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UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA



CSIRO Future Grid

P4 - Robust energy policy frameworks for investment into future grids

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Three Policy Pillars

Aim: Robust energy policy frameworks for investment into future grids

Comprehensive and **coherent**
policy development process

1. Regulation	2. Market Design	3. External Policy Drivers
• Transmission network planning • Distribution network planning • Grid codes	• Fundamental market design • Spot market rules • Ancillary service market rules	• 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	Tariff reform	Market operation with high renewables
• NEM Governance frameworks	• Modelling network tariffs • Shadow pricing alternatives	• Market prices and revenues modelling → market design and regulation with high renewables

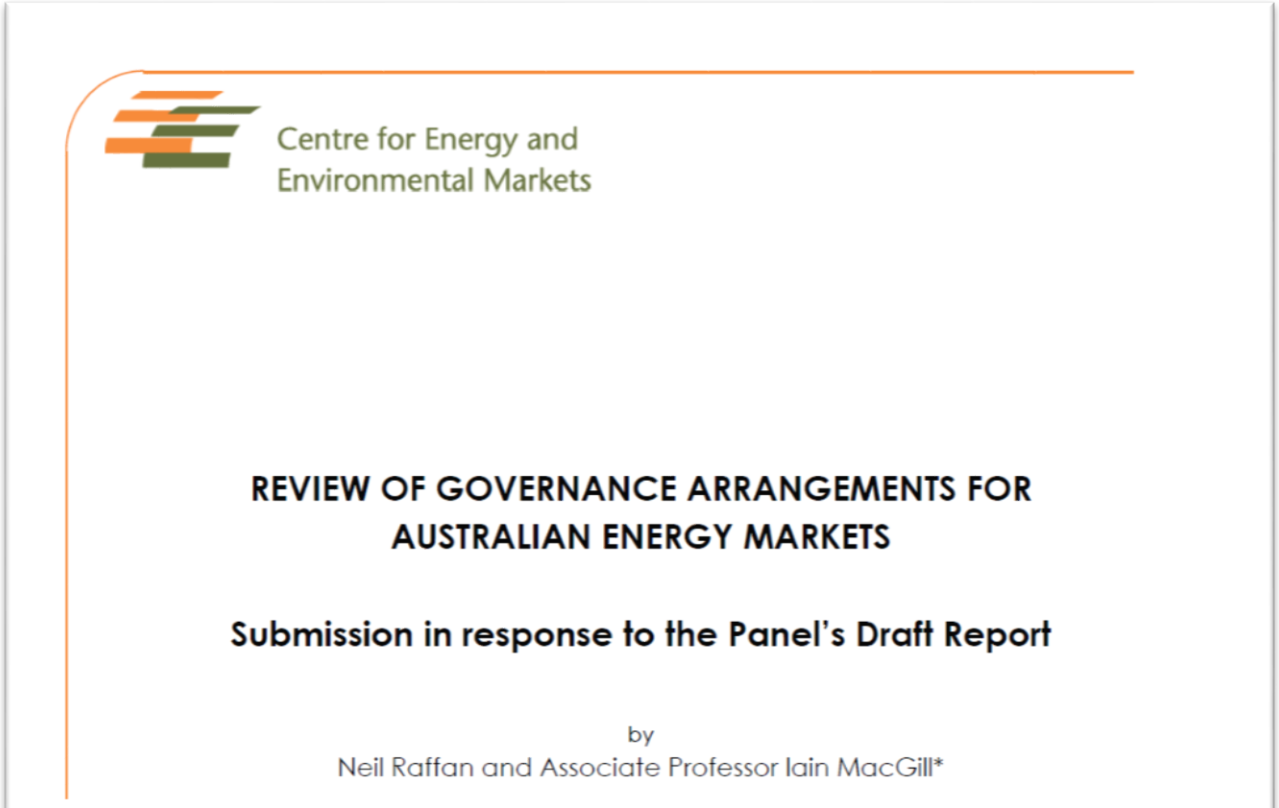
GOVERNANCE REVIEW

Engaging in ongoing policy processes

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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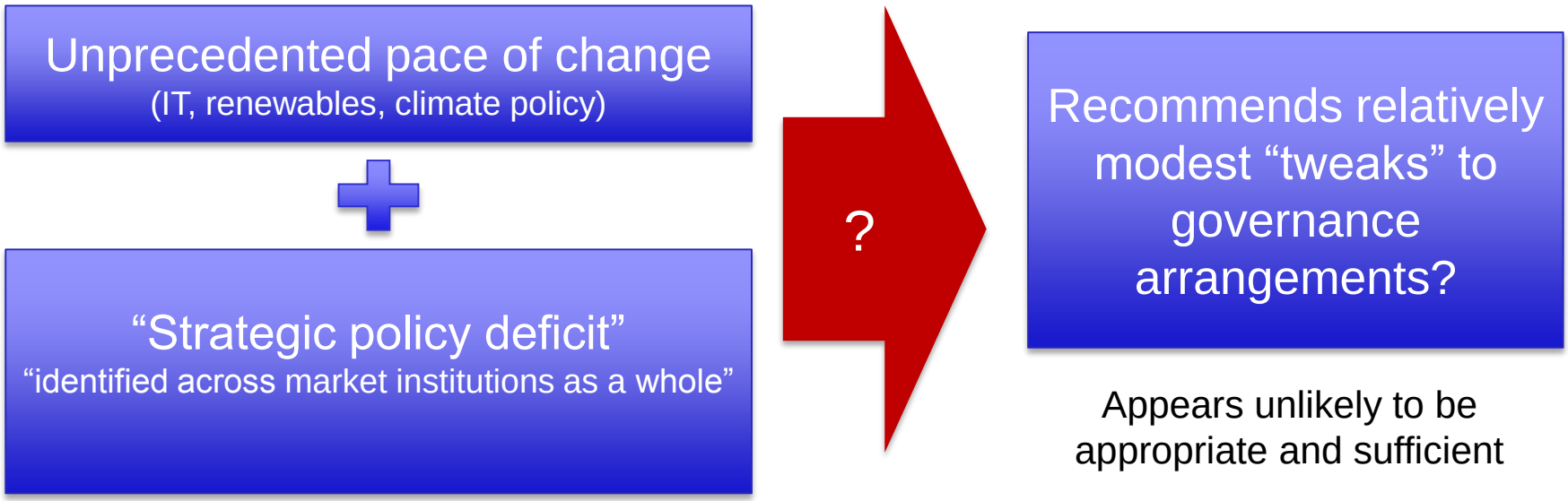
CEEM's submission:

