Submission No 15

INQUIRY INTO EMISSIONS FROM THE FOSSIL FUEL SECTOR

Organisation: The Superpower Institute Ltd and Climate Resource Pty Ltd

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Emissions from the fossil fuel sector

Submission in response to NSW Parliamentary Inquiry

August 2025

About The Superpower Institute

The Superpower Institute's (TSI's) mission is to help Australia seize the extraordinary economic opportunities of the post-carbon world.

A net zero Australian economy will reduce global emissions by just over 1 per cent. But if Australia successfully seizes the economic advantage in exporting zero emissions goods, this can create an opportunity for full employment with rising incomes for a growing population sustained over more than a generation, and reduce global emissions by up to 10 per cent.

Renowned economist Ross Garnaut and economic public policy expert Rod Sims have joined forces through The Superpower Institute, to focus on practical research and policy to unlock this opportunity. The Institute specialises in the policy settings and market incentives needed to make Australia an economic superpower and provides practical knowledge to governments and industry to realise this opportunity.

TSI works across the building blocks of the superpower economy including: renewable energy, green hydrogen, land carbon and minerals processing; the potential zero carbon export products including green iron and green aluminium; and the enablers of this economy including economic and fiscal policy, trade policy and regional development. TSI also hosts several open, auditable, accessible data platforms providing data and analysis on Australia's net zero transition, including Open Methane.

https://www.superpowerinstitute.com.au/ and https://openmethane.org/

About Climate Resource

Climate Resource's mission is to advance the science, translate it better, grow its influence to accelerate the transition to net-zero and address the implications of our changing climate. We use climate science to create tools that support decision makers to assess and respond to climate risk.

Our team is deeply involved in the global science community and active contributors to successive IPCC assessment reports, as lead and contributing authors. We work for governments, non-governmental organisations, financial institutions, corporates, and multinational agencies - including the UNFCCC Secretariat and UNDP, and the International Energy Agency.

We produce widely used datasets of historical and projected emissions for all countries, and climate models to translate emissions scenarios into temperature rise. Our team has led work to synthesise the global energy transition scenarios for IPCC assessment reports, and other global model intercomparison processes.

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Introduction

TSI and Climate Resource welcome the opportunity to contribute to this inquiry into emissions from the fossil fuel sector.

This submission is particularly timing given Premier Chris Minn's recent comments during budget estimates that New South Wales is particularly exposed to a future structural decline in coal markets, given that coal is the state's largest current export.[1] It is critical for New South Wales to proactively manage this decline in a way that is simultaneously in line with the state's net zero commitment and contribution to limiting global warming to 1.5 degrees celsius, provides a just transition for coal workers and their communities, and provides new export opportunities to replace current coal revenue.

In this submission, we have adopted the numbering used in the inquiry's terms of reference. We note for completeness that we have not responded to points (c) or (d) from the terms of reference.

a) Relevance and consequence of fossil fuel emissions on greenhouse gas reduction targets

Strong action to address fossil fuel emissions, including fugitive methane emissions, is critical to achieving:

- NSW greenhouse gas reduction targets.
- Cumulative emissions in NSW in line with the Paris Agreement (PA) long term temperature goal.
- NSW emissions reductions goals at least-cost.

Achieving the NSW greenhouse gas reduction targets

Fugitive methane emissions from underground coal mines in NSW contribute approximately 7% (9.7 $MtCO_2e$) of annual emissions in 2024. Unless addressed through a change in policy or policy implementation, NSW's reported fugitive methane emissions could increase by 75% due to 1) new coal mine projects and mine expansions currently awaiting approval, and 2) improvements in measurement.[2]

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[1] Transcript of NSW Budget Estimates 2025-2026, 20 August 2025, p9. https://www.parliament.nsw.gov.au/lcdocs/transcripts/3551/Transcript%20-%20PC1%20-%2020%20August%202025%20-%20Budget%20Estimates%20(Minns)%20-%20UNCORRECTED.pdf.

