ENERGY & RESOURCE INSIGHTS

Research Note:

Coal Power Closure under AEMO's 2022 Integrated System Plan

August 2022

Overview

- The Australian Energy Market Operator's (AEMO) Integrated System Plan (ISP) 2022 provides the latest roadmap for the transformation of Australia's National Electricity Market to 2050. The ISP included data on forecast coal generation capacity and closure.
- Coal retirement is expected to happen two to three times as fast as is currently scheduled. Under the Step Change scenario, all brown coal and two-thirds of black coal will retire by 2032. Under the more ambitious Hydrogen Superpower scenario (the only scenario aligned with the goal of the Paris Agreement to limit warming to 1.5 degrees) all coal is forecast to be closed by the end of 2031. (The United Nations Secretary-General and the International Energy Agency have made it clear Australia must close coal power stations by 2030 to align with the Paris Agreement on climate change.)
- ERI has undertaken an analysis of AMEO published data and determined the modelled ISP closure dates of each coal power unit in the National Energy Market. This reveals that:
    - In Victoria, the currently expected closure dates for Loy Yang A & Loy Yang B most exceed their likely lifetimes. These power stations will close 15 years earlier if the NEM transforms in a way that is aligned with the Step Change Scenario.
    - In Queensland, under the Step Change scenario, the State's nine coal power stations would close an average of nine years earlier than is currently expected.

The Integrated System Plan

AEMO's 2022 Integrated System Plan (ISP) is the market operator's latest roadmap for the future of Australia's National Electricity Market (NEM). Produced as part of fulfilling AEMO's function as National Transmission Planner, the ISP represents our most current, comprehensive forecast of how the "system of systems" that is the NEM is likely to change in coming decades. This short briefing note explores what insights can be gleaned from the ISP regarding the fate of Australia's coal power stations.

The ISP contains four different scenarios exploring how generation, transmission and demand for electricity could change between now and 2050. These scenarios set out different pathways for the development of the NEM, considering many factors including emission reduction ambition, electricity demand, and decentralisation. All scenarios considered as context existing policy commitments such as Australia's 2050 net zero target.

The ISP is produced over a two-year cycle. Reflecting the pace of change in this space, by the time the final version was published two of the scenarios had already been rendered obsolete: those representing futures with the least transformative change motivated by action on climate change. The two remaining scenarios are:

- **Step Change** – compatible with global efforts to limit warming to less than 2 °C above pre-industrial levels, includes a fast-paced transition to renewables, closely aligned with Australia's recent NDC update to 43% emissions reduction below 2005 levels. This scenario focuses on energy efficiency, high levels of distributed energy resources, and high levels of electrification of transport and heating. Industrial electricity demand doubles as gas and other fuels are phased out to aid decarbonisation.
- **Hydrogen Superpower** – more closely aligned to global efforts to limit warming to 1.5 °C. Australia transforms its energy system even more rapidly and electricity demand quadruples to support a hydrogen export industry.

The Step Change scenario is effectively the ISP's central scenario, considered by the majority of those consulted by AEMO as most closely representing the likely pathway for the development of Australia's electricity system in the coming decades. This briefing note examines the role of coal generation under both this and the more ambitious Hydrogen Superpower scenario.

Modelling the NEM

As part of the ISP's development, AEMO conducts a complex modelling exercise exploring several ways the NEM could develop under each scenario. It then undertakes a cost-benefit analysis to determine the optimal development pathway which maximises benefits for consumers.

The timing of the closure of large, legacy thermal generation (mainly coal) is modelled as part of the capacity outlook model. In this, AEMO uses two approaches: a single-stage long-term model (SSLT) that optimises all the way to 2050 and a detailed long-term model that optimises over sequential, shorter time periods. Both modelling approaches are used to explore and determine when existing generators will retire. For time periods where the scenarios do not have an explicit decarbonisation constraint, the primary driver of closure is financial losses under forecast future wholesale electricity prices.

For each scenario, AEMO uses the SSLT model to determine the trajectory of coal retirement and aggregate capacity to be retired in each region. Then, for each modelled year, AEMO develops an order of coal power station closure based on known closure date information provided by power station owners. By considering the total capacity reduction required against the ordered list of coal power stations, the units to be closed are then identified. Units remain open unless 50% or more of their capacity must close to meet the total cumulative closure required.

Timing of Coal Closure

The graph below presents the coal capacity remaining in the NEM under each of the two scenarios, compared to the capacity that would remain operational based on closure dates in AEMO's Generating Unit Expected Closure Year dataset (which is a mixture of announced closure dates and assumed technical lives) [1].

