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Suboptimal supercritical

Reliability issues at Australia's supercritical coal power plants

There have been recent calls for Australian taxpayers to subsidise the building of supercritical coal power plants (so-called "HELE" plants), but existing supercritical plants experience frequent breakdowns that affect electricity prices and can push grid frequency outside of safe ranges.

Discussion paper

Mark Ogge
Bill Browne
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Level 1, Endeavour House, 1 Franklin St
Canberra, ACT 2601
Tel: (02) 61300530
Email: mail@tai.org.au
Website: www.tai.org.au
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Summary

A number of federal and state politicians and mining industry groups have called for new supercritical or ultra-supercritical coal-fired power stations to be built in the National Electricity Market (NEM).

Data from The Australia Institute's Gas & Coal Watch shows that coal plants are unreliable and prone to break downs – as they have dozens of times since the Institute began monitoring in 2017.

Furthermore, of Australia's black coal plants, the supercritical plants have performed just as badly as subcritical plants relative to generating capacity, despite being newer.

A close study of Kogan Creek, Australia's newest supercritical coal plant, shows that its breakdowns:

1. Occur often,
2. Are the biggest in the NEM,
3. Have contributed to price spikes, and
4. Have caused frequency losses outside of the safe operating band.

The Victorian Nationals, the "Monash Forum" of federal Coalition backbenchers and the Minerals Council of Australia have proposed building supercritical plants in Victoria that would burn brown coal. This raises two concerns. Firstly, Australia's brown coal plants are more unreliable than its black coal plants and, secondly, supercritical brown plants would still be more emissions intensive than the majority of Australia's existing coal plants.

Introduction

In recent years, a number of politicians and mining industry groups have pushed for so-called "high efficiency, low-emissions" or "HELE" coal power stations to be built – either entirely by the government or with government subsidies if new coal plants are not economically viable on their own.

"HELE" is an industry promotional term for supercritical coal plants, which operate above a 'critical' temperature and pressure level, in theory making them more efficient and with lower emissions than "subcritical" coal plants. They still have higher emissions than other energy sources like natural gas and renewable energy.

In 2017, Barnaby Joyce (then Deputy Prime Minister) and Minister for Resources Matt Canavan called for the Federal Government to "fund or indemnify" a new plant in Queensland.[1] One Nation wants the Queensland government to build a new coal plant in North Queensland, with the federal government paying half of the $3 billion cost.[2] The Queensland Resources Council has also called on the federal government to "encourage" investment in a Queensland supercritical plant.[3]

In 2018, backbench Coalition MPs calling themselves the "Monash Forum"[4] called for government assistance for new coal plants, with spokesperson Craig Kelly saying the federal government should be prepared to "build one in its entirety, from scratch". Craig Kelly nominated the Latrobe Valley in Victoria as the potential site for a new plant, meaning that it would burn brown coal.[5] The Victorian Nationals have described

[1] Murphy (2017) *Coal to stay in energy mix for foreseeable future, says Barnaby Joyce,* https://www.theguardian.com/australia-news/2017/jun/18/coal-to-stay-in-energy-mix-for-foreseeable-future-says-barnaby-joyce

[2] Daily Mercury (2017) *One Nation reveals $1.5b plan for NQ coal power station,* https://www.dailymercury.com.au/news/one-nation-reveals-15b-plan-for-nq-coal-power-stat/3261961/#/0

[3] Queensland Resources Council (2018) *Queensland ideal place for HELE coal investment,* https://www.qrc.org.au/media-releases/queensland-ideal-place-for-hele-coal-investment/

[4] Including Tony Abbott, Eric Abetz, Kevin Andrews, George Christensen and Barnaby Joyce.

[5] Hasham (2018) *A new coal-fired power plant would cost $3 billion, drive up energy prices and take eight years to build*, https://www.theage.com.au/politics/federal/a-new-coal-fired-power-plant-would-cost-3-billion-drive-up-energy-prices-and-take-eight-years-to-build-20180403-p4z7jg.html; Chang (2018) *Are you willing to pay $4 billion to support 'clean' coal-fired power plants?,* https://www.news.com.au/technology/environment/climate-change/are-you-willing-to-pay-4-billion-to-support-clean-coalfired-power-plants/news-story/1f1b51d97c0027176c96e5f596860665

such a plant as "essential"[6] and the Minerals Council of Australia "strongly support" the move, releasing modelling on the emissions intensity of supercritical brown plants that is used in this paper.[7]

When he was Minister for Energy and Environment, Josh Frydenberg – now Treasurer and deputy leader of the Liberal Party – said new supercritical coal plants "have a role to play" and "the government stands ready to ensure the best possible outcomes in the marketplace if the market itself can't deliver that".[8] New environment minister Melissa Price has said that she would support a new coal plant being built.[9] In the Australian Senate, the Coalition and One Nation voted for the government "to facilitate the building of new coal-fired power stations".[10] The Minerals Council has called for new coal to be built in NSW or Victoria.[11]

With repeated, prominent and forceful calls for new supercritical coal-fired power stations to be built with taxpayer money, it is important to reflect on the performance of Australia's existing supercritical coal plants.

