

Breaking brown

Gas and coal plant breakdowns in Victoria

Victoria's brown coal fired power stations suffer from frequent breakdowns and Loy Yang A is responsible for the largest number of breakdowns on the National Energy Market, since monitoring began in December 2017, and Loy Yang A's Unit 2 is the most unreliable unit on the grid.

Discussion paper

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Introduction

The Australia Institute founded Gas & Coal Watch in December 2017 to monitor the National Energy Market's fossil fuel power plants for breakdowns, particularly during high heat when generating units are vulnerable. Victoria remains highly reliant on its three brown coal fired power stations for its electricity. Victoria is responsible for around 20% of the National Electricity Market's gas and coal capacity, but 35% of its gas and coal breakdowns. That is largely due to its three brown coal plants, particularly Loy Yang A and Yallourn W.

Victorian coal is responsible for around 13% of the National Electricity Market's gas and coal capacity but 32% of its gas and coal breakdowns. All three of Victoria's coal plants burn brown coal using "subcritical" technology. Coal plants in other states burn black coal only, using either subcritical or "supercritical" technology.

This special report summarises the breakdowns at Victoria's brown coal power stations and compares them to rest of the NEM. It is released in response to the recent long-term breakdown of Unit 2 at Loy Yang A.¹

¹ AGL (June 2019) *FY20 impact of extended unit outage at Loy Yang*, <https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2019/june/fy20-impact-of-extended-unit-outage-at-loy-yang>

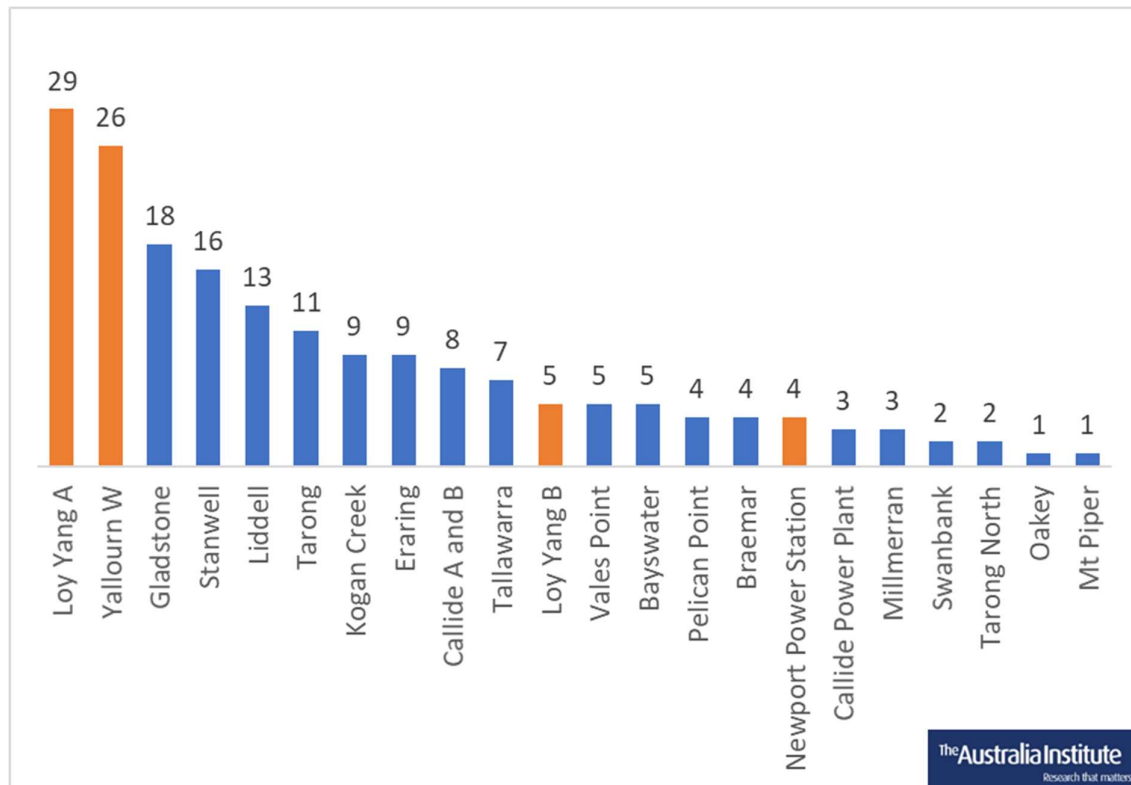
Breakdowns

Since Gas & Coal Watch began in mid-December 2017, there have been 185 breakdowns at gas and coal plants. 64 were at Victorian gas and coal plants:

- 29 at Loy Yang A (brown coal)
- 26 at Yallourn W (brown coal)
- 5 at Loy Yang B (brown coal)
- 4 at Newport Power Station (gas)

That makes Loy Yang A and Yallourn W the least reliable coal plants in the National Electricity Market (NEM), by number of breakdowns.

