Valuing CCS with a Electricity Grid

An Australian Case Study

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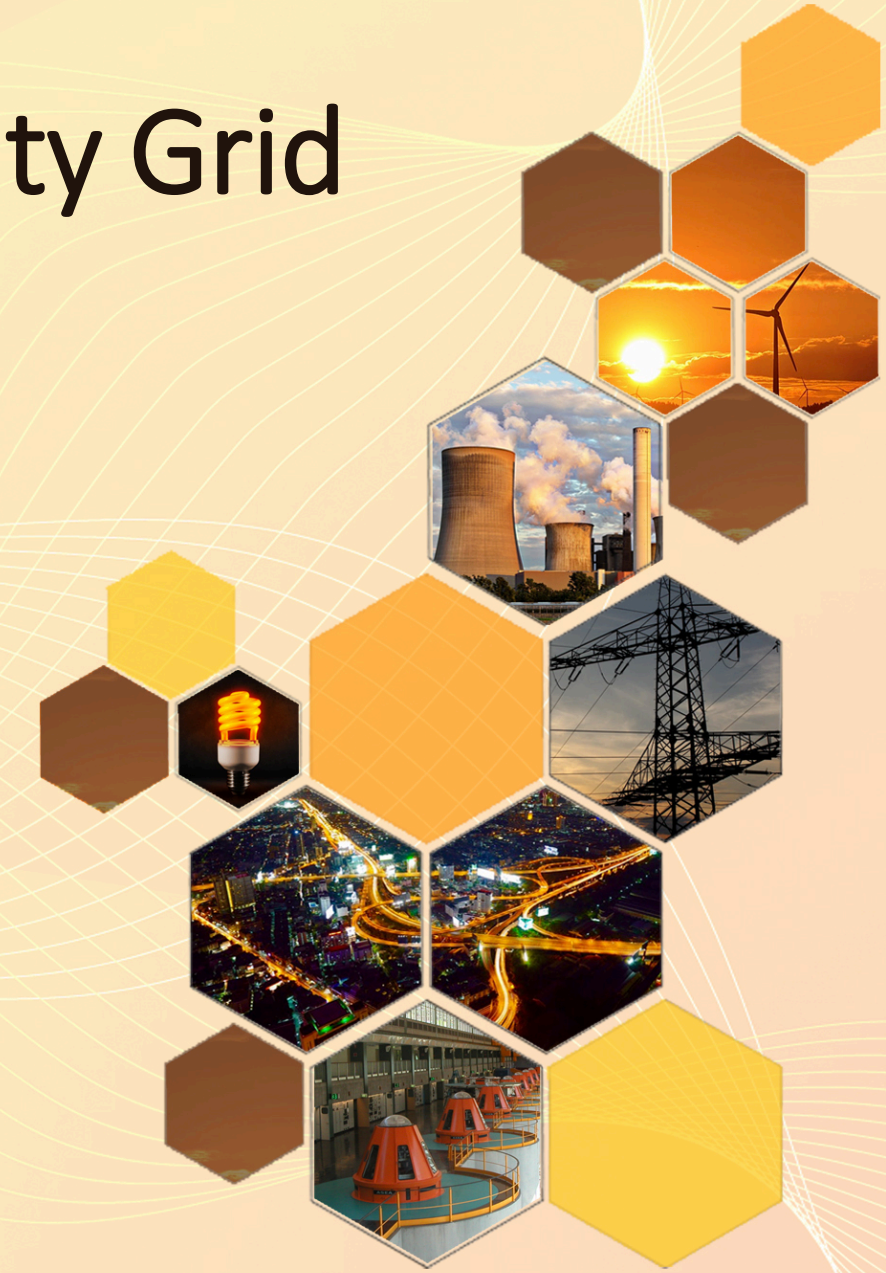

