Analysis of recent changes in NEM wholesale electricity prices

EFFECT ON ENERGY COST ALLOWANCE – MAY 2007

This note describes the extent and nature of the recent changes in the wholesale forward price in the NEM and considers whether these recent changes ought to, in the opinion of Frontier Economics, give IPART reason to revise its energy cost allowance as set out in the Draft Determination.

BACKGROUND

Following the Queensland Government decision to restrict the water available for electricity generation to its generators in the South-East of Queensland the forward prices of electricity hedging contracts jumped sharply. This decision exacerbated tightening supply due to a sustained decline in water availability in the three major hydro systems in South-East Australia encompassing Snowy Hydro, Southern Hydro and Hydro Tasmania. These price changes occurred rapidly and almost immediately after the release of IPART's Draft Determination.

IPART has since retained Frontier Economics (Frontier) to examine the reasons for the changes in forward prices and to advise IPART on whether, in light of these movements, IPART ought to consider revising the energy cost allowance set out in their Draft Determination.

FRONTIER ECONOMICS RECOMMENDATIONS

Frontier considers that IPART need not, at this stage, amend its position as set out in the Draft Determination. There are several key reasons for this view.

The first reason for this is that Frontier considers that there is a very high likelihood that contract prices will return to levels previously estimated and reported for 2009/10, which is the reference point used by IPART to establish the price path from current levels. Frontier is of this view for two key reasons:

- There is strong evidence to suggest that rainfall patterns will return to normal over the next 12 months, which would help replenish the storages of hydro generators. For example, the Australian Bureau of Meteorology has declared the end of the 2006 El Niño event. The Bureau of Meteorology has said that historic records show that the breakdown of past El Niño droughts has usually been associated with a shift to above-normal rainfall across much of eastern Australia. The Bureau of Meteorology further reports that of the 20 past El Niño-related droughts in the Murray-Darling Basin, in all 20 cases, a period of sustained above-normal rainfall occurred no later than the following winter (June-August). The Bureau of Meteorology has found that in 60 per cent of cases this above-normal rainfall had occurred by the February-April period, whilst in the remaining 40 per cent of cases it was later than that, most commonly in the May-July period. Most importantly, the Bureau of

Meteorology report that there is no historical precedent in 107 years of records for dry conditions to continue unbroken through the winter following an El Niño event.[1]

- Frontier's modelling shows that if the delivery of recycled water to the Tarong power station occurs as planned and Kogan Creek is commissioned on time, this will relieve the shortage of capacity and raise competitive pressures for generators across the NEM (as reported below).

Secondly, as set out below, Frontier is of the view that most retailers will be substantially hedged (and may even be overhedged) for the 2007/08 year and that the standard retailers in NSW are completely shielded from any cost increases in the 2007/08 year due to the operation of Electricity Tariff Equalisation Fund (ETEF). The standard retailers are also substantially protected by the ETEF in 2008/09, although they will face increased cost exposure. As far as 2008/09 is concerned, Frontier recognises that water storages may not return to sufficient levels by this time and that, even if they do, market prices may not return to the levels forecast for the purposes of the Draft Determination by the time a prudent retailer would need to commence arranging hedging cover for this period. For this reason, Frontier would recommend that IPART reconsider its Determination prior to the first stage of the roll-off of ETEF, at which point the standard retailers will be more exposed to the prevailing market prices.

RECENT CHANGE IN FORWARD PRICES

The energy cost allowance in IPART's Draft Determination was based on modelling conducted in November 2006. In early March 2007 the Queensland Water Commission (QWC) placed material restrictions on the use of water by power stations in the production of electricity. The QWC stated:

> "The restriction on supplies by SEQ Water to Tarong North power station will operate for 12 months, between April 10 2007 until April 9, 2008. The volume of water supplied by SEQ Water for Tarong North power station will be reduced to 4400 Megalitres. This will require a reduction in the daily water use from the current 20ML/day to 12ML/day.
>
> The volume of water supplied by SEQ Water to CS Energy for its Swanbank power stations will also be reduced to 2130 ML from April 10 until 1 September 2007, representing an average daily reduction from 20 ML/day to 15 ML/day. This restriction applies until 1 September this year by which time CS Energy's

---

1 Bureau of Metrology (2007), Drought Statement, 30 April. http://www.bom.gov.au/climate/drought/drought.shtml

The Bureau also state that "an important consideration in the recovery from this drought event is the different rate at which systems respond to drought. At the current time, many catchments in eastern Australia are excessively dry from a very protracted period of below average rainfall and above average temperatures. This means that it will take above average rainfall just to produce average runoff, and very considerable rainfall to make a material difference to water storages". ibid

Swanbank Power Stations will be supplied from the Western Corridor Recycled Water project."[2]

At the same time, Snowy Hydro had been issuing public warnings in its monthly water situation reports that its water levels were low and declining[3] and on 29 March said that its water inflows were the lowest over the 105 years that records had been kept.[4] Other major hydro systems, such as the Southern Hydro facility in Victoria and Hydro Tasmania are being similarly affected by drought.

Forward wholesale electricity prices jumped soon after the announcement of the restrictions on the use of water by South-East Queensland generators, at approximately the same time that IPART published its Draft Determination.

The change in forward prices, from those used in the Draft Determination to those observed in April 2007, are presented in Figure 1 to Figure 4 for, respectively, base load swap, peak swaps, (implied) off-peak swaps and $300 cap contracts. In all cases the forward prices have increased by a substantial amount and in some cases have more than doubled. The size of these increases, and speed with which they have occurred, are unprecedented in the NEM.

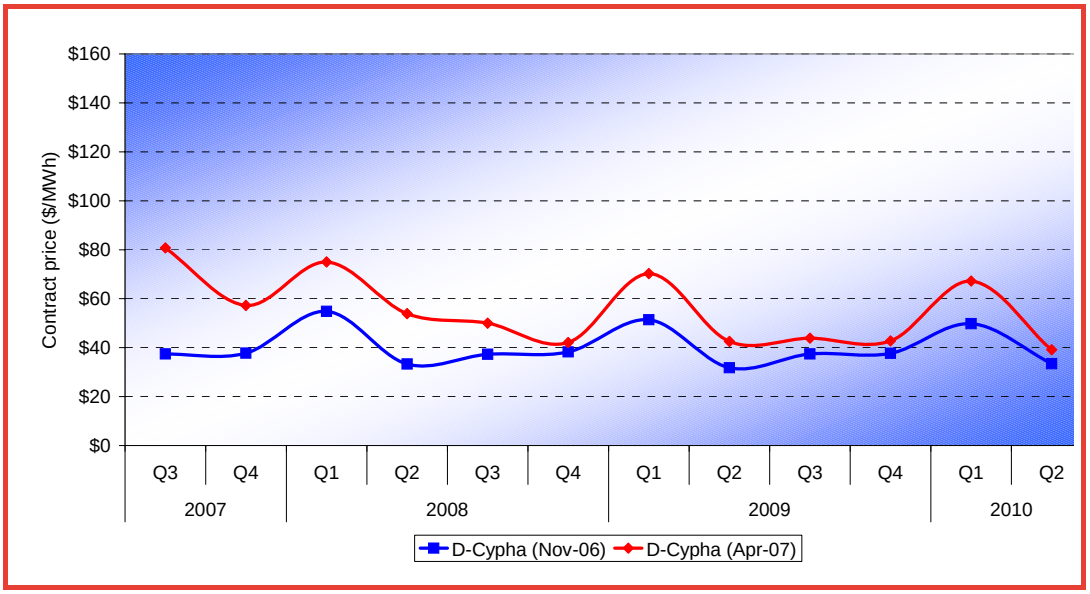

Figure 1: Base swap price changes

Source: d-cypha

2 QWC (2007), *Power Station Curtailment*, 8 March, Website address: http://www.qwc.qld.gov.au/tiki-read_article.php?articleId=69