[2] Common Capital (2025), *Unlocking cost-effective methane abatement in the NSW and QLD coal industry*, https://commoncapital.com.au/wp-content/uploads/2025/05/Common-Capital-2025-Coal-industry-methane-emissions.pdf.

It will be difficult to find a cost-effective pathway to NSW's emissions reductions targets without strong action to address the risk of increases and reduce fugitive methane from current sources.

Delivering cumulative emissions in line with the PA goal

The aim of emissions reduction targets is to ensure that greenhouse gas emissions are reduced in accordance with a total emissions budget that presents the most likely chance of limiting global warming to a certain level, such as 1.5 degrees Celsius (per the Paris Agreement).

However, the pathway used to reach emissions reduction targets (such as 'net zero by 2050') is also vitally important. The volume of greenhouse gas emitted during that time impacts the temperature increase that is observed, as shown below at Figure 1.

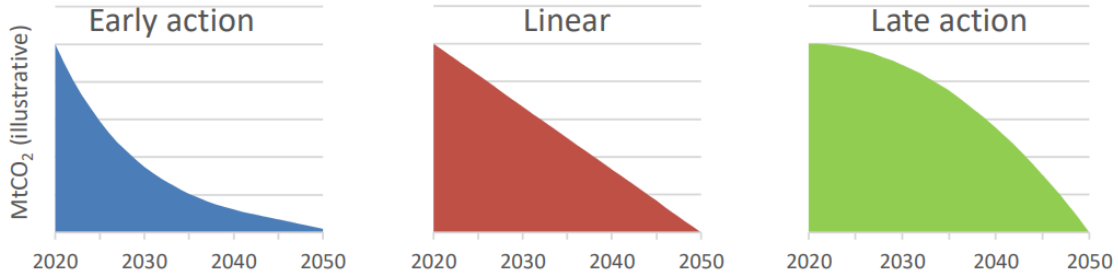

Figure 1: Illustrative decarbonisation trajectories to 2050. Each of these pathways reaches net zero by 2050, but in the Late Action pathway the total cumulative emissions are double the emissions of the Early Action pathway, which leads to double the warming impact.[3]

Emissions from fossil fuels remain by far the highest contributor to global warming.[4] As methane is a relatively short-lived gas with a much higher global warming potential than carbon dioxide, rapidly reducing methane emissions represents a significant opportunity for near-term emissions reductions, improving temperature outcomes and allowing time to develop decarbonisation pathways for sectors that are more difficult to abate.

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[3] McGuire et al. (2020), "The role of carbon budgets in translating the Paris Agreement into national climate policy," *MaREI*, https://www.marei.ie/wp-content/uploads/2020/10/Discussion-Paper_The-role-of-carbon-budgets-in-translating-the-Paris-Agreement-into-national-climate-policy.pdf.

[4] Friedlingstein et al. (2025), "Global Carbon Budget 2024", *Earth System Science Data*, 17(3), https://doi.org/10.5194/essd-17-965-2025.

Achieving NSW's emissions reductions goals at least-cost

A consistent finding is that rapid reductions in fugitive methane emissions from underground coal mining are among the least-cost mitigation options available.

A recent analysis by Climate Resource of least-cost emissions reduction scenarios consistent with 1.5 to 2 degree outcomes found that, at both global and national levels, methane emissions from energy (as opposed to agriculture, forestry, and other land uses) need to decline rapidly by 2030. For example, in Australia methane emissions from energy are reduced by between 73% and 79% by 2030 relative to 2020, depending on whether the scenarios allow for peak warming of 1.6 degrees or 1.8 degrees (see Figure 2).

