Market Design for Battery: An Australian Case Study

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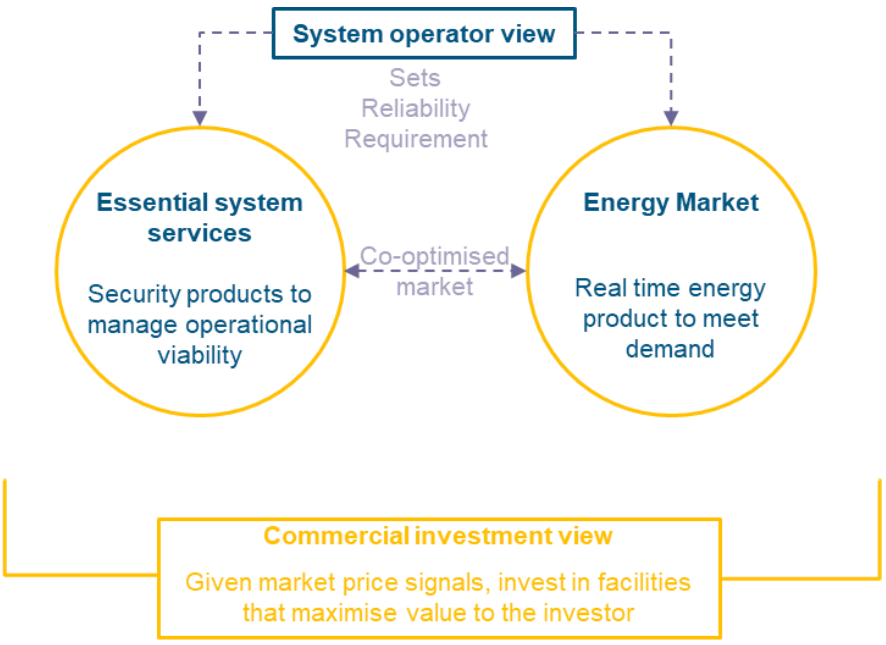
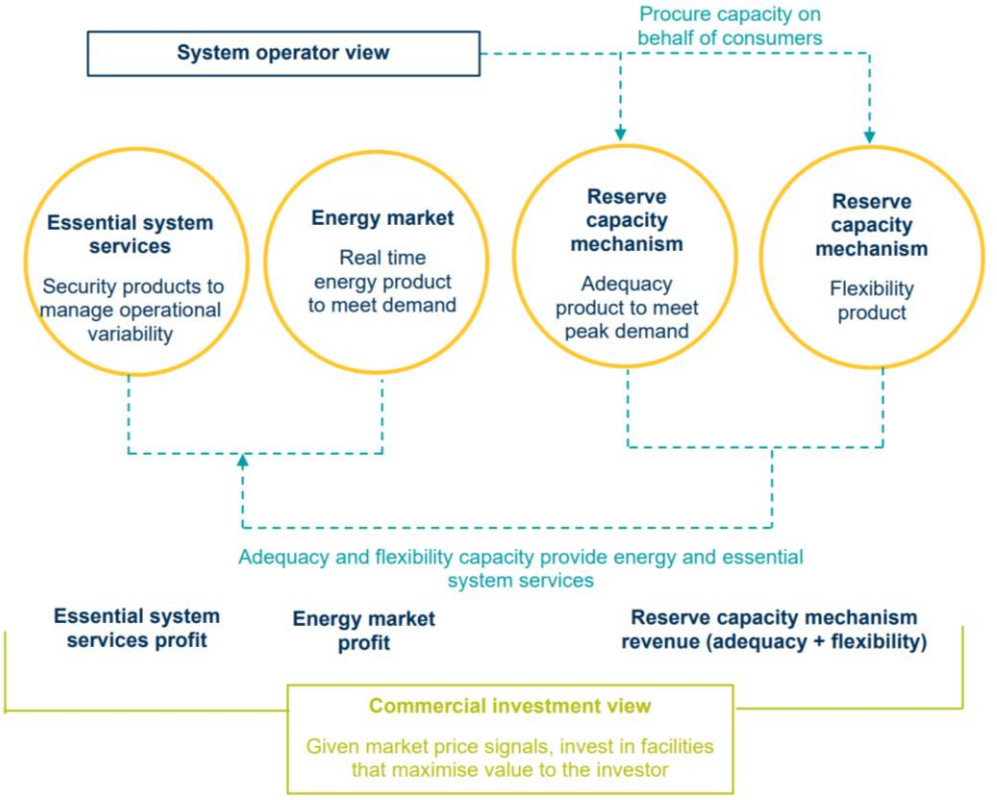
Two Different Markets with different drivers for investment

Revenue Source: Energy Only Market (NEM)



Revenue Source: Energy/Capacity Market (WEM)



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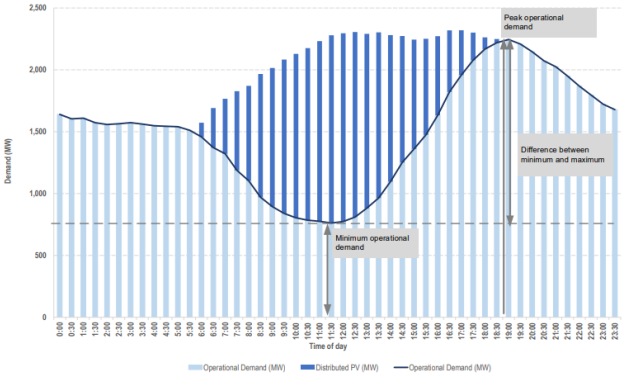
Context: Western Australia (and most other Australian States) energy systems are under stress – but of a different kind

