



Risky Millions: Whitehaven's methane potential

How Australia's biggest pure-play coal company could release more than one million tonnes of methane between now and 2050

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About

This report analyses the climate impact of Whitehaven's coal mining portfolio across Australia over the next two decades and the associated methane footprint.

Executive Summary

Whitehaven's methane footprint

Methane is a potent greenhouse gas released during coal mining, with a short term climate impact 82.5 times more powerful than carbon dioxide (CO₂).

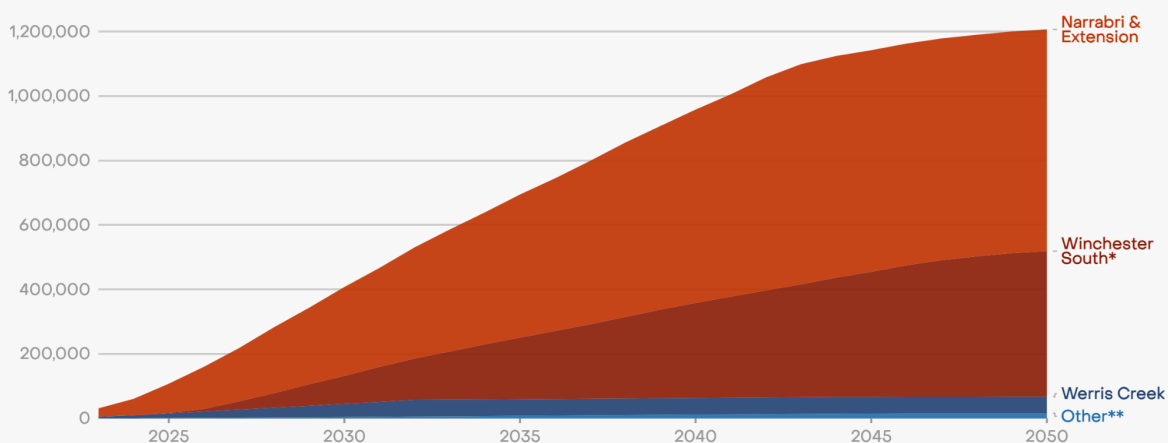
With four coal mines in operation capable of producing 30 million tonnes of coal annually, Whitehaven Coal Limited (Whitehaven) is Australia's largest pure-play coal company, and a significant methane emitter.

In this analysis, we highlight that the company plans to greatly expand its coal mining production, releasing over 1 million tonnes of fugitive methane gas in the process.

If approved, the company's proposed and existing coal mines are on track to double their methane pollution between now and 2030. By 2050, those emissions could have **the equivalent short term climate impact of an additional 56 million cars on the road for one year**, or 100 million tonnes of CO₂-e.

Whitehaven could emit over 1.2 million tonnes of methane between now and 2050

Cumulative methane emissions from operational and proposed* coal mines (tonnes)



Source: Ember calculations, Whitehaven annual reviews & EIS documents - **Includes Tarrawonga Mine, Maules Creek & proposed extension and proposed Vickery Extension

At the same time, this report also highlights that there is a lack of transparency and uncertainty in projecting these emissions. This is due, in part, to inadequacies in Australia's methane measurement, reporting and verification laws which may result in underestimates of the actual extent of Whitehaven's methane pollution.

"At the beginning of a critical decade to combat climate change, and less than 1 year after Australia joined the Global Methane Pledge to reduce emissions by 30%, Whitehaven is planning to potentially double their methane emissions between now and 2030. ***This flies in the face of Australia's climate commitments, and asks serious questions about the amount of risk these expansion plans pose.***"

Chris Wright, Climate Strategy Advisor, Ember

"The clear absence of emissions monitoring or verification makes it difficult to accept Whitehaven's estimation of methane emissions at its current and planned open cut mines, especially as they are often significantly lower than the emissions measured by other coal mines across Australia. ***It shows the urgent need for Australia to improve its greenhouse gas and energy reporting laws and ensure coal mines are accurately measuring their pollution and its impacts.***"

Sabina Assan, Coal Mine Methane Analyst, Ember

01 Over one million tonnes of methane

Between now and 2050, Whitehaven's coal mines will release upwards of 1.2 million tonnes of methane.

