CLIMATE ENERGY FINANCE

Narrabri Underground Mine Stage 3 Extension Project

(SSD 10269) Public Hearing

February 2022

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Acknowledgement

Climate Energy Finance (CEF) has been engaged by Environmental Defenders Office (EDO) on behalf of Lock the Gate to prepare this independent expert witness report covering the global policy, market and financial landscape relating to the energy sector with respect to climate change and technology developments. A copy of my expert brief is attached to this report as Appendix 1. As author I, Tim Buckley, acknowledge that I have read the Expert Witness Code of Conduct in Schedule 7 of the Uniform Civil Procedure Rules 2005 (NSW) and that I agree to be bound by it.

Tim Buckley, 24 February 2022

Introduction

I have been a financial analyst for over 30 years covering a number of sectors in the Australian and global markets, including the Australian coal mining and electricity sectors.

The global energy sector is in the midst of a massive, ongoing transition, driven by the confluence of what I consider to be a powerful grouping of policy, financial, economic and technological forces.

A key point of my analysis is that the energy transition is accelerating rapidly - well beyond the financial markets or most energy experts' expectations, notably the International Energy Agency (IEA) and the United States of America Energy Information Administration (US EIA). What was considered unlikely even 1-2 years ago by respected energy leaders like the Australian Energy Market Operator (AEMO) is now considered the central scenario. This is relevant to the consideration of a new project, such as the predominantly thermal coal Narrabri Underground Mine Stage 3 Extension Project (SSD-10269) (Narrabri Project).

The rapid transition is due to the confluence of a number of factors:

1. Global Policy Developments: The global policy framework relating to energy and climate has seen enormous change in the last 12 months, underpinned by the growing global awareness that the climate scientists were right, and that urgent action to limit the growth in carbon emissions is needed, given the corresponding growth in economic costs of extreme weather events.
2. Technology Driven Deflation: The technology development in the energy sector relating to renewables, batteries and grid systems has been massive and is ongoing, with the learning curve resulting in double-digit percentage annual reductions in unit costs of wind, solar and batteries, with green hydrogen starting down the same trajectory.
3. Global Finance Zero Emissions Pledges: Global financial institutions have responded to the growing threat of litigation and policy actions by regulators, the growing evidence on climate science as well as the extreme volatility in fossil fuel commodities, as well as the growing tens of trillions of investment opportunities emerging in funding the low emission solutions.
4. Transport and Energy Sector Convergence: The technology improvements combined with massive cost deflation in batteries has seen the convergence of the energy and transport sectors, with the rapid rise of electric vehicles (EV) resulting in the now likely terminal trajectory for internal combustion engines in the passenger vehicle sector.
5. Carbon Emissions Pricing: The rise of carbon dioxide (CO_2) emissions pricing has moved dramatically in 2021, and the momentum has accelerated already in 2022 to-date. As one of the largest sources of CO_2 emissions, the burning of coal in the power and steel sectors is economically challenged by the growing global trend to internalise the cost of this CO_2 pollution.

The majority of Australian fossil fuel production for energy generation is exported, including almost all of the coal production of the proponent of the proposed Narrabri Project, that being the Australian Stock Exchange listed Whitehaven Coal Limited (Whitehaven). The use of coal in power and steel markets globally over the longer term is existentially challenged by all of these factors. Contrary to all forecasts at the time, global coal use unexpectedly peaked back in 2013. In my analysis, as per the many reports I have published at IEEFA since 2013, the most likely scenario is that coal use globally has plateaued and is set to enter a slow but inevitably terminal decline. The IEA projects that if the world aligns with a 1.5°C limit to global warming, global coal use will decline by 78% by 2050. I have long argued the IEA, like the US EIA, has been excessively optimistic, underestimating the rate of decline.

I have attached (Appendix 2) a February 2022 paper titled "Australian Thermal Coal Exports Outlook: Volumes Set to Fall Amid Accelerating Energy Transition" prepared for this submission to the IPC by the Institute of Economics and Financial Analysis (IEEFA)'s lead coal analyst Simon Nicolas. He summarises the NSW Treasury report of May 2021[1] and similarly concludes the export demand for seaborne thermal coal is facing a growing number of headwinds in each of its four major markets – Japan, South Korea, China and Taiwan. Combined, these four countries represent 69% of Australian thermal coal exports by value in financial year (FY) 2020/21.[2] And these same trends are building momentum in the smaller markets that many coal analysts have assumed would replace the majors.

China's announcement in October 2021 that it would cease developing coal mines or coal power plants abroad with immediate effect marks the scale of the shift, given it follows similar natured announcements by Japan and Korea. As three of the largest funders of new coal globally in the last decade, this has profound implications for the outlook of Australian thermal coal exports.

The announcement by Sweden's SSAB in January 2022 in relation to its HYBRIT steel decarbonisation program, that it would bring forward the full decarbonisation of its steel production by 15 years to 2030,[3] marks a similar globally significant pivot point for the demand for coking coal (Australia's second largest commodity export). SSAB targets to reduce Sweden's national CO_2 emissions by 10% with this single initiative (and 7% of Finland's country emissions as well).

In announcing in May 2021 its Net Zero by 2050: A Roadmap, the IEA concluded that "This calls for nothing less than a complete transformation of how we produce, transport and consume energy." A second clear conclusion was "from today, no investment in new fossil fuel supply projects, and no further final investment decisions for new unabated coal plants."[4]

This raises another major issue relating to the ability of carbon capture and storage (CCS) to provide abatement of coal power plant emissions. The fossil fuel industry has referenced a number of carbon capture, use and storage (CCUS) projects that involve enhanced oil recovery (EOR), which means injecting CO_2 into reservoirs to extract ***more*** oil and gas. EOR is a well proven technology; CCS in contrast has no commercially viable, commercial-scale facilities operating anywhere near their target rates anywhere in the world. Particularly for coal power plants, CCS has been an abject failure over the last three decades, according to the IEA almost 100% off-track with the industry projections.

All of these factors relating to the structural decline of coal use globally need to be considered in evaluating a 13-year extension to 2044 of the Narrabri Project, particularly in light of the economic and environmental costs of this project on the people of NSW and Australia, whereas the benefits flow narrowly to the global shareholders in Whitehaven, and the relatively small number of 520 direct jobs involved relative to the ten-million-strong workforce of Australia. I have provided a current market estimate of A$2.3 billion (using a $0.6-4.0bn range) on the 27.627 million tonnes (Mt) of CO_2-e of Scope 1 & 2 emissions (refer Section 6), which is multiples of the proponent's projected net benefits to NSW of $599m. Given Whitehaven has actually received a net $22m cash tax refund from the ATO in the last decade (refer Section 7), I question the validity of including $177m as NSW share of corporate tax to be paid on the Narrabri Project.

[1] NSW Treasury. The Sensitivity of the NSW Economic and Fiscal Outlook to Global Coal Demand and the Broader Energy Transition for the 2021 NSW Intergenerational Report. May 2021
[2] Office of the Chief Economist, Resources and Energy Quarterly, December 2021
[3] SSAB Press Release, SSAB plans a new Nordic production system to bring forward the green transition, 28 January 2022
[4] IEA, Net Zero By 2050: A Roadmap for the Global Energy Sector, May 2021, page 13

Section 1: Most Energy Demand Forecasts Have Been Consistently Wrong

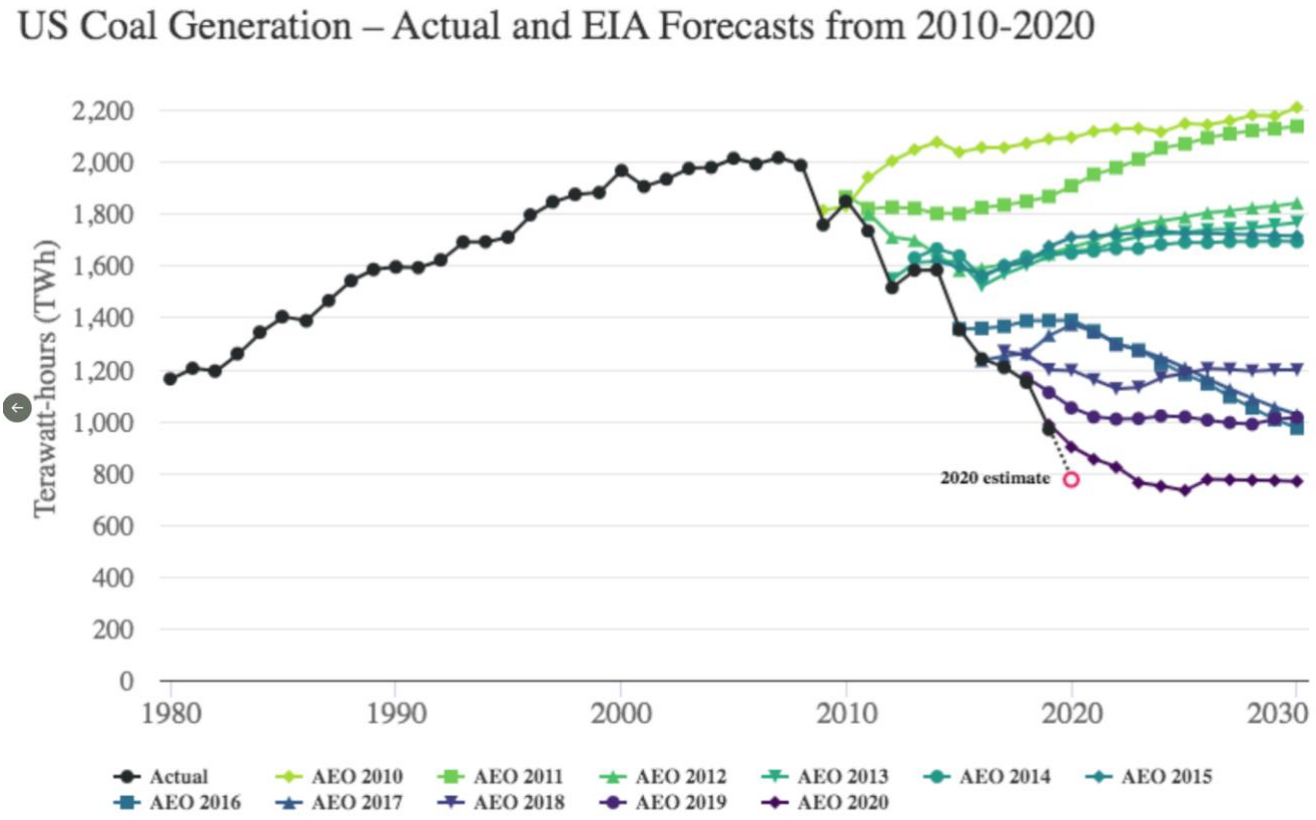
A key point of my analysis is that the energy transition is accelerating rapidly - well beyond the financial markets or most energy experts' expectations, notably IEA and the US EIA. What was considered unlikely even 1-2 years ago by respected energy leaders like the AEMO is now considered the central scenario.

Figure 1 details the massive ongoing collapse in coal power generation in the US since 2008, and the disastrous forecasts by the US EIA – part of the US Government's Department of Energy – entirely unable to predict this more than 50% collapse over the last decade to just 925 Terawatt hours (TWh) in 2021 even as it was happening in real time.

The US in 2010 was the second largest coal producing and consuming nation globally, behind only China.

In response to a joint IEEFA and Carbon Tracker global coal study predicting the peak and subsequent decline of coal use globally, in 2013 the IEA reaffirmed its forecast that China's coal consumption would continue to grow until at least 2030, only to correct its position in 2016 to say that China's consumption most likely peaked back in 2013.

