

The Economic and Strategic Importance of Domestic Mineral Production

Unlocking the Value of America's
Homegrown Mineral Resources

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INTRODUCTION

The world's energy systems are constantly changing. Over the last three hundred years dramatic shifts in technology have advanced the way we produce and use energy. We saw crude oil replace whale oil for lighting and then electricity replace oil. Over a hundred years ago, gasoline and electric vehicles competed to produce the motive power of automobiles. Gasoline won out, but emerging technologies along with government programs have sparked a new competition between gasoline and electric-powered vehicles. For electricity generation in the United States, we have seen the dominance and then decline of coal generation, the advent of nuclear power, a rapid increase in natural gas-fired generation, and a push by federal and state governments to increase the production of wind and solar-generated electricity.

As we look to the future, improvements in technology and increased government involvement in energy markets means we will likely see more electric vehicles (EVs), batteries for storage, solar panels, wind turbines, and increased competitiveness of hydrogen technologies. In addition to improvements in technology, many governments and some businesses around the world are trying to set targets to reach net zero carbon dioxide emissions, which means reducing carbon dioxide emissions to as close to zero as possible so that any remaining emissions are reabsorbed from the atmosphere by oceans, forests, or other plants.¹ The Biden administration, for example, has set a goal for the U.S. to achieve net zero carbon dioxide emissions by 2050.

One of the major impediments to net zero goals and the continued rollout of many of the energy technologies that would help reach them is that they require far more minerals and materials than are currently being produced. As the International Energy Agency (IEA) explains:

An energy system powered by clean energy technologies differs profoundly from one fueled by traditional hydrocarbon resources. Solar photovoltaic (PV) plants, wind farms, and electric vehicles (EVs) generally require more minerals to build than their fossil fuel-based counterparts. A typical electric car requires six times the mineral inputs of a conventional car, and an onshore wind plant requires nine times more mineral resources than a gas-fired plant. Since 2010 the average amount of minerals needed for a new unit of power generation capacity has increased by 50 percent as the share of renewables in new investment has risen.²

According to the IEA's "sustainable development scenario," these new energy technologies will require a 42-fold increase in lithium demand, a 25-fold increase in graphite demand, a 21-fold increase in cobalt demand, a 19-fold increase in nickel demand, and a 7-fold increase in rare earth demand by 2040 to meet carbon dioxide emissions goals set by some governments around the world.³

New mining projects are not projected to keep up with this incredible increase in demand. For example, EV expert Steve Levine recently argued that "the EV industry is in a decades-long battery metals crisis."⁴ He went on to explain that in 2022, lithium and nickel production only support



1 United Nations, Climate Action: For a livable climate: Net-zero commitments must be backed by credible action, <https://www.un.org/en/climatechange/net-zero-coalition>

2 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>

3 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>

4 Steve LeVine, Twitter, Apr. 26, 2022, https://twitter.com/stevelevine/status/1518913709397131264?s=20&t=VDBSMrbUvCUswbzKJGU_fQ

the production of 3.8 million pure EVs, however, automakers said they wanted to make 7.7 million EVs in 2022.⁵ Levine used major metals production forecasts and calculated that by 2030 there will only be enough lithium and cobalt for 15.6 million EVs, while automakers say they want to produce over 40 million in 2030.⁶ What makes this situation even more unrealistic is that demand for lithium-ion batteries is not just coming from EVs, but also storage on the electrical grid made necessary by part-time renewable energy sources being mandated and subsidized into the system.

Not only are there projected shortages for minerals and materials used for EVs and batteries, but there is a massive project shortfall in necessary copper production as some of the world's largest copper mines have operated for more than a century. S&P Global recently released a report which found that "Unless massive new [copper] supply comes online in a timely way, the goal of net zero emissions by 2050 will be short-circuited and remain out of reach."⁷ S&P Global projects that copper demand would have to double between now and 2035 to meet the goal of net zero by 2050.

The increase in demand for these minerals and materials is already putting upward pressure on prices. According to Benchmark Minerals Intelligence, from April 2021 to April 2022, the raw materials that constitute NCM (nickel, cobalt, magnesium) lithium-ion batteries have increased in price by 164 percent, and the raw materials that make-up lithium-ion phosphate batteries have increased by 393 percent.⁸

The problem is not just with minerals and materials shortages, but energy security as well. Russia's leverage over Europe due to its dependence on Russian oil and natural gas is a reminder of the importance of energy security. The United States Geological Survey (USGS) recently estimated that there were 50 minerals critical to the security of the United States. In 2021, imports comprised more than half of the U.S. consumption for 47 of these mineral commodities, and the U.S. was 100 percent net import reliant for 17 of them.

It's not just the U.S. As the IEA has stated, "the production of many energy transition minerals today is more geographically concentrated than that of oil or gas."⁹ The processing of these minerals is even more.¹⁰ China is the largest processor of copper, nickel, cobalt, lithium, and rare earth—processing between 35 percent and 85 percent of these minerals.

At the moment, the United States and the rest of the world are utterly dependent on China to meet the growing demand for critical minerals and materials necessary for our energy. That doesn't have to be the case in the future. Over the last 15 years, the United States changed the world's energy landscape by dramatically increasing our production of oil and natural gas. In 2012, President Obama would tell anyone who would listen that it was "stupid" to think that the United States could lower oil prices by drilling for more oil.¹¹ He argued that "drill, baby, drill" was just a bumper sticker and wouldn't work.

President Obama was wrong. Drill, baby, drill—or simply access to and the production of our vast oil and gas resources—was an energy strategy that worked to lower oil, gasoline, and natural gas prices. Over the past decade, U.S. oil production doubled. Not only that, but the United States became the largest liquefied natural gas (LNG) exporter to Europe, enabling Europe to do without Russian natural gas. Europe's energy crisis would be far worse without the U.S. ramp-up in exports of LNG.

Just as "drill, baby, drill" worked for oil and natural gas production, "mine, baby, mine" can work for minerals. However, the Biden administration is working to stifle any new mining in the United States. Just to name a few examples, the Biden administration has stymied development of the Twin Metals and Polymet mines in Minnesota, the Resolution and Rosemount mines in Arizona, and the Pebble Mine in Alaska. They have also reduced access to the Ambler Mining District in Alaska. The Biden administration has been more disposed toward lithium mines, such as Rhyolite Ridge and Thacker Pass, but actual construction has only begun at Thacker Pass.

If the Biden administration wants to achieve its net zero goals, it should be aggressively working to open more mines in the United States as well as improving our processing capabilities. But they are not. It is possible that the Biden administration hates new mines more than they hate new oil and gas production.

We need a path forward to enable entrepreneurs to do for minerals what they have done for U.S. production of oil and natural gas. In essence, we need to "mine, baby, mine."

5 Globally, EV makers sold about 7.6 million battery electric vehicles in 2022. What accounts for the difference? Levine is modeling a standard battery pack. He has explained, "The estimates are pure EVs, not with hybrids, and a standard 90kWh battery. When you use a different mix, such as 55kWh or 75kWh, you can get more production. But the message is the same: lithium and nickel are limiting factors in how many EVs will be made this decade."

6 Steve LeVine, Twitter, Apr. 24, 2022, <https://twitter.com/stevelevine/status/1518378692254310401>. See also Steve LeVine, Just How Many EVs Can Be Made? Far Fewer Than Expected, The Electric from The Information, Apr. 24, 2022, <https://subscriptions.theinformation.com/newsletters/the-electric/archive/just-how-many-evs-can-be-made-far-fewer-than-expected>

7 S&P Global, The Future of Copper: Will the looming supply gap short-circuit the energy transition?, p. 9.

8 Simon Moore's, <https://twitter.com/sdmoores/status/1518680838057213952>

9 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>

10 Ibid.

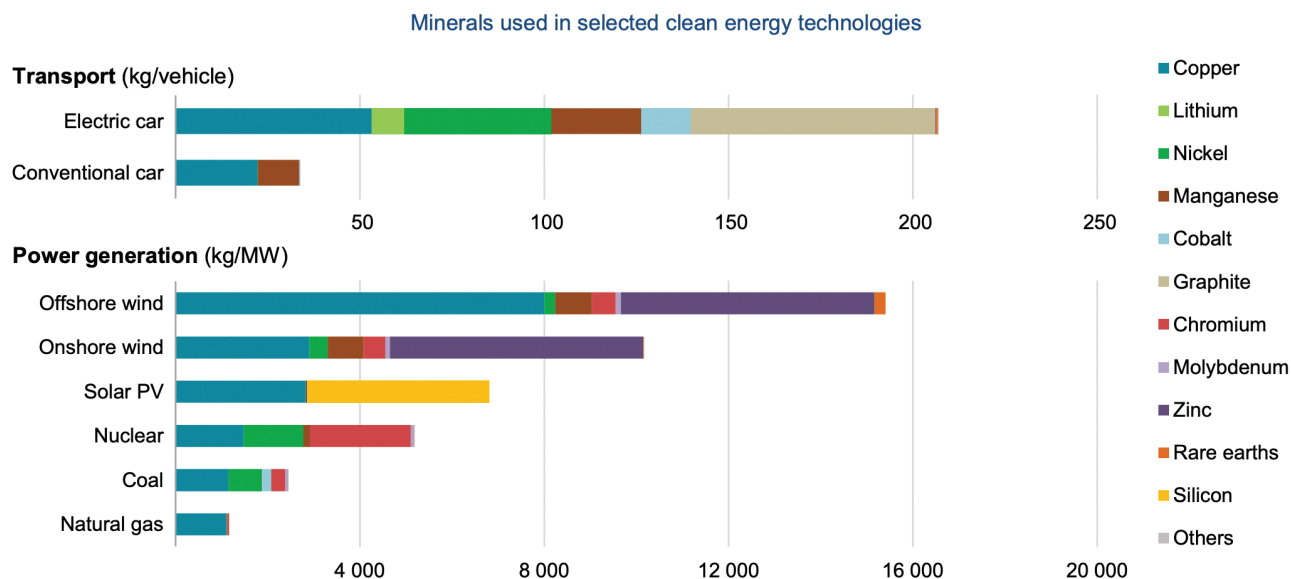
11 President Barack Obama, Obama: 'The American People Aren't Stupid', Feb. 23, 2012, speech at the University of Miami, <https://www.youtube.com/watch?v=wFX2iIM-dSE&ab>

THE MASSIVE MINERAL AND MATERIALS REQUIREMENTS FOR WIND, SOLAR, AND EVS

There has been a lot of talk of an energy transition away from oil, natural gas, and coal and toward wind, solar, and EVs. The IEA calls this a “shift from a fuel-intensive to a material-intensive energy system.”¹² This new energy system would differ profoundly from the current one fueled by traditional hydrocarbon resources.

For example, a typical electric car requires six times the mineral inputs of a conventional car, and an onshore wind plant requires nine times more mineral resources than a gas-fired power plant. In fact, because of the addition of new wind and solar capacity, since 2010, the average amount of minerals needed for a new unit of power generation capacity has increased by 50 percent.¹³

The rapid deployment of clean energy technologies as part of energy transitions implies a significant increase in demand for minerals



Notes: kg = kilogramme; MW = megawatt. Steel and aluminium not included.

Source: [International Energy Agency: The Role of Critical Minerals in Clean Energy Transitions](https://www.iea.org/publications/freemove/TheRoleofCriticalMineralsinCleanEnergyTransitions)

12 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 5, 2021, at 28, <https://iea.blob.core.windows.net/assets/24d5dfbb-a77a-4647-abcc-667867207f74/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>

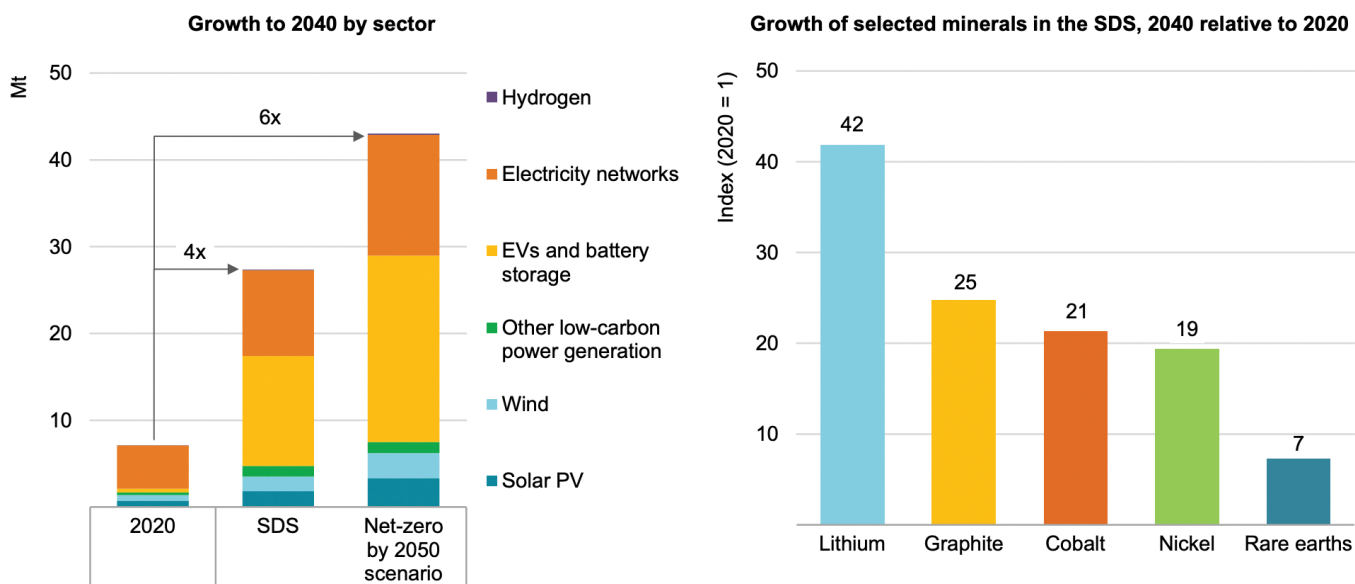
13 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 5, 2021, <https://iea.blob.core.windows.net/assets/24d5dfbb-a77a-4647-abcc-667867207f74/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>

As IEA shows below, its sustainable development scenario results in a 42-fold increase in lithium demand, a 25-fold increase in graphite demand, a 21-fold increase in cobalt demand, a 19-fold increase in nickel demand, and a 7-fold increase in rare earth demand by 2040.¹⁴

The Biden administration is seeking to mandate that 50 percent of new car sales in 2030 be electric, a carbon-free electric grid by 2035, and a carbon-free U.S. economy by 2050. These requirements would put an enormous demand on mining and manufacturing companies for critical minerals and their resulting products. The United States currently has little extraction and processing capability to meet these future demands. The USGS recently estimated that there were 50 minerals critical to the security of the United States. In 2022, imports made-up more than half of the U.S. consumption for 50 of these mineral commodities, and the U.S. was 100 percent net import reliant for 15 of them.

