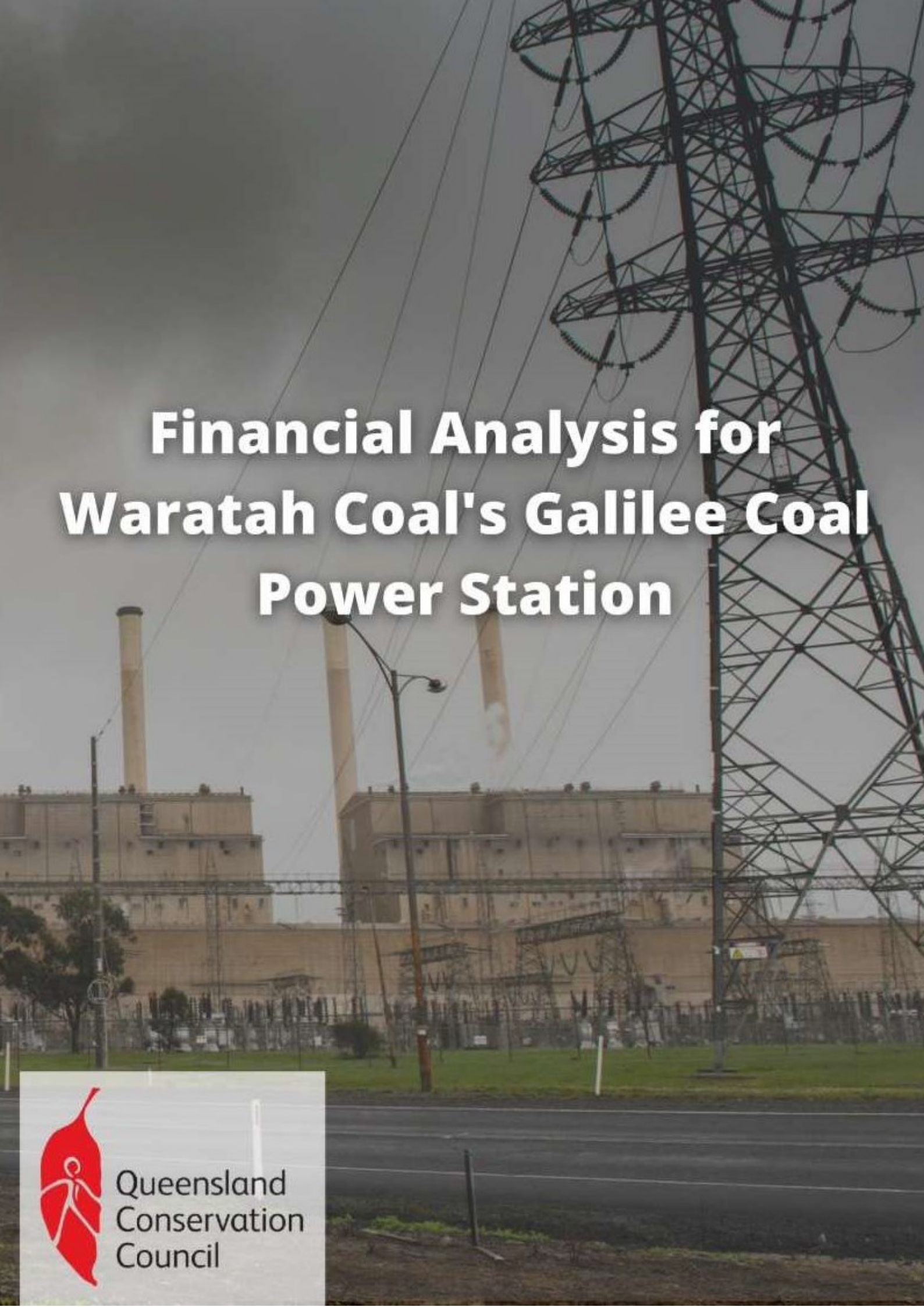

Financial Analysis for Waratah Coal's Galilee Coal Power Station

Queensland Conservation Council

Queensland Conservation Council

POWER UP QUEENSLAND!

