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Nuclear power in context

Melbourne Energy Institute Seminar

John Daley
CEO, Grattan Institute
17 November 2010

The context for Australia's energy technology choices

Reducing Australia's carbon emissions requires a substantial shift in electricity generation

- Electricity generation produces a large percentage of Australia's carbon emissions.
- Getting to near-zero emissions will require a big change in how Australia produces electricity.

Acquiring options to roll out any one a number of technologies is prudent given uncertainties about future technology

- There is a lot of uncertainty about how much energy technologies cost – now – and in future.
- Forecasting technology development and costs is difficult – 20 years ago there were no mobile phones, no internet, and you could still buy a new gramophone record.
- When facing uncertainty, the optimal strategy is usually to acquire a number of options, and then exercise the best option when we have more certainty in the future.

Nuclear is clearly a candidate, but it is just one horse in the field – there is no guarantee that it will finish first

- Future costs of nuclear are uncertain – costs are rising, and are variable.
- Uranium supplies are uncertain – long-term viability depends on shift to commercially unproven Type 4 reactors, or significant geological finds.

On best guess assumptions, Australia cannot count on a nuclear option for roll out towards 2050 emissions targets unless its politicians commit soon to building capabilities

- Even with optimistic assumptions, Australia will need to begin an aggressive rollout of low carbon technology by 2040 at the very latest.
- Given lead times, Australia is running out of time to acquire a nuclear option

Electricity generation produces a large percentage of Australia's carbon emissions today, and will probably be more in future

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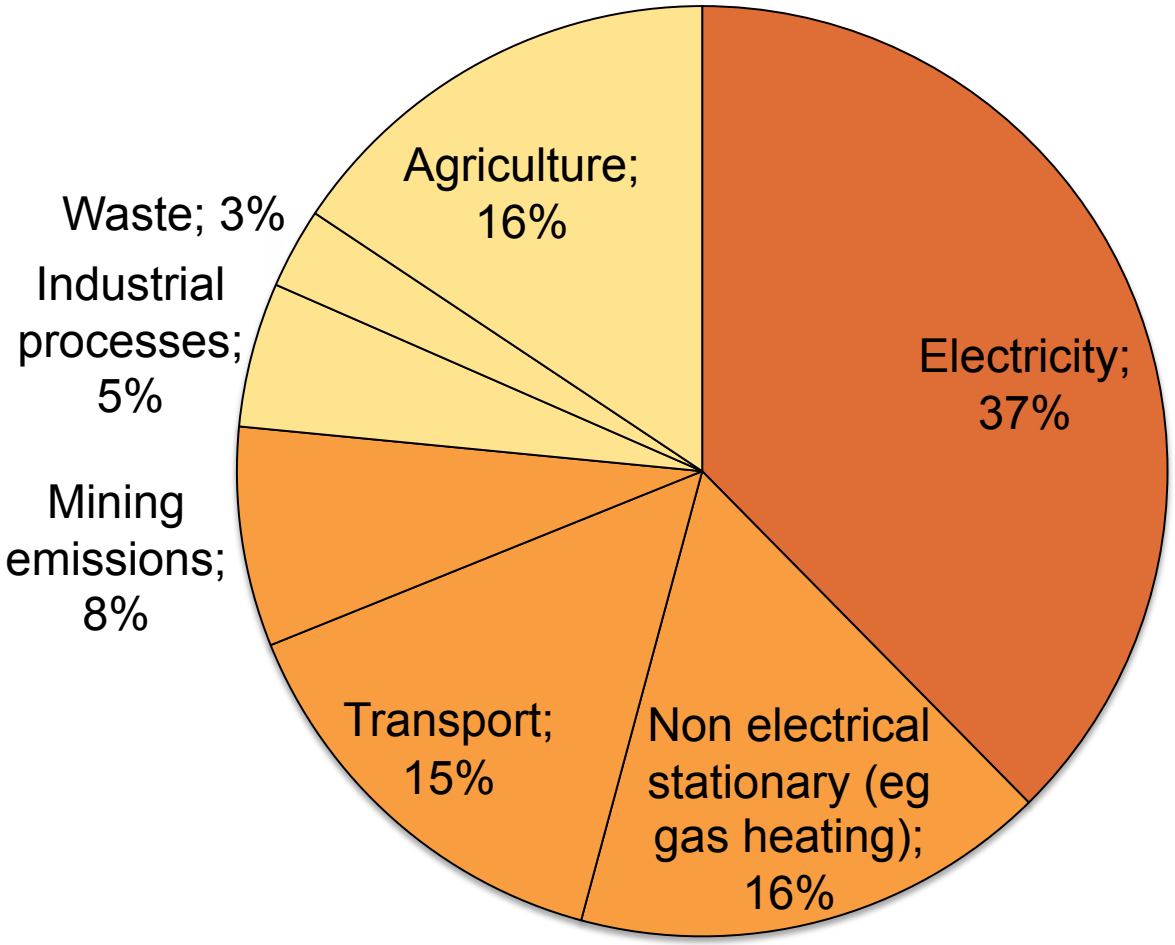
Australian greenhouse emissions

