Wholesale electricity cost investigation

Approaches to setting the wholesale electricity cost allowance

Prepared for Essential Services Commission of South Australia

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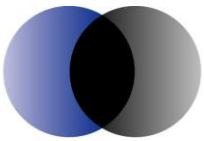

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Contents

Glossary iii

1 Introduction 1

2 Background 3

3 Long run marginal cost approach 5

3.1 Approaches to estimating the LRMC 5
3.2 Impact of market conditions on the energy cost 6
3.3 Incentive to invest in new generation 7
3.4 Application of the LRMC approach by regulators 8
3.4.1 Use of the LRMC approach in Queensland 8
3.4.2 Use of the LRMC approach in New South Wales 10
3.4.3 Use of the LRMC approach in South Australia 11
3.4.4 Use of the LRMC approach in Tasmania 11
3.5 Concluding comments 12

4 Market-based approach 13

4.1 Approach to estimating the EPC 13
4.2 Impact of market conditions on the energy cost 13
4.3 Incentive to invest in new generation 13
4.4 Application of the EPC approach by regulators 14
4.4.1 Use of the EPC approach in Queensland 14
4.4.2 Use of the EPC approach in New South Wales 16
4.4.3 Use of the EPC approach in South Australia 17
4.4.4 Use of the EPC approach in Tasmania 18
4.4.5 Use of the EPC approach in Victoria 18
4.4.6 Use of the EPC approach in the ACT 19
4.5 Concluding comments 20

5 Hybrid approaches 21

6 Conclusion 22

List of tables

Table 1 **Energy cost, Queensland ($ per MWh, nominal)** 9
Table 2 **Energy cost, New South Wales ($ per MWh, real $2009/10)** 11
Table 3 **Energy cost, Tasmania ($ per MWh, real $2009/10)** 12

Glossary

ACT	Australian Capital Territory
AEMO	Australian Energy Market Operator
AFMA	Australian Financial Markets Association
Commission	Essential Services Commission of South Australia
EPC	Energy Purchase Cost
ICRC	Independent Competition and Regulatory Commission
IPART	Independent Pricing and Regulatory Tribunal
LRMC	Long Run Marginal Cost
MWh	Megawatt hour (1million watt hours)
NEM	National Electricity Market
NSLP	Net System Load Profile
OTTER	Office of the Tasmanian Economic Regulator
OTC	over-the-counter
POE	Probability of Exceedence
QCA	Queensland Competition Authority
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

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

may not reflect the efficient costs of a retailer with the standing contract obligation in South Australia (AGL).

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. This report provides advice on the appropriate approach to use in setting the energy cost allowance for the purposes of fixing standing contract prices in South Australia. The report considers the merits of setting the wholesale electricity cost on the basis of the LRMC approach, the EPC approach, and variations on these approaches.

- section 2 provides brief background material on the operation of the National Electricity Market
- the use of the LRMC approach to estimate the cost of energy is discussed in section 3
- the use of the market-based approach or EPC to estimate the cost of energy is discussed in section 4
- hybrid approaches for estimating the cost of energy are discussed in section 5
- concluding comments are provided in section 6.

2 Background[2]

Retailers purchase the energy to supply their customers from the National Electricity Market (NEM) at the wholesale electricity spot price.

As electricity cannot be stored, the demand and supply for electricity must be matched in real time. Generators bid their capacity into the NEM for each half hourly interval. The Australian Energy Market Operator (AEMO) stacks the bids from the lowest to the highest and despatches sufficient generation in five minute intervals to meet the forecast demand.

The spot price is set for each half-hourly interval. The prices that are bid by the marginal generator (the last generator despatched) in each of the six five-minute intervals in a half-hourly period are averaged to set the spot price for that half-hourly interval.

The spot price can vary between -$1,000 per Megawatt hour (MWh) and $12,900 per MWh, but averages around $40-$60 per MWh.

Participants in the NEM require a means of managing the financial risks associated with the significant degree of spot price volatility that can occur. They typically achieve this by using financial contracts that lock in a firm price for electricity that will be produced or consumed at a given time in the future. These contracts have the effect of stabilising and smoothing the cost for a given volume of electricity that is traded through the spot market.