3 Snowy Hydro, Media Releases http://www.snowyhydro.com.au/media.asp?pageID=53&parentID=3

4 Snowy Hydro (2007), *Snowy provides water security through worst drought*, 29 March, http://www.snowyhydro.com.au/sysfiles/media//SnowyHydro_MR_136.pdf

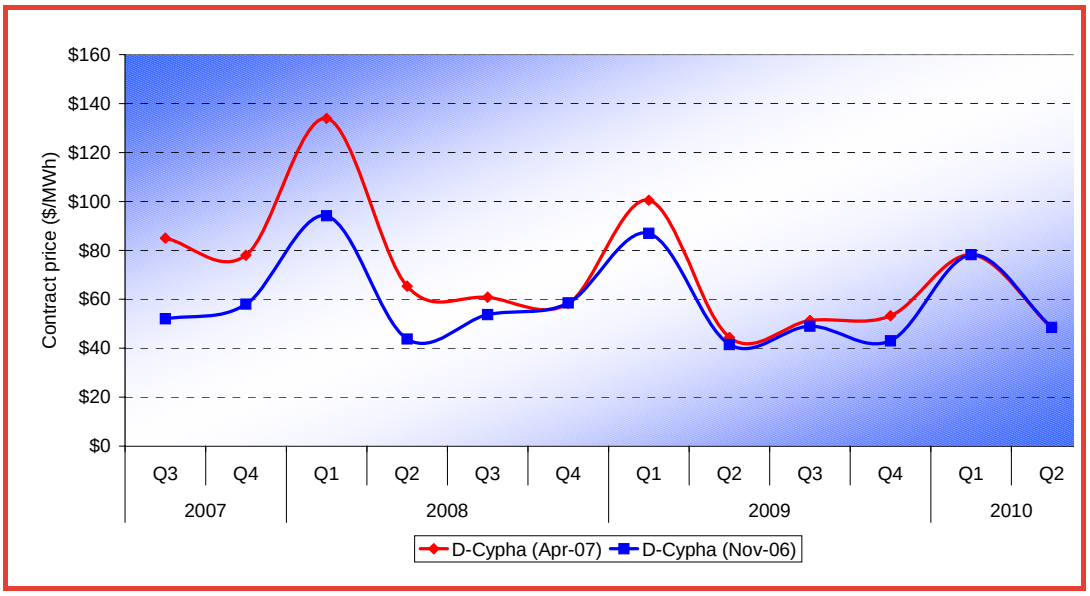

Figure 2: Peak swap price changes

Source: d-cypha

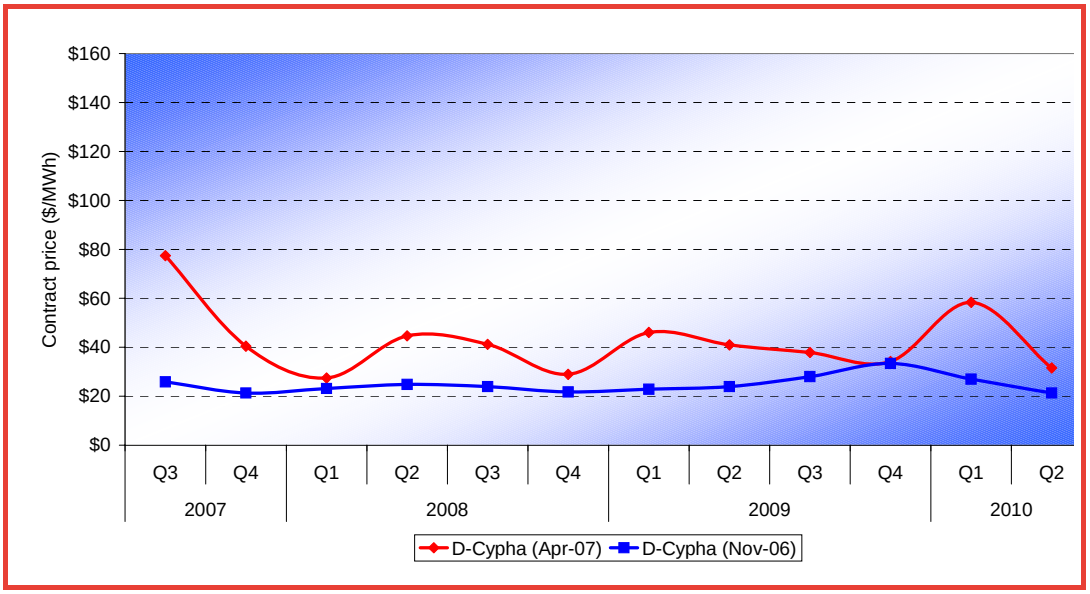

Figure 3: Implied off-peak swap price changes

Source: Frontier Economics estimate

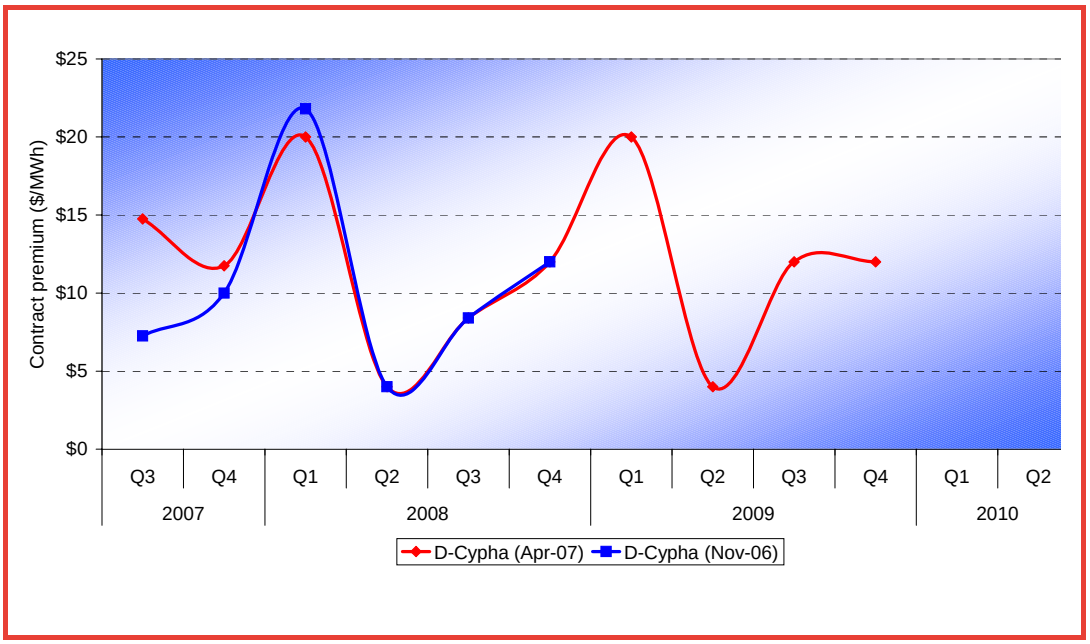

Figure 4: Peak cap price changes

Source: d-cypha

EFFECTS ON RETAILER ENERGY COSTS

The Terms of Reference for IPART's determination require IPART to formulate an energy cost allowance based on the long run marginal cost (LRMC) of meeting the load of each standard retailer. The Terms of Reference also require IPART to have regard to the "hedging, risk management and transaction costs faced by retailers in the absence of the ETEF". This latter requirement tends to suggest that the energy cost relates to the costs facing standard retailers, as they are the retailers directly affected by the removal of the ETEF. This contrasts to the requirement of the Terms of Reference that the retail cost and margin be estimated for a new entrant to the mass market.

In considering the effects on energy costs of recent changes to the forward price, many issues need to be considered. Firstly, it would be reasonable to ask why lower water availability was not taken into account in the previous estimate of the LRMC of generation. There are two reasons why the current drought conditions were not reflected in the estimate of LRMC presented in the Frontier's analysis undertaken for IPART:

- The Terms of Reference require that the LRMC estimate is based on the portfolio of a new entrant generation. Given the high cost and lack of availability of large-scale hydro generation, hydro generation did not form part of the least cost portfolio of plant type.
- The Terms of Reference required the energy cost estimate to be based on the costs of generation in the *long run*. The current drought conditions do not reflect the expected water availability in the long run. The current conditions are atypical.

As far as the inclusion of drought conditions in the estimate of market prices are concerned, modelling by Frontier included low hydrology conditions of the Snowy Hydro and Southern Hydro systems by virtue of the fact that this information had already been factored into forward prices used by Frontier. However, the modelling of market prices did not account for the QWC's decision to restrict water supplied for use by South-Eastern Queensland power stations, as consideration of this policy was not widely known by the market.

The second factor to consider in assessing the impact of the upward movement in forward prices on retailers' energy costs is the nature and extent of the hedging arrangements retailers have in place to guard against such price events. Retailers have consistently argued, throughout the course of IPART's assessment of the energy cost allowance, that they are obliged to behave conservatively with respect to managing pool price risk. For example, EnergyAustralia said the following in their response to Frontier's draft Energy Cost report:

> "The longevity of a retail business is dependant on its ability to contain the uncertainty of its costs. Unlike most other businesses, 70% of an electricity retailer's costs are exposed to significant uncertainty. Furthermore, these risks are focused within a small number of discrete but extreme pricing events across the year making them expensive and difficult to manage, and too significant to ignore.
>
> Because the potential adverse variation in expected wholesale costs is so significant, the businesses cannot tolerate extended occurrences of these events. Therefore, hedging portfolios must be sufficiently robust to withstand most plausible outcomes. Recognising this, EnergyAustralia's Earnings-at-Risk trading limits risk enforce a 97.5% confidence interval using a monte-carlo based analysis."[5]

