Tasmanian Energy Security Taskforce

Energy Crisis Market Impact Study

Energy Crisis, or Risk Management Crisis?

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REPORT HIGHLIGHTS

- What happened?
- Who pays for the Energy Crisis?
- Conclusion

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Executive Summary

Tasmania has faced an unprecedented energy security crisis that has prompted the Government to appoint the Tasmania Energy Security Taskforce. The analysis contained in this report has independently assessed the events leading up to the Energy Crisis and measured the consequential impacts on the consumers of Tasmania.

This report was undertaken as a partnership between Goanna Energy Consulting, the Tasmanian Minerals and Energy Council (TMEC) and the Tasmanian Small Business Council (TSBC). However, the findings and opinions expressed in this report represent the views of Goanna Energy Consulting which may not necessarily be shared by the TMEC and TSBC.

The findings and conclusions of this analysis are:

What happened?

1. Questionable risk management practices appear to have been employed by Hydro Tasmania in managing energy supply. In our view, long term weather forecasting published in May 2015 elevated the risk that there was a strong likelihood of lower than average Spring rainfalls in 2015. Despite this weather outlook from prominent international weather forecasters, there appears to be little pre-emptive remedial action taken by Hydro Tasmanian to manage the risk until it was too late.

2. In the period of late April 2015 to early September 2015, surprisingly Hydro Tasmania continued to be a net exporter of energy into Victoria even though water storage levels were only in the 27% to 32% levels. Prior to 2012, the minimum preferred water storage level as at 30 June each year was set at 30%, and then adjusted to 25% following the introduction of carbon pricing. Whilst this preferred level was not technically breached, given the risks facing the State, it is considered not appropriate prudent risk management to be exporting significant amounts of energy into Victoria over this April to September 2015 period.

3. When the risk management practices of April 2015 to July 2015 are compared to a similar situation in January 2007 to June 2009, it was found that Hydro Tasmania behaved markedly differently. The risk management practices applied in the 2007 and 2009 period appears to be much more prudent and as it turned-out, delivered higher financial rewards to Hydro Tasmania. The April to July 2015 risk management practices have been deemed as questionable.

4. It is recognised that there was significant water inflows during May 2015. This would have led to high levels of generation such as run-of-river power stations operating at full capacity, other power stations at risk of spilling water operating at high capacity levels and Hydro Tasmania needing to maintain quality of supply and system stability. However, it is questionable whether all of the net exported energy was unavoidable.

5. In our view, the announcement to sell the Tamar Valley Power Station in August 2015, is further evidence that risk management practices had been forsaken for shorter term commercial gains. It is

recognised that the sale has not proceeded, but what is of concern is that this strategy was contemplated to the extent of publicly announcing the pending sale on 12 August 2015.

6. Once the dire water storage position began to unfold in September 2015, Hydro Tasmania began to refrain from heavily exporting energy into Victoria. By October 2015, little energy was being exported to Victoria, and high levels of consistent import energy to Tasmania became the norm.

7. It is our expectation that Hydro Tasmania would have been purchasing Victorian based contracts from about August or perhaps September 2015, in order to manage the financial risk of supporting a mainland retailer; given the decreasing likelihood of utilising the physical generation assets to manage the risk.

8. From about mid-August 2015, the Victorian forward market began to rise, and we believe the buying interest in Victorian contracts from Hydro Tasmanian helped feed the trend of a rising forward market. The low Spring 2015 rainfall would have also contributed to the continued rally in the wholesale forward prices.

9. The Tasmanian forward market prices are set in a formulaic approach, based on energy water inflows and Victorian forward prices. Consequently, the Tasmanian wholesale forward prices also rallied in the second half of 2015 following the trend of the forward Victorian prices.

10. It appears that the Victorian wholesale forward price rally in the second half of 2015 was at faster rate than the equivalent forward contracts trading in New South Wales. This had a flow through impact on the Tasmanian forward prices, so therefore consumers in both Victoria and Tasmania appeared to be more heavily impacted by rising wholesale costs than northern States.

11. Based on our analysis, irrespective of the Basslink interconnector failing, the State was in a high risk period until the heavy rains in May 2016. Based on our estimates, water storage levels would have dropped to 18.8% by late March 2016 even with Basslink operational. Energy water storage levels would have been below 25% for the period of late December 2015 until mid-May 2016.

12. The Basslink failure clearly exacerbated the precarious position of the State’s system security. Actions were taken by Hydro Tasmania to organise diesel fired power generation and agreed commercial curtailment agreements with large industrial customers to manage the crisis.

Who pays for the Energy Crisis?

13. The cost of the Energy Crisis is not only borne by Hydro Tasmania in the first instance, but also has impacted the consumers of Tasmania.

14. Hydro Tasmania has stated the expected net cost of the crisis is of the order of $140 to $180m. However, Hydro Tasmania does stand to benefit from a higher forward price in subsequent future periods.

15. Hydro Tasmania publish forward contracts explicitly designed to manage residential and small businesses for 2016/17. If Hydro Tasmania sold 2,000GWh at this elevated price, then Hydro Tasmania revenue would have improved by $32m per annum. Further increased revenues would also follow from higher hedging contracts for customers seeking renewal of their market contracts.

16. Three large industrial customers reached a commercial agreement to reduce consumption through the crisis period. It is not known what the actual cost was to these consumers, but presumably it was not to their advantage. The realised market value of this curtailment measured at the prevailing actual spot prices was estimated to be $49.7m.

17. Looking at other market based customers, a customer seeking to extend their retail agreement during 2016 effective from 1 July 2016, would have incurred an increased energy commodity cost of $1.7m (37%) for a customer consuming 100,000MWh per annum compared to the same offer 12 months earlier. A smaller business or School consuming 200MWh per annum would have incurred an energy commodity cost increase of $3,400 (37%).

18. Regulated customers have also been affected by the price impact of the Energy Crisis. Based on a typical residential customer consuming 8MWh per annum, it is our conclusion that the energy commodity cost component of the tariff has increased by 33% in the 12 month period, an extra $140 per annum. However, this increase has been off-set by a reduction in network charges to maintain the total increase to $79 per annum (+4.1%).

19. There are 37,000 small businesses in Tasmania employing about 70,000 people, mostly on a Regulated Standing Offer Tariffs who were also impacted. Based on a small business such as a newsagency or a single irrigation pump on a rural property, the energy commodity costs increased by $871 per annum (33%) compared to 12 months ago, but again this has been off-set by a network cost reduction of $685 per annum (8.6%). Environmental certificate costs also increased by $266 per annum (55%), leading to an overall increase of $451 per annum (+4.9%).

Conclusion

20. Concerns have been raised in this report about risk management practices which may penetrate further into organisational culture and the setting of performance targets. It is not the intent nor desire of the authors of this report to specific target an individual, a political party, or a Government. It is however, our purpose to constructively learn from past events. Our aim is for Tasmania as a community to move forward and maximise the social and economic benefit of the State's natural energy resources.

21. It would appear that Hydro Tasmania has not demonstrated prudent risk management practices in particular over the period April to July 2015, and as a consequence the impact on consumers has in our opinion been worsened. Once the Energy Crisis was clearly evident, Hydro Tasmania appeared to apply better risk management steps, however pre-emptive steps earlier would have improved the starting position at the time of the Basslink failure.

22. The cost of this Energy Crisis has in the first instance been largely borne by Hydro Tasmania, although those large consumers with half hour spot price exposures (believed to be 5 or so customers), would have also been severely impacted. Large industrial customers agreeing to reduce consumption would have also been presumably negatively impacted, even though there may have been some compensation. However, unlike consumers, Hydro Tasmania does stand to benefit in the medium term, as the rally in the wholesale forward market prices will significantly increase Hydro Tasmania's revenue.

23. Customers have clearly been impacted. Those contestable customers who in early 2016 locked into new retail agreements starting 1 Jul 2016 are already experiencing higher energy commodity costs; and those contestable customers who will sign-up for new agreements starting 1 July 2017, will also face much higher commodity energy costs. These cost increases may however be softened through lower network charges.

24. Regulated Tariff customers are most likely unaware that the commodity energy costs have materially increased, as the network price reduction mitigated the full force of the price increase.

25. In order to manage the energy security of the State there are clear lessons arising from this Energy Crisis, and these are:

    a. It is questionable whether Hydro Tasmania is the best organisation to jointly manage commercial interests and system security interests, which at times, conflict with each other;

    b. Risk management practices need to be improved to avert a similar situation arising again. To be clear, the State was in a precarious position irrespective of Basslink failing;

    c. More levers are required to manage system security in an efficient manner. For example, establishing commercial load curtailment agreements are one option, maintaining access to non-hydrological power generation is another, encouraging further wind farm developments to diversify the State's hydrological risk and leverage another natural advantage of the State is another

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Introduction

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1 Introduction

1.1 Background to the Report

The Tasmanian Energy Security Taskforce was formed following the Energy Crisis that impacted Tasmania as the result of record low water storage inflows and the failure of the Basslink. This report investigates:

a) to what extent was the Energy Crisis predictable and what risk management measures were set in place to manage such a risk
b) the decision and timing of the announcement to sell the Tamar Valley Power Station
c) the impact on the Wholesale Forward Market
d) the impact on Customers

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2

PREDICTING THE ENERGY CRISIS

- Energy Storage Levels
- Predictability of Water Storages & Rainfall
- Risk Management of Water Storages and Practices
- Hydro Tasmania

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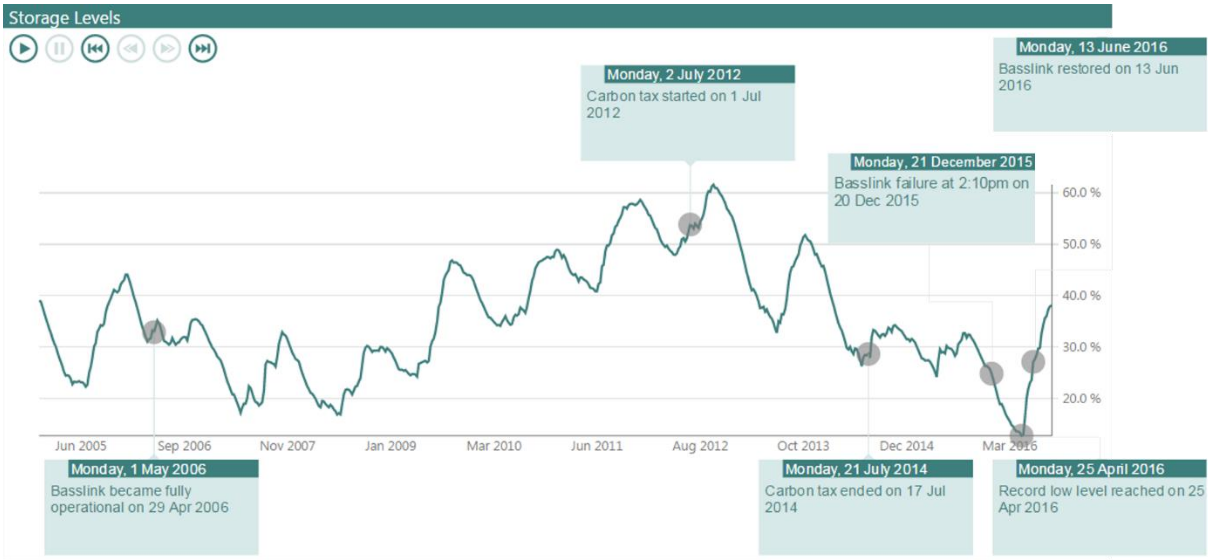
2 Predicting the Energy Crisis

The purpose of this section of the report is to assess whether the Energy Crisis was at any point in time predictable, and whether HydroTas set in place reasonable risk management practices to manage the risk.

2.1 Energy Storage Levels

The journey of the Tasmanian water energy storages since January 2005 is shown in Figure 1 with the key dates marked when the Basslink began operations, the carbon tax period, the Basslink failure and restoration, as well as when the lowest water storage levels occurred on 25 April 2016.

Figure 1: Journey of Energy Water Storages



It can be noted from the storage levels that upon approach of the carbon tax period, the storage levels were accumulated and then depleted through the carbon tax period. At the end of the carbon tax period in July 2014, the water storage levels of 28.4% were at its lowest for that same time of year, and the lowest since the drought years of 2007 and 2008.

Since July 2014, the water storage levels struggled to recover reaching a maximum of 34.3% in November 2014. Basslink failed on 20 Dec-16 when the storage levels were 24.9%.

The lowest recorded energy water storage level was reached on 25 April 2016 with 12.8%.

