Australia's decarbonising transition

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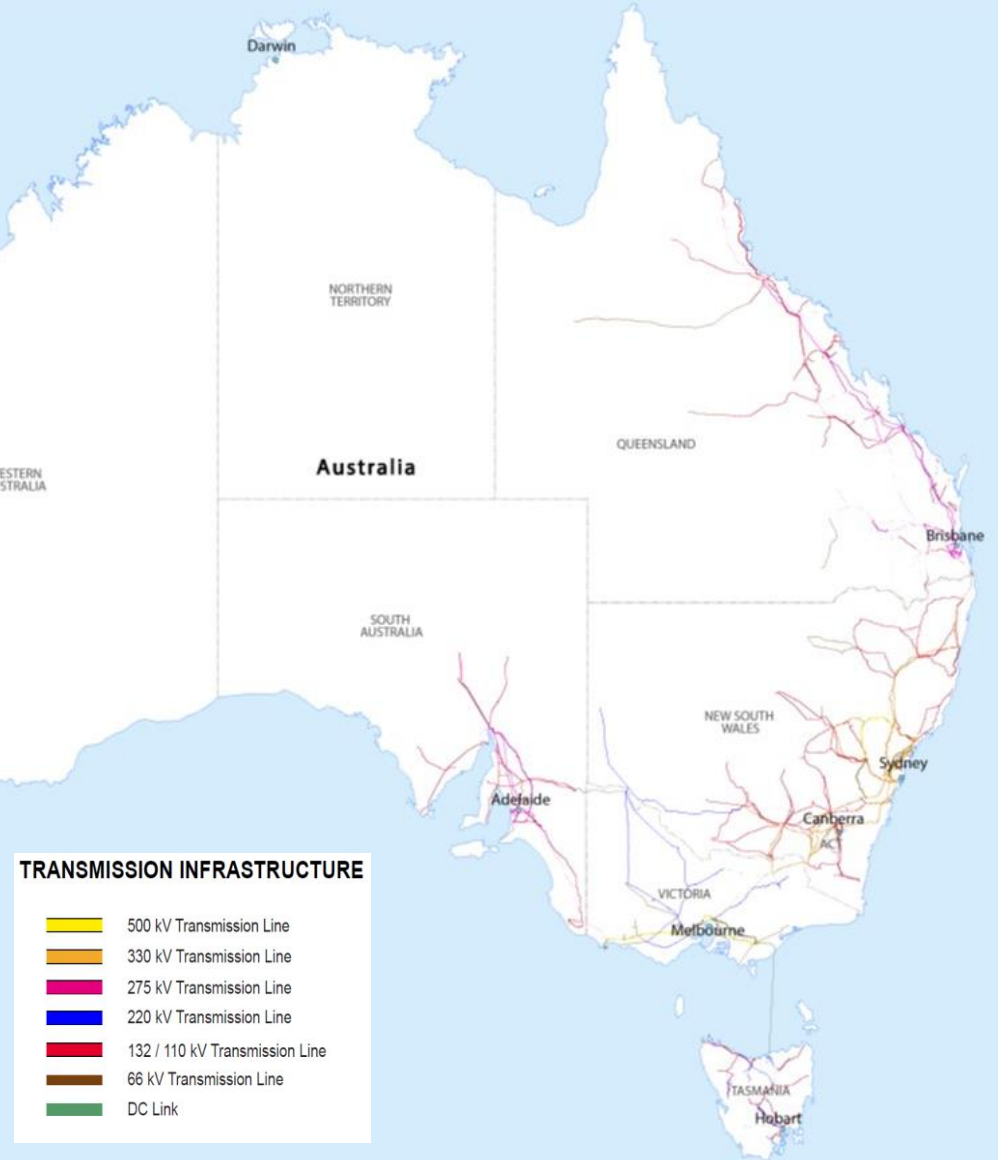
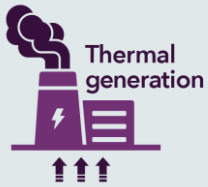
National Electricity Market (NEM)



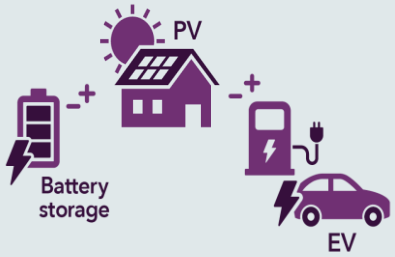
NEM overview

- One of the world's longest interconnected power systems (5,000 km)
- 40,000 km of transmission powerlines
- 10 million customers
- Peak load 35.5 gigawatts (GW)
- Minimum load 15.3 GW
- 56 GW of electricity generation capacity
- This excludes 10.6 GW of rooftop solar