Percent, Dec 2009 quarter

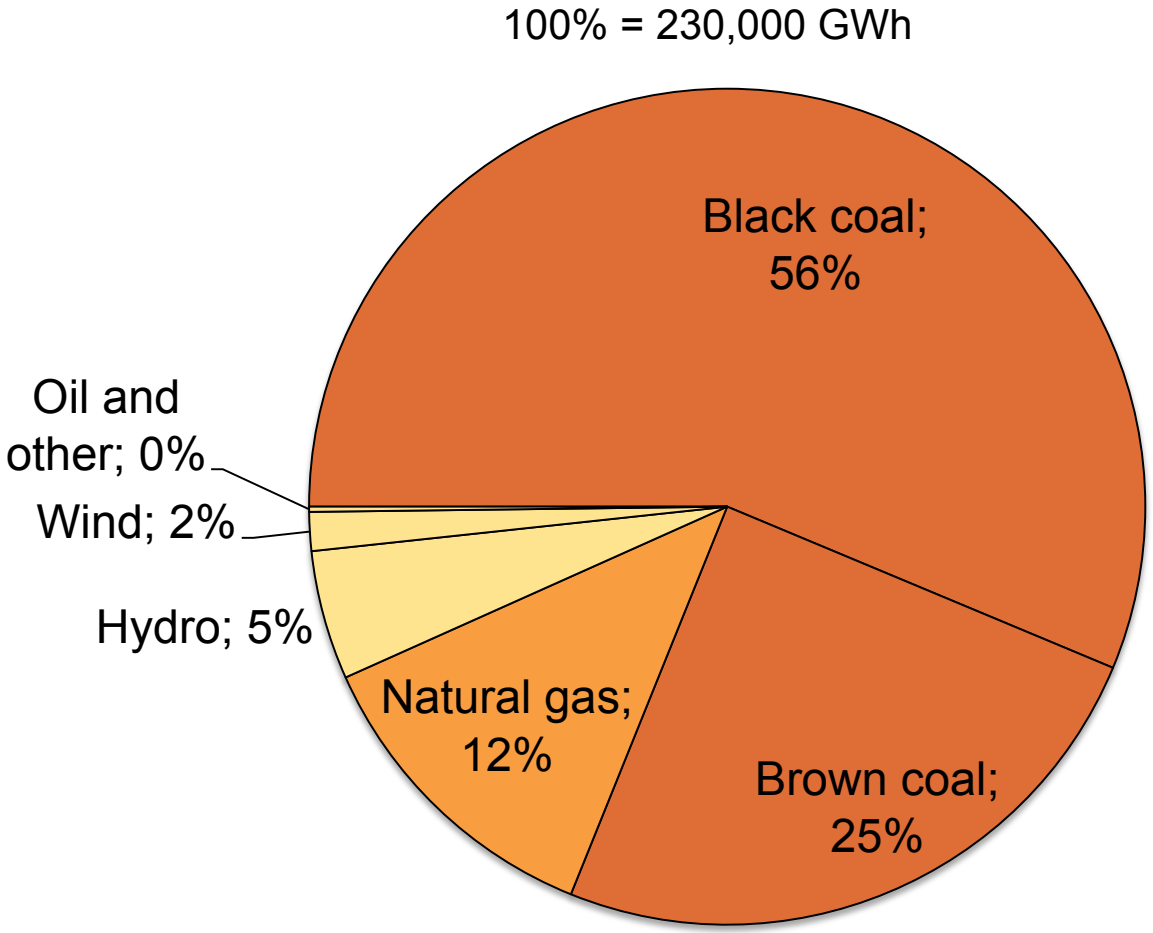


Source: Dept Climate Change, *National Greenhouse Gas Inventory*, May 2010

Getting to zero emissions will require a big change in how Australia generates electricity

Australian electricity generation

Percent, 2008-2009



