# Executive Summary

This submission contains two separate parts that address:

- Part A – Benefit Cost Analysis; and
- Part B – Responses to Reliability Panel Requests

Part A – In Hydro Tasmania's view the tightening of under frequency standards from 47.5Hz to 48Hz will not achieve a positive benefit cost as required by the AEMC terms of reference.

Hydro Tasmania challenges the quantification of benefits and costs used by the reliability panel; concluding that the benefits have been significantly overstated and the costs have been understated. Below is a revised version of the benefit cost utilising the methodology adopted in the Reliability Panel's Draft Decision.

**Benefits and Costs relative to base case**[1]

| Scenario | Energy Cost Savings ($M pa) | FCAS Cost ($M pa) | Basslink Reversal inefficiency ($M pa) | Net Benefit ($M pa) |
|---|---|---|---|---|
| High efficiency CCGT 48Hz 144MW | 3.2 | 3.5 | 5.2 | -5.5 |

The key changes in assumptions are:

- Energy cost saving – new entrant generator marginal 10% of the time (substituting 50% assumption)
- FCAS Cost as provided by Hydro Tasmania (removing 30% inflation assumption)
- Basslink reversal inefficiency corrected for mainland impact.

***Based on the CRA analysis methodology with assumptions changed as detailed in this submission, the benefit cost would indicate that the best approach is to retain the existing standard for under frequency[2].***

Part B of this submission responds to requests contained in the draft determination with the following conclusions:

- A flat line maximum contingency limit of 144MW contained in the frequency operating standards is recommended.
- As a transitionary measure, the contingency for TVPS should be reduced to 110 MW for 3 years from commissioning.
- Causer pays principles need to be applied to the allocation of any additional costs associated with tighter standards.

[1] Final report for Reliability Panel draft determination (Table 6 p.27) – CRA International
[2] Attachment 1 contains Hydro Tasmania's frequency standard recommendations

# Part A - Benefit Cost Analysis

The Reliability Panel commissioned CRA to undertake a benefit cost analysis to establish that there was a benefit to consumers in tightening the standard and allowing high efficiency thermal plant to enter the market. This analysis has been done at a high level with no substantiation for some of the major assumptions.

It is important for the Reliability Panel not to be influenced by the fact that a proponent has chosen to build a generator which does not meet the current standards. Given the increased risks from tightening the standards, if the benefit cost analysis does not show that the benefits clearly outweigh the increased risks and costs to the market of tightening the standard, the Panel should reject the tighter standard. TVPS would then need to find a way of connecting its plant with the current standard remaining in place.

The following are the major concerns with the benefit cost analysis.

## Absence of modelling

The impact of alternative scenarios on the whole NEM can only be accurately assessed by a modelling exercise of the whole NEM. The introduction of a new thermal plant into Tasmania has some complex and far reaching impacts on the market. In the absence of modelling, any quantities are purely subjective.

The complex interactions between the FCAS market, the energy market, the 19 scheduled hydro-generators and contingency size make this form of modelling very challenging. This is compounded by the seasonality of inflows and scarcity of R6 capability resulting in significant inefficiencies in plant operation under a number of scenarios. Hydro Tasmania has undertaken some detailed analysis of the actual performance in the last financial year which we believe will be valuable in guiding any future modelling exercise. During this time, the Bell Bay thermal units were running so the situation is somewhat comparable to those which will exist when TVPS is commissioned and the Bell Bay units are de-commissioned. This detailed analysis forms the basis for many of the subsequent figures in this submission.

## TVPS sets the price 50% of the time

TVPS has a publicly announced contract for its offtake with Aurora energy. It appears to be heavily contracted and under that assumption it would be expected to run when its SRMC is below the market price. Based on some modelling runs which Hydro Tasmania has undertaken, TVPS sets the price between 5% and 15% of the time. This is a very approximate assessment but it indicates that the assumption by the Reliability Panel that it sets the price for 50% of the time is unlikely and the actual value is more like 10%. In addition, as a CCGT operating in a region comprised mainly of (hydro) peaking plant, 10% or less is the most probable outcome.

