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Opinion

The Role of Mining in the Energy Transition and Climate Justice Scenario

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Mining activity is essential for the supply of mineral resources in practically all productive sectors, such as metallurgy, civil construction, chemical industry, and electricity generation. Furthermore, it represents a relevant piece of the energy transition. An energy system based on clean technologies, such as photovoltaic solar plants, wind energy, and electric vehicles, requires many minerals, some deemed critical.[1] On the other hand, the activity is linked to several environmental issues such as landscapes degradation, topographic change, soil erosion and loss of fertile soil, deforestation and habitat destruction, waste generation, pollution of soil, water, noise, and air, emission of greenhouse gases (GHG), and social and cultural impacts where it operates. To make matters worse, increasing demand for key resources for the energy transition implies more impacts. As they are non-renewable resources, there is a tendency towards the depletion of surface mineral deposits of high-grade minerals and closer to the consumer market. In other words, mineral extraction is carried out in increasingly deeper deposits, with more waste rock generation, and lower levels result in more difficulty for mineral processing (greater use of resources such as reagents, water, and energy and greater tailings generation).

Regarding GHG, primary minerals and metals production contributes around 10% of global energy-related emissions, mainly due to mineral beneficiation, land use change, transport, and trucking.[2] However, as mentioned, exploration processes tend to be carried out in deeper and lower-grade deposits. In that case, we will also have greater consumption of resources for their extraction and mineral processing, resulting in greater demands for reagents, water, and energy. It is noteworthy that the consumption of fuel and electrical energy for mineral exploration is the main consideration factor for calculating mining emissions. Indirect emissions arising from the degradation and removal of soil and vegetation in surface mining are also significant for the activity but are often ignored.[3]

Therefore, the mineral sector is currently facing significant challenges related to environmental issues, GHG mitigation as well as the supply of mineral resources needed for the energy transition. These resources are essential in achieving the goal of the Paris Agreement, which aims to limit global warming to 1.5°C.[4] With this in mind and also to achieve an energy transition, as well as climate justice, some recommended practices for reduce mining impacts include:

Reduce energy and water consumption

Reducing the consumption of resources such as energy and water is a fundamental principle of cleaner production. It has been largely achieved by improving process efficiency and technology, reducing leaks, and reusing water in closed systems.

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Improve waste management by exploring options for reuse and recycling

In waste management, whether waste rock or tailings, the mining sector must prioritize options for reuse, recycling, and recovery of remaining minerals. Disposal in modules or dams should be avoided due to the loss of these opportunities for waste recovery, the possibility of generating soil and water contaminants, and even major environmental disasters with the collapse of dams.

Explore possible substitutes for critical minerals and fossil fuels

It is important to explore substitutes for critical minerals and fossil fuels and to develop clean technologies that use renewable sources. This can help prevent many problems caused by increased demand and its impacts. Research and large-scale applications are necessary to achieve these goals.

Recover degraded areas using strategic techniques for future use

Degraded mining sites must be recovered, such as open pit mining and waste rock and tailings disposal locations. The most common is covering with fertile soil and revegetation. Consider future uses, such as parks, gardens, municipal solid waste landfills, agriculture, and pastures. Furthermore, an opportunity is the creation of Technosols with mining waste. They can be amended with organic and inorganic materials to produce fertile soils that enable plant growth and ecological reconstruction of the system.

Prevent and mitigate GHG emissions

Various viable alternatives exist to reduce GHG emissions. Established practices, such as prevention actions, include energy efficiency, the use of low-carbon fuels, and the deployment of renewable energy, and the mitigation actions like CO2 sequestration through Mineral Carbonation, Nature-Based Solutions (NBS), and Carbon Capture, Utilization, and Storage (CCUS), have proven to be effective. However, several technologies are still in their initial stages, and further research and development are necessary to make them viable solutions. These technologies must be economically viable, scalable, and accepted by those involved while ensuring that carbon can be stored for a long time.

Consider social and cultural impacts

Mining activities operate in areas often occupied by communities, including traditional communities with a common cultural, social, and historical identity. The social impact can be complex and depends, among other things, on the level of engagement between the mining companies and the communities. Therefore, mining companies must consider respecting all issues relevant to the community, society's desires, and the possibility of distribution of economic benefits.

Finally, it is of utmost importance to highlight that any measures undertaken towards the implementation of clean energy sources should be in alignment with the sustainable development objectives of the United Nations[5] and adhere to the principles of Environmental, Social, and Governance.[6] Transitioning to environmentally and socially just clean energy sources presents several challenges that must be addressed. Mining is one relevant contributor to greenhouse gas emissions, and it must take responsibility for adapting to cleaner practices, reducing its emissions, environmental impacts and supporting the transition process.[7-10]

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Conflict of Interest

The author declares that there is no conflict of interest.

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