Whitehaven coal mine approval jeopardises UK's international commitments

Analysis by Ember reveals that Cumbria's new coal mine will emit fifteen times more methane than estimated by the developer, because they underestimated the methane risk and overstated the potential for methane mitigation.

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Lead author: Anatoli Launay-Sirmov, CFA

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About

This report takes methane emissions and mitigation assumptions from the West Cumbria Mining Limited's (WCML) application for the Whitehaven coal mine and compares them with UK and international benchmarks for similar coal mines.

Executive Summary

Whitehaven coal mine approval jeopardises UK's Methane Pledge

In 2021, the United Kingdom alongside 100 countries signed the Global Methane Pledge, committing to reduce global methane emissions by 30% this decade. Just over a year later, it approved the UK's first underground mine in over 30 years.

Ember has analysed various documents regarding the Whitehaven coal mine in Cumbria ("Cumbria Mine"), proposed by West Cumbria Mining Limited ("WCML") focussing on its methane emissions and mitigation strategy. We are concerned that Cumbria mine's forecasted methane emissions are substantially lower than what one would expect from a mine of this depth. We also believe that the mine's methane mitigation levels are overstated compared to what is technologically feasible.

The approval endangers the United Kingdom's commitments under the Global Methane Pledge and other international climate change agreements.

01 Expected methane content understated by 3.5x

In assessing the mine's methane content, the Inspector used the developer's estimates rather than the standard Emission Factors provided by UK's National Atmospheric Emissions Inventory (NAEI) for underground coal mines. The International Panel on Climate Change (IPCC) states that these should be used for estimating mine methane emissions unless actual measurements are possible. The developer's estimates are substantially lower than the NAEI emission factors and this leads to a 3.5x understatement of unmitigated emissions over the mine's lifetime.

02 Methane mitigation potential substantially overstated

WCML's application states that it will destroy over 95 per cent of coal mine methane produced by the Cumbria mine. However, the IEA's analysis on methane abatement shows that a figure of 69 per cent is realistic for an underground coking coal mine.

03 Total methane impact 15x greater

The WCML's estimates for lifetime methane emissions are 15x lower than the expected emissions calculated using the official NAEI emission factors and the IEA's assumptions on the viability of methane mitigation.

Cumbria will be the first underground coal mine in the UK approved in over a generation. It is critical that in assessing its methane impacts, internationally approved methodologies are used to estimate mine's methane emissions, with detailed mitigation plans. Failure to do so would be incompatible with the Methane Pledge.

Anatoli Launay-Smirnov, CFA
Coal Mine Methane analyst, Ember

Background

The UK commits to a coal mine at the same time as signing the Global Methane Pledge

"An immediate and significant change in the pace and scale of methane action is needed to achieve reductions consistent with international climate objectives"
IEA Global Methane Tracker 2023