02 Incompatible with Net Zero

Using methane's 20 year Global Warming Potential (GWP), Whitehaven's methane emissions could have a greater short term climate impact of 56 million cars on the road for one year

03 Methane content 5x higher than reported

Mining at Narrabri commenced in 2018, and since then, the existing Narrabri mine has been reporting methane emissions almost 5 times higher than estimated at the time of approval.






Company Portfolio

Whitehaven's emissions set to double by 2030

Whitehaven has plans to ramp up coal mining over the next decade, doubling its annual fugitive methane emissions in the process.

Whitehaven's coal mine portfolio plans to extend beyond 2050

■ Thermal ■ Metallurgical

Name	State	Mine Type	Status	Closure Year	Extension proposed	Coal Grade*	Average annual coal production (Mt)	Cumulative methane emissions (t) [2023 - closure]
Tarrawonga	New South Wales	Open cut	Operational	2030	No		3	144.00
Werris Creek	New South Wales	Open cut	Operational	2032	No		2.4	51,429.00
Maules Creek	New South Wales	Open cut	Operational	2034	Yes		12.4	4,556.00
Narrabri (including Stage 3 extension)	New South Wales	Underground	Operational	2044	Yes		8.5	688,092.00
Vickery Extension Project	New South Wales	Open cut	Proposed	2050	N/A		7.8	6,233.00
Winchester South	Queensland	Open cut	Proposed	2055	N/A		14.3	452,090.00

Source: *Coal grade data from Energy and Resource Insights, All other data compiled from Whitehaven's mine reports, reviews and EIS documents

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Above we summarise Whitehaven's coal mine portfolio, noting whether each of its coal facilities are operational or proposed, and the cumulative methane emissions footprint of each mine between 2023 and each mine's closure date.

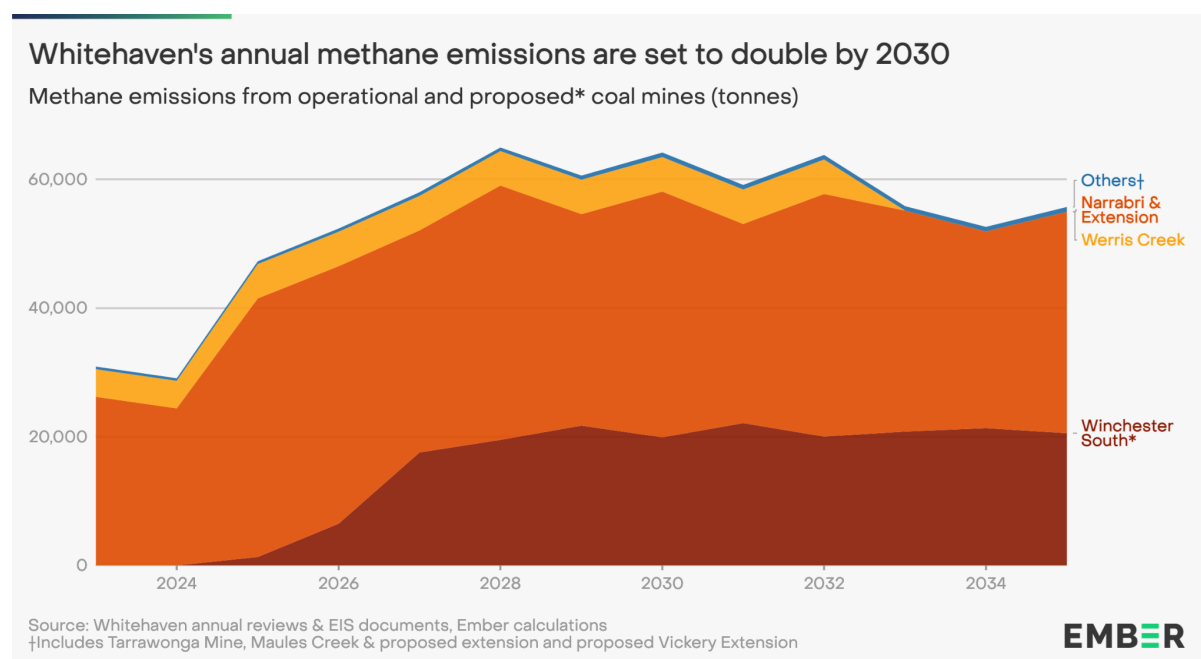
Operating Mines

Whitehaven operates four coal mines in New South Wales, producing up to 30 million tonnes of coal per annum. These include Tarrawonga, Werris Creek and Maules Creek open cut

mines, and Narrabri underground coal mine, which recently received approval for a significant extension (Narrabri Stage 3 Extension Project).

