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# Can the National Electricity Market Survive New Technology?

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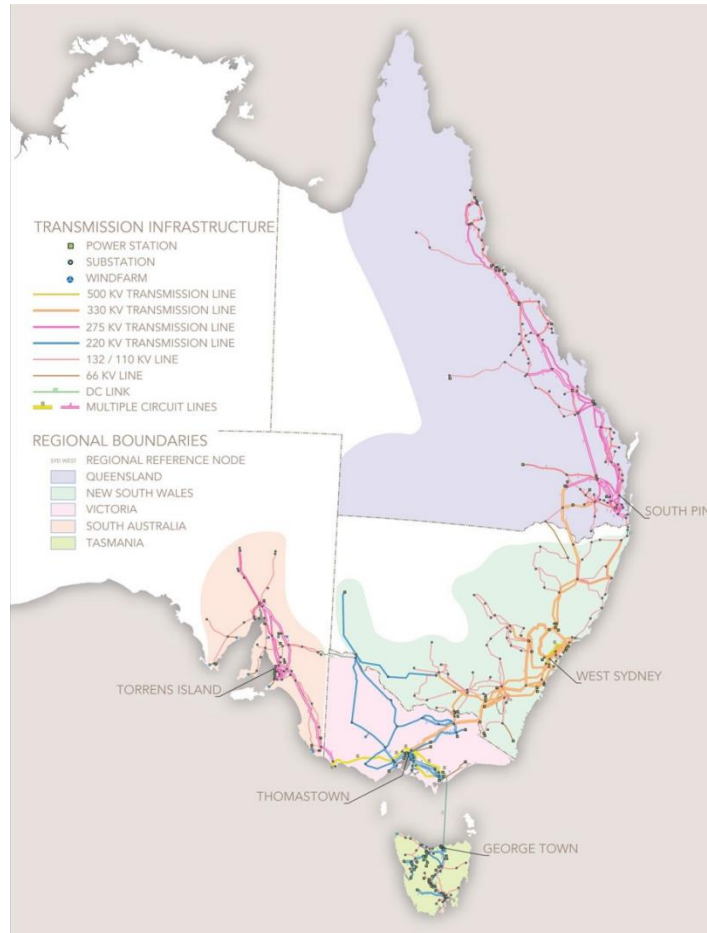
**30 September 216**



## Scope of Presentation

- Review recent developments in the Australian National Electricity Market.
- Identify the issues of current technical, regulatory and political concern.
- Identify how these issues might be addressed, and the likelihood that they will be addressed.

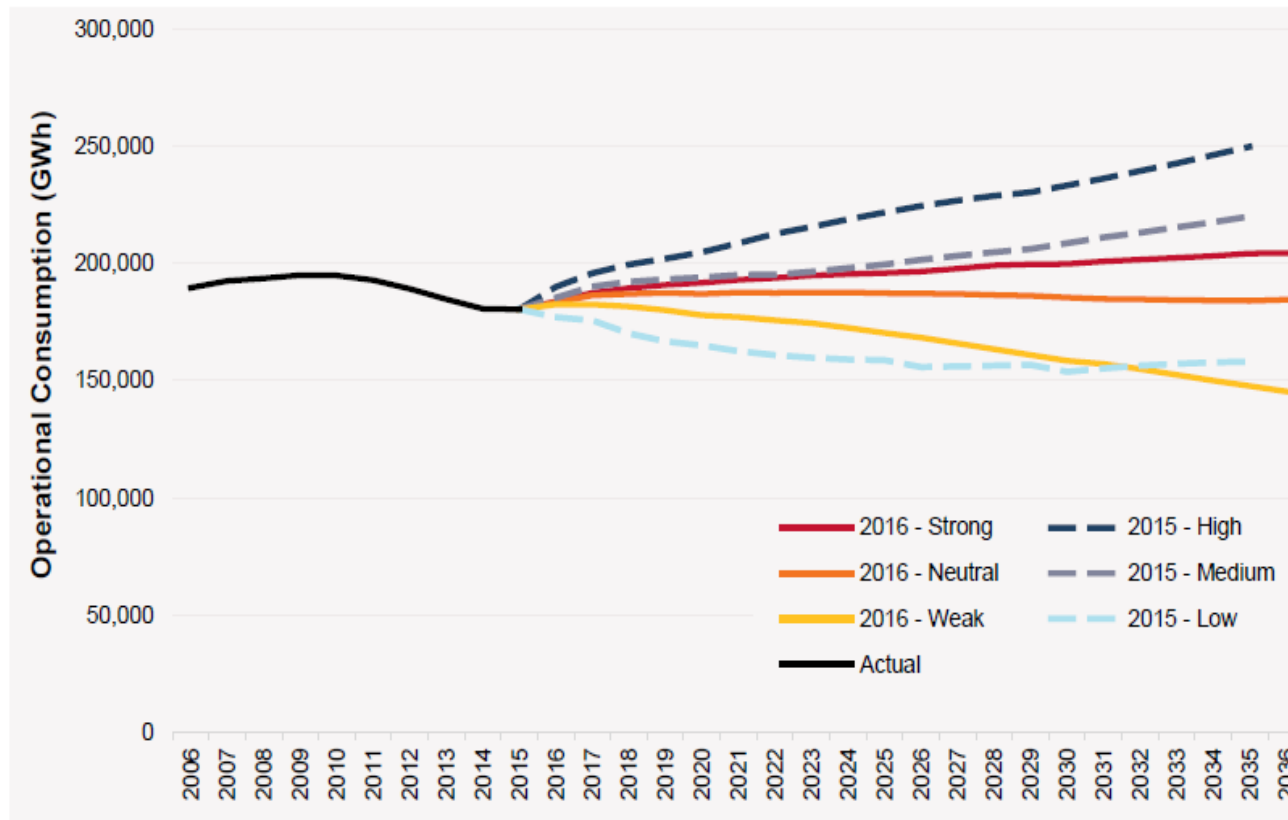
# The Australian National Energy Market (NEM)