- 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



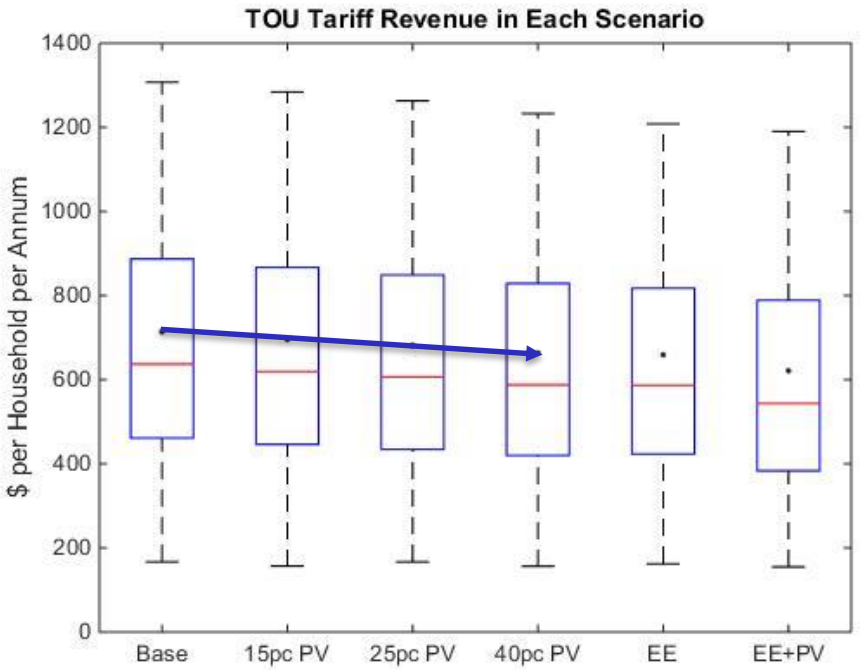
TARIFF REFORM

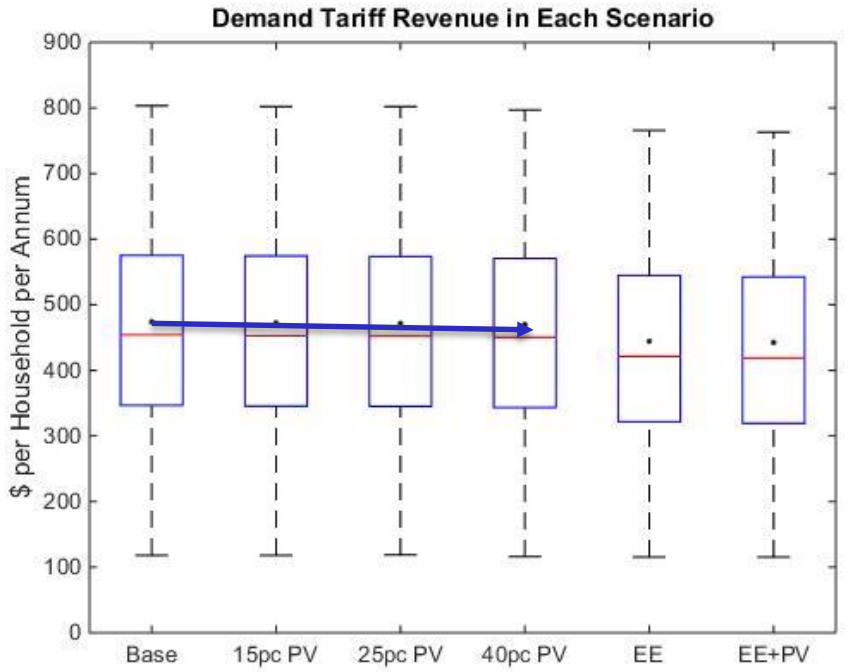
Cost-reflective tariffs and beyond for the future grid

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.

