11 February 2025

Mr Daniel Westerman
Chief Executive Officer
Australian Energy Market Operator
Lodged by email: forecasting.planning@aemo.com.au

Dear Mr Westerman,

Submission to Draft 2024-25 GenCost

Coal Australia is pleased to make a submission to the GenCost 2024-25 consultation draft.

Australia is blessed with an abundance of natural resources that should make our energy among the cheapest and most reliable in the world. Yet, we are falling short of that potential. The very energy that could be powering our economy, driving investment and securing prosperity for future generations is being held back by outdated assumptions and unnecessary restrictions.

Like the CSIRO, Coal Australia is committed to ensuring a strong, prosperous future for our nation, one that seizes the opportunities before us and delivers a higher standard of living for all Australians. Energy is the foundation of economic growth. It drives industry, creates jobs and ensures Australia maintains a high standard of living. Yet policy settings are making it harder, not easier, to provide affordable and reliable power.

Our submission aims to contribute to this critical national discussion. We are here to work with you, providing a broader, fact-based perspective based on real-world data to help the CSIRO chart the right path forward in advising on the future of Australia's electricity grid. A clear-eyed approach, grounded in robust multi-source data will ensure that future decisions about energy policy reflect economic realities.

Australia's best days are ahead. A thriving economy, powered by abundant and affordable energy, is right beneath our feet. Let's work together to make it happen.

Yours sincerely,

Stuart Bocking
Chief Executive Officer
Coal Australia

Executive Summary

Coal Australia submits this response to the CSIRO's GenCost 2024-25 Consultation Draft to address what we believe are methodological flaws in the assessment of coal-fired generation costs. The current GenCost analysis appears to overstate the levelised cost of energy (LCOE) for coal by relying on problematic assumptions, excluding realistic coal plant designs, and overstating capital and operational cost inputs. We believe that these errors distort comparative cost assessments between coal and other technologies. Unless these errors are addressed, it may undermine the credibility of GenCost as a policy-neutral tool for Australia's energy planning.

Independent analysis conducted by Arche Energy (attached) demonstrates that GenCost's capital cost assumptions for black coal ultra-supercritical (USC) plants are between **2.0 and 2.4 times** higher than real-world benchmarks, when adjusted for Australian conditions. GenCost's resulting LCOE range of **$102–164/MWh** for black coal is significantly higher than Arche's current project analysis of **$50–70/MWh** for comparable real-world USC projects.

The real-world capital and levelised cost estimates contained in Arche Energy's report are a significant discount on GenCost's figures. They imply a significant reduction on current power prices in the National Electricity Market (NEM)[1]. This discrepancy arises from GenCost's restrictive focus on expensive, unproven "first-of-a-kind" (FOAK) designs, exclusion of brownfield development savings, understated capacity factors, and asymmetric treatment of fuel costs. The decision to exclude current coal plant designs that are proven, realistic and significantly cheaper, is an oversight for the stated purpose of the GenCost report, which is to provide objective estimates for the cost of building new electricity generation.

Unfortunately, due to the limitations of GenCost's methodology and assumptions, the headline finding— that renewables continue to have the lowest cost range of any new-build electricity generation technology[2]— is false.

If the aim of GenCost is to provide objective estimates for the cost of building new electricity generation, that is both technology-agnostic and policy neutral, then the assumptions chosen in the LCOE calculations are inappropriate for that task.

We strongly recommend that GenCost retracts any claims about which technology is the cheapest form of electricity until it corrects assumptions that underpin the LCOE of coal in GenCost. This will ensure that the report is truly policy-neutral, technology-agnostic and can be viewed credibly by the wider energy market.

It is our view that, based on real-world assumptions, GenCost would find that coal has the lowest cost range of all new-build generation technologies.

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[1] Average annual prices in the NEM by region are taken from the AER Wholesale Markets Quarterly Report Q4 2024. Every NEM state recorded average annual prices over $100/MWh

[2] CSIRO, media release: GenCost 2024-25 draft report released for consultation

Refurbished black coal, or the building of realistic USC plants on brownfield sites, would lead to lower electricity prices in the NEM.

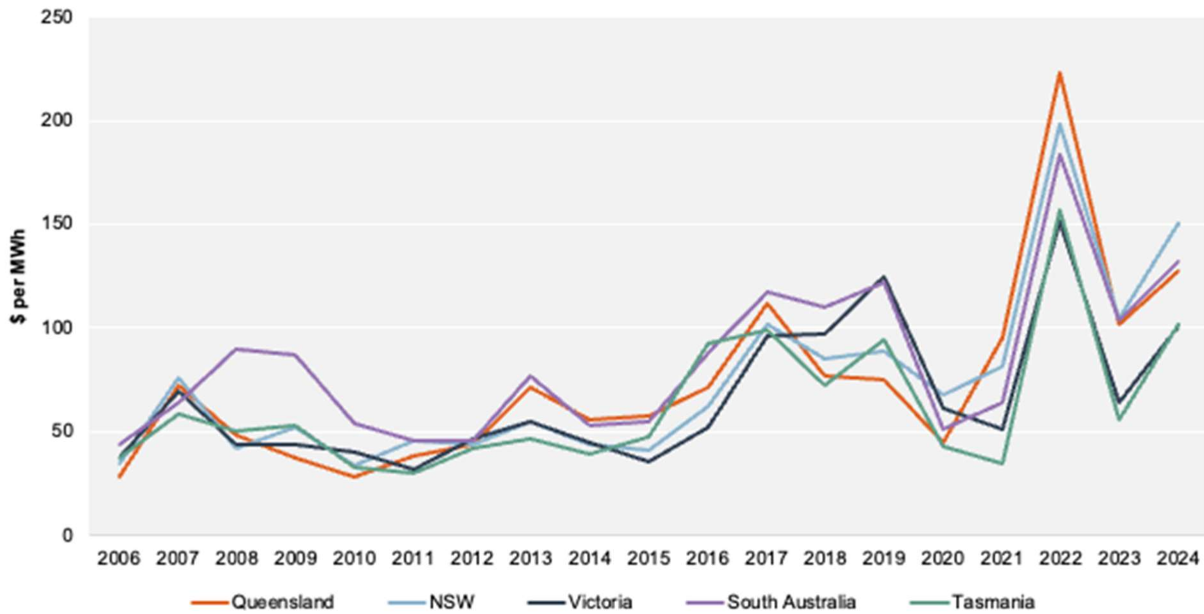

Figure 1: Average annual prices in the NEM by region
Source: AER analysis using NEM data

As shown in **Figure 1**, the weighted average annual wholesale price of energy in 2024 in each NEM state was over $100/MWh, with NSW reaching up to $150/MWh. The estimated $50–70/MWh range for new build coal plants from the Arche analysis is 43%-59% below 2024 wholesale prices which averaged $123/MWh across all NEM states. This illustrates coal's ability to provide a significant reduction in electricity prices in the NEM from current prices.

The Arche Energy report makes the following findings, and Coal Australia makes the following recommendations for the GenCost 2025 final report:

1. **Overestimated coal capex**
   Arche Energy's analysis and benchmarking shows that GenCost's capital cost for ultra-supercritical (USC) coal plants ($6,037/kW including development costs) is between 29% and 145% above real-world benchmarks adjusted for Australian conditions which range from $2,461/kW to $4,685/kW. Australia's most recent supercritical plant (Kogan Creek) has a 2024 escalated capital cost of $2,965/kW, less than half of GenCost's assumptions.

2. **Unrealistic greenfield site land and development costs**
   GenCost assumes 20% of capex for land/development, but brownfield sites (e.g., Mount Piper) require only 5% due to existing infrastructure.

3. **Unrealistic fuel price assumptions**
   GenCost uses export-parity coal prices ($3.1/GJ or $90/tonne) instead of mine-mouth domestic prices ($40/tonne), which inflates LCOE by 30–40%.

4. **Unrealistic capacity factors**
   GenCost assumes a 53–89% capacity factor range, but modern Australian coal plants like Millmerran achieve 72–94% annually (85% on average). A modern, newly built USC plant is likely to operate at the top end of this range.

5. **Underestimated lifespan**
   GenCost uses a 30-year lifespan, ignoring the 50-year operational life of fully depreciated plants that deliver low-cost power post-financing.

6. **FOAK design bias**
   GenCost restricts analysis to first-of-a-kind “advanced USC” designs, excluding existing supercritical plants and international USC benchmarks.

The findings and recommendations outlined in this submission underscore the need for a recalibration of GenCost’s methodology to ensure it aligns with real-world data and maintains its stated commitment to being technology-agnostic and policy neutral.

The consequence of GenCost taking its current approach is to significantly understate the economic viability of coal-fired generation, which does not provide the full picture of Australia’s energy policy landscape.

