# Presentation to Australian Institute of Energy

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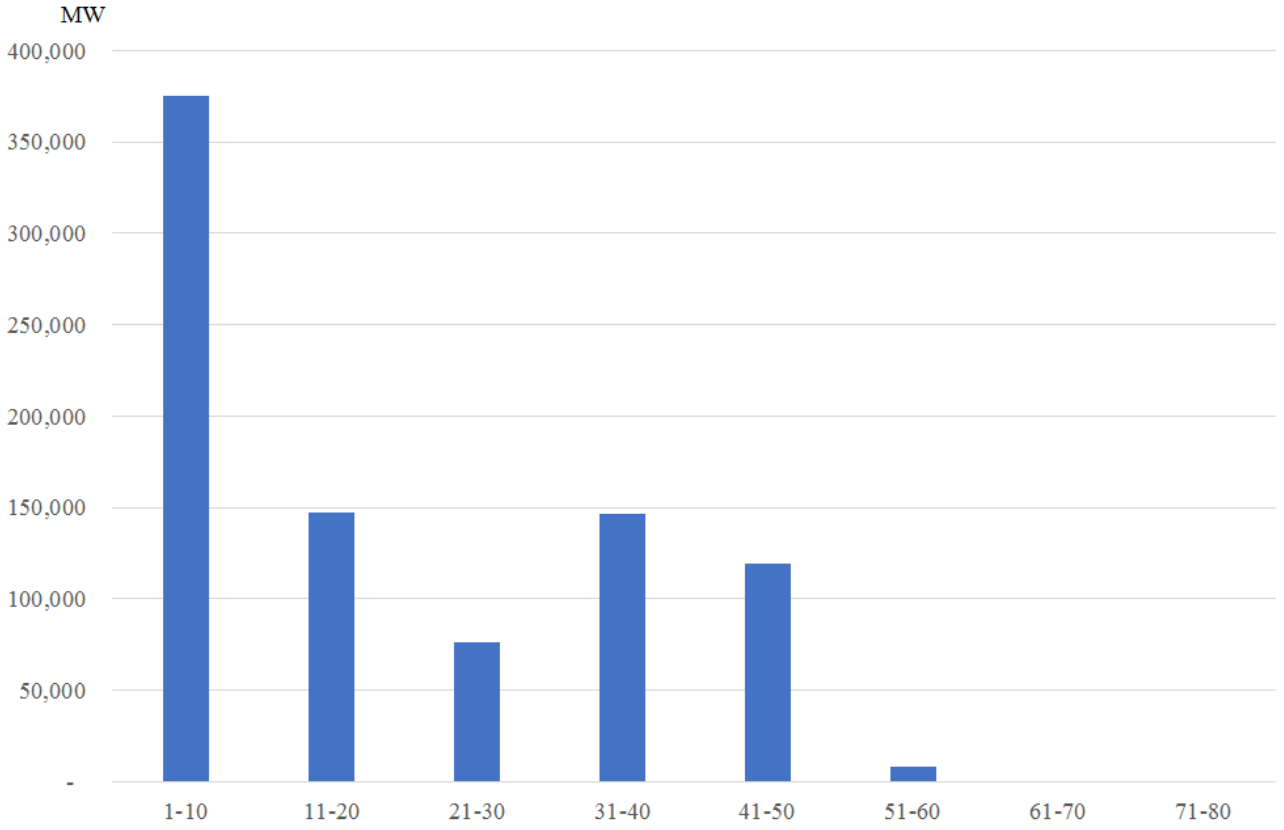
# Future of generation – NSW case study

# Not many power stations operate beyond 50th year

**Internationally, only 1% of power stations in operation are older than 50 years**




Source: EPRI (2017) – excludes China and Russia

# Exit and entry – Australia and the US

**Australian exit has exceeded entry of 'firm' dispatachable capacity since 2013**

| Year of Exit/Entry | Coal Retirements | | Gas Plant Entry | | | Renewables Entry | |
|---|---|---|---|---|---|---|---|
| | No. of plant | Capacity (MW) | No. of plant | Total (MW) | CCGT (MW) | No. of plant | Capacity (MW) |
| 2005-2012 | 2 | 740 | 31 | 8,674 | 2,546 | 112 | 2,640 |
| 2013+ | 9 | 4,656 | 4 | 218 | 52 | 49 | 2,422 |
| Total | 11 | 5,396 | 35 | 8,892 | 2,598 | 161 | 5,062 |
| Av. Age | | 42 years | | | | | |
| Coal-fired generation closure – 18% of fleet | | | | | | | |

Source: Simshauser (2017)

[1] CCGT column is a subset of the total gas capacity column.

