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COAL TO CLEAN

Australia's coal mines can deliver two thirds of methane cuts

Australia could reduce its annual methane emissions by 18% by 2030 from coal mines alone, delivering two-thirds of its commitment in the Global Methane Pledge.

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About

This report presents a pathway for Australia to significantly reduce its annual coal mine methane emissions by 2030.

It estimates the potential emissions reductions that can be achieved through various mitigation methods, using data from Australia's Greenhouse Gas Emissions Inventory System (AEGIS), the Clean Energy Regulator (CER) and annual reports.

Executive Summary

Australia's coal mines can deliver two-thirds of methane cuts

Australia could reduce its annual methane emissions by 18% by 2030 from coal mines alone.

- Methane emitted from coal mines represents 23% of Australia's total methane emissions, second only to agriculture, however mitigating it is four times cheaper.

- This analysis finds that by focussing on coal mines alone, Australia could reduce its annual methane emissions by 18% by 2030. Coal mines could do the heavy lifting to achieve Methane Pledge targets quickly, giving time to harder to tackle sources such as agriculture to implement their mitigation strategies.

- If Australia implemented the suggested pathway, they would be on track with the IEA's ambitious Net Zero Pathway to keep global temperature rise to 1.5 degrees Celsius. Australia could see CMM reductions of greater than 75% by 2030.

- Priority actions include a thermal coal phase-out by 2030, and emission reduction measures for metallurgical coal used for steel. However, no new coal mines or expansions are crucial if Australia is to see significant CMM reductions.

- Underestimated methane emissions could sabotage Australia's climate targets. It will be necessary for mines to improve their measurements as part of mitigating emissions.

“Australia has a special trump card up its sleeve. Coal mines offer the cheapest way to cut methane fast. Plus it buys the country more time to deal with agricultural emissions and those harder-to-tackle cow burps!”

“But Australia may actually end up with higher methane emissions if it doesn’t change course. Without improved monitoring, Australia is flying blind on how big its methane problem is. Moreover, plans to expand coal mining would definitely push Australia in the wrong direction.”

Dr Sabina Assan
Analyst, Ember

“Australia has a serious methane problem with huge volumes of coal and gas-related methane leaking and being released into the atmosphere.”

“Australia’s coal mine methane, in particular, is gaining global attention, outstripping gas in the sheer size of its climate damaging footprint and adding to serious concerns about the accuracy of Australia’s methane measurement and reporting.”

“With ready solutions available to quickly reduce methane emissions from coal mines and gas operations at relatively low cost, there’s no time to waste in taking responsible action on methane in Australia. This starts with signing the Global Methane Pledge and ensuring that no new or expanded coal or gas projects are able to progress in Australia as we work to reduce the methane from those that are already polluting.”

Suzanne Harter
Australian Conservation Foundation, Climate Change and Clean Energy Campaigner

Coal Mine Methane Mitigation

Coal offers Australia cost-effective and rapid methane reductions

Across Australia, coal mines are emitting more than 1 million tonnes of methane every year. This makes up almost one quarter of Australia's total methane emissions, but it is also one of the quickest and cheapest sources to mitigate.

