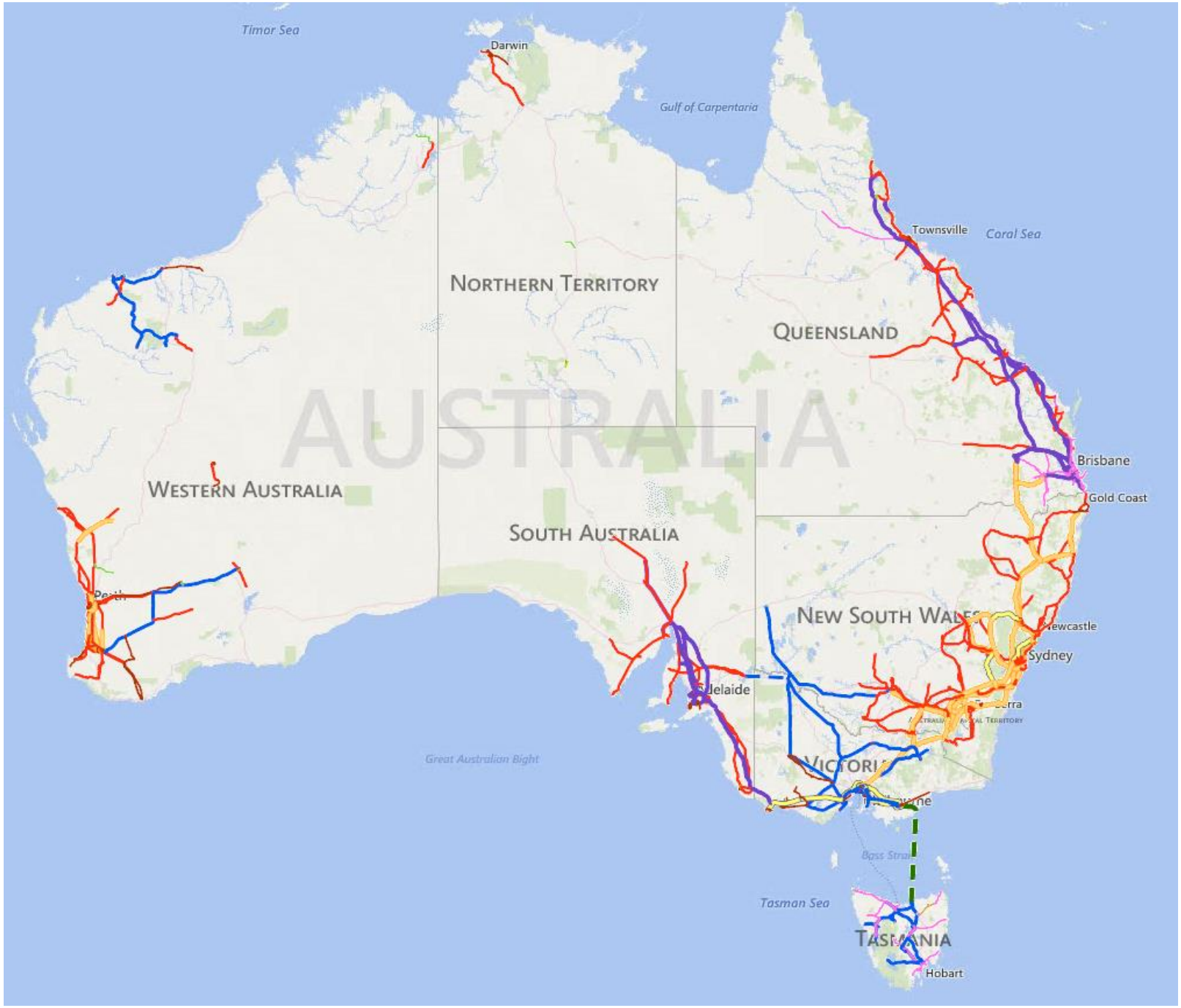
Projecting demand and mapping resources – the Australian experience

Louise Vickery, Energy Efficiency Renewable Energy, International Energy Agency

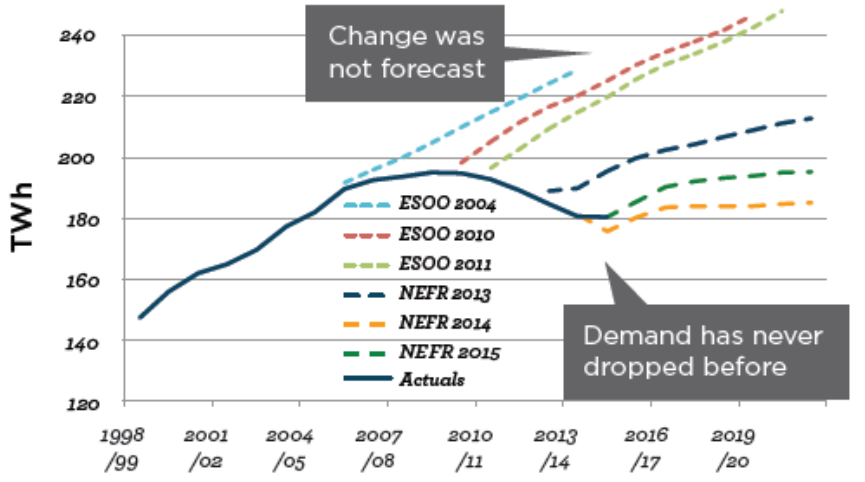
Asia Clean Energy Forum, 6 June 2017


Timor Sea
Darwin
Gulf of Carpentaria
Townsville
Coral Sea
NORTHERN TERRITORY
QUEENSLAND
AUSTRALIA
Brisbane
Gold Coast
WESTERN AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
Newcastle
Sydney
Adelaide
Great Australian Bight
VICTORIA
Melbourne
Bass Strait
Tasman Sea
TASMANIA
Hobart

Downward DEMAND shock

Demand is dropping for the first time – and was not forecast

DEMAND DROPPING – NOT FORECAST



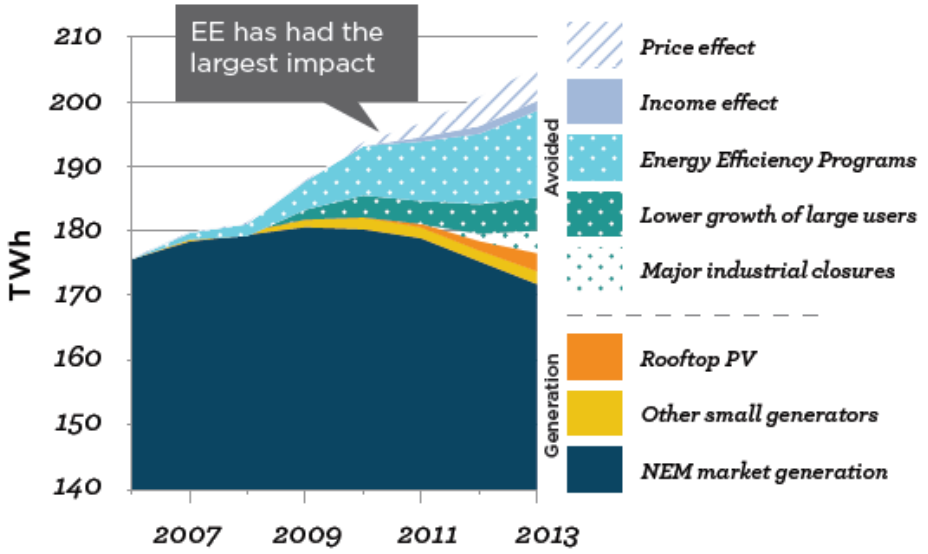
ESOO: Electricity Statement of Opportunities; NEFR: National Electricity Forecasting Report

The drop in demand was not forecast – even after it started. Forecasts drive planning, risking unnecessary investment.