Queensland doesn't need any new coal

Waratah Coal, part of the Mineralogy Group, owned by Clive Palmer, is proposing to build a 1,400 MW new coal fired power station at Alpha in central Queensland. Iterations of this project have been in the pipeline for more than a decade but have never progressed beyond early planning stages.

In that decade, the capital costs for solar and storage have more than halved, while finance costs for coal projects have increased around the globe. Projected electricity demand growth in Queensland evaporated and rooftop PV has massively changed the role for large-scale generation.

Building Galilee power station will lock Queenslanders into paying high electricity prices for capacity and energy which we do not need.

Galilee Power Station would push up prices

In the week beginning 13 September 2021, Queensland's average wholesale electricity price was only $25/MWh. By 2025-26, when the first unit of the Galilee power station is projected to come online[1], AEMO and CSIRO estimate that the levelised cost of electricity (LCOE) from a new black coal fired generator in central Queensland would be $100/MWh. There are no major cost changes forecast by the time the second unit would be commissioned in 2029-30. By contrast, CSIRO[2] found that new renewables and storage could be built to meet up to 90% of Queensland's demand for between $50 - $60/MWh by 2030. Figure 1 shows that Galilee Power Station could never compete with new renewables and storage on price.

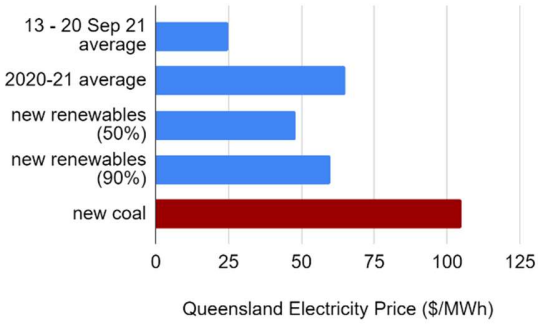

Figure 1: new coal would lock in high prices

The cost of new coal would also be extremely vulnerable to increases in the cost of capital and cost of carbon. Costs of capital are rising as an increasing number of funders walk away from the risks of carbon intensive projects and remaining investors demand higher rates of return. Each 1% increase in cost of capital for Alpha power station increases the cost of electricity, and cost borne by Queensland consumers, by $15/MWh. A $50/tonne carbon price would add at least $40/MWh to the cost of electricity from the station.

[1] https://www.barcaldinerc.qld.gov.au/downloads/file/1484/20200923-covering-letter-to-brc-final

[2] https://publications.csiro.au/publications/publication/PIcsiro:EP201952/

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We don't need the energy

Development application documents submitted for Galilee Power Station frame it as a replacement for the ageing Gladstone power station. However, the Institute for Energy Economics and Financial Analysis[3] (IEEFA) forecast that Queensland coal output would fall by 25% from 2020 to 2025. Figure 2 shows that by the time the first unit of Galilee Power Station would be built in 2025-26, new renewables would have already more than replaced 2020 output from the by then-retired Callide B coal power station, as well as Gladstone and Tarong North power stations. Adding Galilee Power Station to the Queensland power system would make it even more difficult for the rest of Queensland's coal fired power stations to stay online to their end of technical life.

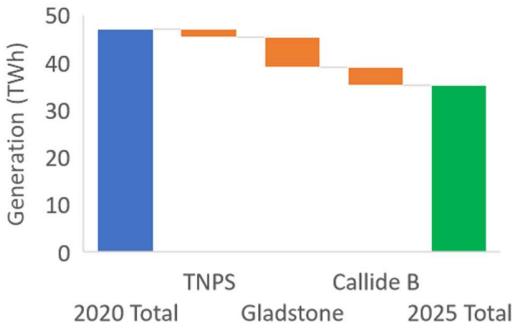

Figure 2: Renewables will reduce coal output by 25% by 2025

New demand won't be driven and can't be met by coal

Galilee Power Station's development application documents forecast up to 1,500 MW of additional load from coal mining in the Galilee and Bowen Basins. This would be an unprecedented expansion, more than double the 750 MW load from LNG extraction and transport.

