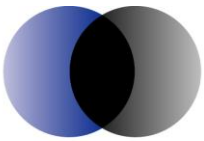
# Wholesale electricity cost investigation

Methodology for estimating the wholesale electricity cost

Prepared for Essential Services Commission of South Australia

**7 August 2012**



ACIL Tasman

Economics Policy Strategy

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# Contents



## List of tables

# Glossary

| | |
|---|---|
| AEMO | Australian Energy Market Operator |
| Commission | Essential Services Commission of South Australia |
| EPC | Energy Purchase Cost |
| ERAA | Energy Retailers Association of Australia |
| ICRC | Independent Competition and Regulatory Commission |
| IPART | Independent Pricing and Regulatory Tribunal |
| LRET | Large-scale Renewable Energy Target |
| MWh | Megawatt hour (1million watt hours) |
| NEM | National Electricity Market |
| NSLP | Net System Load Profile |
| OTC | Over-the-counter |
| OTTER | Office of the Tasmanian Economic Regulator |
| POE | Probability of Exceedence |
| QCA | Queensland Competition Authority |
| RRN | Regional Reference Node |
| SACOSS | South Australian Council of Social Service |
| WACC | Weighted average cost of capital |
| WEC | Wholesale electricity cost |

# 1 Introduction

In December 2010, the Essential Services Commission of South Australia (the Commission) made a price determination, fixing the electricity standing contract price to apply from 1 January 2011 to 30 June 2014 (the 2010 determination).

One of the components of the electricity standing contract price was the wholesale electricity cost (WEC). In determining the WEC, the Commission determined:

- the energy cost
- the costs associated with the large scale renewable energy target (LRET)
- the costs associated with the small scale renewable energy scheme (SRES)
- the Australian Energy Market Operator's fees
- ancillary service charges
- losses.

The energy cost is generally determined using a long run marginal cost (LRMC) approach, a market-based or energy purchase cost (EPC) approach or a hybrid approach.

The Commission has historically determined the energy cost using an EPC approach but adopted an LRMC approach as part of the 2010 determination. This was because the lack of liquidity in the contract market at that time raised doubts about the reliability of contract prices, which are generally relied on under the EPC approach.

The Commission is now of the view that there is at least prima facie evidence that the wholesale market conditions in South Australia have materially changed, with increased liquidity in the forward contract market. It also considers that:

> To the extent that there is a material cost differential between the LRMC estimate used by the Commission in 2010 and the best available evidence, then it may be appropriate to revert to the Commission's standard, market-based, regulatory approach for WEC.[1]

If the LRMC estimate used in the 2010 determination is high relative to the costs incurred by retailers in purchasing energy then the standing contract price may not reflect the efficient costs of a retailer with the standing contract

[1] Essential Services Commission of SA, *Electricity Standing Contract – Wholesale Cost Investigation: Discussion Paper,* 20 June 2012

obligation in South Australia (AGL). If this is the case, then the WEC is not consistent with the Commission's objective to protect the long term interests of South Australian consumers.

The Commission is therefore now re-examining the WEC assumptions that underpinned the 2010 determination to confirm whether or not there has been a material change in those costs. The Commission's findings from this process will provide a basis to determine whether or not to make consequential changes to the 2010 determination that will apply from 1 January 2013 to 30 June 2014.

The Commission has engaged ACIL Tasman to assist it with the review. In a previous report, ACIL Tasman considered the merits of setting the wholesale electricity cost on the basis of the LRMC approach, the EPC or market-based approach, and variations on these approaches. The Commission has subsequently elected to obtain further detail on setting the wholesale electricity cost, for the purposes of fixing standing contract prices in South Australia, on the basis of the market-based EPC approach.

This report provides detailed advice relating to the methodology and key issues to be considered when setting the wholesale electricity costs using a market-based EPC approach. The report is structured as follows:

- an overview of the market-based approach is provided in section 2
- section 3 provides further detail on the modelling of the wholesale electricity spot market
- section 4 provides further detail on the modelling of the contract market
- concluding comments are provided in section 5.