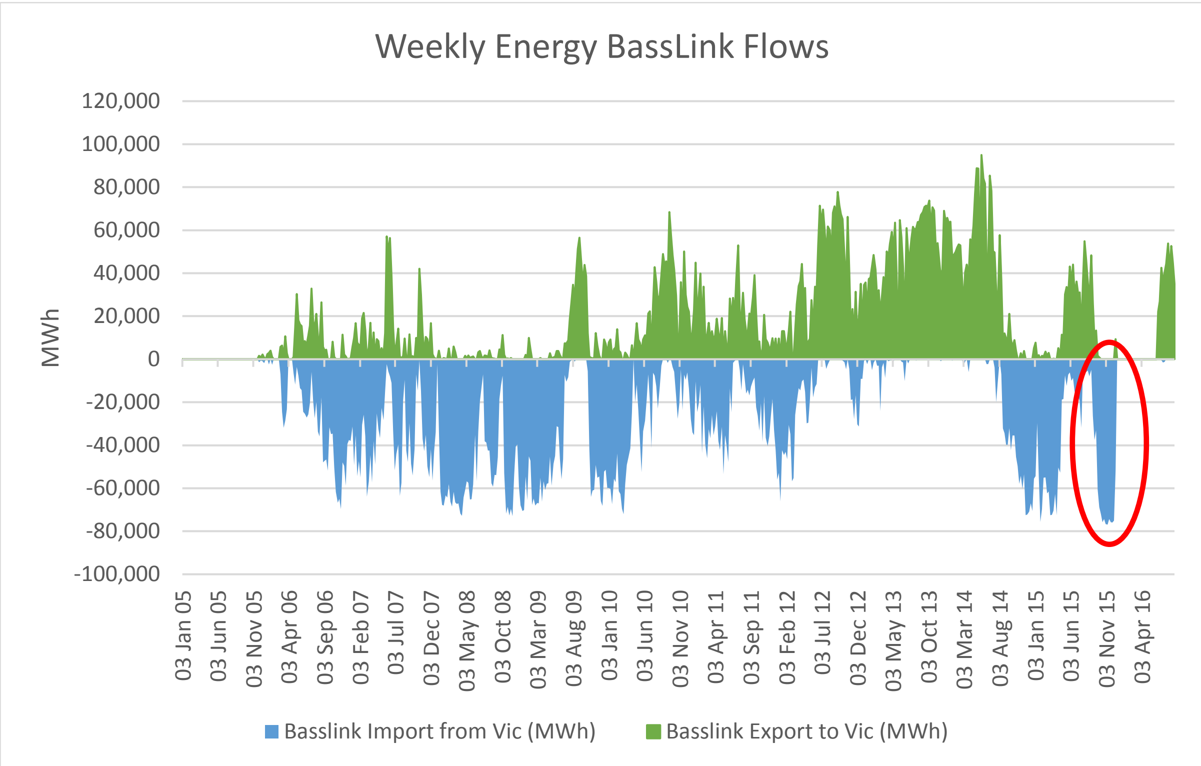
2.2 Predictability of 2016 Water Storages

Prior to the failure of the Basslink, the State of Tasmania was facing significant energy supply risks which were only exacerbated by the failure of Basslink.

Since September 2015, Hydro Tasmania had substantially reduced the amount of energy exported into Victoria and began to rely heavily on the Basslink interconnector for imports as shown in Figure 2 and marked with a red circle.

During the last 9 weeks before Basslink failed, about 75,200 MWh of energy was imported from Victoria each week.

Figure 2: Weekly Energy Basslink Flows



The observable trend from the last 10 years is that water storage levels typically fall over the period of December to April each year, as shown in Figure 3. It should be noted that the light blue line represents the period starting in Dec- 15 when the Basslink failure led to further reduction in water storages, and then has sharply increased due to the significant water inflows.

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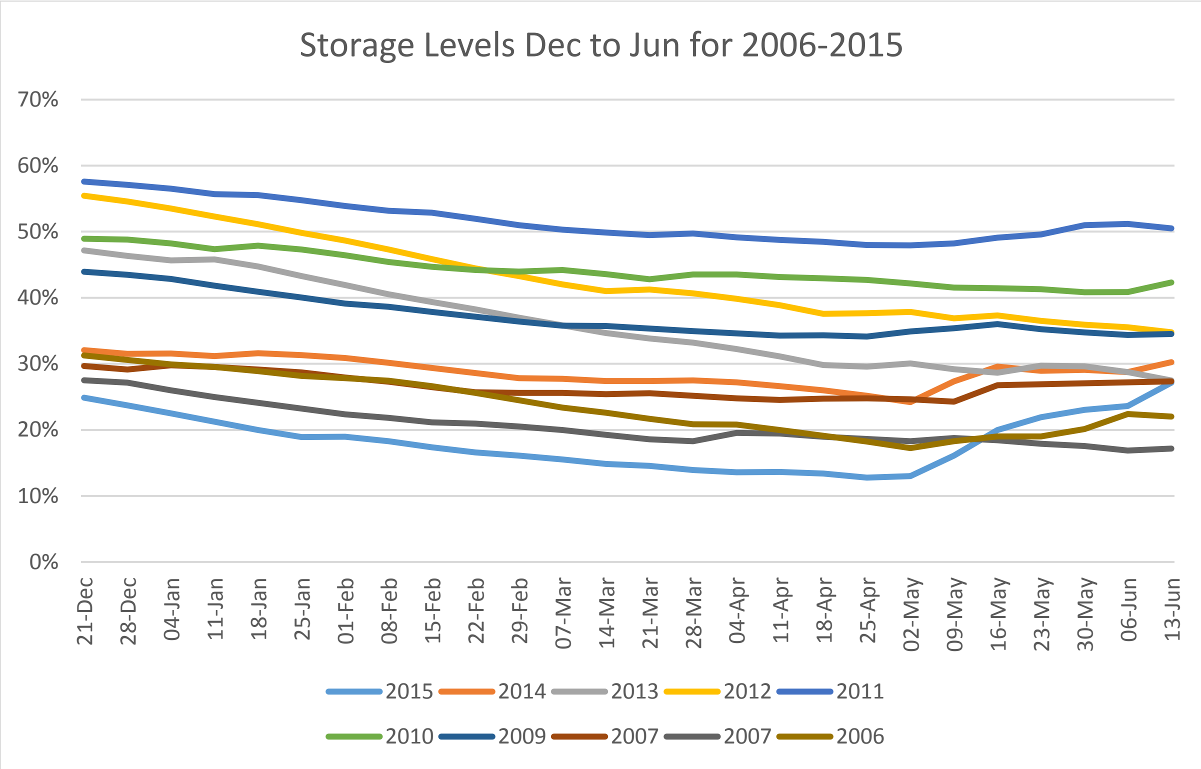
Figure 3: Weekly Water Storage levels from December to June each year

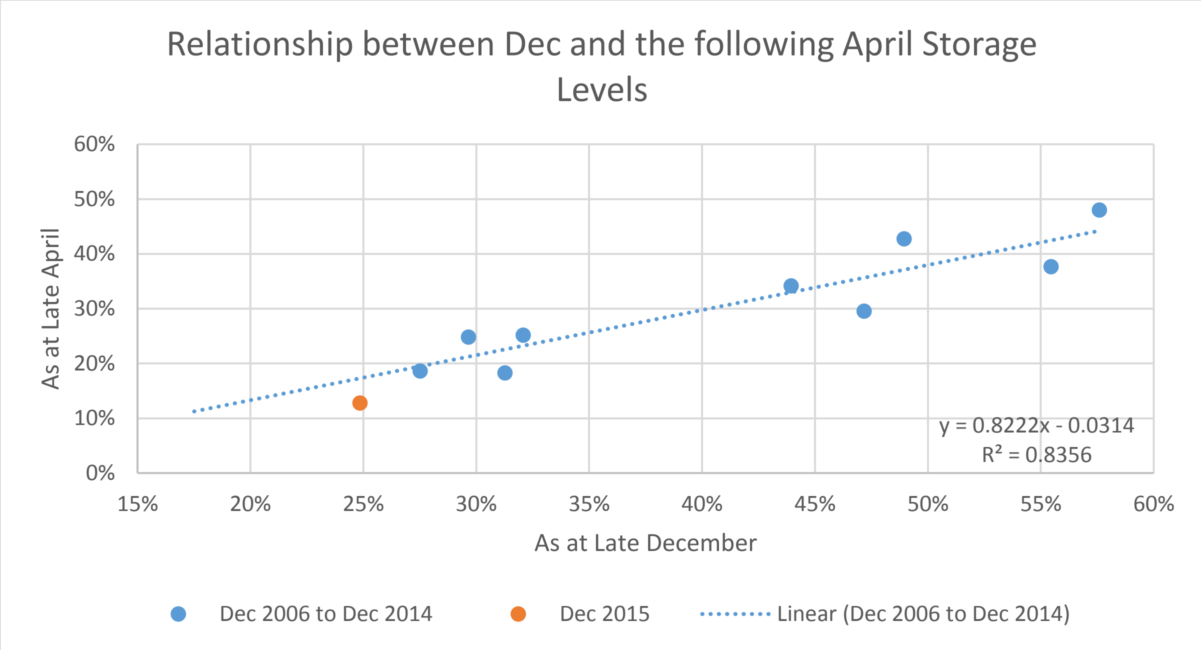


It is noted except for 2016, the fall in water storages from December to April is partially manageable through the risk management of the imports and exports on the Basslink.

The relationship between the December water storage levels and the following April has been reasonably predictable over the years, as shown in Figure 4. This means given the position prior to the Basslink failure when the storage levels was almost 25%, it is clear that the State's energy security was at great risk.

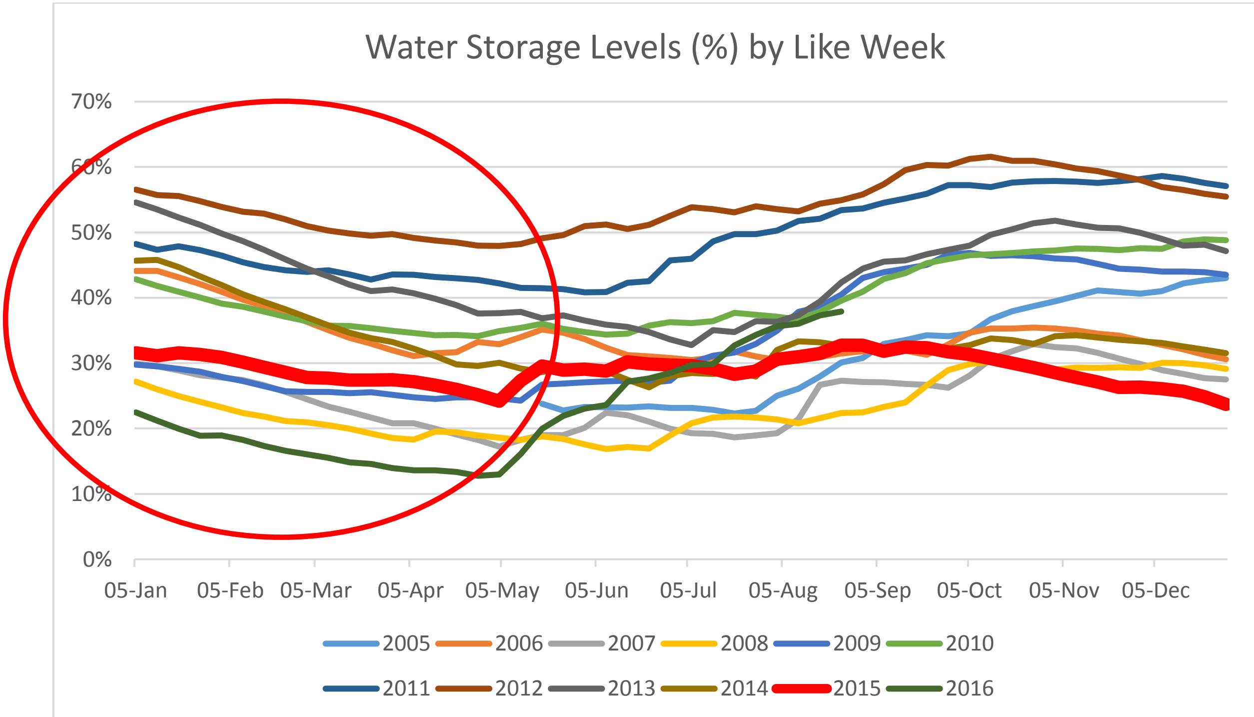
This precarious position is further evidenced by Hydro Tasmania eliminating all exports in the preceding months.

Figure 4: Relationship between December and the following April Storage Levels



It is concluded that the State was by mid December 2015 in a precarious position without significant water inflows, and given the seasonal timing, significant water inflows were not highly probable over the pending summer (see Figure 5 which shows for all years the storage levels decrease in the first part of the year).