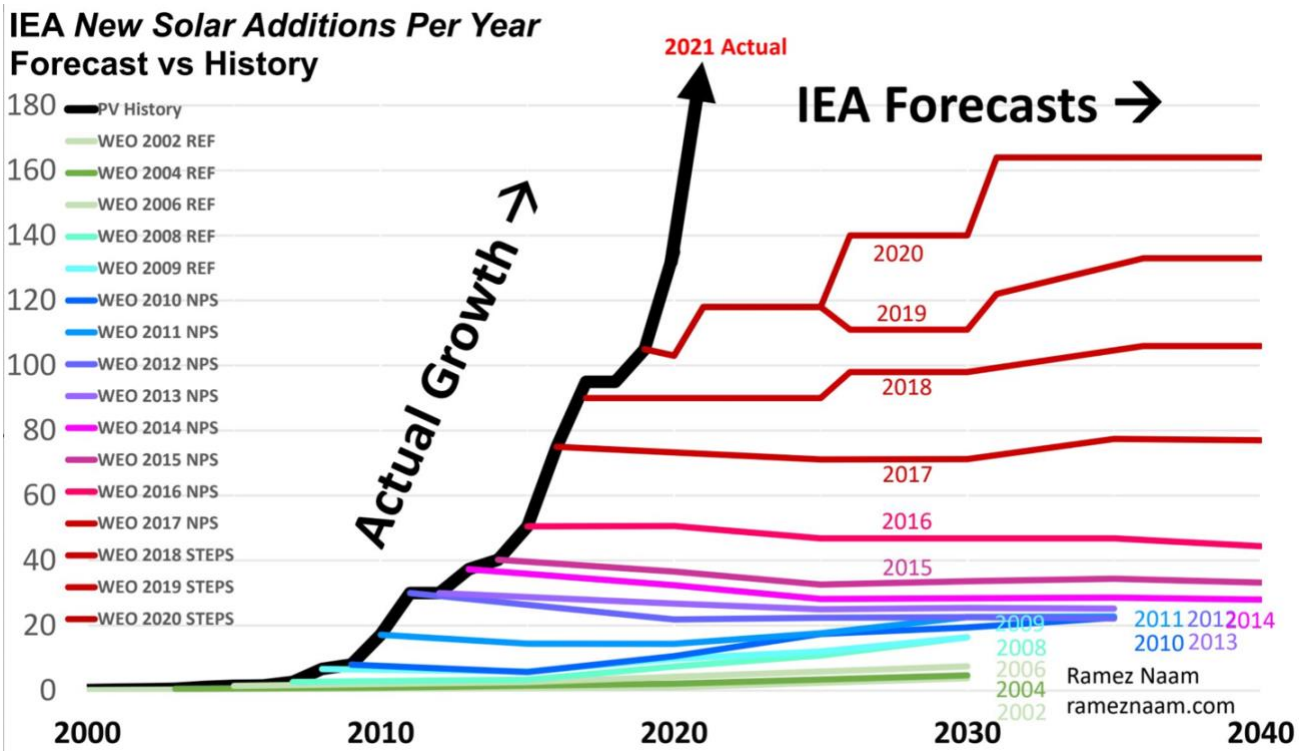
Figure 1: EIA Coal Demand Projections against Actual Outcomes (2010-2020)



Source: US Energy Informational Administration Annual Energy Outlook (2010-2020)

One of the key factors eroding demand for coal power generation is the unexpected, exponential growth in global renewable-energy installations over the last decade, particularly solar power (measured in gigawatts (GW)). Figure 2 shows the IEA projections of installations in the coming two to three decades annually in the World Energy Outlook (WEO), the annual upgrades to their expectations, and the actual growth. The official figure is still being revised upwards, but I expect global solar installs in 2021 to have exceeded 190 GW, more than 50% above the IEA forecast of just one year ago.[5]

Figure 2: The IEA's Inability to Project the Exponential Growth in Solar Installations (2000-2021, GW)



Source: Ramez Naam, Solar's future is insanely cheap, 16 June 2021

In December 2021 AEMO released its draft 2022 Integrated System Plan (ISP),[6] and it concluded that their modelling of the extreme disruption scenario two years ago (of radical new investments coupled with accelerated coal power phaseout) has become the central, most likely scenario today, stating "In considering the remaining four scenarios, the panellists concluded that the Step Change scenario was the clear 'most likely' scenario". The ISP concludes:

> "Coal retiring two to three times faster than anticipated. Current announcements by thermal plant owners suggest that about 5 GW of the current 23 GW of coal capacity will withdraw by 2030. However, modelling suggests that 14 GW may do so. Over the past decade, coal-fired generators have withdrawn from the market before their announced dates, and competitive and operational pressures will intensify with the ever-increasing penetration of cheap renewable generation. All brown coal generation and over two-thirds of black coal generation could withdraw by 2032."

[5] Bloomberg NEF, Solar – 10 Predictions for 2022, 26 January 2022
[6] AEMO, Integrated System Plan (ISP)

The February 2022 decision by Origin Energy to close the 2.88GW Eraring coal power plant in August 2025, seven years earlier than previously slated,[7] is a clear indication of how quickly the Australian and global energy landscape is evolving. Origin will replace this capacity with a 700MW battery on site in support of the accelerating renewable energy infrastructure rollout.

Should the February 2022 Grok Ventures and Brookfield bid for AGL Energy be successful, the acquirers have committed to likewise move to close both of AGL's coal fired power plants up to 15 years ahead of schedule.[8]

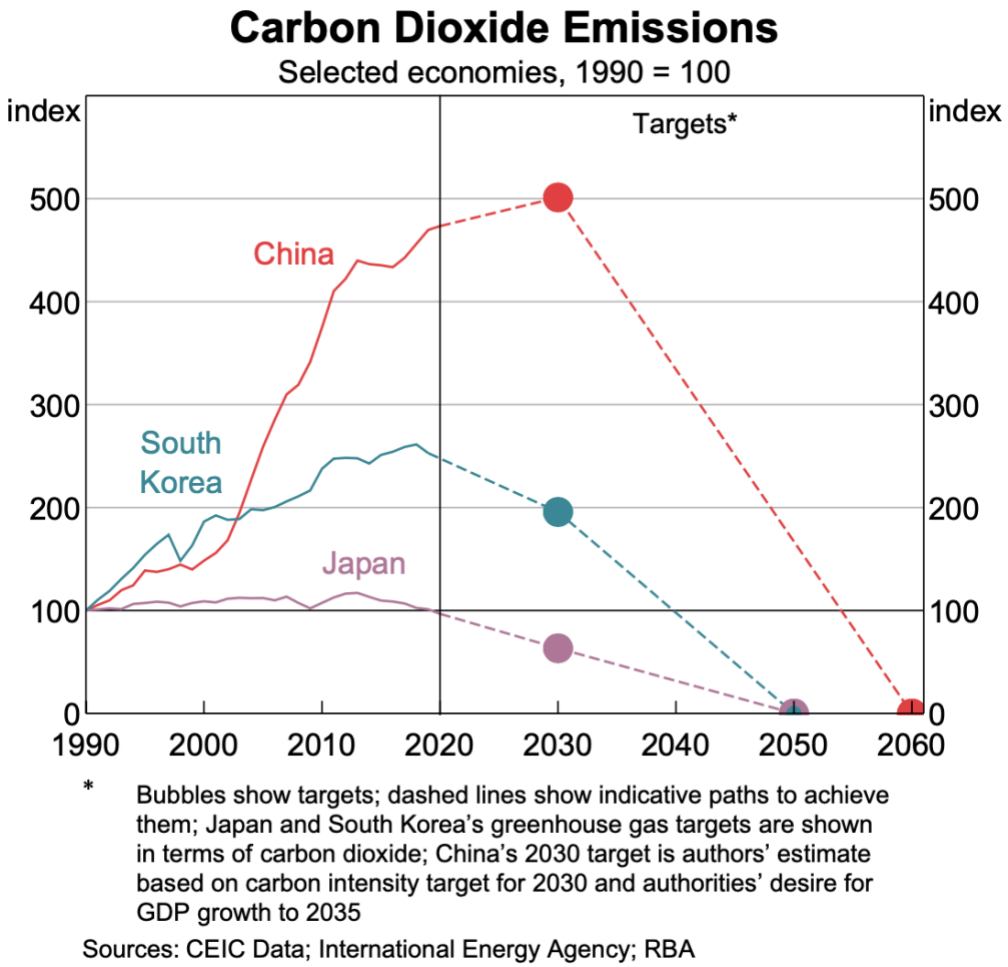
[7] Origin Energy, Origin proposes to accelerate exit from coal-fired generation, 17 February 2022
[8] Australian Financial Review, Cannon-Brookes plans to kill coal by 2030, invest $20b in renewables, 21 February 2022

Section 2: Global Policy Developments

The progress in global policy developments relating to energy and CO_2 emissions seen over 2021 was extensive, all starting with China pledging peak emissions before 2030 and Net Zero Emissions (NZE) by 2060, quickly followed by Japan and Korea committing to 2050. The Paris Agreement acknowledged that developed countries have a greater responsibility and capacity to act (Figure 3).

When President Biden was elected at the start of 2021, he committed to a 50-52% emissions reduction by 2030, changing the global dialogue from vague pledges to do something in three decades time to an immediate action this decade. Japan and South Korea again followed with strong pledges of a 46% and 40% emissions reduction this decade as well.

Figure 3: Carbon Dioxide Emissions Pledges by China, South Korea and Japan



Source: Reserve Bank of Australia October 2021

Recent policy developments show accelerating momentum

October 2021 saw South Korea build on its April 2021 pledge to cut national CO_2 emissions by 40% by 2030 with the presidential committee on carbon neutrality announcing an additional pledge to phase out thermal coal use in power generation entirely by 2050, using the country's existing national emissions trading scheme (ETS) as the mechanism to drive this (refer to Section 6 for how this is driving corporate actions in Europe, Australia and the US).[9] South Korea is Australia's second largest coal export destination.

November 2021 saw Germany accelerate its already world-leading commitment to decarbonisation of its energy system. The new German coalition government announced renewables would be 80% of its electricity mix by 2030 (up from the current law (EEG 2021) mandating 65% renewables by 2030), driven by 130 GW of onshore wind and 30 GW of offshore wind (until 2021 Germany led the world in offshore wind, and this target has just been doubled), and a near quadrupling of solar installations to 200 GW by 2030.[10]

On 30 December 2021 the State-owned Assets Supervision and Administration Commission (SASAC) announced more details of China's decarbonisation strategy.[11] Included in this document was the instruction to the top five power utilities in China that they are required to have at least 50% renewable energy capacity by 2025. This SASAC policy means renewable energy investment will have to accelerate in China, already the world's renewable energy superpower.

January 2022 saw Chinese President Xi Jinping provide additional insights into the profound measures being undertaken by China: "on striving to achieve the goal of carbon peaking and carbon neutrality".[12] Amongst the six priority areas of focus on accelerating the energy system transition, this included:

> "Fourth, speed up the green and low-carbon technological revolution. It is necessary to pay close attention to tackling key green and low-carbon technologies, and accelerate the research and development, promotion and application of advanced and applicable technologies."