Profound changes to the NEM by 2040

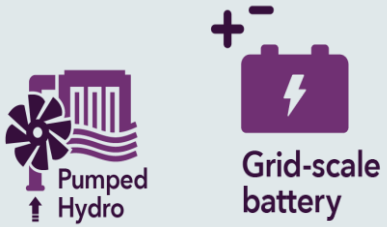


- **63% of coal-fired generation to retire,** the equivalent annual electricity needs of all Australian homes and a proportion of businesses



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

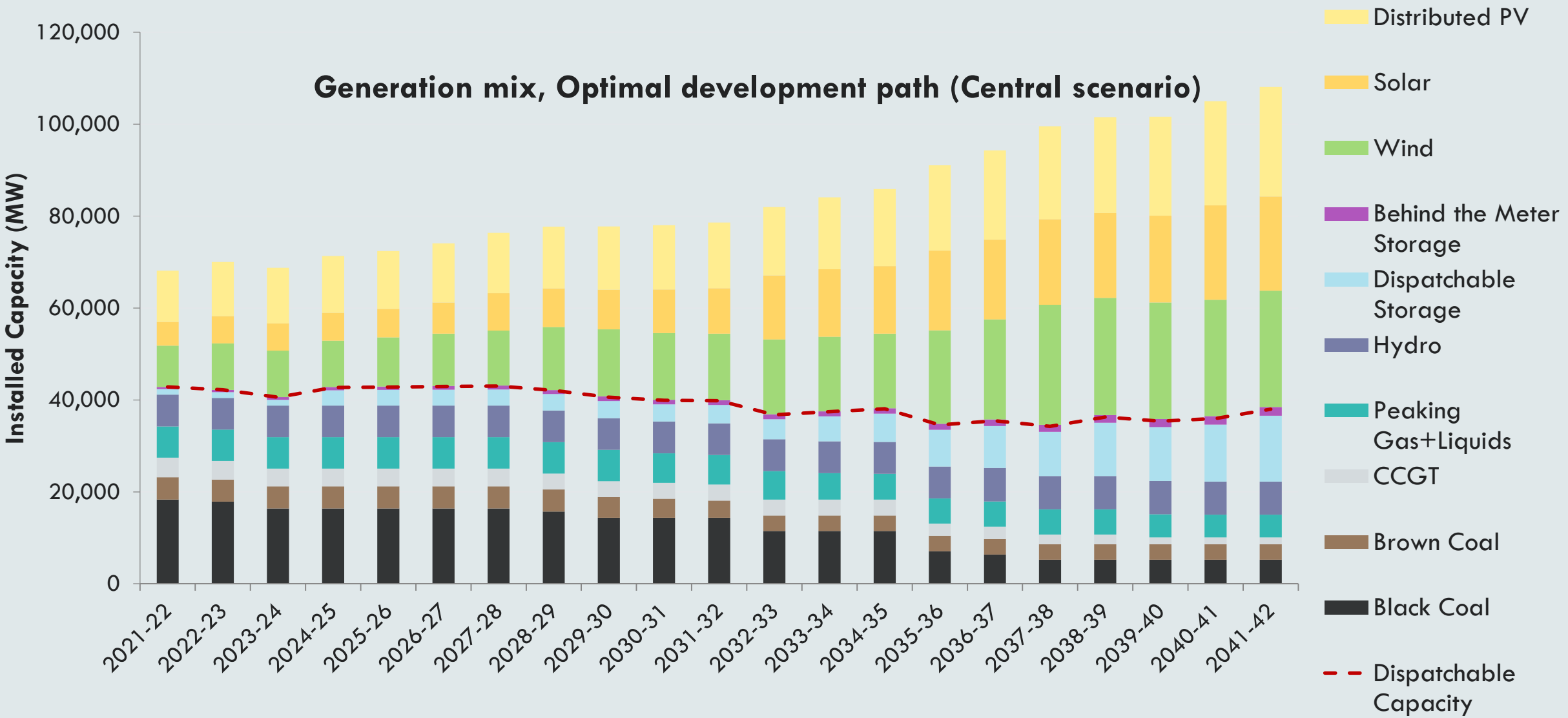
- **More than 26 GW of new variable renewable energy is required** to replace 15 GW of retiring coal-fired generation