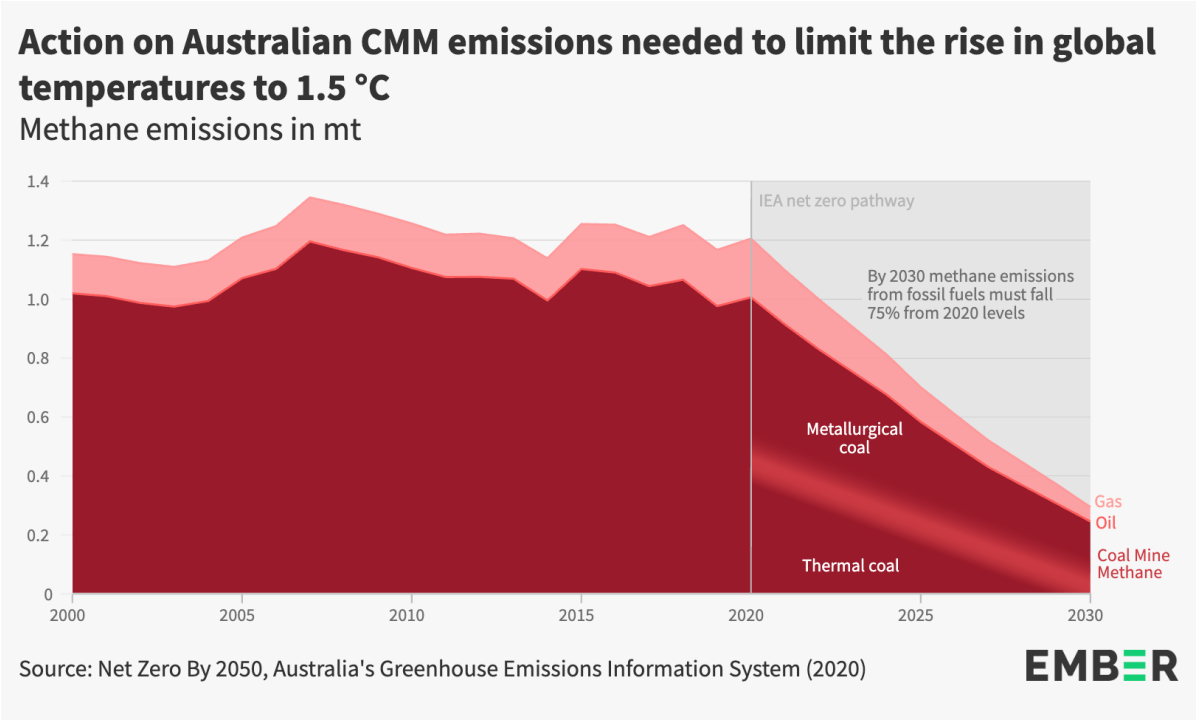
Methane has leapt to the forefront of international climate efforts, as it is now seen as the single most effective opportunity to reduce global warming in the short term. Over a period of 20 years, the greenhouse gas is over 80 times more potent than carbon dioxide, and emissions are increasing at record rates.

The Global Methane Pledge aims to limit global methane emissions by 30% from 2020. As one of the world's biggest per capita methane emitters, Australia's signature was noticeably absent from the pledge that has already been endorsed by 120 countries.

The International Energy Agency (IEA) study of how to transition to a net zero energy system by 2050, found that methane emissions from the coal mining industry must be reduced by 75% from 2020 levels by 2030 to limit the rise in global temperatures to 1.5C. This decline needs a steep reduction in thermal coal use for electricity and an increase in the deployment of emissions reduction measures, in particular for metallurgical coal which will still be critical for steel production in 2030.

Across New South Wales and Queensland, coal mine methane (CMM) emissions totaled 1 million tonnes in 2020 (AGIES), making up 23% of Australia's methane emissions - almost four times larger than the oil and gas industries combined. In fact, our previous analysis found that methane pollution from coal mines in 2019 had a bigger climate impact than all of Australia's cars that year.

The Government's CMM reporting legislation is outdated and likely leading to incorrect emission estimates. The IEA estimates that Australia's reported CMM emissions are missing 800 thousand tonnes of methane, suggesting emissions are almost twice as high as what mines reported in 2020.



Despite raking in record profits, the coal mining industry continues to dodge accountability for these emissions, and remains resistant to the solutions that could not only reduce their methane pollution, but also present the opportunity to improve safety in mines and create jobs in communities as they transition away from fossil fuels.

The Global Methane Assessment found that coal miners have 'ready to go' technologies that are some of the cheapest mitigation options available. According to their estimates, methane from coal mines can be mitigated at an average cost of $270 AUD per tonne of methane (less than $10 AUD per tonne of CO_2-e). For agriculture this cost is closer to $1,200 AUD. That makes mitigation at coal mines about 4x cheaper than it is in agriculture.

Given the last decade of lost action on climate change, Australia needs to act urgently to turn its unregulated methane emissions around. Whilst the red meat industry has been investing heavily to reach their Carbon Neutral by 2030 target,CMM mitigation is a low effort, high reward solution for the coal industry to reduce methane emissions now.