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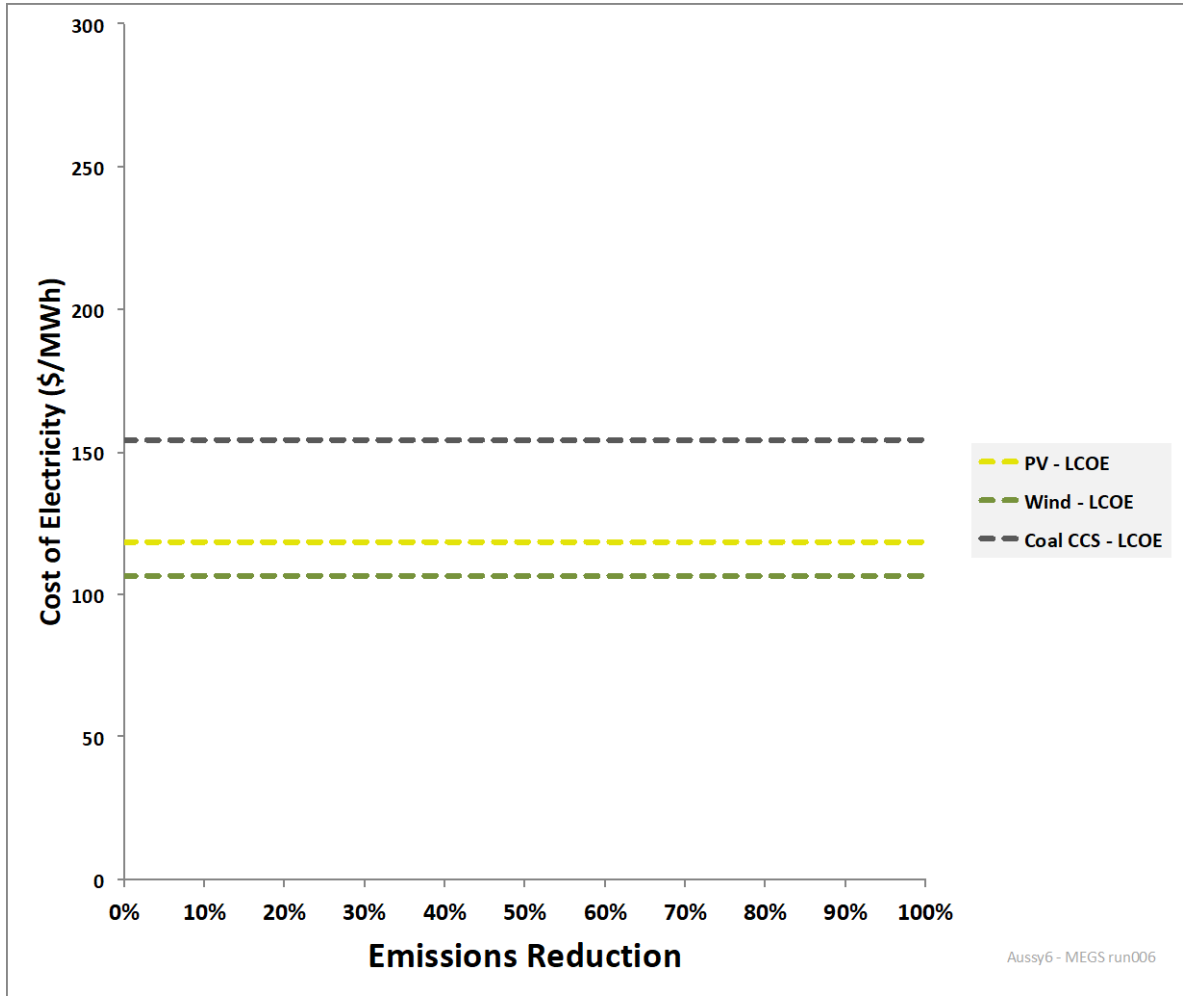
Levelised Cost of Electricity