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

Source: AEMO 2020 ISP

Projected generation mix

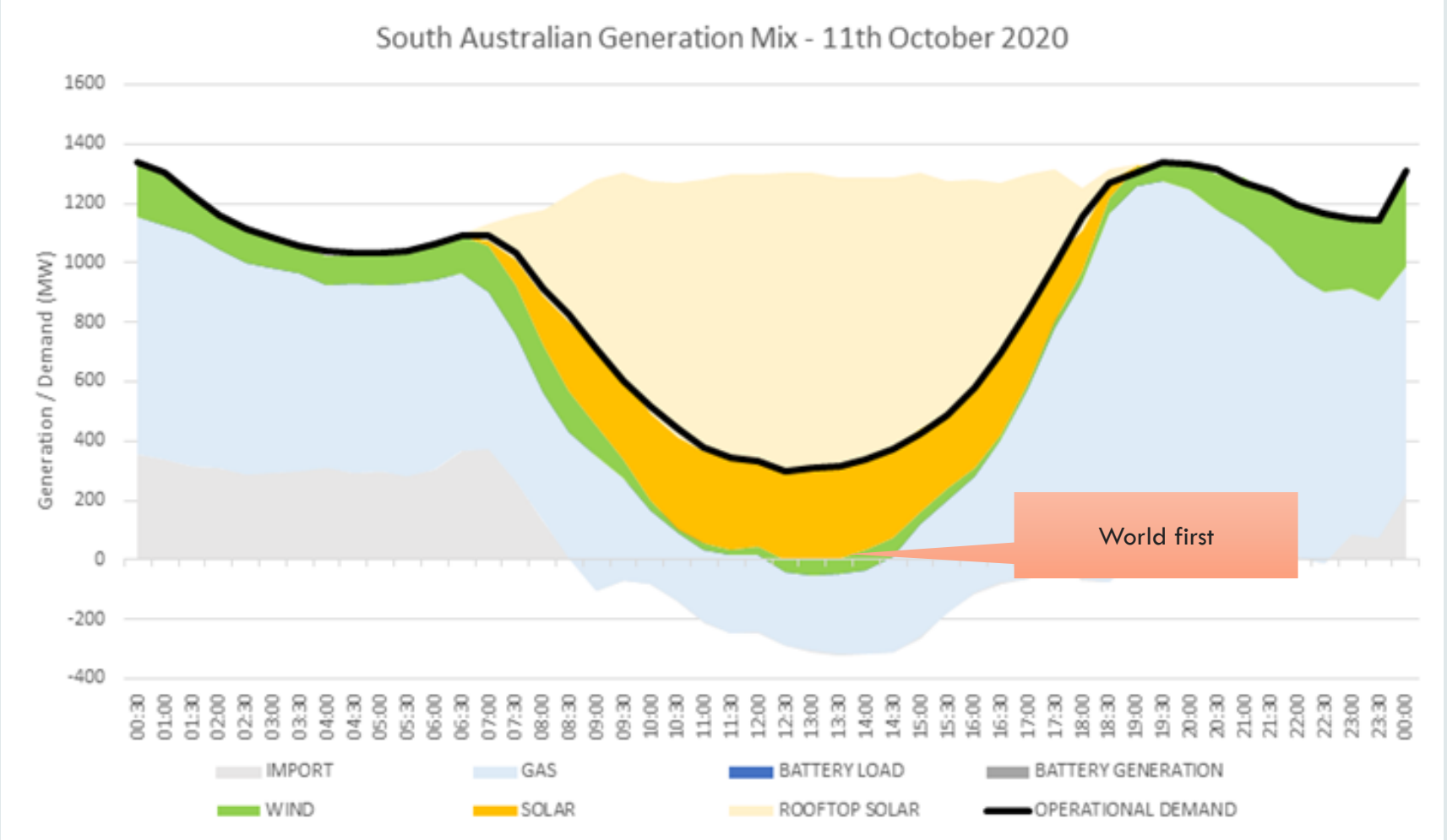


Source: AEMO 2020 ISP

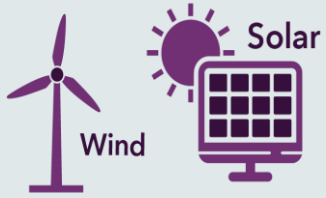
The solar story: Australia leading the world

- **2.5 million systems** in 2020 (100,000 in 2010)
- **8-10%** of total electricity capacity
- **20% of homes - one in three households** in some states
- **15 panels** are installed **every minute**