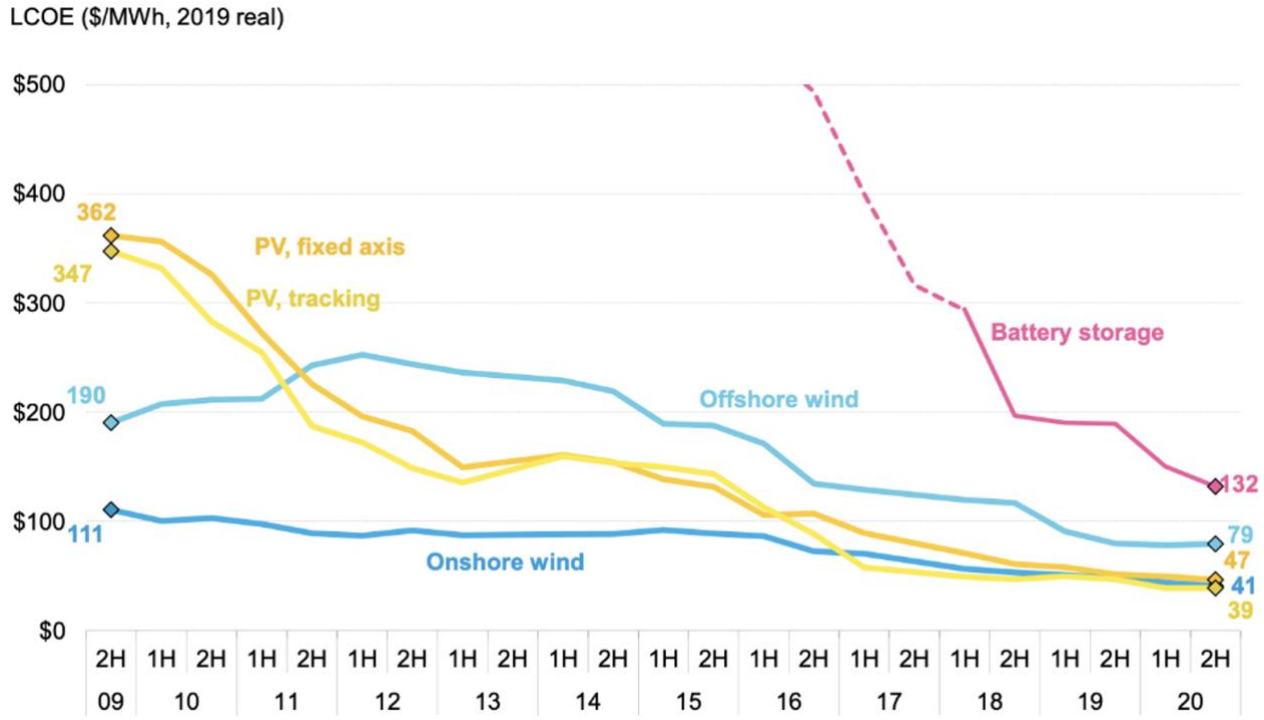
For the global rise in average temperatures to be limited to 1.5°C, McKinsey & Co concludes that greenhouse gas emissions from global economic activity must be reduced to net zero by the middle of this century with roughly 50% of those reductions occurring by 2030.[13]

[9] Argus Media, Seoul plans to phase out coal by 2050, 18 October 2021
[10] S&P Global Platts, German coalition plans for 480-540 TWh renewables by 2030 to exit coal, 25 November 2021
[11] State-owned Assets Supervision and Administration Commission (SASAC), Notice on Printing and Distributing the "Guiding Opinions on Promoting the High-quality Development of Central Enterprises and Doing a Good Job in Carbon Neutralization", 30 December 2021
[12] Xinhua News Agency, Xi Jinping presided over the thirty-sixth collective study of the Political Bureau of the CPC Central Committee, 25 January 2022
[13] McKinsey & Co, Climate Math: What a 1.5-Degree Pathway Would Take, 30 April 2020

Section 3: Technology-Driven Deflation

One of the key factors behind the accelerating global momentum to decarbonisation and energy transition is the ongoing double-digit percentage annual deflation in renewable energy costs, compounded more recently by the even faster deflation evident in battery storage costs – Figure 4.

Figure 4: Ongoing Renewable Energy and Battery Deflation



Source: Bloomberg New Energy Finance (BNEF)

Bloomberg New Energy Finance (BNEF) has been successfully tracking and forecasting the power of 'learning curves' and Swanson's Law in terms of both technology gains and the scaling up of production capacity, primarily led by China in the last decade.[14] The end of the historic reliance on coal-fired power is being brought about as much by the economic un-competitiveness of new coal relative to ever-lower cost renewable energy alternatives as it is by the climate science and resulting global policy and financial market shifts.

Polysilicon is the key input into solar module manufacturing. The Chinese polysilicon industry is on track to double global polysilicon manufacturing capacity by the end of 2022 relative to a year ago, and new capacity expansion announcements in just the last month suggest a doubling again in the following two years.[15]

December 2021 saw Dr Martin Green of the University of NSW forecast that the price of solar could decline by another two-thirds to just A$15/megawatt hour (MWh) by 2030, from the current price of A$45/MWh.[16] A coal power plant requires a price of well over A$50/MWh to even cover the cost of coal. Adding in all the other costs of running including CO_2 externalities would see a total cost for coal

[14] BNEF, Solar – 10 Predictions for 2022, 26 January 2022
[15] Bloomberg, China's solar giants have a fix for their broken supply chain, 11 January 2022
[16] Australian Financial Review, You could get ultra-cheap solar far sooner than you think, 1 December 2021

power of well in-excess of A$100/MWh using the current price of Australian Carbon Credit Units (ACCUs) (refer Section 6).

The last quarter of 2021 saw utility-scale solar and wind farms plus rooftop solar systems supplying an average of just over 100% of local demand every day for a period of almost one week in December 2021, 24 hours a day in Australia's leading energy transition state of South Australia.[17] For most of the last decade leading grid electrical engineers have said it is impossible to reliably run an electricity grid reliant on a significant share of intermittent renewable energy. However, South Australia has no hydroelectricity and closed its last coal power plant in 2017. The electricity transition has taken significant investment, planning and leadership, and in my experience South Australia now leads the world, showing the accelerating trend. AEMO expects rooftop solar alone to represent nearly half the total 2050 Australian installed capacity.[18] [19]

Technology Obsolescence of Thermal Coal Now Extends to Coking Coal

Three European steel industry announcements in the last month illustrate a profound acceleration of non-coal technology deployment relative to that modelled by the IEA detailed just months before in its WEO 2021:

1. The announcement by SSAB relating to its HYBRIT steel decarbonisation program in January 2022 that it would bring forward the full decarbonisation of its steel production by 15 years to 2030 marks a similar global pivot point for the demand for coking coal (Australia's second largest commodity export).[20]
2. Salzgitter of Germany announced a similar strategy in February 2022, flagging its intention to close all 3 of its German blast furnaces by 2033.[21]
3. This was followed by the world's largest steel firm, ArcelorMittal announcing in February 2022 that it would invest €1.7bn to close its three French blast furnaces to drive a 40% emissions reduction in its steel operations across France by 2030.[22]

This reflects the rapid technology improvements and the rising demand for green steel as EU carbon prices surge, the discussions of Carbon Border Adjustment Mechanisms (CBAM) rise, and the corporate commitments to Net Zero Emissions by 2050, or sooner (refer Section 6).

This has profound implications for the use of coking coal, Australia's third largest export by value, given the green steel projects detailed above involve the almost complete removal of the previously critical inclusion of coking coal in the production of virgin steel.

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[17] Renew Economy, South Australia winds up 2021 with smashing new renewables record, 12 January 2022
[18] AEMO, Integrated System Plan (ISP)
[19] I would note that AEMO is referencing the share of installed electricity capacity, not the share of electricity generation coming from rooftop solar. Rooftop solar is projected to be 50% of total capacity, and 25-30% of total generation in the 2050 year. The generation of a particular power plant is dependent on the capacity utilisation rate, meaning what percentage of the year the average power plant is operating. A solar plant operates 25-35% of the time in Australia (reflective of the daylight hours in any given 24 hour period), a wind farm runs 30-40% on average across a year, and a coal fired power plant might operate 50-70% of the time (reflective of demand, maintenance downtime, the cost of coal, and the lack of ability to turn down generation when wholesale power prices go negative).
[20] SSAB Press Release, SSAB plans a new Nordic production system to bring forward the green transition, 28 January 2022
[21] Salzgitter Press Release, Salzgitter presents new "Salzgitter AG 2030" strategy, 2 February 2022
[22] ArcelorMittal Press Release, ArcelorMittal accelerates decarbonisation with a €1.7bn investment in France, 4 Feb 2022

Coal Power Plants Are Becoming Stranded Assets

As renewable energy deflation continues, this gives rise to increased financial losses from stranded assets (fossil fuel assets that will not deliver a commercial rate of return over their remaining useful life, and hence the likely early retirement before their engineered life obsolescence). Stranded assets are today a clear and present financial risk (refer Section 4), as foreseen by ex-Bank of England Governor Mark Carney's landmark 'Tragedy of the Horizon' speech of 2015.[23] The flood of coal power plant writedowns announced by most investors in the Australian power sector in 2021[24] illustrates how boards are rapidly coming to understand the speed of disruption and deflation involved.

January 2022 saw Georgia Power (the largest utility in Georgia, US) announce plans to close all of its remaining coal-fired power plants by 2035, including two of the largest coal power plants in the US, replacing them with more solar power.[25] This follows a record number of more than 50 GW of US coal power plant closures over the last five years, with more than 28 GW scheduled to close in 2028 alone – Figure 5. This trend is consistent with the US President Biden's pledge for the US electricity grid to be zero emissions by 2035, but suggests a rapid acceleration relative to current forecasts.

Figure 5: U.S. Coal Capacity Closures by Year (MW)

Source: S&P Global Market Intelligence, 10 February 2022

[23] Mark Carney: Breaking the tragedy of the horizon – climate change and financial stability, 29 September 2015
[24] Australian Financial Review, AGL Energy hit by $2.69b of write-downs, 4 February 2021
[25] WABE, Georgia Power plans to eliminate coal and double solar by 2035, 31 January 2022

Section 4: Global Finance Zero Emissions Pledges

Global finance is increasingly reflecting the implications of the power of technology to disrupt industries. Renewable energy and lithium ion batteries are in the process of massively disrupting the power and transport sectors. This is driven by the ongoing double-digit annual deflation (Section 3). In my view, the power of renewables deflation is akin to the development of the internet or mobile phones in terms of the scale of global industry disruption.

2021 was an outlier, with commodity and fossil-fuel energy prices surging globally, and as a result renewables saw inflation in costs for the first time in a decade. But the power of 'learning curves' in solar are well proven over the last decade (Section 3), and I expect a return to an aggressive deflation acceleration across zero emission technologies this coming decade, underpinned by massive scaling-up and technology innovation.

UN Net Zero Finance Alliance 1.5°C

Global finance is clearly pivoting. It is my view that financial markets in 2021 realised the end game of decarbonisation is inevitable. The pivot is also reflective of what I estimate to be the cumulative investment opportunities over the coming two to three decades in the order of up to US$100 trillion. Global giants like BlackRock (Assets under Management (AuM) US$10 trillion) and Blackstone (AuM US$649bn) are now moving increasingly rapidly.

BlackRock CEO Larry Fink's 2022 CEO letter[26] is widely read by global corporate leadership. The message is clear – global corporates wanting BlackRock as an investor will need to demonstrate clear, credible targets for decarbonisation, they will have to provide interim 2030 targets aligned with the Science Based Target initiative (SBTi[27]) and support this with timely and full transparency consistent with the newly formed International Sustainability Standards Board.[28]

One of the defining financial climate risk developments of 2021 was the now over US$130 trillion of collective AuM in the UN-sponsored Glasgow Financial Alliance for Net Zero.[29]

December 2021 saw the US Office of the Comptroller of the Currency (OCC) release a draft supervisory guidance for how banks should manage the risks related to climate change. One of the warnings was about investor deception on greenwashing.[30] The OCC tells banks that where they publicly communicate their climate-related strategies, boards and management must make sure those commitments are consistent with their internal strategies. This follows similar warnings from the US Securities and Exchange Commission (SEC) and then in October 2021 by the US Treasury's Financial Stability Oversight Council identifying "Climate Change as an Emerging and Increasing Threat to Financial Stability".[31] Reports of new rules pending from the SEC are building.[32]

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[26] BlackRock, LARRY FINK'S 2022 LETTER TO CEOS: The Power of Capitalism, January 2022
[27] Science Based Target initiative (SBTi)
[28] IFRS, International Sustainability Standards Board
[29] Glasgow Financial Alliance for Net Zero, Amount of finance committed to achieving 1.5°C now at scale needed to deliver the transition, 3 November 2021
[30] By Yevgeny Shrago Public Citizen, Office of the Comptroller of the Currency Climate Guidance for Banks, December 2021
[31] US Department of the Treasury, Financial Stability Oversight Council Identifies Climate Change as an Emerging and Increasing Threat to Financial Stability, 21 October 2021
[32] ClimateWire, BlackRock tallied its climate impact. Here's what it found, 31 January 2022

In January 2022, President Biden appointed Sarah Bloom Raskin as Federal Reserve Vice Chair of Supervision, a key appointment for US action on climate change.[33]

January 2022 also saw Blackstone announce one of the largest renewable energy equity investments in US history, a US$3bn purchase of a minority stake in leading North American renewables company, Invenergy Renewables.[34] Rather than private equity being the funder of last resort for fossil fuels, it is investing in growth industries of the future.[35]

New Fossil Fuel Exclusion Policies Are Impacting Whitehaven

2021 saw 86 new or improved formal coal exit policies from globally significant financial institutions (GSFI). In total, IEEFA tracks 190 GSFI with formal coal financing exit polices.[36]

January 2022 saw the world's second largest asset manager, Vanguard (AuM US$7.2 trillion) announce a coal policy, committing to engage with fossil fuel firms and ensure boards have a clear climate alignment with a credible path to decarbonisation. The overt threat is that Vanguard will start voting against laggards from 2023.[37]

Whitehaven is one of the global coal sector firms excluded by almost every one of these coal exit policies. Even the Vanguard divestment policy would include Whitehaven, given the company's sole energy transition strategy is to shift their exposure from thermal coal to coking coal, a product diversification that does nothing to reduce Whitehaven's 100% revenue and asset exposure to coal.

