System operator perspective

Digitalisation, Disruption, and the Grid of the Future webinar

Tuesday 27 July 2021

Singapore International Energy Week

AEMO

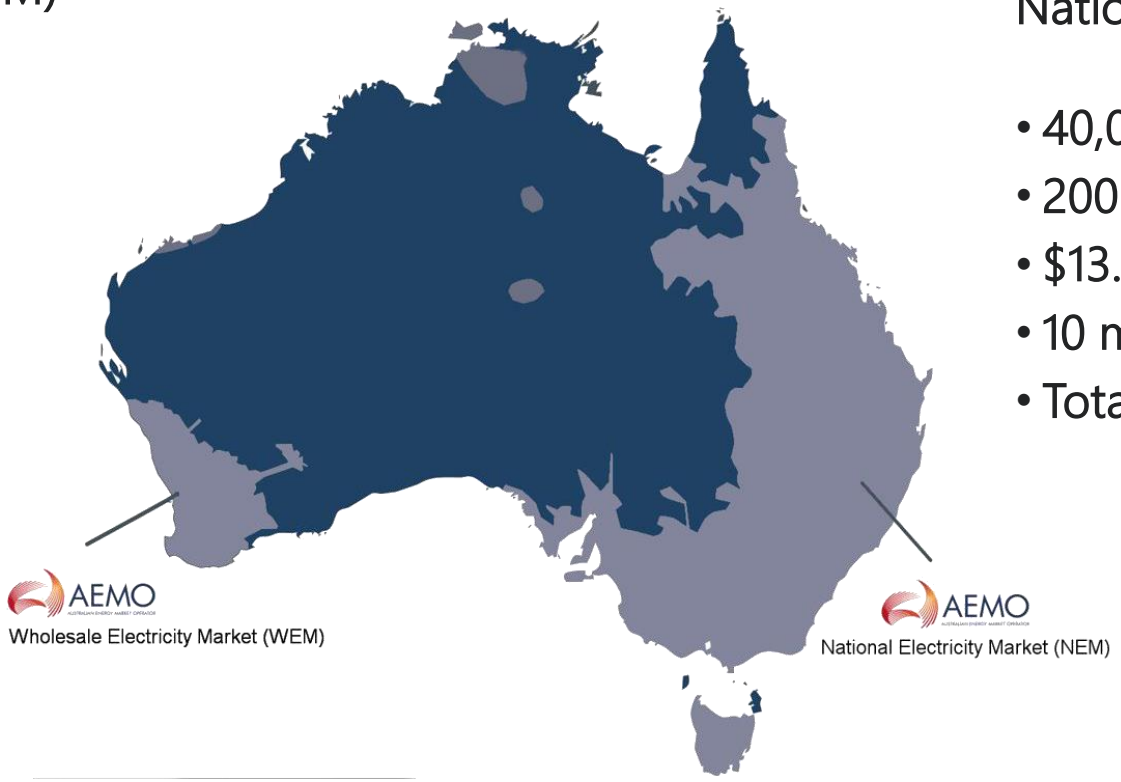
AUSTRALIAN ENERGY MARKET OPERATOR

About AEMO

AEMO is **Australia's independent system and market operator and planner** for the National Electricity Market in Australia's eastern and south-eastern seaboard, and the Wholesale Electricity Market and power grid in south-west WA.

Wholesale Electricity Market (WEM)

- **7,802 km** of transmission lines
- **20 TWh** supplied per year
- **$1.6 billion** annual trade
- **1 million customers**
- Total generation **5.5 GW**



National Electricity Market (NEM)

- **40,000 km** transmission lines
- **200 TWh** supplied per year
- **$13.2 billion** annual trade
- **10 million** customers
- **Total generation: 56.5 GW**

