



## CSIRO Future Grid

*P4* - Robust energy policy frameworks for investment into future grids

**Jenny Riesz**

& UNSW Team including: Iain MacGill, Peerapat Vithayasrichareon, Neil Raffan, Sharon Young, Rob Passey, Anna Bruce, Regina Betz, Ben Elliston, Joel Gilmore

# Three Policy Pillars

**Aim:** Robust energy policy frameworks for investment into future grids

## 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



# Overview

- Presented breadth of work completed at previous Symposium
- Focus on most recent work:

## Governance Review

- NEM Governance frameworks

## Tariff reform

- Modelling network tariffs
- Shadow pricing alternatives

## Market operation with high renewables

- Market prices and revenues modelling  
→ market design and regulation with high renewables

# GOVERNANCE REVIEW

Engaging in ongoing policy processes



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# Review of Governance Arrangements

- Governance is clearly fundamental
  - Effective planning, decision making, risk & reward allocation, and accountability

*N. Raffan, I. MacGill, (2015),  
“Review of Governance  
arrangements for Australian  
Energy markets – Submission  
in response to the Panel’s Draft  
Report”, Centre for Energy and  
Environmental Markets*



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## **REVIEW OF GOVERNANCE ARRANGEMENTS FOR AUSTRALIAN ENERGY MARKETS**

**Submission in response to the Panel’s Draft Report**

by

Neil Raffan and Associate Professor Iain MacGill\*

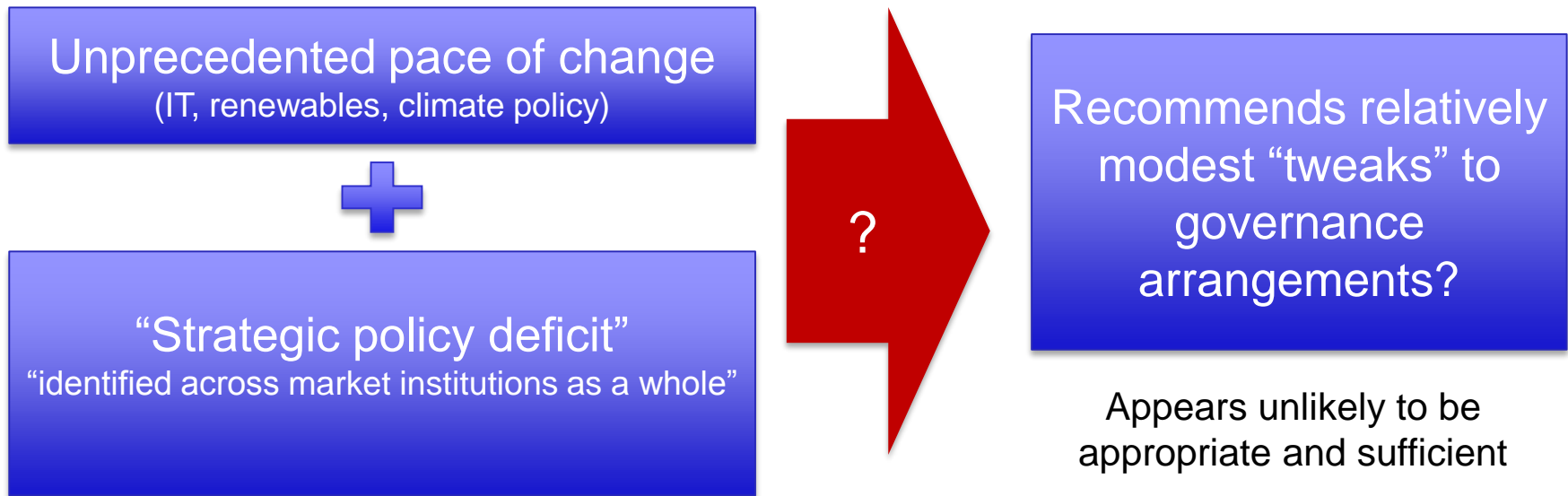


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# CEEM's submission:

- A review should be outcomes-focused, with reference to objectives
  - No assessment against any objectives in terms of desired outcomes
  - NEO?
  - Australian Energy Market Agreement? (AEMA) – key foundation document defining mandate for Energy Council, defines 6 objectives for reform
- Need for integrated planning and decision-making
  - Energy White Paper process not addressed (how can this be out of scope??)
  - Review places climate change mitigation outside energy governance arrangements
    - But virtually all energy policy has climate implications, & most climate policies target energy
  - AEMA: one of six objectives is environmental: *“address greenhouse emissions from the energy sector, in light of the concerns about climate change and the need for a stable long-term framework for investment in energy supplies”*.
  - Failure to effectively address this objective to date – significant governance changes required?
- Insufficiently addresses AEMO's role as national transmission planner

