



Submission to the Lake Vermont Meadowbrook Extension EIS

Analysis of the methane emissions and onsite mitigation opportunities generated by the Lake Vermont Meadowbrook Extension Project, and our recommendations for more accurate emissions estimates and onsite methane mitigation.

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About Ember

Ember is an independent, not-for-profit energy think tank that aims to shift the world to clean electricity using data. It gathers, curates and analyses data on the global power sector and its impact on the climate, using cutting edge technologies and making data and research as open as possible. It uses data-driven insights to shift the conversation towards high impact policies and empower other advocates to do the same. Founded in 2008 as Sandbag, it formerly focused on analysing, monitoring and reforming the EU carbon market, before rebranding as Ember in 2020. Its team of energy sector analysts are based in Australia, the EU and the UK.

Acknowledgement of Country

Ember acknowledges the Traditional Custodians of the many nations across Australia and their enduring connection to Country and the lands, seas and skies. We pay our respects to Elders past and present and extend that respect to all Indigenous Peoples today.

Executive Summary

Ember welcomes the opportunity to make a submission to the Chief Executive, Queensland Department of Environment and Science (the Department), in regards to the Proposed Lake Vermont Meadowbrook Project (the Lake Vermont Extension) prepared by Bowen Basin Coal Pty Ltd (the proponent). The Lake Vermont Extension will increase the production from the Lake Vermont mine for 20 years, resulting in the mine's eventual closure and rehabilitation from 2055. The project contemplates both underground and open cut operations, [producing](#) coking coal products (~87% of output) and thermal coal products (~13% of output).

Ember's submission is solely in relation to the greenhouse gas emissions estimates provided in the Lake Vermont Meadowbrook Extensions Environmental Impact Statement (EIS), specifically Chapter 13 - Air Quality (Chapter 13) and the Appendix L - Air Quality and Greenhouse Gas Assessment (the Greenhouse Gas Assessment).

We are concerned that the climate impacts of the methane emissions from Lake Vermont have not been adequately estimated or assessed in the EIS. Our analysis has found that:

- **Methane emissions from the Lake Vermont Extension and existing mine are likely to be more than double EIS estimates.** This would result in lifetime emissions of up to 100 million tonnes of CO₂-e (20 year GWP), the equivalent to Australia's total reported annual coal mine methane emissions; and
- **The proponent has not credibly attempted to estimate the likely methane emissions or mitigation opportunities from the project.** It has not demonstrated global best practice and transparent methane emissions modelling and measurement, or committed to a credible methane mitigation plan.

Based upon the inadequate methane pollution estimates and lack of onsite mitigation, Ember advises against approving the Lake Vermont Extension. The project does not currently demonstrate integrity in the estimation, or management of methane emissions.

Ember **recommends** the following:

- 1 The Lake Vermont Extension should not be approved because the current methane emissions estimates contained in the EIS do not adhere to best practice methods for estimating coal mine methane emissions and are highly likely to be significant

under-estimates. The regulator should, at a minimum, request further information from the proponent in accordance with s 56A of the *Environmental Protection Act 1994* (Qld).

- 2 The proponent be required to submit new estimates of the methane emissions of the Lake Vermont Extension project (pursuant to s 56AA of the *Environmental Protection Act 1994* (Qld)), based upon the following:
 - Measurements of geotechnical cores to establish the methane content across all the gas bearing strata, combined with field coal gas models, to derive a site-specific emission factor for the proposed open cut operations, which are verified by an independent body. From this modelling, the proponent should then estimate the likely emissions from the proposed open cut mining operations; and
 - Conducting sample measurements and modelling to inform methane emissions estimates for the proposed underground coal mining operations, which are verified by an independent body. The sampling method, results and modelling should be explicitly described in the resubmitted EIS.
- 3 If the Lake Vermont Extension is approved, the following environmental approval conditions should be imposed:
 - Prior to the commencement of the action, the environmental authority holder shall commission an independent and qualified third party to undertake a feasibility study into methane pre-drainage for all proposed open cut operations;
 - Prior to the commencement of the action, the environmental authority holder shall commission an independent and qualified third party to undertake a feasibility study into methane drainage and ventilation air methane abatement measures for all proposed underground for all proposed underground operations;
 - Prior to the commencement of the action, the environmental authority holder shall incorporate the above two feasibility studies into a **Methane Emissions Mitigation Plan** that must include:
 1. Detailed modelling of the likely underground and open cut coal mine emissions generated by the action; and