[6] The Nationals for Regional Victoria (2017) *Keeping the lights on in Victoria,* http://vic.nationals.org.au/keeping_the_lights_on_in_victoria

[7] Minerals Council of Australia (2017) *Latrobe Valley HELE plant would deliver reliable, affordable power,* https://www.minerals.org.au/latrobe_valley_hele_plant_would_deliver_reliable_affordable_power; Nethercote, Aldred and Gibbons (2017) *Securing energy, jobs and Australia's export advantage,* https://www.minerals.org.au/sites/default/files/Latrobe_Valley_Securing_energy_and_jobs_and_Australias_export_advantage_June_2017.pdf

[8] Karp (2017) *New coal plants have a role in Australia's energy future, Josh Frydenberg says,* https://www.theguardian.com/australia-news/2017/aug/13/new-coal-plants-have-a-role-in-australias-energy-future-josh-frydenberg-says

[9] Hondros (2018) *Environment minister backs Paris targets, open to coal-fired power,* https://www.canberratimes.com.au/national/western-australia/environment-minister-backs-paris-targets-open-to-coal-fired-power-20180903-p501eq.html

[10] Murphy (2018) *Coalition backs Hanson motion for new coal-fired power stations,* https://www.theguardian.com/australia-news/2018/jun/27/coalition-backs-hanson-motion-to-build-new-coal-fired-power-stations

[11] Evans (2017) *Independent report backs modern coal generation for Australia,* https://www.minerals.org.au/news/independent-report-backs-modern-coal-generation-australia-0

Subcritical and supercritical coal-fired power plants

The original “subcritical” coal-fired power plants used coal to boil water, with the steam driving a turbine, which in turn drives a generator to generate electricity. In this process, energy is lost as the liquid water turns to steam.

Since 1957, some coal-fired power plants have been designed to reduce this energy loss – and therefore operate more efficiently – by turning the water into a “supercritical fluid” that has properties of both gas and liquid. “Supercritical” coal plants have the specialised equipment needed to keep water at such a temperature and pressure that it turns supercritical.

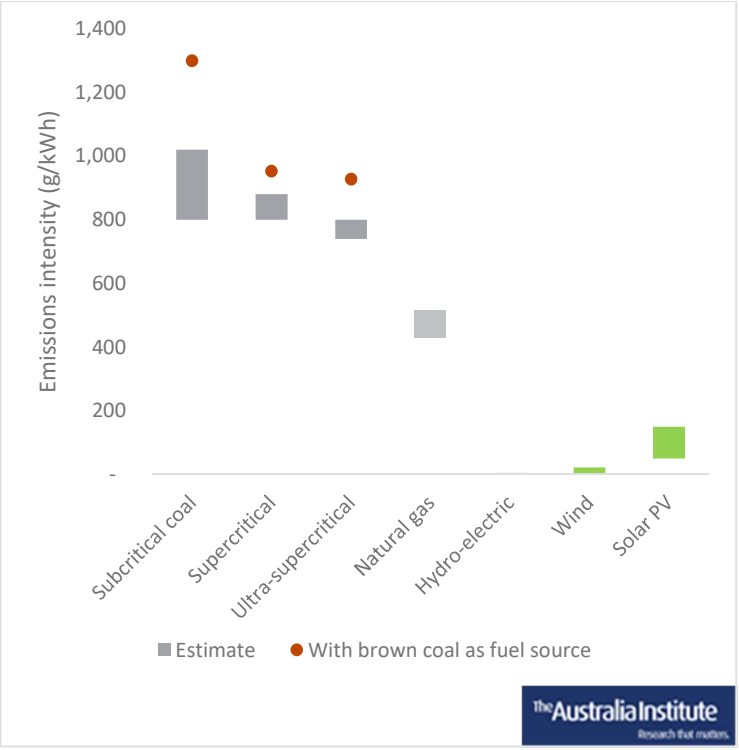
The next generation “ultra-supercritical” plants operate at even higher temperatures and pressures and can further reduce energy loss and make the process more efficient. Since the 1990s, some ultra-supercritical plants have been built overseas. The industry hopes to develop “advanced ultra-supercritical” plants that would take it a step further and increase efficiency through even higher temperatures and pressures.

Supercritical plants (including ultra-supercritical plants) require less coal than subcritical plants in order to generate the same amount of electricity. By burning less coal, these plants emit less pollution. This has lead them to be described as “High-Efficiency, Low-Emissions” technology by coal advocates.

However, this is only true relative to other coal plants, as shown in Figure 1.

The most efficient current coal technology, “ultra-supercritical”, still emits upwards of 740 grams of CO2 per kWh of electricity produced. This is more than the standard range for natural gas, of between 430 and 517 grams of CO2/kWh. Australia has never successfully built an ultra-supercritical coal power plant.

Figure 1: Approximate lifetime emissions intensity of power sources



Source: See Table 1 below

Exacerbating this is the proposal by the Victorian Nationals, the Minerals Council and the "Monash Forum" of federal Coalition backbenchers to build the supercritical plant in the Latrobe Valley, where it would burn brown coal.

