

# Grid and Flexibility Services:

An Overview of the Australian NEM:

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# Power system flexibility timescales



	Short-term		Medium term		Long-term
	Sub-seconds to seconds	Seconds to minutes	Minutes to hours	Hours to days	Days to years
Product overview	FL inertia	Contingency & regulation frequency control	Energy	Energy	Energy
Procurement	Off-market or unpaid	8 x AS markets	5 minute spot market	Not procured	Financial derivative market
Hydropower participation	Yes	Yes	Yes	Yes	Yes
Volume	Unknown	Lower: 100 – 200 MW Raise: 200 – 400 MW	195.7 TWh	Nil	481 TWh
developments	<ul style="list-style-type: none"> <li>• Sys strength frameworks</li> <li>• Mandated pri freq response (\$?)</li> <li>• Market redesign post 2025</li> <li>• Consideration of FFR</li> </ul>	<ul style="list-style-type: none"> <li>• FFR</li> <li>• Increased VRE penetration</li> </ul>	<ul style="list-style-type: none"> <li>• Transition to 5 min settlements</li> <li>• Operating Reserves</li> </ul>	<ul style="list-style-type: none"> <li>• Day ahead markets under consideration for post 2025 mkt redesign</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity mechanisms under consideration for post 2025 mkt redesign</li> </ul>

# Summary of status quo

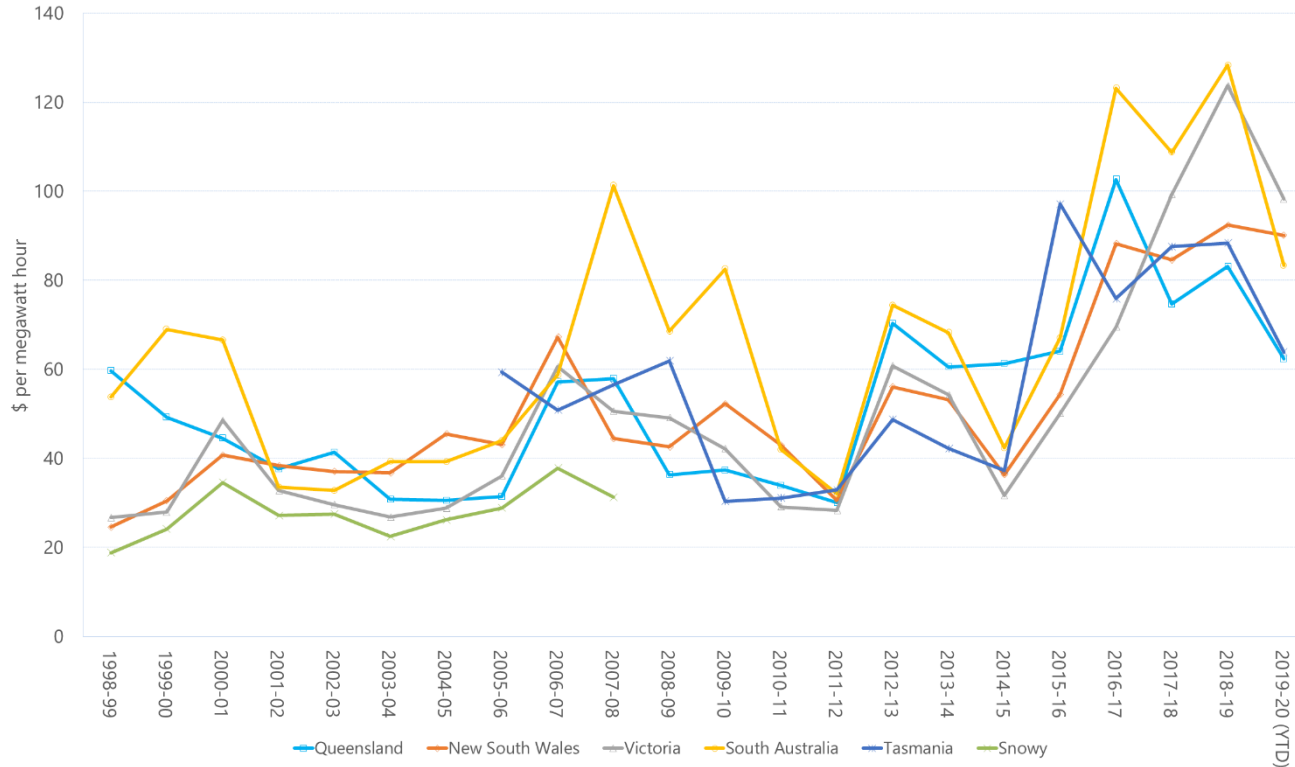
- Last 10 -15 years has seen little or no thought to valuing grid flexibility
- Frequency support has long been considered (mostly) as unimportant (abundant?) until market price events show that its been overlooked
- Other network support requirements are dealt with reactively (not a pun!)
- Thinking is changing with large amounts of VRE and or HVDC inter-connection or both
- At least two regions (SA and TAS) need and have workarounds for grid flexibility – essentially tripping schemes
- No attempt has been made to expand a transparent open market approach to flexibility
- Some green shoots in this area – market reform, system strength regime

