



The Future NEM – how renewable, how energy user oriented, how market oriented?

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*The State of Energy Research
Conference*

Australian National University
3-4 July 2019

The Future NEM

- How renewable?
 - *It depends*
 - How energy user centred?
 - *It depends*
 - How market oriented?
 - *It depends*
 - Depends on things we can influence, yet others we can't
 - For those we can influence
 - How would you like it look? *Consistent with what we know, probably know, not necessarily what we might know?*
 - How seriously do you want that future? *Reasonably assured delivery will require a coherent and comprehensive **regulatory, market and policy** framework robust to most uncertainties*
- ... and then "let's see if the NEM can muddle through" is not an option*



An agreed destination: our long-term interests...
difficult decisions likely required – choose any two? (like NEM NEO)

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

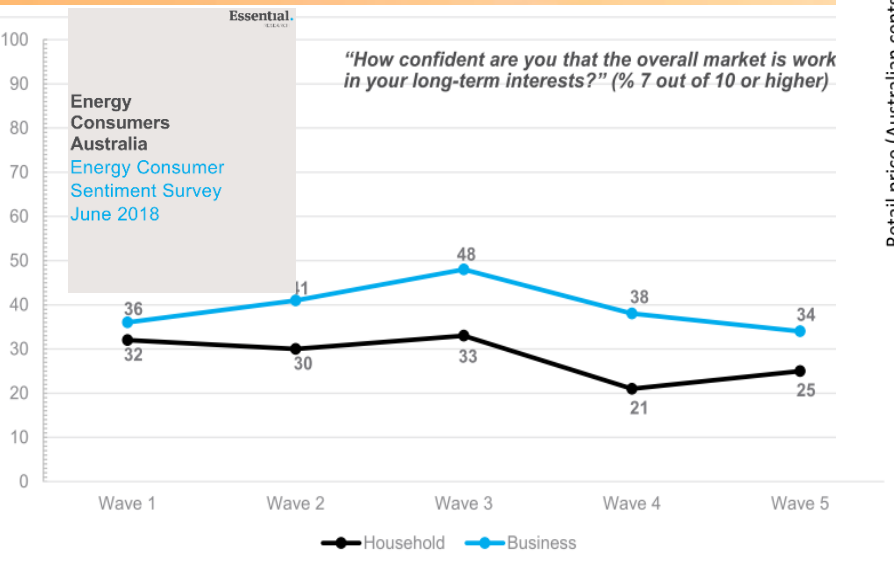
(World Energy
Council, 2016)



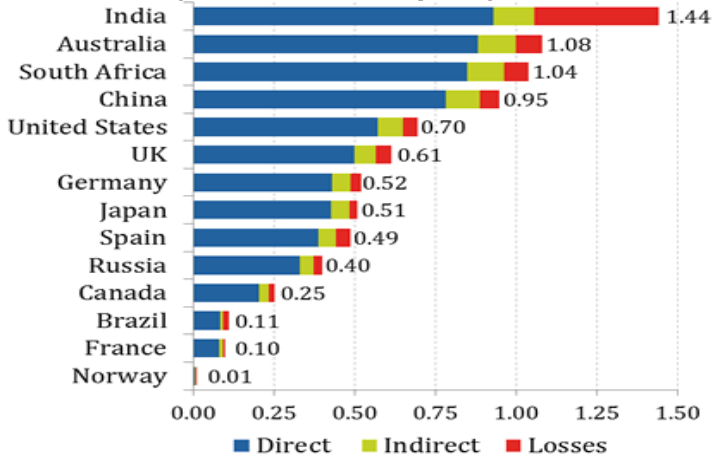
ENVIRONMENTAL
SUSTAINABILITY



..but may get none

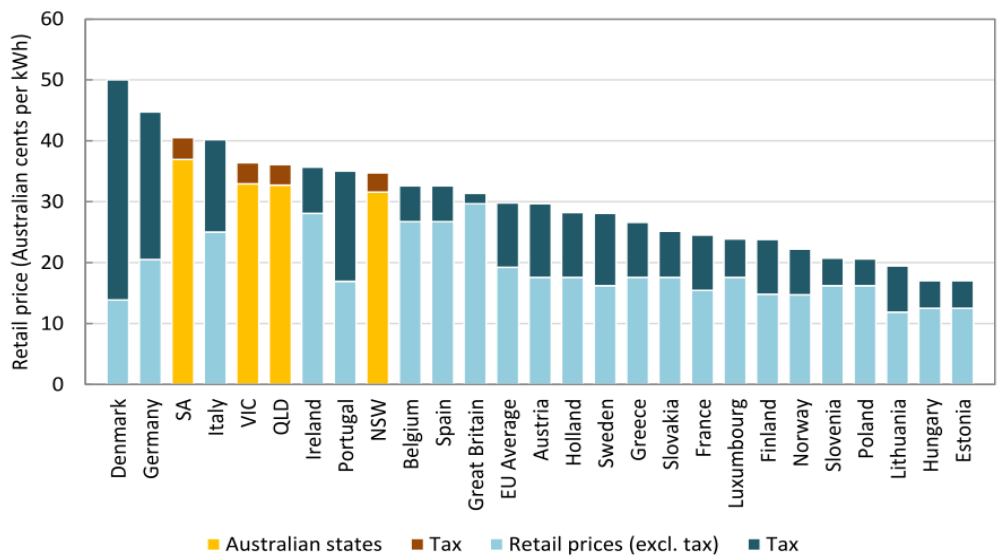


Electricity emissions intensity comparison (shrink that footprint)

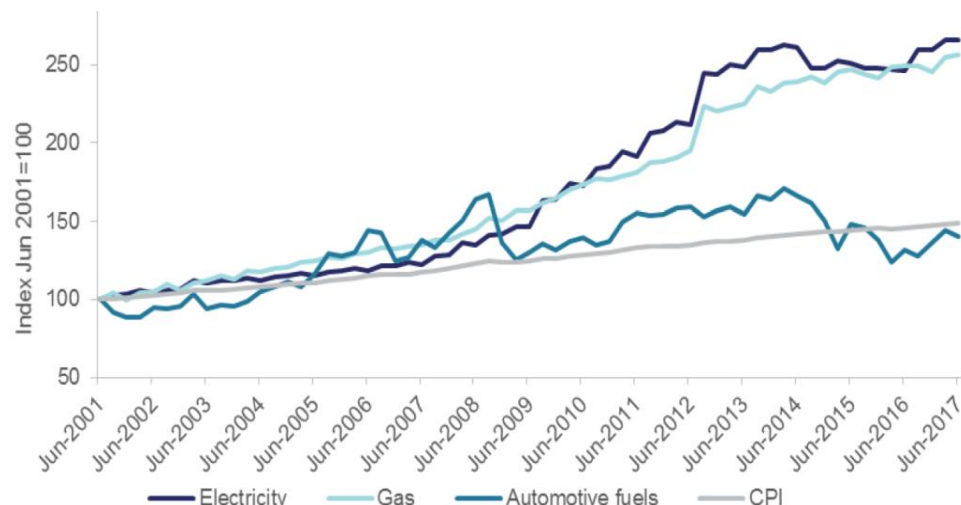


International retail electricity price comparison (ACCC Retail Price Competition Inquiry, 2017)

Figure 1.9: Comparison of residential electricity prices (before and after tax) (Australian cents per kWh) (May 2017 prices in Australia, 2015 prices in European countries)⁶²



Australian residential energy prices index (Australian Energy Statistics Update 2017)



..yet perhaps
can have it all

Falling variable
renewables and *some*
storage costs clearly a
game changer

*.... but we have heard
“too cheap to meter”
before (for nuclear) so
great care required*

Egypt receives two bids under \$0.03/kWh in 200 MW solar tender

The lowest bid was submitted by Spanish developer Fotowatio, which offered US\$0.02791 per kWh. Slightly higher, at \$0.02799 per kWh, was the offer of Saudi power company, ACWA.