Figure 1: Breakdowns by power plant (Victorian plants in orange)



Note: Figures as of 17 June 2019.

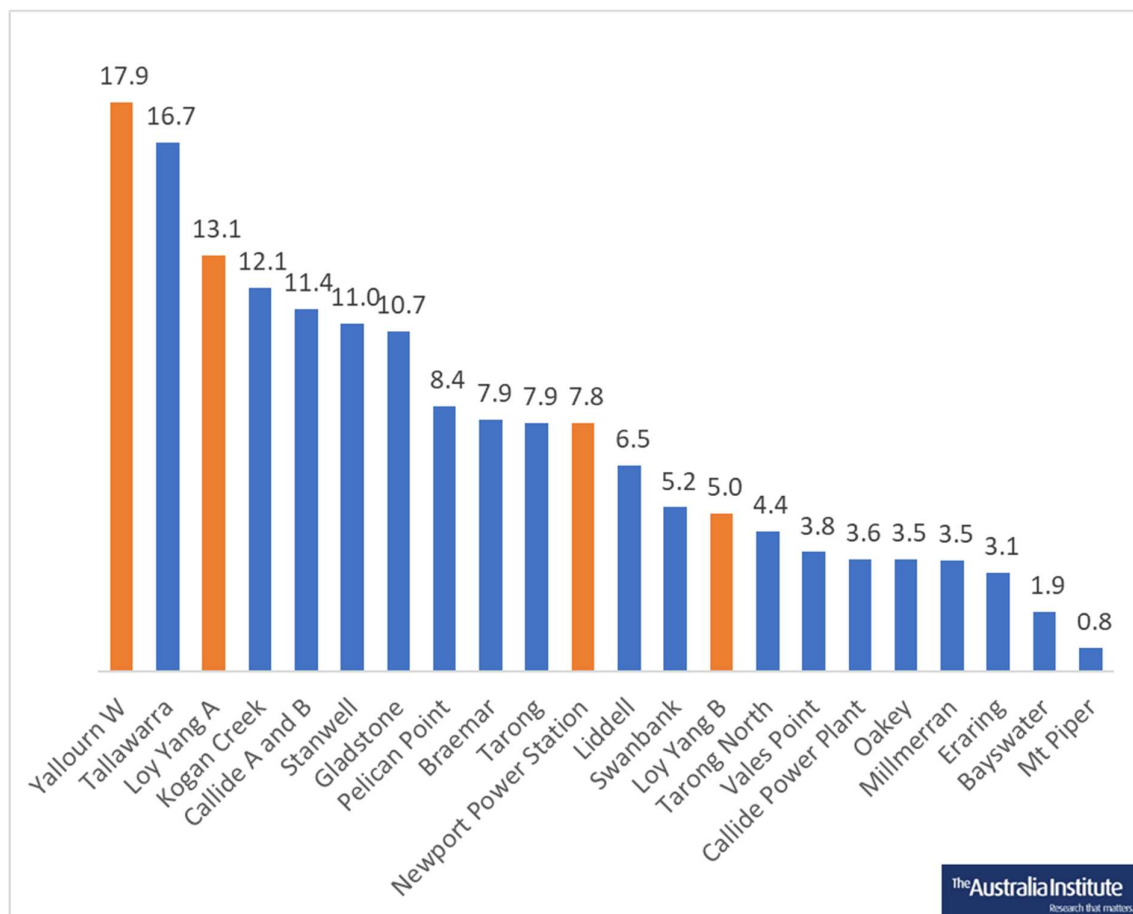
Breakdowns per GW

We also measure breakdowns by Gigawatt of capacity, to reflect that some plants are much larger than others.

