Centre for Energy and Environmental Markets

UNSW THE UNIVERSITY OF NEW SOUTH WALES SYDNEY • AUSTRALIA

100% Renewables for Australia?

Challenges and Opportunities

Dr Jenny Riesz

Solar Supercharge, QUT, 14th February 2016

Who am I?

Powerlink Queensland

ASI Australian Solar Institute

AGL

Ausgrid

ElectraNet electricity transmission

westernpower

Clean Energy Council

origin

Australian Coal Association

imo Independent Market Operator

RioTinto

Delta electricity

AEMC Australian Energy Market Commission

AEMO Australian Energy Market Operator

The University Of Queensland Australia

ROAM CONSULTING ENERGY MODELLING EXPERTISE

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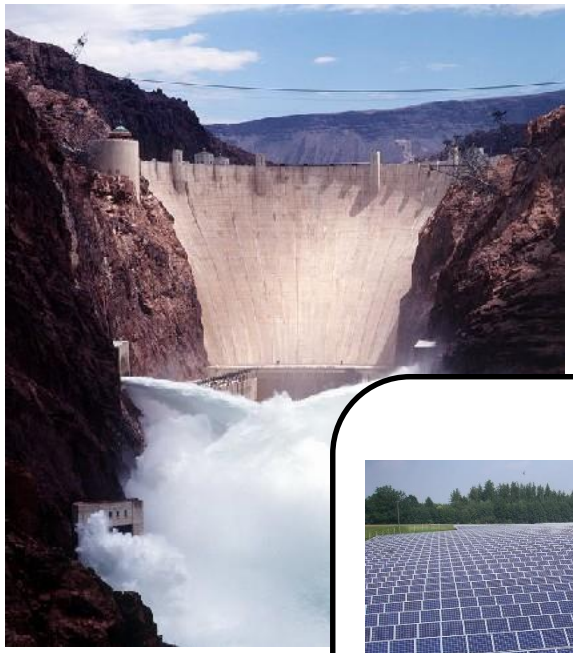
UNSW Australia