From another perspective, it is reasonable to expect that TVPS will run at one of three levels. These are at its efficient level of 100%, or its minimum load or not at all. In any of these three modes, it is unlikely that it will be setting the marginal price.

In our analysis we use 10% for the proportion of time TVPS sets the marginal price.

## R6 Costs Overestimated

Hydro Tasmania has provided an estimate of its costs, assuming it was providing all the additional R6. The CRA/Reliability Panel have wrongly interpreted this to be Hydro Tasmania's share and increased it slightly. The figure which Hydro Tasmania provided should not be increased.

## Basslink inefficiency underestimated

Hydro Tasmania has also provided a cost estimate of the inefficiency of Basslink operation on Hydro Tasmania of $1.2m pa. This effect will also impact on the mainland as well, we suggest, to a much greater degree. The Reliability Panel has made an attempt to estimate this and it would realistically require some modelling to estimate the impact of less efficient Basslink operation on the mainland more accurately.

We have indicated an additional inefficiency of $1.2m pa. This is made up of $0.8m pa from unexpected price spikes which will decrease the value for Hydro Tasmania. The other $0.4m is associated with internal costs associated with inefficient water usage and additional wear and tear on plant.

The impact on Victoria (ignoring the rest of the market) can be approximated by taking its volume ratio compared with Tasmania's which is five times $800k pa. The correct value for the cost benefit should be the $1.2m pa from Hydro Tasmania plus an allowance of 5 X $0.8m for the impact of not reducing spot prices on the mainland. This gives a total of $5.2m pa

## Nominal Contingency Size Increase[3]

In our original submission, our arguments have been based on the assumption that the system was effectively using the 144MW largest contingency which is nominated for Tasmania. In reality, most of the time the contingency is around 110-120MW. This is a "self co-optimisation" used by Hydro Tasmania to reduce the level of R6 required and to facilitate the

[3] New issue, not included in benefit cost assessment.

reversal of Basslink and to utilise the full import capability. Consequently, under the draft determination, there is an additional cost if TVPS runs at a constant 144MW. This issue is documented more fully later in this submission and concludes a transitionary limit of 110MW be applied to TVPS for 3 years.

## FCAS Lower

Tightening of the over frequency bands introduces additional lower FCAS requirements. These additional costs have not been included in the benefit cost analysis.

# Part B - Responses to Reliability Panel Requests

This section responds to specific questions which the Reliability Panel have raised. It includes the following sections:

- Contingency Size (section 4.4)
- Recovering the costs of the increased FCAS requirements (section 4.5)
- Implementation Timing (section 4.6)
- Application of Maximum Contingency Limit (Part D – Definitions)

## B.1 Contingency Size (section 4.4)

The Reliability Panel has proposed an approach for managing the contingency size by including it in the definition of the Tasmanian Frequency Standard. There are two fundamental questions in relation to implementation. These are:

- Is there a better approach than a flat limit?
- If there is a flat limit, what level should it be set?

*A Better Approach?*

The ROAM consulting report demonstrates that there is a benefit in a flexible contingency. Hydro Tasmania agrees with this but we do not believe that there is a practical way to achieve this in dispatch or a legal way for the level of cooperation required to be achieved between two competitors in a market. There are two alternative approaches which Hydro Tasmania has considered:

- **Contingency limit based on Tasmanian load and inertia**. In essence this approach fails to recognise the significant discontinuity introduced by a reversal of Basslink. As described in attachment 2, at times when inertia is typically high, it may be possible to have a higher limit but there are operational constraints in setting a limit which does not consider Basslink flow.