Several transitions underway

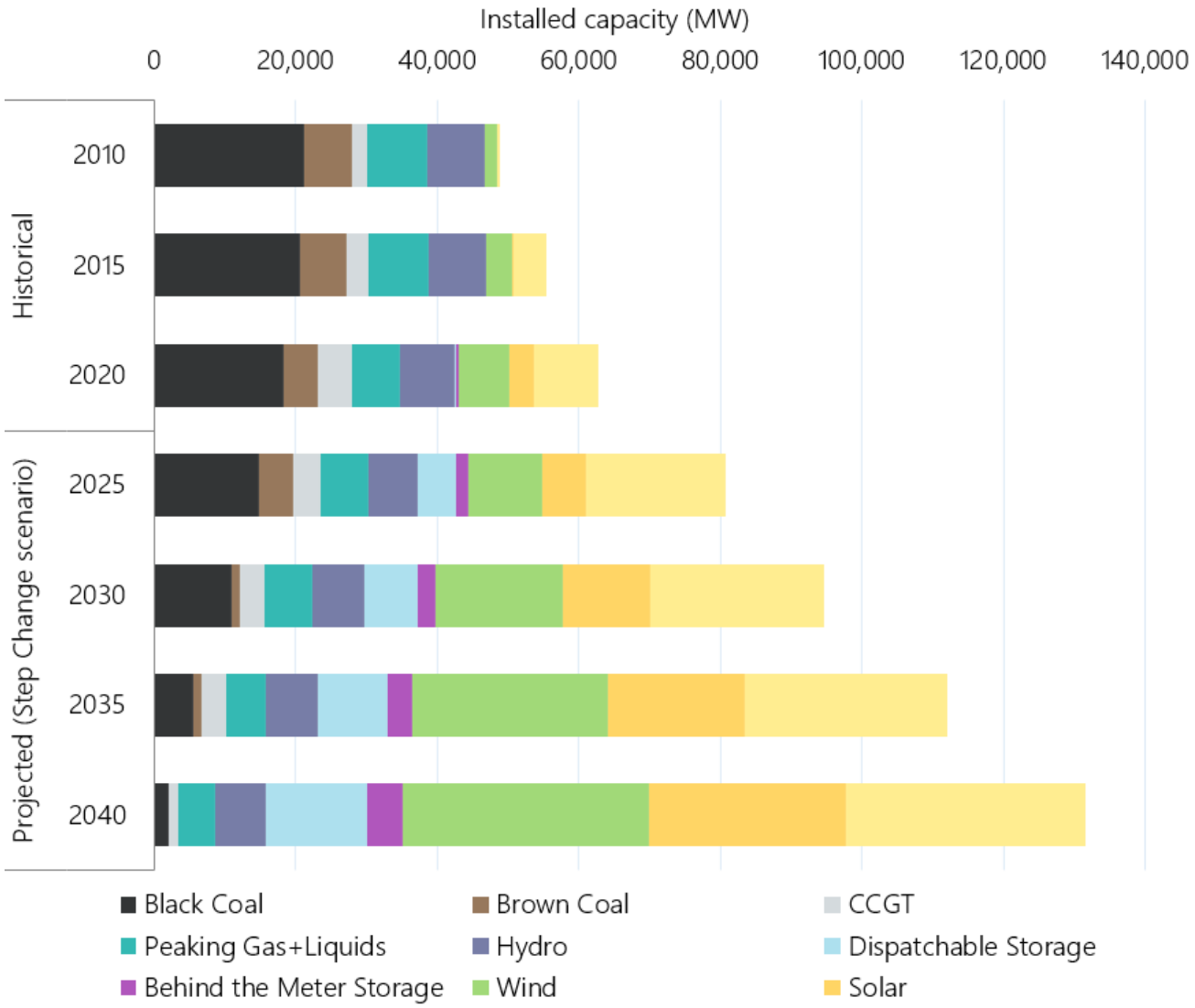
Synchronous → Inverter-based

Centralised → Decentralised

Thermal → Variable renewable

- **Changing system dynamics:** increasing need to replace system stability services provided by synchronous fleet.
- **Weather dependence:** increasing variability in both the demand and supply side of the system.
- **New forms of participation:** new devices, innovation in services and novel interactions with the power system.
- **Volume of data exchange:** increasing sensing and monitoring data and computationally intensive applications
- **Increasing complexity:** increasingly complex data, information exchange and control interactions.
- **Increasing number of actors:** devices and systems developed and operated by many different parties.

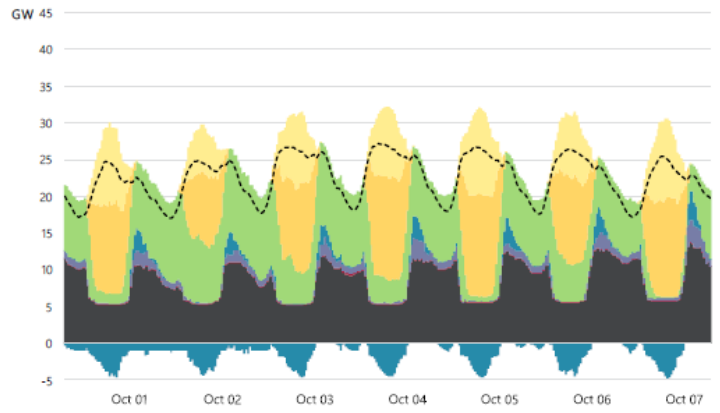
Significant opportunities for digitalisation across all of these areas.



