Improving Western Australia’s Reserve Capacity Market: Steps and thoughts to Date
WA’s Wholesale Electricity Market (WEM) – in the SWIS

The WEM is the electricity market in WA’s Southwest Interconnected System (SWIS)
The WEM is the smallest competitive wholesale market in Asia

**Capacity** (MW)

- SG (NEMS)
- WA (SWIS)
- PH (WESM)
- New Zealand
- EA (NEM)
- South Korea

**Capacity is defined as installed capacity, except for WA (defined as registered capacity) and New Zealand (defined as operating capacity).**
The WEM is unusually peaky and volatile

**Load Duration Curve**

EO markets, actual or proposed

Each Half Hour of a Year Ranked by Level of Load

**TYPE OF MARKET**

“EO” Energy-Only

“E+C” Energy plus Capacity

EO

EO

EO

E+C

EO

E+C

See Note

South Korea

Note: Korea was intended to be an EO market, but reforms stopped following a change in government. Transitional E+C arrangements have been in place since 2002.
WA demand growth is lumpy, volatile, and uncertain

The RCM must be fairly dynamic to adjust appropriately to ever changing supply and demand circumstances.

- Reserve capacity requirement is estimated as the sum of forecast peak demand (10% PoE) and reserve margin.

Variation in Peak Load Forecast for (Just) Six Loads

Normalised difference in forecast demand scenarios
The RCM is the process and mechanism to support new capacity investment

- RCM is a price-based mechanism
  - The number of potential capacity credits is not fixed
  - There can be too many or too few
  - The price must adjust accordingly to signal “more” or “less”

- If too many CCs, the price (RCP) falls; if too few, the RCP rises (or backstop mechanisms kick in to support more capacity development)
  - The basis and extent of these adjustments are key

- The baseline RCP price is linked to the estimated cost of new capacity (a 160 MW OCGT peaker) –
  - Assuring that the price can be high enough to support investment if needed

- If the RCP stays above the cost of new entry even when sufficient capacity exists, then investors will be tempted to build capacity that is not needed (and customers may have to pay for it)
For several years growth in certified capacity out-paced the growing reserve capacity requirement – which has since fallen.
The extent of excess reserve capacity grew for many possible reasons

- The capacity price (RCP) may have exceeded the cost of new entry
- Special tenders as part of the market development and transition
- Government policies that influence local generation and demand-response
  - mandatory renewables
  - rooftop solar
  - demand-side-management
  - energy efficiency
- Changes in macroeconomic factors (delays in new demand)
- Changes in forecasting factors (recalibrating forecasts to reflect new demand behaviours)
- Changes in the cost of new entrant

The RCM itself is only part of the overall picture
A poorly calibrated RCP with a shallow “slope” adjustment → large swings in investment

When MRPC is set too high

When MRPC is set too low

Result = Excess!

Result = Shortage!

RCP formula with steeper slope could limit the excess

RCP formula with steeper slope could limit the shortage

Base RCP too high

Base RCP too low

“RCP Price” (Set by current formula)

Target Quantity (Reserve Capacity Requirement)

Cost of new capacity (Supply curve)
A prudent RCM would incentivise retailers to contract for capacity credits as shortage risk increases – but the current RCM does the opposite!

**Graph 1:**
- **X-axis:** % of Excess Capacity
- **Y-axis:** Total Cost to Retailers (Millions AUD)
- **Legend:**
  - 0% Contracted
  - 100% Contracted
- **Observation:**
  - Higher contract level → Higher cost

**Graph 2:**
- **X-axis:** % of Bilateral Contract Cover
- **Y-axis:** Standard Deviation/Volatility of Total Cost under Different % of Excess Capacity (Millions AUD)
- **Observation:**
  - Higher contract level → Higher Risk
The RCM is one of several valid capacity remuneration structures.

How should capacity markets work?

Two different approaches – each can work; Neither is perfect.

- Avoid the low price cap
- Avoid the premature intervention
- Backstop arrangements?

Set Quantity
Run auction to procure (thus determining price)

PJM (Eastern America)

Set Price
Market responds (thus determining quantity)

Australian WEM (Western Australia)

Capacity Remuneration

Embedded in Energy-Only Market

Separated Capacity Mechanism

Australian NEM
New Zealand
Philippine WESM
Singapore

Australian WEM (Western Australia)

Capacity Remuneration

Embedded in Energy-Only Market

Separated Capacity Mechanism

How should capacity markets work?

