

The role of batteries in a transitioning energy system

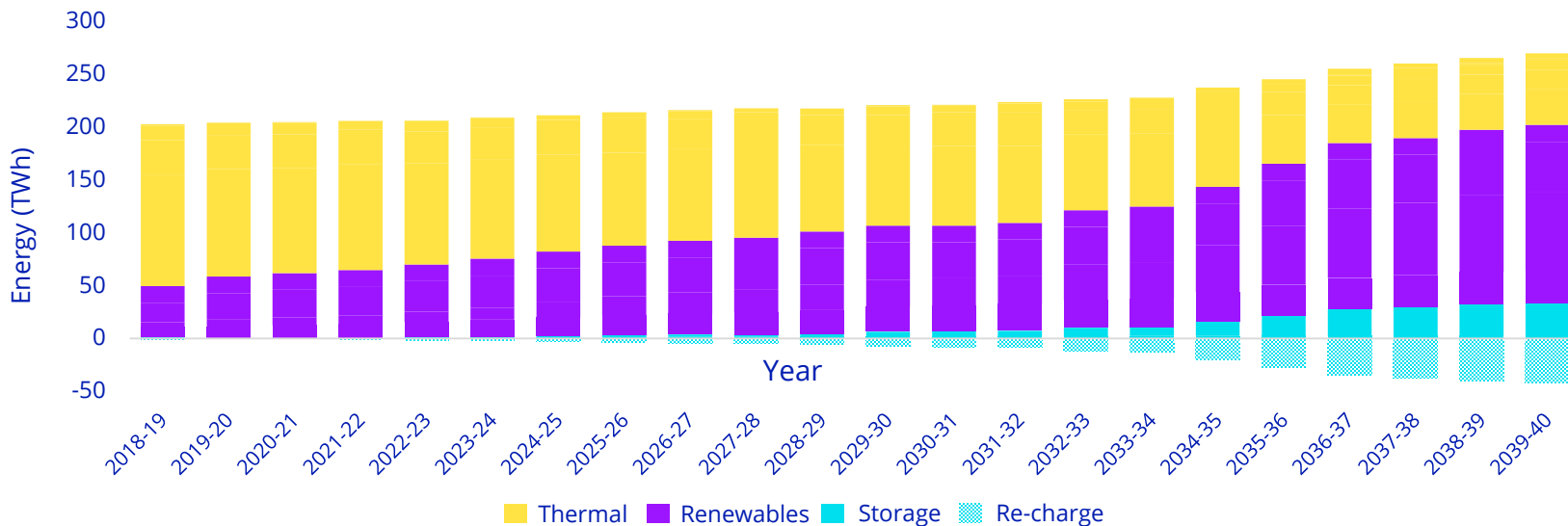
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High levels of renewable penetration will change future energy markets



NEM energy mix – AEMO Integrated System Plan



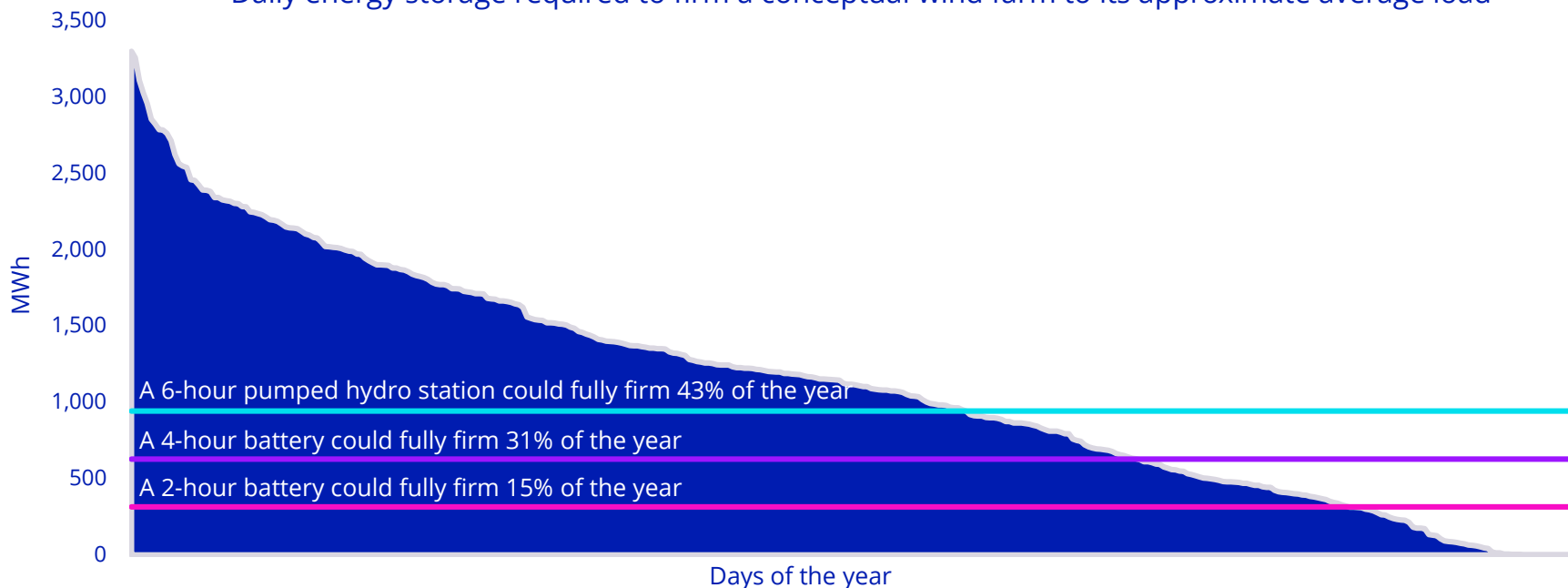
Key: Thermal - Peaking gas + liquids, CCGT, Black Coal, Brown Coal.
 Renewables - Hydro, Wind, Utility Solar, Rooftop PV, Biomass.
 Storage - Utility Storage Generation, Distributed Storage Generation.
 Re-charge - Utility Storage Load, Distribution Storage Load.

