Green Mining Innovation Forum March 17 & 18, 2021 Forum sur l'innovation mines vertes Le 17 et 18 mars 2021

Presented by CanmetMINING Présenté par CanmetMINES



Introduction

- The GMIAC workshop of 2021 was held virtually in two sessions on March 17 and 18.
- After welcome remarks from Jeff Labonté, Patrick Chevalier and Pierre Gratton on day 1, the CanmetMINING progress was presented by Kristie Tarr and Janice Zinck.
- A panel discussion by representatives of the Canadian mining ecosystem focused on the topic of how to better collaborate to achieve net zero in mining, and what CanmetMINING's role can be in this context.
- With this introduction, the topic was expanded in a plenary discussion of 70+ participants. Given the virtual meeting, participants were invited to post comments online, followed by Q&A around emerging themes. The summary of this discussion is enclosed, with a summary of raw data in the appendix.
- Day 2 dove into relevant content topics for CanmetMINING R&D. A MineRP visualization tool for new technology was introduced, which may allow for business case and ESG target modeling of any type of mining technology. This intro was followed by breakout brainstorms of possible towards-net-zero technology solutions where this tool may be applicable.
- For this exercise, the audience was split into 5 groups of about a dozen participants each. The groups topics were: People & Process, Architecture & Mining, Processing, Energy and Digital. Also here, the results summary is enclosed, with raw data in the appendix.
- Day 2 closed with a cross-presentation of the breakout group results and discussion of next steps.



Day 1 agenda: structural direction

09:00 - 09:20	Official opening of the Forum and welcoming remarks Jeff Labonté, Assistant Deputy Minister, Lands and Minerals Sector Setting the stage - opening remarks by the GMIAC Co-Chairs Patrick Chevalier, Director, Science-Policy Integration, CanmetMINING, Natural Resources Canada Pierre Gratton, President and CEO of the Mining Association of Canada
09:20 - 10:20	Achievements of the 2016 – 2021 CanmetMINING Research Plan Kristie Tarr, Director, Transformative Technologies &Specialized Services Janice Zinck, Director, Green Mining Innovation
10:20 - 11:20	Panel Discussion: Ways to achieve net zero in mining Samantha Espley – Bestech Allan Cramm – Novamera Anthony Griffiths – MacLean Engineering John Marsh – Sherritt International
11:20 - 12:00	Plenary Discussion: Building back better- CanmetMINING looks to the future Topics for discussion to include: climate change, critical minerals, competitive and responsible mineral resource development

Presentation: CanmetMINING Research Plan, Kristie Tarr



Full presentation available at <u>https://www.ami-aim.ca/en/publications</u>

With Q&A with Emma Tomini, Steve Gaines, Yan Germain, Gilles LeBlanc, Connie Smith, John Le, Brent Rubeli.

R&D for enhanced productivity

- Technology for deep mines
 - Real-time, remote monitoring of rock bolt integrity (with NRC)
 - Novel rock fragmentation technique (with McGill)
- Data-driven technologies
 - Development of decision-support tools
 - Using digital tools to streamline the navigation of the mining regulatory process
- Improving transportation in and out of deep mines
 - Automated mine hoist guide monitoring system development.
 - Advancing a novel mine hoisting technology

R&D for improved energy efficiency

- Replacing diesel power in mining
 - Electrification of mining vehicles
 - Clean and alternative diesel technology research
 - Hydrogen for mining applications
- Data-driven techs for improved energy efficiency
 - Waste heat recovery
 - Energy efficient heating and cooling for deep mining
 - Mine Energy Benchmarking tool

Presentation: CanmetMINING Research Plan, Janice Zinck



Full presentation available at https://www.ami-aim.ca/en/publications

- Five GMI research priorities:
 - Climate, waste, water, energy, productivity
- Trends and drivers
- Covid context
- Engagement with stakeholders

Technical progress

- Environmental impact assessments
- Rare Earth Elements R&D program
- Ring of Fire Chromite R&D program
- Mining Value from Waste Program
- Battery minerals R&D program
 - Lithium recovery from Canadian spodumene deposits
- Water research
 - Cyanide removal, effluent removal, recycling, water quality sensors, hazard classification
- Climate change adaption research
 - Big data, genomics, effect on metals, saturated cover
- Waste management/ utilization
 - REEs and Sc from coal ash, Ni/ Co from pyrrhotite, tungsten tailings, radioactive waste, ARD/ metal leaching, value from waste, geomicrobiology/ genomics
- Other
 - Waste management, grinding, security, fragmentation