AUGUST 7, 2018 **EMILIANO BELLINI**

HIGHLIGHTS

UTILITY-SCALE PV

EGYPT



Our NEM 'starting point' - 'fit for purpose'?

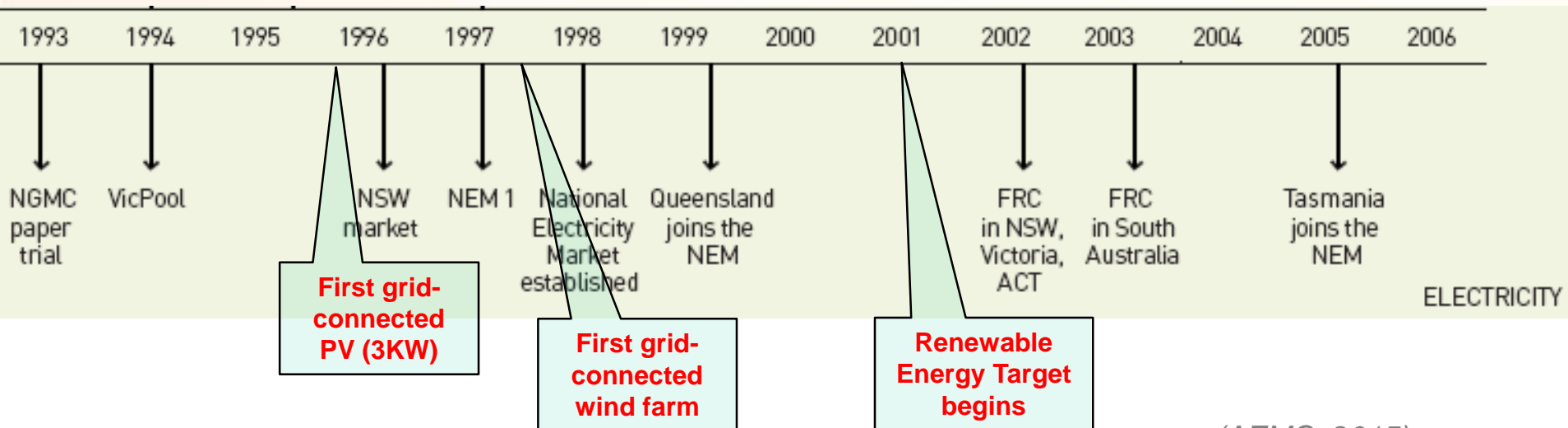
Started with significant coal generation 'excess' in Vic & NSW (thanks to their State Electricity Commissions) and neglect of gas options

Original objectives of technology and participant neutrality...

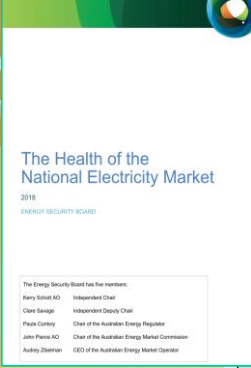
but always challenging, even if genuine intent

Inefficient by design b/c didn't (and still doesn't) price key externalities and facing both internal + external *drivers that look to be accelerating*

Continuing evolution ok, or need for more revolutionary redesign?



(AEMC, 2015)



	Current Status	Outlook
Affordability and satisfied consumers	Critical	Moderate
Secure electricity system	Critical	Critical
Reliable and low emissions electricity supply	Moderate	Critical
Effective development of open and competitive markets	Moderate	Good-Moderate
Efficient and timely investment in networks	Moderate-Critical	Moderate-Critical
Strong but agile governance	Critical	Moderate-Critical

Challenges now widely agreed... but less agreement on cause

ESB - Outcomes dire &/or trending worse... but the key 'market' mechanism is ok & trending better?

...although ESB does have wider scope of mkt redesign for post 2025

POST 2025 MARKET DESIGN FOR THE NATIONAL ELECTRICITY MARKET (NEM)

The COAG Energy Council has tasked the Energy Security Board with developing advice on a long-term, fit-for-purpose market framework to support reliability that could apply from the mid-2020s. By the end of 2020, the ESB needs to recommend any changes to the existing market design or recommend an alternative market design to enable the provision of the full range of services to customers necessary to deliver a secure, reliable and lower emissions electricity system at least-cost. Any changes to the existing design or recommendation to adopt a new market design would need to satisfy the National Electricity Objective. A forward work plan for this project is set out at Appendix 1. This forward work plan was approved by the COAG Energy Council at its December 2018 meeting.

Any significant changes to the electricity market design would need to be well considered, including substantial input from stakeholders and detailed consideration of alternative market designs, and telegraphed well in advance of any change to ensure there is minimal disruption to the forward contract markets for electricity.

If changes are required to deliver a long-term, fit-for-purpose market framework by the mid-2020s, then consideration of any required changes should be concluded by the end of 2020 to enable sufficient time for the market to transition to the new market framework.



Future renewables

NEM-wide RE deployment growing very rapidly at present

- South Australia has one of world's highest regional penetrations of variable renewables

year ending February 2019 were:

total NEM	21.2%
New South Wales	12.0%
Queensland	8.4%
Victoria	20.8%
South Australia	52.8%
Tasmania	97.1%