Source: AEMO – 2018 ISP Generation and Transmission Outlooks – Neutral Scenario.

Batteries can play a role in firming renewables but currently cannot do so on their own



Daily energy storage required to firm a conceptual wind farm to its approximate average load

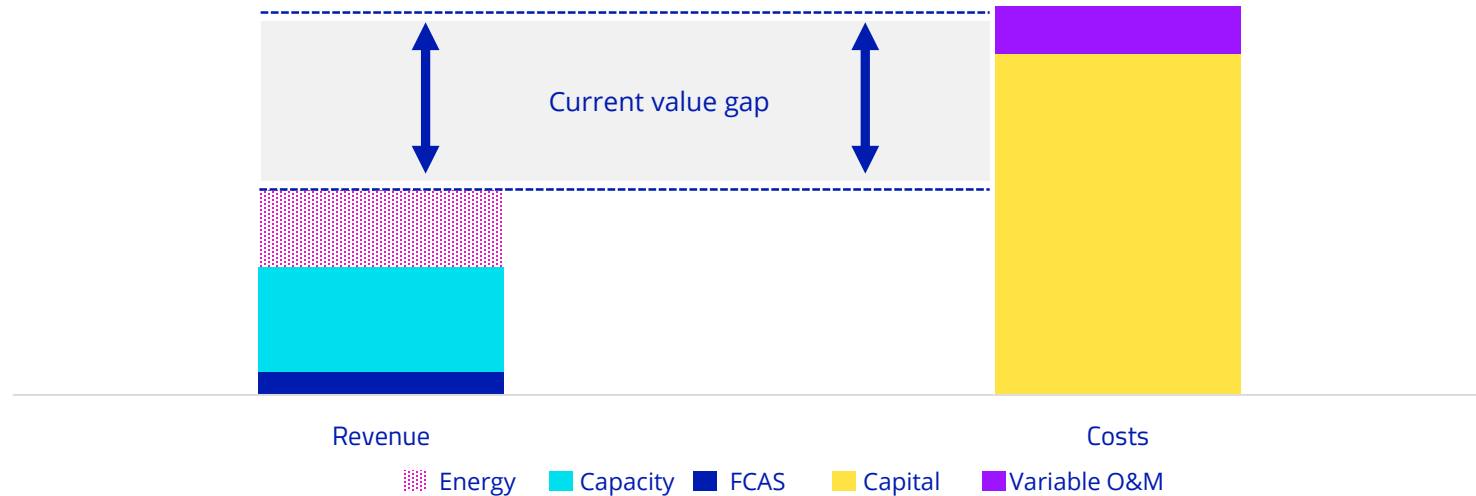


Source: AGL estimates.

Market design and policy settings are required to encourage commercial battery adoption



Indicative battery economics



Source: AGL Estimates, Comparison of Dispatchable Renewable Electricity Options – ARENA 2018.

Battery assumptions: 2 hour, 100MW installed capacity, 20 year life, A\$390k/MW initial capital cost, 2% fixed O&M cost, A\$10/MW variable O&M cost, 7.1% capacity factor, 40% cap capture, 3% degradation/year, 10% loss factor, A\$13 cap price, A\$1m/year FCAS revenue, A\$80/MW pool arbitrage margin earned

AGL is learning from developing and operating batteries at both a grid and household scale



Grid-scale battery project



Dalrymple North Battery Energy Storage System

Household-scale battery project



AGL's Virtual Power Plant

Multiple factors will influence the adoption of battery technology



1. Energy policy certainty

- Stable energy and carbon policy settings
- Market design signals for the right asset mix

2. Improved battery economics

- Technology advances to continue reducing costs while improving battery capabilities
- Greater supplier choices

3. Financial innovation

- Financial partnering between members of the value chain
- Continued incentives are welcome in the short-term to support R&D

About us



AGL is committed to helping shape a sustainable energy future for Australia.

We operate the country's largest electricity generation portfolio, we're its largest ASX-listed investor in renewable energy, and we have more than 3.6 million customer accounts.

Proudly Australian, with more than 180 years of experience, we have a responsibility to provide sustainable, secure and affordable energy for our customers.

Our aim is to prosper in a carbon-constrained world and build customer advocacy as our industry transforms. That's why we have committed to exiting our coal-fired generation by 2050 and why we will continue to develop innovative solutions for our customers.

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