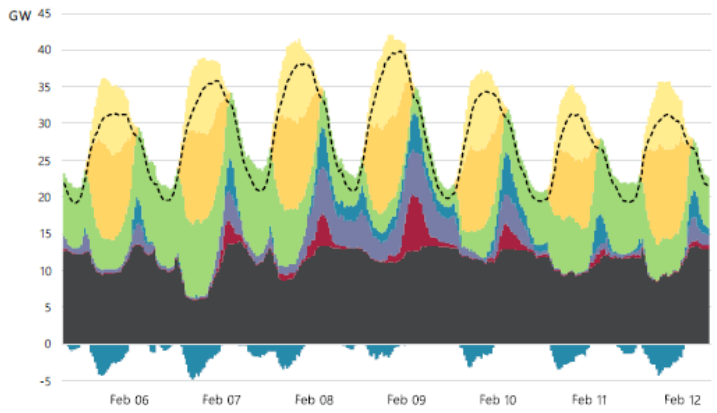
Opportunities for flexibility

Indicative generation mixes in the NEM (2035) – 4 different weeks

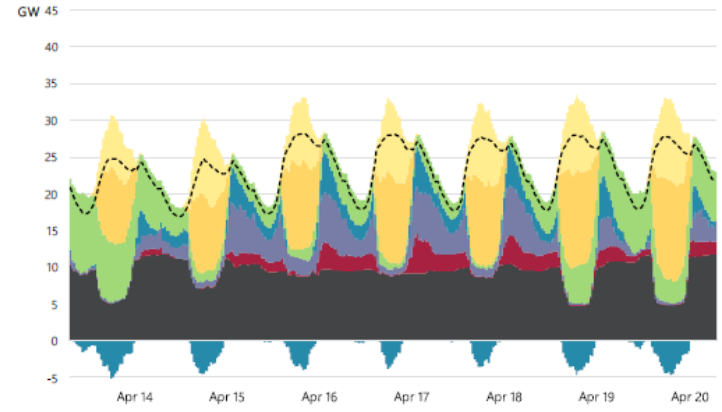
a) High renewables, low demand



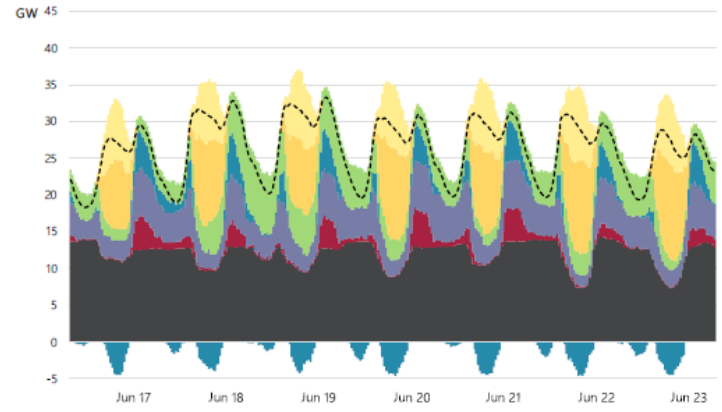
d) High renewables, high demand



b) Low renewables, low demand



c) Low renewables, high demand



Need for a portfolio of different flexibility options

- Conventional generation: peaking and flexible gas and liquid fuel plants, reducing minimum load levels
- Energy storage: pumped hydro, batteries (utility scale and behind-the-meter)
- Demand response: customer response to price signals or other incentives .
- Interconnection: sharing flexibility between regions

Opportunities for storage of different depths:

- Shallow storage: capacity, fast ramping and frequency control ancillary services.
- Medium storage: intra-day energy shifting driven by demand and solar cycles
- Deep storage: covers VRE 'droughts' and seasonal smoothing of energy over weeks or months.

Refer to AEMO's 2020 Integrated System Plan for further information

Integrating distributed energy resources

Distributed energy resources (DER) is comprised of generation, storage, and flexible demand behind the meter or within the distribution network.

