ZETA | ZERO EMISSION TRANSPORTATION ASSOCIATION

May 16, 2025

U.S. Department of Commerce
Bureau of Industry and Security
Office of Strategic Industries and Economic Security1401 Constitution Ave NW
Washington, DC 20230

RE: Docket No. 250422-0070Pu
Notice of Request for Public Comments on Section 232 National Security Investigation of Imports of Processed Critical Minerals and Derivative Products
Submitted via Rulemaking Portal: http://www.regulations.gov.

Zero Emission Transportation Association (ZETA) is an industry coalition representing approximately 50 companies spanning the domestic electric vehicle (EV) supply chain end-to-end, including raw and processed critical mineral and material producers, cell and battery manufacturers, vehicle manufacturers, charging companies and electric vehicle supply equipment (EVSE) providers, utility companies, and battery recyclers. We thank the Secretary of Commerce for the opportunity to submit comments as part of the investigation to determine the effects on national security of imports of processed critical minerals as well as their derivative products, initiated under Section 232 of the Trade Expansion Act of 1962.

- Chinese market dominance has eroded the free market and prevented the U.S. from scaling domestic raw and processed mineral capacity.

- Imposing additional tariffs on processed or derivative products before U.S. battery producers are able to align with alternative domestic suppliers and integrate them into their supply chains poses great risks, including national security risks.

- Prematurely adjusting imports could impact battery supply chains for automotive manufacturing and military technology such as drones, communication platforms, satellites, consumer electronics, outdoor power equipment, stationary storage, and more. Tariffs may also impact the ability of U.S. producers to ensure product safety, durability, and performance over the life of the automotive battery.

- Confidence in a domestic market for derivative products, including EVs, has driven American industry to invest aggressively in upstream capacity. U.S. end users of critical minerals are undergoing qualification processes with potential domestic suppliers of processed mineral commodities. In many cases, end users are still waiting for

construction of potential domestic suppliers before these lengthy validation timelines can begin.

- Additionally, depending on the structure of a supply chain, a U.S.-based automotive cell manufacturer may still face multiple tariffs that effectively stack, depending on whether upstream manufacturers independently import copper to produce copper anode foil, aluminum to produce aluminum cathode foil, critical minerals to produce anode or cathode active materials, and/or steel for the cell casing.

- If the Trump Administration determines that the imposition of new duties is necessary, it should be phased and considerate of the overlapping trade actions to avoid stacking and inadvertently preferencing cell imports over domestic manufacturing.

- Domestic supply chain constraints are particularly challenging for lithium, cobalt, graphite, nickel, manganese, as well as cathode-active-material (CAM) and anode active material (AAM).

- A tariff on imported processed minerals could negatively impact the domestic mining sector, as American minerals processed abroad would be tariffed upon reentry.

- These investments should not be inadvertently burdened by trade policies that rightly aim to expand domestic capacity.

- Without aggressive federal investment in research and development, project deployment, recycling capacity, and a derivative product domestic demand base, tariffs alone risk further jeopardizing America's ability to compete in this vital market.

ZETA and our member companies appreciate the opportunity to work with the Trump Administration to enhance U.S. economic and national security and to deploy policies that derisk current and future investments in domestic manufacturing and material processing. We look forward to discussing these policies in future conversations with your staff. If you have any questions or concerns, please contact me at al@zeta.org.

Sincerely,

Albert Gore
Executive Director

I. ELECTRIC VEHICLE MARKET OVERVIEW

EVs are a rapidly growing sector of the global automotive market, and the expansion of the domestic EV sector creates vast economic opportunities for the United States (U.S.). Today, one-half of domestic vehicle shoppers are considering an EV purchase, and this number is projected to rise to 90 percent by 2033.[1] Given current trajectories, EV sales are expected to make up more than half of domestic vehicle sales by 2030, with higher market shares in the European Union and China.[2] EVs represented more than 20 percent of new global car sales in 2024, and are projected to increase to 25 percent in 2025.[3] Control of key EV supply chains—including the production of critical minerals and materials, batteries, and vehicles—will solidify over the coming years as the EV industry matures, with major implications for U.S. economic and national security. Put simply, it is a matter of strategic national interest that the U.S. position itself to become a dominant player in every segment of the EV supply chain.

As a coalition, ZETA advocates for policy solutions that will unleash the full potential of American industry to compete globally, counter Chinese market dominance, and lead in next-generation manufacturing. Our membership is at the forefront of the resurgence in domestic mineral and battery material production. ZETA represents U.S. producers and processors of lithium carbonate and hydroxide, including the sole active domestic lithium project in the U.S.; the sole U.S. primary cobalt project; two U.S. graphite companies, including the only company in the U.S. planning to mine and process natural graphite; two U.S. copper projects, one of which will also be a major nickel producer, as well as a copper-specific industry coalition. ZETA would like to thank the Trump Administration for its publication of the March 20th Executive Order titled "Immediate Measures to Increase American Mineral Production," which provides several valuable tools to facilitate the continued strengthening of domestic mineral supply chains.

In addition to mineral production, ZETA members are pioneering American capacity for CAM and AAM. Further, in the downstream part of the supply chain, ZETA members represented nearly 70 percent of announced U.S. EV battery manufacturing operations at the end of 2024–or over 300 GWh of battery production capacity.[4,5] In 2024, ZETA members sold over 695,000 American-made battery-electric vehicles in the U.S., representing approximately 53 percent of all new U.S. electric car sales last year. Since 2020, ZETA members in the EV, battery, and

[1] "Cox Automotive 2024 Path to EV Adoption Study," Cox Automotive, May 14, 2024. https://www.prnewswire.com/news-releases/cox-automotive-2024-path-to-ev-adoption-study-suggests-electric-vehicle-consideration-will-surge-in-second-half-of-decade-302145244.html
[2] "Global EV Data Explorer," International Energy Agency, April 23, 2024. https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer
[3] IEA Global EV Outlook 2025. May 14, 2025. https://www.iea.org/reports/global-ev-outlook-2025
[4] Jenkins, J.D., "Potential Impacts of Electric Vehicle Tax Credit Repeal on US Vehicle Market and Manufacturing." March 2025. DOI: 10.5281/zenodo.15001499
[5] The Big Green Machine: Tracking North American Clean Energy Supply Chain, database accessed 2/13/2025 https://www.the-big-green-machine.com/

critical mineral and materials sectors have announced over $55 billion in private sector investments that are projected to yield nearly direct 70,000 jobs in the years ahead.[6]

II. CHINESE MARKET MANIPULATION

In imposing new duties targeting the critical mineral supply chain to bolster U.S. domestic capacity for critical minerals and derivative products, we strongly urge Commerce to ensure, to the best of its ability, that 232 tariff actions balance both the importance of incentivising and protecting nascent American supply chains, while not unnecessarily further restricting exports from China on timelines that leave U.S. end-users without an alternative supply.

European, Asian, and South American markets are already beginning to transition to EVs. Without a concentrated U.S. industrial policy to support domestic automakers and the "Americanization" of their supply chains, we will relinquish our ability — and responsibility — to compete with China on the global stage. U.S. allies' reliance on China for crucial energy and transportation technologies will limit their own independence, leaving America with fewer partners in its efforts to counter China. Allied countries such as Japan and South Korea have already taken steps to decouple their EV sector from Chinese supply chains in response to U.S. industrial policy.[7,8] However, without a clear and enduring strategy from America on its commitment to competing with China in this sector, they are liable to turn back towards the market with the lowest costs and highest growth.

The CCP is currently able to control commodity prices, even in high tariff scenarios, and will retain this power unless other complementary non-trade incentives are maintained and increasingly deployed. Since 2009, the CCP has been working to achieve control over the EV, battery, and critical mineral supply chains. China's aggressive industrial policy has demonstrated an overt willingness to out-leverage foreign competitors. To undercut U.S. and allied market entry, the CCP has deliberately deployed policies such as forced technology transfer, strategic overproduction, and favorable financing terms for state-backed enterprises while adhering to less stringent environmental, safety, and labor standards. As a result, China controls more than half of the processing capacity for most critical minerals used in batteries, with up to 99 percent control for certain minerals, over three-quarters of battery cell production, and 60 percent of finished EV production.[9]

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[6] Atlas Public Policy, Clean Economy Tracker. April 2025. https://cleaneconomytracker.org/about/.
[7] "Korea Pledges $7 Billion Aid Package for EV Battery Supply Chain," Bloomberg, May 8, 2024, https://www.bloomberg.com/news/articles/2024-05-08/korea-pledges-7-billion-aid-package-for-ev-battery-supply-chain
[8] "United States and Japan Sign Critical Minerals Agreement," USTR Office, March 28, 2023. https://ustr.gov/about-us/policy-offices/press-office/press-releases/2023/march/united-states-and-japan-sign-critical-minerals-agreement.
[9] "EV Battery Supply Chains and Anti-Competitive Industrial Policy" Silverado Policy Accelerator, Senate Committee on the Budget Hearing, July 31, 2024. https://www.budget.senate.gov/imo/media/doc/msmaureenhinmantestimonysenatebudgetcommittee.pdf.

Since 2023, the CCP has enacted increasingly stringent export controls on minerals, including germanium, gallium, graphite, antimony, as well as lithium processing and lithium-iron-phosphate (LFP) CAM technology. Recently, in response to the invocation of the International Emergency Economic Powers Act (50 U.S.C. 1701 et seq.) (IEEPA) on April 2, 2025, to impose additional ad valorem duty on all imports from all trading partners, including an additional 125 percent tariff on China, China restricted exports of certain rare earth elements (REEs). This export restriction had an immediate and pointed effect on U.S. manufacturers of derivative products, including battery and vehicle manufacturers—endangering American progress in emerging and advanced technologies. These actions underscore why the industry is already moving aggressively to diversify supply chains. ZETA commends the Trump Administration for its work in negotiating a trade deal with China to alleviate this instance of supply chain disruption and urges continued focus on this risk as the United States works to build domestic capacity.

III. CRITICAL MINERAL CHALLENGES - UPSTREAM & MIDSTREAM

The U.S. has a long history of mining and processing mineral commodities. Increased focus on developing resources for clean technology, semiconductors, and defense applications has oriented manufacturing supply chains toward critical minerals. These commodities include lithium, cobalt, manganese, copper, graphite, REEs, and more. Raw materials needed for lithium-ion batteries used in EVs range in levels of risk based on availability, extraction, processing, and supply-demand fundamentals.

In 2024, imports made up more than one-half of the U.S. apparent consumption for 46 nonfuel mineral commodities, and the U.S. was 100 percent net import reliant for 15 of those.[10] Of the 50 mineral commodities identified in the "2022 Final List of Critical Minerals," the U.S. was 100 percent net import reliant for 12, and an additional 28 critical mineral commodities (including 14 lanthanides, which are listed under rare earths) had a net import reliance greater than 50 percent of apparent consumption.[11]

A lack of domestic infrastructure capacity, limited Free Trade Agreement (FTA) nations with capacity, and China's control over the extraction, processing, refining and production of critical minerals, imposes risks on the battery, EV, and electronics supply chains and the economy at large. China accounts for 85 percent of global rare earth and minerals refining and about 68, 65, and 60 percent of global cobalt, nickel, and lithium refining, respectively, exerting fragility over

[10] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[11] "2022 Final List of Critical Minerals." Federal Register.USGS. 2022.
https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals.

minerals supply chains. This creates a myriad of risks and vulnerabilities concerning shipping, and market manipulation, including artificially induced price levels or volatility.

Confidence in a robust domestic market for EVs has been a primary driver of private sector investment in domestic upstream capacity for critical minerals and material mining and processing. U.S. companies, recognizing domestic market potential and the need to diversify sourcing, are investing aggressively in the production and processing of various critical minerals to onshore key components of advanced technology supply chains. However, new U.S. critical mineral and material projects have been inhibited by the lack of politically stable mechanisms to incentivize domestic sourcing, volatile or artificially low prices, and lengthy and uncertain permitting timelines.