Source: AEMO national electricity and gas forecasting site http://forecasting.aemo.com.au/electricity/annualconsumption/operational

Energy efficiency and industrial productivity have had the largest impact.

DRIVERS OF CHANGING DEMAND



*Estimates from "Power Down" – The Australia Institute Dec 2013 Hugh Saddler

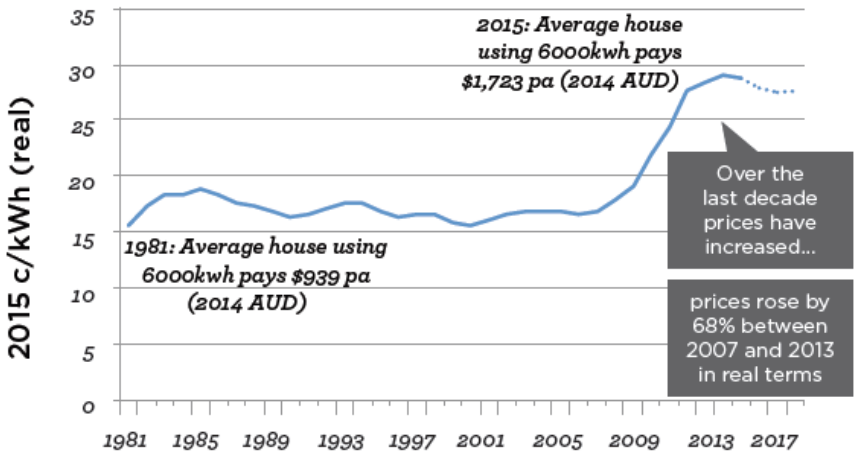
Customers have also begun to respond to prices and impacts of photovoltaics (PV) are growing.

Upward PRICE shock

Over the last decade prices have increased by 73% after being stable for a long time.

Price rise driven primarily by network investment to meet PEAK DEMAND growth reliably with ageing assets.

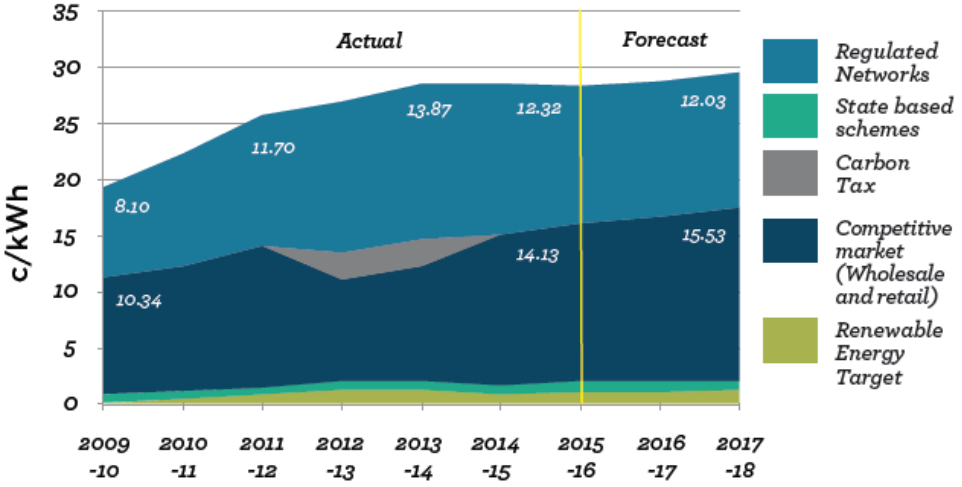
ESTIMATED ELECTRICITY PRICES



Prices are stablising in the short term – but risks of future price rises above inflation remain.

Source: ABS 6401.0 CPI Data and AEMC Residential Electricity Price Trends Report

COMPONENTS OF RETAIL ELECTRICITY PRICES (AEMC)

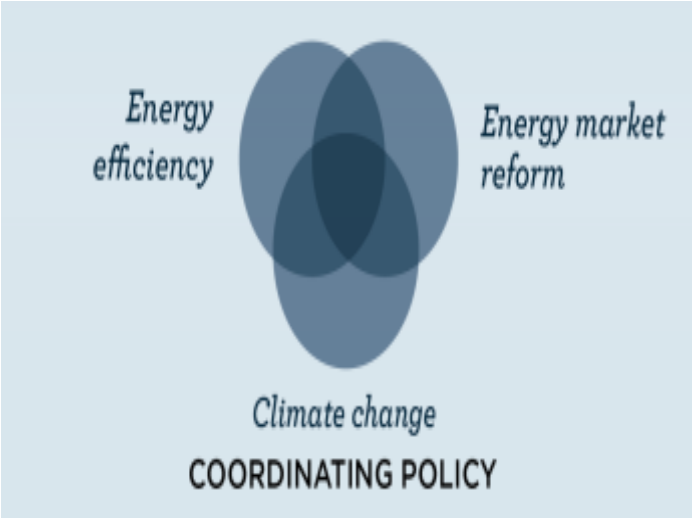


Environmental policies have impacted prices but much less.

Source: AEMC Residential Electricity Price Trends Reports

Australian Government Response

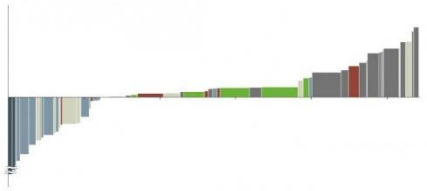
- Energy Productivity Plan
  - Whole of Energy System Productivity = Demand and Supply side Policy
- Energy and Climate Change Policy now in one Department of Environment & Energy
- **Improve demand side data analysis (EUDM)**
- **Open source geospatial mapping tools Improve access to clean energy resources and technology costs (AREMI)**
- **Australian Energy Regulator - New Demand Incentive Scheme and support for innovation**
- Energy Security Review – Market Design mechanisms that drive outcome you want (without predetermining the mix) – reliable, affordable, low carbon energy (June 2017)
- Low Emissions Technology Road Map – Demand, Supply and Enabling Technology (May 2017, CSIRO)



Low Emissions Technology Road Map Both supply-side and demand-side measures are needed for a least-cost transition

Cost of emissions reduction

A$/tCO2e



Demand – Buildings, Appliances Industry Transport
Supply and Enabling Technology – Grids, Storage -

‘Inaccurate forecasting = expensive problem

- Top down’ forecasting models used to work
- Many more factors impacting on demand
- Understanding energy demand is critical to forecasting and informing investment decisions for new generation and distribution infrastructure
- We need better data to support better forecasting

Better data on demand

- The energy market is changing at an unprecedented rate:
- Consumer uptake of new technologies, like PV, more energy efficient appliances, battery storage and electric vehicles can have a huge impact on demand
- Minimum performance standards for common white goods, and efficiency requirements in the Australian building code also changes demand
- Consumer fuel switching, from gas to electric appliances and vice versa is also important
- Currently, energy data and demographic information is dispersed among many data holders, is inaccessible, or doesn’t exist at all.

