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December 2021

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IEEFA.org

Australian Government Emissions Projections Imply Early Coal Exit of 5GW by 2030

Analysis of Australian Government DISER Emissions Projections

DISER Emissions Projections

This analysis of the Australian Government Department of Industry, Science, Energy and Resources' Emissions Projections[1] was prepared to understand the potential impact on the coal generation sector in the National Electricity Market (NEM) if the projections were realised.

The DISER Emissions Projections show that coal capacity in 2030 would be 14GW. The current coal capacity in the NEM is 23GW, and 1.6GW in the SWIS, totalling 25GW in Australia. The Emissions Projections show that 11GW of coal will exit between now and 2030. This represents a 44% drop in Australia's total coal fleet over the next ten years.

The Australian Energy Market Operator (AEMO) has already been notified of ~6GW of closures between now and 2030.[2] Known coal exits to 2030 are Liddell 2000MW, Vales Point 1320MW, Callide B 700MW, Yallourn 1450MW[3] and 2 Muja C units 392MW[4] -- totalling ~6GW. These closures have been reported to AEMO and are official.

High renewables penetration forecasts and lower coal capacity mean some fossil fuel generators will close.

At present with 25GW of coal in Australia, if all goes as per AEMO's schedule, there would be 19GW of coal capacity in 2030. However, the DISER projections show just 14GW of coal in 2030 – that is, 5GW more coal capacity could exit by 2030 in addition to AEMO's expectation.

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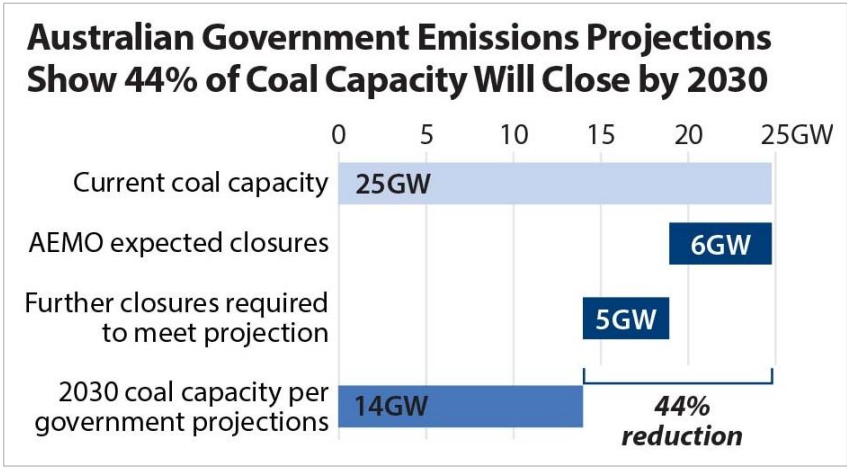
[1] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[2] AEMO. Generating unit expected closure year. October 2021.
[3] Capacity figures per: AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021. Exit schedule per: AEMO. Generating unit expected closure year – October 2021.
[4] Government of Western Australia – Energy Transformation Taskforce. Whole of System Plan. August 2020.

Table 1: DISER Installed Capacity by Technology, GW

Installed capacity	2019	2025	2030
Coal	25	23	14
Gas	18	20	20
Hydro	7	7	8
Wind	7	14	23
Large-scale solar	2	9	10
Mid-scale solar (100kW to 5MW)	<1	1	2
Small-scale solar (≤100kW)	9	27	39
Other	2	4	4
Pumped Hydro	1	2	5
Battery storage	<1	3	8
Total	**71**	**111**	**132**

Note: totals do not sum due to rounding.

Source: DISER Emissions Projections.[5]



Sources: AEMO, IEEFA analysis.

Further, the Emissions Projections estimate that in 2030, NSW will have 84% renewables share of generation, Queensland 43% and Victoria 61%. The total NEM would have 69% renewables, and total Australia would have 61% renewables.

[5] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.

Table 2: DISER Renewable Share of Generation, %

Percentage of Renewables	2005	2019	2025	2030
National Electricity Market		23%	51%	69%
Queensland		*12%*	*37%*	*43%*
New South Wales / ACT		*16%*	*46%*	*84%*
Victoria		*22%*	*50%*	*61%*
South Australia		*53%*	*97%*	*96%*
Tasmania		*96%*	*100%*	*100%*
Western Australia Wholesale Electricity Market		15%	37%	45%
Other grids, including off-grid		1%	8%	13%
Whole Sector	**9%**	**21%**	**45%**	**61%**

Source: DISER Emissions Projections.[6]

IEEFA Analysis

Some fossil fuel generators will need to close or run at lower generation levels to meet the high renewables penetration forecasts, and lower coal capacity, predicted by DISER.