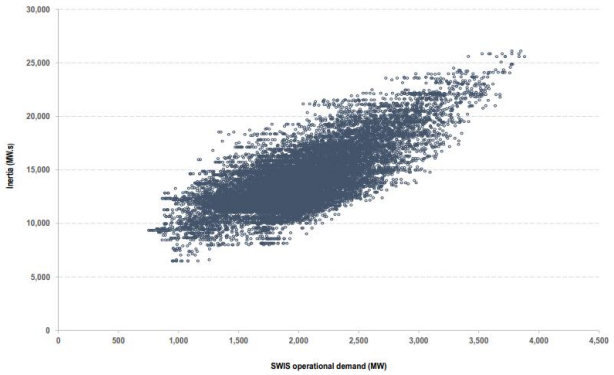
The problem –

- Increasing need for ramping in intraday load, and
- low load creating system reliability risk

Typical Operational demand in the WEM



Scatter plot of operational demand vs inertia from generation

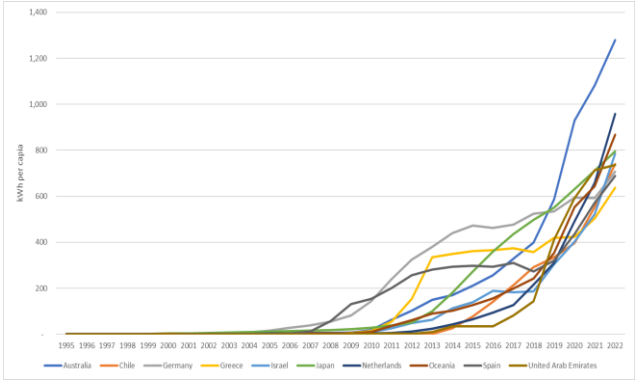


Source: Low load project, Energy Policy WA, June 2022

The cause -

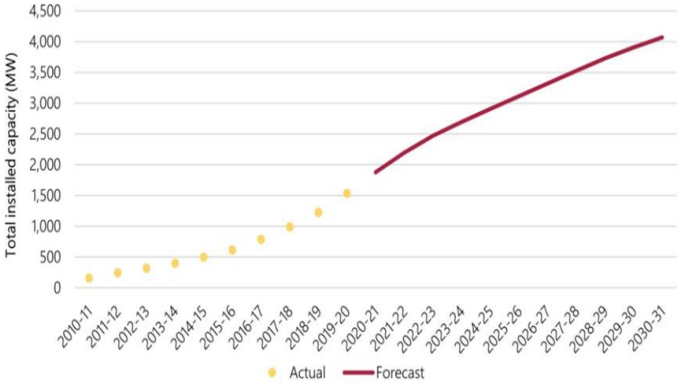
- Increasing take up of roof top solar

Highest per capita uptake of Roof top Solar in the world



Source: Ember (2022); Energy Institute - Statistical Review of World Energy (2023); Population based on various sources (2023), TLG Analysis

…and no sign of slowing in the future



Source: CER, CSIRO and GEM.