MANY MORE FACTORS IMPACTING ON DEMAND

The Energy Use Data Model will provide critical information

- The Australian Government has committed $6 million to the development of an Energy Use Data model

  - committed a further $4.6 million in the 2017 Budget

- The Energy Use Data Model will link energy use data from around Australia with new ‘behind the meter’ behavioural data

- It will become Australia’s most comprehensive set of integrated energy use data and enable insight into the fine-grained behaviour of energy consumers and the aggregate response of populations

- It will be publically accessible through a central platform, while ensuring privacy protections remain in place

- The model will be ready for deployment in 2018

The energy use data model will be developed over 3 years and includes 5 work streams

1

Deep and ongoing stakeholder engagement

Working with energy sector stakeholders to determine the critical facets of a fit-for-purpose national energy use data model.

2

Data sampling and collection

Addressing high-priority gaps and developing statistically and ethically robust sampling methodologies for the collection of new primary energy data.

3

Fusion of data sets

Bringing together high-quality pre-existing datasets to provide a comprehensive view of the key energy data domains.

4

Data innovation

Leveraging cutting-edge science and research to proactively manage data privacy and delivering new insight and value for energy sector stakeholders.

5

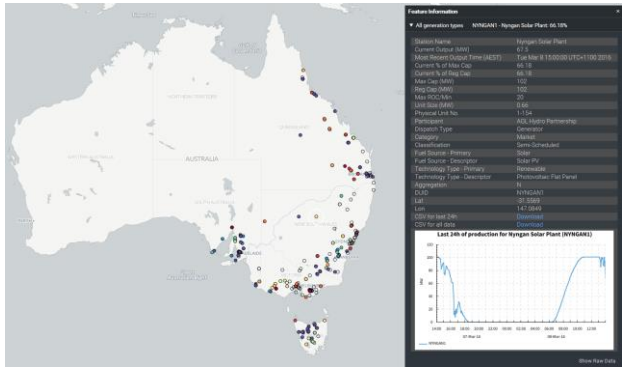
Interactive data

Develop a robust, user-friendly and visually appealing method for accessing all elements of the final energy use data model.

Australian Renewable Energy Mapping Infrastructure

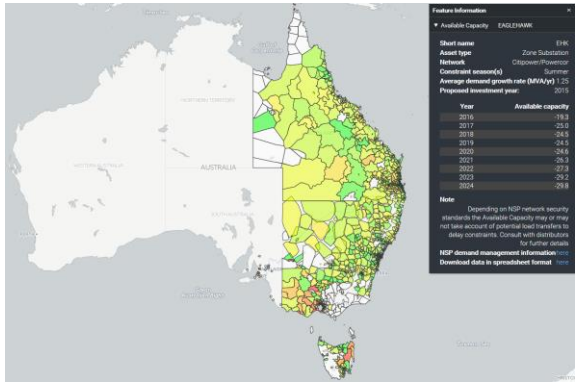
- A freely accessible online map - 650 layers of information about:
  - Energy resources – solar, wind, marine, biomass, geothermal
  - Grid & Substation Infrastructure - Constraints and Capacity
  - Generation performance – real time
  - Environmental information, land tenure, topography
  - Demographics and Household Energy Demand
  - In future - ARENA projects – LCOE and performance
  - In future - Heat maps of large energy users energy demand
- Supported by ARENA funding and available at: www.nationalmap.gov.au/renewables
- Part of Australian Government national policy commitment to Open Data – as source of business and policy innovation
- Think Big – Act Small, Deliver quickly, reiterate wildly

AREMI Project

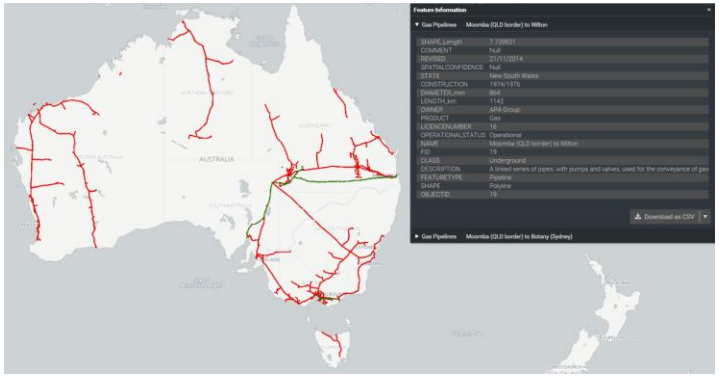


Existing power generation

Transmission lines and substations



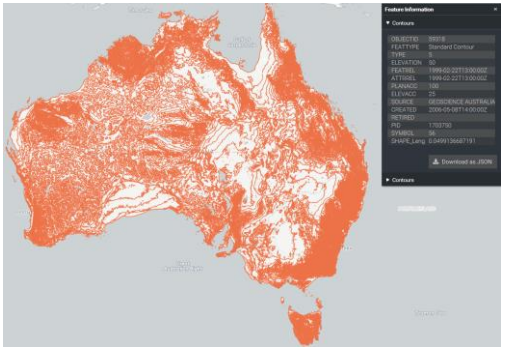
Grid constraints



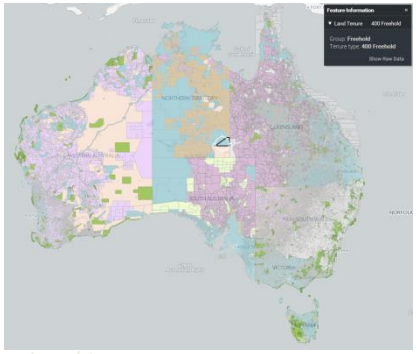
Oil and gas pipelines

Solar radiation

Wind speed



Topography

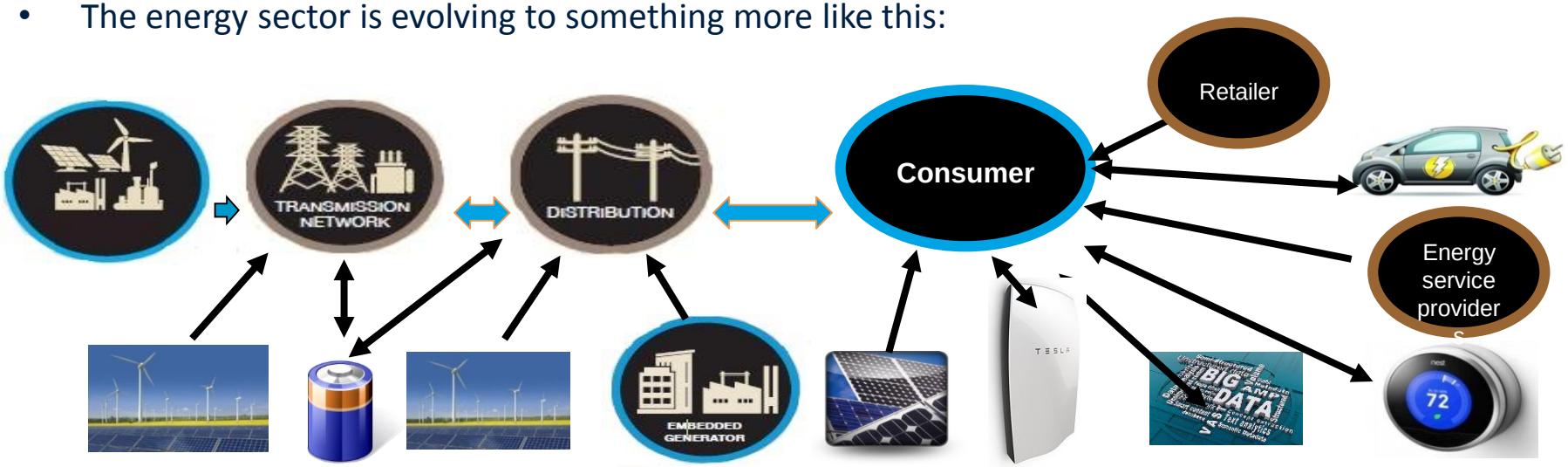


Land tenure

The evolution of the energy sector - Market design and regulation

- Our regulatory arrangements were originally designed based on a sector like this:

- The energy sector is evolving to something more like this:



- Regulatory arrangements are evolving to support this change by incentivising networks to use non-network alternatives and enabling consumers to make more informed choices

Australian Energy Regulator
Demand Management Incentive Scheme & Demand Management Innovation Allowance

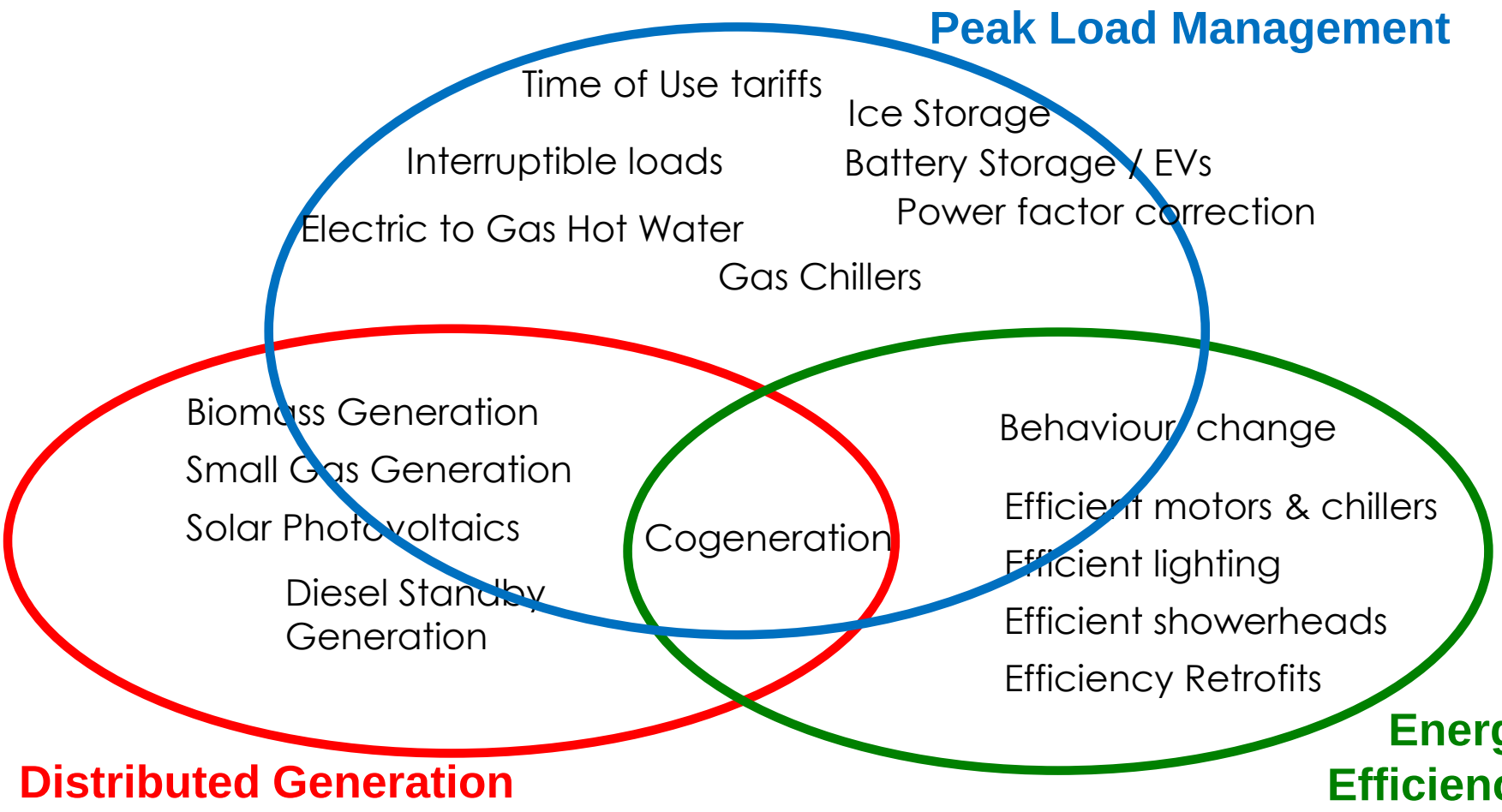
DMIS

- Ongoing incentive for DNSPs to undertake expenditure on non-network options where they are more efficient than network expenditure
- Works with other existing mechanisms to balance the incentives between network and non-network expenditure
- Allows DNSPs to share in any savings demand management projects create in other parts of the supply chain