For this reason, the spot price is not the cost that is incurred by retailers in supplying electricity to small customers. In estimating the costs incurred by an efficient and prudent electricity retailer, both the costs associated with the retailer's exposure to the spot market and the exposure to the contract market must be considered.

The financial contracts that are entered into by electricity retailers are known as derivatives, and include swaps, caps, options and futures contracts. The types of contracts that are specifically referred to in this report are swaps and caps.

The basic form of a swap contract is where two parties (typically a generator and a retailer) agree to exchange cash so that a defined quantity of electricity over a nominated period is effectively valued at an agreed strike price. Under such an agreement, generators pay retailers the difference between the spot price and the strike price when the spot price is above the strike price. When

[2] This section provides a very brief introduction to the NEM. If further information is required, reference should be made to AEMO's *An Introduction to Australia's National Electricity Market*.

the spot price is below the strike price, retailers pay generators the difference between the spot price and the strike price.

Half hourly settled caps are a means for retailers to hedge the risk of spikes in the pool price. Whenever the spot price is higher than the strike price of the cap (say $300), the generator must pay the retailer the difference between the spot price and the strike price. Cap prices have generally traded far above their historical pay-outs but the risks for retailers of being caught short during a high-priced event usually outweigh the premium paid.

Contracts to hedge the retailer's risk can be:

- bilateral contracts between generators and retailers – these tend to be larger contracts and may be over a longer timeframe
- over-the counter (OTC) contracts that are entered into directly between traders or through brokers
- futures, which are standard contracts through the futures exchange.

3 Long run marginal cost approach

The marginal cost is the cost of producing a particular unit of output.

The marginal cost of the first unit of output is all the fixed cost and the variable cost of the first unit.

The marginal cost can be different in the short term, where some costs are fixed, and in the long term, where no costs are fixed.

When determining the long run marginal cost of generation at a point in time, the period over which no costs are fixed (that is, all costs are considered to be variable) is the life of the generator.

The long run marginal cost (LRMC) is therefore defined as the cost of an incremental unit of generation capacity, spread across each unit of electricity produced over the life of the generator.

When calculating the LRMC for new generation, the costs considered include all costs relevant to the investment decision. These costs are:

- the capital cost (including connection and other infrastructure)
- other costs including legal and project management costs
- fixed operating and maintenance costs
- variable costs over the life of the generator
- tax costs (if using a post-tax discount rate).

The LRMC is the average cost over the long term of supplying incremental energy requirements.

In a competitive market, the price outcomes will align with the LRMC over the *long-term*. If the price outcomes were lower than the LRMC over the long term, generators would not be viable. If the market is competitive then the price outcomes will not be higher than the LRMC values over the long term.

As the price outcomes align with the LRMC over the long term, the LRMC has been used by some regulators in determining the energy cost component of the retail electricity price.

3.1 Approaches to estimating the LRMC

There are two approaches to estimating the LRMC[3]:

[3] Independent Pricing and Regulatory Tribunal, *Review of regulated retail tariffs and charges for electricity 2010-2013; Electricity – Draft Methodology Paper,* August 2009, page 16

- A **standalone** or **greenfield** approach, which assumes that there is currently no generation plant to serve the required load. The approach theoretically builds, and prices, a whole new generation system that is least-cost. In effect, it re-prices all existing capacity at efficient levels and includes the capital costs of new plant in the LRMC estimate.
- An **incremental** approach, which assumes that the existing mix of generation plant in the system is in place and that the required load can be served using both existing generation plant and new generation plant. This approach prices loads on the basis of the least-cost way of adding to the existing stock of plant and does not factor in the capital costs of existing plant as this is assumed to be sunk.

The standalone or greenfield approach is used for estimating the LRMC for the purposes of regulating retail prices. The incremental approach results in a very low LRMC (more related to the short run marginal cost) unless new generation is immediately required.

3.2 Impact of market conditions on the energy cost

The LRMC approach looks forward, attempting to estimate the cost of generating additional units of energy in the future from new entrant plant, ignoring the likely market conditions prevailing at that future time.