As a result, Whitehaven's refinancings are becoming increasingly difficult, with the firm in February 2020 having to resort to accessing Asian institutions[38],[39] (and lobbying the Australian Federal Government to set up a public bank of last resort for fossil fuel firms[40]), many of which have since put in coal exclusion policies of their own. The pool of financial institutions still acting in the coal sector is shrinking rapidly.[41]

"China is Coal. Coal is China"

The IEA said this back in 2012, and a decade later it is unfortunately still true, with China producing and consuming more than half the world's annual coal.

October 2021 saw a seismic shift: by the largest funder of coal power in the world in the last decade, the Chinese Government – who announced it will immediately cease funding new coal abroad.[42]

Three days later saw the Bank of China announce it would implement this policy, with immediate effect.[43]

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[33] Yahoo Finance, Biden picks Sarah Bloom Raskin for top Fed regulator, Cook & Jefferson for governors, 14 January 2022
[34] Environmental Finance, Blackstone invests $3bn in North American renewable energy firm, January 2022
[35] Bloomberg, Why Private Equity Won't Be the Savior of Fossil Fuels?, 6 January 2022
[36] IEEFA, Over 100 and Counting
[37] Harvard Law School Forum, Vanguard's Expectations for Companies with Significant Coal Exposure, 7 January 2022
[38] Australian Financial Review, Asian lenders back Whitehaven, buck divestment trend, 21 Feb 2020
[39] Australian Financial Review, Coal miner warns Asian lenders won't fill the void if local banks exit, 3 May 2021
[40] Australian Financial Review, Lender of last resort or money Pitt?, 7 October 2021
[41] Insure Our Future, The 2021 Scorecard on Insurance, Fossil Fuels & Climate Change, 3 November 2021
[42] Aljazeera, 'Game-changer': China to stop funding overseas coal projects, 22 September 2021
[43] Reuters, Bank of China to stop financing new coal mining, power projects overseas from Q4, 24 September 2021

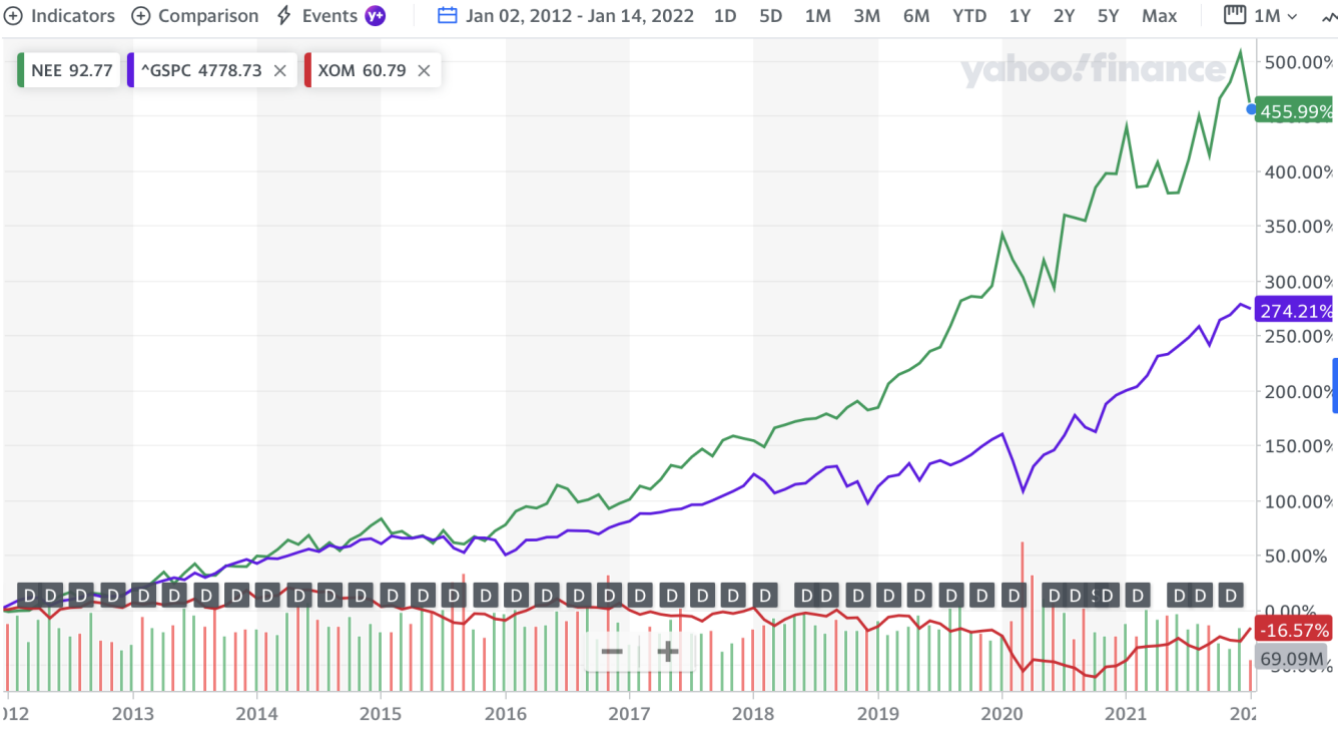
Ping An Bank in January 2022 became the second Chinese banking major to follow.[44]

Bank of China was the first formal coal exit policy I have recorded from China. Given China has been one of the top financiers of new coal mining and coal power development globally over the last decade, this has profound implications for Whitehaven's ability to continue accessing global debt markets. While public data has limited availability, I estimate Chinese banks represented some 20% of Whitehaven's 2020 debt refinancing,[45] providing much of the competitive tension and market depth needed as Australian banks reduced their exposure.

Global Finance is Moving – Exxon vs Nextera

Figure 6 highlights why finance has started to respond to what I see as the combined moral, financial and policy pressures – it is all to do with massive fossil fuel wealth destruction over the last decade. Nextera Energy (in green, up fourfold) is the largest investor in renewable energy in the world, and Exxon (in red, down 16% in the past decade) one of the largest fossil fuel firms. Fund managers have voted with their investments. Purple is the US equity market index (up 274%), for comparison.

Figure 6: The Sustained Outperformance of NextEra Energy and Underperformance of ExxonMobil



Source: Yahoo Finance, Accessed 17 January 2022

[44] Ping An Bank Press Release, PING AN GROUP POLICY ON INVESTMENT IN COAL AND THERMAL POWER BASED INDUSTRIES (2021), January 2022
[45] Market Forces, Banks that have loaned to Whitehaven Coal, accessed 15 February 2022

Corporate Leaders are Responding to this Finance Shift

Global corporate leaders are responding to this shift in global finance, with firms like Fortescue Metals Group committing to Net Zero Emissions by 2040 target (Scope 1-3) and talking about the magnitude of the disruption in energy globally.[46] Asia's richest man, Mukesh Ambani, Founder of Reliance Industries Ltd of India, has similarly committed to net zero emissions by 2035, announcing a US$100bn clean-energy investment plan by 2030.[47]

[46] RenewEconomy, Fortescue designs and builds its own electrolyser ahead of green hydrogen push, 20 December 2021
[47] Bloomberg, Ambani's $75 Billion Plan Aims to Make India a Hydrogen Hub, 30 January 2022

Section 5: Transport and Energy Sector Convergence

When it comes to passenger vehicles, in my opinion the technology race between EVs and hydrogen fuel cells vs petrol vs diesel is over. EVs won this global race.

January 2022 saw China confirm passenger EV sales grew 154% year-on-year (yoy) in 2021 to 3.3 million.[48] China aims to ban internal combustion engine sales by 2035.

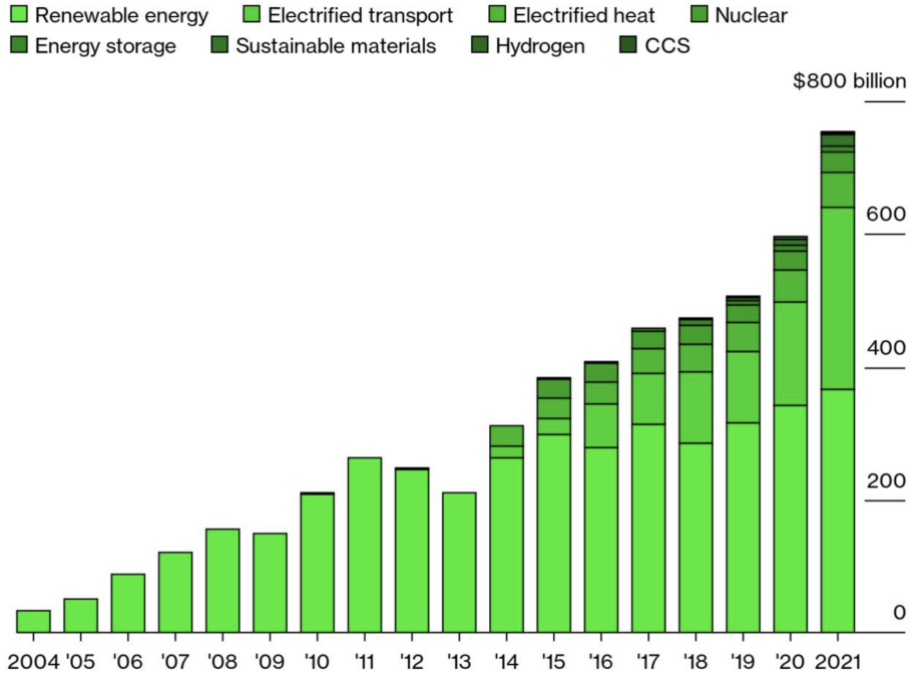
In January 2022, it was reported EVs now outsell diesel cars in Europe for the first time ever.[49]

The US market has been very focussed on the rise of Tesla as the automotive sector disruptor, with the unstoppable rise of its market capitalisation, reaching US$1 trillion at one stage in 2021. A similar market disruption is happening in China, with BYD Co. Ltd (BYD) seeing a 500% increase in its share price over the last two years, with BYD's market capitalisation reaching $100bn. Similarly, the world's largest battery manufacturer is China's Contemporary Amperex Technology Co. Limited (CATL), which saw its shares rise 500% over the last two years, taking its market capitalisation to US$200bn.

January 2022 saw LG Energy Solution list on the South Korean stock market in the largest initial public offering in the country's history, giving the firm a market capitalisation of US$88bn. LG Energy Solutions is the second largest EV battery manufacturer in the world behind CATL.[50]

BNEF estimate global investment in energy transition in 2021 hit a record high of US$755bn in 2021 – Figure 7. The dramatic lift in electrified transport investment since 2014 is a key standout of this ongoing investment surge, which focussed the global financial sector onto evaluating the potential US$100 trillion investment opportunity over the coming three decades of the energy transition.

Figure 7: Global Energy Transition Investment By Sector



Source: Bloomberg NEF, January 2022 Note: Nominal dollars,

[48] Fortune, China EV sales surged 154% last year, with Warren Buffett–backed BYD topping Tesla, 7 January 2022
[49] Financial Times, European sales of electric cars overtake diesel models for first time, 17 January 2022
[50] Financial Times, Tesla Battery Maker LG Energy Solution Surges on Record Market Debut, 27 January 2022

Section 6: Carbon Emissions Pricing

The global energy transition has accelerated because of the combination of technology developments, growing policy support globally, improving economics (ongoing renewables deflation) and the changing assessment of risks and opportunities in global financial markets.

