

What Would a Decarbonized Mineral Processing Plant Look Like: A Case Study in the Canadian-Yukon Region

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ABSTRACT

There is a collective-critical stance and a global shift towards reducing greenhouse gas emissions (GHG). With the impending increase in carbon pricing to curb emissions, the previously alternative mineral processing solutions are becoming attractive economic flowsheets.

To effectively tackle the Scope 1-3 GHG emissions in mining operations, a comprehensive strategy that spans the entire lifecycle of mining activity is required. This includes aspects like land development, facility construction, equipment selection, mining methodology, and more importantly, considerations to reducing emissions at the power generation. Mining in remote areas, where most new deposits are located, becomes challenging to manage and maintain lower GHG emissions, especially when massive energy requirements make traditional renewable power solutions, such as solar and wind, impractical.

This paper discusses the potential transformation of a mineral processing plant in the Canadian Yukon region into an energy-efficient operation, aligning with profitability and significant reductions in GHG emissions.

As part of the analysis and trade-off, a hypothetical large-scale SAG-balling circuit in the Yukon is used as a basecase, processing both competent and soft ores in the mine plan. Alternative comminution flowsheets are compared to systematically reduce the GHG emissions footprint, integrated with mining methods, ore sorting and alternative flotation technologies. These proposed alternative solutions are powered by a compact nuclear reactor, aiming to reduce the GHG footprint by over 50%.

This paper establishes a clear link between carbon pricing, trade-off values, and adopting sustainable practices. In doing so, it outlines a way forward, advocating for innovation and sustainability as fundamental elements of the future mining industry. By creating this comprehensive framework, the paper provides a practical template of what a future mine could look like and details how these innovative solutions can be systematically applied to shape the future of mining.