Galilee Power Project's Net Zero Pathway through Technology (not taxes)

In order to preserve Australia's way of life in a net-zero world, Waratah Coal has an objective of providing low cost, net-zero, dispatchable power using clean coal technologies (not taxes). The focus of this objective is in being able to supply competitive base load power (on a 24/7 basis) to industrial processes such as aluminum refining and copper production and to preserve the value of Australia's mineral wealth in a changing world.

When new, modern and efficient power plant replace older plant, substantial carbon savings are made, thus minimising greenhouse gas emissions as much as possible whilst still providing reliable, affordable baseload (i.e. 24/7) power.

The Galilee Power Station will be capable of being net-zero from its first commissioning and supports the Queensland State Government's 50% renewable target by providing the 50% that is not renewable, as efficiently as possible. Compared with plant currently operating in Queensland, the Galilee Power Station will provide reductions in carbon emissions by between 15% - 22%.

The initial pathway to net-zero that the Galilee Coal Project is:

1. Construct the most efficient and cleanest power station in Australia, in order to minimise carbon dioxide generation,
2. Use a fuel with a low carbon to energy ratio (that is, mass of carbon in the coal divided by the energy content of the fuel) such as fuels commonly found in Queensland,
3. Offset carbon emissions with ACCUs or other certified, verifiable offset credits.

In parallel to the above, other pathways to achieving net-zero will be explored through the following:

1. Conduct an exploration program to identify suitable geological formations to allow geo-sequestration to occur,
2. Undertake a FEED[1] study to plan the conversion of the plant to carbon capture and to design the storage and transportation facility,
3. Sponsor research and development (including pilot trials) of carbon re-use options such as carbonation of slags, minerals and ash to form concrete and the generation of algae based products.

Then, when the long run cost of ACCUs (or other verifiable credits) is forecast to exceed the long run cost of CCUS, the plant will convert to carbon capture and the storage facility will be commissioned. Where technically feasible, the beneficial re-use of carbon will be prioritised over storage. Any residual emissions not captured will be offset using ACCUs (or other verifiable credits).

[1] Front end engineering and design.

Cleanest and most efficient power station in Australia

The Galilee Power Project will utilise the most efficient technology available at the time of design. If designed today, the plant's characteristics would be:

- Very high steam temperatures (650°C),
- Very high pressure (33,000 kPa),
- Dual re-heat cycles,
- Feedwater heaters and air heaters.

Modelling indicates that the above would achieve net efficiency of 42% (LHV) and a carbon intensity of 0.77 t(CO_2e)/MWh; therefore we are targeting between 0.75 to 0.81 t(CO_2e)/MWh gross emissions (pre-offset, pre-capture). As shown in Figure 1 and Figure 2 below, this gross carbon intensity is substantially lower than incumbent plant burning lower quality fuels (e.g. Callide, Yallourn, Loy Yang) or operating with lower thermal efficiencies (e.g. Gladstone, Callide B, Tarong, Stanwell).

Our estimates indicate that, if the Galilee Power Project were to displace the Gladstone Power Station (which we understand is partially traded by the State Government) from the market, then between 1.7 and 2.3 million tonnes per annum of gross emissions (at 90% capacity factor) would be saved, simply through the efficiency gain.

Further, if the Galilee Power Project were to displace Yallourn Power Station, we estimate that (even after allowing for an additional 10% transmission network losses), between 3.9 and 4.5 million tones per annum of gross emissions (at 90% capacity factor) would be saved.