- **Contingency limit based on Basslink flow**. Another approach would be to set the limit based on whether R6 is available across Basslink**.** At times when R6 is available, the limit could be set higher. This is because Basslink is a DC link with a no-go zone (discontinuous) that requires FCAS separation (local & global) for reversal of flows. With this approach the contingency limit for TVPS would not be known until the Basslink flow target was established. This would require several dispatch intervals to achieve conditions where TVPS output would allow Basslink to reverse (Generator ramp rates may also compound this problem).

Hydro Tasmania's conclusion is that there is no practical alternative to a flat contingency limit and hence supports the draft determination proposal to include a flat limit in the frequency standard. See attachment 3 for further detail.

*Level of the Flat Limit*

The level of the flat limit should be strongly related to two factors;

- Current R6 availability; and
- Future R6 availability.

*Current R6:*

The most effective way to determine the economic availability of R6 in Tasmania is to take an historical view of dispatch. The following graphs illustrate the contingency size duration curve for 07/08 financial year and the relationship to Basslink flow. The contingency size has a direct relationship with the availability of R6.

**Figure 1 Contingency size duration curve FY 07/08**

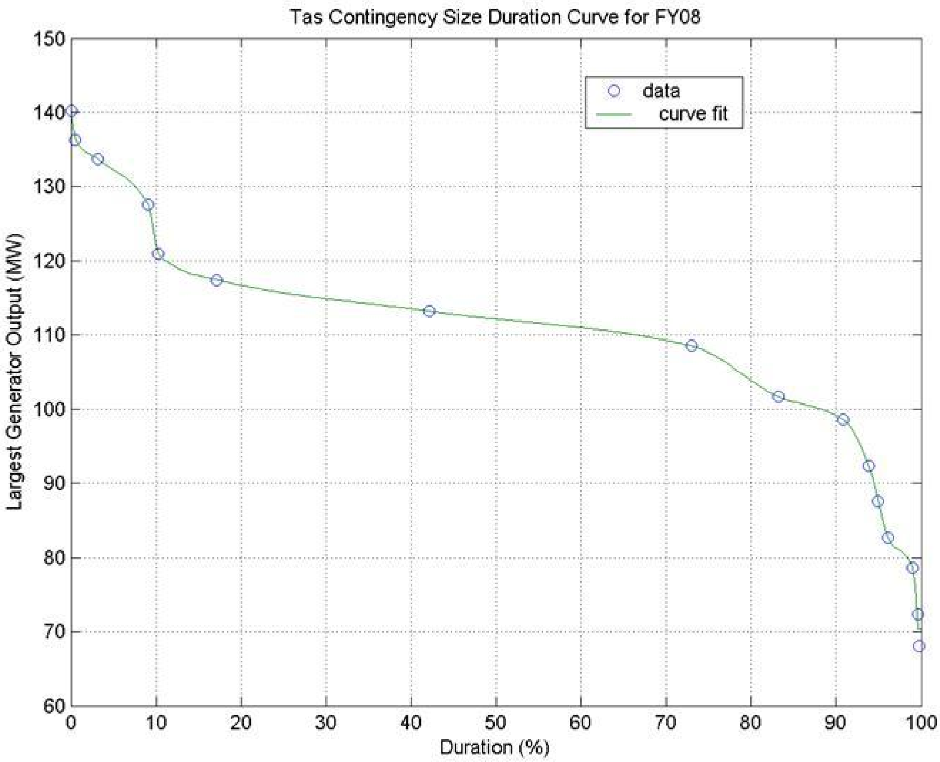
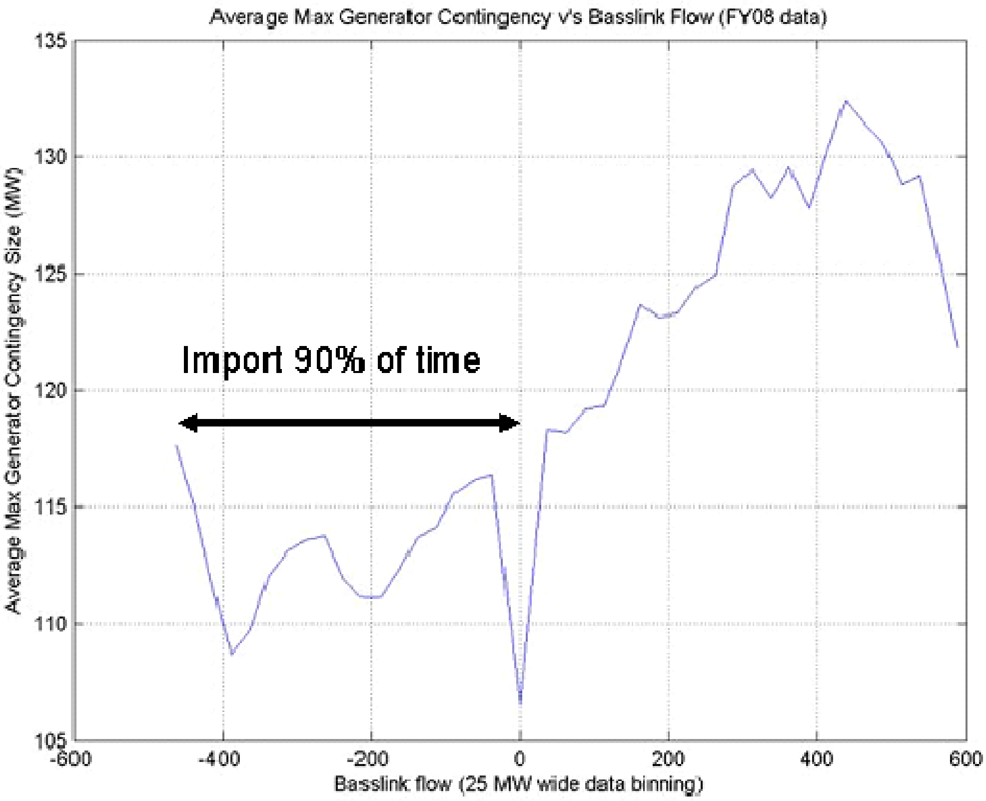