- Auction-based, energy only spot market
  - Five (5) “weakly” interconnected regions in SE
  - Two other separated systems operated by AEMO
- Has operated successfully since 1998
  - Reliability and security maintained until recently
  - Investment in new plant has occurred
  - Wholesale prices reasonable until recently
- Key driving factors at present
  - Low/zero load growth
  - Policies to promote renewable/decentralised energy
  - Overlaid with improved communication and control – moves to a “smart grid”

# Load Growth in The NEM: Low or Declining Growth is the New Reality

## Annual consumption –comparison

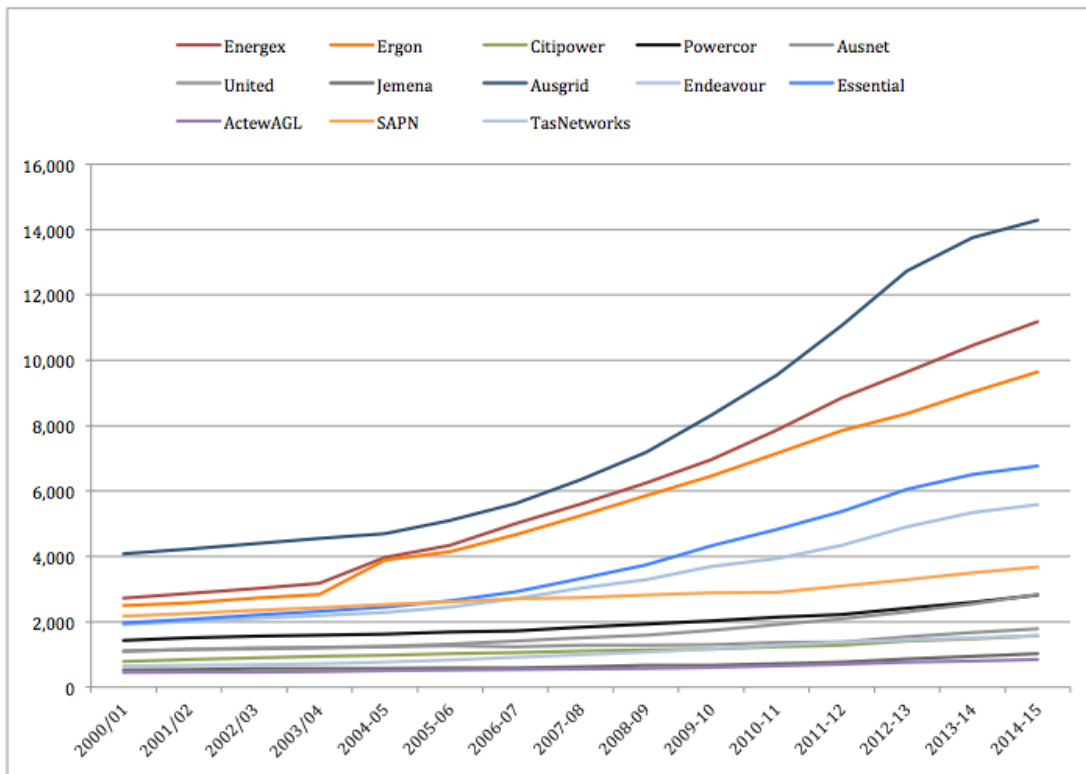


- Load began declining around 2008
  - Initially seen as temporary
  - But trend has persisted and is now seen as long term by AEMO
- Reasons
  - Energy efficiency policy (standards)
  - De-industrialisation
  - Growth in rooftop PV
  - Steeply climbing retail prices!