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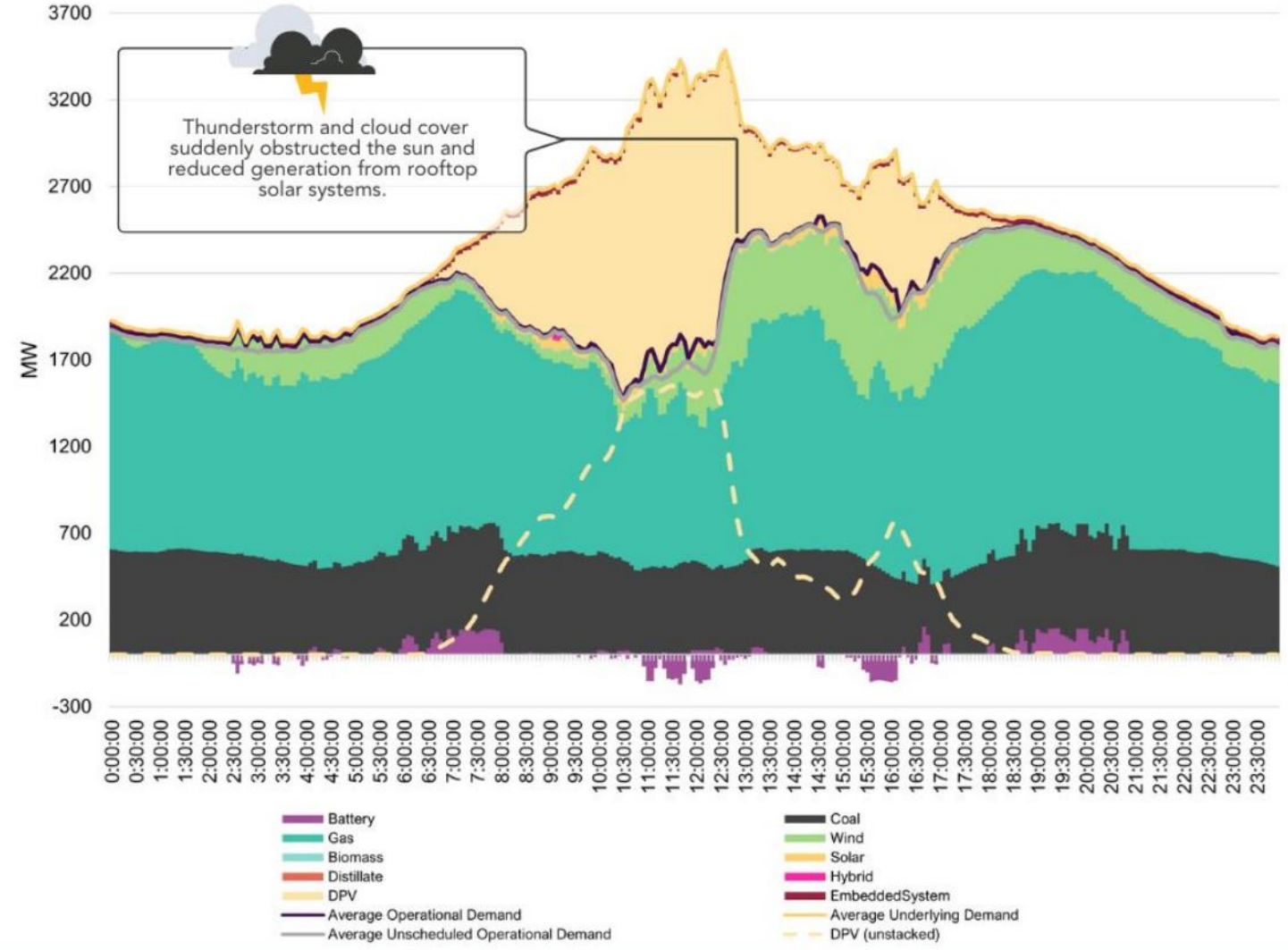
Need for Flexibility in the system is increasing



On 13th March 2025, thunderstorms and cloud cover caused a sudden drop in generation from rooftop solar, resulting in a rapid upswing in electricity from the grid, with demand surging 49% in 40 minutes

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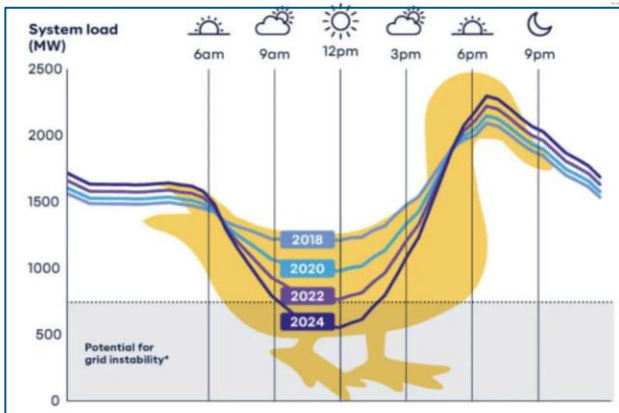
Navigating Minimum Demand Services in WA: Challenges and Opportunities



Minimum Demand Challenges: With increasing solar generation, periods of minimum demand present a risk of oversupply, leading to grid stability issues. The NCESS program specifically targets this by incentivizing the withdrawal of power or reduction in injection during critical low demand hours (9.00 am to 3.00 pm).

The Non-Co-optimised Essential System Services (NCESS) procurement process, initiated by the Australian Energy Market Operator (AEMO) in Western Australia, is designed to address grid stability and reliability issues arising from high renewable penetration and low demand periods.

Focused on both Peak Demand Service and Minimum Demand Service, the NCESS aims to start services by 1 October 2024, covering a two-year duration.

Contract Structure includes availability payments for service readiness and activation payments for actual service provision, fostering a reliable and responsive grid management system.

These initiatives underscore the utility's dual focus on meeting contract requirements for grid support and leveraging new opportunities for revenue generation through essential system services.

