Navigating the transition to the fourth revolution

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR
We operate Australia’s National Electricity Market and power grid in Australia’s eastern and south-eastern seaboard, and the Wholesale Electricity Market and power grid in south-west WA.

Both markets supply more than 220 terawatt hours of electricity each year.

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

Collectively traded more than A$20 billion in the last financial year.

Ownership

40% Market participants

60% Governments of Australia
Our industry is in disruption
Drivers of disruption

- Weather and climate changes
- Reduced Resiliency
- Ageing infrastructure
- New Areas of Vulnerability
- New service models
- Policy uncertainty
- Consumer preferences
- Electronic vs Synchronised Resources
- Cyber security
- Reduced Visibility
- Faster and More Granular
- Supply sources
- Diverse, Variable, Unpredictable Supply and Demand
- Energy industry
- Supply and Demand
- Unknown
Falling costs of renewables are impacting demand.

Here's what's changing:

Changes in resources:

In **2013** there were **22 active projects** totaling **1,231 megawatts**

Fast forward to **2018**, there are currently over **136 connection requests** totaling **19,507 megawatts**

New South Wales:

- Peak demand: **14,700 MW**
- Current capacity: **18,900 MW**
- New connections: **47,000 MW**
- Coal retirements: **1,680 MW in 2022**
Falling costs of renewables and weather impacting demand. Here's what's changing:

Projected changes in scale of resources:

More capacity required to deliver demand.
Falling costs of renewables

Weather impacting demand

Generation and demand mix

Here's what's changing

Changes in customer behaviour

A solar panel is being installed every 6.5 minutes in Australia

The rapid solar and storage consumer uptake
Falling costs of renewables weather impacting demand generation and demand mix. Here's what's changing…contributing to a flat demand outlook.

Changes in customer behaviour.
Falling costs of renewables
Weather impacting demand
Generation and demand mix

Here's what's changing

Changes leading to operational challenges

Increased variability and flexibility

23 July 2017 in South Australia
Falling costs of renewables
Weather impacting demand
Generation and demand mix
Here's what's changing

Fast Frequency Response

Fault current

Voltage phase angle

Changes leading to operational challenges

Needing a real focus on frequency and strength
Falling costs of renewables
Weather impacting demand
Generation and demand mix

Here's what's changing

Bushfires in winter
Climate change

**Australian mean temperature anomaly**

Mean temperature anomalies averaged over Australia (as calculated from the 1961-1990 average). The black line shows the 11-year moving average.
In the **1990s** it took **6+ years** to build a 200 megawatt power plant.

Fast forward to **2018**, it takes **9 months** to build a 200 megawatt solar plant, complete with approvals.

The time taken to determine regulatory reforms has not changed. **18-36 months**
Falling costs of renewables
Weather impacting demand
Generation and demand mix
Here's what's changing

Cyber security
Falling costs of renewables
Weather impacting demand
Generation and demand mix
Here's what's changing
No worries!
The imperative to adopt 4th industrial thinking

1st
Mechanisation, water power, steam power

2nd
Mass production, assembly line, electricity

3rd
Computer and automation

4th
Fusion of physical, digital and biological systems
“We won’t experience 100 years of progress in the 21st century – it will be more like 20,000 years of progress”

Kurzweil
Characteristics of industry 4.0

- Dynamic
- Extreme pace of change
- Interconnected economies
- Integrated systems
- People systems
Applying 4th revolution approaches

Adopting a system of systems approach

- Power System
- Market System
- Regulatory System
- Data System
- Business Systems
- People Systems
- Investments Systems
• Huge computational models for forecasting
• Multiple data inputs from more sources
• Digitalisation allows value to be determined at more granular level
• Optimisation of entire supply chain
The evolution of the energy ecosystem demands an evolution to the market system.

Market system

Market models that:

• value flexibility and availability
• support multi directional flows
• reward household level generating resources
• facilitate aggregators, prosumers and new and emerging business models

Market constructs need to be flexible and neutral to adapt and enable new entry entrants.

Markets designed to enable the optimisation of all available resources.

Zero marginal cost generation need to value necessary flexibility and support services where energy is ‘free’.
Harnessing digitalisation to make things work

Using data to manage the system in an efficient way

Leveraging technology and assets

Data systems

Applying AI to systems solutions for situational awareness

Huge growth in big data - from 6 data points to over 100,000 data points annually

Reducing barriers to entry by investing in whole grid

Harnessing digitalisation to make things work

Using data to manage the system in an efficient way

Leveraging technology and assets

Pre 2010

9,000 data points - for five minute reads

2015

Over 100,000 data points - near real time reads

2021

6 data points per customer meter read

9,000 data points - for five minute reads

Over 100,000 data points - near real time reads

2015

6 data points per customer meter read

9,000 data points - for five minute reads

Over 100,000 data points - near real time reads

2021
Adopting a consumer focus

Apply design thinking to our approach.

Can no longer solely look at challenges through our own lens – need situational awareness to meet the needs of our stakeholders and consumers.
Strategic partnerships will be crucial

Collaborate and partner with range of stakeholders to leverage capabilities where synergies exist
Investment system

Need to optimise capital investment

Where investments can be made to leverage assets and resources, creating value for consumers.
Creating an adaptive entity requires adaptive regulation and policy.

Adaptive regulation and policy

- Outcome bias
- End dogma around business models
- Total customer bill
- Open for partnerships
- Nimble and agile