Market conditions can have a major effect on the costs incurred by retailers of purchasing energy in the short term. Such market conditions include:

- Under or over supply of generation – the wholesale price of electricity will be higher when there is an under supply of generation, including the impact of major unplanned outages, and lower when there is an over supply of generation, including when there has been a reduction in demand for electricity.
- Major weather events – for example, the drought which occurred in the southern and eastern states of Australia during the last decade brought about a significant increase in the wholesale price of electricity.
- Markets for primary energy inputs for electricity generation, such as coal and gas – the wholesale electricity price is generally influenced by long term contracts for coal and gas which have lower prices than new contracts for the new entrant plant assumed in the LRMC approach.
- Changes in government policy – for example, the Large Scale Renewable Energy Target incentivises investment in renewable energy. Where the investment in renewable energy generation has resulted in an over supply of generation, there has been a reduction in the wholesale price of electricity.

The history of Australia's deregulated electricity markets since the mid 1990s indicates that the market moves through cycles in response to the market

conditions. The wholesale electricity price may be higher or lower than the LRMC depending on these market conditions. This is evident by recent regulatory decisions that have been made in Queensland, New South Wales and Tasmania, as discussed in section 3.4.

Regardless of the accuracy of the assumptions and the reliability of the modelling of the LRMC, the LRMC approach does *not* attempt to estimate a retailer's costs to purchase energy. It is only by chance that the LRMC would be similar to the market-based EPC.

If the energy cost is based on LRMC and the market prices are higher than the LRMC, there may be a risk to retailers as they will not be able to recover the necessary revenues to cover their input costs. If the market prices are less than the LRMC, then customers may be paying more for energy than the costs incurred by retailers in purchasing energy.

3.3 Incentive to invest in new generation

It has been argued that investment in new generation will be stifled unless the LRMC is used as a floor for the energy cost.

As demand grows relative to supply, spot and contract prices would be expected to increase to a level which will encourage new generation. This is inherent in the NEM design – as the supply-demand balance tightens, prices rise and new generation investment occurs. When the new generation investment occurs, there will be a short term over supply in generation and prices will fall.

Investment in the new generation will be justified where the average price over the longer term is forecast to be at least the LRMC of the new investment.

As the NEM is a deregulated market, generation investment decisions are entirely in the hands of investors. Any losses that occur or rents that accrue remain with those investors. This includes the resulting performance of any over-optimistic or poorly timed investments. The consequences of those decisions are borne by the investors, not the end-users of electricity.

If a regulator uses the LRMC to estimate the energy cost, and the LRMC is higher than the prevailing wholesale electricity prices at that time, it does not follow that those higher costs would pass through to the generators. The gains accrue to the retailer and there are no increased incentives to invest in new generation.

3.4 Application of the LRMC approach by regulators

The LRMC approach has previously been used by the Queensland Competition Authority (QCA), the Independent Pricing and Regulatory Tribunal (IPART), the Commission and the Office of the Tasmanian Economic Regulator (OTTER) in regulating retail prices in Queensland, New South Wales, South Australia and Tasmania, respectively.

The basis for the QCA, IPART, the Commission and OTTER using an LRMC approach is discussed for each jurisdiction in the following sections. In summary, the LRMC approach is used because of a requirement to do so, either through legislation or specific Terms of Reference, or due to a lack of liquidity in the forward contract market.

Conversely, the Independent Competition and Regulatory Commission (ICRC) has specifically chosen not to use an LRMC approach when regulating retail prices in the ACT. It was of the view that the regulated retail price should be set at a level that would permit an efficient retailer to recover its costs.

> If the incumbent and new entrant retailers mainly sought to meet their energy requirements by building generation plant, then estimates of the LRMC would be an important benchmark. However, the Commission noted that as all retailers – and new entrants in particular – hedge the majority of their load through financial contracts, the Commission's previous practice of estimating the cost of estimating the cost of purchasing electricity on the basis of spot prices and financial derivatives would appear to remain valid.[4]

Prior to the deregulation of retail electricity prices in Victoria, the LRMC approach was not used by the Victorian Government in its oversight of the retail electricity prices proposed by the retailers.

3.4.1 Use of the LRMC approach in Queensland

Prior to 2012/13, the QCA used the LRMC approach when determining the Benchmark Retail Cost Index as it was required to do so by legislation.

