CLIMATE COUNCIL

LIGHTS OUT:
AGEING COAL AND SUMMER BLACKOUTS

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Hotter summers and ageing coal generators are ramping up blackout risk.

While most Australian power outages are caused by network issues – e.g. problems with poles and wires – the Australian Energy Market Operator (AEMO) has forecast increasing risks to energy reliability in future.

New analysis from Baringa, commissioned by the Climate Council, has found that the majority of our coal capacity is over 40 years old, and the ability of our generators to reliably produce electricity has dropped off dramatically.

The analysis also found that coal outages have been a primary driver of power outage warnings in recent years (particularly during summer), as well as contributing to some of the most severe price spikes.

As our coal generators continue to age and shut down, investment in replacement capacity – both renewable power and flexible storage – is critical. Storage capacity is booming and big 'shock absorber' batteries are already playing a significant role in grid security.

As the world reels from its hottest year on record in 2024, and Australia stares down the barrel of another brutally hot summer, **the writing is on the wall for coal: it's on the way out, and we need to replace it fast.**

KEY INSIGHTS

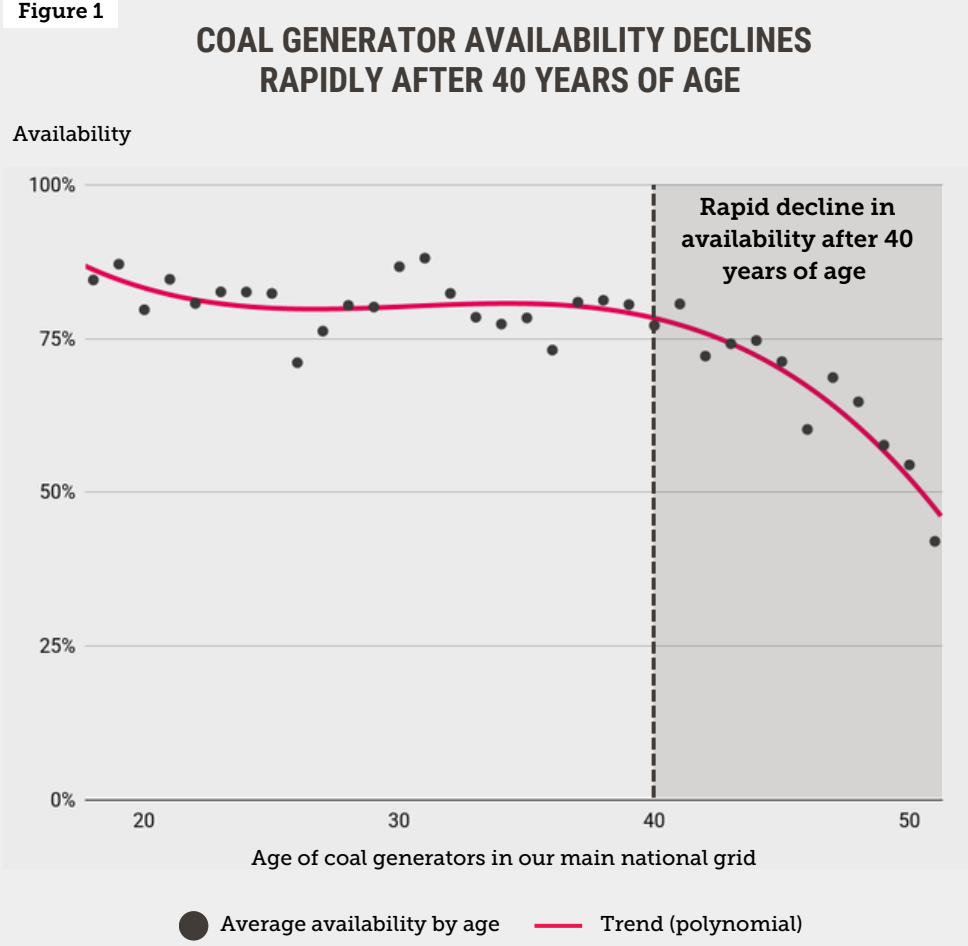
- The majority (**more than 60%**) of coal capacity in our main grid is **older than 40 years**, with some generators operating since the 1970s.
- A coal generator's **availability to produce electricity** begins to decline from 40 years old, decreasing from **81% to 65% on average.**
- Over the past four years, coal power has been **significantly less available** during periods of increased power outage risk than under typical conditions.
- During periods with the **greatest power outage risk** (LOR 3), coal availability has been **10-20% lower** than typical periods.
- The majority of **recent power outage risk conditions** have occurred in **NSW & QLD**, the states most dependent on coal generators.
- Coal outages have played the **largest role in power outage risk conditions in NSW & VIC**, the states with the oldest coal generators.
- During summer (November to March), **hot weather** and **unplanned coal outages** are key drivers of power outage risk.
- Four of the **most severe price spikes** in the past seven years were driven by **unplanned coal outages**.
- **Batteries have already taken over from coal** as the primary source of '**frequency services**': a rapid injection or reduction of electricity into the grid to balance supply and demand.