The brown dots in Figure 1 demonstrate how changing the fuel source from black to brown coal increases the emissions intensity of different technologies. Research from CO2CRC shows that an "ultra-supercritical" plant burning brown coal would emit 928 grams CO2/kWh, which is well above the current emissions intensity of the NEM (around 800 grams CO2/kWh),[12] and above the emissions intensity of many of Australia's existing subcritical coal plants. In 2016–17, 10 coal plants in the NEM reported emissions intensity below 928 grams CO2/kWh.[13]

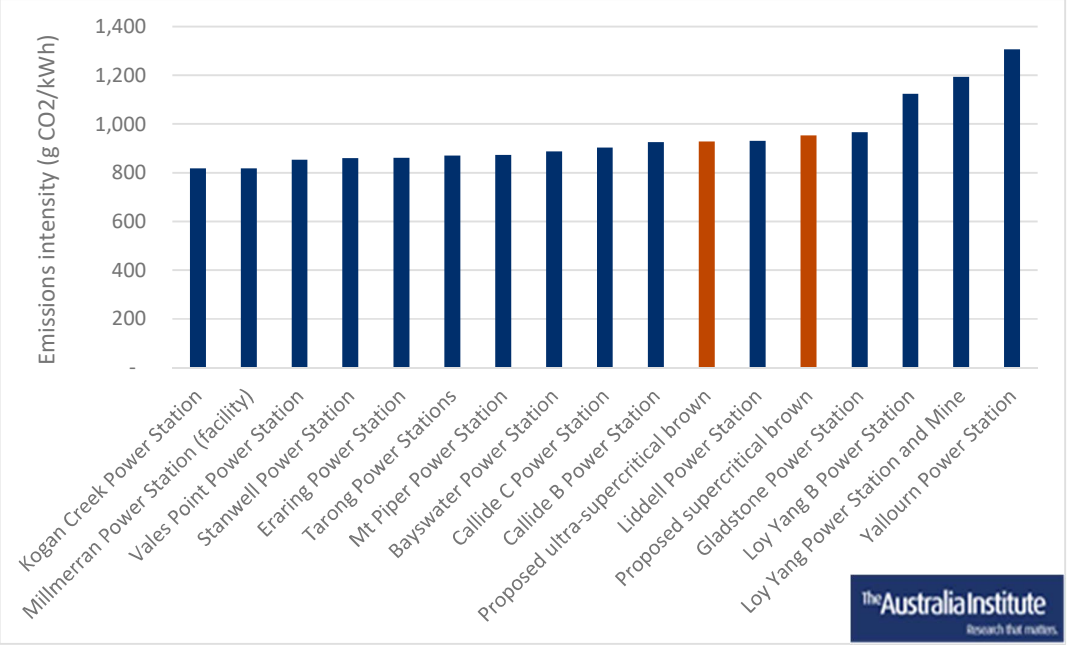
[12] Climate Change Authority (2013) *Analysis of electricity consumption, electricity generation emissions intensity and economy-wide emissions,* http://climatechangeauthority.gov.au/files/files/Target-Progress-Review/Analysis-of-electricity-consumption-electricity-generation-emissions-intensity-and-economy-wide-emissions/Australia%20electricity%20and%20emissions%20final%20report%202013%2010%2018.pdf

[13] Clean Energy Regulator (2018) *Electricity sector emissions and generation data 2016–17,* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20repor

In other words, as illustrated in Figure 2, state-of-the-art, brand new "High Efficiency, Low Emissions" coal plants burning brown coal would be no more efficient or lower emissions than some of Australia's oldest subcritical black coal plants – whether or not they are "ultra-supercritical". As Figure 1 demonstrated, even ultra-supercritical plants burning black coal (i.e., the most efficient existing coal technology burning the "cleaner" variety of coal) are far closer in efficiency and emissions to other coal plants than they are to natural gas, which is itself a polluting fossil fuel.

Calling any coal plant "High Efficiency, Low Emissions" is at best inaccurate, and at worst, a deliberate attempt to muddy the waters.

Figure 2: Emissions intensity, current coal plants (2016–17) and proposed brown supercritical plants



Source: Clean Energy Regulator (2018) *Electricity sector emissions and generation data 2016–17*; Nethercote, Aldred and Gibbons (2017) *Securing energy, jobs and Australia's export advantage;* CO2CRC (2016) *Australian power generation technology report*, p 119, http://www.co2crc.com.au/wp-content/uploads/2016/04/LCOE_Report_final_web.pdf

ting%20data/electricity-sector-emissions-and-generation-data/electricity-sector-emissions-and-generation-data-2016-17

Table 1: Emissions intensity by generation type

Generation type	Estimate (grams CO2/kWh)
Subcritical	≥880 (black coal) Up to 1,306 (brown coal)
Supercritical	800–880 (black coal) 953 (brown coal)
Ultra-supercritical	740–800 (black coal) 928 (brown coal)
Advanced ultra-supercritical (not commercially deployed)	670–740 (black coal) 750 (brown coal)
Natural gas	430–517
Hydro-electric	4
Wind	3–22
Solar PV	50–150

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Source explanation: Black coal subcritical, supercritical and ultra-supercritical ranges are from the World Coal Association's *High efficiency low emissions coal* resource. The advanced ultra-supercritical figure for brown coal is from the figure for BOA Plus in *Securing energy, jobs and Australia's export advantage,* p 16. Supercritical and ultra-supercritical figures for brown coal are from *Australian power generation technology report,* p 119. The subcritical figure for brown coal is Yallourn Power Station's emissions intensity for 2016–17. Figures for natural gas and renewables are from *1 kilowatt-hour*.

