EMBER
DATA INTO ACTION

Submission to Australia's National Greenhouse and Energy Reporting Scheme 2023 Proposed Amendments

Analysis of the inadequacies of relying upon State-based emissions factors for measuring Australian coal mine methane pollution and recommendations for direct measurement standards.

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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

Method 1 underestimates methane pollution from Queensland open cut coal mines and should be phased out. Instead, all coal facilities should be required to report direct measurements from a multi-input model.

Ember welcomes the opportunity to make a submission to the federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) on the 2023 proposed amendments to the National Greenhouse and Energy Reporting Scheme (NGERS). Ember's submission is solely in relation to the proposed update to Method 1 for estimating emissions of methane from Queensland open cut coal mines (Method 1).

While Method 1 is an improvement upon the historical emissions factor for Queensland, it is still wholly inadequate for estimating the methane pollution from Queensland open cut coal mines because:

- State-based emissions factors do not account for the variability of methane pollution from a coal mine; and
- State-based emissions factors disguise major pollution events and methane super emitters, undermining the integrity of NGERS and risking Australia's climate targets.

Method 1 therefore is likely to be an **underestimate** of the methane intensity of open cut coal mines across Queensland.

Ember **recommends** that Method 1 is phased out from the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Cth) (NGER Determination).

Ember **recommends** that all Australian surface mines, including those in Queensland, be required to directly measure their emissions through a combination of technologies to generate a multi-input model. This will improve the accuracy and integrity of methane measurement, reporting and verification (MRV) at Australian coal mines.

The following submission outlines our concerns with Method 1 (section 1) and our recommendations for best practice MRV under NGERS (section 2).

1. The Use of State-Based Emissions Factors

State-based emissions factors severely underestimate methane pollution. While the updated Method 1 is an improvement, it still does not properly take into account the variability of methane emissions from individual coal mines.

1.1. The Historical Queensland Emissions Factor and Review of Method 1

Prior to this proposed update, the State-based emission factor for Queensland open cut coal mines was 0.023 tonnes of CO2-e per tonne of coal (s 3.20(c) of the NGER Determination). This resulted in a methane intensity of 0.8 kg of methane per tonne of coal for all open cut coal mines across the State.

This emission factor was derived from a limited number of small-scale studies undertaken in the early 1990s that relied upon outdated technologies and techniques. As acknowledged in the consultation paper, those studies only tested a small number of locations (and twelve samples) in the Bowen Basin to derive an emissions factor for the entire State.

The current emissions factor has led to **significant** under-estimates of the methane emissions from open cut coal mines in the State.

DCCEEW has proposed to update Method 1 such that the State-based emission factor for Queensland open cut coal mines is 0.031 tonnes of CO2-e per tonne of coal, resulting in a methane intensity of 1.1 kg of methane per tonne of coal (leading to an increase in the estimated methane emissions from open cut coal mines in the State by 35%).

Ember supports reforms to the NGER Determination that seek to implement best practice coal mine methane MRV and that therefore accurately capture the methane intensity of Queensland open cut coal mines (and all other Australian coal facilities).

While the update to Method 1 better reflects the methane intensity of Queensland open cut coal mines, it is neither accurate nor best practice.

1.2. Emissions Factors Do Not Account for Methane Variability

Ember recommends against the use of any State-based emissions factor to estimate the methane pollution from coal mines because of the variability of those methane emissions.

First, there is a large spatial variability of the methane content within coal, within a basin and across seams. For example, in the Upper Silesian Coal Basin (in Poland), studies have measured methane variability and found that methane concentrations vary by a factor of 100 both vertically and horizontally. The Upper Silesian Coal Basin is just 0.4% of the size of Queensland. A State-based emissions factor does not reflect this variability.

Second, 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. State-based emissions factors do not account for these temporal fluctuations.

Third, emissions factors do not account for the change in the permeability of coal seams as overburden is removed. As a result, emissions factors are missing a significant amount of free methane that is emitted from the surrounding strata.

Measurements from 10 open cut coal mines in the State showed that certain mines had a methane emission factor ~50 times higher than others. State-based emissions factors apply a flat rate that do not reflect the fluctuating rates of methane pollution from these mines.

1.3. Emissions Factors Do Not Account for Major Pollution Events or Super Emitters

Method 1, because it reflects a State-based average intensity, does noy account for major pollution events at individual mines or super emitting coal mines. This allows individual coal facilities to effectively disguise the true methane intensity of their processes.
Independent satellite data has identified super emitting open cut coal mines in Queensland. Satellite analysis of the Hail Creek Open Cut Coal Mine has found that it emitted ~230 thousand tonnes of methane in 2018-2019, resulting in a methane intensity of 34 kg per tonne of coal extracted. That methane intensity is **30 times higher** than Method 1's proposed intensity of 1.1 kg of methane per tonne of coal.