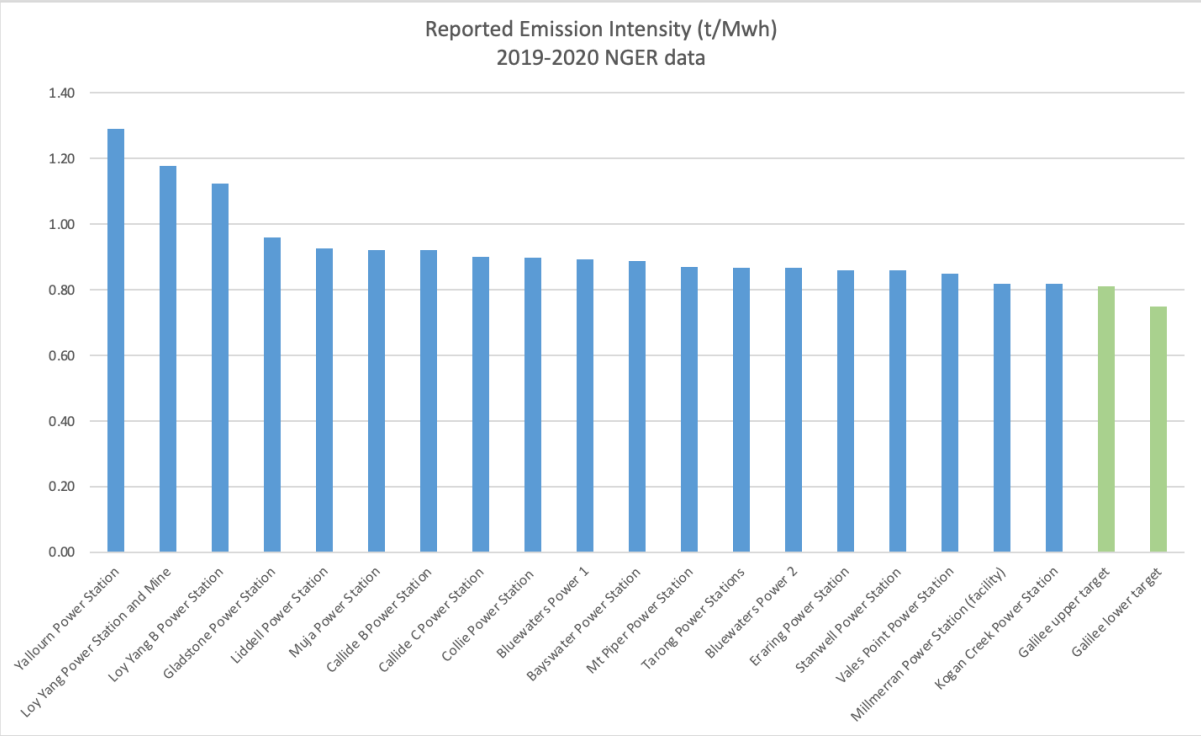

Figure 1: Carbon intensity of all Australian Coal Fire Power Stations[2]

[2] Source: NGER data 2019-2020. Note that Hazelwood (now decommissioned) has been excluded.