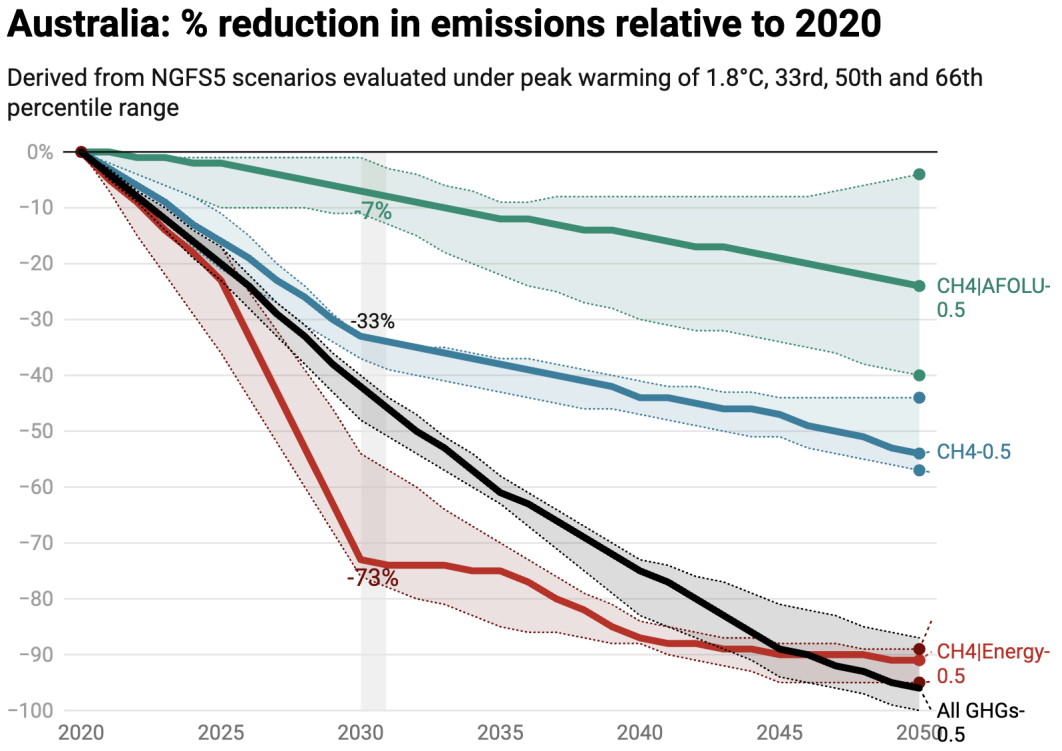

Figure 2: Australian methane emissions from energy and land use, under scenarios with a peak warming of 1.8 degrees.[5]

This finding is consistent with other global studies such as IEA Global Methane Tracker 2024.[6] It implies reducing fossil fuel methane emissions is some of the least cost

[5] Burdon, Lewis, and Spiller (2025), 'Australian Methane Targets Consistent with the Paris Agreement Temperature Goal - Insights from Integrated Assessment Models', June 2025, https://drive.google.com/file/d/1ic0N_OFSwhJdw0haGD_k2iXni0gwN8x_/view.

[6] IEA (International Energy Agency), Global Methane Tracker 2024 – Analysis, https://www.iea.org/reports/global-methane-tracker-2024

mitigation in Australia and globally. If the reductions in fugitive methane emissions from fossil fuels are not achieved, the cost of limiting warming will be higher.

The cost-effectiveness of reducing emissions by addressing fugitive methane emissions from underground coal mining in NSW is also a key finding of Common Capital's report on It found that policies that could reduce 2035 emissions by 4.5-6.9 MtCO2 could contribute $3.4 – $4.3 billion to the economy, at a net cost to the mining sector of $2.70 to $4.10 per tonne of CO2e abated.[7]

Conversely, increasing methane emissions in the near term (including through the expansion of fossil fuel extraction and consumption) risks making it more difficult to reach net zero, and also increases the likelihood that even if we meet net zero, we will exceed temperature perturbation targets.

b) Quantification and Measurement of fossil fuel emissions

Occasionally emissions can be measured directly, for example in stacks of power-stations or vents of underground mines. More commonly, emissions need to be estimated.

There are two broad approaches for estimating fossil fuel emissions. The first, conventionally termed a "bottom-up" approach, combines understanding of the emission processes and data on the quantity of these processes to estimate emissions. This usually simplifies to an estimate of the amount of some activity multiplied by an emission factor associated with that activity. Examples include data on the amount of coal of a particular type consumed by a power station and the carbon content of that coal, or data on the amount of gas extracted from a reservoir and an expected leakage rate. Estimation methods are subject to uncertainties on activity data but, more crucially, on emission factors.