Australia is at the forefront of DER penetration globally due to consumer uptake of distributed PV (DPV) since 2010. AEMO projects continued decentralisation through:

- Ongoing growth of DPV and emergence of other DER including batteries, EVs and demand response.
- Increasingly sophisticated DER coordination.

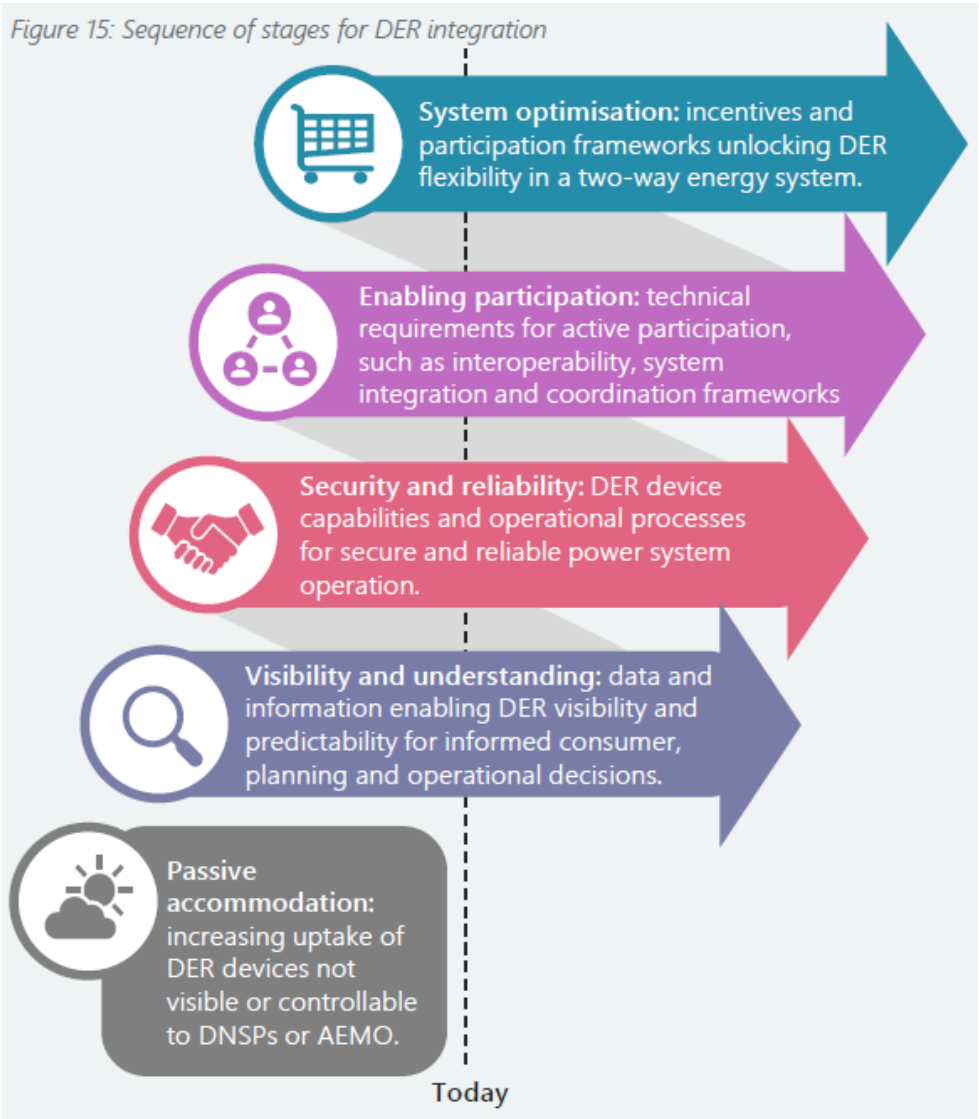
Maximising the opportunities from DER uptake will empower consumer participation in a better optimised two-way power system. This will require a staged transition informed collaboration across industry towards two broad objectives.

- **Empowering optimised consumer participation** – consumers able to make informed energy choices aligned with system needs.
- **Secure and reliable system operation** – as DER becomes an increasingly large component of the supply mix and interactions become more complex.

Digitalisation and innovation in products and services can:

- Empower consumers and businesses to actively manage their energy supply and usage (via third-party service providers or energy management systems).
- Allow more granular, better tailored information to enable informed decision-making across the energy sector.
- Enable DER to be better integrated as a valuable source of flexibility within the power system for the benefit of all end users.

Figure 15: Sequence of stages for DER integration



Refer to AEMO's Engineering Framework March 2021 report for further information