Section 92 of the *Electricity Act 1994* stated that[5]*:*

[4] Independent Competition and Regulatory Commission, *Final Technical Paper: Model for Determining the Energy Purchase Cost Component of the Transitional Franchise Tariff,* Report 3 of 2010, pages 10-11

[5] CRA International, *Calculation of the Benchmark Retail Cost Index for 2006-07 and 2007-08,* 7 May 2007, page 16

- The cost of energy must reflect the pricing entity's view of the likely total of the costs to be incurred during the relevant tariff year to purchase energy to supply all of the NEM load of the State for the relevant tariff year.
- The view must be based on the pricing entity's most recent estimate of the **long run marginal cost of energy** in the part of the State connected to the national grid, after taking into account:
  - The 13% gas scheme under chapter 5A; and
  - The scheme under the *Renewable Energy (Electricity) Act 2000 (*Commonwealth).
- The estimate must take into account the most efficient combination of generating plant to supply all of the NEM load of the State for the relevant tariff year.

The requirement that the energy cost be based on the LRMC was viewed by QCA's consultants as being inconsistent with the requirement for the cost of energy to reflect the total (actual) costs incurred for purchasing energy.[6]

To bridge this inconsistency, the QCA used the LRMC approach but added a factor to the LRMC value in the first year it was applied (2007/08) to reflect considerations that are likely to result in the subject year departing from the long-term expected value. Due to time constraints, the factor was based on the difference between the LRMC and the energy purchase cost determined by IPART.

In subsequent years (2008/09 to 2010/11) a blended energy cost was calculated by applying a weighting of 50 per cent to each of the LRMC and the market-based EPC.

The LRMC was estimated to be higher than the market-based EPC in 2010/11 (just) and 2011/12, and was estimated to be lower than the market-based EPC in 2007/08, 2008/09 and 2009/10, as set out in Table 1.

Table 1 **Energy cost, Queensland ($ per MWh, nominal)**

	2007/08	2008/09	2009/10	2010/11	2011/12
LRMC	$41.98	$42.61	$53.28	$58.59	$64.44
Market-based EPC	$48.86	$52.91	$57.70	$58.51	$46.50

Data source: Various QCA reports

On 11 May 2011 the QCA received a Ministerial Direction to investigate and report on an alternative methodology for regulating the retail electricity price for 2012/13. The Ministerial Direction stated that:

[6] Ibid, page 17

- Queensland electricity consumers should, wherever possible, have the opportunity to benefit from competition and efficiency in the market place.
- For retail electricity markets to be successful electricity prices must **reflect the cost of supply**.

Accordingly, the QCA subsequently moved away from using the LRMC approach to regulate the retail electricity prices, as discussed further in section 4.4.1.

3.4.2 Use of the LRMC approach in New South Wales

The Terms of Reference that were provided to IPART for the regulation of retail electricity tariffs from 1 July 2010 to 30 June 2013 specifically state:

> Regulated tariffs should reflect the efficient costs faced by a Standard Retail Supplier meeting the forecast demand of the regulated customers they are obliged to serve.[7]
>
> …
>
> The Energy Purchase Cost for each year must not be lower than the least cost mix of generating plant (based on those plants earning an economic return on their market value), including any plant that would be required to meet any regulatory obligation, (using generation technology that is available in the NEM for the relevant year/period), to efficiently meet each Standard Retail Supplier's regulated load.[8]

IPART has interpreted the requirement to set the energy purchase cost **no lower** than the least-cost mix of generating plant as the LRMC of generation.

It has therefore set the energy cost as the *higher* of the LRMC and the market-based EPC. The LRMC was estimated to be higher than the market-based EPC in 2010/11 and 2011/12, and was estimated to be lower than the market-based EPC in 2012/13, as set out in Table 2.