Top-down methods (also called atmospheric methods) measure the amount of greenhouse gas in the atmosphere and use a combination of statistical techniques and numerical modelling to infer emissions. These methods are limited by a paucity of atmospheric data and imperfect atmospheric models. Ideally, estimates should combine both these data sources, cognissant of the uncertainties in either to produce a best possible estimate. This is rarely done but we note recent developments from NSW-EPA to trial these over some emission hot-spots in NSW.

Methane emissions from open-cut coal mines have proven a particularly difficult problem for bottom-up methods. The dominant process is desorption of methane

[7] Common Capital (2025), *Unlocking cost-effective methane abatement in the NSW and QLD coal industry*, p7.

from coal as it is depressurised and crushed. The activity data is the amount of coal mined and this is obviously well known. The relevant emission factor is the methane content of the coal. This varies a lot with location, depth and coal type. Default emission factors for Australia or a state do not capture these variations. Improved methods involve measuring gas content of coal but these measurements are not reported and the sampling problem for a heterogeneous coal mass is serious.[8]

There is evidence of significant uncertainty in methane measurements and monitoring, which further increases these risks. Preliminary results from Open Methane[9] show evidence that methane emissions from Australia's twenty highest-emitting fossil fuel sites may be emitting up to twice as much methane as is being self-reported through mechanisms such as the National Greenhouse and Energy Reporting Scheme.[10] This is slightly larger than the International Energy Agency estimate of a 70% underestimate for the fossil fuel sector as a whole, and is supported by other recent studies which demonstrate that bottom-up methods substantially under-report true emissions of methane from coal mines.[11] The reporting errors are most likely to be systematic, meaning emissions from future coal mines or extensions of current mines are also underestimated. Increased emissions from future projects may leave NSW no feasible pathway to net zero by 2050.

The likelihood that true estimates are substantially larger than reported not only impacts the current GHG emissions from NSW but, crucially, projected emissions. The errors are most likely systematic so projected estimates from future mines or extensions are also underestimated. This will make it substantially harder to achieve a reasonable pathway to net zero.

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[8] The difficulties in estimating coal mine emissions are summarised in Karacan et al. (2024), "Mitigating climate change by abating coal mine methane: A critical review of status and opportunities", *International Journal of Coal Geology*, 295, https://doi.org/10.1016/j.coal.2024.104623.

[9] Open Methane is a free, open source platform that utilises satellite observations and environmental modelling to detect, measure and locate methane emissions in Australia.

[10] Rayner and Grant, Groundbreaking Satellite Monitoring Tool Shows Significant Underestimation of Methane Emissions from Fossil Fuel Sites (9 October 2024), https://openmethane.org/analysis/top-methane-emitting-hotspots.

[11] See, for example, Karacan et al., 'Mitigating Climate Change by Abating Coal Mine Methane: A Critical Review of Status and Opportunities', International Journal of Coal Geology 295 (December 2024): 104623, https://doi.org/10.1016/j.coal.2024.104623; Borchardt et al., 'Insights into Elevated Methane Emissions from an Australian Open-Cut Coal Mine Using Two Independent Airborne Techniques'. *Environmental Science & Technology Letters* 12, no. 4 (8 April 2025): 397–404, https://doi.org/10.1021/acs.estlett.4c01063; and Sadavarte et al. (2022), "A high-resolution gridded inventory of coal mine methane emissions for India and Australia", *Elementa: Science of the Anthropocene*, 10(1), https://doi.org/10.1525/elementa.2021.00056.

e) Economic costs of greenhouse gas emissions

Policies to address market failures

The emission of greenhouse gases imposes large costs on society and is a significant market failure. For the most part, except where carbon prices are efficiently levied, these costs are neither borne by producers nor reflected in the pricing of reduced-carbon goods and services. This makes it more challenging for low-emission producers to compete on a level playing field with existing fossil-fuel based businesses.

An efficient carbon price would provide the correct market signals for decisions regarding extending existing coal mines or opening new ones.

