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Environmental Markets

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Some regulatory and market design insights from the Australian experience of integrating high renewable penetrations into its National Electricity Market

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*Japan-Australia Dialogue on
Energy Policy & Regulation*

Keio University, Tokyo

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A destination – shaped by energy trilemma

Choose any two? *but you may get none*

Balancing the 'Energy Trilemma'

Energy Security

The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

Energy Equity

Accessibility and affordability of energy supply across the population.

Environmental Sustainability

Encompasses the achievement of supply and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.



ENERGY
SECURITY

“To promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to –

- *price, quality, safety, reliability, and security of supply of electricity; and*
- *the reliability, safety and security of the national electricity system.”*

National Electricity Law (Schedule to the National Electricity (South Australia) Act 1996), s.7



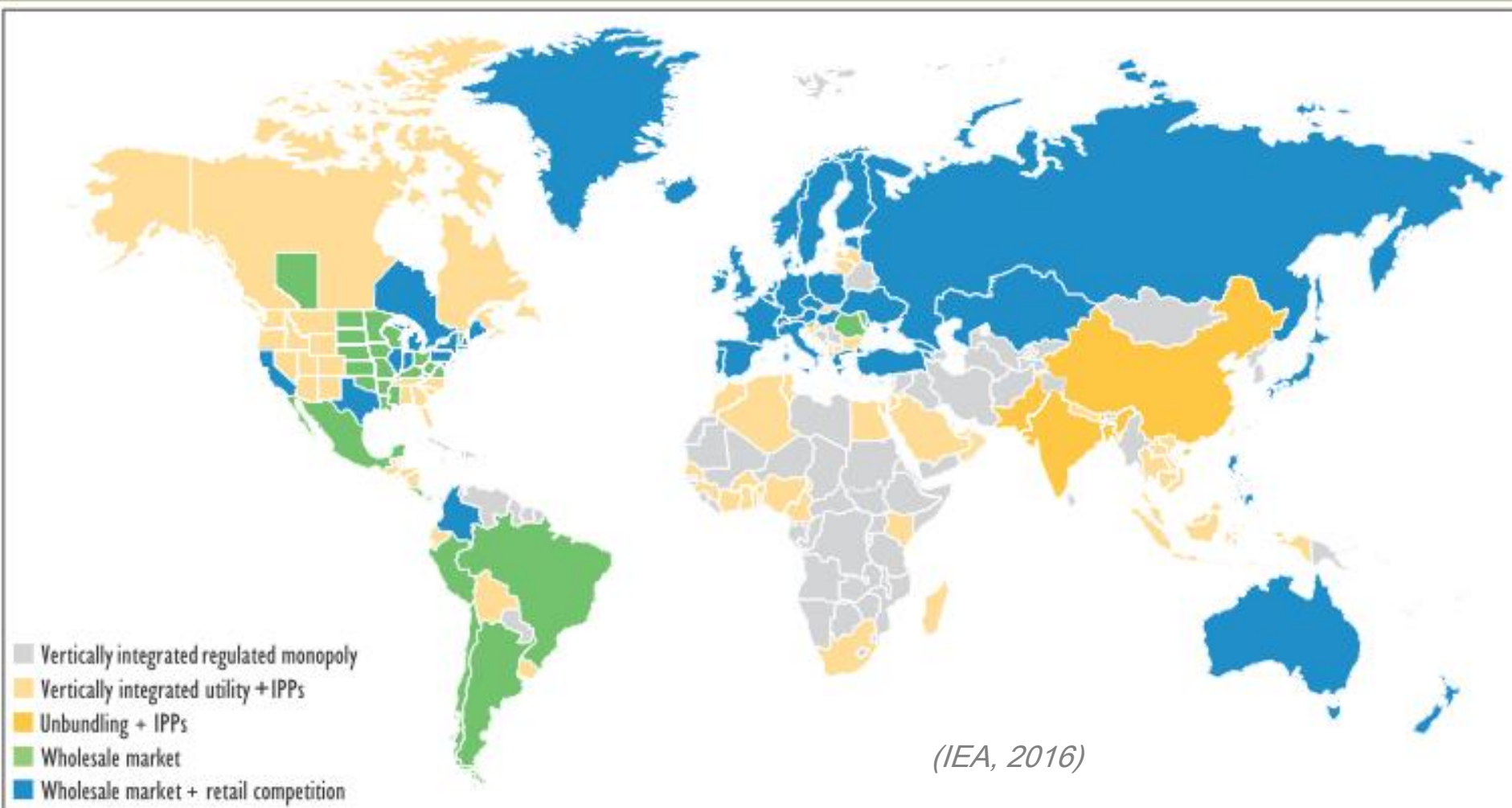
ENERGY
EQUITY

*(World Energy
Council, 2016)*



ENVIRONMENTAL
SUSTAINABILITY

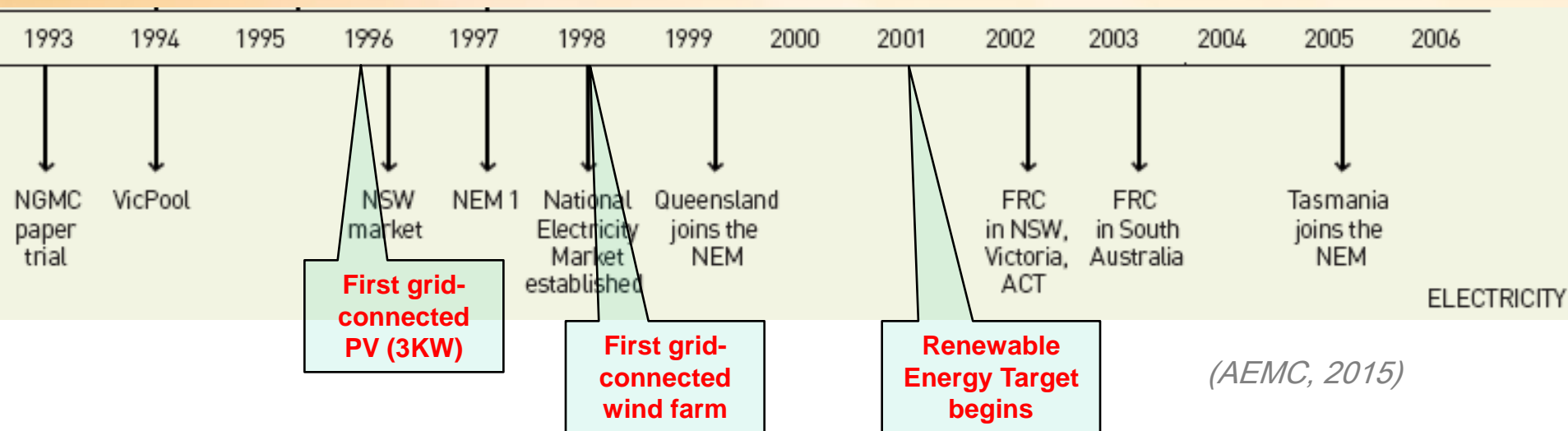
For electricity, no agreed path...



