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Designing a pricing mechanism for distributor-led standalone power systems

A final report for the Australian Energy Market Commission

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Report author/s

Sam Forrest

Ann Whitfield

Brydon McLeod

Contact Us

Sydney
Level 40
161 Castlereagh Street
Sydney NSW 2000

Phone: +61 2 8880 4800

Singapore
8 Marina View
#15-10 Asia Square Tower 1
Singapore 018960

Phone: +65 6817 5010

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Executive summary

The AEMC has recommended the adoption of a service delivery model for distributor-led standalone power systems (SAPS) comprising an administratively set price for wholesale energy to be paid by retailers.

HoustonKemp has been commissioned by the AEMC to provide advice on the design of a price setting mechanism for distributor-led SAPS. As part of providing this advice we:

1. set out objectives of a price setting mechanism.
2. compare considerations for the design of a price setting mechanism.
3. develop and evaluate alternative options for the pricing setting mechanism.

Objectives of a price setting mechanism

We understand that the AEMC is seeking to develop a mechanism for setting the administered price that removes any incentive for a retailer to seek to hedge SAPS customer load with NEM generation while also being simple and straightforward to implement.

In this context, we set out the objectives that we aim to achieve through the design of the pricing mechanism. The objectives we consider are aligned with those considered by the AEMC in its final Priority 1 report and include:

- simplicity, which fosters understanding, promotes confidence in the market which should encourage investment and innovation in providing SAPS services, and is associated with reduced regulatory effort;
- maintenance of incentives for retailers to continue to serve SAPS customers and so foster retail competition and its associated benefits, eg, innovation, competitive prices and a wider range of products that are more likely to meet customer needs;
- mitigate existing risks to retailers through eliminating the exposure of retailers to price volatility within the spot market associated with SAPS customer load and so reduce barriers to retailer participation; and
- stability in response to future market changes, which promotes regulatory certainty and so encourages associated benefits, eg, increased investment.

Considerations for the design of a pricing mechanism

To provide context for the design of a pricing mechanism and to highlight key trade-offs that exist in its design, we set out the key considerations relating to the key choices that feed into the design of an appropriate pricing mechanism. These key choices relate to:

- price data sources;
- wholesale price data characteristics, ie:
  - data sample period;
  - price averaging approach; and
  - outlook period and update frequency.
- contract price data characteristics, ie:
  - the development of prices for individual contracts, including weighting;
  - the mix of contracts to be used; and
  - thresholds for liquidity.

- intra-day variation in administered prices;
- further pricing adjustments;
- ex-post adjustments;
- distribution loss factors; and
- practicality.

Evaluation of options

We have developed five candidate options that are potentially viable for implementation within the SAPS context and evaluate these against the objectives of a price setting mechanism.

The five options are:

- **Option 1A: Simple wholesale price with annual update frequency** – an approach that uses a simple calculation based on historical wholesale prices and is updated annually, with adjustments to ensure a conservative estimate;
- **Option 1B: Simple wholesale price with quarterly update frequency** – an approach that uses a simple calculation based on historical wholesale prices and is updated quarterly, with adjustments to ensure a conservative estimate;
- **Option 2 – Sophisticated wholesale price** – a more sophisticated approach that seeks to more accurately capture the costs of wholesale energy based on past wholesale prices and ex-post adjustments;
- **Option 3 – Base swap contract** – an approach that uses trade-weighted base swap contract price to produce a conservative estimate which incorporates markets expectations regarding future price
- **Option 4 – Sophisticated hedge approach** – a more sophisticated contract-based approach that seeks to accurately replicate the costs of a retailer through an approximation of a retailer's prudent hedging approach.

We find that each option has strengths and weakness with regards to its performance against the objectives we have identified. Under the assumptions that the key selection criteria are that the mechanism is both simple and mitigates existing risks for retailers, we conclude that:

- option 1A is likely to be the approach that best achieves the objectives of the AEMC with Option 1B being a potential viable alternative if capturing prevailing market conditions is deemed to be an important consideration relatively to the simplicity of the mechanism;
- option 2 involves significant additional complexity which is unlikely to outweigh any benefits resulting from administered prices that accurately reflect the true costs to retailers;
- option 3 enables the incorporation of market expectations with regards to prices over the price setting period in the administered price, however, contract data is problematic in parts of the NEM, namely Tasmania and South Australia, and so entail some implementation challenges; and
- option 4, although a sophisticated approach that in theory will enable the estimates of the wholesale costs for a retailer that are highly correlated with the true costs, it presents an additional administrative burden that does not appear justified in this context.

1. Introduction

Changes in technology and reductions in costs of distributed energy resources are making standalone power systems (SAPS) an increasingly cost-effective means for servicing customers. In this context, the AEMC is in the process of conducting a review of the regulatory framework for standalone power systems to remove regulatory barriers to their establishment where it is in the interests of customers to do so.

As part of the first phase of this review, the AEMC published its final report, ie, *Review of the regulatory frameworks for standalone power systems – Priority 1*.[1] The report recommends the adoption of a service delivery model for distributor-led SAPS comprising an administratively set price for wholesale energy to be paid by retailers.

HoustonKemp has been commissioned by the AEMC to provide advice regarding how to best implement the findings from its report, specifically to provide advice on the design of a price setting mechanism for distributor-led SAPS.

The report is structured as follows:

- section 2 describes our understanding of the objectives of a price setting mechanism;
- section 3 describes the key considerations for the design of the mechanism; and
- section 4 sets out options for the price setting mechanism and our evaluation of these options.

In the remainder of this section we set out relevant material background relating to the development of a price setting mechanism for distributor-led SAPS.

1.1 SAPS are becoming increasingly viable

SAPS are power systems that are not physically connected to the main interconnected national grid. This includes both power systems which supply electricity to multiple customers, and individual power systems, which supply electricity to a single customer.

The AEMC defines two types of SAPS: (i) distributor-led SAPS, which are standalone power systems that are operated by a distributor and are the focus of this report; and (ii) third party-led SAPS, which are standalone power systems managed by a party other than a distributor.

As a consequence of technological developments, such as falling costs of distributed renewable generation and storage, SAPS are becoming increasingly viable, particular as a means of supplying those customers for whom the costs of continuing to provide a grid connection may be high.[2]

Further, the AEMC observes that distributors are increasingly considering SAPS in suitable circumstances, and that trials of SAPS have not only been economic but in cases have also led to improved customer reliability. The benefits from utilising SAPS are particularly high for distributors in areas where costs of providing a grid connected service are at their highest, eg, in remote areas, areas with high risk of bushfires and areas that are hard to reach. Following this, as the costs associated with SAPS continue to fall, SAPS may present an increasingly viable alternative for distributors when replacing assets.

[1] Later referred to as the *AEMC's report* or *the report*.

[2] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, ii.

1.2 Recommended framework in the AEMC's final report

In response to increasing viability of SAPS power systems, the AEMC released its final Priority 1 report, which sets out its final recommendations for a regulatory framework that allows SAPS to be adopted by distributors in the National Electricity Market (NEM). Notably the AEMC clarifies that this framework is to be used when:

- it is economically efficient to use SAPS; and
- consumer protections are preserved such that they remain comparable to those afforded to customers supplied via the interconnected grid.

When determining the appropriate framework for the deployment of distributor-led SAPS, the AEMC listed the following criteria:[3]

> Do the regulatory arrangements facilitate competition and consumer choice in energy services and products?
>
> Do the regulatory arrangements promote efficient investment and allocation of risks and costs?
>
> Do appropriate consumer protections and compliance mechanisms apply within standalone power systems?
>
> Are the regulatory arrangements clear, consistent and transparent?
>
> Are the regulatory arrangements proportional to the risks they seek to mitigate?

Applying this framework led the AEMC to its preference for a 'NEM consistency (administered settlement price)' approach as a model for service delivery, which aims to minimise disruption to the relationship between retailers and end customers for customers served through SAPS. The model comprises the following key components:

- a SAPS generator is established to provide power to the SAPS and enters into a contract with the distributor to do so;
- an administered price is set which determines the supply cost that electricity retailer must pay for energy produced by the SAPS generator;
- SAPS customers face the same tariffs as other retail customers in the distribution area; and
- retailers are not exposed to wholesale price risk and so do not need to engage in hedging to manage their retail exposure for SAPS customers.

The AEMC left the task of determining an administered settlement price, which is to be set on a regional basis, as a matter for later development.

1.3 Drivers of wholesale electricity supply costs in the NEM

Within the NEM, retail customers pay a price for electricity that reflects the costs for wholesale purchases of energy, use of both distribution and transmission networks, and the operating costs of retailers. The proposed SAPS administered price is a substitute for the wholesale component of electricity supply costs that retailers face in supplying customers.

The wholesale component of electricity supply costs comprises a number of elements, namely:

- wholesale spot purchases;
- hedging costs;

[3] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, p 28.

- ancillary services fees;
- NEM participant fees; and
- losses.

The largest proportion of the costs are attributable to wholesale market purchases and hedging.

Retailers typically enter into hedging contracts when procuring energy from the wholesale market to manage volatile spot market prices and so obtain certainty over wholesale energy costs,. These hedging contracts take a number of forms, eg:

- swap contracts, which involve the trade of a given volume of energy during a fixed period for a fixed price; and
- cap contracts, which involve the trade of a fixed volume of energy for a fixed price when the spot price exceeds a specified price ('exercise price').