Sources (Table 1 and Table 2): IEA (2016) *An overview of HELE technology deployment in the coal power plant fleets of China, EU, Japan and USA*; World Coal Association (n.d.) *High efficiency low emissions coal*, https://www.worldcoal.org/reducing-co2-emissions/high-efficiency-low-emission-coal; Molyneaux (2017) *Is 'clean coal' power the answer to Australia's emissions targets?,* https://theconversation.com/is-clean-coal-power-the-answer-to-australias-emissions-targets-71785; Holmes À Court (2017) *How clean are Australia's 'clean coal' power stations?,* https://reneweconomy.com.au/clean-australias-clean-coal-power-stations-14224/; BlueSkyModel (n.d.) *1 kilowatt-hour*, http://blueskymodel.org/kilowatt-hour; Nethercote, Aldred and Gibbons (2017) *Securing energy, jobs and Australia's export advantage*; Jotzo and Mazouz (2015) *Farewell to brown coal without tears: How to shut high-emitting power stations,* https://theconversation.com/farewell-to-brown-coal-without-tears-how-to-shut-high-emitting-power-stations-50904; CO2CRC (2016) *Australian power generation technology report*, http://www.co2crc.com.au/wp-content/uploads/2016/04/LCOE_Report_final_web.pdf

Note: Where possible, figures are for lifecycle emissions and/or based on electricity "as generated". Because power stations consume some share of energy themselves (as "auxiliary power"), the actual emissions intensity of "sent out" energy is likely to be higher.

Table 2: Pressure and temperature ranges for coal plant technologies

	Temperature	Pressure	Efficiency (LHV, net)
Subcritical	Up to 560 degrees Celsius	Less than 22.1 MPa	Up to 38%
Supercritical	540–580 degrees Celsius	22.1–25 MPa	Up to 42%
Ultra-supercritical	Greater than 580 degrees Celsius	Greater than 25 MPa	Up to 45%
Advanced ultra-supercritical	Greater than 620 degrees Celsius	Greater than 32 MPa	45–50%

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Source explanation: Subcritical, supercritical and ultra-supercritical ranges are from *Securing energy, jobs and Australia's export advantage,* p 13, and the World Coal Association's *High efficiency low emissions coal* resource.

Many breakdowns at supercritical plants

While supercritical plants are higher efficiency than subcritical plants (when burning similar fuels), this is in physical terms: they are better at converting input energy into useful output energy. They are not necessarily superior to subcritical plants in practical or economic terms. Supercritical plants can have higher capital costs, require more complicated and expensive components and be less able to "ramp" up and down – in other words, slower to respond to changes in demand.

These limitations can cause problems for electricity consumers. For example, boiler tube leaks are the main causes of breakdowns at coal plants.[14] Higher pressures and temperatures, like those seen in supercritical plants, will put greater stress on coal plant boilers. These greater temperatures and pressures could be a reason for the high rate of coal breakdowns at the newer supercritical power plants in Australia.

Australia has four coal power plants that have been built in the last 20 years, all of which are in Queensland. All of these are supercritical power stations.

Table 3: NEM supercritical coal plants in Queensland

Power Station	Age (Years)
Callide Power Plant	18
Millmerran Power Station	17
Tarong North Power Station	17
Kogan Creek Power Station	12

Source: Senate Environment and Communications References Committee (2017) *Retirement of coal fired power stations: Final report,* p 3, https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Coal_fired_power_stations

Other than these four power stations, all other black coal power plants in the NEM are older subcritical plants.

[14] Bamrotwar and Deshpande (2014) *Root Cause Analysis and Economic Implication of Boiler Tube Failures in 210 MW Thermal Power Plant*, https://www.scribd.com/document/306366367/RCA-of-Boiler-Tube-Failure-in-210-MW-plant

The Australia Institute began monitoring breakdowns of gas and coal plants in the NEM in late 2017. In 2018, there have been 74 breakdowns at black coal power plants in the NEM, approximately one every five days.

The older subcritical plants have enormous issues with reliability. This is illustrated by the NSW "energy crisis" in June this year.[15]

New South Wales has no new supercritical coal power plants. All are old subcritical plants between 27 and 48 years old. In early June 2018 they failed spectacularly when up to almost half the New South Wales fleet was offline during peak demand periods, triggering a power "crisis" that resulted in five price surges to over AUD 2,400 per MWh within a few days.

Despite the decidedly low bar set by the antiquated fleet of subcritical coal power plants in the NEM, the newer supercritical power plants are just as unreliable.

In 2018, these plants have broken down more often than the older subcritical plants.

Of the 74 breakdowns at black coal power in 2018, 61 have been at subcritical black coal plants and 13 have been at the newer supercritical plants.

However, the older subcritical power stations make up a far larger proportion of the capacity of the NEM (30%), with the supercritical plants making only up 6%.

As shown in Table 4 below, there have been 4.4 breakdowns per gigawatt of capacity at supercritical plants in the NEM over this period compared to 4.0 breakdowns per gigawatt of capacity at the older subcritical black coal plants.

Table 4: NEM unit trips (2018)

