

Unearthing Michigan's Critical Minerals Potential

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What Is a Critical Mineral?

- A non-fuel mineral or mineral material essential to U.S. economic or national security and that has a supply chain vulnerable to disruption.
- USGS's most recent critical minerals list was published in 2022 and contains 50 minerals.
 - USGS must revise the list at least once every three years.



Energy Technologies Need Critical Minerals

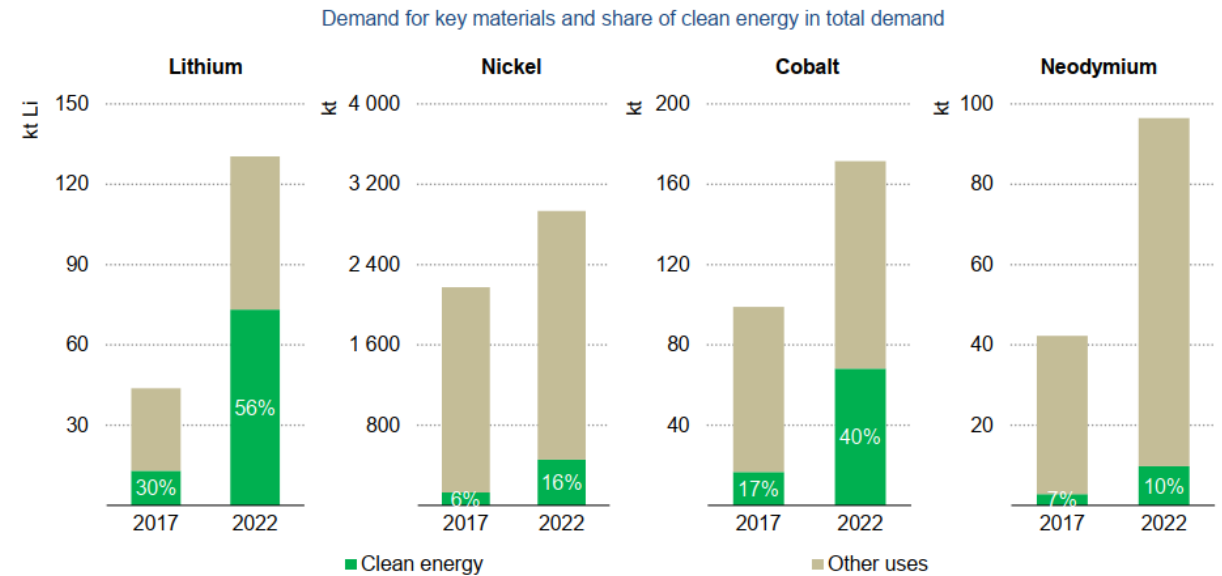
- By 2040, electricity grid (Al and Cu) will require between 7.4 and 10 Mt
- EVs and batt. storage (Li, Ni, Al, Cu, Co, REEs) will require 4 to 12.7 Mt

Critical Mineral Needs for Clean Energy Technologies (Source: IEA 2021)

	Copper	Cobalt	Nickel	Lithium	REEs	Chromium	Zinc	PGMs	Aluminium*
Solar PV	●	○	○	○	○	○	○	○	●
Wind	●	○	●	○	●	●	●	○	●
Hydro	○	○	○	○	○	○	○	○	○
CSP	○	○	●	○	○	●	○	○	●
Bioenergy	●	○	○	○	○	○	○	○	○
Geothermal	○	○	●	○	○	●	○	○	○
Nuclear	○	○	○	○	○	○	○	○	○
Electricity networks	●	○	○	○	○	○	○	○	●
EVs and battery storage	●	●	●	●	●	○	○	○	●
Hydrogen	○	○	●	○	○	○	○	●	○

Critical Minerals Demand Shows No Sign of Slowing Down

- From 2017 to 2022, the energy sector was the main factor in increases in demand for the following minerals:
 - 300 percent for lithium
 - 70 percent for cobalt
 - 40 percent for nickel