Figure 1 provides an overview of the relationship between critical minerals production and original equipment manufacturers. The process from signing an offtake agreement to being able to meet commercial viability specification entails complex challenges, including potential construction and production delay, unpredictable product testing timelines, transportation logistics, limited domestic CAM/AAM supply chains, and downstream production delays. The chart below includes a number of public offtake agreements between battery and vehicle manufacturers and potential alternative suppliers, illustrating that, wherever feasible, offtakers are investing in upstream domestic capacity.

FIGURE 1 - Domestic Offtake Agreements Between Mineral Producers, Battery, and U.S. Auto Manufacturers

Agreement	**Year Announced**	**Details** *(dates are estimated and may be subject to delay)*
Lucid & Syrah Resources (AZ/LA)	2025	Under a three-year supply agreement with Lucid, Syrah will provide 7,000 metric tons of natural graphite AAM beginning in 2026[12]
Toyota and LG (MI)	2025	Toyota agreed to a $1.5 billion order from LG for batteries that will power their battery-electric, plug-in hybrids, or hybrid vehicles. This is from a plant that GM has essentially sold back to LG.
Ford & Albemarle (NV/NC)	2023	A definitive agreement was signed by Albemarle to deliver 100,000 metric tons of battery-grade lithium hydroxide for approximately 3 million Ford EV batteries.
Ford & Energy Source Minerals (CA)	2023	ESM will supply Ford with lithium hydroxide produced at ESM's Project ATLiS™, located in Imperial Valley California.

[12] Syrah Resources Secures Multi-Year Graphite Supply Agreement with Lucid Motors. Harry Minnis. February 24, 2025. https://graphitehub.com/lucid-syrah-deal/.

GM & Element 25 (LA)	2023	GM will provide Element 25 with a $85 million loan to partially fund the construction of a new facility in the state of Louisiana.
GM & Lithium Americans JV (NV)	2024	The JV transaction will deliver $625 million of cash and letters of credit from GM to Thacker Pass.
LG & Elvra Lithium (NC)	2023	LG Chem is investing $75 million to acquire Piedmont Lithium, now Elvra, common shares; Piedmont agreed to supply LG Chem with 200,000 metric tons of spodumene.
LG & Rivian (IL/AZ)	2024	Rivian has signed a five-year battery supply agreement with LG Energy Solution Arizona. LG Energy Solution will provide Rivian with its advanced 4695 cylindrical batteries for over five years, totaling 67 GWh.
SK & Westwater Resources (AL)	2024	SK On signed a natural graphite supply contract with U.S.-based mineral resources company Westwater Resources for its factories from 2027-2031.
LG & ExxonMobil (AR)	2024	A memorandum of understanding was signed for a multi-year offtake agreement for Exxon to supply LG with up to 100,000 metric tons of lithium carbonate.
Lucid & Graphite One (AK/OH)	2024	A nonbinding agreement for 5,000 tons per annum to be supplied to Lucid once Graphite One commences production of graphite.
Panasonic & NOVONIX (TN)	2024	A binding offtake agreement for 10,000 metric tons of anode material for use in Panasonic's U.S. plants over the term of 2025-2028.
Samsung & Syrah Resources (IN/LA)	2023	A memorandum of understanding was signed to evaluate natural graphite active anode material (AAM) supply from the Vidalia AAM facility in Louisiana.
Stellantis & NOVONIX (TN)	2024	A binding offtake agreement for NOVONIX to supply a minimum of 86,250 tonnes, up to a target volume of 115,000 metric tons of high-performance synthetic graphite material.
SK & ExxonMobil (AR)	2024	A memorandum of understanding was signed to explore a multi-year agreement that allows the company to secure up to 100,000 metric tons of lithium.
Stellantis & Element 25 (AUS/LA)	2024	A binding agreement was signed for Element 25 to provide battery-grade, high-purity manganese sulphate monohydrate to Stellantis EV battery packs. Element 25 will source the material from its project in Australia and plans to construct a processing facility in Louisiana.
Stellantis & Samsung JV (IN)	2024	Stellantis N.V. and Samsung SDI to establish a second battery manufacturing facility in the U.S., under the existing StarPlus Energy joint venture.
Tesla & Elvra Lithium (NC)	2023	A binding agreement for Piedmont Lithium, now Elvra, to supply Tesla with 125,000 metric tons of SC6, a key raw

		material for lithium-ion batteries, from the second half of 2024 through the end of 2026.
Toyota & Redwood Materials (NV/SC/NC)	2023	Expanded recycling agreement for end-of-life Toyota batteries and an agreement for Toyota to source CAM and Anode copper foil from Redwood's recycling activities for Toyota's future automotive battery production.
NiCorp & Stellantis	2023	10-year offtake agreement between Stellantis and NiCorp for specific amounts of neodymium-praseodymium oxide, dysprosium oxide, and terbium oxide that NioCorp aims to produce at the Elk Creek Project.
Ioneer Rhyolite Ridge & EcoPro Innovations (NV)	2023	3-year binding agreement between Ford and Ioneer. Ioneer will provide a total of 7,000 tonnes per year (tpy) of lithium carbonate from the Rhyolite Ridge Lithium-Boron operation to EcoPro's U.S. cathode facility, representing approximately 34% of annual output in the first 3 years of production.
Redwood Materials & Panasonic	2022	Panasonic Energy will be using Redwood's recycled CAM in lithium-ion batteries to be manufactured at a new facility in De Soto, KS, starting in 2025, and their recycled copper foil will be used in lithium-ion batteries to be manufactured at Panasonic's facility in Sparks, NV starting in 2024.
Ioneer Rhyolite Ridge & Ford (NV)	2022	5-year binding agreement between Ford and Ioneer beginning in 2025. Ioneer will provide a total of 7,000 tpy of lithium carbonate from the Rhyolite Ridge Lithium-Boron operation, representing approximately 34% of annual output in the first 5 years of production.
Ioneer Rhyolite Ridge & PPES (joint venture between Toyota and Panasonic) (NV)	2022	3-year binding agreement between PPES and Ioneer. Ioneer will provide a total of 4,000 tpy of lithium carbonate from the Rhyolite Ridge Lithium-Boron operation, representing approximately 20% of annual output in the first 5 years of production

In order to demonstrate the opportunities and gaps in the supply chain, ZETA has provided an analysis of critical minerals that are essential to building out the U.S. domestic EV and battery supply chain. This overview includes the following critical minerals: *lithium, cobalt, nickel, graphite, manganese, copper, and REEs.* These next sections also include the import reliance around each of these critical minerals and the state of domestic capacity currently for these valuable EV and battery inputs.

Lithium

Lithium is a critical component for EV batteries. Its density and reactivity allow for more energy-dense batteries and improved charging performance. In 2024, 87 percent of lithium end use was in battery production.[13]

Geological Availability:

- Global identified lithium reserves have increased by more than 50 percent since 2020, as investment and interest in lithium have grown.[14] Total measured and indicated lithium resources are greater than 115 million tons of contained metal worldwide, while global production numbers hit 240 thousand tons of ore in 2024.[15]
- The U.S. has numerous lithium deposits, and it has the third-largest identified lithium resource in the world at 19 million tons.[16] The 2025 USGS Mineral Commodity Summary for lithium demonstrates that known domestic lithium reserves increased over 5042.86 percent from 35,000 metric tons in 2019 to 1,800,000 metric tons in 2023.[17] In recent years, lithium deposits have been confirmed across the U.S. in Arkansas, California, Maine, Nevada, and North Carolina, with many additional sites being assessed for mine production feasibility. For example, Lithium America's feasibility study indicates the measured and indicated resource is as high as 43 million metric tonnes.[18]

Extraction:

- U.S. imports of lithium came primarily from Chile (50 percent) and Argentina (47 percent).[19]
- Australia is the primary producer of hard rock lithium, with 33 percent of projected 2030 production, with China (23 percent) and Chile (12 percent) also producing significant amounts.[20] Argentina is also attracting significant capital investment and is expected to be a major player by 2030.[21]
- In recent years, China has invested heavily in lithium extraction throughout Latin America.[22]

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[13] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[14] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[15] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[16] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[17] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[18] Lithium America Thacker Pass Project SK-1300 Technical Report. December 31, 2024. https://s203.q4cdn.com/835901927/files/doc_financials/2024/ar/Thacker-Pass-Feasibility-Study-S-K_1300_Dec312024.pdf.
[19] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[20] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[21] "Leveraging Argentina's Mineral Resources for Economic Growth." May 14, 2024. https://www.csis.org/analysis/leveraging-argentinas-mineral-resources-economic-growth.
[22] "China's Latin American Gold Rush Is All About Clean Energy." February 27, 2023. https://foreignpolicy.com/2023/02/27/china-latin-america-lithium-clean-energy-trade-investment/.

Processing:

- China produces approximately 65 percent of the world's refined lithium. Chile and Argentina account for 29 percent and 5 percent, respectively.[23]
- Given current pricing, the market for lithium processing is not economically conducive to competitive U.S. processing projects coming online. This is mostly due to the suppressed global average price of lithium, which has been greatly affected by Chinese oversupply. The Chinese monopoly over the processing of lithium ore into lithium carbonate and hydroxide has historically allowed it to artificially manipulate the world market prices for these refined products. This market manipulation has had a significant impact on the capitalization and economics of the lithium mining and processing in the U.S. Two permitted, highly advanced U.S. development projects in Nevada—Lithium Americas Thacker Pass and Ioneer's Rhyolite Ridge—will extract and process lithium into carbonate and/or hydroxide on site. Doing so in the lower-half of the global lithium chemicals cost curve is possible because the sedimentary nature of the deposits allows for processing with far less energy than the hard rock materials mined primarily in Australia; however, neither of those projects will be in production before 2027 or 2028.

  According to the USGS, "spot lithium carbonate prices in China [cost, insurance, and freight] decreased from approximately $14,500 per ton in January to approximately $9,400 per ton in November 2024. For fixed contracts, the annual average U.S. lithium carbonate price was $14,000 per ton in 2024, a decrease of 66 percent from that in 2023. Spot lithium hydroxide prices in China [free on board] decreased from approximately $17,000 per ton in January to approximately $9,900 per ton in November." [24] These price decreases, driven by market manipulation, have significantly burdened projects in free market economies, including those in the United States, and prevented U.S. companies from being able to compete on the global market.

Current and Potential Domestic Capacity

Currently, the U.S. processes less than two percent of the world's lithium supply. While the U.S. is currently set to have significant lithium extraction and processing capability, critical capacity is unlikely to enter into production for at least two more years.Albemarle's Silver Peak mine in Nevada is the only operating lithium extraction and processing operation in the U.S. The Silver Peak project has the capability of producing 5,000 metric tons of technical and battery-grade lithium annually (at maximum production, Silver Peak could provide enough materials to meet 30% of the total U.S. EV demand in 2024).[25]

In 2023, Albemarle announced plans to invest in a lithium hydroxide processing plant in Richburg, South Carolina. The facility is expected to, at minimum, reach 50,000 metric tons of

[23]Fact Sheet: Lithium Supply in the Energy Transition." December 20, 2023 https://www.energypolicy.columbia.edu/publications/fact-sheet-lithium-supply-in-the-energy-transition/.
[24] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.
[25] "Silver Peak, NV, USA." Albemarle Corp. https://www.albemarle.com/us/en/silver-peak.

battery-grade lithium hydroxide annually, with peak potential ranging up to 100,000 metric tons annually. In 2024, the company announced it was pausing plans for production at the site due to overproduction from Chinese rivals.[26] In May 2025, Albemarle confirmed the plans would continue to be on standby because the economics surrounding lithium pricing are not conducive to opening a new production facility.[27] This project would be the first of its kind lithium hydroxide conversion processing facility in the United States.