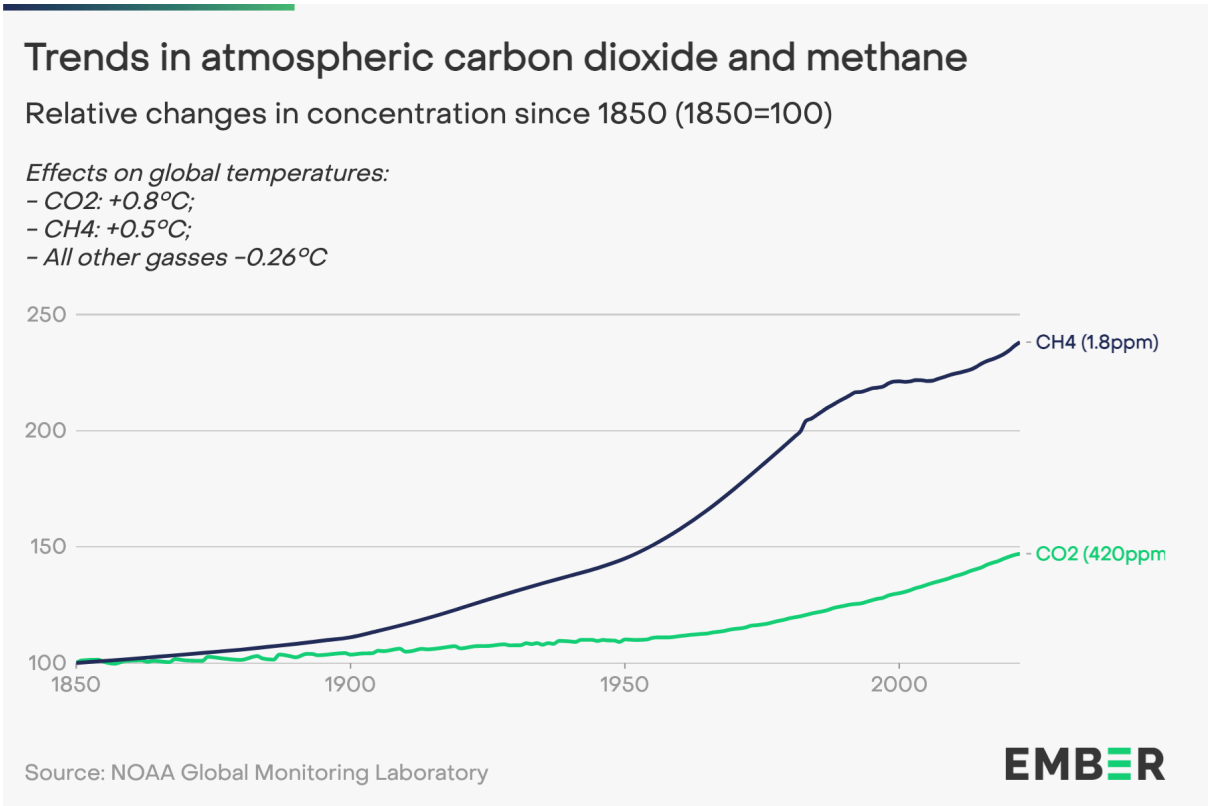
The UK's plans for a new coal mine in Cumbria
On December 7th 2022, the Department for Levelling Up, Housing and Communities approved the Whitehaven mine in Cumbria, making it the first underground coal mine approved in the UK for the past 30 years, developed by West Cumbria Mining Limited (WCML).

The mine will produce metallurgical ("coking") coal for use in the steel industry. Coking coal is characterised by high methane content and Ember's recent analysis showed that it increases the overall climate damage of global steel production by 27 per cent.

If unmitigated, Cumbria mine's methane emissions will lead to the United Kingdom failing to honour its promise under the Global Methane Pledge, yet there is a concerning lack of clarity regarding the mine's methane mitigation plans.

Methane's importance
Methane (CH_4) is a powerful greenhouse gas with more than 80 times more global warming potential than carbon dioxide when compared over 20 years. Atmospheric methane concentrations have more than doubled since the start of the industrial revolution, largely caused by emissions from the agriculture, energy and waste sectors.

The International Panel on Climate Change (IPCC) estimates that methane has substantially contributed to the climate crisis, causing 0.5 degrees of the 1 degree global temperature rise seen to date, making it slightly behind carbon dioxide in terms of its importance to climate change.



On current estimates, global coal mines' impact on climate change is higher than all of the EU's CO2 emissions combined and even that figure is likely to be an underestimate.

According to the IEA's Net Zero by 2050 Analysis, a Roadmap for the Energy Sector, global coal mine methane emissions would need to decrease by 75 per cent by 2030, which is to be achieved by a combination of rapidly reducing coal consumption, closing the gassiest mines and mitigating emissions from existing mines. The roadmap states that no new coal mines or expansions should be approved beyond 2021.

United Kingdom's obligations

The UK has positioned itself as one of the leaders in the fight against global methane emissions. At COP26 in Glasgow, the UK government alongside 100 other countries signed the Methane Pledge, promising to work together to reduce methane emissions by at least 30% from 2020 levels by 2030, thereby eliminating over 0.2˚C of warming by 2050.

