



100% Renewables – will the electricity market work?

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100% renewables feasible and affordable

- Studies indicate 100% renewables is technically feasible and reasonably affordable for Australia

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

Average cost:
\$104 - \$173 /MWh

AEMO

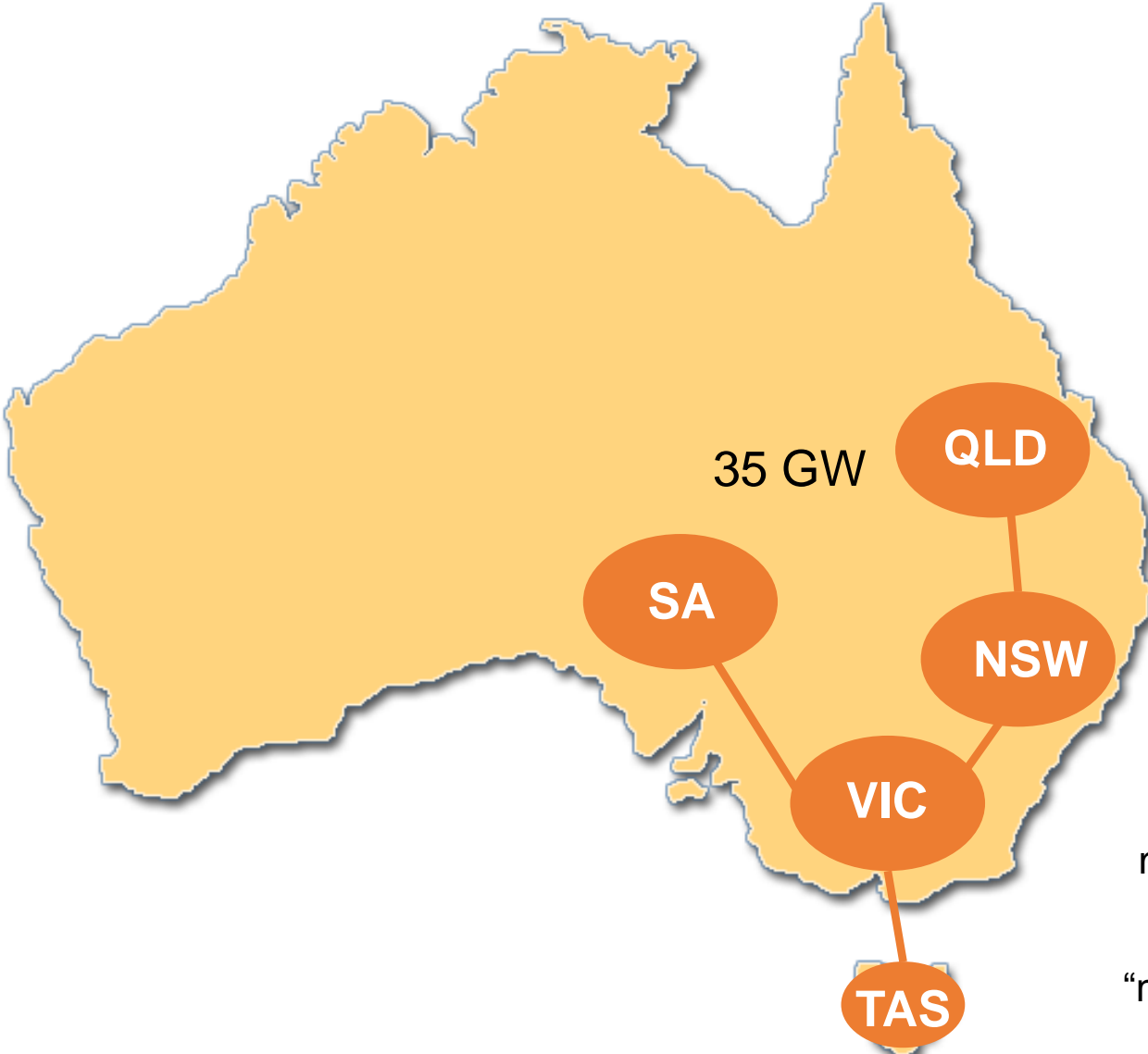
*Australian Energy Market Operator (April
2013) 100 per cent renewables study –
draft modelling outcomes*