Such contracts fix (either partially or entirely) the wholesale price retailers pay for electricity over a given period of time (eg, one or two years). Following this, retailers then fix the retail prices they charge to customers to enable the recovery of total costs (which includes hedging costs).[4]

[4] Noting the retailers still face the risk that they will be over/under hedged.

2. Objectives for a price setting mechanism

In its final Priority 1 report, the AEMC listed numerous objectives that are relevant to the development of a pricing mechanism.

We summarise these key objectives as:

- simplicity;
- incentive for retailers to continue to serve SAPS customers;
- mitigate existing risks for retailers; and
- stability in response to future market changes.

In addition, we consider a fifth objective – the degree to which a price setting mechanism is consistent with 'big stick regulations', ie, retailer tariffs must align with pass through changes in wholesale costs.

We understand that the AEMC is principally seeking to develop a mechanism for setting the administered price that removes any incentive for a retailer to seek to hedge SAPS customer load with NEM generation while also being simple and straightforward to implement.

In the remainder of this section we set out our understanding of these objectives.

2.1 Simplicity

The AEMC's report found that there is overwhelming stakeholder support for a clear and simple framework.[5] This reflects the view that clarity around the price setting mechanism not only promotes ease of understanding, removal of unnecessary risk and increased likelihood of achieving objectives, but promotes confidence in the market which should encourage investment and innovation in providing SAPS based services.[6]

The AEMC describes its objectives relating to clarity in additional detail, suggesting regulation should:

- be transparent and result in predictable outcomes for all participants;
- provide a clear, understandable set of rules to encourage effective participation in the market;
- be understandable to consumers and businesses so as to allow knowledge of what their protections and obligations are, and what others' obligations are, with respect to the transactions they undertake; and
- provide consumers with access to sufficient information to make informed and efficient decisions, especially when attempting to understand whether the SAPS will have long-term implications for the price they pay and the service they receive.

In the context of a pricing mechanism, simplicity also enables reduced cost and burden associated with calculating applicable prices. While simplicity is ideal, in practice a trade-off likely exists between simplicity and the accuracy of the prices that result from the mechanism.

2.2 Incentive for retailers to continue to serve SAPS customers

The AEMC has expressed its preference that SAPS customers are attractive to retailers such that customers that are transitioned to a SAPS have full access to retailers and retail market competition.

[5] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, p 36.

[6] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, p 29.

We understand that the AEMC is concerned that, where retailers do not face appropriate incentives to continue to serve SAPS customers, there may be insufficient retailers willing to serve these customers to promote competitive pricing. It follows that these customers would not receive the full benefits of retail competition. Such benefits include reduced prices and increased choice as, over time, effective competition incentivises innovation, cost minimisation, competitive prices, quality of services and provides customers with a choice of services that may better meet their preferences.[7]

Providing an incentive for retailers to continue to serve SAPS customers requires setting a price that ensures that retailers continue to make a profit from serving these customers. A secondary condition is that providers make profit equivalent to what they would otherwise (ie, from serving customers within the NEM), which ensures that retailers continue to have an incentive to put resource towards competing to serve SAPS participants relative to other customers.

2.3 Mitigate existing risks for retailers

Depending on the design of the pricing regime, retailers who serve SAPS customers may face exposure to price volatility within the spot market associated with SAPS customer load.

To manage risks associated with serving customers, and so to have increased certainty over wholesale energy costs, retailers enter into wholesale hedging contracts. The purpose of such contracts is to fix (either partially or entirely) the wholesale price retailers pay for electricity over a given period of time (eg, one or two years). Following this, retailers then fix their retail prices charged to customers to enable the recovery of their total costs (which includes hedging costs).

If retailers are exposed to such risks for their SAPS customers, retailers may be required to hedge SAPS customers' load with contracts from NEM generators, which may become problematic if, for example, the number of SAPS customers increases substantially.[8] This adverse outcome arises as NEM generators find it increasingly difficult to provide hedging contracts that are sufficient to match total demand, ie, demand for hedges to cover grid and SAPS customer load. Given this, the demand for hedging contracts may exceed the supply of hedging contracts and so increase the expected cost of hedging and decrease overall contract market liquidity.

A retailer may respond to this in numerous ways, eg:

- if it finds it more difficult or costly to hedge its overall load, it may pass price risk through to customers by adjusting retail prices; or
- it may seek to manage its customer portfolios to lower the need for hedging products, which can be done by reducing exposure to identifiable customers with peaky profiles (which may include SAPS customers).

As the consequence of this is likely increased retail prices, it is important to promote the mitigation/removal of retailer exposure to price volatility within the spot market associated with SAPS customer load, that retailers would face in absence of an administered settlement price.

2.4 Stability in response to future market changes

The pricing mechanism selected should reflect the AEMC's preference for consistent regulatory arrangements, ie, the pricing mechanism should be constructed such that is not overly affected by foreseeable changes in market conditions, such as increasing take up of SAPS. This also requires that the pricing mechanism be suitable for a diverse range of SAPS across various locations and customer types.

Applicability into the future is necessary for regulation as it promotes an environment of relative certainty and so encourages investment and market participation.

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[7] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, p 28.

[8] AEMC, *Review of the regulatory frameworks for stand-alone power systems – Priority 1*, Final report, May 2019, p 132.

In circumstances where the pricing mechanism is no longer fit-for-purpose, the AEMC has the option to undertake another rule change process to adjust the mechanism. However, ideally the process would be robust to reasonably foreseeable market changes.

2.5 Consistency with 'big stick regulations'

The recently introduced amendments to the Competition and Consumer Act 2010 under the Treasury Laws Amendment (Prohibited Energy Market Misconduct) Bill 2019, states that a corporation is in breach of the act if:[9]

> the corporation fails to make reasonable adjustments to the price of those [retail price] offers or to the price of those supplies to reflect sustained and substantial reductions in its underlying cost of procuring electricity

If a retailer is found to have engaged in the prohibited conduct described above, then the ACCC has the power to respond in several ways, namely:

- public warning notices;
- infringement notices; or
- prohibited conduct notices.

The Act does not enable the ACCC to issue a contracting order or divestiture order in response to the prohibited conduct.

In light of the above changes to the Competition and Consumer Act 2010, should the transition of customers to a SAPS result in a sustained or substantial reduction in the underlying cost of procuring electricity for a retailer then they may be obliged to pass this saving on to customers. This would give rise to a circumstance whereby retailers can no longer offer the same tariff to customers in a standalone power system where the administered price gives rise to a substantially lower wholesale energy cost and may in turn undermine any incentives that the AEMC seeks to create through the adoption of a conservatively low price for wholesale energy for retailer serving SAPS customers.

[9] Competition and Consumer Act 2010, Part XICA – The Electricity Industry, Section 153E

3. Considerations for the design of a pricing mechanism

In this section, we set out the key design choices relating to a price setting mechanism and the trade-offs inherent in these design choices. We discuss the following key design choices:

- price data sources;
- wholesale price data characteristics, ie:
  - data sample period;
  - price averaging approach; and
  - outlook period and update frequency.
- contract price data characteristics, ie:
  - the development of prices for individual contracts, including weighting;
  - the mix of contracts to be used; and
  - thresholds for liquidity.
- intra-day variation in administered prices;
- further pricing adjustments;
- ex-post adjustments;
- distribution loss factors; and
- practicality.

We do not consider NEM participant fees and ancillary services costs as part of this analysis, consistent with the aim of promoting simplicity in the pricing mechanism. Furthermore, these costs form a relatively low proportion of wholesale costs, ie:[10]

- market participant fees in the NEM are estimated to have been $0.41 per MWh in 2017-18;
- ancillary services costs are estimated to have been between $0.28 and $0.46 per MWh in 2017-18; whilst
- the lowest average NEM wholesale electricity spot market prices were $66.58 per MWh (Victoria) in 2017 and $72.87 $/MWh (Queensland) in 2018.

3.1 Price data sources

We have identified three options regarding sources of underlying price data for use in the price setting mechanism: wholesale price data, contract data or a combined approach which uses both. Both wholesale data and contract data have attractive and unattractive qualities. Table 3.1 provides a summary of the advantages and disadvantages of wholesale market versus contract price data.

[10] EY, *2018 Residential Electricity Price Trends – Wholesale Market Costs* Modelling, December 2018, p 31; AEMO website, see: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#average-price-table.

