Meeting demand for green and critical minerals

MINING’S ROLE IN THE TRANSITION TO A CLEAN ENERGY FUTURE

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The conversion to renewable energy sources, accelerated adoption of electric vehicles (EVs), and general move toward increased electrification are all aspects of the global move toward the future of energy—which promises to drastically alter the demand dynamics of the mining industry. It also heralds new opportunities for miners and could reshape mining portfolios in the next few years. To position for success, however, miners likely need greater visibility into emerging demand drivers as well as regulatory support to diversify the supply chain for critical minerals.

On a global basis, the mining industry is not generally perceived as “clean and green”—but the sector’s realities have been shifting in recent years. Driven in large part by mounting stakeholder pressure to abandon fossil fuels, many mining companies have begun to reimagine the role they will play as the world transitions to a clean energy future. The energy transition presents a significant opportunity for the industry to rebuild trust with society at large as a supplier of critical and green minerals produced in a sustainable and ethical way.

Pressures to transform

Growing concerns surrounding climate change and pollution led to some of the biggest climate protests ever in 2019 as millions took to the streets to demand immediate action. These concerns came into even sharper focus in 2020 when shutdowns in response to COVID-19 delivered measurable environmental benefits, underscoring the significant impact of the world’s industrial practices. In early April 2020, when the global lockdown was in full swing, carbon emissions were down by 17% year over year. Environmental activists are no longer operating in isolation. Investors, governments, and major corporations alike have taken up the gauntlet to reduce carbon emissions. In a charge led by the power and utilities sector, countries across the world are consequently positioning for the large-scale adoption of renewable energy—a move supported by the continuing exponential decline in the cost of renewable energy solutions. Solar photovoltaic (PV) is now the cheapest source of energy in history, and further improvements are expected.

Energy storage provides another case in point. In 2019, average market prices for battery packs fell to US$156/kWh, representing an 86% drop since 2010, according to a report released by Bloomberg New Energy Finance (BNEF). The report further forecasts that by 2023 the price of battery packs will fall further, to US$100/kWh.

Girding for the future of energy

The rise in alternative power sources is only one factor paving the way for the future of energy. Yet another is the shift from internal combustion engines (ICE) to EVs.

In 2019, the combined annual sales of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) tipped over the 2 million vehicle mark for the first time ever. Although the spread of COVID-19 has affected short-term vehicle sales...
forecasts, this impact has not been uniform. Tesla’s sales exceeded expectations, rising by 44% in the third quarter of 2020. Similarly, global EVs are expected to enjoy a compound annual growth rate of 29% over the next 10 years aided in part by the likely banning of ICE vehicles in several countries between now and 2040.

Vehicles powered by hydrogen fuel cells are another important development. In the past few years, Germany launched the world’s first hydrogen-powered train, San Francisco became the first US city to transport commuters via hydrogen fuel cell ferries, and three major automakers began selling hydrogen fuel cell vehicles. A recent report from Information Trends predicts that 6.56 million such vehicles will be sold or leased between 2014 and 2032. In the same vein, a joint report by Deloitte and Ballard Power Systems indicates that by 2027 the total cost of ownership for a fuel cell EV could be less than either a battery electric or ICE vehicle.

Underpinning these trends is a larger move toward electrification in general. “In a bid to improve operational energy efficiency, reduce costs, and minimize their carbon footprints, companies across sectors have begun to electrify their industrial fleets, processes, and spaces. Many are also exploring the viability of using alternative energy sources to power their operations,” says Dr. Jacek Guzek, associate director, Consulting, Deloitte Africa.