# Review of Governance Arrangements



# TARIFF REFORM

Cost-reflective tariffs and beyond for the future grid



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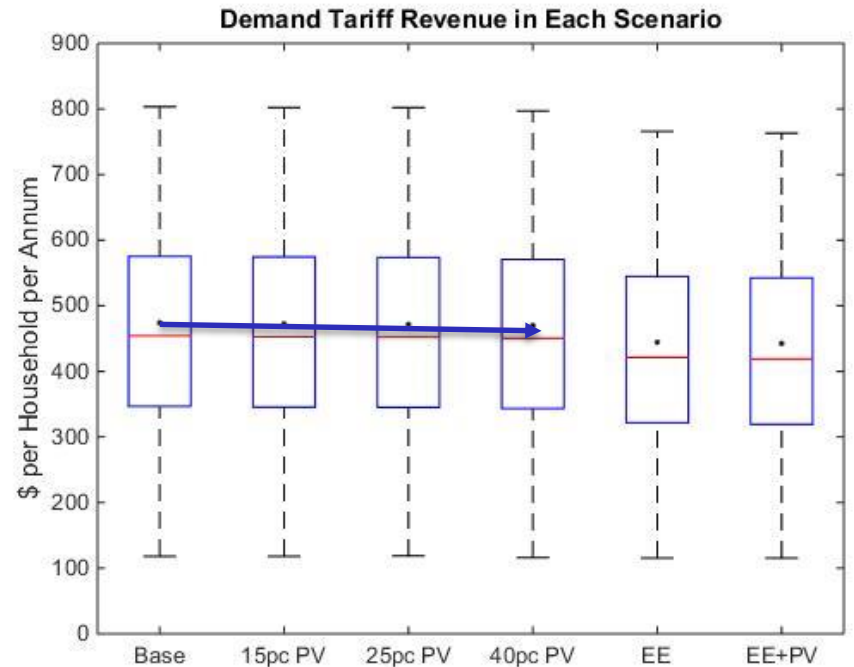
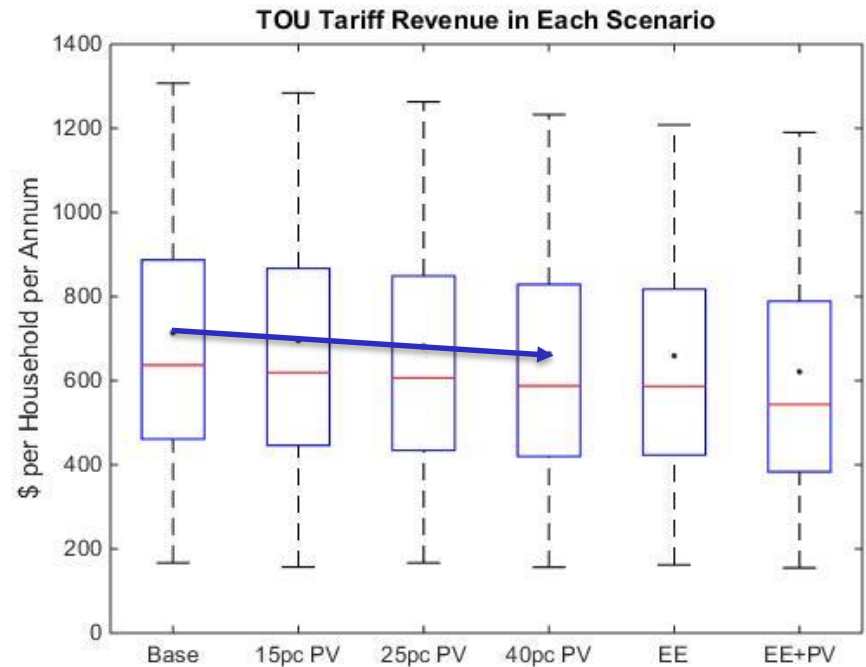
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# Tariff reform

- Cost reflective tariffs generally accepted to be a good idea, but...
- Highly non-trivial in practice
- What does it really mean?
  - Aim?
    - Cost recovery?
    - Price signals to consumers?
  - Which costs?
    - Sunk costs?
    - O&M?
    - Augmentation costs?
- For future grid: appropriate investment signals

- Modelling network tariffs (existing and proposed):
  - Half-hourly demand data, 2012-13
  - 2,200 households
  - Ausgrid Smart Grid, Smart City Trial
- Different tariff structures change impact of PV, energy efficiency and other customer interventions on NSP revenues

