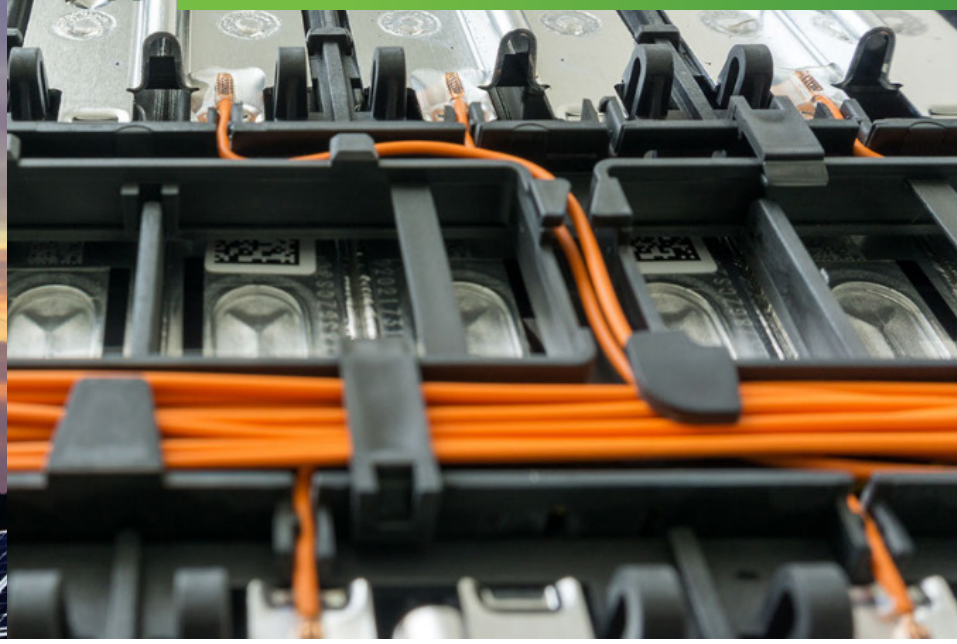
Strengthening America's Mineral Security:

Net Import Dependence, Supply Chain Vulnerability, and the Case for Critical Minerals

MARCH 2022



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Overview

The United States is highly dependent on critical minerals from foreign countries, especially China. Our country's vulnerabilities exist at all stages of the value chain. This includes not only minerals extraction, which must be prioritized, but also the processing and refining activities necessary to convert ore into workable minerals and metals. We can and must reverse this situation with a new set of policies that is both strategic and environmentally sound.

ConservAmerica proposes a three-part framework to tackle the minerals challenge:

1. **Minerals for Clean Energy** – The clean energy future relies on minerals that must be extracted and refined in processing facilities. American minerals – just like American energy – are more cleanly and safely produced than in many other countries. In order to demonstrate that superior environmental and labor performance, industry should work with other stakeholders to evaluate voluntary programs that disclose, certify and promote the use of minerals produced under these higher standards.

2. **Resources for Resources** – The federal government must properly fund and administer the various minerals programs that it has launched and that have been authorized. For example, Congress and the public should monitor and demand compliance with the mandated establishment of new battery facilities, federal lending mechanisms, and mineral data collection. Congress should also consider developing renewable-style tax credits for minerals, as well as expedited permitting.

3. **Strengthening Supply Chains** – Partnering with our Canadian and Australian allies, who also enjoy vast natural resources and a shared commitment to sound environmental practices, must be a top priority. The United States should also accelerate its domestic mapping program, consider a new civilian stockpile for critical minerals, and continue to build relationships with other mineral-rich partners.

Source: Standard Lithium Ltd.

Solving the critical minerals problem presents a rare opportunity for bipartisan cooperation that both strengthens national security and secures economic prosperity for generations to come. Both Republicans and Democrats, in the White House and in Congress, have taken important early steps towards addressing the problem, but additional, deliberate steps to alter the policy framework in support of critical minerals development must be taken.

Critical Minerals 101

Our world consists of minerals. As a result, not only can minerals be found everywhere, their uses–once extracted, processed, and transported by supply chains of varying vulnerability–are virtually limitless. Not all minerals are created equal, however, and in a modern economy some will be more crucial than others for certain applications.

WHAT IS A MINERAL?

Minerals are solid substances that arise naturally and conform to a crystalline pattern. They are created by dynamic processes–flowing magma, tectonic shifts, melting and cooling–below the planet's surface. They can be recovered from the ground, the ocean floor, and even from meteorites. Crustal materials, including rock and sediment, that contain minerals in concentrations that can economically extracted are referred to as ore. **(Figure 1)**.

Chemical Elements → **Minerals** → **Rocks** → **Ore** → **Mining** → **Processing** → **End-Use**

Fig. 1. The Mineral Lifecycle

WHAT IS THE MINERAL SUPPLY CHAIN?

Extracting specific minerals from ore and turning them into products is a principal function of the economy. Often, ore needs to be crushed, separated and processed, forming a supply chain that can be as simple as panning for gold along the river or as complex as physical and chemical processing and refining at an industrial scale **(Figure 2)**. The relative accessibility and ease of processing varies widely across the thousands of mineral types that exist.

WHAT IS MINERALS PROCESSING?

In many ways, mineral processing is similar to petroleum refining, where crude oil is heated and "distilled" (among other processes) into its various components. Crude oil itself has very few uses: the value is in the refined product. In the case of minerals, extracted ore may contain many different minerals. Mineral processing is the method by which the targeted mineral is isolated from the rest of the materials in the ore. These refined minerals then can undergo further processing when, for example, they are used as an alloy in the manufacturing of other metals like steel.