**Figure 2 Contingency size versus Basslink flow FY07/08**




The graphs demonstrate that the system is currently operated so that the maximum contingency is typically below 120MW import periods and below 110MW for Basslink reversals. The contingency is managed downwards at these times to avoid sub optimal dispatch due to shortages of R6. Higher contingencies are generally only economic when Basslink is in strong export (132MW avg). Hydro Tasmania typically optimises the impact of the requirement by reducing the maximum contingency overnight and prior to a Basslink reversal. When TVPS is commissioned, this management of the largest contingency by Hydro Tasmania will no longer be possible and the effective volume of R6 required will be increased relative to current requirements.

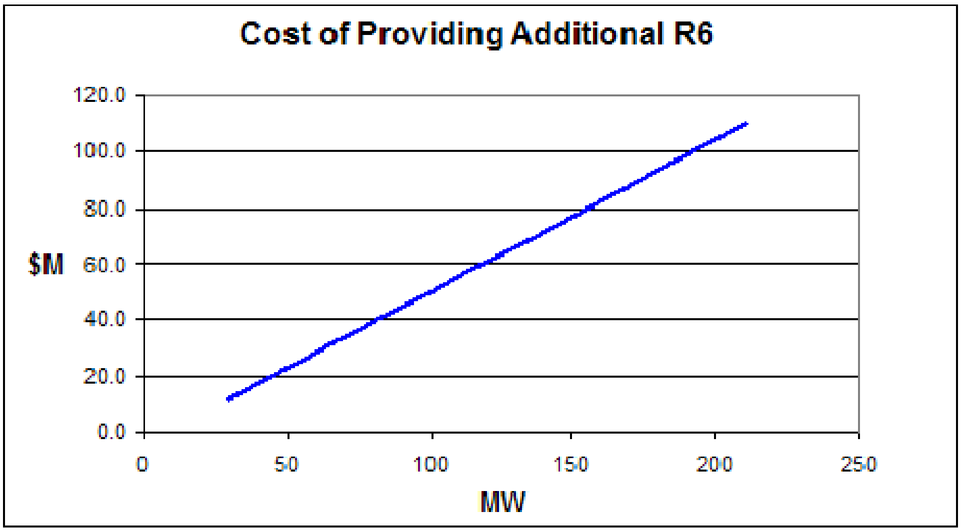
*Future supply of R6*

There are a number of potential sources of R6 which can be developed in Tasmania. These include:

- Governor tuning of hydro machines
- Governor replacement
- Energy storage devices
- Demand response (switch controllers)
- Diesel UPS

However, all of these will take some time to develop and become progressively more expensive to provide. The graph below shows the capital cost for the supply curve for additional R6.

**Figure 3 Cost of providing additional R6 in Tasmania**




If Hydro Tasmania were to embark on a work program to increase R6 availability using its existing plant the time frame for such work is likely to extend well beyond TVPS commissioning. The table below contains the most economic projects (note: at least half would be required to off-set increase in requirement for a constant 144MW contingency based on these estimates).

**Table 1 Hydro Tasmania Potential Projects for Additional Fast Raise Services**

| Project | Additional R6 | Additional L6 | Estimated Completion date |
|---|---|---|---|
| Gordon 1 & 2 governor retune | 10 to 20 MW | 10 to 20 MW | August 2009 |
| Reece 1 & 2 governor replacement and hydraulic system upgrade | 10 to 50MW | 10 to 30MW | June 2010 |
| John Butters governor replacement and hydraulic system upgrade | 5 to 20 MW | 5 to 10 MW | June 2011 |
| Tribute governor replacement and hydraulic system upgrade | 5 to 20 MW | To 10 MW | June 2011 |
| Gordon no 3 governor replacement and hydraulic system upgrade | 5 to 10 MW | 5 to 10 MW | June 2012 |

*Level of Flat Limit Conclusion:*

Hydro Tasmania made strong representation that a 144MW limit for Tasmania should be included in the frequency standard and is still supportive of such an approach. However, due to the analysis of current and future capability would recommend a transitionary measure be applied to TVPS that allows time to develop further capability in the region. This transitionary measure would limit TVPS to a contingency size equal to the next highest contingency (up to 144MW) or 115MW which ever is the greater. This arrangement could be reviewed at regular intervals (e.g. annually) and should only apply for a maximum of 3 years.

## B.2 Recovering the costs of the increased FCAS requirements (section 4.5)

Hydro Tasmania strongly supports the philosophy of causer pays and supports the first alternative cost recovery mechanism as suggested in the draft determination.

"Calculating the cost of the additional FCAS required to meet tighter Tasmanian frequency operating standards and recovering this from the new higher efficiency thermal generating unit"

The Panel noted that alternative cost recovery mechanisms could only occur through a formal Rule change process conducted by AEMC. Hydro Tasmania acknowledges this point but suggests that any implementation of tighter standards (e.g. 53 – 52Hz) be done after final determination of any such Rule proposal.

## B.3 Implementation Timing (section 4.6)

*System Operation*
Hydro Tasmania's view is that the first criteria should be that there is sufficient R6 available in the market, at reasonable cost, to ensure that the operation of the Tasmanian region is efficient.

*TVPS Ready for Connection*
The standard should not be changed until TVPS is ready to be connected. This includes the modification of protection schemes such as OFGSS and Basslink frequency controller to be completed.

*Causer Pays Rule Change*
Any rule change should be submitted within one month of the Reliability Panel final determination. As such, it is proposed that the standards should not be changed until the final determination on the rule change has been delivered.