Albemarle also plans to increase its U.S. production capacity by reopening the Kings Mountain Mine in North Carolina, less than 60 miles from the site of its hydroxide processing plant. The project would restart an idled lithium mine to accommodate on-site, recycled, and Silver Peak feedstocks. The facility is expected to supply 420,000 metric tons of spodumene concentrate annually.[28,29] As of 2025, this project hit mine pit dewatering milestones. With permits expected in 2026, Albemarle expects Kings Mountain to enter production in 2028.

Lithium America's Thacker Pass lithium mine is expected to be the largest measurable lithium reserve in the U.S. and potentially North America.[30] The project includes onsite extraction and processing, which at peak production will produce 160,000 tons of battery-quality lithium carbonate annually, across four distinct phases.[31] Thacker Pass is supported by a joint venture with General Motors.[32,33] Thacker Pass is set to begin Phase 1 production in late 2027, at which point the mine would have a production capacity of 40,000 tons per year of lithium carbonate, with intentions of reaching full capacity in 2028.[34]

Another Nevada lithium project, Rhyolite Ridge, is being pursued by Ioneer for both mining and processing of lithium carbonate or lithium hydroxide. Rhyolite Ridge's first stage is projected to produce approximately 20,600 tonnes of lithium carbonate over its 26-year lifecycle, and support

[26] "Albemarle to cut staff, pause expansions amid falling lithium prices." January 17, 2024. https://www.reuters.com/markets/commodities/lithium-producer-albemarle-cut-workforce-lower-spending-2024-2024-01-17/
[27] "Albemarle CEO says 'math doesn't work' for US lithium refinery project." May 2, 2025. https://www.reuters.com/business/energy/albemarle-ceo-says-math-doesnt-work-us-lithium-refinery-project-2025-05-01/.
[28] "Kings Mountain." Albemarle Corp. https://www.albemarle.com/us/en/kings-mountain.
[29] "DOE Communication to EPA Regarding Critical Mineral Projects." April 14, 2023. https://www.regulations.gov/document/EPA-HQ-OAR-2022-0829-0357.
[30] Thacker Pass Lithium Mine. 2025. https://ndep.nv.gov/land/thacker-pass-project.
[31] "Lithium Americas Increases Mineral Resource and Reserve for Thacker Pass." January 07, 2025. https://lithiumamericas.com/news/news-details/2025/Lithium-Americas-Increases-Mineral-Resource-and-Reserve-for-Thacker-Pass/default.aspx.
[32] "Lithium Americas Receives Conditional Commitment for $2.26 Billion ATVM Loan from the U.S. DOE for Construction of Thacker Pass." March 14, 2024. https://lithiumamericas.com/news/news-details/2024/Lithium-Americas-Receives-Conditional-Commitment-for-2.26-Billion-ATVM-Loan-from-the-U.S.-DOE-for-Construction-of-Thacker-Pass/default.aspx#:~:text=Thacker%20Pass%20Phase%201%20is,(%E2%80%9CEVs%E2%80%9D)%20annually.
[33] "Lithium Americas Announces Closing of Thacker Pass Joint Venture with General Motors." December 23, 2024. https://lithiumamericas.com/news/news-details/2024/Lithium-Americas-Announces-Closing-of-Thacker-Pass-Joint-Venture-with-General-Motors/default.aspx.
[34] "Lithium Americas Increases Mineral Resource and Reserve for Thacker Pass." 2025. https://lithiumamericas.com/news/news-details/2025/Lithium-Americas-Increases-Mineral-Resource-and-Reserve-for-Thacker-Pass/default.aspx.

up to 400,000 EV batteries annually.[35] Over the course of the mine's lifetime, the mine's resource could support lithium production for a total of 75 million American-made EVs.[36] Ioneer's onsite processing facility makes extraction to processing an efficient, cost-effective, and safe process that streamlines the entire EV and battery supply chain. Given its expansion potential due to the size and characteristics of its lithium-boron mineralogy, Ioneer's Rhyolite Ridge project is projected to process enough lithium carbonate to meet 100 percent of U.S. domestic demand within 5 years. However, Ioneer's success at Rhyolite Ridge is dependent on incentives that drive private-sector demand to purchase processed lithium at prices that make cost-effective the capital investment required to begin and expand production capacity for processing lithium domestically. Rhyolite Ridge is supported by offtake agreements with Ford Motor Company, Prime Planet Production (a joint venture battery company between Toyota Motor Corporation and Panasonic Corporation), and EcoPro Innovations.[37]

Outside of Nevada, production and processing facilities are expanding nationwide. In May 2024, Elvra Lithium (at the time named Piedmont Lithium-Sayona Mining) received a finalized mining permit for its planned lithium hydroxide facility in Gaston County, North Carolina. The multi-phased project will produce spodumene concentrate for lithium hydroxide conversion, a key input for battery production. The project is one of two spodumene-to-lithium conversion projects in the U.S. and is expected to provide a low-cost and reliable flow of processed lithium. At full production, the project is expected to produce 60,000 metric tons of lithium hydroxide annually, contributing to a four-fold increase in domestic production.[38] The company has plans for another production site in Tennessee, but the project is currently on hold due to price instability. Both projects' proximity to the "battery belt" stretching across Tennessee, North and South Carolina, and Georgia will help provide a nearby supply of lithium products to auto and battery manufacturing across the region. In Texas, Tesla has been building out a refining facility in Corpus Christi toprocess lithium. The investment of more than $1 billion aims to begin production in 2025, with the goal of producing battery-grade lithium hydroxide for North America.[39,40]

The Smackover formation represents one of the most significant lithium resources in the United States. Several large multinational companies have announced plans to develop lithium resources from the Smackover formation. With world-class geologic properties, the basin is among the most economically competitive resources in the world. TerraVolta's Resources' Liberty Owl Project is a key project within the Smackover. The project, which was awarded $225 million

[35] "U.S. approves massive lithium mine in Nevada, overriding protests." October 24, 2024. https://www.washingtonpost.com/climate-environment/2024/10/24/lithium-mine-nevada-tiehms-buckwheat/.
[36] Rhyolite Ride - Project Overview. 2025. https://www.ioneer.com/rhyolite-ridge-project/about-rhyolite-ridge/.
[37] Ioneer Major Suppliers & Offtake Partners. May 2025. https://www.ioneer.com/investors/major-suppliers-offtake-partners/
[38] Carolina Lithium - Overview. April 2025. https://www.piedmontlithium.com/projects/carolina-lithium/.
[39] "Tesla 1Q Earnings Report." April 2025. https://digitalassets.tesla.com/tesla-contents/image/upload/IR/IR/TSLA-Q1-2025-Update.pdf.
[40] Tesla Lithium Refinery Groundbreaking. May 8, 2023. https://www.tesla.com/blog/tesla-lithium-refinery-groundbreaking .

from The U.S. Department of Energy's (DOE) Office of Manufacturing and Energy Supply Chains, will use direct lithium extraction (DLE) to extract lithium from Smackover brine. In the next three to five years, the initial facility will produce 25,000 tonnes of battery-grade lithium carbonate annually with plans to add additional facilities to increase production.[41]

ZETA appreciates the recent actions made by the Trump Administration to streamline permits for lithium exploration, production, and processing expansion projects such as the Silver Peak Expansion, the South West Arkansas Project, and the McDermitt Exploration Projects.[42] Reliable and predictable permit review and approval is vital to the continued growth of domestic lithium production, and essential for U.S. manufacturers to compete with foreign competitors.

Cobalt

Cobalt is a key battery component used to improve stability, energy density, and voltage advantages in charging.[43] Cobalt is mined across the world and most commonly produced as a byproduct of nickel and copper production.[44]

Geological Availability:

- 2024 worldwide cobalt production was 290,000 tons, while global terrestrial reserves are estimated at 11 million tons.[45]
- Identified cobalt resources of the U.S. are estimated to be about 1 million tons. Most of these resources are in Minnesota. Other notable occurrences are in Alaska, California, Idaho, Michigan, Missouri, Montana, Oregon, and Pennsylvania.[46]

Extraction:

- The Democratic Republic of the Congo (DRC) produces 70 percent of cobalt today. Chinese companies own or have a stake in 15 of the 19 cobalt-producing mines in the DRC.[47]

[41] TerraVolta Resources Selected by U.S. Department of Energy for $225 Million Award Negotiation for Lithium Production Facility in Texarkana Region. September 20, 2024.
https://www.sunya.ai/news/terravolta-resources-selected-by-u-s-department-of-energy-for-225-million-award-negotiation-for-lithium-production-facility-in-texarkana-region

[42] Trump Administration Advances First Wave of Critical Mineral Production Projects. April 18, 2025.
https://www.whitehouse.gov/articles/2025/04/trump-administration-advances-first-wave-of-critical-mineral-production-projects/.

[43] Cobalt in EV Batteries: Advantages, Challenges, and Alternatives. April 13, 2025.
https://www.samaterials.com/cobalt-in-ev-batteries-advantages-challenges-alternatives.html

[44] Cobalt Mining. May 2025.
https://www.cobaltinstitute.org/about-cobalt/cobalt-life-cycle/cobalt-mining/#:~:text=Cobalt%20is%20mined%20across%20the,it%20into%20a%20usable%20form.

[45] USGS Mineral Commodity Summaries – Cobalt. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf.

[46] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.

[47] "A Window of Opportunity to Build Critical Mineral Security in Africa". October 10, 2023.
https://www.csis.org/analysis/window-opportunity-build-critical-mineral-security-africa#:~:text=Chinese%20investment%20has%20been%20heavily,a%20Chinese%20one%20in%202020.

- China's CMOC Group more than doubled its output of cobalt last year, resulting in nearly 60,000 tons of extra metal in the global market of just over 200,000 tons.[48]

Processing:

- China refines three-quarters of the world's cobalt.[49]
- There are no currently operating domestic alternatives for cobalt processing. The largest active, significant non-Chinese-owned cobalt refinery globally is located in Kokkola, Finland, run by Jervois, previously an Australian company, and recently taken private by its U.S. lending group.[50]

Current and Potential Domestic Capacity

The U.S. has no significant domestic production or refining capacity, and all cobalt produced in 2024 was exported for refinement and processing out of necessity.[51] Recycled, secondary cobalt composed about 25 percent of domestic consumption, about 2000 metric tons.[52]

In 2024, the only domestic producing cobalt site was Eagle Mine, Michigan. The mine produced 300 metric tons of cobalt-bearing nickel concentrate—about a 50 percent decrease from 2020 production levels.[53] Australian-based mining company, Jervois, invested approximately a further $250 million in the nation's first primary-cobalt mine in Idaho from 2019 [or $155 million into construction from 2021]. However, despite support from the Department of Defense, the opening of the mine has been on standby as global cobalt prices remain unstable.[54]

The great need for additional cobalt supply has yielded significant interest from mineral developers in the U.S. There are five domestic U.S. companies seeking to process cobalt. However, given persistent, steep competitive disadvantages compared to Chinese-owned mining and processing companies, domestic facilities will be unable to produce a meaningful quantity of cobalt without supportive policies from the U.S.[55]

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[48] "Another cobalt bust but this time it's different." February 6, 2025. https://www.reuters.com/markets/commodities/another-cobalt-bust-this-time-its-different-andy-home-2025-02-06/
[49] IEA Global Critical Minerals Outlook. 2024, p. 155. https://www.iea.org/reports/global-critical-minerals-outlook-2024/market-review
[50] Jervois Finland Presentation. February 27, 2024. https://jervoisglobal.com/wp-content/uploads/2024/02/240226-Jervois-Finland-presentation-MIRU-battery-summit.pdf.
[51] USGS Mineral Commodity Summaries – Cobalt. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf.
[52] USGS Mineral Commodity Summaries – Cobalt. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf.
[53] USGS Mineral Commodity Summaries – Cobalt. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf.
[54] "Financial troubles hit US-backed cobalt producer." January 06, 2025."https://www.eenews.net/articles/financial-troubles-hit-us-backed-cobalt-producer/.
[55] USGS Mineral Commodity Summaries – Cobalt. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf.