# 2 Overview of the market-based approach

A market-based approach, also commonly referred to as the electricity purchase cost (EPC), involves estimating the wholesale energy purchase costs that a prudent and efficient electricity retailer would be expected to incur to supply small retail electricity customers.

Retailers purchase electricity in the National Electricity Market (NEM) at the spot price and use financial contracts to manage their risk. The financial contracting arrangements will vary from retailer to retailer depending on, for example, their generation portfolio and their appetite for risk.

In estimating the wholesale energy purchase costs incurred by a prudent and efficient retailer, it is generally assumed that the retailer is partly exposed to the wholesale spot market and partly protected through a contract hedging strategy. The EPC therefore generally consists of three components:

- Wholesale electricity spot price forecast – the wholesale electricity spot price is generally forecast by simulating the NEM using a proprietary wholesale energy market model.
- Contracting strategy – the contracting strategy represents a strategy that a prudent and efficient retailer would undertake to hedge against risk in the spot price in a given year. It is generally assumed that a prudent and efficient retailer's risk management strategy would result in contracts being entered into progressively over a two or three year period prior to the required date.
- Forward contract price – the forward contract prices are generally estimated from publicly available data, from actual data provided by the retailers or can be modelled. The use of publicly available data implicitly assumes that the value of any bilateral contracts entered into by the prudent and efficient retailer is based on the value of over-the-counter (OTC) and futures contracts.

Further details on the wholesale electricity spot price forecast are provided in section 3. Further details on the contracting strategy and the forward contract price are provided in section 4.

# 3 Modelling the wholesale spot market

The wholesale spot market is modelled by simulating the interconnected National Electricity Market (NEM). The market simulation model replicates the Australian Energy Market Operator's (AEMO's) settlement, pricing and despatch engine. It seeks to minimise the aggregate cost of generation for the market as a whole, while meeting regional demand and other network constraints.

The market simulation model relies on a proprietary market simulation model, which is discussed in section 3.1, and a range of input assumptions relating to the:

- demand side – forecasts of electricity consumption and peak demand, which are discussed in section 3.2
- supply side – existing generators, retirements and new entrants, which are discussed in section 3.3.

No comments were raised in submissions to the Commission's Discussion Paper on the Wholesale Electricity Cost Investigation on the methodology for modelling the wholesale spot market. There is a generally accepted approach to modelling the wholesale spot market that is used by all regulators. Any comments that are made by stakeholders are generally in relation to the detailed assumptions that have been used in the modelling rather than the high level approach.

## 3.1 Use of a proprietary market simulation model

The proprietary market simulation model is a "black box" into which assumptions concerning generation capacity, load growth, outages and generator bidding behaviour are brought together using a replica of AEMO's market settlement algorithm to produce forecasts of the spot prices.

The models contain many implicit assumptions about the way the market operates, including how both thermal and hydro generators formulate their offers, the frequency and duration of random generator outages and the ways in which transmission constraints are dealt with. These model features have usually been developed over time on the basis of the modellers' research and experience and they are not easy for an outsider to verify.

Certain assumptions are made by the modellers to reduce the computational requirements of the models. Different assumptions are made by different modellers. The limitations imposed by these assumptions vary depending on the circumstances. For example, while some models model hourly prices rather than half hourly prices, other models effectively model daily blocks. The

average prices estimated by the models may be similar under normal conditions, but the distribution of prices and the average prices under abnormal conditions (more extreme weather conditions) may be quite different.

The models are sometimes criticised for the lack of consistency in the modelling results. This criticism is commonly addressed by ensuring that the data sources and the processing of input data remain transparent and consistent.

The modelling results will vary depending on the actual load (which will vary based on weather conditions) and unplanned generator outages. A number of scenarios are generally run to understand the range of potential outcomes.

More recently, ACIL Tasman ran 410 scenarios for the Queensland Competition Authority (QCA) – 41 years of temperature data and 10 different unplanned outage scenarios. The median wholesale electricity price was used, but ultimately a judgement could be exercised to use a different percentile depending on the preferred balance between setting prices too high and setting prices too low.

