

Decarbonising the Australia's Electricity Market:

A story of integrated Energy Systems Planning

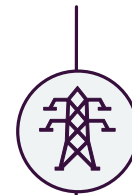
Christian Schaefer

16 September 2020, Melbourne, Australia



The National Electricity and Gas Markets in Australia

About AEMO



AEMO is the independent system and market operator for the **National Electricity Market (NEM)** and the **WA Wholesale Electricity Market (WEM)**.



We also operate **retail and wholesale gas** markets across south-eastern Australia and Victoria's gas pipeline grid.



Combined **Electricity demand** in the **NEM** and **WEM** during **FY20** was **220TWh**. In 2019 annual **gas consumption** on the East Coast was **150PJ**.

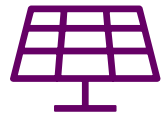


Ownership:

40%
Market participants

60%
Governments of Australia

The Road ahead – challenges and opportunities for our Electricity System



Decarbonised

15MW

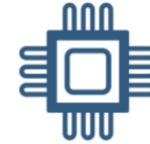
Average daily increase in new generation capacity (NEM)



Decentralised

2.2M

Generators in Australia, versus 100 in 1990s



Digitised



Reliant on IoT for energy generation



Generation now highly dependent on weather

20%+

Australian per capita rooftop solar penetration

100k+

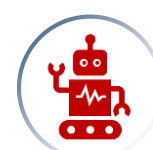
Data points per customer versus 6 points in 2010

-20%

Revenue reduction from network congestion for some generators

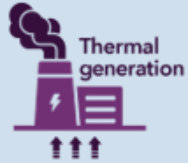
2023

Year Australia will lead in decentralised energy

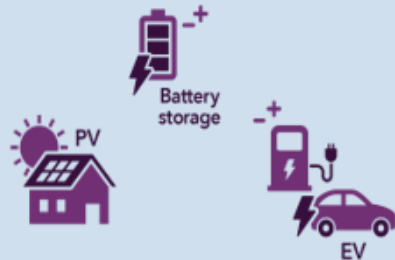


AI-based trading increasingly common

Australia's Electricity Sector in Transition – outlook to 2040



- **63% of coal-fired generation to retire.**



- Distributed energy generation capacity is expected to **double or even triple.**
- **DER will provide up to 22% of total energy.**

