INTERNATIONAL MINERALS INNOVATION INSTITUTE

DEMOday 2023 Industry Technology Needs List

IMII's DEMOday invites innovators with innovative and new technological solutions (inclusive of processes, inventions, tools, designs, etc.) that could be used by the minerals industry in Saskatchewan to solve problems.

For 2023, IMII's minerals industry members are inviting innovators to apply to pitch their solutions to the following industry needs:

Advanced Chemicals:

- Caking or clumping is a significant concern in dry fertilizer production, storage, transport, and application. IMII is seeking advanced/new anti-caking and/or dedusting chemicals that are not petroleum based and are neutral to environment and health that could be developed for and deployed in the potash (potassium chloride product) and/or uranium sectors (ammonium sulphate product).

Carbon Capture, Utilization and Storage (CCUS)

- Carbon capture is a technology that the minerals industry is considering deploying to help achieve carbon emissions reduction targets. IMII is looking for innovative sequestration (e.g., land sinks, engineered sinks) or utilization technologies that don't rely on indefinite ongoing monitoring to ensure there is no release of captured carbon.

Emissions Reduction:

- Saskatchewan's minerals industry often uses shafts (vertical or near-vertical tunnels) to access the province's rich minerals resources underground. Some of these shafts may be up to one kilometre deep, and all must be heated. This is often done by heating air before it is sent down the shaft. Clean heating solutions (e.g., using heat generated by other parts of the mining or milling process, non-fossil sources of heat, others too) are being sought which may both efficiently and safely heat the shafts.

- The minerals industry has large buildings (e.g., mills, warehouses) that often cannot be readily insulated or retrofitted. As such, we are on the hunt for clean (i.e., non-fossil) and efficient heat solutions that could be deployed in our sector.

- Industrial dryers are among the most versatile pieces of equipment within the industries they serve, and the potash industry uses both product and glazing dryers fueled by natural gas. IMII is inquiring for dryers using alternative to natural gas, or materially less natural gas to help reduce energy costs, exhaust volumes, and greenhouse gas emissions. Alternatives to reduce the moisture content of the product before drying may also be considered.

- Waste heat is, by some reckonings, the biggest source of energy on the earth and we are looking for technologies which could economically capture the waste heat from dryers, mine air

exhaust, etc. to be re-used to meet/offset other heating needs (e.g., pre-heating), upgrading to higher grades of heat, or even generate electricity.

Energy Efficiency:

- Some areas involved in the mining or milling of minerals are sources of heat in their own right. Are there efficient area (as compared to point source) heat recovery technologies under development? Heat may be generated from pumping systems or process areas.

- Drying potash is a vital aspect of processing the ore into a usable form for the fertilizer production process, as well as in finishing product coming off of the fertilizer production line. Is there technology that can be retrofitted to existing process dryers to promote better energy efficiency while still achieving the desired the moisture content (typically below 0.5%)?

- The dryers used to dry and glaze potash generate a large amount of heat, and some of this heat makes its way into the finished product. This waste heat may be a resource and is also a safety concern. Separate from the process (dryer), is there a technology to cost effectively recover heat from finished product (which can range in temperature from 80 to 180 degrees C)?

Water Solutions:

- The minerals industry seeks to be a wise user of water and is looking for smart industrial-scale water management solutions to help it responsibly manage the consumption and release of water from its operations.

- Concentration involves the separation of valuable minerals from the other raw materials received from the grinding mill. In large-scale operations this is accomplished by taking advantage of the different properties of the minerals to be separated. There is a need however to dewater the concentrates afterward. Is there a technology that could produce higher grade concentrates at similar recoveries reducing the need for leach water?

- In addition to looking for innovations to reduce energy use and greenhouse gas emissions, the minerals industry is open to technologies that may allow it to reduce its consumption of fresh water. In this case, the industry would like to see if there is a technology that could use less fresh water for dryer exhaust particulate removal?

Production Efficiency:

- One way the minerals industry is looking to further reduce its environmental footprint is by gathering information on mined ore before it reaches the mill. Are there technologies which could fully automate conveyor belt and/or mine face sampling of potash or uranium ores, or at other potential points early in the milling process (e.g., grinding)?

