission, 23 May 2008, p.2 and in Hydro Tasmania presentation slides dated 4 August 2008.

⁶⁸ TRUenergy submission, 23 May 2008, p.2.

⁶⁹ TRUenergy submission, 23 May 2008, p.2.

⁷⁰ TRUenergy submission, 23 May 2008, p.2; Roaring 40s supplementary submission, 4 August 2008, p.3.

- examination of cost recovery mechanisms in the FCAS market may need to be examined;⁷¹
- direct and indirect costs of altering existing systems to accommodate tighter *frequency operating standards* should be taken into account;⁷²
- generators in Tasmania would only be able to recover local FCAS costs 10% of the time;⁷³ and
- full costs would not be recoverable in FCAS raise markets which will increase energy prices for customers.⁷⁴

Below are some stakeholder comments on the potential impacts of the change on those likely to be affected:

- a tighter *frequency operating standard* will require more FCAS to be scheduled;⁷⁵
- a condition on the Tasmanian *frequency operating standard* is that it should not place unnecessary technical barriers to entry of generation technologies;⁷⁶
- the tightening of the *frequency operating standard* could be limited by the availability and cost of fast ancillary services and the frequency of VoLL events;⁷⁷
- additional FCAS would significantly affect water usage, and wear and tear on hydro plant;⁷⁸
- credible scenarios resulting from changing the Tasmanian *frequency operating standards* and rule changes should be developed;⁷⁹
- changes to the Tasmanian *frequency operating standards* should be cognisant of likely developments for the foreseeable future;⁸⁰
- the costs and benefits should be assessed on a NEM wide basis with the NEO;⁸¹
- the net impact on energy and capacity available to Tasmania should be considered for the short, medium and long terms;⁸²

⁷¹ TRUenergy submission, 23 May 2008, p.2.

⁷² NGF submission, 28 May 2008, p.2.

⁷³ Hydro Tasmania supplementary submission, 1 August 2008, p.4.

⁷⁴ Hydro Tasmania presentation to Reliability Panel in supplementary submission, 1 August 2008, p.12.

⁷⁵ Aurora Energy submission, 23 May 2008, p.4.

⁷⁶ Aurora Energy submission, 23 May 2008, p.3.

⁷⁷ Aurora Energy submission, 23 May 2008, p.4.

⁷⁸ Hydro Tasmania supplementary submission, 1 August 2008, p.3.

⁷⁹ Hydro Tasmania submission, 23 May 2008, p.10.

⁸⁰ Hydro Tasmania submission, 23 May 2008, p.10.

⁸¹ Hydro Tasmania submission, 23 May 2008, p.10.

- attribution of the costs and benefits should be done in a manner that ensures a reasonable level of equity in any decision;⁸³
- the impacts on the costs of developing Tasmania's wind energy resources and reducing its ability to use Basslink should be considered;⁸⁴
- the expected changes in FCAS requirements for single credible contingency events should be considered;⁸⁵
- direct impacts on existing Tasmanian market participants should be considered;⁸⁶
- the amount of time that operating constraints may bind should be considered;⁸⁷
- existing opportunities in Tasmania for increasing the volumes of Fast Raise and Lower FCAS capability within Tasmania should be considered;⁸⁸
- balancing the power system security and reliability with the efficient economic operation of the market should be considered;⁸⁹
- consistent application of operational standards across the market, subject to economic and technical feasibility, and agnostic to technology should be considered;⁹⁰
- grandfathering for existing investments should be considered;⁹¹
- impacts on the local market structure, new entrants, the imposition of costs or restrictions on incumbents, and on competitive outcomes should be considered;⁹²
- an outcome where there are frequent or severe constraints on the operation of Basslink or on dispatch, very high costs for FCAS, or an inordinate level of complexity and risk should be avoided;⁹³ and

⁸² Hydro Tasmania submission, 23 May 2008, p.10; Roaring 40s submission, 23 May 2008, p.2.

⁸³ Hydro Tasmania submission, 23 May 2008, p.10.

⁸⁴ Roaring 40s submission, 23 May 2008, p.2; Roaring 40s supplementary submission, 1 August 2008, p.3.

⁸⁵ Transend submission, 23 May 2008, p.16.

⁸⁶ Transend submission, 23 May 2008, p.16.

⁸⁷ Transend submission, 23 May 2008, p.16.

⁸⁸ Transend submission, 23 May 2008, p.16.

⁸⁹ NGF submission, 28 May 2008, p.1.

⁹⁰ NGF submission, 28 May 2008, p.1.

⁹¹ NGF submission, 28 May 2008, p.1.

⁹² NGF submission, 28 May 2008, p.2.

⁹³ David Llewellyn MP submission, 21 May 2008, p.2.