The Australia National Greenhouse and Energy Reporting (NGERs)[51] requirements applying today are a direct outcome of the Federal Government's very limited climate policy objectives of just 26-28% emissions reduction by 2030. As Australia moves to implement a credible climate policy aligned with the Paris Agreement, the benchmarks applying will tighten commensurately, and any thresholds would likely be removed in their entirety in my view. As such, I would draw more on the global comparatives in any negative valuation of the CO_2-e emissions resulting from this proposed Narrabri Project.

The directly observable CO_2 price signal in the European Union's Emissions Trading Scheme (EU ETS) is showing the market's assessment is changing rapidly. The EU ETS tripled in 2021 to a record high of €98/t in February 2022 and are currently trading at €92/t (A$146/t) (to be up tenfold in just five years), as per Figure 8.

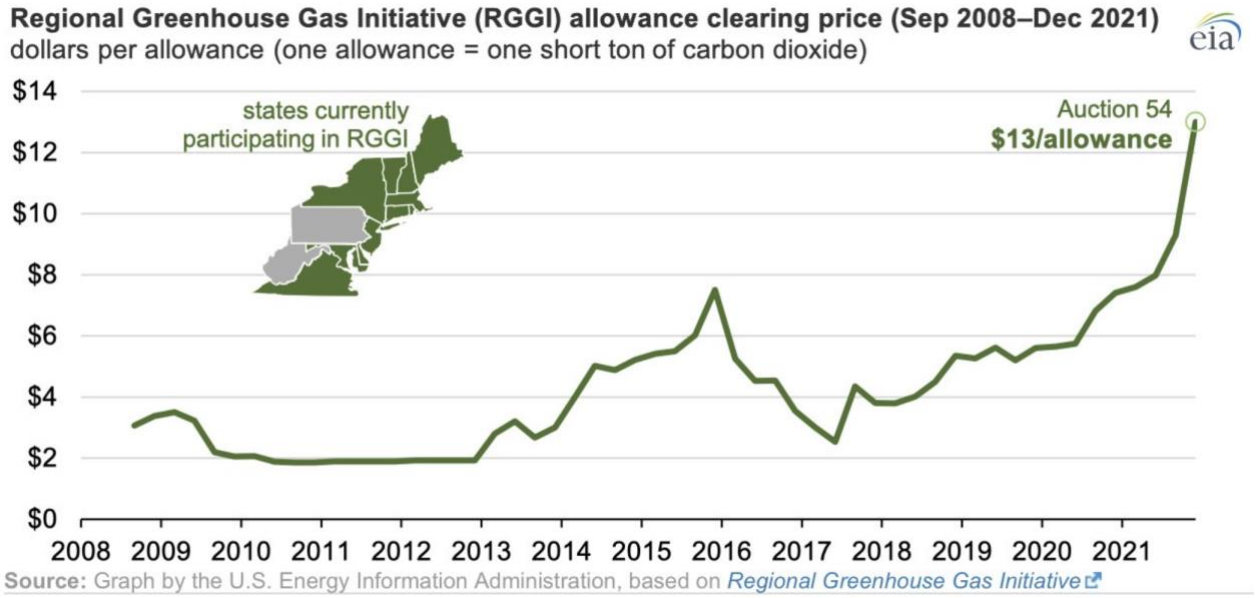
Figure 8: The Five-Year EU ETS Pricing (€/t)

Source: Trading Economics, Accessed 15 February 2022

[51] NGER, Reporting Thresholds, accessed 23 February 2022

The North East US Regional Greenhouse Gas Initiative (RGGI) allowance clearing price has likewise trebled in the last four years, albeit to reach a price of US$13/short ton – refer Figure 9, well below the established EU ETS levels.

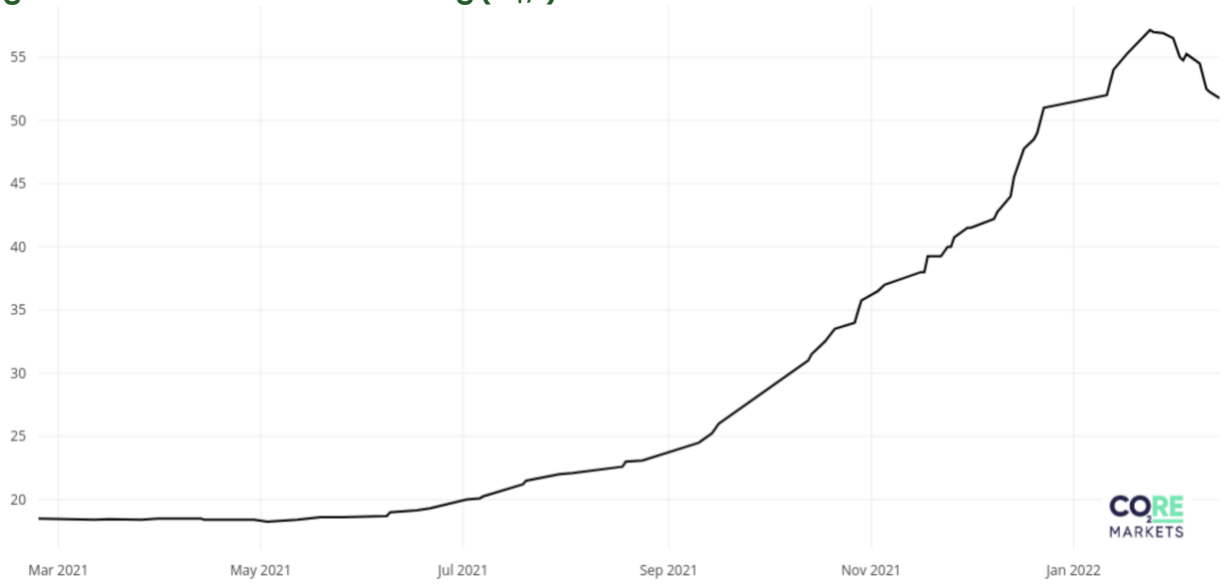
Figure 9: The 13-Year RGGI Pricing (US$/short ton)



Source: US EIA, CO2 emissions allowance prices increased in latest RGGI auction, 24 January 2022

The ACCU certificate price has likewise trebled in the last year to A$51.75/t – Figure 10.

Figure 10: The One-Year ACCU Pricing (A$/t)



Source: Renewable Energy Hub, CORE Markets, Accessed 15 February 2022

January 2022 saw the emerging Australian firm Xpansiv described as the latest unicorn ($1bn valuation ascribed to a startup) as it prepares for an ASX listing, with the firm highlighting the fourfold rise in carbon trading volumes on its global exchange in 2020/21 and the 889% rise in unit prices.[52]

January 2022 also saw reports that China's national ETS – established in July 2021 – is expected to see a significant expansion and the suggestion of a tightening of permit allocations.[53] Currently, the Chinese scheme covers only polluters from the power sector, which account for 40% of the country's total emissions, which still makes it the largest ETS in world.

January 2022 saw Chinese President Xi Jinping provide additional insights into the profound measures being undertaken by China "on striving to achieve the goal of carbon peaking and carbon neutrality".[54] Amongst the six priority areas of focus on accelerating the energy system transition, this included a focus on aligning China's energy and climate policies (termed "dual control"):

> "Fifth, improve the green and low-carbon policy system. It is necessary to improve the "dual carbon" standard, build a unified and standardized carbon emission statistical and accounting system, and promote the transition from "dual control" of energy to "dual control" of total carbon emissions and intensity."

Woodside Energy: A US$80/t Internal Carbon Price

Woodside Energy's 2021 Climate Report [55] confirms the company uses a long term carbon price of US$80/t for CO_2-e in real terms in all of economic evaluations. This provides a leading Australian fossil fuel energy extraction firm's perspective on what is an appropriate cost of this key externality.

In the context of the significant methane exposure of this proposed Project, it is also noteworthy that Woodside considers a 20-year global warming potential of 84-87 as appropriate given the climate crisis, not the IPCC's 100 year view of 28–36 nor the proponent's assumed global warming potential of 25 for CH_4:

> "Given the short-term nature of methane as a greenhouse gas compared to CO2, Woodside assesses methane abatement opportunities using a 20 year global warming potential rather than the IPCC standard 100 year potential. Combined with our long-term carbon price assumption of US$80 t CO2-e (real terms), this results in the prioritisation of methane opportunities when considering the financial value of abating CO2-e emissions."

The IEA reports[56] that methane is responsible for 30% of the rise in global temperatures since the Industrial Revolution, and rapid and sustained reductions in methane emissions are key to limiting near-term global warming and improving air quality. Contrary to the claims by Whitehaven, the IEA states that tackling methane emissions from the energy sector represents one of the best near-term opportunities for limiting global warming because the pathways for reducing them are well known and often cost-effective. The IEA also notes Australia is the fifth largest methane emitter globally.

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[52] Australian Financial Review, World's hottest commodity market heads for ASX listing, 31 January 2022
[53] South China Morning Post, China's emissions trading market likely to see expansion, rising carbon price in 2022, say analysts, 9 January 2022
[54] Xinhua News Agency, Xi Jinping presided over the thirty-sixth collective study of the Political Bureau of the CPC Central Committee, 25 January 2022
[55] Woodside Energy, 2021 Climate Report, page 16, 17 February 2022
[56] IEA, Global Methane Tracker 2022, February 2022

The Narrabri Project's Emissions Create an A$0.6-4.0bn Externality

The Narrabri Project has projected greenhouse gas (GHG) emissions of 27.627 Mt CO_2-e Scope 1 and 2 (operational and post-mining), i.e. excluding the emissions resulting from use of this coal overseas (Scope 3). As part of its international treaty obligations, Australia has committed to acting on the climate science, and with the expected economic costs of climate change rising rapidly – the Climate Council estimated the annual cost to the Australian economy could be A$94 billion by 2060, rising to A$129 billion,[57] it is entirely appropriate that the cost of these emissions be included in any cost-benefit analysis. I am a financial analyst, not a climate scientist, so I will limit my analysis to the question of costing of 27.627 Mt CO_2-e Scope 1 and 2 (refer Appendix 3).

As discussed above, the market pricing of CO_2 emission units has risen rapidly in the last five years. The IEA expects this rising trend to continue and models a 2050 cost of CO_2 emissions at US$250/t for developed countries like Australia, and US$200/t for major developing countries under its Net Zero Emissions By 2050 scenario, and US$95-200/t under its Announced Pledges Scenario.[58]

Using the ACCU, EU ETS and RGGI spot prices evident today, and adding in a fourth observation in the form of Woodside's US$80/t internal price, and assuming these remain flat in real terms over the life of the Narrabri Project, this gives a valuation for carbon in the range of A$564-4,044m, with an average of A$2,300m – refer Table 1. This cost of the direct Scope 1 and 2 emissions should not continue to be externalised onto NSW community. Even the low end of this range exceeds the $599m net benefit posited by the proponent when corporate tax and interest expense errors are removed.[59]

Table 1: The NPV of CO_2 emissions - Narrabri Underground Extension Stage 3

	per tonne	Exchange rate	A$/t
Value of Emissions - ACCU/t spot			52
Value of Emissions - EU ETS (Euro/t)	92	1.59	146
Value of Emissions - RGGI (US$/st)	13		
Value of Emissions - RGGI (US$/t)	14	0.70	20
Value of Emissions - Woodside (US$/t)	80	0.70	114
CO2 emissions Mt CO2-e Scope 1-2			27.627
Net present value (NPV)			**A$m**
NPV of Emissions - ACCU/t A$m			$1,430
NPV of Emissions - EU ETS A$m			$4,044
NPV of Emissions - RGGI A$m			$564
NPV of Emissions - Woodside shadow price A$m			$3,157
Average (A$m)			**$2,300**

Source: Author calculations using spot ETS and currency values as at 15 February 2022
Note: This is a real 2022 $ value assuming spot prices remain constant till 2043

[57] The Climate Council, MARKETS ARE MOVING: The Economic Costs Of Australia's Climate Inaction, 13 October 2021
[58] IEA WEO 2021, page 329
[59] Narrabri Underground Mine Stage 3 Extension Project Environmental Impact Statement Appendix L Economic AssessmentTable ES-1

Section 7: The Net Benefits of the Project Erroneously Assumes Whitehaven Pays Cash Tax

The incremental net benefits to the NSW community are purported to be A$599m – as calculated by the proponent's economist, AnalytEcon – refer Table ES-1. Within this is the assumption that the Narrabri Project will bring $177m as NSW's share of company income tax, that being 31.9% of the incremental corporate tax Whitehaven could pay on the Narrabri Project of $556m nationally.