Figure 6

Monthly renewable shares of total generation, incl. rooftop solar

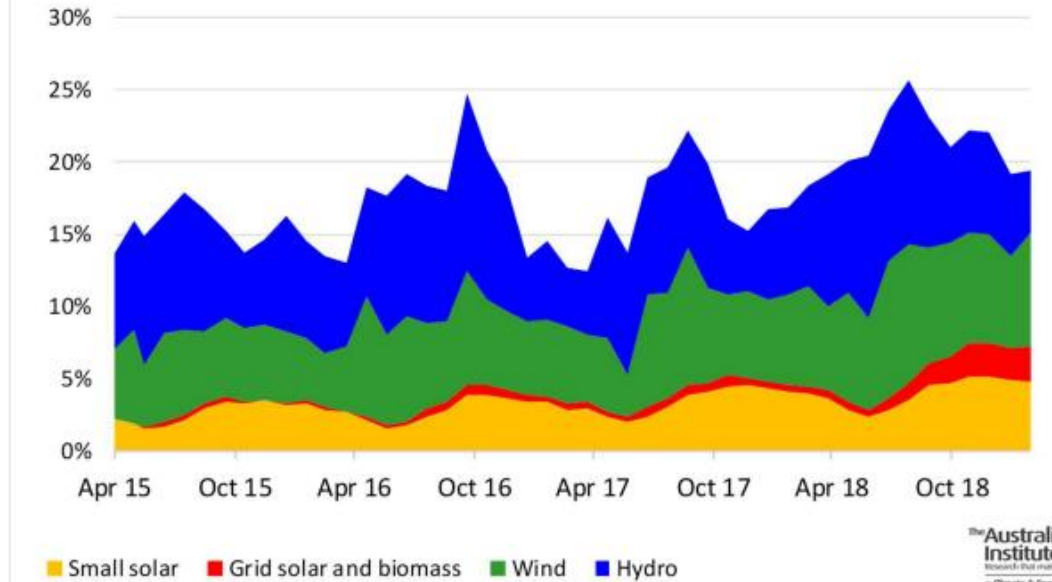
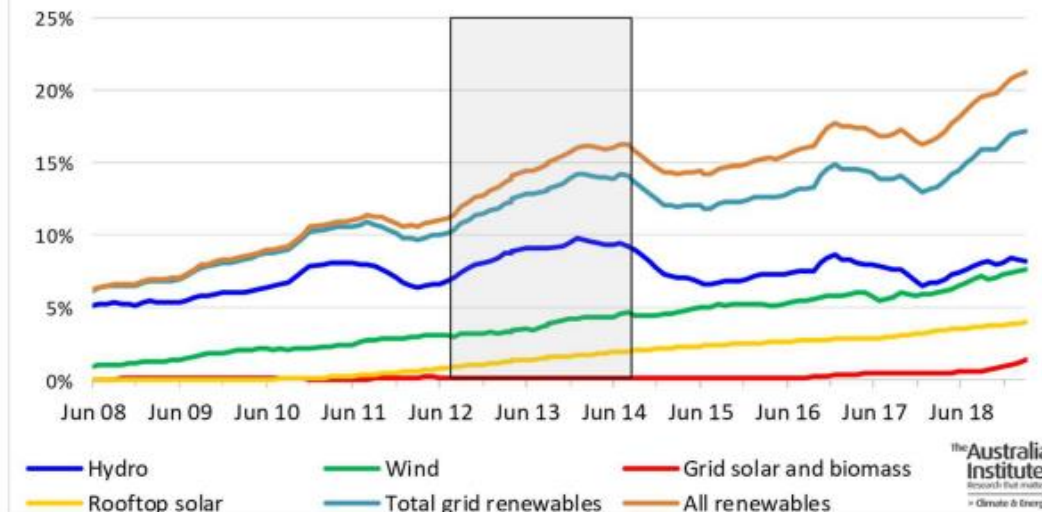


Figure 7

Annual renewable shares of total generation by generation type



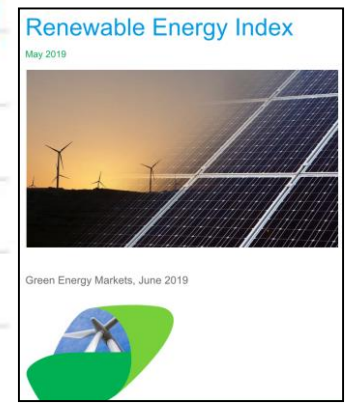
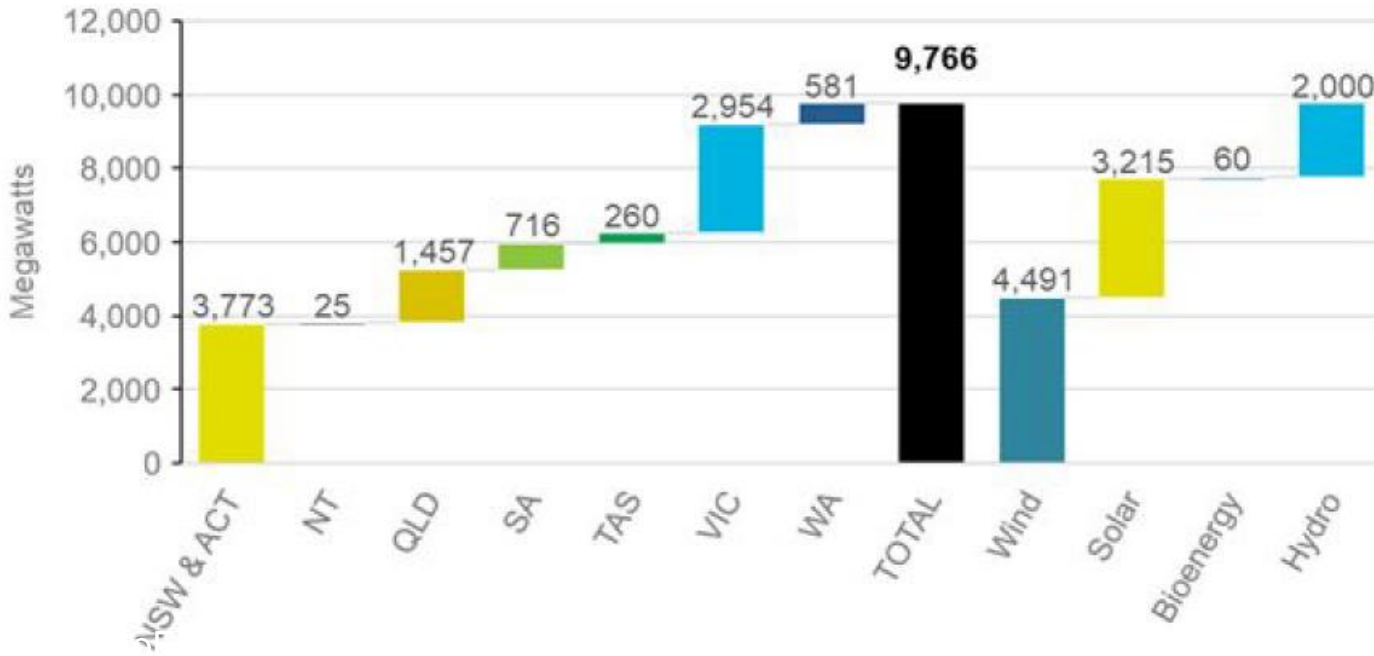
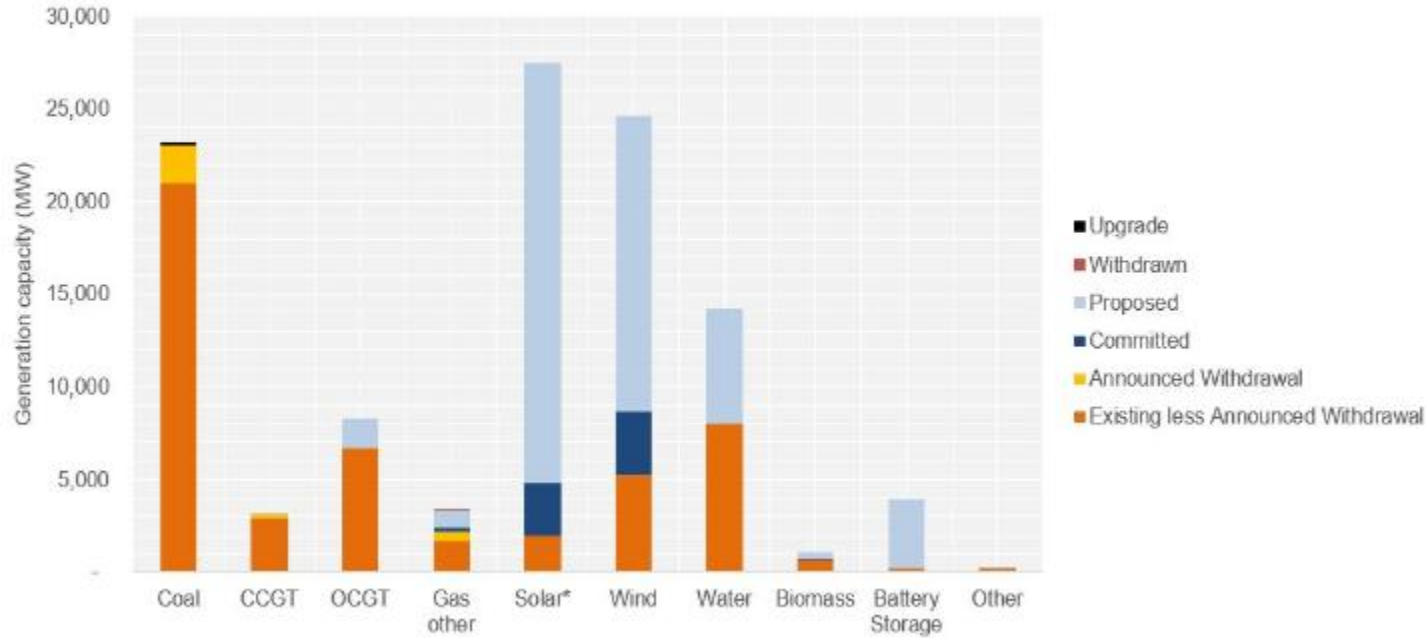