The DISER Emissions Projections do not include a breakdown of the generation of each technology, or the coal generator exit schedule implied to reach the 14GW of coal capacity and 61% renewables share of generation by 2030. Therefore, IEEFA has calculated the implications of the 2030 DISER projected coal capacity and renewables generation proportions, using a scenario analysis and some high-level assumptions.

The projections' 2030 renewables proportion and AEMO's 2030 demand forecasts were used to calculate the 2030 fossil fuel generation. Gas, liquids and coal generation were assumed to reduce in line with the change in fossil fuel generation between 2019 and 2030. The 2030 coal generation was attributed to coal generators by prioritising those expected to be the latest to close.[7] Two scenarios were made, the first in which the open coal generators ran at 100% of their 2019 generation levels, and the second in which the open coal generators ran at 80% of their 2019 generation levels.

Using this method, IEEFA found that:

- In NSW, Liddell and Vales Point B would be closed, as expected, before 2030. Eraring also would be closed before 2030 – earlier than the expected date of 2030-2032. In 2030, Bayswater would have two of its four units closed. Mt Piper would be the sole fully open coal generator in 2030.

- In Queensland, Callide B would be closed as expected before 2030. By 2030, Gladstone would have at least three of its six units closed, and Tarong would

[6] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[7] AEMO. Generating unit expected closure year. October 2021.

have one of its four units closed under scenario 1 only. The remaining generators, Tarong North, Kogan Creek, Stanwell, Millmerran and Callide C, would remain open in 2030.

- In Victoria, Yallourn would be closed as expected before 2030. By 2030, Loy Yang B would close one of its two units under scenario 1 only. Loy Yang A would remain fully open.

This analysis assumes the generators that have the soonest expected closure dates would ramp down first. However, the financial situation of generators could have a strong influence on their operational regime, so the 2030 outcomes could vary from what is presented below. For example, it could eventuate that units at Mt Piper are closed and Bayswater remains fully open, given that the short-run marginal cost of Bayswater is lower than that of Mt Piper.

Table 3: IEEFA Analysis – Potential Coal Exits to Reach DISER Outcomes

Region	Facility Name	Expected closure years per AEMO	Scenario 1: Status 2030	Scenario 2: Status 2030
NSW	Bayswater	2035	2/4 units closed	2/4 units closed
NSW	Eraring	2030-32	Closed	Closed
NSW	Liddell	2022-23	Closed	Closed
NSW	Mt Piper	2040	Open	Open
NSW	Vales Point B	2029	Closed	Closed
QLD	Callide B	2028	Closed	Closed
QLD	Callide C	2051	Open	Open
QLD	Gladstone	2035	Closed	3/6 units closed
QLD	Kogan Creek	2042	Open	Open
QLD	Millmerran	2051	Open	Open
QLD	Stanwell	2043-46	Open	Open
QLD	Tarong	2036-37	1/4 units closed	Open
QLD	Tarong North	2037	Open	Open
VIC	Loy Yang A	2048	Open	Open
VIC	Loy Yang B	2047	1/2 units closed	All units open but plant is running at 74% of 2019 levels
VIC	Yallourn W	2028	Closed	Closed

Source: AEMO Generator Information,[8] IEEFA analysis.

IEEFA scenario 1 provided a NEM coal capacity of 10.8GW and scenario 2 a capacity of 12.7GW. Allowing for another 1.2GW of Western Australia 2030 coal capacity (post closure of two Muja C units), the Australian coal capacity would be 12.0GW in scenario 1 and 13.8GW in scenario 2. When the 13.8GW capacity in scenario 2 is rounded, it is equal to the DISER Emissions Projections' 2030 coal capacity of 14GW.

Scenario 1 arrives at the DISER forecast renewables share of generation, but not the DISER forecast coal capacity. Scenario 2 arrives at both the DISER forecast

[8] AEMO. Generating unit expected closure year. October 2021.

renewables share of generation and the DISER forecast coal capacity. This indicates that IEEFA scenario 2 is closer to emulating the DISER model than scenario 1.

IEEFA scenario 2 arrives at the DISER forecast 14GW of capacity and 2030 renewables proportions by closing the NEM coal generators with the soonest expected closure dates, which are Eraring, half of Bayswater and half of Gladstone, and by assuming that open coal generators generate 80% of their 2019 generation in 2030. This means that in the DISER model, coal generators in the NEM are likely running at about 80% of their 2019 generation levels on average (rather than 100% per scenario 1). IEEFA Scenario 2 led to capacity factors for fully open coal generators ranging from 50% to 72%.