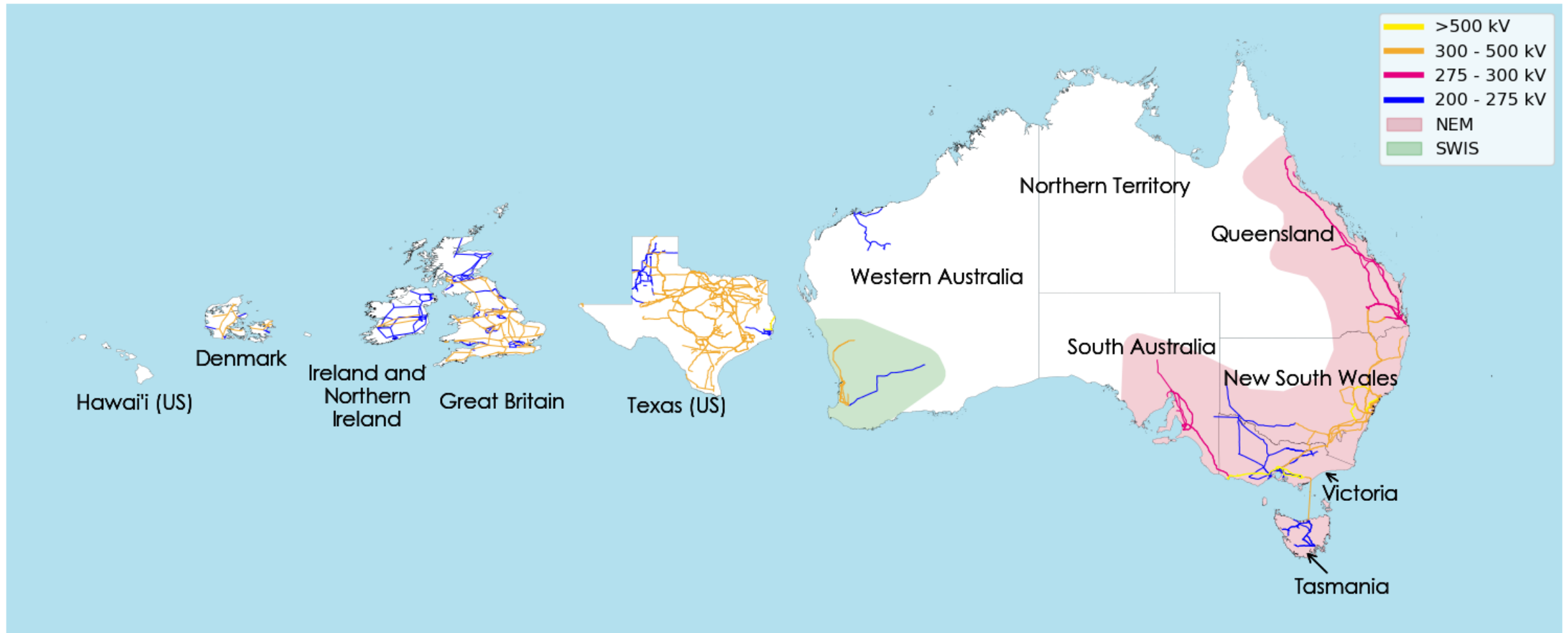


- **More than 26 GW of new variable renewable energy is needed to replace coal-fired generation**



- **Six to 19 GW of new dispatchable resources are needed to back up renewables.**