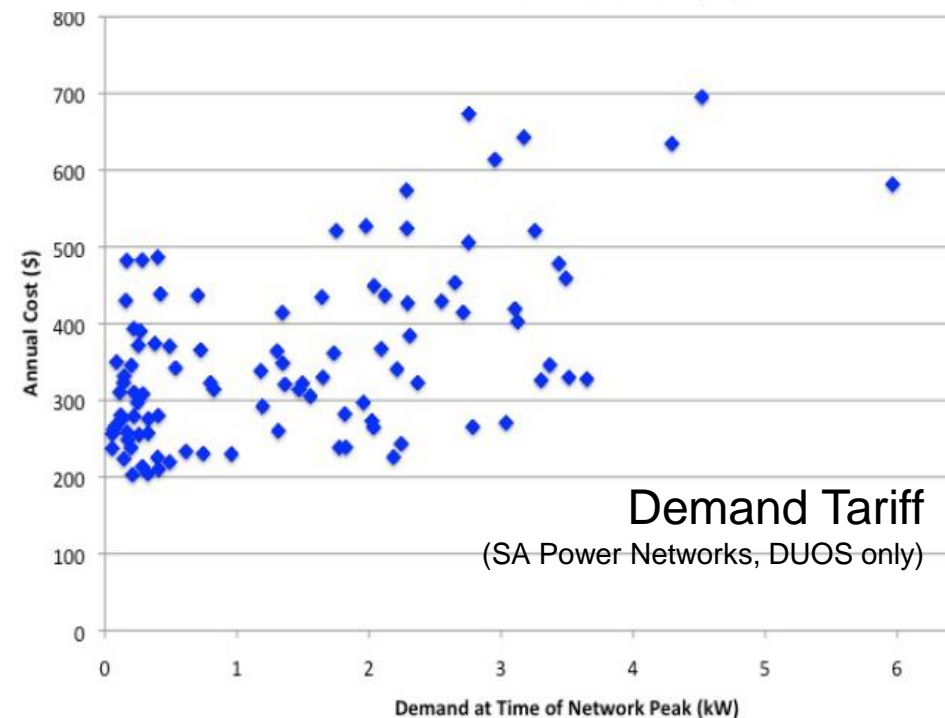
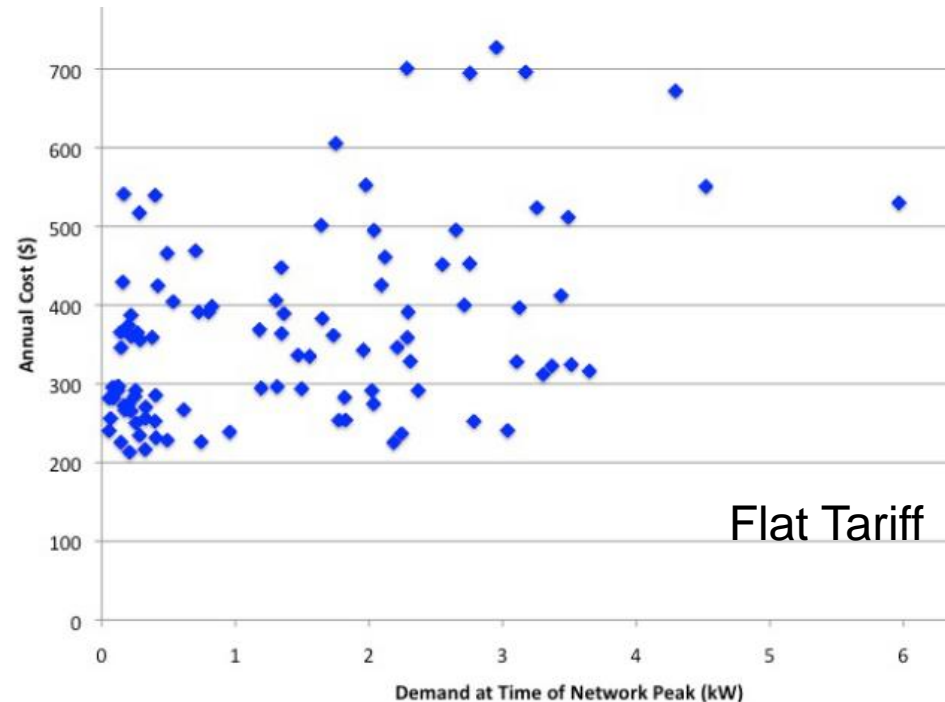


*S. Young, A. Bruce, I. MacGill (2016),  
 "Australian Electricity Network Customer  
 Revenue by Tariff Type in a Variety of  
 Scenarios", submitted to IEEE PES GM.*

- ...but do they necessarily improve investment signalling for network augmentation decisions?