Unfortunately, because the GenCost report overstates the cost of energy generated from coal, and underplays coal’s role in providing reliable, dispatchable energy, findings from the report may prevent the nation from making an informed decision about its energy future.

Coal Australia urges CSIRO to rectify mistakes contained within the current report to ensure that the final GenCost report reflects true market conditions, as observed by independent energy analysts, and provides a fair basis for energy policy decision-making. Failure to do so risks misallocating billions of dollars in public and private investment.

Unfair treatment of coal in GenCost

As outlined in the findings and recommendations above, and in the supplementary capex report attached, we assert that the GenCost report includes unreasonable assumptions in relation to coal costs in their LCOE analysis across a multitude of inputs. However, there are four critical assumptions that we highlight as particularly problematic:

The exclusion of coal plant designs already in use is a policy-driven outcome

Despite its claim to be a policy-neutral cost analysis, GenCost limits its coal cost estimates to expensive, largely unproven advanced designs, and excludes existing plant designs that are demonstratively operational. The report explicitly states, "Prior to 2023-24, the black coal capital cost had previously been based on a supercritical plant. However, an ultra-supercritical technology is the most plausible type given Australia's net zero by 2050 target,"[3]. The most recent coal plant built in Australia utilised a supercritical design, yet GenCost exclusively considers advanced ultra-supercritical plants—a more efficient but significantly more expensive design.

GenCost derives its cost estimates for black coal ultra-supercritical plants from the 2024 Aurecon Energy Technology Cost and Parameters Review. However, this very report acknowledges that "an advanced ultra-supercritical power station with the above main steam conditions is yet to be constructed."[4] By relying on a global first-of-a-kind (FOAK) plant design driven by government policy objectives, GenCost appears to violate its own mandate of ensuring policy neutrality. This has the consequence of artificially inflating the LCOE for coal. Further, we find that GenCost's relative capital costs ($6,037/MW) of new USC are significantly higher than current real-world examples.

GenCost deems new coal deployment as having low plausibility due to its emissions intensity and Australia's bipartisan commitment to achieving net zero by 2050. If CSIRO intends for GenCost to be interpreted as an independent, policy-neutral, and fair economic assessment, it should include coal plant designs that reflect realistic new-build options, free from policy-driven influence.

Greenfield sites are not realistic, and 20% capex assumption is significantly overstated

The second erroneous assumption is the exclusion of brownfield expansion or refurbishment of existing plants. New build should not imply greenfield, particularly when it would be less economically viable than a plausible alternative. The Arche Energy report found that Aurecon's land and development costs reaching 20% of capex ($675 million for the given example) is an excessive estimate—and a result of restricting new coal to the development of greenfield sites. This would not be the logical business case if coal was to be expanded in Australia. Due to the greenfield site requirement, the Aurecon report assumes a new build railway as a fuel connection cost input, further driving up the LCOE of coal. In reality, a new project would likely be situated at the mine mouth of a coal mine (e.g., Kogan Creek or Milmerran), an optimal location to minimise coal transportation costs and utilise cheaper high-ash coal that is not economically viable for export.

Brownfield sites benefit from existing critical infrastructure, including established roads, railways, transmission lines, substations, office buildings, and water supplies. It follows that this infrastructure availability lowers LCOE and accelerates project timelines. GenCost's stated

[3] P Graham et al., GenCost 2024-25 Consultation Draft, pp 38-39.
[4] Aurecon, 2024 Costs and Technical Parameter Review, 12 June 2024, p 53.

reasoning for excluding brownfield assessments in LCOE is that they are "less generally comparable to other options"[5]—but taking this approach penalises the incumbent technology for utlising existing sites, which is a logical and cost-effective option that is most likely to occur. This approach contradicts the concept that GenCost is an exhaustive analysis of all possible technology pathways to find the "optimal path" for the electricity system. GenCost should include brownfield sites for coal given that it is the most likely scenario for coal-fired power generation to expand.

Coal fuel cost methodology

The current fuel price assumptions and sampling methodology unfairly inflate the LCOE of coal in GenCost. Firstly, GenCost uses fuel costs ($3.1/GJ) that reflect export parity costs, rather than the cost of mining seams not suitable for export. As argued above, if coal was to be expanded, a new power station is likely to be located at the mine mouth—meaning a fuel cost of AUD$40/t (for low strip ratio, high-ash coal) is a suitable assumption. Fixing the input fuel costs at the level of export-grade coal artificially inflates the LCOE.

Further, as outlined by other GenCost critics previously, CSIRO continues to use asymmetric sampling methodologies for black coal fuel prices, which are drawn from the 2024 IASR. Specifically, GenCost takes the average of the lower bound for fuel cost, but takes the maximum for the upper bound, inflating the upper range of the LCOE for coal. Further, each figure has an unjustified and opaque inflation range between 3–8%.

Table 1: 2024-25 GenCost (2023-24 IASR Numbers)

Year & Estimate	CSIRO Values ($/GJ)	IASR Average ($/GJ)	IASR Extreme ($/GJ)
2024 Low	$3.1	$2.9	$1.4
2024 High	$4.6	$3.0	$4.5
2030 Low	$2.8	$2.7	$1.5
2030 High	$4.3	$3.0	$4.1
2040 Low	$2.6	$2.5	$1.5
2040 High	$3.9	$2.9	$3.8
2050 Low	$2.6	$2.5	$1.5
2050 High	$3.9	$2.8	$3.6

Source: 2024 IASR Assumptions Workbook

5 Paul Graham et al., GenCost 2024-25 Consultation Draft, p 99: "The study of brownfield projects is always site-specific and more resource intensive and for these reasons less generally comparable to other options. Their inclusion would essentially amount to bringing "one-off" projects into the analysis. This is inconsistent with our goal of providing a general comparison metric."

In its final report, the CSIRO should rectify this discrepancy in their fuel sampling methodology and update the fuel input cost assumptions for black coal to avoid artificially inflating the LCOE of coal.

Capacity Factor for coal is unrealistic and inconsistent with assumptions for other technologies

GenCost assumes a 53–89% capacity factor range for black coal, but recent Australian coal plants like super critical Millmerran are operating at a ten-year average of 85% (within a 72–94% range). A modern, newly built USC plant is likely to operate at the top end of this range.

By contrast GenCost assumes a range of onshore wind capacity factors of 29-48% whereas average achieved capacity factors are reported to be 31% across the NEM and dropping due to the increasing impact of curtailment and site scarcity[6].

GenCost claims to “apply a common rule across renewables, coal, nuclear and gas that the minimum capacity factor for new plant is 10% below the previous ten years average capacity factor for that technology or its nearest equivalent grouping (baseload technologies are treated as one group)”.

However, grouping modern USC coal plants with all other baseload technologies, some of which are approaching 50 years old is unrealistic. The resulting lower limit for GenCost’s capacity factor of 53%, materially lower than the reality of current coal stations like Millmerran (averaging 85%).

Coal is the cheapest form of electricity generation in the NEM

Coal is cheap. It is and always has been the cheapest form of reliable energy in Australia. It was only a decade ago that Australians enjoyed some of the lowest power prices in the world, as coal was a backbone of our energy and resource superpower status.

Energy policy should always be informed by independent and rigorous economic analysis, without fear or favour to specific energy generation methods. The CSIRO is the primary institution responsible for providing the technology-agnostic and policy-neutral independent advice that the government relies on. It is our view that once the final GenCost is updated to better reflect real-world data on the cost of electricity generated from coal, it will be coal that is the cheapest form of energy in Australia.

We are happy to support the CSIRO with any advice or guidance it might require in the process.

[6] Dan Lee, “Bigger or better: Are newer wind farms outperforming older ones?”, wattclarity.com.au, 2023.

Summary of recommendations

1. **Adopt real-world capital costs**
   Replace theoretical FOAK Advanced USC estimates with real-world USC benchmarks adjusted for Australian labour and compliance standards
2. **Include supercritical plant designs for retrofits or expansions**
3. **Reduce land and development costs for brownfield sites**
   Lower the land and development costs to 5% of capex for brownfield developments (e.g., Loy Yang, Mount Piper). Exclude rail infrastructure costs for mine-mouth plants (e.g., Millmerran)
4. **Use mine mouth fuel prices**
   Apply domestic coal, mine mouth costs ($40/tonne) for plants sourcing coal locally, not export benchmarks
5. **Align capacity factors with operational data**
   Raise lower-bound capacity factors to 85–91%, reflecting actual NEM performance and projected performance of a new build USC plant.
6. **Extend economic lifespan to 50 years**
   Model LCOE over 50 years to capture residual value and post-financing cost reductions
7. **Remove technology restrictions to retain policy neutral status**
   Include existing supercritical and USC designs alongside renewables in cost comparisons to ensure the report maintains its neutrality.
8. **Publish more detailed and fully transparent cost calculations**
   Disclose escalation rates, labour and productivity adjustments, and fuel price sampling methodology to avoid any potential claim of bias.