Panel discussion: ways of achieving net zero in mining- an ecosystem view



Allan Cramm Co-Founder. VP of Innovation



Start-up

Samantha Espley VP of Mining Transformation





Anthony Griffiths Fleet Electrification Product Manager



Product supplier



John Marsh Director of Technology Projects











- Know your risks and use proven components, combining them in a new way. That way, even a new mining method is a manageable risk.
- Be measured in the level of disruption you can expect for your customers to be willing to accept, go in steps, but look at everything new.
- You always want to be prepared for change, looking out for the next opportunity, need to know what is coming from any side.
- Geology, new mine designs, tailings, water, microgrids, supply chain logistics all are areas to inspire innovation.
- If suppliers don't take the first step and build a first prototype without order, nothing will happen.
- To reduce the risk, close collaboration with customers is required, who look to suppliers for inspiration.
- Miners need to be looking for robust, risk-free, consistent technology.
- But they must be willing to underwrite the risk others are taking, guaranteeing a market for a new technology, being the lead customer.

All panelists work on technology towards achieving net zero, and represent different stakeholder groups in the ecosystem. They discussed systemic hurdles to moving towards a common goal. To summarize the discussion, this may be a recommendation going forward:

- It is difficult to be the first mover, to take the risk
- There is an expectation gap who is supposed to take the first step, everyone waiting for others to take the initiative.
- To reduce the risk, we need to be talking to each other and inch our way towards closing the expectation gap.
- All sides need to stay flexible, nimble and especially open as the context changes rapidly.
- CanmetMINING can alleviate some of the constraints and unknowns, provide the first steps, create the proof of feasibility, standardize and create a level playing field, provide guarantees and underwrite the risks for industry to get initiatives over the first hump.



Plenary discussion: How to achieve net zero in mining- the ecosystem





Plenary discussion: Building back better- how to achieve net zero in mining?





Day 2 agenda: content direction

09:00 - 09:15	Welcoming remarks and summary of Day 1 by the Co-Chairs
09:15 – 10:00	Mine of the Future Visualization – realizing the concept of net-zero Introduction to building the model Patrick Chevalier, CanmetMINING and Adriaan Davidse, Deloitte Exploring how to use the new tool MineRP
10:00 - 11:00	Break-Out Sessions What areas of "net zero" should be addressed? How can the tool be applied to support R&Ddecision making and technology adoption?
11:00 - 11:45	Plenary Discussion Presentation of the results of the Break-Out Session and Next Steps
11:45 - 12:00	Co-Chairs Summary and Closing Remarks

MineRP future of mining visualization



A sketch of future mining technology examples (Deloitte)

Full presentation available at <u>https://www.ami-aim.ca/en/publications</u>



Proposed process for using MineRP's tool (MineRP)

Breakout sessions: What areas of R&D should be addressed? How can the tool be applied?



Next Steps

- The discussion on the first day informs the direction of the development of CanmetMINING's next 5 year research plan, as do the content areas elaborated on in the day 2 discussions.
- To all participants- please indicate your interest in working with CanmetMINING to take the model discussed on day 2 to the next stage of development. This could include:
 - suggestions of technologies to add to the system as plug-in modules
 - development of potential scenarios that can serve to quantify the benefits from new technologies and mine designs
 - and as always, identification of R&D gaps where CanmetMINING can bridge with research.
- What became apparent in the wrap-up discussion is that work needs to be done in many other areas:
 - The speed of change needs to increase massively, mines for new materials for this change need to open faster, and these mines need to operate with a net-zero target. The biggest delays today come from getting social license to operate, and government needs to play a big role to ensure mining is trusted, and justifiably so.
 - While leading investors are speaking as if the new green world has arrived, analysts still use valuations and risk models that do not consider the changed parameters. Also here, communications needs to ramp up.



Appendix

- Screen shots from the plenary and breakout group sessions:
 - Day 1: structural changes discussion
 - Day 2: content direction discussion

Plenary discussion: Building back better- how to achieve net zero in mining?





Plenary discussion: Building back better- how to achieve net zero in mining?

Plenary discussion: building back better- how to achieve net zero in mining?



What should CanmetMINING's position/ role be? Which should be CanmetMINING's R&D priorities?

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What are Canada's specific needs?





Plenary discussion: building back better- how to achieve net zero in mining?

R&D process and people

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Communications, messaging and the ecosystem

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Plenary discussion: building back better- how to achieve net zero in mining?

Mining method, architecture, mining and transport

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Processing/ plant, tailings &water

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Energy, electrification & greenhouse gas reduction

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Breakout sessions: What areas of R&D should be addressed? How can the tool be applied?

R&D OPPORTUNITIES/ TOPICS FOR CANADA'S COMPETITIVENESS IN ACHIEVING NET ZERO IN MINING. HOW CAN THE TOOL BE APPLIED TO SUPPORT R&D DECISION MAKING AND TECHNOLOGY ADOPTION?