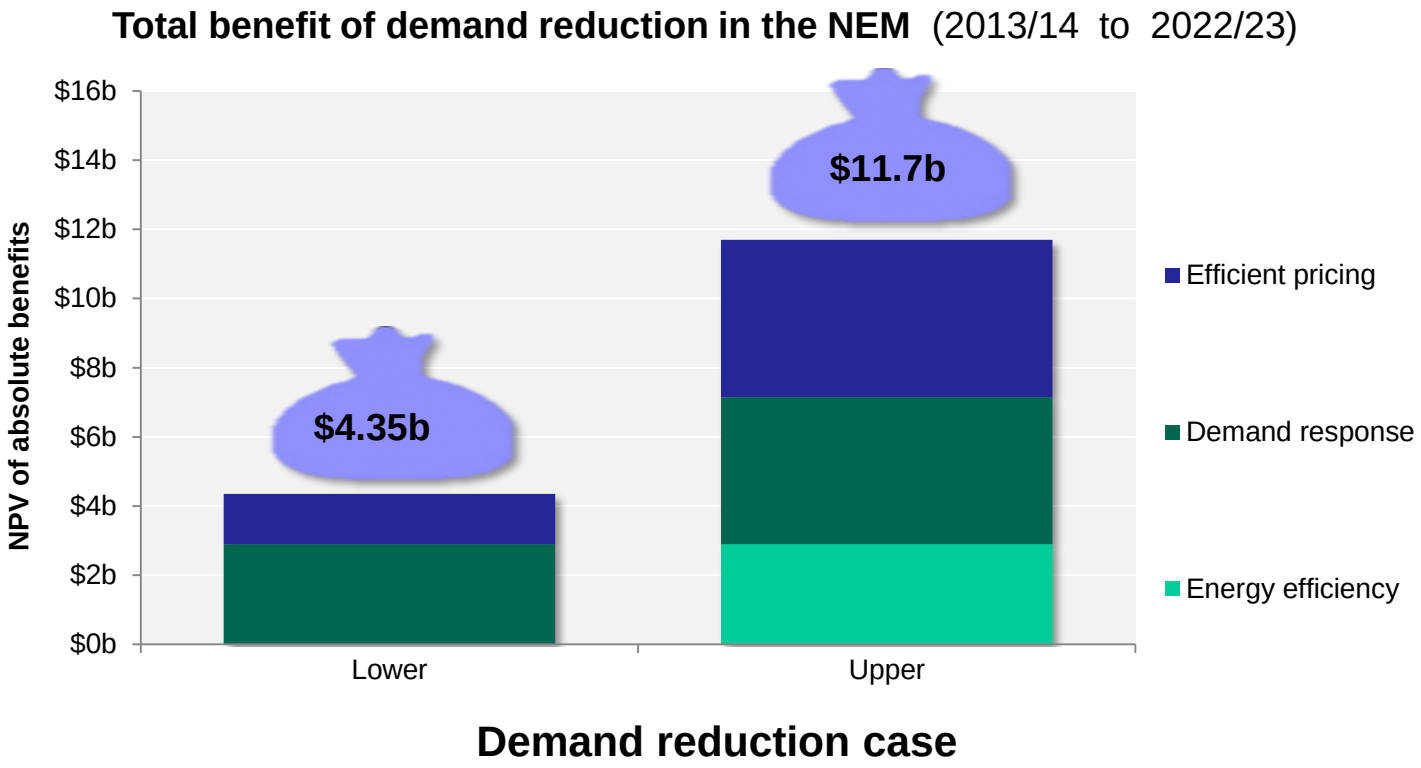
DMIA

- Research and development funding for specific projects
- Must be innovative projects that have the potential to reduce demand and long-term network costs