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[7] NSW Minister for Energy, *Terms of Reference for an investigation and report by the Independent Pricing and Regulatory Tribunal on regulated retail tariffs and regulated retail charges to apply between 1 July 2010 and 30 June 2013 under Division 5 of Part 4 of the* Electricity Supply Act 1995, page 2

[8] Ibid, pages 2-3

Table 2 **Energy cost, New South Wales ($ per MWh, real $2009/10)**

	2010/11	2011/12	2012/13
LRMC			
EnergyAustralia	$66.30	$73.00	$84.90
Integral Energy	$68.40	$75.80	$88.20
Country Energy	$61.70	$69.10	$81.70
Market-based EPC			
EnergyAustralia	$44.20	$71.60	$97.90
Integral Energy	$45.90	$74.10	$103.80
Country Energy	$42.30	$68.10	$95.20

Data source: IPART, *Review of regulated retail tariffs and charges for electricity 2010-2013,* March 2010, page 99

3.4.3 Use of the LRMC approach in South Australia

The LRMC approach was used to estimate the WEC for the 2010 determination due to the lack of liquidity in the forward contract market. The market-based approach, as traditionally used by the Commission, was considered to be too unreliable for that review. The LRMC was considered to be more robust under the conditions prevailing at that time.

However, the Commission indicated that a special circumstances review may be triggered if there is a material change in the wholesale electricity costs. The Commission indicated that it would:

> explore all relevant options for re-examining the WEC, including the possibility of reverting to a market-based approach.[9]

3.4.4 Use of the LRMC approach in Tasmania

The approach used by OTTER to estimate the energy costs is specified in regulations. The regulations take into consideration the circumstances prevailing at the time.

During the most recent price determination, the regulations stated that the estimate of electricity supply costs:

(a) must 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; and

(b) must be more than or equal to the long-run marginal cost of electricity generation by a notional electricity generator to supply electricity to non-contestable customers on mainland Tasmania.[10]

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[9] Essential Services Commission of South Australia, *2010 Review of Retail Electricity Standing Contract Price Path: Final Inquiry Report & Final Price Determination*, December 2010, page A-68

[10] Office of the Tasmanian Economic Regulator, *Investigation of maximum prices for declared retail electrical services on mainland Tasmania, Final Report*, October 2010, page 25

The LRMC was estimated to be higher than the market-based EPC for 2010/11, 2011/12 and 2012/13, as set out in Table 3.

Table 3 **Energy cost, Tasmania ($ per MWh, real $2009/10)**

	2010/11	2011/12	2012/13
LRMC	$73.50	$73.16	$74.33
Market-based EPC	$66.23	$65.13	$66.03

Data source: OTTER, Investigation of maximum prices for declared retail electrical services on mainland Tasmania, Final Report, *October 2010, page 32*

As OTTER was limited in its consideration by the regulations, it adopted the LRMC.

3.5 Concluding comments

The LRMC does not estimate the costs that would be incurred by an efficient and prudent retailer in purchasing energy to supply to small customers.

Rather, it provides an indication of the cost of generation in the long term. In the short term, the costs incurred by retailers in purchasing energy are expected to be higher or lower than the LRMC depending on market conditions.

Those that support the LRMC approach generate using the LRMC only when the LRMC is greater than the market-based EPC so that they can capture the additional rent during that period. When the LRMC is less than the market-based EPC, the use of the market-based EPC is advocated to ensure that the energy cost is set no lower than the costs incurred by a prudent and efficient retailer in purchasing energy. By adopting this approach, the average energy costs recovered over time will be greater than the LRMC.

For all of these reasons, the use of the LRMC approach to estimate the energy costs incurred by a prudent and efficient retailer is not recommended.

4 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.

4.1 Approach to estimating the EPC

As discussed in section 2, 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:

- Forecast wholesale electricity spot price – 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.
- 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 are based on the value of OTC and futures contracts.

4.2 Impact of market conditions on the energy cost

As discussed in section 3.2, market conditions can have a major effect on the costs incurred by retailers of purchasing energy in the short term. Under the EPC approach, the impacts of market conditions are implicitly incorporated into the estimate of the energy cost.

4.3 Incentive to invest in new generation

As discussed in section 3.3, spot and contract prices increase as demand grows relative to supply which provides a signal for investment in new generation.

If a regulator uses the EPC approach to estimate the energy cost, the energy cost will increase and decrease over time to reflect the supply-demand balance in the NEM. As the supply tightens relative to demand, the market-based EPC will increase in line with the increase in spot and contract prices, and investment in new generation will occur. Following investment in new generation there will be an over supply and spot and contract prices will fall. The market-based EPC will fall in line with the decrease in spot and contract prices.

