MEKETA CAPITAL

The Opportunity in Critical Minerals

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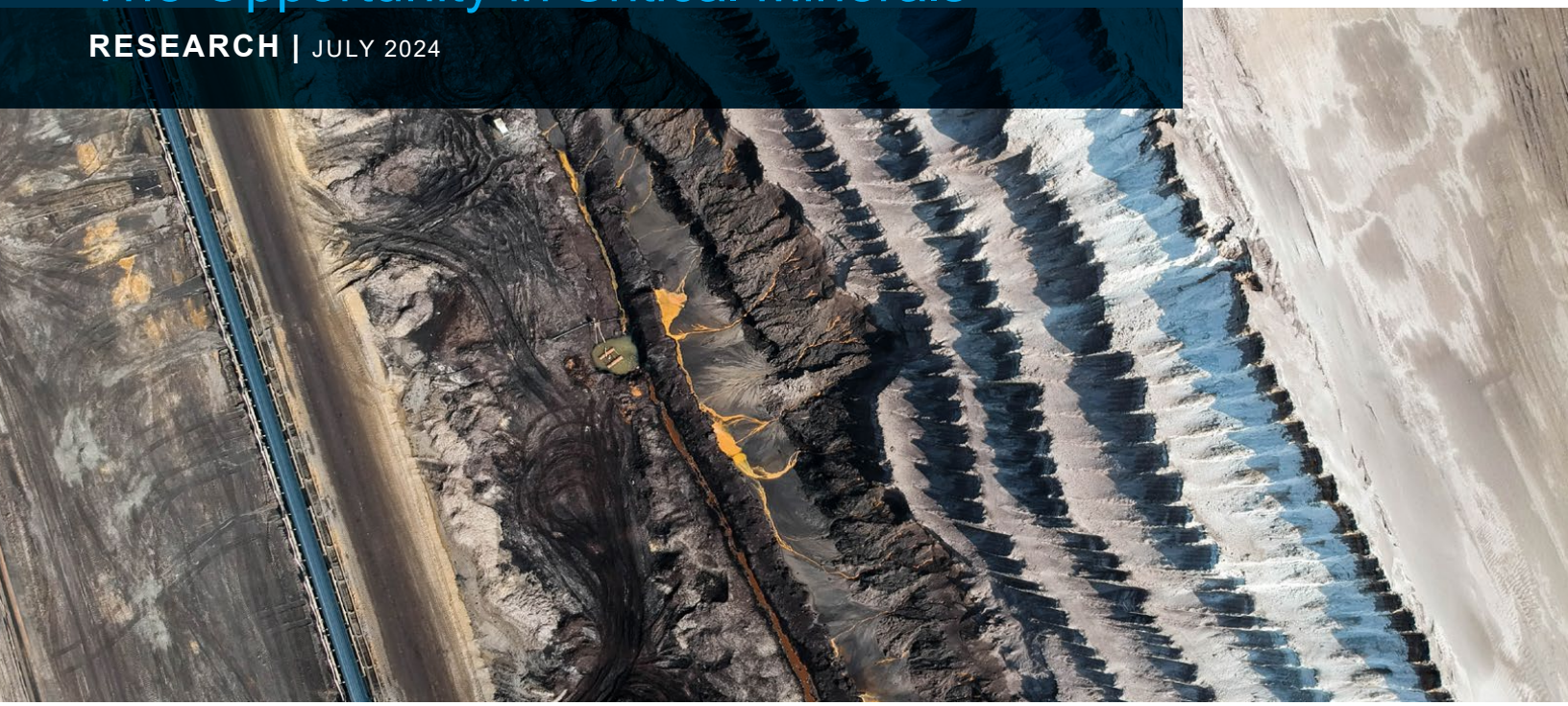

When headlines about the "energy transition" or "energy innovation" appear, the focus tends to be on the necessary infrastructure - topics such as "new grids," "new data centers," and "more green energy" often dominate the conversation. However, discussed less frequently are the natural resources needed to enable innovation. Critical minerals undergird technological advancement and will likely be in higher demand as energy systems evolve.

What Are Critical Minerals?

In broad terms, critical minerals are minerals, elements, substances, or materials that have a high risk of supply chain disruption and serve as a raw material in one or more energy technologies.[1]

[1] Note: They are also key components for defense weapons and semiconductors.

Critical minerals are at the heart of the clean energy revolution, playing a key role in the production of electric vehicles ("EVs"), renewable energy infrastructure, and energy storage systems.

The global demand for critical minerals is surging, propelled by the increasing adoption of green technologies. However, there are concerns about the future supply of these minerals, particularly given the rapid increase in demand for certain materials.

The Department of Energy's criticality matrix (see Figure 1) is a tool that helps policymakers and industry stakeholders understand the supply risks associated with these minerals and take proactive measures to mitigate them. The matrix considers factors such as production concentration, substitutability, recycling rates, and geopolitical stability to determine the criticality of each mineral.

Minerals Used in Traditional Energy Sources Like Coal and Natural Gas

Note: For illustrative purposes only.