The Queensland Government is actively seeking to grow electricity demand in other areas, particularly by developing hydrogen and green manufacturing industries. However, this new demand would need to be met by renewable energy, not new coal, to enable Queensland to participate in these emerging global markets. Other new demand sources, such as electric vehicles, need to be planned to provide services to the system and integrate with flexible energy sources. Building new projects such as Galilee Power Station to meet passive demand from consumers is inefficient and extremely costly.

We don't need more baseload, we need smarter loads such as batteries, pumped hydro and even potentially hydrogen electrolysers that can shift demand from the daytime trough to the evening peak.
These must be prioritised rather than adding an inflexible 1,400 MW to the grid through a new coal fired power station.

[3] https://ieefa.org/ieefa-australia-coal-plant-closures-imminent-as-renewable-energy-surges/

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We definitely don't need the capacity or energy at Alpha

The Galilee Power Station would need a 275 kV transmission line from Broadsound through Lilyvale which would cost at least half a billion dollars to build. Once built, it would suffer losses and potential contingencies which would rule out it being used to supply Boyne Island smelter after Gladstone Power Station retires as implied in the development application documents.

Ross Garnaut's Sunshot project is progressing plans to develop the area around Barcaldine into a renewable energy industrial precinct. This would likely rely on upgrading the same transmission lines as required for the Galilee Power Station. The renewable energy industrial precinct would create far more jobs than the Galilee coal fired power station, but building the power station could cause congestion on the transmission lines and hinder Sunshot's project. There is no evidence that Powerlink have been engaged to check whether the transmission augmentations proposed in the Galilee Power Station's development application documents would be sufficient and if so how much extra headroom would be left for new renewables and associated industries.

Galilee Power Station will push up Queensland's power prices for decades.
It will make managing the system more difficult, cause dangerous climate emissions and preclude new jobs and investment in renewable energy.
We need to rule out new coal fired power stations and start building our renewable future.

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1. Costs

1.1 Capital Costs

As a coal fired power station hasn't been built in Queensland, or the NEM, since 2007, costs are not publicly well known. The Australian Energy Market Operator (AEMO) commissions reviews of new generation technologies regularly for their Integrated System Plan (ISP, and previously National Transmission Network Development Plan). CSIRO has published the GenCost report[4] annually for several years, based on research from ACIL Allen, GHD and Aurecon. The 2021 GenCost report revised the estimate up by over $1000/kW to around $4,500/kW.

In documents obtained by the ABC under Right to Information in 2021, Waratah Coal put the cost of the project at $3.5bn[5]. This would equate to $2,430/kW capital cost. This is significantly below the independent research and in line with unverified estimates from Shine Energy for Collinsville power station and now outdated costs of building Kogan Creek.

The upward trajectory of costs in the ISP and GenCost reports and widening gap between these and company estimates. is shown in Figure 3. Figure 3 also includes AEMO's cost estimates for a 2 hour battery in Queensland, to show the movement in other dispatchable generation costs over the same time period. All costs here are presented in real dollars at the time of publication.