Where next?

Depends who you ask?

..but certainly a lot of new RE

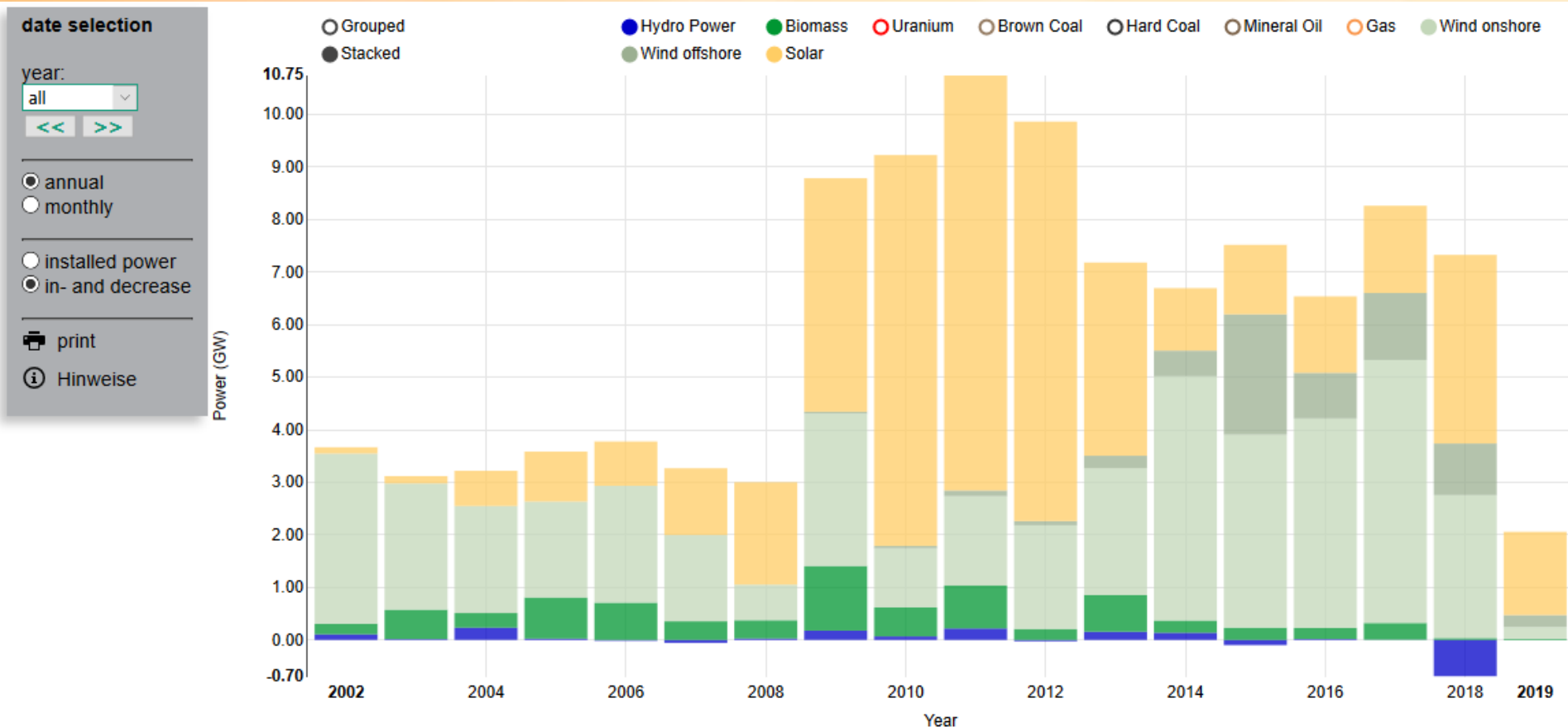
NEM Installed Capacity

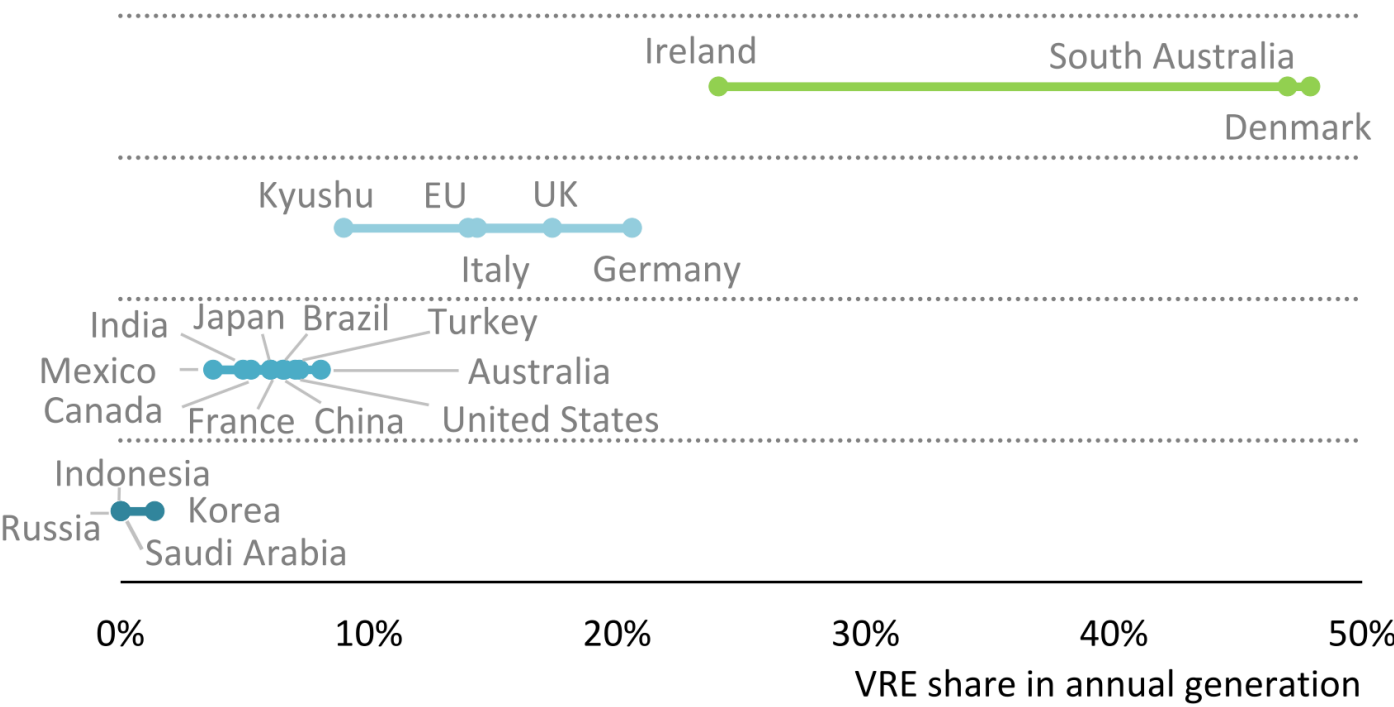


In longer term - "Trend is not destiny"

post peak annual RE capacity additions in Germany highlights potential challenges in driving continued energy transition