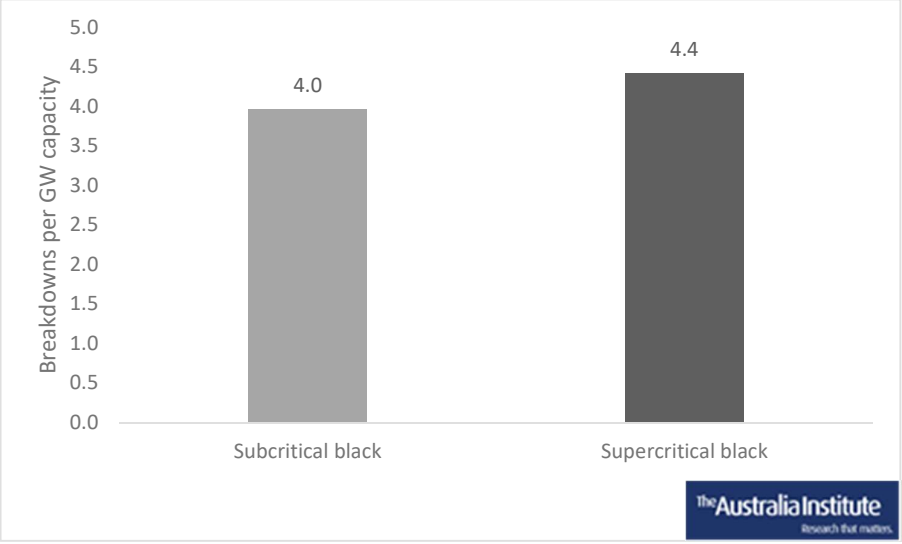
Group	Capacity (GW)	Share of NEM	Breakdowns	% of breakdowns	Breakdowns/ GW capacity
Subcritical black	15.4	30%	61	45%	4.0
Supercritical black	2.9	6%	13	10%	4.4
Subcritical brown	4.7	9%	44	33%	9.4
Gas	12.0	24%	17	13%	1.4
Total	*35.0*	*69%*	*135*	100%	*3.9*
Total NEM capacity	*50.5*				

[15] Ogge (2018) *Coalapse! The New South Wales winter "energy crisis"*

Source: Australia Institute Gas and Coal Watch, Open NEM

As shown in Figure 3 below, the rate of breakdowns of the newer supercritical plants is higher than that of the older subcritical plants.

Figure 3: Breakdowns at black coal plants in the NEM per gigawatt of capacity (2018)



Source: Calculations based on The Australia Institute's Gas & Coal Watch

It is worth emphasising that both subcritical and supercritical black coal plants have performed better than Victoria's brown coal plants, which broke down 9.4 times per GW of capacity. Despite this, Coalition backbenchers and the Minerals Council of Australia have specifically called for new brown coal supercritical plants to be built. This would couple the less reliable technology – supercritical – with the less reliable fuel type – brown coal.

The hapless HELE: Problems with Australia's newest coal plant

Kogan Creek Power Station deserves particular study because – despite being the newest coal plant in the country – its breakdowns are frequent and often the largest in the NEM, causing price spikes and frequency losses.

Built in 2007, Kogan Creek is "one of Australia's most efficient and technically advanced coal-fired power stations".[16] It is also one of the more unreliable power stations in the NEM, having broken down on seven occasions since mid-December last year, including the three largest single breakdowns in the NEM since monitoring began.

Table 5 below shows the breakdowns at supercritical coal power stations in the NEM since mid-December 2017.

Table 5: Supercritical plant breakdowns, 13 December 2017 to 31 December 2018

Plant	Date	Generation actually lost (MW)	Registered capacity of unit lost (MW)
Millmerran	13/12/2017	~580	426
Kogan Creek	23/12/2017	350	744
Millmerran	01/01/2018	156	426
Kogan Creek	11/01/2018	195	744
Callide Power Plant	16/01/2018	405	420
Callide Power Plant	09/02/2018	406	420
Millmerran	19/02/2018	417	426
Tarong North	03/03/2018	255	443
Kogan Creek	18/04/2018	~750	744
Callide Power Plant	30/04/2018	~400	420
Kogan Creek	05/06/2018	750	744
Kogan Creek	16/06/2018	752	744
Kogan Creek	13/08/2018	~286	N/A*
Kogan Creek	13/12/2018	334	N/A*
Tarong North	18/12/2018	442	450

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[16] CS Energy (n.d.) *Kogan Creek Power Station,* https://www.csenergy.com.au/what-we-do/generating-energy/kogan-creek-power-station

Notes: 13 of the 15 breakdowns were unit trips. The (*) marks a decrease, which did not cause the entire unit to be lost. The registered capacity of plants is typically lower than the maximum capacity, so for example Kogan Creek's capacity is given here as 744 MW although it is seen generating more.

As shown in Table 5, Kogan Creek Power Station had seven breakdowns over this period, more than any other supercritical plant. Kogan Creek consists of one generating unit – the largest single unit in the NEM. This means that each breakdown resulted in the single largest loss of capacity of any breakdown in the NEM. In the case of three breakdowns, the unit was at full capacity – meaning that the NEM suddenly lost upwards of 750 MW of generation that it was relying on. In the other three cases, the unit had already been generating below capacity when it broke down.

The breakdowns at Kogan Creek Power Station on 18 April, 5 June and 16 June are shown in Figure 4, Figure 5 and Figure 6 below. The dark shaded area of the charts shows the output remaining fairly constant at around 750 MW before suddenly and unexpectedly dropping to zero. These breakdowns are the three largest breakdowns in the NEM since Gas & Coal Watch began monitoring in mid-December 2017. Since Kogan Creek is a single generating unit, each of these unit trips represents the loss of all generation from Kogan Creek.