Mineral demand for clean energy technologies would rise by at least four times by 2040 to meet climate goals, with particularly high growth for EV-related minerals

Mineral demand for clean energy technologies by scenario



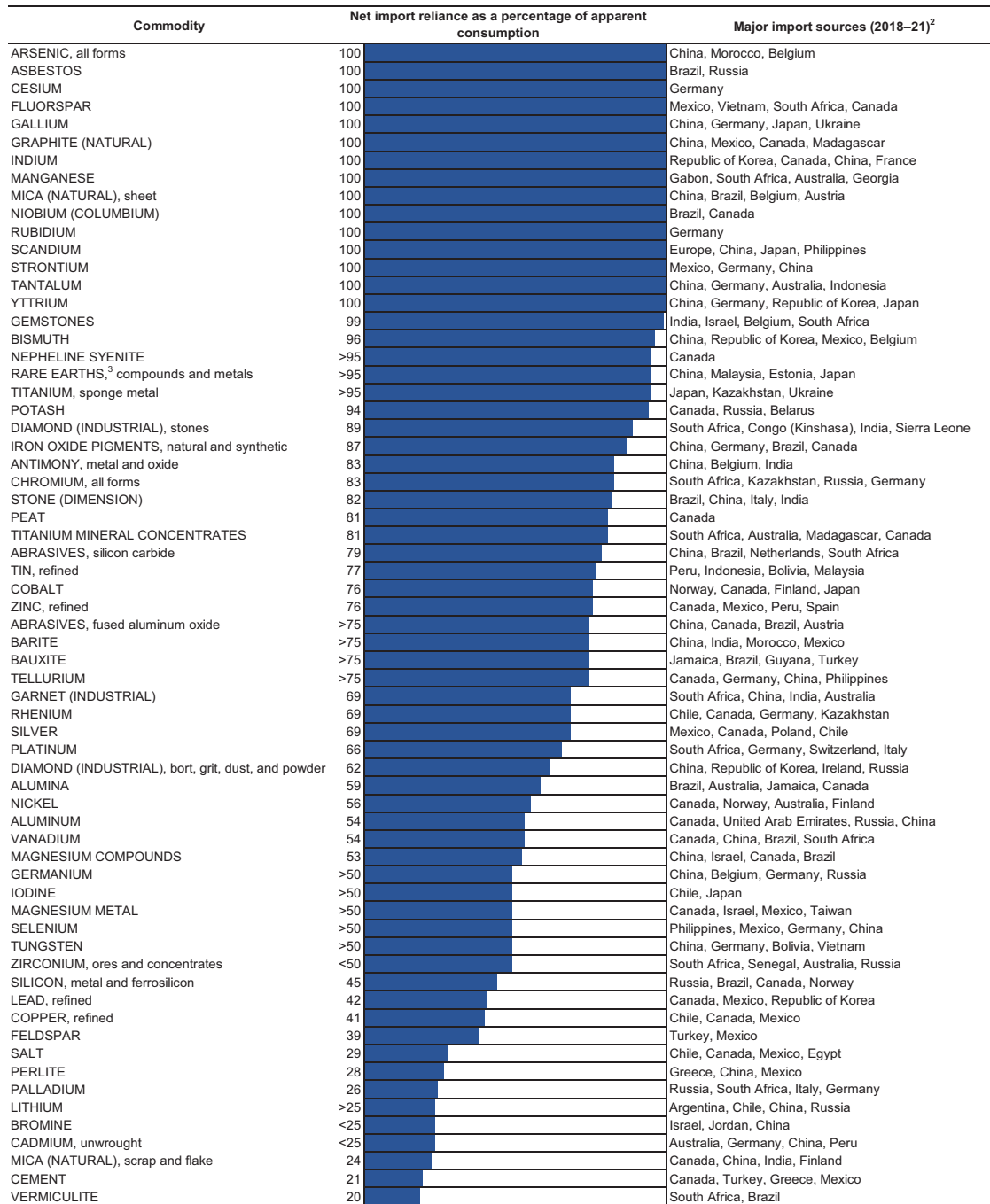
Notes: Mt = million tonnes. Includes all minerals in the scope of this report, but does not include steel and aluminium.

Source: [International Energy Agency: The Role of Critical Minerals in Clean Energy Transitions](https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions)

14 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 2021, <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>

Figure 2 illustrates the reliance of the United States on foreign sources for raw and processed mineral materials.¹⁵

Figure 2.—2022 U.S. Net Import Reliance¹



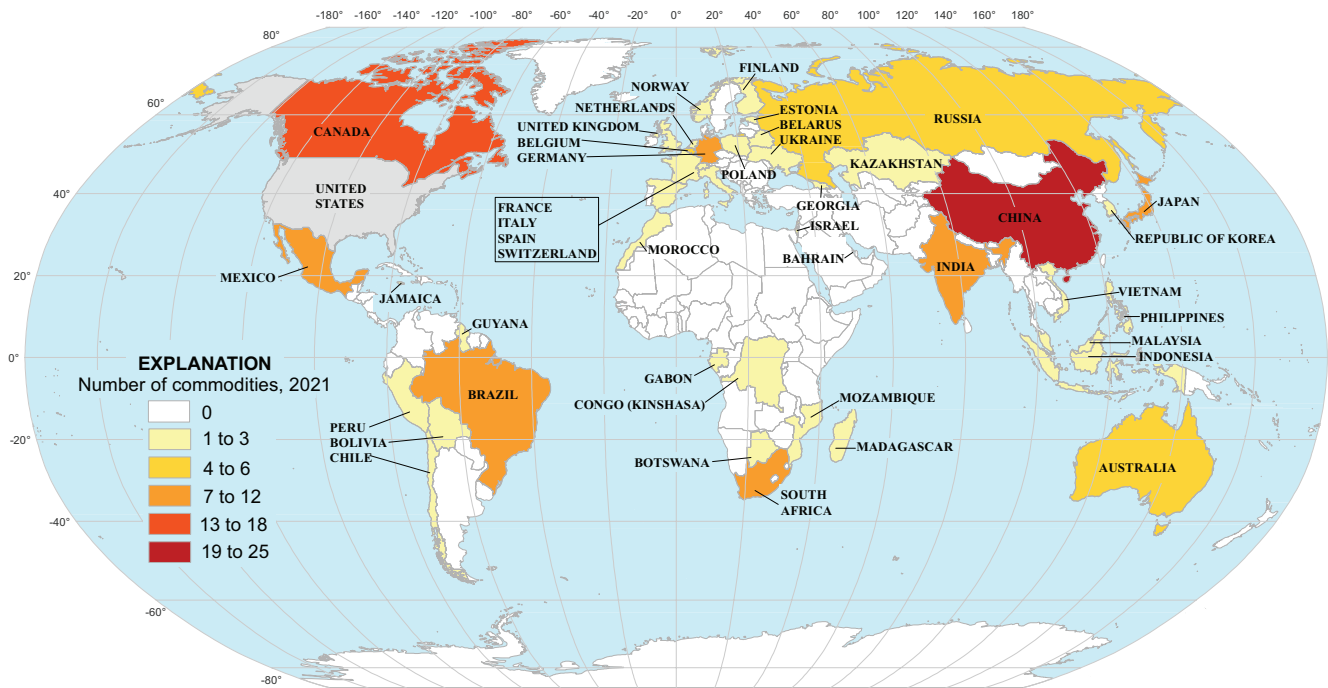
¹Not all mineral commodities covered in this publication are listed here. Those not shown include mineral commodities for which the United States is a net exporter (abrasives, metallic; boron; clays; diatomite; gold; helium; iron and steel scrap; iron ore; kyanite; molybdenum; rare earths, mineral concentrates; sand and gravel, industrial; soda ash; titanium dioxide pigment; wollastonite; zeolites; and zinc, ores and concentrates) or less than 20% net import reliant (beryllium; gypsum; iron and steel; iron and steel slag; lime; nitrogen (fixed)—ammonia; phosphate rock; pumice and pumicite; sand and gravel, construction; stone, crushed; sulfur; and talc and pyrophyllite). For some mineral commodities (hafnium; mercury; quartz crystal, industrial; thallium; and thorium), not enough information is available to calculate the exact percentage of import reliance.

²Listed in descending order of import share.

³Data include lanthanides.

Figure 3 shows the countries that were sources of mineral commodities for which the United States was greater than 50 percent net import reliant in 2022 and the number of mineral commodities for which each highlighted country was a leading supplier. China, followed by Canada, supplied the largest number of these mineral commodities. The countries that were the leading sources of imported mineral commodities with greater than 50 percent net import reliance were: China (26); Canada (20); Germany (14); Brazil (11); South Africa (10); and Mexico (9).¹⁶

Figure 3 — Major Import Sources of Nonfuel Mineral Commodities for which the United States was Greater than 50% Net Import Reliant in 2021



Source: [U.S. Geological Survey Mineral Commodities Summaries 2023](#)

Import dependence on these critical minerals is problematic because it can put supply chains, U.S. companies, and mineral users at risk, particularly when China dominates the mineral supply chains and most of the world’s mineral processing.

16 Ibid.

GREEN ENERGY RUNS THROUGH COMMUNIST CHINA

For years many people and organizations argued that the United States needed to reduce its fossil fuel use to reduce dependence on Middle Eastern oil. Since 2019, however, the United States has been essentially self-sufficient in oil production.¹⁷ Nevertheless, some of the same people and groups now want the United States to ignore this fact and transition to electric vehicles. The problem is that the minerals and materials required for EVs, battery storage, and renewables are much more geographically concentrated than oil production is. A single country, China, dominates these supply chains. Even if China were a trustworthy trading partner, which it is not, this would still be a problem because it creates a near-total supply chain dependence on one single country.

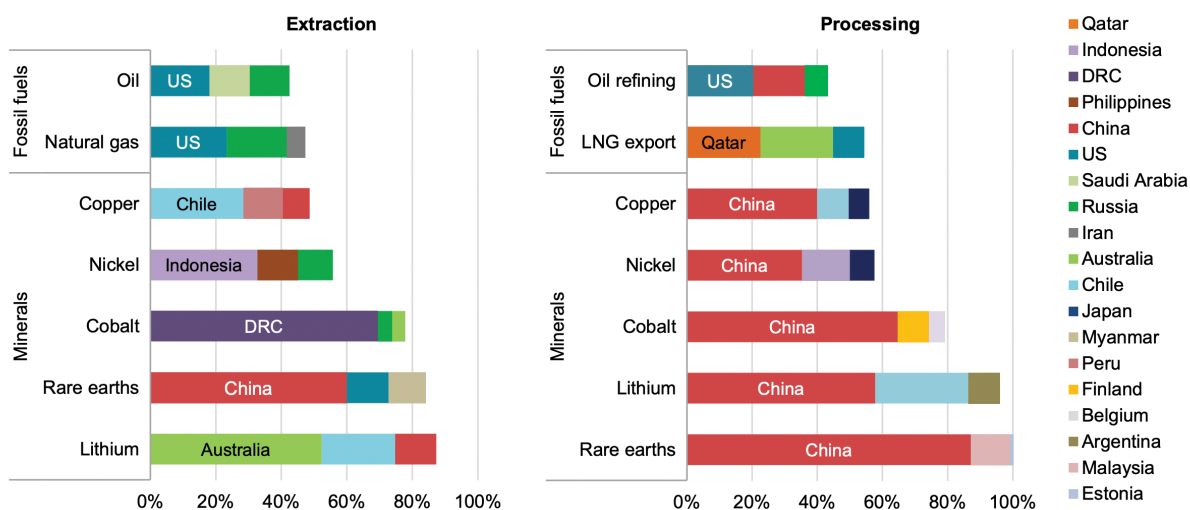
Due to its massive and cheap coal generation, China processes and refines most of the world's critical minerals. Where it does not have domestic raw materials, China invests in them around the world, most notably in Africa, South America, and Asia. China is even invested in the Mountain Pass rare earth mine in the United States.

The world's top three producing nations control well over three-quarters of the global output of lithium, cobalt, and rare earth elements. In 2019, the Democratic Republic of the Congo and the People's Republic of China were responsible for 70 percent and 60 percent of the global production of cobalt and rare earth elements, respectively.¹⁸ For processing operations, China's involvement was and continues to be even higher. China's share of refining is around 35 percent for nickel, 50 to 70 percent for lithium and cobalt, and almost 90 percent for rare earth elements.¹⁹ That

A single country, China, dominates these supply chains. Even if China were a trustworthy trading partner, which it is not, this would still be a problem because it creates a near-total supply chain dependence on one single country.

Production of many energy transition minerals today is more geographically concentrated than that of oil or natural gas

Share of top three producing countries in production of selected minerals and fossil fuels, 2019



Notes: LNG = liquefied natural gas; US = United States. The values for copper processing are for refining operations.

Source: [International Energy Agency](#) World Energy Outlook Special Report

17 See Energy Information Administration, 4-Week Avg U.S. Net Imports of Crude Oil and Petroleum Products (Thousand Barrels per Day), <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=wtntus2&f=4>

18 International Energy Agency, The Role of Critical Minerals in Clean Energy Transitions, May 5, 2021, <https://iea.blob.core.windows.net/assets/24d5dfbb-a77a-4647-abcc-667867207f74/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf>

19 Ibid.

means “green” energy runs through Communist China. Chinese companies have made substantial investments in overseas assets in Australia, Chile, the Congo, and Indonesia. China’s investments and huge role in processing and refining critical minerals increase the risks that could arise from physical disruption, trade restrictions, or other global developments. For example, in 2010, China cut its rare earth exports by 40 percent and cut off supplies to Japan over a territorial dispute, causing prices to soar.²⁰

In 2019, Chinese chemical companies accounted for 80 percent of the world’s total output of raw materials for advanced batteries.²¹ China controls the processing of almost all the critical minerals—rare earth, lithium, cobalt, and graphite. Of the 136 lithium-ion battery plants in the pipeline to 2029, 101 are based in China. The largest manufacturer of electric vehicle batteries, with a 27.9 percent market share, is China’s Contemporary Amperex Technology Co. Ltd founded in 2011.

RARE EARTHS

Rare earth elements are a bit of a misnomer. Rare earths are not that rare in the earth’s crust. However, they can only usually be found in small concentrations and are often bonded to other, more abundant, mineral deposits. The biggest challenge with rare earths is the processing required to separate rare earths from other minerals. These separations can be environmentally damaging if costly techniques are not used. Expensive environmental control technology is one reason less rare earth separations are done in the United States over the past few decades and more are done in China. China is one of the world’s leaders in rare earth separations on an industrial scale.



Rare earth elements and minerals loaded on cargo ship in China.

Worldwide reserves of rare earths total about 120 million metric tons.²² Of that amount, 44 million metric tons, or 34 percent, are located within China. After China, the major rare earth countries based on reserve volume are Vietnam, Brazil, and Russia. The United States also has some reserves, estimated at 1.8 million metric tons. In 2022, China was the world’s largest producer of rare earths, producing 210,000 metric tons, or 70 percent of the world’s production.²³ While China produces most of its rare earths in the southeastern part of the country, in the provinces Jiangxi and Fujian, rare earth production also occurs in Inner Mongolia and Sichuan. In 2022, the United States produced about 43,000 metric tons of rare earth minerals—a fifth of what China produced.²⁴ Those minerals were almost exclusively processed into end materials in China.

In addition to rare earths, the manufacturing of lithium-ion batteries depends on key materials like graphite, cobalt, manganese, and nickel. In 2022, China produced 65 percent of the world’s graphite and has 16 percent of the world’s reserves.²⁵

COBALT

China has only 2 percent of the world’s cobalt reserves,²⁶ but China owns eight of the 14 largest cobalt mines in the Democratic Republic of Congo, and they account for about half of the country’s output.²⁷ China dominates in the processing of raw cobalt, where raw material is turned into commercial-grade cobalt metal, refining over 80 percent of the world’s product. An American company once owned the largest mine in the Congo, but sold it in 2016 to China Molybdenum.

20 Institute for Energy Research, Rare Earth Elements: What Are They? Who Has Them?, July 27, 2016, <https://www.instituteforenergyresearch.org/renewable/rare-earth-elements/>

21 Voa News, How China Dominates Global Battery Supply Chain, September 1, 2020, https://www.voanews.com/a/silicon-valley-technology_how-china-dominates-global-battery-supply-chain/6195257.html

22 Statista, Reserves of Rare Earths Worldwide, as of 2022, February 28, 2023, <https://www.statista.com/statistics/277268/rare-earth-reserves-by-country/>

23 Ibid.

24 Ibid.

25 U.S. Geological Survey, Mineral Commodity Summaries 2023, <https://pubs.usgs.gov/periodicals/mcs2023/mcs2023.pdf>

26 Ibid.

27 Voa News, How China Dominates Global Battery Supply Chain, September 1, 2020, https://www.voanews.com/a/silicon-valley-technology_how-china-dominates-global-battery-supply-chain/6195257.html

LITHIUM

China is among the top five countries with the most lithium resources,²⁸ and it has been buying stakes in mining operations in Australia and South America, where large lithium reserves are located. China's Tianqi Lithium owns 51 percent of the world's largest lithium reserve in Australia.²⁹ In 2018, the company became the second-largest shareholder in Sociedad Quimica y Minera—the largest lithium producer in Chile.³⁰ Another Chinese company, Ganfeng Lithium, has a long-term agreement to underwrite all lithium raw materials produced by Australia's Mount Marion mine—the world's second-biggest, high-grade lithium reserve.³¹ In 2022, China produced 15 percent of the world's lithium, having 8 percent of the world's lithium reserves.³²

MANGANESE

China mined only about 5 percent of the world's manganese in 2022,³³ but refined over 90 percent of it.³⁴ Most manganese supply is concentrated in South Africa, followed by Gabon and Australia. North America produces very little manganese.

NICKEL

Unlike the other minerals, the nickel mining industry is more evenly spread around the world, but China controls most of the chemical processing.³⁵ Indonesia, due to on-again off-again ore bans, has in the past caused volatility in the nickel market. However, in 2022, it produced 48 percent of the world's total nickel production, about 54 percent more than in 2021, and it has 20 percent of the world's reserves.³⁶ Russia produced 7 percent of the world's nickel and has 8 percent of the world's reserves.³⁷ Electric vehicles account for about 7 percent of overall nickel consumption today,³⁸ but that would skyrocket under plans to electrify vehicles as proposed by President Biden and several leaders of western countries.