This, retailers have argued, means that they tend to hedge their expected peak load, and indeed some have argued that they contract beyond this level for extra protection against unexpected demand spikes. On this matter EnergyAustralia commented on the optimal suite of contracts Frontier estimated for their business, stating that:

> "These portfolios are also well outside the risk limits currently permitted at EnergyAustralia and indeed any prudent retail business operating in the NEM".[6]

Energy Australia made this statement because the total contract cover did not cover the most extreme peak demand even though it more than covered the average peak demand. In Frontier's experience EnergyAustralia's view of hedging is typical of most retailers. To the extent that EnergyAustralia's view is typical of the industry position, this tends to support the view that most retailers, whether they be standard retailers or new entrant retailers, are more likely than not to be fully hedged against the current rise in forward contract prices, at least for a period. On this point EnergyAustralia also said:

---

5 EnergyAustralia (2007), *Response to Frontier's Draft Report*, February, p8. Website address: http://www.ipart.nsw.gov.au/files/Submission%20-%20Frontier%20Economics%20analysis%20of%20energy%20costs%20retail%20costs%20and%20margins%20-%20draft%20report%20-%20EnergyAustralia%20-%20George%20Maltabarow.PDF

6 ibid, p15.

> "Retailers must also deal with the fact that it is not possible to perfectly hedge this price uncertainty and that any hedges one does purchase are bought well in advance, typically years, and well ahead of any valuable knowledge of the daily weather patterns."[7]

However, this is not to suggest that retailers will be fully insulated against recent spot price rises that have been associated with the limitations placed on South-Eastern Queensland generators and the tightening water supplies of the hydro generators. For example, a retailer that has a proportion of their load hedged using cap contracts alone will be exposed to increases in spot prices. This will increase overall energy purchases costs, but by a relatively small amount as usually only a relatively small proportion of load is hedged using caps alone. Also, if current conditions persist, retailers will at some point face higher costs.

In the current environment it is likely to be the case that retailers will not compete for new customers if this means that the retailers have to purchase new hedging contracts at current (high) prices. Retailers will be concerned that these relatively high price contracts will face a higher probability of being stranded (out-of-the-money) in the future; for example, if rainfall patterns return to normal and water restrictions are lifted earlier than current commitments.

It is worth noting that if retailers are not marketing for new customers this is likely to reduce their retailing costs. It is also worth noting that to the extent that retailers have more contracts than they need – for example, to account for an unexpected spike in load or to support speculative trading – it is almost certain that the retailer could sell these at a higher price than they purchased them for. This would mean that an over-contracted retailer is earning more margin than IPART has deemed appropriate.

The key uncertainty is how long retailers have adequate contracts to cover them for current prices, what are higher than allowed for by IPART in its draft energy cost allowance. In Frontier's experience, retailers tend to have at least the next 12 months more or less hedged. This means that, by and large, retailers are likely to be shielded from the current rise in contract prices for the next 12 months. Of course, in the case of standard retailers in NSW, the ETEF, which the NSW Government has decided to abolish, completely shields them from any energy cost increase until the 3rd quarter of 2008. After this the ETEF progressively rolls off until it no longer exists at the end of June 2010. The relationship between this roll-off of the ETEF and the previous and more recent forward contract prices (for peak swap contracts) is shown in Figure 5. It is clear from this figure that standard retailers are shielded from the most severe changes in futures contract prices.