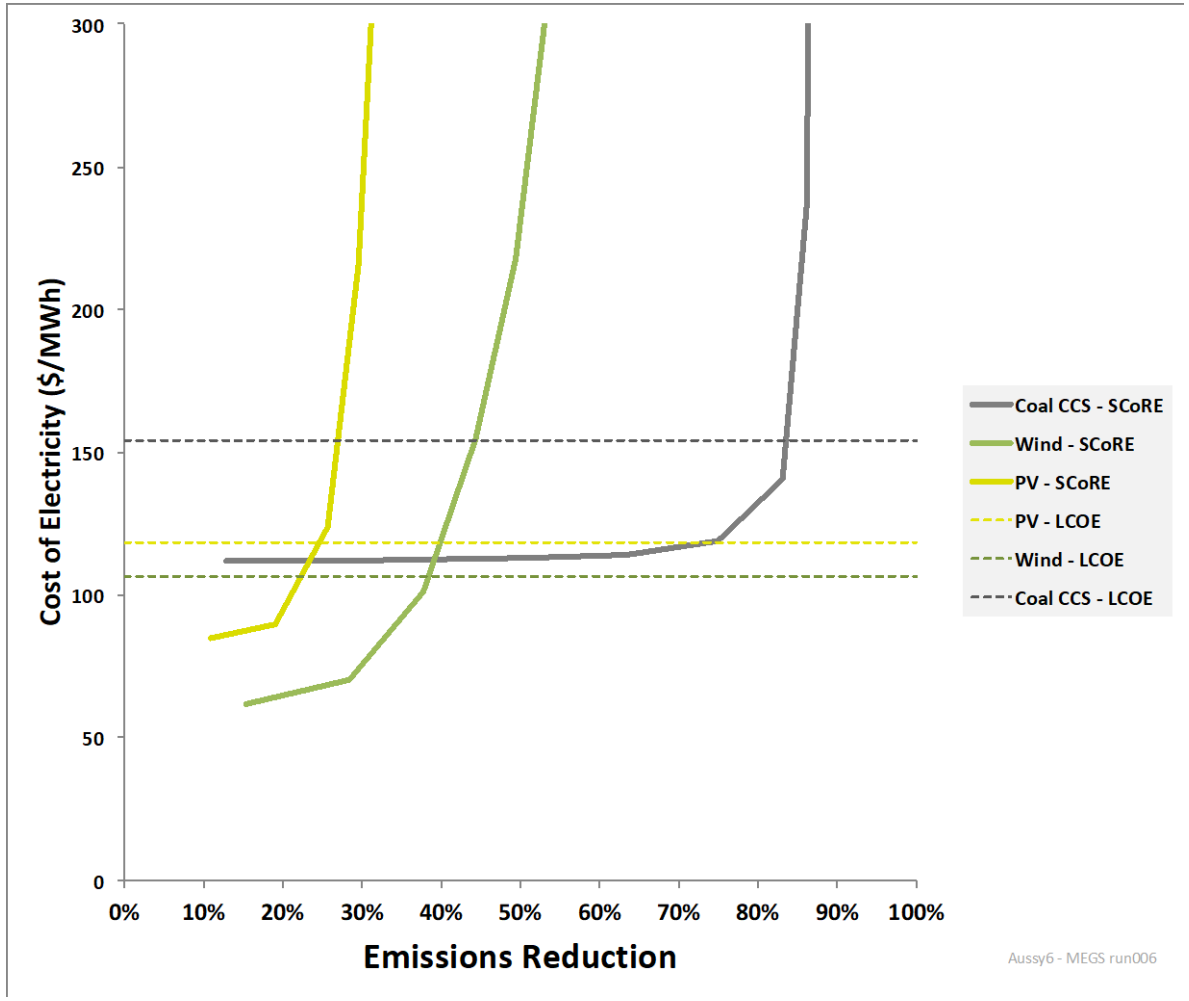
LCOE

A simple metric designed to compare fossil plants, it takes no account of 'the system.'

Assumption is that generation = MWh available

$$\text{LCOE} = \text{Variable Cost} + \frac{(\text{Fixed Cost} + \text{Annualised Capex})}{\text{Annual Availability}}$$

System Cost of Replacement Electricity



Calculated for NEM, closing oldest coal where possible.

SCoRE

SCoRE is similar to LCOE but takes account of the value of the technology to the system and its affect on system cost. It is designed to compare technology cost in a decarbonisation scenario.

SCoRE is lower at low decarbonisation because takes into account of plant that can be retired when new plant is added (unabated coal in this case)

Curtailment of renewables increasingly reduces its value at medium to high penetration

$$\text{SCoRE} = \frac{\text{Increase in Total System Cost due to New Plant}}{\text{Annual Generation of New Plant*}}$$

Where TSC = Sum (variable + fixed + annualised capex)
For all plant on the system
TSC benefits from closure of old high carbon plant which is replaced by new technology (so long as system adequacy is not compromised.)

LCOE vs SCoRE

SCoRE is a metric intended to replace LCOE, but has its limitations compared to a full Total System Cost approach

Comparators	Examples	LCOE	SCoRE	TSC
Thermal plant for Baseload energy	Coal, gas, biomass	Yes - ideal	Yes - but overly complex	Yes - but overly complex
Inflexible thermal plant	Nuclear	No - deceptively high	Yes	Yes
Variable renewables	Wind, PV	No - deceptively high	Yes	Yes
Plant delivering grid services only	Synchronous condensers, standby	No - divide by zero error	No - divide by zero error	Yes
Storage	Batteries, pumped hydro	No - becomes negative	No - becomes negative	Yes

MEGS: Modelling Energy & Grid Services

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- Energy must balance. — **Conservation of Energy**
- There is sufficient supply of reserve and response services. — **Managing imbalances**
- There is sufficient inertia — **Stability: time to react**
- There is sufficient reliable capacity to meet peak demand — **Keeping the lights on!**

Whilst minimising short run cost

- **Fuel**
- **Carbon Storage**
- **Variable**
- **Start-up**

And optimising storage

Adjusts capacity to maintain Loss of Load Hours

THANKS

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