AnalytEcon calculates the pre-tax profit as being revenues less operating costs, labour, royalties, all other taxes and depreciation.[60] This clearly makes the assumption there will be zero debt and hence zero interest expense over the life of the mine extension.

As at 30 June 2021 Whitehaven Coal has net debt of $898m ($918m in 2020). In the last two years, net interest expense averaged $50m per annum, which was well over 100% of the pretax profit. How is it feasible to project a $177m net benefit as NSW's share of corporate taxes paid when the calculation has made a basic omission of one of the largest costs of a coal project, or any industry development – that being financing?

Table ES-1 Incremental net benefits of the Project for NSW community ($2020)

Incremental direct and indirect costs	NPV $m	Incremental direct and indirect benefits	NPV $m
External effects (GHG emissions)	$1	Royalties	$259
		NSW share of company income tax	$177
		Net producer surplus	$163
Total direct and indirect costs	$1	Total direct and indirect benefits	$599
Net benefits to NSW			$599

Source: Narrabri Underground Mine Stage 3 Extension Project Environmental Impact Statement Appendix L Economic Assessment, AnalytEcon ES-2

[60] Narrabri Underground Mine Stage 3 Extension Project Environmental Impact Statement Appendix L Economic Assessment, AnalytEconTable 3.3, page 15

Whitehaven has received a net $22m cash tax refund in the last decade

A review of the last decade's financial accounts for Whitehaven is summarised in Table 2. While Whitehaven has booked cumulative sales of $13,777m over the last decade, the company has provided for a tax expense of a cumulative $491m but has actually received a net $22m cash tax refund from the Australian Tax Office. Given the last decade has seen the highest average coal prices in any of the last six decades, this has been a record high profit period for the industry, one that my industry outlook suggests will not be repeated in the long term. So, the net benefits estimated by the proponent are overstated by more than $177m if the last decade's average performance is used as the baseline for the future.

Table 2: Whitehaven Coal – Sales, Pretax Profits, Tax Expense vs Cash Tax Paid (A$m)

Year ended 30 June	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2012-2021 Total
Sales	618	622	764	774	1,173	1,781	2,264	2,492	1,725	1,564	13,777
Pretax profit	14	-115	-56	-483	28	475	759	736	42	-768	631
Tax expensed	49	33	18	141	-7	-70	-234	-208	12	-224	-491
Cash tax paid *	2	22	21	36	-42	0	0	-15	-14	12	22
Tax expensed as % of PTP	350%	-29%	-32%	-29%	-26%	-15%	-31%	-28%	29%	29%	-77.9%
Tax expensed as % of Sales	8%	5%	2%	18%	-1%	-4%	-10%	-8%	1%	-14%	-3.6%
Cash tax paid as % of PTP	17%	-19%	-37%	-7%	-153%	0%	0%	-2%	-32%	-2%	3.6%
Cash tax paid as % of Sales	0%	4%	3%	5%	-4%	0%	0%	-1%	-1%	1%	0.2%

* A positive is a cash tax refund

Source: Whitehaven Coal Ltd Annual Reports FY2011-FY2021, Author calculations

It is my experience in analysing many sectors and companies operating in Australia over the last 30 years that the fossil fuel sector overall pays remarkably little Australian corporate tax, in stark contrast to many other sectors. Given most operate out of tax havens, transparency from the Australian Tax Office and ASIC is relatively limited, but my financial analysis of many of these complex corporate structures suggests a high Australian corporate tax paying coal mining company is the exception, not the norm. The Australian Senate Inquiry into corporate tax avoidance and aggressive minimisation report of 2015 provides substantive evidence on this, having held five public hearings and receiving more than one hundred submissions.[61]

[61] Parliament of Australia, Economics References Committee, Corporate tax avoidance, 18 August 2015

Section 8: The Structural Decline of Coal

The WEO 2021 report details that should the global economy deliver on the target of constraining global warming to 1.5°C (as outlined in its Sustainable Development Scenario (SDS)), its modelling forecasts a 78.2% reduction in total coal demand globally by 2050 relative to 2020 levels – refer Table 3. Thermal coal is forecast to fall at a faster rate of 82.1%, given the fact that renewable energy is now a rapidly scaling up proven technology that is the lowest cost source of new generation capacity in an increasing number of markets globally.

Should this IEA forecast come to fruition, the speed of the resulting early closure of coal mining capacity global will determine how the coal price equilibrium is achieved. Given the likelihood of ongoing rapid coal-fired power generation capacity declines globally, this would suggest there are material questions over the assumption this proposed Project eventuates and then if it does, if it will continue to operate over the proposed full life to 2044. Any early closure would significantly reduce the total royalty and proponent profits projected, whilst also reducing the significant carbon emission externalities imposed on the community.

October 2021 saw Dr Kerry Schott, then Chair of the Energy Security Board confirm her view that coal power use in the domestic Australian context will be likely gone entirely by 2035, more than 10-15 years earlier than the official schedule.[62] February 2022 saw the accelerated energy transition plans of Origin Energy for the closure of the Eraring Power Station (brought forward by seven years to 2025[63]. In response to the February 2022 proposed takeover of AGL Energy by Brookfield and Grok Ventures, with the plan of an accelerated closure of the Bayswater, NSW and Loy Yang A, Victoria coal power plants by up to 15 years, Dr Schott elaborated further on the increasing operating and financial challenges of trying to continue reliance on out-dated coal power technologies.[64]

Coking coal is forecast by the IEA to more than halve in the next 28 years (Table 3), although I would posit the technology breakthrough to cease use of coking coal entirely by 2030 (fifteen years ahead of their earlier timetable) announced by SSAB's HYBRIT project in January 2022 (refer Section 3) suggests this rate of decline assumption will be accelerated in the WEO 2022 version, consistent with the annual downward revisions I have seen by the IEA in each of their successive annual WEO report over the last decade.

Table 3: World Coal Demand (Total, Coking and Thermal) 2014-2020 and SDS 2050 Forecast

	2014 Mtce	2015 Mtce	2016 Mtce	2017 Mtce	2019 Mtce	2020 Mtce	Decline 2020 vs 2014 % Change	SDS 2050 Mtce	SDS 2050 vs 2020 % Change
Total Coal	5,680	5,531	5,271	5,360	5,717	5,462	-3.8%	1,189	-78.2%
Coking Coal	1,016	994	967	960	973	940	-7.5%	406	-56.8%
Thermal Coal	4,374	4,254	3,979	4,134	4,485	4,296	-1.8%	771	-82.1%

Source: IEA WEO2017 page 644-645, WEO 2021 page 318, CEF calculations
SDS: Sustainable Development Scenario (aligned with a 50% chance of a 1.5°C outcome).
Mtce: Million tonnes of coal equivalent.

[62] Australian Financial Review, Coal power likely gone by 2035: Schott, 11 October 2021
[63] Origin Energy Press Release, Origin proposes to accelerate exit from coal-fired generation, 17 February 2022
[64] Australian Financial Review, Why Scott Morrison is wrong on AGL, 22 February 2022

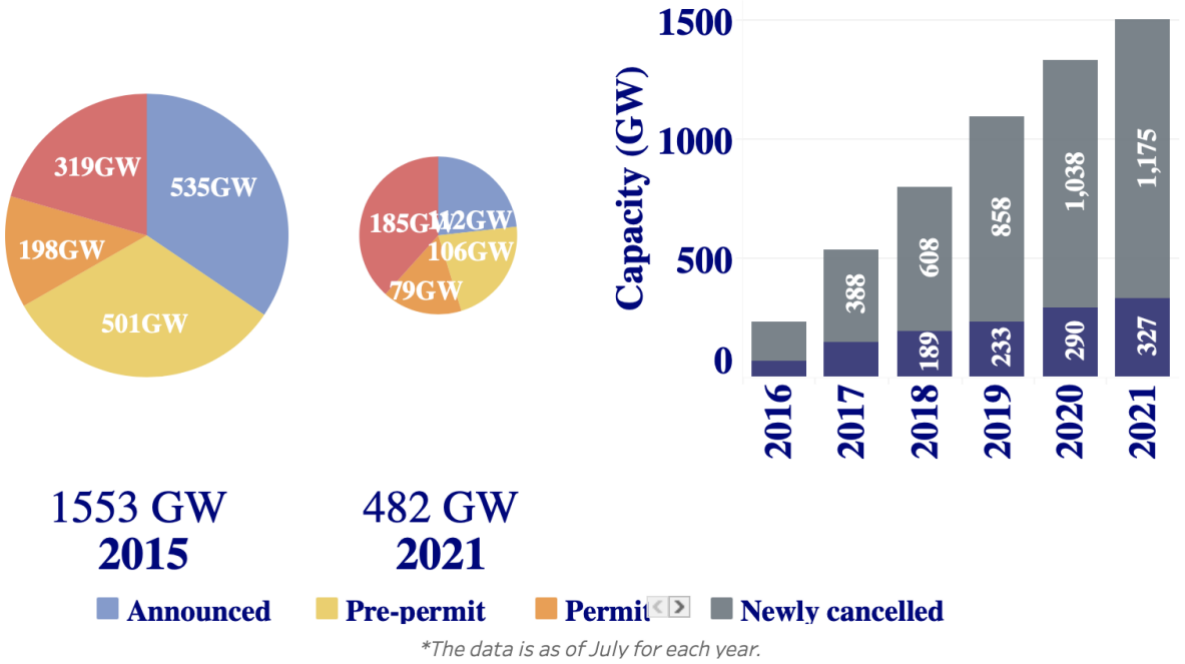
Is There Sufficient Coal Mining Capacity Already Available?

In my opinion, there is already sufficient coal mining capacity globally to run the existing fleet of coal-fired power plants. In forming this review, I have referenced a new paper by the German Institute for Economic Research (DIW Berlin),[65] I have not done a global analysis of the projected global supply of new coal mine capacity over the proposed Project life.

Further, the growth in the pipeline of proposed new capacity expansions of coal power plants have been declining relatively steadily over the last six years, with a cumulative 1,175GW of coal power cancellations as at June 2021, as monitored by the Global Energy Monitor (GEM).[66] With the rising climate crisis combining with the accelerating policy, technology and financial changes, I expect the second trend of increased coal plant closures ahead of their expected design life to accelerate beyond the developed markets today to also progressively cover developing economies too, aided by new climate financing tools like the proposed World Bank Energy Transmission Mechanism.[67]

Countries like India are also increasingly focussed on energy security and energy independence, with recent events relating to Russian gas supply and the Ukraine driving extreme fossil fuel commodity price volatility, undermining the ability of fossil fuel energy import dependent nations to fund this rising external cost. Prime Minister Narendra Modi's Independence Day speech of 2021[68] highlighted his country's priority on ceasing reliance on expensive imported fossil fuel imports, setting a target of energy independence by 2047. This means India seeks to displace coal imports with domestic energy alternatives, including domestic coal, hydro, wind and solar.