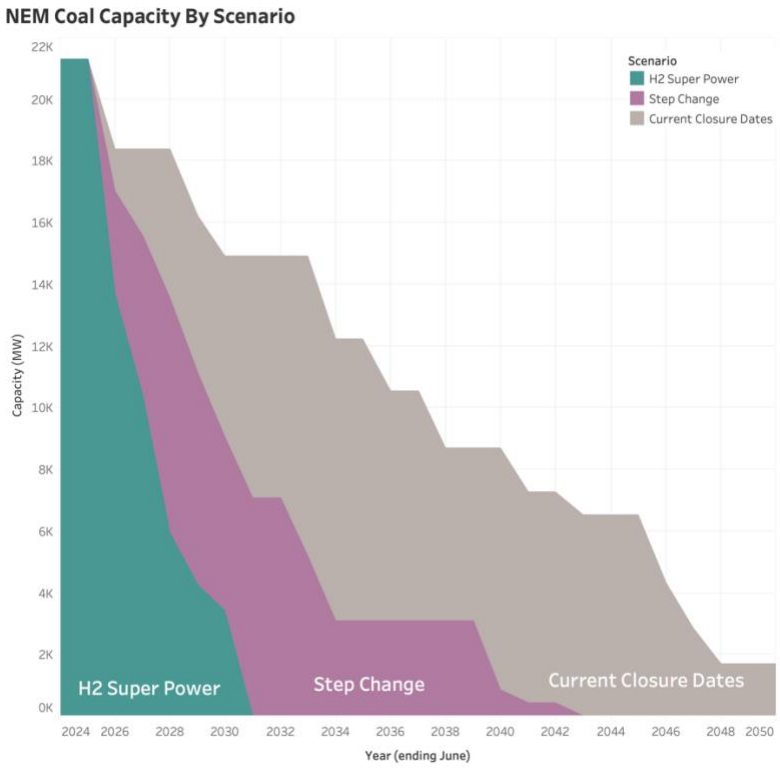

Figure 1 - NEM Coal Generation Capacity by ISP Scenario

The pace of coal power station closure is much more rapid under both ISP scenarios than when modelled based on currently reported closure dates and technical life data proved to AEMO by power station owners.

AEMO also published forecast state-level coal capacity under each scenario. This is presented in the following two graphs, again compared to the currently reported closure date and technical life data provided to AEMO by power station owners (opaque lines).