*Redefine FCAS Trapeziums*

Hydro Tasmania will need to redefine its FCAS trapeziums prior to any new standard being implemented. We require four to six months, inclusive of re-registration, to undertake this task and we are unable to start until NEMMCO have defined the parameters (Market Ancillary Service Specifications).

## B.4 Application of Maximum Contingency Limit (Part D – Definitions)

The draft determination suggests that the maximum contingency limit of 144MW be applied to generation events and the definition of *"generation event means a synchronisation of a generating unit of more than 50MW 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."*

This definition needs to be expanded to include a transmission element providing connection to multiple generating units, therefore eliminating the risk of multiple unit combinations exceeding the 144MW limit and setting the requirement. It should also be defined in terms of equivalent FCAS burden (e.g. no greater burden that a generator operating at 144MW output)

# Summary

Hydro Tasmania's position is summarised by the following dot points:

1. The draft determination will not achieve a positive benefit cost as required by the AEMC terms of reference to support a change of frequency standards for Tasmania. The standards contained in Attachment 1 should be adopted.

2. A flat line maximum contingency limit of 144MW contained in the frequency operating standards is recommended.

3. As a transitionary measure, the contingency for TVPS should be reduced to 110 MW for 3 years from commissioning, reviewed after 18 months of experience.

4. Causer pays principles need to be applied to the allocation of any additional costs associated with tighter standards.

5. Implementation timing should be determined by;
    a. Availability of FCAS for efficient operation;
    b. Causer pays rule change final determination;
    c. TVPS ready to connect;
    d. Protection systems modified; and
    e. Redefinition of current FCAS trapeziums.

6. Definition of how the maximum contingency limit is to be applied needs to be made clear.

## Attachment 1: Hydro Tasmania Frequency Standard Proposal for Tasmania

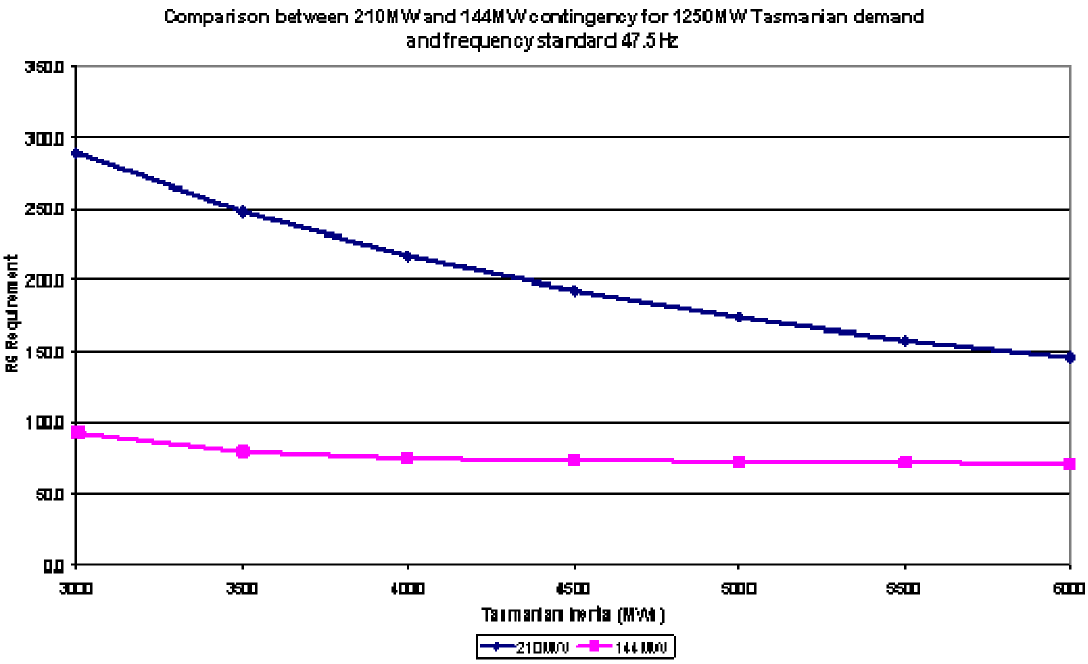
| Condition | Current Standard | Hydro Tasmania recommendation |
|---|---|---|
| **Interconnected operation** | | |
| No contingency or load event | 49.75 to 50.25 Hz, 49.85 to 50.15 Hz 99% of the time | 49.75 to 50.25 Hz, 49.85 to 50.15 Hz 99% of the time |
| Load event | 49.0 to 51.0 Hz | 49.0 to **52.0** Hz |
| Generation event | 47.5 to 51.0 Hz | 47.5 to 51.0 Hz |
| Network event | 47.5 to 53.0 Hz | 47.5 to **52.0** Hz |
| Separation event | 46.0 to 55.0 Hz | 46.0 to 55.0 Hz (With generating units not meeting frequency standard requirements being allowed to trip at >52.0Hz on coordinated basis) |
| Multiple contingency event | 46.0 to 55.0 Hz | 46.0 to 55.0 Hz (With generating units not meeting frequency standard requirements being allowed to trip at >52.0Hz on coordinated basis) |
| **Islanded Operation** | | |
| No contingency or load event | 49.0 to 51.0 Hz | 49.0 to 51.0 Hz |
| Load event | 47.5 to 53.0 Hz | 47.5 to **52.0** Hz |
| Generation event | 47.5 to 53.0 Hz | 47.5 to **52.0** Hz |
| Network event | 47.5 to 53.0 Hz | 47.5 to **52.0** Hz |
| Separation event | 46.0 to 60.0 Hz | 46.0 to **55.0** Hz (With generating units not meeting frequency standard requirements being allowed to trip at >52.0Hz on coordinated basis) |
| Multiple contingency event | 46.0 to 60.0 Hz | 46.0 to **55.0** Hz (With generating units not meeting frequency standard requirements being allowed to trip at >52.0Hz on coordinated basis) |