However, the question is whether the coal fleet would be profitable running at these low capacity factors. In 2030, as low operational cost renewable generation is increasingly added into the grid, wholesale electricity prices are likely to reduce further. Coal generators, as their volume and prices reduce, will have their profitability eroded.

This could lead to closures earlier than expected by AEMO and potentially even earlier than projected by DISER (as the DISER model did not explore the profitability of the coal generators).

IEEFA has previously forecast[9] that an unexpected coal generator exit by 2025 is likely (in addition to Liddell in 2022-23) due to erosion of coal generator profits.

Conclusion

The Australian Government's Emissions Projections show there will be 14GW of coal capacity in Australia in 2030. This indicates that 5GW of coal capacity will close earlier than expected in the current official schedule published by AEMO. This is in addition to 6GW of coal capacity that is already scheduled to close. This represents a 44% drop in Australia's total coal fleet over the next ten years, based on the current Morrison Government's own statements to the Glasgow Climate Conference.

IEEFA analysis found that the DISER Emissions Projections imply that open coal generators would run at only 80% of their 2019 levels in 2030 on average. Further, if the coal generators that have the earliest closure dates were assumed to be brought forward to meet the Federal Government's projections, that would mean that by 2030, Eraring would close (rather than exiting over 2030-2032), half of Bayswater would close (2 of 4 units) and half of Gladstone would close (3 of 6 units).[10]

It should be noted that the Federal Opposition's Powering Australia[11] plan indicates that renewable energy penetration would grow to 82% by 2030.

[9] IEEFA. Fast Erosion of Coal Plant Profits in the NEM. February 2021.
[10] Per Scenario 2.
[11] Australian Labor Party. Powering Australia. December 2021.

This surpasses AEMO's ISP 2020 Step Change Scenario – the fastest renewables uptake scenario in the 2020 ISP – which found renewables would provide 63% of generation in 2030,[12] and the coal capacity would be 12GW in 2030.[13]

Thus, the Opposition's plan, like the current Australian Government's plan, implies that coal capacity will exit sooner than expected by AEMO's official schedule.

Governments and the energy industry need to have an honest conversation with communities and workers about the coal closure schedule.

Delay tactics, such as introducing a capacity payment to be given to coal generators, will extend the lifetime of ageing coal generators, hurt investors in new low emissions plant and undermine the ability of the federal government to meet their own Emissions Projections which they have taken to Glasgow.

Further, delaying the inevitable coal generator closure through a capacity payment will not provide any certainty about when they will exit, and will instead confuse the situation for investors, the energy industry and affected communities. The capacity payment could also cost consumers billions each year.[14]

The Opposition plans to continue the development of a capacity payment. The Powering Australia plan states: "Labor will work cooperatively with the States and Territories following the Energy Security Board's proposed reforms." Labor has included design principles, such as that it "must encourage investment in renewable energy" and "be a bridge to dispatchable technologies like pumped hydro, hydrogen and batteries."[15]

However, given the dramatic pace of change in energy transition, IEEFA recommends a more targeted approach with a clear plan to transition to renewables and storage.

A clear, realistic, enforceable schedule setting out the closure dates of each coal generator is needed[16], as is a just transition plan to support the affected communities and workers. This will be better for power system reliability and provide greater certainty for communities to prepare and plan for their future.

[12] AEMO. 2020 ISP Appendix 4. Energy Outlook. July 2020.
[13] AEMO. 2020 ISP Chart Data. 6 August 2020.
[14] IEEFA. Energy Security Board Capacity Payment: Burden on Households. August 2021.
[15] Australian Labor Party. Powering Australia. December 2021.
[16] IEEFA. There is a Better Way to Manage Coal Closures Than Paying to Delay Them. September 2021.

Appendix 1: Method and Assumptions

The renewables penetration was sourced from the DISER Emissions Projections 2021, which defines the renewable share as "renewable generation sent out over total generation (excluding storage in pumped hydro and batteries)." [17]

Table 4: DISER Renewable Share of Generation, %

Percentage of Renewables	2005	2019	2025	2030
National Electricity Market		23%	51%	69%
Queensland		*12%*	*37%*	*43%*
New South Wales / ACT		*16%*	*46%*	*84%*
Victoria		*22%*	*50%*	*61%*
South Australia		*53%*	*97%*	*96%*
Tasmania		*96%*	*100%*	*100%*
Western Australia Wholesale Electricity Market		15%	37%	45%
Other grids, including off-grid		1%	8%	13%
Whole Sector	**9%**	**21%**	**45%**	**61%**

Source: DISER Emissions Projections.[18]

Then the corresponding share of fossil fuel generation was calculated, assuming it complements renewable generation, a reasonable assumption because storage in pumped hydro and batteries has been excluded from the DISER figures.[19]

The National Electricity Market (NEM) is the focus of this analysis. Tasmania and South Australia are not included below because neither state has coal generators.