Source: IEA 2023

USGS Does Not Consider Copper a Critical Mineral

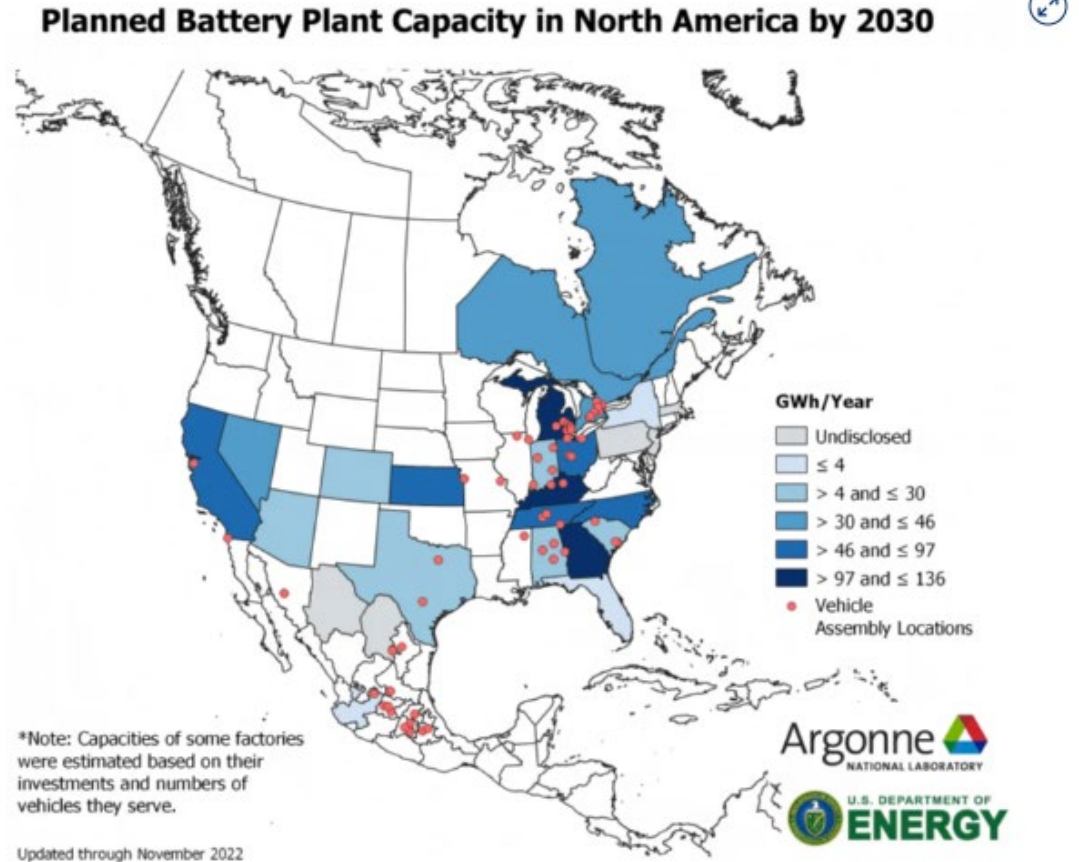
- Copper is arguably the most broadly in-demand mineral across clean energy technologies.
 - Solar PV, wind, electricity networks, batteries
- USGS rejected bipartisan urging to add copper to the list.
- Copper is on other critical minerals lists (e.g., Canada, Australia).
- Michigan has significant copper potential: 68,000 metric tons of annual payable copper projected from Copperwood and White Pine projects (near Ontonagon, MI), according to the project developer.

Geopolitics and Global Supply Chains

- For 12/50 items on the critical minerals list, United States is 100 percent “net import reliant.”
 - Includes gallium (semiconductors), graphite (batteries), and manganese (batteries)
- For another 31 critical minerals, U.S. more than 50 percent net import reliant.
- **For 30/50 items on the U.S. critical minerals list, China is the top producer.**
 - On August 1, China will begin imposing export controls on gallium and germanium (minimize signal loss in fiberoptic networks).
- **Processing:** China holds half of planned lithium chemical plants; Indonesia represents nearly 90 percent of planned nickel refining facilities.
- U.S.-led bilateral (e.g., Japan) and multilateral efforts (e.g., Minerals Security Partnership) to secure supplies.

Where Does Michigan Fit In?

- Michigan is a major end consumer of critical minerals.
- New battery plants
 - (GM/Ultium; LG Energy Solution; Ford/CATL; Gotion; ONE)
- Michigan is 19th in installed solar; projected to hold that position over next five years.



Michigan Can Be a Supplier of Critical Minerals

- Michigan is one of the few jurisdictions that can realistically claim the potential to create end-to-end EV supply chain.
 - Mining can create wealth for communities throughout Michigan.
 - Helps MI compete against other states in EV / battery / high-tech mfg. project race.
 - Strengthen supply chain security—what's the next supply chain shock?
 - Focus on ESG is forcing companies to think about human rights and environment-related risks of global supply chains (e.g., Scope 3 emissions).