Australia, it's a big place!

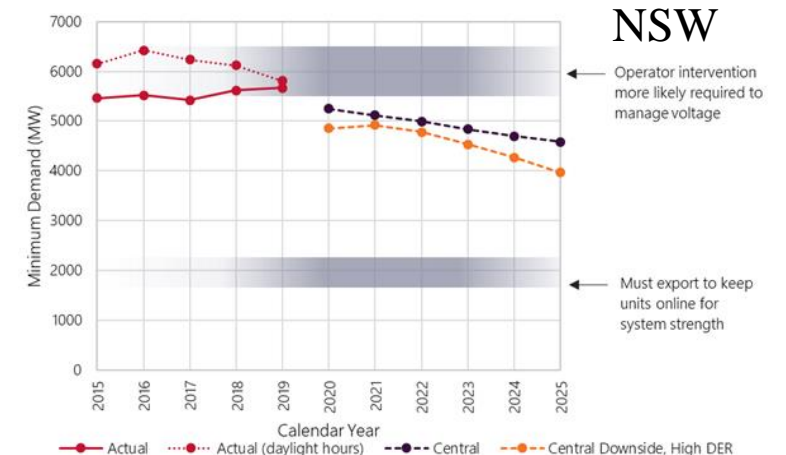
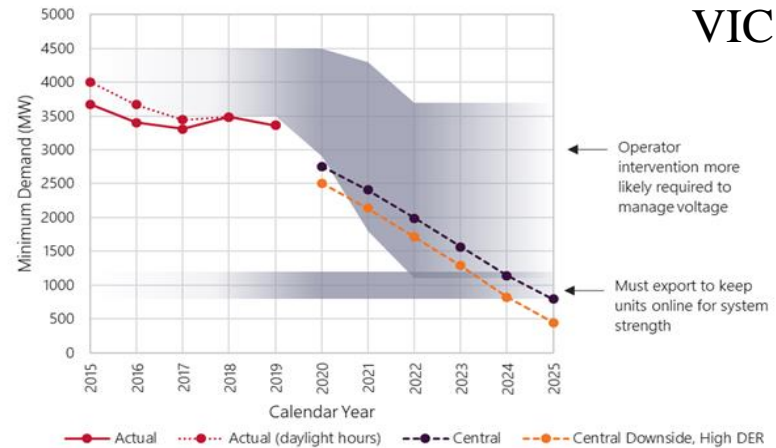
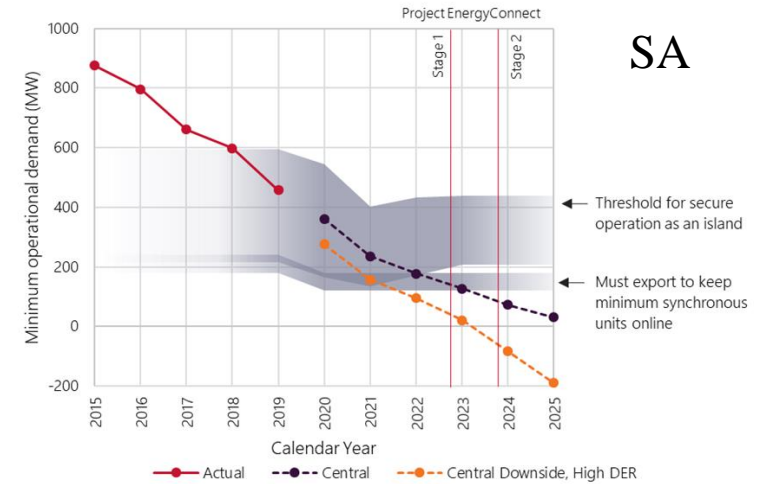
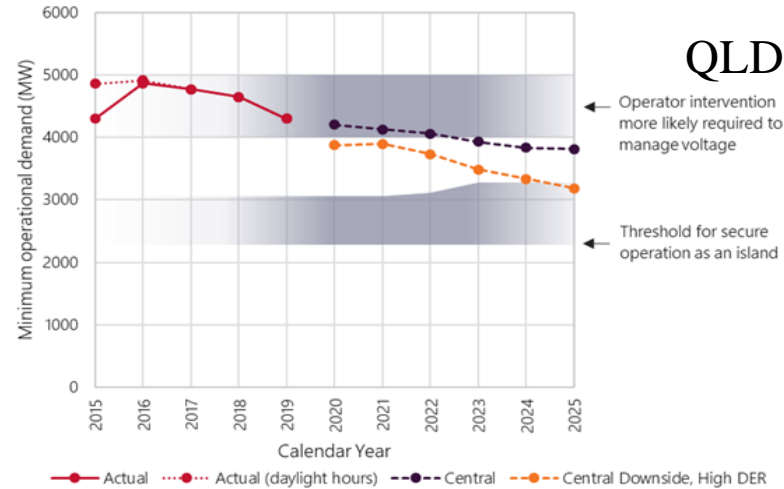