The Independent Competition and Regulatory Commission (ICRC) considers this type of modelling to be very complex. It is of the view that there are serious flaws in the modelling undertaken for the Independent Pricing and Regulatory Tribunal (IPART), and that there is insufficient evidence to determine whether this approach has been validated by the observed outcomes.

While we cannot comment specifically on the modelling undertaken for IPART, the spot prices can be backcast using actual load data and actual outages of generators to validate the model using observed outcomes. Prior to forecasting the spot prices, a backcast should be undertaken to ensure there is a reasonable correlation between the actual spot price outcomes and the spot prices backcast by the model.

## 3.2 Demand side assumptions

The forecast of the spot price relies on assumptions relating to the electricity consumption, peak demand and load shape.

The electricity consumption and peak demand forecasts are generally based on publicly available information published by AEMO. The most recent forecasts

have been published in AEMO's 2012 National Electricity Forecasting Report. The report includes forecasts based on six scenarios[2]:

- **Scenario 1: Fast Rate of Change** – includes higher economic growth, a carbon dioxide equivalent (CO2-e) emissions reduction target of 25 per cent by 2020 and 80 per cent by 2050, a strong rate of new technology development, and includes currently legislated carbon policies based on the Australian Treasury's high scenario.
- **Scenario 2: Fast World Recovery** – includes higher economic growth, a CO2-e emissions reduction target of 5 per cent by 2020 and 80 per cent by 2050, a moderate rate of new technology development, and the inclusion of currently legislated carbon policies based on the Australian Treasury's core scenario.
- **Scenario 3: Planning** – includes predicted economic growth, a CO2-e emissions reduction target of 5 per cent by 2020 and 80 per cent by 2050, a moderate rate of new technology development, and currently legislated carbon policies based on the Australian Treasury's core scenario.
- **Scenario 4: Decentralised World** – includes predicted economic growth, a CO2-e emissions reduction target of 5 per cent by 2020 and 80 per cent by 2050, a moderate rate of new technology development, and currently legislated carbon policies based on the Australian Treasury's core scenario. It is similar to the planning scenario, but with an increased uptake of localised generation and energy efficiency measures.
- **Scenario 5: Slow Rate of Change** – includes lower economic growth, a CO2-e emissions reduction target of 0 per cent by 2020 and 80 per cent by 2050, the development of new technologies slowed, and currently legislated carbon policies based on the Australian Treasury's core scenario for the first 3 years, and a $0 per t CO2-e thereafter.
- **Scenario 6: Slow growth** – includes lower economic growth, a CO2-e emissions reduction target of 5 per cent by 2020 and 80 per cent by 2050, the development of new technologies slowed, and currently legislated carbon policies based on the Australian Treasury's core scenario.

The most relevant scenario to use to forecast the wholesale spot prices that are likely to be incurred by a prudent and efficient retailer is the medium planning scenario (scenario 3).

As the spot prices are sensitive to the electricity consumption and peak demand assumptions, the NEM should be modelled, as a minimum, based on three load scenarios – 10 per cent probability of exceedence (POE), 50 per cent POE and 90 per cent POE.

The load shape is generally determined based on historic data.

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[2] Australian Energy Market Operator, *2012 National Electricity Forecasting Report,* pages 2-7 and 2.8

## 3.3 Supply side assumptions

The market simulation model relies on a range of supply side assumptions. Some of these assumptions specifically relate to existing generators, generators that are forecast to retire during the modelling period and new entrant generators, while other assumptions relate to all generators.

### Existing generators

The key supply side assumptions for existing generators are the short run marginal costs and the availability of the existing generators.

The short run marginal costs take into consideration the variable operating and maintenance costs, fuel costs, thermal efficiency and carbon costs, and are generally based on information publicly available on AEMO's website. The carbon costs should be based on the price of carbon units as set out in the *Clean Energy Act 2011*.

Modellers may vary these assumptions based on their experience. Where this occurs, any variations should be transparent.