Solar powers South Australia for an hour – a world first

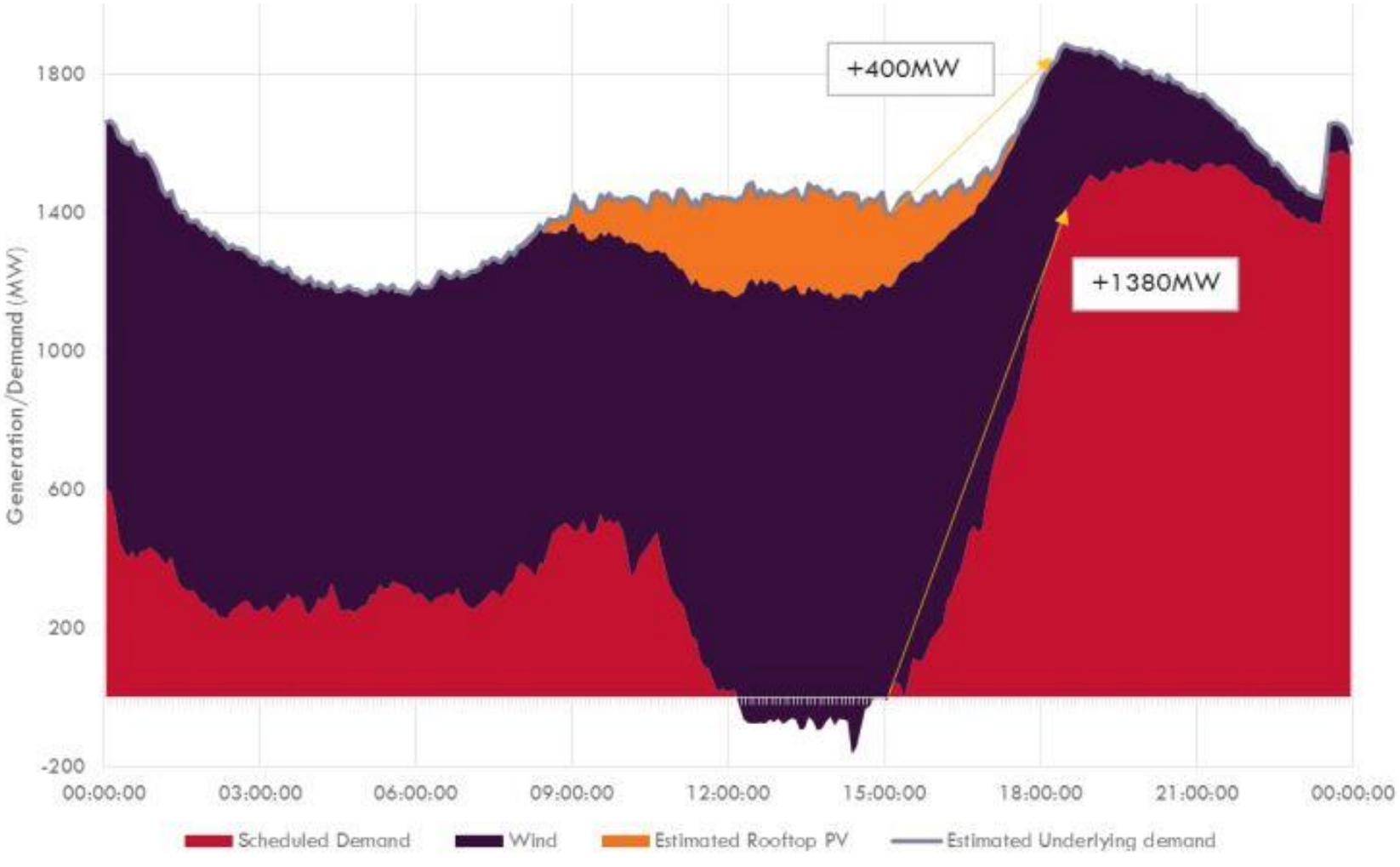


Greater reliance on weather as a “fuel”