Average cost:
\$111 - \$133 /MWh

Present average wholesale price: \$55 /MWh

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

Australian Electricity Markets



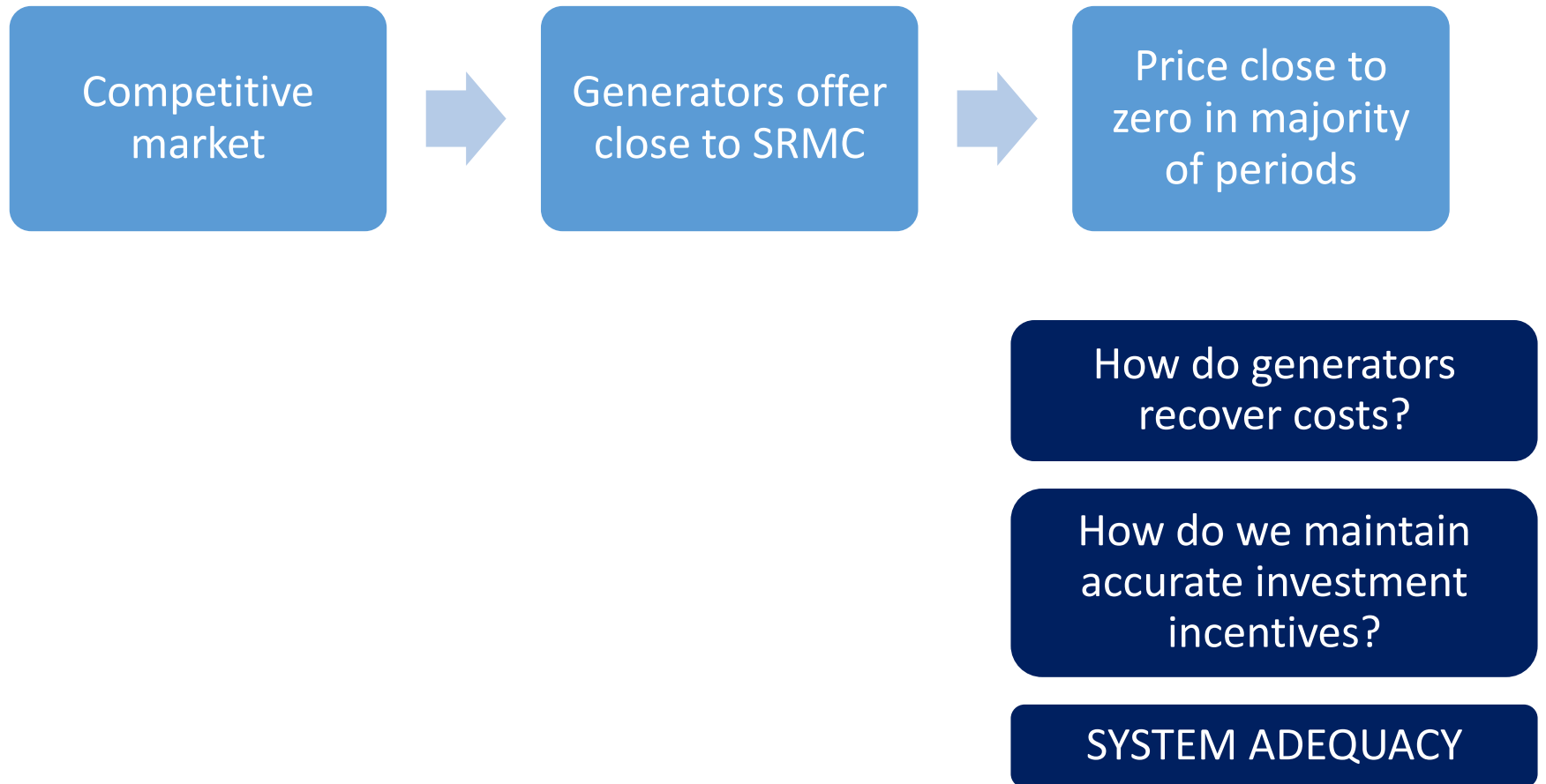
National Electricity Market (NEM)

Energy-only, Market Price Cap = \$13,100 /MWh

Exercise of transient market power is viewed as important aspect of NEM design, to avoid “missing money” problem

Market impacts of renewables

- Will the NEM work with 100% renewables?