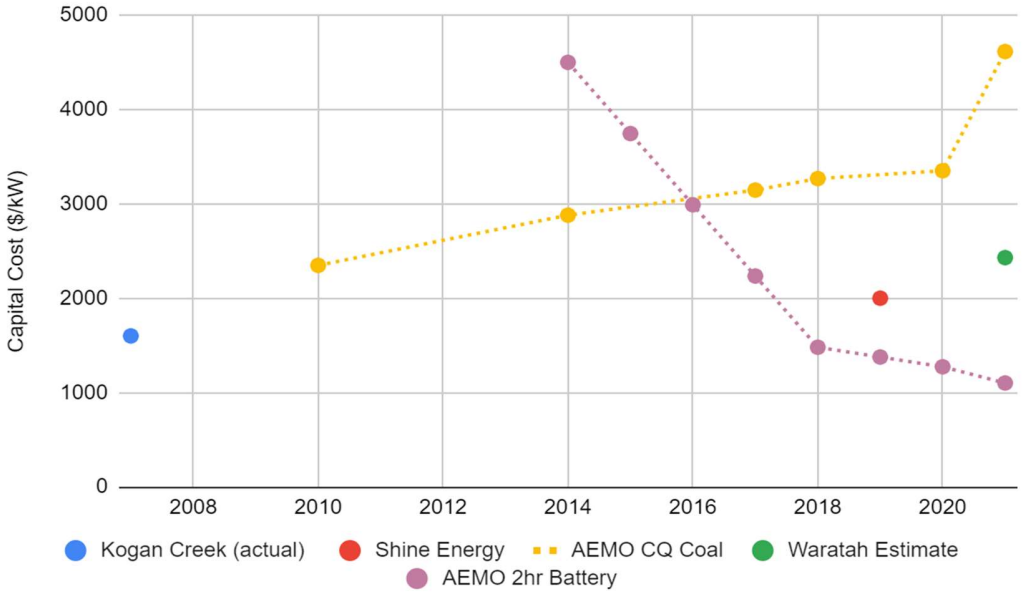

Figure 3: Projected Costs for New Coal and Battery Generation Assets

[4] https://www.csiro.au/-/media/EF/Files/GenCost2020-21_FinalReport.pdf
[5] https://www.abc.net.au/news/2021-09-22/clive-palmer-waratah-coal-power-station-project-fate-decided/100479734

The 2021 Inputs and Assumptions workbook[6] is the most up to date and robust cost estimate for a new power station such as Galilee power station. This is $4,569/kW in 2025-26, when the Galilee Power Station would start to be built, assuming a 2 year build.

It would therefore cost $6.4bn to build the 1400 MW Galilee Power Station.

1.2 Operational Costs

Maintenance costs for generators are both fixed costs, the baseline maintenance that has to be done every year regardless of how an asset is used, and variable costs, which accrue as a unit generates power.

AEMO's Inputs and Assumptions workbook presents these costs for a new coal fired power station in central Queensland as:

- Fixed costs (FOM): $55.15/kW/year
- Variable costs (VOM): $4.37/MWh

This doesn't include any costs of refurbishment, which AEMO estimate at nearly $380,000/MW and potentially needed every 10 years, as these costs are not publicly available to be confirmed.

1.3 Fuel Costs

AEMO's coal price projections are produced by consultants Wood Mackenzie. For new projects, Wood Mackenzie assess whether the projects are export exposed or not. Export linked coal in central Queensland is projected to remain around $2.9/GJ.

The price of coal at power stations which are not export exposed, such as Kogan Creek and Millmerran, is linked to the costs of coal mining and significantly lower at around $1.4/GJ.

Central Queensland in the Galilee Basin is already export exposed and the Galilee Power Station is part of a wider strategy to further open up the Galilee Basin for coal export. This means that the cost of coal for Galilee Power Station is assumed to be at Wood Mackenzie's estimates around $2.9/GJ.

The amount of fuel used is dependent on the efficiency of the plant, measured as heat rate (GJ/MWh). AEMO estimate the sent out heat rate of a new ultra-supercritical plant to be 8.82 GJ/MWh.

[6] https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/current-inputs-assumptions-and-scenarios

1.4 Costs of finance

AEMO's 2021 Inputs and Assumptions estimate the Weighted Average Cost of Capital (WACC) across the energy industry to be 5.5%. This has been falling over recent years, reflecting low interest rates and therefore cheaper access to capital.

CSIRO's GenCost report assumes a 2 year build period for new coal. If Galilee Power Station has to borrow $6.4bn for this project across 2 years of construction and then paid it back at 5.5% over 30 years, the cost of finance would be $7.1bn over the life of the project. This is **additional to** the capital costs, bringing the total cost of the project to over $13.5bn.

Energy projects are generally assumed to be financed at around 30% equity and 70% debt[7]. Waratah Coal may contribute more equity to this project than another energy industry player. The cost of such equity would be the returns shareholders expect and could, in a low interest rate world, be higher than the cost of debt.