4.4 Application of the EPC approach by regulators

The EPC approach has been used by regulators in Queensland, New South Wales, South Australia, Tasmania and the ACT and by the Victorian Government in its oversight of retail electricity prices. The approaches that have been used are discussed in the following sections.

4.4.1 Use of the EPC approach in Queensland

Wholesale electricity spot price

The results from the modelling of the wholesale electricity spot price will vary depending on the assumptions regarding 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, this approach has been extended for the QCA. In its most recent determination it ran 410 scenarios of the wholesale electricity spot price – using 41 years of temperature data and 10 different unplanned outage scenarios. The median wholesale electricity price was used to estimate the expected energy cost, 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.

Contracting strategy

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. 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 80th percentile of off-peak load
- **Peak swaps** – to provide peak swap contract cover up to the 90th percentile of peak load

- **$300 caps** – to provide cap contract cover up to 105% of maximum peak load.[11]

This contracting strategy is relatively basic and does not use the full range of financial derivatives available. However, it has resulted in an energy purchase cost that is reasonably consistent for modelling of a range of weather conditions (10 per cent probability of exceedence (POE), 50 POE and 90 POE).

It is expected that the contracting strategy for a prudent and efficient retailer in South Australia would be different to that of a prudent and efficient retailer in Queensland, with a higher level of caps and lower level of swaps due to the more peaky load and more volatile spot prices experienced in South Australia.

Forward contract prices

The forward contract prices have been sourced from publicly available data (d-Cypha Trade).

Alternative approach

An alternative approach was recently proposed as part of the QCA's determination of the regulated retail price for 2012/13 due to concerns regarding the lack of liquidity in the market and the inability to source publicly available data on the forward contract prices.

The approach relied on the stochastic (or Monte Carlo) modelling of the wholesale spot price as discussed above. 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 50th 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.

The original proposal was that a prudent retailer would want to be covered for the mean potential outcome. However, there were concerns that using the

[11] Please refer to section 2 for a description of these types of contracts.

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 financial contracts at a cost of around the 70th or 75th percentile rather than the mean.

The liquidity of the forward contract market subsequently improved. This enabled a more conventional market-based approach to be used. 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.

Further analysis could be undertaken to inform the appropriate percentile to use if this approach was pursued further.

4.4.2 Use of the EPC approach in New South Wales

IPART has:

- modelled the forecast wholesale electricity spot price
- modelled the optimal combinations of contract cover and spot price exposure for given levels of risk for each of the three retailers in NSW
- calculated the market-based cost on the conservative point of the efficient frontier curves
- included a volatility allowance.

IPART considered the use of publicly available data from the Australian Financial Markets Association (AFMA)[12] rather than a proprietary model to estimate the forward contract prices. However it concluded that, as it is an industry price survey, it is open to manipulation.[13]

IPART has also been concerned about the volatility of publicly available data on forward contract prices. It noted that observable forward data can reflect changes in market sentiment rather than market arrangements or information, which means that the period over which forward prices are assessed could have an impact on regulated tariffs.

It noted that this volatility could be overcome by constructing a portfolio of market data over time, as done in Queensland and ACT. However, IPART considered that:

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12 AFMA provides reference rates that can be used for portfolio revaluation purposes by governments and financial institutions. Reference rates are published for a range of wholesale OTC financial products including bank bill swap rates, corporate bonds and electricity forward curves for New South Wales, Victoria and Queensland.

13 Independent Pricing and Regulatory Tribunal, *Review of regulated retail tariffs and charges for electricity 2010-2013, Electricity – Draft Methodology Paper*, August 2009, page 19

> such an approach may be inconsistent with the principle that retailers should mark their wholesale book to market. In other words, using a rolling average contract price would not value the contract at the current market price for the instrument (known as 'marking to market').[14]

The risk management strategy for a prudent and efficient retailer would be to purchase contracts over a period of time to smooth out the effects of any volatility in the forward contract prices. By doing so, retailers are required to mark their wholesale book to market for the purposes of their financial statements. However, this has no impact on the cash costs that are incurred by retailers in purchasing their financial contracts.