Falling Minimum Demand

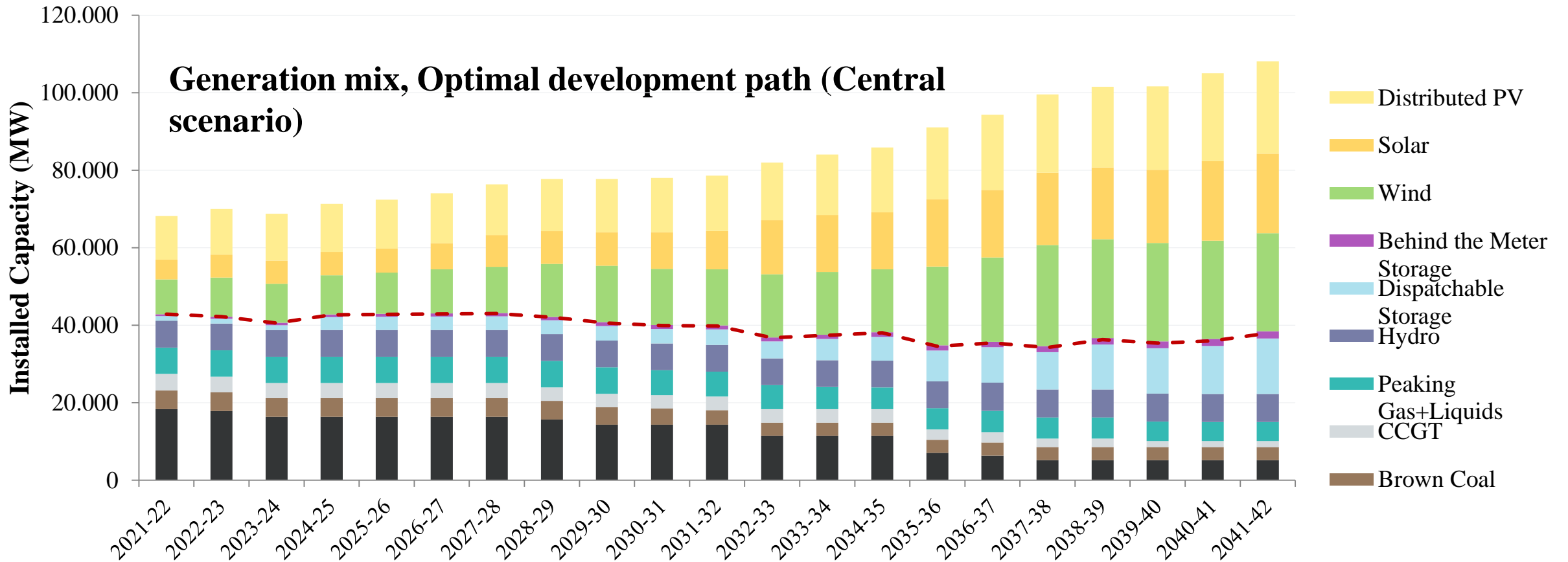
In 2020 ESOO demand is projected to fall significantly due to revisions in distributed PV uptake from 2019 ESOO