Table 3.1: Advantages and disadvantages of wholesale price data versus contract data

	Advantages	Disadvantages
Wholesale price data	• Available for all jurisdictions	• Historical and thus is not reflective of future prices or market conditions
Contract data	• Typically, more aligned with the underlying wholesale costs for retailers over the price setting period • Reflective of future prices and market conditions.	• Liquidity or data issues in some jurisdictions, namely South Australia and Tasmania

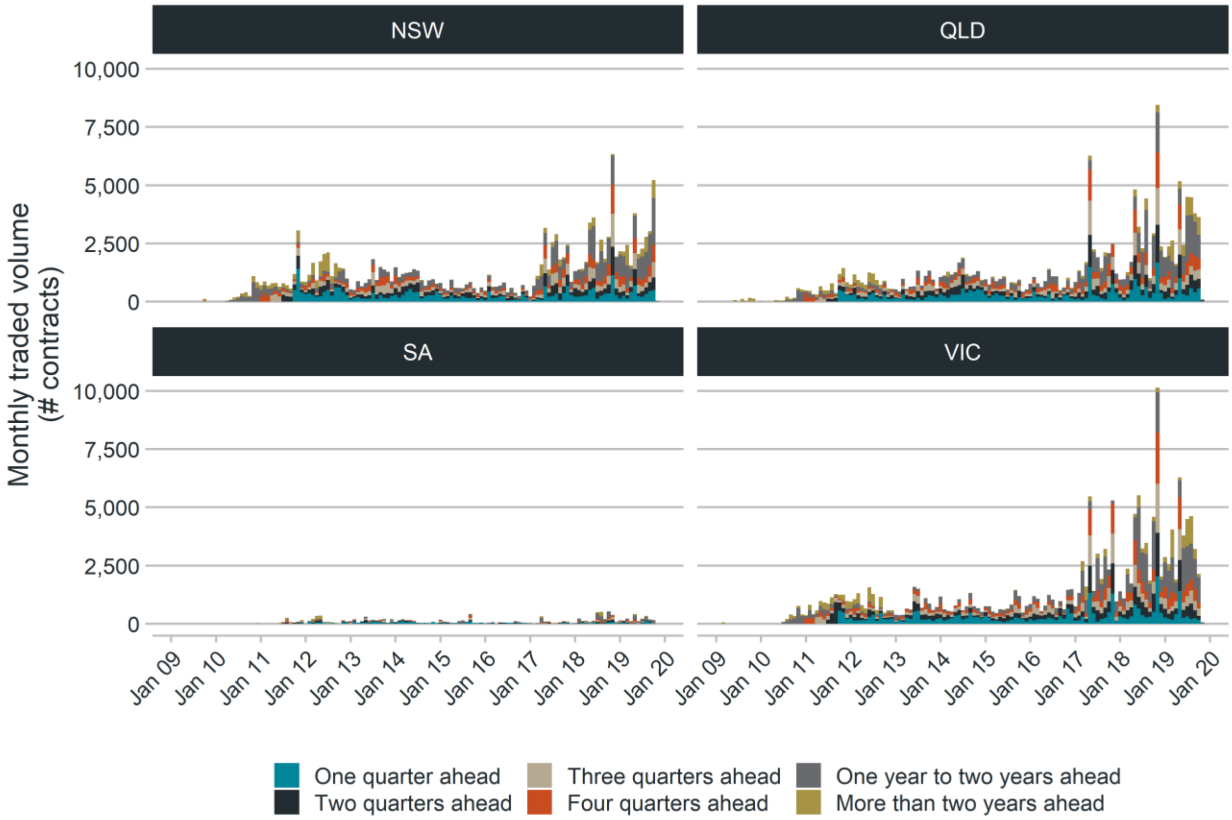
The principal advantage of using wholesale price data is that it is available for all jurisdictions and so can be used without the need to data availability or accuracy.

However, wholesale price data is based on historical market outcomes and so will not reflect changing expectations about future market conditions, and so any future estimated prices will be subject to error. To illustrate this, consider a change to the market such that retailers begin to believe that a generator will close. This will promote an increase in expected future prices and so, as retailer tariff decisions are based on future outlook, will increase retailer tariffs. Notably, this cannot be predicted by historical wholesale price data which does not contain this new information, and so historical data will likely be inaccurate. In addition, this will likely drive a wedge between retail prices within the connected grid (which are forward looking) and prices for SAPS (which are historical), and so may lead to a misalignment between prices.

Contract data, on the other hand, is more aligned with the underlying wholesale cost for retailers as it reflects the cost of hedging which retailers systematically engage in.

Despite this, there are issues associated with the use of contract data, principally related levels of liquidity and data availability. Liquidity issues can arise where there is insufficient supply of and demand for contracts for periods sufficiently far into the future (eg, over half a year away), and so the price of these contracts will be less accurate. This not only applies for periods far into the future but may occur where the contract market is relatively inactive, eg, South Australia. The potential for liquidity issues is highlighted in Figure 3.1 which shows the relatively low trading volumes in South Australia relative to other jurisdictions.

Figure 3.1: Trade volume for base swap contracts by jurisdiction



From the above discussion, we see no clearly superior choice between using wholesale market data, contract data or a combination of the two; as use of both data sets is subject to advantages and disadvantages. In the next two sections we discuss additional considerations specific to the use of these data sources in the price setting mechanism.

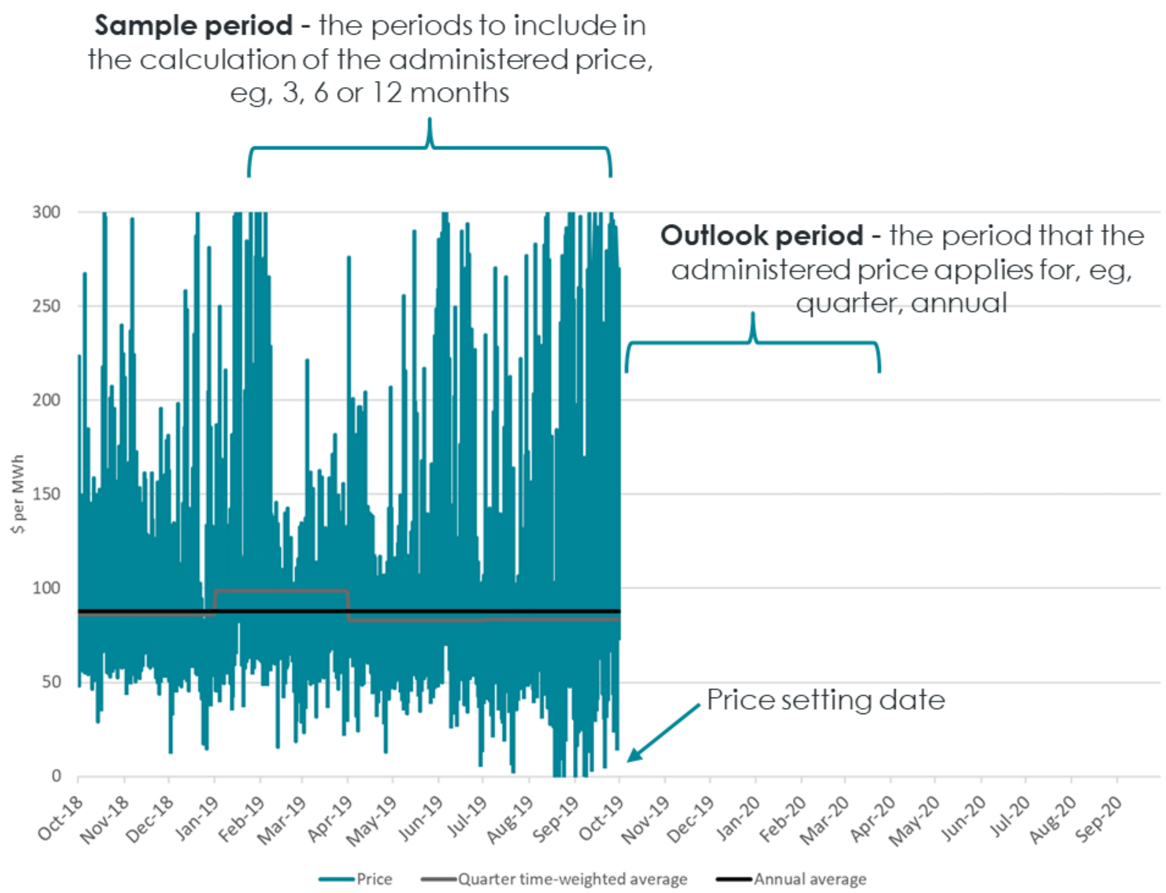
3.2 Setting administered prices using wholesale price data

In this section we outline the key considerations relating to the setting of prices using wholesale price data. In particular, we discuss:

- data sample period
- price averaging approach; and
- outlook period and update frequency.

Figure 3.2 below illustrates the key choices with regards to the use of wholesale market data.

Figure 3.2: Key choices relating to the use of wholesale data



3.2.1 Data sample period

The selected data interval defines the size of the sample to be included when setting prices, ie, it specifies how long into the past pricing data will be drawn from.

The drivers for the choice of data period for wholesale prices principally relate to:

- the degree of smoothing of prices over time, ie, annual prices will smooth out any seasonal component in the data; and
- the accuracy of prices driven by the difference between the period that the price is drawn from and the period for which the price is expected to apply to.

For wholesale prices we consider two approaches, using a year-long interval and using a three-month (quarterly) interval. The key advantages and disadvantages of using annual or quarterly intervals are summarised in Table 3.2 below. We do not consider data intervals of less than a quarter as these would introduce additional risks to retailers and require more frequent updating.

Table 3.2: Advantages and disadvantages of different data sample periods

Sample period	Advantages	Disadvantages
Year	• Smooths out seasonality • Administratively simple	• Less reflective of prevailing market condition due to the use of out of date data

Quarter	• Reduces the risk of discrepancies between wholesale costs and actual costs to the retailer	• Impacted by seasonal trends in the data

Utilising a year-long sample period for wholesale prices is advantageous as it smooths out seasonal trends in the data that may lead to material variations when using data based on shorter timescales, eg, quarterly. However, setting the administered price using wholesale data for a complete year will include price information that is reflective of conditions that were present up to 24 months prior to the end of the period that the administrative price is set for. This in turn increases the risk of misalignment between the administrative price and actual wholesale costs for retailers.

Consequently, using wholesale data from the prior year, without a factor to ensure conservatism or ex-post adjustments, is likely to produce results that are inaccurate and risk prices that are above the wholesale costs for grid-connected customers.

