

# Australian Experience with Renewable Generation: Some Emerging Lessons

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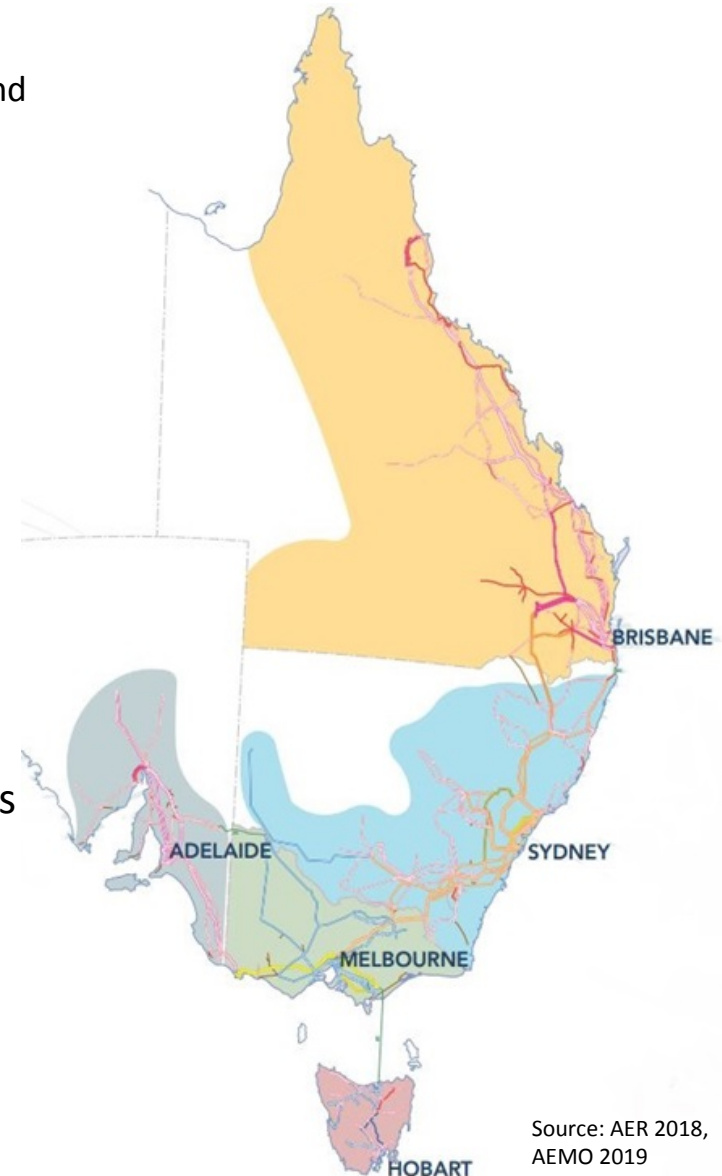
Asia Pacific Energy Research Centre  
Annual Conference:

15 May 2019  
Grand Prince Hotel New Takanawa, Tokyo



# National Electricity Market at a glance

- Participating Jurisdictions: New South Wales, Victoria, Queensland, South Australia, Tasmania and the Australian Capital Territory
- Market Structure: Liberalised and unbundled
- Market Design: 5 zones, energy-only wholesale, largely competitive retail, regulated networks
- Governance:
  - Policy oversight (COAG Energy Council)
  - Law and market rules custodian (AEMC)
  - Market and system operator (AEMO)
  - Regulator (AER)
- Installed Capacity: 55,590 MW, including 240 large generating units
- Networks: 43,000 km of transmission lines and ~750,000 km of distribution lines
- Annual Consumption: 203 TWh serving 10.1 million consumers
- Maximum Demand: 32,469 MW
- Turnover: \$17 billion



Source: AER 2018, AEMO 2019

# A proliferation of programs supported large-scale renewable deployment ...

Program	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Mandated Renewable Energy Target (1)																			
Victorian Renewable Energy Target (v1)																			
Victorian Feed-in Tariff (2)																			
Queensland Solar Bonus Scheme (2)																			
South Australian Feed-in Tariff (2)																			
Renewable Energy Demonstration Program																			
Solar Flagships Program																			
NSW Solar Bonus Scheme (2)																			
Australian Renewable Energy Agency																			
Carbon Pricing Mechanism																			
Clean Energy Finance Corporation																			
Queensland Renewable Energy Target																			
Victorian Renewable Energy Target (v2)																			
Emissions Reduction Fund																			
Victorian Renewable Certificate Purchasing Initiative																			
Queensland Renewables 400 Reverse Auction Program																			
South Australian Renewable Technology Fund																			
Victorian Renewable Energy Auction Program																			