7 EnergyAustralia (2007), p8.

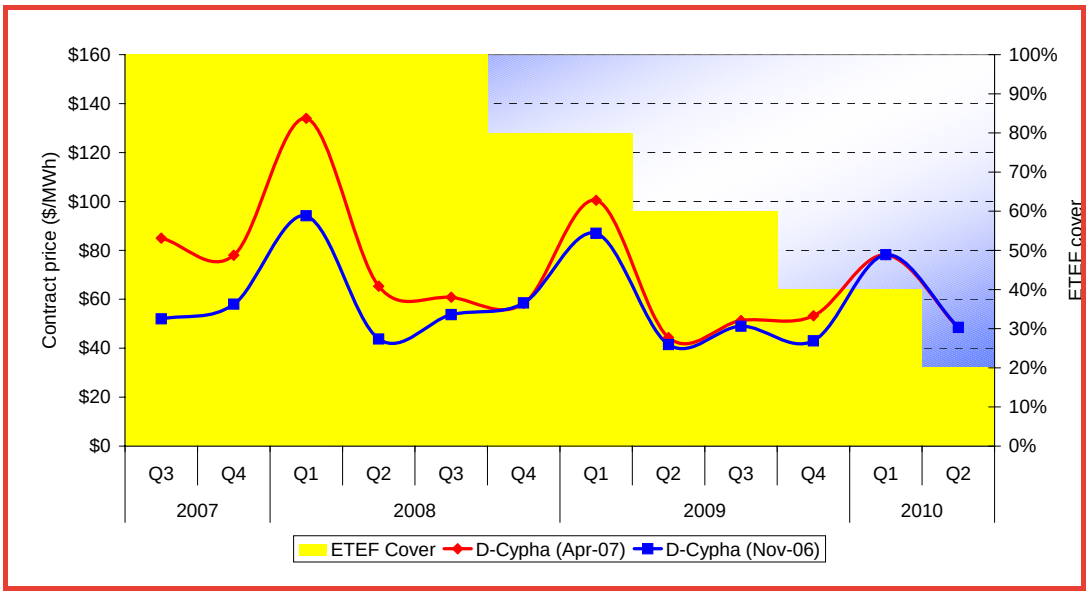

Figure 5: Relationship between ETEF roll-off and peak swap price changes

It is possible that the relatively short-term water restrictions may affect the underlying cost structure of the generation system (perhaps even in the longer term if investors alter the type of plant that is optimal to invest in to account for lower water availability). For example, if cheaper power stations such as Tarong are not permitted to operate to their normal levels, then relatively expensive power stations will have to operate more often. Similarly, if Snowy Hydro is pumping more than normal in off-peak periods to allow it to maintain its peak production, power stations that would normally not operate as much overnight may run more. In this case the cost impacts are more ambiguous as this may cause plant that would otherwise operate at less efficient overnight levels to operate at higher efficiency/lower costs. Conversely, it may be the case that cheaper base load power stations turn off overnight to conserve their water to generate at times when they can earn more money. This could mean that relatively higher cost gas fired generators operate more to meet off-peak load. Overall, these changes in the pattern of production could raise costs.

To test these cost effects, Frontier remodelled the LRMC of the NEM system. In this case the LRMC was estimated using the Incremental Approach (as described in Frontier's Final Report for IPART).[8] As previously discussed, this approach yields an unrealistically low absolute value, and for this reason the Stand Alone approach was used in Frontier's assessment of the appropriate measure of LRMC. The difficulty with using the Stand Alone approach to investigate the effects of low water supplies on the LRMC is that this approach is not based on the current power system but rather on a notional optimal suite of new generation. As identified above, large scale hydro plants do not feature in such a

8 Frontier Economics (2007), *Energy costs*, March 2007.

notional system because of the lack of available sites and the high costs of hydro generation plant.

To measure the possible effects on LRMC of sustained drought – that is, assuming that the current conditions reflect new typical conditions – Frontier has assumed the following conservative (compared to normal) aspects of a new long-term average hydrology scenario:

- Snowy produces at 80% of long-term average and there is significantly more pumping in off-peak times;
- Dartmouth and Eildon power stations do not run at all; and
- For 2007/08, 2 units at Tarong are offline (it is currently reported that this restriction is in place until mid 2008).

It should be noted that this scenario is not as severe as the "low rainfall scenario" analysis recently conducted by NEMMCO to examine the effects of the drought on system security and reliability. In their analysis, NEMMCO have assumed significant reductions in the production capability of numerous base load generators, particularly in NSW where NEMMCO have assumed in their "low rainfall" scenario that capacity is reduced by up to 1,800 MW from the last quarter in 2008.[9] Frontier considers NEMMCO's "low rainfall" scenario to be too unrealistic to warrant any market analysis at this stage, particularly having regard to the Bureau of Meteorology's assessment of the likelihood of the current drought persisting.

The results of Frontier drought scenario modelling are summarised in Figure 6. This figure shows that if drought were sustained, and assuming the current thermal base load generators could continue to supply the market as now (which is different to the NEMMCO "low rainfall" scenario), there would be only a relatively small increase in LRMC, in the order of $1/MWh to $2/MWh.

Clearly this estimated *cost* change due to drought conditions does not reflect the change in contract prices, which have risen by approximately 100 per cent since March 2007. This indicates that generators are charging contract prices that reflect the value of greater capacity scarcity.

To test the effect on prices from capacity scarcity Frontier has remodelled market prices using the same model – *SPARK* – used to formulate Frontier's view of future market prices presented in the Draft Determination. *SPARK* uses game theory to, among other things, test the generators' ability to sustain prices higher than their costs. Using the same hydrology assumptions outlined above, *SPARK* was run for the same time period to estimate sustainable wholesale spot prices. The annual average equilibrium *spot* prices from *SPARK* are in Figure 6 and are compared against the annual average *contract* prices as reported by d-cypha in April 2007. *SPARK* produces spot prices that are below the d-cypha contract price by about $12/MWh in the first year (2007/08), about $9/MWh in the second year (2008/09) and about $2/MWh in the third year. Of course much of

9 NEMMCO (2007), *Potential Drought Impact on Electricity Supplies in the NEM*, Final Report, 30 April, http://www.nemmco.com.au/nemgeneral/900-0001.pdf

the difference between the *SPARK* spot price and the d-cypha contract price is the value of the contract premium, which would be higher for higher expected spot prices. Any remaining difference falls within the *distribution* of spot prices produced by *SPARK*.

These *SPARK* modelling results show that even if the current low hydrology persists, the market price is unlikely to remain high for more than 2 years and would be reasonably expected to return to much the same levels in 2009/10 as used in the Draft Determination. This is largely because of two factors:

- the system can adjust relatively quickly at relatively low overall costs by building additional thermal generators; and
- the return of Tarong to service in mid 2008 has a material (downward) effect on price, which also coincides with the commissioning of Kogan Creek (which uses substantially less water than most other coal fired power stations).