Nickel

The rising demand for batteries and advanced energy technologies increasingly requires nickel for their manufacturing processes.[56] The primary EV battery technologies, lithium-ion (Li-On), nickel-cobalt-aluminum (NCA), and nickel-manganese-cobalt (NMC) rely on refined nickel commodities for energy density, and this demand will only continue as adoption and use of EVs and batteries grows globally.

Geological Availability:

- Global reserves of nickel are more than 130 million tons, with 3.7 million produced in 2024.[57]

Extraction:

- Indonesia is a major nickel developer globally, producing 52 percent of nickel worldwide.[58]
- A global downturn in nickel commodities prices by about 21 percent, due to oversupply of Indonesian nickel production, resulted in reined in production levels in the U.S. and globally.[59] In 2024 alone, nickel prices peaked in mid-year at $21,615 per metric ton, and fell steadily, closing the year at a price of $15,300— a near 30 percent price drop.[60]
- The International Nickel Study Group projects a nickel market surplus of 198,000 metric tons for 2025.[61]

Processing:

- The U.S. currently imports a majority of the resource that is consumed, with 65 percent of utilized nickel coming from Canada, Norway, and Australia.[62]
- Indonesia was 37 percent of all nickel refining in 2023, while China was about 28 percent of the refining market in 2023.
- Moving forward to 2025, Indonesia's share of global nickel refining rises to 40 percent, while China's falls to 24 percent. Chinese companies also account for 75 percent of refining investment in Indonesia.[63]

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[56] The Role of Critical Minerals in Clean Energy Transitions (IEA Executive Summary) - May 2021. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary.
[57] USGS Mineral Commodity Summaries – Nickel. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf.
[58] IEA Global Critical Minerals Outlook. May 2024. https://www.iea.org/reports/global-critical-minerals-outlook-2024/market-review.
[59] USGS Mineral Commodity Summaries – Nickel. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf.
[60] NASDAQ Nickel Price 2024 Year-End Review. January 07, 2025. https://www.nasdaq.com/articles/nickel-price-2024-year-end-review#:~:text=Nickel%20reached%20its%202024%20peak,US%2418%2C221%20on%20October%202.
[61] International Nickel Study Group Nickel Market Observations for 2025. April 24, 2025. https://insg.org/wp-content/uploads/2025/04/pressrel_INSG-Press-Release-April_2025-5al9-lk.pdf.
[62] USGS Mineral Commodity Summaries – Nickel. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf.
[63] IEA, 2021, "The Role of Critical Minerals", pg. 32 https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

Current and Potential Domestic Capacity

U.S. mine production of nickel decreased by nearly half between 2023 and 2024. The U.S. currently has only one active nickel mining operation, the Eagle Mine in Michigan.[64] The mine is a nickel and copper mining co-operation. In 2024, the mine produced 8,000 tons of nickel concentrate, all of which was exported to refiners abroad and in Canada due to the current lack of domestic capacity.[65] The mine anticipates total production of nickel and copper during the mine's lifetime (2014 to 2029) to be at least 440 million pounds and 429 million pounds, respectively.[66] Given Eagle Mine's projected mine life coming to an end in approximately four years, the U.S. will soon have no active nickel extraction if new sites do not come online in the immediate future. In lieu of new production, the majority of domestic nickel consumption (54 percent, coming to about 90,000 tons) in 2024 came from secondary sources, mostly from domestic recycled stainless steel content.[67]

To this end, American-based NewRange Copper Nickel is heavily investing in mining revitalization in the Duluth Complex in Northern Minnesota. The company expects to mine millions of tons of nickel, cobalt, and copper in the "Iron Range" of the state. The Duluth Complex is expected to be one of the largest undeveloped mineral deposits in the world. New Range expects the deposit to supply 95 percent, 88 percent, and 33 percent of America's nickel, cobalt, and copper.[68] The NewRange project, a joint venture between Teck Resources Limited and PolyMet Mining Corp., has unfortunately been in the permitting process since 2005—one of many examples of the problematic nature of the American permitting review process hindering needed mineral development. A recent action by the Trump Administration, adding New Range's NorthMet projects to FAST-41 permitting transparency list, is a major step forward to allow the rich deposits of the NewRange project to move on toward production.[69] ZETA commends the Trump Administration for this decision.

Nickel processing capability in the U.S. is even more limited. NewRange is in the process of scaling a copper-nickel processing facility. However, the timeline of when the project will reach commercial production remains unclear.[70] In 2024, Talon Metals was in the early stages of state and federal permitting for its Tamarack project, which comprises an underground nickel-copper mine in central Minnesota and a battery mineral processing facility in North Dakota. However, the facility in North Dakota will essentially do an initial processing step to prepare the material

[64] Eagle Mine Operations. 2025. https://www.eaglemine.com/operations.
[65] USGS Mineral Commodity Summaries – Nickel. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf.
[66] Eagle Mine Operations. 2025. https://www.eaglemine.com/operations.
[67] USGS Mineral Commodity Summaries – Nickel. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf.

[68] Newrange Mining Projects Within the Duluth Complex. 2025. https://www.newrangecoppernickel.com/about/projects/.
[69] "Trump names NorthMet copper-nickel mine in Minnesota a federal priority." May 2, 2025 https://www.startribune.com/trump-names-northmet-copper-nickel-mine-in-minnesota-a-federal-priority/601343903.
[70] NewRange Copper Nickel completes salvage and recycling project. December 18, 2024. https://www.businessnorth.com/daily_briefing/newrange-copper-nickel-completes-salvage-and-recycling-project/article_2ae00c28-bd8a-11ef-b359-d784acb844d7.html.

for refining. From there, it will have to be transported to a refinery. The company received a contract from the Department of Defense to aid in the research and development of new techniques for extracting minerals from nickel sulphide ores and tailings. Talon is working with Argonne National Laboratory to produce nickel for battery CAM as well as high-quality iron for LFP battery CAM.[71]

Graphite

Graphite is a necessary input for lithium-ion batteries used in EVs and is particularly important for anode production. Graphite constitutes the primary material of the battery and can make up nearly half of the components in an individual battery cell.[72]According to the International Energy Agency (IEA), global total graphite demand by 2040 is expected to increase by over 300 percent from 2021 levels, while global clean-tech demand alone for graphite is expected to demand an over 1000 percent increase during the same period.[73] Graphite is often the greatest sourcing hurdle for many battery and EV manufacturers. It is the largest mineral component of a battery by weight, comprising over 145 pounds of the total 456 pounds of minerals in an EV battery.[74]

Geological Availability:

- The U.S. contains less than 1 percent of the world's graphite reserves and is currently 100 percent import reliant.[75]

Extraction:

- Global production in 2024 of natural graphite was 1.6 million tons, with more than 800 million tons of recoverable graphite resources worldwide.[76]
- China currently accounts for 80 percent of global natural graphite production and over 95 percent of synthetic graphite production.[77,78]

Processing:

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[71] "Talon Metals receives $2.47m funding for nickel extraction research." December 18, 2024. https://www.mining.com/talon-metals-receives-2-47m-us-funding-for-nickel-extraction-research/

[72] "Why graphite may hold the key in a new generation of energy markets." December 12, 2024. https://www.fastmarkets.com/insights/graphite-holds-key-new-generation-energy-markets/

[73] IEA Report on Graphite. May 2024. https://www.iea.org/reports/graphite.

[74] Critical Minerals and the Future of the U.S. Economy. February 2025. https://csis-website-prod.s3.amazonaws.com/s3fs-public/2025-02/250210_Baskaran_Critical_Minerals.pdf?VersionId=Tfu2TnNrQGlN7ol8HSCakMUT8HTwYukd.

[75] CSIS. December 4, 2024. "China Imposes Its Most Stringent Critical Minerals Export Restrictions Yet Amidst Escalating U.S.-China Tech War." https://www.csis.org/analysis/china-imposes-its-most-stringent-critical-minerals-export-restrictions-yet-amidst.

[76] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025.pdf.

[77] IEA. Global Critical Minerals Outlook. 2024. https://iea.blob.core.windows.net/assets/ee01701d-1d5c-4ba8-9df6-abeeac9de99a/GlobalCriticalMineralsOutlook2024.pdfp. 172.

[78] CSIS. December 4, 2024. "China Imposes Its Most Stringent Critical Minerals Export Restrictions Yet Amidst Escalating U.S.-China Tech War." https://www.csis.org/analysis/china-imposes-its-most-stringent-critical-minerals-export-restrictions-yet-amidst.

- China refines more than 80 percent of the world's graphite, producing 93 percent of the battery-grade supply.[79]

Current and Potential Domestic Capacity

In 2024, and for the past 75 years, the U.S. has not produced any natural graphite.[80,81] However, several companies in the U.S. are either exploring or actively developing graphite deposits across the country.

GraphiteOne, an American-based company, is developing a large-scale graphite mining project in Alaska. This natural graphite project will include the mine itself, a processing facility, and an anode manufacturing facility, which will primarily be used to support batteries for EVs.[82] On April 23, 2025, GraphiteOne released its feasibility study for the Alaska project, which was completed with the help of a $37.5 million U.S. Department of Defense grant covering 75 percent of the study cost. Mine construction will begin in 2029 with mining activities ramping up to full production in 2030. In 2024, Lucid Motors and GraphiteOne entered into the first offtake agreement between a domestic vehicle manufacturer and a domestic natural graphite producer.[83]

The U.S. also has experienced growing investment in synthetic graphite production. NOVONIX is an advanced battery materials and technology company planning to reach a synthetic graphite production capacity of 10,000 metric tons annually at its Riverside facility in Chattanooga, Tennessee. The company plans to add an incremental 30,000 metric tons of production capacity by 2025 and reach 150,000 metric tons of total production capacity in North America by 2030. NOVONIX has partnerships with several downstream manufacturers, including LG, Panasonic, and Stellantis, which are invested in the potential of utilizing domestic synthetic graphite in their products.

Copper

ZETA understands that the Trump Administration has already initiated a separate investigation of the national security implications of copper imports.[84] Copper is a critical component of transportation electrification and is essential for EVs, electrical equipment, and battery applications. While copper use and demand have shown to be necessary for many advanced

[79] IEA Global Critical Minerals Outlook 2024, p.168.
[80] Graphite Deposits in the United States. January 31, 2022. https://www.usgs.gov/data/graphite-deposits-united-states
[81] USGS Mineral Commodity Study. 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-graphite.pdf.
[82] Graphite One Receives Indication for Up to $325 Million Financing From the U.S. Export-Import Bank for U.S. Based Advanced Graphite Material Supply Chain Project. October 18, 2024. https://www.graphiteoneinc.com/graphite-one-receives-indication-for-up-to-325-million-financing-from-the-u-s-export-import-bank-for-u-s-based-advanced-graphite-material-supply-chain-project/.
[83] Graphite One and Lucid Supply Agreement Announced at U.S. Capitol Briefing. July 29, 2024. http://www.graphiteoneinc.com/graphite-one-and-lucid-supply-agreement-announced-at-u-s-capitol-briefing/.
[84] The White House. "Addresing the Threat to National Security From Imports of Copper." February 25, 2025. https://www.whitehouse.gov/presidential-actions/2025/02/addressing-the-threat-to-nationalsecurity-from-imports-of-copper/

technology applications, USGS does not currently consider copper a critical mineral, and only recently did DOE add it to the Critical Materials list in mid-2023.[85,86]

Geological Availability:

- Total worldwide identified resources are more than 2 billion tons, with yearly refinery production nearing 27 million tons in 2023.[87]

Extraction:

- In 2024, the U.S imported 50 percent of its copper consumption (41 percent from Chile and 27 percent from Canada).
- Nearly half of production in 2023 occurred in Chile, the Democratic Republic of the Congo (DRC), and Peru.[88]

Processing:

- China controls 40 percent of all copper processing capacity. Similar to lithium, China mines less than 10 percent of the global copper supply, yet has a clear midstream advantage when it comes to processing of the material.[89]
- Despite this, Chile, Canada, Mexico, and Peru accounted for more than 90 percent of U.S. refined copper imports last year.[90]

Supply-demand mismatch:

- Announced copper projects are anticipated to meet only 70 percent of global demand requirements by 2035.[91]

Current and Potential Domestic Capacity

In 2024, the U.S. produced 1.1 million tons of recoverable copper content.[92] Across 25 copper mining sites, Arizona accounted for 70 percent of domestic production, while Michigan, Missouri, Montana, Nevada, New Mexico, and Utah accounted for the remaining 30 percent.[93]

[85] Federal Register: Notice of Final Determination on 2023 DOE Critical Materials List. August 8, 2023. https://www.federalregister.gov/documents/2023/08/04/2023-16611/notice-of-final-determination-on-2023-doe-critical-materials-list.