- Demand tariffs don't necessarily better align household network costs with their contributions to peak demand
- Current demand tariffs use customers' demand peak over a broad period each day, over the full year
- Instead, should be applied based on customers' demand at the time of the annual network peak

*R. Passey, Cost reflective pricing and its impact on storage, APVI Storage Workshop "Solar, Storage, and New Energy Business Models" Sydney, June 2015*



# Moving beyond cost-reflective pricing

What if disconnection genuinely becomes cheaper?

	1. Centralised supply remains cheaper	2. Disconnection becomes cheaper
Centralised supply continues	<p>NSPs implement pricing that reflects the lower cost of the centralized network, and establish customer trust</p>	<p><b>Inefficient subsidies for centralized supply?</b></p> <p><b>Temporary transition to disconnection?</b></p>
Majority of customers disconnect	<p><b>NSPs are inefficient and don't provide pricing that reflects their lower costs</b></p> <p><b>(or fail to engage positively with customers?)</b></p> <p><b>(or inefficient government subsidies for DER + storage?)</b></p>	<p><b>If pricing reflects higher costs of centralized network, could cause rapid disconnection and stranding of existing network assets.</b></p> <p><b>Transition could be slowed with <i>shadow pricing</i> approach.</b></p>



# Shadow Pricing

If storage + DER becomes cheaper than centralised network:

- *Shadow price* centralised network access against the main competitor (storage)
  - Price centralised network access just below viable storage + DER alternatives
  - Recognising storage disrupts “natural monopoly” long held by NSPs
  - “Disruptive Competition”
- Necessitates write-down of network asset value
  - Acknowledge that full cost recovery is no longer possible, but facilitates maximum utilisation of existing assets
  - Government subsidy, in the case of government owned assets, *but still lower cost to consumers* than the alternative rapid disconnection scenario.

# How can NSPs prepare?

- Commence careful tracking and sophisticated forecasting of storage prices
- Implement flexible tariff setting approaches that can adapt to storage prices if it becomes cheaper than centralised network:
  - if storage cost is projected to become lower than centralised network, the implement shadow pricing
- Consider offering a range of reliability levels to customers, at different prices
- Engage with AER to ensure this can be implemented
  - Extensive regulation may not be required in the long term (with a transition to a fully competitive market)