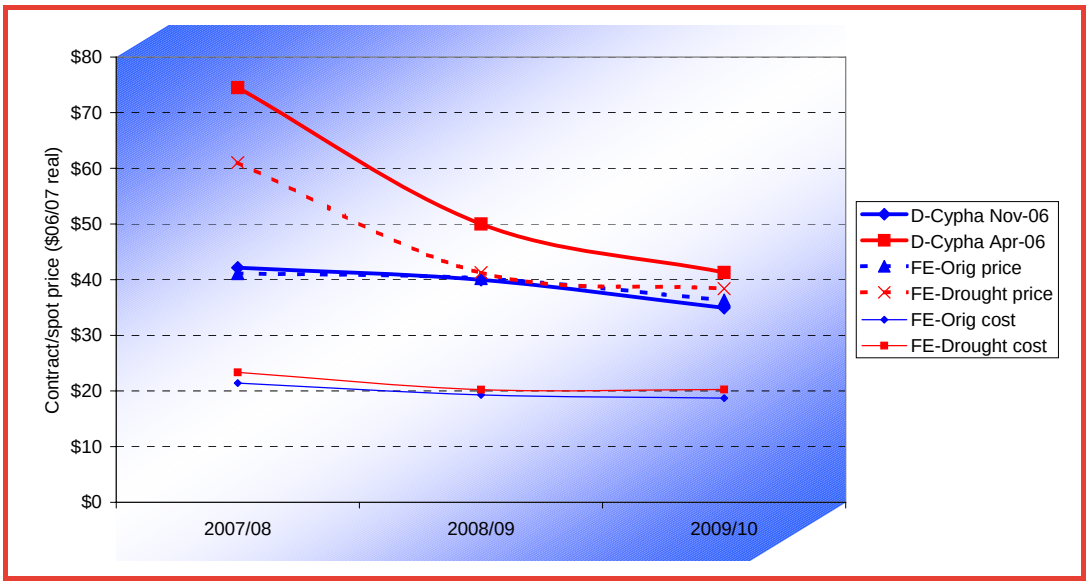

Figure 6: Effects of drought conditions on LRMC and market prices

Efficient frontiers formulated with current d-cypha prices are presented in Figure 7 to Figure 15 for the three years covering the Draft Determination (2007/08 to 2009/10) for, respectively, Country Energy, Energy Australia and Integral Energy. Frontier would not recommend using these current d-cypha prices for the formulation of efficient frontiers for the reasons presented above.

A comparison between the efficient frontiers presented in the Draft Determination and those based on d-cypha forward contract prices in April 2007 show that energy costs are:

- $30/MWh to $40/MWh higher in 2007/08;
- approximately $10/MWh higher in 2008/09; and
- less than $10/MWh higher in 2009/10.