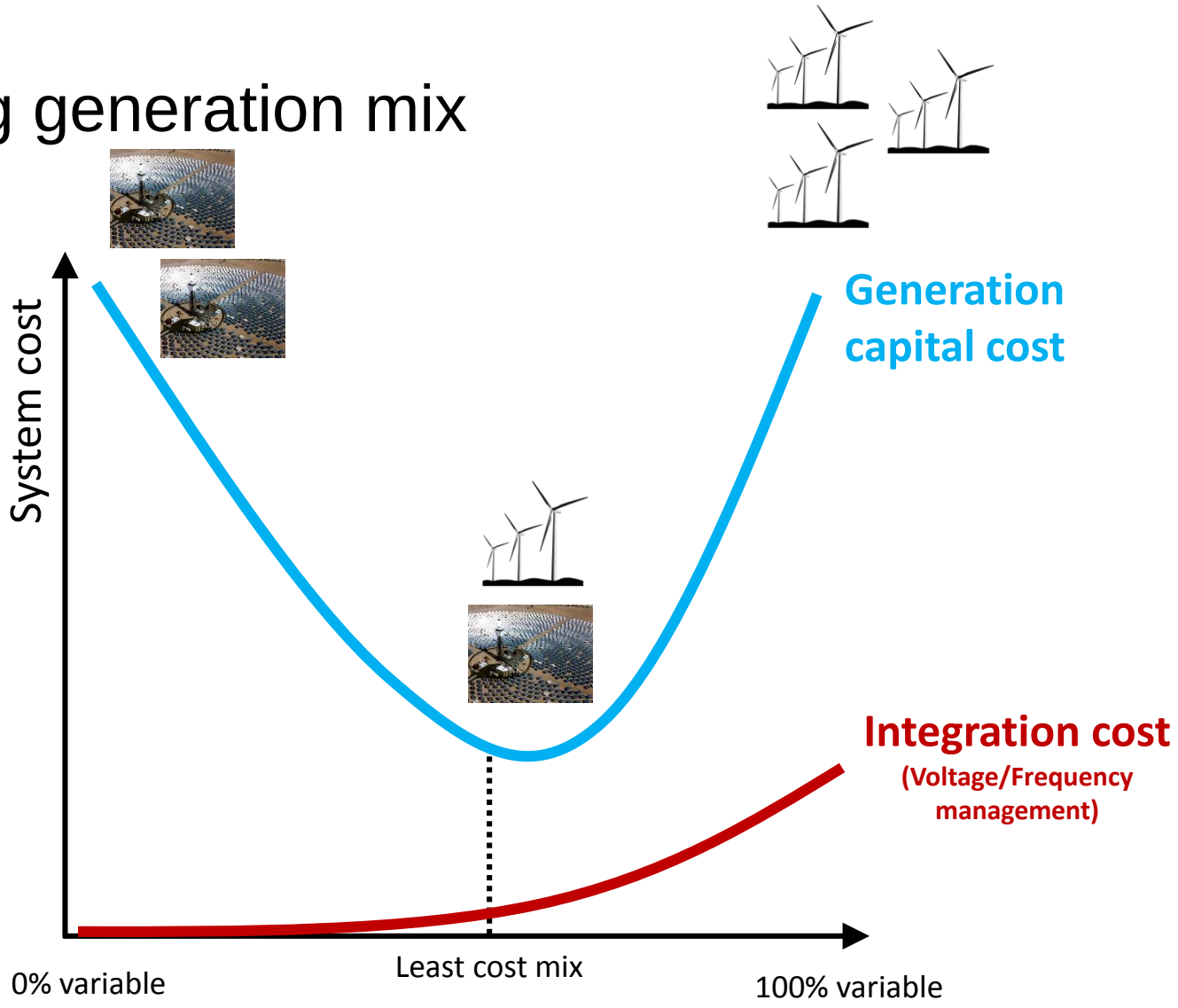
AECOM

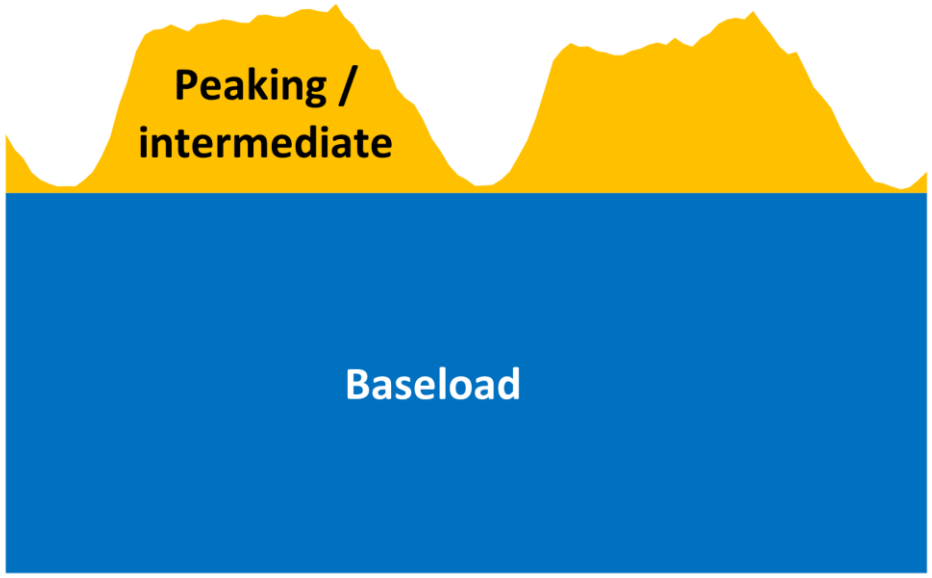
Renewable technologies



Variable & non-synchronous

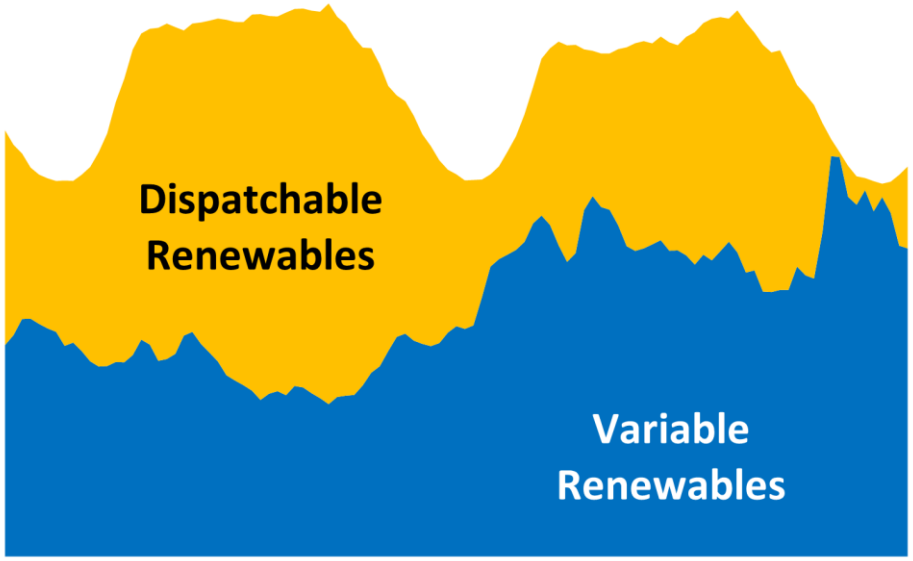
Optimising generation mix





A new power system paradigm

Wind displaces baseload generation