**Over 70 Federal and State policies implemented since 2001**

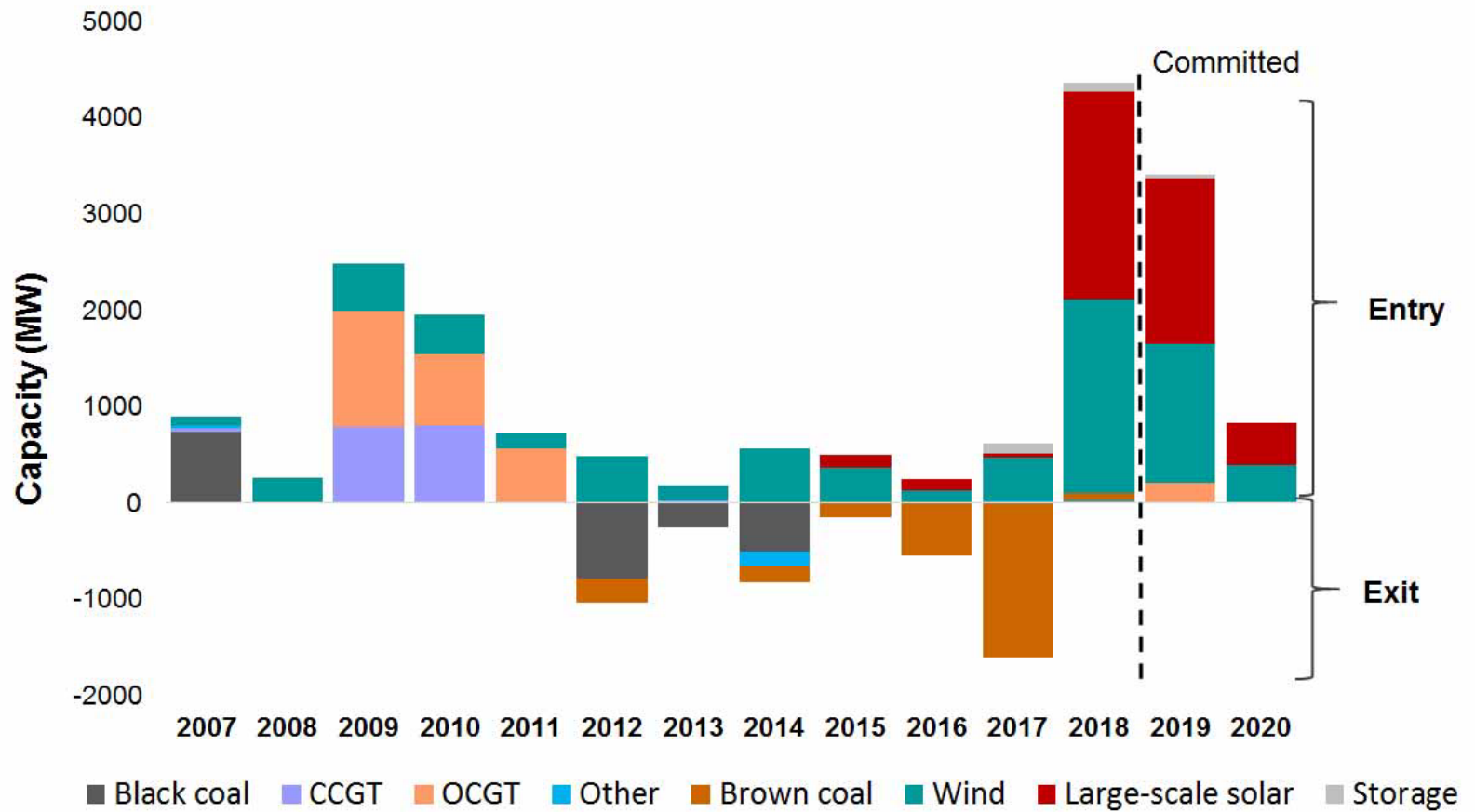
= Federal Program  
 = State Program



(1): MRET target revised and Small-Scale Renewable Energy Scheme added in 2010

(2): Replaced with less generous programs in NSW (2016), Victoria (2016), Queensland (2012) and South Australia (2011)