In addition, the UK has signed the Joint Declaration from Energy Importers and Exporters on Reducing Greenhouse Gas Emissions from Fossil Fuels, where the signatories committed to take *"immediate action to reduce the greenhouse gas emissions associated with fossil energy production and consumption, particularly to reduce methane emissions"*.

Underestimation of emissions

Cumbria's coal mine will emit three times more methane than estimated

Using official UK emissions factors, the Cumbria coal mine would generate 21 cubic metres of methane per tonne of coal produced. In contrast, WCML provided estimates of 3-7 cubic metres.

West Cumbria Mining Limited's emissions were described in the Ecolyse 2 Report. It says that the mine expects to emit between 3-7 cubic metres of methane per tonne of coal mined. The mine also said that it is based on core samples taken at depths of 400-540m.

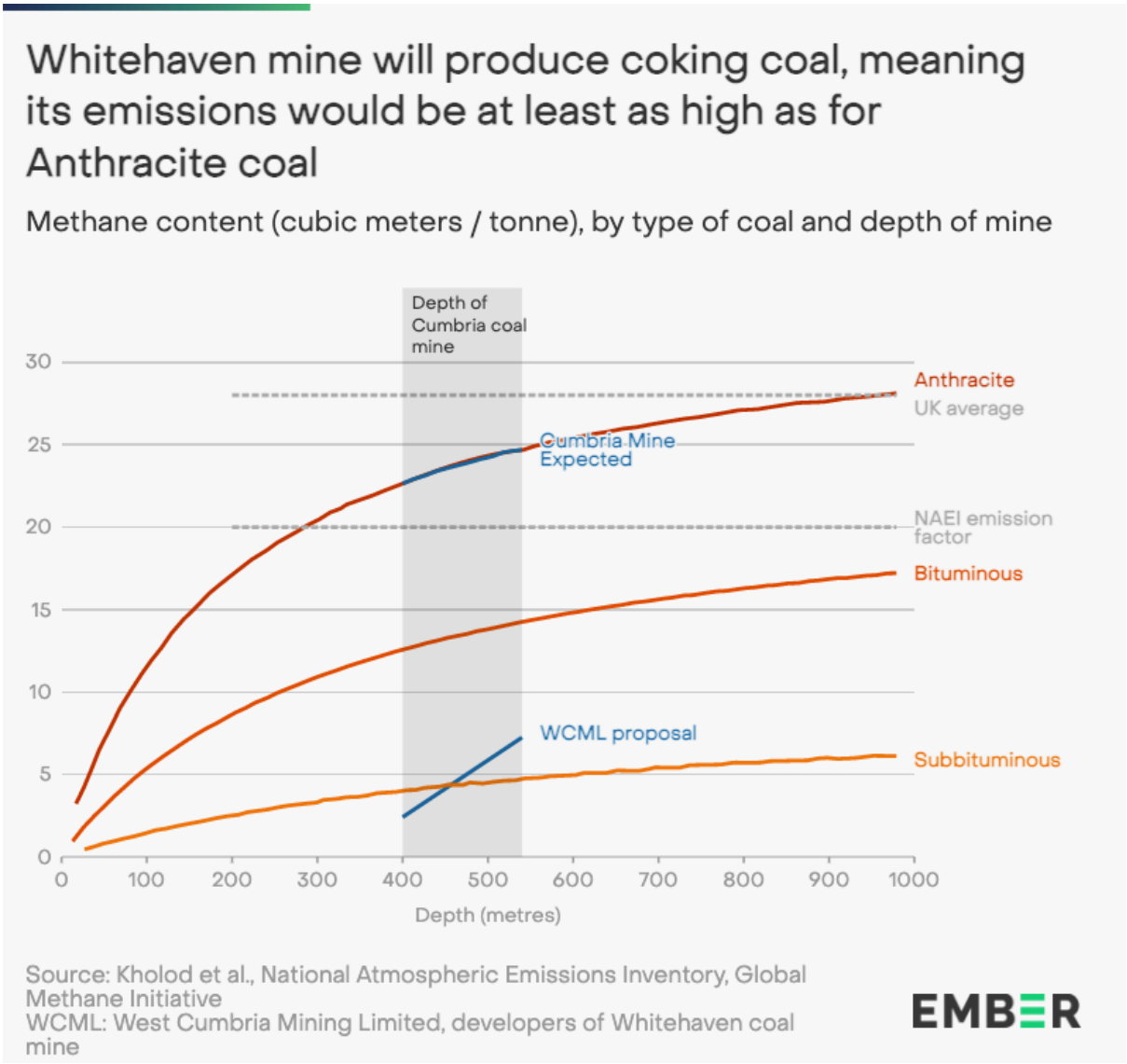
When compared against UK and international measurements of methane emissions from similar mines, West Cumbria's estimate is surprisingly low.

