

Electricity Networks: Australian Experience

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Energy Policy Research Group
2024 Winter Energy Seminar



Agenda

Queensland – Fast Facts

Form of Network Regulation in Australia

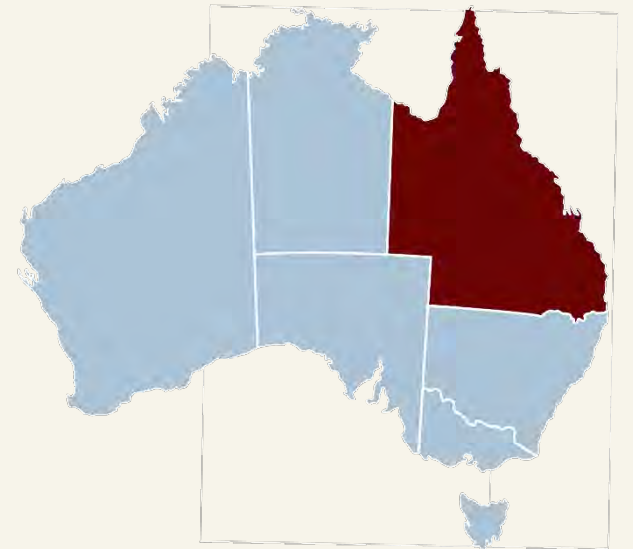
Renewable Connections – by the numbers

Connection Queues – management in the NEM

Financing and Renewable Energy Zones

Powerlink Queensland - Fast Facts

- Queensland population: 5.5 million (2.2 million households) and 241,000 businesses
- Northern region of Australia's National Electricity Market
- Maximum summer demand = 11GW. Energy demand 62TWh (12% rooftop PV)
- Legacy coal fleet 8GW, GTs 3GW, 0.8GW hydro, 5GW wind and utility solar
 - 29% intermittent renewable market share and rising sharply
- Highest take-up rate of rooftop solar PV in the world – 51.6%. 6GW
- Powerlink – State Owned Transmission Network Service Provider (TNSP)
 - 15,000km lines (330, 275, 132kV) and 152 substations
 - Assets ~AUD \$10 billion



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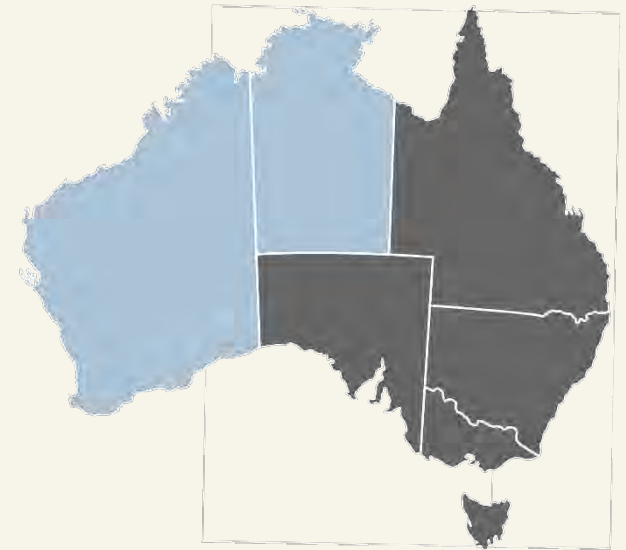
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Form of Network Regulation in Australia

- Network regulation in Australia's National Electricity Market or NEM (eastern states) is based largely on Great Britain's incentive regulation model (Littlechild's RPI-X, 1983)
- Five-year regulatory periods
- Revenue cap
- 'Regulatory Investment Test - Transmission' applies to all investment > \$7m
- Networks are responsible for regional Tx planning
- Market Operator responsible for interregional planning
- Consumer charges: shared network
- Generator charges: shallow connection
- Locational signals – NEM has 5 zonal spot prices + Marginal Loss Factors at each node (annual, static)