2. Include measures to manage and destroy pre-drainage and post-drainage methane and mitigate ventilation air methane emissions;
- Prior to commencement of the action, the Methane Emissions Mitigation Plan in its entirety must be verified by an independent and qualified third party, who did not undertake the feasibility studies; and
 - The environmental authority holder shall not vent drainage methane. All drainage methane gas must be captured and destroyed or utilised, and any flaring of methane gas must be at an efficiency rating of at least 98%.

1. Estimated Methane Emissions

1.1 Estimated Methane Emissions Provided in the Lake Vermont Extension EIS

The final [Terms of Reference for the Lake Vermont Extension project](#) require the proponent to provide an inventory of annual emissions, expressed in CO₂-e terms, using the methods set out in the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (NGERS Determination) and the *National Greenhouse Energy Report Technical Guidelines*.

In Chapter 13 and the Greenhouse Gas Assessment the proponent appears to have relied upon Method 1 of the NGERS Determination (pursuant to s 3.20) to calculate the estimated methane emissions of the open cut mine operations proposed in the Lake Vermont Extension project. The proponent has not, however, described how it estimated its methane emissions from the proposed underground operations, which account for 97% of the methane emissions emitted by the Lake Vermont Extension.

Chapter 13 provides that:

- the methane emissions generated by the Lake Vermont Extension over the life of those operations have been estimated by the proponent to be 10,386,080 tonnes of CO₂-e emissions (approximately 92% of the total Scope 1 emissions); and
- the average annual methane emissions generated by those operations have been estimated by the proponent to be 280,705 tonnes of CO₂-e emissions per year.

Based on the EIS figures and Lake Vermont's current reported emissions to the Clean Energy Regulator, the methane emissions generated by the Lake Vermont mine and extension over the life of the mine are estimated by the proponent to be ~13 million tonnes of CO₂-e emissions.

However, Ember is concerned that these estimates rely upon outdated methods and inaccurate assumptions.

1.1.1 The State-based Emissions Factor for Open Cut Mines is Outdated

In 2023, the federal government proposed to update Method 1 such that the State-based emission factor for Queensland open cut coal mines increased from 0.023 to 0.031 tonnes of CO₂-e per tonne of coal. This is an [increase of 35%](#) in the estimated methane emissions from open cut coal mines in Queensland.

The EIS was prepared prior to these updates to the NGERs Determination, and it relies upon the outdated State-based emissions factor of 0.023 tonnes of CO₂-e per tonne of coal.

1.1.2 Inadequate information on the Estimate for Methane Emissions from the Underground Coal Operations

The Lake Vermont Extension project contemplates both open cut and underground coal mine operations, namely that the project will engage in underground operations for the first 23 years of operation and commence open-cut mining in year 20.

The proponent has not, however, described how it estimated the likely methane emissions from the proposed underground operations. This is a significant concern because underground coal extraction is in general, significantly **more** methane intensive than open cut operations, and will contribute to the majority of the project's total Scope 1 and Scope 2 emissions if approved.

1.1.3 It Is Unclear and Unlikely that the Estimates Account for the Likely Variable Methane Intensity of the Lake Vermont Extension

The methane intensity of coal extraction varies across time and is impacted by the mine's location, the depth of the seam being mined and weather conditions. Methane pollution will also emit from surrounding strata as the removal of overburden during open cut coal mine operations alters the [permeability of the coal seam](#).