Coal Grade

The first point to note is that Cumbria mine produces coking coal, which is on average twice as gassy as thermal coal. Coking coal constitutes 13% of global coal supply, whilst emitting 25% of global CMM emissions.

A 2019 study by Kholod et. al plotted the correlation between methane emissions, mining depth and type of coal ("Anthracite", "Bituminous" and "Subbituminous"). Anthracite is the highest quality coal used in electricity generation and subbituminous being very low quality ("brown") coal, used in electricity generation. The study showed that higher quality coal has far higher gas content than lower quality coal.

Based on Cumbria's mining depth and coal grade, data indicates that the methane content will be at least the level of the highest quality thermal coal, Anthracite, but likely even more as coking coal is often gassier.



National Emission Factors

The UK average methane content of coal in 2000 was 28 cubic metres of methane per tonne of coal produced. This was calculated by taking the UK's methane 2000 emissions estimated by GMI and dividing it by annual underground coal production in that year.

Finally, the emission factor from the National Atmospheric Emissions Inventory (NAEI), which is the UK's official estimate of emissions associated with underground coal mines, states that for each tonne of coal mined an underground coal mine in the UK would emit 13

kilograms of methane emissions as well as 1.2 kilograms of post-mining methane emissions, totalling 21 cubic metres of methane emissions per tonne of coal.

Which number to use?

The comparison of different benchmarks show that the numbers proposed by WCML are very low and must be treated with caution. WCML makes estimates from the methane content of coal core samples from the mine, but that does not take into account all the methane emissions associated with coal mining, as the mining process also disturbs methane holding strata adjacent to the mined seam.

Research by Kholod et al. suggests that coal methane content derived from core samples should be multiplied by an emission factor to account for this discrepancy. They state that globally this number is on average 1.7, but with huge uncertainties and discrepancies, which increase with mining depths (ibid.). For this reason, we do not believe that it is appropriate to use WCML's methodologies for measuring gas content.

The IPCC guidelines for estimating coal mine methane emissions recommend the use of regional emission factors unless actual mine measurements are possible. This approach is mirrored in the UK government's guidance for evaluating greenhouse gas emissions from new projects, which also call for the use of emission factors that are supplied by the National Atmospheric Emissions Inventory (NAEI).

The NAEI emission factor is much more in line with what we would expect from a mine of Cumbria's depth and we therefore believe that the number that should have been used to evaluate the Cumbria proposal.

Using the NAEI number means that if unmitigated, the mine would emit 3.5x more over its lifetime than what is assumed by WCML.

Overestimation of mitigation

Mine's mitigation volumes are unrealistic

WCML's application states that it will destroy over 95 per cent of coal mine methane produced by the Cumbria mine. However, the International Energy Agency's assessment is that only 69% mitigation would be expected from the mine.

Mitigation's Importance

Considering the mine's expected gassiness, it is important that WCML has a robust plan for mitigating these emissions.