ARCHĒ

Australian coal plant capex review

Prepared for Coal Australia

February 2025

Project number: B25001

Rev 2

Acknowledgement of Country

Arche Energy works on the land of the First Nations of Australia.

Arche Energy acknowledges and pays respect to the Traditional Custodians and Elders of the nations on which we work and the continuation of cultural, spiritual and educational practices of Aboriginal and Torres Strait Islander peoples.

Limitations and disclaimer

This report is written solely for the benefit of Coal Australia. This report may not be used, or relied upon, by any person without the written consent of Arche Energy Pty Ltd. Arche Energy Pty Ltd disclaims liability to all persons, other than Coal Australia (and then such liability is limited to that amount set out in the relevant agreement), arising in connection with this report. Arche Energy Pty Ltd also excludes implied warranties and conditions.

This report relies on limited information derived from third parties, assumptions, and heuristics and may contain errors; as such, the outcome of this report is subject to change.

Capital and operating cost estimates rely on heuristics and assumptions and are provided as indicative, concept level estimates.

Arche Energy cannot, and does not claim to, provide financial advice, legal advice or advice in relation to:

1. the depreciation of, or any loss in respect of, an investment or the value of an investment, or the failure of an investment or the value of an investment to appreciate, including but not limited to any:
    a. securities, commodities, currencies, options and futures transactions; or
    b. real estate investment, including but not limited to any related return on investment, capital appreciation or tax benefits; or
    c. leased equipment or any other goods; or
2. any actual or alleged representation, advice, forecast or guarantee, whether express or inferred as to the performance of any investment.
3. mergers and acquisitions.

Acronyms

BESS	Battery energy storage system
CCS	Carbon capture and storage
CCUS	Carbon capture, utilisation and storage
CSIRO	Commonwealth Scientific and Industrial Research Organisation
IEA	International Energy Agency
EIA	Energy Information Agency (US)
LCOE	Levelised cost of energy, typically in $/MWh
LCOS	Levelised cost of storage, typically in $/MWh
NEM	National Electricity Market
PHES	Pumped hydro energy storage
MW	Megawatt
MWh	Megawatt hour
USC	Ultra-supercritical
WEO	World Energy Outlook

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Revision	Drafted	Reviewed	Approved	Issued
2	David Nolan	Andrew Murdoch	Andrew Murdoch	Arche Energy Pty Ltd
	10/02/2025	11/02/2025	11/02/2025	11/02/2025
1	David Nolan	Andrew Murdoch	Andrew Murdoch	Arche Energy Pty Ltd
	08/02/2025	08/02/2025	08/02/2025	08/02/2025
0	David Nolan	Andrew Murdoch	Andrew Murdoch	Arche Energy Pty Ltd
	07/02/2025	07/02/2025	07/02/2025	07/02/2025

1 Introduction

Coal Australia engaged Arche Energy to provide a capital expenditure estimate of an ultra-supercritical (USC) coal-fired power plant based in Australia.

The objective of this work is to provide a comparison estimate of capital costs and levelised cost of energy for coal-fired power, employing credible real-world sources of information to provide a reliable comparison.

The purpose of this report is to be used to compare against the recent CSIRO GenCost estimate of coal-fired power, to assess the potential for the greater use of coal-fired power as an economically viable element of Australia's energy future. It is our understanding that this report will be used as a submission to the CSIRO GenCost 2024–25 draft report, as part of the public consultation process.

Sources of information drawn on for the work are listed in Section 4.

2 Background

2.1 GenCost

GenCost is a document published by the CSIRO that attempts to provide a set of comparative costs between different forms of electricity generation in the context of future deployment to Australia's National Electricity Market (NEM). GenCost's estimates for coal were based upon input provided by Aurecon in their report "2024 Energy Technology Cost and Technical Parameter Review".

Coal Australia's key criticisms of the GenCost estimate, with respect to new Ultra-supercritical coal plant are:

1. the relative capital cost ($5,031/MW) is higher than current, real world, capital costs
2. land and development (20% of capex, $600M in the example given) appear overstated
3. fuel connection costs assume rail, when, in reality, a new power station is likely to be mine mouth (e.g. Kogan Creek, Millmerran)
4. fuel costs ($3.1/GJ) reflect export parity costs, rather than the cost of mining seams not suitable for export (e.g. Kogan Creek, Millmerran)
5. Gencost's "high" case assumed capacity factor of 53% we believe is understated; for example, Millmerran Power Station achieves annual capacity factors between 72 and 94%[1]
6. the economic life of USC should be 50 years as, in the case of 30-year financing, there will always be residual value in the plant while technical life remains.
7. GenCost uses the most expensive technology and fuel, then labels this as "representative" of an Australian project, without providing a range of costs. This report addresses that shortcoming.

2.2 Ultra-supercritical plants vs sub/supercritical plants

Conventional power stations utilise a thermodynamic cycle known as the Rankine Cycle, where water is vaporised under pressure in a boiler, sent through a steam turbine to generate power, condensed under vacuum and then pumped back into the boiler under pressure to repeat the cycle.

Fundamentally, the efficiency of a Rankine Cycle is maximised when the pressure and temperature differential between the inlet and exhaust of the steam turbine is greatest. This is achieved by maximising the pressure and temperature of the steam leaving the boiler and minimising the temperature of the cooling fluid (typically water or air) cooling the condenser.

Over time, improvements to the Rankine Cycle have been made such as the introduction of a re-heat cycle (where steam goes back into the boiler for re-heating after passing through a high pressure steam turbine to add more energy into the intermediate and low pressure turbines), feed water heating (where steam is bled from intermediate stages within the turbine and used to pre-heat feed water between the condenser and the boiler),

[1] Generator Statistical Digest 2023, Global-Roam and Greenview Strategic Consulting, February 2024

improved isentropic turbine efficiency (fewer losses in the turbine due to friction and flow characteristics) and improved boiler and combustion efficiency (few losses in the combustion of the coal).

Australia's existing fleet of coal-fired power plants are all sub-critical (i.e. the plant operates at pressures below steam's critical point[2] (22.1MPa)), with the exceptions of Kogan Creek, Callide C, Millmerran and Tarong North, which are supercritical (i.e. operate at pressures above steam's critical point). It is proposed that if new coal plant were to be built in Australia, it should be built with the highest thermal efficiency and lowest carbon intensity commercially available at the time of the feasibility study. The most efficient coal plant technology currently available is ultra-supercritical (USC) coal plant, which is a less defined term and generally refers to steam conditions above 600°C and 25MPa. At the time of writing, USC plant would have the following characteristics:

- main steam temperature and pressure greater than 620°C and 30 MPa[3]
- two reheat cycles
- very high efficiency steam turbines
- nine feedwater heaters
- air heaters.

Additional USC characteristics are listed below.

Table 1. USC plant characteristics

Characteristic	Description
Capacity	USC plants typically have a capacity of between 600–1,000MW per unit. Large plants have several units; the largest international plants may have four or more units, i.e. >4,000MW. The largest single unit in the Australian NEM is 750MW at Kogan Creek[4].
Efficiency	USC plants can achieve high efficiencies; the highest efficiency USC plant is understood to be the Pingshan Phase 2 unit, with a capacity of 1,350MW and a net efficiency of 49.37%[5].

[2] The critical point is the point at which there is no distinction between water and steam. At subcritical pressures, there is a distinct change of phase between water and steam, at super-critical pressures there is no distinct change of phase.

[3] https://www.powerengineeringint.com/coal-fired/critical-thinking/ accessed 1 February 2025

[4] Kogan Creek is supercritical, rather than ultra-supercritical.

[5] https://www.sustainable-carbon.org/chinas-pingshan-phase-ii-sets-new-bar-as-worlds-most-efficient-coal-power-plant/

3 Assumptions

3.1 Plant characteristics

The assumptions detailed in Table 2 apply to the USC plant characteristics assumed for an Australian context.