# Main opportunities for Hydro



- Peaking to control price volatility
- Frequency control, particularly regulation and slow and delayed services
- System strength - But it depends on a more holistic approach to this
- Firming (operating reserves, capacity markets)
- Fast frequency response (must allow inertia)

# Prices: Regional spot prices increasing

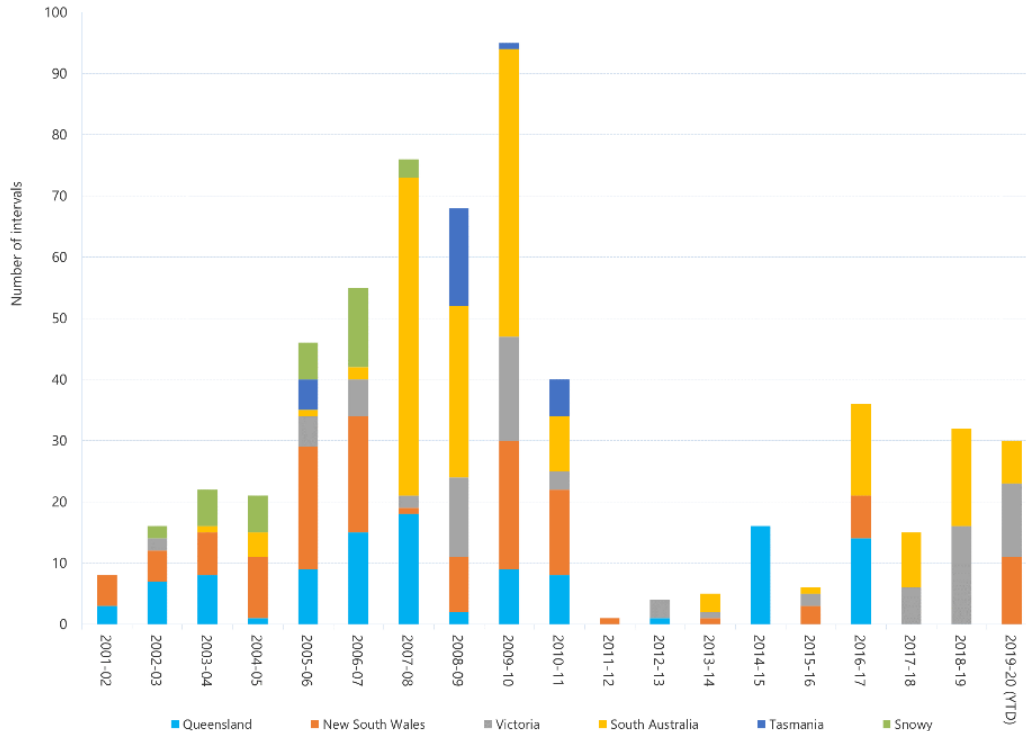


Prices trending up:

- Coal retirements
- Drought
- Plant ageing/reliability leading to price rises

<https://www.aer.gov.au/wholesale-markets/wholesale-statistics>

# Prices: Spot market volatility: No. of intervals > \$5,000 / MWh

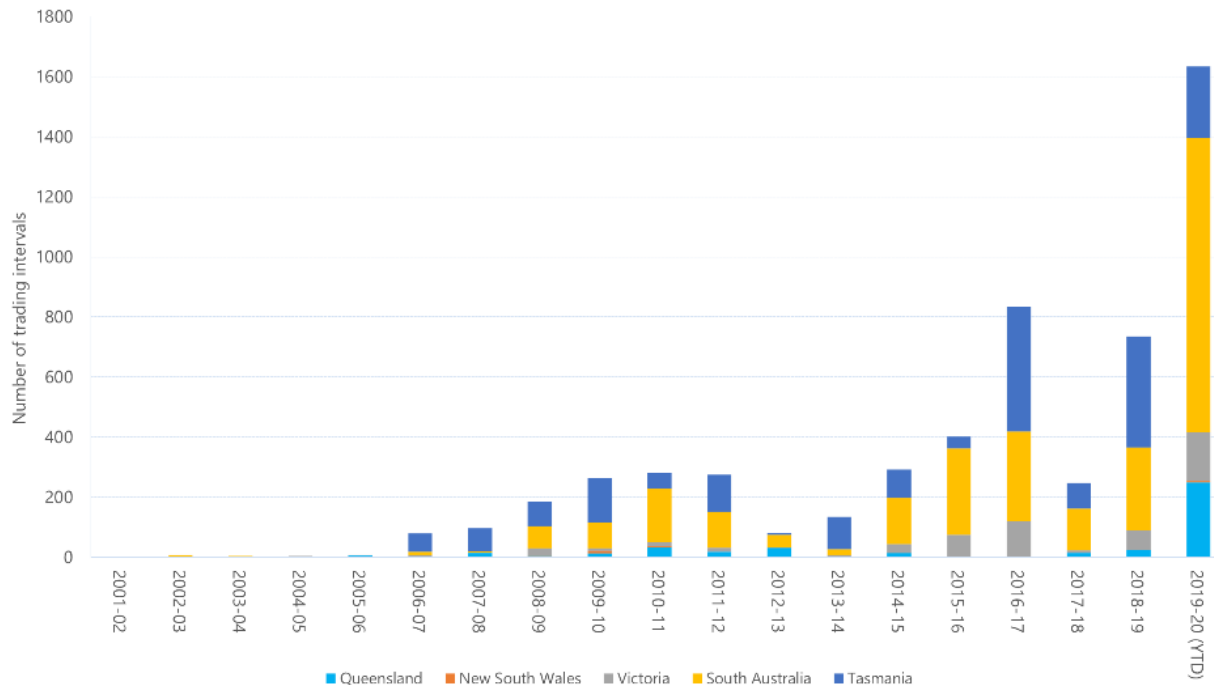


High price intervals:

- Only at modest levels
- Reflection of capacity surplus

<https://www.aer.gov.au/wholesale-markets/wholesale-statistics>

# Prices: Sub-zero price intervals

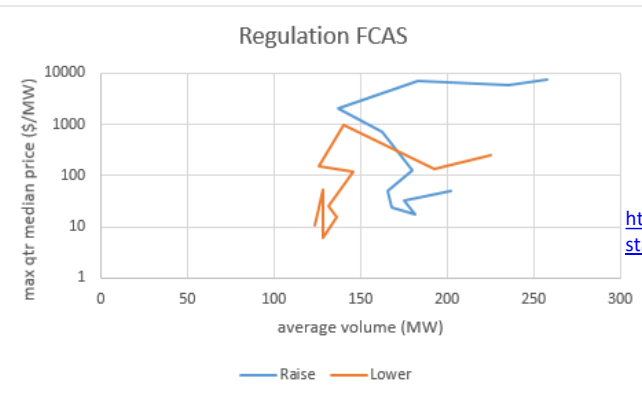
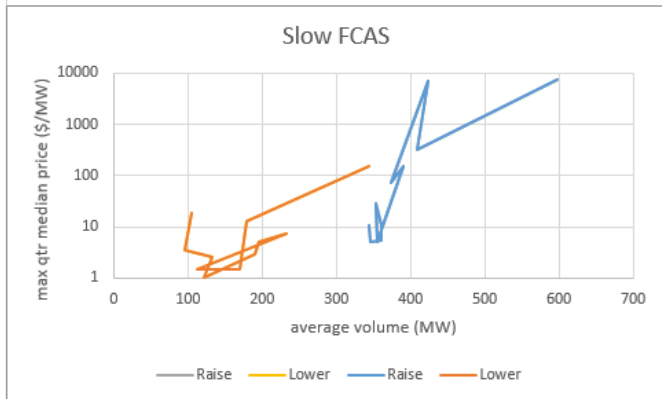
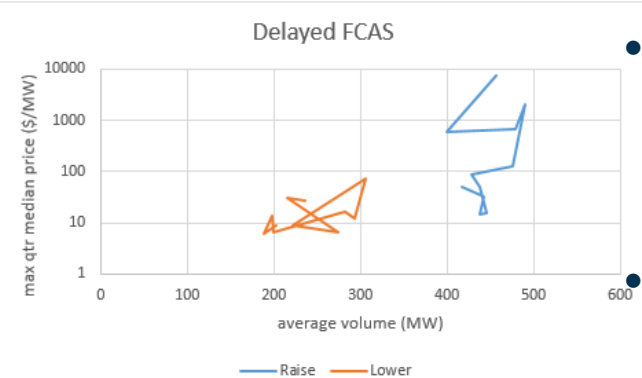
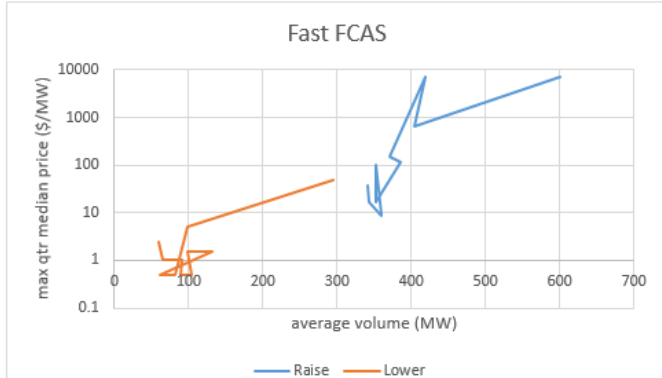