KEY FINDING 1

Australia's coal fleet is old and getting more unreliable.

- The majority (more than 60%) of the coal capacity in our main national grid is older than 40 years, with some generators in operation since the 1970s.
- Analysis of electricity market data from the past decade shows that a coal generator's availability to produce electricity drops dramatically from 40 years of age, decreasing from 81% to 65% on average.
- The Australian Energy Market Operator's modelling finds all coal generators in our main national grid will shut down by 2038.[1]
- As coal generators continue to age and shut down, investment in replacement capacity – both renewable power and flexible storage – is critical.

Figure 1



Note: Availability refers to the amount of electricity supply offered by coal generators, as a share of their maximum total supply. Trend line based on a third-degree polynomial.

[1] *In the most likely (Step Change) scenario*

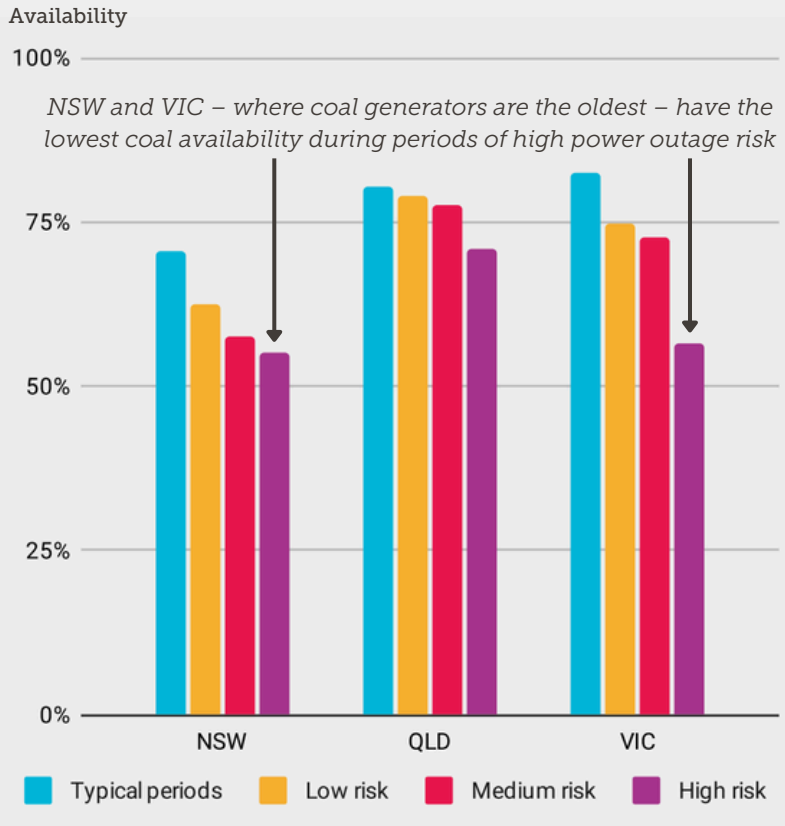
KEY FINDING 2

Coal outages are a primary driver of power outage risk, particularly in New South Wales and Victoria.