The use of default methane emission factors for open cut coal mines do not take into account the variation in gas content between different coal seams, which means the uncertainty associated with estimates is very high, anywhere between [±50%, or a factor of two higher](#). Indeed, researchers [have shown](#) the wide variation in the methane intensity of coal in Australia; measurements from 10 open cut coal mines in Queensland showed certain mines have emission factors ~50 times higher than others.

The proponent should be required to conduct geotechnical cores to establish methane content across all the gas bearing strata combined with field coal gas models to estimate the methane emissions from the open cut and underground mining operations.

1.1.4 The 20 Year Climate Impact of the Lake Vermont Extension Should Considered

The NGERs Determination relies upon the global warming potential (GWP) of methane over 100 years to convert methane to CO₂-e terms. Methane's 100 GWP is 28, compared to CO₂.

However, methane is particularly potent in the first 20 years after it is emitted into the atmosphere. Methane's 20-year GWP is 82.9, compared to CO₂. Given Queensland, and Australia's, climate targets are to 2030 and 2050 (the next 10 to 30 years), the climate impacts of the Lake Vermont Extension should be considered and understood by reference to methane's 20-year GWP.

1.2 The Additional Impact of Likely Emissions Under-Estimation

Ember has calculated, to the extent possible, the likely methane emissions of the Lake Vermont Extension project to assess the likely under-estimation in the EIS. We recommend that the proponent be required to recalculate the likely Scope 1 (methane) emissions and climate impacts of the project.

1.2.1 Estimated Methane Emissions if the Updated State-Based Emissions Factor is Used

If the Lake Vermont Extension project proceeds to operation it will be required to report its methane emissions to the Clean Energy Regulator, and it will be obligated to use the updated State-based emissions factor of 0.031 tonnes of CO₂-e per tonne of coal to estimate the methane pollution from its open cut operations (see s 3.20 of the NGERs Determination, unless an alternative site-specific emissions factor is used). At a minimum the EIS should therefore be updated to reflect these updates to the NGERs Determination.

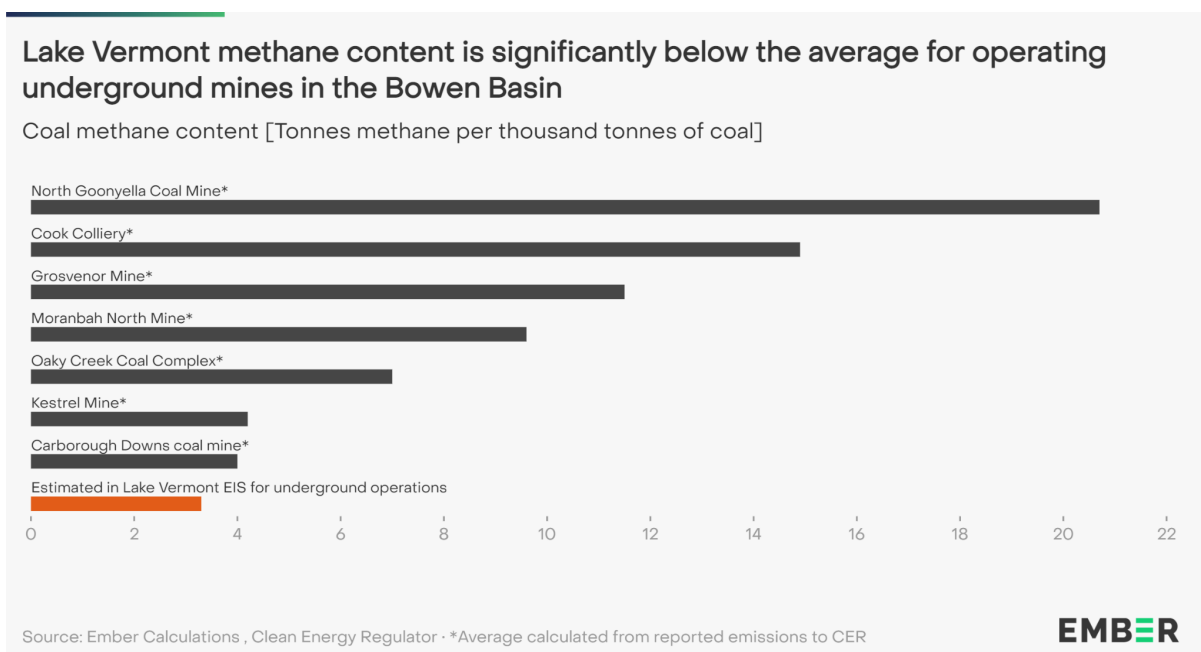
We calculate that if the updated State-based emissions factor is relied upon, then the open cut operations of the Lake Vermont Extension and existing operations will generate a total of 5 million tonnes of CO₂-e emissions over its lifetime. This is a 44% increase in the pollution generated by the open cut project than what was estimated in the EIS. If the short-term climate impact of methane is taken into account, Lake Vermont's open cut operations alone (current mine and open cut extension) will emit equivalent to 15 million tonnes of CO₂-e by 2055.