- Yallourn W had 17.9 breakdowns per GW
- Loy Yang A had 13.1 breakdowns per GW
- Loy Yang B had 5.0 breakdowns per GW
- Newport Power Station had 7.8 breakdowns per GW

That makes Yallourn W the least reliable coal plant by breakdowns per GW. Loy Yang A is the second least reliable coal plant, and the third least reliable *gas or coal* plant. Newport Power Station is the fourth least reliable gas plant.

Figure 2: Breakdowns per GW (Victorian plants in orange)

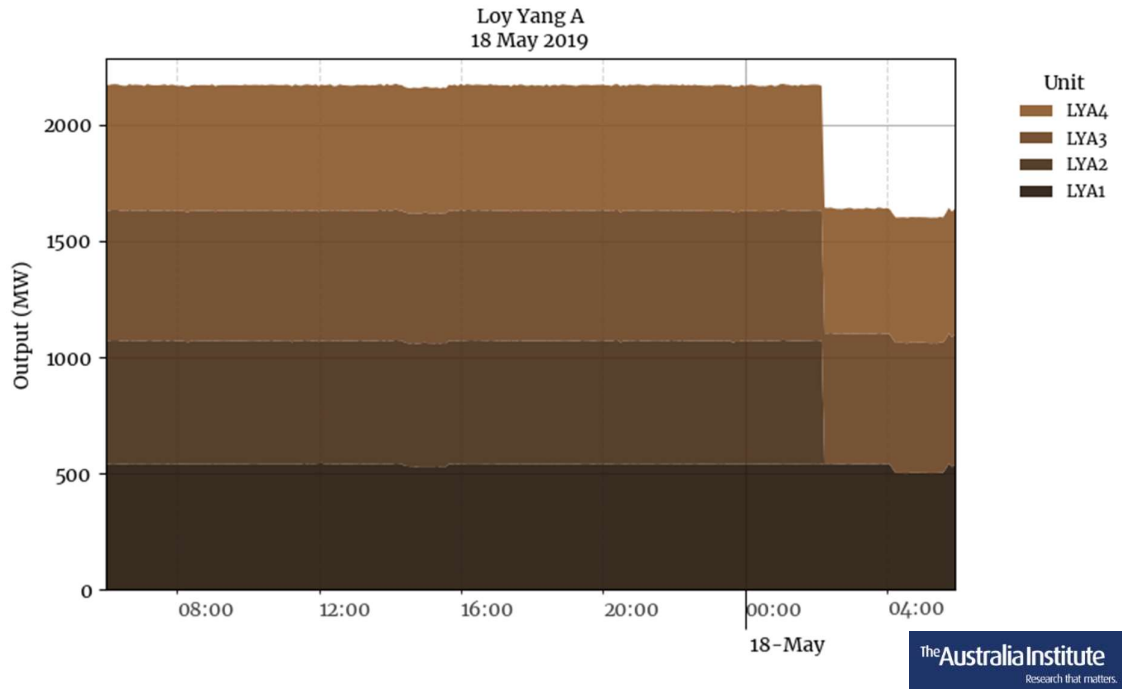


Note: Figures as of 17 June 2019.

Individual units

As reported, Unit 2 at Loy Yang A is out of operation following an 18 May 2019 unit trip – and is expected to remain so for seven months.

The precipitating unit trip appears in Gas & Coal Watch (supplied by OpenNEM):



Unit 2 is the worst performing unit in the National Electricity Market, with 10 breakdowns recorded by Gas & Coal Watch. Victorian coal units are five of the top 10 worst performing units (by number of breakdowns).

Unit name	Type	State	Breakdowns
Loy Yang A Unit 2	Brown coal	Victoria	10
Kogan Creek (only unit)	Supercritical black coal	Queensland	9
Loy Yang A Unit 1	Brown coal	Victoria	9
Yallourn W Unit 3	Brown coal	Victoria	9
Stanwell Unit 4	Subcritical black coal	Queensland	8
Yallourn W Unit 1	Brown coal	Victoria	8
Liddell Unit 2	Subcritical black coal	NSW	7
Yallourn W Unit 2	Brown coal	Victoria	7
Tallawarra Unit 1	Gas (CCGT)	NSW	7
Callide B Unit 1	Subcritical black coal	Queensland	6



Summer out (2019)

On the 25th of January 2019, the two most unreliable power stations in the country were not operating at capacity. According to the Victorian Minister for Energy Lily D'Ambrosio, three units at Loy Yang A and Yallourn W were not working.