[1] AEMO (2022) Generating Unit Expected Closure Year dataset - July 2022

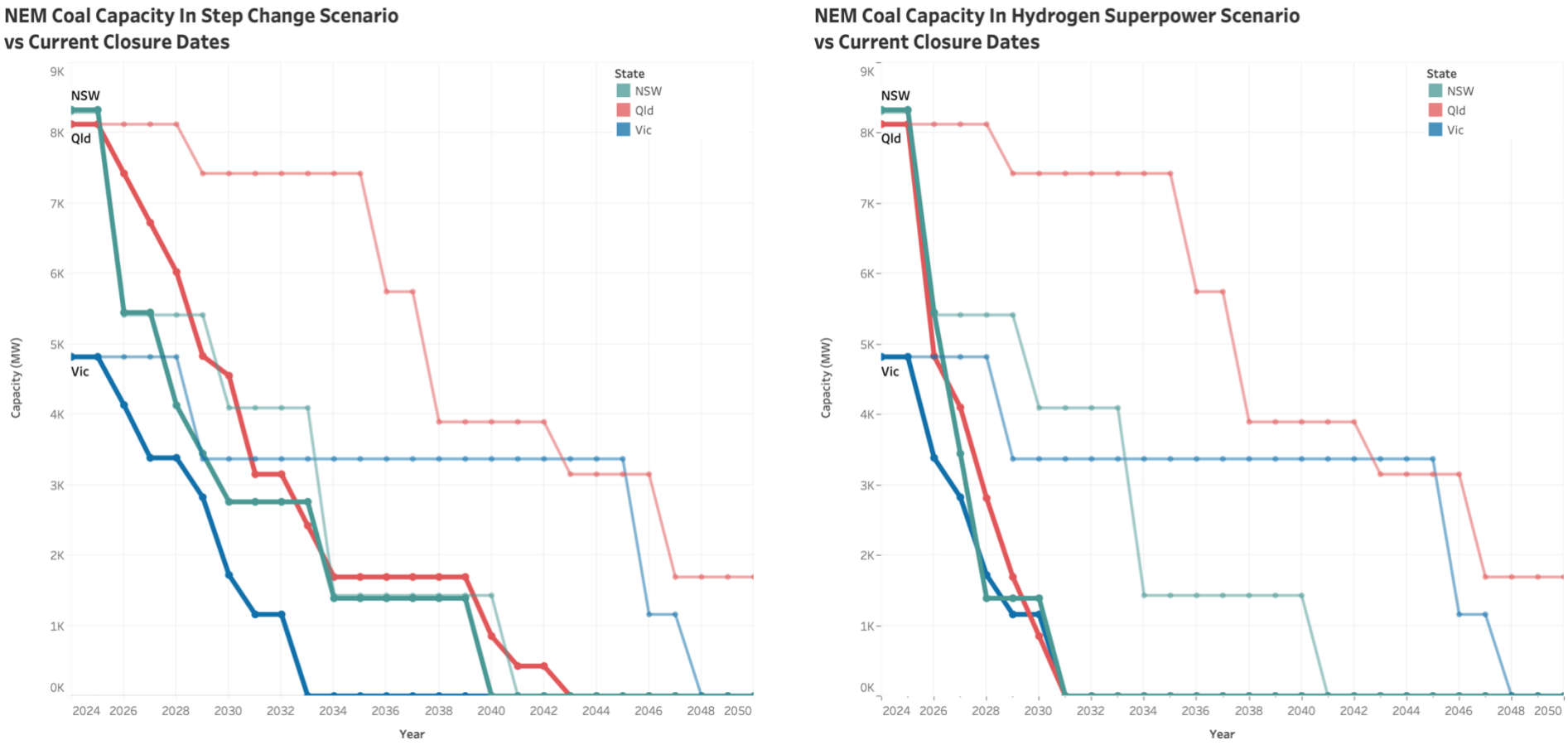

Figure 2 – NEM State-Level Coal Capacity over Time by ISP Scenario

AEMO chose not to publish the closure dates it had modelled for individual coal power stations. However, it is possible to deduce this information by fitting the published state-level coal capacity time-series data to a closure schedule generated using AEMO's published modelling methodology, the Generating Unit Expected Closure Year dataset and the known nameplate capacity of each coal generating unit.

The table and graphs below present the findings of this fitting exercise. An exact match was achieved for both scenarios with the order of coal closure within each state matching the closure sequence order in the Expected Closure Year dataset, with one exception. In the Step Change scenario, it was found that Gladstone is forecast to remain open later than Tarong, Tarong North and Kogan Creek despite their current expected closure years being later than Gladstone's.

As can be seen, in the case of the Step change scenario the closure years for NSW coal power stations remain largely unchanged from those currently expected. In Queensland, power station closures are brought forward very significantly from the currently expected dates: by an average of 9 years (range: 3 - 15 years) across the largest fleet in the NEM of just over 8,000MW.

In Victoria, the closure of both Loy Yang A and B occurs 10 to 15 years earlier than the dates currently expected. This is the largest and most significant variation from the ISP Step Change scenario.

Power Station	State	Capacity (MW)	AEMO expected closure year	Step change		Hydrogen Superpower	
				ISP 2022 unit closure schedule	Change in closure year	ISP 2022 unit closure schedule	Change in closure year
Bayswater	NSW	2,665	2033	2028, 2029, 2 x **2033**	0	2026, 3 x **2027**	6
Eraring	NSW	2,880	2025	4 x **2025**	0	4 x **2025**	0
Liddell	NSW	2,000	2023	2022, 3 x **2023**	0	2022, 3 x **2023**	0
Mt Piper	NSW	1,430	2040	2 x **2039**	1	2 x **2030**	10
Vales Point	NSW	1,320	2029	2 x **2027**	2	2 x **2025**	4
Callide B	Qld	700	2028	2 x **2025**	3	2 x **2025**	3
Callide C	Qld	840	2051	2 x **2039**	12	2 x **2029**	22
Gladstone	Qld	1,680	2035	2029, 5 x **2030**	5	2 x 2027, 4 x **2028**	7
Kogan Creek	Qld	744	2042	**2028**	14	**2025**	17
Millmerran	Qld	852	2051	2040, **2042**	9	2 x **2030**	21
Stanwell	Qld	1,460	2046	2 x 2032, 2 x **2033**	13	2 x 2026, 2 x **2027**	19
Tarong	Qld	1,400	2037	2 x 2026, 2 x **2027**	10	4 x **2025**	12
Tarong North	Qld	450	2037	**2028**	9	**2025**	12
Loy Yang A	Vic	2,210	2045	2028, 2 x 2029 & **2030**	15	2026, 2 x 2027, **2028**	17
Loy Yang B	Vic	1,160	2047	2 x **2032**	15	2 x **2030**	17
Yallourn	Vic	1,450	2028	2 x 2025, 2 x **2026**	2	4 x **2025**	3