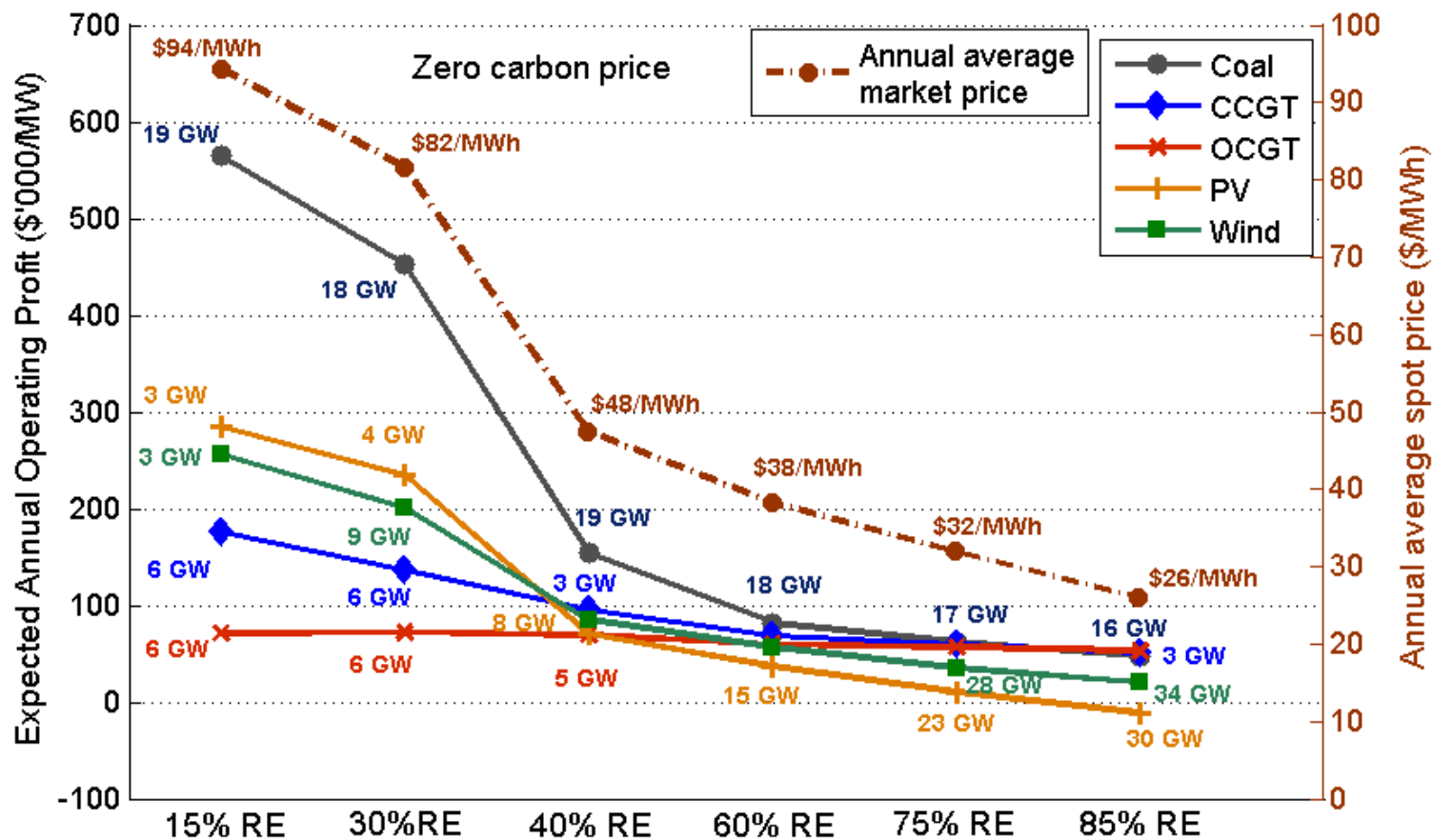
# MARKETS WITH HIGH RENEWABLES

Will market and regulatory frameworks need to adapt?