Table 5: Fossil Fuel Share of Generation, %

	2019	2025	2030
Queensland	*88%*	*63%*	*57%*
New South Wales / ACT	*84%*	*54%*	*16%*
Victoria	*78%*	*50%*	*39%*

Source: IEEFA Analysis of DISER Emissions Projections.[20]

AEMO 2030 demand was sourced from AEMO's Electricity Statement of Opportunity (ESOO) 2021, published on 28/09/2021.[21] The Central Scenario was used.

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[17] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[18] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[19] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[20] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[21] AEMO. Electricity Statement of Opportunities 2021 Data. 28 September 2021.

The DISER Emissions Projections included the following demand sources:

- "The projections use AEMO's forecasts of underlying electricity demand that is met by the grid and from onsite rooftop solar systems." Rooftop solar has been included in this analysis from AEMO's ESOO 2021.

- "Renewable share is defined in this table as renewable generation sent out over total generation (excluding storage in pumped hydro and batteries)." As the DISER Emissions Projections have used "sent out" generation, AEMO operational "sent-out" demand for 2030 has been used in this analysis, and post-auxiliary losses generation (which represents "sent out" operational generation) has been used for all generation figures.

- "The projections further include savings from energy efficiency measures announced under the Climate Solutions Package and measures announced in the 2020-21 and 2021-22 budgets." This has not been included in this analysis.

- "To limit the emergence of negative demand events in the projections modelling, a level of curtailment was assumed to apply to some solar generation. In 2030 this curtailment was assumed to reduce the output of rooftop PV systems by approximately 9,800 GWh, approximately 5% of NEM demand." AEMO's rooftop solar forecasts were used in the IEEFA analysis, as we do not have access to those used in the DISER Emissions Projections. It is assumed AEMO had already accounted for curtailment, so the above curtailment correction was not included in the analysis.

For completeness, the analysis includes small non-scheduled generation. The DISER Emissions Projections[22] did not address whether this form of generation was included.

Table 4 shows the 2030 demand from AEMO's ESOO 2021 for the categories in this analysis, based on the above understandings of what was included in the DISER Emissions Projections.

[22] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.

Table 6: 2030 Generation Forecast from AEMO ESOO 2021

Region	Category	Sub-category	2019 Generation (MWh)	2030 Generation (MWh)
NSW	Operational		68,051,813	61,259,356
NSW	Small Non-Scheduled Generation	ONSG generation	1,579,250	1,248,392
NSW	Small Non-Scheduled Generation	PVNSG generation	244,753	1,396,206
NSW	Rooftop PV	Business	-	2,429,686
NSW	Rooftop PV	Residential	-	8,788,748
NSW	Rooftop PV Actuals		2,951,700	-
NSW	**Total**		**72,827,515**	**75,122,388**
QLD	Operational		51,450,509	48,601,744
QLD	Small Non-Scheduled Generation	ONSG generation	2,067,069	1,554,459
QLD	Small Non-Scheduled Generation	PVNSG generation	231,438	1,045,649
QLD	Rooftop PV	Business	-	1,943,037
QLD	Rooftop PV	Residential	-	8,494,252
QLD	Rooftop PV Actuals		3,805,600	-
QLD	**Total**		**57,554,616**	**61,639,141**
VIC	Operational		42,029,481	36,303,652
VIC	Small Non-Scheduled Generation	ONSG generation	925,042	843,405
VIC	Small Non Scheduled Generation	PVNSG generation	140,894	1,418,540
VIC	Rooftop PV	Business	-	1,577,837
VIC	Rooftop PV	Residential	-	6,997,772
VIC	Rooftop PV Actuals		2,184,730	-
VIC	**Total**		**45,280,147**	**47,141,207**

Source: Operational, small non-scheduled generation and rooftop PV forecast from AEMO's ESOO.[23] *Rooftop PV Actuals from AEMO per OpenNEM.*[24]

Then the fossil fuel generation for 2030 was calculated, based on AEMO's forecast 2030 demand and the percentage of fossil fuel generation in the grid indicated by the DISER Emissions Projections.