... while integration challenges also grow

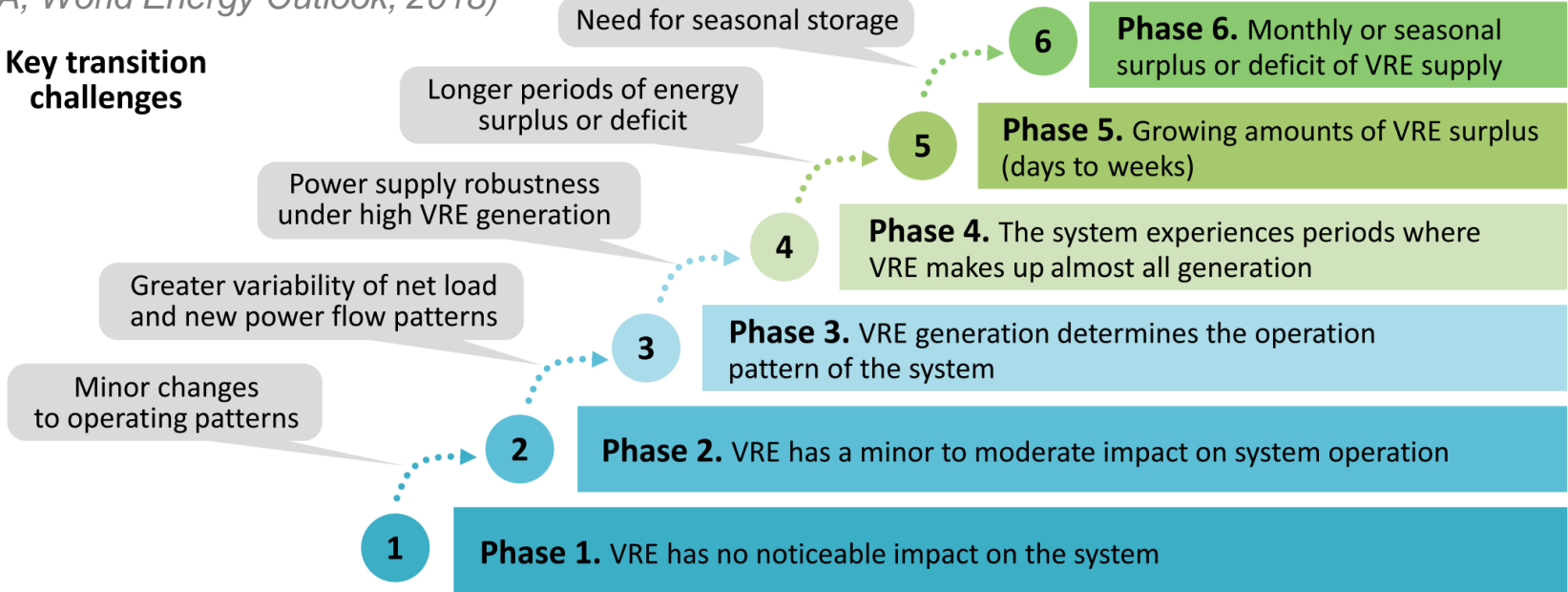




- Phase 4**
Require advanced technologies to ensure reliability
- Phase 3**
Flexibility investments
- Phase 2**
Draw on existing flexibility in the system
- Phase 1**
No relevant impact on system integration

(IEA, World Energy Outlook, 2018)