The actual methane pollution generated by the Lake Vermont Extension’s open cut operations may exceed these estimates. The proponent should be required to conduct geotechnical cores to establish methane content across all the gas bearing strata combined with field coal gas models to estimate the methane emissions from its open cut operations.

1.2.2 The EIS Estimates are Significantly Below All Other Operating Underground Coal Facilities in the Bowen Basin

From the data provided within the EIS, we calculated that the proponent is estimating that the underground mining operations proposed for the Lake Vermont Extension will emit total methane emissions equivalent to ~10 million tonnes of CO2-e over the 23 years of underground mine operation. During those 23 years, the underground operations will produce ~110 million tonnes of run-of-mine coal. The proponent has therefore estimated that the methane intensity of its underground operations will be an average of 3.3 tonnes of methane per thousand tonnes of coal.

This is a concerningly low estimate when compared to **every other** operating underground coal mine in the Bowen Basin. We calculate the average methane intensity of underground coal operations in the Bowen Basin as 10 tonnes of methane per thousand tonnes of coal without excluding outliers. As shown below:



1.2.3 Ember's Independent Assessment of the Likely Methane Methane Emissions from the Underground Operations of the Lake Vermont Extension Project

Our independent estimate of the likely methane intensity for underground operations of the Lake Vermont Extension is between 7-9 tonnes of methane per thousand tonnes of coal, resulting in estimated lifetime methane emissions of between 22 and 29 million tonnes of CO₂-e emissions (100 year GWP).

This estimate is based on a conservative average methane intensity from underground mining operations across the Bowen Basin, the depth of mining operations, and the total estimated underground coal production.

The average methane intensity of all operating underground coal operations in the Bowen Basin is 10 tonnes of methane per thousand tonnes of coal. Based on this average, the potential underground operations of the Lake Vermont Extension could emit up to **31 million tonnes of CO₂-e emissions (100 year GWP)** over its lifetime.

These estimates are reconcilable with the methane content estimated by the [Global Energy Monitor](#) (GEM) for the Lake Vermont Extension proposed underground operations. GEM modelling, which relies upon the location of the mine (Bowen Basin, Queensland) and the [depth](#) (which the EIS estimates as between 250-500 m for underground operations), indicates that the likely methane intensity of the Lake Vermont Extension proposed underground operations is 9 tonnes of methane per thousand tonnes of coal. Based on GEM's analysis, we calculate that the underground operations of the Lake Vermont Extension could emit up to an estimated **29 million tonnes of CO₂-e emissions (100 year GWP)** over its lifetime.

However, we note that the reported methane emissions of all operating underground coal mines in the Bowen Basin contains two statistical outliers - North Goonyella Coal Mine and Cook Colliery. As such, Ember discounts the upper limit of the methane intensity range calculated using the average methane intensity of underground coal operations in the Bowen Basin without excluding outliers (10 tonnes of methane per thousand tonnes of coal).