The NEM path - 'fit for purpose'?

Objectives of technology and participant neutrality, but always challenging...

Exogenous and endogenous drivers that seem to be accelerating



The NEM – a single near-national market

Wholesale value of electricity traded

\$11.7 billion

**40,000 kilometres of
transmission lines**

National maximum summer
operational demand

32,859 MW

Number of metered customers

9.6 million

National maximum winter
operational demand

31,977 MW

Installed capacity

47,148 MW

NEM emissions

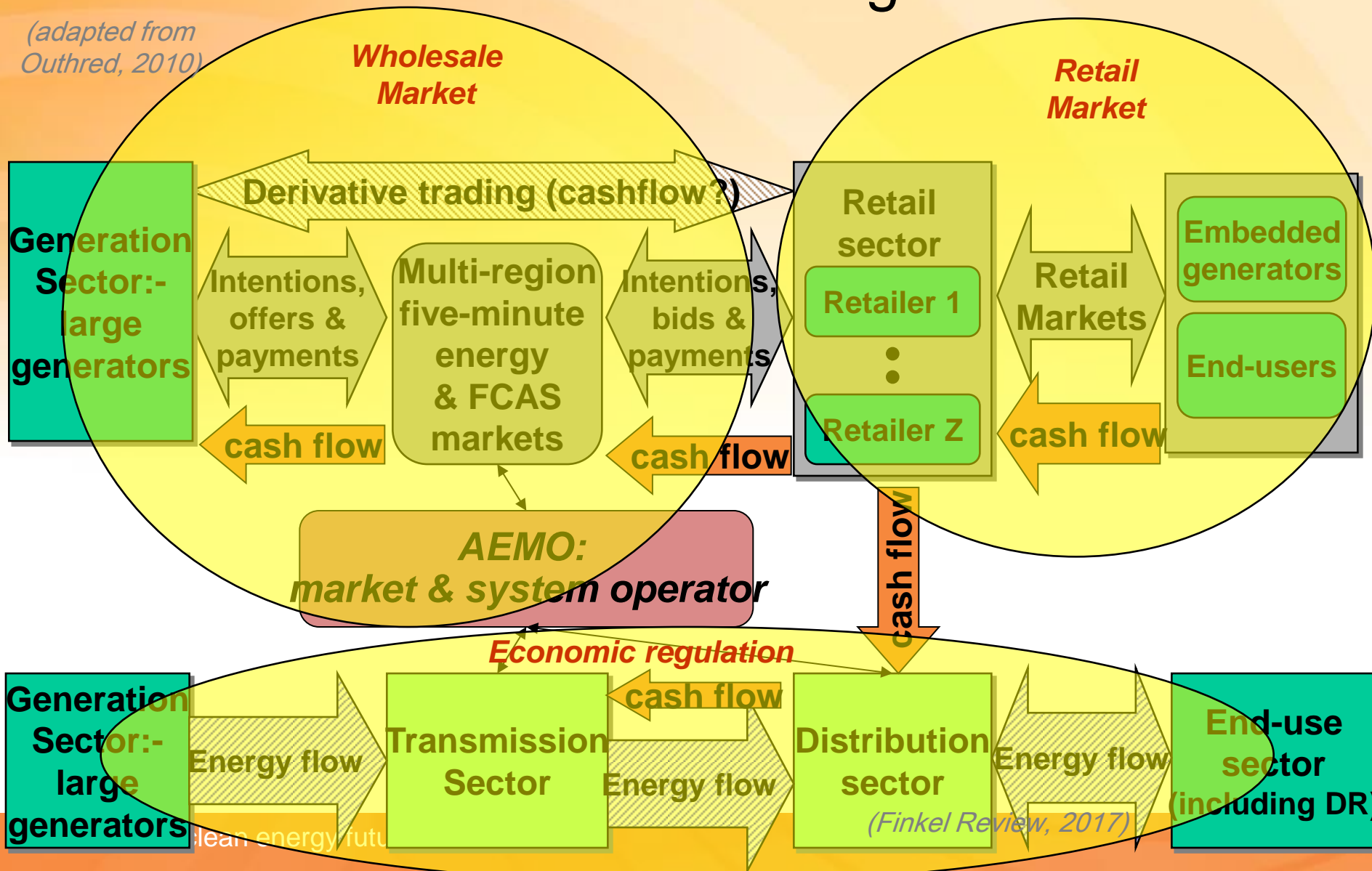
162 Mt CO₂-e



(Finkel Review, 2017)

NEM market and Network arrangements

(adapted from
Outhred, 2010)