IEEFA assumes coal and gas generation changes at the same rate as fossil fuel generation from 2019-2030. IEEFA uses AEMO post auxiliary loss generation for gas, liquids and coal technology types to calculate 2019 fossil fuel generation.

[23] AEMO. Electricity Statement of Opportunities 2021 Data. 28 September 2021.
[24] AEMO data from OpenNEM.

Table 7: Fossil Fuel Generation

	2019 FF gen post aux losses (MWh)	2030 Total Generation (MWh)	Fossil fuel % of generation 2030	Fossil fuel generation 2030 (MWh)	Change in fossil fuel generation 2019-2030	Gas + liquids post aux losses, reduced in line with change in FF gen 2019-2030 (MWh)	Coal post aux losses, reduced in line with change in FF gen 2019-2030 (MWh)
NSW	58,282,706	75,122,388	16%	12,019,582	-79%	402,907	11,616,675
QLD	51,972,441	61,639,141	57%	35,134,310	-32%	3,910,316	31,223,994
VIC	33,308,910	47,141,207	39%	18,385,071	-45%	1,683,452	16,701,619

Source: IEEFA Analysis based on DISER Emissions Projections,[25] AEMO's ESOO,[26] and other AEMO data.
Note: "Gen" refers to generation, and "FF" refers to fossil fuel. All generation figures are post auxiliary losses.

Coal generation in each state in 2019, coal generator information, and expected coal generator closure dates[27] come from AEMO data, using post-auxiliary losses generation figures (since the DISER Emissions Projections indicate that "sent out" generation was used to calculate the renewables percentage share).

[25] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[26] AEMO. Electricity Statement of Opportunities 2021 Data. 28 September 2021.
[27] AEMO. Generating unit expected closure year. October 2021.

Table 8: NEM Coal Generator Information

Region	Facility	Generator Max Capacity (MW)	# units in total	Generator auxiliary losses	2019 Generation As Generated (MWh)	2019 Generation Sent Out (post auxiliary losses) (MWh)	Expected closure year per AEMO
NSW	Bayswater	2690	4	0.94	15,982,668	15,023,708	2035
NSW	Eraring	2880	4	0.94	17,178,850	16,148,119	2030 - 2032
NSW	Liddell	2000	4	0.95	10,788,879	10,249,435	2022 - 2023
NSW	Mt Piper[28]	1390	2	0.95	4,690,634	7,228,006	2040
NSW	Vales Point B	1320	2	0.95	8,083,947	7,679,750	2029
QLD	Callide B	700	2	0.91	5,047,900	4,593,589	2028
QLD	Callide C	840	2	0.94	5,701,019	5,358,958	2051
QLD	Gladstone	1680	6	0.92	7,805,962	7,181,485	2035
QLD	Kogan Creek	744	1	0.91	4,142,537	3,769,709	2042
QLD	Millmerran	852	2	0.94	6,735,384	6,331,261	2051
QLD	Stanwell	1460	4	0.91	8,399,017	7,643,106	2043 - 2046
QLD	Tarong	1400	4	0.92	8,954,533	8,238,171	2036 - 2037
QLD	Tarong North	450	1	0.94	3,267,901	3,071,827	2037
VIC	Loy Yang A	2210	4	0.91	14,851,364	13,514,741	2048
VIC	Loy Yang B	1160	2	0.92	8,648,192	7,956,337	2047
VIC	Yallourn W	1450	4	0.9	9,764,290	8,787,861	2028
NSW	Total	10,280			56,724,978	56,329,017	
QLD	Total	8,126			50,054,253	46,188,105	
VIC	Total	4,820			33,263,846	30,258,939	
Total	Total	23,226			140,043,077	132,776,061	

Source: AEMO Generating unit expected closure year,[29] AEMO 2021 Inputs and Assumptions Workbook,[30] other AEMO data.

The 2030 coal generation by state was attributed to various coal generators on a state by state basis.

Coal generators were assumed to close in line with AEMO's generator exit timeline[31] – i.e., the coal generators with the earliest closure date would have their generation ramped down first.

[28] Note that Mt Piper had significant outages in 2019 such that its 2019 generation was around half its usual annual generation. Therefore, Mt Piper average generation for the years 2017, 2018 and 2020 was used as the basis for calculations, instead of the 2019 generation.
[29] AEMO. Generating unit expected closure year. October 2021.
[30] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.
[31] AEMO. Generating unit expected closure year. October 2021.