- When the Australian Energy Market Operator finds a risk of power demand exceeding supply, it will flag 'Lack of Reserve' (LOR) conditions, meaning an elevated risk of a power outage.
- From 2021-2024, coal power has been significantly less available during periods of increased power outage risk.
- During periods with high power outage risk (LOR 3), coal availability has been 10-20% lower than is typical.
- The majority of recent power outage risk conditions have occurred in New South Wales and Queensland – the states most dependent on coal generators.
- Coal outages have played the largest role in power outage risk conditions in New South Wales and Victoria – the states dependent on the oldest coal generators.
- During the summer months (November to March), high power demand due to hot weather is a key driver of power outage risk, along with unplanned coal outages.
- Summer 2024-25 has already been particularly hot, with very high power demand during heatwaves. Our unreliable and ageing coal fleet is risking reliability during these peak periods.

Figure 2

WHEN POWER OUTAGE RISK IS HIGHEST, COAL IS LESS AVAILABLE



Note: Low risk = LOR 1; medium risk = LOR 2; high risk = LOR 3.

KEY FINDING 3

Coal outages have contributed to some of the most severe price spikes in recent years.

- Sudden electricity price spikes have often coincided with unplanned coal generator outages in recent years.
- These price spikes ultimately flow back to consumers through higher retail prices.
- Four of the most severe price spikes (on a monthly average basis) in the past seven years were driven by unplanned coal outages:
    - In January 2019, the partial loss of Yallourn coal power station in VIC led to tight system conditions and high prices.
    - In May 2021, an explosion at Callide coal power station in QLD caused several other generators to trip offline, reducing supply and increasing prices.
    - In June 2022, high power demand coincided with high gas prices, high coal prices, coal supply chain issues, and coal generator outages.
    - In May 2024, network outages and unplanned outages at the Eraring and Vales Point coal generators led to high prices, especially in NSW.

KEY FINDING 4

Ageing coal generators can be replaced with big batteries and other storage that complement wind and solar to provide reliable renewable power 24/7.

- Battery storage is booming in Australia: battery capacity has more than doubled in the past three years, and is expected to grow at least seven-fold by 2030.
- Batteries have already taken over from coal as the primary source of 'frequency services': a rapid injection or reduction of electricity into the grid to balance supply and demand.
- Baringa's independent projections show that an energy system powered by wind and solar, backed by batteries, pumped hydro and other flexible technologies, can reliably meet our energy needs.
- Both large-scale and rooftop solar are expected to meet most of our electricity needs during the daytime, with a mix of wind and storage providing the majority of generation once the sun goes down.

KEY FINDING 5

Batteries are already playing a significant role in grid security, and will increasingly support reliability.

- Batteries can switch on and off very quickly, meaning they can provide or remove power from the grid within seconds to help balance supply and demand.
- Batteries have been available to provide power during periods of high demand, and will play an increasing role in future, with battery storage capacity expected to increase seven-fold by 2030.
- For example, when heatwave conditions coincided with outages at four of NSW's 12 coal power units in November 2024, the Australian Energy Market Operator called on batteries to be on standby throughout the day.
- Batteries provided a fallback supply option, making over 80 to 90% of their capacity available for a rapid response if other generators became unavailable.
- As more batteries come online in NSW and around Australia, this ability to 'show up' with strong availability when needed is expected to expand, helping to bolster reliability and ensure a stable, secure electricity supply for households and businesses.

APPENDIX

Image credits:

- Cover: 'Coal power plant' by MartinLisner from Getty Images via Canva
- Key finding 3: 'Worried Senior Couple' by Monkey Business Images via Canva
- Key finding 4: 'Renewable Energy Systems Engineering' by serts from Getty Images via Canva
- Key finding 5: The Waratah Super Battery on the Central Coast of NSW via Consolidated Power Projects.

Baringa analysis:

The original analysis commissioned from Baringa to inform this briefing paper can be found here.