Consequences:

- Unintended disconnection of distributed PV in response to power system disturbances (not yet in NSW)
- Minimum demand thresholds to maintain supply of system security services
- Transmission voltage management
- Impacts on emergency frequency control schemes, such as under frequency load shedding (UFLS)
- Impacts on system restart processes.



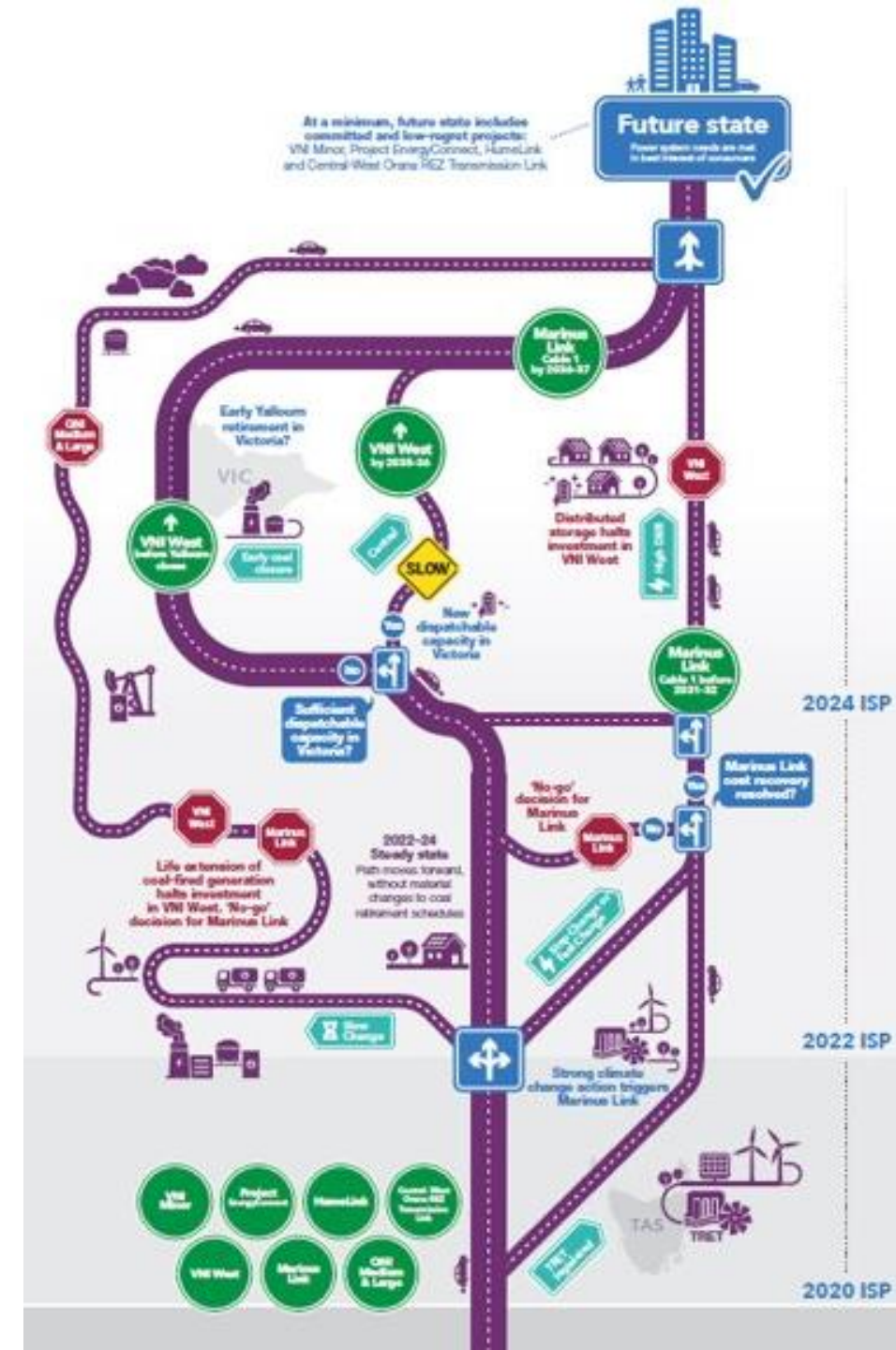
Changing Electricity Generation Capacity