Figure 5: Water Storage Levels (%) by Like Week



2.3 Risk Management of Water Storages

There are two measures that appear to be used when measuring water storage levels for the purpose of energy security; these being the Prudent Water Management and the Preferred Minimum Storage Level. Each of these are discussed below and then tracked for compliance.

2.3.1 Hydro Tasmania's Prudent Water Management

It is noted the extensive section in the Expert Panel's report devoted to hydrological risk management (Appendix 3, 14 pages). Of particular note is the following comment (p. 279):

> *"Since 2001, Hydro Tasmania's Ministerial Charter has required it to demonstrate the prudent management of its water storages. On the joining the NEM, Hydro Tasmania's Prudent Water Management (PWM) obligation became the basis on which to advise the Government of emerging issues in the hydro system.*
>
> *Hydro Tasmania's PWM policy (see Figure 1.4) uses a series of 'triggers' to indicate the increasing risk to security of supply, based on risk levels associated with water levels and potential contingency events, which include a major Basslink outage or major hydro-plant failure. Under the PWM policy, storage management rules are designed to manage storages through low inflow periods.*
>
> *The PWM defines a preferred seasonal minimum operating level and then medium, high and extreme risk zones. These risk zones indicate an increasing risk of supply failure, with the extreme case having both a higher probability of load curtailment, as well as significant environmental consequences. …*
>
> *Hydro Tasmania also defines a shortfall index based on the number of days that load can be met in circumstances that:*
>
> - *Basslink is not available;*
> - *there is no generation from wind or thermal production; and*
> - *inflows are very low.*
>
> *As this index falls, various actions are undertaken to address the commensurate increase in risk, including communication with stakeholders to allow external responses, if required. An index of 60 days or greater indicates that there are no material issues with meeting demand."*

The Panel's report further noted (page 232):

> *"Aurora Energy's acquisition (in 2008), completion and operation of the TVPS (Tamar Valley Power Station) was undertaken as an energy supply security measure, at the direction of the Government and in the context of a unique set of unforeseen hydrological and global financial circumstances."*

And at page 133, volume 2 the Panel says:

> *"Were circumstances to change – for example were the types of low probability scenarios contemplated by the Government at the time of its decision to acquire the TVPS to emerge (critically low water storages and a sustained outage of Basslink over several months), the market prices would rise very significantly, providing a funding mechanism to support the production and capital costs of the TVPS."*

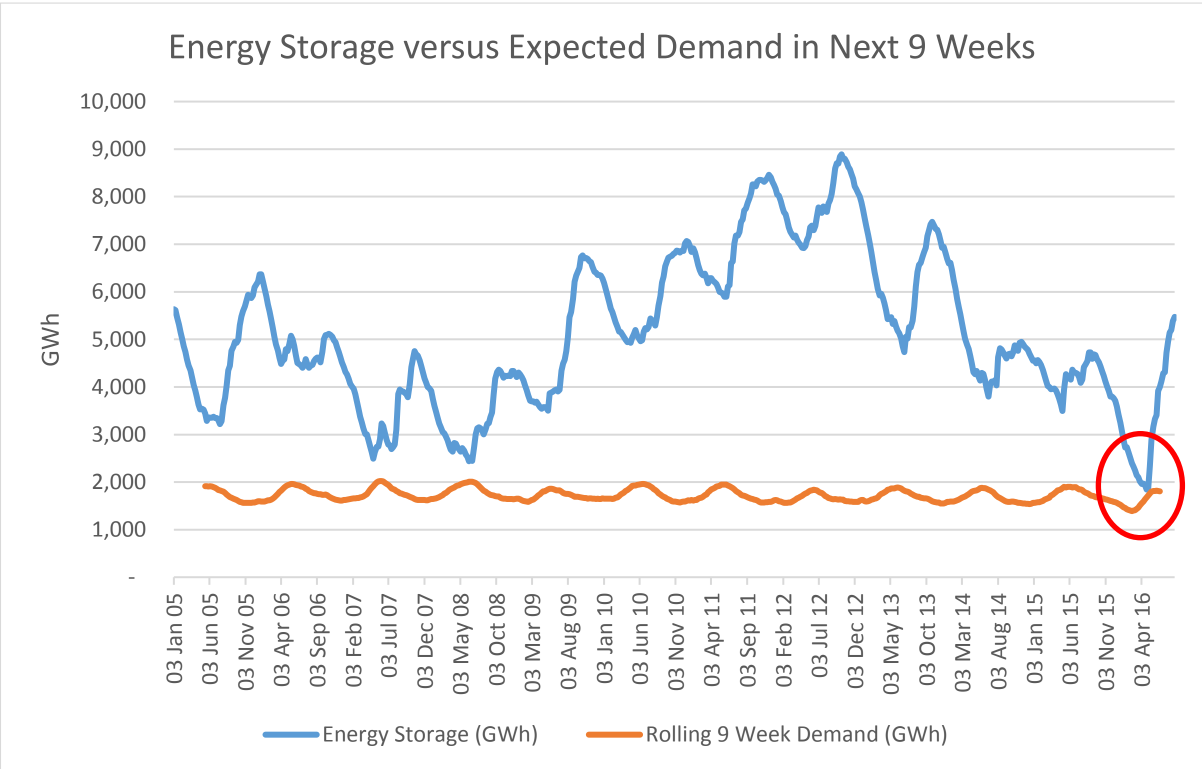
It is noted that the lack of availability of the TVPS output should have resulted in a revision of the PWM policy, which when implemented would be expected to have flagged the need for the reinstatement of the TVPS given the extent of storage declines during 2015.

2.3.2 Testing of the Prudent Water Management

The Prudent Water Management test of 60 days of storage was tested using the published weekly storage data. As a consequence, 9 weeks (63 days) was used as the reference point to determine whether sufficient storages were available.

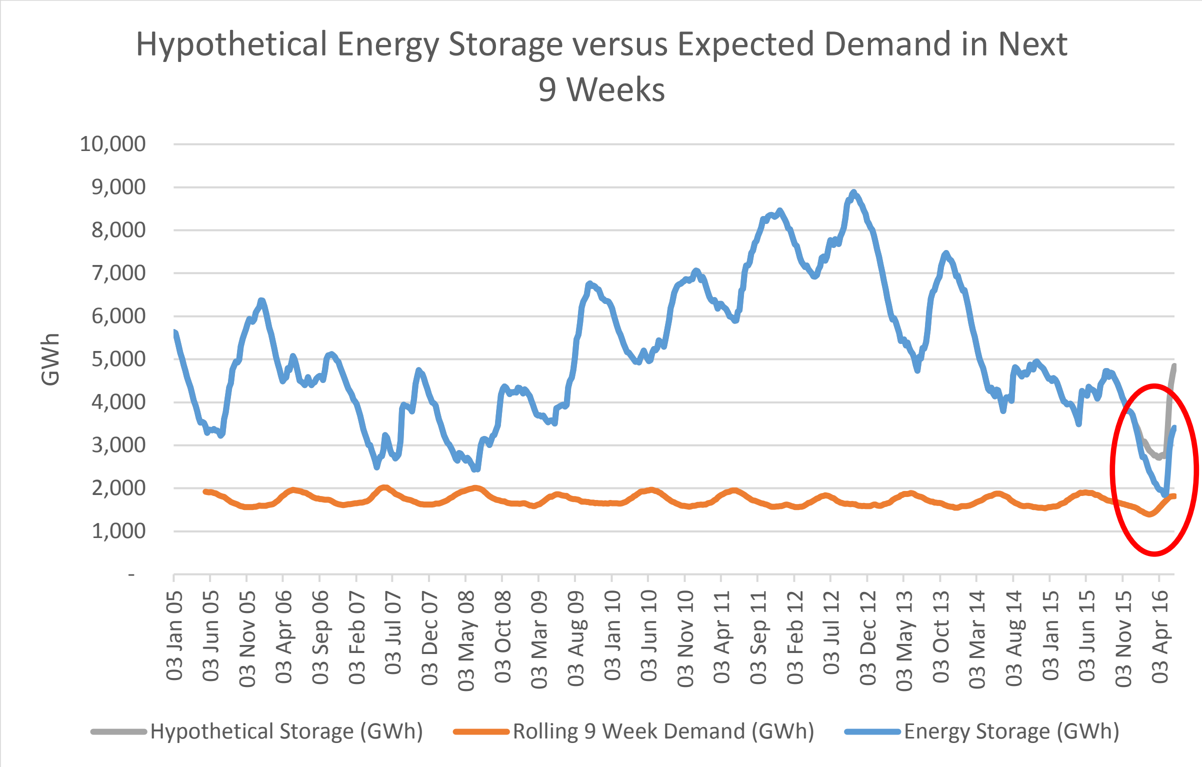
The test results show that when the storage levels reached a minimum on 25 April 2016, it was marginally above the minimum 9 weeks' reserve storage level. The rolling 9-week demand was derived using actual forward looking usage which is known with hindsight, but clearly not known beforehand. Therefore, in real-time, in late April the test was at great risk of not being compliant (see red circle on Figure 6) when the storage levels were 1,844GWh against the expected demand for the next 9 weeks of 1,678 GWh.

Figure 6: Tasmanian Hydro Energy Storage versus Expected Demand in the next 9 Weeks



A further test was performed assuming that the Basslink did not fail. In this scenario, based on the results, the Prudent Water Management test would have been compliant as the minimum storage levels was 2,746 GWh against an expected demand for the next 9 weeks of 1,678 GWh (see Figure 7).

Figure 7: Tasmanian Hypothetical Hydro Energy Storage versus Expected Demand in the next 9 Weeks



2.3.3 Preferred Minimum Storage Level

According to the Ministerial Statement of Energy Security on 8 March 2016[1],

> "In the lead up to the carbon tax Hydro Tasmania commenced the process of building up water storages to maximise export capacity during the carbon tax period.
>
> Up until the introduction of the carbon tax, Hydro Tasmania storages were set at a preferred minimum level of 30% by 1 July each year.
>
> Following the introduction of the carbon tax, in September 2012, the preferred minimum level was lowered by 5% to 25%.
>
> On 1 July in each subsequent year storages have been around 30%. On 1 July 2013 water storages were just under 33%. On 1 July 2014 they were just over 28% and on 1 July 2015 storage levels were just under 30%."

As an additional note, the water storage levels as at 4 July 2016 were 29.7%, following the substantial inflows during May and June.

[1] http://www.premier.tas.gov.au/releases/ministerial_statement_on_energy_security

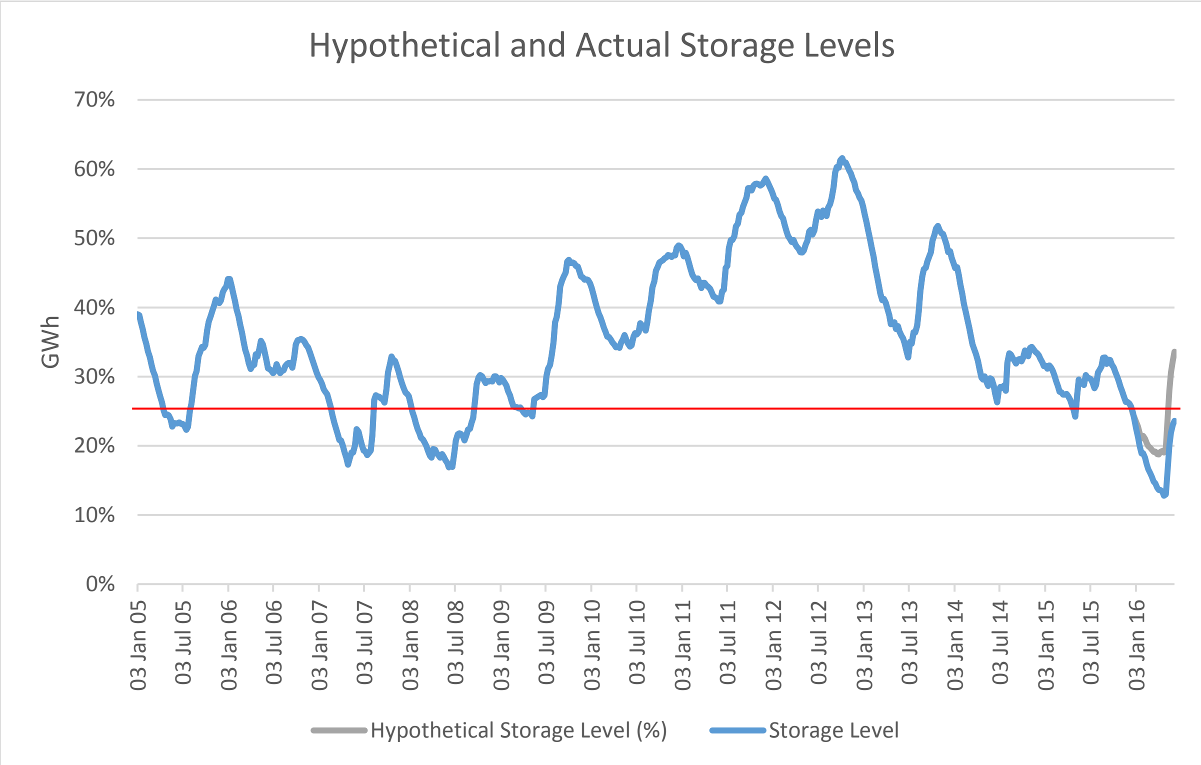
2.3.4 Testing of the Minimum Storage Level

The preferred minimum storage level is measured on each 1 July, although it is understood there is a minimum target for each calendar month but was not able to be found publicly. Using the 25% criteria for each month, the storage levels were below the 25% target on:

1. The week commencing 4 May 2015
2. During the entire Basslink outage period of 20 December 2015 to 13 June 2016

Hypothetically, if Basslink did not fail, then it is estimated that the 25% target would not have been met for most of the Basslink period outage (20 December 2015 until 16 May 2016), which was 3 weeks earlier than the return-to-service date (see Figure 8).

