Mining Cleantech Challenge

A Product Innovation Showcase

April 21, 2022

Instructions and Expectations

- Completion of all application fields is required or the application will not be considered. You will find the application here.
- Deadline for application submission: **5:00 p.m. MDT, Thursday, March 4, 2022**
- The review and selection committee is composed of representatives from Sumitomo, Newmont Mining, BHP, Royal Gold, Fresnillo, Resource Capital Funds, Consulate General of Canada - Denver, Office of Economic Development and International Trade, Colorado Energy Office, and Clareo Partners.
- The expectation of the selection committee is that new strategic development partnerships, pilots/trials, commercial contracts and/or potential investment targets will be identified through this process.
- Companies with more than $20 million in revenue will not be considered for this program.
- If selected, please be prepared to either present in person or online on Thursday, April 21, 2022. CCIA hopes to host the event in a hybrid format in Denver, CO subject to COVID-19 guidelines.
- 10-12 companies will be selected by our sponsor/judges to present to them, and will be notified by Monday, March 28, 2022 of invitation to the Thursday, April 21, 2022 showcase event.
    - If the event is hybrid, we hope that you will consider presenting to our sponsor/judges in person in Denver. You will have ten minutes to present followed by ten minutes of Q&A. The event will be held in a space conducive to social distancing.
    - If you choose to present to our sponsor/judges virtually, you will submit a five-minute (maximum) pitch video which will be played at the event and followed by ten minutes of Q&A.
- Selected companies will have until 5:00pm on Wednesday March 30, 2022 to confirm their attendance to Ashley Perry at ashey@coloradocleantech.com.
- Due to the impact of COVID-19, CCIA has received a grant to partially offset the regular $750 presentation fee. **We are pleased to be able to offer this opportunity at a reduced rate of $350.00 USD (for both virtual and in-person attendees).**
- If selected, you will be notified in advance of the order in which your company will present.
- If selected, you will be asked to sign a letter of commitment to present at your given time as well as an invoice for the $350.00 presentation fee.

Mining Cleantech Challenge
A Product Innovation Showcase

Please contact Mary Austin or Ashley Perry with any questions:
mary@coloradocleantech.com 303-775-2364
ashley@coloradocleantech.com 620-794-1843

Specific technology sectors may include, but are not limited to:

ADVANCED MATERIALS AND CHEMICALS
(including but not limited to): Novel materials or chemicals comprised of no or fewer hazardous chemicals; advanced materials less likely to rust or corrode which will improve containment; improved treating chemicals and detection methods; chemicals to extract hazardous items from produced fluids; new products made from captured CO2, new ways to capture/separate CO2 and NGLs.

BIOLOGICAL SOLUTIONS (including but not limited to) Target microbes or enzymes to treat waste or advance traditional mining extraction processes.

BLOCKCHAINS
(including but not limited to) Blockchains are an immutable, distributed database that opens up new use cases between trust boundaries, such as between disparate organizations. Applications of blockchain technology in mining could include the creation of efficient, trusted marketplaces; or distributed transactional platforms that can provide value in many areas of the business (such as compliance, CSR and social engagement, supply chain efficiency and tracing, and commodity trading).

Carbon capture use and sequestration including nature-based sequestration solutions, carbon mineralization/encapsulation, and use applications such as building materials, etc.

CYANIDE DESTRUCTION AND/OR CYANIDE REGENERATION PROCESSES FOR SLURRIES OR SOLUTIONS (including but not limited to): Numerous methods exist for the destruction of free/WAD cyanide complexes (e.g. Caro's Acid, hydrogen peroxide, CuSO4-SO2, SART) from spent process solutions prior to discharge into a tailing storage facility. Looking for novel equipment design, chemical additions, resins, etc. that result in lower overall cost-of-operation (from consumables, manpower, maintenance, regenerated cyanide for reuse in the operation) and/or improved safety for operating and maintenance personnel.

ELECTRIFICATION OR BATTERY APPLICATIONS (including but not limited to):
Alternatives to diesel, phased implementation, improvement in worker health and safety, less maintenance. Hydrogen energy storage -> need small amounts of platinum. Move to renewable power, reduced infrastructure, needs of ventilation shafts. Alternatives to diesel for mobile equipment using electrification and/or hydrogen-electric hybrid power trains. Energy storage both for mobile equipment and to support a large-scale shift to renewable energy. Hydrogen production (from renewables), hydrogen storage and hydrogen refueling technology is also of interest.

ENVIRONMENTAL CONTROL: Focused on underground dust management using low energy, waterless, dust management and removal.

Mining Cleantech Challenge

A Product Innovation Showcase

ENERGY EFFICIENCY (including but not limited to): More efficient comminution and recovery processes; more energy efficient and responsive drives and motors; efficient and clean generators; more efficient hybrid fuel (diesel and natural gas) engines that coordinate operations to provide power and response. Technologies that can economically convert waste heat sources (reciprocating engine exhaust heat and jacket water heat) into electricity at smaller scales (e.g. 20kW to 250kW). High efficiency engine technologies could include smaller scale natural gas fueled micro-turbine engines (<500kW). Small sale APUs on heavy equipment to eliminate idle during down time; ventilation on demand (VOD). More energy-efficient water purification/desalination as an alternative to reverse osmosis (RO)

MACHINE LEARNING (including but not limited to): Mine characterization, re-envision talent management. Create engaging interactions and stronger business outcomes.

METHANE AND NOX GAS DETECTION OR CONTROL
(including but not limited to): Methane, SO2, CO, CO2 and other emissions control/reduction/detection from valves, piping and vented sources; control of emissions from tanks and pressure vessels; real-time gas detection and alarm systems.