Source: Electricity Supply Association of Australia, *Facts in Brief 2010*

There is a lot of uncertainty about how much energy technologies cost – now –

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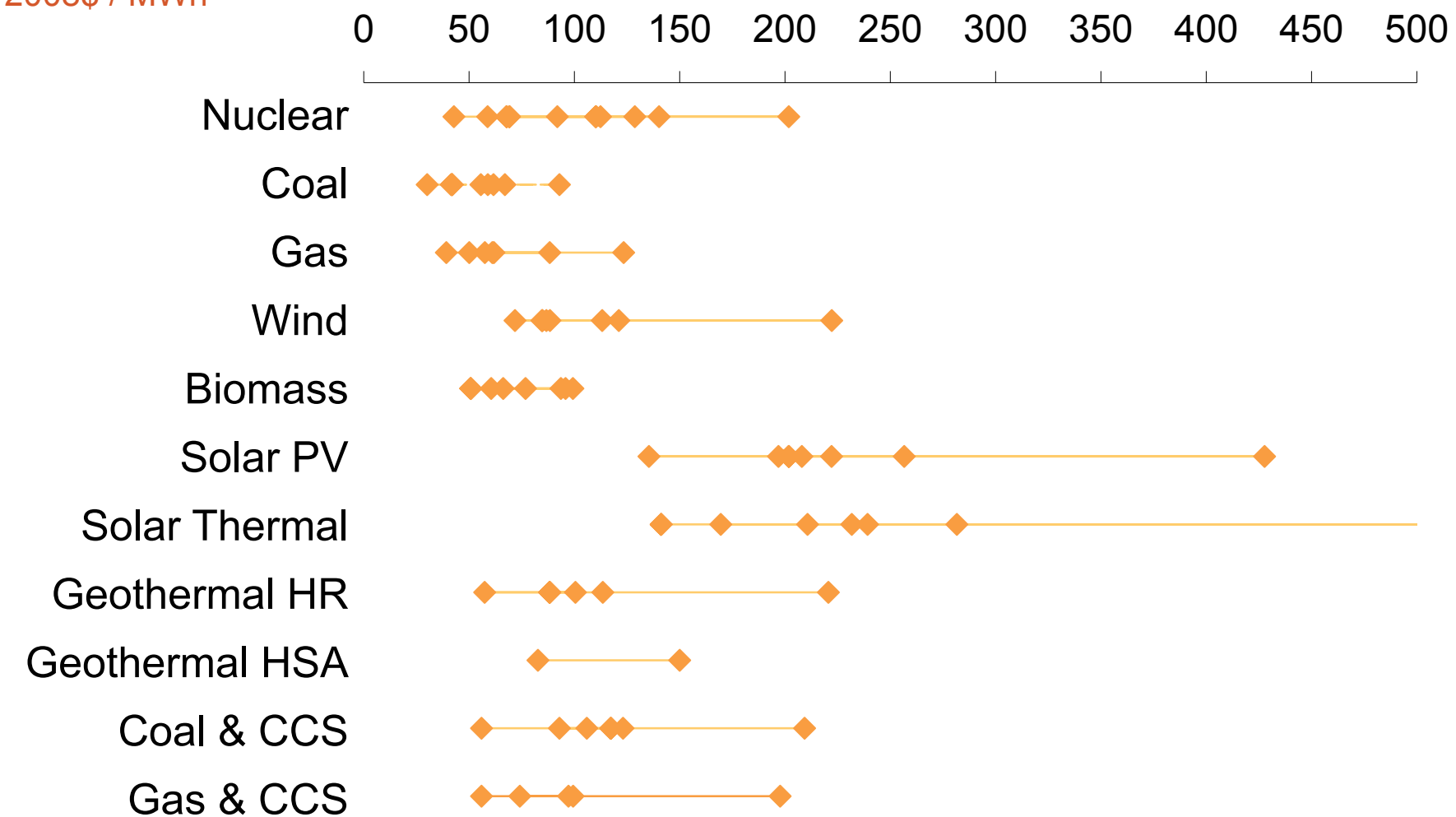
Estimates of electricity generation costs prior to 2015