Figure 11: Global Cumulative New Coal Plant Cancellations (2016-2021)



Source: GEM, How world's coal-power pipeline has shrunk by three-quarters, 14 September 2021

[65] German Institute for Economic Research (DIW Berlin) and Norwegian University of Technology, NTNU Energy Transition Initiative, Stranded Investments in the Coal Export Industry? Accessed February 2022 (formal publication pending)
[66] Global Energy Monitor, Global Coal Plant Tracker, accessed 23 February 2022
[67] World Bank, JUST TRANSITION FOR ALL: THE WORLD BANK GROUP'S SUPPORT TO COUNTRIES TRANSITIONING AWAY FROM COAL
[68] Indian Express, PM Modi's I-Day speech, 17 August 2021

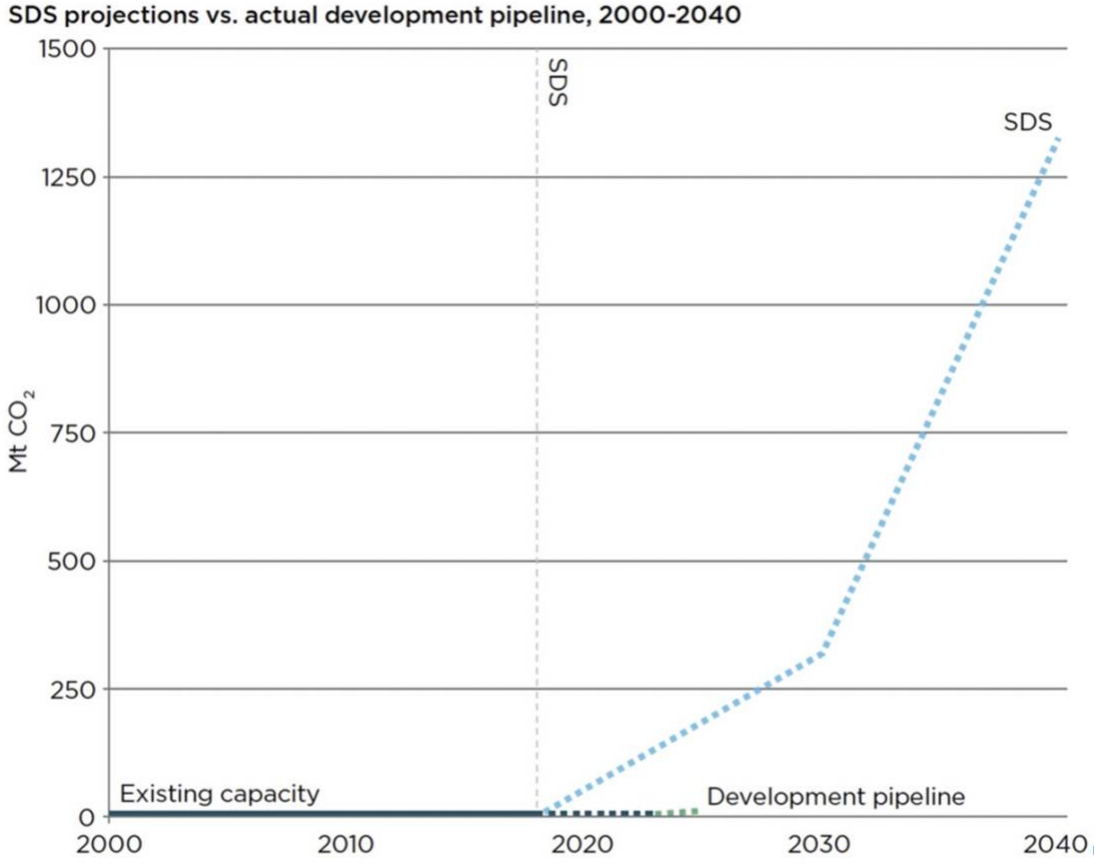
As new coal power plant financing progressively declines, and end of life coal plant closures accelerate, total demand for coal will naturally decline (as forecast by the IEA, Table 3), replaced by ever-lower cost, zero emissions renewable energy alternatives. How fast this eventuates will determine if even the existing coal mines in operation today are able to continue to generate sufficient revenues to maintain their current output, or if early coal mine closures accelerate in parallel with the closure of their consumer base, the coal power plants.

Section 9: CCS is Entirely Different to CCUS-EOR

Carbon Capture and Storage (CCS) is often cited as the new technology in development that is going to allow the continued use of fossil fuels, particularly coal. It is my opinion that CCS has not developed in any meaningful way in the last three decades (see Figure 12). Even for the few CCS pilots that have been commissioned, these involved very significant ongoing government subsidies, and/or never operate anywhere near their target capture rates – Chevron's Gorgon CCS project is often cited as the world's largest CCS project, but Chevron in November 2021 detailed how the facility had operated at less than 30% of its expected rate in the first five years of operation and was shut entirely for the majority of 2021.[69]

For the coal-fired power generation sector, the only operating CCS project in the US was Kemper, and this project was shut down after only five years of operation in 2017 [70] and then dismantled in October 2021.[71] This leaves a single 120 MW unit at the massively government-subsidised Boundary Dam coal power plant in Canada as the only CCS coal power plant facility still operating outside of China, and in 2021 it operated at just 44% of its rated capacity.[72]

Figure 12: Large Scale CO2 CCS Projects in Power Generation



Source: IEA, Exploring Clean Energy Pathways, The Role of CO2 Storage, July 2019

[69] Chevron, Gorgon Gas Development and Jansz Feed Gas Pipeline Environmental Performance Report, 17 November 2021
[70] GTM, Carbon Capture Suffers a Huge Setback as Kemper Plant Suspends Work, 29 June 2017
[71] E&E News, The Kemper project just collapsed. What it signifies for CCS, 26 October 2021
[72] E&E News, CCS 'red flag?' World's sole coal project hits snag, 10 January 2022

One of the key points of confusion is that CCS is not at all well-established and commercially proven technology, with the coal industry having failed to invest any material amount in this technology in recent decades.

Proponents for CCS reference Carbon Capture, Use and Storage (CCUS), which has a completely different objective. CCS aims to capture and store CO_2 permanently deep underground to offset the release of CO_2 from fossil fuel combustion. CCUS is all about producing more oil and gas but injecting CO_2 into depleted reservoirs – the industry phase for this is Enhanced Oil Recovery (EOR). This normally involves a net increase in CO_2 emissions when the oil is burnt.[73]

The Development of Green Ammonia as a Thermal Coal Replacement

January 2022 saw Mitsubishi Heavy Industries (MHI) and JERA (the world's largest buyer of coal and LNG for use in Japan) announce the upscaling and continuation of their eight years to 2028 commercial-scale trial of ammonia co-firing of 50% in two 1-GW coal-fired power plants, supported by Japanese government funding.[74] This is a core strategy to substitute zero emissions green ammonia produced from renewable energy and hydrogen electrolysis to progressively replace Australian thermal coal uses, a key strategy in testing to help deliver on Japan's 46% CO_2-emissions reduction by 2030 pledge (refer Section 2).

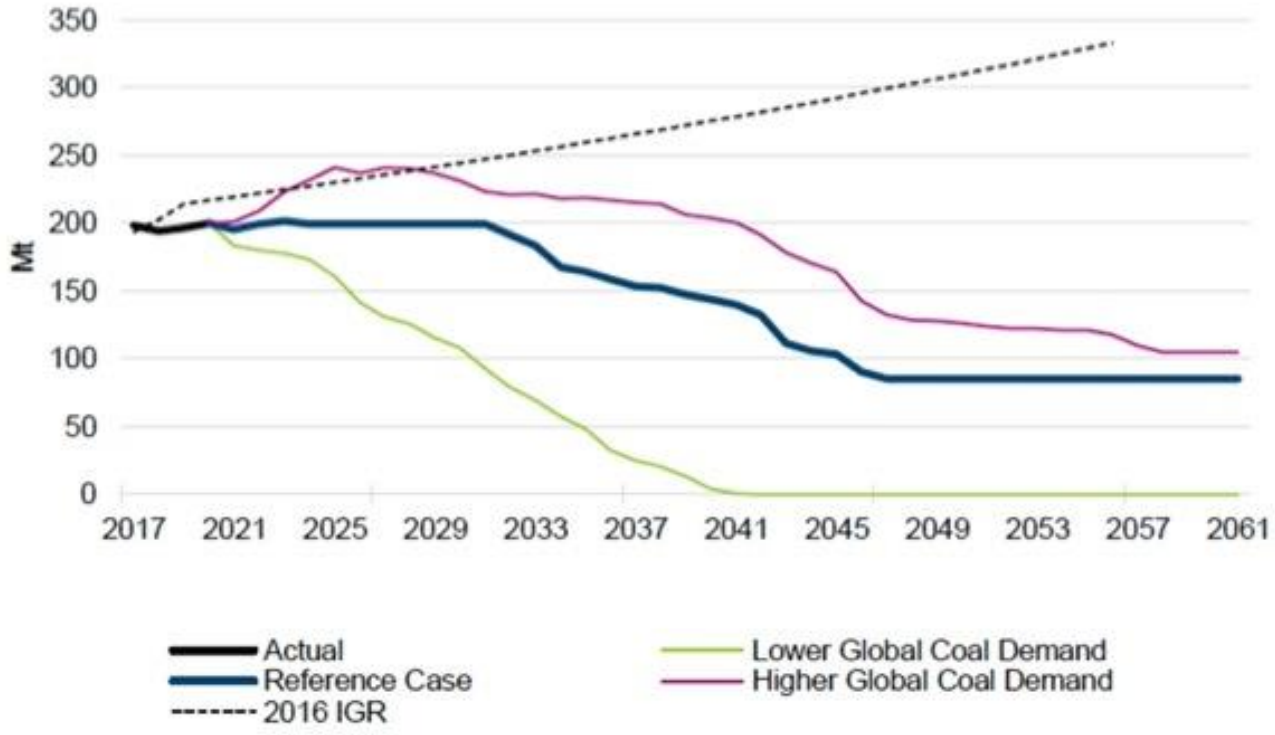
The last month saw three new green hydrogen and green ammonia plants announced across Norway[75], Chile[76] and Spain,[77] each 10-20 times the size of the largest green hydrogen plant operational in the world at the end of 2021 (namely Air Liquide's 20MW Canadian facility). All three facilities are due to be commissioned by or before 2027, illustrating again the acceleration of technology deployments at ever-larger scale.

[73] The Australia Institute, Santos' CCS scam, 8 December 2021
[74] Press release by JERA and Mitsubishi Heavy Industries, Ltd. ("MHI"), JERA and MHI Start a Demonstration Project to Develop Technology to Increase the Ammonia Co-firing Rate at Coal-fired Boilers, 7 January 2022
[75] Copenhagen Infrastructure Partners Press Release, Green ammonia production facility planned in Norway's municipality of Sauda, 3 February 2022
[76] Copenhagen Infrastructure Partners Press Release, CIP announce partnership with AustriaEnergy and Oekowind on HNH Project, the green hydrogen project under development in Chile, 13 January 2022
[77] Copenhagen Infrastructure Partners Press Release, CIP announces partnership with Enagás, Naturgy, Fertiberia and Vestas to build a project for the large-scale production of green hydrogen and ammonia in Spain, creating up to 5,000 jobs and saving up to 1 million tons of Co2 each year, 1 February 2022

Conclusion: Key findings re Narrabri Underground Mine Stage 3 Extension Project (SSD 10269)

1. I estimate the cost of the direct Scope 1 & 2 emissions at $2.0bn, which more than absorbs the entire $599m NPV net benefit posited by the proponent (Section 6).
2. All direct and indirect GHG emissions from this project will adversely impact the NSW environment. The summary in Section 9 of the global failure of CCS can give the Independent Planning Commission no comfort that any of the Scope 3 emissions attributable to this mine will be abated when coal is burnt in power stations overseas.
3. Thermal coal is in structural decline globally, and - as detailed by the NSW Treasury – coal mining employment across NSW could well end entirely as soon a 2041 (Figure 13) [78] showing there is no strategic need for this Project (Section 8).
4. The Net Benefits of the Project erroneously assumes Whitehaven will operate with zero financial leverage and that the company pays cash tax, whereas the actual results of the last decade shows entirely the opposite – ongoing high financial leverage (to the point of financial distress) and a net cash refund from the ATO (Section 7).

Figure 13: NSW Treasury projected coal volumes 2021 vs 2016 (Mt)



Source: NSW Treasury.

[78] NSW Treasury. The Sensitivity of the NSW Economic and Fiscal Outlook to Global Coal Demand and the Broader Energy Transition for the 2021 NSW Intergenerational Report. Page 19 May 2021

Appendix 3: Project Emissions

I have used an estimate of 27.627 Mt of additional Scope 1 and 2 emissions to calculate the market value and hence cost to the NSW economy.