Figure 8: Hypothetical and Actual Storage Levels



The table below shows the tracking of the storage levels against the benchmark of 25% and 30% at the end of each month over the period 2006 to 2016. The results indicate that during the drought period of 2007 and 2008, storage levels were consistently low; and then recovered leading up to the carbon period (shown in italics in Table 1).

Following the carbon period of 1 Jul-12 to mid Jul-14, storage levels were low as shown by the many months shaded orange in the following table. Once the Basslink failed, the storage levels dropped below 25%.

Table 1: Tracking on Monthly Energy Storages

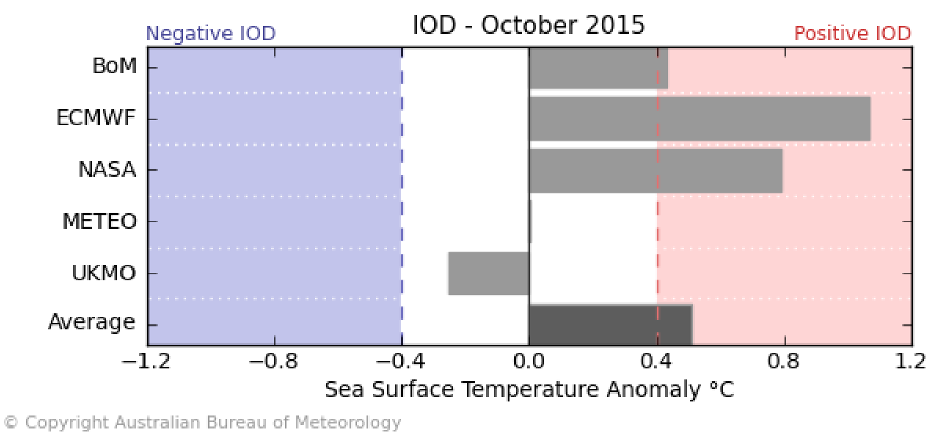
Month	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	35.7%	40.9%	27.8%	23.2%	28.7%	40.1%	47.3%	54.8%	***51.1%***	***44.7%***	31.6%	20.0%
Feb	31.7%	36.3%	24.5%	20.9%	25.7%	37.1%	44.2%	52.0%	***45.9%***	***39.3%***	29.4%	17.4%
Mar	28.0%	32.0%	20.8%	18.3%	25.2%	35.0%	43.6%	49.8%	***41.3%***	***33.2%***	27.5%	13.9%
Apr	24.5%	33.2%	17.2%	18.6%	24.8%	34.1%	42.7%	47.9%	***37.7%***	***29.6%***	25.2%	12.8%
May	23.3%	33.7%	20.1%	17.9%	26.9%	34.7%	40.8%	51.0%	***36.5%***	***29.7%***	29.0%	23.1%
Jun	23.2%	30.8%	20.0%	18.9%	27.3%	36.3%	45.7%	52.6%	***33.6%***	***28.0%***	29.7%	28.5%
Jul	22.7%	30.5%	19.3%	21.7%	32.9%	37.4%	49.7%	***53.6%***	***36.4%***	27.9%	28.8%	34.3%
Aug	30.8%	31.8%	27.1%	22.4%	43.0%	40.9%	53.7%	***55.8%***	***44.5%***	32.7%	32.7%	37.9%
Sep	34.1%	32.8%	26.2%	26.6%	45.0%	45.3%	55.9%	***60.2%***	***47.4%***	32.5%	32.4%	
Oct	39.5%	35.3%	32.5%	29.6%	46.4%	47.1%	57.8%	***60.4%***	***51.8%***	33.0%	29.3%	
Nov	40.7%	33.5%	29.9%	29.4%	44.3%	47.6%	58.2%	***58.0%***	***49.9%***	33.6%	26.3%	
Dec	43.0%	30.6%	27.2%	29.1%	43.5%	48.8%	57.1%	***54.6%***	***46.4%***	31.5%	23.7%	

2.4 Predictability of Spring Rainfall Levels

In its Energy Supply Plan 2015-16, Hydro Tasmania states that the record low Spring rainfall was related to the co-occurrence of two climate phenomena, the positive Southern Annular Mode (SAM) and positive Indian Ocean Dipole (IOD). Hydro Tasmania argues that the onset of the positive IOD was strong and sudden, and that the severity was not predicted.

Goanna Energy notes that the SAM had been in a positive phase throughout 2015 (http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/aao/month_aao_index.shtml) so this aspect at least should have been well known to Hydro Tasmania throughout the year. We also note that there were forecasts made in at least May of a strong positive IOD event to occur in the Spring of 2015 – see Figure 9 below from the Bureau of Meteorology's May 2015 outlook. In any case the fact that the IOD event is described by Hydro Tasmania as "the strongest IOD event since 2006" implies such an event has occurred relatively recently and should therefore not be considered to be an extreme low probability event.

Figure 9: Indian Ocean Dipole Forecast from Bureau of Meteorology May 2015 Outlook



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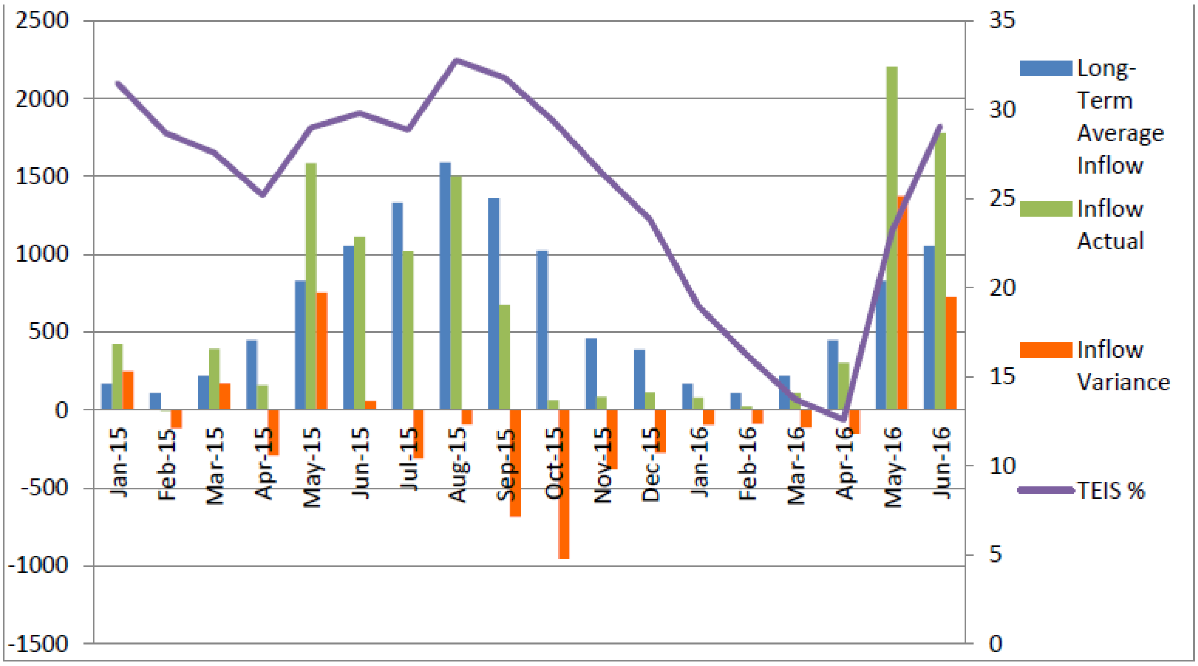
While none of this proves that the low rainfall levels of Spring 2015 should have been expected or predicted, it seems clear that such an event was a very credible outcome; certainly one that must be considered from a risk management perspective given the stakes involved.

2.5 Hydro Tasmania's Management of Water Storages

Figure 10 shows the inflows to Hydro Tasmania's water storages during 2015 and the first half of 2016[2]. The high inflows seen during May 2015 are a stand-out feature. With the Jun-15 inflows also slightly above long-term averages it is clear that had the May rainfall event not occurred, the energy in storage at 1 July 2015 would have been significantly below the 29.1% level actually reached (which in turn is below the minimum operating level of 30% that was in place prior to 2012).

Figure 10: Inflows to Hydro Tasmania Storages 2015-16



While Goanna recognises the strong commercial incentive for Hydro Tasmania to run down the water storages during the carbon pricing period in order to earn higher revenue from its generation, there is little evidence to suggest that since this time the water storages have been managed in line with a goal of restoring the water storages to the levels previously considered prudent.

Treating this from a pure commercial risk management perspective there may be a valid argument at times to accept somewhat higher risks because the returns are high enough to justify the risk. However, in this case it appears that after the commercial returns in terms of spot prices were restored to normal levels, there was no corresponding reduction in the amount of risk exposure sought. It seems then that even from a commercial risk management perspective Hydro Tasmania's behaviour may be called into question.

[2] Sourced from Hydro Tasmania Energy Supply Plan 2015-16 Final Summary, 1 July 2016

2.6 Risk Management Practices Benchmarked

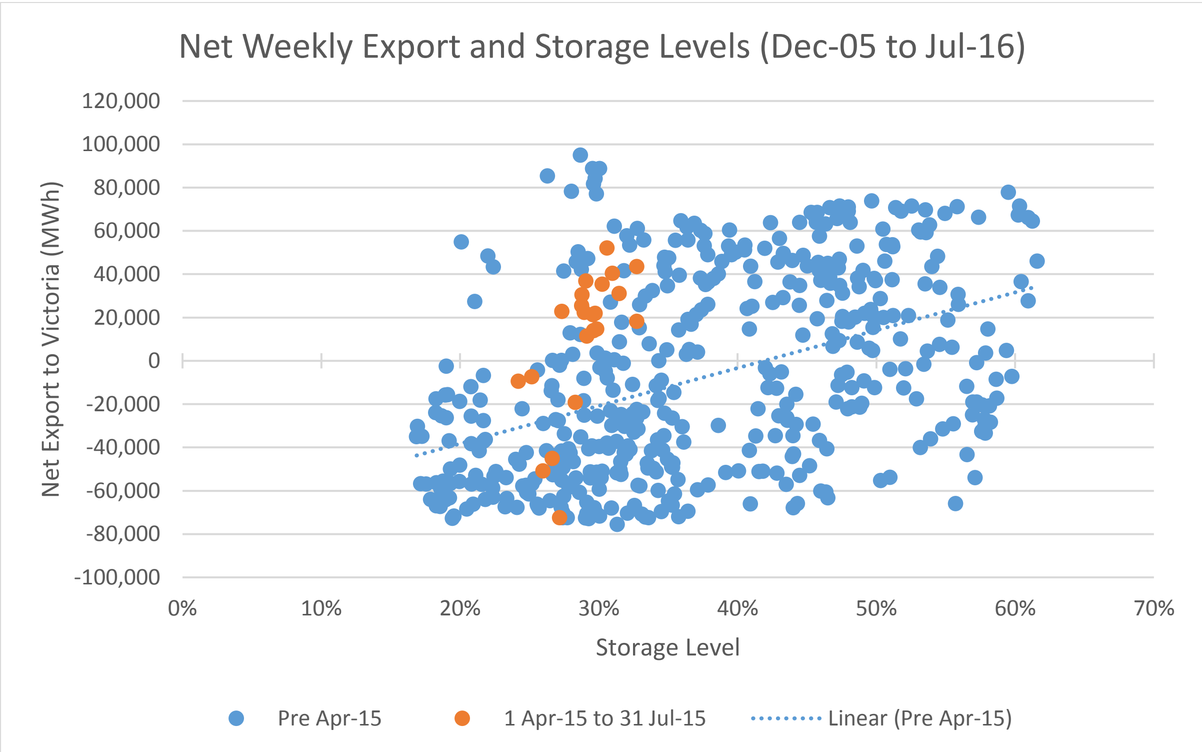
The next stage of the analysis was to assess the risk management practices over time. As stated in the previous section of this report, the journey of water storage levels changed over time, covering periods of drought in 2007 and 2008, building storages for the carbon period, then strategically lowering the storage systematically during the carbon period, and then post the carbon period.