## Low price intervals:

- growing
- Reflection of capacity surplus
- Particularly uncontrolled roof top PV
- But also market positioning

<https://www.aer.gov.au/wholesale-markets/wholesale-statistics>

# FCAS: demand and price increasing



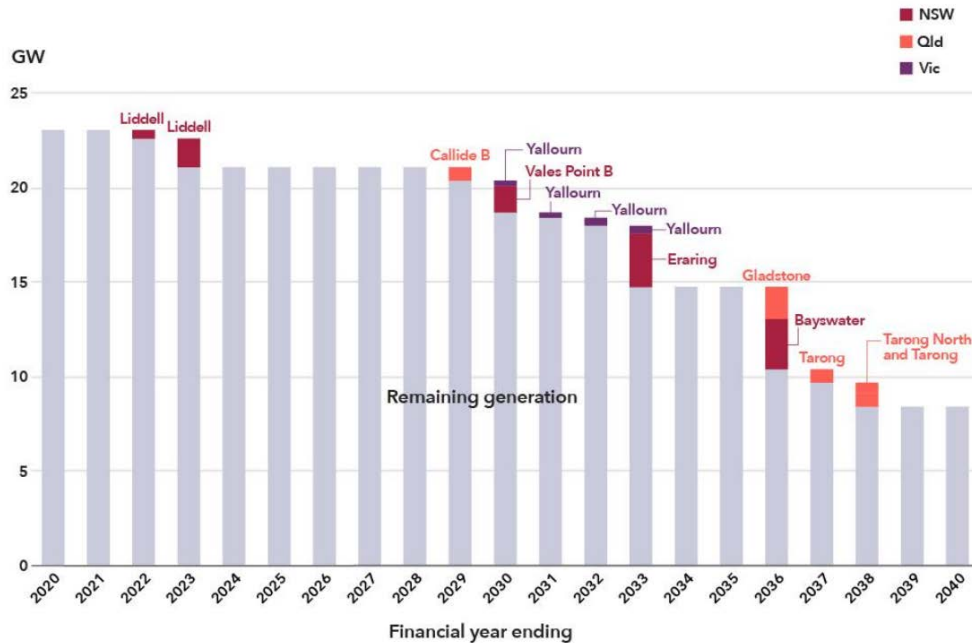
- Increases demand in Fast and Slow shows decreased inertia effects
- Increased regulation shows increased volatility due to VRE AND removal of primary frequency control

<https://www.aer.gov.au/wholesale-markets/wholesale-statistics>



# Coal retirements (AEMO projections)

Figure 9 Coal-fired generation remaining as power stations retire\*



Massive change to energy dynamics:

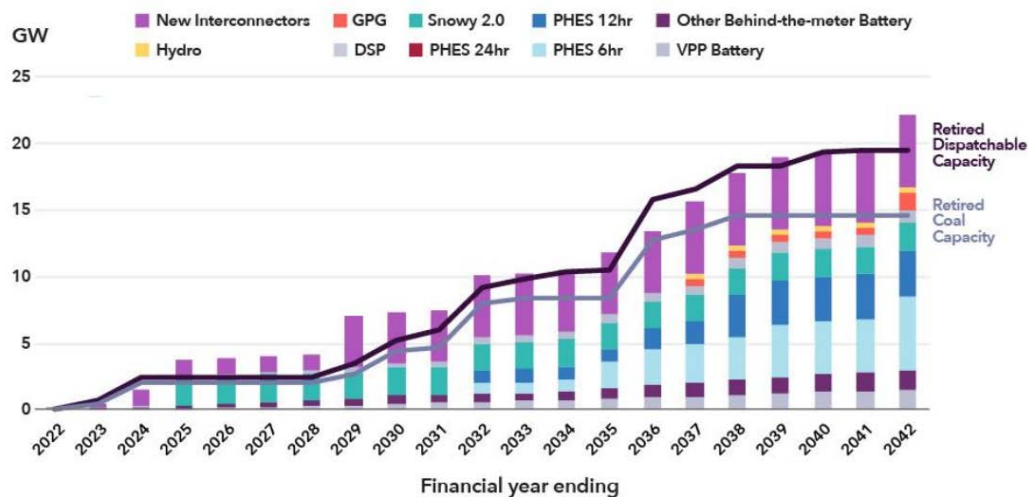
- Base load
- Static system loadflows
- Inertia
- Fault level

Timeline dependent on market conditions, government policy and plant condition

[https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf)

# Expected replacements?

Figure 16 Announced retirements and corresponding builds in Central scenario to help firm VRE

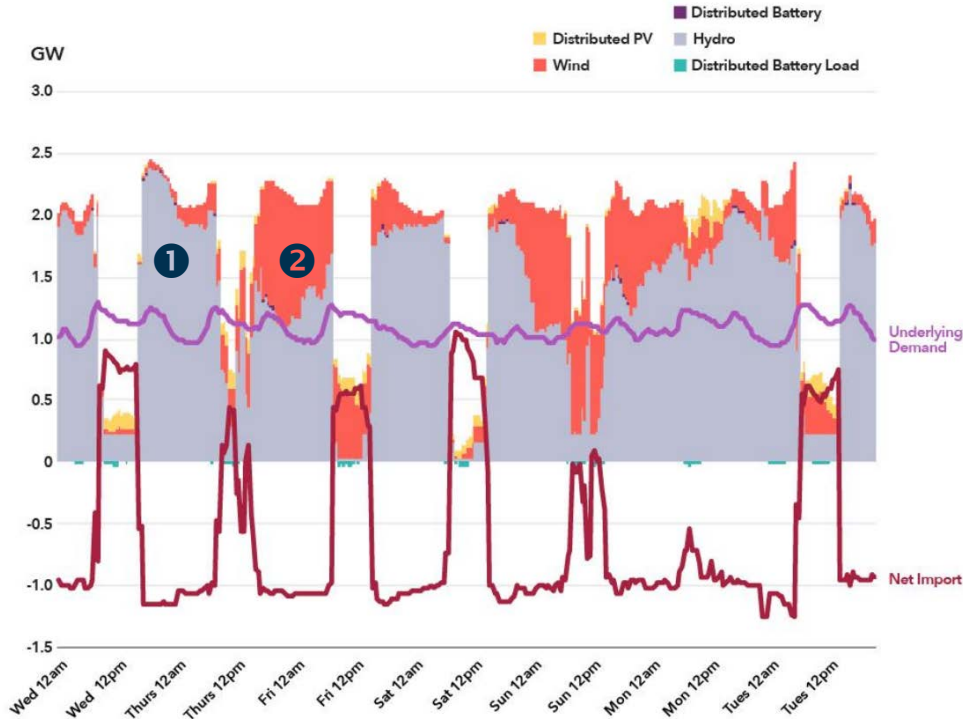


- Lots of pumped hydro
- Better inter-connection
- **Will need market reform to incentivise not just energy**

[https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf)

# Firming

Figure 18 Resources used in Tasmania, same low wind week in June 2040, GW



- Hydro can smooth out VRE – compare ① and ②
- No market mechanism other than price at the moment

[https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf](https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2019/Draft-2020-Integrated-System-Plan.pdf)

# What's next?

- Move to 5 minute settlement
  - Increased value for peaking or responsiveness
- Developing system strength frameworks
- Fast frequency response/Inertia approach on the horizon
- An energy-only market will not deliver what is needed
- Market review for post 2025
  - Operating reserves?
  - Capacity payments?
  - Day-ahead?
  - Co-optimisation of services?
- We need to ensure the market evolves to recognise BOTH value of deep storage and system services

***Australia is just starting out on considering flexibility services.***

***We're looking for overseas examples where the value of these services is realised.***