# Market modelling with high renewables

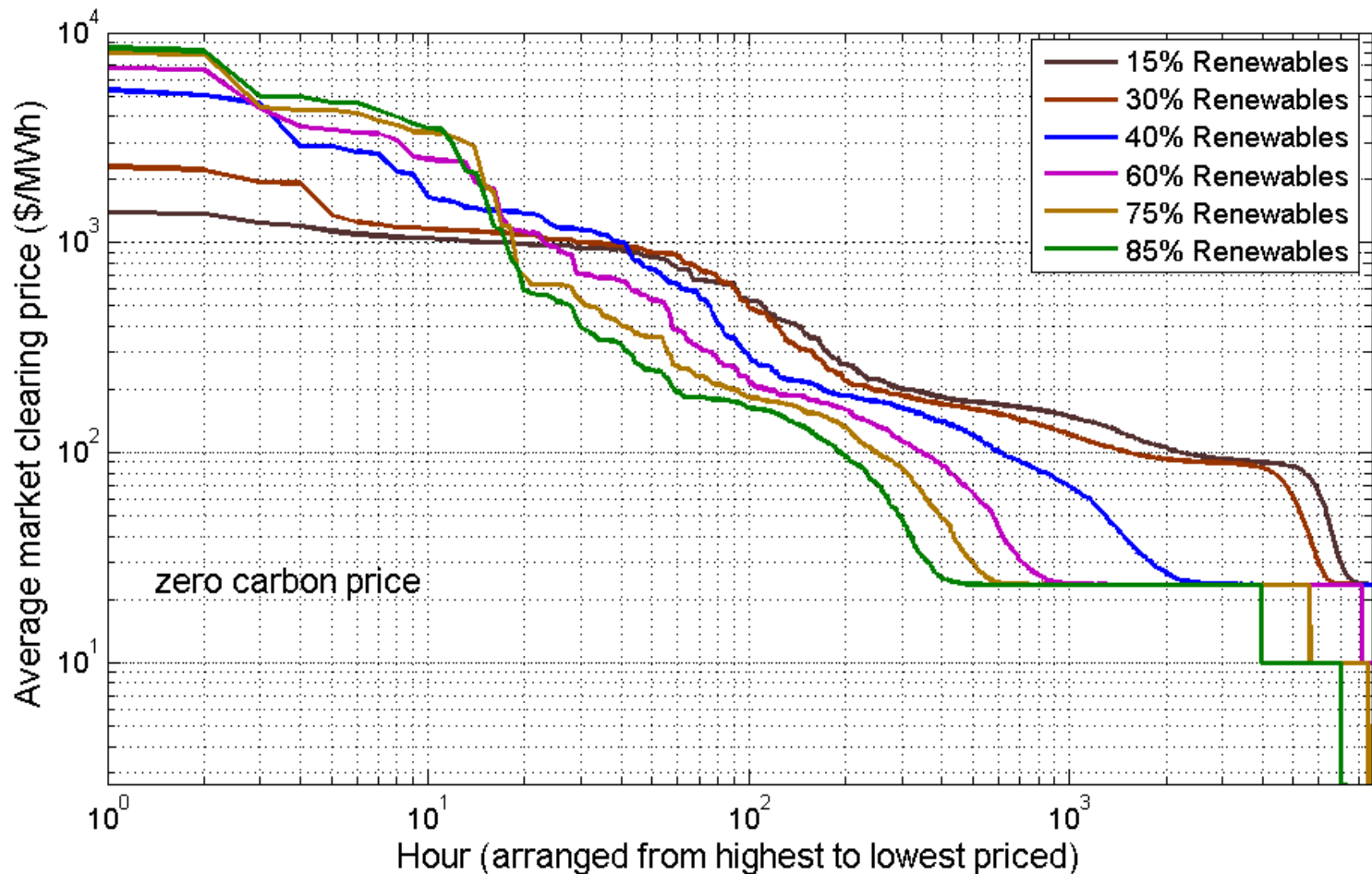
Increase wind & PV → Prices fall

Wind & PV themselves are particularly affected (especially PV)