The findings of the results of this section are further evidence that the risk management practices of Hydro Tasmania were questionable.

The analysis begins by assessing the relationship between net weekly exports of energy from Tasmania to Victoria, noting this behaviour with respect to the amount of water storage available. Intuitively, one would expect the more water storages, the higher level of net exported energy. Conversely, if water storages were low, then one would expect that Tasmania would be a net importer of energy (i.e. negative net exporter).

Figure 11 shows the relationship between the net weekly export energy and the weekly water storages since Basslink began operations in Dec-05 until Jul-16. The sampling has been separated into two series, the first being all weeks up until 1 April 2015 (blue dots), and the second series are from 1 April 2015 (orange dots) to the end of July 2015. The focus in this section is the strategic management of the water reserves in this April to July 2015 period.

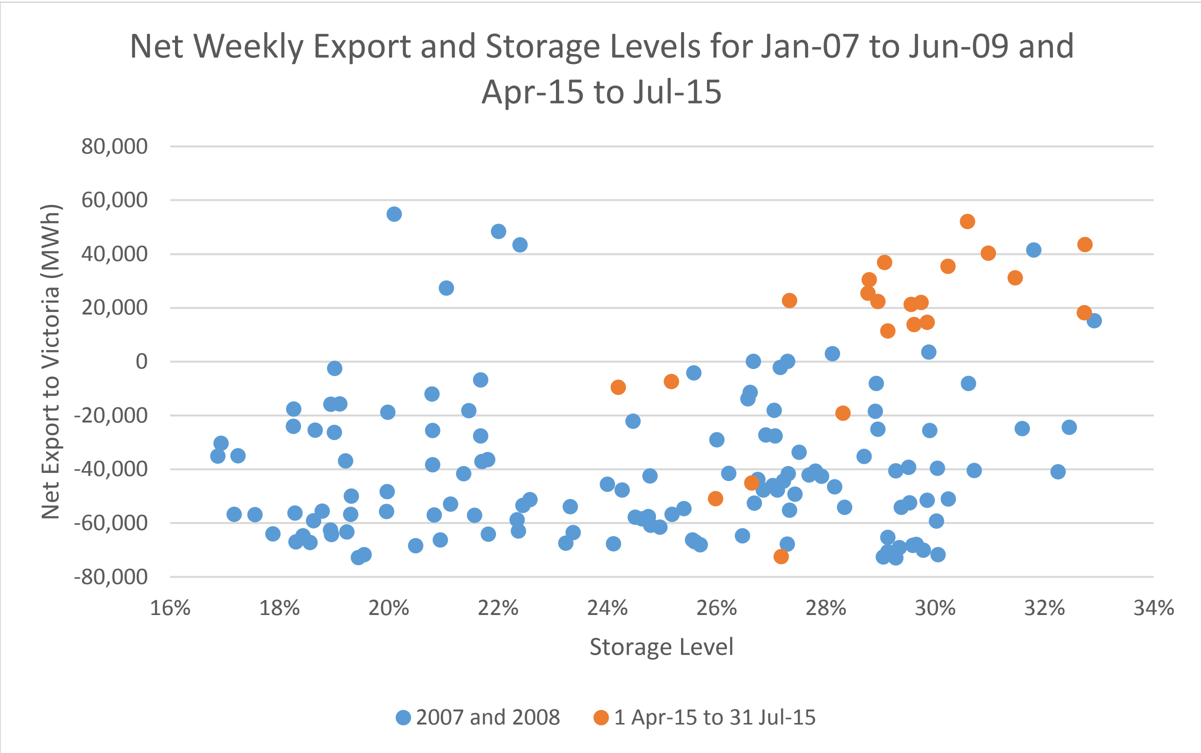
Figure 11: Net Weekly Export and Storage Levels (Dec-05 to Aug-16)



The chart confirms the intuitive result that when storage levels are low, Tasmania tends to import energy evidenced by the cluster of dots on the chart in the bottom left hand corner. For clarity, a simple trend line has been added to the chart, and it confirms the general expectation of low storage levels leads to net imports, and higher storages lead to net exports.

The next stage of the analysis was to compare the Apr15 to Jul-15 period, with a comparable period beforehand. In order to avoid the carbon years, this meant the 2011 through to 2014 were distorted, and it was noted from Table 1 that in the period January 2007 through to June 2009 there was a consistent period where storage levels were consistently below 30%. Using this sample period, the analysis was repeated as shown in Figure 12.

Figure 12: Net Weekly Export and Storage Levels (Jan-07 to Jun-09 and Apr-15 to Jul-15)



The results in Figure 12 show that there were many weeks where water storage levels were below 24% which is not comparable with the 2015 sample period. Consequently, to aid the understanding of behaviour, the sample in 2007 to Jun-09 was restricted to those weeks where the storage levels exceeded 24%, and this result is shown in Figure 13 .

The results indicate there are many weeks in 2015 at a comparable storage level as the previous sample, where net exporting was a more common occurrence. This can be observed by the orange dots in the figure representing the 2015 sample.

In contrast, during the Jan-07 to Jun-09, there was only 2 weeks that clearly net exported and these were when the storage levels were about 32% (i.e. at the higher end of the water storage range). Some 68 of the 74 weeks (92%) sampled had the State as a net importer in this Jan-07 to Jun-09 period. In the 2015 sample period, net exporting was the dominant strategy and was observed in 11 of the 17 weeks (65%). A complete reverse in strategy.

Figure 13: Net Weekly Export and Storage Levels (24% - 34% only) for Jan-07 to Jun-09 & Apr-15 to Jul-15

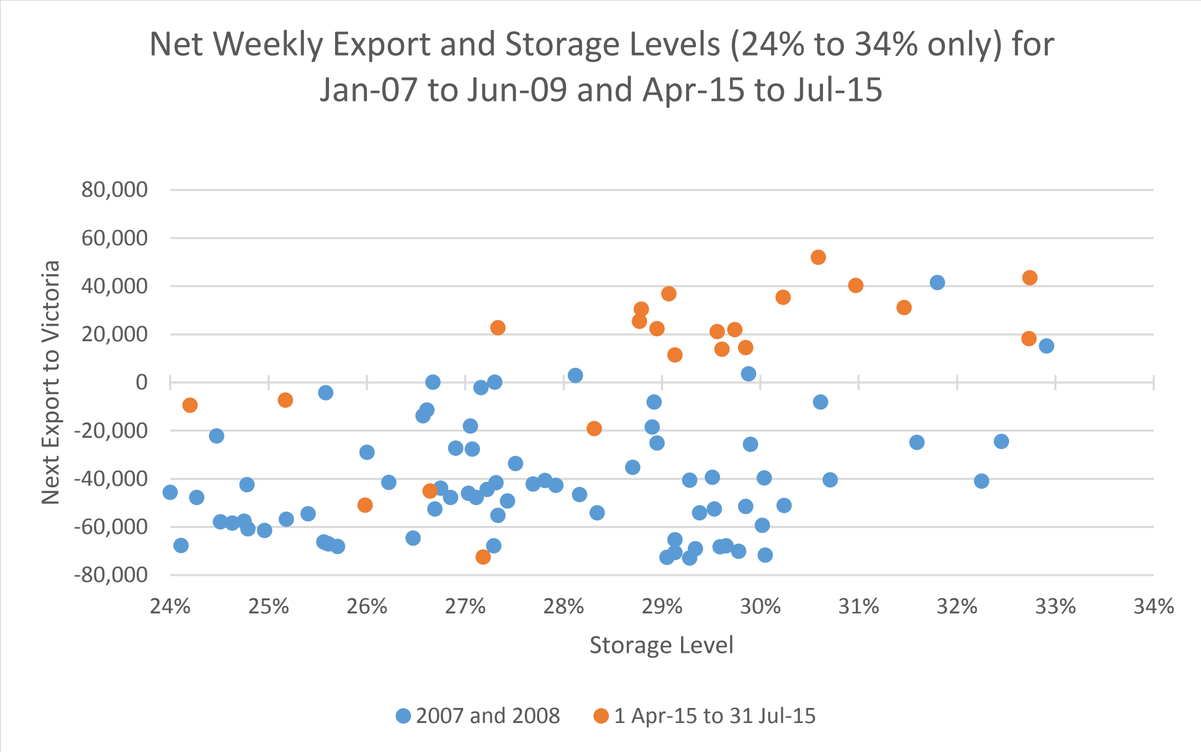


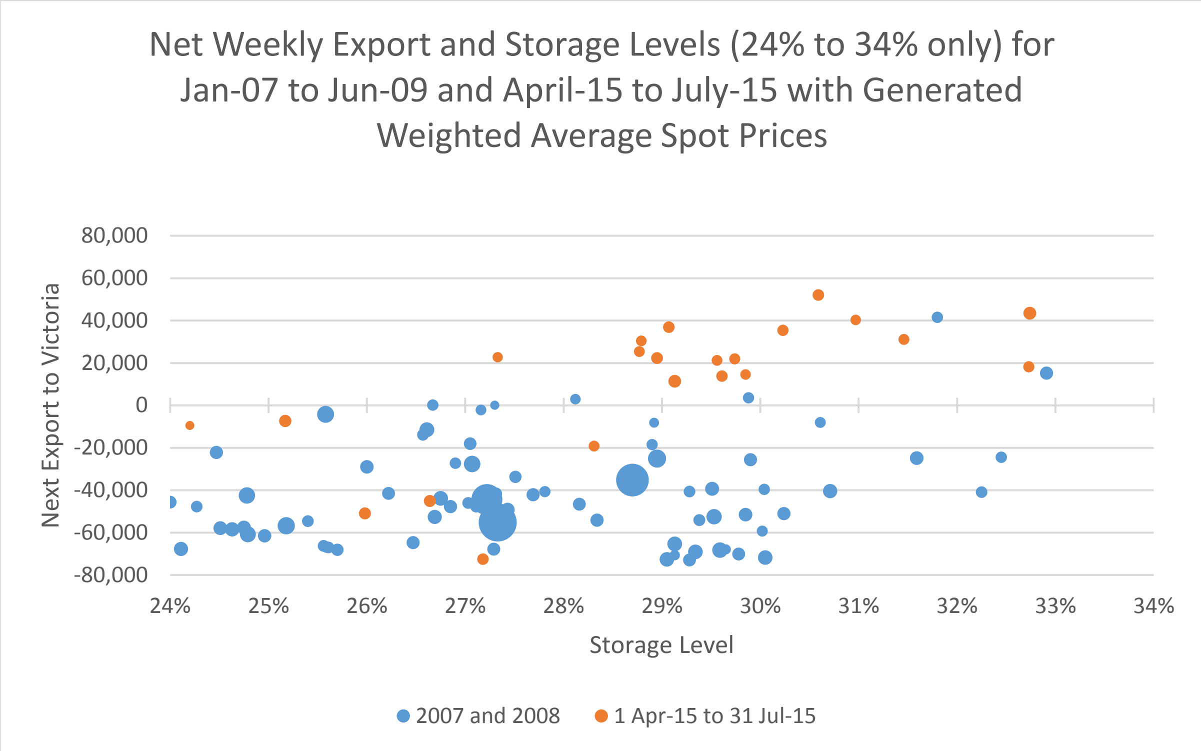
Table 2: Weekly Occurrence of Net Importing and Net Exporting

	Jan-07 to Jun-09		1 Apr-15 to 31 Jul-15	
	Count	%	Count	%
Net Import from Victoria	68	92%	6	35%
Net Export to Victoria	6	8%	11	65%
Total	74	100%	17	100%

Perhaps the rationale to become a predominant net exporter in 2015 was due to the financial gain arising from accessing higher spot prices in the Victorian region? This hypothesis was further tested and it was found that the generated weighted average price was higher in the Jan-07 to Jun-09 period, than the sample 2015 period. This finding is demonstrated in Figure 14.

The size of the dot in the following chart demonstrates the generated weighted average spot prices. It is clear from the dot sizes that the average price was higher in Tasmania during this Jan-07 to Jun-09 period, compared to the average price yielded in the sample 2015 period.