- Copper
- Nickel
- Cobalt
- Chromium
- Molybdenum

Minerals Used in Clean Energy Sources Like Wind and Solar

Note: For illustrative purposes only.

- Copper
- Nickel
- Manganese
- Chromium
- Molybdenum
- Zinc
- Silicon
- Rare Earth

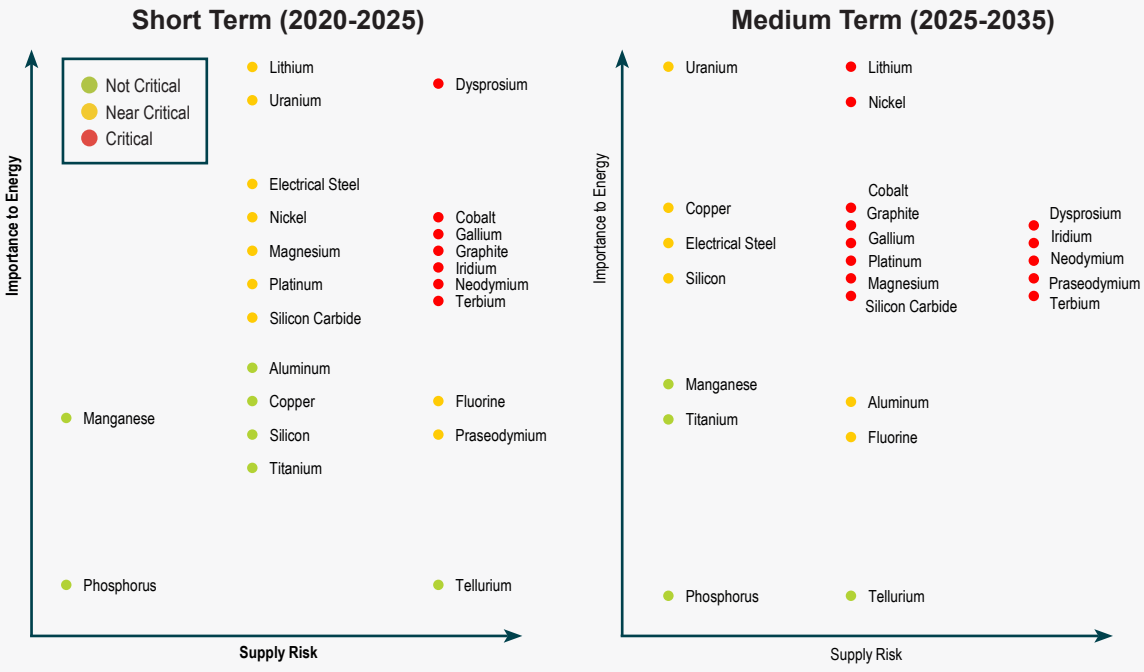

FIGURE 1
Criticality Matrix

Source: US Department of Energy, "Critical Materials Assessment 2023." The report considers 38 minerals/materials, of which 23 were evaluated for criticality after a screening process. Critical minerals are also vital for national security and economic stability.

Where are Critical Minerals Used?

Critical minerals are at the heart of the clean energy revolution, playing a key role in the production of electric vehicles ("EVs"), renewable energy infrastructure, and energy storage systems. The construction of green energy power generation assets often demands a significantly higher amount of mineral resources compared to traditional fossil-fuel-based power generation. For example, an onshore wind plant requires nine times more mineral resources than a gas-fired power plant (see Figure 2). The International Energy Agency ("IEA") has highlighted the need for a secure, sustainable, and affordable supply of critical materials to ensure the success of clean energy transitions.[2]

[2] Source: IEA, "The Role of Critical Minerals in Clean Energy Transitions," as of May 2021.