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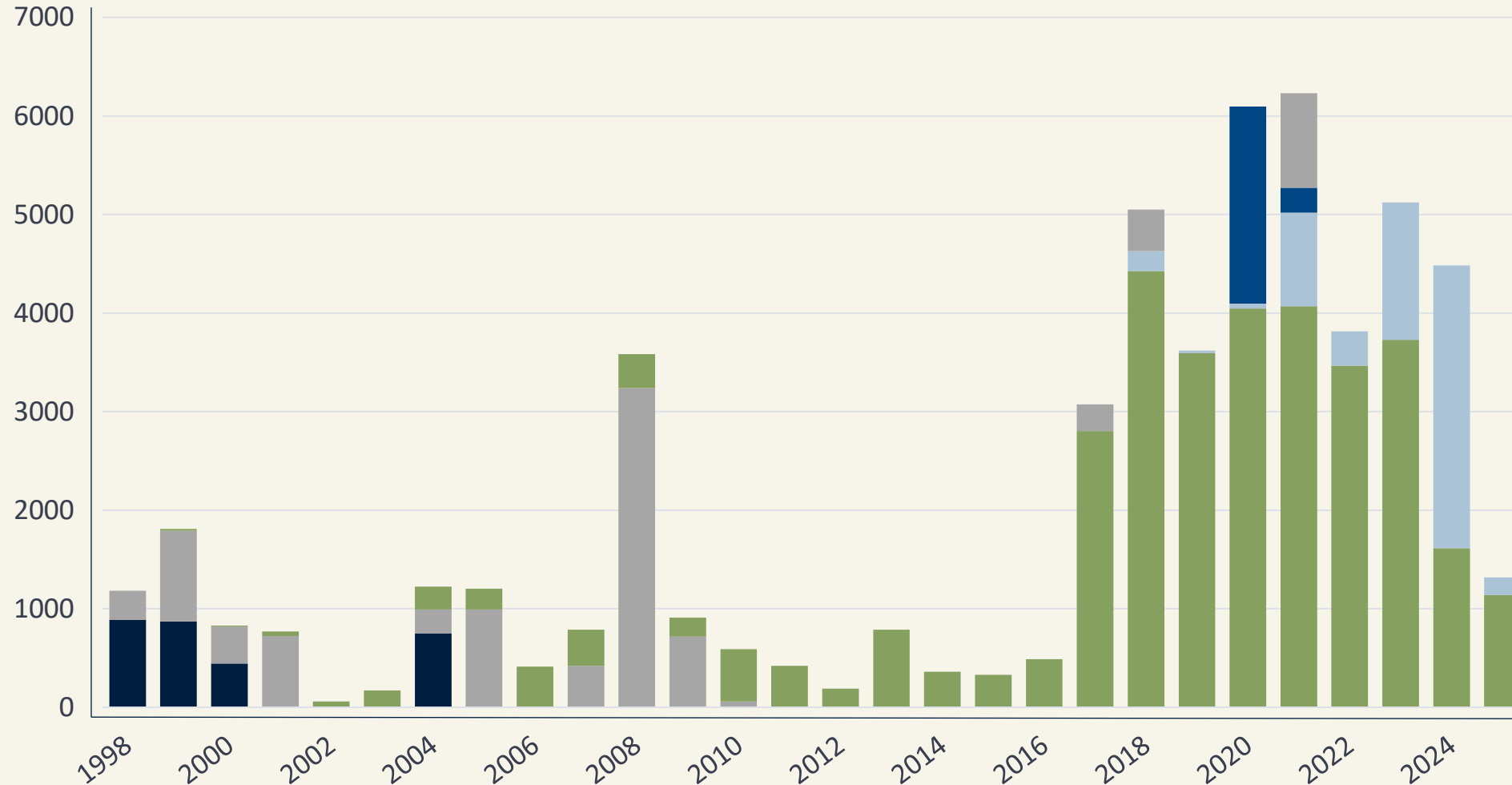
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NEM investment commitments 1998-2024

Generation Capacity (MW)