- alternative approaches in order to retain the existing Tasmanian *frequency operating standards* where the proposed plant can comply with the existing Tasmanian *frequency operating standard* should be considered.⁹⁴

C.3 System security

C.3.1 Coordination of UFLSS, OFGSS, and FCSPS

Submissions support the review of the back-up system protection schemes when considering the proposed changes to the Tasmanian *frequency operating standards*.⁹⁵ These schemes include the Under Frequency Load Shedding Scheme (UFLSS), Over Frequency Generator Shedding Scheme (OFGSS) and Frequency Control System Protection Scheme (FCSPS).

Some stakeholder comments related to proposed changes to the UFLSS settings include:

- there should be sufficient discrimination between the various blocks in the proposed new settings;⁹⁶
- the UFLSS cannot operate for all possible contingencies;⁹⁷
- generators should not trip with changes in block size;⁹⁸
- tightening the frequency bands reduces the available time to carry out UFLSS control actions;⁹⁹
- the UFLSS must not operate for Basslink contingency events;¹⁰⁰ and
- the UFLSS must be capable of arresting frequency if the FCSPS fails.¹⁰¹

In terms of proposed changes to OFGSS settings, some stakeholders made the following comments:

- whether the re-designed OFGSS meets the Rules requirements;¹⁰²
- whether the redesigned OFGSS meets the negotiated access requirements;¹⁰³

⁹⁴ Hydro Tasmania supplementary submission, 1 August 2008, p.35.

⁹⁵ Alinta submission, 24 April 2008, Pp.3-4; Hydro Tasmania submission, 23 May 2008, p.20.

⁹⁶ Alinta submission, 24 April 2008, p.21.

⁹⁷ Hydro Tasmania submission, 7 August 2008, p1.

⁹⁸ Alinta submission, 24 April 2008, p.21.

⁹⁹ ETAC submission, 28 September 2007, p.6.

¹⁰⁰ ETAC submission, 28 September 2007, p.6.

¹⁰¹ ETAC submission, 28 September 2007, p.6.

¹⁰² Alinta submission, 24 April 2008, p.22.

- whether the redesigned OFGSS would create over-tripping of generation, resulting in an under frequency event;¹⁰⁴
- complex logic and coordinated settings would be required in the redesigned OFGSS to ensure robustness;¹⁰⁵ and
- consideration of congestion and existing opportunities to manage it via established market processes.¹⁰⁶

Some stakeholders discussed the following matters in relation to FCSPS:

- FCAS will need to be increased to meet the proposed *frequency operating standards* if the FCSPS settings remain at the current levels;¹⁰⁷
- it will need to be verified on whether the current FCSPS maintains the frequency to above the proposed frequency of 48.0 Hz for the loss of Basslink on import;¹⁰⁸
- whether the current Basslink FCSPS design needs to be redesigned to allow the proposed frequency of 52.0 Hz to be achieved following the loss of Basslink on export;¹⁰⁹
- whether the UFLSS scheme needs to be designed to ensure that it will not operate for the tripping of Basslink during import conditions and that there is enough discrimination between the Basslink FCSPS and the UFLSS;¹¹⁰
- whether the OFGSS will need to be designed to ensure that there is enough discrimination between the Basslink FCSPS and the OFGSS;¹¹¹
- recalculation of required generator tripping for loss of Basslink export would be required;¹¹²
- recalculation of required load tripping for loss of Basslink import scenario's would be required;¹¹³
- the terms in commercial agreements allow loads to be made available to the FCSPS and for major loads to be withdrawn from the SPS if they are tripped for an FCSPS event;¹¹⁴

¹⁰³ Alinta submission, 24 April 2008, p.22.

¹⁰⁴ Hydro Tasmania submission, 23 May 2008, p.20.

¹⁰⁵ Hydro Tasmania submission, 23 May 2008, p.21.

¹⁰⁶ Transend submission, 23 May 2008, p.7.

¹⁰⁷ Alinta submission, 24 April 2008, Pp.22.-23.

¹⁰⁸ Alinta submission, 24 April 2008, Pp.22.-23.

¹⁰⁹ Transend submission, 23 May 2008, p.23; Hydro Tasmania submission, 23 May 2008, p.20.

¹¹⁰ Alinta submission, 24 April 2008, Pp.22.-23.

¹¹¹ Alinta submission, 24 April 2008, Pp.22.-23.

¹¹² ETAC submission, 28 September 2007, p.7.

¹¹³ ETAC submission, 28 September 2007, p.8.