Figure 14: Net Weekly Export and Storage Levels (24% to 34% only) for Jan-07 to Jun-09 and Apr-15 to Jul-15 with Generated Weighted Average Spot Prices



Based on this analysis, it is concluded that the risk management practices of 2007 through to mid-2009 were equally appropriate for the State of Tasmania in 2015. It would appear in 2007 to mid-2009 that not only did the State benefit from being a net importer of energy and therefore conversing relative scarce water resources, but it was able to extract a higher spot price. The 2015 strategy appeared to significantly increase the risks for the State.

2.7 Conclusion

We believe we have identified evidence to support a case that:

1. Hydro Tasmania deliberately depleted its storages during the carbon price period to realise a commercial gain

2. Even prior to the Basslink failure Tasmania's energy storages were at unusually low levels potentially placing the State's energy security at risk

3. The climate conditions credited with causing the record low Spring rainfall occurred or were forecast in May 2015, and the low rainfall should at the least have been identified as a very realistic scenario in a well risk-managed business.

4. Leaving aside issues of social responsibility, Hydro Tasmania's commercial risk management may be called into question.

3

Sale of Tamar Valley Power Station

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3 Sale of Tamar Valley Power Station

In the previous section of this report, it was concluded that from a risk management perspective, the likelihood of record low Spring rainfall in the 2015 was a credible scenario and therefore actions should have been undertaken to manage such an eventuality. The evidence outlining this scenario was known in May 2015.

It is therefore surprising that Hydro Tasmania announced on the 12 August 2015 to sell the Tamar Valley Power Station (TVPS). A copy of the press release is re-produced in the Appendix of this report.

Furthermore, it was recognised that TVPS plays an important role in managing hydrological risks. In the extensive section in the Expert Panel's report devoted to hydrological risk management (Appendix 3, 14 pages). Of particular note is the following comment (p. 232):

> *"Aurora Energy's acquisition (in 2008), completion and operation of the TVPS (Tamar Valley Power Station) was undertaken as an energy supply security measure, at the direction of the Government and in the context of a unique set of unforeseen hydrological and global financial circumstances."*

And at page 133, volume 2 the Panel says:

> *"Were circumstances to change – for example were the types of low probability scenarios contemplated by the Government at the time of its decision to acquire the TVPS to emerge (critically low water storages and a sustained outage of Basslink over several months), the market prices would rise very significantly, providing a funding mechanism to support the production and capital costs of the TVPS."*

Based on that fact that the low Spring rainfall scenario was a foreseeable contingency risk, and it was compounded by the intention to sell TVPS, that the standard of risk management practices applied were below standards expected of a professional and dedicated organisation of the standing of Hydro Tasmania.

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4

Wholesale Market Price Impacts

- Spot Prices
- Vic Forward Market Prices
- Consequential Impacts on Forward Prices

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4 Wholesale Market Price Impacts

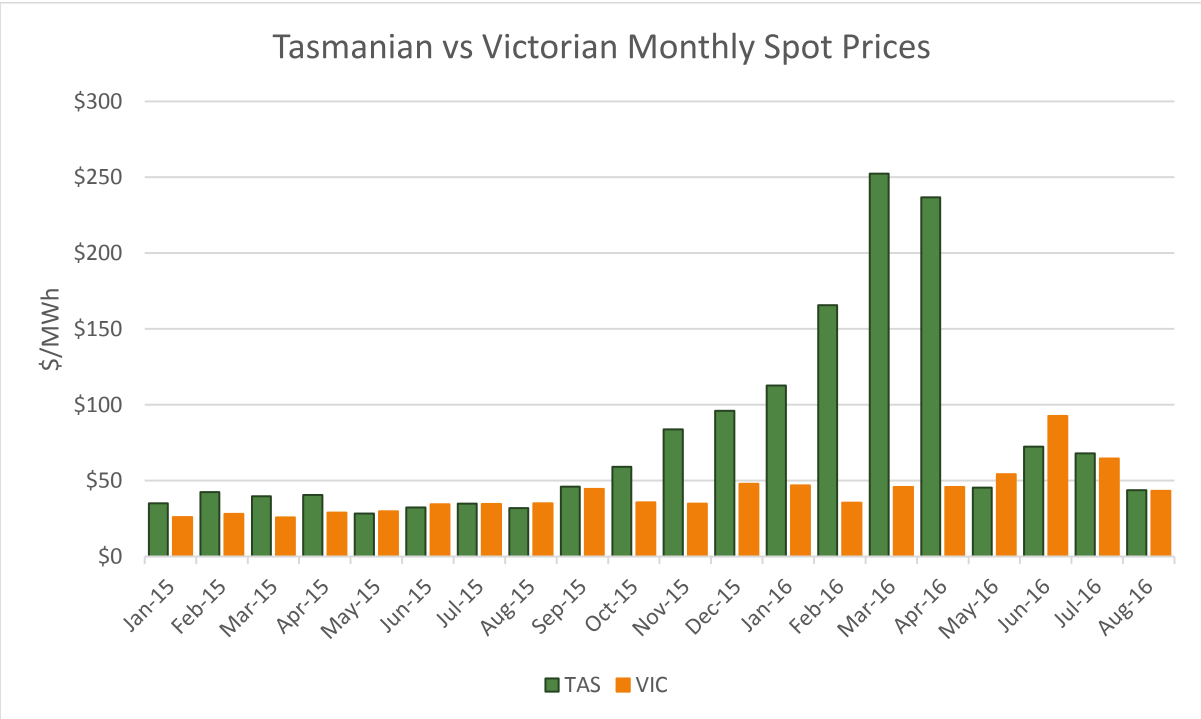
This section of the report focusses on assessing the wholesale price impacts of the low water storage levels as well as the failure of the Basslink interconnector. The impacts are assessed in terms of the impact on:

1. spot prices;
2. forward market prices; and
3. residential retail prices

4.1 Spot Prices

A comparison of the monthly Victoria and Tasmanian spot prices are shown in Figure 15 and demonstrate that in the period when exporting progressively stopped from September 2015 onwards, but most notably from October 2015 onwards, the Tasmanian prices began to escalate prior to Basslink failing, and then were exacerbated following the Basslink failure in late December 2015.

Figure 15: Average Tasmanian and Victorian Monthly Spot Prices



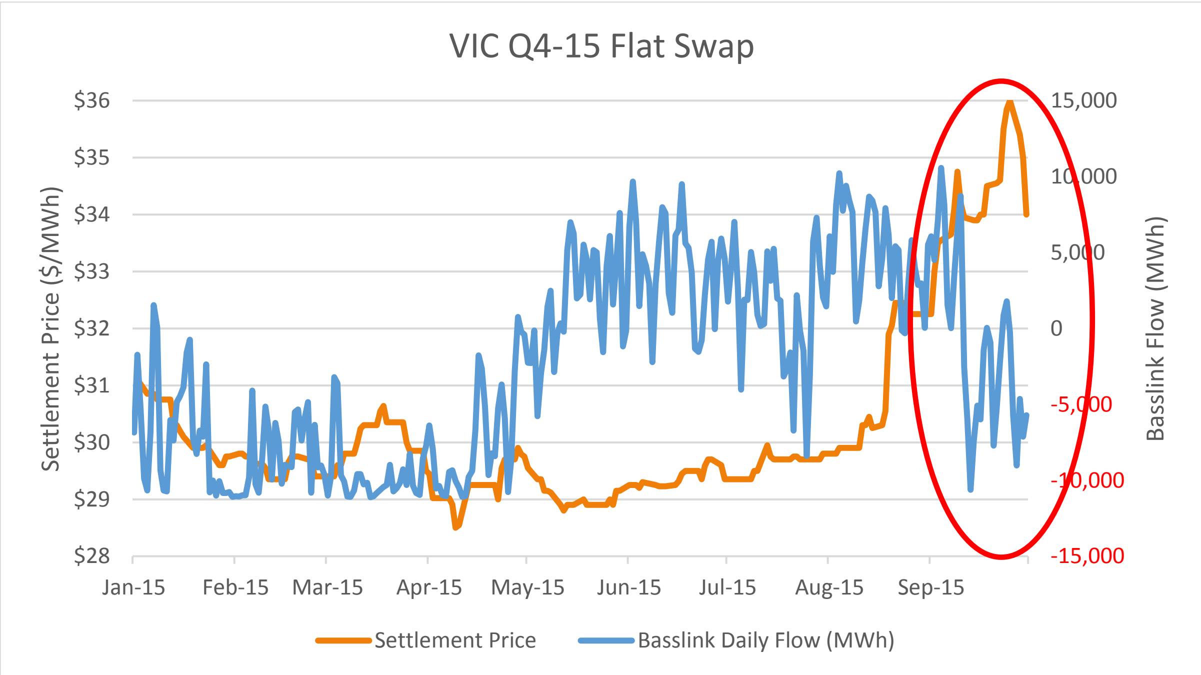
4.2 Vic Forward Market Prices

The Tasmanian forward price is linked to the Victoria forward price in a formulaic approach, and so therefore any movement in the Victoria forward price is the dominant factor setting the Tasmanian forward price. As a result of this linkage, by definition a movement in the forward Victorian price flows through to the Tasmanian forward price.

Hydro Tasmania has an active mainland retailer, Momentum Energy, and presumably the Victorian trading positions are managed through a range of means including the physical generation capability of Hydro Tasmania to export into Victoria. With the exports being curtailed this would mean that Hydro Tasmania would no longer have the physical hedge to manage the Victorian financial risks. As a consequence, it would appear prudent for Hydro Tasmania to buy Victorian hedging contracts. The following charts show for the near term contract periods of Q4-15, Q1-16 and Cal-16, the movement in forward market prices coinciding with export curtailment to Victoria.

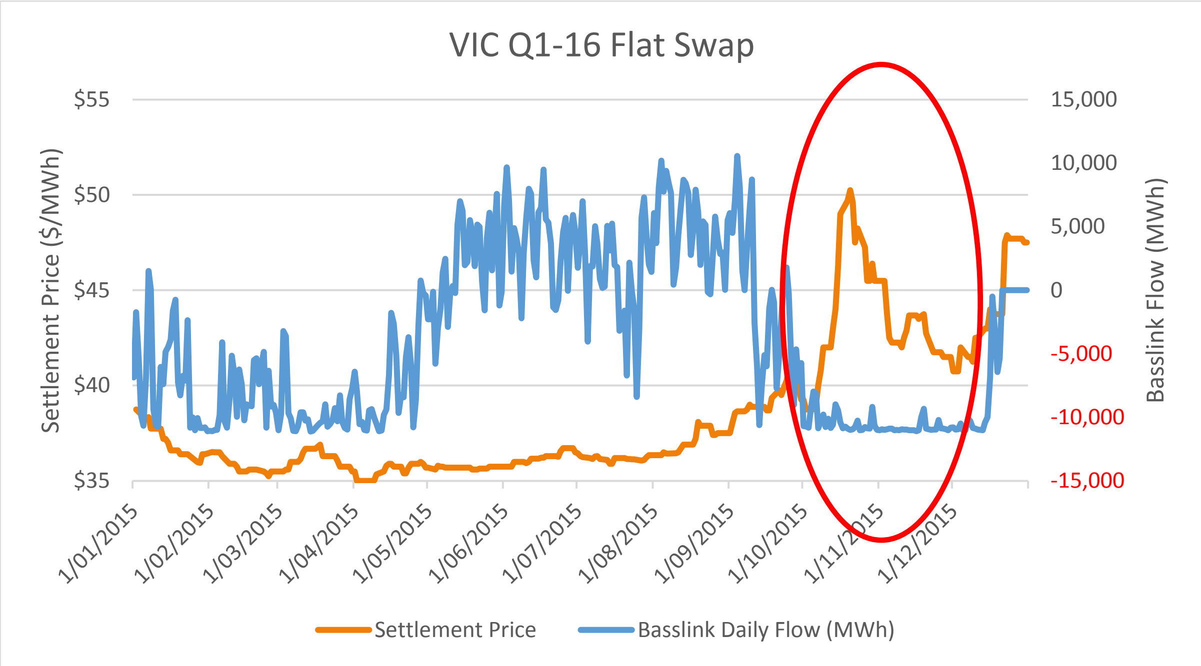
In the Q4-15 contract, the forward prices moved markedly upward from about mid-August, but then continued to rally until almost the commencement of the contract (see Figure 16). It is our contention, that Hydro Tasmania was a contributor to the price rally. This issue is further discussed in Section 4.3 of this report.