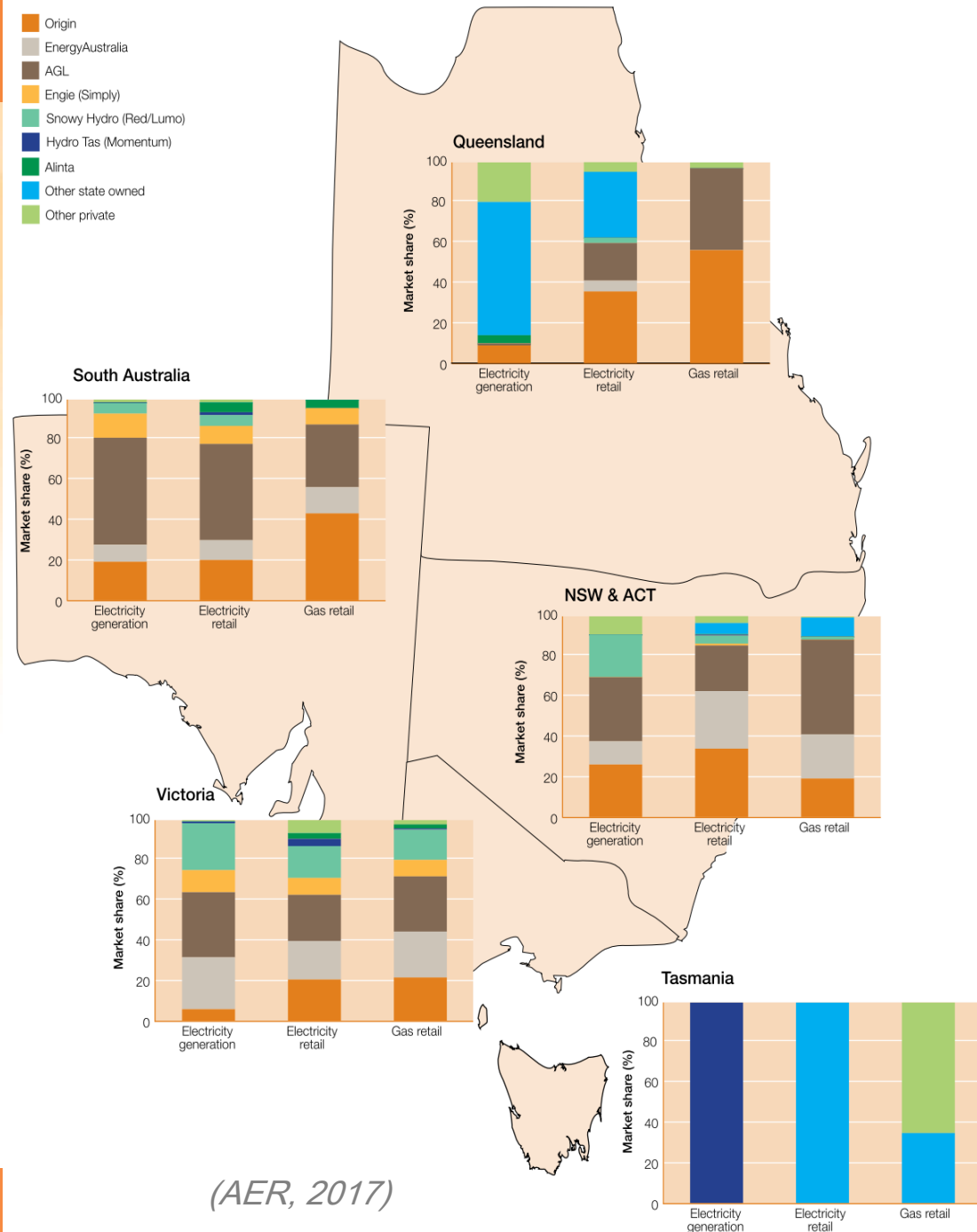




Competitive Generation and Retail ‘markets’?

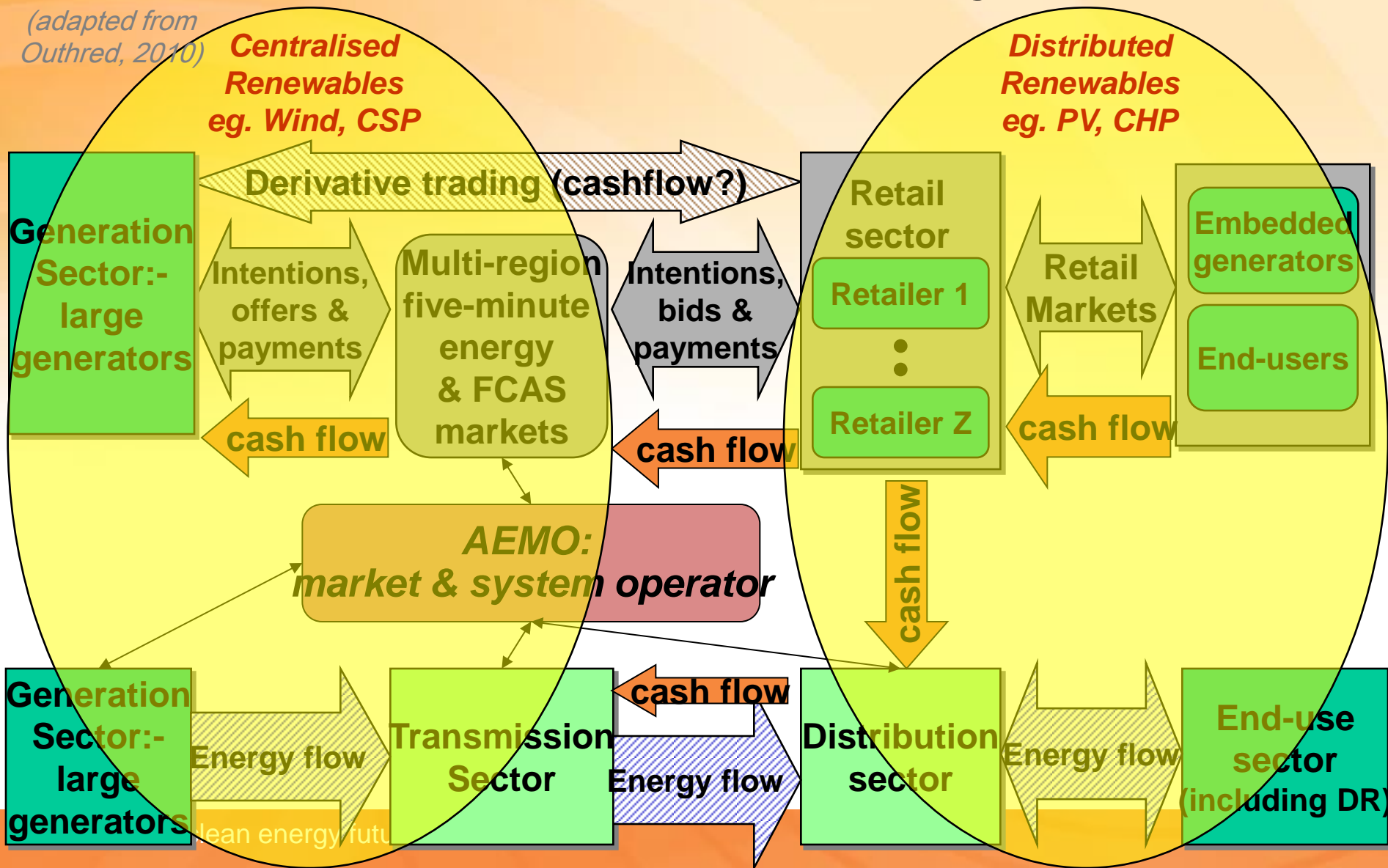
- Predominant private ownership of both generation and retail
- A mix of local + international firms, and foreign government vehicles
- A mix of State and Federal Government participation