2008$ / MWh

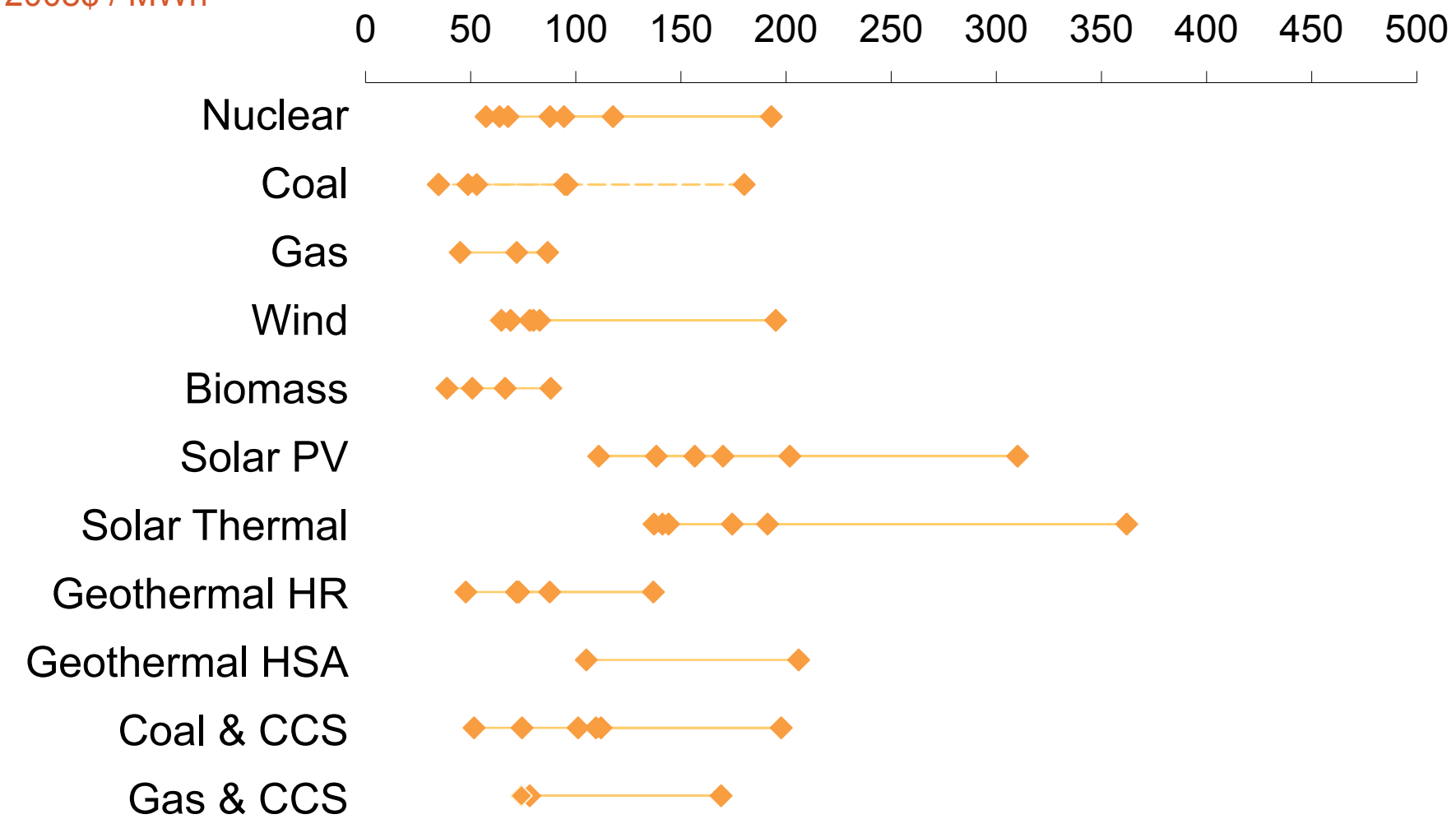


Source: ABARE (2010); ACIL Tasman (2009); EPRI (2009); IEA (2010); MMA (2008); Uranium Mining, Processing and Nuclear Energy Review Taskforce (2006).

– and in the future

Estimates of electricity generation costs 2030

2008$ / MWh



Source: ABARE (2010); ACIL Tasman (2009); EPRI (2009); IEA (2010); MMA (2008); Uranium Mining, Processing and Nuclear Energy Review Taskforce (2006).