# Exit and entry – Australia and the US

**US entry has significantly exceeded exit – largely a function of low cost gas**

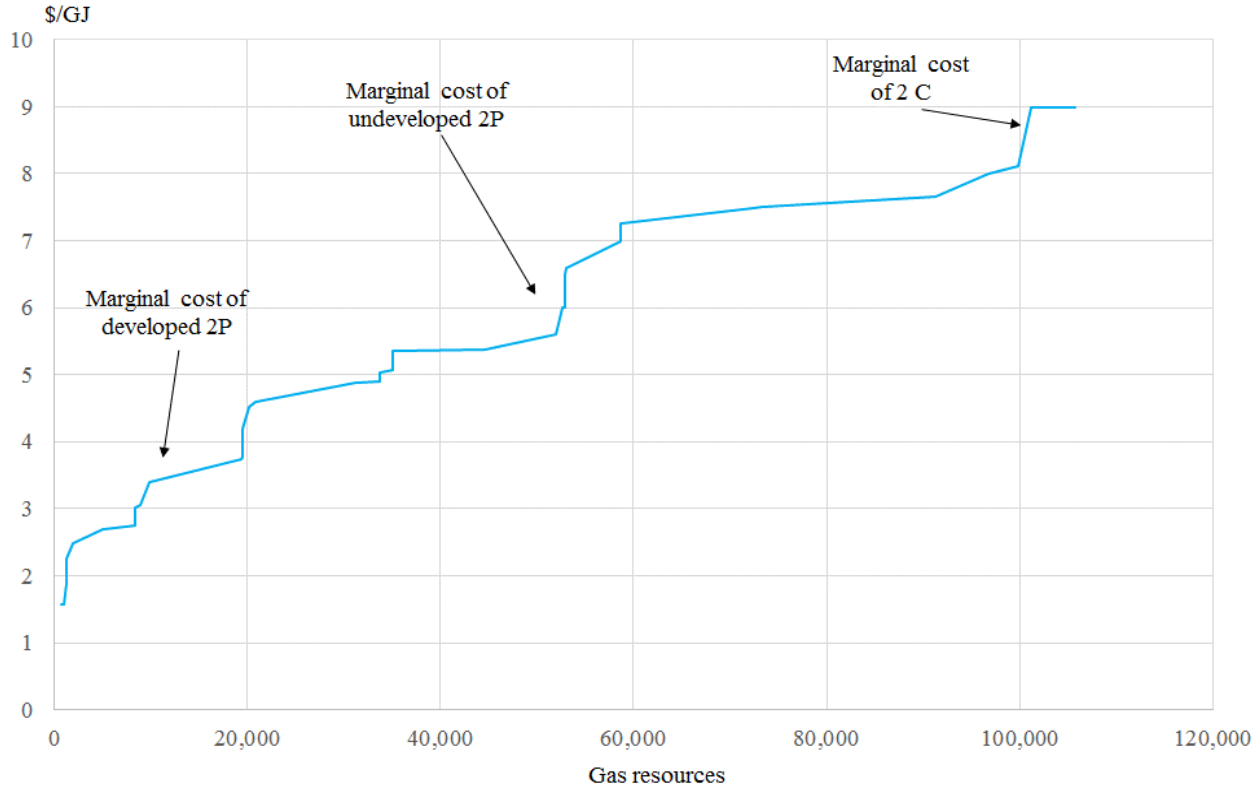
| Year of Exit/Entry | Coal Retirements | | Gas Plant Entry | | | Renewables Entry | |
|---|---|---|---|---|---|---|---|
| | No. of plant | Capacity (MW) | No. of plant | Capacity (MW) | CCGT (MW) | No. of plant | Capacity (MW) |
| 2005-2012 | 245 | 11,257 | 648 | 81,775 | 72,925 | 1,500 | 57,449 |
| 2013+ | 384 | 50,367 | 241 | 36,183 | 14,490 | 2,042 | 44,998 |
| Total | 629 | 61,624 | 889 | 117,958 | 87,416 | 3,542 | 102,447 |
| Av. Age | | 52 years | | | | | |
| Coal-fired generation closure – 18% of fleet | | | | | | | |

Source: Simshauser (2017)

[1] CCGT column is a subset of the total gas capacity column.