Vertical integration in National Electricity Market jurisdictions, 2016



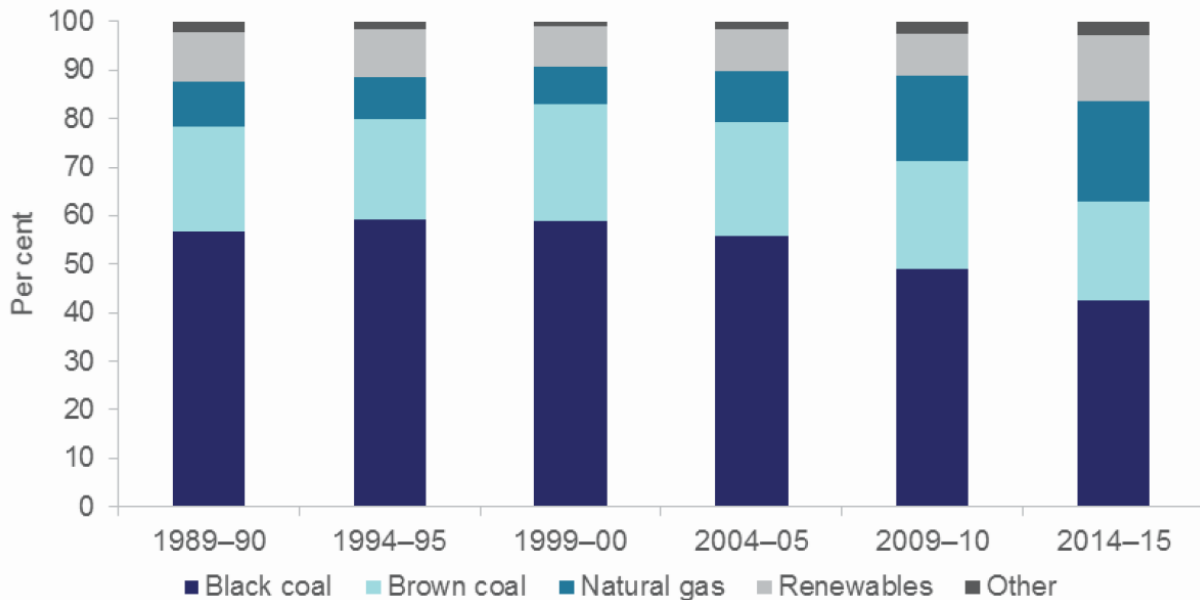
Two 'worlds' for renewables integration

(adapted from
Outhred, 2010)



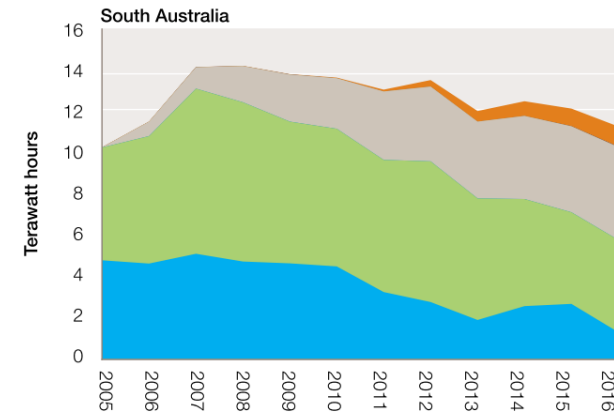
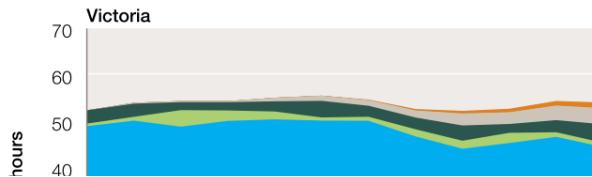
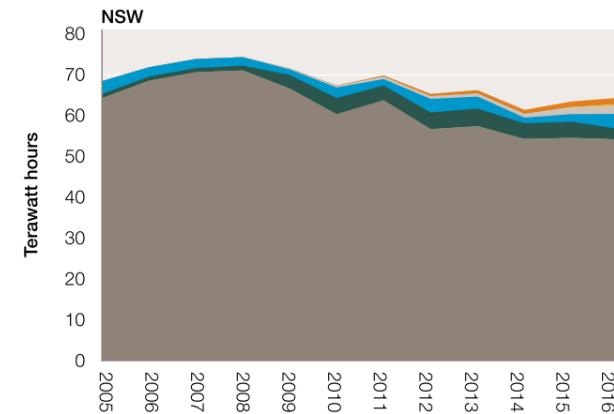
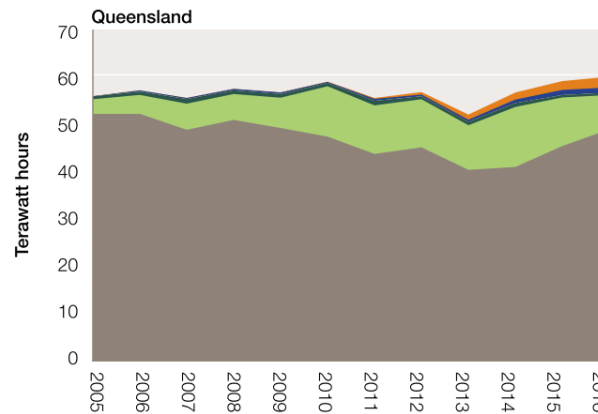


Success to date in low carbon transition?