It is unlikely that even Waratah Coal could finance this fully on equity, meaning some debt would have to be sourced. A recent Oxford Institute of Energy Studies report examined the "loan spread" of coal fired power projects. This is the difference between the lending and borrowing rates of financial institutions. A higher loan spread reflects a higher risk to the financial institution and therefore a greater return required[8]. Around the world, the loan spread of coal power projects have increased 38% since 2010 and in Australia coal mining has seen a 71% increase in loan spread[9]. This effectively means that financial institutions are looking for higher returns, up to around 40% on coal projects[10]. That's a massive increase on a 5.5% WACC.

1.5 Capacity Factor

AEMO's standard assumptions for supercritical black coal are for a 5.75% maintenance rate (that is, each unit will be out on planned maintenance for 5.75% of the year) and a 2.3% forced outage rate. That means that the maximum capacity factor a unit could achieve would be 91.25%. However this would mean that the unit was operating at 100% output at all times when not on outage. CSIRO's GenCost report assumes an 80% capacity factor which we have also adopted. This is quite generous when considering the continued rise of rooftop solar and large-scale renewables will continue to undercut the need for coal fired power.

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[7] https://co2crc.com.au/wp-content/uploads/2019/12/LCOE_Report_final_web.pdf
[8] https://www.weforum.org/agenda/2021/04/finance-coal-power-plant-sustainable-development/
[9] https://www.smithschool.ox.ac.uk/research/sustainable-finance/publications/The-energy-transition-and-changing-financing-costs.pdf
[10] https://www.theguardian.com/environment/2021/apr/19/coal-financing-costs-surge-as-investors-opt-for-renewable-energy

1.6 Carbon Costs

The project would run until 2060, making a carbon price a significant risk. The European Union has proposed a carbon border adjustment mechanism to come into place by 2026, to ensure that goods entering the EU comply with EU carbon targets of a 55% emissions reduction by 2030 and net zero by 2050. Other states are likely to follow and for Australia to remain a trading partner, a similar scheme would have to be enacted here. The cost of carbon could escalate as emissions reductions targets tighten. Even a $50/tonne carbon price would increase the cost of electricity generated at Galilee Power Station by $40/MWh.

2. Future Electricity Demand

2.1 Mining Loads

Waratah Coal's development application document references an additional up to 1,500MW load from coal mines in the Galilee and Bowen Basins. This is 500 - 1000 MW of coal mining in Galilee and 300 - 500 MW of Pulverised Coal Injection projects in the Bowen Basin. This would be a scale of load expansion never seen before in Queensland. The LNG industry pushed up Queensland's demand between 2015 and 2017 by an estimated 750 MW.

Powerlink's Transmission Annual Planning Report (TAPR) covers a 10 year horizon and attempts to identify potential new loads which may require connection to the grid. Figure 4 shows the loads identified in the Galilee and Bowen Basins in the 2010, 2015 and 2020 TAPRs. Despite the increase in projects identified from 2010 to 2015, no material transmission planning was undertaken as projects were not progressed.

Powerlink's 2020 TAPR did not include any additional load forecast from coal in the Bowen Basin. However, the Queensland Government did approve two mines in the lead up to the 2020 election, Valeria and Olive Downs. Olive Downs will be connected to Ergon's network at the 66kV level. Ergon only forecast demand out 4 years publicly. The Olive Downs and Valeria documentation to date has not quantified load.