When facing uncertainty, the optimal strategy is usually to acquire a number of options, and then exercise the best option when we have more certainty in the future

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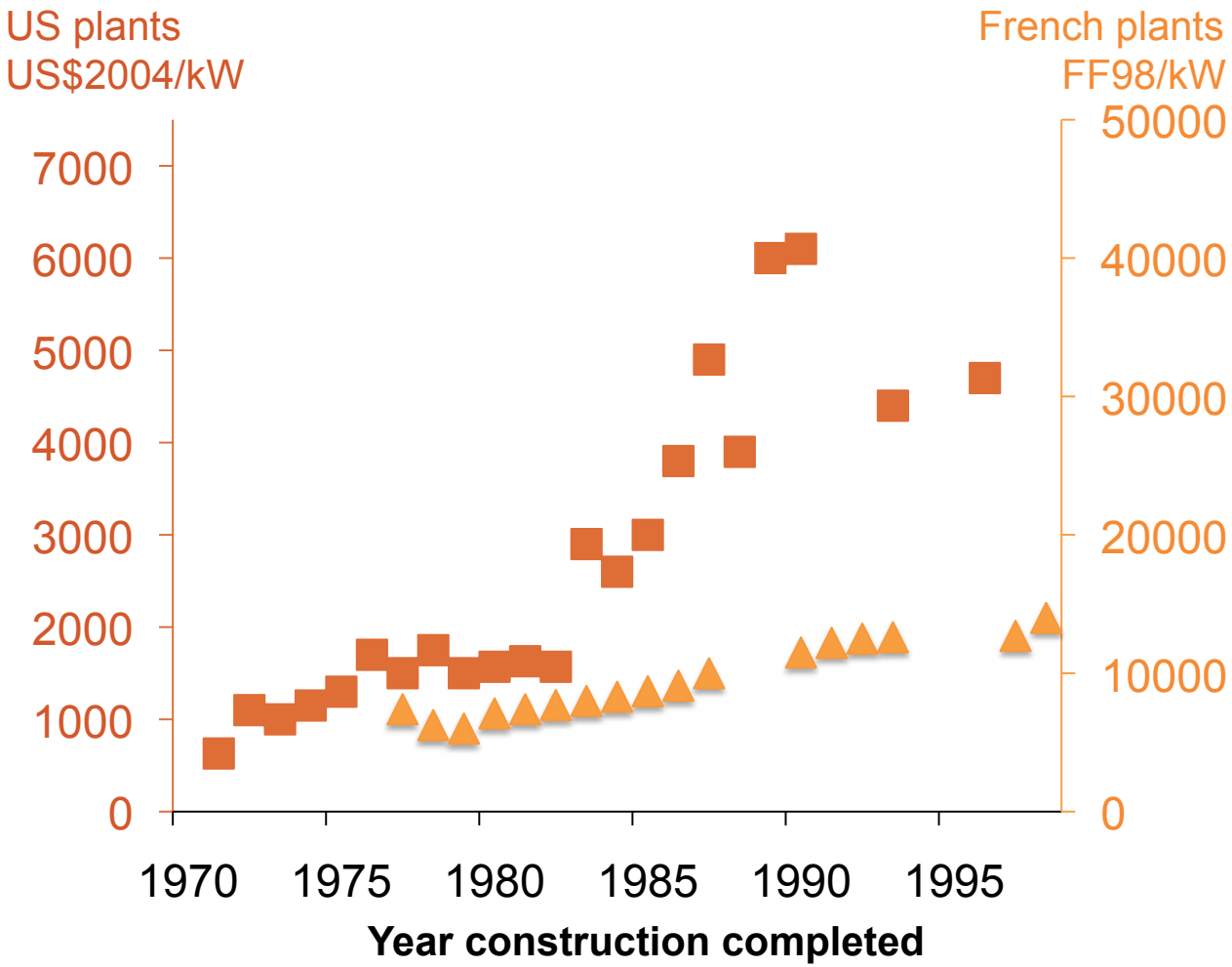
Future costs of nuclear are uncertain - costs have risen over time, and have been variable in the US

