

WHAT ARE MICRO REACTORS?

“Plug and play” reactors right-sized for providing heat and power to mining, heavy industry, and remote communities.

Benefits:

- **Transportable:** Fit on the back of a semi-truck and can be deployed to remote locations.
- **Simple-design:** Fail-safe and self-regulating designs that require fewer components, maintenance, and operators.
- **Fast on-site installation:** Can be connected and generating power within a week of arriving on-site. When the job is done, returned for redeployment or decommissioning.



Agnico Eagle's Meadowbank mining operation located North of Baker Lake, in the Kivallik region of Nunavut, Canada. The region is currently depending solely on diesel for energy. Clean energy alternative solutions are being explored for the near and long-term future.
Source: Agnico Eagle Mines Limited

Miners go to the ends of the earth for the minerals and metals we need to make clean energy. They may soon bring innovative nuclear reactors with them.

MINING

Unearthing a clean energy revolution

Under our feet lie the building blocks of the clean energy systems of the future. An installed solar panel, for example, requires many different materials found naturally, including copper, aluminum, steel, silver, and silicon, with some speciality modules using indium, selenium, gallium, germanium, cadmium and tellurium.

We rely on mining engineers to extract these materials from various locales, including some of the harshest and most remote areas of the world. And the scale of these operations can be mind-boggling: over 1,000 kilograms of copper ore is needed to produce the amount of refined copper used in an electric car—about as much as the car itself weighs.

The extreme conditions and remoteness of these operations can be hard to fathom. Take the Kupol mine in Russia, for example. This gold mine operates in a barren part of Siberia more than 160 kilometers from the nearest town. Temperatures can drop to 50 degrees Celsius below zero in the winter.

Remote operations like Kupol rely on diesel fuel to run their operations. But lugging diesel out to far-flung regions is expensive, and can leave the mines exposed to risks from supply-chain disruptions. It's also a key source of mining emissions.

Miners are looking for better options. And they may find it in nuclear energy—specifically, innovative designs referred to as a “micro-reactors”.

Micro-reactors are even smaller variants of Small Modular Reactors, with an output of around 10 megawatts of electricity or less. A number of concepts are currently under development with the goal of providing energy options to even the most remote locations in the world.

These innovative reactors have found their champion in Vic Pakalnis, CEO of MIRARCO—a non-profit organization dedicated to mining innovation in Sudbury, Canada. According to Pakalnis, there are “a lot of great opportunities for Small Modular Reactors in mining”.

“And did I mention, zero atmospheric emissions?” he adds with a canny smile.

Pakalnis's organization, MIRARCO, is working with researchers and nuclear operators to explore their feasibility for mining applications.

Micro-reactors promise a reliable energy source that is fuelled only once every 10 or 20 years and compact enough to fit on a flat-bed truck, in a rail car, or in a cargo plane. It's estimated they could reduce costs by 20 to 60 percent compared to diesel.

“A typical 20-year mining operation will spend over \$500 million worth of diesel” says Pakalnis. “If you can reduce that by half—can you imagine?”

These reactors are small, simple, and right-sized to the needs and lifetime of mining operations. Once the mining is done, they are designed to be removed and either sent on to another site, or back to a central facility for decommissioning.

As a source of both heat and electricity, micro-reactors can power electric equipment, vehicles, and ventilation systems while also providing heat for mine operations.

Alongside the introduction of renewables at mine sites, micro-reactors could revolutionize remote mining. Pakalnis feels a sense of purpose and opportunity, “It's important for us to get engaged in this technology,” he says, “this is our future.”