Managing system adequacy in the NEM

Determine Market Price Cap (MPC)

Simulate future market

adjust installed capacity to meet 0.002% USE

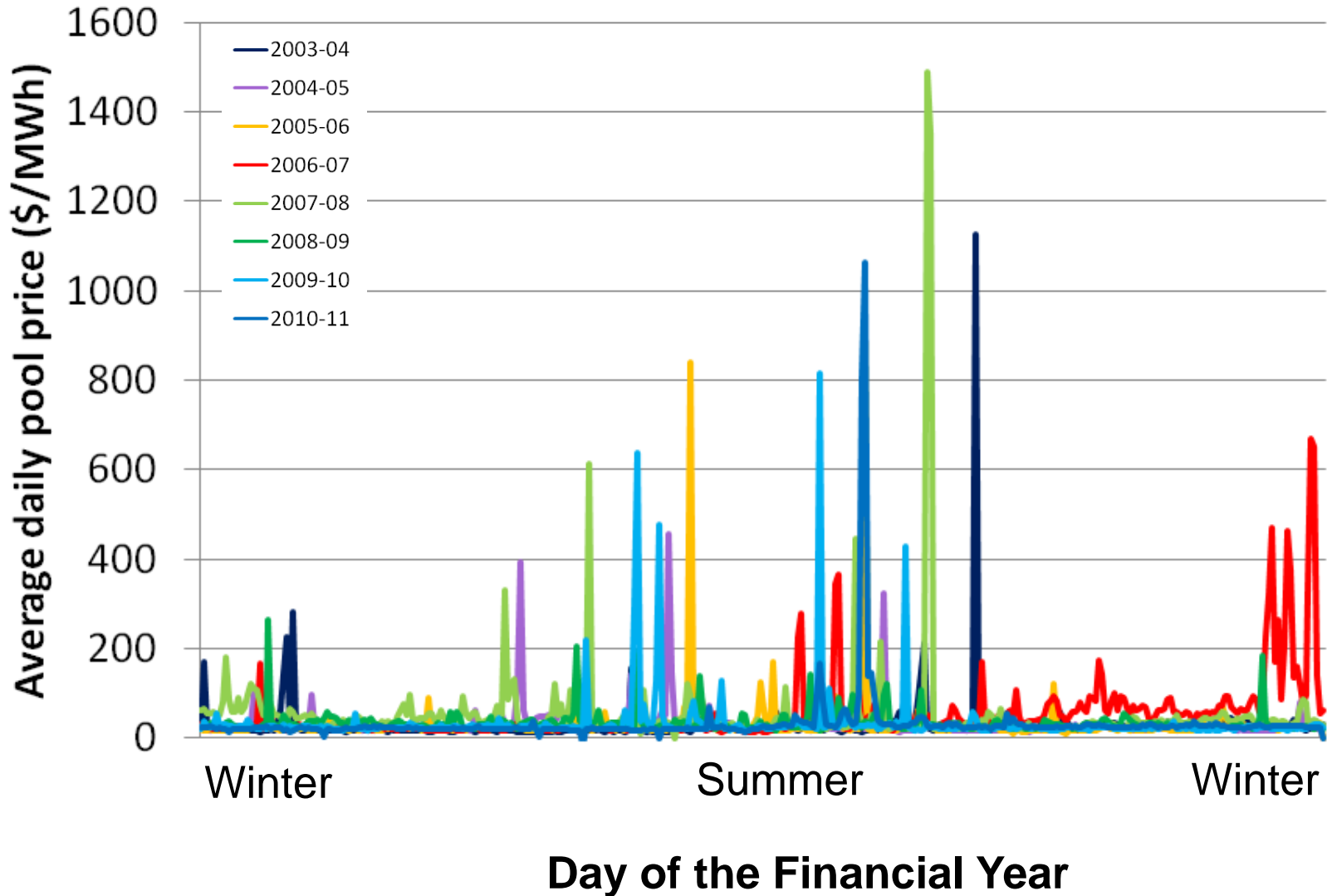
Adjust MPC to allow last generator to meet costs