■ Coal ■ Gas ■ VRE ■ Batteries ■ Pumped Hydro



2016-2024

- 223 projects
- 35.4 GW
- \$83.1 billion

Wind

- 56 projects
- 11.3GW
- \$30 billion

Solar

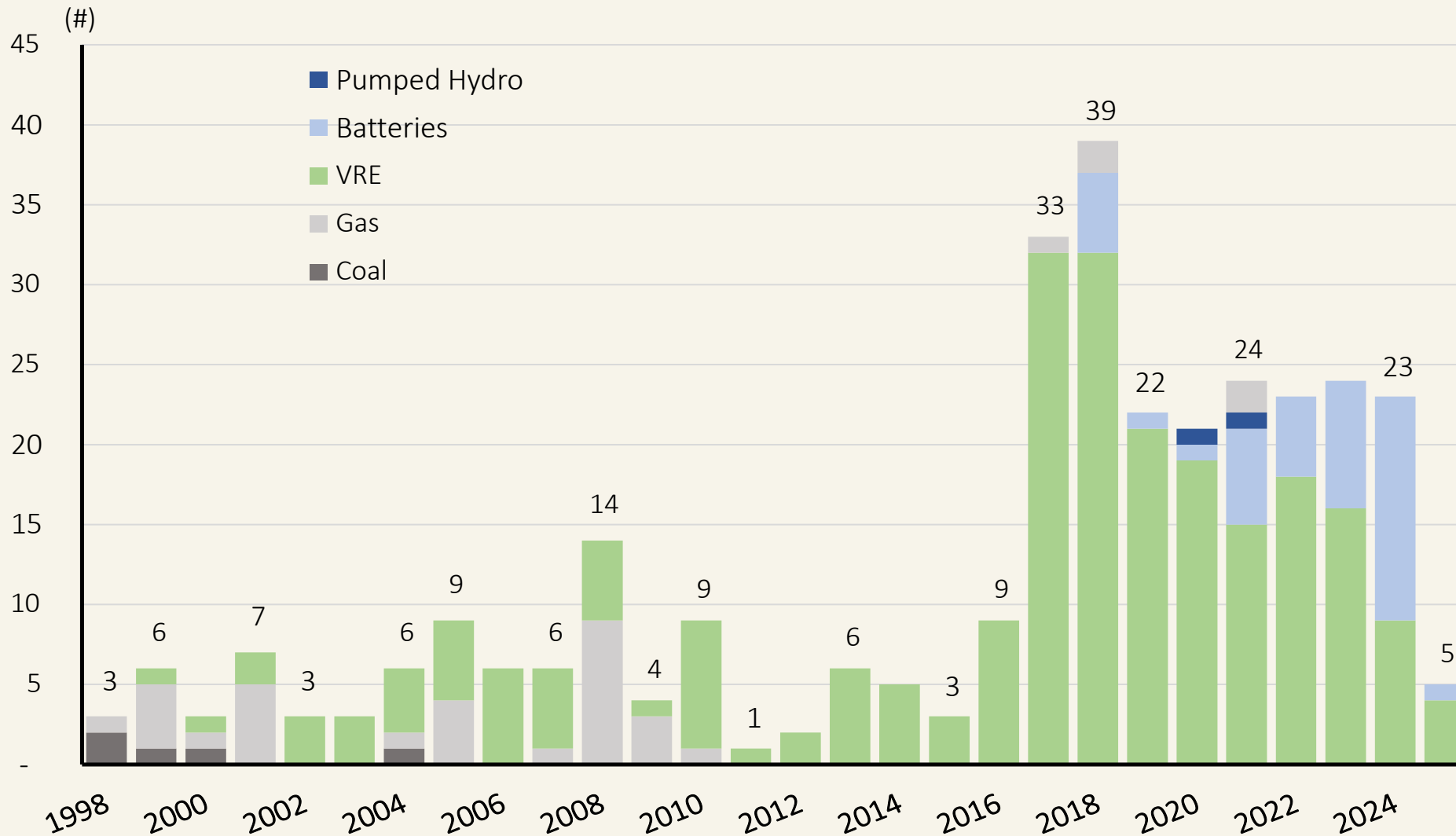
- 111 projects
- 14.1 GW
- \$24.8 bn

Batteries

- 41 projects
- 6 GW
- \$9.9 bn

Investment commitments 1998-2024 – Number of projects

Number of Projects



2016-2024

- 223 projects