Table 2. Assumptions relating to USC plant characteristics

Item	Value
Project location	Project assumed to be located at the mine mouth of a coal mine, which is a logical location to minimise coal freight costs and to utilise cheaper high ash coal that is not economically suitable for export. It would also be reasonable to site the project at a strong network connection point.
Fuel cost	Fuel cost assumed to be AUD$40/t[6] reflecting mine mouth location
New build	This plant is assumed to be a new build.
CCS	The baseline estimating assumptions for this report do not include CCS.
Capacity factor	Assumed to be 91%.
Heat rate (HHV sent out)	8.548 GJ/MWh[7]
Fuel energy density	23 MJ/kg (assumption)

If a power plant's operator is seeking to minimise the average cost of production, then they would bid so as to maximise production and therefore achieve capacity factors close to their availability. In reality, operators bid to maximise profit, which may mean curtailing productions when the marginal cost of supply is greater than the marginal revenue in that trading period (therefore operating with lower capacity factors than they could technically achieve). Therefore, for the purposes of estimating cost, we have used a capacity factor close to a reasonable estimate of availability rather than a lower capacity factor which will not necessarily reflect the lowest cost of production (note that Millmerran operates with annual capacity factors in the range of 72 to 94%).

[6] An estimate based upon confidential enquiries with mine mouth power stations in Queensland. Nominally based upon a strip ratio of 4.5 per bulk cubic metre at a cost of $7.5/bcm.

[7] Aurecon 2024 – https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2024/Aurecon-2024-Cost-and-Technical-Parameters-Review-Report

3.2 Financial assumptions

The following assumptions apply to the financial calculations within this report.

Table 3. Financial assumptions

Item	Value
Weighted Average Cost of Capital (WACC)	5.99% real
Economic life	50 years
Exchange rates (current as at 29/1/25)	
USD per AUD	0.62
INR per AUD	53.9
INR per USD	86.6
CYN per USD	7.25
USD per VND	0.000040
USD per IDR	0.000062
Escalation	3.4% per annum[8]

A real WACC of 5.99% has been chosen for consistency with GenCost. In our experience, 50 years is a realistic economic life for a coal fired power plant.

3.3 Limitations

Limitations of this analysis include the following.

- Dearth of current Australian coal-plant project data. The most recently built coal plant in Australia was the Kogan Creek 750MW power station in Queensland, which was completed in 2007, some 18 years ago. This lack of current projects in the domestic industry makes accurate project estimating difficult in the Australian context.
- Lack of publicly available Chinese cost and performance data on USC coal plants. There is a general lack of data on Chinese coal fired power plant, although a notable exception is information available through the Global Energy Monitor website[9]. Generally, publicly available, verifiable information is difficult to find relating to capital costs, operating costs, plant efficiencies, and other operational data for Chinese plant.

[8] https://www.oxfordeconomics.com.au/resource/cost-escalation-pressures-are-easing-but-key-risks-remain-construction-and-infrastructure/#:~:text=Since%20the%20mid%2D1980s%2C%20when,average%20growth%20in%20the%20CPI.

[9] https://globalenergymonitor.org/projects/global-coal-plant-tracker/tracker/

4 Sources of data

Sources of data for this report include the following.

Benchmark estimates

- International Energy Agency, "Projected Costs of Generating Electricity – 2020 Edition"[10]
- International Energy Agency, "World Energy Outlook 2024"[11]
- US Energy Information Administration, "Capital Cost Estimates for Utility Scale Electricity Generating Plants – 2016[12]
- Aurecon – "2024 Energy Technology Cost and Technical Parameter Review" – Rev 3 2024[13] (also the basis of the CSIRO GenCost 2024–25 Consultative Draft report relating to coal plant capital costs[14])
- Indian Technology Catalogue – Generation and Storage of Electricity – 2022[15]

Real-world examples

Real-world examples identified of USC coal projects are shown below, along with the relevant information source (all accessed in late January/early February 2025).

[10] https://www.iea.org/reports/projected-costs-of-generating-electricity-2020

[11] https://www.iea.org/reports/world-energy-outlook-2024

[12] https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capcost_assumption.pdf

[13] https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2024/Aurecon-2024-Cost-and-Technical-Parameters-Review-Report

[14] https://aemo.com.au/-/media/files/major-publications/isp/2025/draft-2025-inputs-assumptions-and-scenarios-report-stage-1.pdf?la=en

[15] https://cea.nic.in/wp-content/uploads/irp/2022/02/First_Indian_Technology_Catalogue_Generation_and_Storage_of_Electricity-2.pdf

Table 4. USC coal projects around the world

Project	Country	Capacity (MW)	Technology	Project year
Van Phong 1[16] [17] [18]	Vietnam	1,432	USC	2024
Van Aung II (planned)[19] [20]	Vietnam	1,330	USC	2025
Khargone[21] [22]	India	1,320	USC	2015
Pingshan Phase 1[23]	China	1,320	USC	2016
Pingshan Phase 2[24] [25]	China	1350	USC	2022
Banten Suralaya / Jawa 9 & 10[26] [27] [28]	Indonesia	2000	USC	2024
Kogan Creek[29] [30] [31]	Australia	750	Supercritical	2007

16 https://e.vnexpress.net/news/news/2-5b-thermal-power-plant-goes-online-in-central-vietnam-4722421.html

17 https://www.gem.wiki/Van_Phong_power_station#cite_note-28

18 https://www.nsenergybusiness.com/projects/van-phong-1-coal-fired-power-project/?cf-view&cf-closed

19 https://web.archive.org/web/20240510203658/https://tienphong.vn/can-canh-cong-truong-nha-may-nhiet-dien-22-ty-usd-o-ha-tinh-post1627123.tpo

20 https://www.gem.wiki/Vung_Ang_power_station#cite_note-autoref_3-4

21 https://www.gem.wiki/Khargone_power_station

22 https://www.powermag.com/khargone-indias-high-efficiency-leap/

23 https://www.gem.wiki/Huaibei_Pingshan_power_station

24 https://www.nsenergybusiness.com/projects/pingshan-thermal-power-plant-phase-two/?cf-view

25 https://www.sustainable-carbon.org/chinas-pingshan-phase-ii-sets-new-bar-as-worlds-most-efficient-coal-power-plant/

26 https://china.aiddata.org/projects/92603/

27 https://www.nsenergybusiness.com/projects/jawa-9-10-power-plants/?cf-view

28 https://www.gem.wiki/Banten_Suralaya_power_station

29 https://www.power-technology.com/projects/kogan/#:~:text=in%20Queensland%2C%20Australia.-,A%20750MW%20supercritical%2Dsteam%20coal%2Dfired%20power%20station%20is%20now,subsidiary%20of%20the%20Southern%20Company).

30 https://en.wikipedia.org/wiki/Kogan_Creek_Power_Station#:~:text=The%20Kogan%20Creek%20Power%20Station,Basin%20between%20Dalby%20and%20Chinchilla.

31 https://www.power-technology.com/marketdata/kogan-creek-power-station-australia/

5 Cost analysis

5.1 Estimating methodology

5.1.1 Assumptions

Capital costs were established as follows:

- Exchange rates to transfer all projects to both USD and AUD currencies (refer Section 0)
- Capital costs in earlier years were escalated to 2024
- Capital costs were moderated for Australian Standard compliance and Australian labour productivity and costs
- Capital costs were compared per megawatt of plant capacity

A detailed breakdown of the calculations is listed in Appendix A.

5.1.2 Moderating to Australian context

Capital costs of offshore projects were moderated to create an equivalent cost for a 2024 project located in Australia, as follows:

- Labour hours were calculated from a reference Arche modelled project (refer to the "Typical power plant calcs" in Appendix A)
- Difference in labour costs by country were calculated based on the average construction labour rate
- A productivity factor was assigned to labour costs by country (refer "Typical power plant calcs" in Appendix A)
- Equipment costs were increased by 10% to reflect the potential need to modify equipment to Australian Standards
- Labour cost differential was added to equipment cost adjustment, and the total was scaled to the size of the plant on a megawatt basis

For LCOE estimating, land and development costs are not included in Table 5, whereas they are included in Table 7 to be on a like-for-like basis with GenCost. The Aurecon report uses an estimate of 20% of capex ($600M for the example given), which we believe to be excessive. For the purposes of our LCOE estimate, a 5% allowance for land and development costs is used (although we still believe that this estimate is very high).

5.1.3 LCOE estimation

For consistency with GenCost, the LCOE estimation is calculated using the GenCost methodology using the formulae set out in "GenCost2024-25ConsultDraftApxTables_20241127.xlsx", downloaded from the CSIRO's GenCost webpage.

5.1.4 Benchmark capital estimates

Benchmark capital estimates were used to compare other benchmark data from around the world.

5.2 Results

5.2.1 Real-world examples

We identified and moderated the capital estimates of real-world USC projects as presented in Table 5. These moderated values are shown graphically in Figure 2 below.