As temperatures soared to 44 degrees, Minister D'Ambrosio admitted:

This means we can't rule out brownouts ... We have ageing coal-fired power stations. They are becoming less reliable.²

The units were brought offline following tube leaks or because of scheduled maintenance. These examples were not included in the tally of breakdowns given there was some notice given, however their being offline did feed into the unreliability already experienced by these two power stations, which will only increase with the rise in extreme heat.

The heat particularly affects thermal electricity generation because the efficiency of thermal generation depends on temperature extremes between input and output. Closed-system generators typically use water for cooling, and during periods of extreme heat power stations can fail if the water from the cooling tower is too warm, if access to water is limited, or if the discharged water being pumped out of the cooling tower is too hot.³

As climate change results in more hot days, this vulnerability exacerbates. This is compounded by increased demand for electricity on hot days.

On the 25th of January, large scale solar farms were running at 93 per cent of their maximum output, which is in stark contrast to Victoria's brown coal generators, where 1,600 MW of generation was offline.⁴

² Chang (January 2019) *Power outage in Melbourne as electricity generators fail and Victorians brace for hottest day since Black Saturday* <https://www.news.com.au/technology/environment/power-stations-fail-as-victorians-brace-for-hottest-day-since-black-saturday/news-story/b404770015b841f39e348b19e5eec3a7>

³ Union of Concerned Scientists (2011) *Energy and Water in a Warming World: Freshwater Use by US power plants* http://www.ucsusa.org/clean_energy/our-energy-choices/energy-and-wateruse/freshwater-use-by-us-power-plants.html#.WfEcCohx3IU

⁴ Saddler (February 2019) *NEEA January* http://www.tai.org.au/sites/default/files/NEEA%20Electricity%20Update%20Feb%202019%20%5BWEB%5D_0.pdf

With no more generation available, all interconnectors flowing at capacity and all contracted reserves used up, the Australian Energy Market Operator was forced to directly load shed (i.e. forced blackouts).⁵

To some extent, the events of January 2019 were foreseeable, unlike those of the previous summer.

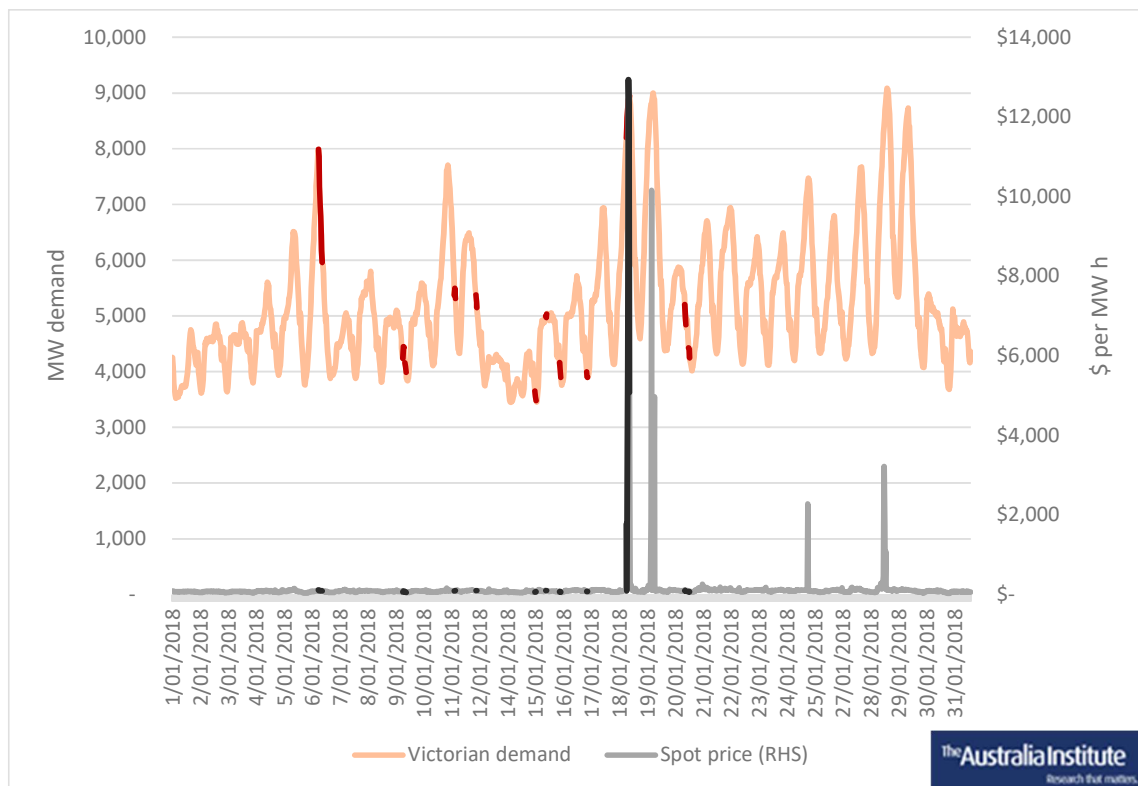
⁵ AEMO (April 2019) *Load Shedding in Victoria 24 and 25 January 2019* https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2019/Load-Shedding-in-VIC-on-24-and-25-January-2019.pdf