# ... which has dominated new investment



Source: AEMC 2019

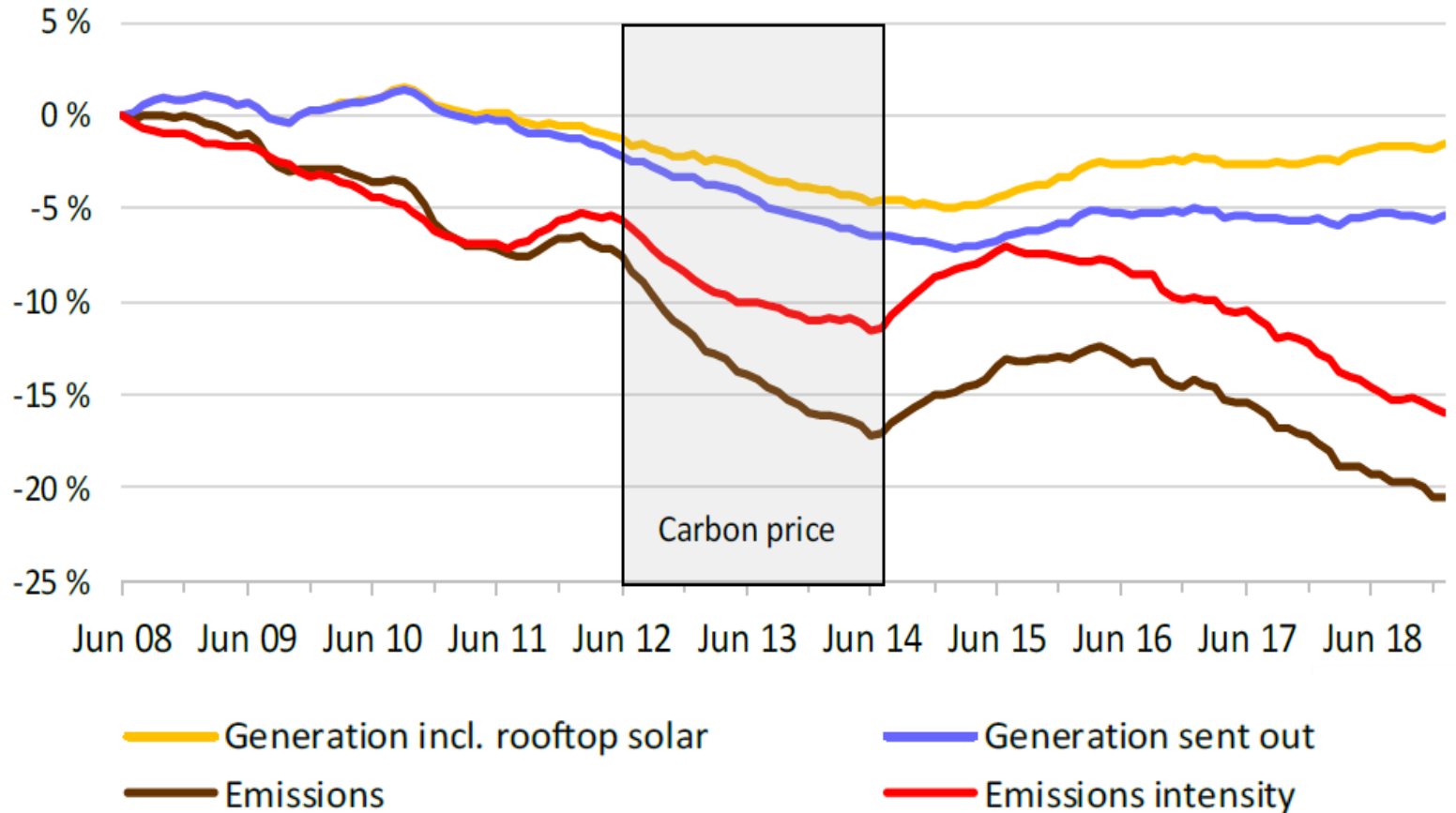
- Large-scale wind and solar plants represent nearly all new generation capacity added to the NEM since 2011

... and delivered a rapid increase in renewable power production ...