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

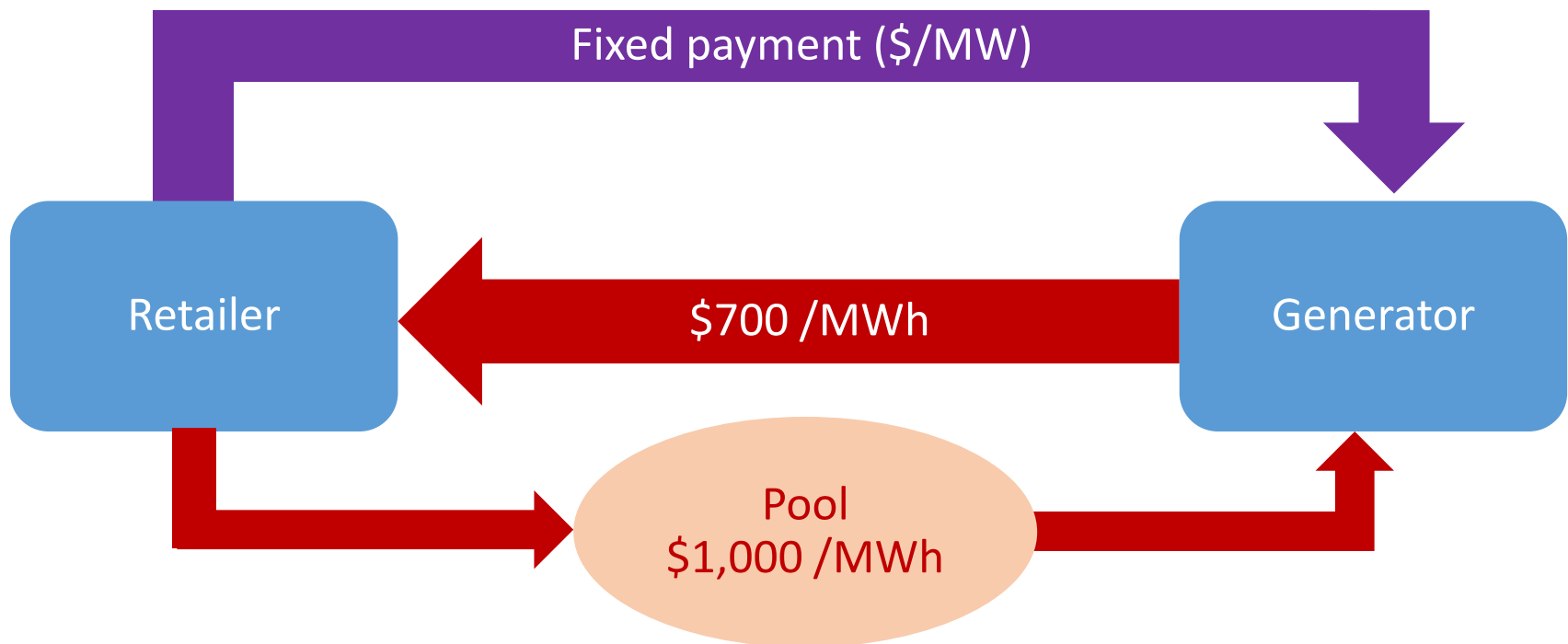


Managing price volatility

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

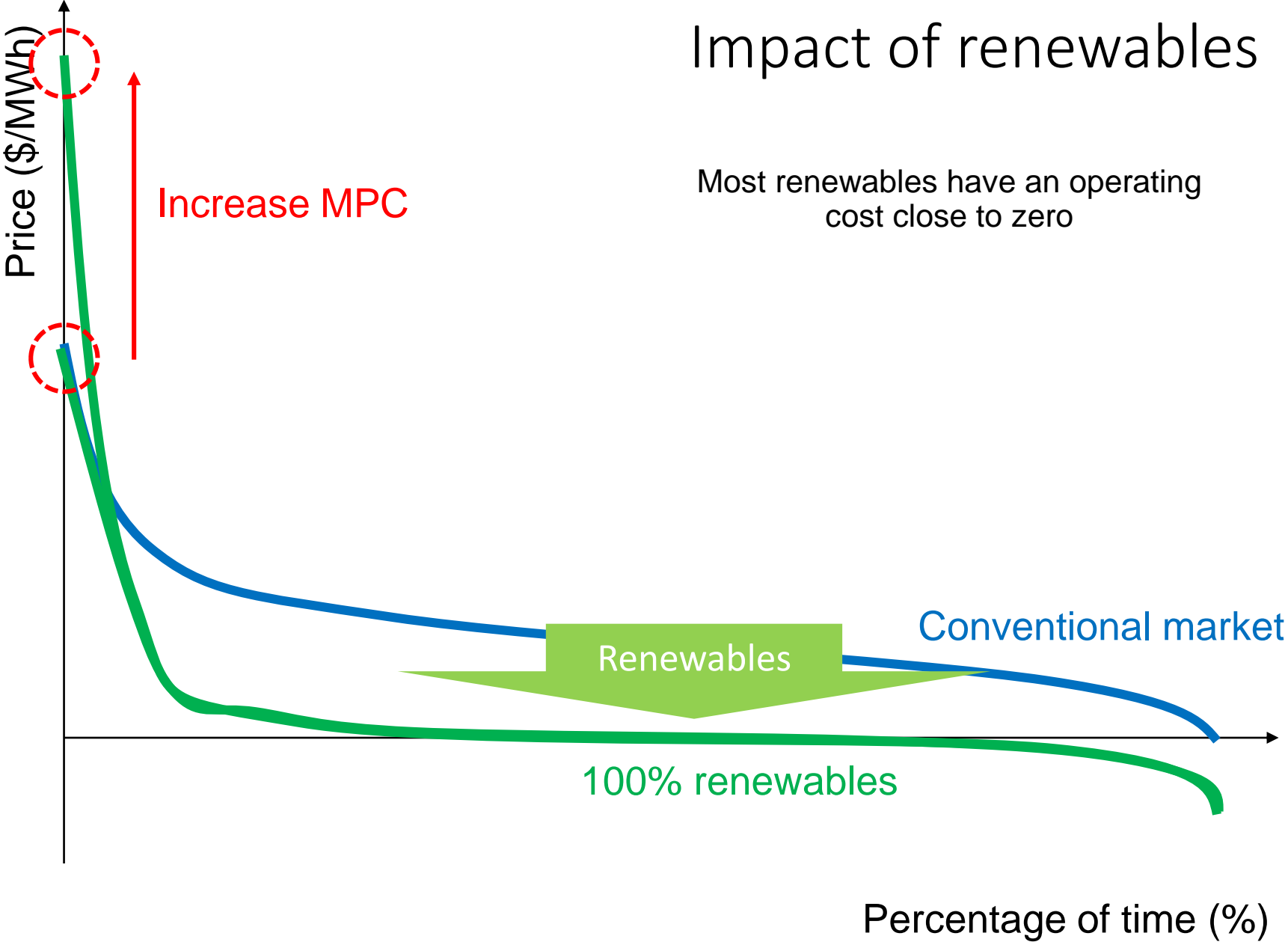
Cap contract:
(\$300 strike price)

Provides many of the benefits of a capacity market, but market participants retain decision making



Impact of renewables

Most renewables have an operating cost close to zero



How much would the MPC need to increase?

2009 selected for analysis (closest level of USE to the Reliability Standard)



Set all historical half-hourly prices below \$300/MWh to zero



Multiply all remaining prices by a “scaling factor”



Adjust scaling factor so that total revenues earned achieve cost recovery (in aggregate) for 100% renewable system

How much would the MPC need to increase?

| | Scaling Factor | MPC (\$/MWh) |
|--|----------------|----------------------|
| Level in 2009 (reference year) | 1 | \$10,000 |
| Maintaining historical aggregate revenues | 3 | \$30,000 |
| Sufficient aggregate revenues to support 100% renewables | 6 - 8 | \$60,000 to \$80,000 |

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

Demand Side Participation

Why have a
Market Price
Cap?