According to company estimates, the coal mined across these operations currently emits an average of 34,000 tonnes of methane per year, with emissions expected to continue over the next 20 years. Currently Whitehaven has [no clear abatement target or roadmap](#) for onsite mitigation of these emissions.

By 2050, this will lead to a total cumulative methane emissions footprint of 744,000 tonnes. When considering methane’s 20 year climate impact, continuing these mines alone would release the equivalent to 61 million tonnes of CO2-e (GWP 20), which is equivalent to the annual emissions of all of Australia’s cars, trucks and buses combined.



Proposed Mines

The company is also planning a significant expansion of their coal production. There are currently two new mining projects planned to commence by 2025 - Winchester South and the Vickery Extension Project (Vickery).

Winchester South is proposed to be Whitehaven’s first greenfield coal mine in Queensland, and is planning to operate until 2055. Whitehaven plans to begin construction of the Vickery Extension project from June 2023 at the Vickery mine in North West NSW, with operations to commence mid-2024 until 2050. In addition, Whitehaven is also seeking approval for a nine

year extension to the existing Maules Creek mine in NSW until 2043, and [considering](#) opportunities to expand mining in the area North West of their existing Narrabri's mine.

If these proposed expansions are to proceed, they will emit an additional 18,000 tonnes of methane per year over the next 20 years. This would lead to cumulative emissions of up to 463,000 tonnes of methane by 2050, which has the equivalent short term climate impact of 14 million tonnes of carbon dioxide, or the annual carbon dioxide emissions of New Zealand (with LULUCF).

In their [EIS](#) for Winchester South, Whitehaven "committed to evaluating further opportunities for Scope 1 and 2 emissions reductions" but does not consider it "feasible" to mitigate any of its methane emissions. Similarly, in their [EIS](#) for Vickery Extension Project, they have not identified any plans to reduce their methane emissions.

Whitehaven Coal is also [yet to develop](#) a decarbonisation plan or set any company wide mitigation targets, well behind other major players in the industry.

Estimating Methane

Discrepancies in Whitehaven's estimates

Across Whitehaven's coal mines, there are clear transparency gaps concerning their existing methane estimates

Ember analysed Whitehaven's mine-by-mine methane emission estimates, and is concerned that the scale of emissions have not been adequately estimated or assessed. In general, a mine's methane intensity will increase relative to the depth of the coal mined. Although there are exceptions to this rule as the methane intensity of coal can vary significantly between regions, basins and coal mines.

Our analysis looks at the methane data reported by Whitehaven, and compares it to methane emissions measured and reported by other mines in Australia. Emissions reported by Whitehaven fall consistently below what could be reasonably expected. It is likely that they are being significantly underestimated.

As far as the authors are aware, the methane emission factors used by Whitehaven have not been independently verified, nor have any on-site methane emissions measurements taken place at the open-cut mines to confirm company estimates.