Key transition challenges

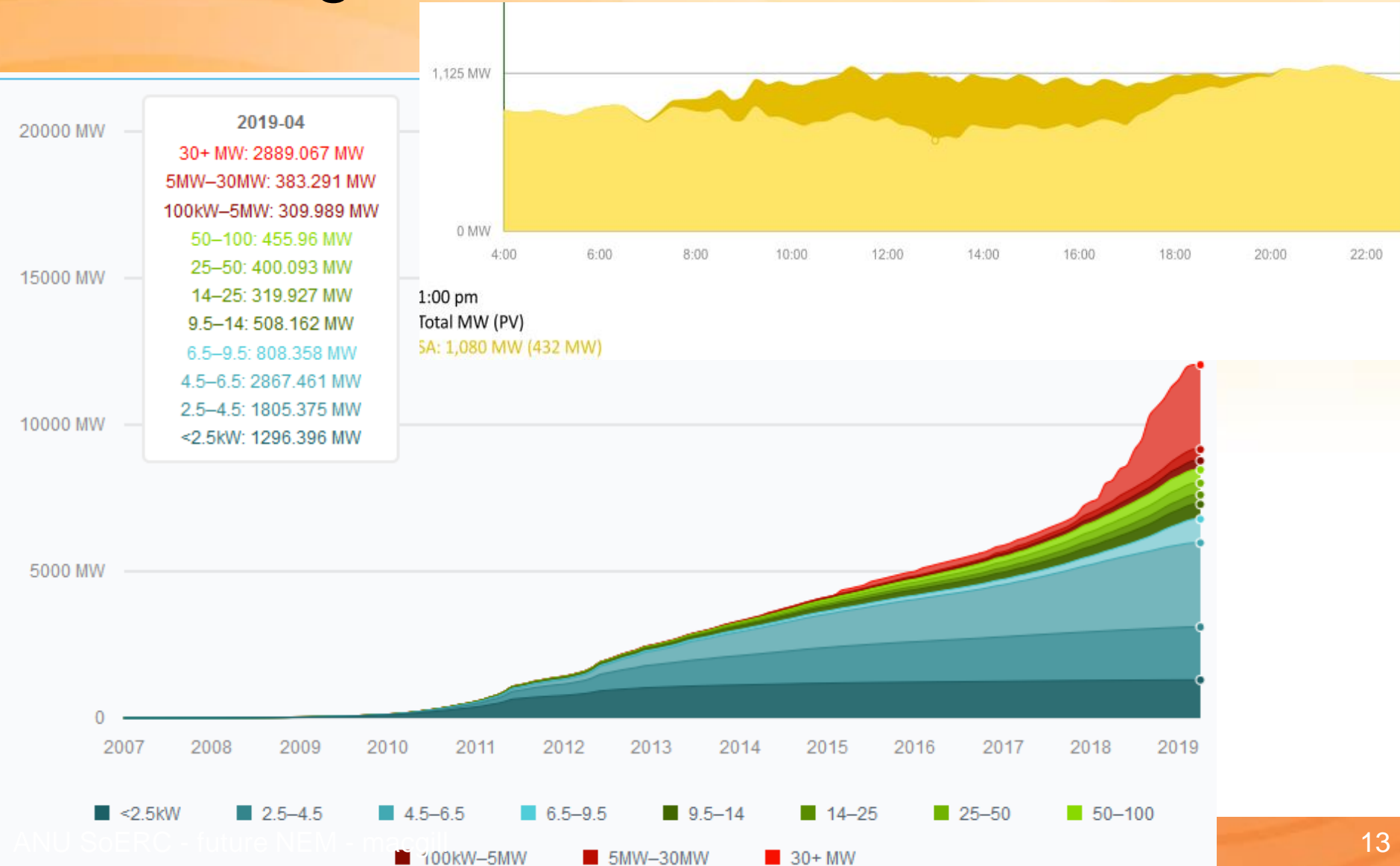


How energy user focussed?

- From clients
 - Early tailored industrial or commercial (lighting) applications with *service oriented contracting arrangements*
- ..to citizens
 - Electricity as an essential public good – rural electrification with *socially constructed tariffs*
- ..to consumers
 - The vertically integrated utility of growing size and scope with overall *cost-recovery, socially constructed, tariffs*
- ..to customers
 - Electricity industry ‘reform’, liberalisation, restructuring with *more mkt oriented energy ‘pricing’, more cost-reflective network tariffs*
- ..to perhaps now partners, competitors, or even ‘deserters’?
 - *More of the same or a genuine market opportunity?*

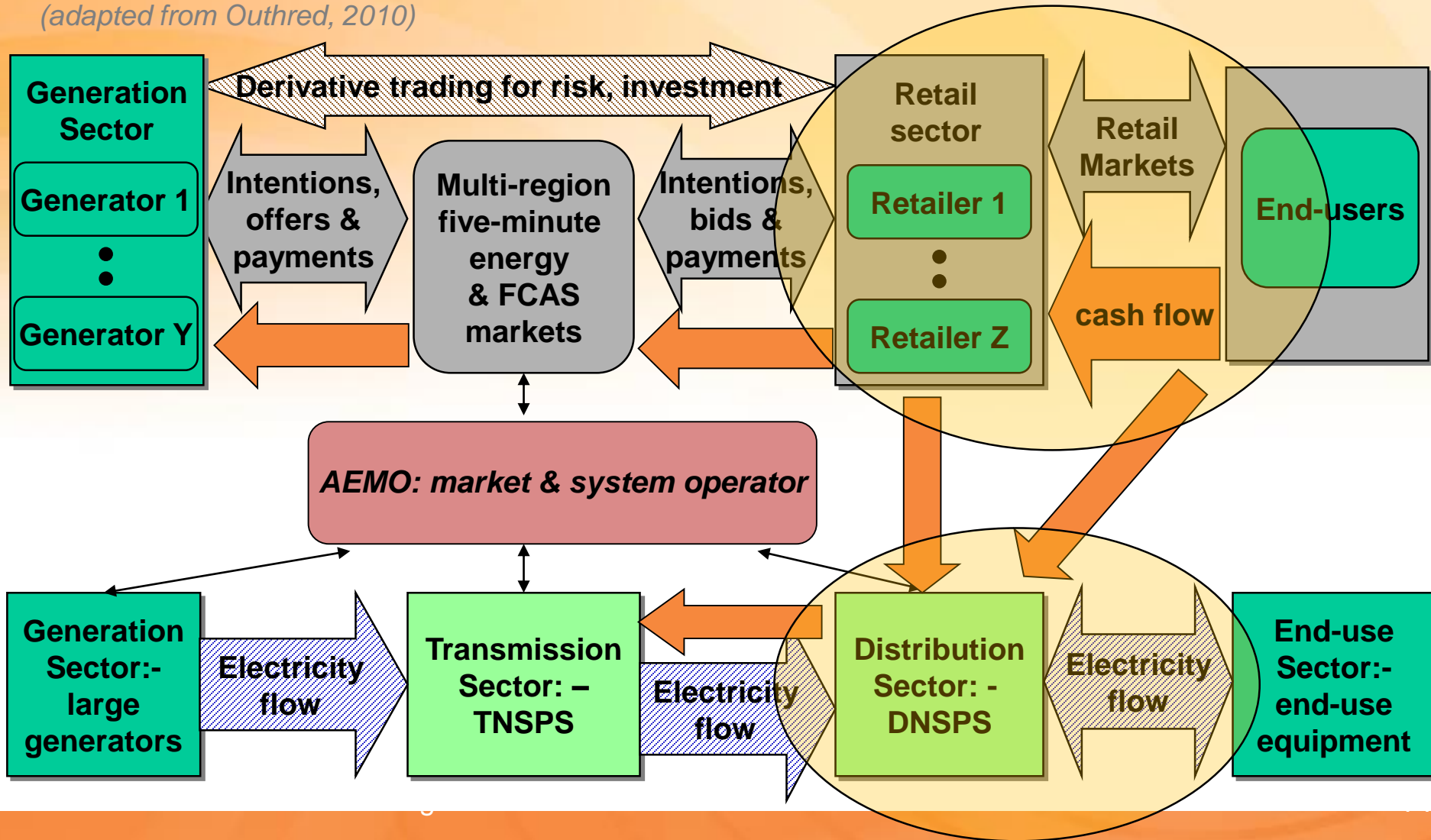


Sufficient given this? *(APVI Solar Map, 2019)*



Currently dysfunctional interface with energy users

(adapted from Outhred, 2010)



Q: What is wrong with the NEM retail market?