- Demand is inelastic
- Need to protect consumers

Increase DSP
sufficiently



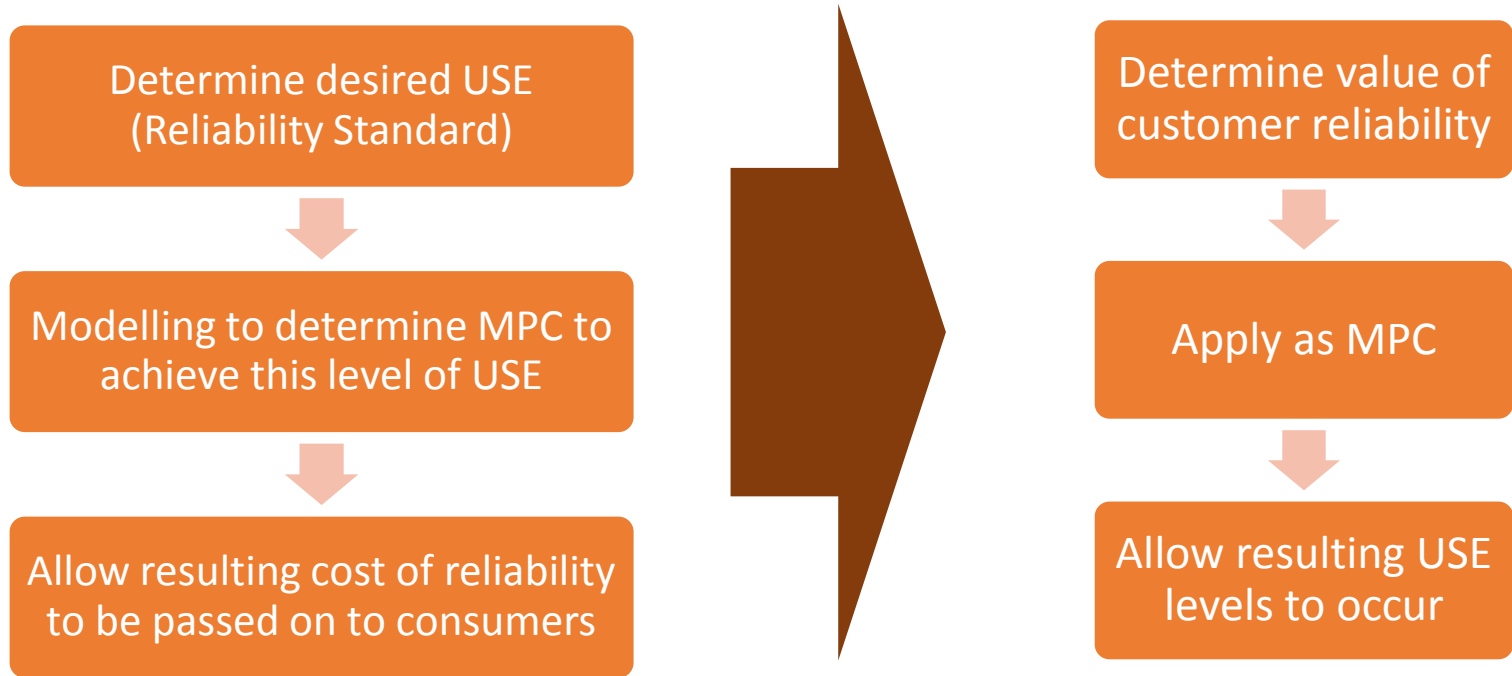
True representation
of “value of lost
load” in market, for
each consumer



No MPC required

Should the NEM invert the process?