- whether there is any impact of future wind developments on overall system response characteristics;¹¹⁵
- appropriateness of safety margins in the FCSPS design;¹¹⁶ and
- whether there is sufficient load and generation currently available to the FCSPS for maximum Basslink transfers under all conditions.¹¹⁷

Alinta and Transend made the following findings on the above issues:¹¹⁸

- changes to settings for the UFLSS to be shifted upwards by 0.5 Hz in the Tasmanian *frequency operating standards* will be required;
- discrimination between FCSPS and OFGSS exists;
- discrimination between FCSPS and UFLSS $\Delta f/\Delta t$ (average frequency over 300 second period) setting in the UFLSS can be achieved by increasing this to 1.2 Hz;
- the CCGT adds significant FCAS lowering capability and reduces FCSPS generation shedding quantity in many cases if this capability were made available to the FCAS markets;
- over-frequency is a problem under multiple contingencies and the CCGT could trip causing UFLSS to shed load which could breach the proposed Tasmanian *frequency operating standard*;
- CCGT plants and other thermal plants should be included in OFGSS and coordinated to shed generation in a planned manner; and
- to prevent all the CCGT plants and other thermal plants tripping simultaneously and causing severe load shedding, the over frequency issue needs to be resolved.

C.3.2 Sufficient interruptible load available for the UFLSS and any additional requirements

Hydro Tasmania notes one type of source of FCAS supply (although “extremely low” in probability due to the current Rules and market structure) is configuring interruptible loads to provide raise services.¹¹⁹ It considers that there are a number of loads not required when Basslink is in export or the no-go zone.¹²⁰ It regards that

¹¹⁴ ETAC submission, 28 September 2007, p.8.

¹¹⁵ Transend submission, 23 May 2008, p.7.

¹¹⁶ Transend submission, 23 May 2008, p.7.

¹¹⁷ Transend submission, 23 May 2008, p.8.

¹¹⁸ Alinta submission, 24 April 2008, Pp.3-4;

¹¹⁹ Hydro Tasmania submission, 23 May 2008, p.4.

¹²⁰ Hydro Tasmania submission, 23 May 2008, p.4.

“[t]he current market design is unlikely to entice any of these customers into the market”.¹²¹

C.3.3 Sufficient FCAS and other ancillary services available

ETAC notes that insufficient FCAS within Tasmania to manage potential contingency events with Basslink being constrained results in a violation of FCAS constraints. NEMMCO is then required to place constraints on the relevant load or generator.¹²²

ETAC considers that the variables that may affect the setting of the FCAS requirement include Basslink flow, local FCAS availability and system demand that “is an important consideration for all market participants”.¹²³ It suggests that “[a] tightening of the [Tasmanian] frequency [operating] standards would present challenges for the connection of any new generation or load that results in increased FCAS requirements (above those presently seen)”.¹²⁴ In addition, ETAC considers that “[i]t is also reasonable to assume that increasing the requirement for some FCAS services in a region where local sources of FCAS are limited, will lead to higher prices for those services”.¹²⁵

It regards the volume and price of available FCAS are under the control of service providers. With respect to changing the Tasmanian *frequency operating standards*, it proposes that the associated risks of FCAS availability and price need to be taken into account.¹²⁶

The Transend submission discusses issues relating to the availability and procurement of FCAS to support the proposed changes in Tasmanian *frequency operating standard*.¹²⁷ It proposes a list of areas that should be considered in terms of cost benefit analysis which is discussed in section C.2 of this Paper.

C.4 Impact of drought

There were two stakeholder comments that considered the impact of drought.

In Aurora’s submission, it notes that “Tasmania is predominately supplied by hydro generation, which is currently at record low water storage levels due to current

¹²¹ Hydro Tasmania submission, 23 May 2008, p.4.

¹²² ETAC submission, 28 September 2007, p.11.

¹²³ ETAC submission, 28 September 2007, p.11.

¹²⁴ ETAC submission, 28 September 2007, p.12.

¹²⁵ ETAC submission, 28 September 2007, p.12.

¹²⁶ ETAC submission, 28 September 2007, p.13.

¹²⁷ Transend submission, 23 May 2008, Pp.16-17.

drought conditions”.¹²⁸ It considers that the “barriers to entry for new generation” should be avoided “to ensure that the supply/demand balance”.¹²⁹

Hydro Tasmania considers that changing to Alinta’s proposed Tasmanian *frequency operating standards* would increase the FCAS raise requirements to maintain system security and slightly decrease existing FCAS supplies.¹³⁰ It suggests that the combination of these two events would decrease average Basslink imports in order to satisfy system constraints, resulting in “reduce[d] competition in the Tasmanian market by limiting access for mainland generators and could cause supply problems under the current drought conditions”.¹³¹

¹²⁸ Aurora Energy submission, 23 May 2008, p.1.

¹²⁹ Aurora Energy submission, 23 May 2008, p.1.

¹³⁰ Hydro Tasmania submission, 23 May 2008, p.5.

¹³¹ Hydro Tasmania submission, 23 May 2008, p.5.