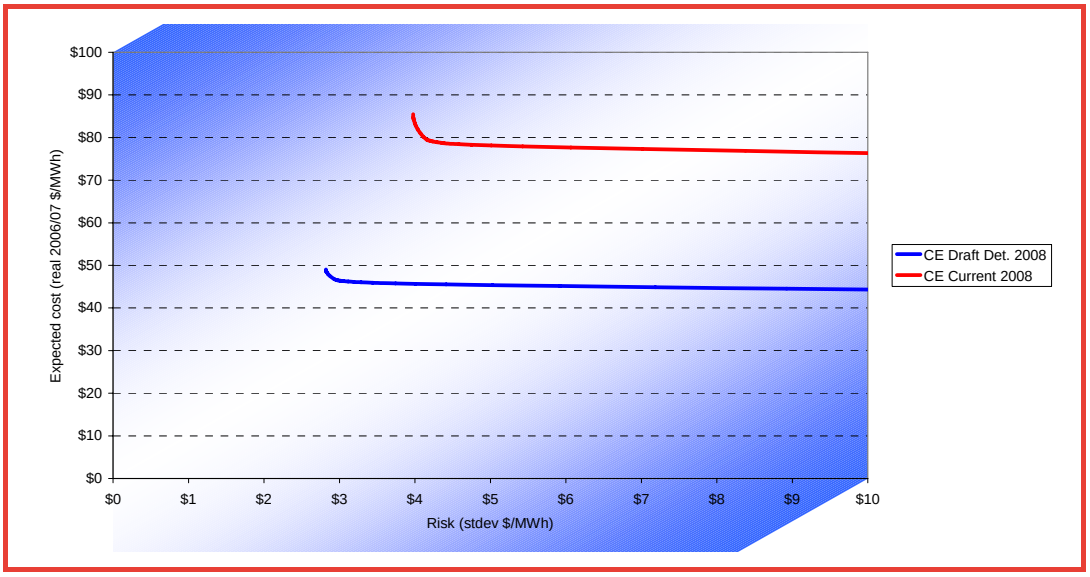

Figure 7: Efficient frontiers - Country Energy 2007/08

Source: Frontier estimate

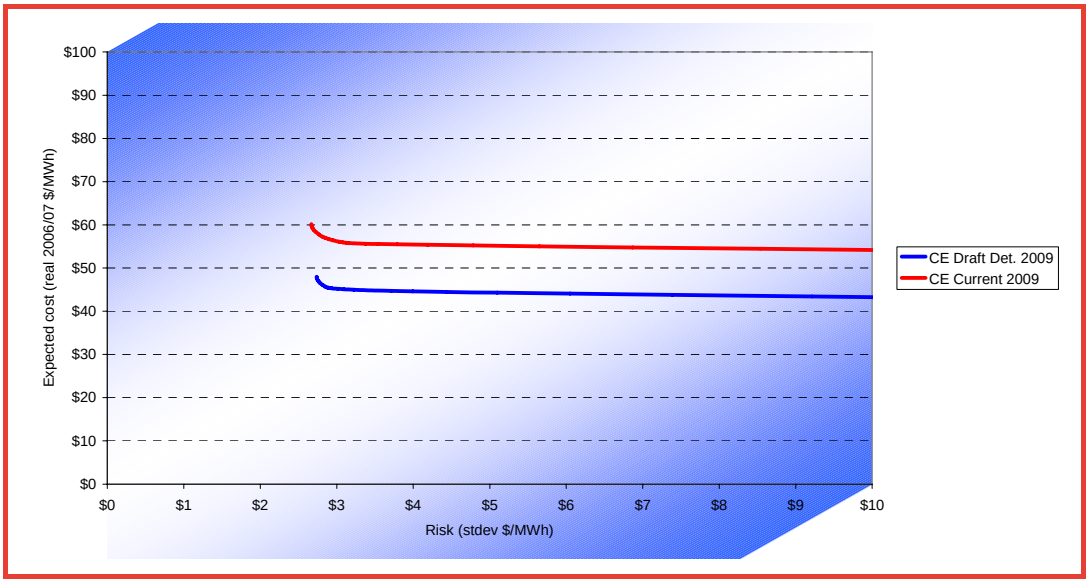

Figure 8: Efficient frontiers - Country Energy 2008/09

Source: Frontier estimate

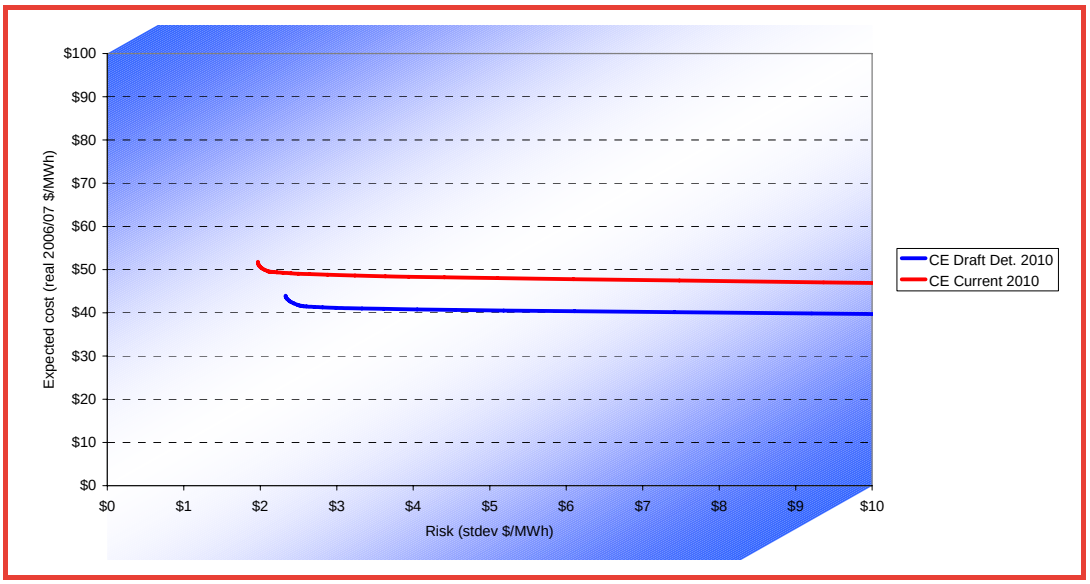

Figure 9: Efficient frontiers - Country Energy 2009/10

Source: Frontier estimate

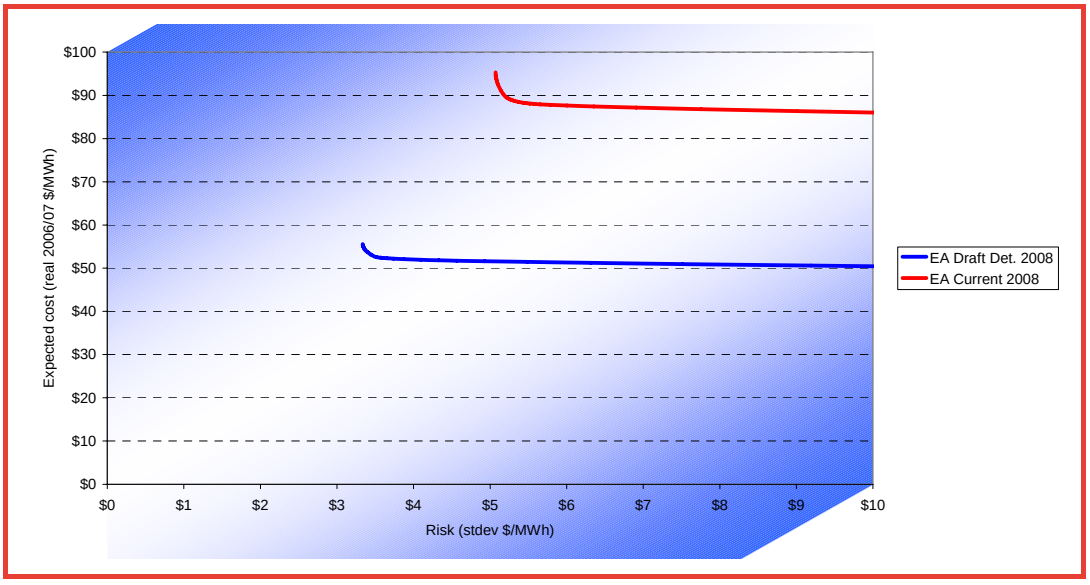

Figure 10: Efficient frontiers – Energy Australia 2007/08

Source: Frontier estimate

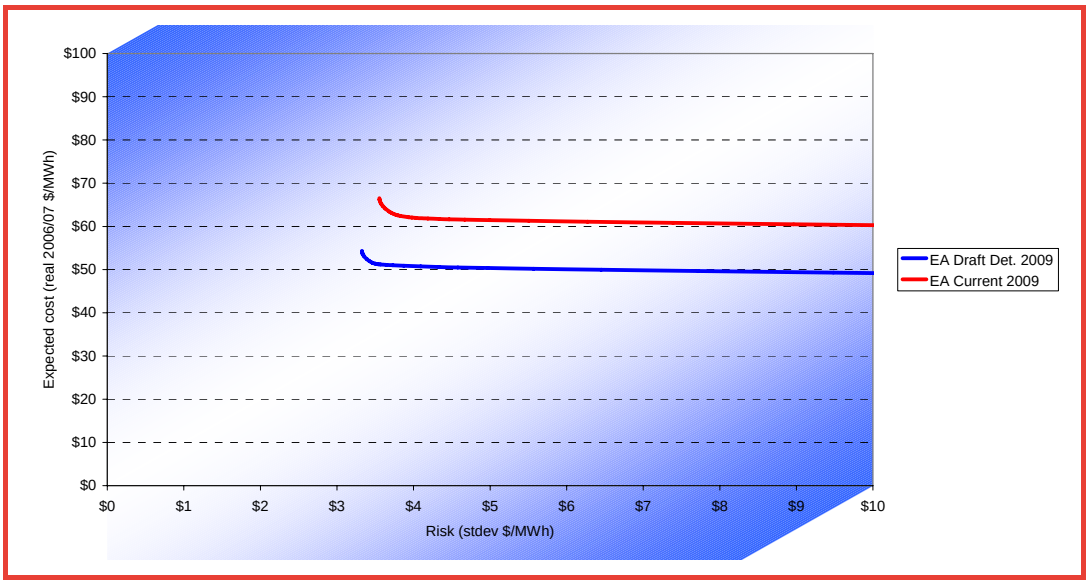

Figure 11: Efficient frontiers - Energy Australia 2008/09

Source: Frontier estimate

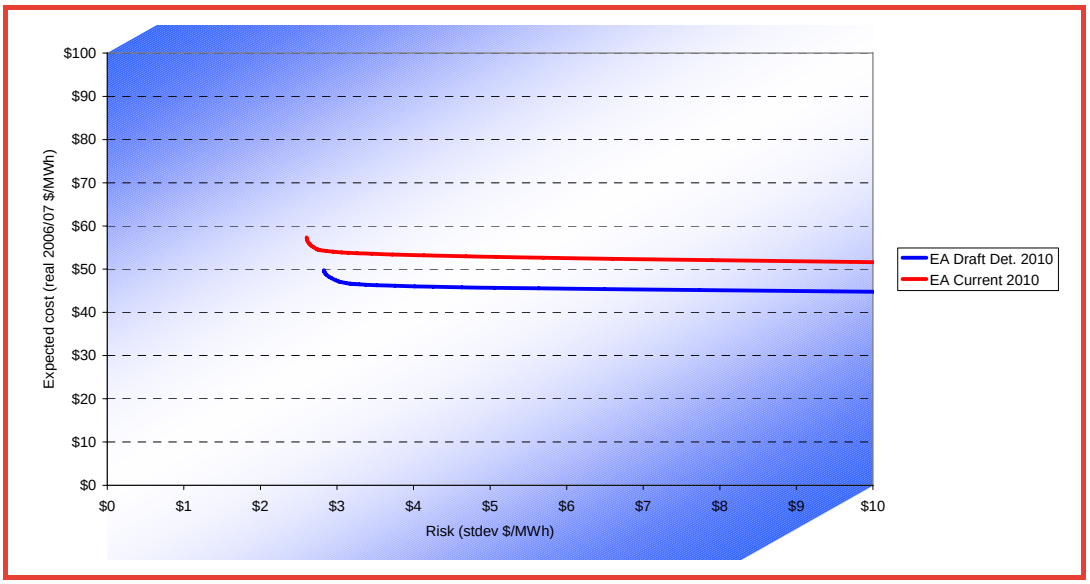

Figure 12: Efficient frontiers - Energy Australia 2009/10

Source: Frontier estimate

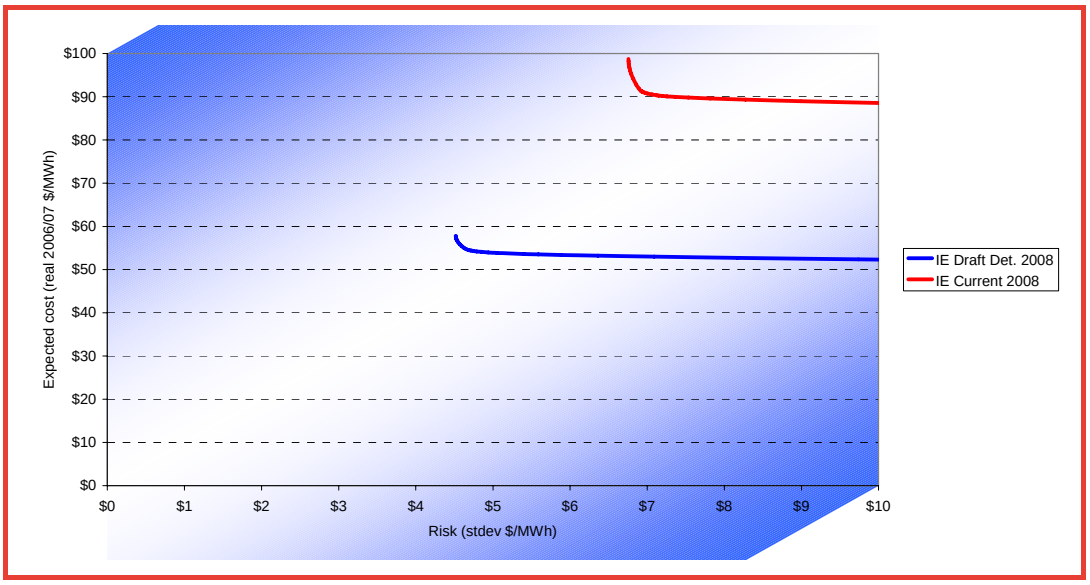

Figure 13: Efficient frontiers – Integral Energy 2007/08