COPPER

Copper is another example of a mineral where it looks like demand will far outstrip supply. S&P Global recently released a study calling copper the "metal of electrification." They found:

The study seeks to quantify the amount of additional copper that will be required by increased electrification and the energy transition—most specifically, the rapid move to electric vehicles (EVs) and renewable electricity and the need for increased electricity infrastructure. It concludes that copper demand will double by 2035 and continue to grow thereafter. On the supply side, it finds how challenging that will be, whether on the basis of current trends or with an unprecedented acceleration of supply from mining and recycling.



Large scale mining of copper in central Chile, region of Coquimbo.

28 U.S. Geological Survey, Mineral Commodity Summaries 2023, <https://pubs.usgs.gov/periodicals/mcs2023/mcs2023.pdf>

29 Voa News, How China Dominates Global Battery Supply Chain, September 1, 2020, https://www.voanews.com/a/silicon-valley-technology_how-china-dominates-global-battery-supply-chain/6195257.html

30 Fuels and Lubes, Tianqi Lithium's purchase of SQM shares would make Chinese firm world's largest producer of lithium, May 24, 2018, <https://www.fuelsandlubes.com/tianqi-lithiums-purchase-of-sqm-shares-would-make-chinese-firm-worlds-largest-producer-of-lithium/>

31 SMM News, the sale of shares in the Australian mine involves 57000 tons of lithium concentrate Ganfeng lithium industry to obtain half of the shares, December 21, 2018, <https://news.metal.com/newscontent/100913083/%5bsmm-express%5d-the-sale-of-shares-in-the-australian-mine-involves-57000-tons-of-lithium-concentrate-ganfeng-lithium-industry-to-obtain-half-of-the-shares/>

32 U.S. Geological Survey, Mineral Commodity Summaries 2023, <https://pubs.usgs.gov/periodicals/mcs2023/mcs2023.pdf>

33 Ibid.

34 Mining, China's stranglehold on electric car battery supply chain, April 16, 2020, <https://www.mining.com/chart-chinas-stranglehold-on-electric-car-battery-supply-chain/>

35 Ibid.

36 U.S. Geological Survey, Mineral Commodity Summaries 2023, <https://pubs.usgs.gov/periodicals/mcs2023/mcs2023.pdf>

37 Ibid.

38 Mining, China's stranglehold on electric car battery supply chain, April 16, 2020, <https://www.mining.com/chart-chinas-stranglehold-on-electric-car-battery-supply-chain/>

One possible challenge to the future copper supply is the new government of Chile. Chile is the largest copper-producing country in the world, but has recently installed a socialist government. The new government has proposed to increase taxes on mining and possibly to nationalize mining companies. So far, the latter has not worked. BHP Billiton, which operates the world's largest copper mine, is reconsidering investments in Chile.³⁹

CHINESE CONTROL OF PROCESSING

A study by KU Leuven University shows that meeting the European Union's Green Deal goal of "climate neutrality" by 2050 will require 35 times more lithium and 7 to 26 times the amount of rare earth metals compared to Europe's current use.⁴⁰ According to the study, besides the increase in lithium and rare earth metals, Europe's energy transition will also require 30 percent more aluminum than what is used currently, 35 percent more copper, 45 percent more silicon, 100 percent more nickel, and 330 percent more cobalt.

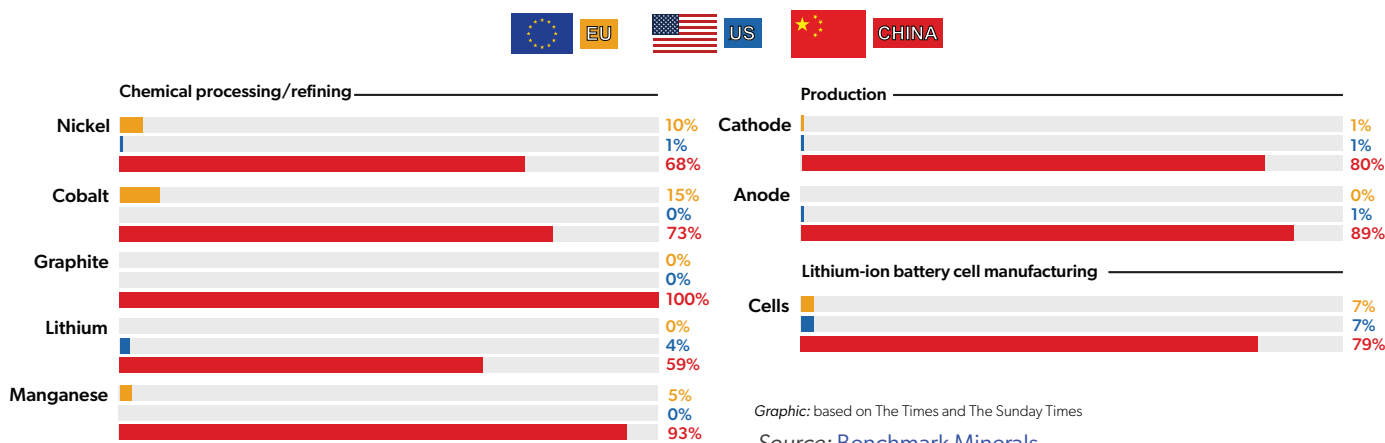
That results in massive numbers—about 4.5 million metric tons of aluminum, 1.5 million metric tons of copper, 800,000 metric tons of lithium, 400,000 metric tons of nickel, 300,000 metric tons of zinc, 200,000 metric tons of silicon, 60,000 metric tons of cobalt, and 3,000 metric tons of the rare earths metals neodymium, dysprosium, and praseodymium, which is an increase between 700 and 2,600 percent from current levels.

The report indicates that Europe faces critical shortfalls in the next 15 years without more mined and refined metals supplying its renewable energy system. Because of its rapidly rising energy costs, Europe is currently closing aluminum smelting and other industrial processing just as their governments are pressing for additional renewable energy sources and electrification.

China dominates the United States and Europe regarding critical minerals and will likely continue to do so for the foreseeable future. In 2019, the United Nations Environment Program, UNEP, reported in its "Global Trends in Renewable Energy Investment" that China has outspent every nation when it comes to green research and development. China spent nearly \$760 billion between 2010 and 2019 on renewable energy, a figure that's double the \$356 billion investment made by the United States, and which surpassed the \$698 billion invested by Europe.⁴¹ As a result, China has positioned itself to be the primary supplier of the "clean" economy, as the graph below depicts.

The United States will be competing with Europe for these critical mineral supplies, unless something is done about mining regulations in the U.S.

China dominates the processing key minerals



39 Reuters, Miner BHP may reconsider investments in Chile if tax hikes go forward, July 17, 2022, <https://finance.yahoo.com/news/miner-bhp-may-reconsider-investments-143212986.html>

40 Mining, Europe's Green Deal requires massive amounts of battery metals—study, May 1, 2022, <https://www.mining.com/europes-green-deal-requires-massive-amounts-of-battery-metals-study/>

41 Mining, Europe's Green Deal requires massive amounts of battery metals—study, May 1, 2022, <https://www.mining.com/europes-green-deal-requires-massive-amounts-of-battery-metals-study/>

CHINA'S DOMINANCE OF THE SOLAR PANEL MARKET

U.S. solar developers are highly dependent on China for materials that are instrumental in solar panel production. Whether it be the solar panels themselves, the glass that is needed for bifacial panels, or the polysilicon for the solar cells there are issues dealing with cost, delays, and human rights. Costly disruptions to the solar supply chain are emerging at a time when President Biden is planning on using solar and wind power to meet a mandate of net zero emissions from the generating sector by 2035 and the deployment of 500 million solar panels within 5 years that he touted as a candidate for president.⁴²

A critical material needed in solar panel production is polysilicon. Raw polycrystalline silicon,⁴³ commonly known as polysilicon, is a primary feedstock material used to produce solar cells. Polysilicon feedstock generally consists of large rods which are broken into chunks or chips of various sizes, then cast into multicrystalline ingots. The ingot materials are subsequently sliced into silicon wafers suitable for solar cell production.

China dominates all stages of the solar supply chain, producing between 60 and 80 percent of the world's polysilicon, wafers, crystalline silicon cells, and solar modules.⁴⁴ The United States relies almost entirely on Chinese manufacturers for low-cost solar modules, many of which are imported from Chinese-owned factories in Vietnam, Malaysia, and Thailand.⁴⁵ China supplies more than 80 percent of the world's polysilicon,⁴⁶ of which nearly half comes from Xinjiang, where the Chinese government has mass detentions of minority groups such as Uyghurs and other Muslim minorities.⁴⁷ Another 35 percent comes from other regions in China.⁴⁸ In 2019, less than 5 percent of the world's polysilicon came from U.S.-owned companies.⁴⁹

China's low-cost, coal-fired electricity has provided the country's solar-panel manufacturers a competitive advantage, allowing them to dominate global markets. Coal-fired electricity rates in the Xinjiang region can be as low as 0.22 yuan (\$0.03) per kilowatt-hour, compared with 0.6 to 0.7 yuan in central China.⁵⁰ Polysilicon factories refine silicon metal using a process that consumes large amounts of electricity, making access to inexpensive coal power a cost advantage. To support polysilicon manufacturers, China built coal-burning power plants in Xinjiang and Inner Mongolia. Since electricity is 40 percent of the operating cost of manufacturing polysilicon,⁵¹ cheap coal-fired electricity is a goal of its producers. China's cheaper polysilicon production has forced the shutdown of several factories in other countries that use power sources with lower carbon emissions than Chinese producers but with much higher electricity prices.



42 PV Magazine, Biden-Sanders task force calls for 500m solar panels in five years, July 13, 2020, <https://www.pv-magazine.com/2020/07/13/biden-sanders-task-force-calls-for-500m-solar-panels-in-five-years/>

43 Targray, Polysilicon for Solar PV Manufacturing, <https://www.targray.com/solar/solar-silicon/virgin-polysilicon?nowprocket=1#:~:text=Raw%20polycrystalline%20silicon%2C%20commonly%20referred,production%20of%20solar%20cells%20today.>

44 New York Times, President Biden extends solar tariffs, with major caveats, February 24, 2022, <https://www.nytimes.com/2022/02/04/business/economy/solar-tariffs-caveats.html?searchResultPosition=1>

45 CSIS, Solar PV Trade and Manufacturing, February 2021, <https://csis-website-prod.s3.amazonaws.com/s3fs-public/Solar%20PV%20Case%20Study%20-%20BloombergNEF.pdf?wDUUIXhfxWtA0ILU66HdshX539MvZHDI>

46 New York Times, China's Solar Dominance Presents Biden with an Ugly Dilemma, June 24, 2021, <https://www.nytimes.com/2021/04/20/business/economy/china-biden-solar-panels.html>

47 New York Times, 'Absolutely No Mercy': Leaked Files Expose How China Organized Mass Detentions of Muslims, November 16, 2019, <https://www.nytimes.com/interactive/2019/11/16/world/asia/china-xinjiang-documents.html>

48 New York Times, China's Solar Dominance Presents Biden with an Ugly Dilemma, June 24, 2021, <https://www.nytimes.com/2021/04/20/business/economy/china-biden-solar-panels.html>

49 CSIS, Solar PV Trade and Manufacturing, February 2021, <https://csis-website-prod.s3.amazonaws.com/s3fs-public/Solar%20PV%20Case%20Study%20-%20BloombergNEF.pdf?wDUUIXhfxWtA0ILU66HdshX539MvZHDI>

50 Bloomberg, Why It's So Hard for the Solar Industry to Quit Xinjiang, February 10, 2021, <https://www.bloomberg.com/news/articles/2021-02-10/why-it-s-so-hard-for-the-solar-industry-to-quit-xinjiang>

51 Bloomberg, Secrecy and Abuse Claims Haunt China's Solar Factories in Xinjiang, April 13, 2021, <https://www.bloomberg.com/graphics/2021-xinjiang-solar/>

China has become dominant in the solar manufacturing industry due to its cheap coal, lax environmental standards, government subsidies, and forced labor. Because renewable energy sources, such as wind and solar power, are intermittent and unstable, China's officials indicate that they must rely on a stable power source.⁵² They note that coal is readily available, while renewable energy needs to develop further in China despite its dominance in the solar manufacturing arena. China uses coal to make solar panels that it sells to the West, where governments direct and mandate their purchase.

In the Special Report on Solar PV Global Supply Chains,⁵³ the International Energy Agency warns of the solar PV supply imbalance. China's share in all the key manufacturing stages of solar panels currently exceeds 80 percent and for key elements, including polysilicon and wafers, it is set to increase to more than 95 percent in the coming years based on current manufacturing capacity under construction. This is more than double China's share of global PV demand. For perspective, OPEC's 13 countries produce close to 40 percent of total world oil.⁵⁴ That is, China accounts for twice as high a percentage of the world's solar panels as the world depends upon OPEC for oil. In addition, the country is home to the world's 10 top suppliers of solar PV manufacturing equipment. The agency stipulates, "This level of concentration in any global supply chain would represent a considerable vulnerability."

Since 2011, China has invested over \$50 billion in new PV supply capacity—ten times more than Europe—and created more than 300,000 manufacturing jobs across the solar PV value chain. In 2021, the value of China's solar PV exports was over \$30 billion, almost 7 percent of China's trade surplus over the last five years. In addition, Chinese investments in Malaysia and Vietnam made these countries major exporters of PV products, accounting for around 10 percent and 5 percent, respectively, of their trade surpluses since 2017. The total value of global PV-related trade—including polysilicon, wafers, cells, and modules—exceeded \$40 billion in 2021, an increase of over 70 percent from 2020.

According to the IEA, meeting international energy and climate goals requires the global deployment of solar PV to grow on an unprecedented scale, which demands a major additional expansion in manufacturing capacity, raising concerns about the world's ability to rapidly develop resilient supply chains. Annual additions of solar PV capacity around the world need to more than quadruple to 630 gigawatts by 2030 to be on track with the IEA's pathway to reach net zero emissions by 2050. Global production capacity for the key building blocks of solar panels—polysilicon ingots, wafers, cells, and modules—would need to more than double by 2030 from today's levels, and existing production facilities would need to be modernized.

High commodity prices and supply chain bottlenecks have led to an increase of around 20 percent in solar panel prices. These bottlenecks—particularly apparent in the market for polysilicon—have resulted in delays in solar PV deliveries across the globe and higher prices. Because PV production is largely concentrated in the provinces of Xinjiang and Jiangsu, where coal accounts for more than 75 percent of the annual power supply and benefits from favorable government tariffs, coal generates over 60 percent of the electricity used for global solar PV manufacturing—nearly twice its share of global power generation. Ironically, China's solar PV manufacturing industry owes its success to cheap coal-fired generation.

The IEA report finds that new solar PV manufacturing facilities along the global supply chain could attract \$120 billion worth of investment by 2030. According to the report, the solar PV sector has the potential to double the number of direct PV manufacturing jobs to about one million by 2030, with the most job-intensive areas in the manufacturing of modules and cells.

The IEA stresses that governments need to address the level of geographical concentration in global supply chains immediately if they intend to

China's share in all the key manufacturing stages of solar panels currently exceeds 80 percent and for key elements, including polysilicon and wafers, it is set to increase to more than 95 percent in the coming years based on current manufacturing capacity under construction.

52 CNBC, China Has 'No Other Choice' But to Rely on Coal Power for Now, Official Says, April 29, 2021, <https://www.cnbc.com/2021/04/29/climate-china-has-no-other-choice-but-to-rely-on-coal-power-for-now.html>

53 International Energy Agency, Solar PV Global Supply Chains, July 2022, <https://www.iea.org/reports/solar-pv-global-supply-chains>

54 Council on Foreign Relations, OPEC in a Changing World, March 9, 2022, https://www.cfr.org/background/opecc-changingworld?gclid=EAlaIqObChMIxzcZ_Yzp-AIVrsqUCR1kMgCIEAAYAiAAEgK6lvD_BwE

meet their net zero goals. China has been and will continue to be the leader in solar PV panels, particularly as President Biden takes cues from environmentalists to block critical mineral mines in the United States.⁵⁵ The United States is way behind and slipping further as President Biden continues to implement his “no action” policies for renewable energy supply chains.

CRITICAL MINERAL PRICES ARE SKYROCKETING

Increased demand and constrained supply are causing energy transition minerals to dramatically increase. Nickel, lithium, copper, and other minerals’ prices are rising, and there isn’t a new supply readily available to balance supply and keep prices lower. Likely due to concerns about Environmental, Social, and Corporate Governance (ESG), a term that refers to investments made in adherence to a set of rules about environmental and social impacts, companies have been spending less on mining expansions.