J. Riesz, J. Gilmore, (2014) "Does wind need "back-up" capacity – Modelling the system integration costs of "back-up" capacity for variable generation". International Energy Workshop (Beijing)

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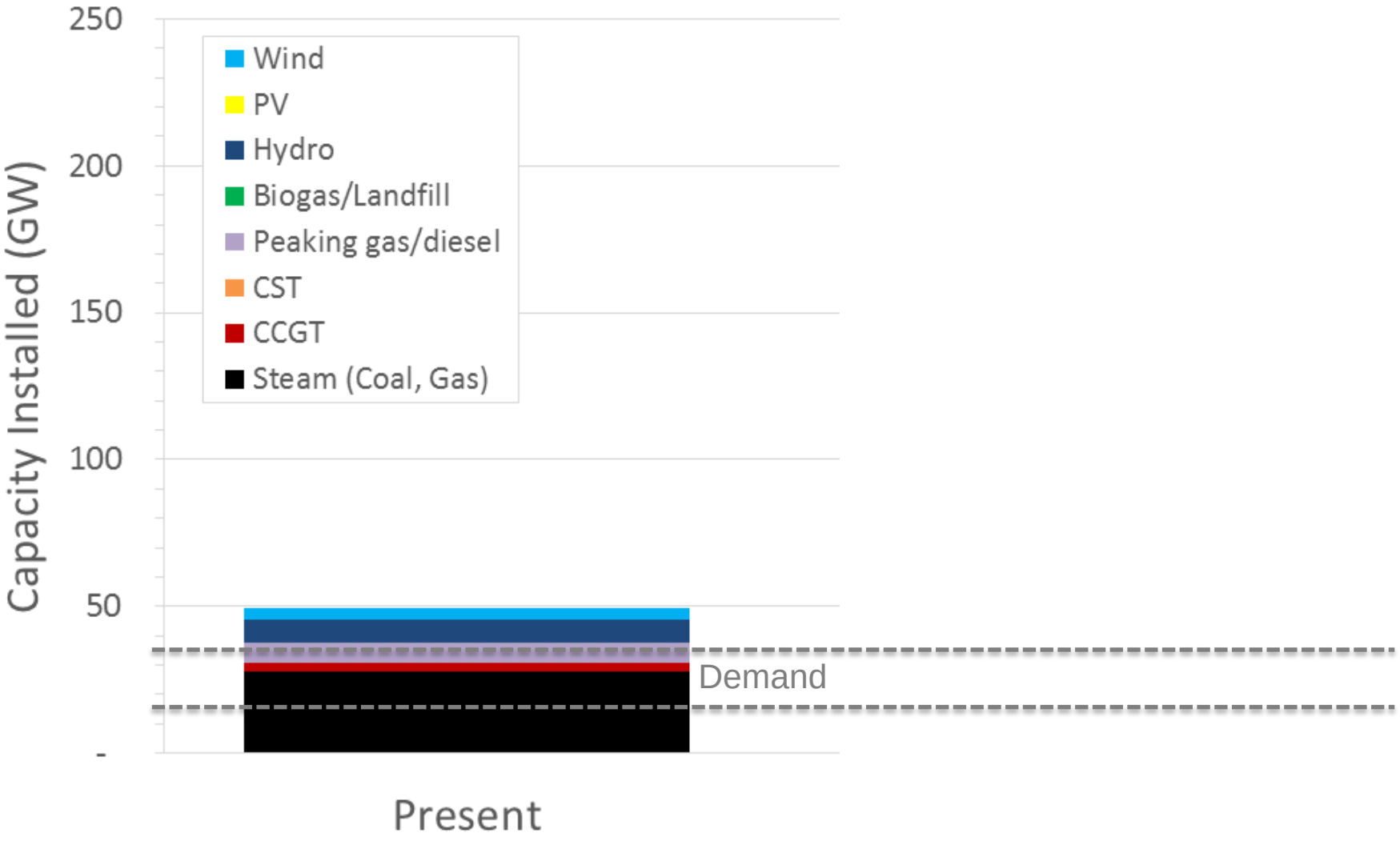

