***Assessing Coal plant exit trajectories for australia***

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## Overview

This study provides an empirical assessment of the economic viability of existing coal fired power stations under increasing competition from renewable energy sources. It is applied to Australia; the underlying issues are similar in many other countries, and the methods used for our analysis would be applicable elsewhere.

Australia's coal fired power plant fleet is relatively old with about half the plants and about two thirds of overall generating capacity older than 30 years. At the same time, wind and solar PV power have become cost competitive, and Australia has enromous renewable energy opportunities. New coal fired power stations would not be commercially viable in competition with renewables, and practically the entire investment pipeline in new generating capacity consists of renewable power installations.

Existing coal plants are coming under increasing economic pressure as the amount of renewable electricity generation increases, both because the additional supply tends to reduce wholesale prices and because capacity utilisation factors of coal plants is reduced as renewables fulfil a greater share of electricity demand. There will also be increasing need for coal plants to follow residual load by ramping production, increasing wear and tear as well as running costs. These factors are likely to result in accelerated closure of coal fired power plants. Exit of individual power stations could come suddenly, as it has with several of Australia’s plants in the past, for example when major repairs become necessary.

Sudden coal plant exit disrupts electricity markets as it takes time to bring replacement investment on the grid, and is detrimental to local communities and regional economies as time is insufficient to prepare for job losses. The potential speed and sequence of coal plant exits is therefore a burning question for the energy industry, governments and communities.

Key factors for the speed of the transition from coal to renewables are the levelized cost of electricity from new renewables installations, including effects of any policy support; pricing of carbon emissions or other externalities and other regulation; changes in coal prices; capacity utilisation factors that fall as renewable penetration increases (Seel et al 2018); and timing and costs of major refurbishment and repairs.

## Methods

We provide a plant-by-plant and year-by-year analysis of future economic viability of the 16 remaining coal fired power stations in Australia’s National Electricity Market, under a range of scenarios for key variables. These include trajectories and scenarios for future wholesale prices, influenced by the cost of new renewable energy installations; carbon pricing; coal prices faced by individual plants; capacity factors; and scheduled refurbishment points and costs.

Our analysis assesses the economic viability of continued operation of each plant at each point in time, proxied by the expected discounted future cashflow at that point in time, and using latest available data for each plant (including from AEMO 2018).

This allows us to construct a large number of scenarios for timing of exit of Australia’s coal plants, assuming that exit were to occur at the point in time when continued operation is not expected to be profitable. It also allows an assessment of the likely relative importance of the different factors impacting the speed of coal-to-renewables transition.

## Results

Our analysis shows that under plausible assumptions, most of Australia’s coal fired power stations would become unprofitable well before reaching their design lifetime (typically taken to be 50 years) and sooner than the average age of closure of the ten coal power stations closed so far (40 years). Australia could conceivably see a wave of coal fired power station closures in the 2020s and early 2030s, with capacity replaced by renewables backed by energy storage. This would mean much lower emissions from the power sector and would allow significant reductions in national emissions. But it would also mean significant local and national adjustment pressures, sooner than generally anticipated in the Australian energy debate.

We find that carbon prices could have a large effect on timing of coal transition, with a shift from the current zero effective carbon price to a price at the EU ETS level turning many plants unprofitable immediately. We also find that plausible continued reductions in wholesale prices and capacity factors, both driven by the continued addition of wind and solar power, could depress revenue to force relatively rapid coal plant exit even with a low or no carbon price. Typically, plants turn unprofitable when refurbishment or major repair becomes necessary, which may lead to operators to run plants into the ground.

[Final quantitative results still under development, can be provided later]

## Conclusions

The prospect of many coal plants becoming unprofitable potentially relatively quickly and in quick succession calls for a strategy to facilitate orderly exit. Such a strategy should foster predictability, to aid with replacement investments and preparation of local communities. This could mean a roadmap for closure of coal plants, implemented through a mechanism to provide incentives to plant owners to exit the market at agreed points in time (building on Jotzo and Mazouz 2015). It also means that Australia may be able to achieve more ambitious emissons targets by 2030, less onerously than previously thought.

Insights from the Australian experience have direct relevance for other energy markets where renewable power is cheap and plentiful, where coal plays a big role in electricity supply, and where coal plants are owned and operated by private companies.

## References

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