Two different approaches – each can work; Neither is perfect

The Lantau Group
All capacity markets face the “zero/infinity” value problem of how to use short-term signals to deal with potential shortage or excess of \textit{long-term} capacity.

\textbf{Zero / Infinity Problem}

- A small shortage of capacity relative to a target can produce a very high capacity price if there is not enough time for the market to respond.
- A small excess of capacity can produce a near zero price for similar reasons.

\begin{itemize}
  \item[(1)] \textbf{Quantity-based markets}
  \begin{enumerate}
    \item Use administered demand curves and rely on auctions involving forward price discovery and rolling requirements.
    \item “X” years out must hold “Y” percent of “Z” targeted capacity requirement.
    \item Administered demand curve: must buy more when the price is lower / buy less when price is higher.
  \end{enumerate}

  \item[(2)] \textbf{Price-based markets}
  \begin{enumerate}
    \item Use administered price curves and rely on calibration to ensure that prices adjust sufficiently to “start” or “stop” investment as appropriate.
    \item Price adjusts formulaically as the amount of “excess” capacity varies – mitigating disruptive value swings due to combinations of external (demand growth rate variation) and internal (policy-driven) events.
  \end{enumerate}
\end{itemize}

In both, the challenge is to send the right signal to the incremental investor, but without forcing disruptive windfall gains or losses upon one stakeholder group or another.
RCM Review – 18 month journey

• The RCM review considered a wide range of issues
  – Focus on fixing the problem and not creating winners and losers
  – Enhance market responsiveness of key RCM mechanisms to create greater self-corrected-ness

• Much initial uncertainty and lack of common understanding of the issues
  – Confusion between price- and quantity-based mechanisms
  – Conflation of value transfer with problem solving

• Was the RCM so broken as to require complete replacement or should/could it be fixed?
  – Replaced by quantity based mechanism? Too drastic and risk of shocking all market participants?
  – Adjustments to current RCM? Individual element or in the form of package?

Assuming growth in WA electricity demand, the current excess reserve capacity situation will eventually reverse -- so the review looked at both the cost of excess and the cost of shortage
First step was the review of the MRCP – which led to a significant reduction

- The RCP is a function of the MRCP, which is, in turn, based on the estimated cost of connecting a 160MW gas turbine to the WEM.

- Importantly, this review led to significant methodological and definitional adjustments, not just parameter updates:
  - The basis for the estimate of transmission connection costs was changed; and
  - The specification of the generation technology was altered to incorporate inlet cooling.

- Together these specific one-off changes reduced the MRCP by over 20%

The reference price in a price-based regime is a key parameter – if too high or too low, then it can lead to persistent capacity excess or shortage
The MRCP review materially reduced the RCP – but the relationship between the RCP and excess capacity remained unchanged and quite shallow.

The shallow RCP “slope” puts most of the burden for RCM effectiveness on the MRCP value – risky!
In fact, the economic value of *incremental* capacity falls steeply (based on the loss of load probability) as the amount of excess reserve capacity increases.
The RCM review recommended a steeper slope to make the RCP better reflect market conditions while avoiding the disruptive zero/infinity value swings.

Finding an agreeable basis for the slope involves balancing many factors – the minimum change is to ensure that the RCP adjusts to stop or start investment when needed.
The proposed new arrangements also create a modest incentive for retailers to enter into bilateral contract with new capacity (when needed)

**Proposed New Arrangement Incentives**

Costs could be **higher** if contracted when there is much excess reserve capacity.

Costs could be **lower** if uncontracted and more excess reserve capacity.

Costs could be **higher** if uncontracted and less excess reserve capacity.

Costs could be **lower** if contracted when there is less excess reserve capacity.
Summary

- To work effectively and acceptably, a price-based regime must be sufficiently responsive to market conditions
  - Implementation is almost certainly easier than a quantity-based auction approach
  - Possibly less *theoretically* efficient because price-based adjustment will tend to be very approximate
  - But, once calibrated, much easier to avoid the zero/infinity challenge, which reduces arbitrary risk in the market and may reduce the cost of long-term capacity investment when needed

- A quantity-based approach (auction) is equally feasible,
  - But involves a comprehensive change
  - Also requires administered (quantity) curves in order to avoid the zero/infinity problem
  - Requires significant attention to what precisely is being auctioned
  - May benefit from a process in which auctions address rolling requirements one, two, and three years out
  - Based on experience elsewhere, adjustments will be needed periodically to “get the kinks out”

- Any proposed structure should promote efficient contracting incentives
Thank you

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