[86] There are no special sourcing requirements or incentives for importing copper products into the US, beyond trade tariffs and sanctions in place. Despite its widespread conventional use and fundamentality to the energy transition, copper is not currently designated a "critical mineral" by the US Geological Survey. Nor is it defined as an "applicable critical mineral" in the Inflation Reduction Act (Section 45X(6)). Nonetheless, 98% of copper imports to the US are from countries with which the US has an FTA. Almost two-thirds come from Chile alone. The US, then, is likely to remain reliant on external sources for copper for years to come. "Copper In The US: Opportunities and Challenges." Mohsen Bonakdarpour, Frank Hoffman, and Keerti Rajan. August 2024. https://view.highspot.com/viewer/f15367148e71dbfd68def7b8338645d2#1.

[87] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-copper.pdf.

[88] IEA Global Critical Minerals Outlook 2024. p.108.

[89] China's Role in Supplying Critical Minerals for the Global Energy Transition. Rodrigo Castillo and Caitlin Purdy. July 2022. https://www.brookings.edu/wp-content/uploads/2022/08/LTRC_ChinaSupplyChain.pdf.

[90] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-copper.pdf.

[91] IEA Global Critical Minerals Outlook 2024. p.7-8.

[92] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-copper.pdf.

[93] Ibid.

In 2024, about 50 percent of domestic copper resources are in production, while the other half remain in pre-production (11 percent), feasibility (4 percent), and reserve development (36 percent) phases.[94] Despite half of the known domestic copper reserves remaining undeveloped, U.S. copper mine capacity has steadily grown in the last 25 years, and is expected to further increase.[95]

Aligned with global trends for other minerals, it is economically difficult to bring a refinery online in the U.S. Notwithstanding the difficult economic conditions, domestic companies are attempting to bring refineries online in response to geopolitical uncertainties and the need to reorient away from China. Despite efforts to increase domestic refining, copper refining capacity has decreased by 40 percent since 2000.[96] The asymmetry between domestic copper mining and refining capacity has resulted in increasing exports of U.S. copper for processing and refining.[97] Presently, the U.S. only has two copper smelters that can convert copper ore into processed materials for manufacturing inputs, and one secondary smelter that processes scrap copper.[98]

The recycling of scrap copper is a significant opportunity for the U.S. and is a substantial supply stream. In 2024, recycled copper from scrap accounted for about 35 percent of the U.S. copper supply.[99] Despite this, as with raw material, the U.S. refined recycling capacity has fallen over the last 30 years, from about 14 percent of refined copper production in 1997 to less than 4 percent.[100]

Out of the 1,100,000 metric tons of copper produced by U.S. mines in 2024, only 850,000 metric tons were refined at home.[101] Increasing demand for refined copper and the shortfall of refining capacity may exacerbate this trend in exports, unless more processing and refining capacity can come online domestically.

Manganese

EV batteries, including those most commonly found in the U.S., primarily use lithium, nickel, manganese, and cobalt-based (NMC) chemistries in their cathodes and graphite-based anodes. In Li-ion batteries, manganese acts as a stabilizer in CAM.[102] Further, emerging battery chemistries and technologies present an opportunity to replace some cobalt with manganese. Given the

[94] "Copper In The US: Opportunities and Challenges." Mohsen Bonakdarpour, Frank Hoffman, and Keerti Rajan. August 2024. https://view.highspot.com/viewer/f15367148e71dbfd68def7b8338645d2#1.
[95] Ibid.
[96] Ibid.
[97] Ibid.
[98] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-copper.pdf.
[99] Ibid.
[100] Copper In The US: Opportunities and Challenges. Mohsen Bonakdarpour, Frank Hoffman, and Keerti Rajan. August 2024. https://view.highspot.com/viewer/f15367148e71dbfd68def7b8338645d2#.1
[101] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-copper.pdf.
[102] "Lithium Manganese Spinel Cathodes for Lithium-Ion Batteries." Huang, Y., Dong, Y., Li, S., Lee, J., Wang, C., Zhu, Z., Xue, W., Li, Y., Li, J., June 23, 2020. https://doi.org/10.1002/aenm.202000997.

geopolitical and labor concerns associated with China's control over DRC cobalt mining, the potential to decrease the use of cobalt in EV batteries through manganese substitutions adds further importance to strong manganese supply chains.[103]

Geological Availability

- The majority of manganese is found in South Africa, Gabon, Australia, and Brazil, in that order.[104]
- South Africa accounts for 70 percent of the world's known manganese resource.[105]

Extraction

- Australia has a well-developed manganese mining sector, providing 14 percent of the world's manganese in 2024.[106]
- The U.S. imports manganese ore from Gabon (63 percent), South Africa (23 percent), and Mexico (13 percent).[107]

Processing

- China processes over 90 percent of the global manganese supply.[108]

Current and Potential Domestic Capacity

According to USGS, the U.S. does not hold any significant manganese deposits. Although there are some manganese deposits domestically, mining and producing them as a primary product is not economically viable.[109] USGS also estimates that manganese production from recycling is negligible and almost always incidental.[110]

To help quickly ramp up domestic manganese production, the Department of Defense announced a $20 million award to South32, an Australian-based metal and mining company, to accelerate the development of battery-grade manganese at the Hermosa Project in Santa Cruz County, Arizona.[111] The project will be the only fully-integrated source of battery-grade manganese in North American, where it is mined and processed on-site.[112] The project will also mine and refine

[103] "A Global Race to the Top: Using Transparency to Secure Critical Mineral Supply Chains." March 2023. https://safe2020.wpenginepowered.com/wp-content/uploads/2023/03/SAF-_CritMinReport_v06.3_Spreads_Final.pdf.
[104] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-manganese.pdf.
[105] Ibid.
[106] Ibid.
[107] Ibid.
[108] IEA Global Critical Minerals Outlook 2024. p.196-197.
[109] USGS Mineral Commodity Summaries 2025. https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-manganese.pdf.
[110] Ibid.
[111] DOD Awards $20 Million to Enhance Domestic Manganese Supply Chain. May 17, 2024. https://www.defense.gov/News/Releases/Release/Article/3779115/dod-awards-20-million-to-enhance-domestic-manganese-supply-chain/.
[112] "Hermosa Project Gives US Chance at Manganese Self-reliance." Andrea Hotter. February 21, 2025. https://www.fastmarkets.com/insights/hermosa-project-us-chance-manganese-self-reliance-andrea-hotter/#:~:text=%E2%80%9CHermosa%20would%20be%20the%20only,go%20into%20precursor%20material%20domestically.

zinc. The project will help reduce the 100 percent import reliance of processed manganese, of which 97 percent is sourced from China.[113]

Additionally, recent federal and private investments in onshoring manganese processing and refining will strengthen the supply chain and reduce downstream imports of manganese. In 2023, General Motors and Element 25, an Australian-based mining company, entered into an agreement to bring manganese processing to Louisiana.[114] GM will provide an $85 million investment to the joint venture to construct the facility, and Element 25 will supply 32,500 metric tons of manganese sulfate annually.[115] Production is slated to begin in 2025, and the facility will provide enough battery-grade manganese to supply up to 1 million General Motors' EV batteries.[116]

Rare Earth Elements (REE)

REEs are a group of 17 different minerals.[117] Rare earths—including neodymium and dysprosium—are primarily used in the EV sector for permanent magnets in electric motors. Internal combustion engine vehicles also use REEs in catalytic converters. Because of their unique physical and chemical properties, REEs can be used in defense, energy, industrial, and military technology applications.

Geological Availability:

- Global reserves are approximately 90 million tons, while 390 thousand tons were produced in 2024.[118]
- The U.S. has 3.6 million tons of measured and indicated resources and 1,900,000 reserves.[119]

Extraction:

- China is the top REE producer, and is projected to produce 54 percent of REEs globally by 2030.[120]

Processing:

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[113] Hermosa Project Overview.
https://south32hermosa.com/wp-content/uploads/2023/10/Why-Hermosa-Matters-102323-WEB-READY.pdf
[114] GM, Element 25 to Expand U.S. EV Supply Chain with Domestic Manganese Sulfate Production. June 29, 2023.
https://www.manufacturing.net/supply-chain/news/22866185/gm-element-25-to-expand-us-ev-supply-chain-with-domestic-manganese-sulfate-production?__lt-lid=649da849e1dc7c71f1205c41&__lt-usr=8919J6517189C8C&utm_source=IMCD230623014&utm_medium=email&utm_campaig.
[115] Ibid.
[116] Ibid.
[117] USGS. "What are rare earth elements, and why are they important?" American Geosciences Institute. 2025.
https://www.americangeosciences.org/critical-issues/faq/what-are-rare-earth-elements-and-why-are-they-important
[118] USGS Mineral Commodity Summaries 2025.
https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-rare-earths.pdf.
[119] Ibid.
[120] IEA Global Critical Minerals Outlook 2024. p.178.

- U.S. import reliance for REEs is as follows—China (70 percent), Malaysia (13 percent), Japan (6 percent), Estonia (5 percent), and other (6 percent).[121]
- China processes nearly 90 percent of REEs.[122] In response to recently imposed U.S. tariffs, China put export restrictions on REEs, impacting not only mined minerals but finished products.[123] While the export restriction applied to all countries, U.S. end users faced particularly long delays in regaining access to supply. The action impacted seven categories of medium and heavy rare earths, including samarium, gadolinium, terbium, dysprosium, lutetium, scandium, and yttrium-related items.[124]

Current and Potential Domestic Capacity

There are several REE deposits in the U.S., most located in the Southwest and West. In 2024, 45,000 metric tons of rare earth oxides in mineral concentrates were mined and processed, and 1,300 mixed rare-earth compounds were produced domestically.[125,126] Since 2020, mineral concentrate production has increased 15 percent, and REE compounds and metals production have increased by over 900 percent.[127] However, there is only one operating mining and refining facility in Mountain Pass, California. Before the 1990s, California's Mountain Pass Mine was the world's largest source of REEs. The mine shut down in 2002, but was acquired in 2017 by MP Materials. Since the Chinese responded to the 125 percent tariff with REE export controls, Mountain Pass received a flood of inquiries from domestic producers. The mine does not, however, have enough material to meet U.S. demand. Furthermore, the facility only has enough processing capacity for half of what they mine. This may result in an increased risk of downstream bottlenecks given the export restrictions U.S. producers are facing.[128]

Several other domestic mining companies are exploring opportunities to develop REEs. Colorado-based mining company, NioCorp Developments, is in the process of developing the Elk Creek Mining project in Nebraska. The project will be North America's only source of scandium (a REE), and NioCorp has an agreed-offtake contract with Stellantis.[129] Another company, American Rare Earths, is exploring the viability and feasibility of various expected

[121] USGS Mineral Commodity Summaries 2025.
[122] "What China's Ban on Rare Earths Processing Technology Exports Means." Gracelin Baskaran. January 8, 2024. https://www.csis.org/analysis/what-chinas-ban-rare-earths-processing-technology-exports-means.
[123] "China hits back at US tariffs with export controls on key rare earths." Lewis Jackson, Amy Lv, Eric Onstad, and Ernest Scheyder. April 4, 2025. https://www.reuters.com/world/china-hits-back-us-tariffs-with-rare-earth-export-controls-2025-04-04/.
[124] Ibid.
[125] Ibid.
[126] Mixed rare-earth compounds are materials containing two or more rare-earth elements in a combined chemical form.
[127] Ibid.
[128] "America's only rare earths mine is hearing from lots of anxious companies…" Joshn Funk and The Associated Press. April 18, 2025. https://fortune.com/article/americas-only-rare-earths-mine-mp-materials-mountain-pass-mine-us-china-trade-war-tariffs/.
[129] Stellantis and NioCorp Sign Rare Earth Offtake Term Sheet. July 6, 2023. https://www.niocorp.com/stellantis-and-niocorp-sign-rare-earth-offtake-term-sheet-in-support-of-stellantis-commitment-to-reaching-carbon-net-zero-by-2038/.