If the outliers are excluded, the average methane intensity of underground coal operations in the Bowen Basin would be 7 tonnes of methane per thousand tonnes of coal.

Based upon this revised average emissions intensity, we estimate that the lower range of methane emissions from underground operations of the Lake Vermont Extension could emit **22 million tonnes of CO₂-e emissions (100 year GWP)** over its lifetime.

Our modelling and independent calculations indicate that the methane intensity of the underground operations contemplated by the Lake Vermont Extension are more likely to be within the range of 7 to 9 tonnes of methane per thousand tonnes of coal. This would result in lifetime methane emissions of between 22 and 29 million tonnes of CO₂-e emissions (100 year GWP). These estimates are between 2.2 and 2.9 times higher than the estimates provided by the proponent in the EIS.

The proponent should be required to conduct, and publicly report on, on-site measurement and modelling to estimate the methane emissions of its underground operations.

1.2.4 Climate Impact of the Lake Vermont Extension Project Over the Next 20 Years

Given Queensland, and Australia’s, climate targets are to 2030 and 2050 (the next 10 to 30 years), the climate impacts of the Lake Vermont Extension project should also be considered and understood by reference to methane’s 20-year GWP.

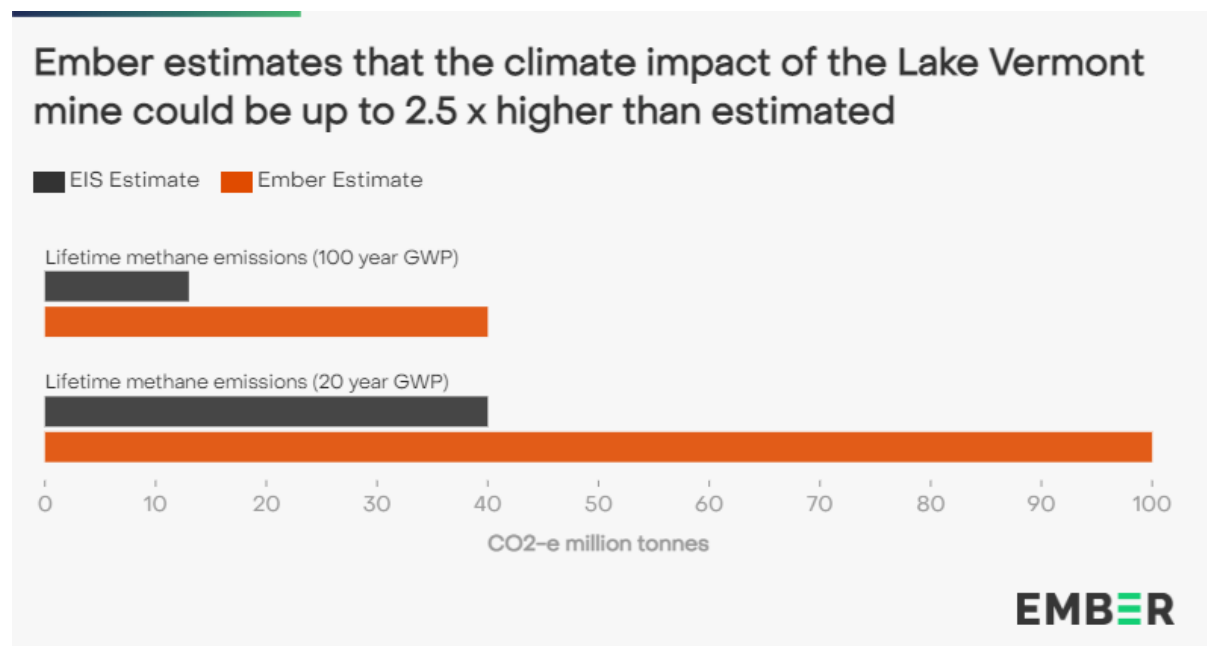
Ember calculates that the climate impact of the methane pollution from the current Lake Vermont mine operations and proposed Extension (including open cut and underground operations) as:

Method	Methane emissions over lifetime of current and extension mine (100 year GWP) [CO2-e]	Methane emissions over lifetime of mine current and extension mine (20 year GWP) [CO2-e]
Estimated methane emissions from the EIS	13 million tonnes	40 million tonnes
Estimated methane emissions from the EIS, if updated State-based emissions factor is used (0.031 tonnes of CO2-e per tonne of coal)	15 million tonnes	44 million tonnes (10% increase)
Ember’s independent analysis, using updated State-based emissions factor and calculating underground emissions from the Bowen Basin average, excluding outliers	27 million tonnes	78 million tonnes (2 x increase)
Ember’s independent analysis, using updated State-based emissions factor and calculating underground emissions from the GEM modelling	34 million tonnes	100 million tonnes (2.5 x increase)
Ember’s independent analysis, using updated State-based emissions factor and calculating underground emissions from the Bowen Basin average, including outliers	46 million tonnes	105 million tonnes

As stated in the previous section, Ember discounts the upper limit of the methane intensity range calculated above, namely, the average methane intensity of underground coal operations in the Bowen Basin without excluding outliers (resulting in an estimate of 105 million tonnes of CO2-e using a 20 year GWP).

Therefore, over the next 20-30 years (2026-2055), we estimate that the Lake Vermont Extension and existing mine will emit up to between 78-100 million tonnes of CO2-e emissions (20 year GWP), which is equivalent to the annual CO2 emissions of Belgium.

This is a conservative estimate based only on the updated State-based emissions factor for Lake Vermont Extension’s proposed open cut estimates and the average likely methane intensity of the proposed underground operations. On-site measurement and modelling is necessary to more accurately determine the likely emissions from the open cut and underground operations proposed, and may increase the estimated methane emissions.



This pollution will make it **more difficult** for Australian and Queensland governments to achieve their respective climate targets of 43% and 30% greenhouse gas emissions reduction on 2005 levels by 2030, and net zero emissions by 2050.

The Lake Vermont Extension, if approved, would also undermine the federal government’s safeguard mechanism and impact whether the hard cap on that scheme is exceeded by 2030. The existing Lake Vermont mine is currently regulated under the safeguard mechanism and obligated to comply with a baseline of 394,117 tonnes of CO2-e per year. In 2021-2022, the Lake Vermont mine [reported](#) Scope 1 emissions of 369,934 tonnes of CO2-e.

According to the EIS, the Lake Vermont Extension would result in increases to that facility's Scope 1 emissions, leading to average annual Scope 1 emissions of 552,778 tonnes of CO₂-e per annum. This is 1.4 times higher than the current baseline. Ember's analysis further indicates that the estimate provided by the proponent of the methane intensity of the Lake Vermont Extension is an under-estimate, increasing the likelihood that the project will exceed its current baseline going forwards.

If the Lake Vermont Extension was approved, the proponent would either need to negotiate for a higher baseline under the safeguard mechanism or surrender a significant number of Australian Carbon Credit Units to remain compliant with its obligations. In any event, the Lake Vermont Extension would increase the total emissions regulated under the safeguard mechanism and impact whether the safeguard mechanism drives genuine emissions reduction to 2030 and beyond.

1.2.5 Ember's Recommendation

We **recommend** that the Lake Vermont Extension should not be approved because the current methane emissions estimates contained in the EIS do not adhere to best practice methods for estimating coal mine methane emissions and are highly likely to be significant under-estimates. The proponent does not appear to have conducted any on-site methane measurement or modelling, and its estimated methane emissions are significantly below all other operating mines and studies of the Bowen Basin.

The regulator should, at a minimum, request further information from the proponent in accordance with s 56A of the *Environmental Protection Act 1994* (Qld).