Adopting a sample period of one quarter has an advantage over a sample period of a year as the data will be more reflective of recent market conditions. However, an administered price based on a sample period of a quarter:

- is more susceptible to inaccuracies arising due to seasonality, ie, prices in a summer quarter are not necessarily reflective of prices in an autumn or winter quarter; and
- may lead to variation in quarter on quarter prices that increase the tendency for retailers to seek to hedge their exposure to the wholesale market resulting from their SAPS customers.

The first issue could be addressed via a seasonal adjustment, ie, a modification to the quarterly data collected (or the resultant prices) to be more consistent with the quarter for which prices are being estimated. For example, if spring data is to be used to estimate summer prices, the average difference in spring and summer prices from the previous year could be added to the estimated spring price, thus accounting for average seasonal differences. However, we consider seasonal adjustments to be inconsistent with the simplicity objective and so do not consider further.

The above discussion does not provide a clearly preferred approach, ie, sample periods of both a quarter and a year have advantages and disadvantages. It follows that we consider both approaches in the specification of options in section 4.

3.2.2 Update frequency, price variation period and outlook

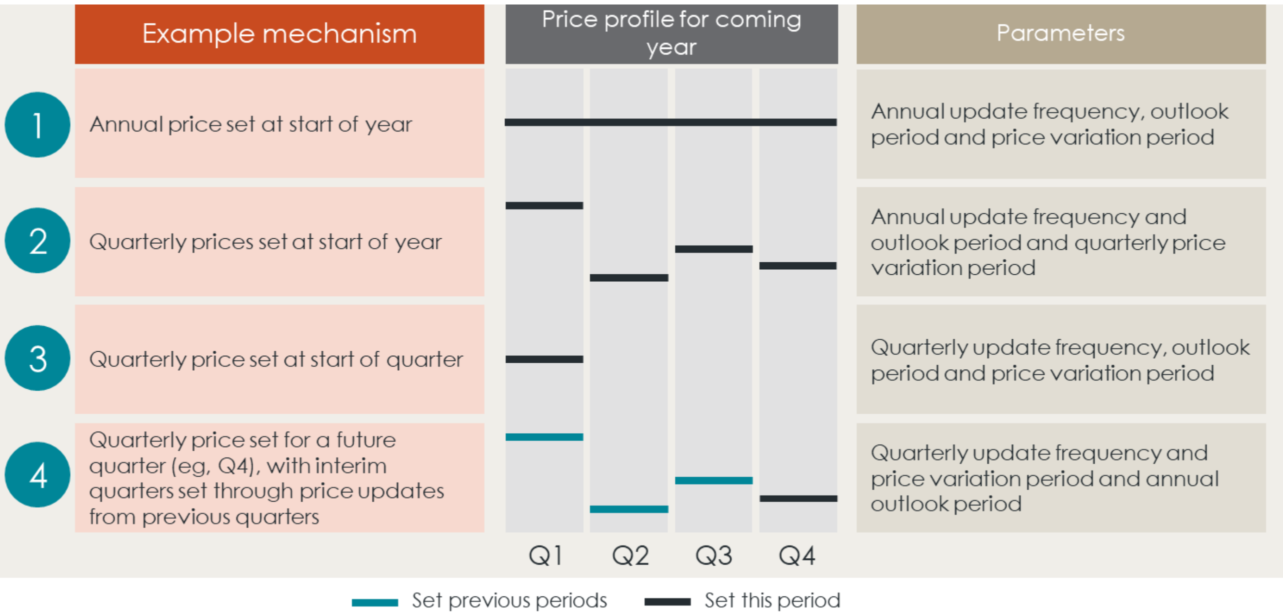
There are three parameters, in addition to data sample period, which determine how prices are set using a pricing mechanism with wholesale prices. These are:

- update frequency – the frequency with which the administered price is revisited;
- outlook period – the length of time into the future the period for which prices are set is; and
- price variation period – the period over which a single price applies – a single update can involve setting multiple different prices for periods in the future.

Figure 3.3 below provides example of potential combinations across these dimensions. In the remainder of this section, we discuss each of the dimensions with reference to the examples provided in the figure below.

Based on the discussion below. we conclude that examples one and three are worth considering in the evaluation of options.

Figure 3.3: Potential combinations of update frequency and outlook period



Update frequency

The update frequency refers to how often the process of setting the price is undertaken. We consider two approaches to update frequency, annual and quarterly. In practice, semi-annual updating is also feasible. We summarise the advantages and disadvantages of annual and quarterly update frequencies in Table 3.2 below.

Table 3.3: Advantages and disadvantages of quarterly and annual update frequency

	Advantages	Disadvantages
Annual update frequency	• More certainty for stakeholders with regards to price • Reduced burden for regulator/responsible body	• Prices that are less reflective of prevailing market conditions
Quarterly update frequency	• More accurate reflection of prevailing market conditions	• Less certainty for stakeholders with regards to price • Increased burden for regulator/responsible body

Updating the administered price on an annual basis (coupled with an annual outlook period) creates additional certainty for retailers and other market participants with regards to the future administrative prices that would be payable. The incremental impact of this additional certainty is a function of the accuracy with which retailers can project wholesale market prices. If retailers are able to produce accurate projections of wholesale prices for the coming year then having the setting prices for a year into the future will not lead to material increase in certainty.

Adoption of an annual update frequency also reduces the resources required by the body responsible for setting the price in that price updates are required less frequently. The exact impact of this more frequent price updating on the resources required for calculating the administered prices may be low where the calculation can be automated by the responsible body.

Updating prices annually, however, will likely result in prices that are less reflective of actual market conditions and so would results in administered prices that are less reflective of the true costs to retailers. Such consideration are most material where sudden changes in the supply-demand balance in the markets, such as the entry or exit of a large generator. The most material risk to the price being conservative, is when, for example, a large new plant enters leading to lower prices.

The above discussion suggests that annual and quarterly update frequency have advantages and disadvantages and that neither approach is clearly preferred. It follows that we consider both approaches in the options evaluated in section 4.

Outlook period

The outlook period is the length of time for which prices are set at any given time. It is related to the update frequency in that the outlook period cannot be for a period shorter than the update frequency. Option four in Figure 3.3 above provides an example where the outlook period is greater than the update frequency. In this case, after prices are initial set for a year in advance, quarterly updates changes prices for the quarter in 9-12 months time.

As was the case with the update frequency, a trade off exists between setting an outlook period that is longer and so provides additional certainty to retailers and other stakeholders with regards to future prices and one that is shorter and so enables the setting of prices that are more responsive to changes in market conditions.

We see limited value in adopting an approach that is similar to example four, where the outlook period and update frequency are not aligned, relative to the simpler cases of option one or three. This is because:

- the administered prices are set based on the information which will not fully reflect the market conditions that will emerge;
- the process introduces additional complexity; and
- the incremental certainty that setting prices into the future provides can also be achieved with a uniform price.

For the above reasons we do not consider this approach in our evaluation of options.

Price variation period

The price variation period specifies the period over which a single price applies. A single update can involve the specification of multiple future prices, eg, setting prices for all four quarters at the start of the year – see example two in Figure 3.3 above. We focus on price variation periods that are aligned with update frequency, as we see limited value in specifying different prices over time, without the benefit of new information.

3.2.3 Price averaging approach

We consider two ways in which wholesale prices can be averaged, ie, averaged across time and averaged using demand weighting. We provide a summary of the key advantages and disadvantages of these approaches in Table 3.4 below.

Table 3.4: Advantages and disadvantages of approaches to price averaging

	Advantages	Disadvantages
Averaged across time	• Simple approach • Tends to be conservative, owing to positive correlation between price and demand.	• Ignores demand and so is less reflective of true costs for retailers
Demand weighted average (wholesale prices)	• More reflective of true costs for retailers	• Requires more data and is more complex than time weighted average.

A time-weighted average involves calculating the average market price by weighting the price in each trading period equally, without regard to demand for that period. This approach is the most computationally simple requiring no data in addition to the underlying price data, and so is both easy to understand and requires relatively little effort to implement. However, the issue inherit with this approach is that it fails to account for demand, which lead to prices that are less reflective of the true costs incurred by retailers.

A demand-weighted average calculates the average market price by weighting the price in each trading period by the level of demand for that period. This method requires the determination of applicable demand profile. Potential approaches include:

- net system load profile (NSLP);
- system operational demand; or
- SAPS-specific demand profile.

The **NSLP** is used as a proxy for the consumption profile of consumers with accumulation meters (as opposed to smart or interval meters) in the market settlement process. The NSLP is separately calculated for each distribution network. The NSLP can then be adjusted by subtracting a profile which reflects controlled load energy[11] – a process which is known as “peel-off”.[12] This adjustment converts all basic meter readings into consumption. The weighting of prices by the NSLP gives rise to administered prices that are more reflective of distribution network demand as it does not include consumption from large, transmission-connected loads. However, the decreasing prevalence of accumulation meters suggests that this method may become less appropriate over time.

Operational demand is the demand that is met by the dispatch of generators in the wholesale market and is estimated for each NEM region. The operational demand profile reflects the total demand on the system in each region. It follows that this demand profile includes transmission connected loads. We see the NSLP as preferable to system operation demand since:

- it excludes transmission connected loads which are less to be reflective of SAPS loads; and
- it is calculated for each distribution network.