Coal Mine Methane Reduction Pathway

Reductions in CMM have the potential to reduce Australia's methane emissions by ~18%. Priority actions including a thermal coal phase out, and mitigating methane from active mines would put Australia on track to achieve the IEAs ambitious Net Zero Pathway

This CMM reduction pathway estimates the potential for CMM emission reductions in Australia, the numbers are indicative and based on best available data (see Methodology). Our findings suggest that Australia could reduce its annual methane emissions by approximately 770,000 tonnes by 2030, equivalent to a 77% reduction of CMM emissions and 18% of Australia's total methane emissions in 2020.

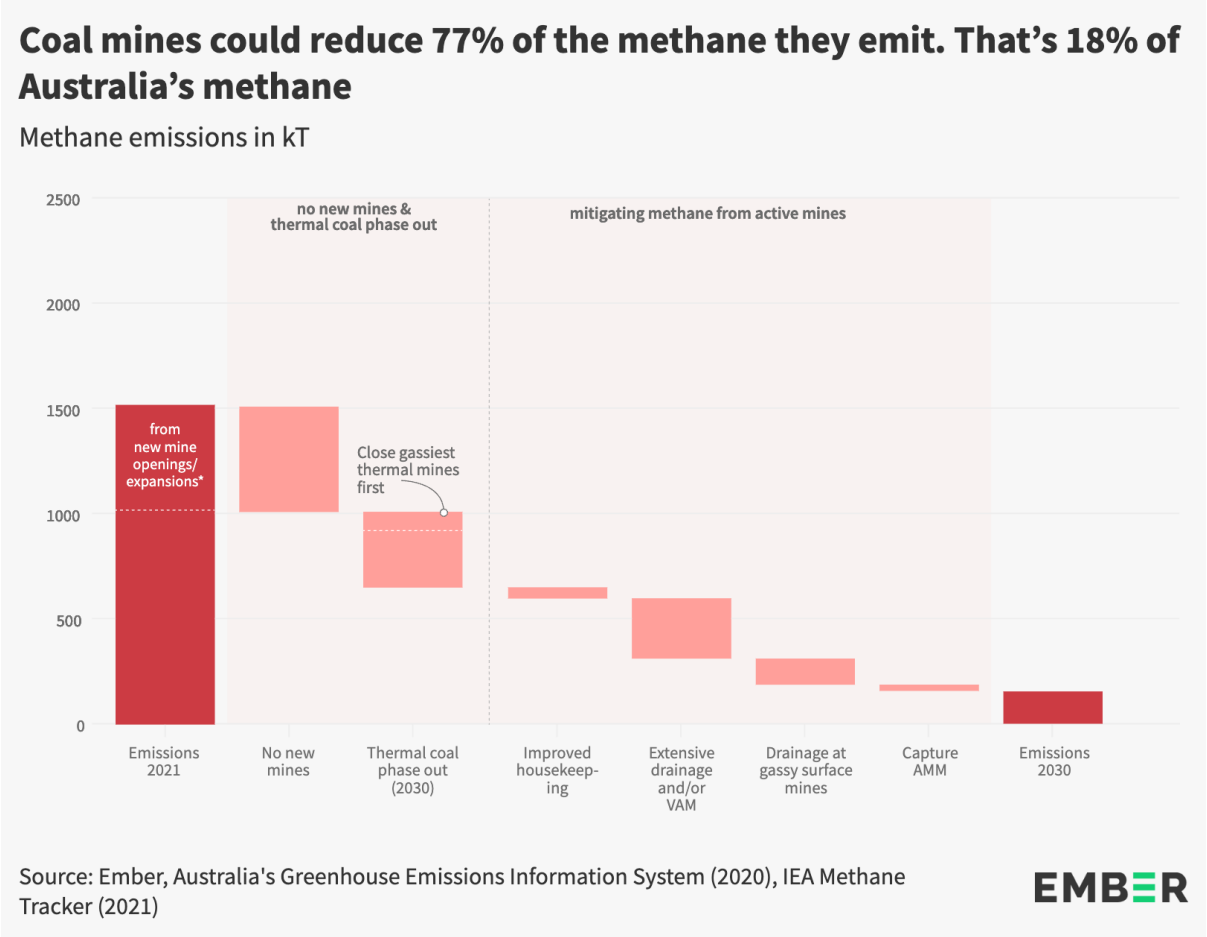
Over half of the reductions in coal mine methane can be achieved by phasing out thermal coal used for electricity generation and thermal coal exports (410,000 tonnes a year by 2030). The remainder is achieved by reducing methane pollution from both thermal and metallurgical mines (370,000 tonnes a year by 2030). By 2030, the remainder of emissions are from the metallurgical coal sector, after the implementation of mitigation technologies.