Table 5. Capital estimates of existing USC projects

Project	Country	Capacity (MW)	Capital cost in project year	Project year	Escalated cost to 2024 (USD)	Cost/MW (USD)	Cost/MW (AUD)	LCOE (AUD$/MWh)
Van Phong 1	Vietnam	1,432	US$2,580,000,000	2024	$2,580,000,000	$1,801,676		
Van Phong 1	Adjusted to Aus	1,432			$3,961,833,571	$2,766,644	$4,462,328	$70
Vung Ang II	Vietnam	1,330	US$2,200,000,000	2025	$2,200,000,000	$1,654,135		
Vung Ang II	Adjusted to Aus	1,330			$3,483,406,878	$2,619,103	$4,224,360	$67
Khargone	India	1,320	₹ 5,580 crore	2015	$644,639,556	$488,363		
Khargone	Adjusted to Aus	1,320			$1,918,396,758	$1,453,331	$2,344,082	$50
Pingshan Phase 1	China	1,320	US$940,000,000	2016	$1,228,265,246	$930,504		
Pingshan Phase 1	Adjusted to Aus	1,320			$2,502,022,448	$1,895,472	$3,057,212	$56
Pingshan Phase 2	China	1,350	US$733,333,333[32]	2022	$784,047,733	$580,776		
Pingshan Phase 2	Adjusted to Aus	1,350			$2,086,753,963	$1,545,744	$2,493,135	$51
Banten Suralaya / Jawa 9 & 10	Indonesia	2,000	US$3,500,000,000	2024	$3,500,000,000	$1,750,000		
Banten Suralaya / Jawa 9 & 10	Adjusted to Aus	2,000			$5,429,935,154	$2,714,968	$4,378,980	$69
Kogan Creek	Australia	750	AU$1,200,000,000	2007	$1,313,475,857	$1,751,301	$2,824,679	$54

[32] Note that Pingshan's Phase 2 cost was reported as "an estimated investment of USD$220M" (NS Energy, Nov 5 2020). This has been interpreted as a 30% equity cost only, with debt assumed to comprise the remaining capital cost. Hence the capital cost has been adjusted accordingly.

Figure 1. Capital costs per MW and LCOE; international coal plant projects — moderated to Australian context

5.2.2 Benchmark capital costs

The benchmark capital costs identified are shown in Table 6. In order to compare a range of opinions on benchmark capital costs, Arche has undertaken a scan of publicly available information. Each of these benchmarks have been escalated to 2024 and converted to Australian dollars. They have not been moderated for Australian compliance nor Australian labour productivity/cost.

Table 6. Benchmark capital costs identified

Technology	Country	Capacity (MWe)	Capital cost per MW (USD/MWe)	Capital cost per MW (AUD/MWe)	Info source
Supercritical pulverised	Australia	722	$2,433,000	$3,924,194	IEA 2020
Ultra-supercritical	Japan	749	$2,419,000	$3,901,613	IEA 2020
Ultra-supercritical	Korea	954	$1,151,000	$1,856,452	IEA 2020
Pulverised	USA	138	$4,382,000	$7,067,742	IEA 2020
Pulverised	USA	140	$3,447,000	$5,559,677	IEA 2020
Pulverised	USA	650	$2,478,000	$3,996,774	IEA 2020
Supercritical pulverised	USA	650	$2,582,000	$4,164,516	IEA 2020
Ultra-supercritical	USA	641	$4,157,000	$6,704,839	IEA 2020
Other coal (lignite)	Brazil	900	$2,189,000	$3,530,645	IEA 2020
Ultra-supercritical	China	347	$800,000	$1,290,323	IEA 2020
Ultra-supercritical	India	400	$1,148,000	$1,851,613	IEA 2020
Ultra-supercritical	India	400	$1,111,000	$1,791,935	IEA 2020
Ultra-supercritical	USA	650	$3,636,000	$5,864,516	US EIA 2016
Coal 2023	USA		$2,100,000	$3,387,097	IEA WEO 2024
Coal 2023	EU		$2,000,000	$3,225,806	IEA WEO 2024

Technology	Country	Capacity (MWe)	Capital cost per MW (USD/MWe)	Capital cost per MW (AUD/MWe)	Info source
Coal 2023	China		$800,000	$1,290,323	IEA WEO 2024
Coal 2023	India		$1,200,000	$1,935,484	IEA WEO 2024
Technology catalogue benchmark price	India	660-800	$1,037,536	$1,558,433	India technology catalogue

These capital costs are shown graphically in Figure 2 below.

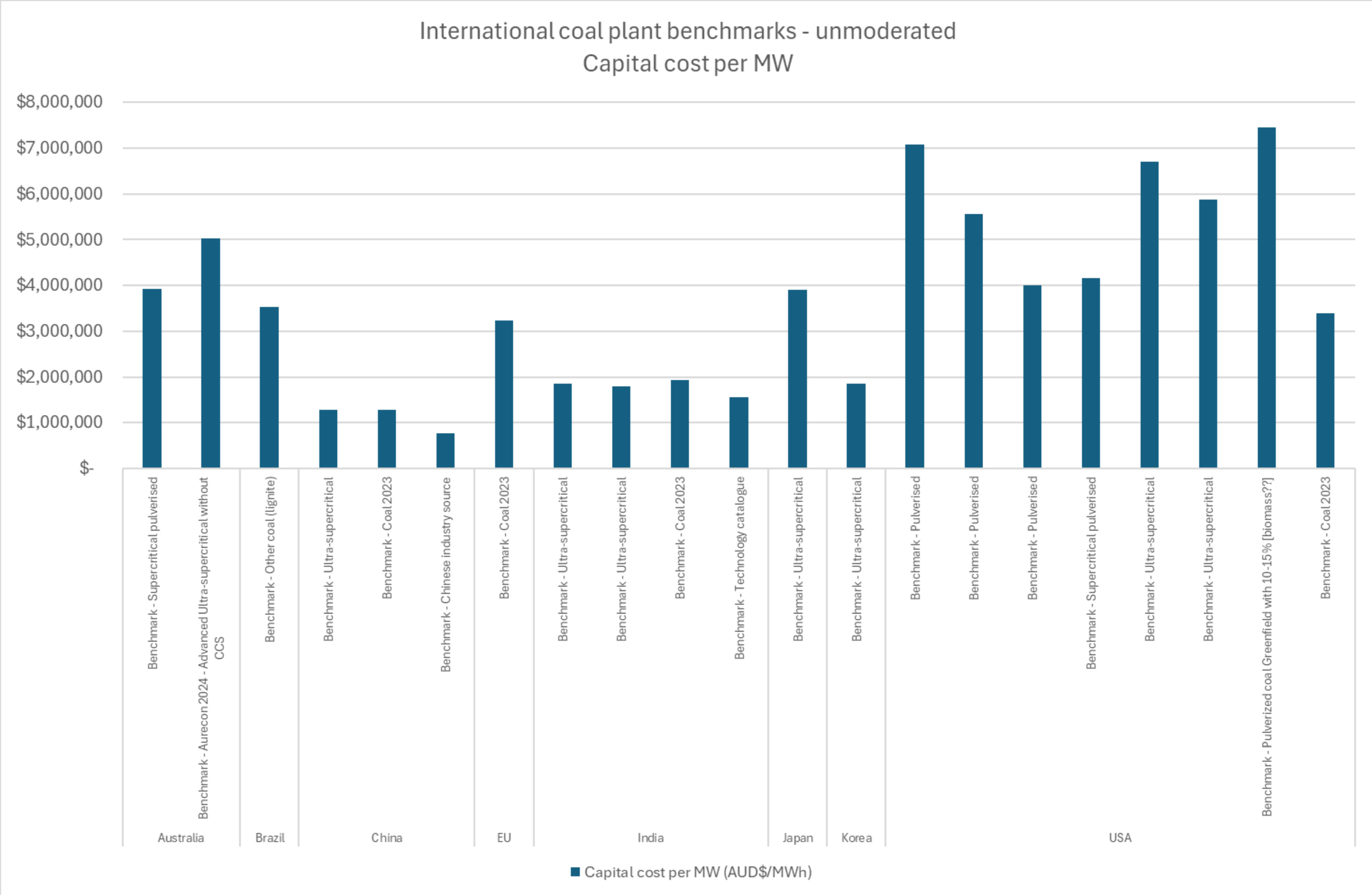

Figure 2. Capital costs per MW and LCOE; international coal plant benchmarks — unmoderated

5.3 Discussion

The real-world examples show a range of capital costs in the range of 41% to 78% of the capital cost rate used in GenCost when moderated to reflect escalation, compliance with Australian Standards and Australian labour productivity and cost.

When an LCOE is calculated for each of the real-world examples (as if they were deployed onto the NEM in a mine mouth location) using the GenCost methodology with Arche's moderated assumptions, the estimated LCOEs range from $50/MWh to $70/MWh. These estimates are well under GenCost's estimates of $102–164/MWh and well under current average wholesale electricity prices on the NEM.