We **recommend** that the proponent be required to submit new estimates of the Scope 1 (methane) emissions of the Lake Vermont Extension project (pursuant to s 56AA of the *Environmental Protection Act 1994* (Qld)), based upon the following:

- Measurements of geotechnical cores to establish the methane content across all the gas bearing strata, combined with field coal gas models, to derive a site-specific emission factor for the proposed open cut operations, which are verified by an independent body. From this modelling, the proponent should then estimate the likely emissions from the proposed open cut mining operations; and
- Conducting sample measurements and modelling to inform methane emissions estimates for the proposed underground coal mining operations, which are verified by an independent body. The sampling method, results and modelling should be explicitly described in the resubmitted EIS.

2. Onsite Methane Mitigation

2.1 The Limited Methane Mitigation Proposed in the EIS

The proponent intends to implement the following measures to mitigate and manage its Scope 1 greenhouse gas emissions, including the methane pollution generated by coal extraction (see 4.7 of the Greenhouse Gas Assessment):

- regular maintenance of plant and equipment, and staff training, to minimise emissions;
- regular assessment and review of potential greenhouse gas emissions reduction opportunities; and
- the flaring of waste coal gas as part of gas drainage activities, "**where practicable**", to reduce equivalent CO₂ emissions.

As a result, the proponent provides no greenhouse gas emission or methane specific conditions in Chapter 23 Proposed Environmental Authority Conditions of the EIS.

Ember urges the Department to impose more ambitious onsite methane mitigation conditions that reflect the technical and economic feasibility of reducing up to [~80% of the methane emissions](#) from the Lake Vermont Extension, especially from the underground operations of the project over the first 20 years of the Extension's lifetime.

2.2 Feasible Onsite Methane Mitigation Opportunities and Conditions

The Lake Vermont Extension should not be approved without extensive methane mitigation measures being implemented across both the proposed open cut and underground coal mine operations.

The proponent has not considered pre-drainage from its open cut operations which could, according to Queensland Department of Resources estimates, reduce the methane emissions from its open cut coal mine operations by ~35%. The proponent has also not specified the efficiency and manner in which it will deal with its drainage gas and ventilation air methane emissions from underground operations, despite those underground operations representing the largest portion of Scope 1 emissions over the lifetime of Lake Vermont.

2.2.1 The Feasibility of Extensive Pre-Drainage for the Proposed Open Cut Coal Operations

It is technically and economically feasible for the proponent to mitigate fugitive methane emissions generated from its open cut operations through pre-drainage. [The Queensland Department of Resources](#) determined from a study of coal mines in the Bowen Basin, that on average 35% of methane emissions from open cut coal mine operations can be reduced or eliminated through pre-drainage.

The proponent should be required to conduct a feasibility study, undertaken by an independent third party, into the opportunities for pre-drainage at the current and proposed Lake Vermont open cut operations. We estimate, relying upon the Queensland Department of Resources study, that the proponent could reduce the total methane emissions from all its open cut operations by 63 thousand tonnes of methane, or more than 5 million tonnes of CO₂-e emissions (20 year GWP).

2.2.2 The Feasibility of Drainage and Ventilation Air Methane Abatement for the Proposed Underground Coal Operations

According to the EIS and our independent analysis, the fugitive methane emissions from the Lake Vermont Extension's underground operations will be the largest source of Scope 1 emissions over the lifetime of the mine and across all mine operations. Despite this, there

are **critical gaps** in the EIS and inadequate information from the proponent on how it will manage its methane emissions from the underground mine.

There are [technically and economically feasible mitigation measures](#) that the proponent should be required to investigate and implement as part of the Lake Vermont Extension environmental approval conditions, should it be approved. If surface-to-inseam (SIS) pre-drainage and ventilation air methane (VAM) abatement measures are appropriately deployed, the proponent could mitigate up to 60-80% of its underground coal mine methane emissions (relying upon International Energy Agency [estimates](#)).

The EIS [states](#), in respect of SIS pre-drainage, the following:

Once the gas has flowed through the control and monitoring equipment, it can be piped to its final destination. This may be via several methods, such as venting, flaring or on-site power generation.