REE deposits across the U.S. in Wyoming, Arizona, and Nevada.[130] On April 8, 2025, the Department of the Interior issued approval for Dateline Resources to continue its development of the Colosseum rare earths project situated within the Mojave National Preserve in San Bernardino County, California.[131]

The Texas Mineral Resources Corp. is exploring the development of REEs, technology metals, and industrial minerals at its Round Top project located in Hudspeth County, Texas.[132]

Furthermore, in 2023, DOE invested $16 million in REE separation and processing R&D.[133] Recipients of funding included West Virginia University and the University of North Dakota. Growing investments from public and private entities will improve the U.S. ability to efficiently mine, separate, and process the essential REEs needed to decouple supply chains from China and other countries employing predatory pricing practices.

IV. BATTERY COMPONENTS

Similarly to critical minerals, China controls significant portions of the sub-assembly process, from cathode- and anode-active materials to final battery assembly, causing significant uncertainty in mid-stream EV supply chains. This is the result of decades of conscious industrial policy that provides China's operations with significant advantages over competitors in terms of technological sophistication and production capacity.

Current policies and announced projects are expected to shift the center of battery production, resulting in about a quarter of battery production occurring in Europe or the U.S. by 2030.[134,135] However, Chinese dominance has been maintained through the significantly lower cost of production equipment in China compared to the U.S., Japan, and Korea. China will still likely retain a disproportionate share of the market for years to come, particularly in the area of anode-active materials, given its dominance in graphite production and refining.[136]

Although manycomponents for battery production in the U.S. are currently imported, domesticcapacity has been rapidly developing in recent years.[137] The majority of imports are sourced from the Asia Pacific, including South Korea and Japan. South Korea, an FTA partner,

[130] American Rare Earths. 2025. https://americanrareearths.com.au/.
[131] US greenlights rare earth mine next to Mountain Pass in California. April 28, 2025. https://www.mining.com/us-greenlights-rare-earth-mine-next-to-mountain-pass-in-california/.
[132] Texas Mineral Resources Corp. 2025. https://tmrcorp.com/projects/rare_earths/ .
[133] Department of Energy National Energy Technology Laboratory. 2023. https://netl.doe.gov/node/12422.
[134] For policies that have driven domestic U.S. production growth, see the recommendations section of the comment letter, in the "stabilizing existing incentives" sub-section.
[135] "Global Supply Chains" IEA. 2022. https://www.iea.org/reports/global-supply-chains-of-ev-batteries.
[136] Ibid.
[137] Korea holds largest share of US battery material import market in 2023. 2024. https://www.koreatimes.co.kr/business/companies/20241222/korea-holds-largest-share-of-us-battery-material-import-market-in-2023.

where the largest share of U.S. battery component imports originated in 2023—representing around 33.7 percent of all components imported.

Cathode Active Material (CAM)

CAM is one of two electrodes in a lithium-ion battery, and a critical part of producing an EV battery.[138] CAM undergoes electrochemical reactions that enable the storage and release of electrons in a battery. CAM typically varies depending on the specific application or material used.[139] For EV batteries, two common types of CAM are NMC and LFP.[140]

In 2025, China controls almost 84 percent of CAM production.[141] North America produces less than 1 percent of CAM. As a result, almost all cathode materials are imported.[142] Over time, more of the U.S. domestic EV battery industry will need to secure CAM from EV battery recyclers. It will take time for that segment of industry to get up and running in the U.S. at scale. In the meantime, overseas CAM refining and production will be required. Aggressive action is needed now to avoid fundamental gaps in the midstream EV supply chain. This demands increasing domestic mineral refining and production of CAM.

Current and Potential Domestic Capacity

Much of the potential facilities producing CAM in the U.S. have yet to come online, though more are expected to open over the next few years. Since 2020, an estimated $7.2 billion in private investments have been announced for CAM facilities in the U.S., although how many of those facilities come online remains to be seen.[143] Clarity in market demand and government support will be essential for any of these projects to reach the market.

In June 2024, Princeton NuEnergy broke ground on the nation's first commercial-scale lithium-ion battery direct recycling facility in Chester County, South Carolina. The first stage, a black mass processing facility, is currently being commissioned. Expansion to a full Cathode Manufacturing Center, producing wholly U.S-sourced CAM, is contingent on strong public private partnerships and financing. When complete, annual production will be more than 10,000 metric tons annually of battery-grade cathode material, equivalent to producing more than 100,000 propulsion batteries.[144]

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[138] Redwood Materials, 2024. https://www.redwoodmaterials.com/resources/cathode-and-anode/.
[139] Ibid.
[140] "What Are Battery Anode and Cathode Materials?" AquaMetals, 2025. https://www.aquametals.com/recyclopedia/lithium-ion-anode-and-cathode-materials/.
[141] "Global EV Outlook 2025." IEA. Paris. 2025. https://www.iea.org/reports/global-ev-outlook-2025.
[142] McKinsey, 2024. "The battery cell component opportunity in Europe and North America." https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-battery-cell-component-opportunity-in-europe-and-north-america.
[143] Atlas Public Policy, data pulled on April 30, 2025: https://cleaneconomytracker.org/ - investment rounded to nearest ten million, jobs to nearest hundredth.
[144] "Princeton NuEnergy Launches Flagship Facility In South Carolina" 2024. https://pnecycle.com/062024-2/

LG has announced that it signed a $19 billion offtake agreement with GM for 500,000 tons of cathode materials out of a forthcoming facility in Tennessee.[145] The plant is expected to come online in 2026 and reach an annual production of 60,000 tons per year. GM's deal with LG lasts from 2026 to 2035 and will produce enough CAM to power 5 million EVs.

Redwood Materials aims to produce commercially viable CAM in Sparks, Nevada. Located near the Tesla and Panasonic facilities, Redwood aims to produce 20 GWh of CAM per year, before the company upgrades the facility to 100 GWh, or enough to power 1.3 million EVs per year. Redwood is working with companies including Panasonic, BMW of North America, Ultium Cells, Volkswagen, Volvo, Toyota, and Lyft.[146]

Anode Active Material (AAM)

AAM is the other of the two electrodes in a lithium-ion battery, and a necessary part of producing an EV battery.[147] It is the negative electrode, where the loss of electrons occurs. Anodes are typically made from carbon-based materials like graphite or silicon.[148]

- The top six AAM producers are all Chinese and account for two-thirds of global production capacity.
- In 2025, China controls over 90 percent of AAM production capacity.[149]

Current and Potential Domestic Capacity

North American production of anode material represents about 5 percent of all global production.[150] Since 2020, an estimated $5.8 billion in private investments have been announced for facilities in the U.S. that will produce AAM.[151]

GraphiteOne's Ohio facility expects the first 48,000 tonnes per year of commercial AAM production to come online by 2028. By 2031, the company expects to be able to produce 169,000 tpy of AAM.[152]

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[145] "GM, LG Chem ink $19B cathode material supply deal" 2024. https://www.automotivedive.com/news/gm-general-motors-lg-chem-15b-cathode-deal-EVs-Tennessee-plant/706851/.
[146] "Redwood Materials: About Us" https://www.redwoodmaterials.com/.
[147] Ibid.
[148] Aqua Metals. 2025. https://www.aquametals.com/recyclopedia/lithium-ion-anode-and-cathode-materials/.
[149] "Global EV Outlook 2025." IEA. Paris. 2025. https://www.iea.org/reports/global-ev-outlook-2025.
[150] McKinsey, 2024. "The battery cell component opportunity in Europe and North America." https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-battery-cell-component-opportunity-in-europe-and-north-america.
[151] Data comes from Clean Economy Tracker, Atlas Public Policy, data pulled on April 30, 2025: https://cleaneconomytracker.org/ - investment rounded to nearest ten million, jobs to nearest hundredth.
[152] "Graphite One Advances its United States Graphite Supply Chain Solution with Completion of a Bankable Feasibility Study." April 23, 2025. https://www.graphiteoneinc.com/graphite-one-advances-its-united-states-graphite-supply-chain-solution-with-completion-of-a-bankable-feasibility-study/.

Additionally, Syrah Resources, an Australian company, invested and completed construction of a graphite anode material facility outside of China to Vidalia, Louisiana. Syrah's Vidalia facility processes natural graphite imports and will produce about 11.25 kilotons of graphite anode material per year.[153]

NOVONIX also has a $30 million partnership with LG Energy Solutions for graphite anode material research and development, as well as a purchase agreement for 50,000 tons of artificial graphite anode should the R&D prove successful. NOVONIX and Panasonic Energy signed a binding off-take agreement for NOVONIX to supply synthetic graphite anode material, including a step-up pricing component to adjust the purchase price based on raw material cost changes. This agreement involves the supply of at least 10,000 tonnes of anode material over the 2025-2028 period, with shipments scheduled to start in 2025.

V. BATTERY AND VEHICLE PRODUCTION

In his April 15th announcement, "Ensuring National Security And Economic Resilience Through Section 232 Actions On Processed Critical Minerals And Derivative Products," President Trump accurately noted that "a resilient and sustainable manufacturing base for derivative products is vital to creating a stable demand base for processed critical minerals."[154] As the derivative products driving the largest share of mineral demand, a robust market to support EV and battery manufacturing is essential to reducing import reliance for raw and processed critical minerals and materials.

Since 2020, there has been nearly $213 billion in private investment in the U.S. for manufacturing efforts to produce batteries and EVs across the country, which are projected to yield nearly 215,000 jobs.[155] In total, around 1.1 million EVs were produced domestically in 2024. About 17 percent of those EVs were exported to other markets, representing around 186,000 units.[156] Most of those vehicles were shipped to Canada and Mexico, with the remainder heading to Europe.

According to the Energy Information Agency (EIA), approximately 78.9 percent of the total battery EVs sold during the 3rd quarter of 2025 in the U.S. were produced in North America.[157]

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[153] "Syrah commences AAM production at its 11.25ktpa Vidalia facility in Louisiana, USA." 2024.https://www.syrahresources.com.au/news/syrah-commences-aam-production-at-its-11-25ktpa-vidalia-facility-in-louisiana-usa.

[154] "Ensuring National Security And Economic Resilience Through Section 232 Actions On Processed Critical Minerals And Derivative Products" April 15, 2025. https://www.whitehouse.gov/presidential-actions/2025/04/ensuring-national-security-and-economic-resilience-through-section-232-actions-on-processed-critical-minerals-and-derivative-products/.

[155] Data comes from Clean Economy Tracker, Atlas Public Policy, data pulled on April 30, 2025: https://cleaneconomytracker.org/ - investment rounded to nearest ten million, jobs to nearest hundredth.

[156] Ibid.