An alternative to these options is to utilise distributor submitted **SAPS-specific load profiles**, which will allow for relatively accurate measures of the SAPS profiles and so the true cost to serve the profile of SAPS customers. However, we do no consider the use of SAPS specific load profiles as appropriate in this context owing to:

[11] Controlled load energy refers to load that is controlled by the distributor, eg, the off-peak demand of water heating. https://www.aemc.gov.au/sites/default/files/content//Net-system-load-profile-2012.pdf

[12] AEMO, *Understanding load profiles published from MSATS,* August 2013, available: https://www.aemo.com.au/-/media/Files/PDF/MTMA1772v0055UnderstandingLoadProfilesPublishedfrom-MSATS.pdf.

- substantial increase in complexity associated with the collection and application of numerous different profiles;
- additional administrative burden to have a given SAPS profile specified and verified; and
- issues related to the managed of confidentiality of load profiles;

We do not consider the adoption of SAPS-specific load profiles to be feasible in the context of this price setting mechanism. Of these three options for demand-weighting, we consider the NSLP approach to be the most appropriate.

The above discussion highlights the trade-off between using a time weighted average price relative to a demand-weighted average price. While using time-weighted averages is simple to implement and requires limited data, using demand-weighting should result in estimates that more closely resemble the true electricity supply costs for retailers. We consider both approaches in our evaluation of options in section 4.2.

3.3 Setting administered prices using contract price data

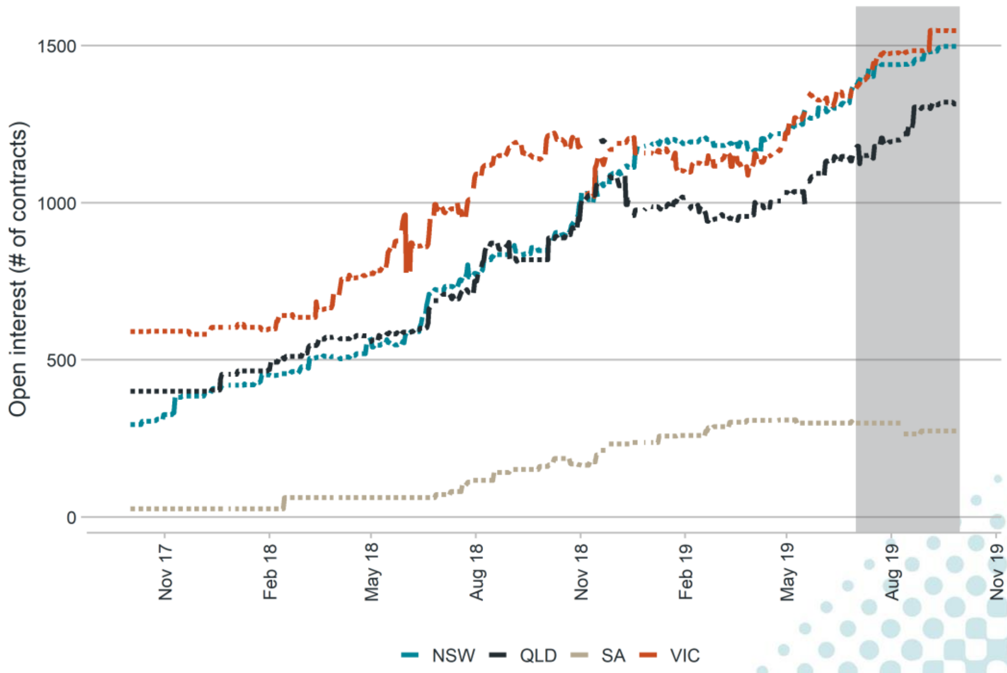
Setting the administered price based on contract price data requires consideration of:

- the development of price for individual contracts, including weighting;
- the mix of contracts to be included; and
- thresholds for liquidity.

The considerations relating to the appropriate choice of data sample period for contracts is fundamentally different to that for wholesale prices. Where wholesale prices reflect prices for different periods over time, contract data for a quarter reflects the price for the same period over time.

It follows that a principal issue relating to contract data is the accuracy or availability of the price for points in time before the period of the contract. Figure 3.2 below shows the level of open interest and trading volumes for flat swap contracts in each jurisdiction for the July – September quarter of 2019.

Figure 3.2: Open interest and trading volumes for base swap contracts for Q3 2019



As the figure illustrates, the volume of trade for a product increases as the contract period approaches. It follows that increasingly long sample periods increasingly draw on price information that is based on lower trading volumes. This diminishes the accuracy of prices and the relevance of the prices for estimating actual costs for retailers. The principal means of addressing this issue is by weighting prices by trading volumes. We consider potential approaches to weighting contract price data below.

3.3.1 Contract data weighting

When considering contract data, prices can either be time-weighted or weighted by trading volume.

Whilst weighting contract price data by time is simple and so can easily be completed, it fails to account for changes in liquidity over time and that the number of contracts purchased at a given price determines how relevant a given price will be in determining retailer costs.

As retailers undertake contracting for a particular period over time, we view it as beneficial to calculate an average price that is weighted by volume of trade. This approach involves calculating an average market price by weighting the price in each trading period by the contracted volume of energy traded for that period. As this method accounts for volume of trade, it is more reflective of the market value of energy.

It follows that, if contract data is used, prices should be weighted by trade volume.

3.3.2 Mix of contracts

A range of different contracts are used by retailers to hedge their load against fluctuations in wholesale electricity price. The most common contracts include:

- base swaps – ie, a contract to trade a fixed quantity (MW) of electricity for a particular price at any time in a day.
- peak swaps – ie, a contract to trade a fixed quantity (MW) of electricity for a particular price during a particular time on a working day.
- $300 caps – ie, a contract that gives the holder the option to buy a particular quantity of electricity at $300/MW (and so will be exercise by the holder if prices exceed $300/MW).

There is variation in the complexity associated with the selection of an appropriate mix of contracts to be used to estimate price. For example, from a highly simplistic approach based on a single contract, eg, a flat swap, to the selection of a portfolio of contracts that attempts to replicate the portfolio that a prudent retailer would construct in reality. The more simplistic approaches are less administratively burdensome and require less judgement in setting, but inevitably will tend to provide a less accurate estimate of the wholesale costs for a retailer.

A number of regulatory bodies throughout the NEM develop estimates of wholesale purchase costs using a portfolio of contracts. For example, the Office and the Tasmanian Economic Regulator (OTTER) in Tasmania and the Independent Competition and Regulatory Commission (ICRC) in the ACT create portfolios which aim to emulate a retailer's hedge. Such approaches involve determining a portfolio of securities that are commonly used to hedge risk within energy markets and selecting appropriate quantities of these. We briefly describe the approaches used in these jurisdictions below.

Tasmanian approach

The approach used by the OTTER requires the calculation of the maximum price for the load-following swap contract for the quarter. This is calculated based on the equivalent cost of adopting a prudent hedge profile to account for load fluctuations where:[13]

[13] OTTER, *Wholesale Contract Regulatory Instrument*, September 2019, pp 7-8, see: https://www.economicregulator.tas.gov.au/Documents/Wholesale%20Contract%20Regulatory%20Instrument%2019%201715.pdf

- baseload swap contracts are purchased – these cover the estimated average load during non-business days within the quarter;
- additional peak period swap contracts are purchased – these cover the estimated average daily maximum load on business days in the quarter;[14] and
- additional baseload $300 cap contracts are purchased – these cover the estimated maximum half-hourly load in the quarter during peak periods.[15]

The cost of adopting this prudent hedge profile is then calculated as the sum of:

- the cost of energy, which is based on the cost of peak period swap contracts to cover average load during peak periods and the cost of off-peak swaps to cover average load during off-peak periods;
- the cost of the additional hedging component, which is based on the extent to which an assumed prudent level of swap contracts exceeds the average load in peak and off-peak periods, and peak and off-peak contract premiums as determined by the OTTER; and
- the cost of the additional baseload $300 cap contracts.

ICRC approach

In its *2018-19 Electricity model and methodology review*,[16] the ICRC constructs a contract position which consists of quarterly base swaps, peak swaps and cap contracts. In line with methods adopted by other regulators, it decided to develop a heuristic which involves running a model over five years of demand data to get an average efficient contract position.[17] This is to be refreshed yearly in line with an additional year of demand data becoming available.

Furthermore, the ICRC applies a 23-month averaging period for the forward price calculation, which it supports with reference to recent regulator reports:

- the ACCC's findings in its retail electricity pricing investigation (2018) that most medium to large retailers hedge for two years;
- the AEMC assumption that large retailers hedge for two years in its residential electricity price trends report; and
- although the ESC Victoria adopted a 12 month forward price averaging period in its 2019 Victorian default market offer draft recommendation, it noted that this does not systematically result in a higher or lower price estimate than using a 24 month average.

Discussion

In the context of developing a price setting mechanism for SAPS, the selection of a single contract based on a flat swap would be both simple and conservative, and so delivers two of the AEMC's key objectives for the mechanism. Such an approach would be conservative as in reality retailers have a variable load profile and so require additional contracts to manage this variability, which attracts higher costs.

More sophisticated approaches would require consideration of the appropriate portfolio to be adopted., including the types of securities and the appropriate quantities for each security type. We consider that such a portfolio should ideally consist of the three principal contracts used by retailers, namely:

- baseload swaps;

[14] This is limited to the extent that it exceeds the baseload swap contracts referred to in (a).