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Wind

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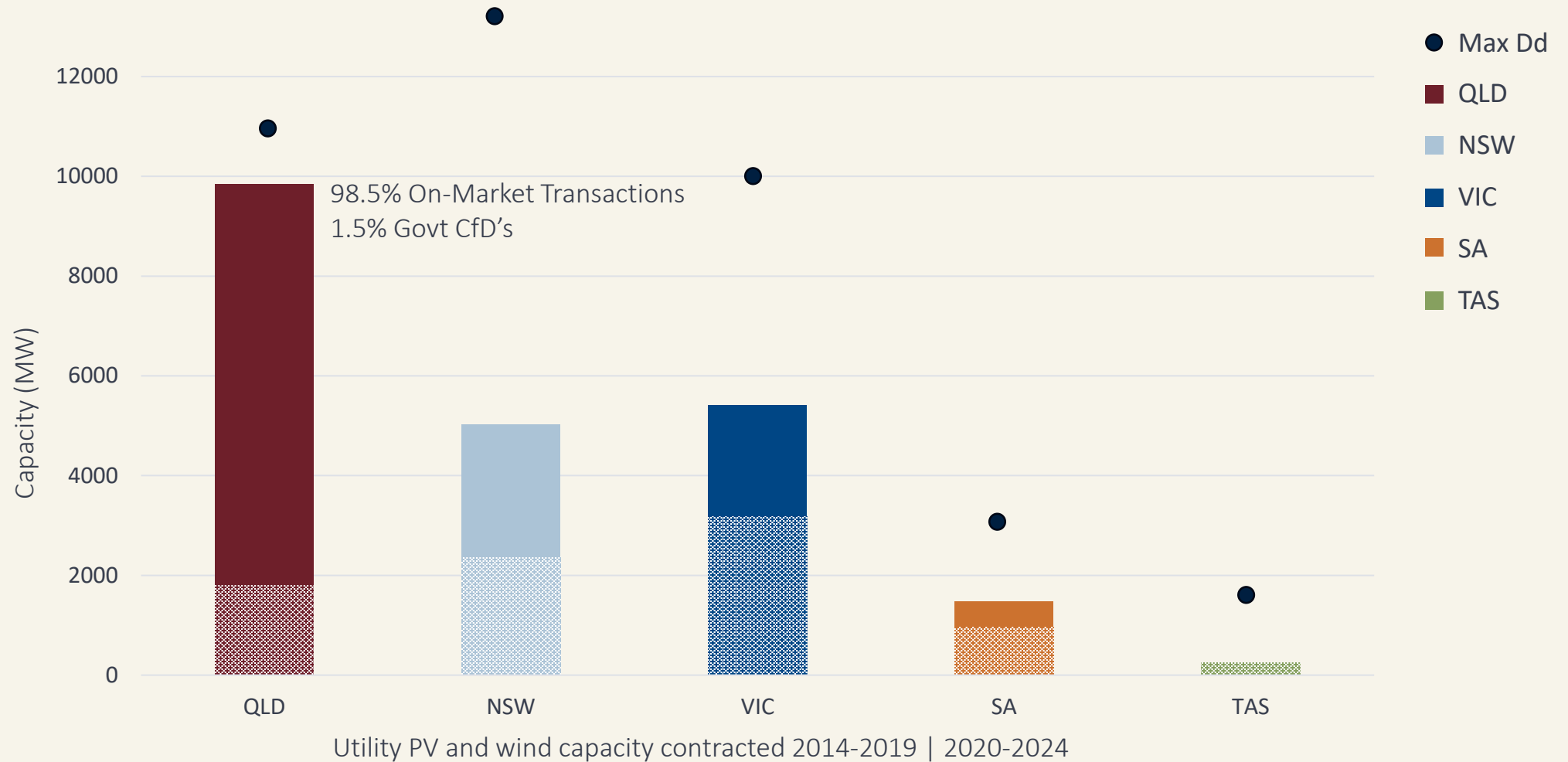
Solar

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Renewables by NEM region



Queensland connections pipeline

44 renewable and storage projects operational or under construction with combined maximum output of 8,950MW