MERCURY ABATEMENT AND/OR REMOVAL PROCESSES (including but not limited to): Novel materials and/or chemicals that prevent or reduce the formation of mercury cyanide complexes or selectively remove mercury cyanide complexes from cyanide leach media (slurry or solution). Off-gas treatment system to remove/recover mercury from refinery electrowinning circuit sources (e.g. strip vessel, heated solution storage tanks, electrowinning cells, etc.) and/or retort/furnace/carbon regeneration kiln operation.

PELLETISING, BRIQUETTING AND GRANULATION: New technologies to deliver low cost, robust pelletising and briquetting of materials ahead of smelting and refining process. And, the ability to deliver low cost, rapid granulation of both products and waste materials to alleviate transport and storage.

PRE-CONCENTRATION (including but not limited to): Ore sorting at the shovel or mine face; coarse waste reduction prior to the plant; other rejection techniques to reduce energy and reagent application low grade or barren material. The use of sensors to determine mineralogy of material at the ore face, in the shovel, at stockpiles and on conveyors, and when pumped as a slurry around the plant.

PLANT or BIOLOGICAL SOLUTIONS (including but not limited to): Salt tolerant vegetation or trees targeted for beneficial use of produced water; vegetation or trees targeted for growth in drill cutting based soils; site or spill remediation solutions. Bio-characterization for produced/released water cleanup, soil remediation.

PROCESS SOLUTIONS (including but not limited to): New processes or novel applications of existing processes to improve the recovery of valuable minerals at lower capital or operating cost.

PRODUCTION EFFICIENCY (including but not limited to): Analytics to improve availability and utilization of fixed and mobile assets; advanced process control; remote operations management; application of new technology to reduce operating costs.

Mining Cleantech Challenge

A Product Innovation Showcase

PRODUCTION MANAGEMENT (including but not limited to): Management of mobile fleets in mixed surface/underground environments, real-time activity monitoring in active working areas, data capture/access and telemetry solutions for mixed fleets, proximity warning and collision avoidance, ventilation on demand (VOD).

REMOTE / DISTRIBUTED POWER (including but not limited to): Renewable/rechargeable sources including solar, wind, wave, geothermal, nuclear and fuel cells; storage technologies including batteries, flywheels, compressed air, thermal and pumped hydro-power; modular combined heat and power, micro/islanded grid technology, field gas powered equipment. Specific interest in high efficiency, low-emissions, cold weather-tolerant power generation technologies (50kW to +10MW) applicable to off-grid exploration or mine sites (e.g. methanol fuel cells that can use field-grade methanol, higher efficiency thermoelectric generators, micro-CHP systems). Increased interest in energy generation and storage technologies at a larger scale for our remote sites, including hydrogen, nuclear modular reactors, flow batteries, gravity storage, etc.

REMOTE OPERATION OR AUTOMATION OF MACHINERY (including but not limited to): Better efficiencies, improved safety, increased productivity, reduce unscheduled maintenance, improved working conditions, technology that can provide more reliable communication and data transfer underground, precision, technology to aid in interaction between autonomous and non-autonomous equipment, how to better implement a new automation program.

REMOTE SENSING (including but not limited to): Use of unmanned aerial (drone) and satellite-based systems to improve efficiency and safety of operations including; facilities inspections, site progress surveys including stockpiles, environmental monitoring, security monitoring and alarm systems, supply delivery systems.

RESOURCE CHARACTERIZATION AND MINE PLANNING (including but not limited to): Improving predictability and accuracy of resource estimates, reductions in elapsed time from sampling to digging (e.g. lab-on-a-rig), geochemistry in resource models and circuit designs; planning tools for combined surface and underground mines, machine learning. Additional geophysics approaches to extract more information from each exploration hole, not just during drilling but post drilling and post rehabilitation of the borehole.

SCALE MITIGATION/PREVENTION (including but not limited to): Chemical treatment to sequester or precipitate potential scaling compounds (commonly carbonates, sulfates, or silicates) and/or potential equipment design modifications within problematic process unit operations (e.g. autoclaves, quench tanks, thickeners, filters) to reduce scale build-up on equipment surfaces.

SLURRY AND/OR DIRTY SOLUTION FILTRATION (including but not limited to): Novel materials (equipment construction or filter media), design and/or chemical additions that reduce the operating/maintenance cost of filtration per unit basis (i.e. solid ton filtered for slurry or gallons filtered for dirty solution) by increased availability/utilization, longer component life, etc.

TAILINGS / WASTE HANDLING AND DISPOSAL (including but not limited to): Reduced water consumption; lower impact/risk tailings disposal techniques; improved management of acid generating material; advances in reclamation. Any alternatives to limestone ($CaCO_3$) to neutralize acid, which when combined with sulfuric acid produces CO_2 associated with the neutralization of acidic ores and acidic waste products.

Mining Cleantech Challenge

A Product Innovation Showcase

UNDERGROUND MINING ALTERNATE ENERGY OPTIONS (including but not limited to): Mobile mining equipment powered by non-fossil fuel sources (e.g. batteries, electricity, hydrogen or some type of fuel cell) could significantly reduce underground ventilation requirements. Potential use of batteries/solar for hoist and/or ventilation.

WATER (including but not limited to): Real-time monitoring including efficient sampling and analysis; beneficial reuse of produced water including recycling or conversion to solid salt suitable for secondary use (e.g. winter road maintenance or dust control); recycling of process water; new disposal methods; minimization of water volumes, wellbore integrity monitoring systems, alternative sourcing and processing to freshwater, water-less processing, metals treatment.