Nuclear plant construction costs



In future:

Costs might be higher

- Costs increasing due to rising regulatory requirements
- US costs variable as designs not standardised

Costs might be lower

- Chinese "mass production"

Source: Grubler (2010) The costs of French nuclear scale-up: A case of negative learning by doing

Uranium supplies are uncertain – long-term viability depends on shift to commercially unproven Type 4 reactors, or significant geological finds

On current patterns Uranium supplies are limited

- Known recoverable reserves - 5 million tonnes Uranium
- Current use – 67,000 tonnes / year
- Implies about 70 years' supply

Uncertainties about supply issues

- Demand might increase – but how fast will other countries build reactors?
- Reserves might increase – but we have been looking actively for other minerals that are often associated with Uranium deposits
- Demand may reduce – Type 4 breeder reactors only use 1-10% of the fuel – but will they be economic?

Even with optimistic assumptions, Australia would need to begin an aggressive rollout of near zero electricity generation by 2040

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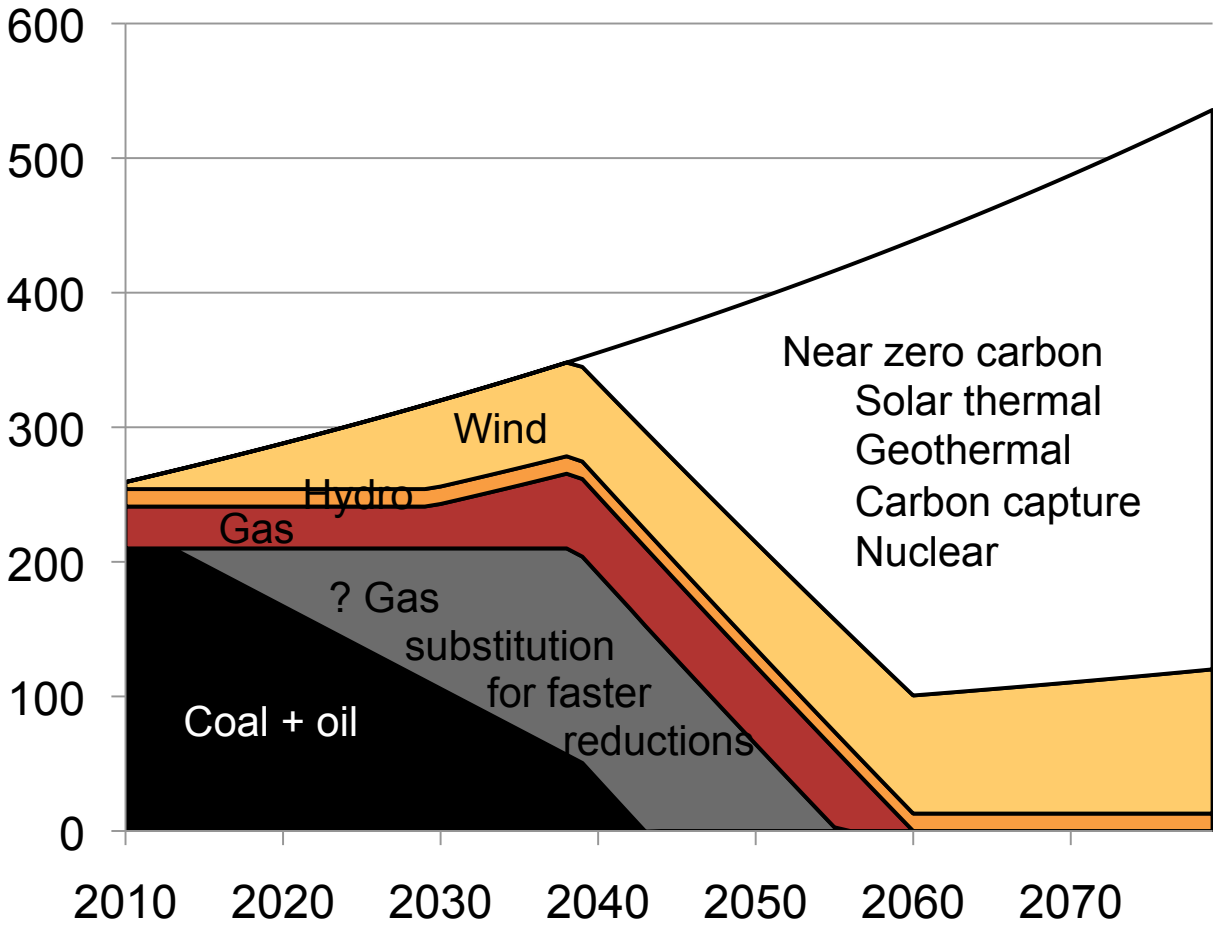
Australian electricity production

