Everything has a cost:’ High-tech products and the new era of mineral mining

New iPhones and Teslas come with an insatiable demand for lithium and other 'critical metals.'

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AERIAL VIEW OF BRINE PONDS AND PROCESSING AREAS OF THE LITHIUM MINE OF THE CHILEAN COMPANY SQM (SOCIEDAD QUIMICA MINERA) IN THE ATACAMA DESERT, CALAMA, CHILE, ON SEPTEMBER 12, 2022.

CREDIT: MARTIN BERNETTI/AFP VIA GETTY IMAGES

Late last month, the U.S. Bureau of Land Management granted approval for a massive new lithium mine in the Nevada desert, the start of what could foretell a rapid ramp-up of domestic mining for so-called “critical minerals” in the coming years. When the plant comes online, it’s expected to produce enough lithium to help power the batteries of 370,000 electric vehicles every year. Though an impending Donald Trump administration seems poised to roll back many EV and climate change initiatives, the need for particularly coveted metals—which include copper, cobalt, and nickel—supersedes politics. Critical metals are at the core of the iPhone, Teslas, and countless other high-tech products. Global demand for these metals is expected to rapidly increase by 400-600 percent in the next few decades.

But there’s a problem brewing. All this rapid new demand for metals and the products they power may be outpacing the available supply. That means domestic mining operations, which have a long history of dealing devastating environmental damage and displacing communities, are about to get a lot more common. Governments and businesses rushing to extract as many of these resources from the Earth as quickly as possible risk further polluting the planet.

Ironically, these metals are also crucial to building the wind turbines and solar panels being built to stave off a future climate disaster.

These are some of the dilemmas journalist Vince Beiser wrestles with in his new book, *Power Metal: The Race For the Resources That Will Shape The Future*. Beiser provides a stark account of the mind-bending amounts of extracted resources that will be needed to fuel what he's calling the coming "Electro-Digital Age." To illustrate that, Beiser travels to several sources of production, including a lithium mine baking in Chile's Atacama desert. The experience of mine workers and nearby residents there at times overlap in meaningful ways with the planned mine in Nevada. The book notably isn't arguing that a renewables-first approach isn't worth pursuing. Rather, Beiser uses shocking forecasts and first-hand experience in active mining areas to serve as a wake-up call for what to expect moving forward.

"Everything has a cost," Beiser writes. "There are no solutions, no technologies, no social or economic developments that bring only benefits. Every development, however positive, also has some kind of downside."

'Minerals don't fall from the sky. They are ripped from the Earth.'

An increasingly high-tech global economy will require far more critical metals than are currently being produced. To put it in

perspective, Beiser notes that a single smartphone can contain up to two-thirds of all the elements on the periodic table. At some point, these elements had to be extracted, or as is often the case, blasted out of the Earth.

Beiser estimates as much as seventy-five pounds of copper ore have to be pulled from the ground in order to build one single-four and half-ounce iPhone. A single Tesla Model S electric vehicle, by comparison, requires as much lithium as roughly ten thousand iPhones. The Biden administration and other governments around the world have set targets of having half of all new cars sold be electric by 2030. Carmakers are already charging ahead, which means millions more of these resource intensive EVs will be hitting roads, not in decades, but several years.

More of these metals will be needed to produce the many wind turbines and solar panels that will come to dominate a global economy increasingly powered by renewable energy sources. Even if a Trump administration reverses course on climate initiatives in the US, the global trend towards renewables and away from fossil fuels has already been set in motion. After decades of false starts and setbacks, renewable energy sources currently account for nearly a quarter of the electricity in the US according to the International Energy Agency (IEA). Solar and wind capacity alone are expected to double by 2027. By that same year, the IEA estimates renewables will be the single greatest source of electricity worldwide.

[Related: What's the most sustainable way to mine the largest known lithium deposit in the world?]

All of that hinges on more metals being extracted from the ground. The IEA estimates the world will need ten times as much lithium by 2050 to meet renewable energy demands. By around that same time, annual demand for copper could be greater than the total amount used worldwide between 1900 and 2021. Global demand for minerals broadly is expected to increase 400-600 percent in the next few decades. Whether or not we can collectively meet that demand isn't entirely certain.

“We might not have enough metals to build wind turbines, solar panels, and electric cars as quickly as we need in order to keep the world from warming to the point after which climate change could become truly cataclysmic,” Beiser writes.

The environmental toll of lithium

Although a minority of new startups are experimenting with innovative new chemical processes to extract lithium directly from rock, the vast majority of mining for the resource now uses more traditional brine mining techniques, which requires vast amounts of water and can take a toll on local ecologies. In Argentina, lithium mining operations have already reportedly contaminated streams used to irrigate crops. In China, a lithium mine reportedly polluted a nearby river so badly that it killed the fish who lived in it and the yaks that drank its water. Mining, regardless of the target resource, generally leaves a lasting mark on its land source and the people responsible for extraction. In the US the EPA estimates that 40% of all US watersheds have already been contaminated by various forms of hardrock mining.