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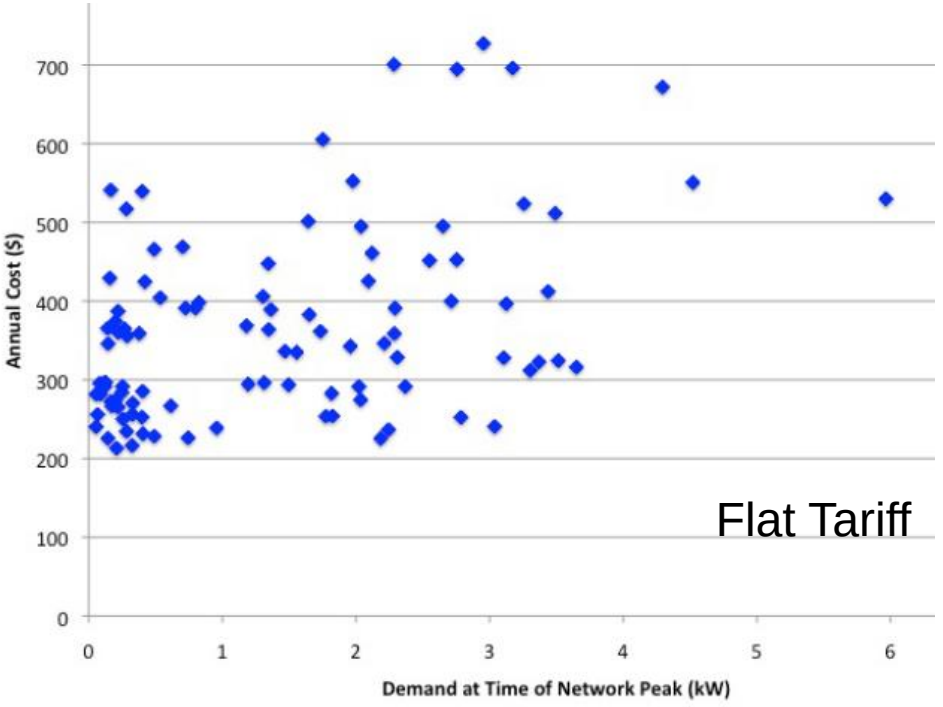
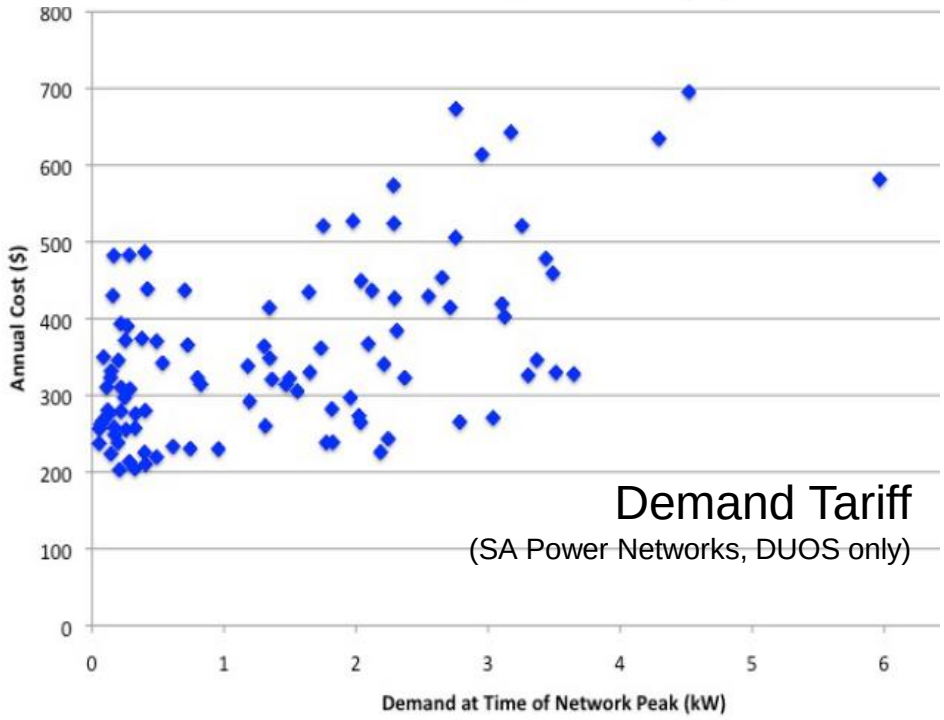
- …but do they necessarily improve investment signalling for network augmentation decisions?
  - Demand tariffs don't necessarily better align household network costs with their contributions to peak demand
  - Current demand tariffs use customers' demand peak over a broad period each day, over the full 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

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Moving beyond cost-reflective pricing

What if disconnection genuinely becomes cheaper?

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

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.

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)