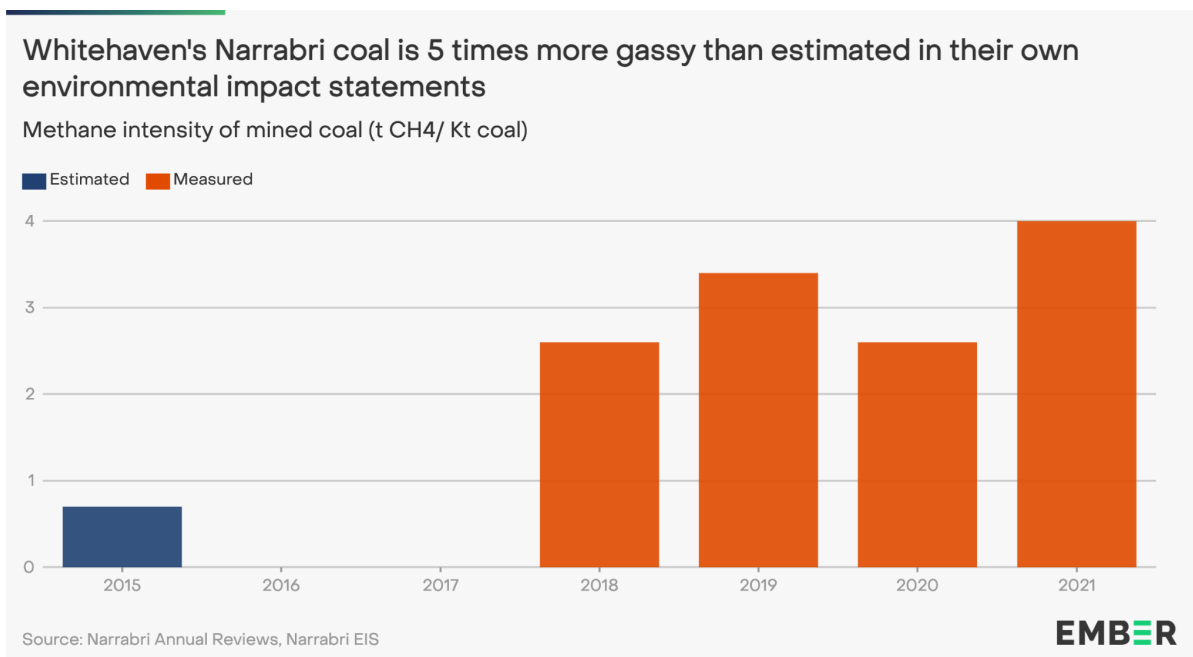
Narrabri methane content 5 times higher than originally reported

The Narrabri mine is Whitehaven's only underground coal facility. As a result, it is the only mine required to directly measure its methane emissions during operation, pursuant to Australia's greenhouse and energy reporting laws.

In its initial Environmental Impact Statement (EIS) in 2009, the company estimated an average methane intensity of 2.2 tonnes of methane per thousand tonnes of coal. This average intensity was derived from internal exploration drilling results that have not been publicly released.

In 2015, the company updated this estimate, applying modelling from the average gas content measured on site. This reduced its estimate by a factor of three, to 0.7 tonnes of methane per thousand tonnes of coal.

Mining at Narrabri commenced in 2018, and since then, **the existing Narrabri mine has been reporting methane emissions almost 5 times higher than their final EIS estimates.** From data reported in Whitehaven’s annual reviews, Ember’s independent calculations show that, for the last four consecutive years (2018-2021), Narrabri’s methane intensity has varied between 2.6 - 4 tonnes of methane per thousand tonnes of coal.



In 2015, Whitehaven estimated that its Narrabri operations would emit 108,000 tonnes of methane throughout its lifespan of 17 years. Using the average emission factor calculated from the last four years, **the lifetime emissions are more than four fold higher**, closer to 490,000 tonnes.

This has the same short-term warming impact as close to 40 million tonnes of carbon dioxide, or the equivalent of three years of emissions at Australia's biggest coal fired power plant, Eraring power station.

Methane estimates for Whitehaven's open cut mines

Whitehaven estimates its methane emissions from its open cut operations using emission factors rather than directly measuring emissions, in line with Australia's greenhouse gas reporting regulations. Improved remote sensing, including the use of satellites and independent analysis, indicates that the lack of on-site methane monitoring at Australian open cut coal facilities, including Whitehaven's mines, could be leading to underreporting of methane emissions.

For example, the open cut coal mine, [Hail Creek](#) in Queensland, has been detected by satellites to emit [more than 10 times as much](#) as it currently reports for four years consecutively.

Whitehaven estimate emissions factors below the average in Australia

All of Whitehaven's mines have calculated methane emission factors below the average for their mine type in Australia, however two of them in particular seem to be significantly underestimating their methane emissions beyond what would be reasonably expected.