Table 1 - Coal Power Station Closure Dates by ISP Scenario

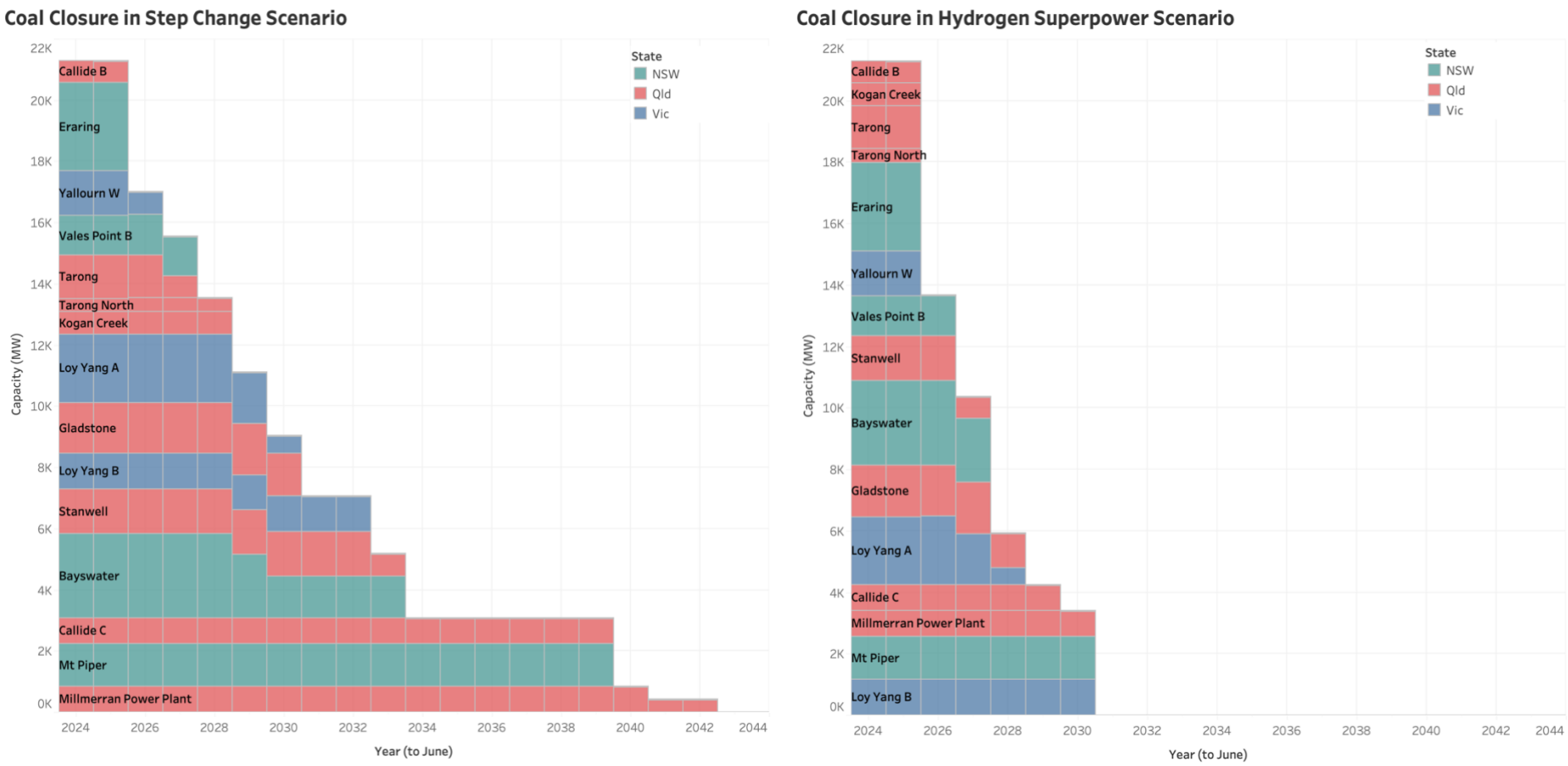

Figure 3 – NEM Coal Power Station Closure by ISP Scenario