[15] This is limited to the extent that it exceeds the baseload swap contracts and peak swap contracts as referred to in (a) and (b).

[16] ICRC, *Electricity Model and Methodology Review 2018-19*, May 2019, pp 15-17, see: https://www.icrc.act.gov.au/__data/assets/pdf_file/0011/1369190/Report-5-of-2019-Electricity-Model-and-Methodology-Review-Final-Report.pdf pp 15-17.

[17] The heuristic will be developed in the ICRC's next price investigation and will be reviewed in each investigation.

- baseload caps; and
- peak swaps.

Once established, a portfolio can be used to derive weights that can be applied to contract prices.

To prevent contract data from being overtly affected by liquidity issues and so to promote robustness of any price estimate, a lower bound on contract liquidity is required. For example, within Tasmania's framework:[18]

- Hydro Tasmania is required to offer the full range of regulated contract products for eight forward quarters, provided there is more than 100MW of Open Interest in Victorian Baseload Swaps in each particular quarter.
- If the test is not met in a particular quarter, Hydro Tasmania will not be required to offer regulated contracts in that quarter until the Test is met.

Determining the correct bound on contract liquidity is an important trade-off between ensuring data used is robust, whilst not removing too much data and so having insufficient data to calculate meaningful prices. An additional complication is that, due to different levels of trading between NEM regions, it may be appropriate to apply different levels of liquidity in establishing prices between regions. We do not consider the complexity inherent in such a consideration as justified in the context of the SAPS pricing mechanism.

If liquidity limits are not satisfied, then an alternative specification of the estimate of the wholesale costs is required. This will typically involve reverting back to a wholesale price-based method. We consider the implications of this approach in our discussion of options in section 4 below.

3.4 Inclusion of intra-day pricing periods as part of SAPS administered prices

Intra-day variation in the administered price refers to whether the SAPS pricing mechanism comprises a single price across the day or week or multiple prices that apply across different periods to capture the underlying changes in the cost of energy over these periods.

We summarise the advantages and disadvantages of applying a single price and an off peak / peak pricing system in the table below.

Table 3.5: Advantages and disadvantages of options for intra-day pricing periods

	Advantages	Disadvantages
Single price	• Less complex • Consistent with NEM administered price model and minimisation of the need for retailers to hedge the load.	• Less reflective of the costs for retailers of providing electricity supply
Off peak and peak pricing	• Reflects that prices vary in high/low demand periods	• Reduces simplicity of approach.

A single price promotes both certainty and simplicity within the pricing mechanism. Whilst adding peak and off-peak pricing allows for movements in line with demand and is likely to be more cost reflective, we do not consider that multiple periods are appropriate for adoption in the context of the SAPS price setting mechanism. In particular, it:

[18] The '100MW Open Interest Liquidity Test' recognises that there may be times when the published Victorian contract market prices used in the pricing methodology are not sufficiently robust due to limited liquidity in the trading of that price. OTTER, *Regulation of Hydro Tasmania's wholesale electricity contracts in Tasmania,* Framework Guide, August 2013, pp 5-6 & 11, available: https://www.economicregulator.tas.gov.au/Documents/Wholesale%20Instrument%20Framework%20August%202013.pdf.

- reduces simplicity; and
- creates an incentive for retailers to seek to hedge their exposure to these prices through activity in NEM contract markets.

It follows that we do not consider any options in our evaluation in section 4 that adopt multiple intra-day prices.

3.5 Application of further adjustments to the wholesale cost estimate

Further adjustments to the estimate of the wholesale costs may be required to:

- ensure a conservative approach by discounting the price to reduce the risks of administered prices being above retailer's actual costs; or
- to incorporate retailer's costs that are not factored into the pricing data, eg, costs associated with exposure to wholesale price for portion of load unhedged under contract and so exposed to quantity risk.

The issue with making further adjustments is that these require discretion, eg, a factor to incorporate impacts of the shape of the demand profile may require implementation through the AER rather than AEMO – see discussion of practicality below.

There are numerous forms of further adjustments that can be made, these are discussed below.

3.5.1 Inflation of wholesale price to reflect hedging costs

Wholesale prices may be adjusted to reflect hedging costs. In this section, we set out the rationale for this approach and how it has been used in other jurisdictions.

The ACT's ICRC accounts for the cost of hedging using an uplift factor.[19] The quarterly uplift factor is applied to the quarterly wholesale cost of energy (forward price) and is calculated using load shape, load ratio and forward price margin. The ICRC estimates the uplift factor on wholesale energy purchase cost for 2019-20 to be between 1.15 (Q3) and 1.28 (Q1), which reflects an increase in price associated with hedging costs (which is driven by changes in load shape/ load ratio, rather than the forward price margin, which is fixed at 5 per cent) of between 15 and 28 per cent each quarter.[20]

The Grattan Institute[21] conducted a literature review of prior calculations of hedging costs, nothing that these are difficult to estimate and that retailers do not tend to think about their energy costs as the sum of spot wholesale market cost and hedging cost. Its literature review is summarised in Table 3.6 below.

Table 3.6: Summary of estimates of the hedge premium

Firm	Note
Frontier Economics (2014) Frontier Economics (2015) for the AEMC's 2015 price trends report	For the 2015 report, Frontier estimated costs of around $45 per megawatt hour, reflecting a $14 increase relative to the time-weighted average spot price of $31 per megawatt hour ($2015-16). For the 2014 report, Frontier estimated costs of around $66 per megawatt hour reflecting a $15 increase relative to the time-weighted average spot price of $51 per megawatt hour.
NERA (2013)	For the AEMC's 2013 price trends report, NERA purchase costs to be around $65 per megawatt hour, reflecting an $8 increase relative to the time-weighted average spot price of $57 per megawatt hour (ie, for the 2012-13 period) estimated
ACIL Allen (2016):	For the QCA's 2016-17 price determination, ACIL Allen's simulated hedged electricity prices were $15 (on

[19] ICRC, *Retail electricity price recalibration 2019-20*, Final decision, June 2019, p 19, available: https://www.icrc.act.gov.au/__data/assets/pdf_file/0003/1372773/Report-6-of-2019-Electricity-Price-Reset-2019-20.pdf.

[20] ICRC, *Retail electricity price recalibration 2019-20*, Final decision, June 2019, p 24, available: https://www.icrc.act.gov.au/__data/assets/pdf_file/0003/1372773/Report-6-of-2019-Electricity-Price-Reset-2019-20.pdf.

[21] Grattan Institute, *Price Shock – Is the retail electricity market failing consumers?* March 2017, p 36, available: https://grattan.edu.au/wp-content/uploads/2017/03/Price-shock-is-the-retail-market-failing-consumers.pdf.

	average) higher than simulated time-weighted average prices.
CME (2016)	Using a 'premium approach', CME estimated hedged wholesale costs using an uplift of $10 per megawatt hour in compensation of arrangement, hedging, regulatory and other costs.

Source: Grattan Institute, Price Shock – Is the retail electricity market failing consumers? March 2017, p 36.

In its 2018 Residential Electricity Price Trends report, the AEMC discusses a previously applied method of calculating wholesale costs which uses forecast spot market outcomes and applies a contract premium for managing risk. It considered that:[22]

> it became apparent in the past two years, that with high volatility in forward prices after generator retirements, that short-term estimates made through this method were becoming inconsistent with market outcomes.

This led the AEMC to consider a blended method which, where possible, uses observable market contract prices that retailers use to build up their hedge contract book over time and only uses a forecast of spot market outcomes and a contract premium when there is limited forward contract data available.

Returning to the ICRC's pricing methodology, we note its comments that:[23]

- there is evidence that its model, which applies a 23-month averaging period in calculating forward prices, reflects the energy purchasing practices of a prudent retailer; and
- with references to the Australian Competition and Consumer Commission (ACCC)'s 2018 report of its retail electricity pricing investigation, the majority of retailers hedge for two years whilst few hedge on a short-term basis (eg, from month to month or quarter to quarter) or operate with no hedging in place.

3.6 Ex-post adjustments

In the context of SAPS, ex-post adjustments are payments made to the retailer which ensure that quarterly administered prices do not exceed the retailer's actual wholesale costs.

Through the application of ex-post adjustments, issues relating to retailers facing inadequate incentive to serve SAPS customers are mitigated, ie, this ensures that the costs faced by retailers in serving SAPS customers are at least as low as the actual costs that retailers face in serving their existing non-SAPS customers.

Inherit in the provision of an ex-post adjustment is the need to identify which customers have been served by a particular retailer over a given period of time, which becomes difficult when customers change retailers. The disadvantage of the use of an ex-post adjustment is thus that there is an increased regulatory burden.

3.7 Distribution loss factors

Under the wholesale market settlement process, the price that retailers pay for wholesale electricity is adjusted by the distribution loss factor applicable for each distribution network. The distribution loss factor is a measure of the extent of losses attributable to the transfer of electricity on a distribution network between a distribution network connection point, a transmission connection point, or a virtual transmission node.

A conservative approach to the setting of prices for SAPS would be to assume that a distribution loss factor of 1 applies to SAPS customers. This would also alleviate difficulties associated with determining and reassessing distribution loss factors.

[22] AEMC, *2018 Residential electricity price trends* review, December 2018, pp viii-ix, available: https://www.aemc.gov.au/sites/default/files/2018-12/2018%20Price%20Trends%20-%20Final%20Report%20-%20CLEAN.PDF.