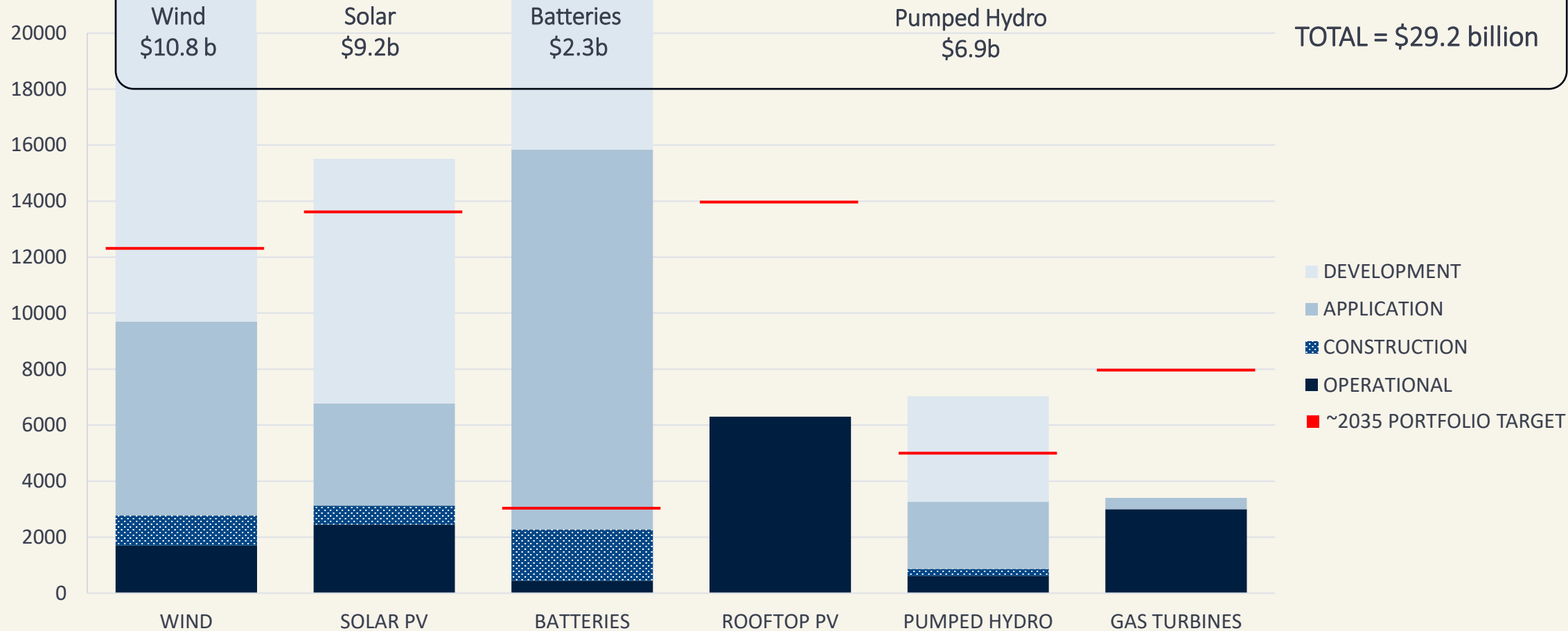
As at October 2024, 71 renewable applications being processed representing 29,000MW

208 projects at the enquiry stage (including early engagements) with combined max output of ~103GW



Queensland forward pipeline

Sum of Capacity (MW)



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Connection Queues in the NEM

- While the NEM is an open access regime, the Rules manage connection queues *quite efficiently*
- In theory, open access = ‘first in, first served’. And initially, this is the case.
- But the stages of connection become progressively more intensive, and expensive and therefore shifts to ‘first ready, first served’ (enquiry stage, **application stage**, Connection & Access Agreement = C&AA)
- Acute system strength shortfalls in certain locations caused a 2018 Rule change (s5.3.4b) which has accidentally pre-empted, and has helped to manage, the renewable queue problem
- Before proceeding to a C&AA, projects must satisfy:
 - s5.3.4a of the Rules – Generator Performance Standards
 - s5.3.4b of the Rules – System Strength Studies (the 2018 Rule to ‘do no harm on entry’)
- Both are absolute ‘conditions precedent’ for Project Financing (through bitter experience!)
 - Adds 6 months to the development cycle, requires project OEM to be selected
 - Collectively, this filters out *zombie projects*
 - Projects have historically moved from s5.3.4b to construction within weeks

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Renewable Energy Zones in Queensland

- Queensland has a 1700km transmission backbone (long stringy network!)
- REZ are 275kV radials extending from the Tx backbone
- REZs traverse areas of high-quality wind (and solar) resources
 - Sequential renewable projects, acting independently, would otherwise duplicate connections (costly), amplifying community impacts.
- Market-led ('first ready'), triggered by an 'anchor entrant' at scale (e.g. 500-1000 MW wind farm)
- User charges levied on connecting generators
- Powerlink deploys patient capital while waiting for a REZ to be fully subscribed
- Above all, QLD REZ are merchant (or semi-merchant) assets.
 - A 'residual' can be allocated to Powerlink's RAB under special conditions (Qld legislation)
 - To the best of my knowledge, globally unique framework
- Very good support from consumer groups, and renewable generators (speed to market)