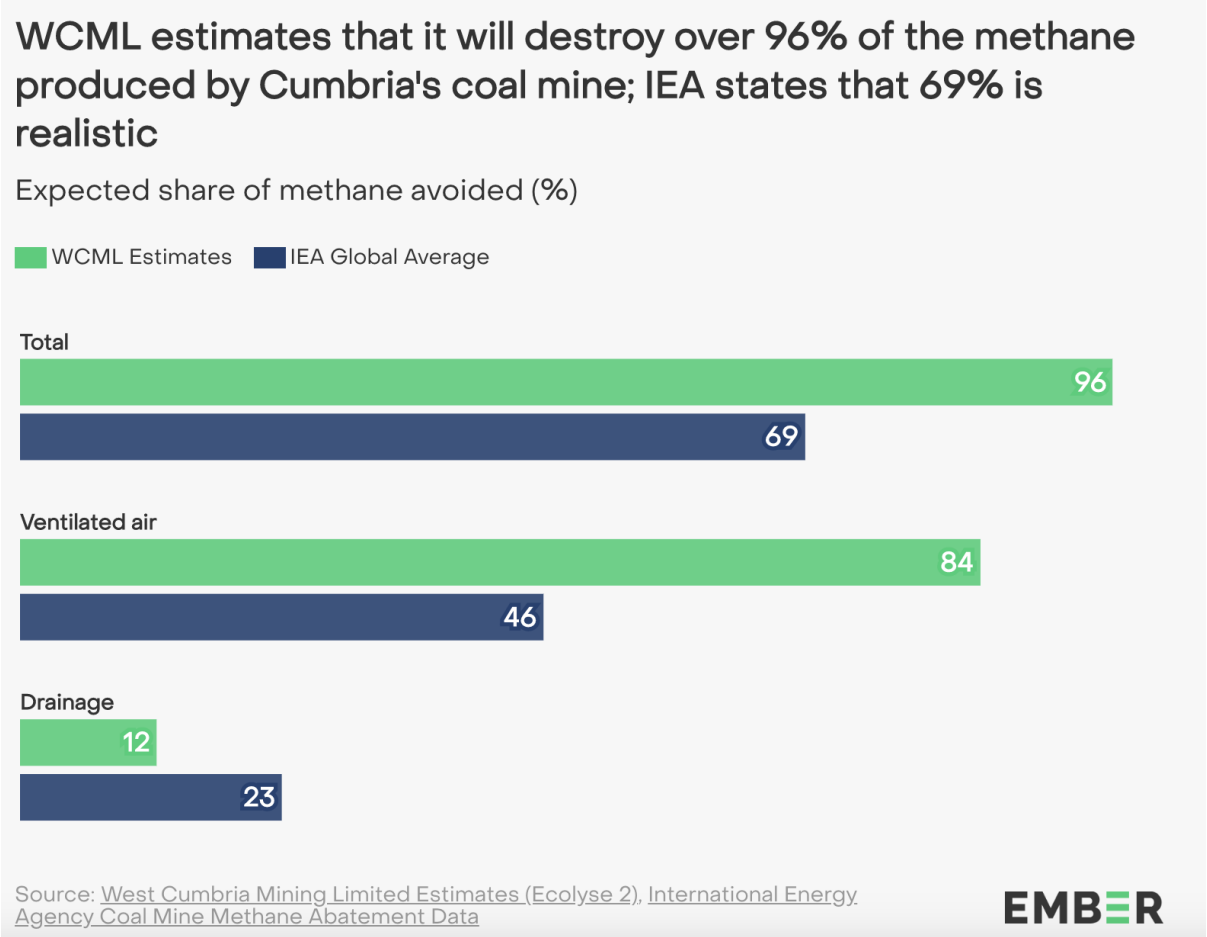
A condition of Cumbria starting operations is that it submits a methane Mine Gas Capture Management Scheme to the Mineral Planning Authority, who must review and approve it (*Planning Condition 61 - Mine Gas Capture*). The scheme must identify the methods for capture and management of methane (and other mine gases) and that once installed, the gas management systems must extract at least 95% of the total methane produced from the mine during any calendar month.