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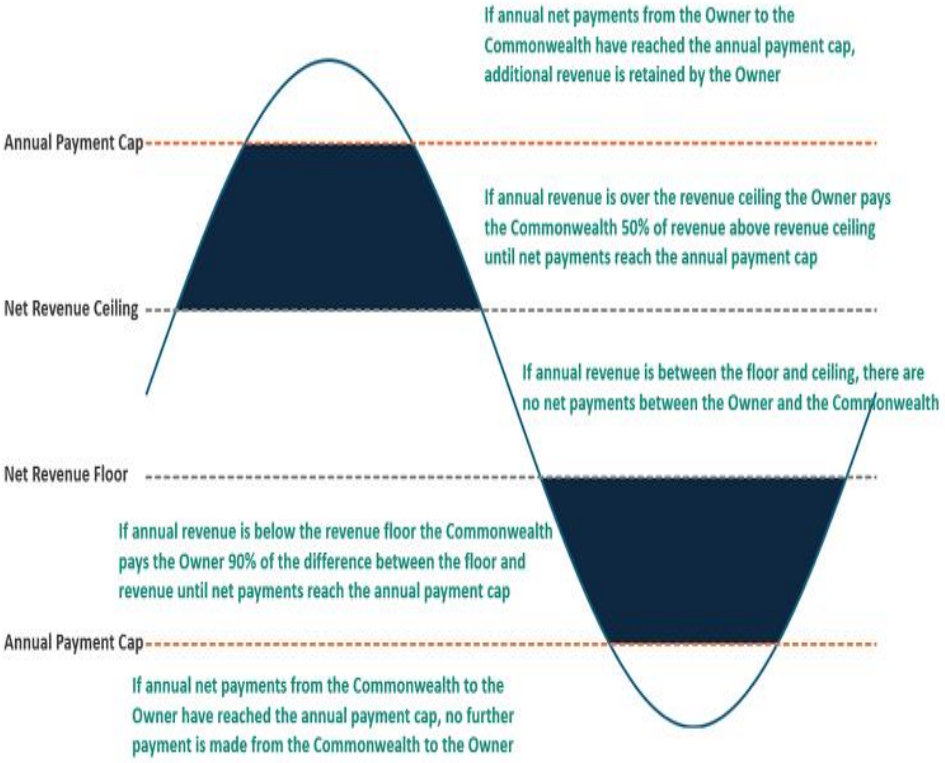
Numerous Initiatives were undertaken to incentivize Battery Entry

- Allowing for Batteries to earn capacity payments – changes to definition of capacity aimed at Batteries
- Capacity Investment Scheme (CIS) – A Government Scheme Introduced
- 5-minute dispatch – Changes to Real Time Market that recognize and reward Batteries' contribution
- Ancillary Services Market Introduced to allow flexible resources (like Battery) to participate

Capacity Investment Scheme (CIS): Revenue Underwriting Design Instrument

Government will guarantee revenue for selected facilities. It functions as a revenue guarantee

- A series of competitive tenders seeking bids for clean renewable generation and storage projects. Not all capacity will be successful, so market may end up with similar projects with and without this support.
- Eligible tech must have zero scope 1 emissions: dispatch & sourced from renewable fuels, storage charging from the grid or collocated with renewables (i.e not fossil fuel generation), demand response. Aggregated BTM VPPs not eligible.
- Rated capacity will be converted to MW of 4-hour storage equivalent using derating factors based on contribution 1 in 10-year unserved energy events.
- Projects under CIS contracts will have a revenue floor and ceiling for up to 15 years. Under pilot procurement rules, recipients face refunds when availability is less than 97%, and when not producing required energy during LO3 events (load shedding)



Source: DCCEEW 2025, Capacity Investment Scheme 2025 Western Australia Wholesale Electricity Market (WEM) Design Paper

"It is expected that CIS contracts issued in WA will be adapted to complemented the existing Reserve Capacity Mechanism, for example, by supporting the entry of new, zero emissions plant which can participate in the Reserve Capacity Mechanism"

Conventional Rules for Capacity Credit allocation do not apply to Battery

Conventional Generation must be available at every interval to be eligible for capacity credit

Limited duration would disqualify Batteries from receiving capacity credits

Uncertain availability dictates capacity credits for Intermittent Generators to be based on past performance

Battery charge/ discharge is controllable and so the same criteria cannot apply

Rules that were written for conventional or intermittent generation requires changes to accommodate Battery Storage for Capacity Qualification and facilitate Investment in Grid Scale Batteries

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Certification for storage facilities: ‘Derating method’ for assessing the capacity value of storage facilities in the WEM

