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Towards energy transition in the mining supply chain

The mining industry plays a crucial role in the global energy transition, which is essential for achieving net-zero carbon emissions. As the main source of critical minerals essential to renewable energy technologies, mining supplies the foundational materials needed for the development and deployment of clean energy solutions. Consequently, the demand for these minerals is projected to grow significantly in the coming years. However, supporting the energy transition poses substantial challenges for the mining sector, including high energy consumption, dependence on fossil fuels, complex supply chains, large-scale technological investments, and significant environmental and social impacts. This research addresses these challenges by proposing an optimization approach to mining supply chain planning that enhances both operational efficiency and sustainability.

The study integrates clean-efficient technologies and renewable energy to reduce carbon emissions and improve energy efficiency within mining operations. Recognizing the capital-intensive nature of these initiatives, it emphasizes the importance of long-term strategic planning to ensure economic feasibility and sustainable outcomes.

An optimization model is developed for long-term mining supply chain planning, encompassing multiple echelons, periods, and mineral products. A case study of the Chilean mining industry illustrates the practical application of this model, analysing the sector's specific challenges in transitioning to a cleaner energy paradigm. By providing a decision-support tool, this work aims to contribute to the transformation of the mining industry toward sustainability and support the global clean energy transition.

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