Figure 16: Vic Q4-15 Flat Swap Prices and Basslink Flows



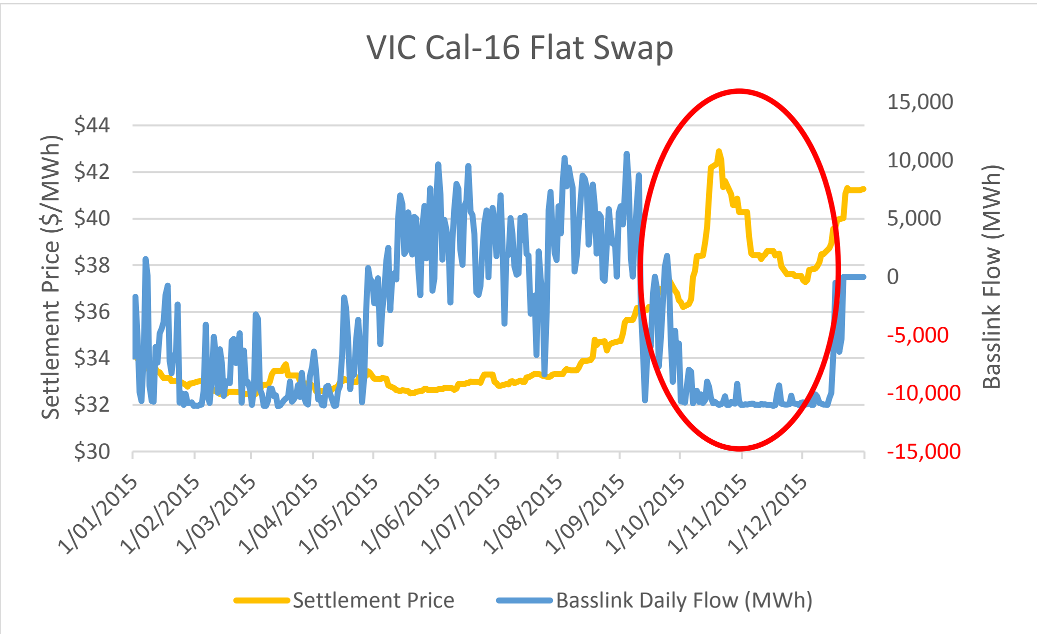
Similarly, for Q1-16 the market price began to move upward from mid-August and profoundly moved upward in mid-October when Tasmania was consistently importing more than 10,000 MWh per day (see Figure 17).

Figure 17: Vic Q1-16 Flat Swap Prices and Basslink Flows



The Cal-16 followed the same trend of the previous forward contracts discussed earlier by rallying from about mid-August and then peaking in mid-October, before softening followed by another rally through December (see Figure 18).

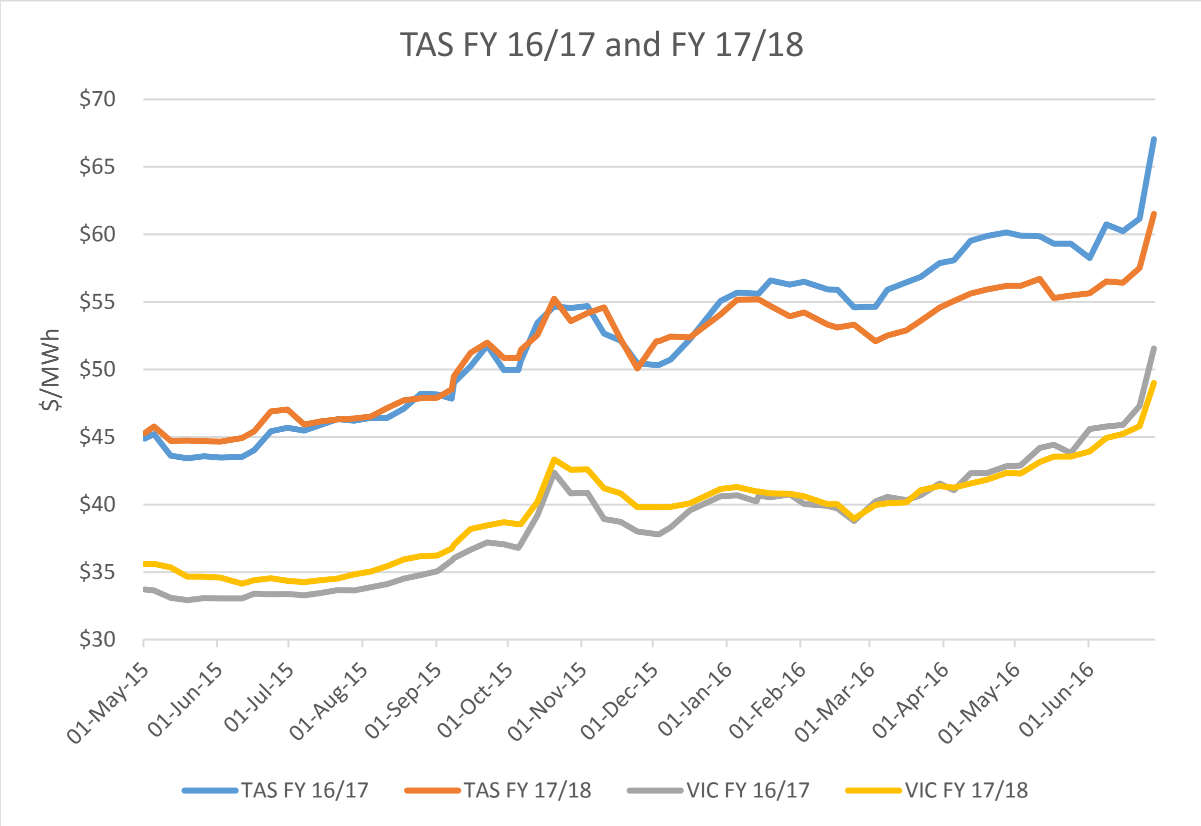
Figure 18: Vic Cal-16 Flat Swap Prices and Basslink Flows



As shown by the assessment of Q4-15, Q1-16 and Cal-16 forward contracts, the behaviour of the forward markets is highly correlated, and therefore FY 16/17 and FY 17/18 also followed a similar behaviour.

Figure 19 shows the correlated Vic and Tas FY 16/17 and CY 17/18 forward prices since January 2015.

Figure 19: Vic and Tas FY 16/17 and FY 17/18 Flat Swap Prices



The correlation coefficients between each financial year in both Victoria and Tasmania is shown in Table 3 below and shows that the correlation is strong ranging from 94.6% to 98.2%.

Table 3: Correlation Coefficients between Tas and Vic Financial Year Forward Prices

	TAS FY 17/18	VIC FY 16/17	VIC FY 17/18
TAS FY 16/17	97.1%	97.1%	94.6%
TAS FY 17/18	97.1%	95.6%	96.3%
VIC FY 16/17	94.6%	96.3%	98.2%

4.3 Consequential Impacts on Forward Prices

Tasmanian forward price is set on a formulaic approach based on the Victorian forward price and the water storage inflows into the hydro generation assets. Consequently, if Hydro Tasmania directly or indirectly affects the Victorian forward price, then it has a consequential flow-on impact on the Tasmanian forward price.

As outlined earlier in this report, given the low water storage levels in Tasmania most notable from about mid-August or September 2015, it would have been quite reasonable and appropriate for Hydro Tasmania to pro-actively manage the mainland financial risk by buying Victoria based contracts for the foreseeable future. Execution of such a strategy would have placed an upward pressure on the Victorian forward price.

Furthermore, energy water storage data is publicly disclosed by Hydro Tasmania and other market traders operating in the electricity market will also have ready access to interconnector flow information, and so therefore it would have become fairly well known that Hydro Tasmania would no longer be a net exporter to Victoria. This perception which would have no doubt grown progressively through Spring 2015 and would have also led to a shift in perceptions of the inherent value for the Q4-15 forward price, but also flow-on onto the subsequent calendar and financial year forward prices.

Knowing that the Victorian price could be directly or indirectly impacted by Hydro Tasmania which then by definition flows through to the Tasmania forward price, it was important for our study to find an indicator that can measure the consequence of the position Hydro Tasmania found itself within. It was considered little value measuring the forward price movement of Victoria against the forward price movement of Tasmania to determine whether the price increases were the result of Hydro Tasmania's strategy or a general market movement, as the two factors are by definition linked.

The indicator selected was the difference between the New South Wales and equivalent Victorian forward price to determine whether the price increases in Victoria and Tasmania were consistent with any general price movement across the National Electricity Market (NEM).

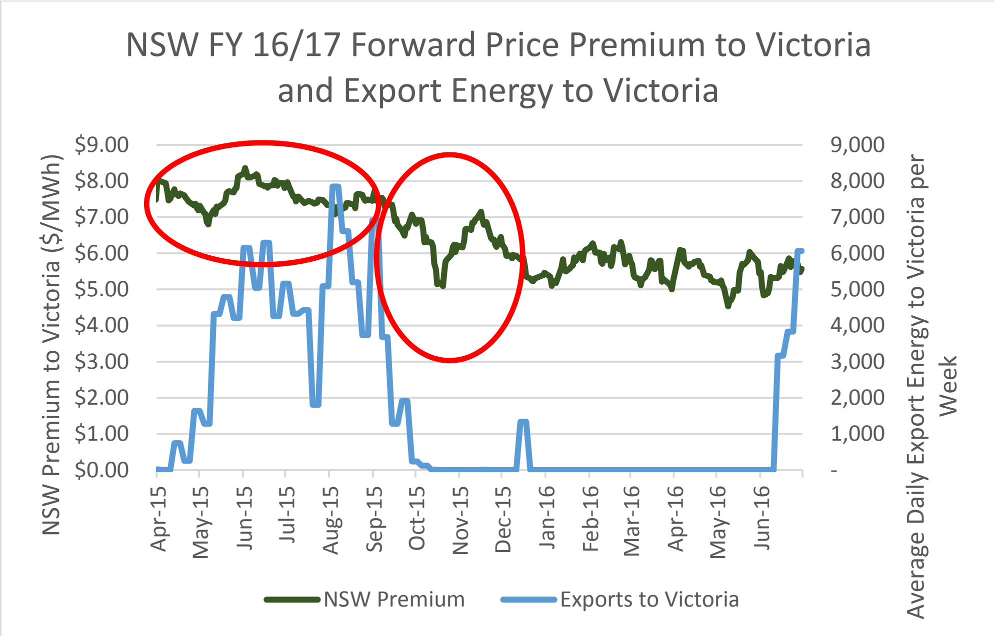
Figure 20 shows the difference between the NSW and Victorian Financial Year 2016/17 forward price since April 2015. For easy reference purposes, the net export energy is also shown on the same chart.

The results indicate that during the period of April 2015 to the end of August 2015, the NSW premium was trading in the range of $7/MWh to $8/MWh (marked as a red vertical oval on chart). From about the start of September 2015 through to when the Basslink failed in late December 2015, the NSW premium decreased to about a $6/MWh premium (marked as a red horizontal oval on chart). Throughout the Basslink outage, the NSW premium was trading in the range of $5/MWh to 6/MWh.

It is therefore concluded that the Victoria price and therefore the Tasmanian forward prices for 2016/17 increased at a faster than would have normally been expected. Not all of the upward price movement can be associated directly with Hydro Tasmania's questionable risk management practices in the April to July period, as the low Spring 2015 inflows would have contributed to the perception of the change in risk and value. However, it is troubling that the management of the water resources in the April to July 2015 placed Tasmania in a much risker positon and as the events played-out, Hydro Tasmania would have directly and indirectly caused the forward market to rally to higher levels that would otherwise occurred.

As an aggravation to consumers, this movement in the Victoria forward market price systematically increases the Tasmanian forward price providing the opportunity to Hydro Tasmania to extract higher revenue. Customers on the other hand, are forced to bear the brunt of higher energy costs.

Figure 20: NSW FY 16/17 Forward Price Premium to Victoria and Export Energy to Victoria



4.4 Conclusion

It is not surprising to conclude that the low level of water storages prior to the Basslink failure impacted the spot prices in both Victoria and Tasmania through the period of September to December 2015. As the State of Tasmania became more dependent on imports from Victoria, the spot prices increased as the energy water storages became more scarce. This phenomenon is not surprising.

What is not as obvious, it is our belief that due to Hydro Tasmania's mainland financial exposure, and with the water storage levels depleting in the second half of 2015, Hydro Tasmania would have been buying Victorian hedging positions in order to manage their mainland financial risk. Such action is perfectly reasonable and considered good risk management practice. However, the consequence of the stronger interest in buying forward contracts would have contributed to the rising Victorian forward price.

Given the formulaic link between the Victorian forward price and the Tasmanian forward price, we are of the belief that Hydro Tasmania's actions contributed to a rising of the Tasmanian forward price. Such consequence would be beneficial to Hydro Tasmania not only in the short term, but for the full trading outlook which is years ahead.