Table 7. Real-world projects compared to GenCost

Project	Capital cost per MW (AUD/MWe)	Capital cost per MW (AUD/Mwe) incl. Land and Development	Capital cost percentage of GenCost benchmark	LCOE (AUD$/MWh)
Benchmark — GenCost: advanced ultra-supercritical without CCS	$5,031,000	$6,037,199	100%	$102–164[33]
Van Phong 1: adjusted for Australian project	$4,462,328	$4,685,445	78%	$70
Vung Aung II: adjusted for Australian project	$4,224,360	$4,435,578	73%	$67
Khargone: adjusted for Australian project	$2,344,082	$2,461,286	41%	$50
Pingshan Phase 1: adjusted for Australian project	$3,057,212	$3,210,073	53%	$56
Pingshan Phase 2: adjusted for Australian project	$2,493,135	$2,617,792	43%	$51
Banten Jaway 9 & 10: adjusted for Australian project	$4,378,980	$4,597,929	76%	$69
Kogan Creek: escalated to 2024	$2,824,679	$2,965,913	49%	$54

International benchmarks undertaken by other agencies range in their capital estimates from as low as $1,558,433/MW (AUD) in India, through $1,856,613 in Korea, $3,901,613 in Japan and a broad range of higher estimates for the USA (from $3,387,097 up to $7,067,742 (IEA 2020)).

Like Australia, the USA has not constructed coal fired power plant for many years; hence the benchmark estimates for the USA are not necessarily backed by real world data; this report does not attempt to scrutinise these benchmarks in any detail.

[33] GenCost Ap Table B.10.

The international benchmarks indicate that, for comparable economies, labour costs and safety standards to Australia (Japan, Korea, USA), the capital ranges from $1,856,613 to $4,000,00/MW AUD (if the lower range of the USA benchmarks are used).

5.4 Chinese coal plant construction pipeline and learning curve

An excerpt from Section 5.3.1 of the CSIRO GenCost 2024–25 Draft is as follows:

> *"Black coal ultra-supercritical is treated in the projections as a learning technology. However, global new building of ultra-supercritical coal is limited to the Current policies scenario and the learning rate is low. The outlook for costs in all scenarios is flat, with a slight increase due to increasing land costs."*[34]

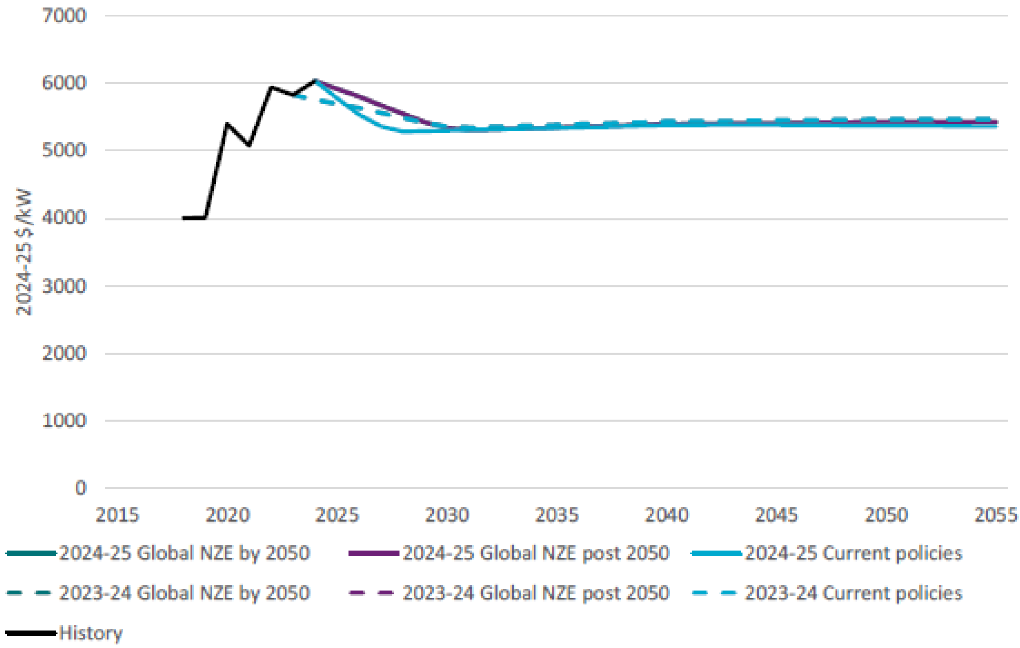

Figure 5-3 Projected capital costs for black coal ultra-supercritical by scenario compared to 2023-24 projections

It should be noted that according to the Global Energy Monitor website[35], there is a large number of ultra-supercritical coal plants being proposed to be commissioned in China by 2027. According to this source, there are 694 coal plant units (modules 350–1350MW, approximately 421GW total capacity) either in construction, announced or in the permitting/pre-permit stage in China. Of these, 443 coal plant units (approximately 369GW total capacity) are understood to be ultra-supercritical, and 221 have operating dates scheduled by 2027[36] (refer Figure 3 below for a map of planned Chinese coal plants).

[34] https://www.csiro.au/-/media/Energy/GenCost/GenCost2024-25ConsultDraft_20241205.pdf

[35] https://globalenergymonitor.org/projects/global-coal-plant-tracker/tracker/

[36] https://globalenergymonitor.org/wp-content/uploads/2024/07/Global-Coal-Plant-Tracker-July-2024.xlsx

This enormous number of coal plants is very likely to create downward pressure on capital costs through learning curve effects. If Australia were to employ Chinese technology, this would appear to contradict the assumption that the future outlook on USC plant cost is flat through to 2050, excluding future cost impacts such as a carbon price.

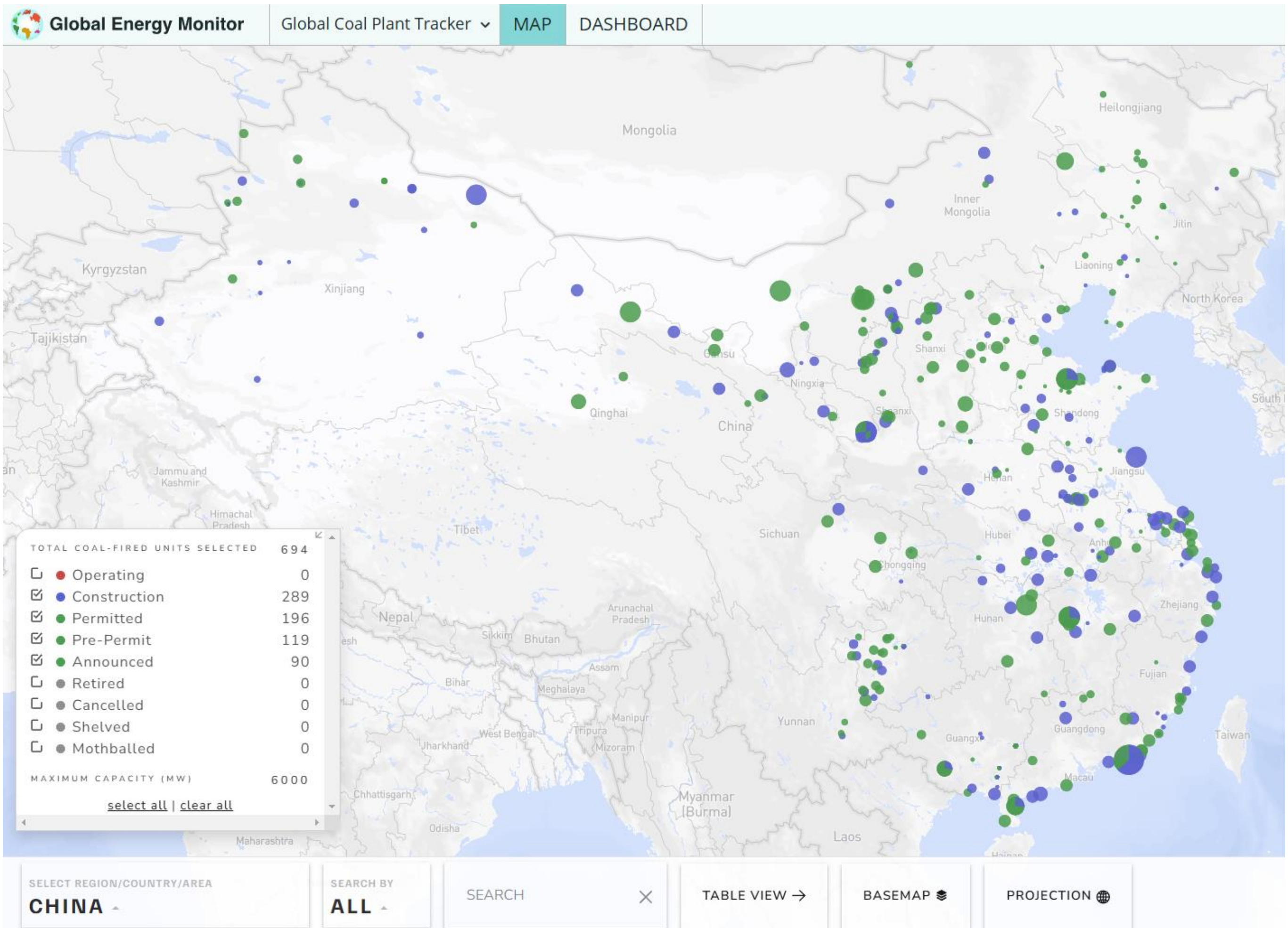

Figure 3. Coal-fired power plants in China either in construction, permitted, pre-permit or announced (Global Energy Monitor's Global Coal Plant Tracker)[37]

[37] https://globalenergymonitor.org/projects/global-coal-plant-tracker/tracker/

6 Coal plant life extension

6.1 Approach and assumptions

The cost of extending coal plant beyond their nominated closure dates was assessed. The following method was used.