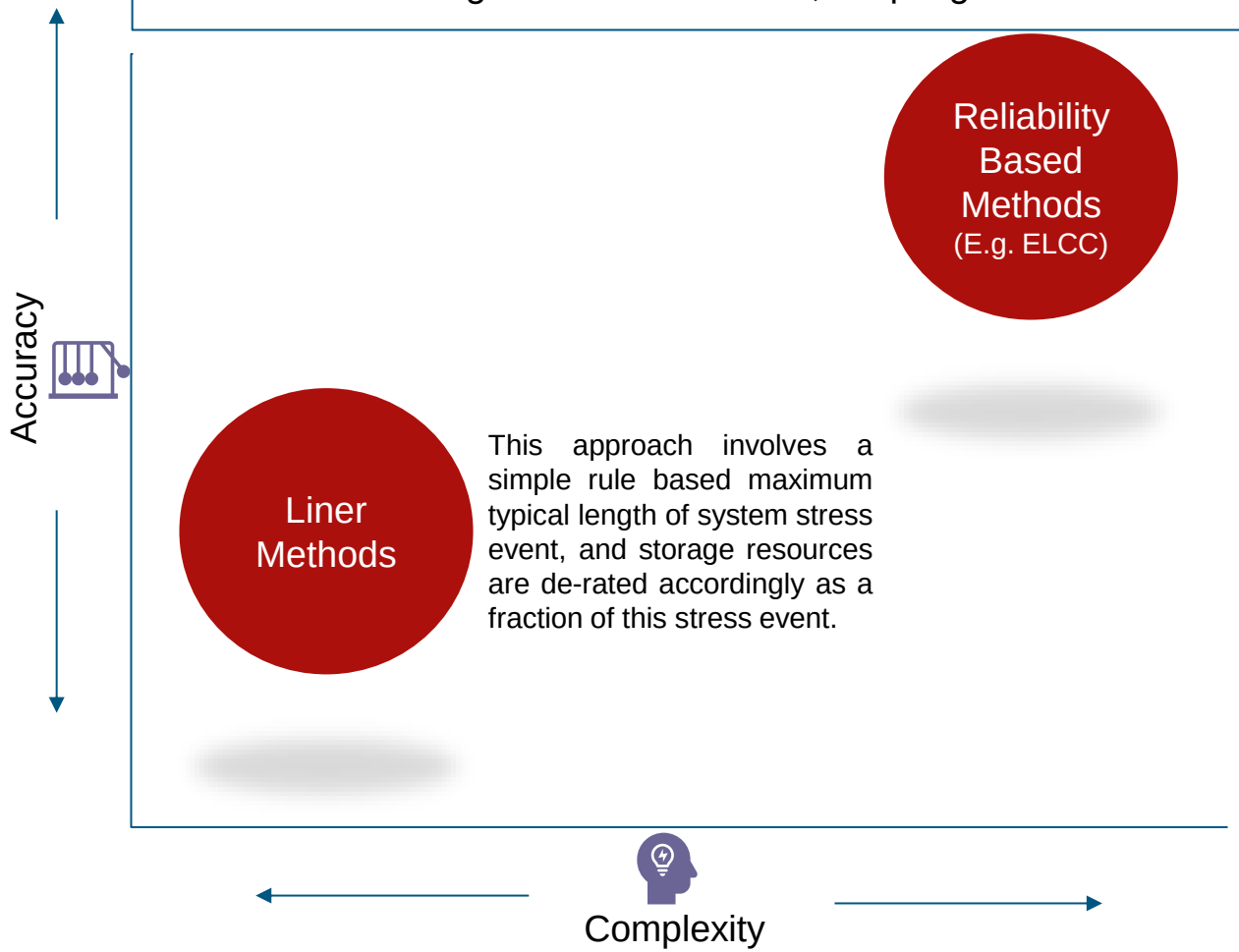
- Under this approach, the amount of Capacity Credits awarded to a storage facility is based on its maximum output and duration
  - Determines contribution to a reliability during system peak events

- A benchmark duration corresponding to typical peak demand events is first established

- Capacity Credits are adjusted for facilities with shorter durations than the benchmark

Developing the Capacity Credit Rule for Battery Storage is a trade-off between Accuracy and Complexity

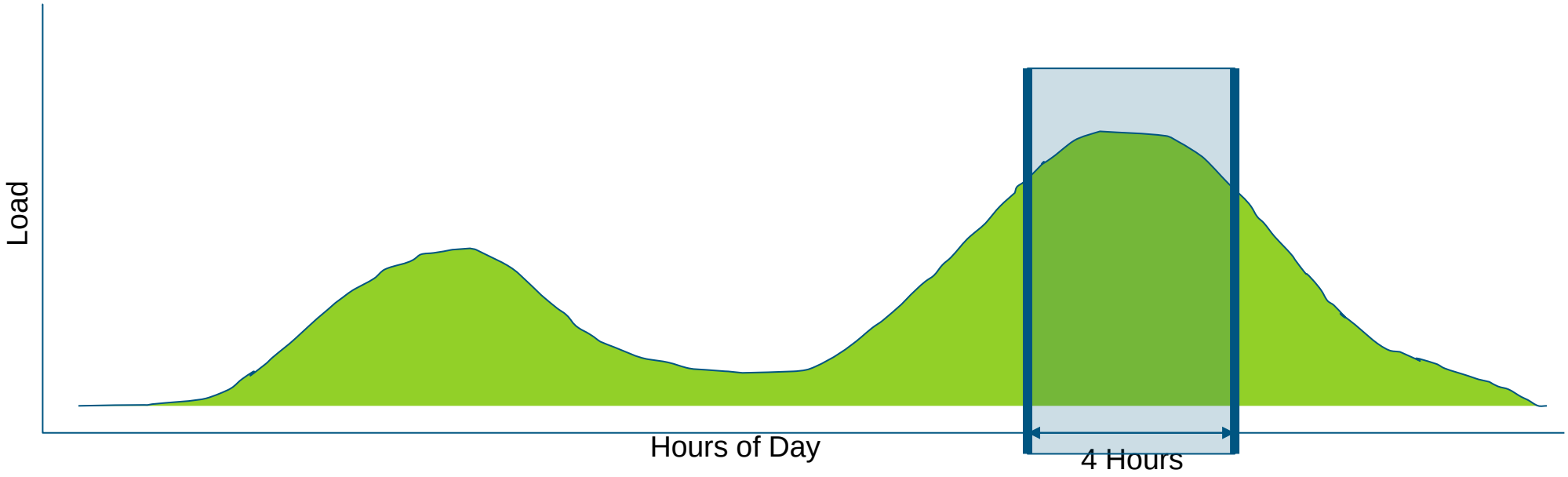
Various methodologies were considered, in opting for a 'Linear Method'



This approach involves a simple rule based maximum typical length of system stress event, and storage resources are de-rated accordingly as a fraction of this stress event.