# Trends in Distribution and Transmission Costs in Australia

## Growth in Distributor Regulated Asset Base

Source: ResponseAbility

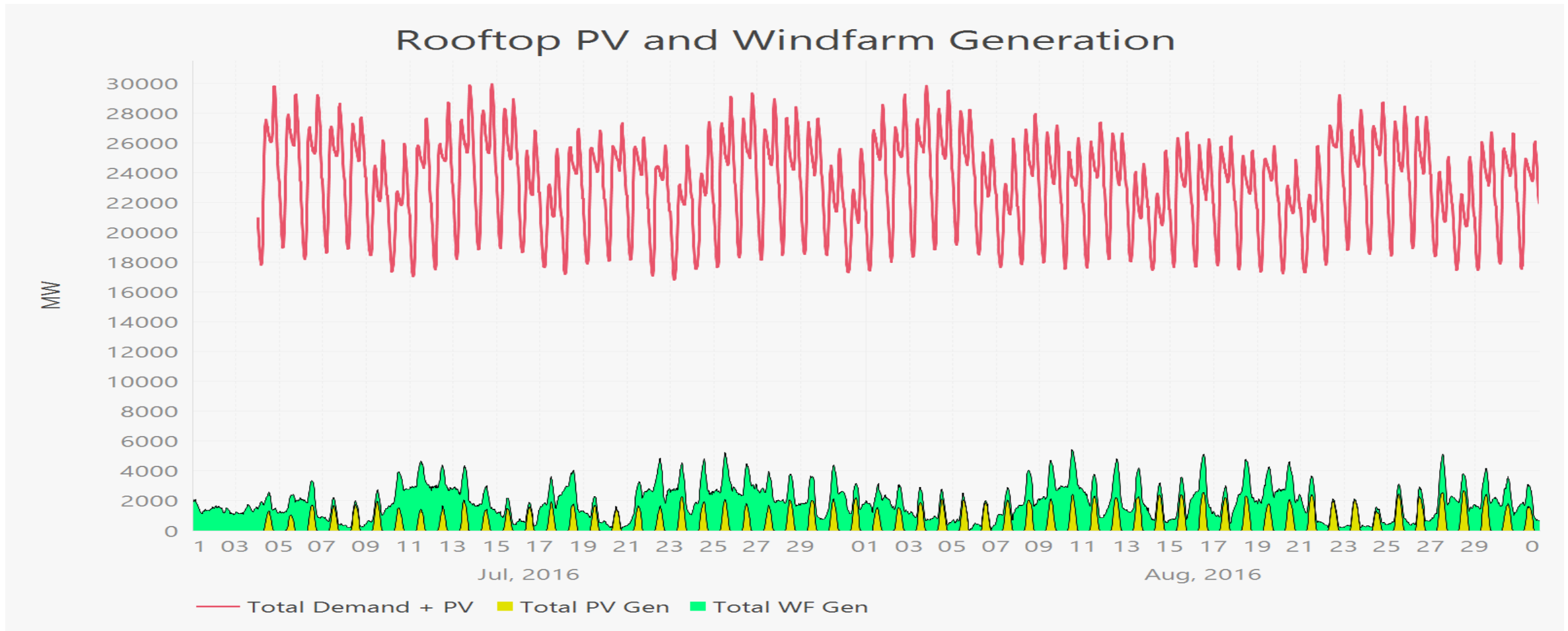


- The Regulated Asset Base (RAB) directly determines distribution costs to consumers
- Increase since 2000 is typically 2-3 times
  - Increases not related to load growth
  - Greatest for government owned entities
- Network price regulation has been weak.
  - Hypothesis – to prepare for sale at a high price
- Network charges now dominate small retail customer tariff costs.
  - Typically around 60% of the retail tariff.

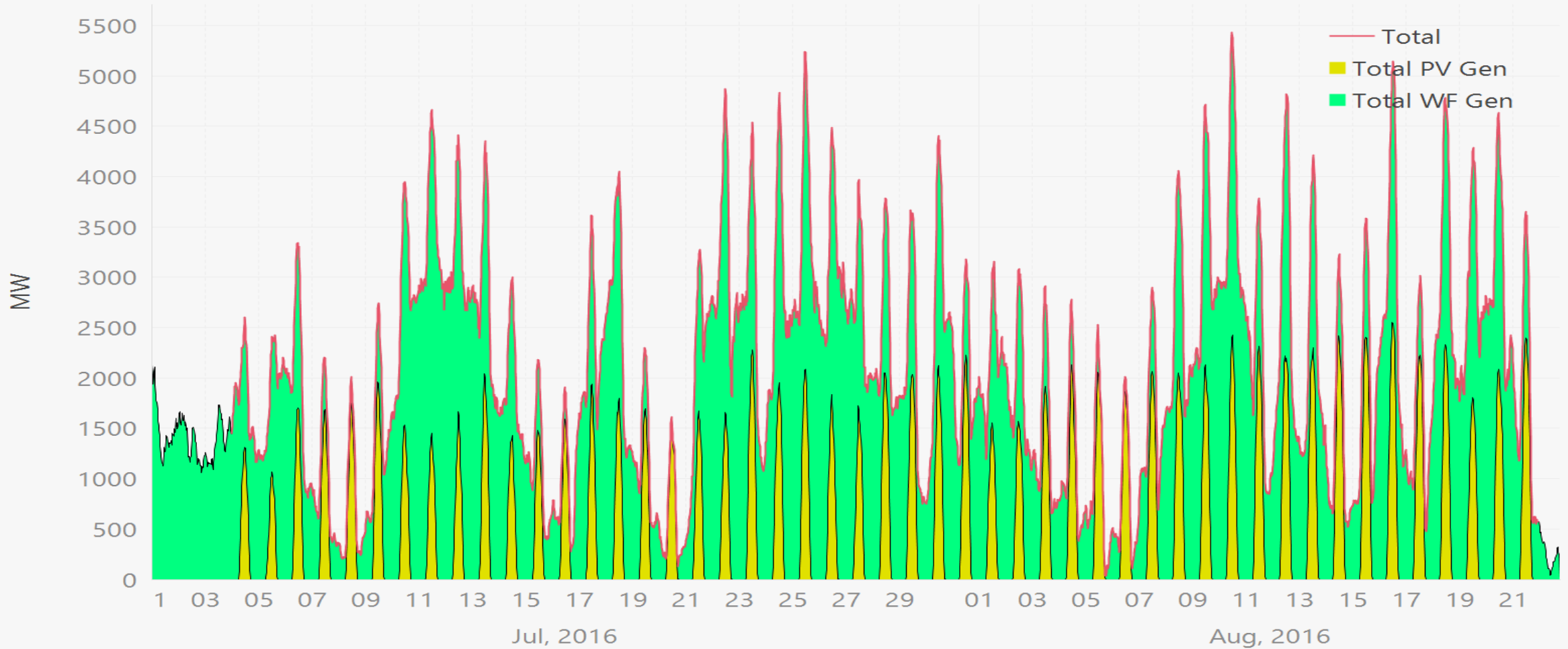
# Renewable Energy Policy Affecting Electricity In Australia