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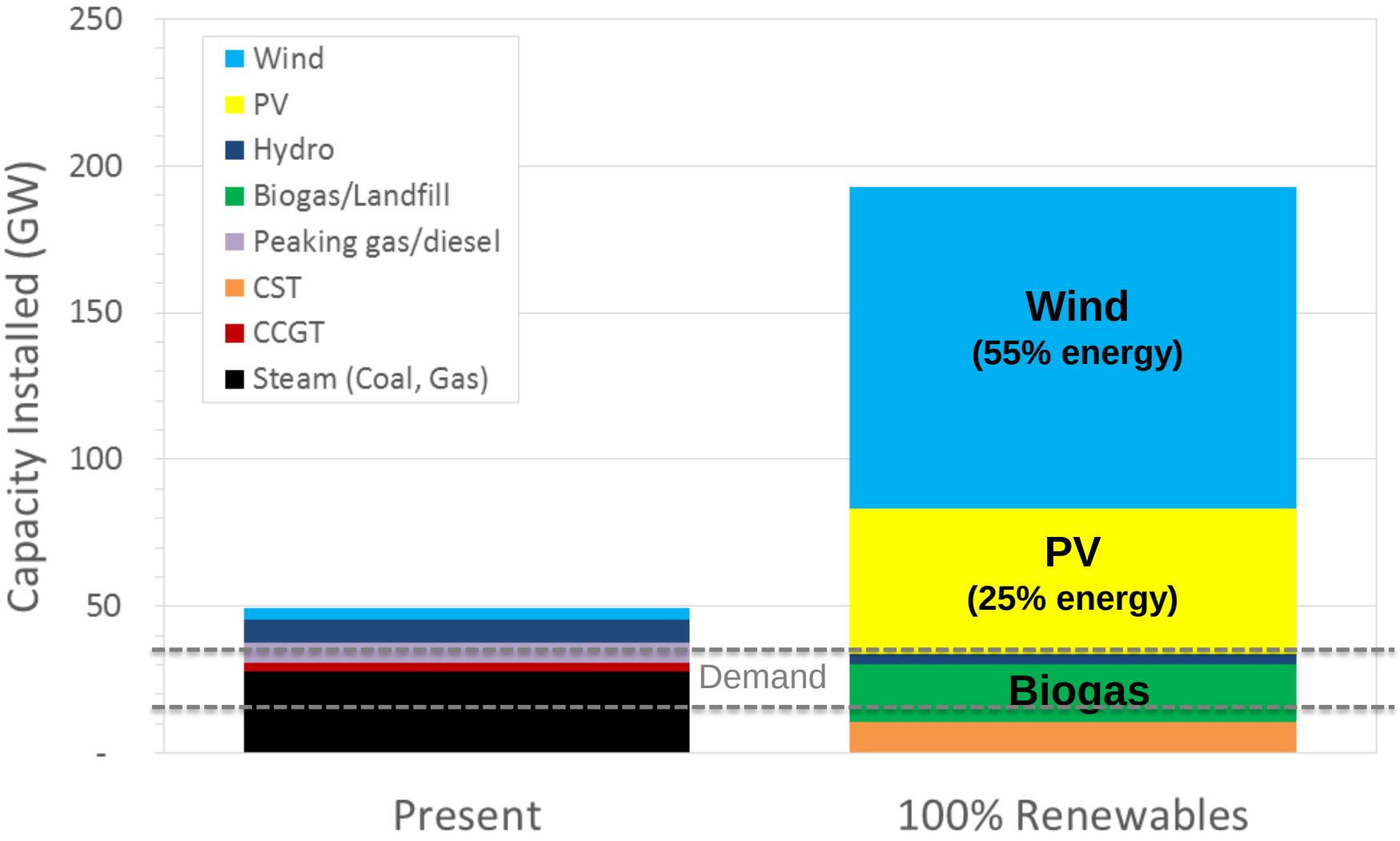

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Engineering challenges

Frequency control - seconds (inertia)

- Displacement of synchronous generation

Frequency control - minutes (regulation)