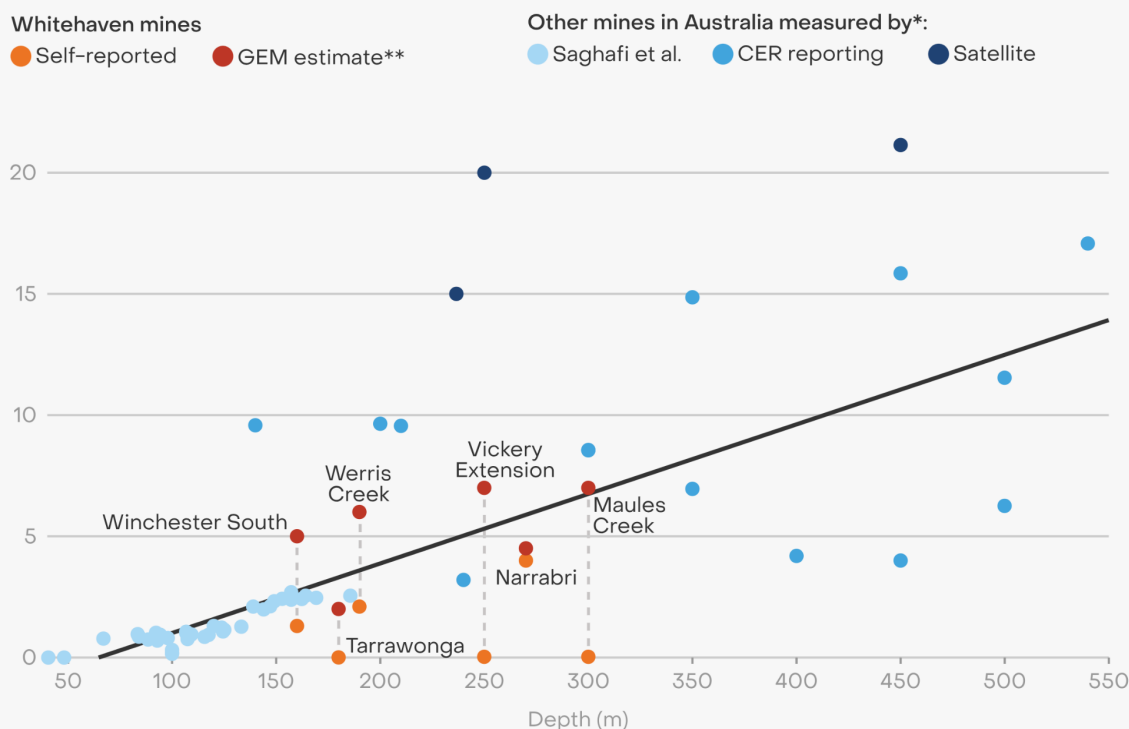
Maules Creek and Vickery Expansion Project

These coal mines have an estimated methane intensity which is almost **200 times lower** than what would be expected at their proposed depth for coal mines in Australia, according to Ember's independent calculations.

Whitehaven estimates methane emissions for most of its open cut mines using internal data to calculate site-specific emission factors, which is considered more robust than a default (State-based) emission factor. The company is not required to monitor or verify these methane emissions, and methodologies are not made publicly available, making the verification of the accuracy of emissions estimates particularly challenging.

Whitehaven's methane estimates are substantially below those measured from other Australian mines of similar depth

Relationship between the methane content of coals (t CH₄/kt coal) and mine depth (m)



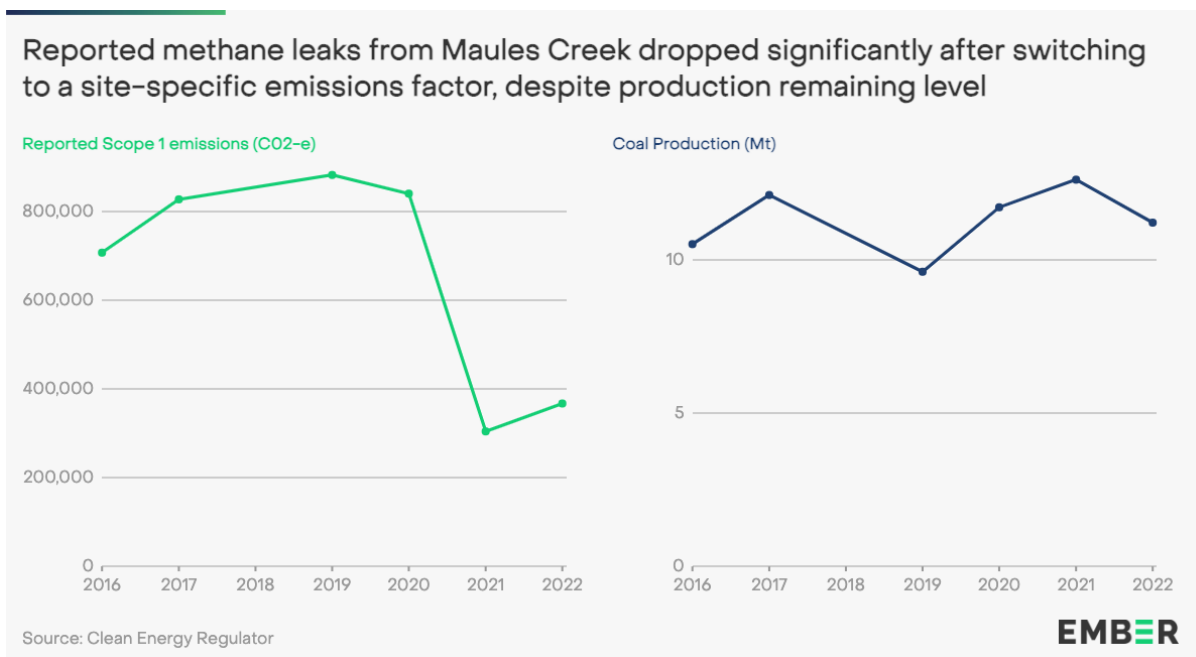
*Ember calculated coal methane intensity from data reported in scientific studies (Saghafi et al), Scope 1 emissions as reported to the Clean Energy Regulator, and satellite data, ** GEM estimate for Narrabri adjusted for methane captured by pre-drainage