# Issues in Australia

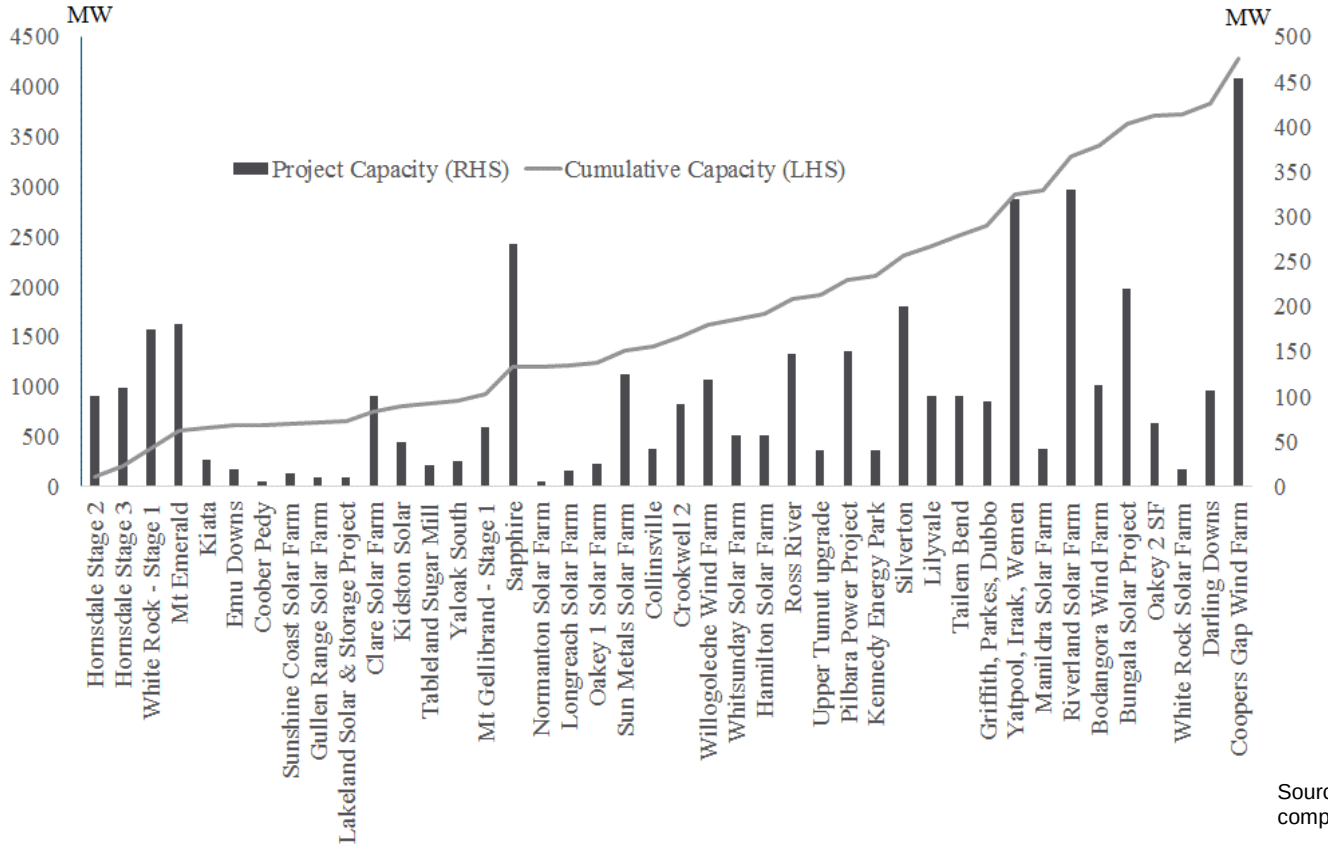
## Policy uncertainty in relation to climate change objectives and issues related to gas supply