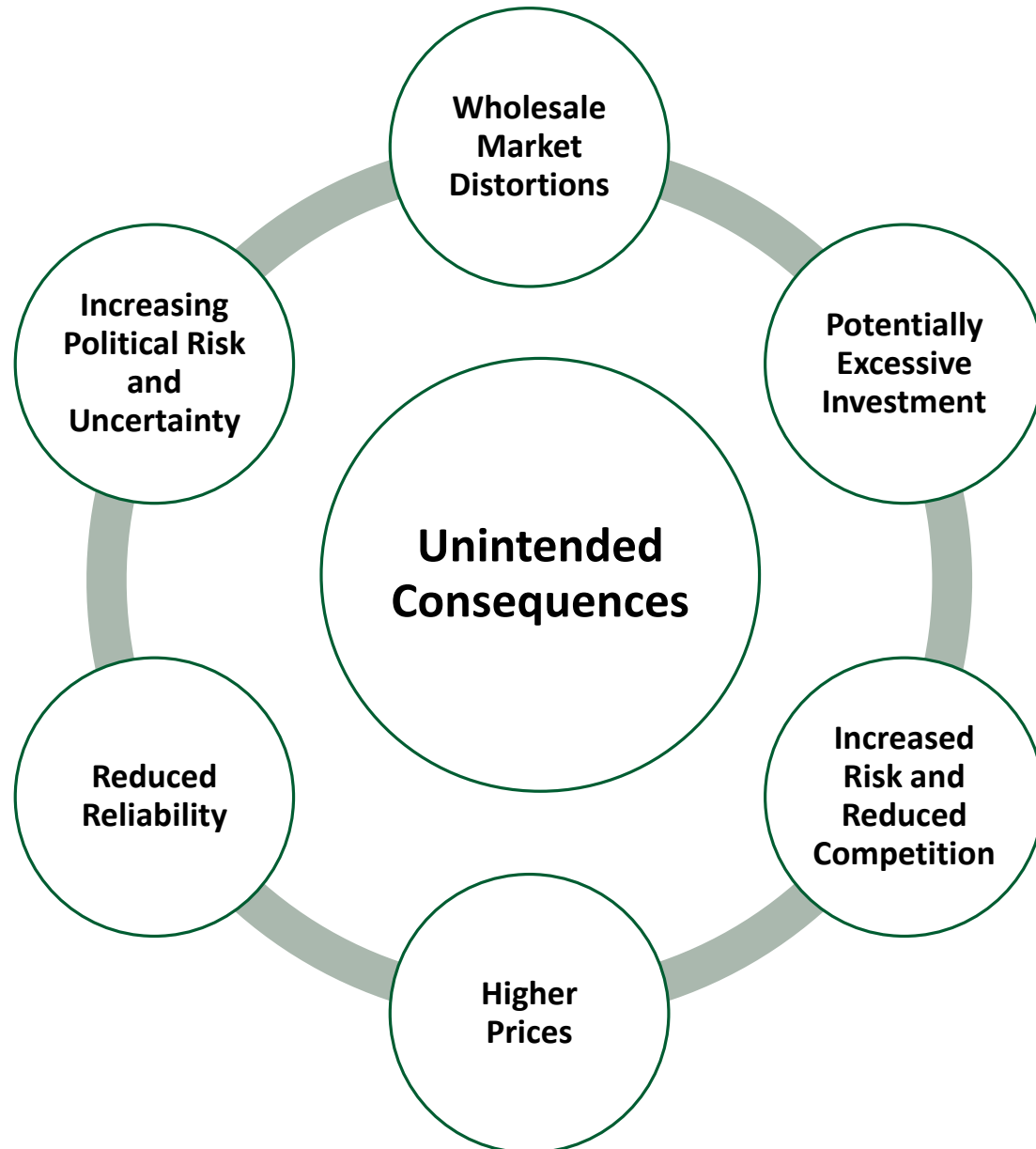
Source: AEMO and AEMC 2019

# ... while significantly reducing NEM carbon intensity and emissions

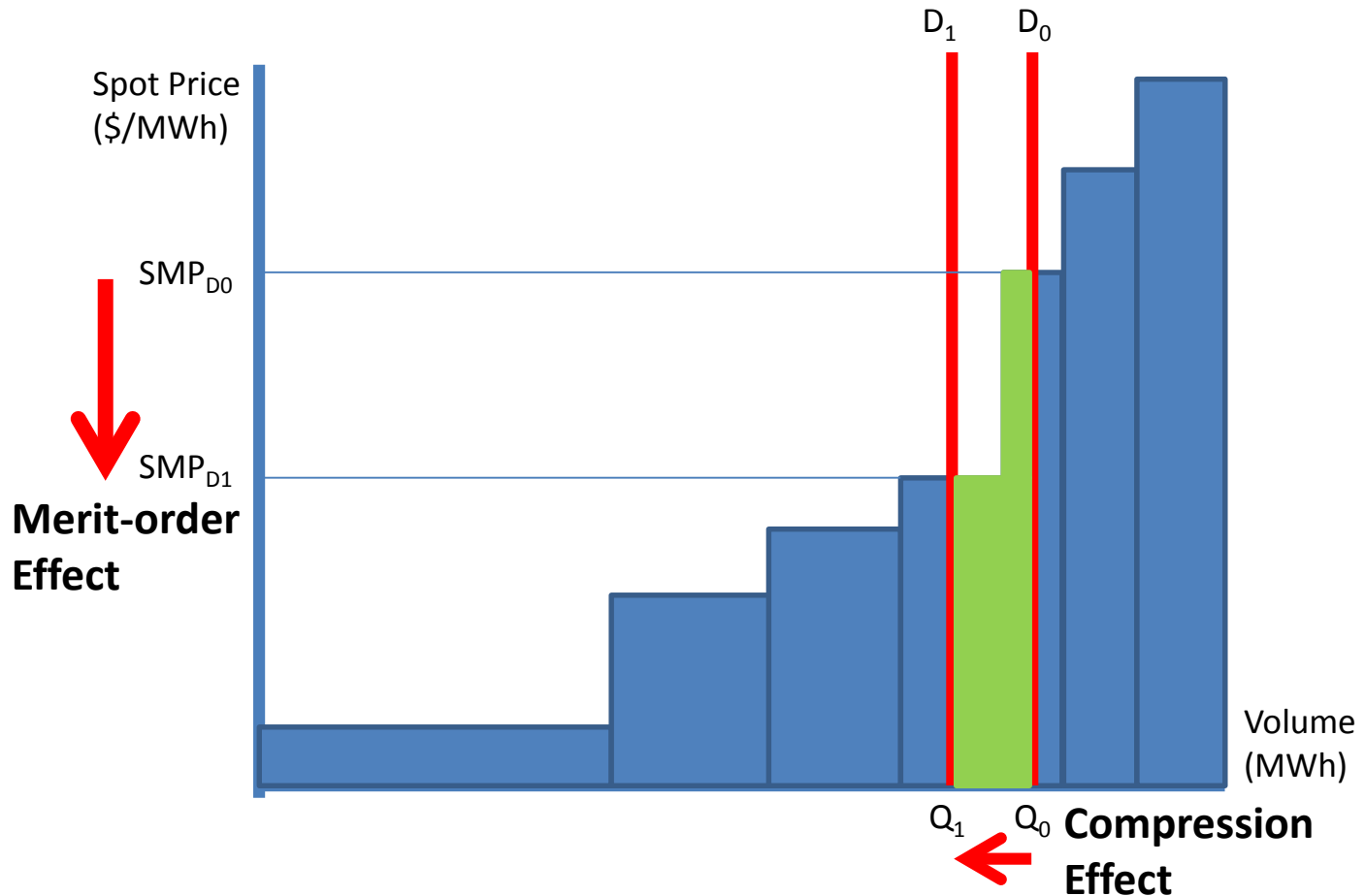


# However, success has come at a cost

...