Maules Creek

The relationship between methane content and coal rank has been studied intensively, showing that [higher ranked coals](#) hold more gas. Maules Creek mine boasts a [significant proportion of metallurgical coal](#), and the “[highest quality high energy thermal coal](#)” with an energy content above [average at 7150 kcal/kg](#). The mine has also reportedly reached a depth of 300m, similar to many gassy underground coal mines.

The depth, and quality of the coal at Maules Creek would suggest that it contains considerable quantities of methane. Between 2016 and 2018, Maules Creek was one of the highest emitting mines reporting to the CER. It estimated its emissions using the NSW State-based emissions factor for open cut coal mines. In 2019 Whitehaven voluntarily undertook an internal re-estimation of the methane intensity of Maules Creek Mine, and estimated that the mine-specific emission factor is 0.031t CH₄/ Kt coal.

This is **65 times lower than the regional (NSW) default emission factor**, which is 2 t CH₄/ Kt coal. Other mines operating at similar depths report emissions between 100 and 300 times greater (3 and 9 tCH₄ /Kt coal).



Vickery Mine

The Vickery coal mine is a deep, open cut metallurgical coal mine planning to reach a maximum depth of ~250m. We expect, taking into account the proposed mine depth and stated quality of metallurgical coal, that the Vickery Expansion Project would extract coal with a high methane intensity.

In the Vickery Expansion Project EIS, Whitehaven has estimated the mine’s methane emissions to be **60 times lower than the default emission factor for the region**, at 0.035 t CH₄/ Kt coal. Whitehaven estimated this emissions factor using site-specific emissions samples that have not been publicly released. Concerningly, this is again much lower than mines reporting at a similar depth. Our analysis also found errors in the mine’s EIS, as Whitehaven has continued to use an outdated Global Warming Potential (GWP) and data from 2009 to estimate the Vickery Extension project’s potential methane emissions.

Total methane emissions could be 5 times higher

Whitehaven's methane emissions could be almost five times as large, with their existing and proposed mines emitting up to 6 million tonnes of methane by 2050.

Our analysis has incorporated company-based methane estimates into our forward projections to 2030 and 2050. However, we believe these projections may be underestimating the true scale of Whitehaven's potential methane pollution due, in part, to inadequate measurement methods under Australia's greenhouse and energy reporting scheme.

Whitehaven estimates and reports that all of its mines emit methane at a rate significantly lower than Australia's State-based emissions factors, neighbouring mines in their respective regions, or external estimates from the International Energy Agency (IEA) and the Global Energy Monitor (GEM). By contrast, GEM estimates the methane intensity of coal by taking into account location, coal type and mine depth. While there are data gaps and limitations to this methodology, GEM's estimates indicate that **Whitehaven's methane emissions could be emitting up to 6 million tonnes of methane by 2050.**

Recommendations

A transparent plan to Net Zero

Whitehaven's expansion plans are in direct conflict with the IEA's global roadmap to [net zero](#). Furthermore, the lack of transparency and third party verification make it difficult to substantiate the full extent of Whitehaven's methane emissions, yearly variability of that pollution, or the potential to mitigate these emissions in line with the [Global Methane Pledge](#) and Australia's climate targets.