The actual Scope 1 and 2 emissions that the proponent estimates seem to be rising with each iteration of the correspondence with DPE.

Table 3-6. Project emissions valuation ($2020)

		Central price scenario	High price scenario	Low price scenario
	Total scope 1 & 2 emissions	EUAs - Futures prices	Clean Energy Future Policy Scenario	US EPA Social Cost of Carbon
	(Mt CO_{2-e})	(NPV $m)	(NPV $m)	(NPV $m)
Total emissions / valuation				
Project	26.7	$471	$814	$313
Narrabri Mine	8.1	$192	$269	$121
Difference	18.6	$279	$546	$192
NSW share of emissions / valuation				
Project	0.08	$1.45	$2.52	$0.97
Narrabri Mine	0.03	$0.59	$0.83	$0.37
Difference	0.06	$0.86	$1.69	$0.59

Notes: NSW share of emissions has been calculated with reference to relative GDP/GSP. The Australian share of world GDP as of 2018 was 0.95%, and the NSW GSP share of Australian GDP as of 2018-19 was 32.6%. The €/AU$ exchange rate was assumed to be 1.68.

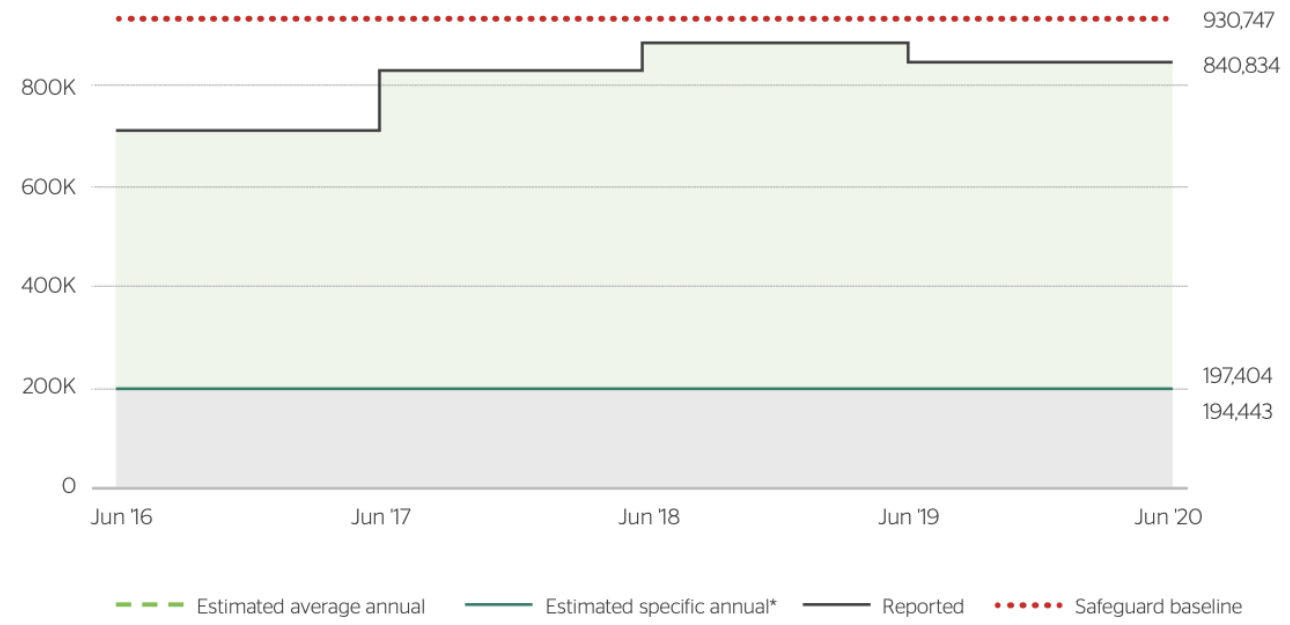
Source: NCOPL; World Bank 2019; https://www.eex.com/en/market-data/environmental-markets/derivatives-market/european-emission-allowances-futures, accessed on 10 May 2020; ABS, 2018; 5220.0 Australian National Accounts: National Income, Expenditure and Product; Table 1 & Table 26.

Source: Narrabri Underground Mine Stage 3 Extension Project Environmental Impact Statement Appendix L Economic Assessment, AnalytEcon ES-2

I note the new report by Australian Conservation Foundation (ACF) and the Australian National University (ANU)[79] that concludes estimate provided by the proponents of new fossil fuel project proposals are regularly materially understated relative to the actual resulting emissions reported once the projects are implemented, suggesting the $2.3bn CO2-e emissions value I have estimated is quite likely to prove very conservative. Figure 14 details the Maules Creek coal mine of the proponent, where ACF contrasts the actual between 2016 and 2020 at 3.6-4.5 times what was estimated. Over four reporting years, Whitehaven Coal has emitted approximately 16.5 years' worth of the emissions estimated for the life of the Maules Creek mine. I attach this report as Appendix 4.

[79] Australian Conservation Foundation Australian and the Australian National University, Emissions exposé: Australia's biggest polluters are emitting more than approved and getting away with it, 24 February 2022

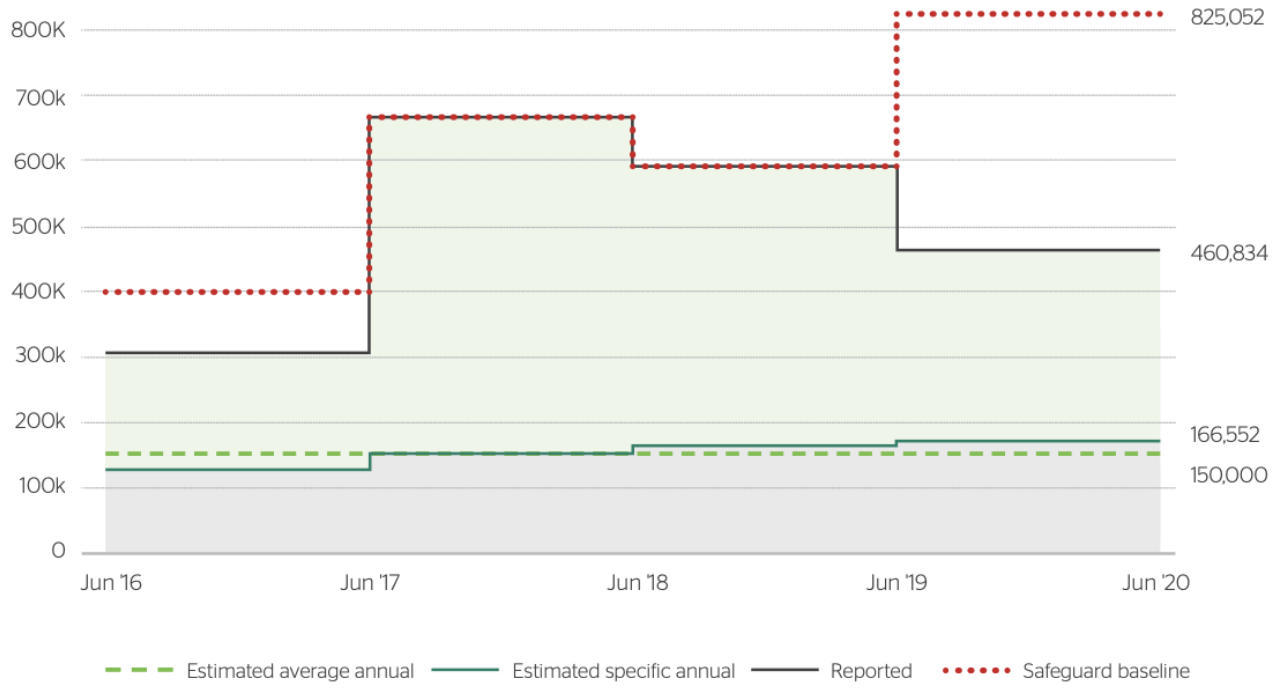
Figure 14: Maules Creek Open Cut Coal Mine: Annual GHG emissions, tCO2e



Source: Australian Conservation Foundation and the Australian National University

At Narrabri underground coal mine, Whitehaven's actual emissions were either double or triple the estimate (ranging from 2.4 to 3.4 times the anticipated amount) (Figure 15).

Figure 15: Narrabri Underground Coal Mine: Annual GHG emissions, tCO2e



Source: Australian Conservation Foundation and the Australian National University

Scope 1 emissions

Table 3 of the Amendment Report (May 2021)[80] estimates that total Scope 1 emissions (Jacob's revised gas modelling) with flaring of pre-drainage gas would be 31.189 Mt CO_2-e between 2022 and 2044.

Table 2 of correspondence from Whitehaven Coal to NSW DPE (December 2021)[81] provides a summary of estimated GHG emissions post-mine decommissioning, which total 1.607 Mt CO_2-e between 2045 and 2064.

31.189 Mt of operational GHG emissions + 1.607 Mt of GHG emissions post mining = 32.796 Mt CO_2-e.

Scope 2 emissions

Table 3 of the Amendment Report (May 2021) estimates that total Scope 2 emissions from the operational phase of the mine (Jacob's revised gas modelling) with flaring of pre-drainage gas would be 2.787 Mt CO_2-e.

Table 2 of correspondence from Whitehaven Coal to NSW DPE (December 2021) provides a summary of estimated Scope 2 greenhouse gas emissions post-mine decommissioning, which total 0.144 Mt CO2-e between 2045 and 2050.

2.787 Mt of operational Scope 2 GHG emissions + 0.144 Mt of Scope 2 GHG emissions post mining = 2.931 Mt CO_2-e.

Scope 1 & 2 emissions from the Project

I have taken Whitehaven's new estimate of 35.727 Mt over the life of the entire mining period including rehabilitation (2022-2064) and deducted Whitehaven's AnalytEcon estimate of Scope 1 & 2 for the already approved Narrabri Mine (2022-2031) of 8.1 Mt to derive a Project estimate of 27.627 Mt.

Scope 3 emissions from the Project

I am of the view that the entire supply chain emissions (Scope 1-3) should be considered, and that the continued failure of CCS (refer Section 9) means that Scope 3 emissions will likely dwarf the Scope 1 and 2 direct and indirect emissions of mining. However, I have excluded a financial valuation of the Scope 3 emissions as they fall outside of Australia, notwithstanding there is only one global atmosphere and the costs of increased extreme weather events becoming even more extreme strongly indicates to me Scope 1-3 should be considered in their entirety for the Project.

[80] Narrabri Underground Mine Stage 3 Extension Project Amendment Report, May 2021
[81] Whitehaven Coal correspondence to NSW DPE, 17 December 2021

Climate Energy Finance

Climate Energy Finance (CEF) conducts public interest research and analyses on global financial and economic issues related to the global energy transition, as well as the implications for the Australian economy, with a key focus on the threats and opportunities for Australian investments and exports.

About the Author

Tim Buckley

Tim Buckley, CEF's director of energy finance research, Australasia, has 30 years of financial market experience covering the Australian, Asian and global equity markets from both a buy and sell side perspective. Before founding CEF as a public interest thinktank in 2022, Tim founded the Australia and Asian arms of IEEFA in 2013 and worked as the Australasian Director on the global energy transition for eight years till the start of 2022. Prior to this, Tim was a top-rated Equity Research Analyst and has covered many sectors of the Australian economy over the previous 2 decades, including spending two years as Head of Equity Research in Singapore at Deutsche Bank covering Asian markets in 1996-1998. Tim was a Managing Director, Head of Equity Research at Citigroup for 17 years till 2008, then spent two years as Head of Institutional Equities at Shaw & Partners and subsequently in 2010-2013 was co-Managing Director of Arkx Investment Management P/L, a global listed clean energy investment company that was jointly owned by management and Westpac Banking Group. Tim started his career as a lecturer in Finance and Market Regulation at the University of Technology, Sydney before moving to Macquarie Group in 1988 to work in equity research. Tim has a Bachelor of Business majoring in Accounting and Finance from UTS Sydney (1985-87), and has received the US SEC Series 7 (General Securities Representative Qualification Examination) and Series 24 (General Securities Principal Qualification Examination) qualifications.

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