- There is a bipartisan policy to promote renewable electricity generation in Australia
  - Australia has committed to an emissions reduction target
  - Although one side of politics is more enthusiastic than the other.
- There are two schemes
  - A large scale Renewable Energy Target (LRET), requiring retailers to have about around 23% renewable energy in their portfolios by 2020 or pay a penalty
  - Small scale Renewable Energy Scheme, which provides a subsidy for small, usually domestic, installations such as rooftop PV
  - State based feed-in tariffs were generous and common 5 years ago, but are now mostly withdrawn.
- A carbon tax at \$23/tonne CO<sub>2</sub> was in force from July 2012 but was abolished by an incoming government in 2014, after much political controversy.

# How Much Renewable Energy Capacity is Already Installed in Australia?

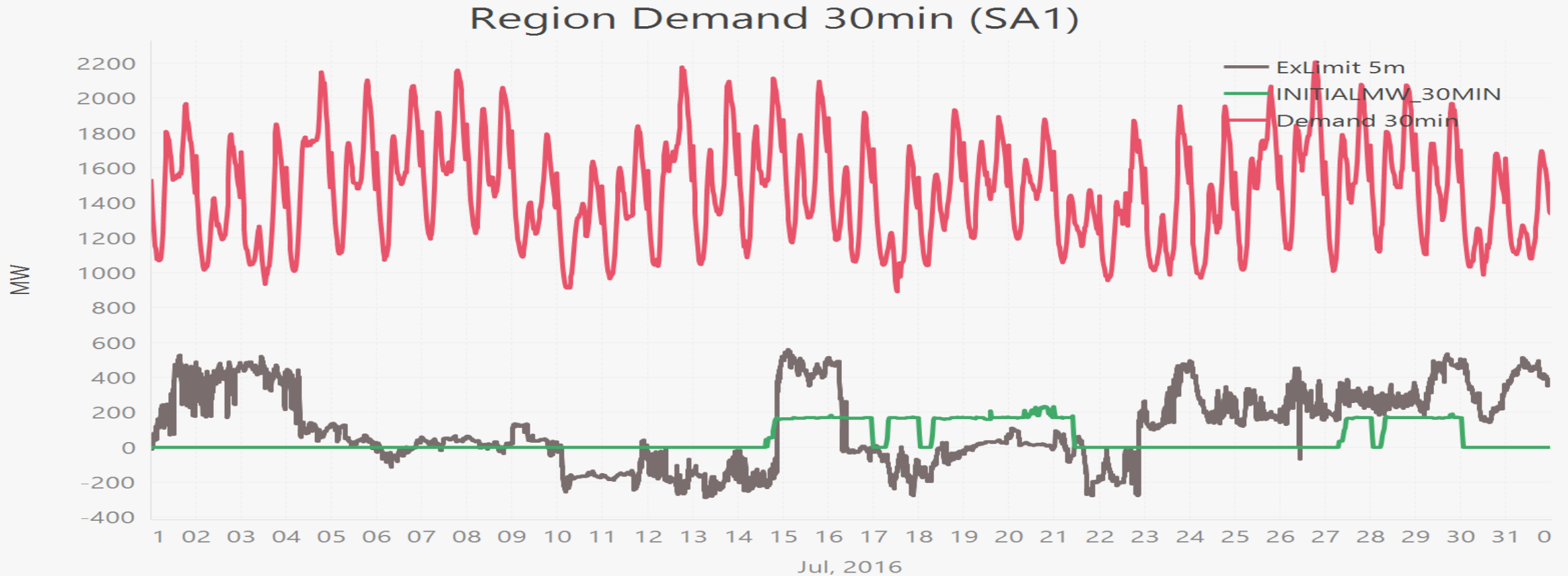


## Rooftop PV and Windfarm Generation - All Regions

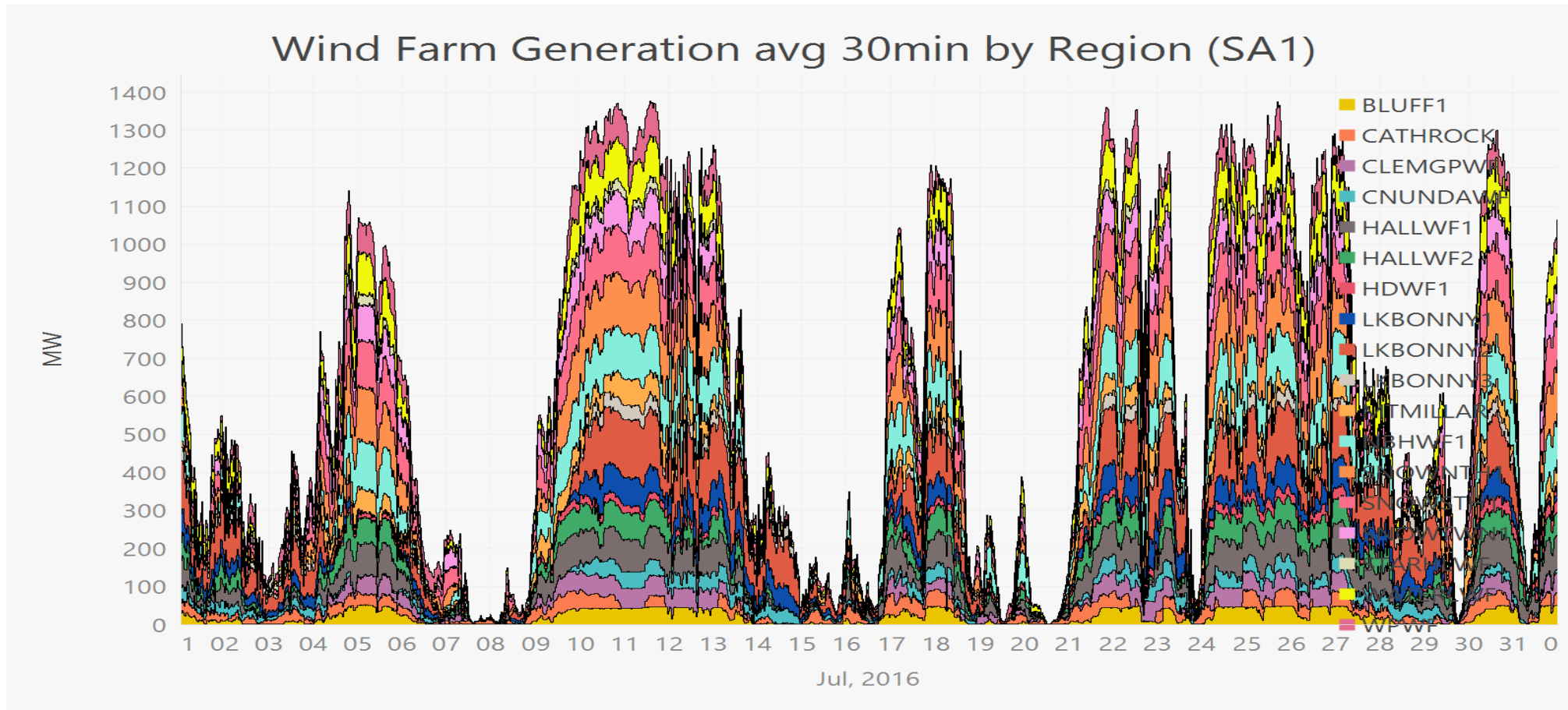




## Some Components Affecting Low Regional Reserves (and Prices) in SA in June

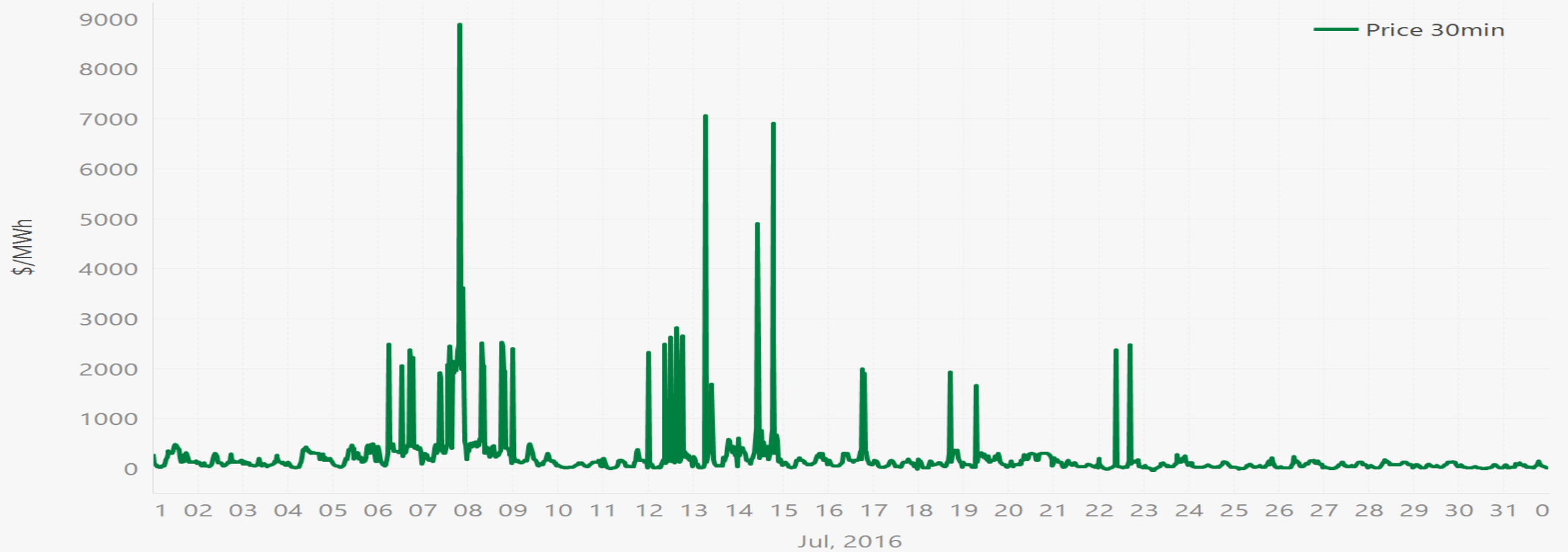


## And Wind Variability Topped It Off.....



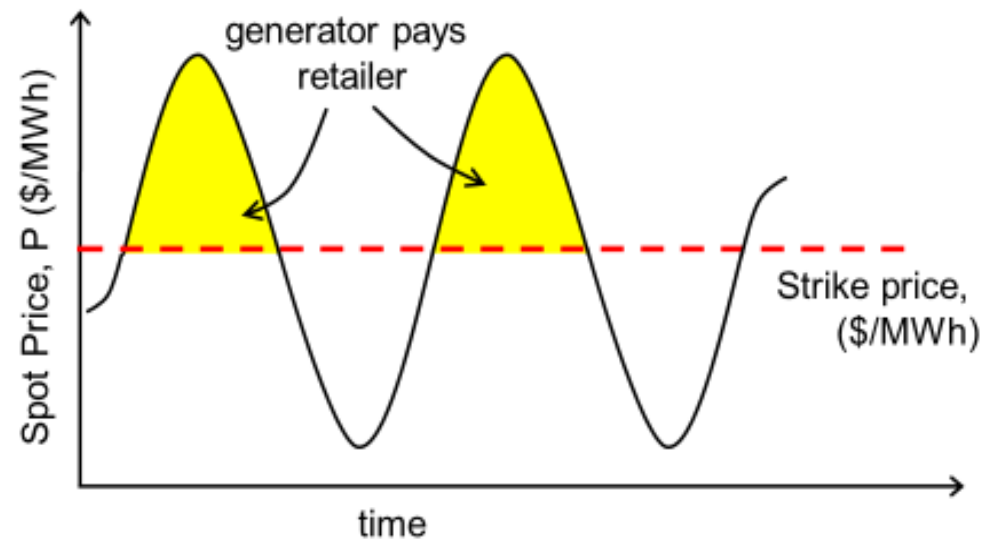
## Exciting Times In South Australia In July

Region Price 30min (SA1)