The 2030 coal generation would be attributed first to open generators (generators with the latest AEMO closure dates), and then any leftover generation would be attributed to a "partially closed" generator.

For example, three NSW generators were assumed to close, and the leftover generation to meet the NSW 2030 Coal Generation (per above table) was attributed to the "partially closed" Bayswater.

Two scenarios were made, the first in which the open generators ran at 100% of their 2019 generation levels, and the second in which the open generators ran at 80% of their 2019 generation levels. The second scenario is a simplifying assumption, meant to indicate the likelihood that coal generation will increasingly be displaced by lower operational cost renewable generation out to 2030 and beyond. The two scenarios and how coal generation in 2030 is calculated in each are explained in the below table.

Table 9: IEEFA Analysis Scenario Settings

	Scenario 1 2030 Coal Generation	Scenario 2 2030 Coal Generation
Open generators	100% of 2019 levels	80% of 2019 levels
Partially closed generators	Any remaining 2030 coal generation in the state after all open generators run at 100% of 2019 levels	Any remaining 2030 coal generation in the state after all open generators run at 80% of 2019 levels
Closed generators	Zero	Zero

Source: IEEFA analysis.

These settings led to the results in scenario 1 and 2.

Appendix 2: Results Tables

Table 10: Scenario 1, Open Coal Generators Run at 100% of 2019 Levels

Region	Facility Name	Expected closure year per AEMO	Status 2030	2030 Generation post aux losses (MWh)	% Generation compared to 2019	Capacity Factor 2030 (pre aux losses)	# units closed	Capacity of open units (MW)	Unit explanation
NSW	Bayswater	2035	Partially closed	4,388,669	29%	20%	2 / 4	1310	Plant has 4 units all with the same size in 2030/31 (655MW each)
NSW	Eraring	2030-32	Closed	-	0%	0%	All	0	
NSW	Liddell	2022-23	Closed	-	0%	0%	All	0	
NSW	Mt Piper[32]	2040	Open	7,228,006	100%	62%		1390	
NSW	Vales Point B	2029	Closed	-	0%	0%	All	0	
QLD	Callide B	2028	Closed	-	0%	0%	All	0	
QLD	Callide C	2051	Open	5,358,958	100%	77%		840	
QLD	Gladstone	2035	Closed	-	0%	0%	All	0	
QLD	Kogan Creek	2042	Open	3,769,709	100%	64%		744	
QLD	Millmerran	2051	Open	6,331,261	100%	90%		852	
QLD	Stanwell	2043-46	Open	7,643,106	100%	66%		1460	
QLD	Tarong	2036-37	Partially closed	5,049,134	61%	45%	1 / 4	1050	Plant has 4 units all with size in 2030/31 (350MW each)
QLD	Tarong North	2037	Open	3,071,827	100%	83%		450	
VIC	Loy Yang A	2048	Open	13,514,741	100%	77%		2210	
VIC	Loy Yang B	2047	Partially closed	3,186,878	40%	34%	1 / 2	540	Plant has 2 units, one is 550MW and one is 540MW in 2030/31. Chose the smallest for keeping open.
VIC	Yallourn W	2028	Closed	-	0%	0%	All	0	
NSW	Total			11,616,675	-79%			2,700	
QLD	Total			31,223,994	-32%			5,396	
VIC	Total			16,701,619	-45%			2,750	
Total				**59,542,288**				**10,846**	

Source: AEMO Generating unit expected closure year,[33] AEMO 2021 Inputs and Assumptions Workbook,[34] AEMO data, IEEFA analysis.

[32] Note that Mt Piper had significant outages in 2019 such that its 2019 generation was around half its usual annual generation. Therefore, Mt Piper average generation for the years 2017, 2018 and 2020 was used as the basis for calculations, instead of the 2019 generation.
[33] AEMO. Generating unit expected closure year. October 2021.
[34] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.