This has certainly been the case in the mining industry. As part of its FutureSmart Mining™ innovation program, Anglo American is developing the world’s largest hydrogen-powered haul truck in collaboration with ENGIE and expects to put it into use in early 2021. As a completely renewable system, the hydrogen will come from on-site solar power generation. Newmont Goldcorp officially opened an all-electric mine in Canada in 2019, and Gold Fields in Australia now meets over half its energy needs through renewable sources after backing up its hybrid power microgrid with a lithium-ion battery energy storage system (BESS) in 2020. For its part, BHP, a strong proponent of electrical transport, reports being on track to reduce its operational greenhouse gas emissions to below FY2017 levels by FY2022. Some of the initiatives it has adopted include moving toward 100% renewable electricity in its Chilean operations and investing in low emissions technologies to decarbonize its operations.

The conversion to renewable energy sources, accelerated adoption of non-ICE vehicles, and general gravitation toward increased electrification are all central elements of the future of energy. They promise to drastically alter the demand dynamics of the mining industry as demand for a range of commodities, such as copper and nickel, rises.

The list goes on (and on)

Which commodities will be the stars of a climate-neutral future? As with any forecast that requires a high level of prediction, it’s hard to say. Ramping up renewable energy generation is bound to heighten the need for nickel, cobalt, lithium, heavy rare earths, and copper. That list would further include graphite and manganese if lithium-ion batteries win the race for supremacy of the EV market. Redox flow batteries—just one proposed alternative to lithium-ion batteries in stationary energy storage applications—would require greater supply of vanadium and zinc. Conversely, if hydrogen fuel cells gain greater traction, demand for platinum seems likely to spike.
“While there could potentially be dozens of minerals considered critical for the future, no one wants to take the risk of losing access to the commodities they deem essential,” says Richard Longstaff, managing director, Deloitte Consulting LLP, Deloitte US. “As a result, we’re already seeing a worldwide scramble by governments, state entities, and original equipment manufacturers (OEM) to lock in supply.”

In February 2020, for instance, battery maker Samsung SDI entered an agreement with Glencore to secure a five-year supply of cobalt. In June, Glencore entered a similar supply agreement with Tesla. Then, in a more sweeping move, Tesla effectively entered the mining industry in September 2020 after securing the rights to mine lithium in Nevada.

However, while these demand drivers signal good news for the mining industry, challenges remain.

**Commodity quagmires**

When it comes to the critical and green minerals required for clean energy technologies, a commonly cited challenge revolves around potential supply shortages.

Nickel is a case in point. Most nickel produced today is used for stainless steel production and has neither the proper chemical form nor sufficient level of quality to be used in batteries. The production process is sufficiently different that miners cannot simply switch from producing lower-quality class two nickel to the higher-quality class one nickel required for battery applications, and there is currently little incentive to switch as battery makers now consume only 5% of global nickel output. As the world’s electrification mandate gains steam, however, that could change. Depending on which forecasts one follows, the demand for battery-grade nickel is expected to rise 10-to-20-fold by 2030 and could rise even more if it becomes a critical catalyst in the hydrogen economy.

Demand/supply imbalances are not the only challenge associated with a transition toward a clean energy future. One of the most pervasive concerns revolves around the sourcing of cobalt. With 50% of global cobalt reserves located in the Democratic Republic of Congo (DRC), the country’s human rights practices have come under intense scrutiny. To address the challenges associated with cobalt mining, hundreds of companies have joined the Responsible Minerals Initiative in a bid to improve global supply chains within conflict-affected and high-risk jurisdictions. Several companies, BMW among them, have also refused to purchase cobalt sourced in the DRC.

Although battery manufacturers and tech giants alike are avidly seeking cobalt alternatives—including Tesla, which seeks to make zero-cobalt batteries—the search continues. As a result, considerable hope now pins on creating an effective recycling ecosystem. While low recovery rates may make recycling of commodities such as lithium and...
manganese less attractive, that’s not the case with cobalt, 95% of which can usually be recovered during the recycling process. A key now is to develop a road map that makes large-scale recycling economical, an initiative unlikely to come together over the next decade, as there are insufficient EV batteries being returned for recycling at this stage.