A carbon price would also provide a market signal to direct investment to lower-emission industries and commodities, factoring in the societal cost of carbon emissions. For example, New South Wales has good renewable energy and biomass resources which would make it a prospective producer for green commodities including hydrogen, fertilisers, and low-emission liquid fuels. TSI's *A New Energy Trade* report[12] found that Australia's potential annual export revenue from green carbon industries such as ammonia, methanol, and green fuels could amount to $476 billion by 2060. With the right policy settings to address market failures such as the lack of a carbon price New South Wales could secure a significant portion of these new industries, increasing regional economic diversification and employment opportunities, and providing diversified export revenues for the state to replace its current reliance on coal exports.

Just transition

The economic transition from decarbonisation is occurring - the question is whether governments and communities shape that change, or have it forced upon them. Global demand for coal is expected to decrease by at least 25% by 2035 based on current policies, and by as much as 70% if world governments pursue policies representing higher climate ambition.[13]

Working with affected industries and communities to ensure that the energy transition meets their needs is crucial to sustaining strong local economies and maintaining social licence for the transition. Organisations such as Beyond Zero Emissions and The Next Economy collaborate with industries and communities respectively to navigate the transition, learning from successes and challenges such as the abrupt closure of the Hazelwood coal plant in Victoria's Latrobe Valley. These efforts can be supported

[12] Finighan (2024), *The New Energy Trade: Harnessing Australian renewables for global development*, TSI, https://www.superpowerinstitute.com.au/work/the-new-energy-trade.
[13] IEA, World Energy Outlook 2024, https://www.iea.org/reports/world-energy-outlook-2024.

by governments through clear transition policy signposting and industrial net zero roadmaps, reducing uncertainty and supporting future economic planning at local and regional scales.

f) Any other matters

Future liability risk

The recent advisory opinion by the International Court of Justice (ICJ) on the obligations of states in respect to climate change confirms that member states (countries) of the ICJ face increased risks of litigation should they continue to approve fossil fuel exploration and development. Although this does not present a direct liability risk to sub-national governments, the ICJ's findings are already being applied in cases against fossil fuel approvals internationally.

Regulatory response

Beyond adoption of an efficient carbon price, many of the powers required to mitigate coal mine methane are already legislated,[14] including:

- Refusing new coal mine and extension applications
- Incorporating strong requirements for methane mitigation in environmental protection licences and management plans, including best-practice methane monitoring, measurement, and capture
- Enforcing existing regulations and licence conditions regarding methane emissions
- Monitoring abandoned and closed mines for methane emissions

In particular, a clear policy position on the cessation of new fossil fuel approvals would provide investment certainty. Policies such as phase-out and phase-in targets have been a successful feature of other elements of the energy transition. In line with the recommendations of the NSW Productivity and Equality Commission, decisions about the future of coal in NSW and Australia should be made as soon as possible.[15]

Offsets versus abatement

Relying on mechanisms such as the Safeguard Mechanism creates an outcome where emitting companies are more likely to offset their emissions using land-based

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[14] Environmental Defenders Office (2025), *Improving Regulation of Coal Mine Methane in NSW*, https://www.edo.org.au/wp-content/uploads/2025/06/250531-EDO-Report-Improving-coal-mine-methane-regulation-in-NSW-1.pdf.

[15] NSW Productivity and Equality Commission, *Ensuring a Cost-Effective Transition*, Achieving Net Zero Paper 1 (November 2024), https://www.productivity.nsw.gov.au/sites/default/files/2024-11/NSW-Productivity-and-Equality-Commission-Achieving-net-zero-paper-1-Ensuring-a-cost-effective-transition.pdf.

methods. Concerns about the efficacy of such methods is well-publicised, with a focus on low integrity offsets that will be ineffective in mitigating greenhouse gas emissions from other sources. This is particularly the case for fossil fuels, which introduce new carbon into the atmosphere from outside the terrestrial carbon cycle. The only way to genuinely abate fossil fuel emissions is to limit their release into the atmosphere at the source.

Further Information

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