Table 11: Scenario 2, Open Coal Generators Run at 80% of 2019 Levels

Region	Facility Name	Expected closure year per AEMO	Status 2030	2030 Generation post aux losses (MWh)	% Generation compared to 2019	Capacity Factor 2030 (pre aux losses)	# units closed	Capacity of open units (MW)	Unit explanation
NSW	Bayswater	2035	Partially closed	5,834,270	39%	26%	2 / 4	1310	Plant has 4 units all with the same size in 2030/31 (655MW each)
NSW	Eraring	2030-32	Closed	-	0%	0%	All	0	
NSW	Liddell	2022-23	Closed	-	0%	0%	All	0	
NSW	Mt Piper[35]	2040	Open	5,782,405	80%	50%		1390	
NSW	Vales Point B	2029	Closed	-	0%	0%	All	0	
QLD	Callide B	2028	Closed	-	0%	0%	All	0	
QLD	Callide C	2051	Open	4,287,166	80%	62%		840	
QLD	Gladstone	2035	Partially closed	3,693,569	51%	27%	3 / 6	840	Has 6 units all at 280MW in 2030/31. Assumed 3 are on.
QLD	Kogan Creek	2042	Open	3,015,767	80%	51%		744	
QLD	Millmerran	2051	Open	5,065,009	80%	72%		852	
QLD	Stanwell	2043-46	Open	6,114,484	80%	53%		1460	
QLD	Tarong	2036-37	Open	6,590,537	80%	58%		1400	
QLD	Tarong North	2037	Open	2,457,462	80%	66%		450	
VIC	Loy Yang A	2048	Open	10,811,793	80%	61%		2210	
VIC	Loy Yang B	2047	Partially closed	5,889,826	74%	63%		1160	Plant has 2 units, one is 550MW and one is 540MW in 2030/31. Assumed all stay on.
VIC	Yallourn W	2028	Closed	-	0%	0%	All	0	
NSW	Total			11,616,675	-79%			2,700	
QLD	Total			31,223,994	-32%			6,586	
VIC	Total			16,701,619	-45%			3,370	
Total				**59,542,288**				**12,656**	

Source: AEMO Generating unit expected closure year,[36] AEMO 2021 Inputs and Assumptions Workbook,[37] AEMO data, IEEFA analysis.

As demonstrated in the results table below, this analysis then delivers the expected 2030 fossil fuel share of generation per the DISER Emission Projections, being 16% in New South Wales, 57% in Queensland and 39% in Victoria.

[35] Note that Mt Piper had significant outages in 2019 such that its 2019 generation was around half its usual annual generation. Therefore, Mt Piper average generation for the years 2017, 2018 and 2020 was used as the basis for calculations, instead of the 2019 generation.
[36] AEMO. Generating unit expected closure year. October 2021.
[37] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.

Table 12: Fossil Fuel Share of Generation – IEEFA Analysis

			Scenario 1 - Open Coal Generators Run at 100% of Their 2019 Levels				
	2019 FF (MWh)	2030 Liquids + gas (MWh)	2030 Coal Gen (MWh)	2030 FF Gen (MWh)	2030 FF %	2030 RE %	2019 to 2030 change in FF gen
NSW	58,282,706	402,907	11,616,675	12,019,582	16%	84%	-79%
QLD	51,972,441	3,910,316	31,223,994	35,134,310	57%	43%	-32%
VIC	33,308,910	1,683,452	16,701,619	18,385,071	39%	61%	-45%
Total	**143,564,058**	**5,996,675**	**59,542,288**	**65,538,963**			

			Scenario 2 - Open Coal Generators Run at 80% of Their 2019 Levels				
	2019 FF (MWh)	2030 Liquids + gas (MWh)	2030 Coal Gen (MWh)	2030 FF Gen (MWh)	2030 FF %	2030 RE %	2019 to 2030 change in FF gen
NSW	58,282,706	402,907	11,616,675	12,019,582	16%	84%	-79%
QLD	51,972,441	3,910,316	31,223,994	35,134,310	57%	43%	-32%
VIC	33,308,910	1,683,452	16,701,619	18,385,071	39%	61%	-45%
Total	**143,564,058**	**5,996,675**	**59,542,288**	**65,538,963**			

Source: IEEFA analysis.
Note: "Gen" refers to generation, and "FF" refers to fossil fuel. All generation figures are post auxiliary losses.

The current coal capacity in the NEM is 23GW, and 1.6GW in the SWIS – giving a total Australian coal capacity of 25GW. Removing the closures that AEMO knows will occur before 2030 the 2030 Australia coal capacity would be 19GW (known closure capacity includes Liddell 2000MW, Vales Point 1320MW, Callide B 700MW, Yallourn 1450MW[38] and 2 Muja C units 392MW, totalling 5862MW). However, the DISER projections show that only 14GW of coal will be in the grid in 2030.

[38] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.