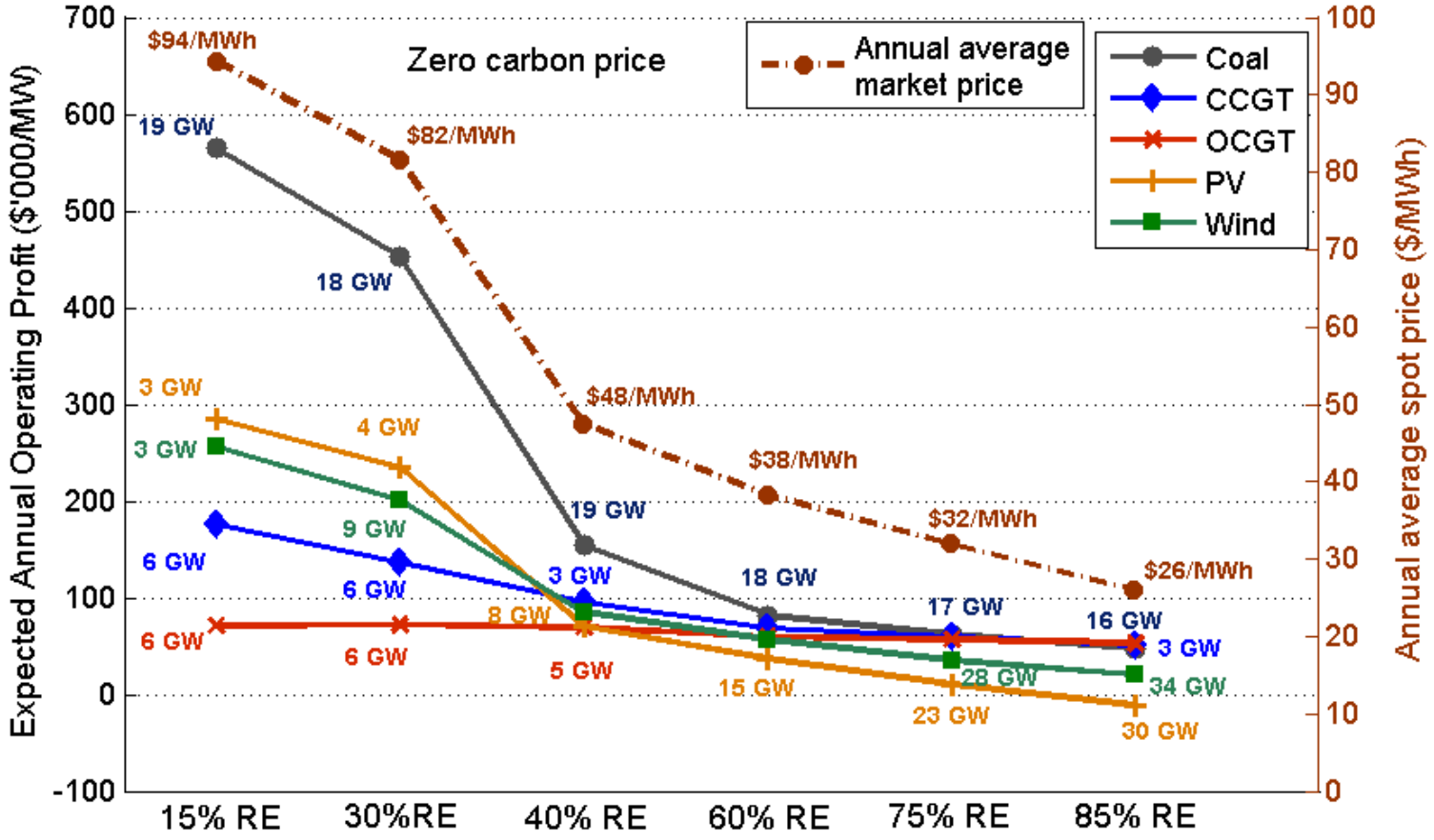
MARKETS WITH HIGH RENEWABLES

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)