In their Application, WCML estimated that it will in fact capture and destroy 96% of methane produced by the mine, with 84% from destroying methane in ventilation air (VAM) and 12% from drainage.

Mitigation Concerns

Ember has major concerns regarding the mitigation plans for the Cumbria mine. Having read through various documents, proofs of evidence from WCML and experts promoting and opposing the mine, it is clear that during the application process, WCML changed its mitigation plans on several occasions and it requires forensic analysis to understand their thinking and calculations.

We cross referenced WCML estimates with the IEA's recently published data of methane abatement potential for coal mines. The IEA estimate that an average underground coking coal mine can mitigate 69% of its emissions, from a combination of drainage and VAM mitigation.



Cumbria's proposal is far above what is expected from such a coal mine, particularly regarding its expectations that it will mitigate 95 per cent of the methane that enters its ventilation systems.

Concerns about the technology

Evidence from documentation indicates that the Inspector did not understand the technologies proposed by the mine. In his decision, he said 95% of the methane would be drained:

> *"95% of the methane generated by the mining operations and underground crushing processes would be captured by the methane drainage system. This methane would be drawn out of the mine in a system of integrated pipes into methane pumps and into the methane plant located on the surface."*

This shows a misunderstanding of the scheme, as the mine documentation states that it would drain and utilise just 12 percent of the methane, with the remainder coming through VAM destruction.

VAM destruction involves a totally different technology, that is technically proven but is rarely seen in real world operations due to its cost. Renewable Thermal Oxidisers are highly niche technologies, with only four mines globally known to operate them. Three of the mines are in China and one in the United States.

In their Proof of Evidence, WCML referred to a US based project, showing generalised brochures. The project operated since 2014 and WCML states in their proof of evidence that as of December 31 2017 the project had registered 1,045,923 tCO2e in emission reductions.

There is no public data available for the three VAM destruction projects in China, but the US based project, Marshall Mine, reports its methane emissions. In the period of 2014 when it installed the VAM destruction equipment until end of 2017, it has emitted over 8 million tonnes of CO2 equivalent of methane, meaning it only destroyed 12% of the methane it emitted.

We cannot comment on the viability of the methane mitigation plans, as they are lacking detail. Therefore, it is important that the Mine Gas Mitigation Plan has much more detail about the proposed measures to destroy methane emissions.

It must at the very least include:

- Detailed geological analysis, demonstrating the basis of mine's methane emissions forecasts;
- Modelled hourly gas flows from the mining process;
- Detailed information about VAM oxidation technology used, including its manufacturer, footprint, technical characteristics, safety and impacts on the local environment.

