

Pathways Call for Evidence Submission

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Question 1

1a. What policies or market mechanisms could accelerate emissions reductions?

- Long-term carbon policy certainty and stable / clear carbon credits methodologies for quantifying methane reductions.
- Recognition of methane abatement as a high-impact and viable mitigation pathway.
- Systematic permitting approach for implementing emissions reduction projects.
- Funding / incentives for demonstration / first deployments and applied R&D.

1b. How could NSW stimulate private finance at the scale and pace needed for the net zero transition?

- Government-backed low-interest loan guarantees

1c. Drivers and risks to reaching NSW's interim targets in 2030 and 2035, and net zero by 2050?

Drivers

- Commercially available and proven methane abatement technology: RTOs are proven and readily available.
- Increasing ESG expectations
- Mine operators and the public are seeking lower emissions
- Growing engineering experience on VAM abatement.

Risks

- Project development timelines
- Regulatory / permitting complexity, especially in terms of safety
- Varying mine operating lives and site-specific engineering constraints

1d. What are opportunities and barriers for collaboration across sectors to support the transition?

Successful deployment requires collaboration between:

- mine operators

- technology suppliers
- EPC contractors
- regulators
- carbon policy administrators

Question 2

2a. What technologies are available or emerging, and what is their current state of readiness?

- Regenerative Thermal Oxidation (RTO) systems are proven in Ventilation Air Methane (VAM) abatement applications.
- Multiple operational installations were implemented in the last 15 years on coal mine ventilation shafts.
- Suitable for high airflow, low-concentration VAM streams down to 0.2%.

Emerging technologies:

- Catalytic oxidation
 - Catalytic oxidation could bring down the treatable CH₄ concentration range down further (about 0.1%) or bring down the size of systems for a given concentration range. It is currently being studied by RTO suppliers and through governmental research programs on a pilot scale to evaluate its effectiveness on long-term, full-scale applications.
 - Still facing catalyst durability and contamination challenges in mining applications (i.e. resistance to dust and moisture, catalyst poisoning, temperature effects, etc.). This currently makes it too difficult cost-wise to implement it at large scale.
- Waste heat recovery
 - Can improve overall project economics depending on available concentrations.

2b. What constraints exist around technology uptake and deployment?

- Site footprint: Very high airflow rates mean multiple systems to implement on an existing ventilation infrastructure with possibly limited available space.

- Shaft life: Some mine shafts with short life duration (< 4 years) require the systems to be moved to a new shaft on a short time frame.
- Low concentration: Very low methane concentration (<0.2%) is not currently feasible in a long-term, large-scale deployment.
- Mine safety / permitting approvals and approval timelines.

2c. What does the evidence say about current and future costs?

- Project costs depend primarily on:
 - Methane concentration distribution
 - VAM airflow to abate methane concentration (it dictates the required general size of the system(s))
 - Site layout
 - Level of integrated safety features as imposed by safety regulations.
 - And others...
- Current estimations propose 20 AUD/t(CO₂-e), which could be improved over time with frequent deployments.
- Future costs may decrease through:
 - Standardization and supply chain maturity with increased deployment
 - Confidence of safety regulators toward RTO technology.

2d. What role could the NSW Government play in strengthening technology development and deployment?

- Government could support knowledge sharing from commercial deployments.
- Publicly available data concerning precise emissions characteristics and physical characteristics of individual coal mines would be helpful in assessing potential for deployment at specific mines.

Question 3

What are the opportunities to foster demand reduction and behaviour change?

No answer.

Question 4

What are the likely economic effects on NSW of different emissions pathways?

Positive economic impacts

- Significant greenhouse gas reductions with opportunity to decarbonize coal mining without fundamentally changing production processes.
- Creation of engineering, construction, commissioning and maintenance jobs.
- Strengthening Australia's leadership in methane mitigation, an area of increasing international attention.

4a What are the most significant economic or workforce pressures the pathways should account for in your sector or community?

Future deployment of methane abatement technologies will require:

- Fabrication and construction contractors familiar with industrial process equipment, with capability for fast deployment.
- Long-term operation and maintenance personnel which require training.

Question 5

What are the opportunities and barriers to addressing socio-economic priorities for a just transition, including equitable outcomes for First Nations people and rural, regional and remote communities?

Opportunities

- Supports continued employment in existing mining communities while reducing emissions.
- Creates highly skilled technical jobs in regional areas.
- Allows mines to contribute to emissions reductions without requiring fundamental operational changes.
- Encourages investment in regional industrial infrastructure.
- Can leverage existing industrial and mining expertise.

Barriers

- High upfront capital costs.
- Uneven economic viability between mine sites.
- Short remaining mine life for some operations.
- Availability of skilled workforce in remote locations.

Question 6

What evidence can you provide to inform pathway inputs and assumptions? For example, cost curves, deployment rates, or sector-specific data, include commercially sensitive data where relevant.

VAMOX deployment:

- There are successful case studies in the US: experience in design, commissioning and operation of full-scale VAM oxidation systems in the US on active mine shafts.
- Mine ventilation/safety constraints in the US are different than those of Australia. This is an important consideration that can affect the design of the systems.

Deployment considerations:

- Typical procurement, construction and commissioning timelines.
- Availability of specialized contractors.
- Access to remote locations (condition of roads to haul equipment parts of considerable size). This may require mine operators to adapt access to shafts to ease the delivery process.

Operational evidence:

- Great availability is achievable (~97%).
- Typical planned maintenance requirements: about 1 week downtime per year for maintenance, excluding any special externally requested maintenance activities (ex: mine fan maintenance, instrument safety checks, etc.).
- Instrumentation, monitoring and reporting: A dedicated verification period is required, where carbon reduction measuring instruments are field checked on site.
- Operator training and availability requirements are to be considered. Local operators should be available on call to address operational events.

Question 7

Beyond emissions reduction, what outcomes should be considered? For example, impacts on business, jobs, land-use, water and biodiversity.

Regional economic development close to mine sites:

- Engineering and construction jobs, with increase in opportunities for local contractors.
- Long-term operation and maintenance employment.
- Investment in regional mining communities.
- Reduced emissions intensity of coal production = improved ESG performance.
- Potential access to markets with increasing environmental expectations.

Land and water use

- Additional footprint around the existing mine vent shafts.
- No process water requirements.

Biodiversity

- Minimal additional habitat disturbance.
- Projects generally remain within existing industrial areas.
- Some increase in noise level due to moving equipment and compressed air being exhausted.

Question 8

Do you have any other comments or information you would like to provide?

Overall observations:

- Methane abatement represents one of the fastest opportunities for emissions reduction in the mining sector.
- Participation in future technical working groups or stakeholder consultations would make deployment faster.
- Obtaining precise emissions data (including methane concentration distribution) is crucial to evaluate project feasibility.