



ECO-EFFICIENCY IN MINING

Innovation, Integration & the Path Forward

Executive Roundtable Capture | March 4, 2026 | PDAC, Toronto

Hosted in partnership with:



Senior sustainability, innovation, and operational leaders from a cross-section of global mining companies gathered for a closed-door breakfast roundtable co-hosted by CEEC International, Agnico Eagle, and the Global Mining Guidelines Group (GMG). The conversation ranged from the systemic barriers to technology adoption, to the imperative for interdisciplinary mine design, to the role of pre-competitive collaboration in accelerating eco-efficient practice across water, energy, tailings, and technology.

This document captures the key themes and insights that emerged.

THEME 1: INNOVATION IS A PEOPLE PROBLEM

The opening presentation – drawing on personal experience navigating a multi-year effort to adopt renewable diesel – reframed innovation not as a technology challenge but as an organizational and human one. The instinct to pursue many ideas simultaneously ("random acts of innovation") dilutes effort and rarely produces results. A sharper strategic lens – anchored in investor priorities of cost, production certainty, and operational control – helped focus energy on what actually matters.

“You have 150 different carbon reduction projects? That means you have nothing. Give me a top 10.”

KEY INSIGHTS

- Meaningful innovation requires deliberate prioritization, not portfolio proliferation.
- Existing assets can serve as test beds for technologies being built into next-generation operations.
- Change management and operational readiness are routinely underestimated – innovation ultimately requires people to change what they do.
- Governance frameworks designed for risk mitigation actively work against the adoption of new technology; workarounds are often needed.

THEME 2: REFRAMING RISK

A recurring thread through the discussion was that the industry talks about risk as something to avoid, rather than something to characterize, bound, and transfer. The distinction matters enormously for advancing innovation.

“We don't talk about how to shift risk. Some majors have bounded theirs by saying, we're not going to risk an existing operation — investing in a junior at arm's length contains the exposure.”

KEY INSIGHTS

- Perceived risk – not actual risk – is often the real barrier. Overcoming perception takes as long as overcoming the technical challenge.
- Isolating risk (dedicated test sites, ring-fenced capital, greenfield partnerships) makes innovation more actionable without threatening production.
- Simulation and systems-level modelling are significantly underused in mining compared to other industries; investing here could accelerate the risk-bounding process.
- Technology readiness is systems-level, not component-level. Individual elements may be TRL 8–9 while the integrated system sits at TRL 2.
- The 'fast follower' posture is now near-universal – creating a structural gap: if everyone is following, who is leading?

THEME 3: THE INTEGRATION IMPREATIVE

Participants broadly agreed that the industry's siloed design process is a fundamental barrier to eco-efficiency. Mines are designed in disciplinary compartments – process, tailings, water, safety – with each discipline inheriting constraints set by those upstream. The result is that sustainability considerations arrive too late to shape outcomes.

“Mines get designed, then handed over to the water people: here's the design, figure your part out.”

KEY INSIGHTS

- The conceptual study phase is where assumptions can be challenged – yet it is where the industry invests least. By pre-feasibility, options have already been foreclosed.
- Tailings, water, and energy are downstream symptoms of upstream design decisions. Conversations about sustainability need to begin at the system level.
- Early commitments to technology or production timelines anchor entire project teams to conventional approaches – often before exploration data is even complete.
- The EPCM model reinforces siloed accountability; collaborative co-design with integrated monthly coordination can drive substantially different outcomes.
- Other industries (chip manufacturing, aerospace, automotive) routinely design for an unknowable future within a fixed footprint – mining can learn from this.

THEME 4: SUSTAINABILITY PRIORITIZATION & THE CARBON QUESTION

A candid debate surfaced around the allocation of sustainability investment. Participants were clear that decarbonization remains important – but challenged the industry to avoid treating it as the singular lens, at the expense of water, tailings, community risk, and production continuity. The consensus was not that climate matters less, but that all sustainability priorities are deeply interlinked and must be weighed together.

“We need to be clear-eyed about where the levers are. Decarbonization matters – but so does water, tailings, and community. If chasing one metric compromises another, we've lost the plot. These priorities are deeply interconnected.”

KEY INSIGHTS

- Investor pressure on climate metrics may be driving capital allocation away from the interventions with the greatest actual sustainability leverage – particularly water and tailings.
- Physical risk (water scarcity, tailings liability, community disruption) is often more material and more immediate than transition risk – but harder to quantify.
- Long-term closure liabilities are systematically discounted under NPV frameworks, removing the economic signal that would incentivize better design decisions today.
- Social license failures – protests, permitting delays, community opposition – are the industry's most costly sustainability failures, yet receive proportionately less investment.
- Mining's essential role in supplying critical minerals for the energy transition is itself a sustainability contribution that deserves more explicit framing in industry narrative.

THEME 4: THE CASE FOR PRE-COMPETITIVE COLLABORATION

Participants acknowledged that no individual company can solve these challenges alone – and that there is far more scope for pre-competitive sharing than the industry typically assumes. CEEC International and GMG were introduced as complementary platforms built specifically to enable this.

WHAT PRE-COMPETITIVE COLLABORATION ENABLES

- Shared risk on technology development – reducing the burden on any single operator to run expensive trials.
- Common language and trust: a shared Technology Readiness framework lets mining companies and suppliers communicate about maturity without ambiguity.
- Cross-company validation: a CEO hearing from a peer is more persuasive than an internal champion. Pre-competitive forums create these moments.
- Network effects: connecting companies with overlapping challenges (e.g., two Chilean majors facing the same desert water problem) can unlock research collaborations neither could have structured alone.
- Open knowledge: outputs are publicly available, building the industry commons rather than proprietary silos.

THEME 4: WHAT PARTICIPANTS SAID THEY NEED

In closing reflections, participants pointed to several concrete areas where continued engagement would be valuable:

CONTINUE THE CONVERSATION	CEEC ENGAGEMENT	GMG ENGAGEMENT
<ul style="list-style-type: none">• CEEC/GMG Industry Lab at CIM Week, Vancouver: multidisciplinary, multi-company format• Focused dialogue on stage-gating processes and how to embed sustainability earlier• Cross-company discussion on innovation inhibitors and change management approaches	<ul style="list-style-type: none">• Input into Global Water Initiative, Global Tailings Initiative, and Energy Program roadmaps• Nominations for the annual CEEC Medal (outstanding eco-efficiency papers)• Mining Technology Readiness initiative – supporting technology assessment and site readiness evaluation	<ul style="list-style-type: none">• Participate in active working groups producing open guidelines on BEVs, automation, and more• Shape the next version of guidelines relevant to your operational priorities



CEEC International: Coalition for Minerals Efficiency

Advancing eco-efficient minerals production globally

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