WHY ARE MINERALS IMPORTANT?

Minerals are processed into metals, chemicals, fertilizer, construction supplies, glass, etc. **(Figure 3)**. Without exception, every single economic sector relies on minerals. Every computer, phone, car, plane, battery, plastic or steel appliance, electric or conventional engine, artificial joint or prosthetic limb, digital camera or high-definition television is built from minerals.

Generic High-Level Supply Chain Topology	Upstream	Midstream	Downstream
Specifically Applied to Minerals	Production	Processing	End-use
Illustrative Activities	Drilling, blasting, crushing, milling,	Separation, concentration, refining, alloying, smelting, calcination	Value-added goods, manufactured products

Fig. 2. The Mineral Supply Chain

Bauxite/ Aluminum	Clay	Iron Ore	Phosphate Rock	Salt	Stones/Sand/ Gravel
2,069 lbs	11,379 lbs	17,068 lbs	13,448 lbs	27,413 lbs	1.32 million lbs
Lead	**Zinc**	**Copper**	**Gold**	**Cement**	**Others**
776 lbs	445 lbs	828 lbs	1.51 Troy oz.	52,757 lbs	54,137 lbs

Fig. 3. Lifetime Needs Per American

Source: Minerals Education Coalition.[1]

WHAT IS A CRITICAL MINERAL?

According to the federal government, a "critical mineral" is defined as "(i) a non-fuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security."[2] The United States Geological Survey identified 35 mineral commodities as critical to more than five major industrial sectors **(Figure 4)** in 2018 and proposed to modify that list to include 50 total mineral commodities in 2021.[3] (The increased number of critical minerals is mostly due to expanding groups into their constituent parts.) In short, such minerals must be vital and access to them must be vulnerable to meet the definition.[4]

HOW ARE CRITICAL MINERALS DESIGNATED?

The United States Geological Survey utilizes several "supply risk" metrics to determine whether a mineral can be deemed "critical" to the nation, publishing an updated methodology in 2020.[5] First, it estimates "disruption potential" by assessing the concentration of a particular mineral's production globally (i.e., how many countries produce how much of it) and

Critical Minerals		Industrial Sectors
2018 List	aluminum (bauxite), antimony, arsenic, barite, beryllium, bismuth, cesium, chromium, cobalt, fluorspar, gallium, germanium, graphite (natural), hafnium, helium, indium, lithium, magnesium, manganese, niobium, platinum group metals, potash, rare earth elements group, rhenium, rubidium, scandium, strontium, tantalum, tellurium, tin, titanium, tungsten, uranium, vanadium, and zirconium	• aerospace • defense • energy • telecommunications and electronics transportation • other – glass and ceramics – plastics – medical applications – pharmaceuticals – steel – lasers – metallurgy – catalysts
2021 Draft List	Expand platinum metals and rare earth elements groups into constituent commodities; add nickel and zinc; remove helium, potash, rhenium, strontium, uranium	

Fig 4. Industrial Uses of Critical Minerals

Source: United States Geological Survey[6]

the willingness and ability of producing countries to supply this mineral. Second, it considers the "trade exposure" of a given mineral, which essentially refers to net import reliance of the United States (i.e., how dependent the nation is on foreign sources of a mineral for its consumption). Third, it develops a measure of "economic vulnerability" posed by this mineral by analyzing profit margins, contributions to gross domestic product, and industrial expenditures (i.e., how badly would a disrupted mineral supply chain be felt across the country).

Qualitative metrics can also be used when quantitative data is lacking. Beryllium, nickel, and zirconium are designated as critical because they are vulnerable to single points of failure in the domestic United States. It is important to note that the U.S. Geological Survey does not make the criticality determination; it is ultimately a political decision that is informed by this analysis, but not strictly conditional upon it.

WHAT IS THE SCOPE OF THE PROBLEM?

In 2021, the International Energy Agency (IEA) released a groundbreaking study on the role critical minerals play in the much-discussed "energy transition" from conventional fuels to low-carbon technologies. The report warns: "As clean energy transitions accelerate globally and solar panels, wind turbines and electric cars are deployed on a growing scale, these rapidly growing markets for key minerals could be subject to price volatility, geopolitical influence and even disruptions to supply."[7] The agency's groundbreaking report warns that mineral production is concentrated geographically, that new projects are difficult to construct, and that the quality of mineral ore is declining globally. In other words, too few countries are producing too few minerals.