[157] U.S. EIA. "U.S. share of electric and hybrid vehicle sales reached a record in the third quarter." December 4, 2024. https://www.eia.gov/todayinenergy/detail.php?id=63904.

Similarly, ZETA analysis of data provided by Cox Automotive and Kelley Blue Book suggested that 70 percent of U.S. EVs sold in 2023 and 2024 were assembled in the U.S.[158,159] In 2024, 1.5 million EVs were sold in the U.S., with about 38 percent of all sales imported from outside of the country, or 595,000 EVs in total.[160] EVs from Europe made up 28 percent of all U.S. EV imports, with Japan and South Korea representing 23 percent and 20 percent of the U.S. EV imports, respectively.[161]

Current and Potential Domestic Production Capacity

U.S. domestic battery manufacturing capacity is expected to reach around 400 GWh online by the end of 2025.[162,163] Many facilities are expected to come online this year, with hundreds of gigawatt-hours of cell production capacity under construction as a result of increasing U.S. market demand for batteries and EVs, as well as public policies to stimulate demand.

Panasonic has a major facility under construction in DeSoto, Kansas, that is expected to produce 30 GWh of EV batteries annually. In addition, it has a 38 GWh facility in Reno, Nevada, that supplies Tesla's EV efforts.

LG has several EV battery factories in operation or under construction. Their joint venture with GM and Ultium Cells, has two facilities in Ohio and Tennessee, that represent 90 GWh in battery production capacity.[164] LG also has joint ventures established with Honda for 40 GWh of production in Ohio and one with Hyundai for 30 GWh in Georgia, which are both expected to scale up over the next two years.[165,166] Finally, LG has its own factories under construction that should supplement its EV and stationary storage efforts over the next few years.

[158] "A Record 1.2 Million EVs Were Sold in the U.S. in 2023, According to Estimates from Kelley Blue Book." January 9, 2024. https://www.coxautoinc.com/market-insights/q4-2023-ev-sales/.
[159] "Electric Vehicle Sales Jump Higher in Q4, Pushing U.S. Sales to a Record 1.3 Million. January 13, 2025. https://www.coxautoinc.com/market-insights/q4-2024-ev-sales/.
[160] RhoMotion. 2025. https://source.benchmarkminerals.com/article/trump-automotive-tariffs-whats-at-risk-for-the-ev-industry.
[161] Ibid.
[162] Jenkins, J.D., "Potential Impacts of Electric Vehicle Tax Credit Repeal on US Vehicle Market and Manufacturing," REPEAT Project, Princeton, NJ, March 2025. DOI: 10.5281/zenodo.15001499.
[163] The Big Green Machine: Tracking North American Clean Energy Supply Chain, database accessed 2/13/2025. https://www.the-big-green-machine.com/.
[164] Ultium Cells. 2022. https://www.ultiumcell.com/our-locations/warren-oh
[165] Gresham Smith. "Designing Honda's First Battery Plant." https://www.greshamsmith.com/projects/honda-lges-electric-vehicle-battery-plant/#:~:text=Set%20to%20be%20completed%20by%20the%20end,hours%2C%20and%20it%20will%20create%202%2C200%20jobs.
[166] Hyundai Motor Group. May 23, 2023. Hyundai Motor Group and LG Energy Solution to Establish Battery Cell Manufacturing Joint Venture in the U.S. https://www.hyundai.news/eu/articles/press-releases/hmg-and-lg-energy-solution-establish-battery-cell-manufacturing-joint-venture.html#:~:text=Hyundai%20Motor%20Group%20and%20LGES,CEO%20of%20LG%20Energy%20Solution.

Samsung is also ramping up EV battery production facilities in both New Carlisle and Kokomo, Indiana, for joint venture efforts with GM and Stellantis, respectively.[167,168] Together, these facilities will add over 60 GWh of battery production to the market.

In addition, the U.S. has seen increased manufacturing capacity for EV assembly, including by ZETA members. Tesla maintains three major facilities in the U.S., with a maximum capacity of over 1 million EVs per year across California, Nevada and Texas.[169] Rivian has recently expanded its factory in Normal, Illinois, for a maximum capacity of 215,000 units annually, and is planning a Georgia facility that aims to produce 200,000 units per year initially.[170][171] Lucid's factory in Casa Grande, Arizona, is the first greenfield—or purpose-built—EV factory in North America. The factory will have the capacity to manufacture over 300,000 EVs annually, with planned expansion[172] Lucid also recently acquired Nikola's former Coolidge manufacturing facility and Phoenix development facility. These buildings collectively add more than 884,000 square feet to Lucid's Arizona footprint. Slate Auto recently announced that they aim to manufacture in Indiana, hoping to produce up to 150,000 EVs per year.[173]

The growing EV sector has created additional jobs and investment in states with a strong automotive history, like Michigan and Ohio, as well as in the emerging battery belt: Georgia, Tennessee, North Carolina, South Carolina, Indiana, and Kentucky.

Top 10 states with the most private investment in EVs, batteries, and minerals since 2020[174]

State	Private investment ($ billion)	Jobs estimated as a result of the investments
Michigan	$25.61	23,400
Georgia	$22.97	24,700
North Carolina	$21.73	17,300

[167] Samsung. August 28, 2024.Samsung SDI and General Motors Finalize Agreement to Establish Battery Joint Venture in the U.S. https://www.samsungsdi.com/sdi-now/sdi-news/3942.html.
[168] KED Global. September 27, 2023. "Samsung SDI to invest $2 bn to build 2nd US battery plant with Stellantis. https://www.kedglobal.com/batteries/newsView/ked202309270011.
[169]"Tesla 1Q Earnings Report." April 2025. https://digitalassets.tesla.com/tesla-contents/image/upload/IR/IR/TSLA-Q1-2025-Update.pdf.
[170] Building for R2 Expanding our manufacturing footprint in Illinois. March 25, 2025. https://stories.rivian.com/r2-expansion-03-2025
[171] Rivian Receives Conditional Commitment for up to $6.6 Billion Loan from the U.S. Department of Energy's Advanced Technology Vehicle Manufacturing (ATVM) Program. November 25, 2024. https://rivian.com/newsroom/article/rivian-receives-conditional-commitment-from-doe-for-6-6b-for-ga-plant
[172] Lucid Motors Factory. 2025, https://lucidmotors.com/company#:~:text=Lucid%20Motors%20Factory,300%2C000%20annually%20with%20planned%20expansion
[173] "Here's Where Slate Will Build Its $20,000 Electric Pickup Truck." April 30, 2025. https://insideevs.com/news/758225/slate-cheap-ev-production-location-indiana/
[174] Atlas Public Policy, Clean Economy Tracker. April 2025. https://cleaneconomytracker.org/about/

South Carolina	$16.30	13,900
Indiana	$15.85	8,400
Tennessee	$15.50	14,200
Kentucky	$14.55	12,800
Nevada	$13.21	6,800
Ohio	$10.43	9,000
Arizona	$8.43	8,900

While growing EV adoption offers an important opportunity in an increasingly competitive global auto market, there is still great risk to these investments and the success of domestic U.S. automotive manufacturers. The increased domestic market for EVs has been the driving force behind domestic critical mineral projects. **ZETA urges the Trump Administration to reduce uncertainty generated by policy instability**, which negatively impacts investment momentum in domestic critical minerals and materials production and processing.

V. ELECTRIC VEHICLE BATTERY RECYCLING

As the global demand for critical minerals increases, the impetus for battery recovery and recycling will also grow. Battery minerals retain their value upon undergoing recycling processes. By 2032, S&P Global Mobility estimates around 900 GWh of end-of-life (EOL) batteries will be available for recycling, the equivalent of the batteries needed for 12 million EVs.[175] The anticipated retirement of high-value battery materials will require best practices for EOL management, reuse, and recovery practices. By 2027, there will be 200,000 metric tons of EV batteries in the U.S., and about 800,000 metric tons will reach EOL globally.[176] As the Trump Administration explores ways to meaningfully reduce import reliance for processed critical minerals, investing long term in American battery recycling innovation and capacity is essential.

Closed-loop benefits

Reclamation of materials in the U.S. market could ensure that the critical minerals are more protected from shocks to the global economy. In 2022, global prices for critical minerals like lithium spiked, making it more expensive to purchase some of the key inputs into EV batteries.[177]

[175] S&P Global. "Looming EV raw materials supply crunch has OEMs eyeing battery recycling and production scrap." 2023. https://www.spglobal.com/mobility/en/research-analysis/ev-raw-materials-supply-crunch-battery-recycling.html.
[176] IEA. December 2023. "Critical Minerals Market Review 2023." Implications – Critical Minerals Market Review 2023 – Analysis - IEA.
[177] Kim, Tae-Yoon, IEA. 2022. "Critical minerals threaten a decades-long trend of cost declines for clean energy technologies." https://www.iea.org/commentaries/critical-minerals-threaten-a-decades-long-trend-of-cost-declines-for-clean-energy-technologies

Having a robust domestic supply will not necessarily ameliorate all global shocks, but it can give the U.S. a domestic economic resource to tap into in response to price instability.

Creating this circular economy in the U.S. will take time to set up, but it will provide an increased level of localized supply stability for domestic manufacturers that rely on critical minerals.

National security benefits

U.S. EV battery recycling has a strong national security benefit by allowing the industry to be more self-reliant for its critical mineral inputs as well as battery component material production.

The Trump Administration highlighted the need for critical minerals for national security reasons as a part of its March 20, 2025, executive order (EO) on "Immediate Measures to Increase American Mineral Production."[178] In the EO, the Administration notes that "our national and economic security are now acutely threatened by our reliance upon hostile foreign powers' mineral production. It is imperative for our national security that the U.S. take immediate action to facilitate domestic mineral production to the maximum possible extent."[179] Many of the byproducts discussed in the order can be supported through domestic EV battery recycling.

Recycling can play a role in reducing this reliance over time, alongside the domestic mining of new critical minerals. ZETA members like Redwood Materials and Princeton NuEnergy have recycling outputs, such as CAM, that can be inserted into the EV and battery midstream directly.

Military readiness

EV battery recycling can also be helpful for how the military handles its day-to-day operations. The Army Corps of Engineers has also published a study of the importance of EV battery recycling to the military.[180] Their technical note argues that lithium-ion batteries are of increased use in the global market, and are now increasingly used by the U.S. military to power activities, transportation, and communication. Lithium-ion battery recycling could help improve the safety of personnel on bases as well as remove potential fire hazards for the materials the military uses each day. The study notes that using lithium-ion batteries by the military results in some unique challenges, so it recommends increased standardization for collecting materials to recycle and finding other ways to increase safety for end-of-life batteries.

[178] Trump Administration. March 20, 2025. "Immediate Measures to Increase American Mineral Production." https://www.whitehouse.gov/presidential-actions/2025/03/immediate-measures-to-increase-american-mineral-production/.
[179] Ibid.
[180] Young, A. R., S. C. Davidson, E. E. Wilson, B. Begay, and A. B. Urban. 2024. The Military and Planning for Lithium-Ion Battery Recycling. ERDC/CERL TN-24-2 Champaign, IL: US Army Engineer Research and Development Center, Construction Engineering Research Laboratory. https://erdc-library.erdc.dren.mil/server/api/core/bitstreams/980af3ca-d708-4d1e-b46f-804c7a603dff/content.

Separately, many of the minerals that the EV battery industry uses are also used in key military assets. Rare earth minerals are used in Air Force fighter jets and ballistic missiles. Additionally, drones used by the military are powered by lithium-ion batteries.