### Retirement of existing generators

The modelling of the wholesale electricity market may forecast the retirement of existing generators. The retirements may include retirements that have been publicly announced and retirements that have not been publicly announced.

The methodology used to forecast the retirement of generators varies from model to model. However, the retirements are generally based on assumptions regarding the fixed operating and maintenance costs and short run marginal costs. These assumptions are generally based on information publicly available on AEMO's website.

Modellers may vary these assumptions based on their experience. Where this occurs, any variations should be transparent.

### New entrant generators

The modelling of the wholesale electricity market may forecast investment in new entrant generators to meet the increase in electricity demand or, in the case of renewable energy generators, to meet the Large-scale Renewable Energy Target (LRET).

The methodology used to forecast investment in new entrant generators varies from model to model. However, the investments are generally based on assumptions regarding the capital costs, fixed operating and maintenance costs,

and short run marginal costs of new entrant generators. These assumptions are generally based on information publicly available on AEMO's website.

Modellers may vary these assumptions based on their experience. Where this occurs, any variations should be transparent.

### Other assumptions

Forecasting the wholesale electricity market also relies on assumptions in relation to:

- the proportion of output from each generator that is assumed to be contracted
- planned maintenance
- forced outage rates (unplanned maintenance)
- other inputs to the long run marginal costs of new entrant generators (for example the weighted average cost of capital (WACC))
- any constraints that are placed on the entry of new generators
- any changes to the capacity of interconnectors.

The assumptions that are made in the model should all be transparent.

The electricity generated and sent out by power stations is paid for at the Regional Reference Node (RRN). The modelling needs to take into account the losses between the generator and the RRN. The appropriate loss factor is the marginal loss factor at the generator's node.

The marginal loss factors should be taken from publicly available information. The most recent information is provided in AEMO's *List of Regional Boundaries and Marginal Loss Factors for the 2012-13 Financial Year*.

# 4 Modelling the contract market

The costs associated with a contract hedging strategy for a prudent and efficient retailer supplying small retail electricity customers in South Australia will also need to be estimated.

As discussed in section 2, there are two key components to be considered in modelling the contract market:

- the contracting strategy, which is discussed further in section 4.1
- forward contract price, which is discussed further in section 4.2.

## 4.1 Contracting strategy

The contracting strategy should represent a strategy that a prudent and efficient retailer would undertake to hedge against risk in the spot price in a given year.

It is generally assumed that contracts are purchased over a two to three year period prior to the required date. The weighting of contracts over the two or three year period relies on judgement, with some using a flat profile over time, some using the retailer's actual contacting strategy to inform the strategy and some using a stylistic approach based on experience and judgement.

In some cases the contracting strategy needs to be adapted based on the liquidity of the forward contract market and therefore the public information available on forward contract prices.

When the QCA determined retail electricity prices in May 2012 for 2012/13, three years of data was not available for each quarter. There was insufficient data early in the period due to the uncertainty associated with the carbon price prior to the passing of the legislation.

As a result, a different approach was adopted for each quarter based on the best information available, as summarised in Table 1.

Table 1 **Contracting strategy used for QCA's 2012/13 determination**

| | 2012/13 | | |
|---|---|---|---|
| | Base contract price | Peak contract price | Cap contract price |
| Q3 2012 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (mid-2009) | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (mid-2010) | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (mid-2010) |
| Q4 2012 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (mid-2009) | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (mid-2010) | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (late-2010) |
| Q1 2013 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since 8 November 2011 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since 8 November 2011 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (early -2011) |
| Q2 2013 | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since 8 November 2011 | Latest traded price (11 July 2011) on D-Cypha Trade | Trade-weighted average of d-Cypha Trade daily settlement prices and trades since trading commenced (early -2011) |
| Key: | | | |
| | = trade-weighted average of all trades | | |
| | = trade-weighted average since the Senate passed the carbon price legislation on 8 November 2011 | | |
| | = latest traded price (11 July 201) as theer have been no trades since 8 November 2011 | | |

*Data source:* ACIL Tasman, *Estimated energy purchase costs for Final Determination; Report prepared for Queensland Competition Authority,* May 2012

It is not recommended that the Commission use a retailer's actual contracting strategy as:

- AGL is a national retailer with a large generation and retail presence in all NEM states except Tasmania. It would be difficult to infer the hedging costs that specifically relate to South Australia.
- AGL would not bear the consequences of its purchasing decisions. It would have no incentive to purchase efficiently and customers would bear the consequences of inefficient purchasing decisions.