Australia needs to ensure it does not actually increase its methane emissions. Mandating no new coal mines or mine expansions would avoid a 50% increase on current CMM emissions (500,000 tonnes a year by 2030).

Furthermore, there is a risk that CMM emissions are being underreported which would challenge the integrity of Australia's methane accounts and climate targets. To improve the quality of emissions data all mines should be required to report detailed source types using source-specific activity and emission factors, and reconcile these measurements with site-level measurements.

A similar effort is already taking place in the oil and gas industry, which together with the International Methane Emissions Observatory (IMEO) has developed a methodology for measuring methane leaks - the Oil and Gas Methane Partnership (OGMP) 2.0 Framework.

Learn about the [OGMP 2.0 Framework](), and how Europe is improving measurement and mitigation of methane from coal mines through the proposed [EU Methane Regulation]().



Action 1 : No new coal mines or mine expansions

Our recent analysis found that if most of Australia's proposed mines go ahead, annual coal mine methane emissions would increase by 50% by 2030. That would be 1.5 million tonnes of methane emitted per year, adding 11% to Australia's 2020 methane emissions. Any reductions to Australia's methane emissions will be severely hindered if the Government's strategy continues to allow new coal mines or expansions.

Action 2: Phase out thermal coal mines

Based on IEA estimates, we calculate that methane pollution from thermal coal production in Australia amounts to ~470 thousand tonnes of methane emissions each year. This reduction

pathway estimates that closing all thermal coal mines by 2030 would reduce annual CMM emissions by 40% from 2020 levels.

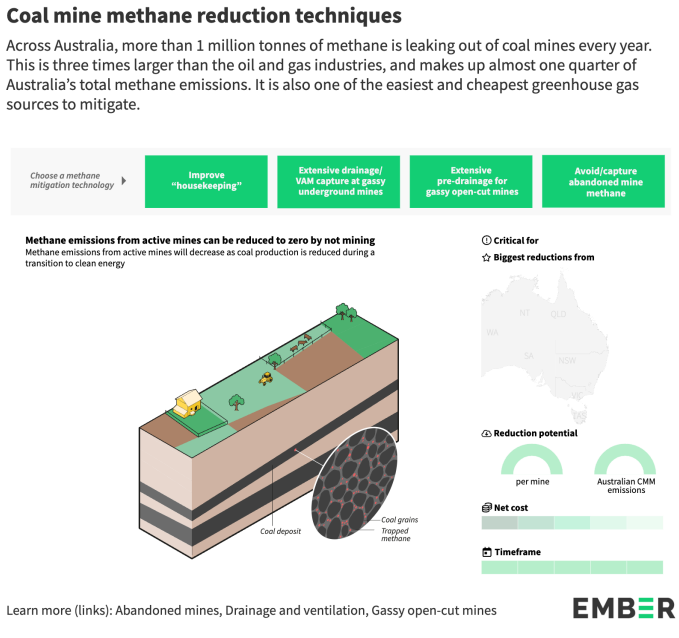
Taking into account the CO_2 emissions from burning coal in Australia (156 Mt in 2020), this means that phasing out thermal coal would reduce Australia's total greenhouse gas emissions by 30% or 170 million tonnes CO2e.

Closing the gassiest thermal coal mines first enables the fastest reductions. We estimate that by closing Narrabri (Whitehaven Coal), Mandalong (Centennial), Myuna (Centennial), Ensham (Idemitsu) and Chain Valley (Delta Coal) coal mines, Australia's total CMM emissions would be reduced by 9% (~90 Kt/year) whilst only reducing coal output by 2%.

Action 3: Reduce methane pollution from existing mines

Whilst Australia transitions from coal, there are available technologies already in use around the world, that both thermal and metallurgical coal mines should implement to reduce methane emissions well before 2030.

Over a third of the cuts in coal mine methane - 370,000 tonnes a year by 2030 - could be achieved by tackling methane pollution from existing mines. The plan would cost an estimated $99.1 million AUD, just 0.2% of the coal industry's $51 billion income last year.