Renewable Energy Zones



Renewable Energy Zones – In-flight

- Far North Queensland (energised)
- Southern Downs (energised)
- Western Downs (energised)

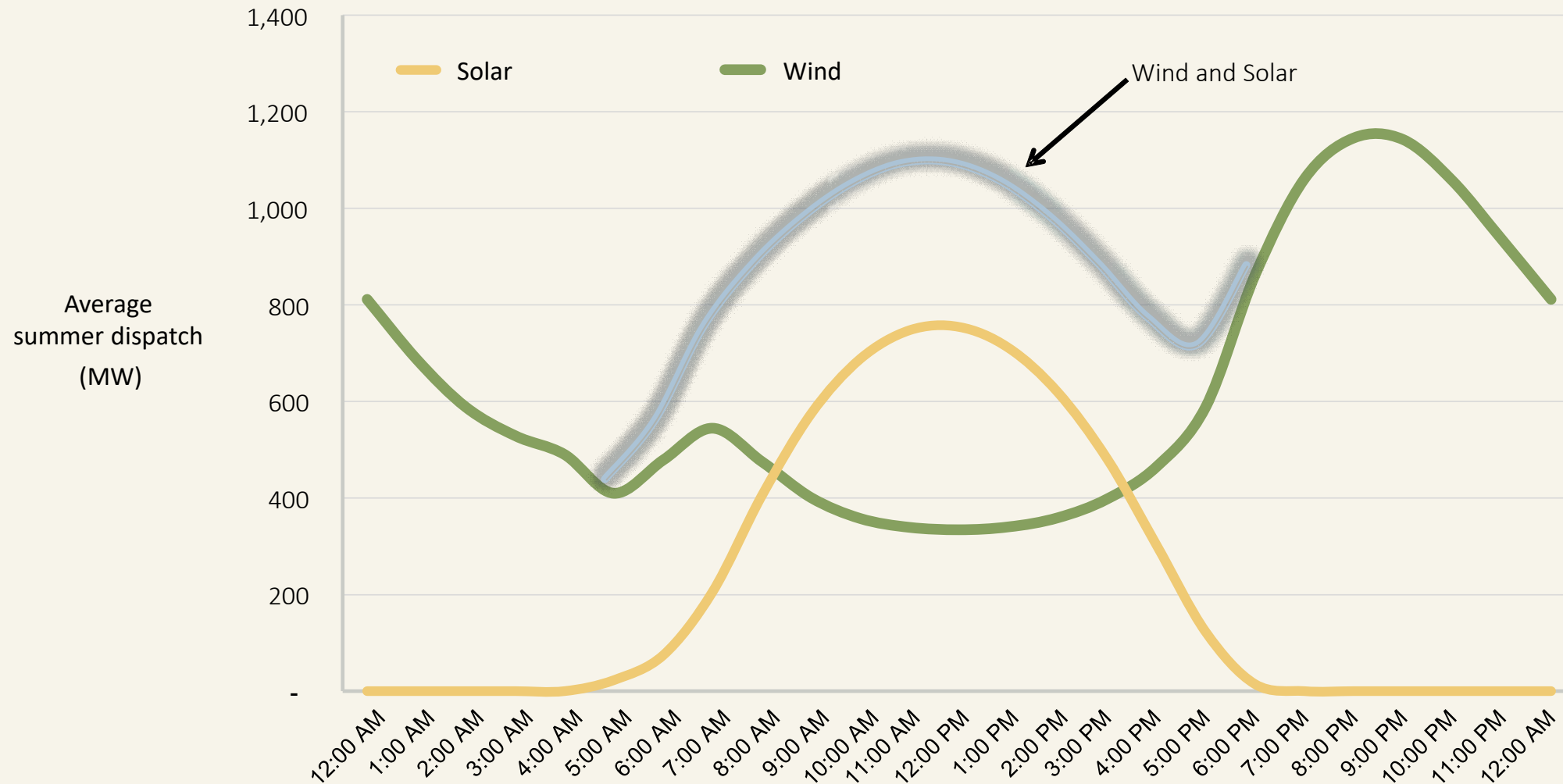


Renewable Energy Zones - Planning