# Drilling Down - Premium Curve Analysis of NEM Prices— July 2016

## Cap Contract Payout

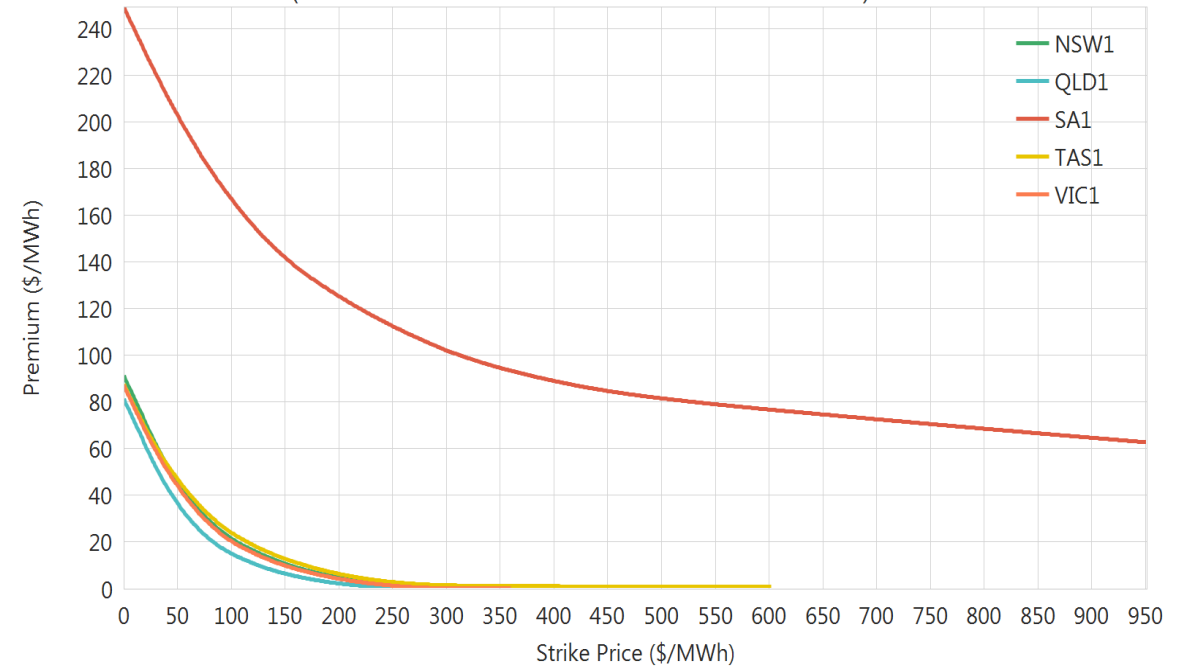


Intelligent Energy Systems

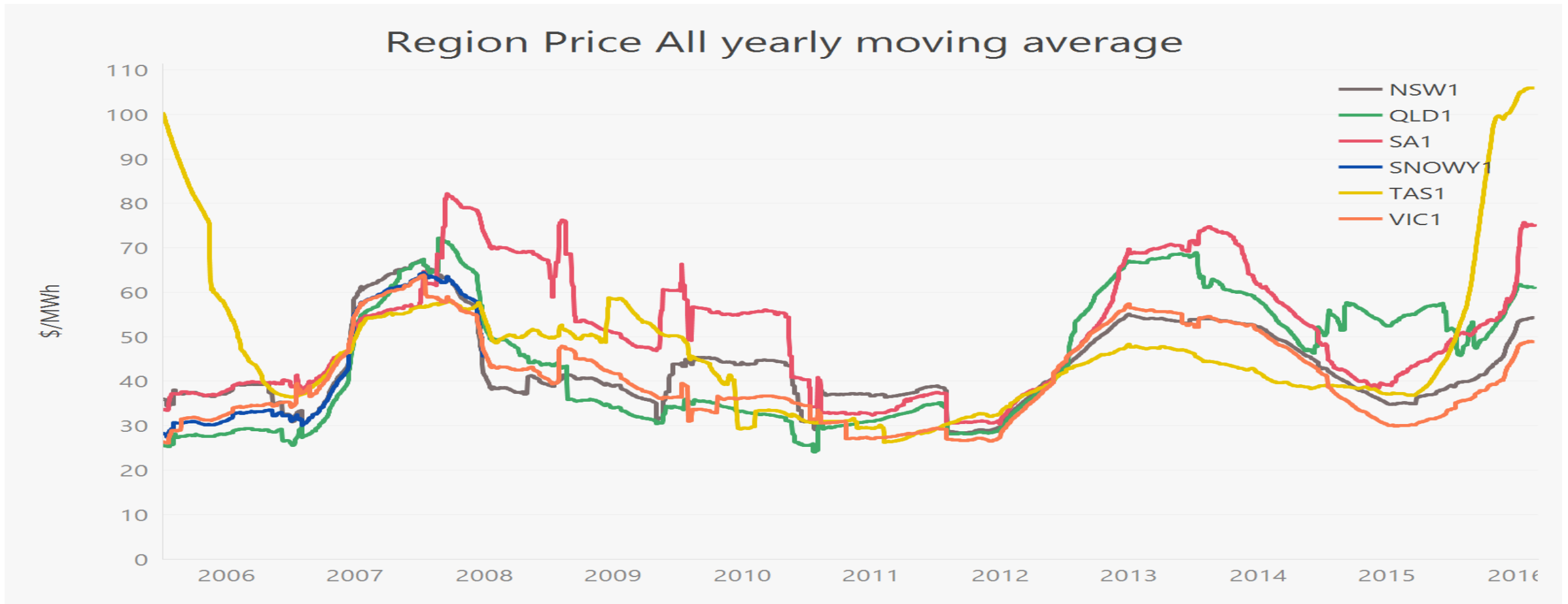