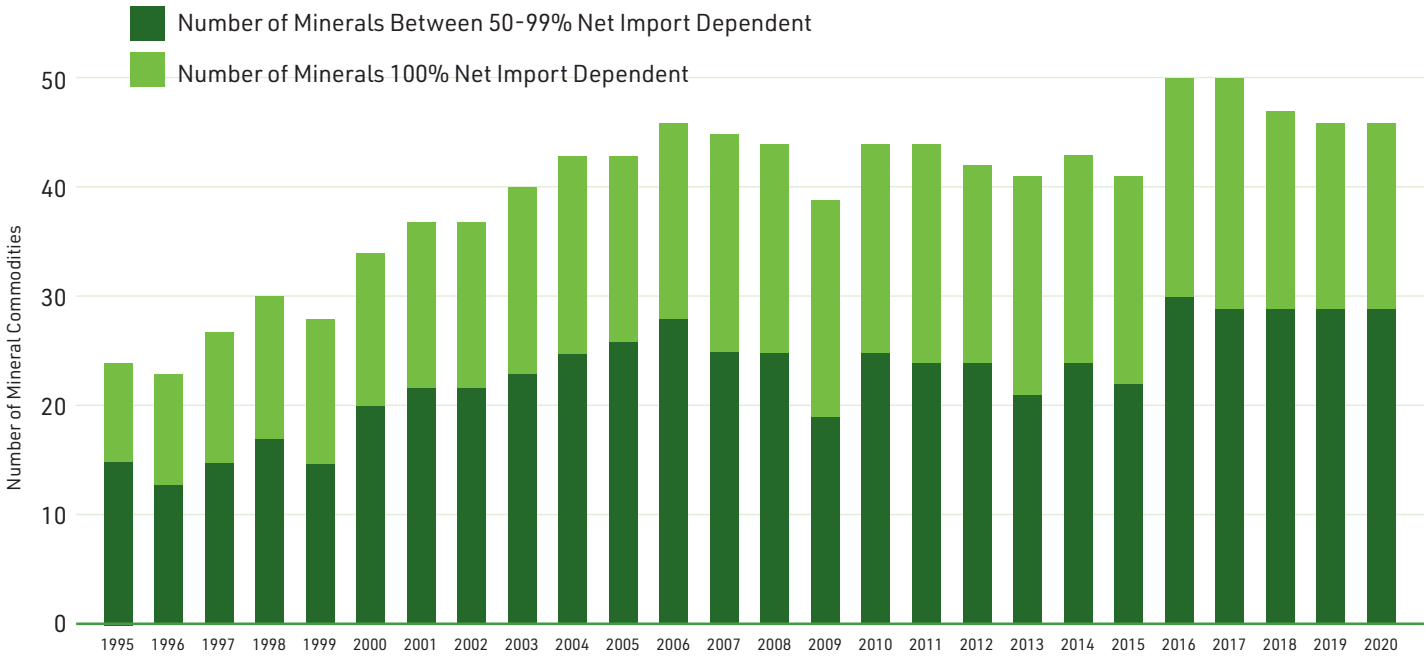

Fig. 5. Minerals and Degrees of Net Import Dependence

Source: USGS Annual Mineral Commodity Summaries, compiled by Comarus Analytics LLC.

Note: USGS began counting bauxite and aluminum as separate mineral commodities in 2015 data. Prior to 2015, the two were listed on a single line. To reflect this change in methodology, the number of minerals for which the United States was 100% net import dependent has been increased by one for each year before 2015.

IS THE PROBLEM IMPROVING OR WORSENING?

The United States Geological Survey publishes annually a list of selected mineral commodities, estimating the degree of net import dependence for each and identifying the major sources of these imports (Figure 5). From 1995 to 2020 (the earliest and latest years for which this dataset is available, respectively), the number of minerals with greater than 50% net import dependence has doubled (from 23 to 46), as have the number of minerals with 100% net import dependence (from 8 to 17). While much of this increase occurred between 1995 and 2006, and the trend line has remained much flatter since then, the key observation to draw from the data is the persistence and depth of net import dependence. The problem is worsening, not improving.

WHAT IS THE CURRENT STATE OF U.S. MINERALS PRODUCTION?

According to the U.S. Geological Survey, the nation's top produced nonfuel minerals (those worth more than $1 billion) included cement, copper, gold, iron ore, lime, phosphate rock, salt, sand and gravel, soda ash, and zinc.[8] The lead producing state is Nevada, followed by Arizona and Texas. Given the size of the country, it is not surprising that the United States produces many kinds of minerals, including rare earth elements. The problem is one of depth: the data makes it clear that America's dependence on overseas production is deep and pervasive. But the problem is not limited to mineral extraction. As noted above, minerals production involves processes that turn mined ore into usable commodities. These processing facilities have also been centralized in far too few countries, with the United States lagging in many categories.

WHAT ROLE DOES CHINA PLAY IN THE CRITICAL MINERALS PROBLEM?

China is the world's top producer of 19 of the USGS-identified critical minerals: aluminum, antimony, arsenic, barite, bismuth, fluorspar, gallium, germanium, graphite (natural), indium, magnesium, rare earth elements, scandium, tellurium, tin, titanium, tungsten, and vanadium. China is also the top supplier to the United States for 13 of these minerals.[9] Through its concentrated control of production, China poses a severe threat to the critical minerals supply chain.[10]

China also plays a pronounced role in the processing of minerals. The International Energy Agency notes that China's share of refining is around 35% for nickel (the figure becomes higher when including the involvement of Chinese companies in Indonesian operations), 50-70% for lithium and cobalt, and as high as 90% for rare earth elements that produce oxides, metals and magnets.[11]