In their [Sustainability Report for 2022](#), Whitehaven's CEO acknowledged the "considerable stakeholder interest in what a decarbonisation pathway may entail for our business, including assessing the scale of the emissions abatement challenge to achieve net zero by 2050". However, **they have yet to commit to *this*, or any company wide target.**

They also recognised that "Australia will need to introduce legislative and regulatory mechanisms that would eventually require us to reduce operational emissions." They need not wait for this reform. We believe the company has the potential to address its methane emissions, and engage in improved monitoring and mitigation that aligns with its corporate social and environmental governance responsibilities. We recommend the following:

1. Improve Data Transparency and Reporting

Ember recommends that Whitehaven take immediate action to improve their emissions data transparency. This includes providing detailed information on each mine's estimated and measured methane emissions, and the methods used to generate those figures. This should be standardised across Whitehaven's portfolio to demonstrate best practice corporate transparency, ensuring that regulators, investors and the public can be confident in the integrity of Whitehaven's reported emissions.

2. Invest in Third Party Verification

We recommend that Whitehaven invest in a third party verification programme across all of their existing coal mines. Third party verification, based on diverse and direct methane measurement technologies, including remote monitoring methods, will improve the integrity of Whitehaven's reported emissions across their portfolio.

Verification programmes also generate important co-benefits, including enhancing the identification of both gassy seams and opportunities for methane abatement. This would contribute to Whitehaven delivering on its corporate [commitment](#) to identify and implement measures to reduce emissions at each point of their value chain.

3. Invest in Diversification and a Just Transition

We recommend that Whitehaven proactively respond to the IEA's [Net Zero By 2050 roadmap](#) and commit to the diversification and decarbonisation of their portfolio. Whitehaven should prioritise divestment of their most methane intense assets first and develop a Just Transition pathway for their existing thermal coal assets. We recommend against any new coal mines or expansions, as this is incompatible with a net zero by 2050 pathway as set out by the IEA in its [Net Zero By 2050 roadmap](#).

4. Investment in Significant Methane Abatement Measures

We urge Whitehaven to implement the recommendations from any fugitive emissions abatement studies they have undertaken (as emphasised in their latest sustainability report). Based on [IEA cost estimates](#), methane abatement has been achieved at both open cut and underground mines in Australia for approximately [AUD\\$1 per kilogram of methane](#).

We recommend Whitehaven invest in ambitious methane abatement measures that are in line with IEA, IPCC and Climate Analytics 1.5 degree pathways, delivering a 75% reduction in Whitehaven's portfolio-wide methane emissions by 2030. Last year, Ember outlined [opportunities](#) for Australia's coal sector to meet this reduction pathway.

Supporting Materials

Disclaimer

The findings in this report are based on Whitehaven's reported emissions and estimates pursuant to Australia's greenhouse and energy reporting scheme. That scheme adheres to UNFCCC reporting requirements recommended by the IPCC, but does not reflect industry best practice methane measurement, reporting or verification as highlighted by [UNECE](#), and may produce inaccurate methane emissions estimates.

We have noted where reported emissions or estimates may be substantially lower than the actual amount of methane released. This information has been prepared as information or education use only, and does not constitute financial, legal or other professional advice.

The information in this report has been prepared using the material outlined below and although the findings in this report are based on an analysis of that material, no warranty is made as to the completeness, accuracy or reliability of the statements or representations that arise from the material gathered to conduct this analysis. Ember did not have access to Whitehaven's internal emissions data. Whitehaven was contacted for comment prior to the publication of this report.

Methodology

Ember calculated methane intensities from Australian coal mines by compiling data from measured emissions, and compared them to the estimated emissions from Whitehaven mines. Our sources include academic papers reporting on methane content in coals at open cut mines in Australia from research by [Saghafi et al.](#), data reported to the Clean Energy Regulator (CER) by underground mines, and estimates from satellite data ([Sadvarte et al.](#) and [CarbonMapper](#)).

The methane intensities reported by Whitehaven, are also compared to estimates by Global Energy Monitor (GEM). A detailed methodology, and sources can be found in the Supplementary materials.