A prudent and efficient retailer would not be expected to cover 100 per cent of all expected energy purchases because of the very high cost involved. As an example, the contracting strategy that has been adopted for the QCA since 2008/09 consists of:

- **Flat swaps** – to provide flat swap contract cover up to the 80$^{th}$ percentile of off-peak load
- **Peak swaps** – to provide peak swap contract cover up to the 90$^{th}$ percentile of peak load
- **$300 caps** – to provide cap contract cover up to 105% of maximum peak load.

This contracting strategy is relatively basic, not using the full range of financial derivatives available. However, it resulted in an energy purchase cost that is

reasonably consistent for modelling of a range of weather conditions (10 per cent POE, 50 per cent POE and 90 per cent POE), as illustrated in Table 2.

Table 2 **Total energy purchase cost for Queensland, 2011-12 draft decision**

| | 10% POE | 50% POE | 90% POE |
|---|---|---|---|
| Total MWh | 41,059,444 | 40,989,557 | 40,948,983 |
| Total pool costs | $3,481,150,362 | $1,933,199,970 | $1,450,776,766 |
| Swap difference payments | -$1,313,752,314 | $11,132,855 | $456,471,959 |
| Cap premiums | $120,493,263 | $120,493,263 | $120,493,263 |
| Cap payments | -$392,099,878 | -$114,623,385 | -$35,628,138 |
| Total energy purchase cost | $1,895,791,433 | $1,950,202,703 | $1,992,113,850 |
| Total energy purchase cost (per MWh) | $46.17 | $47.58 | $48.65 |

*Data source:* ACIL Tasman, *Calculation of energy costs for 2011-12 BRCI,* Draft report of 16 December 2010, page 37

Table 2 illustrates that the pool costs under the 10 per cent POE scenario were significantly higher than under the 50 per cent POE and 90 per cent POE scenarios, however the swap difference payments and cap payments were also significantly higher. As a result, the energy purchase cost, in both dollar terms and per unit of energy, was lower under the 10 per cent POE scenario than under the 50 per cent POE and 90 per cent POE scenarios.

It is expected that the contracting strategy for a prudent and efficient retailer in South Australia would be different to a prudent and efficient retailer in Queensland due to the peakier load and more volatile spot prices experienced in South Australia. A prudent and efficient retailer in South Australia would be expected to have a higher level of caps and lower level of swaps. Nevertheless, a contracting strategy could be similarly determined for which the total energy purchase costs are similar for a range of weather conditions.

Alinta Energy supported consideration of a contracting strategy to meet a 10 per cent POE scenario.

Both Origin Energy[3] and QEnergy[4] have indicated that the contracting strategy should take into consideration that many retailers in South Australia are vertically integrated and have longer term PPAs. If the retailers have an efficient portfolio of generation assets and have efficiently entered into PPAs then the costs that would be incurred over the longer term should be no higher than a retailer that enters into an efficient contacting strategy.

[3] Origin Energy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 6

[4] QEnergy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 2

In determining the appropriate contracting strategy, assumptions are required regarding the magnitude and shape of the small retail electricity customer load for South Australia. Consistent with the approach previously adopted by the Commission, it is recommended that the:

- load magnitude is as per the 2010 determination, adjusted for the lower growth in the mass market electricity consumption that has subsequently been experienced
- load shape is as per the Net System Load Profile for South Australia, based on a 10 per cent POE, 50 per cent POE and 90 per cent POE.

## 4.2 Forward contract price

The market-based approach relies on public sources of data on forward contract prices, generally from d-Cypha. This data has often been supplemented with other sources of non-public data such as from brokers.