Source: Frontier estimate

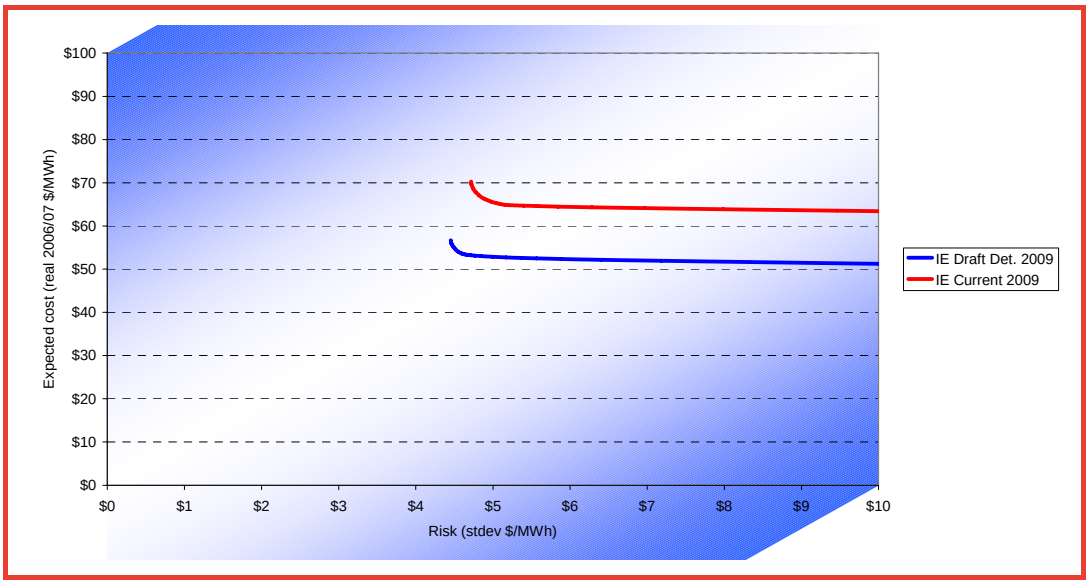

Figure 14: Efficient frontiers - Integral Energy 2008/09

Source: Frontier estimate

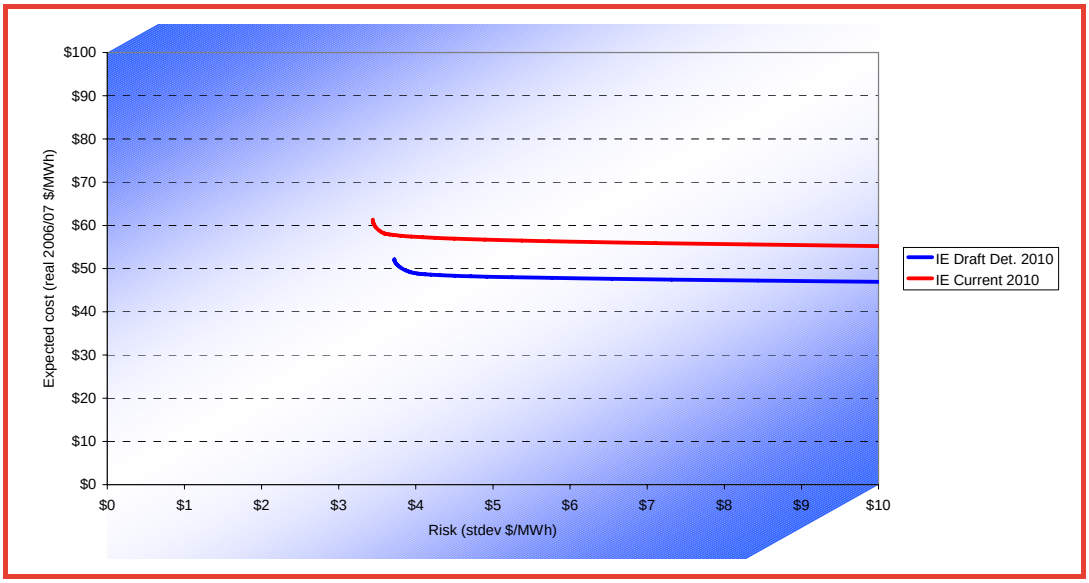

Figure 15: Efficient frontiers – Integral Energy 2009/10

Source: Frontier estimate

RENEWABLE ENERGY COSTS

In the submissions received by IPART in response to its Draft Determination (see, for example, Country Energy[10]) it has been claimed that the large and rapid rise in 'black' energy costs has been paralleled by a rise in the market price of Renewable Energy Certificates (RECs) associated with the Commonwealth Government's Mandatory Renewable Energy Trading scheme (MRET). Frontier accepts this claim but would note that REC prices have now risen to almost precisely the level set by IPART (see Figure 16).