Bad timing (2018)

Victoria's gas and coal breakdowns in January 2018 coincided with some of Victoria's periods of highest demand – and highest electricity prices.

The following graphs show Victoria's demand for electricity (in MW) and the spot price of electricity (in MW h) for January 2018.

Figure 3: Victorian electricity demand and prices, January 2018



Source: Australian Energy Market Operator (2019) *Data Dashboard*,
<https://aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard>

Note: The darker colours indicate times when there was a gas or coal breakdown.

January 2018 was a particularly bad period for Victorian brown coal. There were 12 breakdowns in the 16 days between the 6th and 21st of January. Summer is a period of high demand for the National Electricity Market, and two of these breakdowns coincided with periods of particularly high state electricity demand. In other words, the breakdowns came at the worst possible time for the grid. In one of these incidents, the breakdown coincided with large price increases.

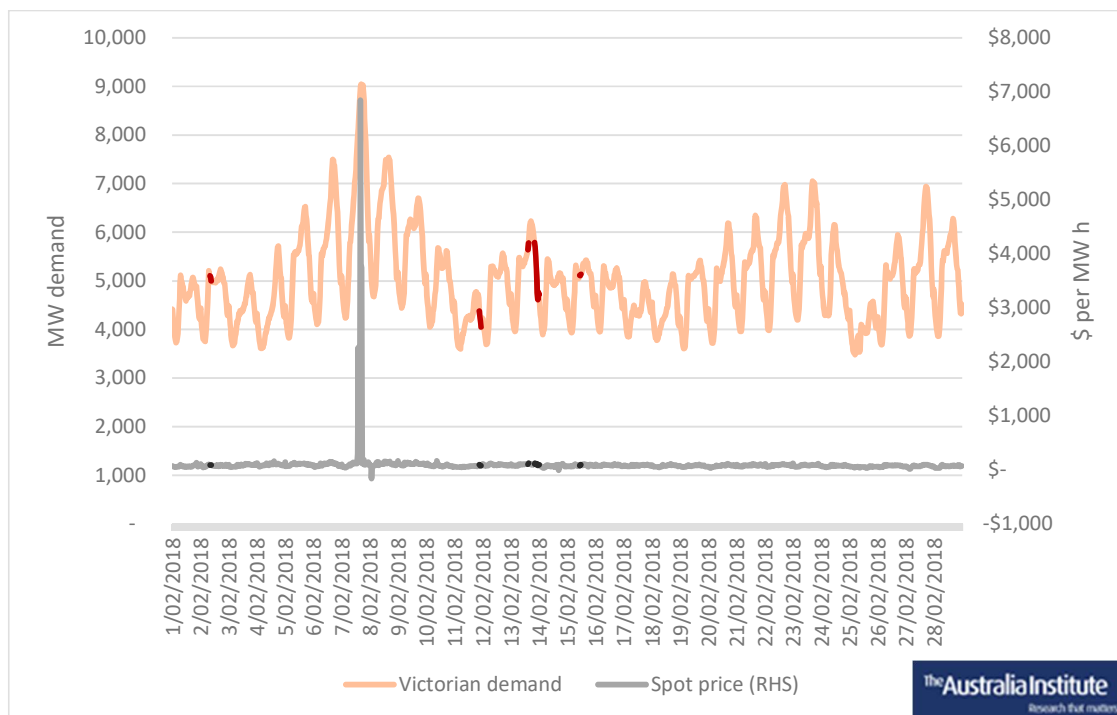
At 4:30pm on the 6th of January, Loy Yang A lost 264 MW, and did not recover for several hours. This came during the highest demand for the first half of January, and the seventh highest demand in the summer months of 2018.