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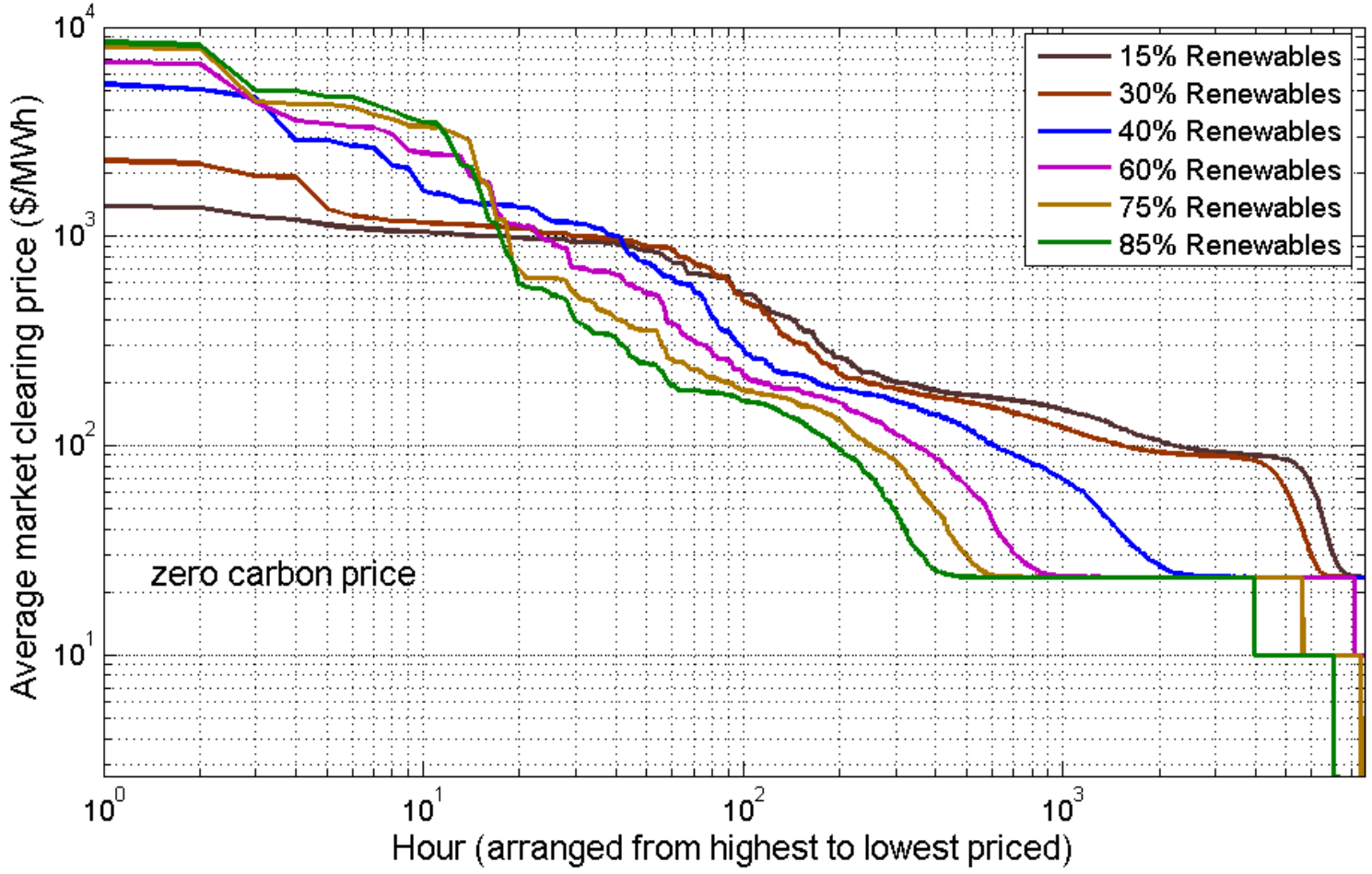
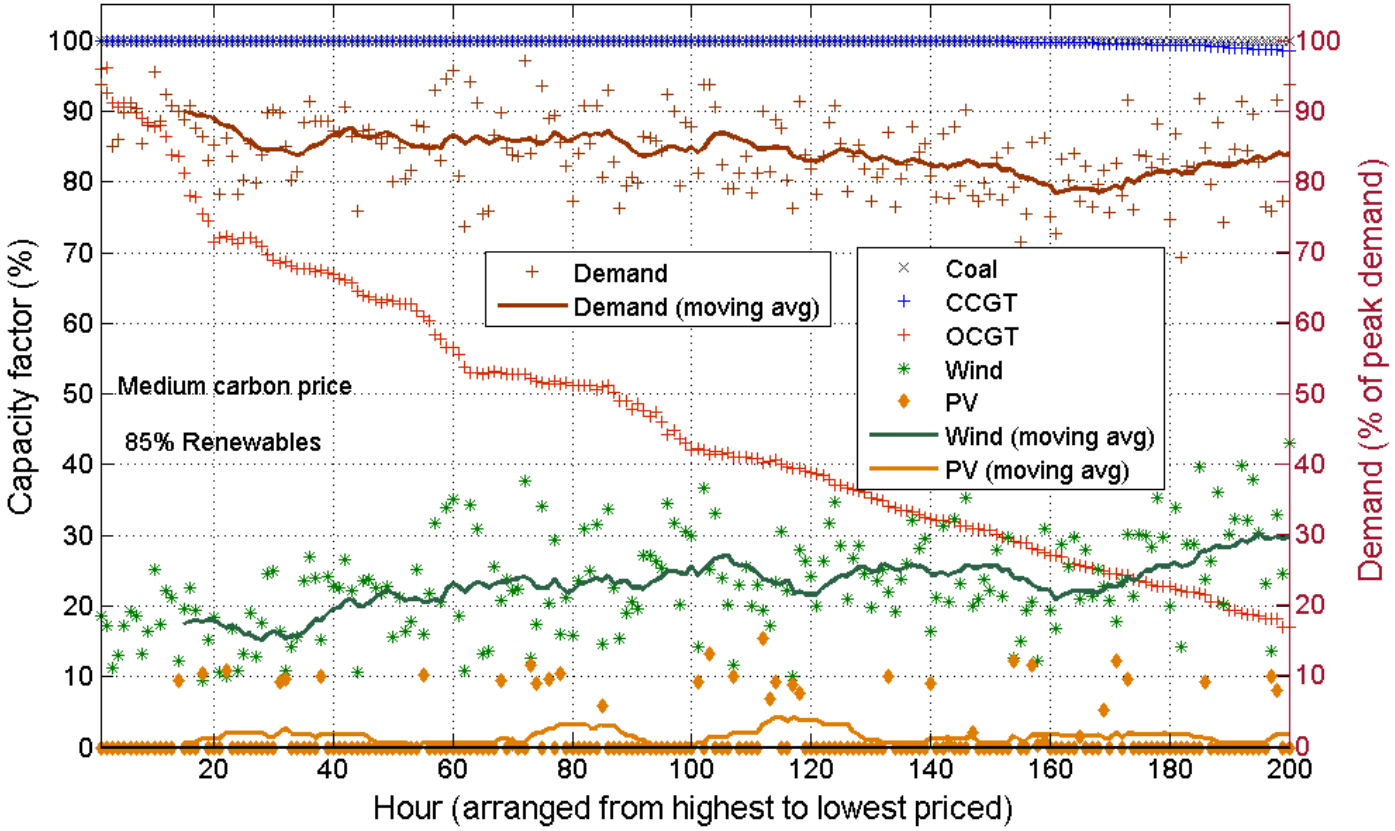
- Greater incidence of zero and low prices as renewable proportions grow
- BUT, also greater incidence of extreme high prices
- May not need to increase Market Price Cap very much to maintain same incentives to contract?