- Stanwell's coal fleet was used as a basis with data taken from Stanwell's annual reports.[38]
- Stanwell's sustaining capital spent since financial year 2019/20 was attributed to the coal fleet only (Mica Creek Gas and Stanwell's hydropower plants, which ceased to be part of Stanwell's active portfolio in 2020, were assumed to attract minimal sustaining capital expenditure in the period 2019–2024).
- Similarly, Stanwell's Meandu coal mine was assumed to attract only minimal sustaining capital for the purposes of this assessment.
- The average expenditure per MWh can be used as a benchmark cost to apply to other coal plants to provide an indication of appropriate allowance for sustaining capital to keep the plant operating past its nominated closure date. Note that each plant will have its own specific requirements for sustaining capex depending upon its design, age and how it has been maintained.
- For context, the refurbishment of ageing coal plant would likely include the following work performed on major equipment, although the actual requirements would vary for each plant, depending on plant design, operating life, and maintenance practices:
  - Replacement of high-pressure steam headers
  - Replacement of reheat headers
  - Replacement of economiser banks/piping
  - Rewinding generators.

6.2 Results

The results of the assessment are shown in Table 8.

[38] https://www.stanwell.com/information-publication-scheme

Table 8. Assessment results

Financial year	Sustaining capital spent (AUD$M/annum)	Active coal fleet capacity (MW)	Total energy produced (GWh/annum)	Expenditure /MW / annum	Expenditure AUD$/MWh
2023/24	171.5	3,303	19,085	$51,922	$ 8.99
2022/23	157.3	3,303	19,423	$47,623	$ 8.10
2021/22	144.2	3,303	18,237	$43,657	$ 7.91
2020/21	235.0	3,303	18,655	$71,147	$12.60
2019/20	114.7	3,303	18,595	$34,726	$ 6.17
			Average expenditure/MWh:		$8.75

If this benchmark were applied to a 10-year life extension decision for a (nominal) 2,880MW power plant, the cost would be in the order of $1.4B ($500,000 per MW).

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Appendix A.

Calculations spreadsheet

Exchange rate USD/AUD	0.62	Exchange rate as at 29/01/2025
Exchange rate (AUD/cr. INR)	0.00000539	Exchange rate as at 29/01/2025
Exchange rate (USD/cr. INR)	0.00000866	Exchange rate as at 29/01/2025
Exchange rate (CNY/USD)	7.25	Exchange rate as at 29/01/2025
Exchange rate (VND/USD)	0.000040	Exchange rate as at 29/01/2025
Exchange rate (IDR/USD)	0.000062	Exchange rate as at 29/01/2025
Annual escalation rate	3.4%	https://www.oxfordeconomics.com.au/resource/cost-escalation-pressures-are-easing-but-key-risks-remain-construction-and-infrastructure/#:~:text=Since%20the%20mid%2D1980s%2C%20when,average%20growth%20in%20the%20CPI.

Gencost USC capex AUD$/kW: $6,036

Source	Source	Source
Assumption	Calculation	Calculation

Filter column	Info source	Info source 2	Info source 3	Country	Project	Technology	Capacity (MWe)	Electrical conversion effiency	Capital cost in project year	Benchmark Capital cost (/MWe)	Project year	Escalation factor to 2024 cost	Original currency	Capital cost escalated to 2024 (USD)	Capital cost per MW (USD/MWe)	Capital cost per MW (AUD/MWe)	% of Aurecon cost no CCS	Exchange rate (AUD/USD)	Land and development cost (%)	Capex incl. land and devel cost (AUD$/MWe)	**LCOE (AUD$/MWh)**	% of Aurecon non-CCS plant LCOE	% of GenCost
2	IEA 2020			Australia	Benchmark - Supercritical pulverised	Supercritical pulverised	722	40%							$ 2,433,000	$ 3,924,194		0.62	5%	$ 4,120,403			68%
2	IEA 2020			Japan	Benchmark - Ultra-supercritical	Ultra-supercritical	749	41%							$ 2,419,000	$ 3,901,613		0.62	5%	$ 4,096,694			68%
2	IEA 2020			Korea	Benchmark - Ultra-supercritical	Ultra-supercritical	954	43%							$ 1,151,000	$ 1,856,452		0.62	5%	$ 1,949,274			32%
2	IEA 2020			USA	Benchmark - Pulverised	Pulverised	138	36%							$ 4,382,000	$ 7,067,742		0.62	5%	$ 7,421,129			123%
2	IEA 2020			USA	Benchmark - Pulverised	Pulverised	140	36%							$ 3,447,000	$ 5,559,677		0.62	5%	$ 5,837,661			97%
2	IEA 2020			USA	Benchmark - Pulverised	Pulverised	650	40%							$ 2,478,000	$ 3,996,774		0.62	5%	$ 4,196,613			70%
2	IEA 2020			USA	Benchmark - Supercritical pulverised	Supercritical pulverised	650	42%							$ 2,582,000	$ 4,164,516		0.62	5%	$ 4,372,742			72%
2	IEA 2020			USA	Benchmark - Ultra-supercritical	Ultra-supercritical	641	43%							$ 4,157,000	$ 6,704,839		0.62	5%	$ 7,040,081			117%
2	IEA 2020			Brazil	Benchmark - Other coal (lignite)	Other coal (lignite)	900	34%							$ 2,189,000	$ 3,530,645		0.62	5%	$ 3,707,177			61%
2	IEA 2020			China	Benchmark - Ultra-supercritical	Ultra-supercritical	347	45%							$ 800,000	$ 1,290,323		0.62	5%	$ 1,354,839			22%
2	IEA 2020			India	Benchmark - Ultra-supercritical	Ultra-supercritical	400	45%							$ 1,148,000	$ 1,851,613		0.62	5%	$ 1,944,194			32%
2	IEA 2020			India	Benchmark - Ultra-supercritical	Ultra-supercritical	400	45%							$ 1,111,000	$ 1,791,935		0.62	5%	$ 1,881,532			31%
2	US EIA 2016	https://www.eia.gov/analysis/studie		USA	Benchmark - Ultra-supercritical	Ultra-supercritical	650								$ 3,636,000	$ 5,864,516		0.62	5%	$ 6,157,742			102%
2	US EIA 2016	https://www.eia.gov/analysis/studie		USA	Benchmark - Pulverized coal Greenfield with 10-15	Pulverized coal Greenfield with 10-15% [bi	300								$ 4,620,000	$ 7,451,613		0.62	5%	$ 7,824,194			130%
2	IEA WEO 2024	https://www.iea.org/reports/world-e		USA	Benchmark - Coal 2023	Coal 2023									$ 2,100,000	$ 3,387,097		0.62	5%	$ 3,556,452			59%
2	IEA WEO 2024	https://www.iea.org/reports/world-e		EU	Benchmark - Coal 2023	Coal 2023									$ 2,000,000	$ 3,225,806		0.62	5%	$ 3,387,097			56%
2	IEA WEO 2024	https://www.iea.org/reports/world-e		China	Benchmark - Coal 2023	Coal 2023									$ 800,000	$ 1,290,323		0.62	5%	$ 1,354,839			22%
2	IEA WEO 2024	https://www.iea.org/reports/world-e		India	Benchmark - Coal 2023	Coal 2023									$ 1,200,000	$ 1,935,484		0.62	5%	$ 2,032,258			34%
2	https://cea.nic.in/wp-content/uploads/irp/2022/02/Fi			India	Benchmark - Technology catalogue	Ultra-supercritical	660-800	41%		₹ 8.40	2022	107%	INR (crore 10^7)		$ 1,037,536	$ 1,558,433		0.62	5%	$ 1,636,355			27%
2	https://aemo.com.au/-/media/files/major-publications			Australia	Benchmark - Aurecon 2024 - Advanced Ultra-super	Advanced Ultra-supercritical without CCS	671.3	42%	$ 3,377,310,000		2024	100%	AUD	$ 2,093,932,200	$ 3,119,220	$ 5,031,000	100%		20%	$ 6,037,199	$ 102	100%	100%
1	https://e.vnexpres	https://www.gem.	https://www.nser	Vietnam	Van Phong 1	Ultra-supercritical	1432		$ 2,580,000,000		2024	100%	USD	$ 2,580,000,000	$ 1,801,676	$ 2,905,929		0.62	5%	$ 3,051,225			51%
3				Vietnam	Van Phong 1 - adjusted for Aust project	Ultra-supercritical	1432							$ 3,961,833,571	$ 2,766,644	$ 4,462,328	89%		5%	$ 4,685,445	$ 70	68%	78%
1	https://web.archiv	https://www.gem.wiki/Vung_Ang_po		Vietnam	Vung Ang II [to be completed 2025]	Ultra-supercritical	1330		$ 2,200,000,000		2025	100%	USD	$ 2,200,000,000	$ 1,654,135	$ 2,667,960		0.62	5%	$ 2,801,358			46%
3				Vietnam	Vung Aung II - adjusted for Aust project	Ultra-supercritical	1330							$ 3,483,406,878	$ 2,619,103	$ 4,224,360	84%		5%	$ 4,435,578	$ 67	66%	73%
1	https://www.gem.	https://www.powermag.com/kharg		India	Khargone	Ultra-supercritical	1320		₹ 5,580		2015	135%	INR (crore 10^7)	$ 644,639,556	$ 488,363	$ 784,276		0.62	5%	$ 823,490			14%
3				India	Khargone - adjusted for Aust labour	Ultra-supercritical	1320							$ 1,918,396,758	$ 1,453,331	$ 2,344,082	47%		5%	$ 2,461,286	$ 50	49%	41%
1	https://www.gem.wiki/Huaibei_Pingshan_power_statio			China	Pingshan Phase 1	Ultra-supercritical	1320		$ 940,000,000		2016	131%	USD	$ 1,228,265,246	$ 930,504	$ 1,500,813			5%	$ 1,575,854			26%
3				China	Pingshan Phase 1 - adjusted to Aust labour	Ultra-supercritical	1320							$ 2,502,022,448	$ 1,895,472	$ 3,057,212	61%		5%	$ 3,210,073	$ 56	55%	53%
1	https://www.nser	https://www.susta	https://www.gem	China	Pingshan Phase 2 - full capex assuming reported cost was 30% equity only	Ultra-supercritical	1350		$ 733,333,333		2022	107%	USD	$ 784,047,733	$ 580,776	$ 936,736			5%	$ 983,572			16%
3				China	Pingshan Phase 2 - adjusted to Aust project	Ultra-supercritical	1350							$ 2,086,753,963	$ 1,545,744	$ 2,493,135	50%		5%	$ 2,617,792	$ 51	50%	43%
1	https://china.aidd	https://www.nser	https://www.gem	Indonesia	Banten Suralaya / Jawa 9 & 10 - brownfield expansion in Suralaya	Ultra-supercritical	2000		$ 3,500,000,000		2024	100%	USD	$ 3,500,000,000	$ 1,750,000	$ 2,822,581			5%	$ 2,963,710			49%
3				Indonesia	Banten Jaway 9 & 10 - adjusted to Aust project	Ultra-supercritical	2000							$ 5,429,935,154	$ 2,714,968	$ 4,378,980	87%		5%	$ 4,597,929	$ 69	67%	76%
3	https://www.powe	https://en.wikiped	https://www.pow	Australia	Kogan Creek	Supercritical	750		$ 1,200,000,000		2007	177%	AUD	$ 1,313,475,857	$ 1,751,301	$ 2,824,679	56%		5%	$ 2,965,913	$ 54	53%	49%

