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Timing is everything

Liddell Power Station's record of breaking down when it is needed most

Liddell is the oldest power station in Australia. It is particularly vulnerable to breaking down in hot weather when demand is high, and electricity is most needed. It has suffered four major breakdowns so far this year. Two of these were within two hours of peak demand on very hot summer days. The continued reliance on Liddell will lead to less reliable and more expensive energy in NSW and will undermine investment in new capacity.

Discussion paper

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Timing is everything

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Summary

At 47 years old, Liddell power station is the oldest power station operating Australia. The older power plants are, the more inefficient, unreliable and dangerous they become.¹ That is why internationally, only 1% of power stations in operation are older than 50 years.²

So far this year Liddell has broken down four times. Liddell has four large generating units of 500 MW each, although the “effective capacity” capacity has been reduced to 420 MW each "due to age and reliability issues".³ The size of these units means that breakdowns at Liddell have a relatively large impact compared to many other power plants.

Liddell’s breakdowns are not only frequent, but badly timed.

Hot summer days drive high demand and they are when the electricity system has the greatest challenge in supplying enough electricity. These are the times power plants need to be relied upon most to be able to deliver electricity.

During the February 10 heatwave day in NSW in 2017, extreme temperatures led to very high demand and a series of breakdowns at coal and gas power plants. In all, 20% of gas and coal power plants in New South Wales were unable to deliver power at the critical peak interval leading to load shedding at the Tomago Aluminum Plant.⁴

On that day two 500 MW generators at Liddell were out of action due to boiler tube leaks, a problem associated with old at coal power plants. This made Liddell the largest single contributor to the load shedding at Tomago Aluminum plant.

So far in 2018 Liddell has had four major breakdowns.

¹ Todd (2016) *Why coal fired power stations don't work so well when they are old*, <https://reneweconomy.com.au/coal-fired-power-stations-dont-work-well-old-72946/>

² Nelson (2017) Electricity production and consumption in NSW P.10, <http://aglblog.com.au/wp-content/uploads/2017/11/ATSE-November-2017.pdf>

³ Hannam (2017), *Liddell power plant operating below 40 per cent capacity, faces 'mammoth' woes*, <https://www.smh.com.au/environment/liddell-power-plant-operating-below-40-per-cent-capacity-faces-mammoth-woes-20170907-gycij7.html>

⁴ Ogge (2017) Can't stand the heat; The energy security risk of Australia's reliance on coal and gas generators in an era of increasing heatwaves, <http://www.tai.org.au/sites/default/files/P454%20Can%27t%20stand%20the%20heat%20FINAL%2020231.pdf>

Two of those breakdowns were within 2 hours of peak demand on extreme temperature high demand day.

The staged investment by AGL to replace Liddell by 2022 will deliver more reliable and lower cost energy to NSW electricity consumers.

Can't stand the heat

Extremely hot days result in very high demand due largely to demand for cooling. These hot days are the greatest challenge for our electricity system. The relentless increase in extremely hot days as a result of global warming will continue to exacerbate this problem.⁵

Liddell's breakdowns tend to occur on very hot days when demand is highest and breakdowns have the greatest impact on the reliability of the electricity supply.

Coal plants generally become less efficient and break down more in the heat. Liddell's advanced age increases its vulnerability to extreme heat.

On the heatwave day of February 10th 2017, two of Liddell's 500 MW units broke down, making it the single largest contributor to the load shedding at the Tomago aluminum plant that day.

This year there have been four major breakdowns at Liddell. Two of these occurred on very hot days within an hour of NSW reaching peak demand.