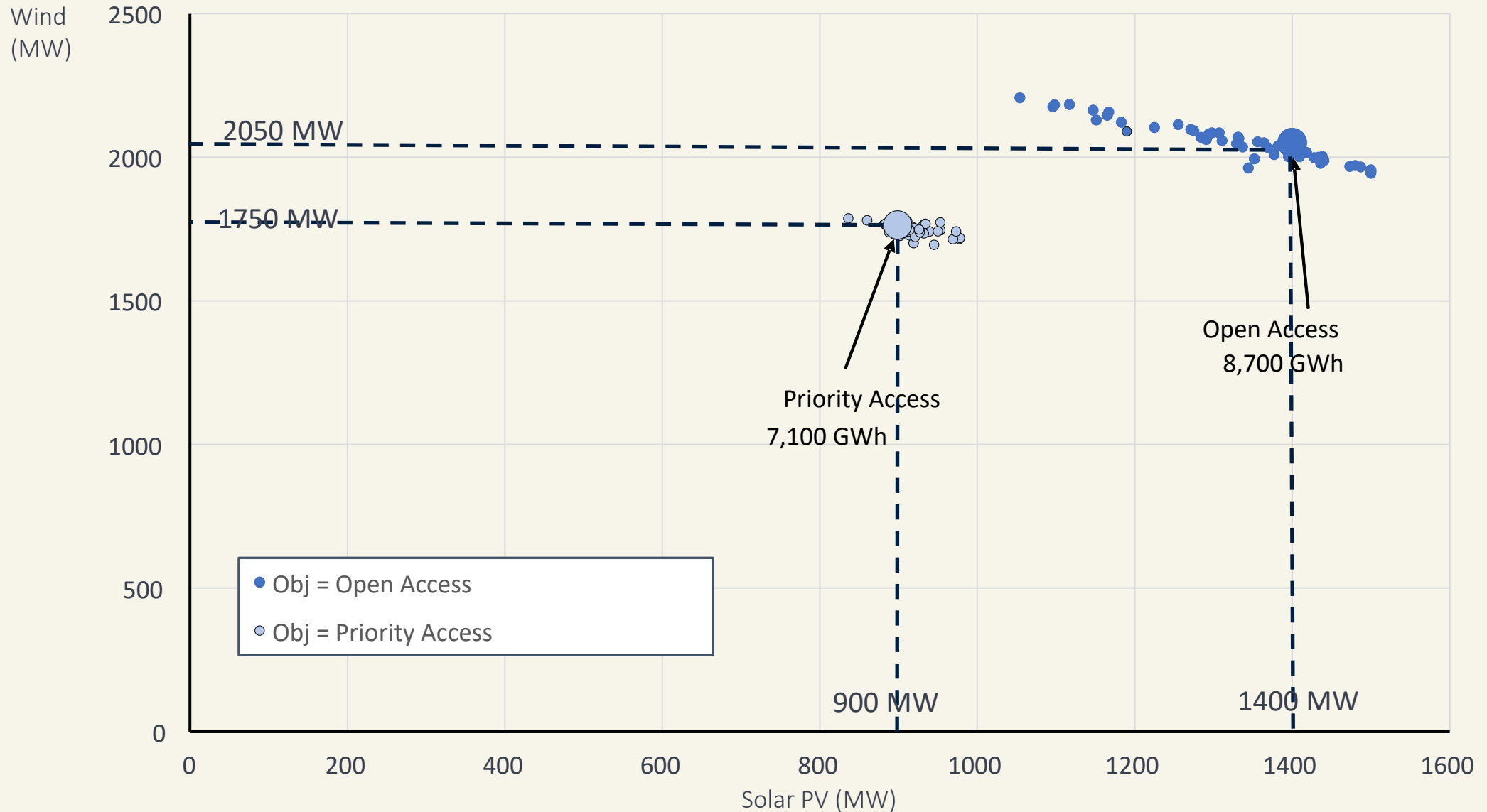
- Callide
- Calliope
- Darling Downs



Queensland wind and solar (Western Downs)



REZ Open Access v Priority Access (275kV REZ)



REZ Access: Impact of Batteries (275kV REZ)