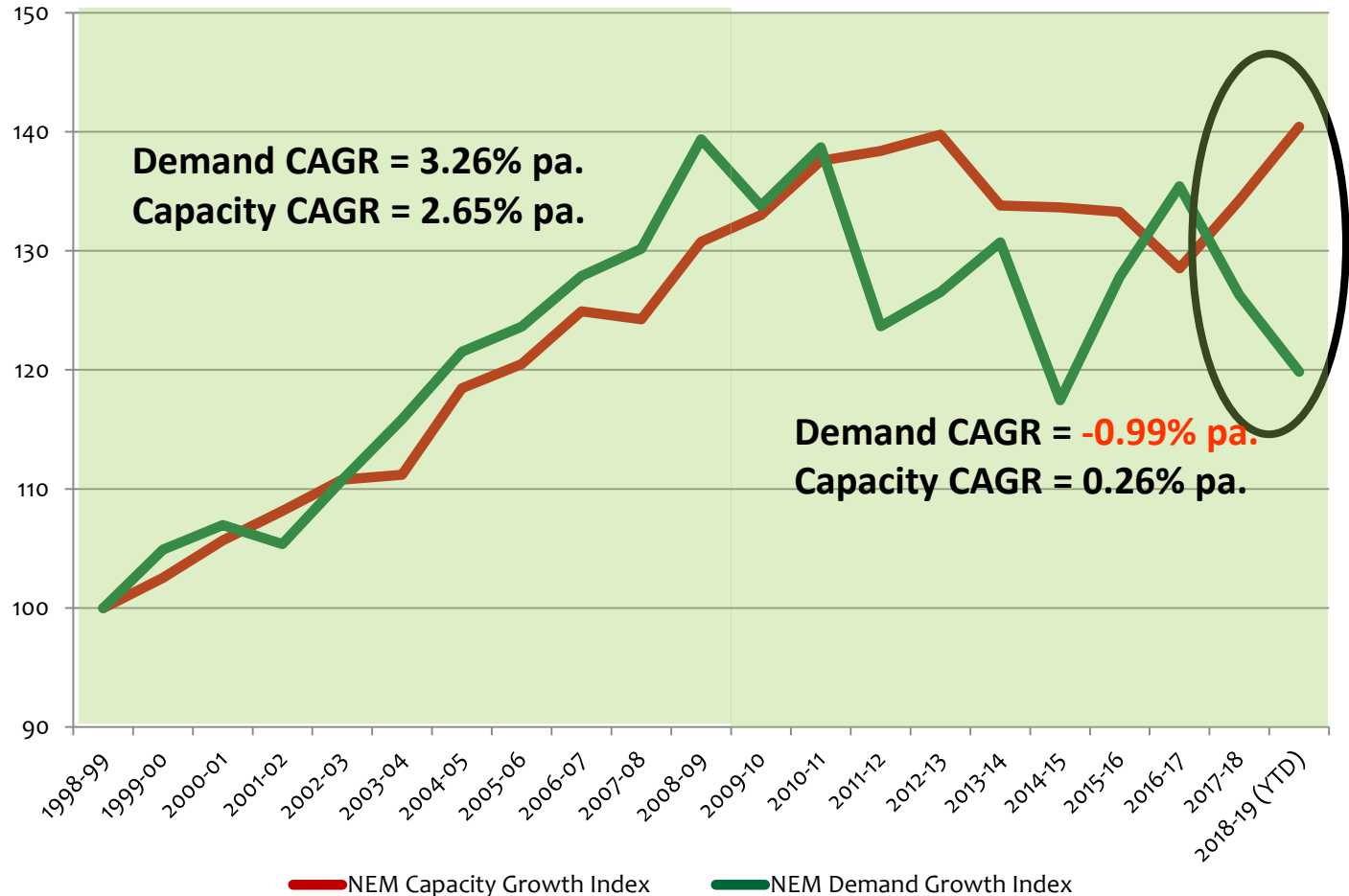


# Poor integration of renewables adds inefficiency and risk ...

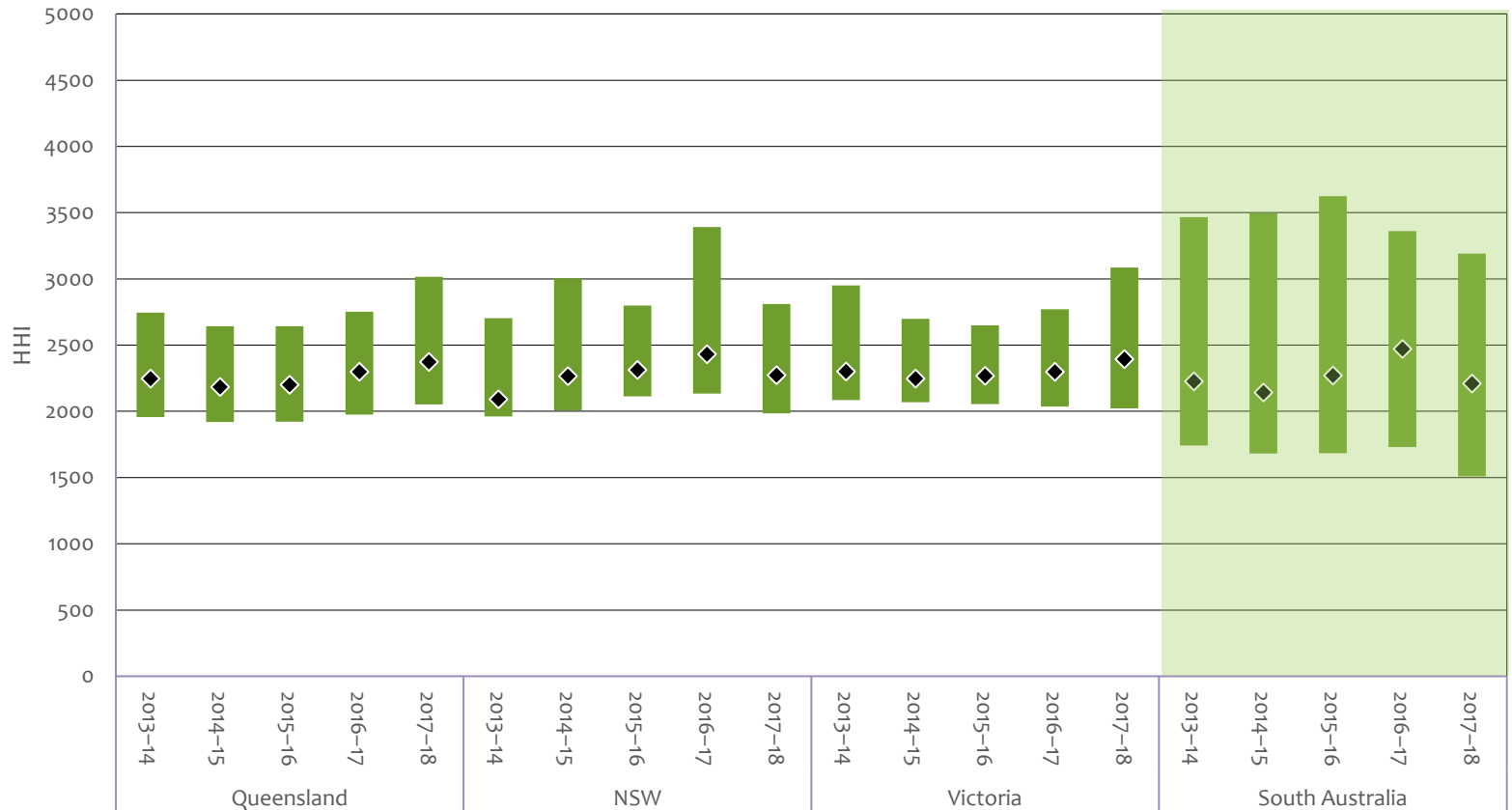