- 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



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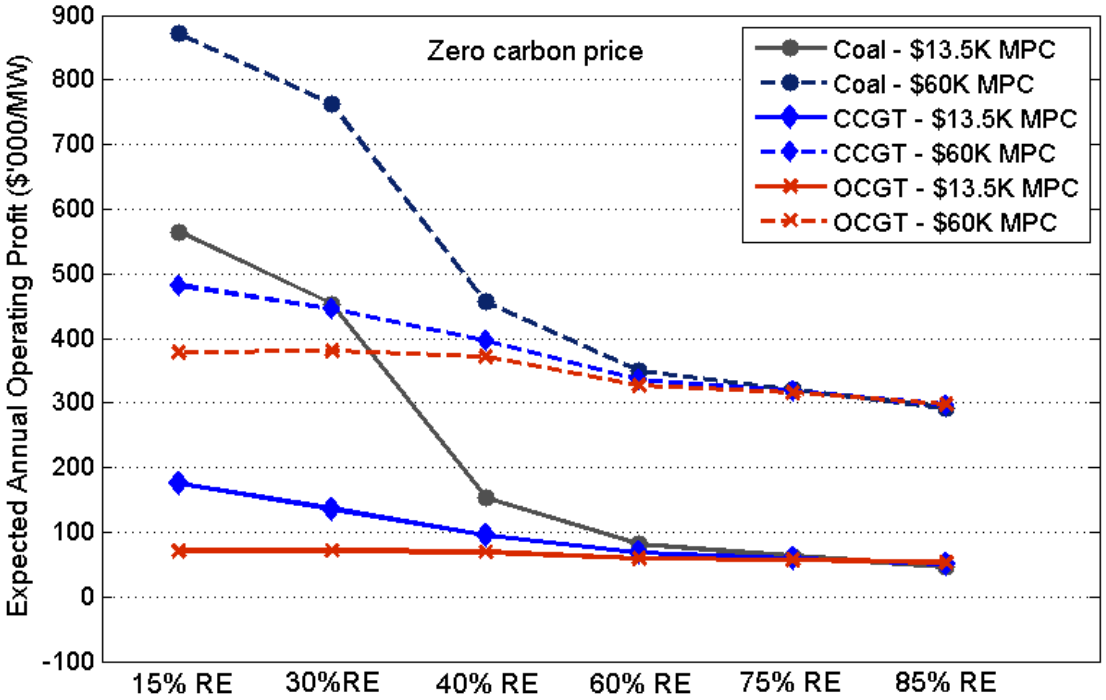
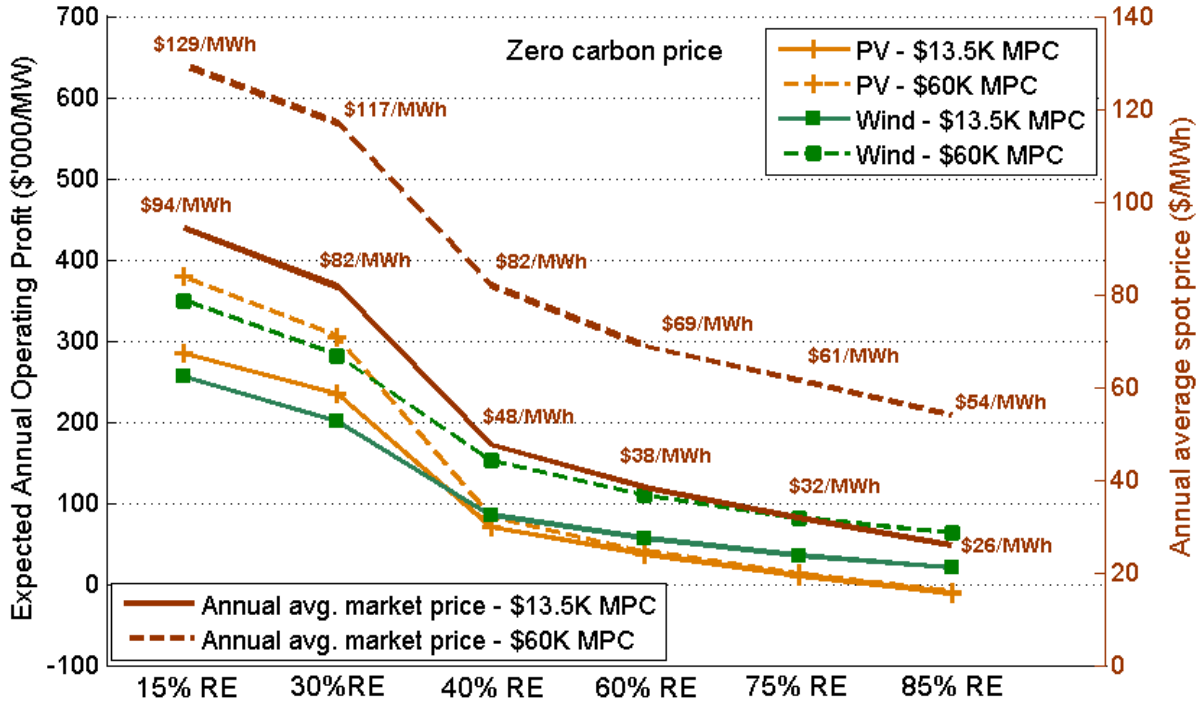
Increasing the MPC:

- 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.





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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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