Electricity System Planning for the NEM

The Integrated System Plan (ISP) describes Australia's future least cost energy transition:

- Provides a whole-of-system plan
- Maximises value to end consumers
- Utilises the opportunities provided from existing technologies and anticipated innovations
- Aims to inform policy makers, investors, consumers, researchers, and other energy stakeholders.
- Considers multiple scenarios to capture variables such as demand growth, growth of distributed sources, and utility scale renewables.
- From 2021 will also include H₂ influences in the ISP (as well as in the Gas Statement of Opportunity)



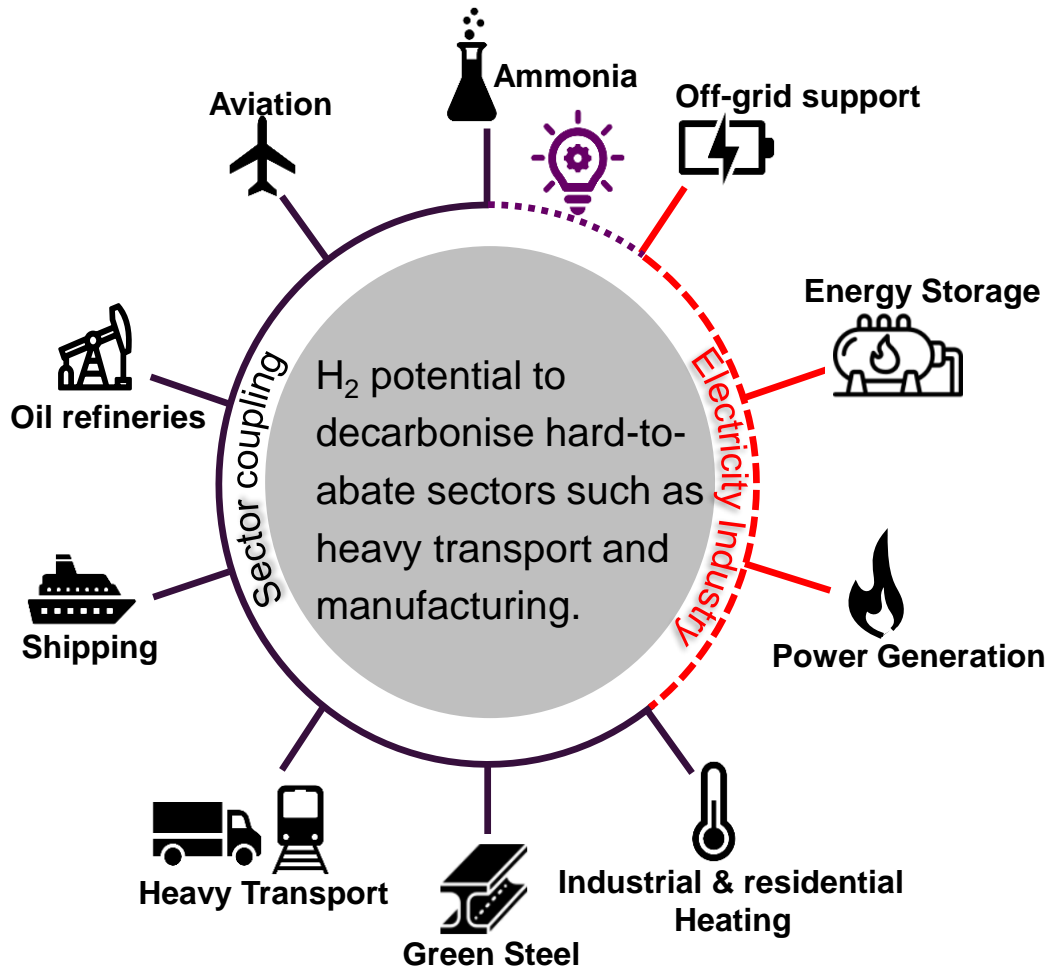
Greater Interconnection is needed!