Distributed energy resources

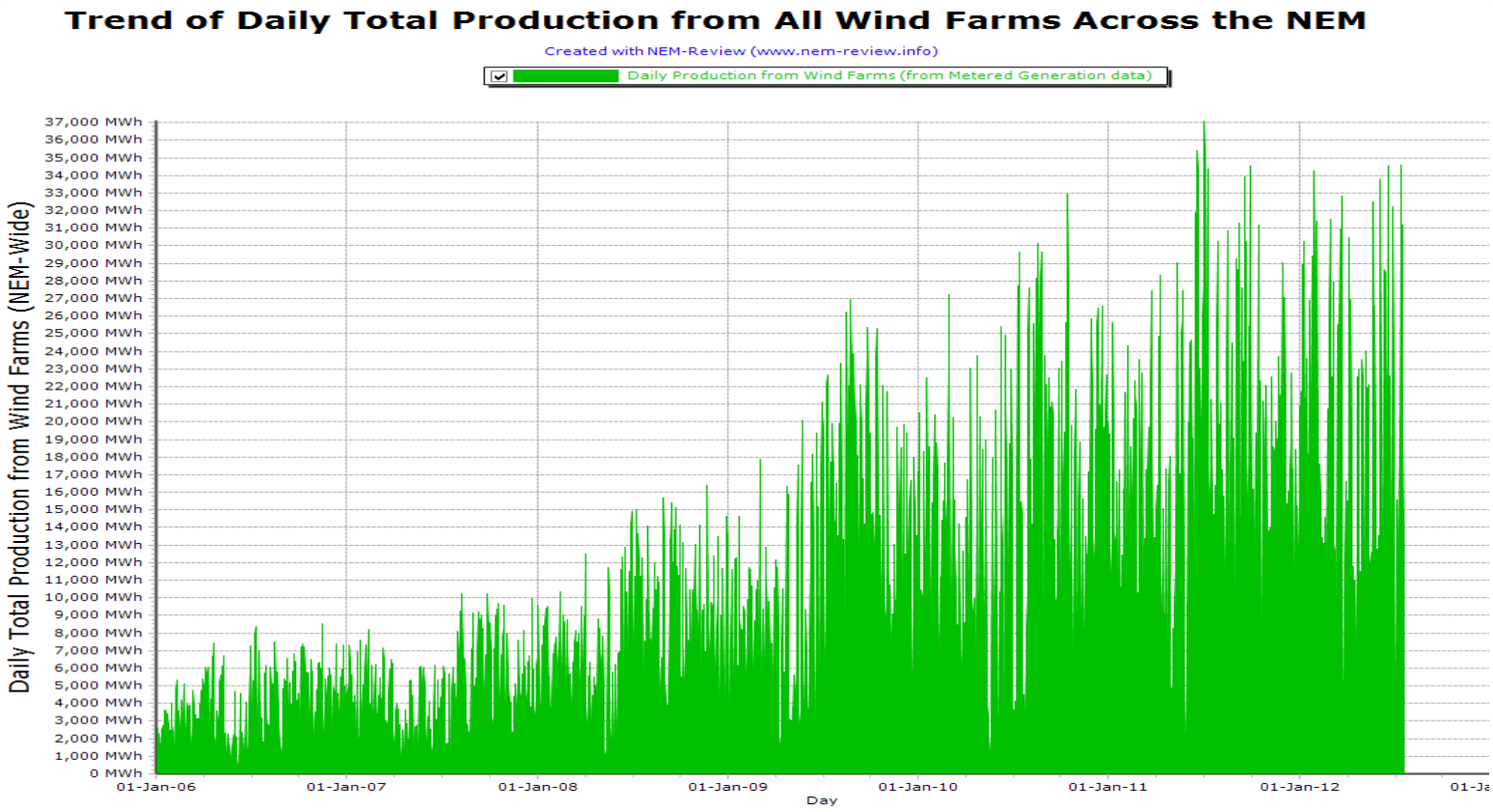


A Demand Management Incentive Scheme could unlock $billions in DM savings

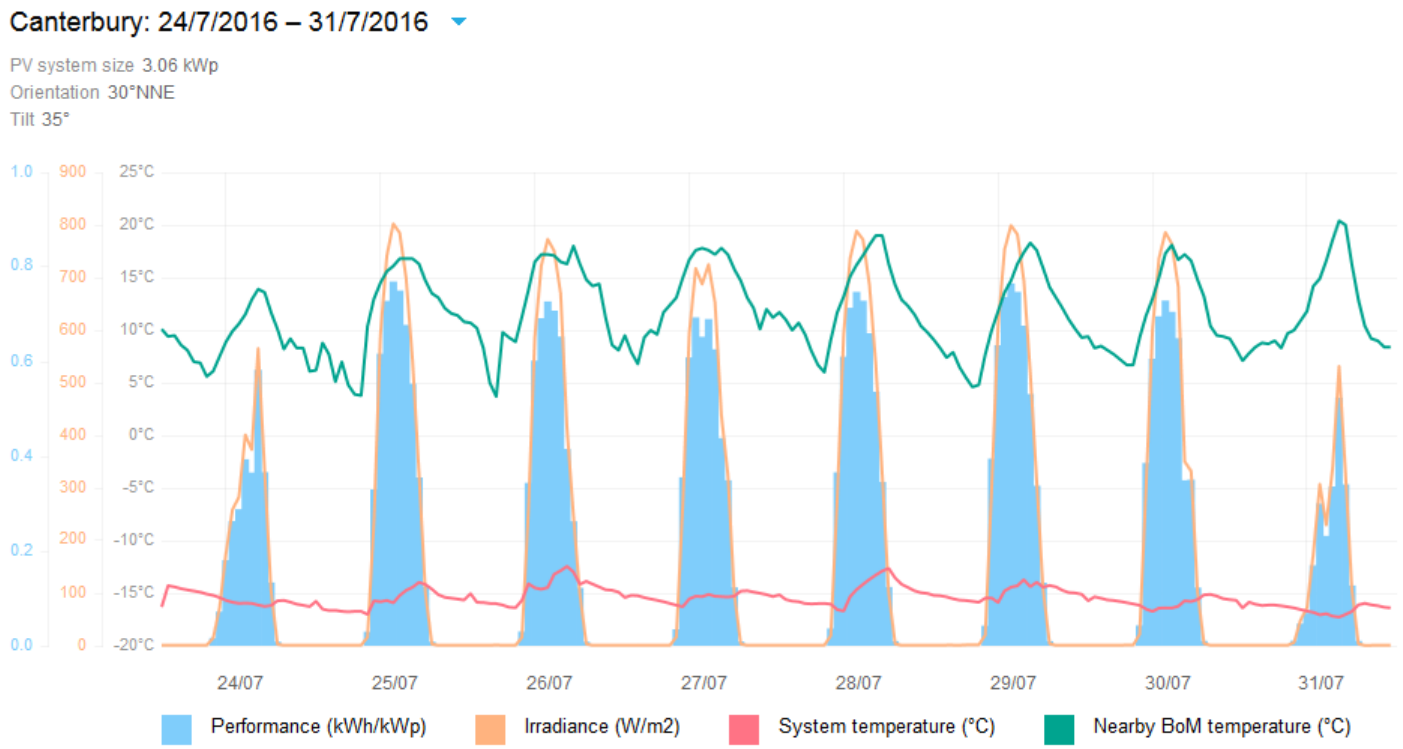


Source: AEMC **Power of Choice** Review Final Report, 2012

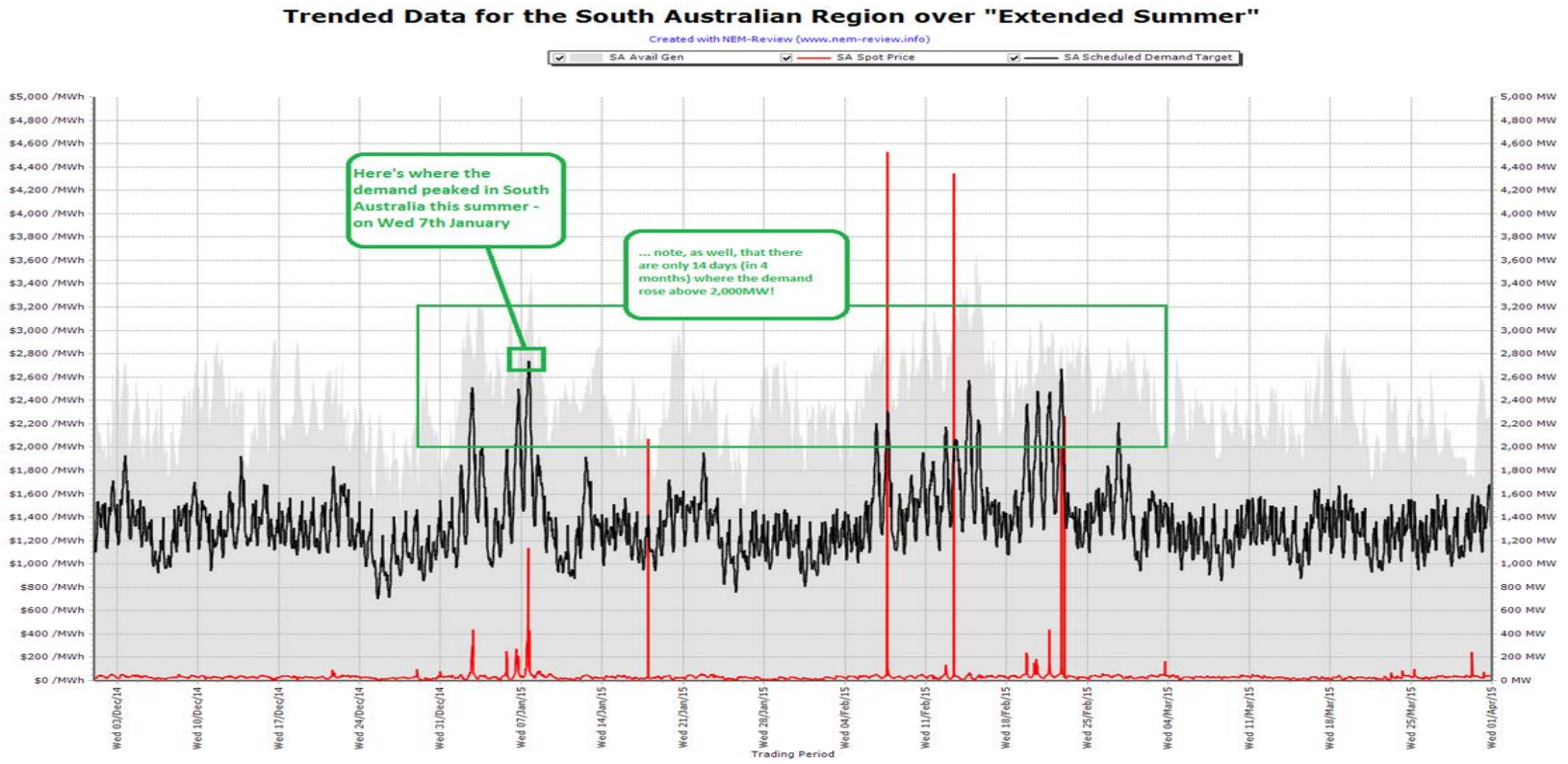
Wind is very variable…



… And so is solar… (Solar PV output)