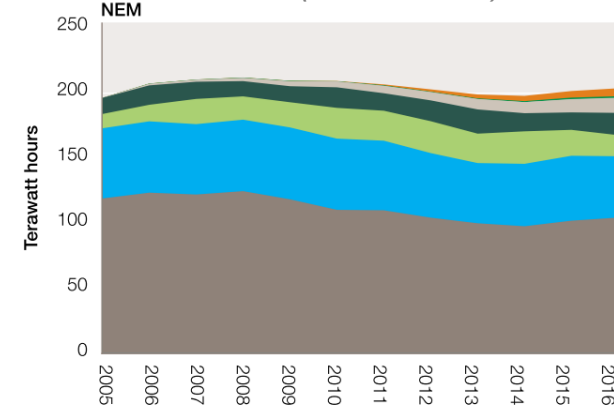
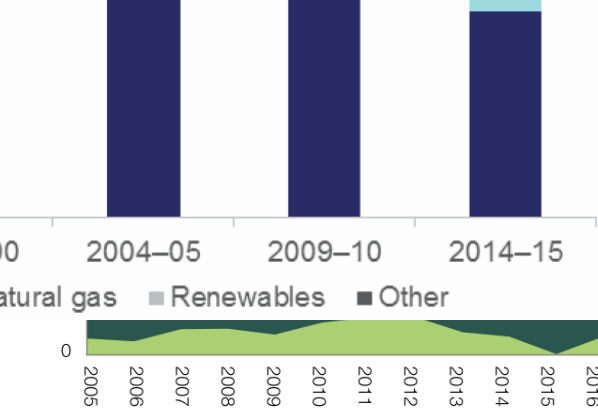


(Australian Energy
Statistics, 2016)

Lessons on sustainable electricity in



(AER, 2017)



Black coal Brown coal Gas Hydro Wind Solar farm Other dispatched Rooftop solar

Residential PV penetration



Overall governance challenge

Comprehensive and coherent policy development process

1. Regulation

- Transmission network planning
- Distribution network planning
- Grid codes

2. Market Design

- Fundamental market design
- Spot market rules
- Ancillary service market rules

3. External Policy Drivers

- Carbon policies
- Renewable & energy efficiency policies
- Fuel policies

Robustness and Resilience: ability to perform reasonably well
under a wide range of possible futures

(Riesz, 2016)

Changing status of large-scale RE in NEM

■ Non-scheduled

- *Original category for intermittent gen – RE treated as negative demand*
- Can only be curtailed for system security or key network issues
- Don't pay for FCAS
- *Recent changes:* technical connection standards relevant to wind generators
Historical windfarm outputs published
Centralised wind forecasting system (AWEFS)

■ Scheduled

- *All major generation SA formerly required new wind farms to register as scheduled*
- Submission of dispatch offers
- Compliance with targets
- Causer-pay for ancillary services
- Ability to offer ancillary services
- Publication of individual outputs:- forecast, offered & actual