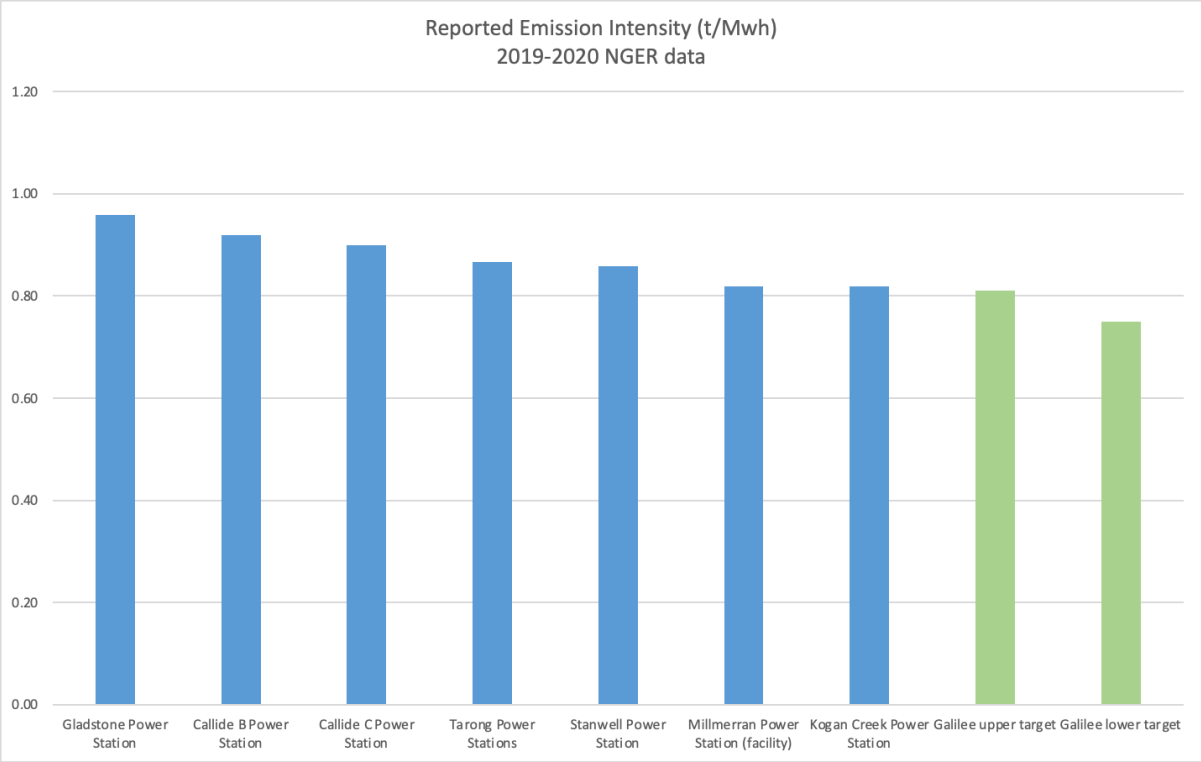

Figure 2: Carbon intensity of all Queensland Coal Fired Power Stations[3]

Lower carbon coal

Analysis of the Galilee Coal Project's coal indicates a carbon intensity of approximately 91.6 kg CO_2(e)/GJ (HHV).[4] This compares to our estimated calculation of carbon intensity of Callide coals of around 105.1 kg CO_2(e)/GJ (HHV)[5].

Over the 2019/2020 NGER reporting year, Callide B and Callide C reported 9,346,770 tones of CO_2(e) emissions[6]. If Galilee Coal Project coal were used in place of Callide Coal, then we estimate that 1.35 million tonnes of CO_2(e) emissions could have been saved (see Figure 3). This saving would be substantially greater if Galilee Basin black coal were to displace La Trobe Valley brown coal.

[3] Source: NGER data 2019-2020.
[4] The National Greenhouse Accounts uses higher heating value (HHV) rather than lower heating value; in typical Queensland black coals, there is a 4% difference between higher heating value and lower heating value accounting for the heat of vaporisation in the water vapour in the flue gas.
[5] Coal quality data sourced from "Callide Oxyfuel Project – Lessons Learned", Oxyfuel Technologies Pty Ltd, May 2014, Table 1. Combustion calculations undertaken internally.
[6] Source NGER data 2019-2020.