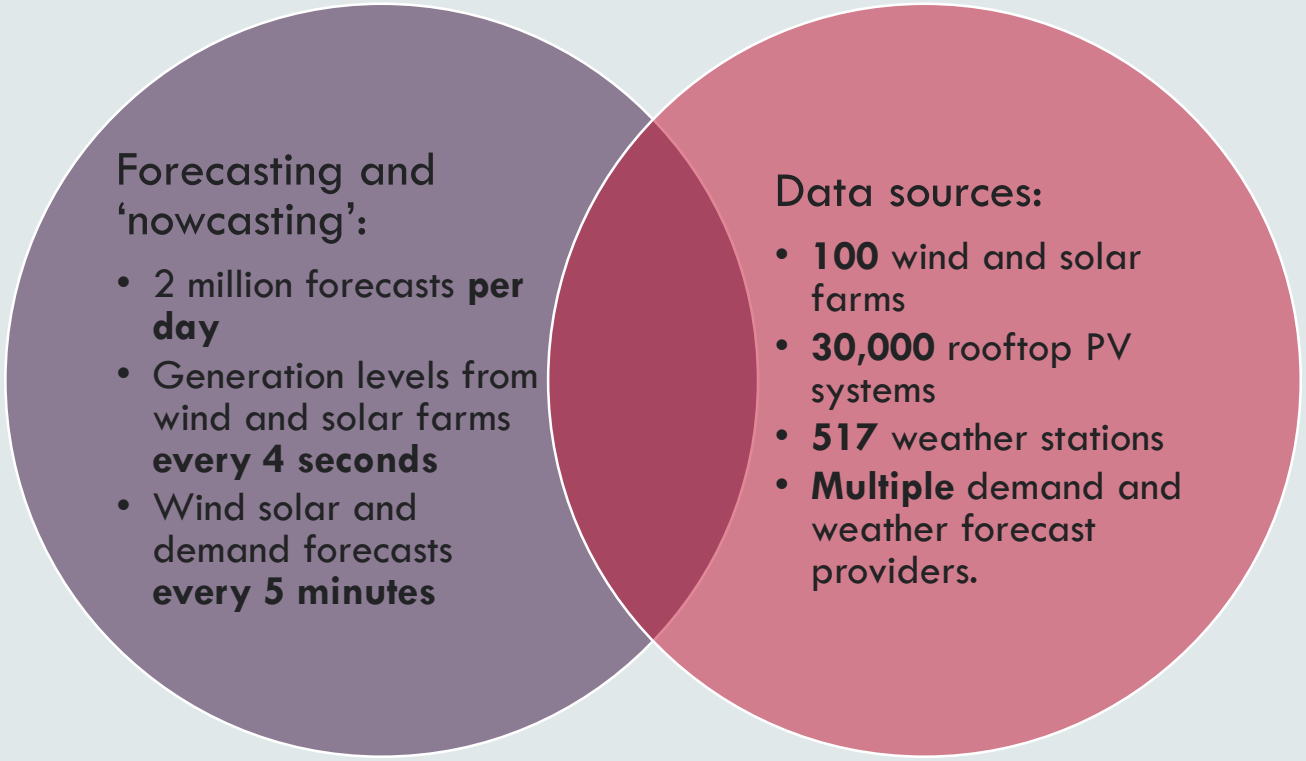
- Entire region’s demand met by **renewable resources**
- Sudden **wind change**
- High demand for **flexible generation to ramp**
- Need **visibility** to anticipate changes

Wind ramping event – South Australia, 2017



Data and decision tools

Growing and enhanced data sets



Decision-making technologies

- Artificial Intelligence
- Machine learning
- Real-time simulator

Power system services

1. 
Supply and demand balance

2. 
Uncertainty and variability

3. 
Frequency

4. 
System strength and voltage

Hours | Minutes | Seconds | Milliseconds

Refer to AEMO's 2020 Renewable Integration Study for more details:

https://aemo.com.au/en/energy-systems/major-publications/renewable-integration-study-ris

Global Power System Transformation (PST) consortium

A new **Consortium** focused on identifying **shared problems** and developing **innovative solutions** for **Power System Operators**

1. **Research Innovations**
2. **Tools, Knowledge & Capacity**
3. **Localised Technology Solutions**

www.globalpst.org

Complementary market reforms are also needed

7 initiatives	Benefits
• **Two-Sided Markets**	Meet consumer needs: especially the development of a two-sided market, which changes how consumers interact with the market.
• **DER Integration**	Valuing demand flexibility and the integration of DER
• **Essential System Services** • **Ahead Mechanisms** • **Resource Adequacy Mechanisms**	Manage variability and uncertainty: ensure the system operator and market participants have the tools needed to keep the system in a secure operating state.
• **Transmission Access and the Coordination of Generation and Transmission** • **Aging Thermal Generation Strategy**	Capital replacement: how the market can help integrate new sources of generation and storage.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