Those are just a few of the worrisome outcomes activists in Nevada are fighting to avoid. A recent lawsuit attempting to reverse the mine’s government approval alleges the operation would endanger various sites deemed sacred to the Indigenous, Western Shoshone people. One of those areas includes a place called Cave Spring, which the suit describes as “a site of intergenerational transmission of cultural and spiritual knowledge.” The bulk of the lawsuit, however, argues the mine would wind up decimating the local Tiehm’s buckwheat population, a delicate, six-inch-tall wildflower with cream and yellow blooms that only grow in that area. It is currently listed as an endangered species.

Ioneer, the Australian-based mining company tasked with running the project, has said it plans to “vigorously defend” its approval. As for the Buckwheat, the company maintains it is taking necessary steps to ensure its operation can coexist with the plants. If all does go according to plan, Ioneer says it intends to start breaking ground

on the mine in the stretch of desert between Reno and Las Vegas next year. Under that timeline, the mind should be fully operational by 2028.

In both Chile and Nevada, these environmental stressors directly end up impacting already disadvantaged Indigenous groups. Beiser visited villages of Atacama people living in the foothills not far from the lithium mines. Those villagers rely on nearby streams and runoff from the Andes mountains to grow their food. Locals reportedly told the author the mine's massive water consumption already meant there was less available for them to use for farming. Those claims tend to track with a 2019 study from Arizona State University researchers which found soil moisture and vegetation had declined in the areas near the salt mines between 1997 and 2017. That's around the same period lithium mines there quadrupled in size.

"Here, again, is the familiar conundrum," Beiser writes. "The spread of digital technology and electric vehicles will ultimately benefit *most* places, but the heaviest costs of this shift are being paid by only *some* people and *some* places."

Critical mineral extraction may still less harmful than gas and coal

Supporters of expanded mining for critical minerals argue this approach, as extractive as it may be, is still far more palatable than an alternative future powered by dirty fossil fuels. An analysis released earlier this year by a prominent environmental research center called the Breakthrough Institute compared various types of mining operations and found that mining associated with wind and solar still had a much smaller environmental footprint than those tied to coal or natural gas. Generating just one gigawatt-hour of electricity with coal is reported to require 20 times the mining footprint as the same amount of electricity generated by solar or wind.

Other, more experimental efforts are also being considered to meet soaring mineral demand. Beiser highlights several startups currently

investing millions into controversial, "deep sea mining" which involves scrapping the mineral deposits from the seabed at depths greater than 200 meters. Geological surveys have shown those deep seabeds remain virtually untapped and are rich with copper, nickel, aluminum, manganese, zinc, lithium, and other metals. Opponents of this approach worry the process of essentially stripping the ocean floor could deal significant and irreversible damage to marine diversity and ecosystems. Other "space mining" startups, some with the financial backing of prominent tech leaders like Larry Paige, are exploring ways to one day extract minerals and metals from the thousands of asteroids orbiting between Mars and Jupiter. Those moonshot efforts, though admittedly eye-catching, are unlikely to actually gain traction anytime soon.

Get ready for more mines in more places

All of that points to a reality where mines like the one being contested in Nevada become much more common in the future. It's not all bad news. Experts are cautiously optimistic innovations in battery tech could make future iterations powering vehicles far more efficient and less resource-intensive than the current generation. Advances in lithium-ion battery recycling simultaneously mean future EVs may be able to source a sizable chunk of their necessary metals and components from older, phased-out models. On a societal level, government leaders in the US and Europe say new domestic mining operations could add many needed jobs to shaky economies and help diversify global supply chains. Still, it's almost guaranteed a wave of new critical minerals would put pressure on environments and the communities that reside near them.

All of these approaches, from new mines to deep sea excavation, are rooted in the same underlying assumption: humans will keep consuming more and more resources. That doesn't necessarily need to be the case. Governments and individuals could shift attitudes away from cheap, dispensable consumer goods. Technicians and mechanics empowered by right-to-repair laws could extend the lives of phones and other resource-intensive electronics rather than have

them disposed of on a yearly basis. In general, the most surefire way to sidestep the need for a new age of extractive mining might be simply to use less and prevent the demand from manifesting in the first place. Unfortunately, all signs seem to suggest that the train has left the station.

“Maintaining the same level of consumption is impossible,” Chilean scientist and microbiologist Cristina Dorador told Beiser. “We need to change the way that we live on Earth