Explore interactive: CMM SVG | FlourisFlourishh

3.1 Improve “Housekeeping”

Management of methane emissions is an essential part of underground mine planning and safety. Simple improvements to the existing technology will reduce a mine's emissions, e.g. better borehole seals, enhancing water management in pipelines etc. Such improvements can be implemented immediately, and come at a negative/low cost.

Demanding best practice “housekeeping” could reduce an individual mine's emissions by ~10% . We estimate this would reduce Australia’s CMM emissions by 6% if applied to all 38 active underground mines (60 Kt/an).

3.2 Extensive drainage/VAM capture at gassy underground mines

In general, mines implement the minimum required drainage in order to adhere to safety and mining protocols. Through additional investment in existing gas infrastructure, mines can apply extensive pre and/or post drainage which theoretically reduces emissions by up to 80% , although in practice around 40% reductions are achieved. It also reduces the risk of explosions in underground mines - a critical element of ensuring workers’ health as inadequate drainage has led to serious incidents and deaths in the past.

For the gassiest mines which cannot reduce methane emissions sufficiently with drainage alone, current thermal oxidiser technology can remove up to 99% of ventilation air methane (VAM) emissions vented at exhaust fans. Unlike drainage, for VAM removal there is rarely an economic or operational benefit to the mine, so some form of financial incentive may be needed to promote its use.

Our analysis identified 15 gassy underground metallurgical coal mines which could reduce their emissions through drainage or a combination of drainage and VAM mitigation. Our estimates indicate this would decrease Australia’s CMM emissions by 20% (206 Kt/an).

Learn more from the UNECE Best Practise Guidance on Methane Drainage, the US EPA CMM Finance guide and VAM technologies report or see project examples in China here and here.

3.3 Extensive pre-drainage for gassy open-cut mines

Sixty-five percent of Australia’s mines are open-cut, but the magnitude of their emissions are relatively unknown and may be much larger than currently estimated [See Note].
Pre-drainage from boreholes at surface mines has been demonstrated to achieve measurable reductions, however it is not common practice as many surface mines extract low gas content coal as well as there being no operational benefit to the mine.

Our analysis found that if pre-drainage is implemented at Australia's gassy surface mines, CMM emissions could be reduced by approximately 8% (79 Kt/an). This could be larger if emissions from open-cut mines are significantly underestimated.

Learn more from the UNECE Best Practise Guidance on Methane Drainage, or see an example from the US here.

3.4 Avoid/capture abandoned mine methane (AMM)

In the case of underground mines, methane emissions can continue for decades after mining ends. Abandoned mine methane can be reduced to almost zero if mines are flooded. In cases where flooding is not technically feasible, mines can be sealed, or the methane can be used as a resource as is frequently done in Europe.

Abandoned mine methane currently represents 3% of Australia's CMM emissions, although this is likely to be an underestimate [see Note]. Seeing as emissions are highest immediately after operations cease, all operating mines should be required to have an AMM mitigation plan to be implemented immediately after closure. As coal is phased out AMM will become increasingly important to address.

Learn more from the UNECE Best Practise Guidance on Methane Recovery from Abandoned mines, or see an example from Europe here.

Note: The underestimation of Australian CMM emissions

Satellite data has found some mines emit significantly more methane than they report. Such mines may be key to understanding part of Australia's underreported emissions, and demonstrate why current measurement methods are inadequate.

For example, Hail Creek (Glencore) open-cut mine has been seen to emit 10 times the amount officially reported for four years consecutively. On average, the SRON Netherlands Institute for Space Research estimate that Hail Creek emits 200,000 tonnes of methane annually. This represents 25% of the additional 800,000 tonnes of methane emissions estimated by the IEA.