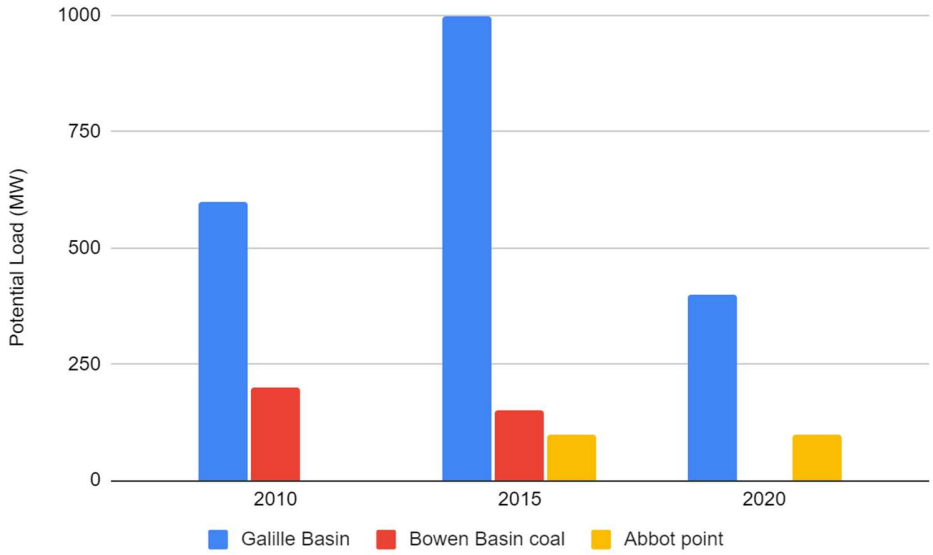

Figure 4: Powerlink forecast mining and processing loads in north and central Queensland

2.2 Electrification

Electrification of transport and processes currently served by liquid fuels or gas are more likely to drive demand growth in Queensland. Under the Net Zero scenario in the latest AEMO Inputs and Assumptions workbook, electric vehicles will reach nearly 15 TWh/year by 2050, around 25% of Queensland's current annual demand. Electrification of heating and industrial processes from current natural gas or diesel could contribute even more electricity demand. Figure 5 shows electric vehicle and total electrification demand under AEMO's Net Zero scenario. Queensland's current annual electricity demand is around 57 TWh/year. Under a Net Zero scenario, electrification would increase rapidly in the late 2040s to meet the net zero target in 2050 but would be a significant factor in demand from 2030.

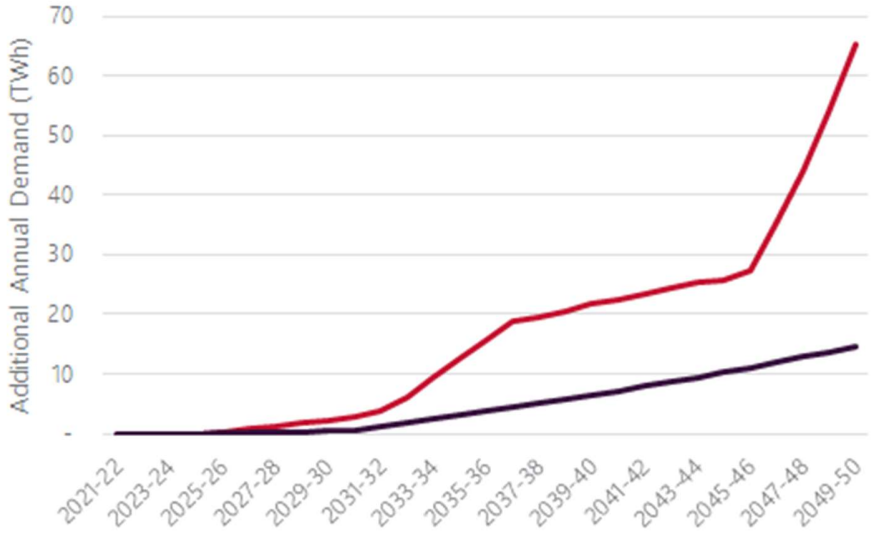

Figure 5: Electricity demand for electric vehicles as a subset of total electrification

Some of this electrification, for industrial processes, will be effectively baseload but it is mostly seasonal, e.g. electrification of heating, and/or dependent on time of day, e.g. electric vehicles.

The peak demand impacts of these could be huge. If electric vehicles were all charged when convenient, Queensland's peak demand could increase by around 6 GW. However, if all vehicles were charged flexibly, when renewables were available, which would usually be in the middle of the day, electric vehicles could actually benefit the system and the impact on peak demand would be reduced by about 90%.

This shows that we don't need new baseload, inflexible, coal fired power stations like Galilee. We need new infrastructure, control systems and tariffs that will allow newly electrified demand to benefit the system and support higher penetrations of renewable energy.