Nickel prices have skyrocketed since Russia’s February 2022 invasion of Ukraine amid fears that Russian nickel supplies may be cut off. Nickel prices surged in March 2022, after which trading was temporarily suspended for several days, and new trading restrictions were applied. As a result of the high prices and the suspension of trading, automakers and other companies that need nickel, as well as other battery raw materials like lithium or cobalt, are looking for alternatives to shield against future price shocks. There are known nickel deposits in Canada and the United States in Minnesota. However, President Biden’s Department of the Interior revoked existing federal leases for Twin Metals Minnesota to mine copper, nickel, cobalt, and platinum-group elements.⁵⁶ Other mines are facing similar problems.

Establishing new mining operations here or elsewhere will take years, even decades, because of the time needed to develop the infrastructure, acquire permits, and secure financing. Automakers and other big nickel buyers are looking for alternative suppliers, using more recycled material, or switching to battery designs that require less nickel. In the meantime, consumers will have to pay higher prices for goods that require nickel, including goods made from stainless steel. The nickel price increases in March 2022 would more than double the cost of the 80 pounds of nickel that an average electric car battery needs to \$1,750 per car.⁵⁷

Analysts expect nickel prices to come down to around \$25,000 a metric ton compared to the peak of \$100,000 a metric ton, and remain much higher than in 2021.⁵⁸ The price of nickel topped \$20,000 a metric ton after hovering between \$10,000 and \$15,000 a metric ton for much of the past five years because of limited production due to the pandemic. After Russia invaded Ukraine in late February 2022, the price rose above \$30,000 in a little over a week.⁵⁹ One month later, Tsingshan Holding Group of China made a bet that the price of nickel would drop. When the price rose, Tsingshan owed billions of dollars. The price then shot up to a little over \$100,000 a metric ton,⁶⁰ threatening the existence of many other companies that had bet wrong and prompting the London Metal Exchange to halt trading. By January 2023, its price was hovering around \$25,000 to \$30,000 a metric ton.⁶¹

The commodity with even greater price increases is lithium. Lithium carbonate in China jumped about 472 percent from a low in June of 2021 to a record high on March 15, 2022, according to Asian Metal Inc.⁶² An index of global lithium prices compiled by Benchmark Mineral Intelligence

There are known nickel deposits in Canada and the United States in Minnesota. However, President Biden’s Department of the Interior revoked existing federal leases for Twin Metals Minnesota to mine copper, nickel, cobalt, and platinum-group elements. Other mines are facing similar problems.

55 Institute for Energy Research, Biden Invokes Defense Production Act to Boost Domestic Critical Minerals Production, April 6, 2022, <https://www.instituteforenergyresearch.org/renewable/bidens-invokes-defense-production-act-to-boost-domestic-critical-minerals-production/>

56 Institute for Energy Research, Interior Department Revokes Federal Leases for Twin Metals Minnesota, January 27, 2022, <https://www.instituteforenergyresearch.org/regulation/interior-department-revokes-federal-leases-for-twin-metals-minnesota/>

57 New York Times, How the War in Ukraine Could Slow the Sales of Electric Cars, March 18, 2022, <https://www.nytimes.com/2022/03/18/business/energy-environment/nickel-russia-battery-electric-cars.html>

58 Ibid.

59 Ibid.

60 Ibid.

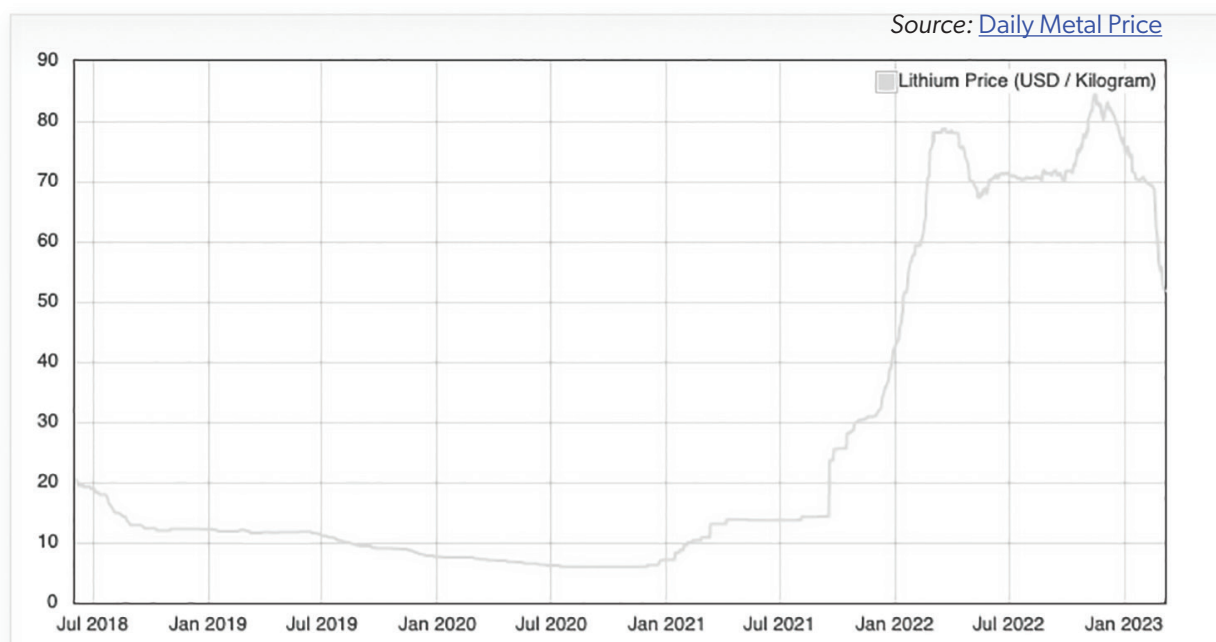
61 Daily Metal Price, <https://www.dailymetalprice.com/metalpricecharts.php?c=li&u=kg&d=240>

62 Republic of Mining, The Battery Metal Really Worrying China Is Lithium, Not Nickel, April 4, 2022, <https://republicofmining.com/2022/04/04/the-battery-metal-really-worrying-china-is-lithium-not-nickel-by-annie-lee-bloomberg-news-april-2022/>

surged almost 490 percent in the past year. Part of the reason for the price increase is that extracting lithium is a cumbersome process. In April 2022, Tesla CEO Elon Musk noted that the price of lithium had gone to “insane levels.”⁶³ In 2022, lithium prices reached over \$80 per kilogram.⁶⁴ By the middle of March 2023, however, lithium prices eroded to just under \$45 per kilogram—still over 4 times higher than in 2020—mostly because demand for the metal has not risen as fast as some in the industry expected.

LITHIUM PRICE (USD/KILOGRAM)

Lithium Prices for the Last 5 Years



A new reality for President Biden’s net zero ambition is that mining companies are not increasing the level of spending that would be needed to meet his and other western countries’ goals. Similar to the oil industry, mining companies are responding to pressure from investors to give priority to dividends and share buybacks and to limit the sector’s environmental damage, rather than invest in new mines.

Lithium use is exploding due to the growth in electric vehicles and its use in multiple technology industries, including cell phones and mobile computers. Lithium has also become the preferred metal along with other elements including cobalt for batteries. China has largely cornered the market on lithium production due to its own production and its stake in other countries. Other large lithium mines are located in South America and Australia. The United States has 3 percent of the world’s lithium reserves, but produces very little of the world’s supply.

Joe Lowry, an expert known in mining circles as “Mr. Lithium,” has been sounding the alarm on the prospects of a lithium shortage. Since 2012, Lowry has been a consultant to mining companies and an investor, owning shares of companies including Tesla and Lithium Americas. According to Lowry, in the next two years, even

63 Fox Business, Lithium shortages impact Tesla, other EV carmakers, numerous tech markets, April 25, 2022, <https://www.foxbusiness.com/markets/lithium-shortages-tesla-ev-tech-markets>

64 Daily Metal Price, <https://www.dailymetalprice.com/metalpricecharts.php?c=li&u=kg&d=240>

though there will be significant growth in lithium supply, it will be less than demand, so the gap will continue to grow. While there will be a day in the future when lithium is in oversupply, it won't be in this decade. A battery factory can be built in two years, but it takes up to a decade to bring on a lithium project.⁶⁵

A new reality for President Biden's net zero ambition is that mining companies are not increasing the level of spending that would be needed to meet his and other western countries' goals. Similar to the oil industry, mining companies are responding to pressure from investors to give priority to dividends and share buybacks and to limit the sector's environmental damage, rather than invest in new mines.⁶⁶ Project spending by 10 large mining companies, including Rio Tinto PLC, BHP Group Ltd., and Glencore PLC, is expected to stay at roughly \$40 billion in 2023, putting capital expenditures well below a peak in 2012 close to \$80 billion.⁶⁷ With rising costs for fuel and equipment, higher interest rates, and challenges developing deposits in emerging markets that are seeking a greater share of industry earnings, it is no wonder that many mining companies are being cautious about investing in new mines and infrastructure.⁶⁸

Total global mining capital expenditures, which include smaller firms and state-owned enterprises, averaged about \$100 billion annually over the past decade. But mining companies need to spend \$160 billion annually to accelerate an energy transition away from hydrocarbons to meet the timelines that politicians want. The low expenditures were the result of a recent rally in copper and iron ore, with both materials up more than 40 percent in the past two years, driving up costs for solar panels, wind turbines, and batteries.⁶⁹

A FURTHER NOTE ON CHINA

China has the willingness and capability to pursue development of the necessary energy and minerals to retain its global dominance. China's "Silk Belt and Road" initiative links and further strengthens trade relations with other nations, most notably for their natural resource wealth.⁷⁰ Linking to developing countries by both surface roads and maritime infrastructure, China's initiative extends credit to nations with little economic base who are rich in natural resources that China wishes to develop for future manufacturing, economic, and national security interests. China offers infrastructure investments these nations require, in return for commitments of natural resources in payment.

China's commitment and capabilities to develop the massive infrastructure necessary for economic growth is clear. For example, during just 3 years of the Obama administration, China used 140 percent of the cement used by the United States during the entire 20th century.⁷¹ China makes over half the world's steel and uses over half the world's coal,⁷² almost nine times that of the United States.⁷³ Clearly, China has the means and—more importantly—the will, to develop these resources and thus spread its influence throughout the globe.

China's commitment and capabilities to develop the massive infrastructure necessary for economic growth is clear. For example, during just 3 years of the Obama administration, China used 140 percent of the cement used by the United States during the entire 20th century.

65 Mining, 'Mr. Lithium' warns there's not enough battery metal to go around, April 22, 2022, <https://www.mining.com/web/mr-lithium-warns-theres-not-enough-battery-metal-to-go-around/#:~:text=Lithium%20warns%20there's%20not%20enough%20battery%20metal%20to%20go%20around,->

66 Wall Street Journal, Commodity Prices Have Soared, but Miners Aren't Investing, May 25, 2021, https://www.wsj.com/articles/commodity-prices-have-soared-but-miners-arent-investing-11621940401?mod=article_inline

67 Wall Street Journal, Mining Firms Cautious Spending Threatens Shift to Green Energy, June 19, 2022. https://www.wsj.com/articles/mining-firms-cautious-spending-threatens-shift-to-green-energy-11655566976?st=qewjwqyp6d3ijh&reflink=desktopwebshare_permalink

68 Wall Street Journal, Governments Want to Cash in on Miners' Ballooning Profits, July 12, 2021, https://www.wsj.com/articles/governments-want-to-cash-in-on-miners-ballooning-profits-11626028199?mod=article_inline

69 Wall Street Journal, Inflation Adds to Cost of Clean Energy Transition, December 19, 2021, https://www.wsj.com/articles/inflation-adds-to-cost-of-clean-energy-transition-11639918803?mod=article_inline

70 Council on Foreign Relations, China's Massive Belt and Road Initiative, January 28, 2020, <https://www.cfr.org/backgrounders/chinas-massive-belt-and-road-initiative>

71 Washington Post, How China used more cement in 3 years than the U.S. did in the entire 20th century, March 24, 2015, <https://www.washingtonpost.com/news/wonk/wp/2015/03/24/how-china-used-more-cement-in-3-years-than-the-u-s-did-in-the-entire-20th-century/>

72 Foreign Policy, Don't Let China Steal Your Steel Industry, May 19, 2020, <https://foreignpolicy.com/2020/05/19/dont-let-china-steal-your-steel-industry/>

73 BP Statistical Review of World Energy, July 8, 2021, <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/downloads.html>

Further, to meet the Biden administration's goals, substantially more critical minerals will be needed. While the United States is largely dependent on imports currently, it could secure some of these resources by opening mines that are currently having trouble receiving final government approvals. Without increasing the U.S. extraction and processing of these critical minerals, the United States will become more dependent on China for them as China dominates their supply chains. This makes the U.S. much more dependent on China than it ever was on the Middle East for oil. The U.S. imports about 80 percent of its rare earth requirements from China, compared to a high of 23 percent of imported oil from the Middle East in 2001.⁷⁴

China thus sees efforts among western nations, including the United States and Europe, to pursue a "green transition" as a boon to their economy since they are the predominant force in the world in the markets for the materials and minerals necessary for it. As mentioned, they control significantly more of the world's supply of minerals than any nation or group of nations ever controlled the world's oil supplies.

74 Oil Price, How the United States has Reduced Its Dependence on Middle East Oil, January 15, 2020, <https://oilprice.com/Energy/Energy-General/How-The-US-Has-Reduced-Its-Dependence-On-Middle-East-Oil.html>

MINE, BABY, MINE: THE U.S. CAN INCREASE OUR MINING CAPACITY

The situation with energy and materials for massive increases in renewable energy and EVs looks bleak. However, the not-too-distant past gives us a good example of how new technologies, coupled with a reasonable regulatory environment, have overcome natural resources constraints here in the United States.

Oil and natural gas production in the mid-2000s looked like they were in terminal decline, and federal officials believed that the future of oil and natural gas development in the United States was limited. In 2006, President Bush declared that America was “addicted to oil,” and created the renewable fuel standard mandating the use of billions of gallons of biofuels and cellulosic ethanol. President Obama, as late as 2012, said that drilling for more oil as a response to high energy prices was essentially stupid. Specifically, he said, “I mean, the American people aren’t stupid. They know that’s not a plan—especially since we’re already drilling. That’s a bumper sticker. It’s not a strategy to solve our energy challenge.”⁷⁵

As we know today, President Obama was completely wrong. From February 2012 and March 2020, oil production in the United States grew 105 percent and the price of gasoline fell from \$3.26 per gallon to \$2.53 per gallon.⁷⁶

DRILL, BABY, DRILL WORKED

How did the United States prove both President Bush and President Obama wrong on the potential for oil and natural gas development? The answer was new technology, reasonable regulation, and private ownership of resources.

Starting in the 1970s, the Department of Energy (DOE) and the private sector started working together to attempt to extract hydrocarbon resources from shale formations.⁷⁷ The DOE spent millions of dollars to develop various technologies to improve hydraulic fracturing. But advancing the technology was not enough to make these new drilling and fracturing technologies a cost-effective reality. That required something else, which came from the private sector.

The next critical step was real-world experimentation and the regulatory environment played an important role in making this natural gas revolution happen. Entrepreneurs experimented to figure out how to make these drilling and fracturing technologies work in a cost-effective manner.

This experimentation mostly occurred on state and private land and not nearly as much on federal lands. The major difference was—once again—the regulatory environment. One illustrative example of the difference in the regulatory environment is the amount of time necessary to obtain a permit to drill. On federal lands in 2012 it took an average of 307 days to obtain a permit to drill, but only 10 days in North Dakota, 14 days in Ohio, and 27 days in Colorado. The regulatory and permitting morass on federal lands made the necessary experimentation difficult on federal lands.



Marcellus-Shale gas drilling well in Southwestern Pennsylvania.

75 President Barack Obama, Obama: ‘The American People Aren’t Stupid’, Feb. 23, 2012, speech at the University of Miami, <https://www.youtube.com/watch?v=wyFX2iM-dSE&ab>

76 Energy Information Administration, U.S. Field Production of Crude Oil, <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=p&s=mcrfps2&f=m>; Energy Information Administration, U.S. All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon), https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=P&s=EMM_EPMO_PTE_NUS_DPG&f=M

77 Breakthrough Institute, <https://thebreakthrough.org/issues/energy/where-the-shale-gas-revolution-came-from>

The shale revolution was helped along by federal funding to advance technology but hindered by federal regulations on federal lands. As a result, the shale revolution gathered speed almost exclusively on private and state lands in places like Pennsylvania, Texas, North Dakota, Ohio, and Colorado.

WHAT DOES THIS MEAN FOR MINERALS AND MATERIALS?