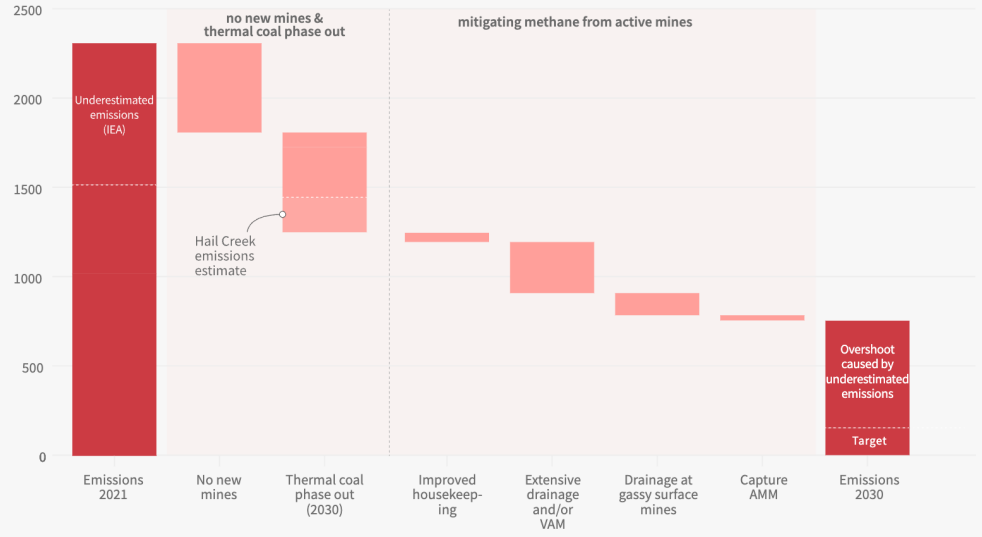
In Australia, inactive underground mines can remain in "care and maintenance" for years without being fully closed and rehabilitated. Most of these will continue emitting methane indefinitely, however the mines are only required to report these emissions for the first 20 years after an official closure.

The industry and government assume that methane is flared with 98% efficiency, however a recent study from the US has found flare efficiency to be ~90%. It is therefore plausible that emissions from flaring are higher than currently estimated.

The analysis in this report is based on officially reported data (AGEIS), and consequently our estimated reduction potentials do not take into account any underreported CMM emissions. It is likely that some reduction potentials are greater or smaller than estimated in this analysis. Emission reduction strategies will need to improve quantification of emissions to apply meaningful targets.

Underreported emissions mean CMM reduction pathway would miss climate targets

Methane emissions in kT



Source: Ember, Australia's Greenhouse Emissions Information System (2020), IEA Methane Tracker (2021)

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Supporting Materials

Methodology

Reduction Potentials

This analysis is based on data from AGEIS, CER Safeguard and annual reports. All numbers are indicative, the assumptions for calculating the emission reduction potentials in this report can be seen in the table below. A flaring efficiency factor of 98 per cent is used, consistent with Australian reporting and the IPCC Good Practice Guidance 2000 and 2006 IPCC Guidelines.

	No new coal mines/ expansions	**Phase out thermal coal**	**Close gassiest coal mines first**	**Improve house keeping**	**Extensive drainage & VAM for U-mines**	**Extensive drainage for OC-mines**	**AMM mitigation**
Reduction Potential (CH4)	500 Kt avoided	470 (407) Kt reduction	82 Kt reduction	60 (52) Kt reduction.	206 Kt reduction	79 Kt reduction	29 Kt reduction
Data used	Ember	AGEIS & IEA	CER & annual reports	AGEIS	CER & annual reports	AGEIS & CER	AGEIS
Assumptions	Estimate based on analysis from our previous report, The Federal Office of the Chief Economist 2020 Resources and energy major projects report, and NSW EPA emission estimates.	Australia's Met:Thermal coal mix calculated from IEA. 407 Kt reduced if combined with mitigation technologies.	Gassiest mines identified from CER. CH4 emissions from annual reports, or when missing 80% of CER reported emissions for U-mines.	10% of AGEIS reported U-mine emissions. 52 Kt reduction assuming gassiest thermal coal mines close first.	15 gassiest mines identified from CER. CH4 emissions from annual reports, or when missing 70% of CER reported emissions for U-mines. Post drainage: 40% reduction on all 15. VAM reduction: On mines with methane intensity >3 t/Mt after drainage. Assume 33% of VAM shafts gassy enough and CH4 mitigation of 80%.	Estimate mines reporting to CER account for 60% of emissions. Assume 40% reduction from these emissions.	All AGEIS reported AMM mitigated

Acknowledgements

Contributors

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Cover photo

Myuna coal mine, New South Wales, Australia.

Credit: Horizon International Images / Alamy Stock Photo