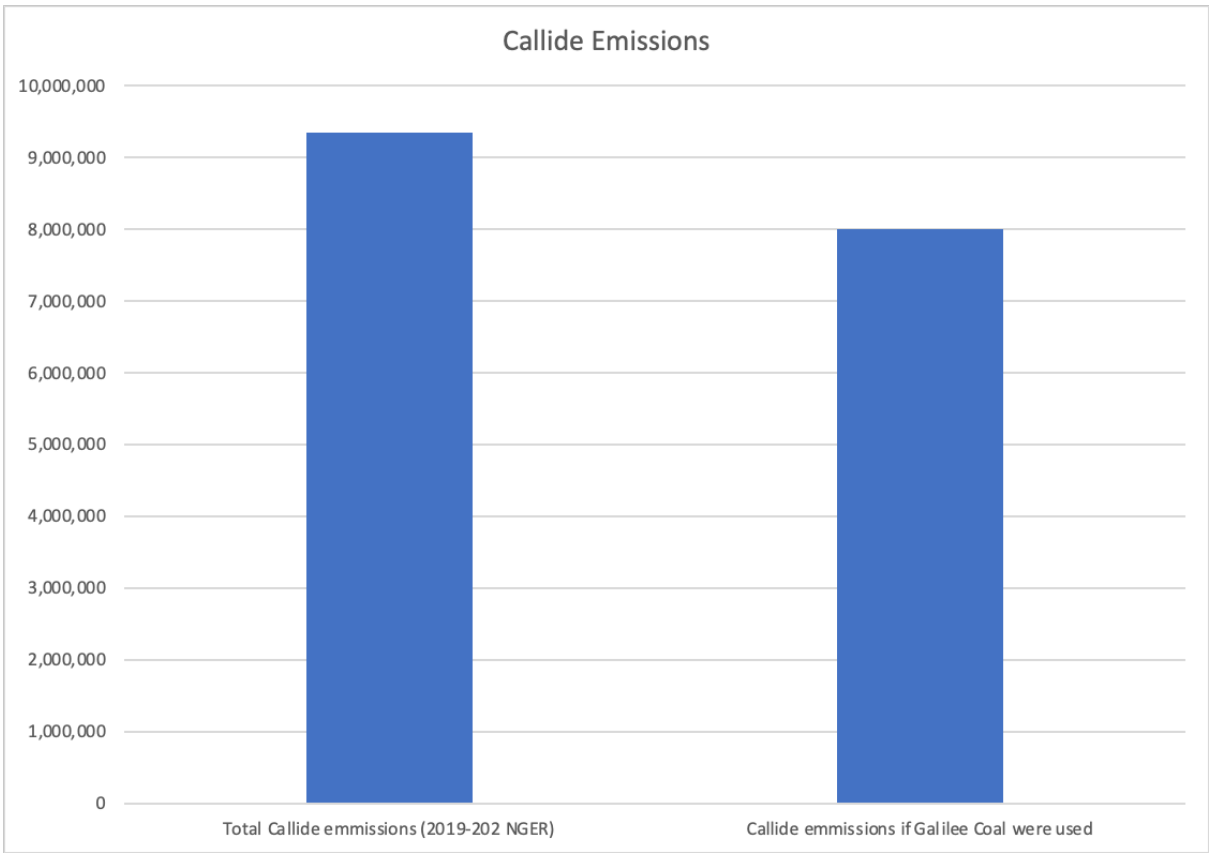

Figure 3: Carbon emission savings at Callide using Galilee Coal Project coal

Offsets

Offsets should form part of any net-zero strategy as they are often an economical and efficient means of reducing the absolute concentration of carbon dioxide in the atmosphere. Offsets also often have positive second order conservation and employment effects (such as preservation and enhancement of habitat and indigenous employment opportunities). Offsets can be implemented today and do not require significant technology development. To be effective, offsets must be verifiable through a certification body, such as the Clean Energy Regulator (for the ACCU system).

An ACCU at $30/tonne implies an operating cost impact of around $23/MWh (at a carbon intensity of 0.77 tonnes/MWh). We consider this to be very affordable cost impact in the context of emissions reductions and in the context of supplying base load power on a 24/7 basis.

The average financial year to date price in Queensland is $80.85[7]. The Galilee Power Project's target long term base load pricing is in the order of $60/MWh (before carbon costs). The sum of the long run pricing plus offset cost, implies that the Galilee Power Project will be able to provide base load, net-zero power at around $80MWh, which means that the project will be able to provide net-zero, base load power, without adversely impacting power prices in Queensland and without any government subsidy.

[7] https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/data-nem/data-dashboard-nem accessed 15 November 2021.

Carbon capture and storage

Studies undertaken by the Australian Petroleum Cooperative Research Centre's GEODISC program have already previously identified that the Galilee Basin is within the top 10 locations for geosequestration in Australia.[8]

In February 2021, Waratah Coal undertook a carbon storage prospectivity study to identify geological formations potentially suitable for carbon dioxide storage for the Galilee Power Station. The study also developed a concept field design and cost estimate.

The prospectivity study identified that the Colinlea Sandstone Formation in the region between Jericho and Blackall is a possible storage location suitable for use in concert with carbon capture at the power station. The formation sits at the optimal depth of approximately 800 m to 1000 m and is geologically sealed and separated from the Great Artesian Basin.

In February 2021, Waratah also undertook a pre-feasibility study into carbon capture at the power station. The study identified that the most appropriated means of capturing carbon dioxide was by post combustion amine scrubbing and that transportation should be by pipeline as a compressed, super-critical liquid.

In May 2021, Waratah Coal lodged an expression of interest for greenhouse gas storage exploration tenure through the Queensland Exploration Program and, should this EoI be successful, intends commencing an exploration program to build confidence in the target formation's ability to store carbon dioxide.

Once development approval is in place for the power station, the FEED study will commence in order to further define the arrangements for, and cost of carbon capture and storage. If exploration tenure is granted, a CCS exploration program would also commence.

The FEED study (and management of the exploration program) will be undertaken in Australia, creating high value, high skilled, clean energy jobs here in Australia, without government subsidy.

Opportunities for carbon reuse

Carbon reuse presents opportunities to create new industries in regional Northern Australia. While most opportunities are in their infancy, Waratah Coal will work with developers of potential technologies to grow a carbon re-use industry in regional Northern Australia. Potential opportunities include high value products manufactured from algae and concrete like products manufactured through the mineralization of materials such as ash, slag and minerals.

[8] Bradshaw, B.E, Simon, G, Bradshaw, B and Mackine, V. (2005). GEODISC Research: Carbon Dioxide Sequestration Potential of Australia's Coal Basins. CO2CRC Report Number RPT05-0011.