Classification	Project	Indicative timing
Committed	SA System Strength Remediation	2021-22
	QNI Minor	2021-22
	Western Victoria Transmission Network Project	2025-26
Actionable¹	VNI Minor	2022-23
	Project EnergyConnect	2024-25
	HumeLink	2025-26
	Central-West Orana REZ Transmission Link	Mid-2020s
	VNI West ²	2027-28
Preparatory Activities Required	Marinus Link ² - Cable 1 - Cable 2	2028-29 to 2031-32 2031-32 to 2035-36
	QNI Medium & Large	2030s
	Central to Southern QLD	Early-2030s
	Reinforcing Sydney, Newcastle and Wollongong Supply	2026-27 to 2032-33
	Gladstone Grid Reinforcement	2030s
	New England REZ Network Expansion ³	2030s
Future ISP Projects	North West NSW Network Expansion ⁴	2030s
	Far North QLD REZ	2030s
	South East SA REZ	2030s
	Mid North SA REZ	2030s

1 Estimated practical completion including any subsequent testing - projects may be delivered earlier
 2 Decision rules may affect timing
 3 May be accelerated by government initiatives
 4 Not shown on map. AEMO requires that preliminary engineering designs be completed by 30 June 2021

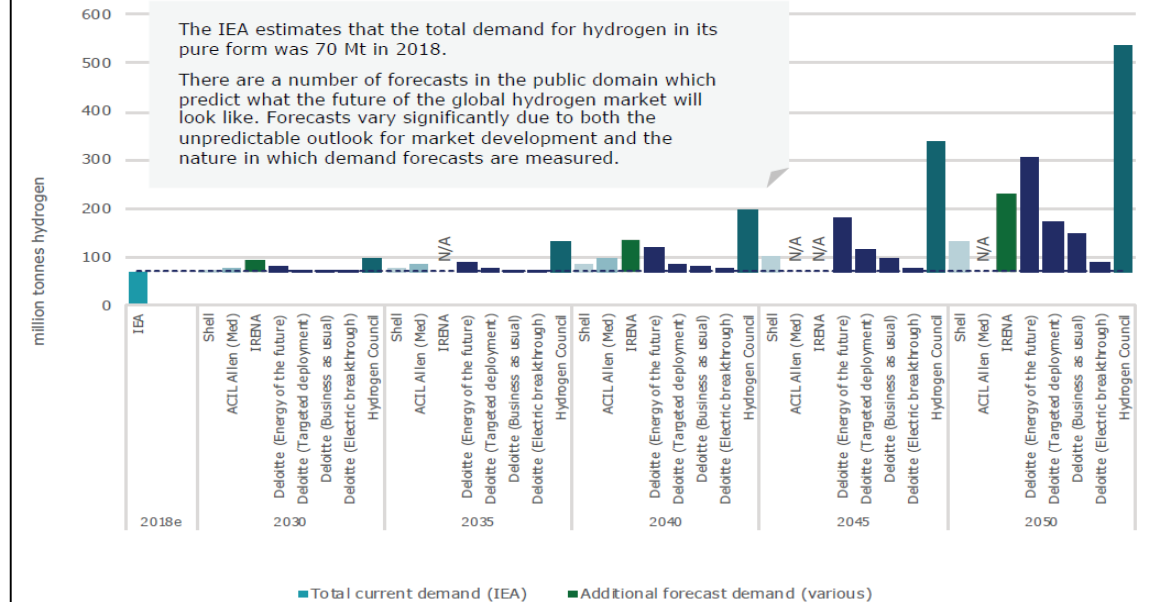


Opportunities for Hydrogen Applications



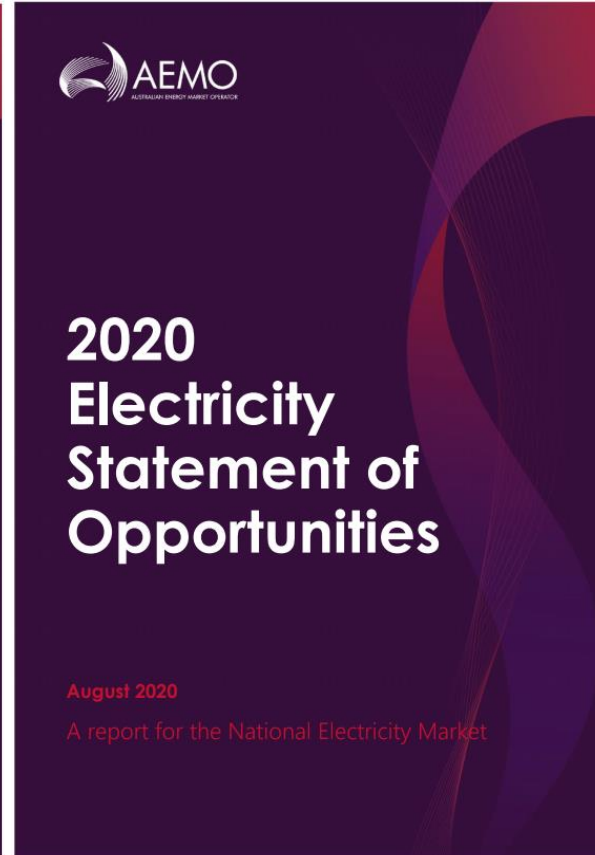
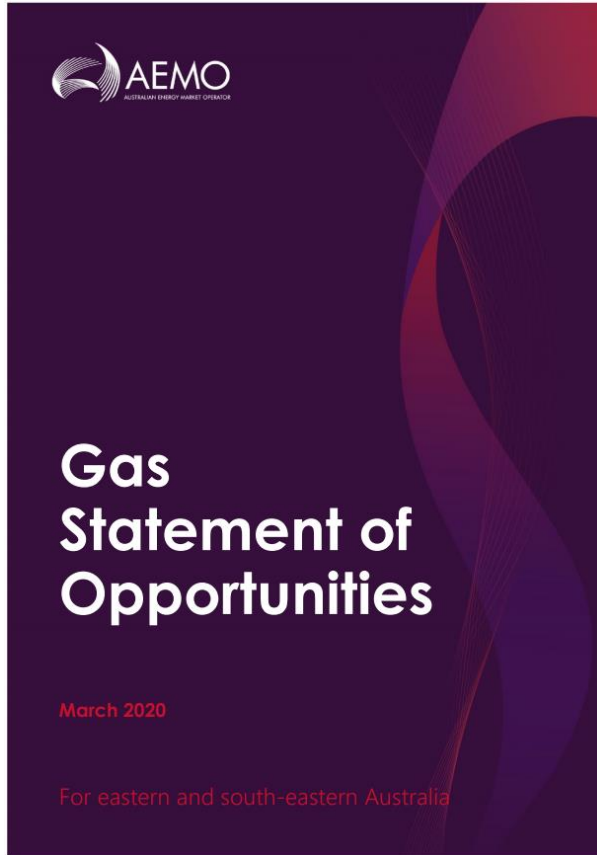
- Australia produces 1Mt pa from SMR
- Present global H₂ demand is estimated 55-70 Mt or 6,600-8,400 PJ (mainly chemical feedstock).
- Global LNG trade is around 17,000PJ
- Eastern Australia exports about 1,250 PJ of LNG and consumes around 600PJ domestically.

Figure 2.1 Forecasted global hydrogen demand (million tonnes hydrogen)