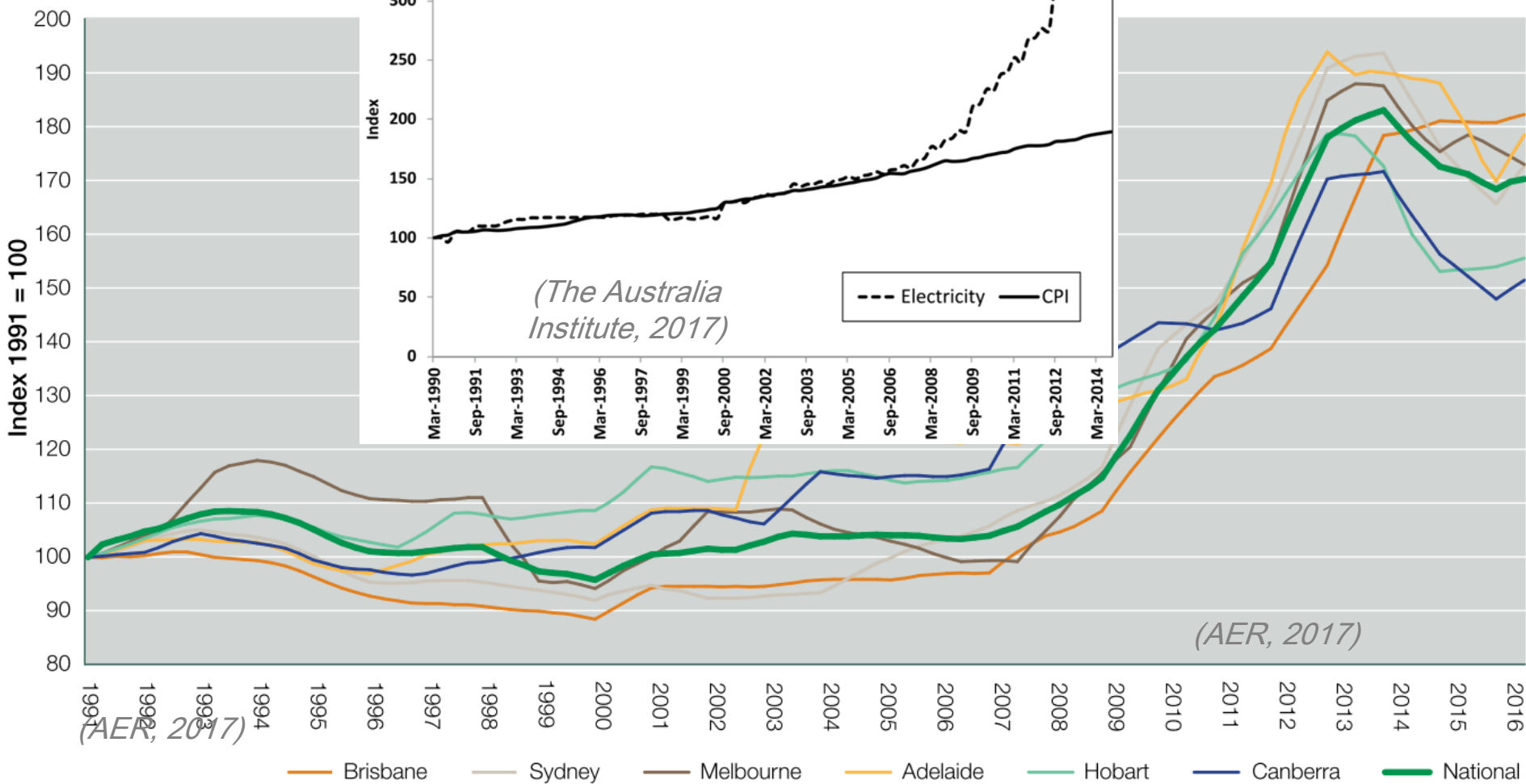
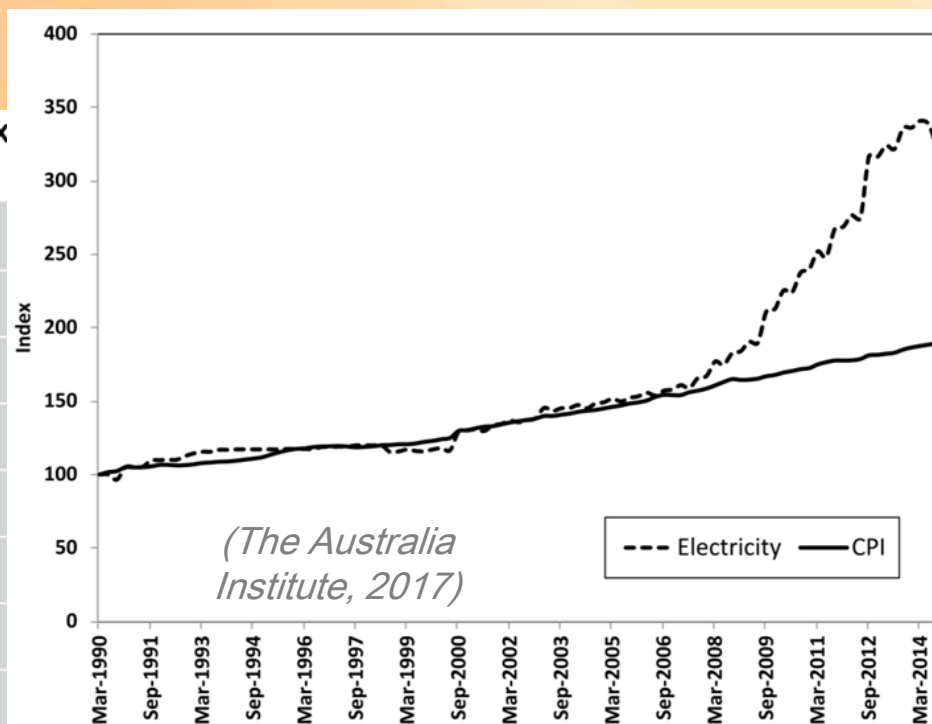
*(adapted from
Outhred, 2010)*

■ Semi-Scheduled

- *Specifically intended for intermittent gen >30MW + compulsory from March 2009*
 - Submission of dispatch offers
 - Causer-pay for ancillary services
 - Ability to offer ancillary services
 - Are treated as positive supply
- If involved in a constraint
- Compliance with targets if less than forecast

Retail pricing – does this look like success?

Electricity retail price index



Facilitating greater consumer engagement

– demand-side participation *in principle*

Efficient markets are characterised by effective participation of both the supply and demand side. The supply side of the market provides a product or service at a price, and the demand side (ie consumers) responds to the price/value of the product or service being offered.

While there is some evidence of uptake of DSP in the NEM over recent years, the efficiency of the electricity market can be improved by more active participation by the demand side. This will require changes to some aspects of how the supply side of the electricity market operates and interacts with consumers.

(AEMC, Power of Choice, 2012)

The Power of choice review has identified opportunities for consumers to make more informed choices about the way they use electricity. Consumers require tools - information, education, and technology, and flexible pricing options - to make efficient consumption decisions. Recommendations presented in this report will support these conditions and enable consumers to have more control of their electricity expenditure.

Facilitating greater engagement *in practice?*

CRT proposals to date:

- steep declining block
- higher fixed charges
- ‘non-peak demand’ demand charges
- special ‘solar’ household tariffs



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UltraFlex energy storage.
The only place it does better than on the grid, is off the grid.

Queensland pushes through massive rises in fixed electricity charges

By Giles Parkinson on 19 June 2015

A victory for McMansions? Fixed charges to households surge, while small business may pay two-thirds of their bill on fixed charges, as government owned utilities move against solar and energy efficiency.