# ... while mandated rates of deployment risk creating excess capacity



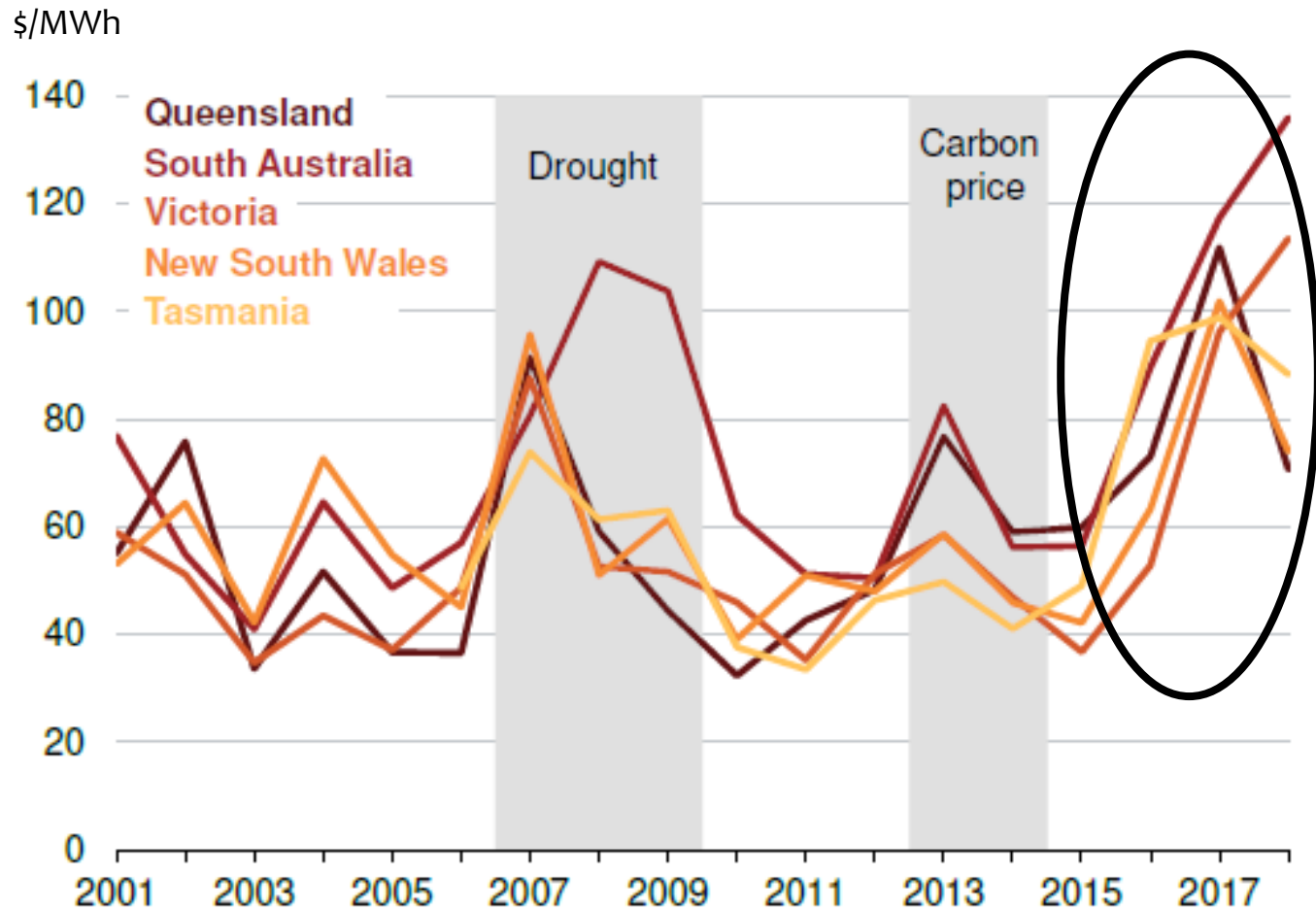
# Increasing risk and uncertainty has encouraged 'strategic' responses ...