Figure 4: Kogan Creek unit trip of 18 April 2018

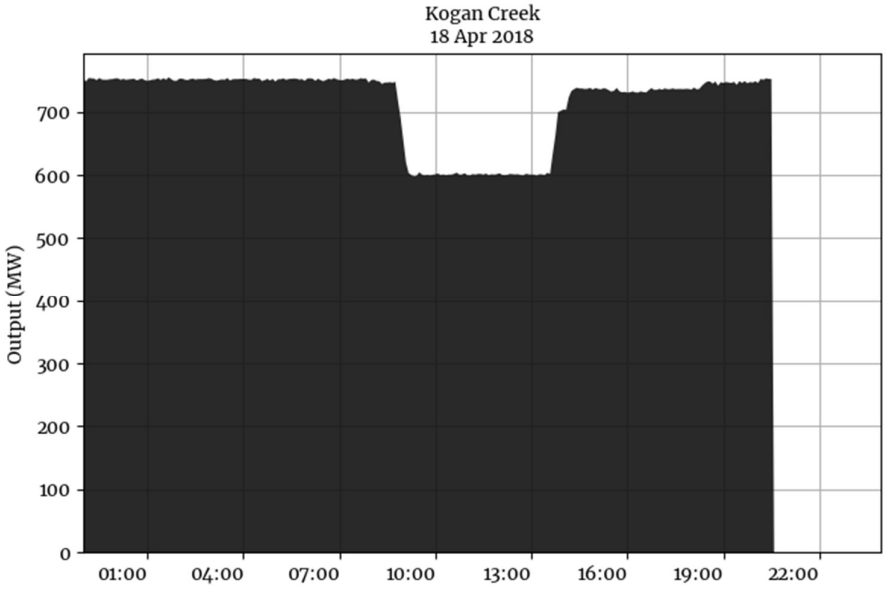


Figure 5: Kogan Creek unit trip of 5 June 2018

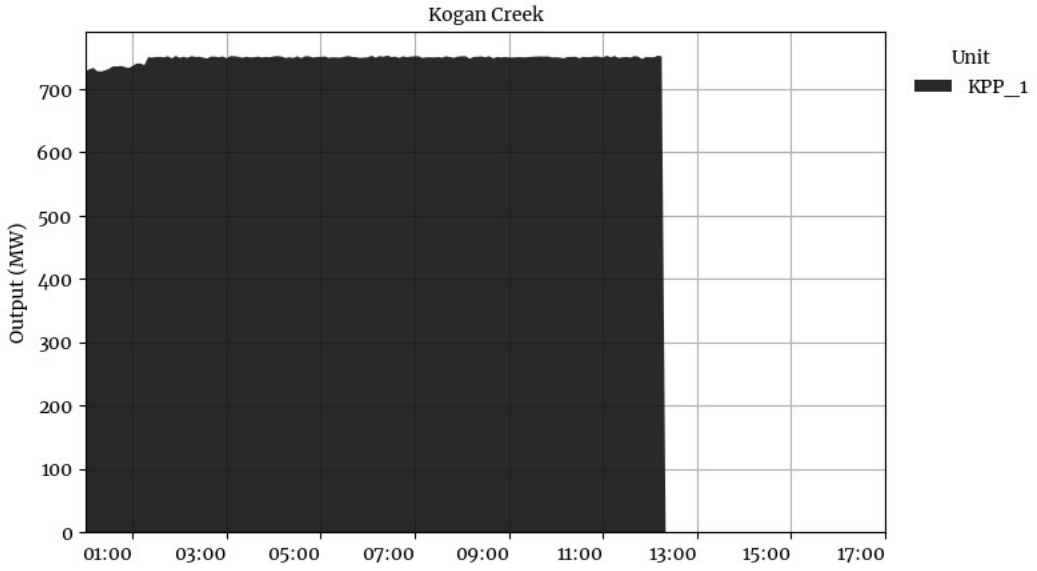
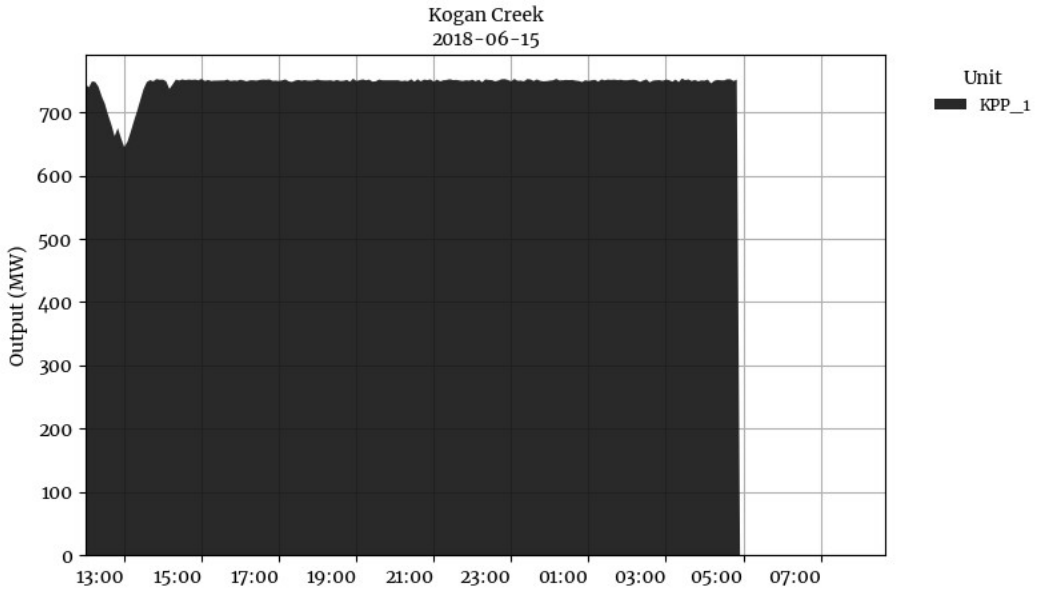


Figure 6: Kogan Creek unit trip of 16 June 2018



Source: OpenNEM

Note: The date on the figure is 15 June as the graph begins in the afternoon of the previous day.