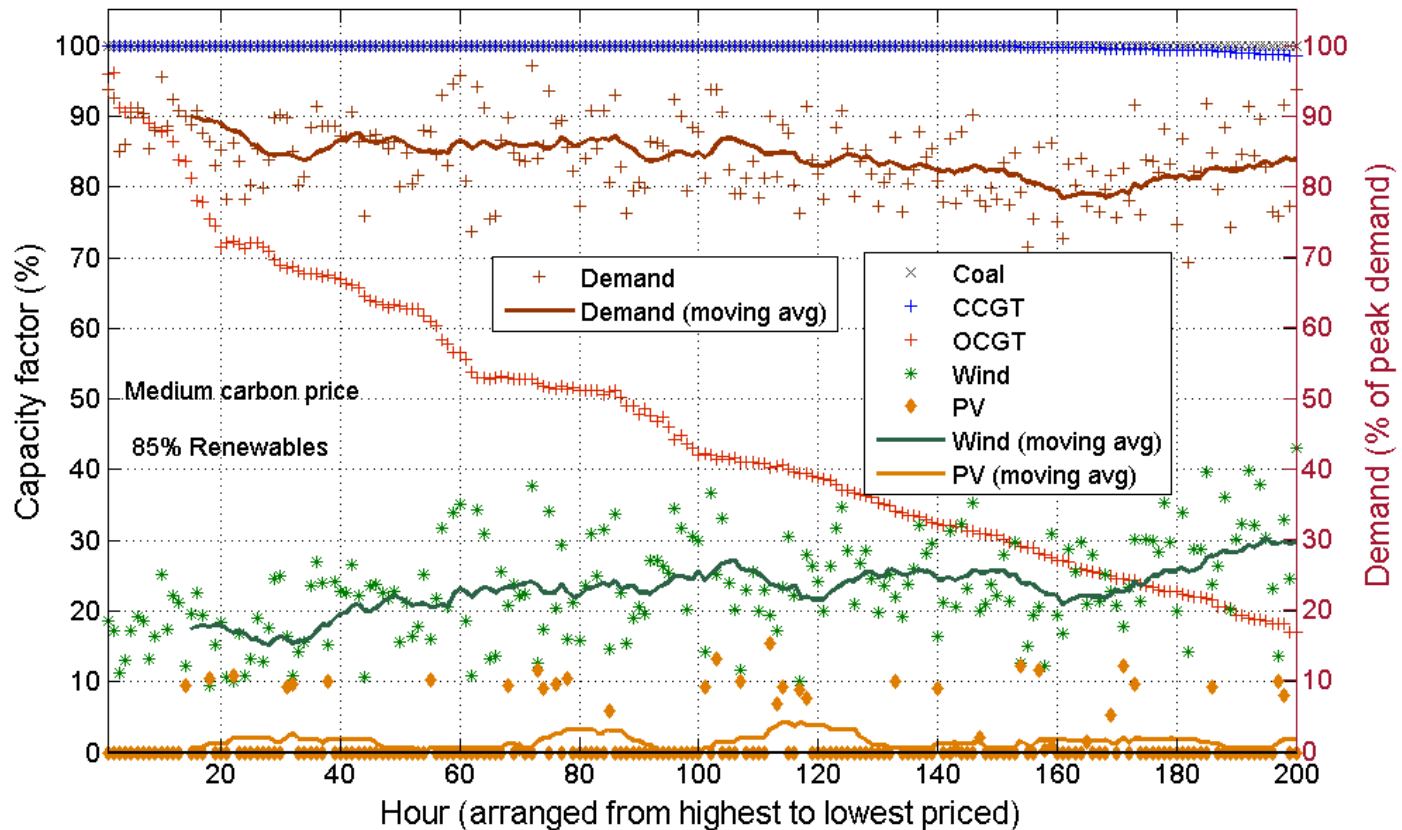




- Greater incidence of zero and low prices as renewable proportions grow
- BUT, also greater incidence of extreme high prices
- May not need to increase Market Price Cap very much to maintain same incentives to contract?



- Top priced 200hrs:
  - Very low PV, moderate wind
  - High demand, and coal, CCGT & OCGT almost fully operating (full benefit of high prices)
  - Greater demand for cap contracts? (more periods at extreme prices)
  - Invest in PV with caution

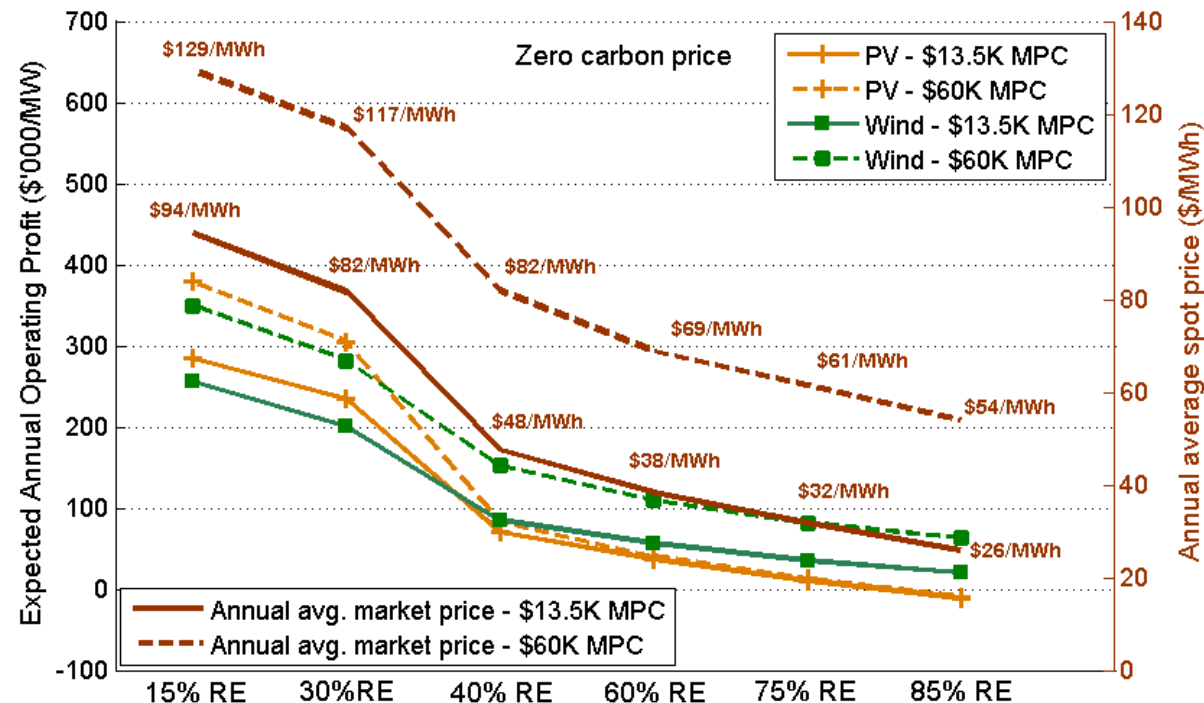
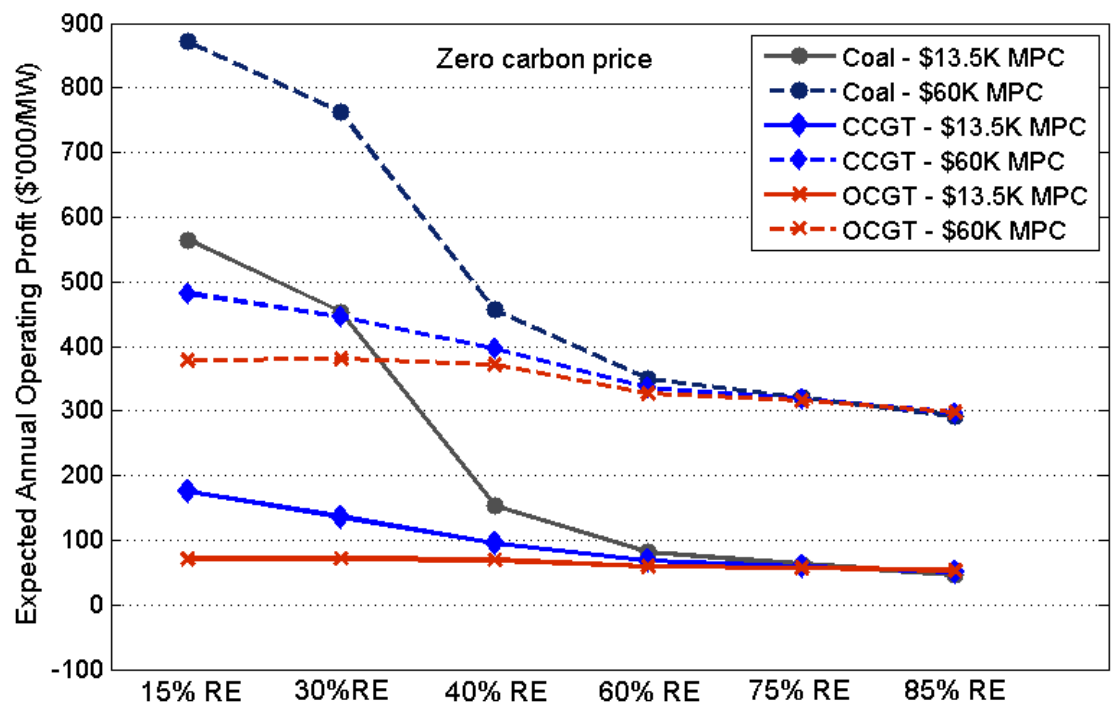


