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## COMMENTARY: Critical need for cobalt supply chain outside of Africa

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As we move toward integration of renewable energy sources and electric vehicles, we must pay greater attention to the cobalt supply chain and diversification of supply for cobalt sources.

Cobalt plays an integral part of the common lithium-ion battery, and as battery-powered applications such as electric vehicles become ubiquitous, cobalt mining will need to grow proportionally to avoid supply bottlenecks.

Industry projections show that if we reach 24.7 million cars by 2025, we will need the cobalt supply to have a compound annual growth rate of about 8 percent from 2020 to 2025. If demand is higher, such as upward of 63.2 million cars by 2025, it will require a growth of about 14 percent from 2020 to 2025. Such growth rates hinge on a precarious supply chain.

The foremost risk, and perhaps the most challenging to solve, is geopolitical. Sixty-two percent of the world's cobalt comes from the Democratic Republic of Congo, and combined with production from Zambia, Madagascar, South Africa and Zimbabwe, the five countries mine more than 71 percent of the world's cobalt. Companies process ore locally and export more than 90 percent of the total to China for further processing and refining to produce commercial cobalt compounds used in batteries.

This status quo of exclusive trade between African countries and China exposes the market to Chinese regulatory volatility and export restrictions, a recent example being that of the rare earths market, which saw extreme shortages after the Chinese enacted export restriction in 2010. China controlled almost 100 percent of the rare earths market and continues to control more than 95 percent of it. Since then, countries and private industries have had to resort to alternate sources and materials, and stockpiling. Similarly, less cobalt-intensive batteries and alternate energy storage technologies will lessen the stress on the cobalt supply chain.

Battery manufacturers should integrate with chemical manufacturers, stockpile buffers and enter into long-term contracts to hedge their risk. Mining companies need to explore resources in Australia,

Canada and the United States that are less volatile.

A second risk is that most of the cobalt produced is a copper or nickel byproduct. Meaning, even as economics for cobalt

production improve with growing demand, producers may not be able to scale cobalt production independent of the primary metal. Efforts to develop more independent resources are underway, but we need to invest more in improving processing efficiencies, secondary recovery from old tailings, and recycling.

A third risk is the time it takes to set up a new mine. A typical project can take seven years to come on line. Therefore, investors will need at least a stable public policy for electric vehicles and grid energy storage to bank their resources on.

More geological and drill hole data should be made public through state and federal geological agencies to reduce exploration risk and attract more capital. State governments can indicate high-value resources exclusively for future natural resource development to streamline the permitting process.

Lastly, more than 20 percent of the cobalt production in the Congo comes from artisanal miners. A significant portion of this production violates human rights and child labor laws, as a 2016 Amnesty International report, "This Is What We Die For," documented all too well. Battery manufacturers in the United States and around the world must be diligent about their supply chain and be transparent about suppliers.

Overall, a combination of high demand expectations and a precarious supply chain has already pushed the cobalt price up 140 percent since this time last year. A continued price trend will therefore challenge the expected decrease in battery price, on which electric vehicles and large-scale battery use is largely contingent. Another continued concern is whether new cobalt supply will be available to non-Chinese battery manufacturers.

This status quo supply chain is too risky for an increasingly important commodity. The growing energy storage industry is an opportunity to grow the country's natural resource and chemical manufacturer industry.

It is upon the policymakers, private industries and academic institutions to build a positive ecosystem, and the time to act is now.

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