A: it isn't actually a market

“A market is any place where the sellers of a particular good or service can meet with the buyers of that good and service where there is a potential for a transaction to take place”

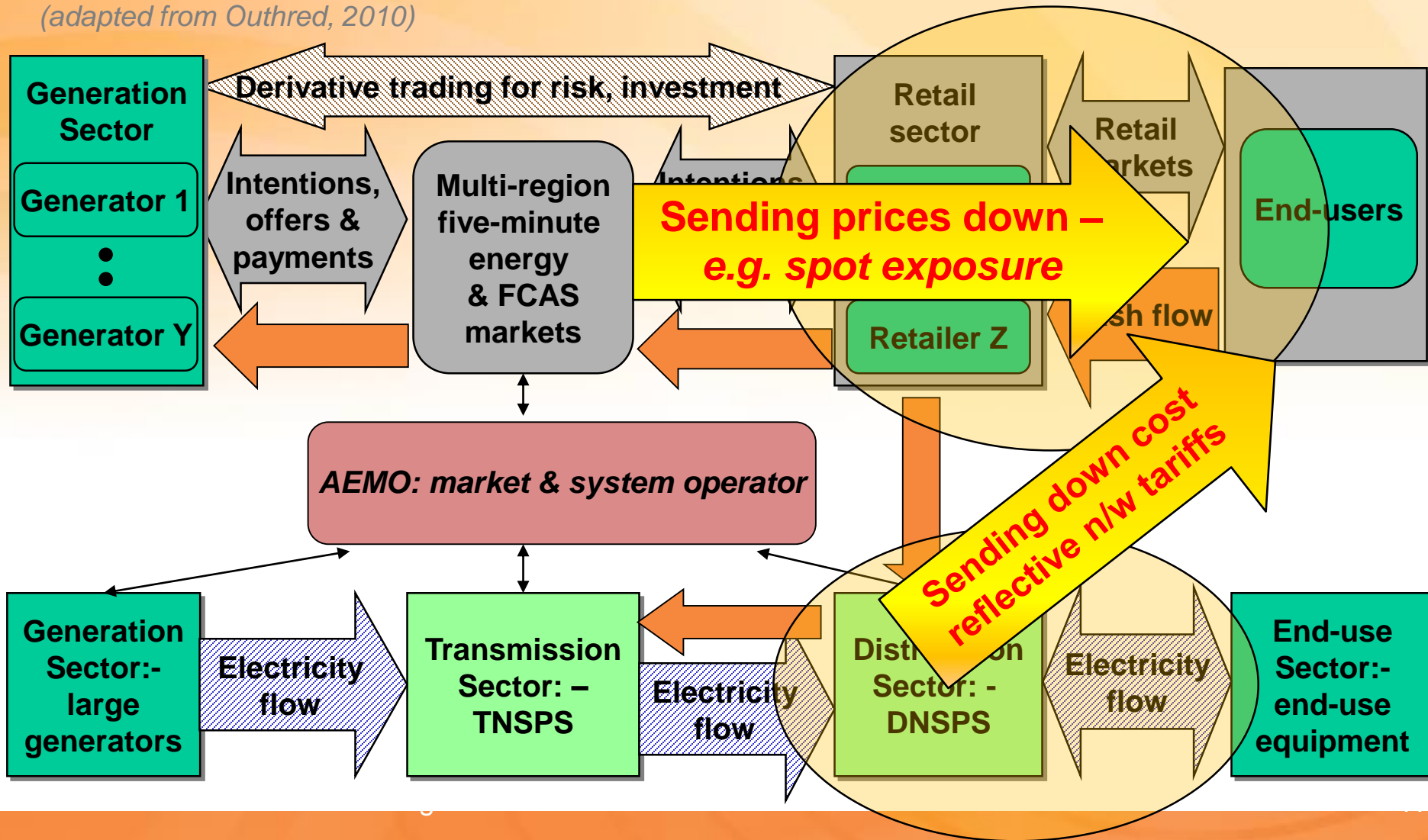
- In NEM retail markets
 - Do consumers ‘meet’ with sellers?
 - Poor end-user engagement, inefficient levels of DSP and EE
 - Does the market sell the good or service desired?
 - Energy users want to buy energy ‘services’, not kWh ‘goods’

How best to facilitate more meaningful mkt?

- What drives end-user engagement and decision making?
 - “A key assumption behind this review is that consumers will always make the best decision from their viewpoint, based on the prices they face, the technology and equipment they have access to, the information they have ...” (AEMC, Power of Choice Discussion Paper, 2011)
- An alternative view point
 - NEM a highly complex ‘designer’ market with network infrastructure, regulated monopolies, major asymmetries between supply + demand. *“expecting energy consumers to optimise their level of DSP without any support from third-parties and specific DSP schemes is **preposterous**... The EEC recommends that the AEMC focus on DSP schemes, barriers to third-parties driving DSP”* (EEC, 2011)
 - Similar issues for distributed storage?
- ...that clearly links to further question of how to proceed
 - *Aggregate consumers and their DERs up to wholesale, network level*
 - *... or send prices down to energy users with appropriate facilitation*
 - *... or both, or something else entirely*