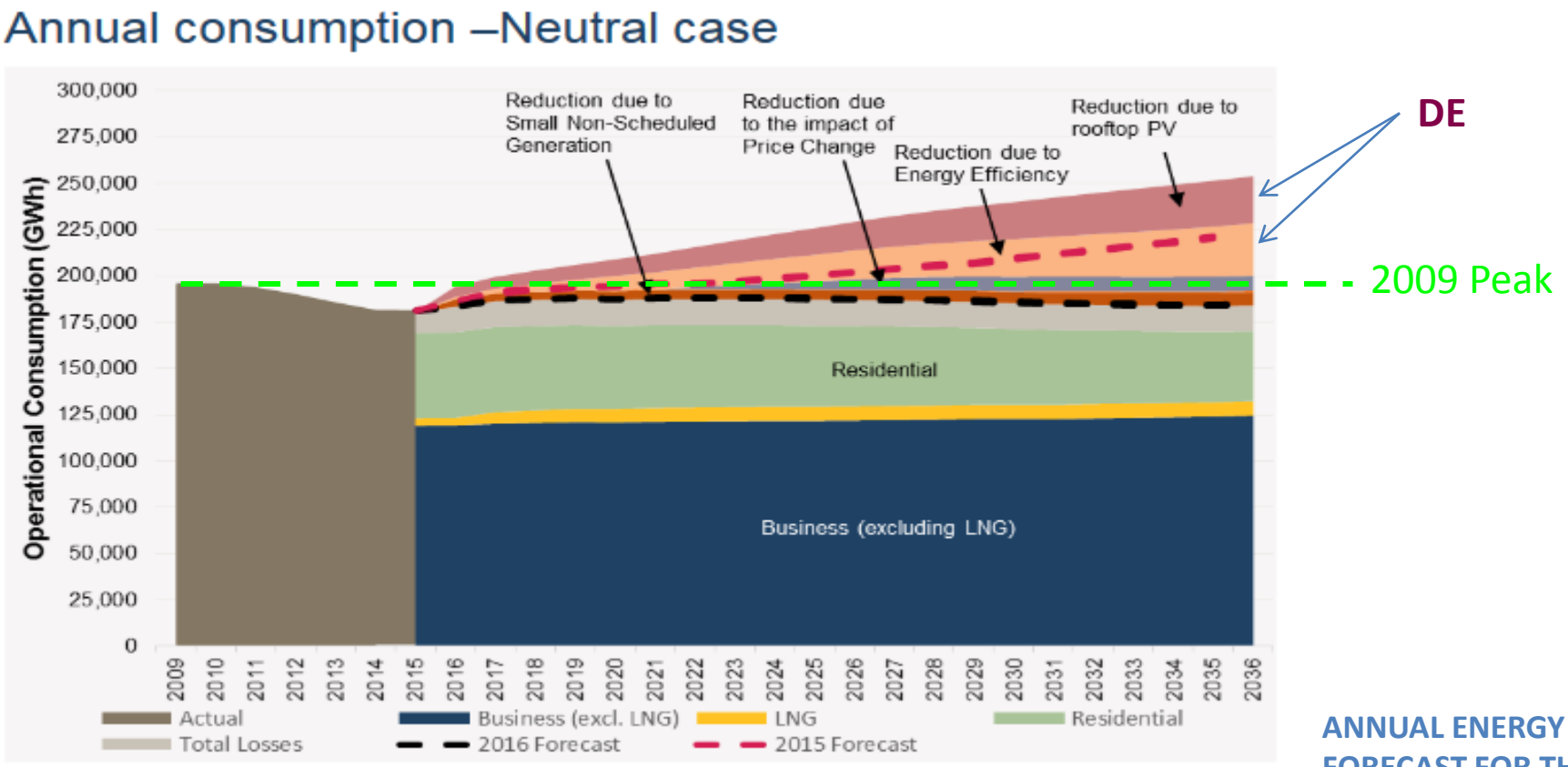
Demand as variable as renewable energy



In summary – lessons learnt

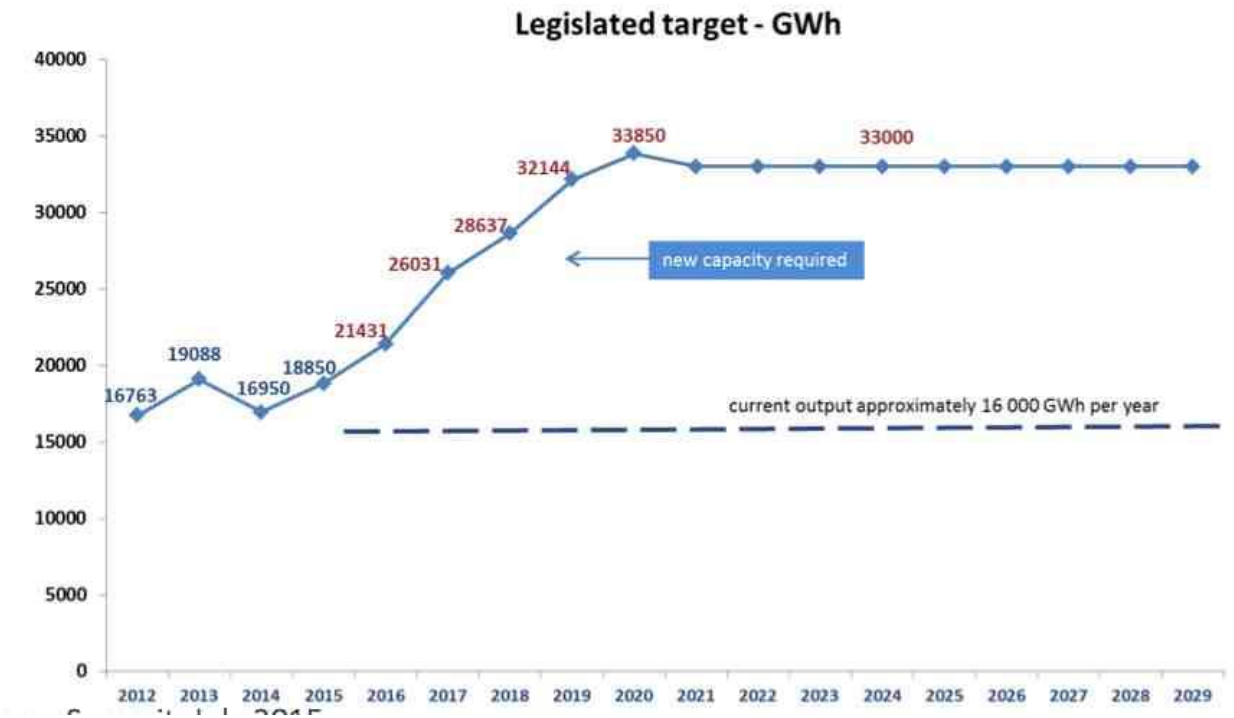
- Understand demand and the technologies and policies which can impact on demand. Be careful of policy and market incentives which result in an over investment in supply.
- Energy Efficiency and Demand Management offer low cost ways to reduce and shift load – reducing need for investment in infrastructure and helping balance the system.
- Need for greater alignment between our energy efficiency, renewable energy and energy market and climate change policies, including institutional arrangements.
- Market Design and Policy need to provide signals to drive end goals and integrated energy service models, while also factoring in returns to public good infrastructure.

Forecast Energy Consumption is flat, as DE grows



ANNUAL ENERGY FORECAST FOR THE NEM (June 2016 NEFR)

And the RET: Add another ~16,000 GWh p.a. by 2021



So What?

1. **Much more variable generation**
2. **Radically shifting local supply and demand patterns**

… *which means either*

1. ***Back up with expensive flexible capacity & interconnectors, or***
2. ***Seek to delay the transition, or***
3. ***Much more flexible DM (incl. price reform)***

… *the latter means*

1. ***Constructive customer-utility collaboration is essential***
2. ***Regulatory reform essential (incl. DMIS)***

IEA – Energy Efficiency and Renewable Energy

- Governance Institutional Arrangements
  - Linked up policy design, implementation and evaluation processes
- Tools to better assess demand trends, local clean energy resources and infrastructure, optimal mix of demand and supply measures
- Policies which encourage new integrated energy service business models - efficient clean energy services
- While providing sustainable return on investment for enabling infrastructure – grids, storage
- Market design and policy which provides the right signals to achieve outcomes without predetermining the mix
- Short Term Competitive Markets & Long Term Technology Innovation Support

Improving access to energy demand, resources and infrastructure data

1. Energy Use Data Model (EUDM)

2. Australian Renewable Energy Mapping Infrastructure (AREMI)

3. Optimisation Tools

During time of rapid change – how do we work out what the optimal mix of demand and supply side policies and technologies is.