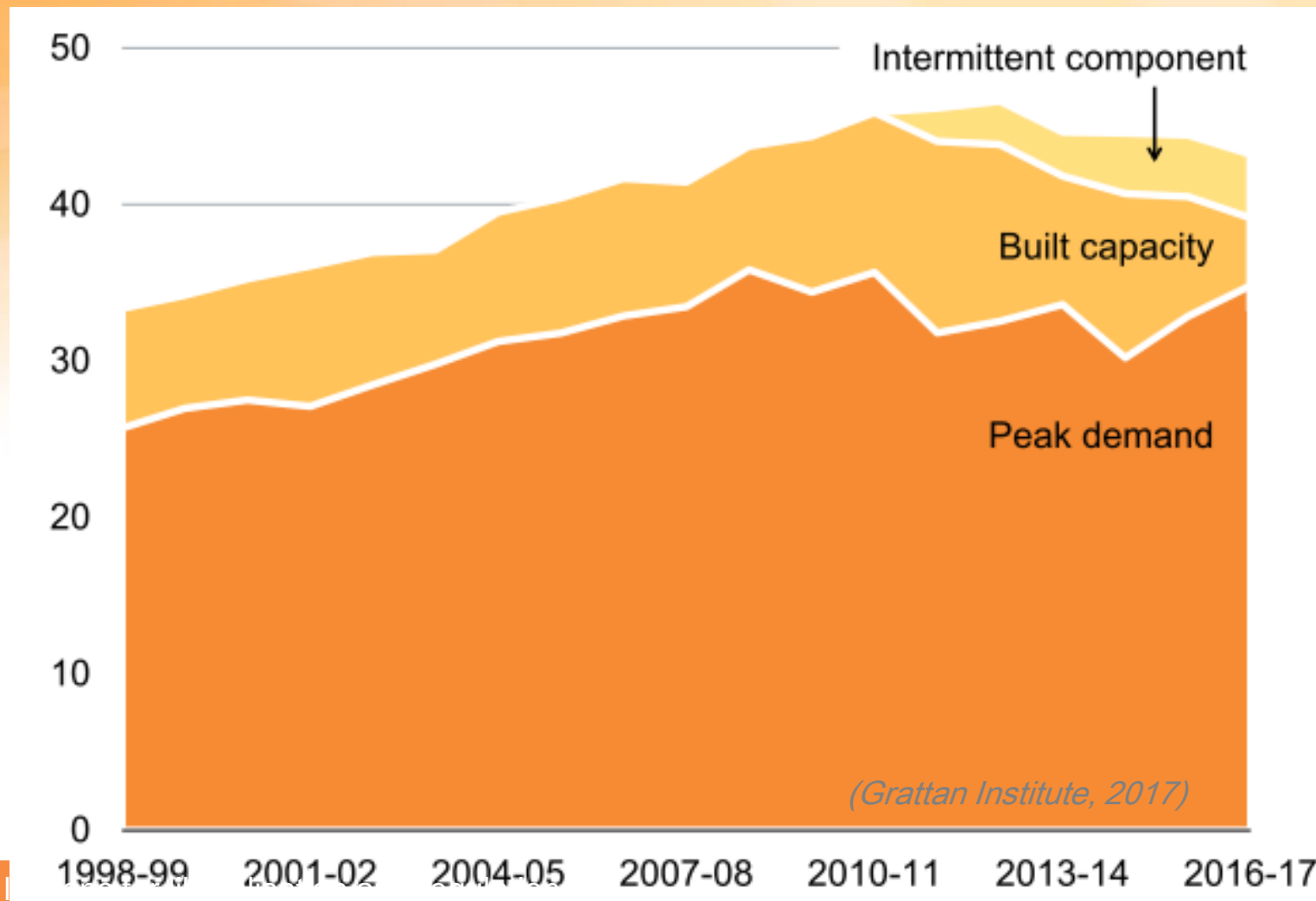
(Reneweconomy, 2015)

While some cross-subsidies are not to be discussed

- eg. locational between urban and regional consumers

All may limit consumer options to invest in new technologies and behave in ways that reduce bills while also reducing longer-term network expenditure

Resource adequacy tightening



SA blackout – Was it wind?

- A complex question
- *Electricity industry run to remain secure, major failures almost always involve multiple factors*
- *Wind and residential PV added to the challenges*

How the South Australia blackout occurred: what the data tells us

29

By Bruce Mountain on 29 September 2016

Print



The Adelaide CBD as seen on 7 News Adelaide's sky cam at about 7pm Wednesday. *Yahoo7*

When catastrophic failures occur, people quickly demand explanations and start to point fingers. It takes time to get to the right explanations and point fingers in the right direction. Forensic reviews, done thoroughly, often point to underlying risks which made catastrophic failures more likely.

So, what can we say about the extraordinary "system black" in South Australia 20 hours (at the time of writing this) after it occurred, and after about 75% of demand has since been restored.

At the five minute trading interval starting at 16h20 NEM time (so 15h50 in Adelaide), the system was humming along as normal. The spot price was \$60 per MWh, peak demand was 1686 MW of which 535MW was being met from imported power from Victoria (430 MW on Heywood and 105 MW on Murraylink).

Torrens Island was the only South Australian fossil plant producing (from two of its four "B" units, but all four of its "B" units were synchronised. The remainder of the supply was coming from wind farms of which 659 MW in the Northern region and 384 MW in the South East.

If I understand it from the limited information currently available, at around 15h40 Adelaide time, lightning and severe wind knocked out the main transmission lines bringing power from the North, and so dropping about 40% of South Australia's supply.



South Australian Government intervention



BATTERY STORAGE AND RENEWABLE TECHNOLOGY FUND

Australia's largest battery will be built in South Australia to store renewable energy and add stability to supply as part of a new \$150 million Renewable Technology Fund.



NEW GENERATION MORE COMPETITION

The State Government will use its bulk-buying power to attract new electricity generation to increase competition and put downward pressure on prices.



STATE-OWNED GAS POWER PLANT

The South Australian Government will build its own gas power plant to have government-owned stand-by power available in South Australia for emergencies.



SOUTH AUSTRALIAN GAS INCENTIVES

The State Government will offer incentives to source more gas for use in South Australia, replacing coal-fired energy from Victoria.



LOCAL POWERS OVER NATIONAL MARKET

The State Government will legislate to give the Energy Minister direction over the market so South Australia's best interests always come first if there is an electricity shortfall. *(South Australian Government, 2017)*



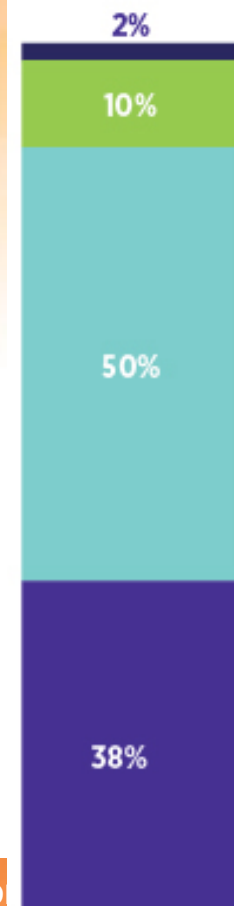
ENERGY SECURITY TARGET

A new target will increase South Australia's energy self-reliance by requiring more locally generated, cleaner, secure energy to be used in South Australia.