- Underground conveyor lines are just one piece of a complex system for transporting extracted rock and minerals. Their construction requires a great deal of effort and comes with a need for

the highest possible safety and reliability. IMII's minerals members are looking for an underground conveyor structure builder/jib with the ability to reduce heavy lifting required when constructing on site the 100+ conveyors anticipated to be installed by the potash industry in the near-term.

Remote Sensing:

- Rock mechanics instrumentation is deployed throughout many underground operations to gather information on the behaviour of rock in response to the stresses and strains of mining activities. Much of this instrumentation is becoming "smarter" when tied into underground communications networks. However, operations are constantly changing, creating a need for technologies for gathering information from such instrumentation even when they may not be tied into an LTE/WiFi network all the time.

- Drifts in underground mines in Saskatchewan are often built using tunneling technology. Can such technology be adapted to provide rock mechanics data and/or geophysical information of the roof of such openings? Technologies built on multi channel analysis of surface waves may be of particular interest.

- Mine shafts are often lined with concrete or steel to provide for ground support and the safe travel of personnel, equipment, other supplies, and ore to and from underground operations. IMII is looking for technologies (digital or otherwise) that could be developed and deployed to routinely gather data on the integrity of shafts and shaft lining in a safe and efficient way to minimize the manual collection of such data and the time dedicated to data collection.

- Mine shafts rely on steel ropes and other attachments to safely move personnel, equipment and supplies, and ore to/from underground operations. These ropes and attachments must be maintained to a high standard. IMII is looking for technologies (digital or otherwise) that could be developed and/or deployed to improve on the gathering of information as to the condition of such ropes and attachments.

Mine Planning:

- The minerals industry has benefited from the development of tools such as seismic land streamers capable of undertaking multichannel analysis of surface waves, refraction, reflection and surface-way surveys above ground. It would like to equally benefit from the development of similar technologies which could be deployed easily underground at a low cost to provide geotechnical and seismic data without compromising data quality.

Safety Solutions:

- Safety is a paramount concern in the minerals industry, and this extends to all types of equipment deployed. The industry is looking for technologies for the detection and suppression (e.g., passive isolating heat from fuel) of potential mobile equipment fires – be they diesel or

battery powered. A variety of technologies are of interest - shields, paint, sensors, or detectors providing warning for example (and not to limit innovation).

- Drifts are horizontal tunnels in rock that allow access to and from ore bodies and other underground mine workings. IMII is looking for technologies or techniques which could be deployed to detect when a potash mine sidewall in a drift needs to be addressed or scaled. The technology or technique should deploy non-destructive testing and could piggyback on technologies already deployed in the industry for other purposes (such as roadbed resonance, thermal imaging, etc.).

Mobile Equipment:

- The minerals industry deploys mobile equipment underground and on surface to move people and supplies, and this needs to be done safely. Are you developing navigation assist terrain detection technologies able to provide warning/guidance for evading large bumps or voids while operating mobile equipment and minimize the potential for harm to employees operating such equipment? Technologies could be deployed on equipment or personnel.

- While many assets associated with the minerals industry are deployed within mine and mills, some are deployed remotely. The industry is looking for technologies which could monitor the location and status of such assets when the communication infrastructure associated with the mine/mill is not readily available.

Capital Efficiency:

- The minerals industry is a large, capital-intensive industry and it is believed the building or expansion of a mining operation could become more efficient through new technologies which could be deployed through the engineering, procurement, and construction phases. Are there new technologies, for example, such as real-time, 3-D project management, which could be adapted for use in the minerals industry to lower capital costs and time?

Others:

- Mine and mill control room operators are tasked with running operations safely and efficiently. IMII is looking for innovative technologies which may help such operators learn the skills required to run a plant in less time than in traditional classroom settings, as well as aiding if required to respond to unexpected events in “real-time.”

- While mineral operations are often large, are there small or micro-options for generating electricity – such as micro-wind turbines or micro-hydroelectric plants for sealed pipelines for use in industrial operations?