The Hague Centre
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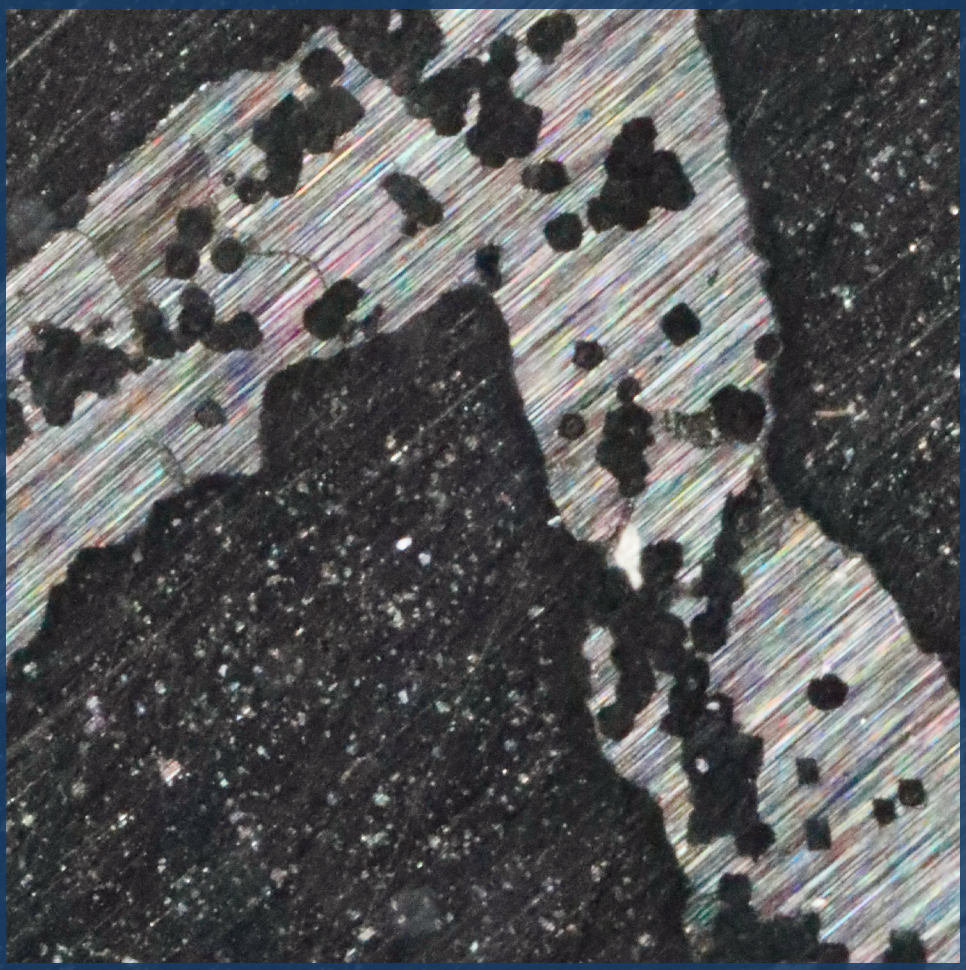
Executive Summary

Graphite

Supply chain challenges & recommendations for a critical mineral

Amrish Ritoe, Irina Patrahau, Michel Rademaker

March 2022



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Supply chain challenges & recommendations for a critical mineral - Executive Summary

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Executive summary

The energy transition relies on secure supplies of raw materials for the large-scale deployment of low-carbon technologies. Graphite is a critical mineral for governments across Europe and the United States (US), given its importance to strategic sectors and the risks associated with its supply. The mineral plays an essential role in decarbonizing two economic sectors with high emissions of greenhouse gases: transportation and heavy industry. Technologies that enable the decarbonization of transport and steel production will rely heavily on a consistent supply of high-quality graphite, leading to an exponential growth in the demand for graphite over the coming decades. This paper analyses the practical, geopolitical and environmental challenges of sourcing graphite, and provides recommendations of how the European Union (EU) and the US can mitigate supply risks in the next decades.

As most countries strive toward carbon neutrality within the coming decades, the demand for graphite could increase up to 500% compared to 2018 levels.[1] The concentration of graphite production and processing in China, which accounts for approximately 80% of global graphite supply, leaves the EU and US vulnerable to supply chain disruptions.[2] When it comes to lithium-ion batteries, Chinese dominance becomes even more striking. China dominates the entire supply chain for lithium-ion batteries, not just those parts of the supply chain that rely on the production of graphite. As China is committed to decarbonizing its economy, the global supply of graphite and batteries will be placed under considerable stress.

There are two types of graphite: natural and synthetic graphite. Whereas natural graphite can be mined in multiple jurisdictions worldwide, synthetic graphite has a narrower supply base as it is produced from oil or coal-based needle coke. Synthetic graphite is preferred in the production electric arc furnaces (EAFs) for steelmaking, but battery producers can use both synthetic and natural graphite as their raw material. Due to its predictable, consistent performance and auspicious characteristics, synthetic graphite has long been preferred over natural graphite. However, its production is expensive, energy-intensive, and environmentally harmful. The use of synthetic graphite in 'green energy' technologies is highly problematic from an environmental, social, and governance (ESG) perspective and therefore becomes increasingly difficult to justify by producers. The increased demand for synthetic graphite from EAFs together with other ESG challenges could lead producers of lithium-ion batteries to move toward natural graphite and new processing methods.

The processing of natural graphite is becoming increasingly popular due to new and sustainable production processes and the potential to scale up in regions outside of China. Natural flake graphite mines exist in African countries like Mozambique and European countries like Ukraine and Norway. Companies in the EU and the US have developed cleaner methods to process natural flake graphite in an environmentally responsible and economically efficient manner. Producing countries in Africa, the EU and the US are in a unique position to bring together their capital, knowledge and raw materials and set up a solid supply chain that meets environmental and social standards, and that secures the graphite supplies required for the energy transition. Government initiatives could incubate an eco-system that reduces investment risks, increases public acceptance of industrial processes, and scales processing capacity at home.

1 Kirsten Hund et al., "Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition" (World Bank Group, 2020), 12.

2 USGS, "Mineral Commodity Summaries: Graphite," 2022, https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-graphite.pdf; Govind Bhutada, "Visualizing the Natural Graphite Supply Problem," Elements, November 18, 2021, https://elements.visualcapitalist.com/visualizing-the-natural-graphite-supply-problem/.

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