Is it possible to recreate the oil and gas revolution with minerals and materials? We believe so. The United States provides a good operating environment for mining companies once they are actually operating because of the rule of law and the unlikelihood of the government nationalizing the mines. In much the same way as patents protect intellectual property, private property and its Constitutional protections promote investment and technologies that reward those willing to risk. That said, it is incredibly difficult to permit new mines in the United States, despite enormous geological potential.

If the Biden administration or others are serious about net zero goals not wrecking the economy, then it is critically important that they support the reforms necessary to enable a large increase in new mines and mineral processing in the U.S. With the right regulatory environment, we could see a mining renaissance like the dramatic growth in oil and gas production over the past 15 years, with all of its economic, national security, and geopolitical benefits.

With the right regulatory environment, we could see a mining renaissance like the dramatic growth in oil and gas production over the past 15 years, with all of its economic, national security, and geopolitical benefits.

THE U.S. IS CURRENTLY MOVING IN THE WRONG DIRECTION ON MINING

As this report shows, there will be strong demand for many minerals as EVs continue to enter the market and other energy technologies emerge. The Biden administration has aggressive net zero goals which would greatly increase the demand for these minerals. At the same time, it has been working against allowing the needed new mines in the United States. It is illogical to develop technology that relies heavily on increased mining, while refusing to take any action to develop the capacity for that mining, and choosing instead to block or slow that development wherever possible.

In May 2021, President Biden indicated that he wants to import critical metals, supposedly from allies.⁷⁸ However, our European allies are actually temporarily closing mining and processing facilities due to their exceptionally high energy prices and reducing exports to fill the need for critical mineral resources for their own energy transition. As discussed in the previous section, a majority of global lithium production comes from China, Australia, Argentina, and Chile. Russia dominates the global nickel market, and the Democratic Republic of Congo is the world's largest cobalt producer (with half of its large mines owned by China). Child labor is being used to mine cobalt in the Congo and forced labor from Uyghurs and other Muslim minorities is being used in China. As a response to these realities, President Biden released an executive order regarding the domestic mining of these critical minerals.

President Biden talks about wanting domestic production of these minerals, but his actions demonstrate otherwise. His administration has focused on making it more difficult to mine in the United States.

On March 31, 2022, President Biden invoked the Korean War era Defense Production Act (DPA) to attempt to increase domestic production of minerals used in making electric vehicles, such as nickel, lithium, and cobalt, because the country is depending on unreliable foreign sources for many materials necessary for transitioning to the use of renewable energy.⁷⁹ The act allows Defense Department (DOD) funding for some early-stage mine development activities. President Biden's order directs the DOD to consider at least five metals—lithium, cobalt, graphite, nickel, and manganese—as essential to national security and authorizes steps to bolster domestic supplies. But President Biden's action does little to increase domestic mining because he did not waive, streamline, or suspend existing regulations. He also failed to address a major hurdle to increased domestic extraction of these critical minerals: the multiple years-long process needed to obtain the necessary federal permits for a new mine.

President Biden talks about wanting domestic production of these minerals, but his actions demonstrate otherwise. His administration has focused on making it more difficult to mine in the United States. It has revoked federal leases; used regulatory action to delay or revoke mining, air pollution, and water quality permits; and labeled a flowering plant “endangered” as ways to delay or cancel metal mines in the United States. Further, a study by finance company MSCI estimates that the majority of U.S. reserves for cobalt, lithium, and nickel are located within 35 miles of Native American reservations, causing a potential conflict with President Biden's stated commitment to racial equity.⁸⁰

In April 2022, the Department of Interior (DOI) reversed a Trump administration decision that limited the scope of compensatory mitigation the Department could force upon projects on federal land as a condition of receiving a permit. This will hit mining projects especially hard.⁸¹ Under

78 FrontPage Magazine, Biden Lied to Miners: “Made in America” Electric Car Metals Will Be Imported, May 25, 2021, <https://www.frontpagemag.com/point/2021/05/biden-lied-miners-made-america-electric-car-metals-daniel-greenfield/>

79 AP News, Biden order to boost mining may not have quick payoff, April 30, 2022, <https://apnews.com/article/biden-technology-business-trending-news-environment-04e20d148dc50c09831d2530d1fd2f8e>; New York Times, Biden Invokes Cold War Statute to Boost Critical Minerals Supply, March 31, 2022, https://www.nytimes.com/2022/03/31/business/economy/biden-minerals-defense-production-act.html?campaign_id=4&emc=edit_dk_20220401&instance_id=57307&nl=dealbook®i_id=63692790&segment_id=87196&te=1&user_id=edd9a99552656979b642d62e6445e311

80 MSCI, Mining Energy-Transition Metals: National Aims, Local Conflicts, June 3, 2021, <https://www.msci.com/www/blog-posts/mining-energy-transition-metals/02531033947>

81 United States Department of the Interior, Memorandum, Withdrawal of M-37046 and Reinstatement of M-37039, “The Bureau of Land Management's Authority to Address Impacts of its Land Use Authorizations Through Mitigation”, April 15, 2022, <https://www.doi.gov/sites/doi.gov/files/m-37075-compensatory-mitigation-m-op-reinstatement-04.15.22.pdf>

the new guidance, opponents in the federal government could assess mitigation located far from the project, giving bureaucrats a blank check to request whatever they wish of a permit seeker with little controls or relationship to the project. This decision was made less than a week after the DOI Inspector General reported that there were no controls or apparent records justifying previous versions of this program and warned they may have to review the overall program again.⁸²

The following details a few of the critical mineral mines in the United States seeking to obtain permits so that they can begin mining operations, and the obstacles they face from the federal government and environmentalists in doing so.

TWIN METALS MINE

In January 2022, the Biden administration revoked the federal leases for the Twin Metals mine in Minnesota that contains copper, nickel, cobalt, and platinum-group elements.⁸³ In January 2023, the Biden administration followed that decision by withdrawing more than 225,000 acres of the Superior National Forest from consideration for mining operations for 20 years, thereby ensuring the Twin Metals project's demise for the foreseeable future.⁸⁴ The two leases for the Twin Metals mine originated in 1966 and were up for renewal in 2016. In December 2016, however, the Obama administration declined to renew the two leases after a legal opinion from the Interior Department held that Twin Metals did not have an automatic right to renew the leases.⁸⁵ The following year, the Trump administration reversed that decision, and the Bureau of Land Management (BLM) subsequently reinstated the leases and then renewed them for an additional ten years.⁸⁶ With those leases, Twin Metals formally proposed its mining plans in 2019, which began a multi-year environmental review and permitting process by state and federal regulators.⁸⁷ But, in January 2022, a new legal opinion was released by the Biden administration that overturned the Trump administration's actions, revoking the leases.⁸⁸ The final straw was the withdrawal of the acreage from the Superior National Forest for two decades. Twin Metals is expected to challenge these decisions and defend its existing mineral rights.

Since 2010, the Twin Metals mine has invested more than \$450 million into the Minnesota economy.⁸⁹ The Twin Metals project, once operational, is projected to directly employ 750 people long-term⁹⁰. Furthermore, approximately two spinoff jobs would be created in other industries for each mining job. These spinoff jobs provide new employment opportunities in manufacturing, retail, restaurants, and energy. The Twin Metals project is expected to generate more than 1,500 indirect and induced jobs in goods and services and other sectors, while providing essential minerals for the burgeoning demand expected from President Biden's net zero ambitions.



Processing plant at Galaxy Lithium Mine in Ravensthorpe, Western Australia. Mechanical processing used to refine lithium spodumene concentrate.

82 United States Department of the Interior, Weaknesses in the BLM's Compensatory Mitigation Program Data Management, April, 2022, <https://www.oversight.gov/sites/default/files/oig-reports/DOI/AuditBLM-CompensatoryMitigationProgramDataMgmt.pdf>

83 Institute for Energy Research, Interior Department Revokes Federal Leases for Twin Metals Minnesota, January 27, 2022, <https://www.instituteforenergyresearch.org/regulation/interior-department-revokes-federal-leases-for-twin-metals-minnesota/>

84 The Federalist, Interior Department Blocks Minnesota Twin Metals Mining Project In Big Win For Beijing, January 26, 2023, <https://thefederalist.com/2023/01/26/interior-department-blocks-minnesota-twin-metals-mining-project-in-big-win-for-beijing/>

85 MPR News, Feds halt Twin Metals plan for Minn. Copper mine near Boundary Waters, December 15, 2016, <https://www.mprnews.org/story/2016/12/15/feds-deny-minerals-lease-renewals-for-twin-metals-mine>

86 MPR News, Feds reverse course, keep Minnesota copper mine alive, December 22, 2017, <https://www.mprnews.org/story/2017/12/22/twin-metals-mn-copper-mine-alive-fed>; MPR News, Interior Department renews leases for Minnesota mine project, May 2, 2018, <https://www.mprnews.org/story/2018/05/02/interior-department-renews-leases-for-minnesota-mine-project>; MPR News, Trump administration gives Twin Metals new lease on copper-nickel mining, December 20, 2018, <https://www.mprnews.org/story/2018/12/20/feds-move-to-formally-renew-leases-for-twin-metals-mine>

87 MPR News, Twin Metals submits formal plans for mine near the boundary water, December 18, 2019, <https://www.mprnews.org/story/2018/12/20/feds-move-to-formally-renew-leases-for-twin-metals-mine>

88 United States Department of the Interior, Authority to Cancel Improperly Renewed Twin Metals Mineral Leases and Withdrawal of M-37049, "Reversal of M-37036, 'Twin Metals Minnesota Application to Renew Preference Right Leases (MNES-01352 and MNES01353)'" , January 25, 2022, <https://www.doi.gov/sites/doi.gov/files/m-37072.pdf>

89 Jobs for Minnesotans, Jobs & Impact, <http://jobsforminnesotans.org/jobs/>

90 Ibid.

On May 24, 2022, Congressional Democrats held a hearing on legislation that would permanently ban mining in the Superior National Forest. That was followed by the U.S. Forest Service (USFS) releasing, on June 23, 2022, an environmental assessment recommending a region-wide mining ban on minerals, including copper, nickel, cobalt, and platinum-group elements in the Superior National Forest. The Forest Service included taconite mining in that ban, which northern Minnesotans have been doing safely for the last 130 years and which accounts for 80 percent of all U.S. produced steel.⁹¹ Also, on June 23, 2022, the USFS and BLM announced that they will request public comment on the environmental assessment to withdraw lands from new mineral leasing for 20 years in the Rainy River watershed, which is adjacent to the Boundary Waters Canoe Area Wilderness in the Superior National Forest.⁹²

In August 2022, the developers sued the Biden administration to seek the reinstatement of federal mineral rights leases that are crucial to the \$1.7 billion project. Twin Metals Minnesota alleged in its lawsuit, filed in federal court in Washington, that the Interior Department acted illegally earlier this year when it canceled the leases. The company asked the court to declare that those leases remain valid and in force, so that it can proceed with the environmental review and permitting process.⁹³



Heavy dump truck carrying ore from an open-pit mining operation.

POLYMET MINE

Also in Minnesota, the PolyMet copper and nickel mine is being held up by court and regulatory action despite having undergone more than a decade of thorough, public environmental reviews.⁹⁴ The PolyMet copper and nickel mine is located within Minnesota's Mesabi Iron Range and would be the first copper-nickel open pit mine in Minnesota. Besides holding significant deposits, the project has existing rail, roads, utilities, and an established supplier network in a traditional mining area where mining has occurred for well over a century.⁹⁵ Like other projects in the region, PolyMet has a Project Labor Agreement with building trades unions who are familiar with and expert in mining projects.

The project first entered the environmental review and permitting process in 2005, when George W. Bush was president. Seventeen years later, aspects of the mine's plan and its permits are still being investigated or challenged in court due to environmentalist opposition. According to PolyMet, its mining techniques, water treatment, and waste reclamation plans meet environmental standards and will even improve water quality in the area.

In 2019, PolyMet, under the Trump administration, received all state and federal permits needed to mine for 20 years, but three key permits needed for the project were subsequently suspended or reversed.

One of those is the project's permit to mine—a permit approved by the Minnesota Department of Natural Resources (DNR) that was reversed by the Minnesota Supreme Court in April 2021.⁹⁶ PolyMet's permit to mine indicates planned mining and reclamation activities will conclude in about 2072, though long-term maintenance and "active water treatment" will continue indefinitely until state rules on mine closure are met and the need for maintenance ends. The Supreme Court indicated that PolyMet models show "post-closure maintenance" is likely needed for at least 200 years. The DNR will determine a revised date and get public input on it. The court also told DNR that it must hold a "contested case

91 Press Release, Stauber Statement Blasting Biden Administration's Latest Anti-Mining Action, June 23, 2022, <https://stauber.house.gov/media/press-releases/stauber-statement-blasting-biden-administration-s-latest-anti-mining-action>

92 Press Release, SDA Forest Service Announces Plans to Open Comments on Rainy River Mineral Withdrawal in Northern Minnesota, June 23, 2022, <https://www.usda.gov/media/press-releases/2022/06/23/usda-forest-service-announces-plans-open-comments-rainy-river>

93 CBS, Twin Metals sues Biden administration to regain mine leases near Boundary Waters, <https://www.cbsnews.com/minnesota/news/twin-metals-sues-biden-administration-to-regain-mine-leases-near-boundary-waters/>

94 MinnPost, Why 2022 could be a critical year for the controversial PolyMet mining project in northern Minnesota, January 5, 2022, <https://www.minnpost.com/greater-minnesota/2022/01/why-2022-could-be-a-critical-year-for-the-controversial-polymet-mining-project-in-northern-minnesota/>

95 Minnesota Department of Natural Resources, Minnesota mining history, <https://www.dnr.state.mn.us/education/geology/digging/history.html#:~:text=Iron%20ore%20was%20discovered%20on,ore%20out%20of%20the%20rock.>

96 State of Minnesota Supreme Court, In the Matter of the NorthMet Project Permit to Mine Application, April, 2021, <https://mn.gov/law-library-stat/archive/supct/2021/OPA181952-042821.pdf>

hearing” on whether the company’s plan to use bentonite, a clay sealant, in its tailings pond as a key pollution prevention strategy would be effective.

PolyMet opponents are also suing state regulators over a water-pollution permit granted by the Minnesota Pollution Control Agency. In June 2021, the federal Environmental Protection Agency (EPA) ruled that discharges from PolyMet may affect water quality, as required by the Clean Water Act.⁹⁷ That allowed opponents of PolyMet to object to a federal “Section 404” permit previously granted by the U.S. Army Corps of Engineers (Army Corps) and request a hearing on the issue. The 404 permit is tied to construction-related damage to wetlands including the discharge of dredged and fill material into water. The Army Corps is holding the hearing, but meanwhile, President Biden’s EPA has recommended that the permit not be reissued. That ruling by the EPA occurred after President Biden invoked the Defense Production Act, and conflicts with his statements about wanting to develop a domestic critical metals mining industry.⁹⁸

Another issue involves a critical air emissions permit given to the project.⁹⁹ The court ruled that the Minnesota Pollution Control Agency had not sufficiently justified granting the permit after opponents raised allegations that PolyMet was planning a much larger mine. A report that PolyMet filed with Canadian regulators suggested that PolyMet was considering expanding the mine to four times the size that the air permit would allow. In December, the Minnesota Center for Environmental Advocacy affirmed the permits, saying in an agency order that there was not enough evidence to prove PolyMet was asking for the smaller permit “in bad faith.”¹⁰⁰

The company expects the roughly \$1 billion project to bring 360 direct jobs to the region and more than 600 indirect ones after construction.

IONEER LTD.’S LITHIUM MINE

Ioneer Ltd.’s lithium mine in Nevada, which could supply 22,000 metric tons of lithium annually (enough for about 400,000 electric cars), is being held up by environmentalists, who claim the mine threatens Tiehm’s buckwheat, a rare flowering plant.¹⁰¹ The Trump administration’s Interior Department refuted that claim, finding that it was actually squirrels who were threatening the buckwheat. Despite the analysis, environmentalists asked the Biden administration to list the buckwheat as an endangered species. Interior regulators subsequently proposed a listing to that effect. The U.S. Fish and Wildlife Service (USFWS) will permanently zone off 910 acres near Ioneer Ltd.’s proposed lithium mine to preserve the flower, a major step backward in the project’s bid to proceed.¹⁰² The Fish and Wildlife Service indicated in its filing that the zone should “not have a significant economic impact” on nearby business activity. Ioneer believes it can protect the flower, even if it needs to tweak its mine plans.

Final approval by BLM is based on a completed environmental review under the National Environmental Policy Act (NEPA), which begins with the public review and comment phase of the NEPA process that will be incorporated in the Environmental Impact Statement (EIS) Plan. The NEPA process culminates in the BLM’s Record of Decision (ROD), which is expected in the first quarter of 2024.¹⁰³

Pouring hundreds of millions of dollars into a domestic mining industry that remains unable to obtain permits in a timely and rational manner does little to enhance U.S. energy security or facilitate the demand for secure domestic mineral supplies.