[23] ICRC, *Retail electricity price recalibration 2018-19*, Technical paper, February 2019, p 5, available: https://www.icrc.act.gov.au/__data/assets/pdf_file/0010/1349605/Report-1-of-2019-Technical-Paper-Electricity-Model-and-Methodology-Review-201819.pdf p 5.

Table 3.7 below contains estimates of the distribution loss factors for the 2019/20 financial year for each distribution network.

Table 3.7: Example distribution loss factors for 2019/20

Distribution network	Region	DLF – Low voltage	DLF – Subtransmission
Energex	QLD	1.05592	1.00463
Jemena	VIC	1.0513	1.0043
CitiPower	VIC	1.0474	1.0042
Powercor	VIC	1.0996	1.0039
AusNet Services	VIC	1.0752	1.0018
United Energy	VIC	1.0714	1.0040
Endeavour Energy	NSW	1.0628	1.0022
Essential Energy	NSW	1.0691	1.0099
Ausgrid	NSW	1.05	1.0048
SA Power Network	SA	1.101	1.0220
TasNetworks	TAS	1.394	1.0046

Source: AEMO, Distribution loss factors for the 2019/20 financial year, 2019, available: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Loss_Factors_and_Regional_Boundaries/2019/Distribution-Loss-Factors-for-the-2019-20-Financial-Year.pdf

3.8 Practicality

In implementing any SAPS pricing mechanism there are additional practical considerations that must be taken into account. These principally relate to:

- the appropriate market body that would be responsible for setting the price; and
- the length of time taken to calculate the administrative price and the impact that this may have on the mechanism.

We discuss these points below.

3.8.1 The appropriate market body for implementation

SAPS pricing is likely to be determined by either AEMO or the AER, depending on the level of discretion required in determining the prices.

If the pricing calculation is mechanistic, AEMO is likely well placed to set prices. However, as the complexity and requirement for discretion within pricing decisions increases, the AER will become better suited to determining prices, consistent with its role as economic regulator.

The advantage of AEMO calculating prices aligns with those of having a simple calculation, ie, the process would be both more transparent and swifter. Yet, by allowing the AER to exercise discretion to make the pricing decision, it may be more accurate. Furthermore, if the AER were to calculate prices, it would be done through a regulatory process, which would subject SAPS prices to greater scrutiny.

3.8.2 Time requirements to implement the administrative price

The second practical consideration relates to the lag between obtaining data, calculating measures and finally, publishing an updated price.

Based on our understanding of the AEMO settlement process, the calculation of the price for SAPS customers could be updated in a straightforward manner where it is a formulaic calculation based on wholesale prices. It follows that, in such circumstances, prices from the previous quarter could be fed into the administered price for the next quarter.

We consider it likely that an administered price which uses forward price information would similarly require limited time to calculate once information becomes available and assuming that discretion is not applied. Some further resources may be required to verify the use of the contract price information relative to wholesale prices that are already managed by AEMO.

Where some discretion is applied (eg, for options requiring the application of discretion by the AER), such a process will impact the timing of the determination of the administered price and the price information that can be used in developing the price estimate. In particular, there would likely be a delay between when the price information is available and when it is able to inform the administered price, which is the consequence of the AER having to follow regulatory process to set prices.

4. Evaluation of options

In this section we consider possible pricing mechanisms, first determining a list of possible options (either broad or specific) and second, determining which approach would be likely to be best considering the previously listed criteria. All options involve price setting on a regional basis.

4.1 Description of options

The options considered reflect the discussion in section 3, ie, we have removed options which we consider likely to be less appropriate and have retained those that merit a more detailed consideration of the trade-offs involved in their adoption. The options we have considered are:

- **Option 1A: Simple wholesale price with annual update frequency** – an approach that uses a simple calculation based on historical wholesale prices and is updated annually, with adjustments to ensure a conservative estimate;
- **Option 1B: Simple wholesale price with quarterly update frequency** – an approach that uses a simple calculation based on historical wholesale prices and is updated quarterly, with adjustments to ensure a conservative estimate;
- **Option 2 – Sophisticated wholesale price** – a more sophisticated approach that seeks to more accurately capture the costs of wholesale energy based on past wholesale prices and ex-post adjustments;
- **Option 3 – Base swap contract** – a contract-based approach that uses trade-weighted base swap contract prices to produce a conservative estimate which incorporates market expectations regarding future price; and
- **Option 4 – Sophisticated hedge approach** – a more sophisticated contract-based approach that seeks to accurately replicate the costs of a retailer through an approximation of a retailer's prudent hedging approach.

Table 4.1 sets out the key design features for each of the above options. For all of the options, we also assume:

- a distribution loss factor of one – to adopt the most conservative estimate of losses and avoid issues relating to charging different customer groups different administrative prices based on network connection level; and
- that other fees associated with participation in the NEM are excluded from the calculation (ie, ancillary services costs and NEM participant fees).

We apply a conservative adjustment to mitigate the risk that the administered price leads to case where the administered price is greater than the wholesale costs that a retailer would incur in reality. To determine an appropriate adjustment to ensure conservative estimate we have conducted an analysis of variation in historical quarterly averaged wholesale prices. Our analysis indicates that an adjustment of approximately 0.8 is appropriate for Options 1A and 1B since:

- based on a moving annual of prices, the quarterly reduction in prices exceeds 20 per cent on two occasions since 2012;[24] and
- based on calendar-year annual average prices the reduction in annual average prices exceeds 20 percent on two occasions since 2012, aside from periods associated with the end of the carbon price.[25]

[24] in Queensland in response to the Queensland government's directive to state-owned generators to adjust their bidding and in Victoria as a result in reduction in prices between the Jan-March quarters of 2016 and 2017

[25] These periods are associated with the Queensland government directive to state-owned generators above in Tasmania between 2017 and 2018.

Table 4.1: Summary of SAPS pricing mechanism options

Option	Primary price data source	Price calculation	Update frequency and outlook	Adjustments	Other features	Responsible body
Option 1A: Simple wholesale price – annual update frequency and annual outlook period	Wholesale prices	Annual sample period Time-weighted prices	Annual update frequency and outlook	Conservative adjustment of 0.8 to mitigate the risk that period-on-period changes lead to the administered price exceeding retailer's actual costs.	None	AEMO
Option 1B: Simple wholesale price – quarterly update frequency and annual outlook period	Wholesale price	Annual sample period Time weighted prices	Quarterly update frequency and outlook	Conservative adjustment of 0.8 to mitigate the risk that period-on-period changes lead to the administered price exceeding retailer's actual costs.	None	AEMO
Option 2: Sophisticated wholesale price	Wholesale prices	Annual sample period Demand-weighted prices (weighted by the Net System Load Profile)	Annual update frequency and outlook period	Adjust for hedge premium with 10 per cent factor. Ex-post adjustment to ensure quarterly administered prices do not exceed retailer's actual wholesale costs.	Hedge premium set as fixed value and updated through rule change process.	AEMO
Option 3: Base swap contract	Contract prices	Trade-volume weighted price for base swap contract using available data up to a maximum of 23 month period to contract date Estimate the price of the contracts which expire in each quarter of the coming year Average the quarterly contract estimates to get an estimate of annual price	Annually	None	No threshold for contract liquidity and uses the Victoria contract price for Tasmania SAPS.	AEMO
Option 4: Sophisticated hedge approach	Contract data with fallback to wholesale price data	Estimate full supply costs adjusting for load shape Similar to ICRC retail price regulation methodology for 2017-2020	Quarterly	Adjust calculated values by a factor of 0.8 to ensure conservative approach	Revert to wholesale cost estimate, based on Option 1 if liquidity threshold is not met Composition of prudent hedge portfolio determined by AER through determination process.	AER, with discretion to update composition of prudent hedge portfolio