■ Range ♦ Mean

Source: AER 2018

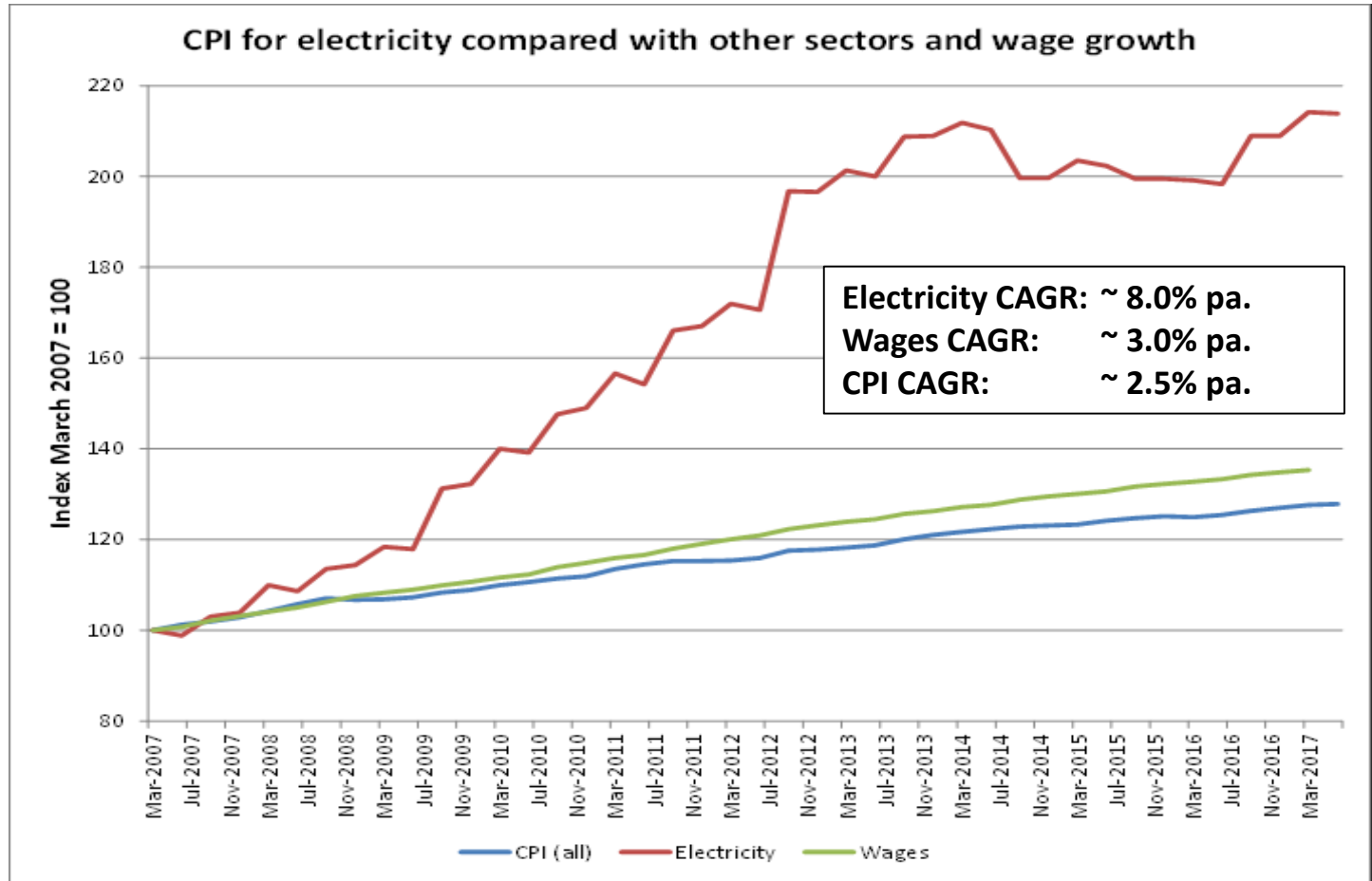
... which have led to rising spot and wholesale prices ...