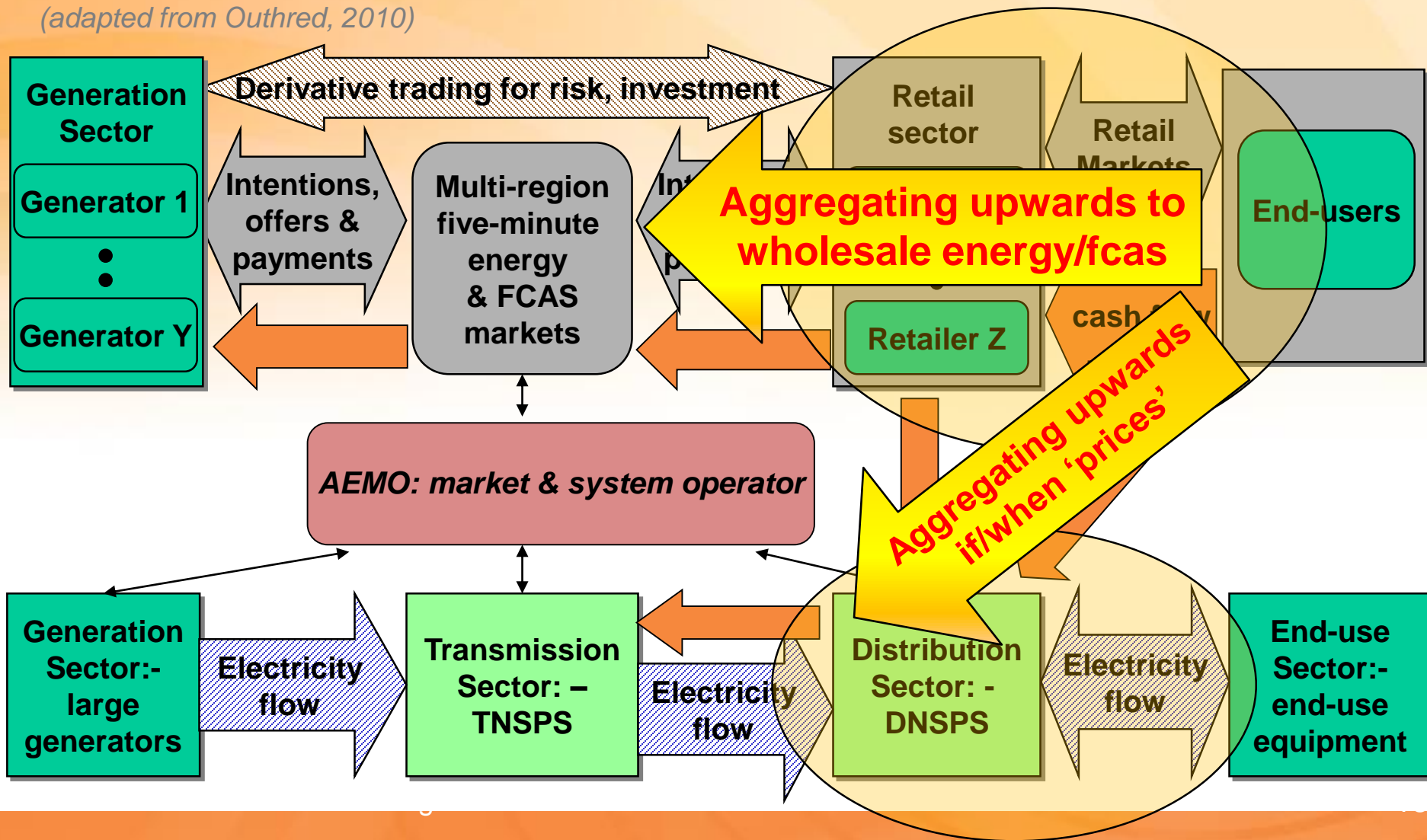
Bringing energy users in – *send prices down*

(adapted from Outhred, 2010)



Bringing energy users in – *aggregate upwards*

(adapted from Outhred, 2010)



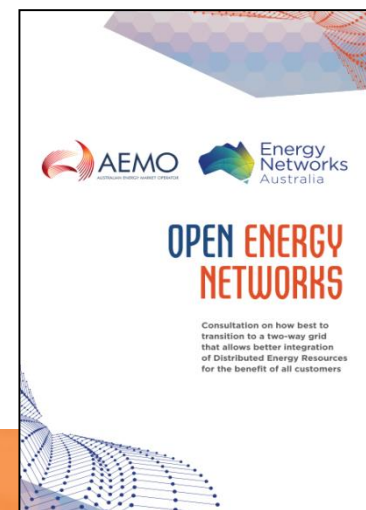
Other possible ‘coordination’ paths forward

Single Integrated Platform (SIP) - The single platform model envisages a unitary point of entry to the entirety of the NEM and WEM. Under this option, the platform would be an extension of the wholesale market. AEMO would provide the platform as part of its market and system responsibilities and along with the individual distribution utilities will develop a single integrated platform that will use a set of agreed standard interfaces to support the participation in the integrated multi-directional market by retailers, aggregators, and VPP platform companies. The SIP will then simultaneously solve local security constraints and support wholesale market entry. Under this configuration, access to the platform will be a one-stop shop that provides market participants the opportunity to participate anywhere in the NEM or WEM without having to develop separate systems or tools to integrate with the various individual distribution platforms. Network businesses will be linked into the platform, with distribution business providing information on local constraints to AEMO. AEMO would consider this information and economically dispatch these resources alongside other resources (transmission connected load, large scale generation etc.).

Two Step Tiered Regulated Platforms - A second alternative is a model where there is a layered distribution level platform interface operated by the local distribution network and an interface between the distribution network's platform and AEMO. Under this design, individual distribution networks can design interfaces that best meet their system requirements. Participants would then need to communicate directly with the distribution level platform for the local constraint issues and the distribution network would optimise these resources against local network constraints based on bids from the aggregators servicing the area.

Distribution networks would provide an aggregated view per the transmission connection point. AEMO would take this information and consider the overall system security and economic dispatch.

Independent DSO - A third option, that is a variant of the second, is for an independent party - a DSO that is separate from AEMO and the distribution utility. Under this model the independent DSO would work with the distribution utility to optimise the dispatch of the DER based upon local system constraints that are provided by the network business, provide the aggregated bids to AEMO for incorporation into the larger dispatch. This option will be more complex than the others and may be significantly more costly.



Orchestration?

Do you have what it takes to play in the Berlin Philharmonic?

By **Jordan Smith** - Apr 18, 2015



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The Berlin Philharmonic is one of the leading orchestras in the world with a powerful tradition going back decades. Now they are hiring, and that's not just for the position of chief conductor following the [departure](#) of Sir Simon Rattle.

Community Orchestration?

Surrey Hills, North Sydney, Balmain,
Mosman, Maruki (Canberra)



Jazz orchestration?



Sportestratation?

LEAGUE

Tongan crowd stun Kangaroos by singing Australian national anthem as a mark of respect



The Tongan crowd sang both anthems before the match out of respect.

Source: FOX SPORTS



October 20, 2018 8:48pm, MARK ST JOHN @markdfstjohn

Source: FOX SPORTS

What might a real mkt look like? *A focus on*

- Consumer energy services rather than ‘commodity’ kWh/MWh prices in their long-term interests, including need for clean energy transition
- Facilitation for energy users to participate in a wide range of services
 - Aggregating up vital for DE to contribute value that takes coordinated behaviour, not necessarily all the way to wholesale for some services
 - *NEM currently has limited locational pricing, opaque derivatives, market power and inefficient by design because don't include env. externalities.*
 - *DE network, local ancillary services value likely greater than at Tx level*
 - Sending prices down also vital in appropriate circumstances, not necessarily all the way down to all consumers *as very consumer and context dependent; major reform of interface b/n supply + demand sides of electricity sector and Network Providers required before genuine ‘price discovery’ can occur, and users appropriately supported to engage.*
 - ***We need ESCOs, not retailers*** - have to properly support new players with innovative business, community and other models for efficiently delivering end-user energy services, coordinated end-user participation

NEM redesign part of broader design challenge *across regulation, markets and external policies and with a focus on robustness, rather than efficiency*

Comprehensive and coherent (Riesz et al, 2017) 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

The future NEM

How affordable, secure and sustainable?

- In part an outcome of past, often poor, choices, but excellent opportunities to improve outcomes

How renewable, energy user centered and competitive?

- Achieving goals seems likely to require effectively integrating much higher levels of renewable generation
- Which seems likely to require higher levels of energy user engagement and participation in terms of both establishing social consensus as well as providing flexibility
- Which will likely require greater levels of genuine, meaningful competition in energy services.... or abandonment of much of the current 'competitive construct'

With thanks from the SPREE/CEEM Energy User Centered Modelling and Analysis Team

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