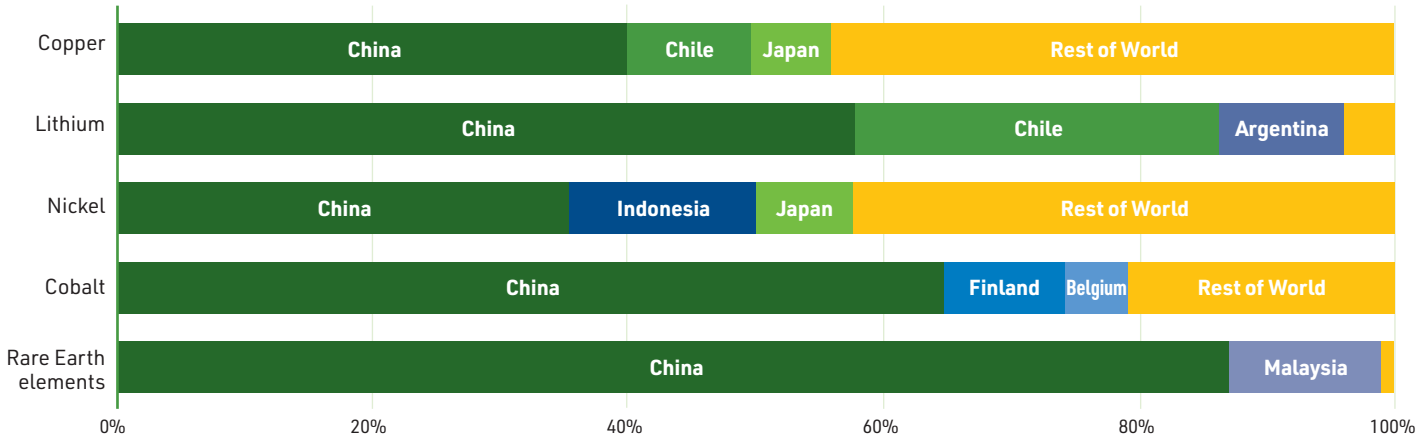

Fig. 6. Shares of Processing Volume for Selected Minerals, 2019

Source: International Energy Agency

U.S. Federal Activities

Reversing the pervasive and persistent vulnerability of critical mineral supply chains has the potential to emerge as a rare arena for bipartisan cooperation in the coming decade. This is particularly true as renewable energy technologies and electric vehicle deployments require ever greater volumes of minerals and future high-tech areas, including quantum computing and space exploration, create further supply demands.

WHAT ACTIONS HAS THE EXECUTIVE BRANCH TAKEN?

Presidents representing both parties have increasingly recognized the critical minerals problem.

OBAMA ADMINISTRATION

- In 2010 (along with a 2011 update), the Department of Energy published a Critical Materials Strategy. It examined the role of rare earth elements, in particular, in solar, wind, electric vehicle, and energy efficient technologies.[12] In 2013, DOE established the Critical Materials Institute at Ames National Laboratory.
- In 2012, the United States filed a complaint with the World Trade Organization regarding China's virtual monopoly of rare earth minerals.[13]
- In 2015, DOE published the Quadrennial Technology Review, which contained a chapter of assessments focused on critical materials.[14]
- In 2016, the National Science and Technology Council developed the Critical Mineral Early Warning Screening Methodology.[15]

TRUMP ADMINISTRATION

- In 2017, President Trump issued Executive Order 13817, which mandated the publication of the critical minerals list by the Department of the Interior and the compilation of an interagency report, led by the Department of Commerce, to make recommendations for addressing the critical minerals problem.[16]
- In 2019, the Trump administration designated light and heavy rare earth elements, alongside other minerals related to magnets, as eligible for federal support through the Defense Production Act. More than $12 million was awarded by the Department of Defense to several rare earths-related commercial operators.[17]
- In 2020, President Trump issued Executive Order 13953, which established the following policy:

  > It is the policy of the United States that relevant agencies should, as appropriate and consistent with applicable law, prioritize the expansion and protection of the domestic supply chain for minerals and the establishment of secure critical minerals supply chains, and should direct agency resources to this purpose, such that:
  >
  > **(i)** the United States develops secure critical minerals supply chains that do not depend on resources or processing from foreign adversaries;
  >
  > **(ii)** the United States establishes, expands, and strengthens commercially viable critical minerals mining and minerals processing capabilities; and
  >
  > **(iii)** the United States develops globally competitive, substantial, and resilient domestic commercial supply chain capabilities for critical minerals mining and processing.[18]

- Executive Order 13953 also directed DOE to open up its multibillion-dollar Loan Program Office to critical minerals-related projects.
- Also in 2020, the United States established the Critical Minerals Mapping Initiative, a collaboration with Canada and Australia.[19]
- DOE launched the $122 million Carbon Ore, Rare Earth, and Critical Minerals Initiative for U.S. Basins and continued research and development grant programs related to basic science, recycling, and processing.[20]

BIDEN ADMINISTRATION

- In 2021, the Biden administration issued Executive Order 14017, which outlined the importance of secure supply chains and mandated 100-day interagency reviews.[21] The reviews, published in June 2021, included reporting by the Department of Energy on advanced batteries and by the Department of Defense on critical minerals and materials.[22]
- Sectoral supply chain assessments, mandated by Executive Order 14017, are due on March 1, 2022.
- In November 2021, the Department of the Interior published a draft updated list of critical minerals, expanding the number from 35 to 50. Most of this expansion can be attributed to counting individually each type of rare earth element, rather than treating them all as a single critical mineral. The same is true of the platinum group metals, which were expanded into individual elements instead of grouped together.
- In September 2021, the Commerce Department initiated an investigation into the national security impacts of neodymium permanent magnet imports. This authority stems from Section 232 of the Trade Expansion Act and can be quite powerful if the investigation concludes that national security is impaired as a result of these imports.[23]
- DOE continued research grant programs on rare earths and other critical minerals.[24] DOD also awarded $30 million in Defense Production Act financing to a rare earths processing company.[25]

Unfortunately, the Biden Administration has also taken steps that may complicate efforts to end import and supply chain vulnerabilities:

- On October 7, 2021, CEQ announced[26] that it would reverse the prior Administration's attempt to streamline and update the permitting processes of the more than 50 year-old National Environmental Policy Act (NEPA).[27]
- The Administration has a shown its willingness to abruptly halt ongoing permitting processes,[28] and previously approved critical minerals projects,[29] stranding resources, creating market uncertainty, and potentially causing a "chilling effect" around future development projects.