For example, if the maximum typical stress event on the system was four hours, then under a linear method a one-hour duration storage device will be de-rated to 25% of its capacity, a two-hour device will be de-rated to 50% of its capacity, and so on.

Electric Storage Resource Obligation Intervals – 4 Hour Duration



- ESROI is determined by the Market Operator (AEMO)
- This is reviewed to account for changes in the system requirements.
- Market Operator also has the flexibility to change the window of time (but not the length of the window).

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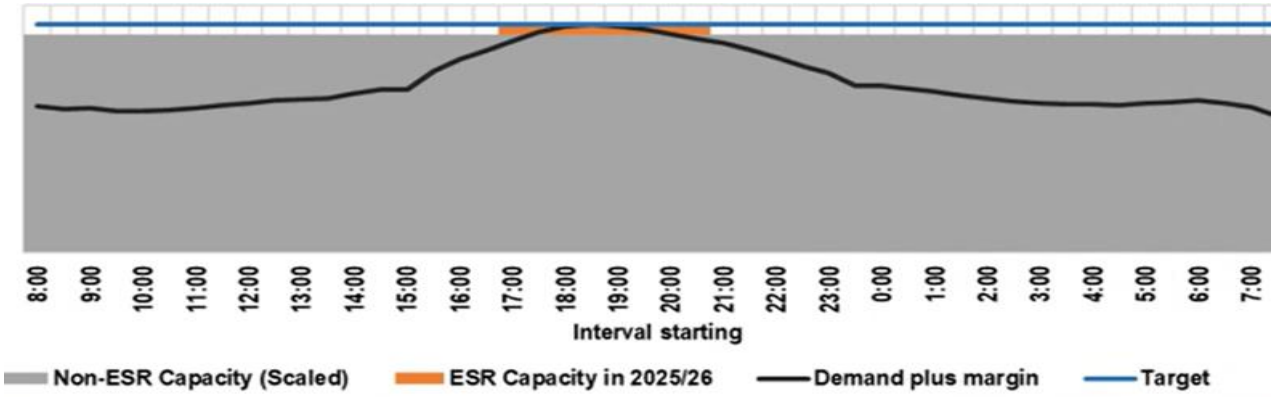
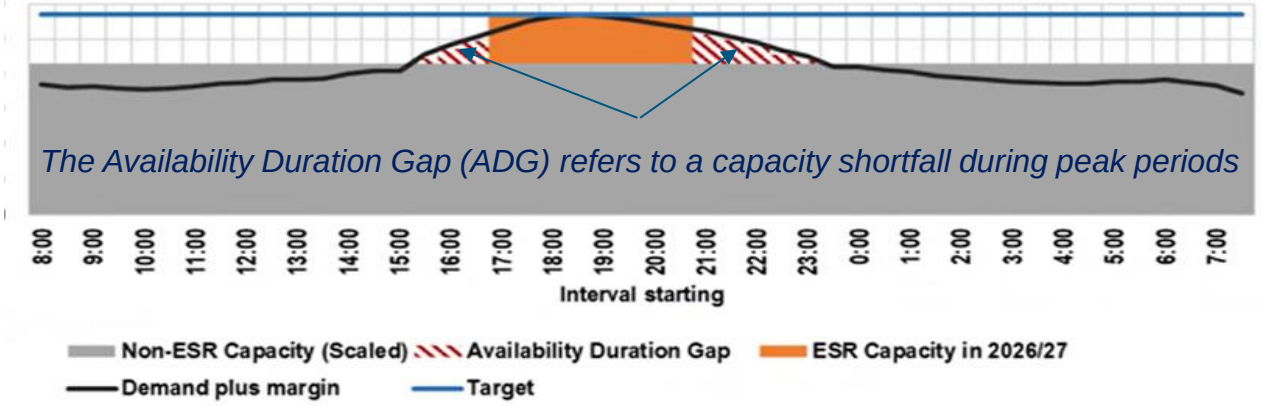
Increasing Availability Duration Gap (ADG) Has Initiated a Need for Change

Currently, 4 Hour Duration ESROI is sufficient to meet peak Demand

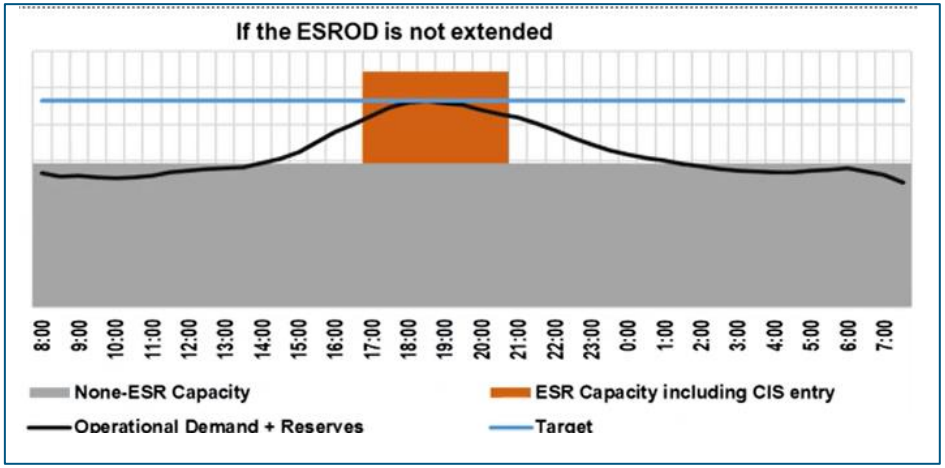


With Increasing demand (and load curve flattening), Availability Duration Gap is formed