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## Region Price ALL 30min Premium Curves

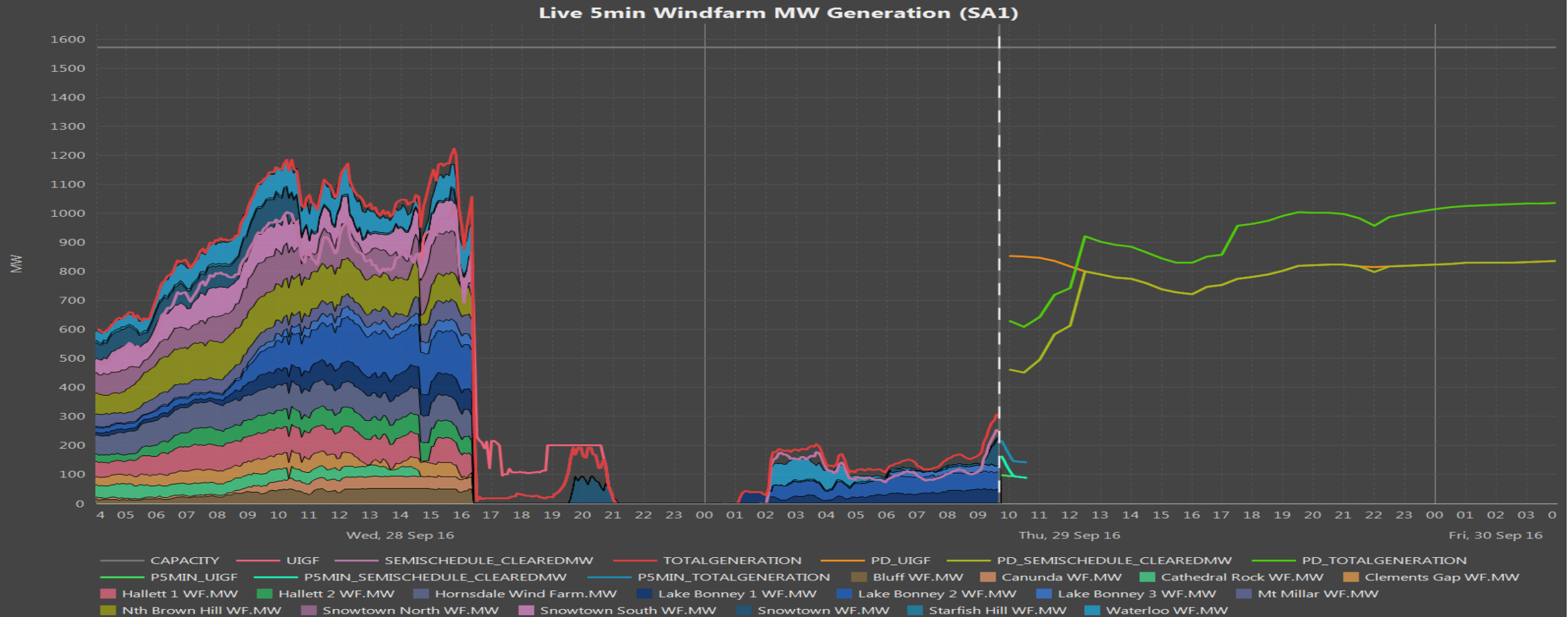
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# Is The NEM and South Australia in a New Paradigm? Or Has It Happened Before?