- Increasing variability and uncertainty → increase in regulation reserves

Frequency control - hours (ramping)

- Managing long wind & PV ramps

Fault level in-feed

- Non-synchronous technologies don't provide sufficient fault feed-in
- Protection systems may no longer be able to determine when and where a fault has occurred

Grid code performance standards

- New reactive power and voltage support capabilities required during disturbances

Reliability and Resource Adequacy

- Need to assess differently to present

Assessment by Australian Energy Market Operator (AEMO)

- Responsible for operating the grid
- Study on 100% renewables in 2013:
  - Reliability standard maintained
  - Operational issues "appear manageable" (high level review, based upon international research)

*"High penetrations of semi-scheduled and non-synchronous generation would constitute a system that may be **at or beyond the limits of known capability and experience anywhere in the world to date…**"*

but…

*"There are **no fundamental technical limitations** to operating the given 100 per cent renewable NEM power system generation portfolios that have been identified."*

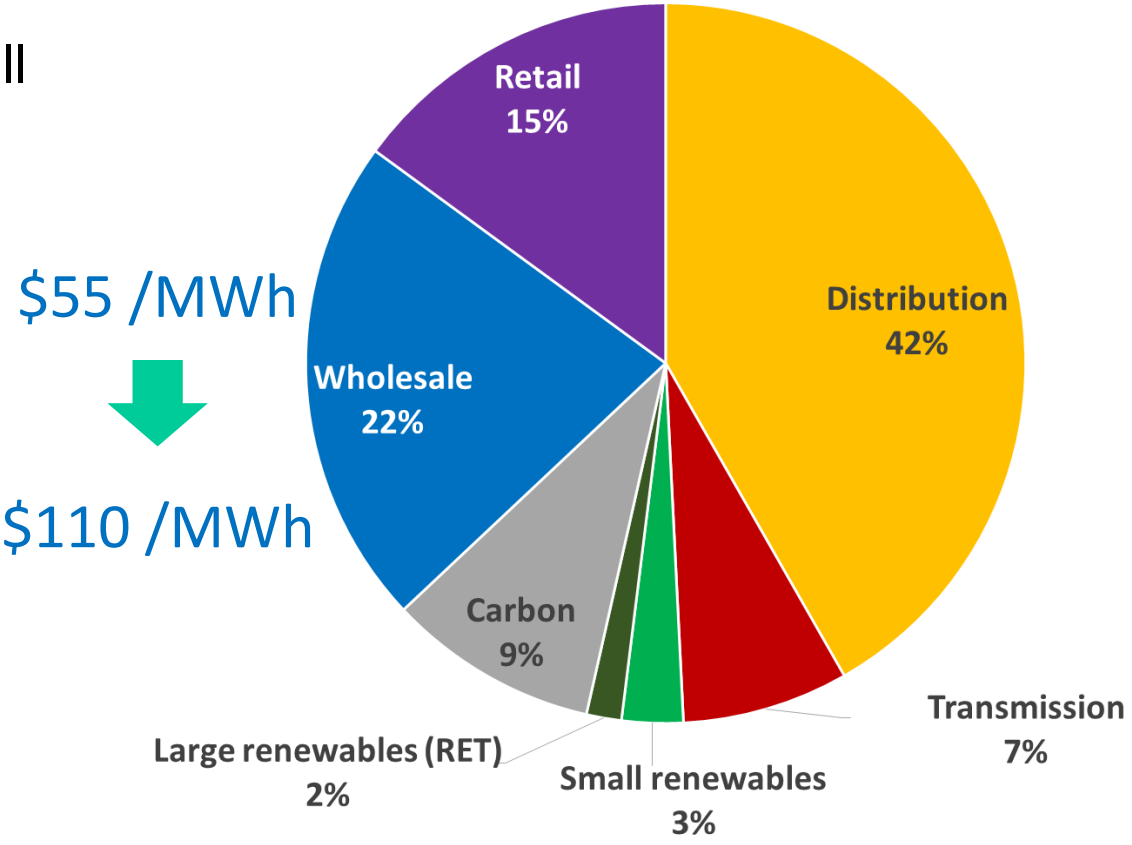
AEMO (2013), "100 per cent renewables study – Modelling outcomes".