## Attachment 2: Contingency Size Set by Tasmanian Load and Inertia

Background

There is general consensus that TVPS contingency size should be limited to 144MW (or less?) during periods of low Tasmanian demand and low inertia due to the excessive amounts of R6 that would be required to satisfy a generating unit event. Insufficient local (Tasmanian) R6 would then typically result in Basslink being constrained, either near the no-go zone or in respect of its potential import target, to permit global FCAS transfer. The graph below is a reminder of the difference in R6 requirement for an average Tasmanian demand (1250MW) with 144MW and 210MW contingencies.

**Figure 1: Graph showing comparative R6 requirements between 210MW and 144MW contingency for 47.5Hz frequency standard**




Basslink constraints due to R6

We note from the graphs that the difference in R6 varies from around 75MW at 6000MWs inertia to nearly 200MW at 3000MWs inertia. Referring to Reference 1[4], Figure 1, we note that the average R6 in dispatch is around 70 to 80MW (assume 80MW). With these numbers in mind, Basslink is at risk of being constrained when energy prices require increased southern flow on Basslink (i.e. reduced export or increased import) under the following scenarios:

[4] Final Advice on Tasmanian Frequency Standards (NEMMCO) dated 26 August 2008

Scenario 1: 210MW contingency, 4500MWs inertia, R6 required approximately 200MW:

If Basslink is at an export level of approximately 170MW and assuming 80MW of local R6 in Tasmania, Basslink will effectively be constrained at this point as 120MW of R6 will be sourced from global (taking Basslink to 50MW). With 80MW of R6 being provided in Tasmania, this gives the total of 200MW. For lower inertia cases, the constraint point could approach 300MW export.

Scenario 2: 210MW contingency, 3500MWs inertia, R6 required approximately 300MW

If we again assume 80MW of R6 in dispatch, and Basslink import capability of 480MW (approximately), Basslink import would be constrained by 350 - 80 = 270MW or be constrained at 260MW import. Note that even for 144MW contingency, Basslink would be constrained by around 50MW for 144MW contingency and same R6 in dispatch. The contingency size should in fact be limited to around 120MW or less to ensure no constraint on import.