# Recent System Failure in South Australia – 28 September 2016



## Emerging System Security Issues in The NEM

- The Market Operator (AEMO) and Rule Maker (AEMC) are jointly reviewing system security issues arising from high renewable penetration in some regions (e.g. in South Australia). There are two main issues.
- Decreasing system inertia as asynchronous plant replaces synchronous plant
  - Not yet a problem nationally (if all interconnectors operating)
  - Already a potential problem in some regions (e.g. SA) in the event of regional isolation.
- Decreasing system strength in some parts of the network where there may be insufficient synchronous generation to withstand faults.
- There are technical solutions to these challenges and a range of potential implementation options. e.g. regulated or market oriented.
  - AEMC will ultimately determine arrangements, perhaps guided by government directive

## Improving Control Technology

- The “Smart Grid” is everywhere a popular and developing concept, including Australia. There are two broad models one could follow:-
- Control and management of most batteries/load management by the networks
  - This will be the default outcome unless an alternative strategy can be demonstrated as viable
  - This outcome increases centralised control and increases market power – consistent with NEM objectives?
- Decentralised control managed through market mechanisms
  - There are competitive benefits but also risks, such as potential instability driven by step changes in price in tariffs
  - Much technical and rule-making work needs to be done to support this option



# Can System Reliability be Maintained in a High Renewables System?

- There is every reason to expect that the NEM can deliver enough investment in open and combined cycle gas plant to compensate for renewable intermittency
- The viability of the battery option for domestic consumers depends not only on further declines in battery cost but also on the tariff structures that the regulator will allow.
- Additional interconnectors with to some region could also improve reliability in the face of other interconnect outages
  - But interconnector costs will be high and benefits may be better obtained in other ways
- However, the existing policy mix is poor and leads to higher costs than necessary
  - Forcing in renewable energy puts pressure on black coal plant to withdraw for the market while dirtier brown coal plant continues operating.
  - A mix of emission pricing and a more modest renewables target, perhaps targeted more to solar, could lead to more robust and cost effective outcomes.

# Can System Security be Maintained in a High Renewables System?

- AEMO and AEMC have begun to address system security issues around renewables only recently.
- There are technical solutions to these challenges.
- There is a range of procurement options such as
  - Contracting for inertia
  - Setting up a short term market in inertia, including real time pricing of performance
- Some options are pro-competitive and others are not
  - The choices made here will determine whether the current NEM moves to a greater degree of market dominance.
  - Does re-regulation of the NEM to deal with system security mean that the NEM survives?

## Are Governments, Rule Maker and Regulator up for the Task?

- Recent market events in South Australia and Tasmania have re-politicised the electricity sector.
  - Policy decisions made in this environment may easily be misdirected and address the wrong problem.
- The policy dysfunction around renewable energy targets and emission pricing are now embedded in the political system and are unlikely to change.
- Incumbent generators are understandably resistant to policy that would ease the entry of more renewable generation and more competition generally.
- Can the rule maker and regulator stand up to the pressures of politics and incumbent interests? Recent history does not give confidence.

# What Happens as we Approach 100% Non-dispatchable Renewables?

- The prevailing logic for electricity markets, in Australia and elsewhere, is to schedule plant where bids and offers are presumed to approximate marginal cost except when reserves are low.
- What happens when non-dispatchable plant comes to dominate the market? How is the price set? If an auction is retained, how stable will it be? How could investment occur in this environment?
- Batteries and other storage options can help delay this conundrum, but not up to 100% renewables.

**This is a challenge for a somewhat distant future!**

# What Will More Renewables do to Consumer Tariffs?

- Most studies show that encouraging renewables through the LRET actually reduces spot prices
  - Eventually forcing some thermal plant out of the market (usually older plant that may have been close to retirement)
  - Except possibly for a small region such as South Australia, the net effect, even after some plant withdrawal, is likely to be lower wholesale prices than without the LRET.
  - This may be masked by price increases from the exercise of generator market power, due to increased ownership concentration horizontally and vertically (through “gentailers”)
- Retail tariffs may also be depressed, even after pass-through of LRET costs.
- Explanation for this apparently strange outcome? Incumbent generators are paying for current higher cost costs of renewables, and they know it!
- However, near doubling of gas costs will raise cost of marginal gas plant, raise spot prices and may keep many older coal plants viable for longer.

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# THANK YOU!!