Modified from GenCost Appendix Table B.9 Data assumptions for LCOE calculations

Discount rate 5.99%

	Constant						Low assumption			High assumption		
	Economic life	Construction time	Efficiency	O&M fixed	O&M variable	CO_2 storage	Capital	Fuel	Capacity factor	Capital	Fuel	Capacity factor
	Years	Years		$/kW	$/MWh	$/MWh	$/kW	$/GJ		$/kW	$/GJ	
2024												
Black coal	30	2.0	42%	64.9	4.7	0.0	$ 6,037	3.1	89%	6037	4.6	53%
Arche assumptions on Aurecon Capex	50	2.0	42%	64.9	4.7	0.0	$ 5,283	1.7	91%			
Van Phong 1	50	2.0	42%	64.9	4.7	0.0	$ 4,685	1.7	91%			
Vung Aung II	50	2.0	42%	64.9	4.7	0.0	$ 4,436	1.7	91%			
Khargone	50	2.0	42%	64.9	4.7	0.0	$ 2,461	1.7	91%			
Pingshan 1	50	2.0	42%	64.9	4.7	0.0	$ 3,210	1.7	91%			
PingShan 2	50	2.0	42%	64.9	4.7	0.0	$ 2,618	1.7	91%			
Banten Jaway 9 & 10	50	2.0	42%	64.9	4.7	0.0	$ 4,598	1.7	91%			
Kogan Creek	50	2.0	42%	64.9	4.7	0.0	$ 2,966	1.7	91%			

	Comparison against Low-range GenCost USC					
	Capital	Fuel	O&M	CO2 storage	**Total (LCOE) (AUD$/MWh)**	**% of mid-range Gencost USC LCOE**
Black coal	$ 63.13	$ 26.15	$ 13.00	$ -	$ 102	
Arche assumptions on Aurecon Capex	$ 47.16	$ 14.86	$ 12.82	$ -	$ 75	56%
Van Phong 1	$ 41.83	$ 14.86	$ 12.82	$ -	$ 70	52%
Vung Aung II	$ 39.60	$ 14.86	$ 12.82	$ -	$ 67	51%
Khargone	$ 21.98	$ 14.86	$ 12.82	$ -	$ 50	37%
Pingshan 1	$ 28.66	$ 14.86	$ 12.82	$ -	$ 56	42%
PingShan 2	$ 23.37	$ 14.86	$ 12.82	$ -	$ 51	38%
Banten Jaway 9 & 10	$ 41.05	$ 14.86	$ 12.82	$ -	$ 69	52%
Kogan Creek	$ 26.48	$ 14.86	$ 12.82	$ -	$ 54	41%

	High-range				
	Capital	Fuel	O&M	CO2 storage	**Total (LCOE) (AUD$/MWh)**
Black coal	106	39	19	0	$ 164

Transferred Swanbank / 3 x hydro projects to Cleanco on 31/10/19

	Capacity (MW)						
	2023/24	2022/23	2021/22	2020/21	2019/20	2018/19	2017/18
Tarong							
Tarong North							
Tarong combine	1,843	1843	1843	1843	1843	1843	1843
Stanwell	1,460	1460	1460	1460	1460	1460	1460
Mica Creek				218	140	115	115
Mackay GT				34	34		
Wivenhoe hydro				4.7	4.7		
Swanbank						385	385
Hydro plants					164	164	164
Total	3,303	3,303	3,303	3,560	3,646	3,967	3,967
Assumed capacity for expenditure/annum	3303	3303	3303	3303	3303		

Stanwell sustaining capital figures					
Financial year	Sustaining capital spent (AUD$M/annum)	Active coal fleet capacity (MW)	Total energy produced (GWh/annum)	Expenditure /MW / annum	Expenditure AUD$/MWh
2023/24	171.5	3,303	19,085	$ 51,922	$ 8.99
2022/23	157.3	3,303	19,423	$ 47,623	$ 8.10
2021/22	144.2	3,303	18,237	$ 43,657	$ 7.91
2020/21	235.0	3,303	18,655	$ 71,147	$ 12.60
2019/20	114.7	3,303	18,595	$ 34,726	$ 6.17

AVERAGE EXPENDITURE AUD$/MWh SINCE 2019/20: $ 8.75

Source: https://www.stanwell.com/information-publication-scheme

Note this sustaining capital is across all Stanwell assets including coal mine at Meandu and assumes negligible capital was spent on Mica Creek, Mackay GT and hydro plants in 2019-21

Base assessment back to 2019/20 only
Assume no sustaining capital spent on Mica Creek or hydro plants - only on coal plant

COAL PLANT FOR EXTENSION	Value	Unit	Source
Total energy produced (GWh/annum)	6000	GWh	Assumption
Sustaining capital cost	$ 52,515,559	AUD per annur	Calculation

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