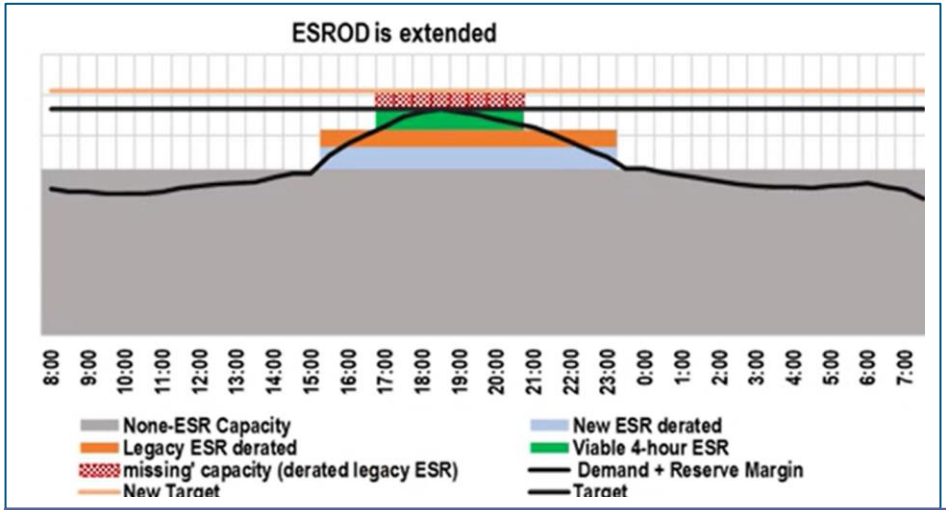


The ADG calculation involves forecasting peak demand, subtracting ESR availability to find residual demand, and identifying intervals exceeding ESR capacity.

The Need to Act: Additional Battery on an ongoing 4 hour duration for eligible capacity credits, only exaggerates the Availability Duration Gap



If the Energy Storage Resource Obligation Duration (ESROD) is not extended, either the demand cannot be reliably served, or significant increases in overall capacity requirements become necessary.



Extending the ESROD ensures reliability, reasonable market costs, and fair allocation of capacity credits.

Proposed Change: ESROD is increased from 4 hours Duration to 6 hours Duration to be eligible for capacity credit certification

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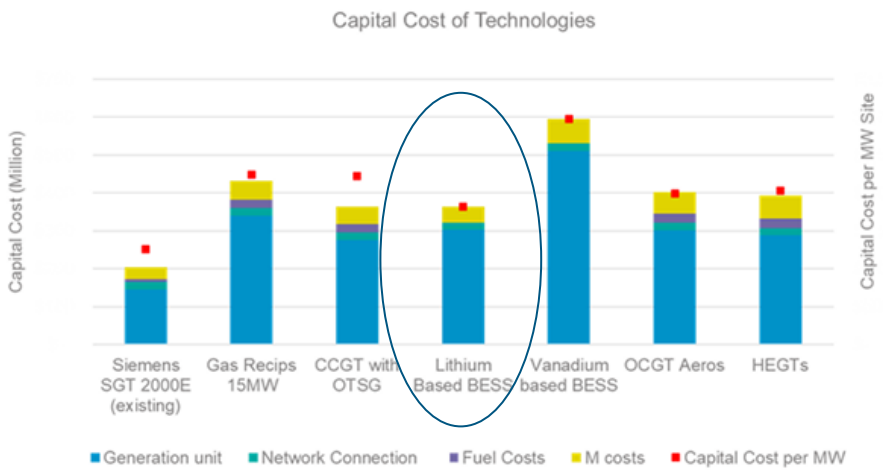
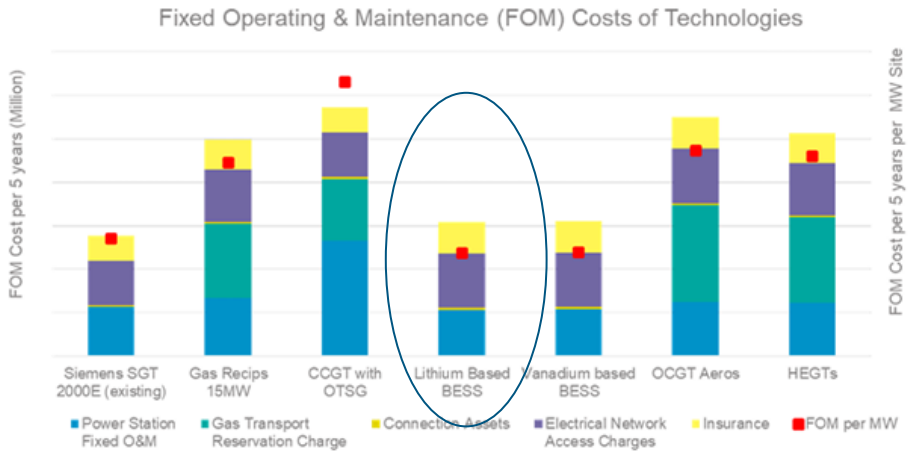
Capacity Price is Based on Cheapest New Entrant Technology

The BRCP Reference Technology Review aims to ensure that the WEM Rules provide sufficient incentives for investment in new capacity to maintain system security and reliability at efficient cost to consumers.