000 GWh/yr



Assumptions

- Demand growth as CPRS-5 (1.1% / yr)
- No new coal
- Build wind for all new demand until 20% of supply (➔1.1GW/yr)
- Near zero emissions by 2060
- Build near zero carbon at 3GW capacity/yr, with 60% utilisation

Must start building near zero carbon in earnest by 2040

Note: Simplified Grattan Institute model for illustrative purposes only

Source: Current supply calculated according to Electricity Supply Association of Australia, *Facts in Brief 2010*

Australia is running out of time to acquire a nuclear option as part of this rollout

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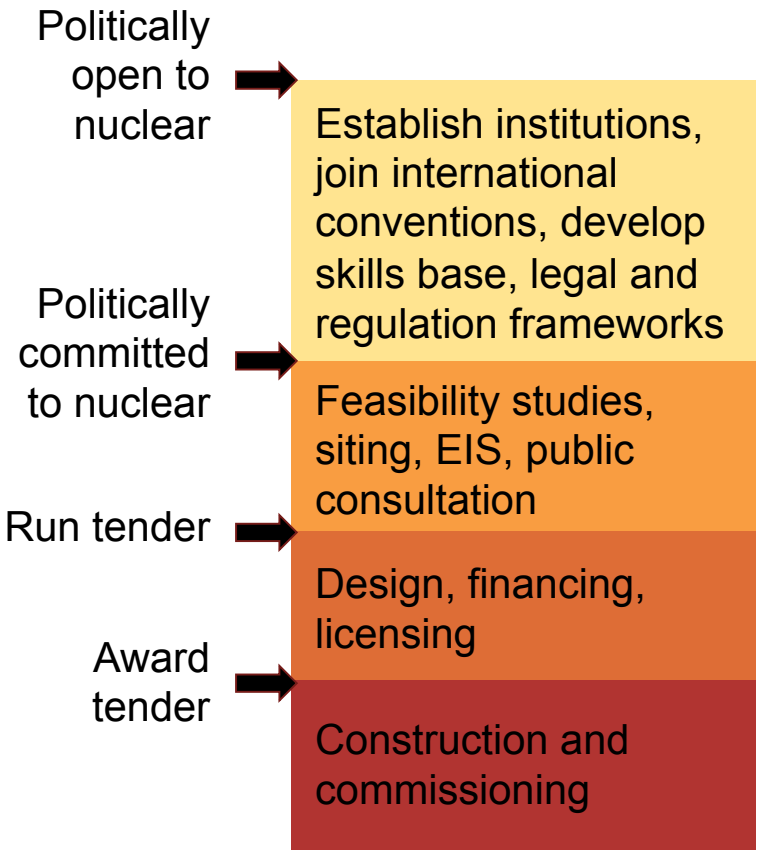
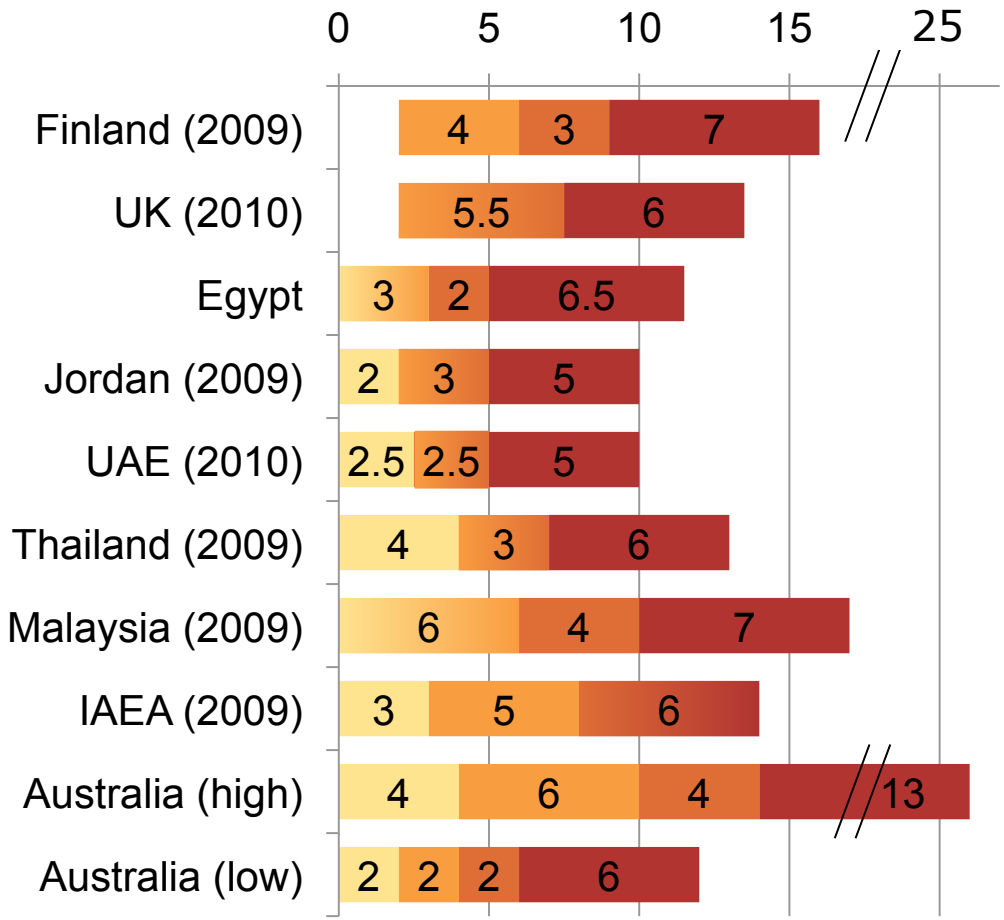
Stages in nuclear power development



Years to commence operation



Note: The extent of **prior work** varies greatly between countries. For instance, in Thailand a nuclear program had been started and then put on hold during the 1980s. In others, such as the UAE, joining conventions and policy development began several years prior to commencement of the official policy. The UK and Finland have operating nuclear sectors

Source: Grattan Institute analysis

On best guess assumptions, Australia cannot count on a nuclear option for roll out towards 2050 emissions targets unless its politicians commit soon to building capabilities

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Maximum possible delay
- Still 0.2t CO2/MWh in 2050
- Roll out 3GW capacity/yr
- 12 yr lead time for nuclear

Best guess
- 0.1t CO2/MWh in 2050
- Roll out 2GW capacity/yr
- 15 yr lead time for nuclear

Plausible crunch
- Near zero carbon by 2050
- Roll out 3GW capacity/yr
- 20 yr lead time for nuclear