We strongly oppose the unabated venting of any methane from the underground operations of the Lake Vermont Extension. Venting represents unmitigated methane pollution into the atmosphere. At a minimum, all drainage methane should be flared with at least 98% efficiency, if it is not captured for utilisation. The proponent should therefore be required to provide a detailed plan for the utilisation and performance of pre- and post- methane drainage, specifying the drainage efficiency it aims to achieve.

The proponent should also be required to commission an independent feasibility study regarding onsite VAM abatement, capture and mitigation. VAM abatement technologies are a proven and cost-effective mitigation measure, [utilised](#) by underground coal mines globally over the last 25 years.

The Lake Vermont Extension should not be approved based upon the current proposed methane mitigation in the EIS. We estimate that the methane intensity of the Lake Vermont Extension underground operations, without credible mitigation, is currently between 7 and 9 tonnes of methane per thousand tonnes of coal. To comply with international best practice targets for the methane intensity of metallurgical coal production, the proponent must be able to provide a detailed and credible methane mitigation strategy that demonstrates the adoption of extensive methane mitigation technology and results in an average methane intensity of 3 tonnes of methane per thousand tonnes of coal (as [outlined](#) by UNEP as part of the Met Coal Methane Partnership).

2.2.3 Ember's Recommendation

As stated above, we **recommend** against the approval of the Lake Vermont Extension. The regulator should request further information from the proponent on the likely methane emissions and mitigation measures in accordance with s 56A of the *Environmental Protection Act 1994* (Qld).

We further **recommend**, should the Lake Vermont Extension be approved, that the following environmental approval conditions be imposed:

- Prior to the commencement of the action, the environmental authority holder shall commission an independent and qualified third party to undertake a feasibility study into methane pre-drainage for all proposed open cut operations;
- Prior to the commencement of the action, the environmental authority holder shall commission an independent and qualified third party to undertake a feasibility study into methane drainage and ventilation air methane abatement measures for all proposed underground for all proposed underground operations;
- Prior to the commencement of the action, the environmental authority holder shall incorporate the above two feasibility studies into a **Methane Emissions Mitigation Plan** that must include:
 3. Detailed modelling of the likely underground and open cut coal mine emissions generated by the action; and
 4. Include measures to manage and destroy pre-drainage and post-drainage methane and mitigate ventilation air methane emissions;
- Prior to commencement of the action, the Methane Emissions Mitigation Plan in its entirety must be verified by an independent and qualified third party, who did not undertake the feasibility studies; and
- The environmental authority holder shall not vent drainage methane. All drainage methane gas must be captured and destroyed or utilised, and any flaring of methane gas must be at an efficiency rating of at least 98%.

Supporting Information

Detail of inquiry

This submission was [made](#) to the Chief Executive, Queensland Department of Environment and Science, in regards to the [Proposed Lake Vermont Meadowbrook Project](#) prepared by Bowen Basin Coal Pty Ltd. The submission was pursuant to ss 51 and 52 of the *Environmental Protection Act 1994* (Qld) and s 45 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

Methodology

Conversion Factors

This submission is based on the GWPs contained in the IPCC's latest [emissions metrics](#), in order to express methane in CO₂-equivalent emissions. Throughout the report, where methane emissions data was reported in metres cubed it has been converted into methane emissions in tonnes using the [conversion factors](#) applied by the United States EPA.

Calculating the Estimated Methane Emissions from the EIS and Independently

This submission has calculated estimated methane emissions from the fugitive emissions estimated in tonnes CO₂-e by the proponent in the EIS. Methane emissions from the current Lake Vermont mine operations were estimated by using the reported run-of-mine coal production and the relevant State-based emissions factor, and calculations of the estimated underground methane emissions were derived from comparing the open cut mine emissions to the total estimated fugitive emissions provided in the EIS.

Our analysis on the average methane intensity of underground mines in the Bowen Basin is based on data reported to the Clean Energy Regulator in CO₂-equivalent emissions, averaged over the last five years (2016-2021). To convert to methane emissions, our analysis assumed that 90% of reported CO₂-e emissions from underground mines are fugitive methane.