Conclusions

The discussion above shows that it will not be possible to calculate a contingency size based simply upon Tasmanian demand and inertia as this does not in the first instance take into account the discontinuity in reversing Basslink (reducing export). Secondly, the extent of impact upon Basslink import is such as to suggest that TVPS should remain at 144MW (or below) for Basslink anywhere between import and around 300MW export.

**Attachment 3: Issues with a Variable Contingency**

In the original Roam report submitted by Alinta, a case is made for the increased efficiency from a variable contingency size.

The following extracts from the Roam paper: "Tasmania Frequency Reserve Market Impact Study Stage 2 – Market Simulations to Develop Energy & Reserve Price" illustrate this argument.

"Dispatching a larger single generator of up to 210MW causes significant market distortion, increasing FCAS R6 average price and costs by a factor of up to thirty. Dispatch of a larger single generation unit however can be managed in the Tasmania system through controlled dispatch at times of low demand or shortages of FCAS raise services provision. For the period preceding new entry of a second significant thermal generation development, the analysis shows that the Alinta plant may provide the least cost of energy supply for the market at dispatch up to full load at times. Dispatch of up to 190MW is achievable without any self provision of FCAS in excess of 30% of the time. Such a base loaded generation will facilitate local firm supply under critical water shortages, allow building up of storages and also cover possible extreme events such as loss of Basslink for long periods of time."

## 210MW CONTINGENCY

"The modelling results indicate that full dispatch of the CCGT prior to entry of a second large new entry generator has dramatic effects on the Tasmanian market, leading to severe negative settlement residues on Basslink and very large increases in the Tasmanian energy and fast raise ancillary service market costs.

Co-optimization of the CCGT's energy dispatch target with the R6 FCAS requirement was ineffective in mitigating this outcome. A system mechanism outside the market dispatch engine would appear to be initially required to limit the largest unit online to an 'optimal' dispatch level at times. Future new entry, particularly the Gunns development is likely to significantly reduce the requirement for such a mechanism however.

One of the reasons co-optimisation is ineffectual is that there is no cost associated with transferring FCAS across Basslink. Extending MNSP transport offers to the FCAS markets may provide a tool to mitigate the Tasmanian R6 requirement."

Hydro Tasmania agrees that the TVP contingency size could in theory be controlled to various levels below 210MW and accepts the studies conducted by Roam showing that there are protracted periods during which TVP could be operating at 190MW without the need for additional local R6. In reality (and based upon historic operation) the contingency size around the Basslink no-go zone and at higher imports (at low inertia) needs to be less than 144MW and is often as low as 100MW at times in accordance with energy prices and R6 available in dispatch. In essence, Hydro Tasmania currently manages the contingency size down to reduce R6 requirements. This level of co-optimisation is not possible between two competing generators.

Hydro Tasmania is not aware of any non-market mechanism that could (pre-emptively and efficiently) provide the control required to manage the contingency size in accordance with the market requirements. Hydro Tasmania would be happy to support a system if one could be developed to satisfy these criteria. Off-market systems are typically reactive, e.g. the Basslink SPS which responds to Basslink flows and Tasmanian demands and sets up tripping accordingly.

Examples showing the need for pre-emptive response are as follows:

- Basslink is in export mode and Tasmanian energy prices require Basslink to reduce export and reverse to import. What mechanism would change TVP from 210MW to say 130MW to ensure that the market outcome is based upon energy prices?
- Similarly if Basslink is already importing (at low import at which TVP could be permitted to be at 190MW) and energy prices require Basslink to move rapidly to full import. Here again, a mechanism is required to immediately reduce TVP contingency size (to possibly 100MW or so) to permit full Basslink import without constraint due to R6.