Source: RMI 2023

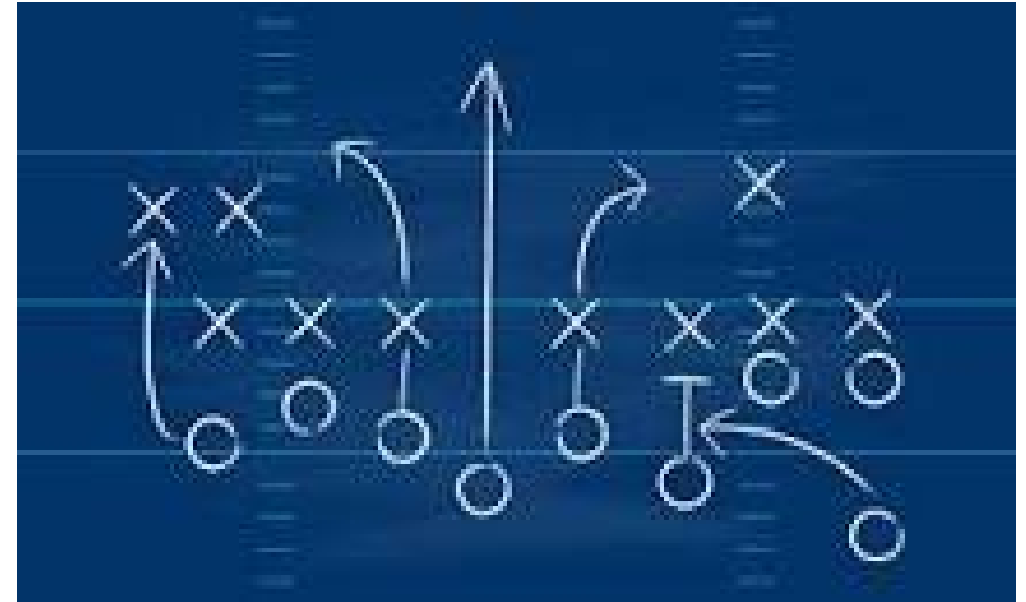
Michigan Has Mineral Resources and Manufacturing Know-how

- We have been a mining state for more than 125 years, with production totaling about \$50 billion since the mid-1990s.
- Mining supports approximately 26,000 jobs in Michigan.
- Mining contributes roughly \$1 billion to the state's GDP annually.
- In 2022, Michigan ranked 9th among U.S. states in value generated from mineral production.
- Michigan is one of the only states that mines iron ore for the steel industry, and still the only state that produces nickel (18,000 metric tons of nickel concentrate in 2022).



Michigan Has the Playbook for Mineral Development with Minimal Environmental Impact

- Prof. Nancy Langston, Michigan Tech: “We have critical minerals needs; we also have a critical watershed.”
- Notable success story: the U.P.’s Eagle Mine, the only operating nickel mine in the U.S.
- The mine owner worked with members of the local community to create a stringent monitoring program that has prevented pollution since the mine began operating in 2014.
- Eagle Mine life recently extended to at least 2027.



Michigan Is Already Developing a “Circular Economy” for Key Minerals



- Michigan Tech and Eagle Mine are co-recipients of \$8.1 million to prove new research technologies that develop sustainable processes to supply critical minerals for EV battery manufacturing.
- The university and company received an additional \$2.5 million from the U.S. Department of Energy to enable the study of recycling opportunities in Eagle Mine’s tailings facility.
- The state’s most recent budget includes \$5 million to support the Michigan Tech recycling hub.
- Broader definition of mining: “full value” mining; revitalizing abandoned mine sites.

Major Federal Dollars Are on the Table

- Infrastructure Investment and Jobs Act (2021)
 - Funding for projects that increase the domestically produced supply of critical minerals.
- Inflation Reduction Act (2022)
 - Advanced manufacturing credits for the domestic production of certain critical minerals.
 - Tax credits to purchasers of EVs with large quantities of critical minerals mined and processed in the U.S. or a trade agreement partner.
- Defense Production Act
 - Encourages “sustainable and responsible domestic mining” through hundreds of millions of dollars in purchase commitments and loan guarantees.

Michigan Has Already Begun This Work

Michigan's Mining Future Committee Report issued in 2021 made valuable and bipartisan recommendations to:

- Increase public and tribal engagement around Michigan's mining potential
- Focus on workforce development
- Reevaluate Michigan's mining tax structure
- Streamline regulations, including the accommodation of responsible mining practices within Michigan water, wetland, and lake regulations

The recommendations should be reviewed and potentially expanded in light of rising demand and increased funding for domestic mining development since the report's release.



Key Takeaways and Q-and-A

- **Permitting.** Need balanced approach that does not put red tape over need to build (DOE vs. DOI). We need to assume *some* risk to achieve long-term energy goals—shouldn't offshore it to places hard to find on a map.
- **Community engagement.** Need to be out there, explaining the *local* project benefits (and then the state, nat'l, and int'l ones).
- **Michigan stands to benefit.** Opportunity for Michigan to pursue a comprehensive “mining-to-mobility-to-sustainability” that strengthens supply chain security for MI manufacturers, cements state's leading role in building the clean technologies of the present and future, and creates jobs and prosperity for residents.



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