2.3 Existing Coal Retirement

The ISP is a least-cost model of the system out to 2042. The Central scenario includes Boyne Island smelter operating until 2042, while Gladstone retires in 2035. The least cost way to fill that supply gap is not coal. It is additional wind, solar, storage and transmission.

3. Transmission

3.1 Upgrades Required

Plans to upgrade transmission in central Queensland to cater for mining growth have been in discussion for more than 15 years. In 2011-12, Powerlink submitted the easement between Lilyvale substation and Surbiton Hill (near the Galilee Power Station site) for designation. Planning work was not continued after mine projects did not progress.

There is already a double circuit, 275 kV transmission line between Broadsound and Lilyvale substation, and a single 275kV circuit out to Barcaldine. Powerlink's 2020 Transmission Annual Planning Report (TAPR)[11] discusses potential connections for new coal mining in the Galilee Basin. While smaller loads may be able to be connected through the Lilyvale - Surbiton Hill line, larger projects would require either or both of a third circuit between Lilyvale and Broadsound and installation of capacitor banks at Lilyvale.

Waratah Coal's development application document suggests running a new 275kV line around 350 km from the Broadsound substation, as well as a new 40km 132 kV line to Alpha as shown in Figure 6. It is unclear if Waratah Coal have engaged Powerlink to determine whether the additional 275kV circuit from Broadsound would be sufficient.

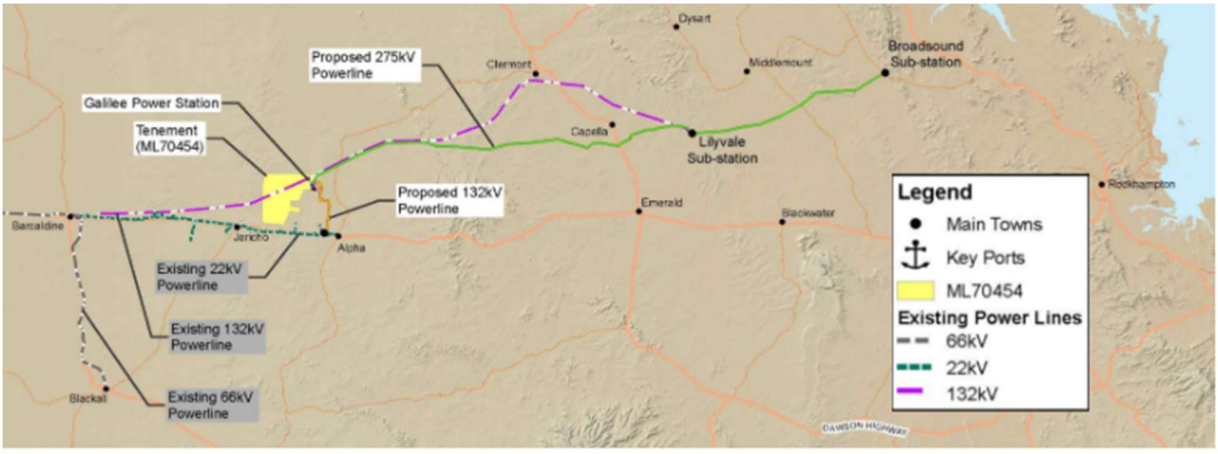

Figure 6: Transmission upgrades flagged in Waratah Coal planning documents

3.2 Costs

If we assume the above infrastructure is built, the cost estimates based on AEMO's assumptions are shown in Table 1.

[11] https://www.powerlink.com.au/sites/default/files/2020-10/Transmission%20Annual%20Planning%20Report%202020%20-%20Full%20report.pdf

Table 1: Costs of transmission to Galilee Power Station

Transmission Element	AEMO Assumption	Cost to Galilee Power Station
275 kV line	$1.42m/km	$496m
132 kV line	$0.98m/km[12]	$39.3m

This would add over $500m to the project, not including substation and transformer costs.

[12] Inferred as AEMO Assumptions only cover transmission (220 kV +)