It is critical for the integrity of Australia's greenhouse gas emissions accounting and for the efficacy of the safeguard mechanism reforms, that coal facilities be required to directly measure their methane emissions. This will ensure major pollution events and super emitters are appropriately accounted for and will underpin genuine reductions to the emissions intensity of these facilities.

1.4. Ember's Recommendation

Accordingly, Ember recommends that Method 1 is phased out from the NGER Determination for all Australian coal mines, irrespective of their location or whether they are open cut/underground.

Ember emphasises that the NGERS Determination currently includes alternative methods for Queensland open cut coal mines to estimate their methane emissions, namely, Methods 2 and 3 (ss 3.21 and 3.26 of the NGER Determination). Open cut coal facilities have the technical capacity to estimate their emissions based on in-situ sampling. It is feasible to phase out Method 1, and improve the accuracy and integrity of Methods 2 and 3, while shifting all coal facilities to those methods.

2. Improving Open Cut Coal Mine Measurement, Reporting and Verification

Australian open cut coal mines should be required to implement improved and accurate MRV and directly measure their emissions using a combination of technologies to generate a multi-input model.

2.1. Strengthening the NGER Determination for Coal Mine Methane Measurement

In addition to phasing out Method 1, Ember recommends that improved MRV standards be included in the NGER Determination to ensure accurate methane emissions reporting. While Methods 2 and 3 of the NGER Determination (ss 3.21 and 3.26 of the NGER Determination) are an improvement from Method 1, they also **do not represent best practice or accurate MRV**. We note there are also integrity concerns with the current Methods 2 and 3.

Ember recommends measurement standards that require open cut coal mines to measure their emissions using a combination of technologies to generate a multi-input model. This will ensure that the in-situ methane intensity of coal extraction at a facility is measured, accounting for methane variability (spatial, climatic and accounting for changes to the permeability of the coal seam) and major pollution events.

We recommend the following methodologies be considered as part of a multi-input model:

- Geotechnical cores/holes for specific methane contents across all gas bearing strata and not just target seams (to ensure “free methane” in the field is accounted for);
- Field coal gas model generated from cores;

- Drones taking surveys on a regular basis to generate snapshots for model input;
- Fixed gas monitoring around field, although the accuracy of such measurements will be low without other inputs as we recommend;
- Weather monitoring (wind, rain, barometer) as surface mine emissions will be barometer affected; and
- Ground based methane measurements across the worked face.

We also recommend the use of satellites for regular comparison and verification, ensuring a top-down verification to bottom-up reporting.

2.2. Achieving Accurate MRV

Ember encourages DCCEEW to implement accurate and best practice MRV of coal mine methane, drawing upon comparative jurisdictions, academic and industry analysis, and the proposed MRV standards outlined by the Met Coal Methane Partnership (MMP).

In particular the MMP's draft MRV standards require coal mines to implement the following measures to meet the Level 5 standard:

- Site and source-specific measurements taken at an appropriate sampling frequency to achieve the lowest uncertainty in emissions reporting; and
- Complementary total site-level measurements to ensure there is site-level reconciliation with source-specific measurements that are undertaken at an appropriate frequency to achieve the lowest uncertainty in emissions reporting;
- Site-level measurements should be generated from a multi-input model including sensors mounted on mobile platforms (e.g. drones); and
- Site-level measurements may also be independently verified with satellite imagery.

Ember encourages DCCEEW to integrate the draft MMP Level 5 standard for MRV into the NGER Determination, to ensure Australian coal mine methane measurement is aligned with best practice.

2.3. Ember’s Recommendation

Ember therefore recommends that all Australian surface mines, including those in Queensland, be required to record source-specific and site-level measurements and verification through a combination of technologies to generate a multi-input model.

Supporting information

Detail of consultation

This submission was made to the Australian government's 2023 National Greenhouse and Energy Reporting (NGER) Scheme updates and consultation process in April 2023.

Methodology

This response was developed from Ember's previous research on the scale of Australia's coal mine methane emissions, how Australia could deliver two-thirds of its Global Methane Pledge by tackling this major source of emissions and how cost effective reducing coal mine methane through the safeguard mechanism would be.

This analysis is based on data reported to the Clean Energy Regulator in CO2-equivalent. To convert to methane emissions, our analysis assumed that 80% of reported CO2-e emissions from underground mines are fugitive methane, and 60% of reported CO2-e emissions from surface mines are fugitive methane. In practice this will vary from mine to mine and may be higher than assumed.