Conversely, customers would be impacted adversely by a higher forward price as is further discussed in the next section of this report.

5

Customer Impacts

- Large Customers exposed to Half Hour Spot Prices
- Large Customers Curtailing Consumption
- Contestable Customers Renegotiating Contracts
- Small Business Tariff Customers
- Residential Customers

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5 Customer Impacts

The events commencing from mid-2015 to mid-2016 have impacted customers to various levels. These customers have been classified into:

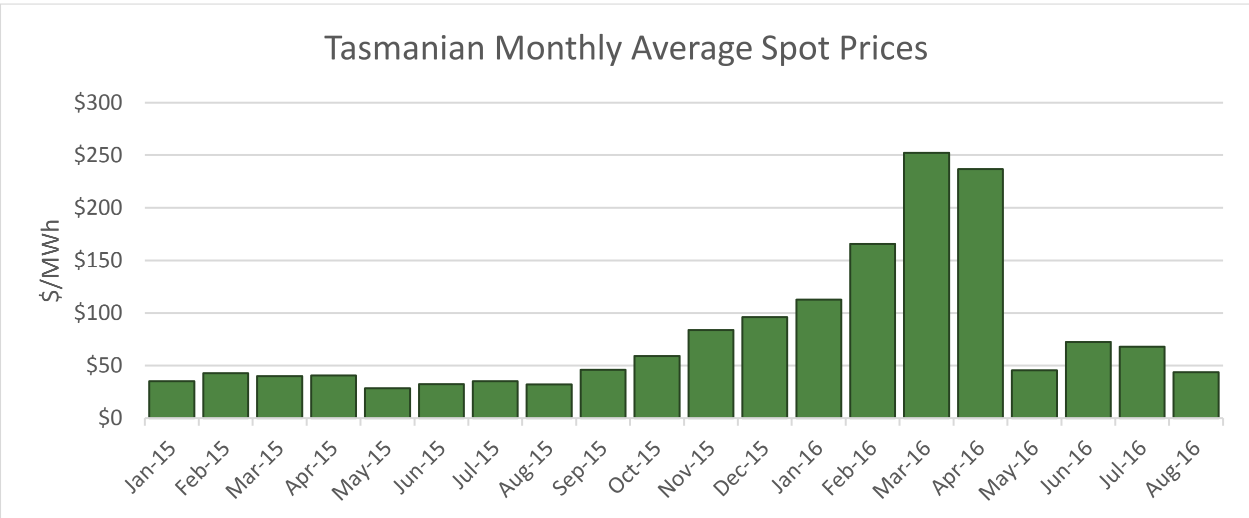
1. Large consumers exposed to the half-hour spot prices
2. Large consumers curtailing operations
3. Contestable customers re-negotiating contracts
4. Small business tariff customers
5. Residential tariff customers

5.1 Large Customers Exposed to Half Hour Spot Prices

Some large customers in Tasmania take some exposure to the half hour spot prices. Customers in this category are typically those that have some ability to curtail operations for short periods of time to avoid extreme spot prices.

Public information is not available to know how many customers are in this category, and the size of the exposure. Nevertheless, for those in this category would have faced financial stress beginning from October 2015 which then worsened appreciably following the Basslink failure, reaching the worst months of February to April 2016.

Figure 21: Tasmanian Monthly Average Spot Prices



It can be observed that for the 'normal' months the average price was less than $50/MWh, and so during the stressful period organisations would have been trying to avoid increases of the doubling, or trebling costs. In the case of March 2016, large customers would have been trying to avoid cost increases of 5 times the 'normal'.

The monthly average prices are developed by averaging each half hour of each day in the month. If the customer had their operations biased towards Monday to Friday with say a single shift operation, the cost exposure would have been greater as higher than average prices were more likely to occur during the customer's operating times.

5.2 Large Customers Curtailing Consumption

It is understood that 3 large industrial customers voluntarily curtailed operations during the Basslink failure, and this has been confirmed by Hydro Tasmania[3]. The customers who voluntarily agreed to reduce their consumption via commercially agreed agreements were:

1. Tasmania's largest energy consumer, Bell Bay Aluminium, reduced its electricity consumption by about 10 per cent from February.

2. TEMCO reduced its power use by 30MW in January. From early March until late April, it shed a further 35MW by shutting down another furnace. The 65MW reduction was extended through May.

3. A third company, Norske Skog, cut power consumption at its Boyer Mill by more than 40MW for one week in March and April, and three days in May.

On 19 May 2016, following several weeks of strong inflows, Hydro Tasmania reached an agreement for Bell Bay Aluminium and TEMCO to resume full production several weeks earlier than expected.

It is not known what cost was borne by these consumers, or indeed the fee paid by Hydro Tasmania to reach these commercial agreements. However, based on the information outlined by Hydro Tasmania, the spot market valuation of the curtailed load based on actual spot prices was estimated as $49.7m as outlined below:

Table 4: Estimated Spot Price Valuation of Load Curtailments

Assumed Start Date	Assumed End Date	Participant	Average Load (MW)	Energy Curtailed (MWh)	Pool Cost
4/01/2016	6/03/2016	TEMCO	30	45,360	$ 6,877,165
7/03/2016	18/05/2016	TEMCO	65	113,880	$ 22,352,386
4/02/2016	18/05/2016	Bell Bay Aluminium	35	88,200	$ 17,052,259
14/03/2016	20/03/2016	Norske Skog	40	6,720	$ 1,675,785
4/04/2016	10/04/2016	Norske Skog	40	6,720	$ 1,657,861
10/05/2016	12/05/2016	Norske Skog	40	2,880	$ 130,214
		Total		**263,760**	**$ 49,745,670**

[3] Hydro Tasmania, Energy Supply Plan 2015-16 Final Summary, 1 July 2016

5.3 Contestable Customers Renegotiating Contracts

July each year is a popular anniversary time for contestable electricity agreements. As a consequence, there were many customers through the period of say January to June who were facing re-negotiating their electricity agreements.

The wholesale forward price for 2016/17 back in May 2015 was trading around $43.50/MWh and then twelve months later the same period was trading at $59.60/MWh, a 37% increase in costs. For a contestable customer consuming:

a) 100,000MWh per annum, this cost increase would have been in the order of an additional $1.7m;
b) 200MWh per annum such as a School or medium sized business, the additional cost would be $3,400 per annum

5.4 Small Business Tariff Customers

In order to measure the impact on small business customers, it was assumed that a typical business customer consumes 50MWh per annum and is allocated on the retail tariff of Business LV General Tariff and TAS22 network tariff equating to some $11,600 pa. A customer of this type could be a newsagency or a small irrigation pump on a rural property. There are over 37,000 small businesses in Tasmania, employing over 70,000 people.

When comparing the bundled retail tariff of July-15 and July-16, there was a modest increase of 4.1% (about $451 per annum). However, when the components of the tariff are assessed, there are significant cost movements.

Network charges which currently represent 63% of the total cost decreased by 8.6%, providing our worked example with $685 saving per annum. However, commodity costs increased by 33% ($871 per annum), and environmental costs increased by almost 55% ($266 per annum). The commodity costs were taken as the Net System Load Profile hedge price published by Hydro Tasmania in early May of each year.

Table 5: Analysis of Small Business Tariffs

		Costs				Proportion of Costs	
		Jul-16	Jul-15	Variation		Jul-16	Jul-15
Tariff Revenue							
	Supply Charge	$331	$320	3.4%		2.7%	2.7%
	First 500kWh/qtr	$646	$625	3.4%		5.2%	5.2%
	Remainder	$11,388	$11,010	3.4%		92.1%	92.1%
	Total	$12,366	$11,956	3.4%		100.0%	100.0%
Cost Breakdown							
Network	Supply Charge	$175	$166	5.0%		1.5%	1.5%
	Energy	$7,084	$7,778	-8.9%		61.2%	70.0%
	Sub Total	$7,259	$7,944	-8.6%		62.7%	71.5%
Commodity	NSLP Cost	$3,506	$2,636	33.0%		30.3%	23.7%
Environmental	LGC	$566	$274	106.2%		4.9%	2.5%
	STC	$187	$213	-12.1%		1.6%	1.9%
	Sub Total	$753	$487	54.6%		6.5%	4.4%
Market Fees	Market & Ancillary	$50	$50	0.0%		0.4%	0.4%
TOTAL		$11,568	$11,116	4.1%		100.0%	100.0%
Gross Margin		**$798**	**$839**	**-4.9%**			

5.5 Residential Customers

In order to test the impact on residential consumers, a comparison was undertaken of customer bundled tariffs as set in July 2015, and then July 2016. For the purpose of the comparison, a typical residential customer consuming 8MWh per annum was used.

The results indicate that the total cost increased by 4.1% ($79 pa), just below $2,000 per annum. The expected retailer gross margin slightly decreased to $204.84, a reduction of 2.9%. However, whilst the total cost remained relatively stable, the components making up the bundled tariff have moved appreciably.

The commodity costs were based on the published Net System Load Profile price as at early May each year, which is the standard hedging product available to retailers to manage the residential customer base, and is offered and published by Hydro Tasmania. The analysis shows that the commodity costs (or hedging costs) increased by 33% from one year to another, taking the commodity costs to represent 28.1% of the total cost (up from 22.0%). Environmental charges were the other big price mover increasing by almost 55%, representing 6% of the total cost.

Contrary to commodity and environmental charges, network charges which is the dominant cost component, decreased by 7.3% and now represent 65.5% of total costs, down from 73.5%.

Table 6: Analysis of Residential Tariffs

		Costs			Proportion of Costs	
		Jul-16	Jul-15	Variation	Jul-16	Jul-15
Tariff Revenue						
	Supply Charge	$306.79	$296.61	3.4%	13.9%	13.9%
	Energy	$1,895.64	$1,832.73	3.4%	86.1%	86.1%
	Total	$2,202.43	$2,129.34	3.4%	100.0%	100.0%
Cost Breakdown						
Network	Supply Charge	$174.70	$166.38	5.0%	8.7%	8.7%
	Energy	$1,133.44	$1,244.40	-8.9%	56.7%	64.9%
	Sub Total	$1,308.14	$1,410.78	-7.3%	65.5%	73.5%
Commodity	NSLP Cost	$561.00	$421.70	33.0%	28.1%	22.0%
Environmental	LGC	$90.54	$43.90	106.2%	4.5%	2.3%
	STC	$29.91	$34.01	-12.1%	1.5%	1.8%
	Sub Total	$120.44	$77.91	54.6%	6.0%	4.1%
Market Fees	Market & Ancillary	$8.00	$8.00	0.0%	0.4%	0.4%
TOTAL		$1,997.59	$1,918.39	4.1%	100.0%	100.0%
Gross Margin		**$204.84**	**$210.94**	**-2.9%**		

The conclusion from this residential tariff analysis is that residential customers are paying a higher cost due to the lower water shortages and failure of Basslink. Compared to last year, the cost increase is about $140 per customer per annum. This commodity cost increase has been off-set by lower network charges, saving a typical customer about $100 per annum.

6

Appendix: Tamar Valley Power Station Sale

Press Release

Press release regarding the Sale of Tamar Valley Power Station[4]

Changes to operation of Tamar Valley Power Station

12 August 2015

Hydro Tasmania is making changes to the operating regime of the Tamar Valley Power Station in preparation for the decommissioning and sale of the combined cycle gas turbine.

The Tamar Valley Power Station and associated assets were transferred from Aurora Energy to Hydro Tasmania on 1 June 2013. This included a significant amount of debt.
Since that time, Hydro Tasmania has optimised the power station within its broader generation portfolio. This optimisation has included not using gas-fired generation when there is ample hydro generation or when imports from Victoria are cheaper.

Throughout this process, the workers at the Tamar Valley Power Station have worked hard to support the optimised running of the station in our portfolio.
The combined cycle gas turbine (CCGT) is one of five gas turbines at the power station, and it is designed to operate as baseload plant. Due to changes in the market since the power station was designed and commissioned, it is not cost-effective to use the CCGT for baseload energy generation.
Since the decision was made to purchase and build the plant in 2008, market conditions have changed significantly. Hydro Tasmania has undertaken extensive modelling and confirmed that the CCGT is not required for energy security.
The Tasmanian Government has approved the decommissioning and sale of the CCGT. Four other (open cycle) gas turbines at the power station will continue to be operated to provide peak supply. The sale will allow Hydro Tasmania to reduce its debt levels.
The business has advised workers at the power station of the changes and their implications. Employees are being appropriately supported and relevant unions have been advised. We are working to maximise redeployment opportunities within Hydro Tasmania to minimise job losses.

4 http://www.hydro.com.au/about-us/news/2015-08/changes-operation-tamar-valley-power-station