WHAT ACTIONS HAS THE LEGISLATIVE BRANCH TAKEN?

Congress, under the leadership of both parties in recent years, has passed legislation in the area of critical minerals **(Figure 6)**.

- In 2020, Congress incorporated the American Mineral Security Act into the end-of-year omnibus. This bipartisan bill, co-sponsored by Senator Lisa Murkowski (R-AK) and Senator Joe Manchin (D-WV), authorized new DOE research programs on rare earths and materials recycling, innovation, efficiency, and alternatives; new data and analysis requirements (including the production by USGS and the Energy Information Administration of an Annual Critical Minerals Outlook); the creation of a materials-focused Energy Innovation Hub, a Critical Materials Consortium, and a Critical Materials Supply Chain Research Facility; critical mineral designations by the Department of the Interior; and a Department of Labor workforce program. In addition, Senator Mitt Romney (R-UT)

secured a monitoring requirement related to China and mineral supply chains.[30]

- In 2021, Congress passed the Infrastructure Investment and Jobs Act. This bill included a title, "Supply Chains for Clean Energy Technologies," that authorized $3 billion for the Battery Material Processing Grant Program and another $3 billion in battery manufacturing and recycling grants. Both grant programs will be housed at DOE. The new law also established battery recycling research, development, and demonstration grants at DOE in coordination with the Environmental Protection Agency.[31]
- In addition, the infrastructure legislation codifies the Trump administration's expansion of DOE's Loan Program Office to cover critical mineral projects and directs the Departments of the Interior and Agriculture to "to expedite the permitting of activities that will increase exploration for, and development of, domestic critical minerals, while maintaining environmental standards."[32]
- Finally, the United States Innovation and Competition Act of 2021, which passed the Senate in June 2021, directs the Department of Commerce to support critical minerals research activities and provide grants for pilot projects.[33]

The Way Forward

The critical minerals problem is a challenge that can – and must – be solved. The focus should be on scaling the critical minerals value chain in the United States and among our allies. In order to expedite the development of economically competitive American mining and processing operations, federal assistance far beyond research grant programs and ministerial gatherings in exotic locations will be required. China will not, and has not been, playing the slow game. We cannot afford to either.

ConservAmerica proposes a three-pillar framework under which U.S. policy objectives can be advanced coherently and consistently.

MINERALS FOR CLEAN ENERGY

Policymakers increasingly recognize that the modern economy needs affordable, reliable access to critical minerals. Using the shift to cleaner energy as an example, wind turbines depend on magnets that contain rare earth elements and photovoltaic cells for solar power rely on various semiconductor materials. Battery chemistry, particularly for next-generation designs, is incredibly mineral intensive, requiring cobalt, lithium, manganese, nickel, rare earth elements, among others. Without these minerals, there is no green energy future.

But these minerals are not going to magically appear. One cannot have it both ways – advocating for clean energy but refusing to facilitate a domestic production and processing capacity. Clean energy is not clean when its components are outsourced to countries that lack enforceable and verifiable environmental and labor standards.

The U.S. industry differentiates itself with its commitment to higher environmental and labor standards. American minerals – just like American energy – are more cleanly and safely produced than in many other countries. For those concerned with the environmental, social, and governance (ESG) agenda, locating much of the mineral value chain in the United States would be a significant improvement over reliance on extended trade routes and problematic regimes, such as China or the Democratic Republic of Congo.

That superior environmental performance should be capitalized upon and used as an incentive to develop critical minerals capacity domestically. Even voluntary means could prove helpful. For example, upstream producers and midstream processers could disclose and certify environment and safety records;

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downstream users and manufacturers could reveal where they source their minerals and the life-cycle impact of their product so that consumers can make product choices that are consistent with their values.

It is also important that the federal government not prioritize battery metals to the exclusion of other types of critical minerals, nor should it devote disproportionate resources to secondary recovery (recycling) programs that are not sufficient to meet projected demand.

RESOURCES FOR RESOURCES

Policymakers must properly resource and timely implement existing programs, as well as consider enacting new authorities. As for existing programs

and projects, it is essential to hold government officials' feet to the fire. To date, for instance, DOE's Loan Program Office has not made any conditional commitments to critical minerals projects and the U.S. Geological Survey and the Energy Information Administration have not published the first Annual Critical Minerals Outlook. In addition, the new battery programs funded by the recently passed Infrastructure Investment and Jobs Act, remain to be established.