On January 21, 2018 the temperature in the Hunter Valley near Liddell Power Station reached 37.1 degrees Celsius.⁶ This was the 3rd highest demand day in NSW that month.⁷ As shown in Figure 1 below, at 3.30pm, 90 minutes before peak demand was reached, Unit 1 at Liddell broke down, losing 420 MW of generation instantaneously and without warning.⁸

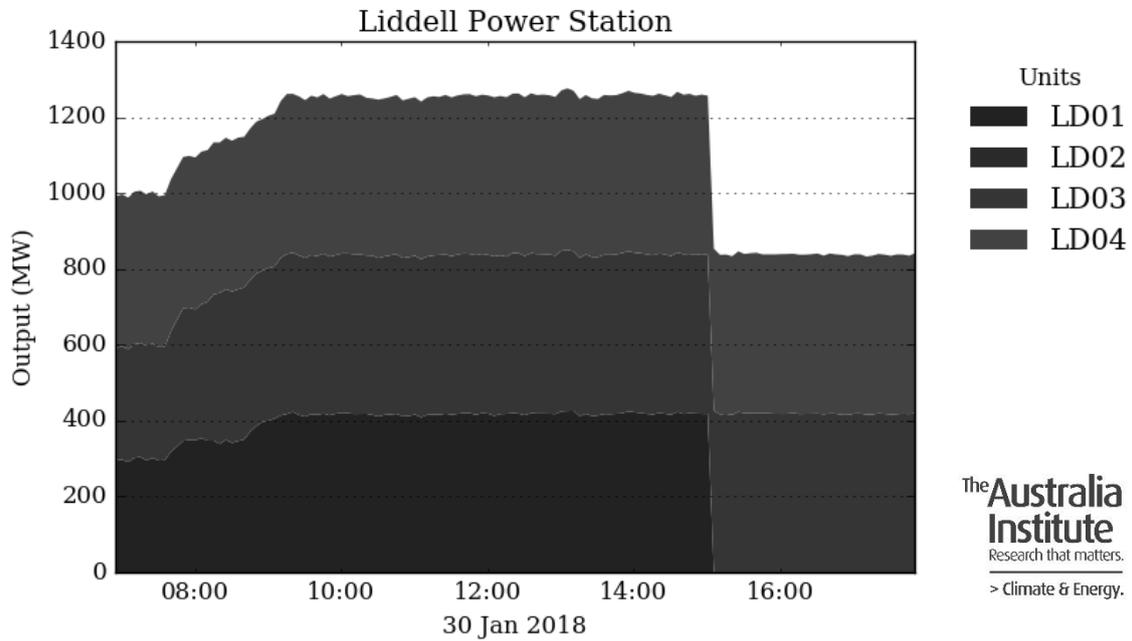
⁵ AEMO (2017) *Summer operations 2017-18*, Figure 2 P.8, https://www.aemo.com.au/-/media/Files/Media_Centre/2017/AEMO_Summer-operations-2017-18-report_FINAL.pdf

⁶ BOM (2018) *Climate data Online*, Scone Airport. <http://www.bom.gov.au/climate/data/index.shtml>

⁷ AEMO (2018) Aggregated price and demand data, <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#aggregated-data>

⁸ The Australia Institute (2018) *Gas and coal watch*, <http://www.tai.org.au/gas-coal-watch>

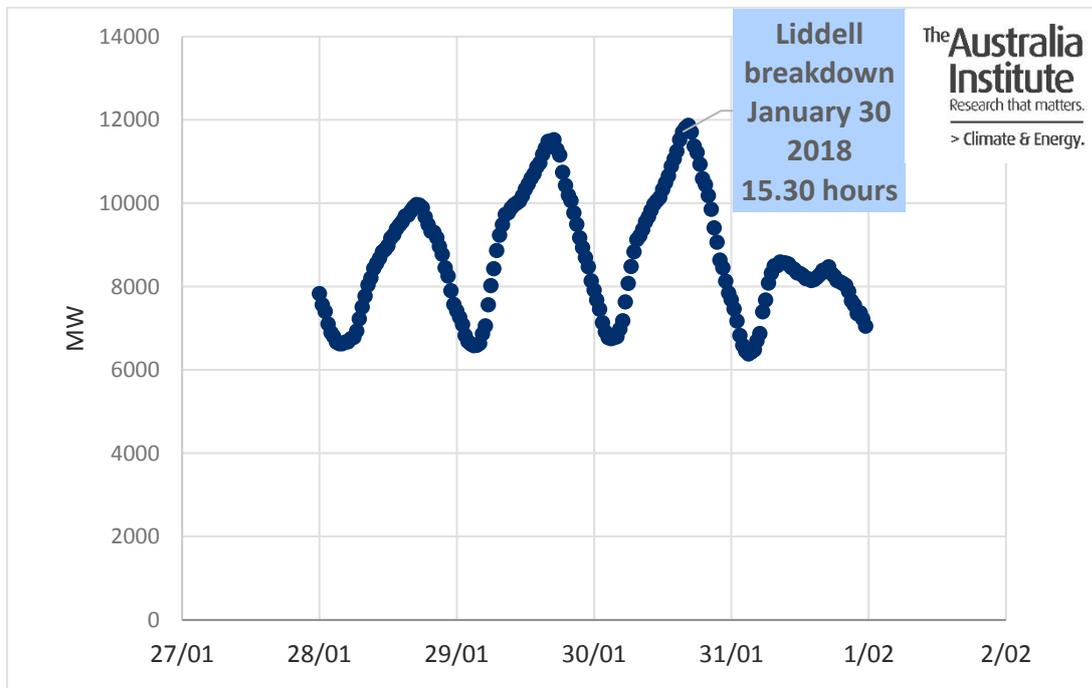
Figure 1: Liddell Power Station unit trip January 30th 2018



