

**2021 Mining Cleantech Challenge  
A Product Innovation Showcase**

**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 11, 2021**
- The review and selection committee is composed of representatives from Newmont Mining, BHP, Royal Gold, Fresnillo, Ausenco, Rocky Mountain Institute, Resource Capital Funds, Consulate General of Canada - Denver, 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 attend the full day program on Thursday, April 22, 2021 online.
- 10-12 companies will be notified by Monday, April 5, 2021 of invitation to the Thursday, April 22, 2021 showcase event online. You will have two and a half weeks to create and submit a video of your presentation (five minutes maximum).
- Selected companies will have until 5:00pm on Wednesday, April 7, 2021 to confirm their attendance to Haley Whittaker at [haley@coloradocleantech.com](mailto:haley@coloradocleantech.com).
- There is no fee to apply to the Mining Cleantech Challenge. Due to the impact of COVID-19 CCIA has waived the \$750 presentation fee.
- If selected, your pitch presentation will be a combination of a pre-recorded five-minute video of your presentation followed by ten minutes of live Q&A.
- 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.

Please contact Mary Austin with any questions.

[mary@coloradocleantech.com](mailto:mary@coloradocleantech.com)

303-775-2364

**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 CO<sub>2</sub>, new ways to capture/separate CO<sub>2</sub> 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).

#### **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, CuSO<sub>4</sub>-SO<sub>2</sub>, 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.

**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).

**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, SO<sub>2</sub>, CO, CO<sub>2</sub> 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.

**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.

**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.

**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).

**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.

**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.

**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, well bore integrity monitoring systems, alternative sourcing and processing to freshwater, water-less processing, metals treatment.