97 United States Environmental Protection Agency, PolyMet NorthMet Mine, <https://www.epa.gov/mn/polymet-northmet-mine#nextsteps>

98 MPR News, EPA recommends Army Corps not reissue PolyMet water permit, May 3, 2022, <https://www.mprnews.org/story/2022/05/03/army-corps-of-engineers-holds-hearing-on-controversial-polymet-water-permit>

99 AP News, 2nd PolyMet permit complaint reaches Minnesota Supreme Court, November 5, 2020, <https://apnews.com/article/environment-minnesota-courts-air-pollution-pollution-00a50365e8717c66eaa48aa7047149f4>

100 State of Minnesota Pollution Control Agency, In the Matter of Issuance of Air Emissions Permit No. 13700345-101 for PolyMet Mining, Inc., City of Hoyt Lakes, St. Louis County, Minnesota, December 20, 2021, <https://www.pca.state.mn.us/sites/default/files/Findings%20FactAndConclusionsOfLawDec20-2021.pdf>

101 WSJ Opinion, Critical Mineral Contradictions, April 3, 2022, https://www.wsj.com/articles/critical-mineral-green-energy-climate-change-electric-cars-biden-mining-zinc-lithium-copper-china-pollution-endangered-species-defense-production-act-11648850666?st=ileha2hjnvl5tom&reflink=desktopwebshare_permalink

102 Reuters, rare flower to get protected zone near Ioneer’s Nevada lithium mine, February 3, 2022, <https://www.reuters.com/business/environment/us-regulators-preserve-acreage-near-ioneers-lithium-mine-site-2022-02-02/>

103 PR Newswire, Ioneer’s Rhyolite Ridge Project Advances into Final Stage of Permitting, December 19, 2022, <https://www.prnewswire.com/news-releases/ioneers-rhyolite-ridge-project-advances-into-final-stage-of-permitting-301706219.html>

In normal circumstances, the process of getting a mine to first production can be a 7 to 10 year enterprise.¹⁰⁴ But recalcitrant federal bureaucracies and politics can extend that timeline, as seen by the Twin Metals mine, whose lease began in 1966. Pouring hundreds of millions of dollars into a domestic mining industry that remains unable to obtain permits in a timely and rational manner does little to enhance U.S. energy security or facilitate the demand for secure domestic mineral supplies. This, unfortunately, is the reception those interested in investing in mining in the U.S. are currently accustomed to receiving.

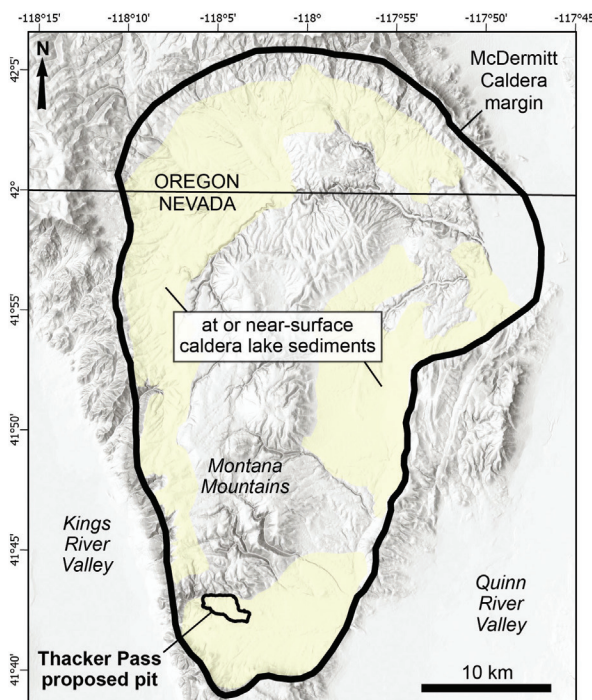
THACKER PASS LITHIUM MINE

The Thacker Pass Lithium Mine is located in Humboldt County, Nevada, about 25 miles from the Nevada-Oregon border. The proposed mine could produce a quarter of today's global lithium demand. This is significant, but demand for the mineral is skyrocketing due to electric vehicle mandates from governments here and around the world. The BLM granted the project its final federal permit in January 2021. The mine's development, however, is still on hold, due to legal challenges. On February 25, 2022, the final state-level permits (air, water, and mining) required for the proposed Thacker Pass Lithium Mine Project were issued, moving it a step closer to operation.¹⁰⁵ As part of the decision, no mining will be allowed below the water table.

A federal lawsuit was filed by a coalition of nearby indigenous communities, environmental groups, and a local rancher that argued the environmental review downplayed the likely effects on groundwater, streams, and a threatened species of trout.¹⁰⁶ The suit alleges that when the BLM approved the project in January 2021, it was based on a flawed environmental review and rushed through without adequate consultation of tribes, as required by law.¹⁰⁷ The district court ruled in favor of the BLM and Lithium Americas, allowing Lithium Americas to break ground on the project in March 2023.¹⁰⁸

In October 2022, Lithium Americas Corporation, the company developing the mine, entered a Community Benefits Agreement (CBA) with the Fort McDermitt Paiute and Shoshone Tribe, which is located approximately 40 miles from the Thacker Pass project, in Humboldt County, Nevada. The CBA establishes a framework for continued collaboration and defines the long-term benefits for the Tribe, the largest Native American community within the vicinity of the Project. The Company agreed to build an 8,000 square feet community center for the Tribe that includes a daycare, preschool, playground, cultural facility and communal greenhouse to support reclamation efforts and provide income for the Tribe.¹⁰⁹

Lithium Nevada is expecting to be fully operational in 2024, when the mine is expected to produce 60,000 tons per year of battery quality lithium carbonate over a 46-year life span. The mine will provide over 1,000 construction jobs and 300 permanent jobs. After mining, the open pits will be filled and restored with sagebrush and mine tailings will be placed in dry stacks. The mine will consume less than 1 percent of the approximately 350,000 acre-feet of water pumped annually from wells in the county.¹¹⁰



Proposed boundaries and surrounding areas of the Thacker Pass Project. Courtesy of Lithium Americas.

104 Forbes, Biden's Efforts to Boost Mining Won't Matter Without Permits, April 4, 2022, <https://www.forbes.com/sites/davidblackmon/2022/04/04/bidens-efforts-to-boost-mining-wont-matter-without-permits/?sh=257bf78c6720>

105 Nevada Division of Environmental Protection, Thacker Pass Lithium Mine, <https://ndep.nv.gov/land/thacker-pass-project>

106 Protect Thacker Pass, Native Americans Enter Legal Battle Against Thacker Pass Lithium Mine, July 26, 2021, <https://www.protectthackerpass.org/native-americans-enter-legal-battle-against-thacker-pass-lithium-mine/>

107 Grist, A controversial lithium mine in Nevada is one step closer to operation, March 2, 2022, <https://grist.org/equity/nevada-issues-permits-for-lithium-mine/>

108 Hilary Beaumont, Nevada lithium mine breaks ground despite Indigenous opposition, Al Jazeera, Mar. 15, 2023, <https://www.msn.com/en-us/news/world/nevada-lithium-mine-breaks-ground-despite-indigenous-opposition/ar-AA18EDIf>

109 Lithium Americas, <https://www.lithiumamericas.com/news/lithium-americas-signs-community-benefits-agreement-with-fort-mcdermitt-paiute-and-shoshone-tribe>

110 Washington Times, Nevada lithium mine pits Biden green agenda against radical environmentalists, June 13, 2022, <https://www.washingtontimes.com/news/2022/jun/13/nevada-lithium-mine-pits-biden-green-agenda-against/>

RESOLUTION COPPER MINE

The Resolution copper mine in Oak Flat, Arizona, which can meet about 25 percent of U.S. copper demand, is currently under federal environmental review.¹¹¹ In March 2021, just weeks into the new Biden administration, the federal government rescinded its approval for the copper mine days before it was to transfer thousands of acres of federal land for the project.¹¹² The land could have been handed over under a congressionally approved swap in which the federal government would have traded 2,422 acres of land to Resolution Copper in exchange for 5,459 acres of other land in southeast Arizona.¹¹³

President Biden's Department of Agriculture (USDA) said it ordered the rescission to allow for a "thorough review based on significant input from collaborators, partners and the public" after the January 15, 2021 release of a final environmental impact statement on the project. In ordering the reversal, the USDA cited President Biden's memorandum calling for increased tribal consultation, saying it wanted to ensure "the Forest Service has complied with the environmental, cultural, and archaeological analyses required."¹¹⁴ Further, in September 2021, the Democratic controlled House Natural Resources committee voted to include language in the House reconciliation package to block the building of the Resolution copper mine. It did not pass the Senate.¹¹⁵

In November 2022, the 9th U.S. Circuit Court of Appeals indicated that they will weigh whether the federal government improperly gave Rio Tinto Plc thousands of acres in Arizona for its Resolution Copper mining project, taking into account religious rights versus the needs of the green energy transition. The San Francisco-based court said it will decide the case en banc, meaning all of its 11 members will participate in the decision.

Three members of the court previously ruled in favor of Rio and the land swap. The new hearing occurred on March 21, 2023, and a decision will be released in the coming months. The dispute centers on the federally owned Oak Flat Campground, which some Apache consider home to deities and which sits atop a reserve of more than 40 billion pounds of copper.¹¹⁶

The proposed mine is expected to create up to 1,450 high-paying jobs and generate about \$1 billion a year in direct and indirect economic impact for the state.¹¹⁷ The project could pump \$61 billion into the economy over the projected 60-year life of the mine, annual increases of up to \$113 million in state and local taxes, and \$200 million in federal taxes.¹¹⁸ Arizona is the nation's largest copper-producing state and has a very long history with copper mines and mining.

ROSEMONT COPPER MINE

The Rosemont copper mine in the northern Santa Rita Mountains in Arizona received a setback when federal regulators rejected its mining company's request to reduce critical habitat for jaguars deemed endangered on land that overlaps the footprint of the proposed mine.¹¹⁹ Hudbay Minerals Inc. has been working for more than a decade to open the mine which would create thousands of jobs and bring billions in economic development to the region. The mine only needed about 6 percent of the land that had been excluded for the jaguars.



Giant shovel of an excavator used in African critical mineral mining operations.

111 Nation World News, US House committee moves to block Rio Tinto's resolution mine, December 9, 2021, <https://nationworldnews.com/us-house-committee-moves-to-block-rio-tintos-resolution-mine/>

112 Cronkite News, Feds rescind OK for copper mine at Oak Flat, seek 'thorough review', March 1, 2021, <https://cronkitenews.azpbs.org/2021/03/01/feds-rescind-ok-for-copper-mine-at-oak-flat-see-thorough-review/>

113 Ibid.

114 United States Department of Agriculture, Resolution Copper Project and Land Exchange Environmental Impact Statement, <https://www.resolutionmineeis.us/>

115 AZ Mirror, How the House reconciliation bill scraps Resolution Copper mine in Oak Flat, September 13, 2021, <https://www.azmirror.com/2021/09/13/how-the-house-reconciliation-bill-scraps-resolution-copper-mine-in-oak-flat/>

116 Reuters, Full 9th US Circuit to tackle complex Resolution Copper mining case, November 18, 2022, <https://www.reuters.com/markets/commodities/full-9th-us-circuit-tackle-complex-resolution-copper-mining-case-2022-11-18/>

117 Cronkite News, Feds rescind OK for copper mine at Oak Flat, seek 'thorough review', March 1, 2021, <https://cronkitenews.azpbs.org/2021/03/01/feds-rescind-ok-for-copper-mine-at-oak-flat-see-thorough-review/>

118 Resolution Copper, Myths and Facts, <https://resolutioncopper.com/myth-and-facts/>

119 Cronkite News, Feds deal another setback to Rosemont mine by upholding jaguar habitat, September 3, 2021, <https://cronkitenews.azpbs.org/2021/09/03/feds-deal-another-setback-to-rosemont-mine-by-upholding-jaguar-habitat/>

Further, Tucson Arizona officials are trying to block operators of the Rosemont copper mine from storing water in a recharge facility the city co-owns. The contract would allow Rosemont to store up to 1,124 acre-feet of water—about 366 million gallons—at the facility each year from 2022 to 2032.¹²⁰ Hudbay Minerals Inc. pledged to return some of the 1.7 billion gallons of groundwater it plans to pump each year back into the aquifer. The city is considering options that include diverting water from its other recharge facilities to block Rosemont or take legal action.

The original proposed Rosemont mine is estimated to be a \$2 billion open-pit mining project and would add up to 2,500 jobs in an area with a high poverty rate for the 19 years where the mine is set to operate.¹²¹

In April 2022, it was announced that a Hudbay Minerals Inc. subsidiary will begin clearing and grading private land on the Santa Rita Mountains' western slope south of Tucson for a planned new mine with five open pits.¹²² Pima County regional flood control officials were notified that the company plans to start seeking environmental permits from state agencies for construction of the Rosemont Copper World project. Hudbay said it would strive to minimize environmental disturbances and comply with all government requirements.

The organization Earth Justice has been fighting the Rosemont mine project since 2017, representing Indian Tribes that claim to have burial grounds in the area. Earth Justice sought a preliminary injunction to stop any digging from starting at the eastern mine. Instead of granting a preliminary injunction, the judge ruled on the merits of the Tribes' case, holding that the Forest Service made a "crucial error" by assuming Hudbay Minerals had a right to use public lands without any evidence of a valuable mineral deposit, and that this error "tainted the Forest Service's evaluation of the Rosemont Mine from the start." The judge prevented any mining activities from going forward, and called out the Forest Service for abdicating its duty to protect our public lands.¹²³

PEBBLE MINE

The Pebble copper and gold mine on state lands 100 miles from Bristol Bay, Alaska, had its permit application rejected in November 2020 by the Army Corps.^{124,125} The Pebble Mine also is rich in two important rare earth minerals, palladium and rhenium. It contains enough rhenium to supply the entire world's needs for nearly half a century.¹²⁶ Rhenium is used in the construction of military jet engines and as a catalyst in high-octane fuel combustion.¹²⁷

In January 2021, the Pebble Partnership requested the Army Corps to reverse its denial of the proposed mine's Clean Water Act dredge and fill permit. According to Northern Dynasty Minerals, that decision

is receiving new oversight and is likely to take a year or longer.¹²⁸

However, Biden's EPA indicated that, depending on the outcome



Heavy dump truck carrying ore from an opencast mining operation.

- 120 AZ Central, Tucson digs in against Rosemont copper mine in a dispute over a water storage project, January 31 2022, <https://www.azcentral.com/story/news/local/arizona-environment/2022/01/31/tucson-uses-dispute-over-water-recharge-renew-rosemont-opposition/9247404002/>
- 121 9 KGUN Tucson, Federal judge throws out approval to start construction on the Rosemont Mine, July 31, 2019, <https://www.kgun9.com/news/local-news/federal-judge-throws-out-approval-to-start-construction-on-the-rosemont-mine> ; AZ Central, Tucson digs in against Rosemont copper mine in a dispute over a water storage project, January 31, 2022, <https://www.azcentral.com/story/news/local/arizona-environment/2022/01/31/tucson-uses-dispute-over-water-recharge-renew-rosemont-opposition/9247404002/>
- 122 Tucson.com, Hudbay to clear land near Tucson for goal of 5 open-pit mines, April 6, 2022, https://tucson.com/news/local/subscriber/hudbay-set-to-clear-land-near-tucson-for-goal-of-5-open-pit-mines/article_82f4edb2-b21a-11ec-9637-0fe54ce05803.html
- 123 EarthJustice, Tribes Halt Major Copper Mine on Ancestral Lands in Arizona, November 7, 2022, <https://earthjustice.org/blog/2019-november/rosemont-mine-arizona-tribes-Tohono-Oodham>
- 124 Mining News North, Pebble Mine Death Grossly Exaggerated, August 24, 2020, <https://www.miningnewsnorth.com/story/2020/08/28/news/pebble-mine-death-grossly-exaggerated/6415.html>
- 125 National Fisherman, Pebble Mine owners discuss delay in appeals process, August 17, 2021, <https://www.nationalfisherman.com/alaska/pebble-mine-owners-discuss-delay-in-appeals-process>
- 126 Bloomberg, Why Palladium is Suddenly the Most Precious Metal, October 28, 2019, <https://www.bloomberg.com/news/articles/2019-10-28/why-palladium-is-suddenly-a-more-precious-metal-quicktake-k2ap4ryc>
- 127 Mining News, Rhenium—the hot superalloy element, June 22, 2020, <https://www.miningnewsnorth.com/page/rhenium-the-hot-superalloy-element/5748.html>
- 128 National Fisherman, Access Denied: Pebble Mine permit does not pass go, November 25, 2020, <https://www.nationalfisherman.com/alaska/access-denied-pebble-mine-permit-does-not-pass-go>

in the courts, it would reopen a proposed veto of the Pebble mine, which, if finalized, would effectively block its development on state-owned lands.¹²⁹ That process, started under the Obama administration, culminated in a proposed veto of the mine in 2015, before Pebble had even filed a permit application with the Army Corps.