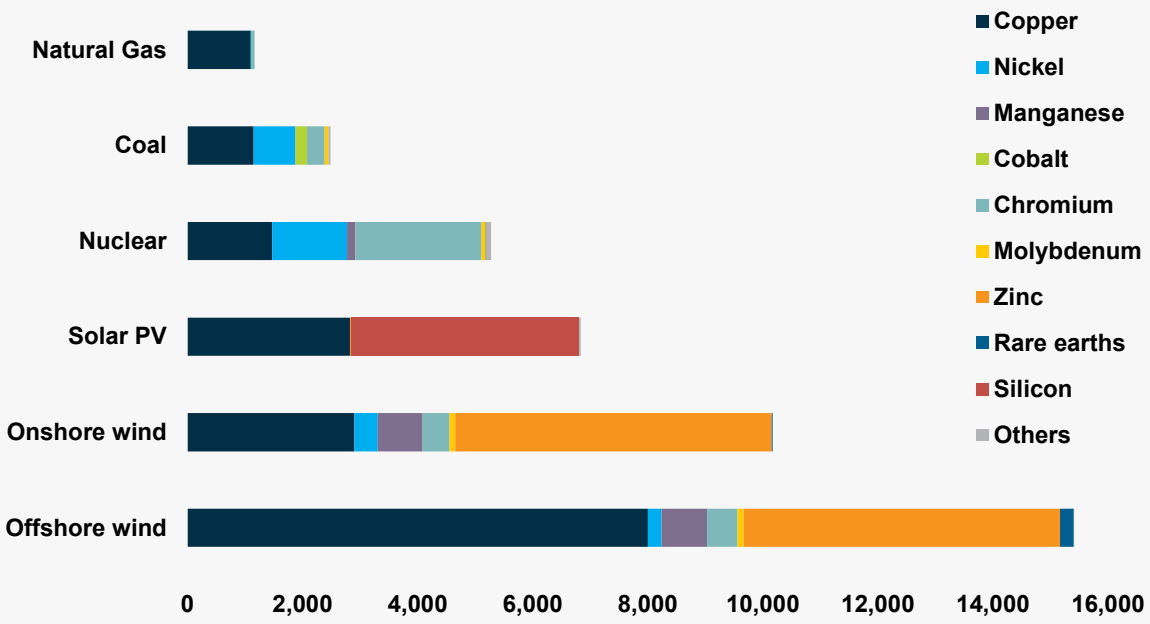

FIGURE 2
Minerals used in Clean Energy versus Other Power Sources (kg per MW)

Source: IEA, "The Role of Critical Minerals in Clean Energy Transitions," as of May 2021.

Importance to Electrical Vehicles & Batteries

An EV requires six times the mineral inputs of a conventional gas-powered car.[3] Besides copper and manganese, which are used in traditional cars, EVs also utilize critical materials like graphite and cobalt, as well as nickel and lithium, which are expected to become critical in the medium term.[4] In the US, EVs represented 8% of car purchases in 2022, a figure that is anticipated to rise owing to the incentives introduced in the Inflation Reduction Act and state laws that will prohibit the sale of new gas-powered vehicles by 2035.[5]

[3] Source: Ibid.

[4] Source: IEA, "Critical Minerals Market Review 2023."

[5] Source: White House, Inflation Reduction Act, 2022.

Investing in Critical Minerals

The demand for and global price of critical minerals is increasing, while mining and production are highly geographically concentrated. Current mining (i.e., supply) levels are also a concern, one that is likely to worsen if demand growth outstrips the increase in supply. Hence, there is a need and an investment opportunity to find new, geographically diverse, supplies of critical

minerals. In the venture capital sector, critical mineral startups raised a record $1.6 billion in 2022, representing a 160% year-on-year increase.[6] Globally, mineral resource exploration spending has increased in four of the past five years (with the exception of 2020), growing 20% from 2021 to 2022.[7] Opportunity extends beyond strictly mining, as some of the largest mineral-consuming companies (such as EV and battery manufacturers) are looking to move up the supply chain and secure minerals directly with their own mining companies.[8]

Investment opportunity may also lie in the processing of critical minerals. With major manufacturers like General Motors promising to offer only EVs (for new US light duty vehicles) by 2035,[9] EV and battery production capabilities must grow in order to have the capacity to process much larger quantities of minerals.

Currently, China has the largest share of global EV battery production capacity at 77%, while the US stands at just 7%.[10] The Inflation Reduction Act acknowledges this gap and puts an emphasis on the domestic EV and battery supply chain. As a result, the US government has pledged billions through a combination of tax credits, loan authority, and funding to the domestic critical minerals supply chain,[11] and billions of private investments have been announced for domestic EV manufacturing.[12]

The EV battery recycling sector is also expected to grow over the next decade. The total amount of spent batteries from EV and storage applications was under 2 GWh as of May 2021, and projections show that it could grow to 100 GWh by 2030.[13] Currently, China accounts for nearly 50% of global battery recycling capacity.[14] Thus, many countries are also focusing on expanding their own domestic battery recycling capabilities. For example, in the US, the IRA includes a clause that incentivizes EV automakers to use US recycled battery materials.[15]

Conclusion

The increasing global demand for critical minerals, coupled with potential supply chain risks, highlights their strategic importance and the need for a secure and sustainable supply. The unique investment opportunities presented by critical minerals may offer a promising avenue for investors to participate in the green energy transition and potentially contribute to a more sustainable future.

6 Source: IEA, "Critical Minerals Market Review 2023."

7 Source: Ibid.

8 Source: New York Times, "Lithium Scarcity Pushes Carmakers into the Mining Business," July 2023.

9 Source: General Motors Newsroom.

10 Source: IEA, "Global Supply Chains of EV Batteries," July 2022.

11 Source: Building a Clean Energy Economy: A Guidebook to the IRA's Investments in Clean Energy and Climate Action, January 2023.

12 Source: Environmental Defense Fund, "Report Finds Investments in U.S. Electric Vehicle Manufacturing Reach $120 Billion, Create 143,000 New Jobs," March 2023.

13 Source: IEA, "The Role of Critical Minerals in Clean Energy Transitions," as of May 2021.

14 Source: Ibid.

15 Source: Reuters, "Dead EV batteries turn to gold with US incentives," July 21, 2023.

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