The liquidity of the forward contract market has been an issue over the last few years particularly with the uncertainty as to whether a carbon price would be introduced, and if so, when and in what form. The liquidity has improved with the passing of the legislation for the carbon price in 2011. However, the liquidity of the South Australian forward contract market continues to be weak relative to the forward contract market in other states, particularly Victoria.

There is now uncertainty as to whether there will be a change in Government at the next Federal election and whether the legislation for the carbon price will be subsequently repealed. As a result, the contract market is less liquid in 2013/14 than for the first half of 2013.

AGL[5], Alinta[6], the Energy Retailers Association of Australia (ERAA)[7], International Power[8], Lumo Energy[9], Origin Energy[10], QEnergy[11], the South

[5] AGL's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 19 July 2012, page 2

[6] Alinta Energy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 20 July 2012, page 4

[7] ERAA's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 2

[8] International Power's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 20 July 2012, page 7

[9] Lumo Energy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 1

[10] Origin Energy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 1

[11] QEnergy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 2

Australian Council of Social Service (SACOSS)[12] and TRUenergy[13] commented on the liquidity of the South Australian contract market and either explicitly or implicitly stated that it is too low to provide confidence that forward contract prices can be reliably used for setting standing contract prices.

TRUenergy also noted that future contract prices don't fully reflect the costs associated with a carbon price due to the uncertain political environment and may be affected by recent price spikes in the gas market.[14]

COTA concluded that:

> … the Commission needs to adopt a range of methodologies which have the capacity to assess forward contract prices regardless of liquidity.[15]

A variety of alternative methodologies were proposed for determining the forward contract price:

- Macquarie Generation noted that it is possible to construct a South Australian contract price using Victorian contract prices supported by the Victoria/South Australia inter-regional settlement residues[16]
- Macquarie Generation also proposed that the wholesale electricity supply obligation for standing contract customers could be competitively tendered as an alternative way of delivering a market-based energy allowance[17]
- SACOSS suggested that, as AGL is substantially vertically integrated, the spot market rather than the contract market is the relevant consideration[18]
- Similarly, a private individual proposed that the wholesale market pool price is an acceptable proxy for the marginal cost of electricity as it reflects the price at which the marginal generator and retailer are prepared to trade electricity[19].

If there is sufficient liquidity in the forward contract market, then there will be publicly available data that can be used to establish forward contract prices. In

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12 SACOSS's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, Attachment 2, page 14

13 TRUenergy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 1

14 Ibid, page 2

15 COTA's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 2

16 Macquarie Generation's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 19 July 2012, page 2

17 Ibid, page 5

18 SACOSS's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, Attachment 2, page 16

19 Private individual's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, undated, page 4

the absence of a liquid market, alternative means of estimating the forward contract price are required. The alternative methodologies identified are discussed in the following sections.

### 4.2.1 Constructing a forward contract price by reference to the Victorian forward contract price

As indicated above, Macquarie Generation noted that it is possible to construct a South Australian contract price using Victorian contract prices supported by the Victoria/South Australia inter-regional settlement residues.

The Office of the Tasmanian Economic Regulator (OTTER) adopted a similar approach in its last retail price determination. The regulations that applied to the determination required OTTER to take into consideration the price Aurora Energy would pay to purchase electricity in Victoria and transport the electricity to mainland Tasmania for supply to non-contestable customers on mainland Tasmania.

As there is no actively traded financial (derivative) market for energy in Tasmania as there is in other jurisdictions, publicly available information on contract prices is not available.

The contract prices used by OTTER were therefore based on the publicly available contract prices in Victoria and adjusted for the difference between the spot price in Tasmania and the spot price in Victoria.

Before adopting such an approach, detailed analysis would need to be undertaken to understand whether there is a relationship that could be relied upon to be able to base the South Australian forward contract prices on the Victorian forward contract prices.

### 4.2.2 Competitively tendering the wholesale electricity supply obligation

The approach proposed by Macquarie Generation to competitively tender the wholesale electricity supply obligation for those small customers on the standing contract is not consistent with the South Australian legislative framework. The approach has therefore not been considered further.