Notes: Prices represent weighted annual average real spot prices for each state in 2017 dollars. 2018 figures are part year.

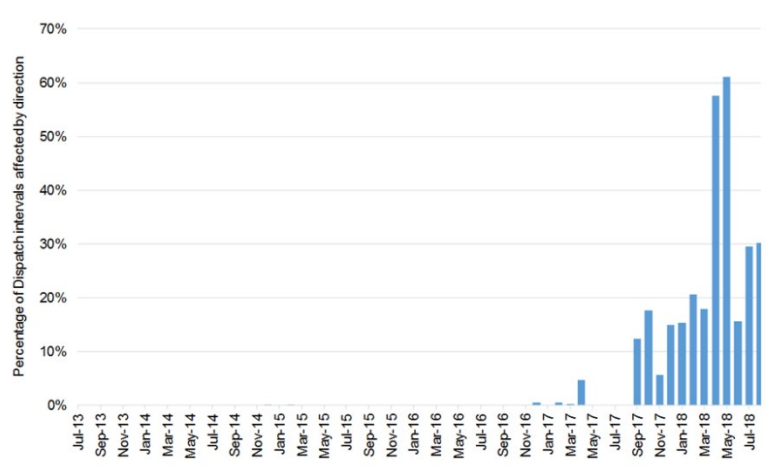
Source: The Grattan Institute 2018

... that have put pressure on retail prices and affordability ...

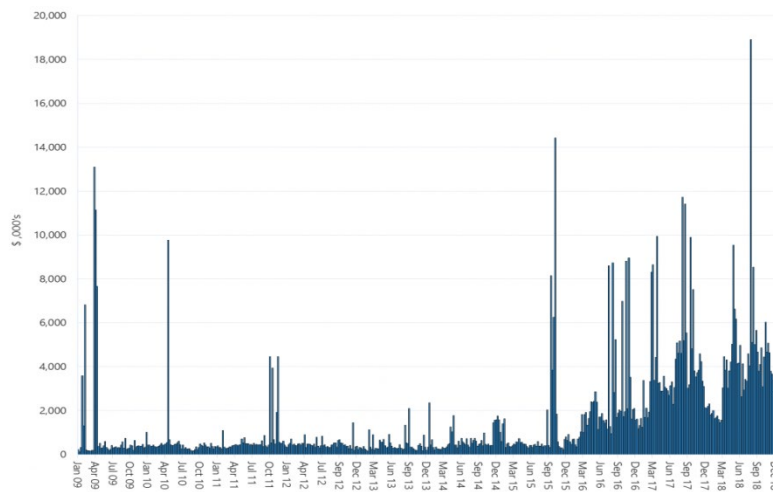


Source: ACCC 2017

# ... while more variable renewables are increasing system security challenges



Source: Energy Security Board 2018



Source: AER, AEMO 2019

- All but one of these interventions were needed to manage large volumes of variable renewable generation in South Australia
- Large-scale deployment of variable renewables has led to substantial increases in FCAS costs since 2015

# ... prompting interventions that have further magnified risk and uncertainty

Jurisdiction	Generation Investments	Transmission Investments	Renewable Targets	Financial Assistance	Non-price Regulation
Federal	?		✓	✓✓✓?	??
New South Wales		?		?	
Victoria			✓	✓✓✓?	
Queensland	✓✓?	?	✓	✓✓✓	✓
South Australia	✓✓	?		✓✓✓??	
Tasmania	?	?			



= committed/implemented measures



= announced/proposed measures

Note: Measures as at late 2018  
Source: AER 2018

# Some emerging lessons ...

1

- Large-scale deployments of renewables need to be fully integrated into power systems and markets

2

- Interventions to support renewable deployment ought to reinforce and complement commercial incentives

3

- The pace of deployment should not exceed inherent economic, technical and social 'speed limiters'

4

- Governments should adopt a predictable, consistent and incremental policy approach

5

- Policies need to be holistic, objective and adaptable

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