The average annual carbon dioxide (CO₂) emissions of a typical passenger vehicle was estimated using 2021 data from [Carbon Dioxide Emissions Intensity for New Australian Light Vehicles 2021](#) research by the National Transport Commission. Data on the average distance travelled per year by a typical vehicle in Australia was taken from the Australian Bureau of Statistics' [Survey of Motor Vehicle Use](#), 2020. Ember notes that the average distance travelled by vehicles in the financial year 2019 - 2020 may have been affected by COVID restrictions, but this is the latest available data for Australia.

Supplementary materials

In general, a mine's methane intensity will increase relative to the depth of the coal mined. Although there are exceptions to this rule as the methane intensity of coal can vary significantly between regions, basins and coal mines.

As far as the authors are aware, the methane emission factors used by Whitehaven have not been independently verified, nor have any on-site methane emissions measurements taken place at the open-cut mines to confirm company estimates.

Global Warming Potential

Global Warming Potential (GWP) is a measure to express the effects of GHGs in CO₂ equivalent terms. Given that CH₄ absorbs much more energy when in the atmosphere, but has a shorter lifetime than CO₂, the IPCC considers its impact over 20 years (GWP = 82.5) and over 100 years (GWP = 29.8). One of the shortcomings of this metric is that it assumes a constant value of methane's effects over time, when in reality it varies significantly.

Historically, the 100-year value has been used by Governments and in major international agreements on the basis that global warming is a long term challenge.

At Ember, we propose to use the 20-year GWP. Climate change is an emergency, and the next 20 years are critical with regards to climate action. Methane's short atmospheric lifetime means emissions reductions can reduce global heating in the near term.

Coal methane intensity from Australian coal mines

Ember compiled methane emissions data from coal mines in Australia from the following sources:

- Scope 1 emissions from underground coal mines reporting to the Clean Energy Regulator were used to estimate mine methane intensity. Methane was assumed to be responsible for 80% of reported Scope 1 emissions.

- Gas content at open cut coal mines was compiled from the academic paper by Sagahfi et al. 2013 "[Estimating greenhouse gas emissions from open-cut coal mining: application to the Sydney Basin](#) "
- Estimates of methane emissions from satellite data were compiled from the research paper by P. Sadavarte et al., 2021 "[Methane Emissions from Super-emitting Coal Mines in Australia quantified using TROPOMI Satellite Observations](#)".
- Other satellite data was gathered from estimates of methane emissions fluxes of plumes detected in Australia by Carbon Mapper. The methane emissions detected are assumed to be constant, and calculated as yearly emissions.

Methane emission estimates were compared against best estimates for annual coal production and depth of coal per mine. Coal production and depth were determined through Annual Reports, EIS estimates and company websites.

Coal methane intensity of Whitehaven coal mines

Calculations of methane intensity of Whitehavens coal mines is based on data from Annual reports and EIS documents. When not specified, methane was assumed to be 100% of fugitive emissions.

Global Energy Monitor Estimates

Global Energy Monitor employs its Global Coal Mine Tracker to estimate methane emissions at individual mine levels worldwide, aggregating the data on national and global scales. The tracker monitors operational coal mines producing 1 million tonnes or more per year, and smaller operations with available data, providing baseline estimates for coal mine methane emissions. These estimates utilise mine-level activity data, such as production, operating depth, methane content at depth, and emissions factors, following the peer-reviewed Model for Calculating Coal Mine Methane (MC2M) methodology. In cases where precise coal rank and depth data is lacking, supplemental estimates are included for underground and surface operations.

Werris Creek Closure

The projections in this report are based on Whitehaven's formalised projection updates, Environmental Impact Statements and Mining Licences. For Werris Creek mine, there is a potential for the mine's [reserves](#) to be [fully extracted](#) by the end of 2024, however Whitehaven has not announced the mine's early closure, or cancelled their mining licence. We note that if the production at Werris Creek ceases in 2024, the projected emissions would decrease by 5,357 tonnes of methane per year from 2025 to 2032. This would not impact the other outcomes within this report.

Acknowledgements

Annika Reynolds played a critical role in developing policy elements of this report. Eleanor Whittle, Rini Sucahyo and Ye Yuan all played key roles in editing and improving this work. Chelsea Bruce-lockhart and Reynaldo Dizon developed and refined all of the data visualisations.

Header image

Whitehaven's Narrabri underground coal mine, western New South Wales, Australia.

Credit: Alamy Stock Photo

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