GRID FREQUENCY DISRUPTIONS

When sudden decreases in supply push grid frequency out of its safe range there are a number of risks, including damage to equipment on both the power generation and demand sides. As the largest single generator in the NEM, and with its record of breakdowns, Kogan Creek power station poses a particular threat to grid frequency.

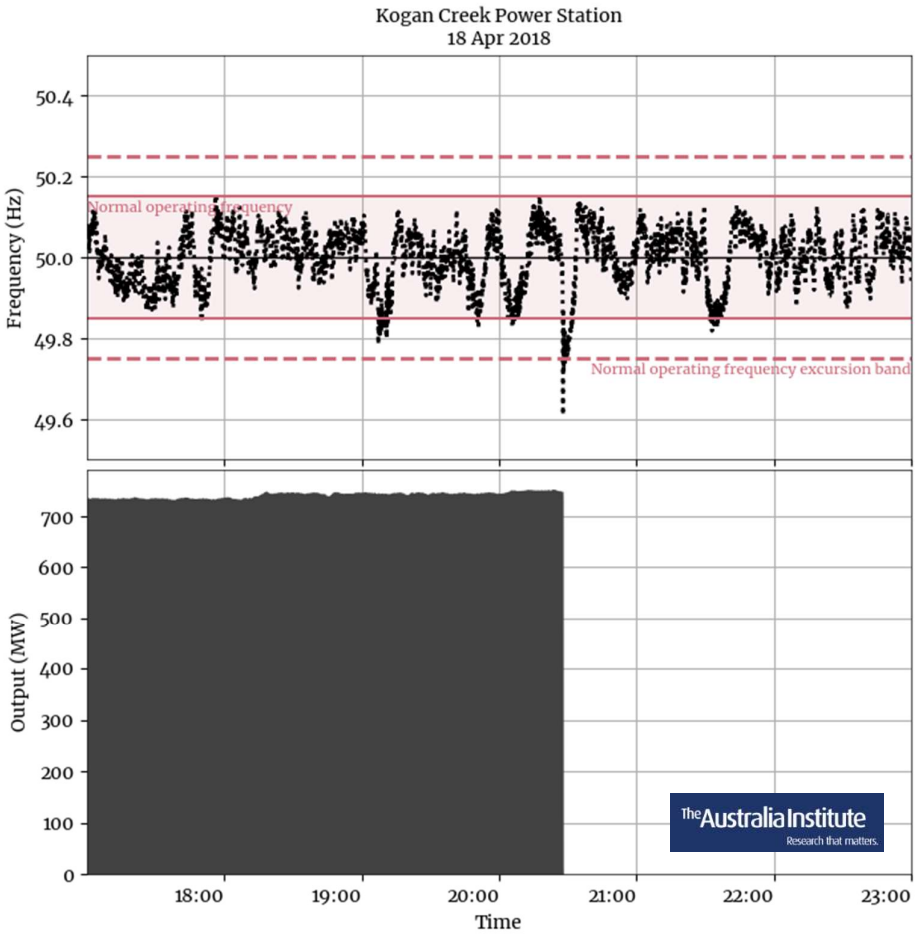
If supply exactly meets demand, the frequency of the power system is 50 Hertz (Hz). Because demand and supply never remain exactly matched, routine frequency fluctuation is between 49.85 and 50.15 Hz (the “normal operating frequency band”).

When a gas or coal plant breaks down, the frequency will often fall below 49.85 Hz, at which point new supply needs to be brought on quickly to restore the frequency. The Frequency Control Ancillary Services market is activated to address the fall in frequency.

The lowest level of frequency that is acceptable when there is a contingency event like a power plant breakdown is 49.75 Hz (the “normal operating frequency excursion band”).

As can be seen in Figure 7 below, the sudden breakdown at Kogan Creek on breakdown on 18 April this year caused a drop in frequency to well below the acceptable lower limit of a secure power system.

Figure 7: Frequency impact of Kogan Creek unit trip of 18 April 2018



Source: OpenNEM

PRICE IMPACTS

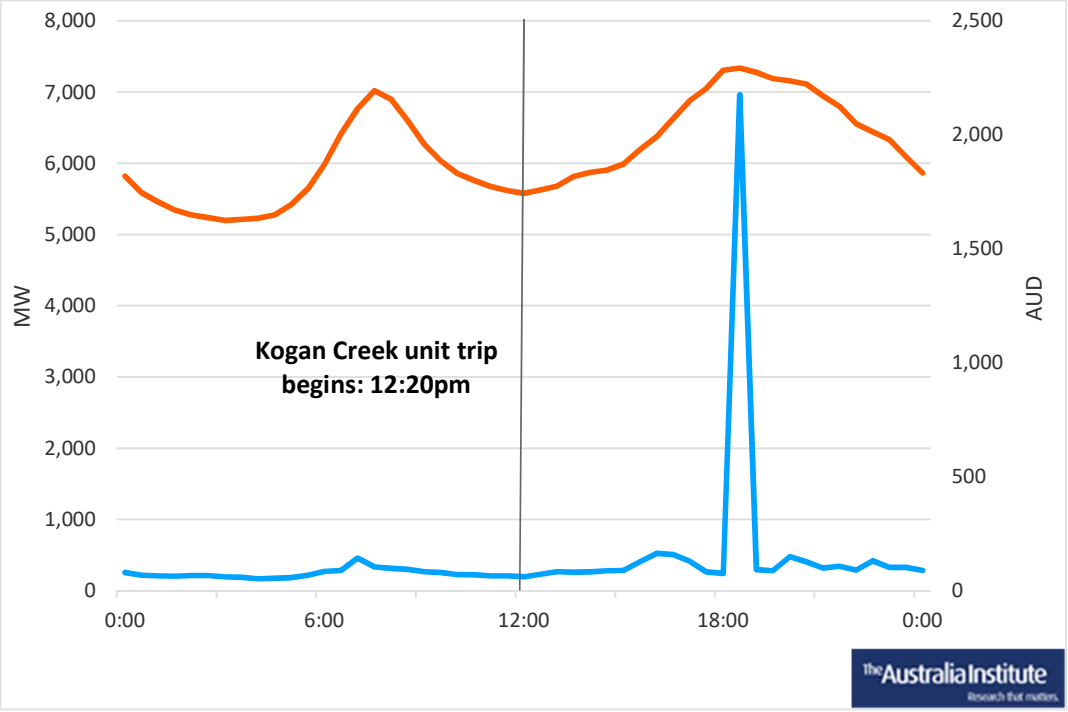
The larger and more sudden the loss of power from a coal breakdown, the more disruptive it is to the electricity supply. When coal plant breakdowns contribute to or cause spikes in wholesale electricity prices, these price increases are ultimately passed on to consumers.