Renewables
don't affect
VCR



| | Value of Customer Reliability (\$/MWh) |
|----------------|--|
| Residential | 20,710 |
| Small business | 413,120 |
| Large business | 53,300 |
| Average | 94,990 |

Conclusions

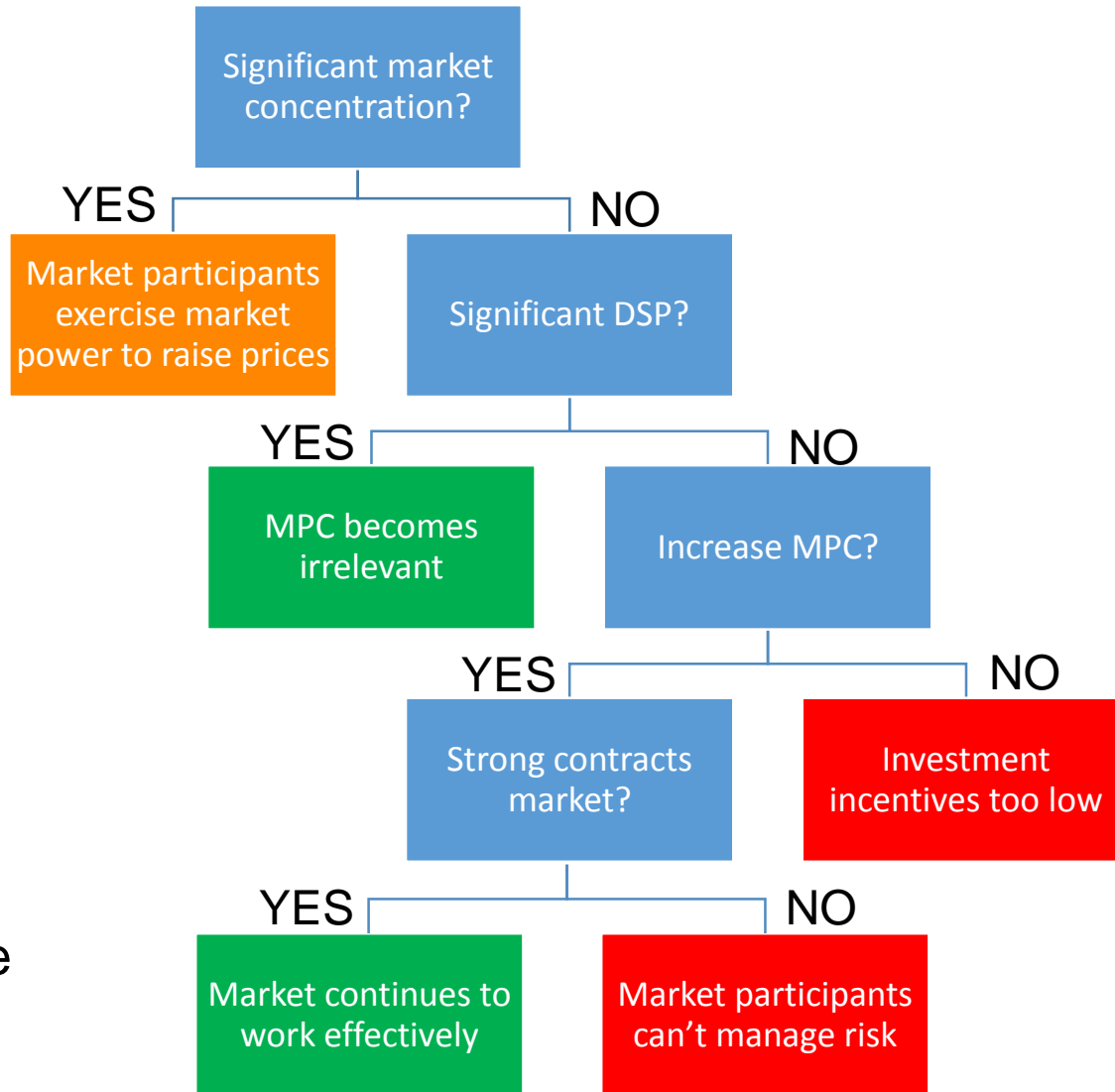
More renewables



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?



Constant monitoring is wise – new issues will arise over time



Centre for Energy and
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Thank you

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