### 4.2.3 Reliance on the spot price

In a paper commissioned by SACOSS, CME argues that the spot market rather than the contract market is the relevant market to consider in determining the price of wholesale energy in the standing contract.

> AGL's interest in wind farms, cogeneration and fossil fuel generators in South Australia is likely to provide sufficient generation to meet the needs of their South

> Australian electricity consumers in aggregate over the year. Their controllable generation capacity is likely to exceed the peak demand of their South Australian customer base. As such, AGL is substantially "vertically-integrated" in retailing and generation in South Australia and hence hedged against spot prices (after adjustment for transmission losses, its retail business will pay the same spot price for electricity as its generation business receives). To the extent that AGL chooses to enter into future or forward contracts, this is a matter for AGL reflecting their wholesale price risk management strategy, or perhaps to fix prices for the procurement of energy from the spot market when spot prices are below their production costs.[20]

In reaching this conclusion, CME notes that:

- spot prices have been reasonably well predicted in the futures market at least as measured by quarterly futures contracts particularly in the second, third and fourth quarters of each calendar year
- prices in the quarterly futures contract market have lagged changes in the spot market.

Conversely, TRUenergy submitted that the Commission should not use modelling of the spot prices as the basis for setting the WEC as it "fluctuates based on weather sensitive inputs or predictions used"[21].

ACIL Tasman proposed an alternative market-based approach that was based on the spot price rather than the contract market as part of the QCA's determination of the regulated retail price for 2012/13.

The approach relied on the stochastic (or Monte Carlo) modelling of the wholesale spot price. It did not rely on any assumptions about the forward contract market.

The basic premise of the approach was that retailers take out forward contracts covering their load to insure against the potentially high prices that can sometimes occur in the NEM.

The distribution of possible price outcomes is not a symmetrical and well-behaved bell curve where the probability of high prices is the same as that for low prices. The price at the 50$^{th}$ percentile (the median) may be $40-$50 per MWh, while the lowest half-hourly price is -$1,000 per MWh and the highest is $12,900 per MWh. The skewed nature of the distribution of potential price outcomes means that the mean of such possible outcomes is higher than the median.

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[20] SACOSS's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, Attachment 2, pages 14-15

[21] TRUenergy's submission to the Commission's Wholesale Electricity Cost Investigation Discussion Paper, 18 July 2012, page 3

The original proposal was that a prudent retailer would want to be covered for the mean potential outcome. It was assumed that insuring against an outcome higher on the distribution of possible price outcomes than the mean would be to over-insure.

However, there are factors that would indicate that retailers may hedge at a cost that is greater than the mean of the probability distribution. These include:

- Risk profile – counterparties to hedge contracts may have different risk profiles and risk appetites. They may be prepared to pay more than the mean of the probability distribution.
- Regulatory changes – which would need to be considered on a case by case basis.
- Reactionary component in contract prices – forward contracts being offered or negotiated at a time of high price volatility tend to be higher in price than they would be otherwise.
- Time value component in contract prices – contracts with longer tenor or commencing later may have an additional cost component reflecting time value.

There were concerns that using the mean of the probability distribution did not reflect the risk appetite of a prudent and efficient retailer. It was argued that a prudent and efficient retailer would enter into hedge contracts at a cost of around the 70$^{th}$ or 75$^{th}$ percentile rather than the mean.

The liquidity of the forward contract market improved with the passing of the legislation for the carbon price. This enabled publicly available data to be used in estimating the forward contract price. Therefore, despite using the price distribution methodology for many years to evaluate energy costs for industry participants, the approach was not considered further as part of the QCA's 2012/13 determination. As a consequence, this approach has not been used to date as part of a retail price determination.

If such an approach were to be adopted, further analysis could be undertaken to inform the appropriate percentile to use. For example, modelling could be undertaken to determine where on the probability distribution curve previous decisions on the appropriate energy purchase cost lie. Ultimately there is a judgement as to the preferred balance between setting a WEC that is too high (using a high percentile) and setting a WEC too low (using a low percentile).