Source: Compiled from various companies and AEMO

# But new supply is on the way…..

**Around 4.5 GW of new renewables and some low capacity factor gas is being built**

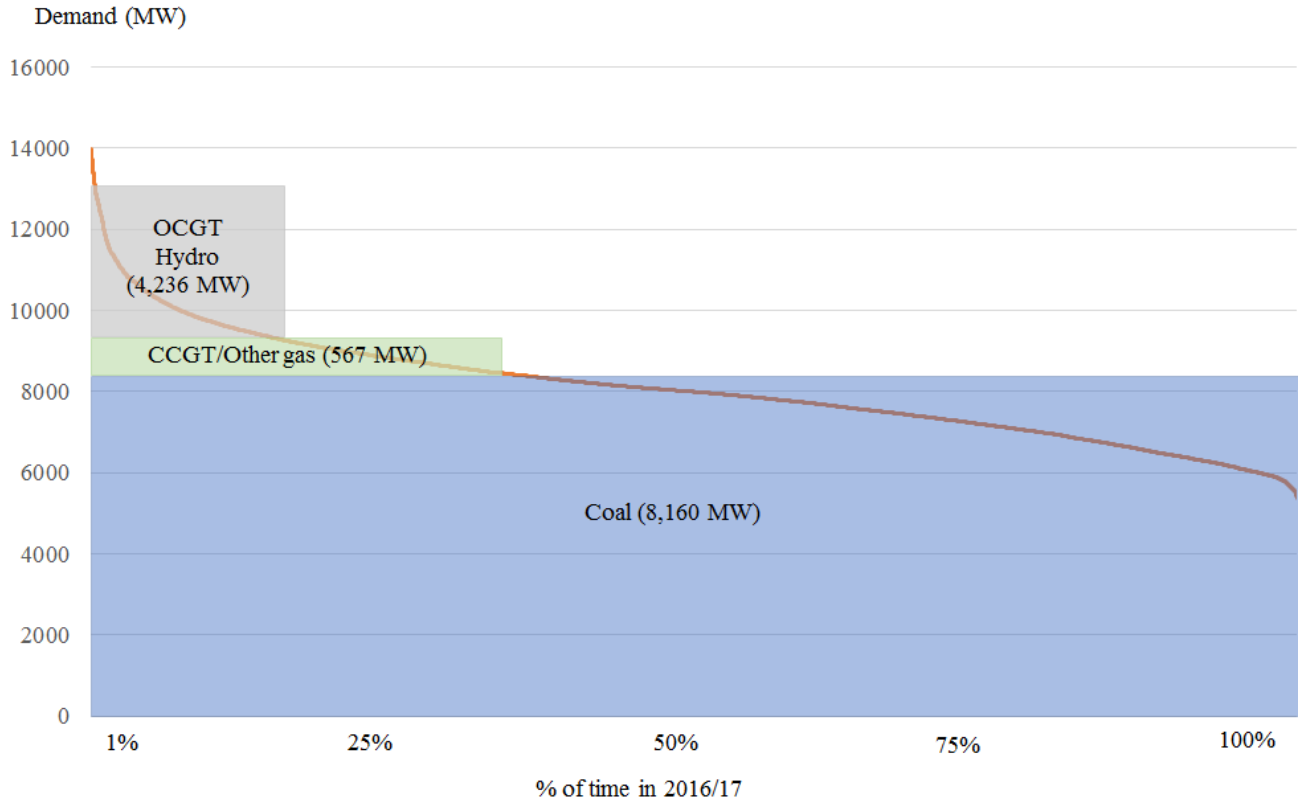



Source: Compiled from various companies and AEMO