Frontier would also note that the NSW Greenhouse Abatement Certificate (NGAC) prices have not changed materially since the Draft Determination. Given this, and given that REC prices are the same as already allowed by IPART in the Draft Determination, Frontier sees no reason for any adjustment to the green energy component already set out in the Draft Determination.

10 Country Energy (2007), Country Energy's Response to the Draft Report and Draft Determination, May, p18. Website address: http://www.ipart.nsw.gov.au/files/Submission%20-%202007%20Review%20of%20Regulated%20Retail%20Tariffs%20-%20Draft%20Report%20-%20Country%20Energy%20-%20Natalie%20Banicevic.PDF

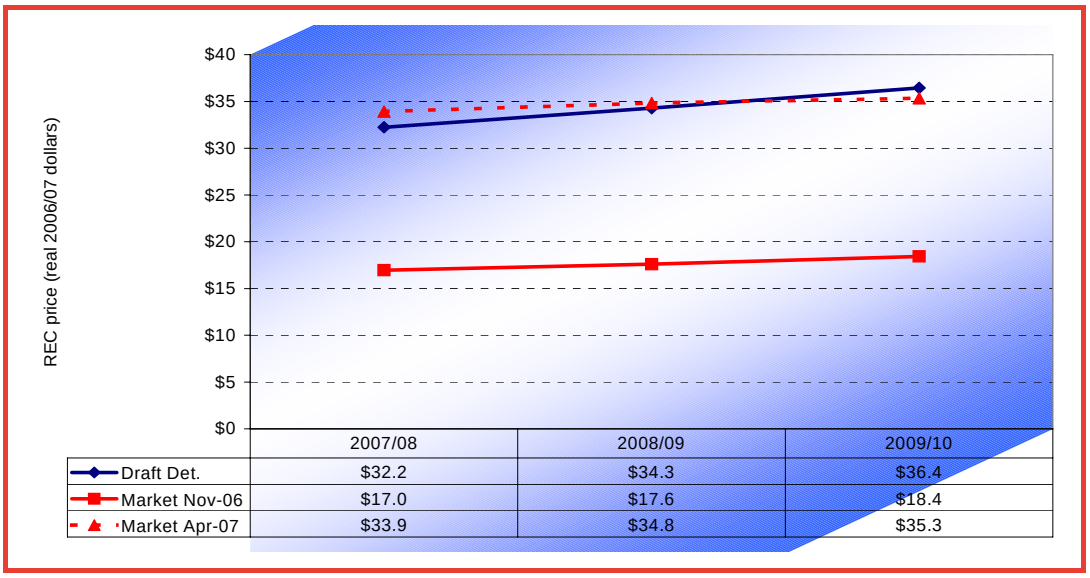

Figure 16: Comparison of REC prices

NEM-RELATED COSTS

Frontier notes that since it estimated NEM-related costs for its final report, NEMMCO has issues its draft Statement of Corporate Intent for 2007/08, in which NEMMCO indicates that it anticipates that its costs will rise by 4.6 per cent.[11] Frontier estimated NEMMCO-related costs on the basis of cost forecasts by NEMMCO and econometric analysis of ancillary service charges. Each of these cost categories represents approximately half the total NEMMCO-related costs.

A 4.6 per cent change in the NEM cost allowance provided for by IPART in the Draft Determination represents around 3 cents/MWh. Frontier considers that given the level of precision that can be achieved by the econometric modelling of the ancillary services costs, and the fact that our cost estimate for ancillary services already erred on the side of caution, there is insufficient reason to change the recommended NEM fee allowance from that set out in the Draft Determination.

11 NEMMCO (2007), *2007/2008 Statement of Corporate Intent*, Draft April, p5. Website address: http://www.nemmco.com.au/corporateinfo/000-0234.pdf

WORKING CAPITAL PREMIUM

Integral Energy and EnergyAustralia have commented on the approach for valuing the costs of managing residual volatility not captured in either the selection of the conservative point on the efficient frontier or in the retail margin.[12 & 13] The retailers generally support the approach proposed by Frontier, but question the parameter values that have been applied.[14] To support their concerns about these parameter values the Integral Energy and EnergyAustralia note the recent significant change in the NEM price, which exceeds the level implied by the 1:200 year price event that the volatility premium provided for. While Integral Energy simply asserts that the current circumstances represent a 1:20 year event,[15] EnergyAustralia has developed a more sophisticated argument to support their contention that the current prices represent a 1:20 year event.

Specifically, EnergyAustralia has argued that the market will be characterised by an investment cycle that they assess to be of 15-25 years duration. The key characteristic of this cycle is regular periods of capacity oversupply and shortages associated with, respectively, periods of low and high wholesale prices (cf. the long-term average generation cost). EnergyAustralia seek to link the most recent rise in prices with this assumed investment/price cycle:

> "While the recent price events have not previously occurred, the risk of these events occurring has always been inherent in the design of the NEM"[16]

The difficulty with EnergyAustralia's argument is that the recent price rise has little if anything to do with an investment cycle. The recent price rise is mostly, if not entirely, due to the drought conditions that have gripped much of Australia for some years now. While Integral Energy has claimed that these conditions are more likely a 1:20 year event, historically at least, the evidence would not support this assertion.

As far as EnergyAustralia's investment cycle is concerned, it would be reasonable to expect that if EnergyAustralia could predict such a cycle then so could other market participants. This being the case, it would be reasonable to expect that entrepreneurs would seek to sell services (e.g. financial and physical hedging options) that would assist industry participants smooth the price effects of this investment cycle. This commercial activity would then have the effect of breaking the price cycle.

---

12 Integral Energy (2007), Submission to the Independent Pricing and Regulatory Tribunal of NSW on Draft Report No 1, 2007, *Promoting retail competition and investment in the NSW electricity industry* and Draft Determination No 1, 2007 *NSW Electricity Regulated Retail Tariffs and Charges 2007 to 2010,* May p24. Website address: http://www.ipart.nsw.gov.au/files/Submission%20-%202007%20Review%20of%20Regulated%20Retail%20Tariffs%20-%20Draft%20Report%20-%20Integral%20Energy%20-%20Frank%20Nevill%20webdoc.PDF

13 EnergyAustralia (2007), p15-17.

14 Country Energy (2007), p17.

15 Integral Energy (2007), p24.

16 EnergyAustralia (2007), p15.

Based on historic data Frontier considers that the current drought conditions are not likely to represent a 1:20 year event, as argued by Integral Energy and EnergyAustralia. More importantly, for the reasons set out in this report, Frontier considers that the current forward prices are unlikely to persist over the long-term, and that contract prices are likely to return to levels previously estimated and reported for 2009/10. In this case, as set out in Frontier's final report, a conservative estimate is that the allowance for working capital would be sufficient for 99.5 per cent of forward price outcomes. For these reasons, Frontier considers that there is currently no reason to alter IPART's position on the allowance for working capital set out in the Draft Determination.