New mines and processing facilities require many years to site, permit, and construct. The National Mining Association, an industry group, estimates that the permitting process for critical minerals development can take more than a decade and reduce the value of a

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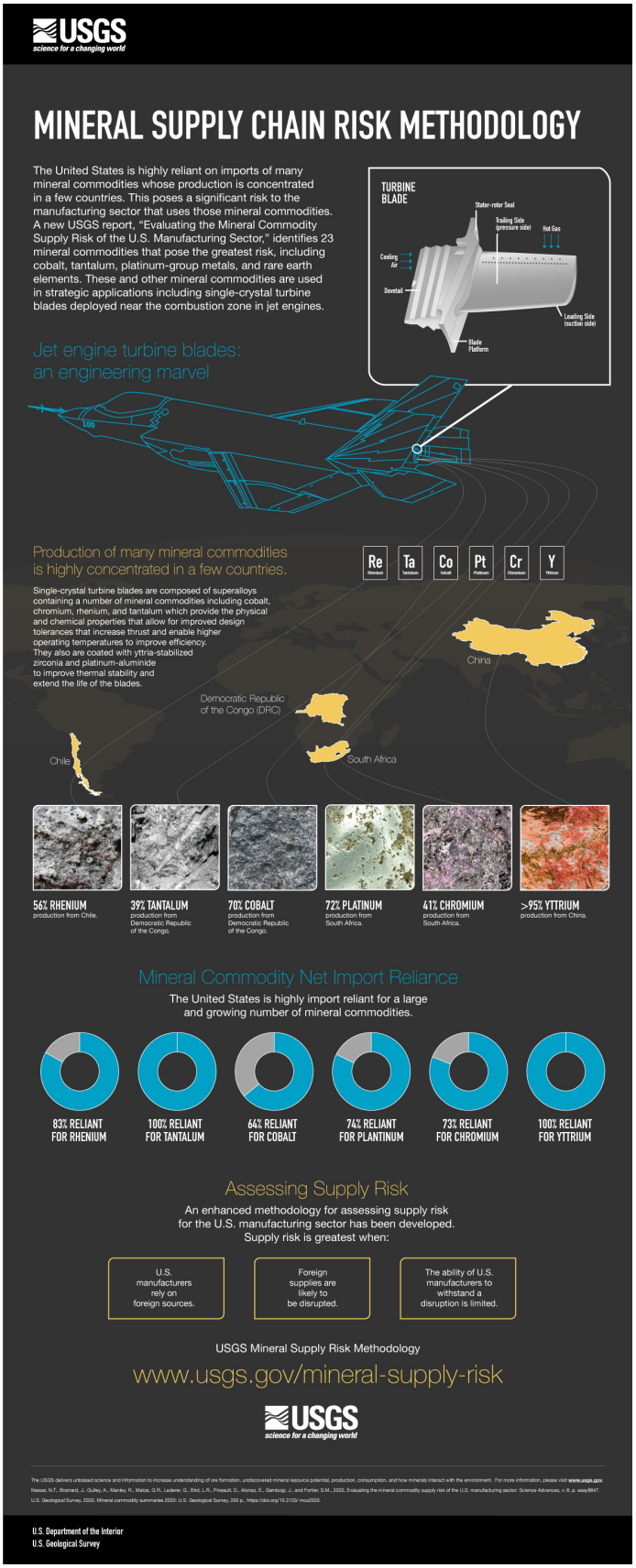
proposed project by more than one-third.[34] And the IEA estimates that new mines generally take more than 16 years.[35] So if we are going to develop the resources we need, expediting permitting – including, but not limited to, enforceable timetables – is essential.

To ensure that progress is being made, metrics and scorecards would be very valuable. Legislative oversight should play a significant role too.

Congress should also consider developing a new suite of policies to address various parts of the value chain. For example, a mineral production tax credit modeled after existing renewable-focused tax credits, or a mineral recycling tax credit could improve end-use economics and provide a beneficial waterfall effect down the entire supply chain. To achieve a level playing field, fiscal policy should incentivize production and demand for domestically sourced minerals.



STRENGTHEN SUPPLY CHAINS

Enabling the shift of critical mineral supply chains away from China is a national security imperative.[36] The Covid-19 pandemic highlighted the dangers of concentrating production in a single nation. Even before the pandemic, China demonstrated a propensity to wield its resources as a weapon. Through its Belt and Road Initiative and other economic and infrastructure programs, China has made a strategic decision to capture market share in multiple areas, including in critical minerals. Chinese investment in "proxy production" of critical minerals – developing production and processing capabilities in other countries – poses an additional source of uncertainty and another area ripe for further analysis.

Increasing exploration and production of minerals domestically is the surest way to make supply chains more resilient to disruption. As noted in an article published in 2018 on EOS.org authored by two USGS physical scientists, "A common misconception is that the United States must import mineral commodities because no domestic resources exist. In general, the United States does not lack mineral resources."[37] See **Figure 7**. Another USGS official testified before the Senate Committee on Energy and Natural Resources that "only about one-third of the United States has been mapped at the detailed scales required for mineral exploration."[38] We know we have resources; we just don't know exactly how much.

In addition, partnerships such as the mapping initiative with Australia and Canada should be continued and possibly developed with other countries, such as Chile, Mexico, and other key partners. Diversity of supply, even if not localized within U.S. borders, can also enhance supply chain resilience. Such international programs must focus on extracting new minerals out of the ground and building new processing capacity; workshops and exchanging best practices are not sufficient. The federal government should also consider establishing a civilian stockpile for critical minerals similar in concept to the Strategic Petroleum Reserve. The National Defense Stockpile is neither designed nor equipped to fill such a function in the national economy.