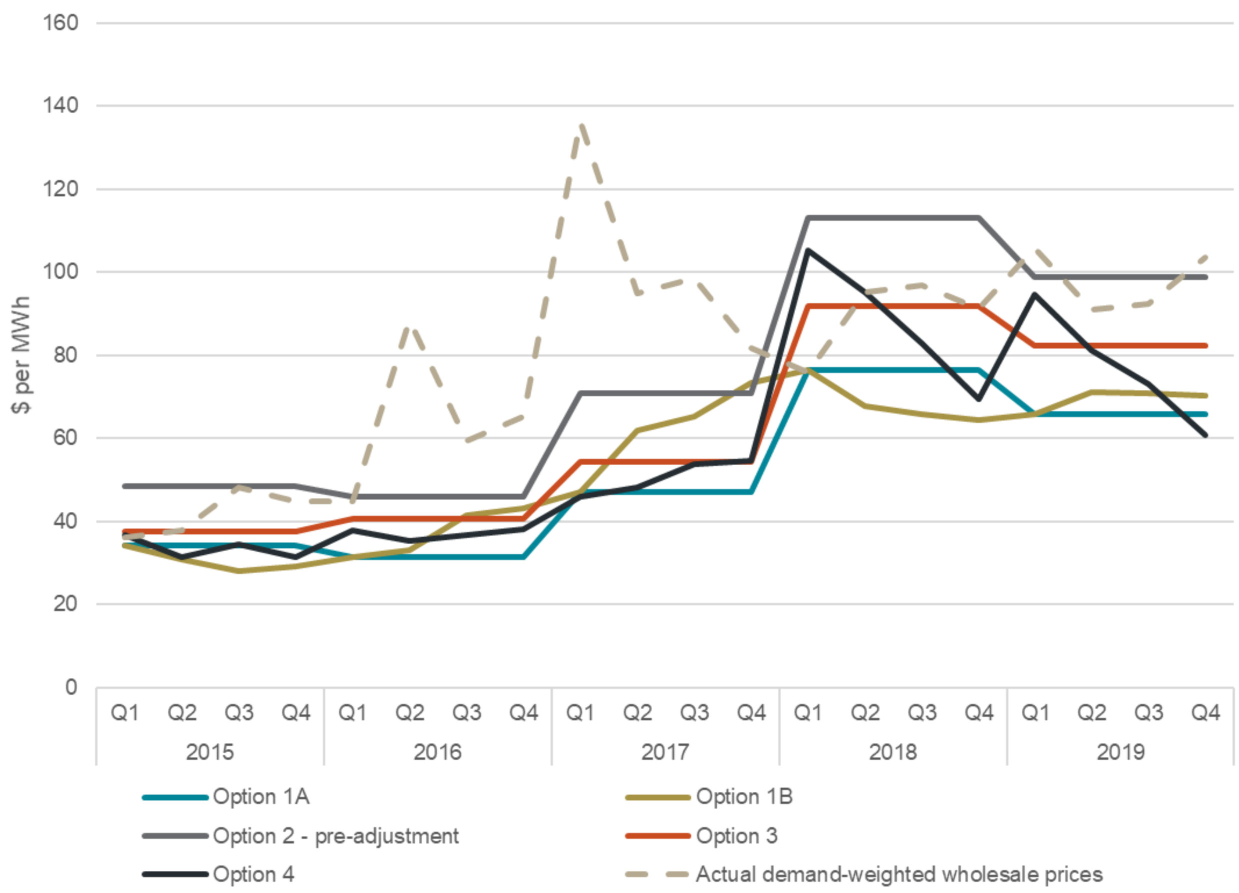
4.2 Evaluation of options

We have evaluated each of the four options in terms of its ability to fulfil the objectives described in section 2. We have placed emphasis on a simple price setting mechanisms which completely removes any incentive for a retailer to seek to hedge SAPS customer load with NEM generation, ie, one which achieves the “simplicity” objective, and the “mitigate existing risks to retailers” objective.

A summary of the results of the evaluation is provided in Table 4.2.

Figure 4.1 below provides a comparison of the estimates that would have applied historically under each of the options considered. We have produced these estimates based on the descriptions in Table 4.1. For Option 2, we present the results before any ex-post adjustments are applied. After the adjustment, the prices would reflect the estimate of the actual wholesale prices also presented in the chart.

Figure 4.1: Comparison of prices calculated under the four options for NSW



The above analysis indicates that the most conservative option is likely to be either variation of Option 1, principally as a result of the conservative adjustment factor of 0.8, as discussed in the previous section. This is followed by Option 3, where the use of the base swap contract leads to a systematic underestimation of the electricity supply costs.

Option 4 leads to somewhat conservative estimates, again principally driven by the conservative adjustment factor of 0.8. This approach is less conservative in cases as it aims to reflect the actual supply costs in a more accurate manner. As is the case with Option 2, to prevent the administered price from exceeding the actual supply costs, additional complexity is required, ie, ex-post adjustments.

The options that utilise wholesale price information tend to produce lower estimates (noting that Option 2 is depicted as pre-adjustment) of the price over the period of substantial increases through 2015 and 2016. This is driven by the lag inherent in using historical wholesale price information.

Table 4.2 below summaries our evaluation of the options across each of the objectives set out in section 2.

Each of the options has strengths and weakness with regards to their performance. Given the objectives that the AEMC have expressed, the principal selection criteria are that a mechanism is both simple and mitigates existing risks for retailers. If accuracy is less of a concern and simplicity is paramount, then we consider that Option 1 is the most appropriate option. We find that Option 1A is likely to be the approach that best achieves the objectives of the AEMC with Option 1B being a potential viable alternative if capturing prevailing market conditions is deemed to be an important consideration relatively to the simplicity of the mechanism.

Option 3 involves additional complexity relative to the Option 1 variants, owing to the use of contract data, but this additional complexity means a more straightforward process for developing administered prices that are reflective of future system conditions and so more likely to be reflective of retailer's actual costs. However, this option comes with a substantial risk of poor performance in Tasmania and South Australia. No contract market exists in Tasmania and liquidity is an issue in the contract market in South Australia. We propose the use of the Victorian price as a proxy for the base swap contract price in Tasmania, which is a rough proxy for the price that will likely emerge in Tasmania.

Option 2 involves additional complexity due to the need for ex-post adjustments but avoids liquidity and complexity issues relating to the use of contract data. The viability of this option ultimately hinges upon the AEMC's view of ex-post adjustments and the challenges that such an approach would present in practical terms. Such adjustments are required to mitigate the impact of seasonal trends on the performance of the pricing mechanism.

We view the application of a sophisticated contract-based approach such as Option 4 as presenting an additional administrative burden that is not justified in the context of the SAPS pricing mechanism. While this approach is most likely to lead to the most accurate estimate of the true wholesale costs for a retailer, the degree of precision inherent in this approach is not required in this instance. In addition, this approach would require updating and revisions over time to reflect changes in the underlying load profiles.

Table 4.2: Evaluation of options

Objective	Option 1A	Option 1B	Option 2	Option 3	Option 4
Simplicity and low administrative burden	Simple approach that is likely to lead to minimal additional administrative burden.	Simple approach that is likely to lead to minimal additional administrative burden.	More sophisticated approach that would require additional resources to implement and may be less transparent to some stakeholders.	Simple approach that is likely to lead to minimal additional administrative burden.	Complexity of method and requirements for AER discretion mean this option leads to additional administrative burden.
Incentive for retailers to serve SAPS customers	With an appropriately set conservative adjustment factor, retailers will continue to have a strong incentive to serve SAPS customers.	With an appropriately set conservative adjustment factor, retailers will continue to have a strong incentive to serve SAPS customers.	Incentives to serve retail customers maintained through ex-post adjustments	The conservatively low price implicit in the use of the base swap contract means retailers will likely maintain a strong incentive to serve SAPS customers.	Adjustment factor used to ensure that there is incentive to serve retail customers.
Mitigation of existing risks to retailers	Limited incentive for retailers to seek out hedging for SAPS load, owing to annual sample for wholesale price calculation.	Limited incentive for retailers to seek out hedging for SAPS load, owing to annual sample for wholesale price calculation	Greater incentive for retailers to seek out hedging for SAPS load owing to quarterly sample of update period for wholesale price calculations.	Limited incentive for retailers to seek out hedging for SAPS load, due to annual price setting outlook period and use of contract information which is more aligned with cost	Greater incentive for retailers to seek out hedging for SAPS load owing to quarterly update period.
Stability in response to future market changes	Time weighting encourages consistent applicability regardless of market changes.	Time weighting encourages consistent applicability regardless of market changes.	The demand weighted approach selected may become less applicable as uptake of smart meters increases.	Lack of liquidity floor means diminishing liquidty will risk the reliability of estimates.	Discretion allows modification in response to market changes.
Consistency with big stick regulations	Risk that a conservative adjustment may introduce issues relating to wholesale prices for SAPS being lower than retail tariffs charged to customers.	Risk that a conservative adjustment may introduce issues relating to wholesale prices for SAPS being lower than retail tariffs charged to customers.	Consistency with big stick regulations managed through adjustments.	Risk that adopting contract price that is systematically lower than retailer supply costs may introduce issues relating to wholesale prices for SAPS being lower than retail tariffs charged to customers.	Consistency with big stick regulations broadly expected due to more sophisticated approach to future looking supply costs but adjustment factor undermines this objective.

A1. Detailed description of price calculation under Option 1A

Within the main report, we consider a range of options that may be implemented by the AEMC. We consider that Option 1A is most likely to be the option that is most consistent with the AEMC's principal objectives (simplicity and mitigation of risk to retailers). As follows, we provide details as to how administered prices are determined under this option.

To summarise the prior description, this option calculates the administered settlement price using wholesale prices and:

- a time weighted average;
- an annual outlook period;
- an annual update frequency;
- the prior year of data; and
- a conservative adjustment factor of 0.8.

As such, this option calculates the administered settlement price (ASP) for the coming year using a time weighed average of last year's prices within each region. This approach calculates the set of prices for the year at its beginning, eg, if the year starts on January 1, the calculation of prices for the coming year will be made on January 1 (or within AEMO's settlement period). Noting that a fast turnaround is enabled by the simplicity of this calculation method.

The administered settlement price is calculated as follows, for year i and region r:

$$ASP_{i,r} = 0.8 \times Year\ Average_{i-1,r}$$

Where the year average for year i-1 and region r is calculated as follows:

$$Year\ Average_{i-1,r} = \frac{\sum_{p=a_{i-1}}^{b_{i-1}} RRP_{i-1,r,p}}{N_{i-1}}$$

Where:

- p is the period for which wholesale prices are set, eg, 30-minute trading interval;
- a is the first period within year i-1;
- b in the final period within year i-1;
- RRP is the regional reference price for period p; and
- N is the total number of periods within year i-1.

HOUSTONKEMP
Economists

Sydney
Level 40
161 Castlereagh Street
Sydney NSW 2000

Phone: +61 2 8880 4800

Singapore
8 Marina View
#15-10 Asia Square Tower 1
Singapore 018960

Phone: +65 6817 5010

HoustonKemp.com