100% Renewables
Will the electricity market work?

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The long term – 100% renewables

• Studies indicate 100% renewables is technically feasible and reasonably affordable

**UNSW**

Elliston, MacGill, Disendorf (2013)
Least cost 100% renewable electricity scenarios in the Australian National Electricity Market. *Energy Policy (in press)*

Average cost: $104 - $173 /MWh

**AEMO**

Australian Energy Market Operator (April 2013) 100 per cent renewables study – draft modelling outcomes

Average cost: $111 - $133 /MWh

Present average wholesale price: $55 /MWh

2 - 3 times increase in wholesale prices (~30% of retail bills)
Market impacts of renewables

- Will the *market* work with 100% renewables?

- Competitive market
- Generators offer close to SRMC
- Price close to zero in majority of periods

**SYSTEM ADEQUACY**

- How do generators recover costs?
- How do we maintain accurate investment incentives?
Managing system adequacy in the NEM

Determine Market Price Cap (MPC)

- Simulate future market
- Adjust installed capacity to meet 0.002% USE
- Adjust MPC to allow last generator to meet costs

Market participants make investment decisions

- Higher MPC rewards more investment
Price volatility

Generators already earn 20-50% of annual revenue in top 20 days of the year
Managing price volatility

- Market participants manage price volatility via:
  - Contractual arrangements – mature derivatives market
  - Vertical integration

Cap contract:
($300 strike price)
Impact of renewables

Market Price Cap may need to increase by a factor of 2-5
(sensitive to demand profile & degree of market concentration)

Increase MPC

100% renewables

Conventional market

Percentage of time (%)
Issues with increasing the Market Price Cap

- Increased costs of hedging
- Increased prudential obligations
  - Increased barriers to entry
- Discouragement of inter-regional contracting
  - May interfere with generation locational decisions
Increasing importance of the contracts market

Consider:

- Close monitoring
- Mechanisms for increased transparency
- Disincentivise vertical integration
  - Reduces liquidity and contracting options
Increased challenges in calculating the MPC

How frequently are extreme prices likely to occur?

Shape of net demand curve in scarcity periods

- Present demand shape
- Wind and solar contributions (correlation with demand)

DSP, energy efficiency, embedded generation, EVs

Market concentration

- Rapid market transformation
- Present market concentration
Demand Side Participation

Why have a Market Price Cap?

- Demand is inelastic
- Need to protect consumers

Increase DSP sufficiently

True representation of “value of lost load” in market, for each consumer

No MPC required
Conclusions

More renewables

Prices close to zero in majority of periods

• Not that different from the present NEM
• Already:
  • High price volatility
  • Market Price Cap » generator SRMC
  • Participants manage risk via contracts or vertical integration
Will the energy-only market work?

- Significant market concentration?
  - YES: Market participants exercise market power to raise prices
  - NO: Significant DSP?
    - YES: MPC becomes irrelevant
    - NO: Increase MPC?
      - YES: Strong contracts market?
      - NO: Investment incentives too low
        - NO: Market participants can’t manage risk
        - YES: Market continues to work effectively
          - YES: Market participants can’t manage risk
          - NO: Market continues to work effectively
            - YES: Strong contracts market?
            - NO: Increase MPC?
              - YES: MPC becomes irrelevant
              - NO: Significant DSP?
                - YES: Market participants exercise market power to raise prices
                - NO: Significant market concentration?
A journey of discovery

Present power system

100% renewables
Thank you

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