Source: The Australia Institute, Gas and Coal Watch 2018/ Opennem

Figure 2 below puts the timing of breakdown in the context of peak demand that day.

Figure 2: NSW electricity demand January 28- 31, 2018

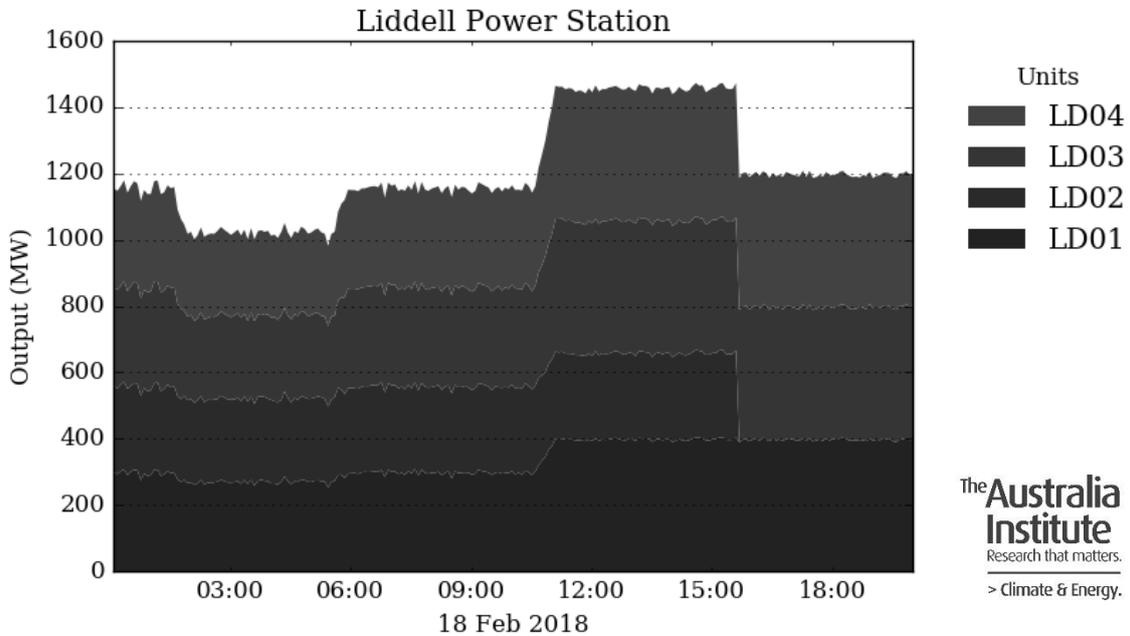


Source: AEMO aggregated price and demand data 2018. The Australia Institute Gas and Coal Watch/ Opennem.