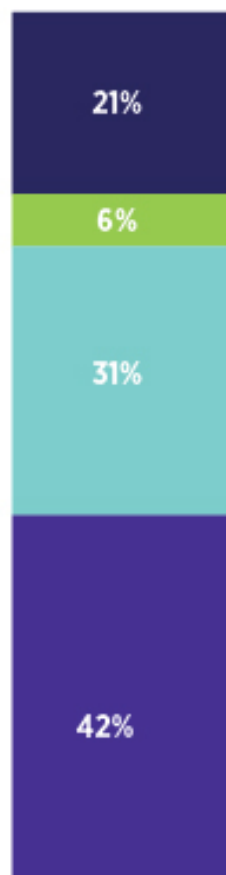
Renewed focus on competition challenges

Figure 7 Addressing Affordability

Contribution to C&I
electricity costs



Contribution to
household
electricity costs



Retail

- Get lower income people off high offers
- Reduce switching costs
- Improve customer understanding

Green

- Reduce the smeared costs and inequity of current (and future) green schemes

Generation

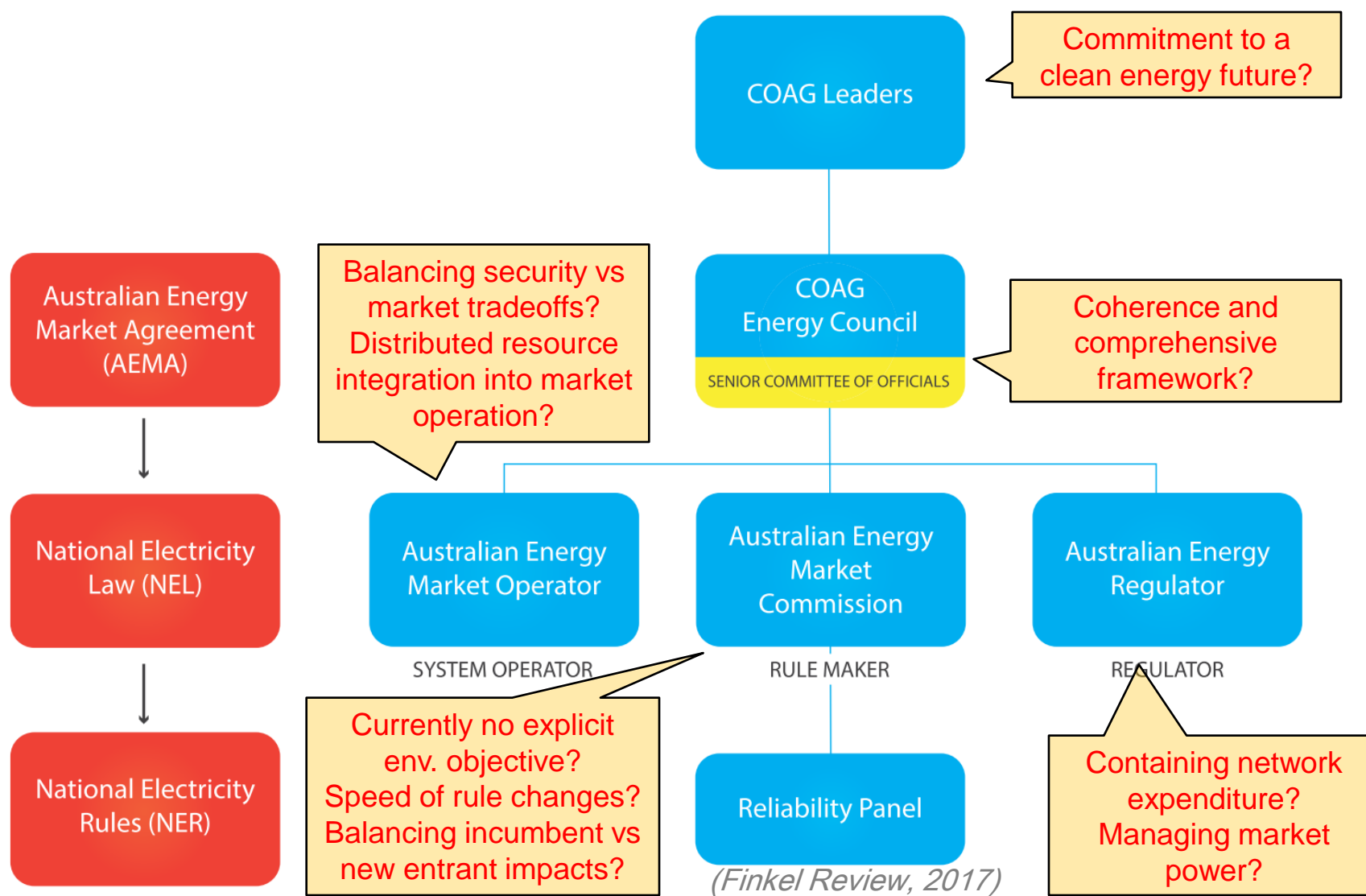
- Lower gas prices
- Address or reduce the effects of market power
- Explore barriers to C&I-led investment
- Establish what demand-side measures are best

Network

- Remove Limited Merits Review (LMR)
- Reduce inefficient costs
- Reconsider asset values

*(ACCC, Sims speech to
National Press Club, 2017)*

NEM Governance – fit for purpose?



Possible lessons for RE integration

- Wholesale market arrangements
 - *RE just one of the challenges facing electricity industries*
 - As RE penetrations increase, require greater integration into formal ‘energy’ market arrangements
 - External RE policy should retain ‘exposure’ to energy market signals
 - Distributed RE particularly challenging, needs more formal integration
- Retail market arrangements
 - Need to accept, work within ‘social construct’ for small energy users
 - Network businesses have key role – currently conflicted b/n existing and possible new business models; *Need to revisit interface b/n monopoly regulation + retail mkt competition given new technologies*
- *More generally, market limitations wrt integration across policy objectives, longer term perspectives mean greater govt. involvement essential for effective low-carbon transition*



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Thank you... and *questions*

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