It is noted that similar arguments on the appropriate percentile to use have been raised previously in the context of using a Monte Carlo approach to determine the WACC as part of network businesses' revenue determinations. For example, as part of the 2006-10 Victorian electricity distributors' revenue determination, AGL, supported by the Energy Networks Association and United Energy, proposed that a Monte Carlo approach be used to determine

the WACC. AGL proposed that the 75th-80th percentile be used in determining the WACC.[22]

### 4.2.4 Modelling the forward contract price

In previous retail price determinations, IPART has relied on a proprietary portfolio optimisation model to determine the forward contract price rather than publicly available data. The proprietary portfolio optimisation model:

> estimates optimal combinations of contract cover and spot price exposure of given levels of risk for each Standard Retailer.[23]

[22] Essential Services Commission, *Electricity Distribution Price Review, Volume 1: Statement of Purpose and Reasons, Final Decision,* October 2005, pages 334-335

[23] Ibid, page 19

# 5 Conclusions

A market-based or EPC approach involves estimating the wholesale energy purchase costs that a prudent electricity retailer would be expected to incur to supply small retail electricity customers.

Retailers purchase electricity in the NEM at the spot price and use financial contracts to manage their risk. The financial contracting arrangements will vary from retailer to retailer depending on, for example, their generation portfolio and their appetite for risk.

In estimating the wholesale energy purchase costs incurred by a prudent and efficient retailer, it is generally assumed that the retailer is partly exposed to the wholesale spot market and partly protected through a contract hedging strategy. The EPC therefore generally consists of three components:

- Wholesale electricity spot price forecast – the wholesale electricity spot price is generally forecast by simulating the NEM using a proprietary wholesale energy market model.
- Contracting strategy – the contracting strategy represents a strategy that a prudent and efficient retailer would undertake to hedge against risk in the spot price in a given year. It is generally assumed that a prudent and efficient retailer's risk management strategy would result in contracts being entered into progressively over a two or three year period prior to the required date.
- Forward contract price – the forward contract prices are generally estimated from publicly available data, from actual data provided by the retailers or can be modelled. The use of publicly available data implicitly assumes that the value of any bilateral contracts entered into by the prudent and efficient retailer is based on the value of OTC and futures contracts.

There is a generally accepted approach to modelling the wholesale spot market that is used by all regulators. Any comments that are made by stakeholders are generally in relation to the detailed assumptions that have been used in the modelling rather than the high level approach. Any concerns on the modelling can be minimised by using publicly available data to the maximum extent possible and by backcasting using actual data to verify the reliability of the modelling.

Using a similar approach adopted in Queensland, an efficient contracting strategy can be determined by using a combination of flat and peak swaps and $300 caps so that the total energy purchase cost is relatively consistent under a range of weather conditions (10 per cent POE, 50 per cent POE and 90 per cent POE).

If the forward contract market is liquid, publicly available forward contract prices can be used to estimate the energy purchase costs incurred by an efficient and prudent retailer.

However, many submissions to the Commission's Discussion Paper on the Wholesale Electricity Cost Investigation raised concerns regarding the liquidity of the South Australian forward contract market and therefore the ability to estimate a forward contract price.

Four alternative methodologies to estimating the forward contract price were considered:

- Constructing a forward contract price for South Australia based on the forward contract price for Victoria – a similar approach has previously been adopted by OTTER. However, further analysis is required to determine whether there is a relationship that can be relied upon in using this approach.
- Competitively tendering the wholesale electricity supply obligation for standing contract customers – as this approach is not consistent with the legislative framework, this approach has not been considered further.
- Reliance on the spot market – while a stochastic approach has been used by industry participants for many years to determine the energy cost based on the wholesale spot market, it has not been used as part of a retail price determination. Further analysis is required to determine the appropriate percentile on a probability distribution curve to achieve the preferred balance between setting a WEC that is too high (using a high percentile) and setting a WEC too low (using a low percentile).
- Modelling the forward contract price – in making retail price determinations, IPART has relied on modelling of the forward contract price using a proprietary model.