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Then on February 18, 2018 Liddell again broke down at 3.40pm, less than an hour before the demand peak,⁹ losing 263 MW of generation and 420 MW of capacity.¹⁰

Figure 3: Liddell Power Station unit trip February 18th, 2018



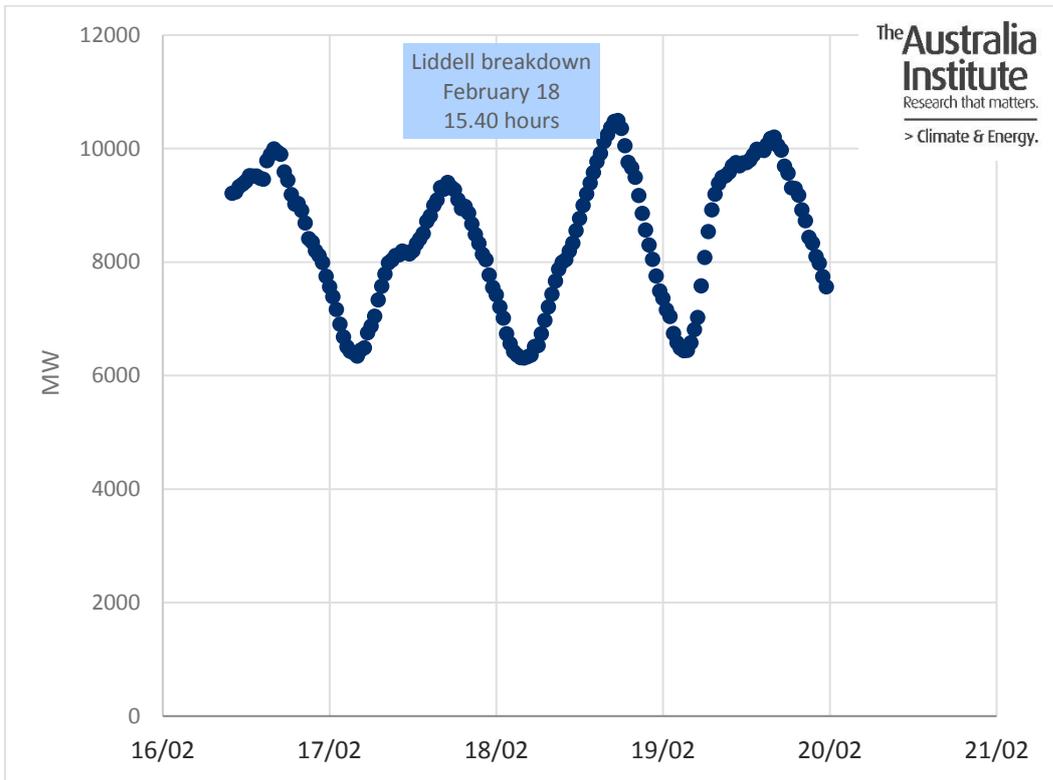
Source: The Australia Institute, Gas and Coal Watch 2018/ Opennem

Figure 4 below shows the February 18th breakdown in the context of peak demand.

⁹ AEMO (2018) Aggregated price and demand data, <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#aggregated-data>

¹⁰ The Australia Institute (2018) *Gas and coal watch*, <http://www.tai.org.au/gas-coal-watch>

Figure 4: NSW electricity demand February 16-19, 2018



Source: AEMO aggregated price and demand data 2018. The Australia Institute Gas and Coal Watch/ Opennem.

How extending Liddell’s life would undermine the reliability of our electricity supply

Alinta Energy have made an offer to buy Liddell Power Station with the intention of extending its life a further five to seven years.¹¹

In 2015, Alinta closed Northern Coal Power Station in South Australia. Alinta gave less than one-year notice of the closure.¹²

In contrast to Alinta, the current owners of Liddell Power Station, AGL, have given the local community, workers and the governments seven years notice of the closure.¹³

Unlike Alinta, AGL is also investing in replacing the electricity generating capacity that will be lost when Liddell closes. The replacement is being carried out in three stages prior to the planned closure in 2022. It includes a combination of new renewable energy and gas generation, demand response, upgrading the existing Bayswater coal power station and battery storage.¹⁴

This combination includes a significant amount of flexible dispatchable generation, including battery storage and gas peaking plants. This means the replacement will be more suited to supplying power on the critical peak demand events on extremely hot days than Liddell, which is old inflexible “baseload” generation.