	Cost for 100% renewables (AEMO)
Total capital cost including transmission	$219 - 332 billion
Wholesale cost including opex	$111 - 133 /MWh

- 20% increase in total bill

$55 /MWh

$110 /MWh



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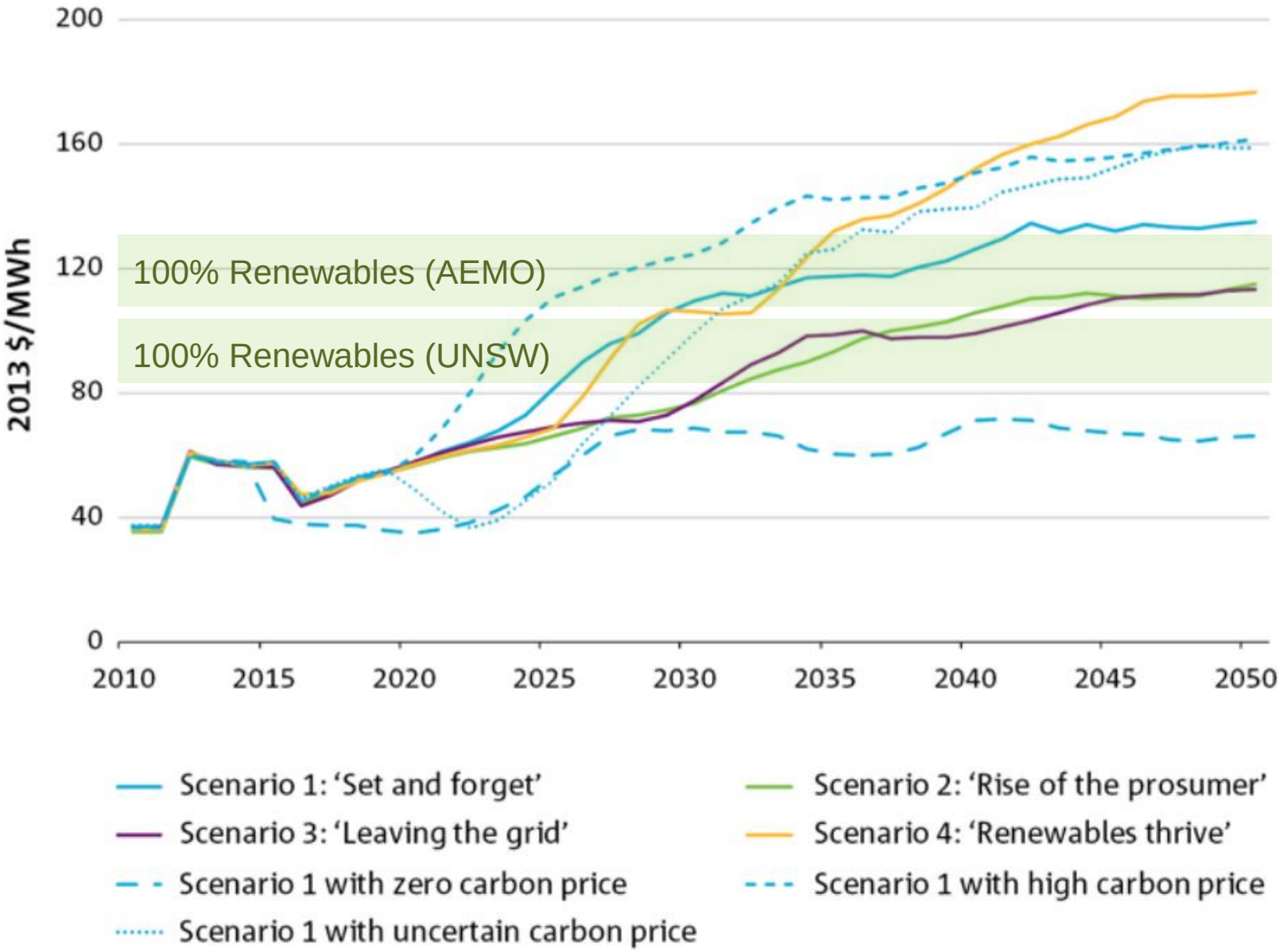
AEMC, Electricity Price Trends Final Report, March 2013, Results for QLD in 2012-13.

Costs are going up anyway...

CSIRO Future Grid (2013) "Change and Choice – The Future Grid Forum's analysis of Australia's potential electricity pathways to 2050"



Summary

- 100% renewables is technically feasible
- Some technical challenges remain
  - But high confidence they will be solved as we progress
- Costs are similar to those we'll probably be paying anyway
  - 20% increase in electricity bills from present?
  - And bills are likely to go up regardless

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Thank you

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