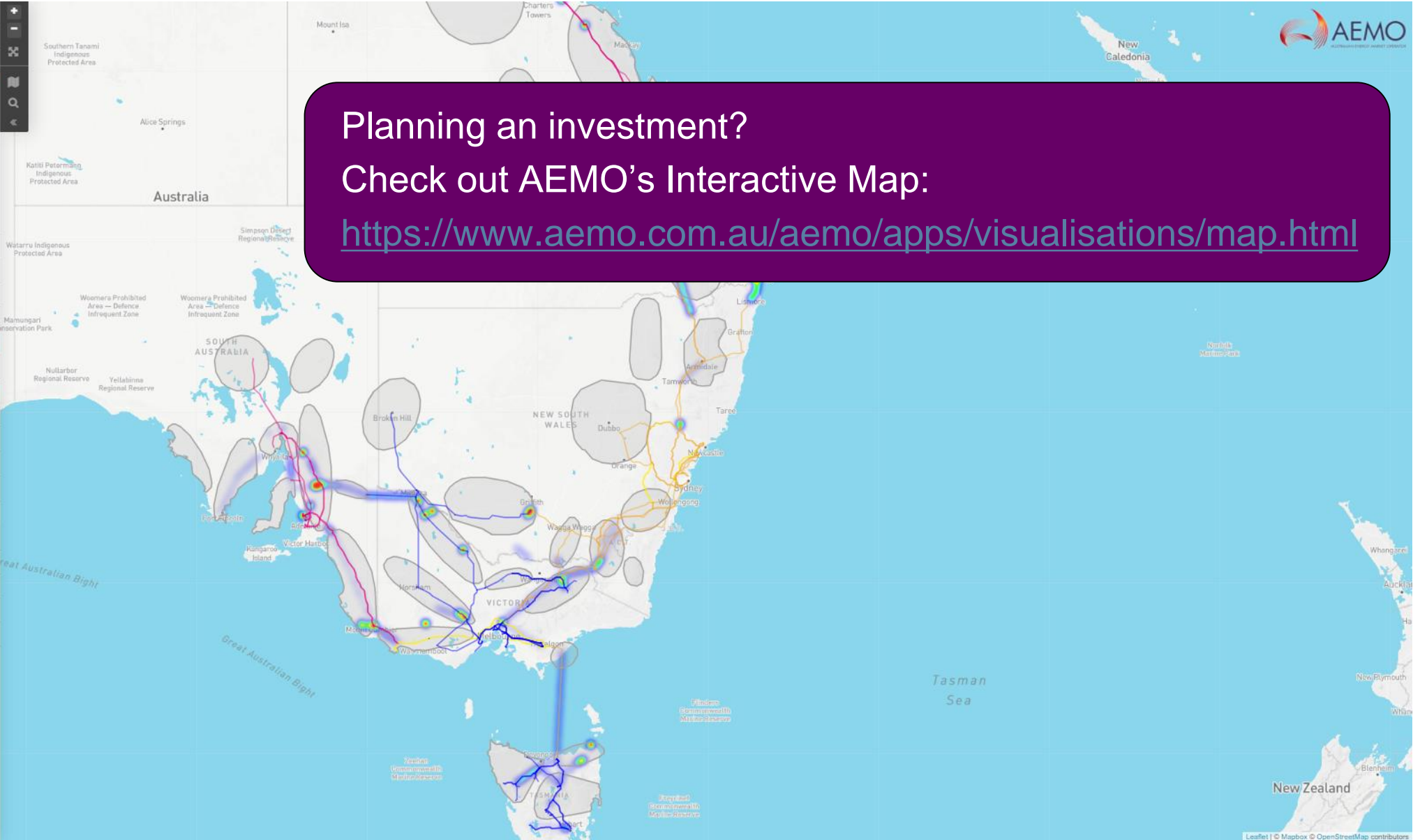
Source: IEA, ACIL Allen, IRENA, Hydrogen Council, Deloitte Analysis

Further Reading at www.aemo.com.au



Layers

- Electricity Network
 - Transmission Infrastructure
 - Transmission Lines
 - 500 kV Transmission Line
 - 330 kV Transmission Line
 - 275 kV Transmission Line
 - 220 kV Transmission Line
 - 132 / 110 kV Transmission Line
 - 66 kV Transmission Line
 - Transmission Substations
 - Generation Infrastructure
 - Electricity Statement of Opportunities (ESOO)
 - 2020 Integrated System Plan
 - 2019-2020 System Normal Congestion
 - Renewable Energy Zones
 - REZ Information
 - Forecast Generation
 - Renewable Resources Potential
 - Network Investments
 - Interconnector Utilisation
 - Generation Outlook
 - System Strength
 - Victorian Annual Planning Report (VAPR)
 - Demand Forecasts
 - Historical Information
 - Reset all layers



Planning an investment?
 Check out AEMO's Interactive Map:
<https://www.aemo.com.au/aemo/apps/visualisations/map.html>





Federal Ministry
for Economic Affairs
and Energy



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GLOBAL
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Thank you for your attention!

Christian Schaefer

16 September 2020, Melbourne, Australia



Facilitator