Finding of a Review of Reference Technology in 2024:

"*The 200 MW/800 MWh BESS has the lowest capital cost and fixed operations and maintenance cost per MW per annum for both the Peak and the Flex product. As the economic lives are assumed to be the same across the options, the 200 MW/800 MWh BESS is the lowest cost new entrant on a gross basis. This technology is capable of meeting the requirements of both the Peak and the Flex services as defined*."

Source: Energy Policy Western Australia, BRCP Reference Technology Review

Reference Technology was subsequently changed from OCGT to BESS in 2024

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Whats are the Implications of this? Be careful what you wish for

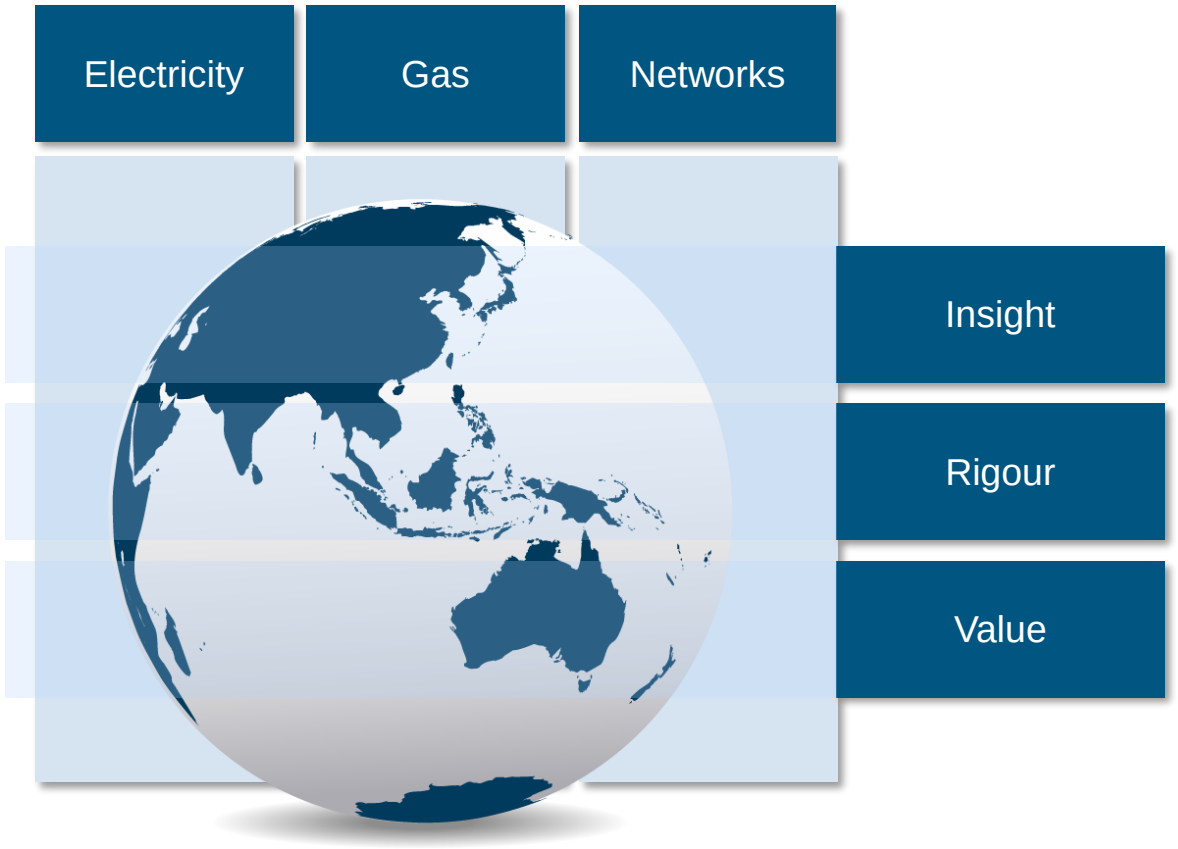
- Moving ESROD from 4 hours to 6 hours Capacity Credits for BESS is **reduced by 50%**
- Further, this increases the cost of BESS - leading to BESS being **no longer being the reference technology** for setting capacity price.

- Investors in BESS feel aggrieved
- However, some protection remains (5 years for current investors)
- What is the impact on future Investment?

Key Take Away:

- Building in Incentives for BESS to enter the Market is expensive.
- Markets are expected to, and do, react to those incentives.
- If the design of the market and incentives is not stress-tested, it may lead to perverse outcomes.
- This requires further intervention to reverse those incentives.
- Regular intervention in Markets causes investment uncertainty and may result in the exact opposite of what you are trying to achieve.

End



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