Then there are rare earths. While the United States once led the production of rare earth elements, cost challenges, combined with the environmental impact of mining these elements, saw the country pull back from producing them in the 1990s. China quickly filled the vacuum, gaining a stronghold on the global rare earths market in the process. Although Western economies could potentially reenter the market, the capital commitment required may be prohibitive, especially given the difficulty of separating rare earths into their component elements. Similarly, while the rare earth minerals discovered off the coast of Japan could arguably supply the whole world, the country has yet to determine how to efficiently mine them from the sea floor.

To counter these obstacles, in 2019 the United States launched the Energy Resource Governance Initiative (ERGI). A collaboration between the governments of the United States, Canada, Australia, Peru, and Botswana, ERGI aims to promote resilient energy mineral supply chains. Part of its mandate includes diversifying supply chains for rare earth elements, which are considered strategically critical minerals.

This is not an isolated quest. Potential alliances between the United States, Canada, Australia, and the United Kingdom are purportedly in the works, and the European Union (EU) has initiatives to reduce its reliance on China as well.

This focus on diversification may have already yielded results. According to USA Rare Earth and Texas Mineral Resources Corp., Round Top Mountain in Texas offers a 130-year supply of most of the rare earth elements currently produced in China. With sufficient support, there is hope that Western economies will soon be in a position to open local facilities capable of separating the rare earths into their individual metals. Although this gain alone will not resolve all the supply challenges associated with critical minerals, it does point to the long-term feasibility of sourcing and processing these commodities in an ethical and reliable manner, while still adhering to strict environmental standards.
Get strategic. Although numerous commodities may play a role as the world embraces alternative forms of energy, predicting long-term demand remains problematic. That’s especially relevant in light of the long lead times and massive capital investments currently required to develop new mines. Without a clear view of the future market, however, many mining companies are struggling to identify where to allocate their investment dollars. Strategic planning is essential in this regard, not only to assess how to identify demand signals but also to clarify your investment options. As with all major capital expenditures, it’s imperative to pursue only those opportunities aligned to your strategic objectives, rather than taking a scattered approach. At the same time, your plan should be sufficiently flexible to enable you to respond as different technologies either gain supremacy or fall out of favor. Given the complexity of battery applications—and the constantly shifting parameters related to required levels of performance, safety, cost, and environmental impact—there will always be room for niche materials and nonmainstream technologies.

Consider new business models. One way to reduce the risk associated with mining battery minerals is by embracing more flexible business models. Rather than investing upfront to build massive mines in anticipation of future demand, companies should consider developing smaller, modular, and rapidly scalable models instead. This can provide them with a lower risk, lower capital way to develop more options, positioning them to scale up fast when opportunities present themselves. Additionally, mining companies with the processing expertise may want to consider diversifying into recycling. Rather than selling metals to OEMs, could they “lease” these metals for a reduced price in exchange for a commitment to return the metals for recycling at the end of the battery’s life? Beyond helping mining companies reduce risk, these innovative business models can also confer a long-term advantage, especially for first movers.
ENDNOTES


7. Woodward et al., *Electric vehicles*.


12. Ibid.


23. Ibid.


Tracking the trends 2021
Closing the trust deficit

TREND 1
Building resilience amid volatility
Scenarios for strategic leaders

TREND 2
M&A in an altered world
Winning back investor trust

TREND 3
ESG: Getting serious about decarbonization
From strategy to execution

TREND 4
ESG: Working to overcome the social trust deficit
Linking social investments to sustainable outcomes

TREND 5
ESG: Corporate governance adding to competitive advantage
Emerging risks mandate greater oversight

TREND 6
Creating an agile supply chain
Overcoming the vulnerabilities exposed by global shocks

TREND 7
The path towards integrated operations
Positioning miners to pivot in the face of change

TREND 8
Advancing the future of work
Redefining leadership and adapting the workplace culture

TREND 9
On the road to zero harm
Creating the next generation of integrated predictive safety systems

TREND 10
Meeting demand for green and critical minerals
Mining's role in the transition to a clean energy future