# Quick overview of NSW market

# Existing ‘firm’ supply to meet demand

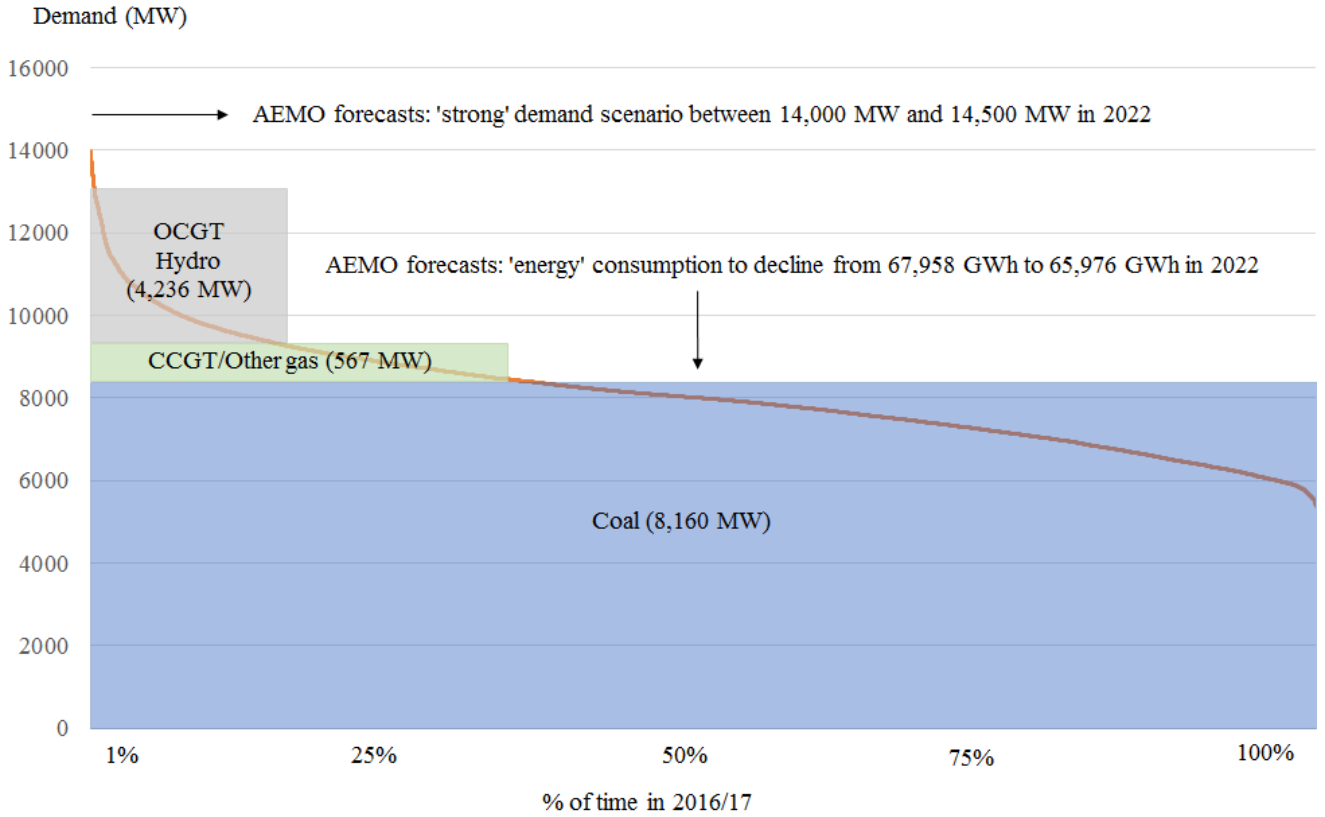
**Without Liddell, existing ‘baseload’ and ‘intermediate’ plant is adequate but more peaking plant is required**