President Biden's EPA, citing its authority under the 1972 Clean Water Act, proposed a legal determination that would ban the disposal of mining waste rock in the Bristol Bay watershed. The proposal would create permanent protections for the waters and wildlife of Bristol Bay, about 200 miles southwest of Anchorage.¹³⁰ It would prohibit disposing of mine-related waste within 308 square miles around the site of the proposed Pebble Mine project, an area about four times as large as Washington, D.C.

More than 600,000 people commented on the proposal. Many opposed the mine, though some tribes near the site favor the project, as does the State of Alaska. In late November 2022, Casey Sixkiller, the Region 10 EPA Administrator, sent a recommendation to EPA headquarters to veto the proposed mine.¹³¹ In January 2023, the EPA issued a final determination under the Clean Water Act that bans the disposal of mine waste in part of the bay's watershed. Determinations using the 1972 Clean Water Act are rare with only three issued in the past 30 years. The Pebble Limited Partnership is likely to appeal the determination.¹³²

ACCESS TO AMBLER MINING DISTRICT

Federal regulators recently suspended a right-of-way for a road in Alaska, previously granted by the Trump administration, which provided the state access to one of the world's largest mineral deposits including zinc and copper.¹³³ On March 11, 2022, the BLM notified the Alaska Industrial Development and Export Authority that it suspended a previously issued 50-year right-of-way that covers 25 miles of a proposed 211-mile road connecting the Ambler Mining District to Alaska's highway system. President Biden's BLM determined that the effects the proposed Ambler Road might have on subsistence uses were not properly evaluated and that tribes were not adequately consulted prior to issuing the right-of-way, despite a record of seven years of such evaluations and consultations. The State of Alaska deemed access was essential to its economic development promised in its Statehood Act.

BLM requested a remand to have time to supplement the administrative record. U.S. District Court Judge Sharon Gleason granted BLM's motion for voluntary remand without vacatur.¹³⁴ Since then, BLM has held public comments, is drafting a supplemental environmental impact statement, and studying preliminary comments to see if it needs to consider alternatives. The federal agency will issue its final decision on the proposed Ambler road project in the fourth quarter of 2023.¹³⁵ The Alaska Industrial Development and Export Authority had planned more than \$30 million worth of field work in 2022, half funded by the state-backed corporation and the other half by Ambler Metals, a joint venture owned by South32 Limited and Trilogy Metals. The field work would inform a budget for a final investment decision in 2024. In light of the remand, the partners—as well as NANA Regional Corporation, the Northwest Arctic Borough, and the State of Alaska—are reassessing AIDEA's proposed plan and budget.¹³⁶

PROPOSALS TO CHANGE THE GENERAL MINING ACT

Despite the difficulty of getting needed permits, as illustrated by the above mentioned projects, a number of Congressional lawmakers still want to make changes to the century-old General Mining Act of 1872 to make it more costly to mine for these metals in the United States. In the 117th Congress, former House Natural Resources Chairman Raúl Grijalva (D-AZ) and Senator Martin Heinrich (D-NM) introduced legislation,

129 E&E News, EPA revives Pebble mine veto, September 9, 2021, <https://www.eenews.net/articles/epa-revives-pebble-mine-veto/>

130 New York Times, Biden Administration Settling a Long Feud, Moves to Block a Mine in Alaska, May 25, 2020, <https://www.nytimes.com/2022/05/25/climate/pebble-mine-alaska-epa.html>

131 Alaska Public, EPA edges closer to banning Pebble Mine in Alaska. A veto is now just one step away. December, 1, 2022, <https://alaskapublic.org/2022/12/01/epa-edges-closer-to-banning-pebble-mine-in-alaska-a-veto-is-now-just-one-step-away/>

132 New York Times, EPA Blocks Long-Disputed Mine Project in Alaska, January 31, 2023, https://www.nytimes.com/2023/01/31/climate/pebble-mine-epa-decision.html?campaign_id=2&emc=edit_th_20230201&instance_id=84188&nl=todaysheadlines®i_id=63692790&segment_id=124063&user_id=edd9a99552656979b642d62e6445e311

133 Mining News, White House puts up and Ambler roadblock, March 14, 2022, <https://www.miningnewsnorth.com/story/2022/03/18/news/white-house-puts-up-an-ambler-roadblock/7297.html>

134 Alaska Business, Ambler Access Work Continues Despite Disappointing Ruling, May 26, 2022, <https://www.akbizmag.com/industry/mining/ambler-access-work-continues-despite-disappointing-ruling/>

135 Alaska Beacon, Bureau of Land Management Schedules Amber Road Decision for Late 2023, November 17, 2022, <https://alaskabeacon.com/briefs/bureau-of-land-management-schedules-ambler-road-decision-for-late-2023/>

136 Alaska Business, Ambler Access Work Continues Despite Disappointing Ruling, May 26, 2022, <https://www.akbizmag.com/industry/mining/ambler-access-work-continues-despite-disappointing-ruling/>

both titled the “Clean Energy Minerals Reform Act,” that would fundamentally alter how U.S. mining companies are able to produce minerals on federal lands.¹³⁷

Representative Grijalva’s version would establish a federal leasing system for mining, analogous to the program for oil, gas, and coal companies that want to produce energy on public lands. Grijalva’s bill would establish a 12.5 percent royalty rate on new mining operations and an 8 percent royalty rate on existing mines. Currently, these mines operating on federal lands do not pay royalties to the government for locatable minerals,¹³⁸ and instead pay taxes on income and the employment the mine brings. The bill would also set “strong environmental standards” under the mining law “for mining activities and long-term reclamation” of closed or abandoned mines and require the government to consult with Indigenous tribes prior to “permitting mining activities that will impact tribal communities.”

Senator Heinrich’s version would require mining companies to pay a rate “not less than 5 percent and not greater than 8 percent based on the gross income” of mining production on federal land.¹³⁹ Gross income would not allow for the deduction of expenses related to mining and would seriously affect the competitiveness of U.S. mines on federal lands. The rate, however, “would not apply to mining operations already in commercial production or those with an approved plan of operations.” Senator Heinrich’s bill would also require “annual rent payments” for mineral claims on federal lands. The Heinrich proposal bill was co-sponsored by 6 other Democratic senators.

These two proposed bills would make it harder to mine or process these metals in the United States, which will only make energy more expensive for Americans. More likely, it will stop most mines dead in their tracks.

THE GENERAL MINING LAW OF 1872

The principal law affecting most hard rock mining on federal lands in the U.S. is the Mining Law of 1872 (Mining Law). It was passed the same year as the establishment of Yellowstone National Park, America’s first national park. Both were signed into law by President Ulysses S. Grant, with the National Park preceding the Mining Law by two months. Thus, the principles of protecting and preserving public lands for enjoyment as well as for providing for the public interest in economic development and access to valuable minerals were established at the same time.

The Congressional Research Service (CRS) wrote that the primary purposes of the 1872 law were to “promote mineral exploration and development on federal lands in the western United States, offer an opportunity to obtain a clear title to mines already being worked, and help settle the West.”¹⁴⁰

CRS goes on to say, “the 1872 Mining Law was one of the primary forces behind the development of mineral resources in the West, along with the industries and services that supported mineral production.”¹⁴¹ Major hard rock minerals developed in the West include copper, silver, gold, lead, zinc, molybdenum, and uranium. During the 19th century, major mining districts for silver and gold were developed under the Mining Law in Colorado, California, Idaho, and Nevada. Early in the 20th century, there were major developments of porphyry copper in Arizona. Large molybdenum and tungsten deposits in Colorado were also developed. The Mining Law continues to provide the structure for much of the Western mineral development on public domain lands. Western mining, although not as extensive as it once was, is still a major economic activity, and a high percentage of hard rock mining is on public lands.”



President Ulysses S. Grant, who signed the 1872 Mining Law.

The Mining Law has changed numerous times over its history.¹⁴² In 1920, the Mineral Leasing Act removed oil, gas, oil shale, phosphates, sodium, and certain other minerals on federal public domain lands from the claim-patent system of the 1872 Mining Law and set up a system of

137 E&E News, Citing ‘clean energy’, progressives mount mining law overhaul, April 26, 2022, <https://www.eenews.net/articles/citing-clean-energy-progressives-mount-mining-law-overhaul/>

138 Ibid.

139 Ibid.

140 Congressional Research Service, Mining on Federal Lands: Hardrock Minerals, July 17, 2009, <https://crsreports.congress.gov/product/pdf/RL/RL33908>

141 Congressional Research Service, Mining on Federal Lands, September 10, 2002, https://www.everycrsreport.com/files/20020910_IB89130_f99a9848eaea77d35f12f472a184809b6da6e665.pdf

142 Ibid.

leasing in which the federal government retains ownership of the leased lands. Coal, which previously had its own claim-patent law (the 1873 Coal Act), was also included in the 1920 Leasing Act. After 1955, common variety minerals such as sand, stone, gravel, cinders, and pumice were sold under the Materials Act of 1947, as amended. During the 1960s and 1970s, the Multiple Use Sustained Yield Act, Wilderness Act, National Forest Management Act, NEPA, and Federal Land Policy Management Act generally addressed environmental protection, multiple use, and management of federal land. By imposing new requirements on agency actions, and by withdrawing some federal lands from development, these acts have affected mineral development under both the leasing system and the Mining Law claim-patent system. The Mining Law contains no direct environmental controls, but mining claims are subject to all environmental laws as a precondition for development.

Between 1872 and 2000, only about 1.5 percent of total public lands transferred out of federal ownership had been patented for mining. About 3.3 million acres had transferred as a consequence of miners proving their claims and paying transfer fees to the treasury to develop mines. The other 98.5 percent were transferred under homestead entries, statehood grants, railroad grants, and other non-mineral public land laws.

THE REPEAL OF THE MINING LAW

Critics of the Mining Law have attempted to repeal it for decades, alleging that it should be changed to a leasing system akin to energy and that title to all lands should remain under the control of the federal government. This comes at a peculiar time, since adding new costs and regulations to mining would simply make mining more difficult in the U.S. at a time when demand for minerals is skyrocketing in response to the transition pursued by European and U.S. governments. As discussed, “green transition” technologies require multiples more mineral products than their carbon-based energy counterpart systems.

The Biden administration has pledged support for this repeal, despite their acknowledgement that there must be more investment in mining and minerals processing in the U.S. to provide the critical minerals necessary for their net zero ambitions. They are rebranding the repeal of the Mining Law as the “Clean Energy Minerals Reform Act,” to make it appear to make it easier to develop minerals in America when the legislation would actually make it harder to mine.¹⁴³

In response, Congressman Pete Stauber (R-MN), Chairman of the House Energy and Minerals Subcommittee, offered an alternative name for the legislation: “...the UNclean Energy Minerals from China, Russia, and Child Slaves in the Congo Act?”¹⁴⁴

The U.S.—where the Mining Law’s critics argue the law makes it too easy to mine—is woefully inadequate in mining and mineral processing even to meet today’s needs, never mind the mineral needs of an energy transition requiring mountains of new minerals produced and processed at factors of larger quantities. The irony, of course, is that many of the same groups and elected representatives who want to repeal the Mining Law are also supportive of the shift away from hydrocarbons and towards a minerals and critical materials energy system. At that same time, the U.S. is nearly 4 times as dependent upon China for many of these essential minerals as we were ever dependent upon the Middle East for oil.

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143 Representative Pete Stauber, Remarks from Energy and Mineral Resources Subcommittee Ranking Member Pete Stauber on Today’s Mining Hearing, May 12, 2022, <https://stauberforms.house.gov/news/email/show.aspx?ID=ZEXZATUKTUXDO>

144 Ibid.

AVERAGE LEAD TIMES FOR PROJECT DEVELOPMENT

Regulatory delays are one of the biggest barriers to new mining development in the United States. They raise costs, extend timelines, and threaten investor confidence. Because of this, the U.S. struggles to compete globally in the minerals marketplace, especially in comparison to countries like China which recognizes the strategic geopolitical advantage of dominating the market share of these critical materials and is developing these capacities at a rapid pace.

It takes 7 to 10 years for a mining project to gain the necessary permits to begin operations in the United States.¹⁴⁵ Even for countries with similar environmental standards to those of the United States, such as Australia and Canada, it takes only two years. What causes this massive difference in approval times? The answer is largely a regulatory one.

The United States legal system contains many jurisdictional layers, meaning that in many cases, there are federal, state, and local governments all in some way regulating the development of new resources. Federal law has preemption and supersedes state and local law and regulation when they are in conflict. When they aren't in conflict, this creates a multi-layered system of interlocking regulations that are incredibly difficult for developers to navigate. This is made even more difficult by complex codes set out by the various executive agencies that have authority to codify regulations on mining, most notable among them the Bureau of Land Management.¹⁴⁶

Legislative attempts to simplify the regulatory process and ensure that developers can operate with reasonable certainty regarding when their applications will be reviewed and responded to have been made, but to little avail.

There are many federal laws in place that affect mining development. Chief among these is the National Environmental Policy Act (NEPA), discussed in the next section, and the General Mining Law of 1872, examined earlier in this paper. But those two laws are just the beginning of the many laws and regulations that developers must comply with. These are just a few examples:

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NATIONAL ENVIRONMENTAL POLICY ACT

At first blush, it might seem like there is nothing objectionable to NEPA. After all, NEPA requires federal agencies to study the environmental impacts of their actions and does not necessarily require any changes to projects. The original purpose was to provide decision makers with adequate information to ultimately make a decision. But in practice, NEPA is now used to slow down projects that have a federal nexus and increase the costs of financing to an unsustainable level.

To understand how NEPA can be used to stop projects, consider the example of the Keystone XL pipeline:

- In July 2008, TransCanada announced its intention to build the Keystone XL pipeline from Canada to the United States.

145 Standards, Best Practices, & Guidance for Mineral Resources & Mineral Reserves, Comparison of reporting environments, August 2008, https://nma.org/wp-content/uploads/2021/05/Infographic_SNL_minerals_permitting_5.7_updated.pdf

146 ICLG, Mining and Regulations Law USA, 2022, <https://iclg.com/practice-areas/mining-laws-and-regulations/usa>

- In September 2008, because it crossed the U.S.-Canada border, they filed for a cross-border permit with the U.S. State Department.¹⁴⁷
- In January 2009, the U.S. State Department held the first of 20 scoping meetings for the Environmental Impact Statement for the pipeline.¹⁴⁸
- In April 2010, the U.S. State Department released a Draft Environmental Impact Statement (EIS) finding that Keystone XL would have “limited environmental impacts” and started accepting comments on the Draft EIS.
- In April 2011, the U.S. State Department released a supplemental Draft EIS.
- August 2011, the U.S. State Department releases a final EIS and starts its National Interest Determination.¹⁴⁹
- September 2011, the final EIS finds no major environmental risks
- November 2011, President Obama delays approval until after the 2012 election
- December 2011, Congress grows frustrated with delays in approving the Keystone XL pipeline and requires President Obama to make a decision within 60 days.
- January 2012, after over 3 years of study by the U.S. State Department, but compelled by law to issue a decision, President Obama denies the cross border permit citing inadequate time to complete environmental examination.¹⁵⁰
- In 2012, Nebraska holds a hearing on a new route for Keystone XL through Nebraska.
- In September 2012, TransCanada submits a new Keystone XL route through Nebraska for the U.S. State Department to study.
- January 2013, Nebraska’s governor approves a new route for Keystone XL through Nebraska.
- March 2013, the U.S. State Department releases a Draft Supplemental EIS finding the project again will not have a significant environmental impact.
- January 2014, the U.S. State Department released the Final Supplemental EIS, again finding that Keystone XL would have negligible effects on the environment.¹⁵¹
- November 2015, President Obama rejects TransCanada’s application to build the Keystone XL pipeline stating he did not think it was in the national interest.¹⁵²
- January 2017, President Trump signs an executive order to permit the Keystone XL pipeline.
- January 2021, President Biden revokes the Keystone XL presidential permit.
- In June 2021, TransCanada, now renamed TC Energy, terminates Keystone XL.



The end of a pipeline with nobody working on it.