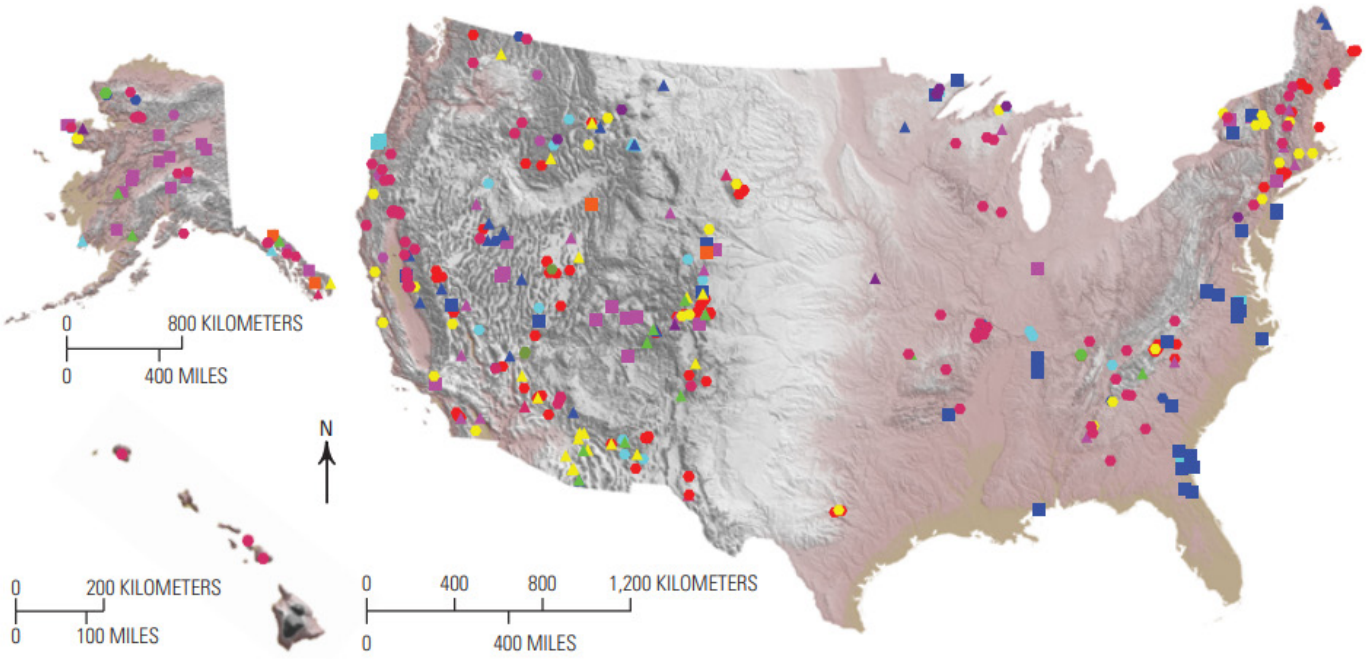


Fig. 7. Resource Areas in the United States.

Source: USGS.[39]

Conclusion

Under the current policy and regulatory framework, the U.S. critical minerals industry faces serious challenges in competing against many foreign countries, particularly China, where government-backed industries have made it a strategic priority to control the market. This is not acceptable. Minerals are to clean energy and advanced technology what semiconductors are to computers. We are facing major economic and national security vulnerabilities that need to be eliminated through the establishment of a strong, competitive domestic capability.

Policymakers and government officials have the tools to solve this challenge. The federal government should recognize the nascent stage of the industry and act accordingly. With proper policy support and the use of market principles, American workers and industries will be able to develop clean energy technologies and strengthen supply chains – thereby putting America into a position of strength.

Source: Standard Lithium Ltd.

ABOUT THE AUTHORS

TRISTAN ABBEY is President of Comarus Analytics LLC. Prior to its founding, he served for nearly a decade in senior policy roles at the Senate and the White House. In October 2020, the Energy Policy Research Foundation, Inc., named him a Distinguished Fellow.

TODD JOHNSTON is vice president of policy at ConservAmerica. Todd previously served at the Virginia Department of Environmental Quality and on committees with jurisdiction over environment, infrastructure, and energy issues in the U.S. Senate and House of Representatives. Todd has represented various industries on state and federal policy, permitting, and regulatory compliance matters.