# Increasing the MPC:

- Main mechanism to increase investment to meet the reliability standard
- Successfully increases average prices
- Significantly increases revenues of OCGTs, CCGTs and coal
- Increases wind profitability somewhat
- PV profitability unchanged at high renewable levels (too much PV)

## Key conclusion:

- The present energy-only market *could* work, if we can increase the MPC, and the contracts market is sufficiently robust.



# Summary and further reading:

## ■ Governance Review:

- N. Raffan, I. MacGill, (2015), “**Review of Governance arrangements for Australian Energy markets – Submission in response to the Panel’s Draft Report**”, Centre for Energy and Environmental Markets

## ■ Network Tariff Reform:

- J. Riesz, J. Gilmore, “**Rethinking Business Models for Network Service Providers – Shadow Pricing against Storage**”, IEEE Power and Energy Society (PES) Asia-Pacific Power and Energy Engineering Conference (APPEEC), Brisbane, 15-18 Nov 2015.
- J. Riesz, M. Hindsberger, J. Gilmore, C. Riedy, **Perfect storm or perfect opportunity? Future scenarios of the electricity sector and their implications for utilities** (July 2014), in “The Rise of Decentralized Energy - What is at stake for the electricity supply industry?”, Edited by Fereidoon P. Sioshansi.
- S. Young, A. Bruce, I. MacGill (2016), “**Australian Electricity Network Customer Revenue by Tariff Type in a Variety of Scenarios**”, submitted to IEEE PES GM.
- R. Passey, “**Cost reflective pricing and its impact on storage**”, APVI Storage Workshop “Solar, Storage, and New Energy Business Models” Sydney, June 2015

## ■ Modelling high renewables markets:

- P. Vithayasrichareon, J. Riesz, I. MacGill (2015), “**Impact of variable renewable generation on future market prices and generator revenue**”, IEEE Power and Energy Society (PES) Asia-Pacific Power and Energy Engineering Conference (APPEEC), Brisbane, 15-18 Nov 2015.
- P. Vithayasrichareon, J. Riesz, I. MacGill, “**Market pricing and revenue outcomes in an electricity market with high renewables – An Australian case study**“, 38th IAEE International Conference, Antalya, Turkey, May 2015.
- P. Vithayasrichareon, T. Lozanov, J. Riesz, Member, I. MacGill, “**Impact of Operational Constraints on Generation Portfolio Planning with Renewables**“, 2015 IEEE Power and Energy Society General Meeting, Denver, CO, USA. [Best conference papers on Integration of Renewable & Intermittent Resources]
- J. Riesz, J. Gilmore, I. MacGill (2015) “**Assessing the viability of Energy-Only Markets with 100% Renewables – An Australian National Electricity Market Case Study**“, Economics of Energy and Environmental Policy (EEEP), in press.





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