Source: AEMO

# Existing ‘firm’ supply to meet demand

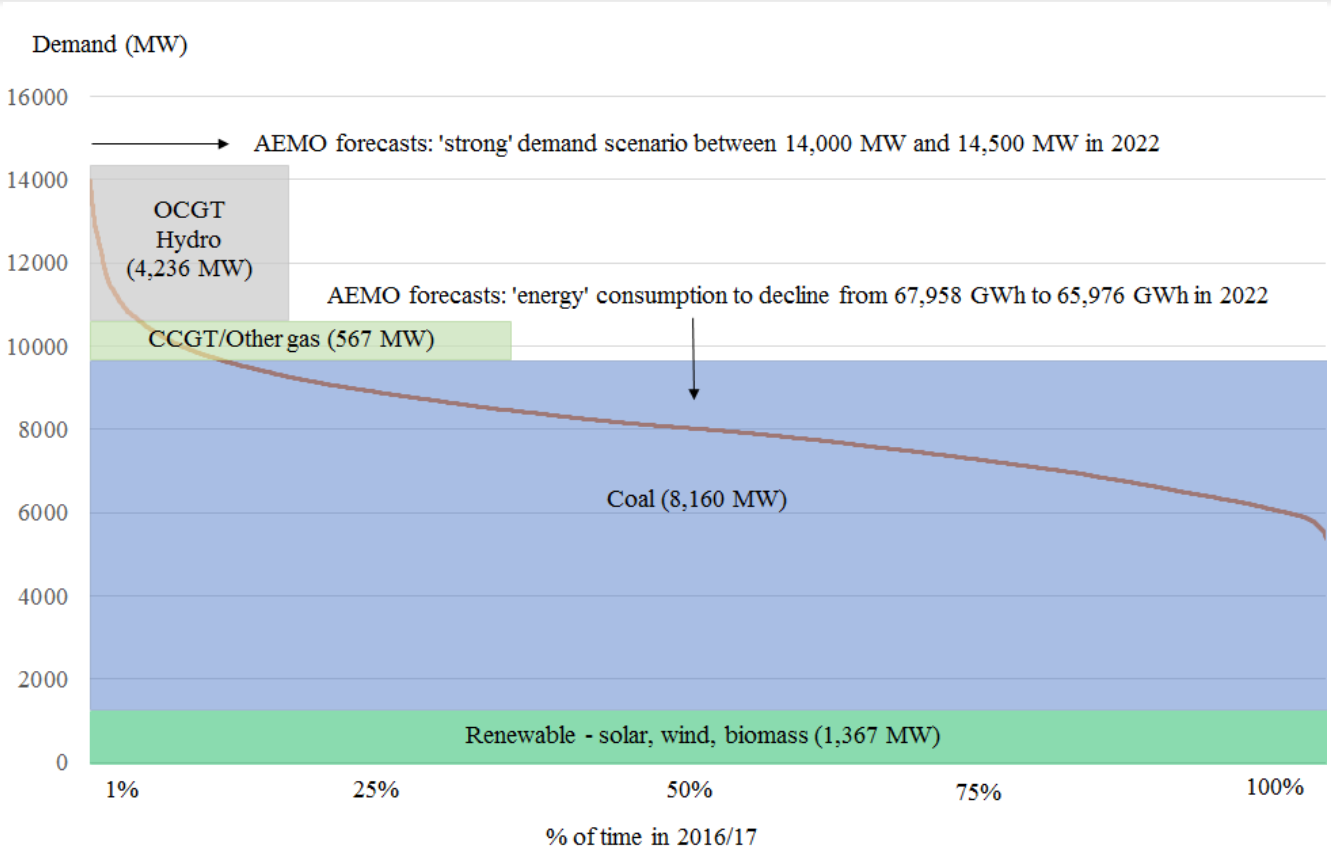
**With peak demand growth and underlying consumption declining, still mainly a requirement for ‘peaking’ capacity**