A few notes about this timeline:

It took the U.S. State Department three years (from 2008 until 2011) to find that Keystone XL posed no significant environmental risks. In 2008

147 U.S. State Department, Record of Decision and National Interest Determination [HTML], <https://2012-keystonepipeline-xl.state.gov/nid/249254.htm#8>

148 U.S. Chamber of Commerce, Keystone XL: A Long Road to Approval, https://www.uschamber.com/assets/archived/images/00_energy_keystone_osfc_800px.jpg

149 U.S. State Department, Record of Decision and National Interest Determination [HTML], <https://2012-keystonepipeline-xl.state.gov/nid/249254.htm>

150 Suzanne Goldberg, Keystone XL pipeline: Obama rejects controversial project, Jan. 18, 2012, <https://www.theguardian.com/environment/2012/jan/18/obama-administration-rejects-keystone-xl-pipeline?newsfeed=true>

151 Institute for Energy Research, Keystone XL: State Department’s Latest Report Is Favorable, Feb. 4, 2014, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/keystone-xl-state-departments-latest-report-is-favorable/>

152 U.S. State Department, Keystone XL Pipeline Application, <https://2012-keystonepipeline-xl.state.gov/index.htm>

there were 170,000 miles of oil pipelines in the United States.¹⁵³ The risks were well known. And yet it took three years to study the environmental impacts of a state-of-the-art pipeline.

TransCanada submitted a new route for the Keystone XL pipeline through Nebraska in September 2012, and it took another 16 months to go through the NEPA process and find that—yet again—the pipeline posed negligible environmental impacts.

In 2013, President Obama stated that he won't approve the Keystone XL pipeline if it will "significantly exacerbate the problem of carbon pollution."¹⁵⁴ Despite the fact that the U.S. State Department's NEPA work concluded that Keystone XL would have a negligible impact on carbon emissions (because moving oil by pipelines is more energy and carbon dioxide-emissions efficient than moving oil by train or truck),¹⁵⁵ President Obama rejected the pipeline anyway on climate grounds.

The Obama administration used the NEPA process to delay making a decision on Keystone XL for more than four years. The president stated he would make the decision on climate grounds, but when the NEPA studies found insignificant climate impacts, he denied it anyway. President Trump tried to revive the project, but President Biden killed it for good.

With Keystone XL, the Obama administration abused the NEPA process to drive up the costs of building the pipeline by stalling for years and years. The environmental impacts were negligible from the start because there are already so many oil pipelines in the U.S., and pipelines are proven energy transport systems with the least possible impacts.

NEPA is manipulated in a similar manner to slow down mining or stop mining projects. The point of campaigns against economic investments is to lengthen the process for so long that the financial backers of the projects walk away. It has worked remarkably well in the United States as a device to stop economic development.

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CLEAN AIR ACT

Mining activities are also regulated under Title 30 of the Clean Air Act (CAA).¹⁵⁶ The Clean Air Act establishes the guidelines that each type of mineral processing must comply with, there are four broad categories, with the National Emission Standards for Hazardous Air Pollutants being the most stringent. These standards apply to hazardous materials and processes that involve heavy chemicals.

RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act (RCRA) gives the EPA the authority to control hazardous wastes. An amendment to the law gives it the authority to control non-hazardous wastes. The EPA regulates the generation, transportation, storage, treatment, and disposal of these various wastes.¹⁵⁷

153 Pipeline and Hazardous Materials Safety Administration, Annual Report Mileage for Hazardous Liquid or Carbon Dioxide Systems, <https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-hazardous-liquid-or-carbon-dioxide-systems>

154 Institute for Energy Research, It's Time for President Obama to Approve Keystone XL, July 30, 2015, <https://www.instituteforenergyresearch.org/fossil-fuels/gas-and-oil/keystone-xl-it-is-time-for-president-obama-to-approve-it/>.

155 Drew Johnson, Criticism of Keystone pipeline proving baseless, embarrassing, The Washington Times, June 9, 2015, <https://www.washingtontimes.com/news/2015/jun/9/drew-johnson-criticism-of-keystone-pipeline-provin/>

156 Office of the Law Revision Council, United States Code Title 30 <https://uscode.house.gov/browse/prelim@title30&edition=prelim>

157 United States Environmental Protection Agency, Summary of the Resource Conservation and Recovery Act 42 U.S.C. §6901 et seq. (1976), September 28, 2021, <https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act>

CLEAN WATER ACT

Under Section 402 of the Clean Water Act (CWA), mines are required to attain a National Pollution Discharge Elimination System permit in order to discharge wastewaters of any kind. This first requires a NEPA Environmental Impact Statement. This is another example of the interconnected nature of the various regulations that apply to mining activities. Additionally, to fill or dredge any waters or wetlands, mining projects must receive a permit under section 404 of the Clean Water Act.¹⁵⁸

TOXIC SUBSTANCES CONTROL ACT

The Toxic Substances Control Act (TSCA) regulated the “development and application of new and existing chemical substances.” Many of the chemicals and materials used in the processing of ores fall under TSCA regulation.¹⁵⁹

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

Under Section 108 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), passed in 1980, financial responsibility requirements for the risks posed by various sites are established. Establishing these CERCLA or “Superfund” sites, “gives EPA the authority to require that classes of facilities establish and maintain evidence of financial responsibility to cover the costs associated with releases or threatened releases of hazardous substances from their facilities.”¹⁶⁰ CERCLA defines hazardous substances broadly, and this includes the wastes of many mining, milling and smelter byproducts and wastes other regulations like the RCRA may not cover. Under this law, “Regulators have the authority to use special funds, undertake emergency responses, and hold all historical owners or contributors—principal responsible parties—liable for cleanup costs. The definitions of liability are very broad and controversial under CERCLA and provide regulators tremendous enforcement powers.”¹⁶¹

FEDERAL LAND POLICY AND MANAGEMENT ACT

The Federal Land Policy and Management Act (FPLMA) relates to land-use on federal lands and controls the way that the BLM and the Forest Service administer mining on public lands. According to the EPA:

“Under FLPMA, BLM and USFS land use decisions are subject to NEPA. Federal land managers generally require Plans of Operation, which include reclamation plans and describe details of the proposed operation. By describing these plans in a NEPA document, other federal and state regulatory agencies can comment on aspects of the project design that relate to their respective statutory authorities, regulatory requirements, or that pertain to their particular expertise.”¹⁶²

Given the incredible volume of interconnected regulations and agencies, even under a development-friendly administration, it would be expensive and time-consuming to get a mining project approved. Under an anti-development administration, the difficulty is only heightened. None of this is meant to imply that we shouldn't operate mines in the safest and least impactful manner possible. It is meant to show the various ways that these rules and regulations have been

Given the incredible volume of interconnected regulations and agencies, even under a development-friendly administration, it would be expensive and time-consuming to get a mining project approved. Under an anti-development administration, the difficulty is only heightened.

158 United States Environmental Protection Agency, EPA's Hardrock Mining Framework, September 1997, <https://www3.epa.gov/npdes/pubs/appc.pdf>

159 American Geosciences, What are environmental regulations on mining activities, <https://www.americangeosciences.org/critical-issues/faq/what-are-regulations-mining-activities#:~:text=The%20TSCA%2C%20passed%20in%201977,ores%2C%20are%20regulated%20under%20TSCA.>

160 United States Environmental Protection Agency, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Federal Facilities, <https://www.epa.gov/enforcement/comprehensive-environmental-response-compensation-and-liability-act-cercla-and-federal>

161 American Geosciences, What are environmental regulations on mining activities, <https://www.americangeosciences.org/critical-issues/faq/what-are-regulations-mining-activities#:~:text=The%20TSCA%2C%20passed%20in%201977,ores%2C%20are%20regulated%20under%20TSCA.>

162 United States Environmental Protection Agency, EPA's Hardrock Mining Framework, September 1997, <https://www3.epa.gov/npdes/pubs/appc.pdf>

manipulated to discourage or stop mineral development altogether.

Attempts have been made to reduce the regulatory burden on developers and streamline the development process, but yet, no attempt has been able to successfully reconcile reasonable precautions for environmental protection with the need for a uniform and consistent system of application that allows for system confidence. Developers have no certainty over things like approval timelines, which makes the process unnecessarily more expensive, and excludes companies with fewer resources who could compete with clearer upfront costs from doing so.

Each of these laws, and the body of regulations relating to them, are subject to appeals and legal challenges by outside parties, providing ample opportunity for delay and increasing uncertainty. Given the significant volatility in minerals prices as demonstrated previously in this paper, investors face growing uncertainty if appellants to a mining project succeed in delaying or denying a mine. The U.S. has earned a reputation as a bad place to invest in a new mining project as a consequence of an almost limitless appeals and “lawfare” process., essentially weaponizing the intricacies of the law to block projects that should be approved on the merits.

INTERNATIONAL POLICY COMPARISONS

Beyond expanding domestic capacity, it may also be prudent for the United States to pursue an extension of our critical minerals’ capacity beyond China, especially in countries like Australia and Canada. The greater the supply of these minerals that comes from domestic, or more reliable international sources, the less reliant the U.S. becomes to the vacillations that could be incurred from sudden changes in our relationship with China.

Some legislative efforts to utilize the resources of our allies are underhanded, serving to block domestic production more than anything else. In February 2022, the White House released a fact sheet on “Securing a Made in America Supply Chain for Critical Minerals,”¹⁶³ which seeks to shore up domestic supply lines for these resources. The reasoning behind this was that “The U.S. is increasingly dependent on foreign sources for many of the processed versions of these minerals. Globally, China controls most of the market for processing and refining for cobalt, lithium, rare earths, and other critical minerals.” But a few months later, the Biden administration pivoted to a minerals policy more concerned with relying on our allies—Canada, Australia, Brazil, and others—than with building domestic supply.¹⁶⁴

Why is it that the U.S. has a far less robust mining industry than what is present in both Australia and Canada despite a wealth of mineral resources? The differences are largely because of regulation and investment policy.

One key difference among these three is in the matter of reporting requirements. When companies are seeking investment in mining projects, there are specific regulations around what information they are required to collect and report. Although all three countries have similar sets of guidance in place, in the U.S. there is an additional and more arduous layer in place on top of this shared one. In Canada, mining projects reporting requirements are regulated under National Instrument 43-101, the Standards of Disclosure for Mineral Projects in the country.¹⁶⁵ In Australia, a similar code, the JORC Code, is used.¹⁶⁶ This code is established by the Joint Ore Reserves Committee, and members include all relevant minerals and financial councils in the country. The U.S. has a code with similar requirements to both of these, the SME Guide for Reporting Exploration Results, Mineral Resources, and Mineral Reserves. But this code isn’t what is generally used in the regulation of U.S. reporting standards because the Securities and Exchange Commission does not acknowledge

Why is it that the U.S. has a far less robust mining industry than what is present in both Australia and Canada despite a wealth of mineral resources? The differences are largely because of regulation and investment policy.

163 The White House, FACT SHEET: Securing a Made in America Supply Chain for Critical Minerals, February 22, 2022, <https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/22/fact-sheet-securing-a-made-in-america-supply-chain-for-critical-minerals/>

164 Reuters, Exclusive: Biden looks abroad for electric vehicle metals, in blow to U.S. miners, May 25, 2021, <https://www.reuters.com/business/energy/biden-looks-abroad-electric-vehicle-metals-blow-us-miners-2021-05-25/>

165 Standards, Best Practices & Guidance for Mineral Resources Mineral Reserves, Comparison of reporting environments, August 2008, <https://mrmr.cim.org/en/library/magazine-articles/comparison-of-reporting-environments/>

166 Ibid.

these standards and uses its own Industry Guide 7 instead.¹⁶⁷ This code is both distinct from the other country's codes and does not recognize the same concepts. Most notably, instead of allowing a pre-feasibility study or other form of assessment of viability as Canada and Australia do, respectively, it requires a full feasibility study, which is a costly action to take prior to being able to access investment capital.

This difference in reporting requirements discourages domestic development. The United States reporting requirements for mining companies result in companies traded here looking worse than their global counterparts. The Toronto Stock Exchange and TSX Venture Exchange offer a different paradigm for this and is resultantly the exchange where 47 percent of the world's public mining companies are listed.¹⁶⁸

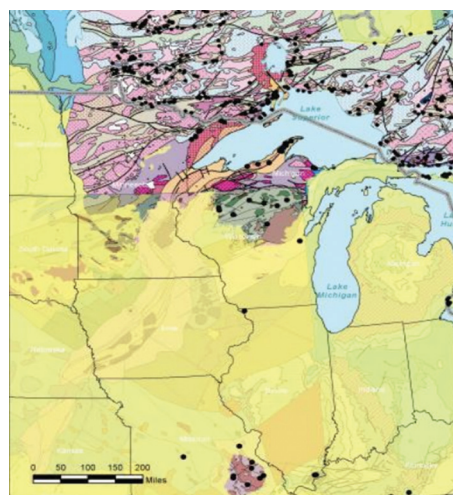
The U.S. and Canada are great examples of different mineral policies at play because of proximity and geological similarity, the key difference tends to be one of policy rather than of physical conditions. After China, Canada is the country that the United States is the most reliant on for critical mineral resources.¹⁶⁹

It's helpful to look at a visual of the difference in mineral activities between the two countries. For example, this map showcases the huge disparity in the number of mines in Ontario, Canada, and directly over the border in the United States.¹⁷⁰

Mines in Ontario vs. USA

No geological reason why mineral endowment stops at the U.S.- Canadian border

- Sedimentary rocks covering Precambrian basement
- Sedimentary rocks covering Precambrian basement



Source: [Groundbreaking! America's New Quest for Mineral Independence](#)

167 Ibid.

168 Toronto Stock Exchange, 2022 Guide to Listing, 2022, <https://www.tsx.com/ebooks/en/2022-guide-to-listing/28/>

169 United States Geological Survey, Risk and Reliance: The U.S. Economy and Mineral Resources, April 12, 2017, <https://www.usgs.gov/news/featured-story/risk-and-reliance-us-economy-and-mineral-resources>

170 Ann Bridges, Addendum to List of Figures in Groundbreaking! America's New Quest for Mineral Independence, <https://authorannbridges.files.wordpress.com/2018/11/website-references-to-figures.pdf>

CONCLUSION

There is a growing recognition that mining is critical for many evolving energy technologies, especially for electric vehicles, batteries, and renewable energy technologies. The International Energy Agency estimates that we would need 42 times as much lithium, 25 times as much graphite, 21 times as much cobalt, 19 times as much nickel, and 7 times as much rare earths as in 2020 in order to meet the policy goals of the Biden administration and our European counterparts.¹⁷¹

While there is a great need for these minerals, the United States is import-dependent on many of them. The USGS recently estimated that there were 50 minerals critical to the security of the United States. In 2021, imports made up more than half of the U.S. consumption for 47 of these mineral commodities, and the United States was 100 percent net import reliant for 17 of them.

While it may appear that the United States will have to import more minerals over time, America's incredible increase in oil and gas production over the last 15 years shows us what is possible if entrepreneurs were granted similar access to the mineral resources along with a regulatory environment that protects the environment and is amenable to experimentation at the same time. America's shale oil and gas deposits were well known to geologists for well over a century. The problem was making the oil and gas flow efficiently and economically. With the advent of horizontal drilling and hydraulic fracturing technologies, along with the right market conditions, America's oil and natural gas producers literally changed the world.

In 2008, U.S. oil production averaged 5 million barrels a day, but by 2019, the U.S. oil production averaged 12.3 million barrels a day.¹⁷² This is an astonishing 146 percent increase in oil production in only 11 years. This production growth was the result of technological improvements like hydraulic fracturing, better subsurface imaging, and improved directional drilling. But technological advancements were not enough. The revolution that made this dramatic growth possible happened almost exclusively on state and private lands, which allowed for the necessary experimentation without sacrificing the environment.

Around 2008, many people argued that we should "drill, baby, drill" domestically to lower oil and gasoline prices. Some experts disagreed that the U.S. could dramatically increase production through drilling. They were wrong.

There is no reason why we couldn't repeat this successful policy by streamlining regulations to allow more domestic mining and mining experimentation so the U.S. can experience a mining revolution like we saw with oil production. If we continue to hold ourselves back with excessive red tape, then we are deciding as a country that we should import more minerals and especially processed minerals. China currently dominates mineral processing, but there is no reason why the United States can't assume a leadership role in mining as well as mineral processing. A failure to do so will consign the U.S. to a future of economic and national security weaknesses Americans have never known.

Around 2008, many people argued that we should "drill, baby, drill" domestically to lower oil and gasoline prices. Some experts disagreed that the U.S. could dramatically increase production through drilling. They were wrong. There is no reason why we couldn't repeat this successful policy by streamlining regulations to allow more domestic mining and mining experimentation so the U.S. can experience a mining revolution like we saw with oil production

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