5 June 2018 was a day of relatively high winter demand in Queensland. Supply was already tight as another supercritical coal plant, Tarong North, was not operating.

Figure 8 below shows the Queensland electricity demand plotted against the wholesale electricity price on 5 June this year. The beginning of the 5 June breakdown at Kogan Creek Power Station is indicated by the line.

The loss of Kogan Creek's entire 750 MW of capacity around 12:20pm occurred in a period of relatively low demand. However, Kogan Creek did not come online again by evening, meaning that when the peak demand trading interval occurred at 6:30pm prices surged to over AUD 2,000 per MWh. Had Kogan Creek still been generating, there would have been an extra 750 MW of supply helping to keep prices down.

Figure 8: Queensland electricity demand (orange) and price (blue) on 5 June 2018



Source: OpenNEM

Table 6 shows the output of all of Queensland's power stations during this trading interval and price surge. During this period the average wholesale electricity price was AUD 2,175 per MWh. During this interval another supercritical power plant, Tarong North, was also offline – as was the combined cycle gas power station at Swanbank.

Table 6: Output of QLD gas and coal power plants June 6 2018, 18:00-18:30 hr

Power Station	Technology	Registered Capacity	Average Output	Difference
Barcaldine	Gas (CCGT)	37	0	37,0
Braemar	Gas (OCGT)	504	506.4	-2.4
Braemar 2	Gas (OCGT)	519	289.2	229.8
Callide	Black coal	760	662.5	97.6
Callide C Nett Off	Black coal	840	619.7	220.3
Condamine A	Gas (CCGT)	143	42.7	100.3
Darling Downs	Gas (CCGT)	643	475.2	167.8
Gladstone	Black coal	1,680	1,050.4	629.6
Kogan Creek	Black coal	744	0	744.0
Millmerran Power Plant	Black coal	852	843	9.0
Oakey	Gas (OCGT)	282	170.6	111.4
Roma Gas Turbine Station	Gas (OCGT)	80	70.2	9.8
Stanwell	Black coal	1460	1,283.3	176.7
Swanbank B & Swanbank E Gas Turbine	Gas (CCGT)	385	0	385.0
Tarong	Black coal	1,400	1,253.3	146.7
Tarong North	Black coal	443	0	443.0
Townsville Gas Turbine	Gas (OCGT)	242	238.9	3.1
Yarwun	Gas (CCGT)	154	159.8	-5.8
Total (Gas)		*2,989*	*1,953.0*	*1,036.0*
Total (Coal)		*8,179*	*5,712.1*	*2,466.9*
Total		*11,168*	*7,665.1*	*3,502.9*

Source: OpenNEM

Conclusion

Energy policy should improve reliability, reduce energy prices and reduce emissions. Building new coal plants in Australia will introduce unreliable, expensive and polluting power plants.

There are four coal plants in Australia built within the last twenty years. In 2018, these supercritical plants have broken down at a higher rate than the antiquated subcritical black coal plants in the NEM, relative to capacity. This is despite serious reliability issues with the subcritical black coal fleet as evidenced by the “energy crisis” in New South Wales in June this year.

Australia’s newest black coal power plant at Kogan Creek in Queensland is particularly unreliable, having experienced seven breakdowns since mid-December last year, including the three largest breakdowns in the NEM.

A particular focus on two of Kogan Creek’s breakdowns reveal the effects that coal unreliability has on the electricity market as a whole.

The Kogan Creek breakdown on 18 April this year caused a drop in frequency to below the acceptable level for a secure electricity system.

The Kogan Creek breakdown on 5 June this year contributed to a massive price spike during the period of highest demand.

Australia is experiencing a boom in renewable energy. The September 2018 issue of the National Energy Emissions Audit reports that by the end of 2020 there will be 41% more wind generation capacity attached to the National Electricity Market, and almost three times as much solar capacity as there currently is. The new renewables generation will equal the total annual output from Eraring coal plant, Australia’s largest power station, and be double the Liddell coal plant’s current output.

Building new coal power plants at this point would displace renewable energy and lock in far higher emissions for decades to come, at a time when Australia is experiencing the devastating impacts of global warming.