At 3:30pm on the 18th of January, Loy Yang B lost 528 MW, and did not recover until 6:00pm. This was during the second highest demand in January. During this period, prices reached their highest point for the summer months of 2018, going to \$12,931 per MW h. This is 97 times higher than the average price in January, of \$134.

This price speak was reported by Fairfax at the time,⁶ and energy analysts subsequently warned that these problems would become more likely as the plants get older.⁷

In February and December 2018, gas and coal breakdowns did not coincide with any particular demand or price peaks, as shown in Figure 4 and Figure 5.

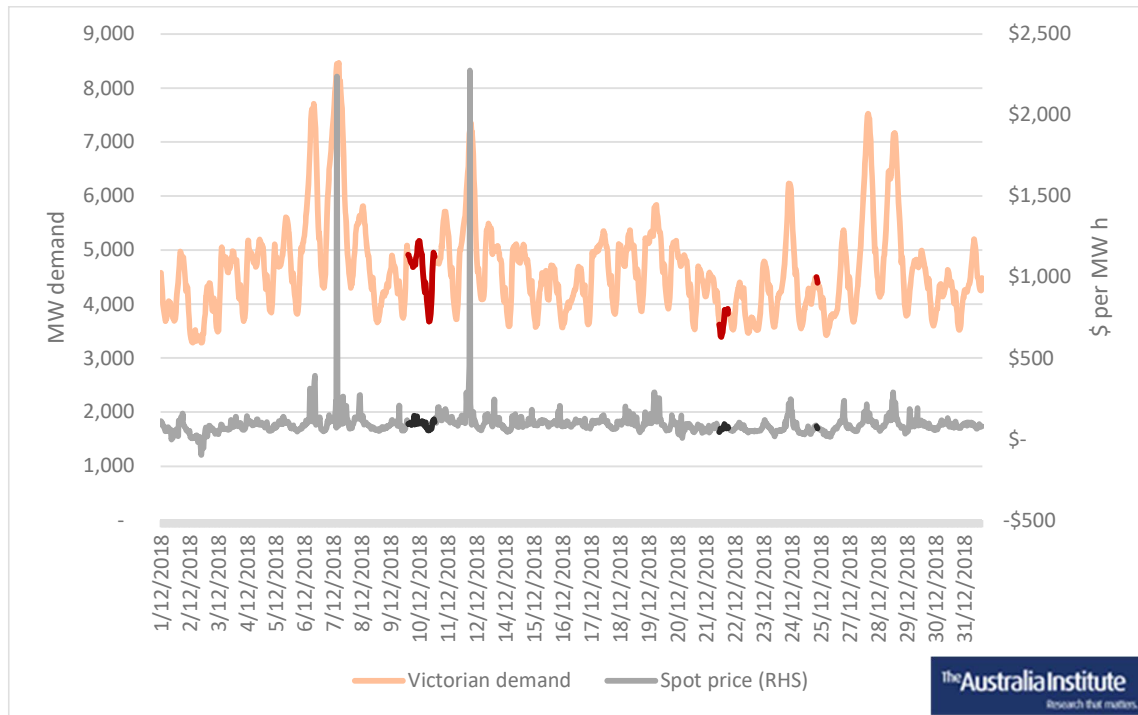
Figure 4: Victorian electricity demand and prices, February 2018



⁶ Latimer (2018) *Loy Yang B failure sends prices soaring, triggers supply safeguards*, <https://www.smh.com.au/business/the-economy/loy-yang-b-failure-sends-prices-soaring-triggers-supply-safeguards-20180119-p4yymr.html>

⁷ Latimer (2018) *Victorian coal power station failures put NEM reliability at risk*, <https://www.canberratimes.com.au/business/the-economy/victorian-coal-power-station-failures-put-nem-reliability-at-risk-20180409-p4z8l9.html>

Figure 5: Victorian electricity demand and prices, December 2018



Source: Australian Energy Market Operator (2019) *Data Dashboard*,

Note: The darker colours indicate times when there was a gas or coal breakdown.

Conclusion

As climate change worsens, there will be more heatwaves, putting more pressure on Victoria's brown coal power generation.

The solution to the energy trilemma of reliability, price and pollution is more renewable energy and storage. Renewables bring down the peak demand during summer, are the cheapest new energy and are emissions-free.