THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Conflict and Supply Risks in Critical Materials for the Energy Transition

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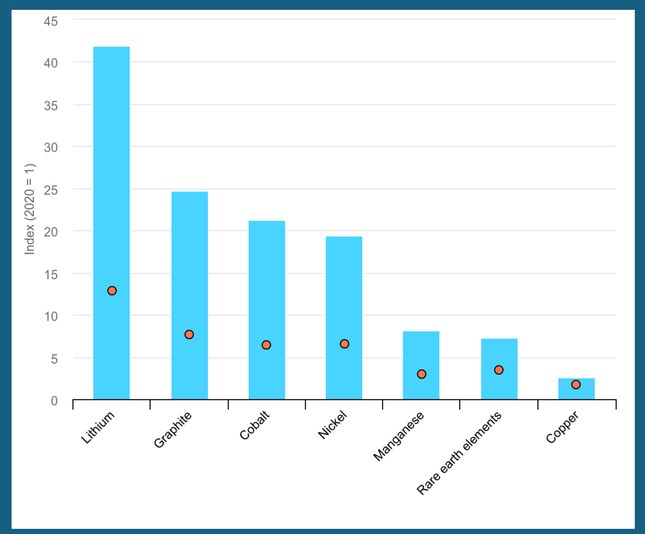
Abstract

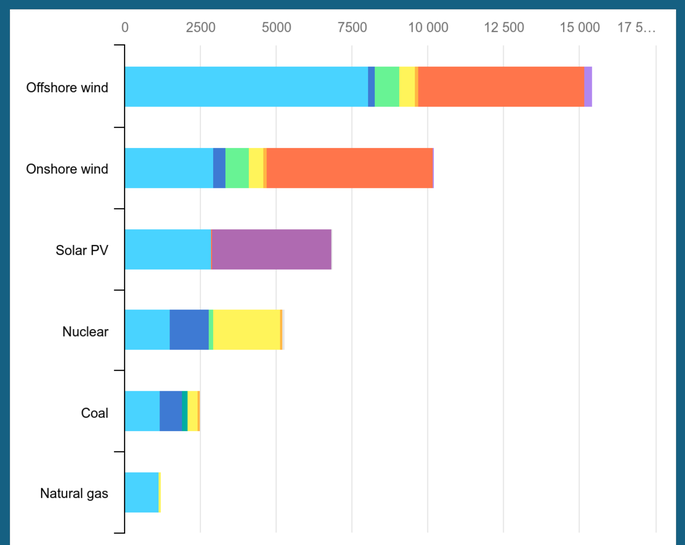
This research investigates the relationships between conflicts and the resources necessary to promote a clean energy transition, including lithium, cobalt, graphite, nickel, and rare earth elements. It documents the current production and extraction of these resources, including the countries of origin and major global actors involved in the process. The next step will be to identify conflicts that have arisen around the extraction and production of these resources, including conflicts related to property rights, labor issues, ethnic and civil war, and international civil and military conflicts. Finally, the project explores the approaches of the US government and the European Union to balancing conflict resolution with the need for critical resources for the clean energy transition. Ultimately, this research provides insight into the role of resource control in fueling conflict and the potential for peaceful resolution of such conflicts in the context of clean energy transitions. This presentation summarizes such findings.



IEA, Growth in demand for selected minerals from clean energy technologies by scenario, 2040 relative to 2020, IEA, Paris https://www.iea.org/data-and-statistics/charts/growth-in-demand-for-selected-minerals-from-clean-energy-technologies-by-scenario-2040-relative-to-2020, IEA. Licence: CC BY 4.0

Methods

To understand the current state of production and the level of demand for clean energy resources, I collected data on the production and extraction of materials such as lithium, cobalt, graphite, nickel, and rare earth elements from different countries around the world. Sources such as the United States Geological Survey (USGS) Mineral Commodity Summaries provided information on global production and major actors involved in extraction and production.



IEA, Minerals used in clean energy technologies compared to other power generation sources, IEA, Paris https://www.iea.org/data-and-statistics/charts/minerals-used-in-clean-energy-technologies-compared-to-other-power-generation-sources, IEA. Licence: CC BY 4.0

Short-Term Constraints, Long-Term Innovation: While there may be short-term constraints in the supply of critical materials due to inadequate mining and refining capabilities, disruptive innovations such as material substitutions and efficiency improvements are helping reshape demand patterns and mitigate these constraints.

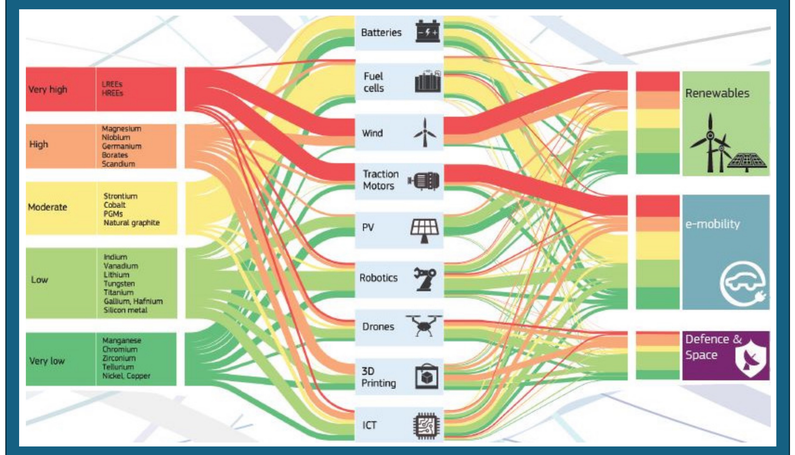
Geographic Concentration: The concentration of critical material mining and processing in a few countries raises questions about geopolitical vulnerabilities. Countries with significant control over the refined supply of these materials hold substantial leverage in global markets.

Results and Conclusions

Trade Dynamics: Unlike fossil fuels, trade in critical supply chains due to concentration in certain regions. However, long-term trmaterials is less extensive and not always openly traded on exchanges. This lack of standardization influences the vulnerability of supply chains and makes them susceptible to disruptions.

Geopolitical Risks: Short- to medium-term disruptions could pose risks to critical material ends suggest that geopolitical influence over these supply chains will likely be less pronounced than that over fossil fuels.

Structural Trends and Uncertainty: The impact of geopolitical considerations must account for structural trends that can impact mineral availability and demand, such as declining ore grades, material substitutions, and technological innovations. These factors contribute to uncertainty in predicting future demand.



This research reveals a complex interplay between conflicts and the resources required for a clean energy transition. I have found that regions rich in lithium, cobalt, graphite, nickel, and rare earth elements often coincide with areas prone to conflicts, such as resource-related disputes, geopolitical tensions, and social unrest. **The mining of critical materials is highly concentrated in specific geographical locations.** Australia (lithium), Chile (copper and lithium), China (graphite, rare earths), the Democratic Republic of Congo (cobalt), Indonesia (nickel) and South Africa (platinum, iridium) are the dominant players. **Processing is even more geographically concentrated**, with China accounting for more than 50% of the world's refined supply of (natural) graphite, dysprosium (a rare earth), cobalt, lithium and manganese (Geopolitics of the Energy Transition, 35). These conflicts often stem from issues related to extraction rights, environmental impacts, labor conditions, and international competition for these valuable resources.