Can we develop optimisation tools which take more informed demand forecasts, latest technology costs and then try and work out the least cost mix of policies and technologies

Eg Cost of reducing load through EE buildings and industry, vis

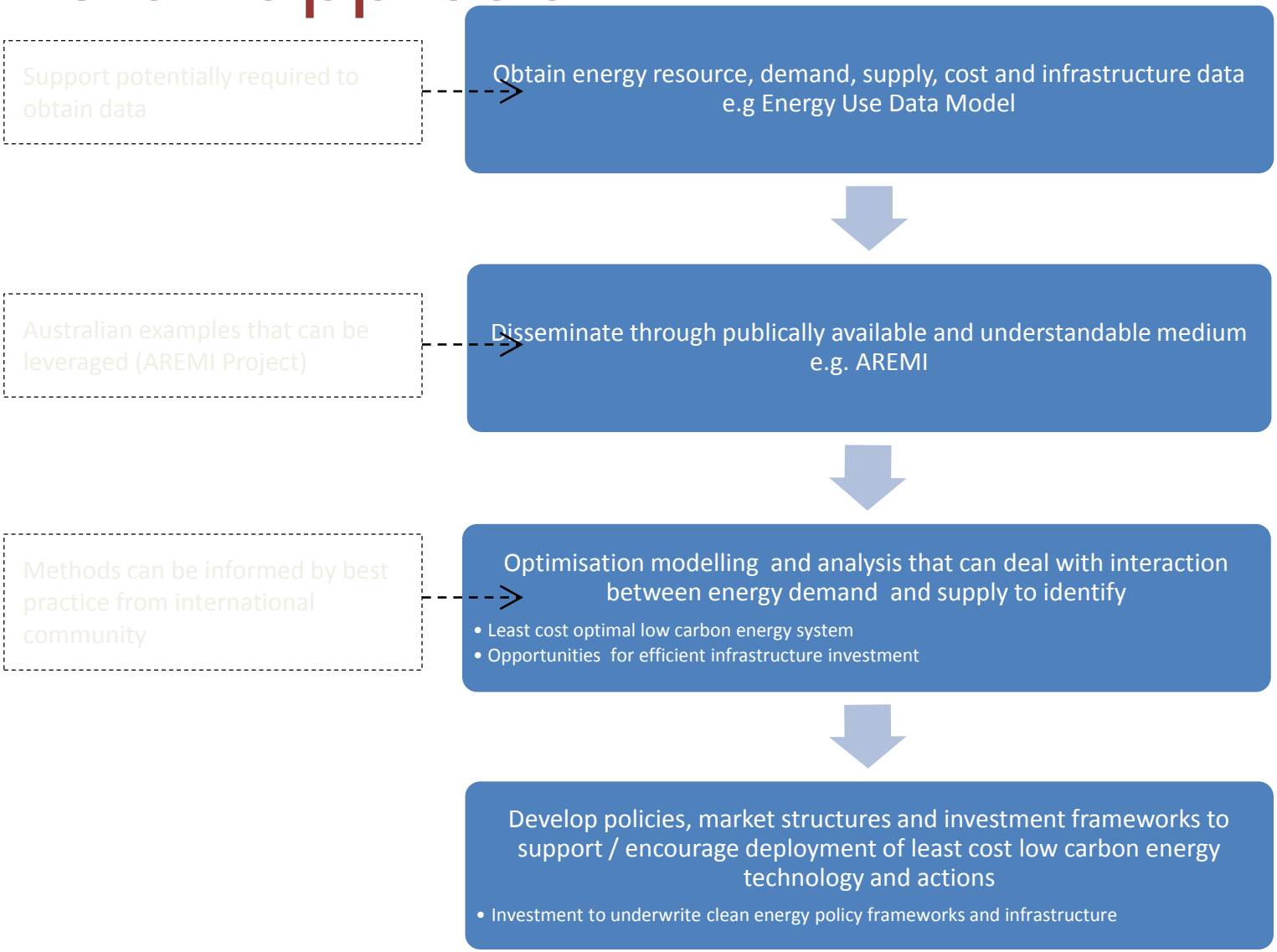
Cost of Distributed Energy and Storage vis

Cost of Centralised Geothermal / Hydro and Grid

Help inform clean finance options & energy service models

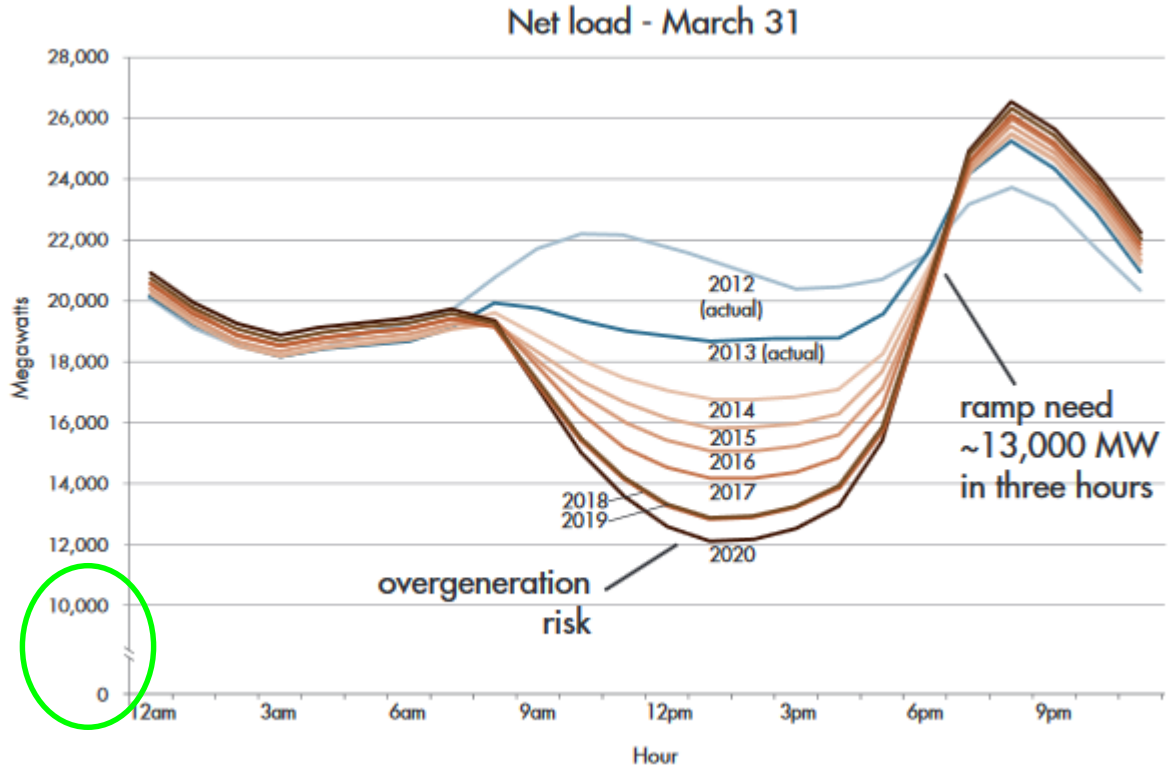
Energy Policy and Market Design (noting technology and costs will change)

Overall approach



The dreaded “Duck” curve

- (Official Californian ISO Load forecasts)



http://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

Australia's Electricity System - a combination of public and private operators

POWER STATION

Generates electricity.

TRANSMISSION NETWORKS

Transports electricity over long distances.

DISTRIBUTION LINES

Transports electricity to its final destination.

SUBSTATION TRANSFORMER

Raises the voltage of the electricity for efficient transportation.

SUBSTATION TRANSFORMER

Lowers the voltage of the electricity ready to deliver for everyday use.

HOMES AND BUSINESSES

Electricity is used to power our everyday life including appliances, lighting and heating.

The recent South Australian experience