For example, if a contract was bought for $1 million, it would be initially valued on the retailer's Balance Sheet at $1 million. If the value of the contract subsequently reduced to $800,000, then the contract would be revalued on the Balance Sheet at $800,000 and the retailer would incur a cost on their Profit and Loss Statement of $200,000. When the contract is exercised, the value on the Balance Sheet is reduced to $0 and the retailer would incur a cost on their Profit and Loss Statement of $800,000.

The cash cost that is incurred by the prudent and efficient retailer is $1 million. The only impact of 'marking to market' is the timing of the revaluing of the contract on the Balance Sheet and the timing of the cost in the Profit and Loss Statement.

It could be argued that the prudent and efficient retailer may be uncompetitive compared to a retailer that has purchased its forward contracts at short notice (or purchased solely on the spot market) at a lower price than the forward contract prices over the two to three year period. However, this is a risky strategy which is unlikely to be sustainable for a retailer to compete in the market over the longer term.[15]

The requirement to "mark to market" forward contracts therefore does not preclude constructing a portfolio of market data over time to estimate the energy cost.

4.4.3 Use of the EPC approach in South Australia

The EPC approach was not used in South Australia in 2010, but was used in previous determinations.

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[14] Ibid, page 20

[15] If a retailer was able to be competitive by adopting this strategy over the longer term, all retailers would adopt their strategy over time. Experience to date indicates that a two to three year period is an appropriate period over which to purchase forward contracts.

In 2007, a range of scenarios were modelled to estimate the wholesale electricity spot price. An optimal portfolio of peak and off-peak swaps and caps over a three year period was determined to minimise risk and publicly available date was used to determine forward contract prices.

An alternative approach previously considered by the Commission was to use AGL's actual costs rather than benchmark costs. There are two key issues associated with using the actual costs:

- 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.

For these reasons, an approach based on actual data from a retailer(s) is not recommended.

4.4.4 Use of the EPC approach in Tasmania

The regulations that apply to the determination of retail electricity prices in Tasmania require 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.

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 therefore not available.

The contract prices used by OTTER were 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.

4.4.5 Use of the EPC approach in Victoria[16]

The approach adopted in Victoria involved:

- determining how much contract volume is purchased and the time periods over which these purchases take place
- applying benchmark prices to cost the purchases using publicly available contract prices.

[16] CRA International, *Calculation of the Benchmark Retail Cost Index for 2007-08 and 2008-09,* 24 January 2008, page 80

Each year was divided into four quarters and a block approach was used to model energy purchases through swap contracts (flat, peak and off-peak) and cap contracts.

Data from AFMA was used to determine swap contract prices. While the AFMA data was identified as having limitations, it was considered to be a good indicator of market prices. Swap contracts were assumed to be purchased over a 24 month period in advance of the year in which the energy is purchased.

Cap prices were calculated using a proxy of an open cycle gas turbine, assuming a range of input costs.

An allowance was added for contract mismatch and demand variability.

4.4.6 Use of the EPC approach in the ACT

The ICRC considers the modelling of forecast wholesale electricity spot prices to be too complex. It has developed an alternative approach to estimating the energy cost that it considers to be simpler, more convenient and transparent, less resource intensive and does not have the "potential for gross errors".[17]

The ICRC has adopted a "cost build-up approach" which is a model based on the:

> actual costs of hedging in the market. The total cost of hedging the market using swaps and caps can be calculated for any arbitrary level of hedging. … it allows the Commission to derive a relationship between the forward prices and the resulting costs of serving the market. This relationship can then be applied to historical data to derive insights based on the available data.[18]

The ICRC considered that the energy purchase cost should consist of the following components:

- The forward price for base load electricity, which was calculated from the average of daily d-cypha data for a base load contract over a two year period.
- A component which reflects the expected cost of the load shape, which was calculated as the average of the load weighted to time weighted prices since 1 July 2003 using the half hourly spot prices for the New South Wales region and the net system load profile for the ACT.
- A component to reflect all hedging costs to purchase electricity, which was made up of the ratio of the maximum load to the average load (which was

[17] Independent Competition and Regulatory Commission, *Final Technical Paper: Model for Determining the Energy Purchase Cost Component of the Transitional Franchise Tariff,* Report 3 of 2010, page 19

[18] Ibid, page 27

determined to be 2.25), the load shape and the percentage mark-up of the forward price to the spot price (which was determined to be 5 per cent).