Because the new capacity is mostly up to date, modern technology it is likely to be far more reliable than the old legacy coal plant that breaks down in peak demand periods.

The company also expects the Levelised Cost of Energy (LCOE) from the replacement plan to be \$83 MWh, this is significantly lower than \$106 MWh if the life of Liddell

¹¹ Latimer, Hannam (April 2018), *Alinta lobs \$250m bid for AGL's Liddell power station*, <https://www.smh.com.au/business/companies/alinta-lob-250m-bid-for-agl-s-liddell-power-station-20180430-p4zcdg.html>

¹² ABC (2016) *Port Augusta's coal-fired power station closes in South Australia*, <http://www.abc.net.au/news/2016-05-09/port-augustas-coal-fired-power-station-closes/7394854>

¹³ AGL (2017) *NSW Generation Plan*, <https://www.agl.com.au/-/media/agl/about-agl/documents/media-center/asx-and-media-releases/2017/171209nswgenerationplandecember2017.pdf?la=en&hash=529E1A89370A33DA8F378D761CEE1D919C9C91D>

¹⁴ Ibid.

were to be extended.¹⁵ Given LCOE costs of as low as \$40/MWh for wind, \$57/MWh for solar and declining storage costs, AGL's estimates do not seem optimistic.¹⁶

The replacement could have reduced electricity prices even more if solar thermal with storage (CST) had been used rather than gas peaking plants as CST has lower LCOE than gas peaking power plants which have to pay expensive fuel costs.¹⁷

As such the closure of Liddell will provide more reliable electricity to New South Wales consumers at a lower cost.

However, the ad hoc proposal to extend Liddell's life would also have longer term consequences.

Investors require certainty to make these investments. If coal power plants close suddenly, there is insufficient time for investors to plan and build new power stations to be ready with the additional electricity supply when the coal plant closes.

If Liddell's life is extended, the certainty required for investment in capacity to replace it will be undermined. This would make it less likely that other companies will make the investment to provide additional capacity when Liddell does eventually close, potentially leaving NSW electricity consumers in a far worse position than if Liddell closed as currently scheduled.

In the future, it will be difficult for potential investors to have confidence that announced closures won't be reversed. This could undermine their willingness to invest in providing additional capacity to replace coal plants when they close.

¹⁵ Ibid P.4

¹⁶ Lazard (2017) Levelised Cost of Energy 2017, <https://www.lazard.com/perspective/levelized-cost-of-energy-2017/>

¹⁷ Ibid

Conclusion

The critical challenge for the National Electricity Market is supplying electricity on very hot days.

This is because demand for cooling drives high demand, while at the same time fossil fuel generators are very vulnerable breakdowns as a result of high temperatures. This challenge is continually increasing as extreme heat events inexorably increase as a result of global warming.¹⁸

The propensity of coal power plants to break down is increased by age. Liddell is Australia's oldest coal power plant and regularly breaks down on hot high demand days when electricity is most needed.

Certainty is central to ensuring sufficient investment to replace power plants when they close. If coal plants close without sufficient warning the market does not have time to replace the capacity. Conversely, if announced closure dates are changed, investment is undermined, as investors have planned on the basis of the demand for electricity to replace closing power plants.

AGL has given seven years notice for the closure of Liddell and is investing in more flexible dispatchable power to replace it. This will provide more reliable and lower cost power to New South Wales electricity consumers than prolonging the life of Liddell given the costs of the upgrades required to do so.

Political pressure that leads to prolonging the life of Liddell will result in less reliable power, particularly in extreme heat conditions, as well as higher electricity prices for New South Wales electricity consumers.

¹⁸ AEMO (2017) *Summer operations 2017-18*, Figure 2 P.8, https://www.aemo.com.au/-/media/Files/Media_Centre/2017/AEMO_Summer-operations-2017-18-report_FINAL.pdf