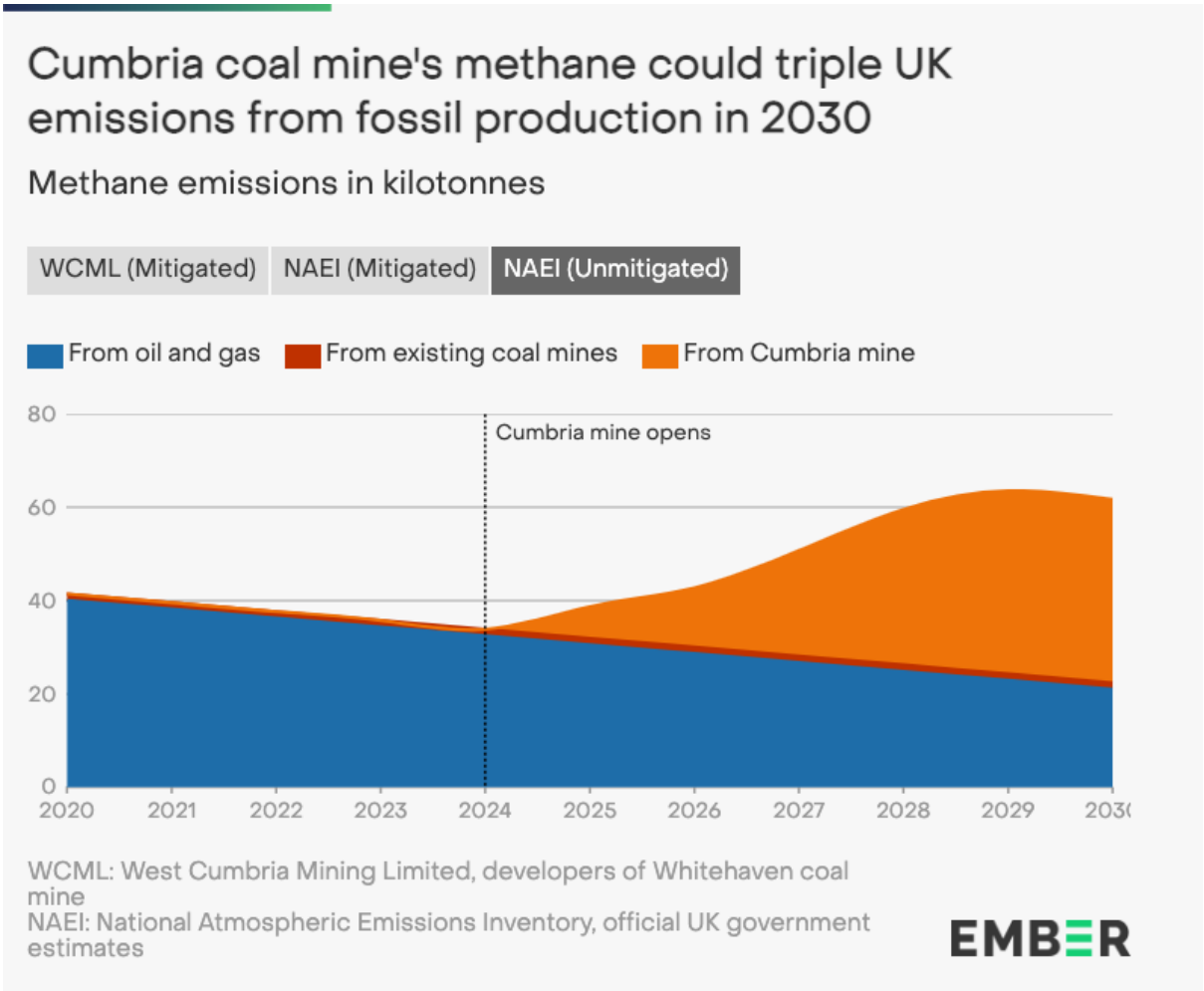
It must also be put into the public domain, with experts being invited to scrutinise it.

Total methane impact

Total methane impact 15x greater

More emissions and less mitigation means the Cumbria mine's methane impact will be 15x greater than suggested.

Taken together, the mine's methane content and the fact that it is only expected to mitigate 69 per cent of methane emitted by the mine, mean that the mine is likely to emit 15x more methane over its lifetime than what WCML estimates, adding almost 40% to UK's methane emissions from the production of oil, gas and coal in 2030. The figure will rise to 41x if the mine does not implement any mitigation plan.



Based on WCML's estimates the impact on UK methane emissions in 2030 would be just 0.3 kilotonnes compared to a total of 22 kilotonnes of methane from other sources.

Based on Ember calculations using the official NAEI emission factor and IEA's mitigation estimates, the mine would produce 12 kilotonnes in 2030, more than half the emissions from other sources. If the Cumbria mine fails to implement any mitigation, it risks producing 39 kilotonnes of methane in 2030, almost tripling the UK's total methane emissions from oil, gas and coal production in 2030.

If taken over the mine's lifetime, the differences become substantial. WCML's estimates for mitigated lifetime emissions total 22 kilotonnes of methane, whilst using Ember calculations the number would be 334 kilotonnes, rising to 901 kilotonnes if unmitigated.

Supporting Materials

Acknowledgements

Cover image

Train transports coal in Greenholme, Cumbria.

Credit: Avalon/Construction Photography / Alamy Stock Photo

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