Table 13: Current and Future Coal Generator Capacity

Current Coal Capacity	**Capacity (MW)**
Current NEM coal capacity	23,226
Current SWIS coal capacity	1,569
Total current coal capacity	24,795
AEMO expected closures	
NEM expected closures 2019-2030	5,470
SWIS expected closures 2019-2030	392
Total expected closures	5,862
2030 capacity implied by AEMO expected closures	
Expected NEM 2030 coal capacity	17,756
Expected SWIS 2030 coal capacity	1,177
Expected total 2030 coal capacity	18,933
DISER capacity implication	
Current coal capacity	24,795
2030 DISER forecast coal capacity	14,000
AEMO expected coal closure 2019-2030	5,862
Further closures required to reach DISER projection	4,933
Closed capacity to 2030	10,795
% of capacity closed by 2030	44%
2030 capacity implied by IEEFA scenario 1	
Scenario 1 NEM 2030 coal capacity	10,846
Expected SWIS 2030 coal capacity	1,177
Expected total 2030 coal capacity	12,023
2030 capacity implied by IEEFA scenario 2	
Scenario 2 NEM 2030 coal capacity	12,656
Expected SWIS 2030 coal capacity	1,177
Expected total 2030 coal capacity	13,833

Source: AEMO Inputs and Assumptions Workbook 2021,[39] AEMO Generating unit expected closure year,[40] WA WOSP[41] IEEFA analysis.

[39] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.
[40] AEMO. Generating unit expected closure year. October 2021.
[41] Government of Western Australia – Energy Transformation Taskforce. Whole of System Plan. August 2020.

Table 14: DISER Installed Capacity by Technology, GW

Installed capacity	2019	2025	2030
Coal	25	23	14
Gas	18	20	20
Hydro	7	7	8
Wind	7	14	23
Large-scale solar	2	9	10
Mid-scale solar (100kW to 5MW)	<1	1	2
Small-scale solar (≤100kW)	9	27	39
Other	2	4	4
Pumped Hydro	1	2	5
Battery storage	<1	3	8
Total	**71**	**111**	**132**

Note: totals do not sum due to rounding.

Source: DISER Emissions Projections.[42]

Scenario 1 provided a 2030 NEM coal capacity of 10.8GW and scenario 2 a NEM coal capacity of 12.7GW. Allowing for another 1.2GW of Western Australia 2030 coal capacity (post closure of two Muja C units), the Australian coal capacity would be at maximum 13.8GW in 2030 from IEEFA scenario 2. When rounded this is equal to the DISER Emissions Projections 2030 coal capacity of 14GW.

Scenario 1 arrives at the DISER forecast renewables share of generation, but not the DISER forecast coal capacity. Scenario 2 arrives at both the DISER forecast renewables share of generation and the DISER forecast coal capacity. It can thus be assumed that IEEFA scenario 2 (in which open coal generators run at 80% of their 2018 levels) is closer to emulating the DISER model than scenario 1.

This indicates that in the DISER model, coal generators in the NEM are likely running at about 80% of their 2019 generation levels on average, i.e., capacity factors of 50%-72% per scenario 2. The DISER model predicts that coal closures will occur sooner than expected – which IEEFA calculated could be Eraring, half of Bayswater and half of Gladstone (per scenario 2). The remainder of the coal closures implied by the DISER model appear to be consistent with AEMO's generator exit schedule.

While scenario 1 provides a lower 2030 capacity than indicated in the DISER model, it does deliver DISER's projected 2030 renewables share of generation in each relevant state. It represents a potential way in which the dynamics could play out in 2030. Scenario 1 sees some earlier unit closures compared with scenario 2, but the open generators keep running at 100% of their 2019 generation, and would therefore be more profitable than they might be in scenario 2.

[42] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.

Appendix 3: Further Notes

- The DISER Emissions Projections and AEMO's ESOO are based on financial years, and so is this analysis. Therefore, '2030' throughout this document refers to financial year 2029-30, i.e. 1 July 2029 to 30 June 2030.
    - Per DISER: "Reporting years for all sectors are reported for financial years as key data sources are published on this basis. For instance, '2030' refers to financial year 2029–30."[43]
    - Per AEMO: "Operational consumption and maximum and minimum demand forecasts are provided over a 30-year period from the financial year 2021-22 to 2050-51"[44]
- Eraring is expected by AEMO, per the Input and Assumptions Workbook, to start exiting in 2030-31 – so it would still have all its units online in FY30. [45] Therefore, for it to exit by FY30 per the IEEFA analysis, that represents an early exit.

[43] Australian Government, Department of Industry, Science, Energy and Resources (DISER). Australia's emissions projections 2021. October 2021.
[44] AEMO. Electricity Statement of Opportunities (ESOO) 2021. August 2021.
[45] AEMO. 2021 Inputs and Assumptions Workbook 3.2. 10 August 2021.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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