Endnotes

1. https://mineralseducationcoalition.org/mining-mineral-statistics
2. Executive Order 13817, "A Federal Strategy To Ensure Secure and Reliable Supplies of Critical Minerals," 82 FR 60835 (Dece mber 20, 2017): https://www.federalregister.gov/documents/2017/12/26/2017-27899/a-federal-strategy-to-ensure-secure-and-reliable-supplies-of-critical-minerals
3. "2021 Draft List of Critical Minerals," U.S. Geological Survey (November 9, 2021): https://www.federalregister.gov/documents/2021/11/09/2021-24488/2021-draft-list-of-critical-minerals.
4. Another relevant term is rare earth elements. They are chemical elements identified in the periodic table as the lanthanide series, plus scandium and yttrium. In its 2018 Critical Minerals List, the U.S. Geological Survey grouped rare earth elements and yttrium as a single category alongside scandium. In its proposed 2021 draft list, the agency eliminates the larger basket category and instead individually specifies each rare earth element for inclusion. Rare earths have a wide range of applications in defense, catalysis, ceramics, and metallurgy. They are used to manufacture magnets (which underpin many renewable energy technologies), batteries, automobile components, personal electronics, and other industrial and consumer products.
5. https://pubs.er.usgs.gov/publication/ofr20211045.
6. *Draft Critical Mineral List–Summary of Methodology and Background Information–U.S. Geological Survey Technical Input Document in Response to Secretarial Order No. 3359*, U.S. Department of the Interior (Open-File Report 2018-1021): https://pubs.usgs.gov/of/2018/1021/ofr20181021.pdf
7. IEA, "The Role of Critical Minerals in Clean Energy Transitions," World Energy Outlook Special Report (May 5, 2021), p. 1: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/reliable-supply-of-minerals.
8. U.S. Geological Survey, *Mineral Commodities Survey 2021*, p. 6: https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf.
9. See Table 2 of *Draft Critical Mineral List*, ibid.
10. The problem is not solely centered on China, however. South Africa, for example, is the primary U.S. source for chromium, manganese, titanium, and vanadium.
11. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/the-state-of-play#abstract.
12. DOE, Critical Materials Strategy 2011: https://www.energy.gov/articles/department-energy-releases-its-2011-critical-materials-strategy
13. Darren Samuelsohn and David Saleh Rauf, "Obama hits China's hold on minerals," Politico (March 13, 2012): https://www.politico.com/story/2012/03/obama-hits-chinas-hold-on-minerals-073975
14. DOE, *Quadrennial Technology Review 2015, Chapter 6: Innovating Clean Energy Technologies in Advanced Manufacturing, Technology Assessments*: https://www.energy.gov/sites/prod/files/2015/12/f27/QTR2015-6F-Critical-Materials.pdf
15. Assessment of Critical Minerals: Screening Methodology and Initial Application, NSTC (March 2016): https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/NSTC/csmsc_assessment_of_critical_minerals_report_2016-03-16_final.pdf
16. Executive Order 13817, ibid.
17. Four presidential determinations were published in the Federal Register on July 25, 2019. For example, see: https://www.federalregister.gov/documents/2019/07/25/2019-15995/presidential-determination-pursuantto-section-303-of-the-defense-production-act-of-1950-as-amended.
18. Executive Order 13953, "Addressing the Threat to the Domestic Supply Chain From Reliance on Critical Minerals From Foreign Adversaries and Supporting the Domestic Mining and Processing Industries," 85 FR 62539 (September 30, 2020): https://www.federalregister.gov/documents/2020/10/05/2020-22064/addressing-the-threat-to-the-domestic-supply-chain-from-reliance-on-critical-minerals-from-foreign
19. USGS, "International Geoscience Collaboration to Support Critical Mineral Discovery" (July 2020): https://pubs.usgs.gov/fs/2020/3035/fs20203035.pdf

20. For a non-exhaustive list, see: https://www.energy.gov/articles/department-energy-announces-122-million-regional-initiative-produce-rare-earth-elements-and; https://www.energy.gov/articles/department-energy-provide-18-million-research-critical-materials; https://www.energy.gov/articles/doe-announces-69-million-research-rare-earth-elements-coal-and-coal-byproducts; https://www.energy.gov/articles/department-energy-announces-30-million-innovation-critical-materials-processing.

21. Executive Order 14017, "America's Supply Chains," 86 FR 11849 (February 24, 2021): https://www.federalregister.gov/documents/2021/03/01/2021-04280/americas-supply-chains

22. "Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth: 100-Day Reviews under Executive Order 14017," The White House (June 2021): https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf

23. https://www.commerce.gov/news/press-releases/2021/09/us-department-commerce-announces-section-232-investigation-effect

24. For a non-exhaustive list, see: https://www.energy.gov/fecm/articles/us-department-energy-invest-2835m-advanced-processing-rare-earth-elements-and-critical; https://www.energy.gov/articles/doe-announces-30-million-research-secure-domestic-supply-chain-critical-elements-and; https://www.energy.gov/articles/doe-awards-30m-secure-domestic-supply-chain-critical-materials.

25. https://www.defense.gov/News/Releases/Release/Article/2488672/dod-announces-rare-earth-element-award-to-strengthen-domestic-industrial-base.

26. https://www.natlawreview.com/article/biden-administration-proposes-to-walk-back-key-trump-era-nepa-regulation-changes

27. https://trumpwhitehouse.archives.gov/ceq/nepa-modernization/

28. https://www.fs.usda.gov/detail/r3/home/?cid=FSEPRD858166

29. https://www.globalminingreview.com/mining/28012022/us-doi-cancels-twin-metals-minnesota-mineral-leases/

30. H.R. 133, Consolidated Appropriations Act, 2021: https://www.congress.gov/bill/116th-congress/house-bill/133

31. H.R. 3684, Infrastructure Investment and Jobs Act: https://www.congress.gov/bill/117th-congress/house-bill/3684

32. Ibid., Section 40401 for the Loan Program Office and Section 40206 for the permitting review.

33. S. 1260, https://www.congress.gov/bill/117th-congress/senate-bill/1260/

34. https://nma.org/wp-content/uploads/2016/09/SNL_Permitting_Delay_Report-Online.pdf

35. IEA, p. 12.

36. Alex Fitzsimmons, "Time to Build a Domestic Critical Minerals Supply Chain," ClearPath: https://clearpath.org/our-take/time-to-build-a-domestic-critical-minerals-supply-chain/

37. https://eos.org/features/meeting-the-mineral-needs-of-the-united-states

38. Testimony of Dr. Murray Hitzman, Senate Committee on Energy and Natural Resources (March 28, 2017).

39. https://prd-wret.s3.us-west-2.amazonaws.com/assets/palladium/production/s3fs-public/thumbnails/image/United%20States.png

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