Source: AEMO

# And then there is renewable energy

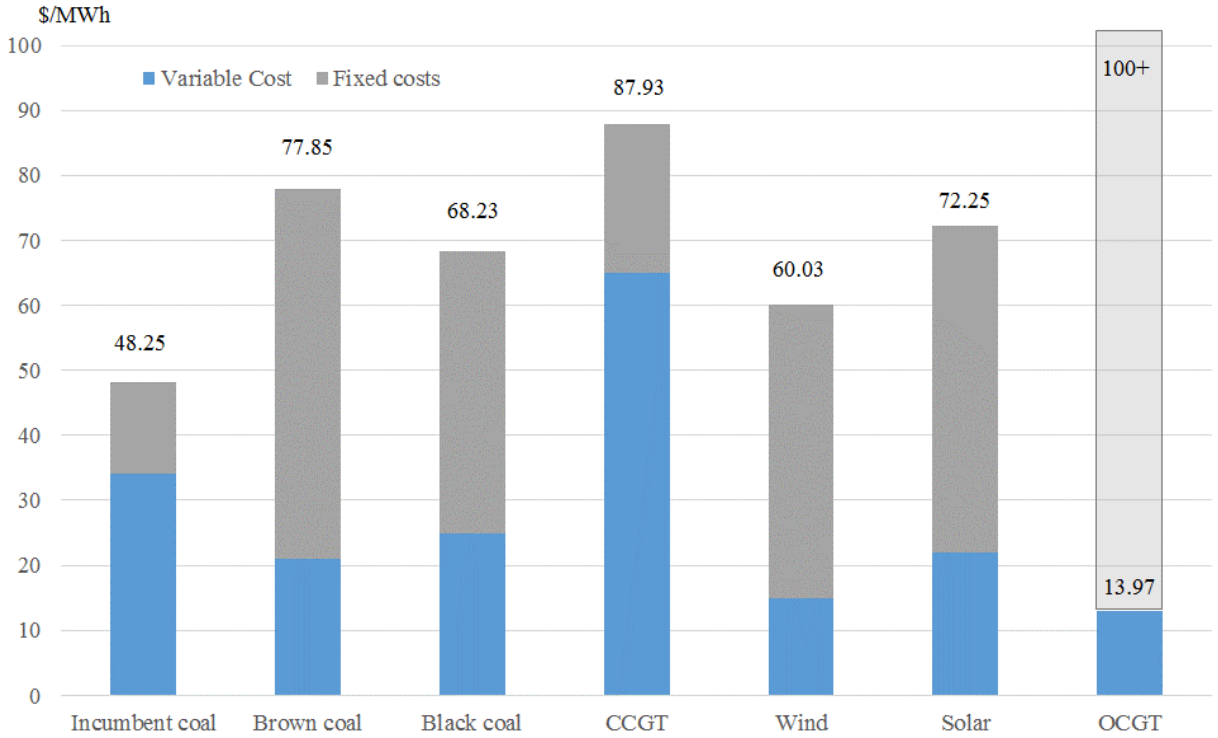
**Renewable energy is not 'firm' but still provides energy (in a market with declining *energy* consumption)**




Source: AEMO

# Cost of building and operating power stations

**Renewables are increasingly cost-competitive with traditional 'thermal' sources such as coal and gas**




Source: Simshauser (2017)

# Optimal plant mix results

**Given *energy* consumption forecast to decline and new renewables providing more energy, peaking capacity required**

| Category | Optimal | Actual (2022) | Imbalance | Weighting |
|---|---|---|---|---|
| Baseload | 7,295 | 8,160 | 865 | overweight |
| Intermediate | 1,669 | 567 | -1,102 | underweight |
| Peaking | 5,022 | 4,236 | -786 | underweight |
| | 13,986 | 12,963 | -1,023 | |

[1] This assumes no new investment apart from plant under construction. It also assumes Liddell power station is closed.

# So what can we conclude?

# Some observations….

**Not all dispatchable plant is also flexible**

1. Renewable energy provides the lowest *long-run marginal cost* of 'energy'
2. But as renewables begin production, they require complementary firm 'capacity'
3. In the short-term, existing coal-fired units can provide some 'flex'
4. But while dispatchable, coal is not as 'flexible' as gas or hydro
5. In the medium-term, an 'optimal plant mix' is likely to transition to gas-fired peaking units and demand response
6. Gas-fired peaking units provide 'capacity' but not significant volumes of 'energy'
7. In the long-term, renewable energy is likely to be complemented by pumped hydro and battery storage to allow energy to be consumed at times when it is needed

# National Energy Guarantee

**Some opportunities…..**

1. Consideration of the NEG is driving new solutions for overcoming issues related to renewables not participating in contract market.
2. Additional new capacity investment may be driven by the reliability obligation.
3. Demand response likely to be most cost effective solution for extreme low probability but very high consequence events (e.g. POE10 etc).

# Contact

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