AGL did not support the approach as it:

- does not reflect the way in which retailers hedge their load or price a customer
- implies that retailers can perfectly forecast their load, with no allowance for forecasting error
- imposes uncertain price outcomes on retailers as they are highly exposed to pool prices
- does not account for retailer risks including liquidity and extreme event risk, that is, there is no account for holding insufficient hedge cover at specific times and being exposed to high pool prices.[19]

While the ICRC's approach has not been analysed in detail by ACIL Tasman, it appears relatively arbitrary without any assurance that the energy purchase cost remains reasonably consistent with variations in weather conditions.

Additionally it is noted that the rationale for using the alternative approach appears to be flawed. It assumes a single point estimate is adopted for the modelling of spot prices and contract prices rather than a stochastic approach which has been adopted in Queensland. It also does not recognise that models can be used to backcast data to check their accuracy.

4.5 Concluding comments

The EPC approach estimates the cost that would be incurred by a prudent and efficient retailer in purchasing electricity to supply small customers. The EPC approach will provide an estimate of the costs that will be incurred by retailers based on the market conditions prevailing at that time.

The market-based EPC will increase as the supply tightens relative to demand and spot and contract prices increase. Conversely, the market-based EPC will decrease when there is an over supply of generation capacity and spot and contract prices fall.

Different approaches have been adopted by different regulators to estimating the EPC. However, each approach generally consists of the following three components – the wholesale electricity spot price, the hedging strategy and the forward contract price. The differences in approach generally reflect the circumstances prevailing in that jurisdiction at the time of the determination.

[19] Submission by AGL to the ICRC's Issues Paper – Retail prices for non-contestable electricity customers 2012-14, December 2011, 3 February 2012, pages 1-2

5 Hybrid approaches

Various hybrid approaches have been referred to in sections 3 and 4, including:

- averaging the LRMC and the EPC, by applying a weighting of 50 per cent to each
- adopting the higher of the LRMC and the EPC, by applying a weighting of either 0 per cent and 100 per cent.

In effect, there is a continuum of hybrid approaches applying different weightings to each of the LRMC and the EPC.

Each of these hybrid approaches uses the LRMC as a reference point. As the LRMC does not estimate the costs incurred by retailers in purchasing energy, the hybrid approaches are not recommended.

6 Conclusion

In estimating the energy cost component of regulated retail electricity prices for small customers, a variety of approaches have been adopted by the regulators in New South Wales, Queensland, South Australia, Tasmania and the ACT, and by the Victorian Government.

The three common approaches that are used are the LRMC approach, a market-based or EPC approach and a combination of the two (a hybrid approach).

While the LRMC is an estimate based on the cost of generation, the market-based or EPC is an estimate of the expected costs that would be incurred by a retailer to purchase electricity.

In a competitive market, the price outcomes will align with the LRMC over the *long-term*. If the price outcomes were lower than the LRMC over the long term, generators would not be viable. If the market is competitive then the price outcomes will not be higher than the LRMC values over the long term.

However, in the short term, the EPC will be higher or lower than the LRMC based on market conditions. If, for example, there is an under supply of generation, the EPC will be higher than the LRMC and if there is an over supply of generation, the EPC will be lower than the LRMC.

If the energy cost is based on LRMC and the market prices are higher than the LRMC, there may be a risk to retailers as they will not be able to recover the necessary revenues to cover their input costs. If the market prices are less than the LRMC, then customers may be paying more for energy than the costs incurred by retailers in purchasing energy.

It is recommended that the EPC approach be used to estimate the WEC component of the retail electricity price, noting that the LRMC has generally only been used where required to do so by legislation or by the Terms of Reference for the review of retail prices.

Regardless of which approach is adopted, judgement is ultimately required to achieve the preferred balance between setting a price that is too high (resulting in the customers unwilling or unable to move to a market contract paying too much) and setting a price that is too low (which may stifle competition in the retail market).