Current and Potential Domestic Capacity

Nearly two dozen EV battery recycling initiatives have been announced in the U.S.. A database has been published by the International Council on Clean Transportation (ICCT) of existing or announced EV battery recycling facilities.[181]

Major battery recyclers across the country with existing or announced facilities include companies like Ascend Elements, American Battery Technology Company, Cirba Solutions, Redwood Materials, and Princeton NuEnergy. According to ICCT, taken together, these facilities represent a combined capacity of 652,000 tons of EV batteries – enough to produce 1.3 million battery EV units in 2030.[182]

U.S. battery recyclers have already begun to integrate into the U.S. automotive supply chain. Many of these firms have signed off-take agreements with automakers. In these agreements, automakers agree to source battery components from the end-of-life recycling at the recycling plants. EV battery recycling facilities established thus far have partially lined up in clusters with the automotive manufacturing centers in key states like Nevada, Arizona, and Ohio. More facilities are expected to come online towards the end of the decade, which is when additional EV battery materials should be more widely available for recovery.

Research has shown that EV batteries are degrading more slowly than initially anticipated, lasting up to 40 percent longer than owners initially expected.[183] While this is great news for EV adoption, it may mean that the recycling industry could take a few years longer to become economically viable, both globally and in the U.S.

State of the Chinese Recycling Market

The Chinese market is facing its first substantial wave of EV battery retirements and expects to reach up to 15 to 20 million cumulative scrapped EVs by the end of 2025.[184] With a mature

[181] Takou, Alex and Hall, Dale. September 2023. "Will the U.S. EV battery recycling industry be ready for millions of end-of-life batteries?" ICCT. https://theicct.org/us-ev-battery-recycling-end-of-life-batteries-sept23/.
[182] Ibid.
[183] Geslin, A., Xu, L., Ganapathi, D. *et al.* "Dynamic cycling enhances battery lifetime." *Nat Energy* 10, 172–180 (2025). https://doi.org/10.1038/s41560-024-01675-8 (and summary article link).
[184] Lican, Liu. February 27, 2025. " China prepares for wave of EV battery retirements." https://dialogue.earth/en/digest/china-prepares-for-wave-of-ev-battery-retirements/#:~:text=This%20year%2C%20the%20number%20of%20scrapped%20EVs,will%20exceed%2060%20gigawatt%2Dhours%2C%20Securities%20Daily%20reported.

battery recycling industry and innovative research environment, China is shaping up to be the leader in recyclable critical mineral feedstock.

In fact, to date, China has dominated both patent and academic journal publications related to EV-battery recycling technologies and methodologies, more than ten-fold that of the U.S. Despite a decade of regulatory action by Chinese regulators to strengthen a battery recovery industry, there is a significant gap in safe, transparent, and effective practices.

As early as 2016, China established an implementation plan for managing the entire Li-ion lifecycle, including policies for collection, storage, and EOL disposal. Such actions have positioned China to overtake the global battery recycling economy and further its influence over critical mineral commodities. In 2018 and 2019, the Chinese Ministry of Industry and Information Technology (MIIT) took considerable steps in implementing policies and provisions for traceability management, battery recycling, waste collection, and battery handling. In 2020, China established an extended producer responsibility system for automotive batteries, effectively banning waste imports. Since then, China has published multiple detailed plans for the automotive industry, including recycling efforts, circular economy plans, and requirements for industries engaged in battery recycling.

China's inability to effectively dominate the battery recycling industry to the same extent they've achieved throughout the supply chain creates an opening for the U.S. to become a leader in next-generation recycling technology. Lack of effective regulatory oversight in China has crippled a fair and properly functioning market from emerging. Studies have found that only about 25 percent of EOL EV batteries are recycled through formally regulated channels in China.[185] The other 75 percent of waste management and recovery operates in shadow markets outside of regulatory oversight.[186] The U.S. government should invest in battery recycling R&D and processes to ensure that U.S. recyclers can scale up and compete with global competitors.

VI. RECOMMENDATIONS

Tie Imposition of Tariffs on Processed Mineral Imports to Qualification Timelines for Domestic Alternatives

To ensure that any tariffs imposed on imports of critical minerals or derivative products support domestic production and sourcing, ZETA urges the Administration to first ensure the availability of alternative supply within the U.S. that meets the material qualification standards of U.S.

[185] Li, Jingjing; et. al. April 26, 2024. "Which policy can effectively promote the formal recycling of power batteries in China?" Energy. https://www.sciencedirect.com/science/article/abs/pii/S0360544224012180.
[186] Li, Yifei. January 18, 2025. "China's EV success faces a battery recycling problem." East Asian Forum. https://eastasiaforum.org/2025/01/18/chinas-ev-success-faces-a-battery-recycling-problem/.

derivative product end users. U.S. industry cannot use critical mineral materials and derivative products until they are qualified.

The ability of a battery manufacturer to integrate an alternative material into its supply chain for commercial production entails qualification timelines of varying length depending on the commodity. Today, future U.S. critical mineral processors and producers are undergoing qualification processes with domestic battery and vehicle manufacturers. Because specification requirements for battery materials—including processed minerals, CAM, and AAM—are highly specific, each unique formulation must go through qualification. For well-established suppliers, this process might take one year. For new suppliers, this process can take two to three years. Automakers also typically require suppliers to move through a validation process for the automotive material as well as battery cells and packs, which can take 3-4 years in total for even the most experienced suppliers.

Today, battery and vehicle manufacturers are engaged in a myriad of qualification partnerships, offtake agreements, and MOUs with potential alternative domestic suppliers. Supporting these partnerships is a national security imperative. Imposing additional tariffs on processed or derivative products before U.S. battery producers are able to align with alternative domestic suppliers and integrate them into their supply chains poses great risks, including national security risks. It introduces a distraction at a crucial point during the EV race. Tariffs may also impact the ability of U.S. producers to ensure product safety, durability, and performance over the life of the automotive battery.

Many U.S.-based suppliers do not have the capacity or experience to serve as immediate, commercially viable battery-grade materials alternatives for these inputs. The U.S. automotive battery landscape is evolving quickly in the context of an industry that has existed for 125 years. However, additional time is required to adequately develop the U.S. supply base. ZETA urges the Trump Administration to work with industry to ensure that tariff imposition adequately supports the domestic market without causing bottlenecks or leading to manufacturers incurring costs by imposing tariffs when there is no domestic alternative and while they are already working to identify alternative domestic and allied suppliers.

Stacking of Tariffs

The average new car price in the U.S. has hovered between $48,000 and $49,000 for much of the past year.[187] With the imposition of a 25 percent import tariff on vehicles, the average price of a vehicle is likely to rise, with studies showing the impact varying depending on how far the tariff

[187] Kelley Blue Book. “Average New Car Price Held Steady in Pre-Tariff Sales Surge - Kelley Blue Book” “April 11, 2025. https://www.kbb.com/car-news/average-new-car-price-held-steady-in-tariff-sales-surge/.

extends; some analysis indicates an impact of $3,000 on the cost of a vehicle could be possible, while others suggest prices could increase by as much as $12,000.[188, 189, 190]

ZETA commends the Administration for the Executive Order, "Addressing Certain Tariffs on Imported Articles," issued on April 29, 2025. In that EO, the Administration recognized that, "to the extent [national security tariffs, such as those under Section 232] apply to the same article, these tariffs should not all have a cumulative effect (or "stack" on top of one another) because the rate of duty resulting from such stacking exceeds what is necessary to achieve the intended policy goals."[191]

The basis for that EO—that one article may be inadvertently subject to tariffs from various trade actions, and that such an outcome should be avoided —also applies to processed critical minerals and derivative products. Just as an automobile or auto part could be tariffed under both the automobiles/auto parts and the steel and aluminum Section 232 tariffs, so too could potential Section 232 tariffs on processed critical minerals and derivative products duplicate the existing Section 232 auto parts tariffs, aluminum tariffs, steel tariffs, and potential copper tariffs.

Lithium ion battery cells, packs, and vehicles are already covered under the Administration's Proclamation 10908 of March 26, 2025 (Adjusting Imports of Automobiles and Automobile Parts Into the U.S.).[192] Since lithium-ion batteries and cells are already covered by the Automotive Parts list, electrodes, lithium-ion cells, and batteries for use in EVs should be excluded from the critical mineral derivative product list. Prematurely adjusting imports before additional U.S. manufacturing capacity comes online could impact battery supply chains for automotive manufacturing and military technology such as drones, communication platforms, satellites, consumer electronics, outdoor power equipment, stationary storage, and more.

Additionally, depending on the structure of a supply chain, a U.S.-based automotive cell manufacturer may still face multiple tariffs that effectively stack, depending on whether upstream manufacturers independently import copper to produce copper anode foil, aluminum to produce aluminum cathode foil, critical minerals to produce AAM or CAM, and/or steel for the cell casing.

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[188] Car Prices Poised for $12,000 Surge on Trump's New Tariffs. 2025. https://www.bloomberg.com/news/articles/2025-03-03/car-prices-are-poised-for-12-000-surge-on-trump-s-new-tariffs?srnd=homepage-americas&embedded-checkout=true.

[189] Fact Sheet: President Donald J. Trump Adjusts Imports of Automobiles and Automobile Parts into the United States. 2025. https://www.whitehouse.gov/fact-sheets/2025/03/fact-sheet-president-donald-j-trump-adjusts-imports-of-automobiles-and-automobile-parts-into-the-united-states/5.

[190] "US auto industry could be collateral damage in Trump's trade wars." AP. March 1, 2025. https://apnews.com/article/tariffs-cars-automakers-trump-canada-mexico-7d34c3ba8b96864ea77c6b16780cf349.

[191] "Addressing Certain Tariffs on Imported Articles." The White House. April 29, 2025. https://www.whitehouse.gov/presidential-actions/2025/04/addressing-certain-tariffs-on-imported-articles /.

[192] Proclamation 10908 of March 26, 2025. Annex I https://img.federalregister.gov/ED03AP25.000/ED03AP25.000_original_size.png.

ZETA commends the Trump Administration for increased flexibility for automakers, which will help ease the burden of this transition period on the industry and ultimately benefit consumers through smaller price impacts.[193] If the Administration determines that Section 232 tariffs should be applied to processed critical minerals and derivative products, the same framework described in the April 29, 2025, EO for avoiding tariff stacking in other contexts should apply here as well.

Protect the American Minerals Market from Global Price Volatility

Based on the predatory pricing actions and market manipulation by the CCP, we have strong reason to believe that they will continue to manipulate prices to the best of their ability. China's state-owned, state-supported enterprises benefit from low-interest government loans and subsidies allowing them to build at a cost advantage to Western companies.[194] Chinese companies do not consistently adhere to the same labor and safety standards, which can result in lower operational costs compared to U.S. producers. Until and unless American industry has some protection from price volatility, it will be economically challenging to scale. ZETA encourages the Trump Administration to explore non-tariff price support mechanisms to assist the burgeoning domestic critical minerals market during global price dips.

Enter into Durable Trade Agreements with American Allies

As companies along the value chain for processed critical minerals and derivative products work to diversify their sourcing away from China and develop domestic production capacity, access to economically viable alternative sources is essential. In considering the imposition of any duties on processed critical minerals or components for derivative products, ZETA urges Commerce to exempt current U.S. FTA countries.

In the absence of near-term domestic capacity, circumventing the predatory practices of the Chinese state-backed industries and firms requires partnerships that instill predictability in the market. America's ability to compete in advanced manufacturing of EVs, electronics, batteries, and other advanced technologies is dependent on stable supply streams of minerals, which in turn are dependent on effective and fair trade practices, agreements, and coalitions.

ZETA is supportive of durable trade actions and policies that strengthen and support the development of a proactive and cohesive approach to FTAs to secure necessary supply chains or to promote other relevant market opportunities. The U.S. can leverage its strong posture in global markets to secure common-sense bilateral and multilateral trade arrangements with allied nations that share our democratic values and uphold human rights and environmental standards, as well

[193] "Addressing Certain Tariffs on Imported Articles." The White House. April 29, 2025. https://www.whitehouse.gov/presidential-actions/2025/04/addressing-certain-tariffs-on-imported-articles/.
[194] See report from China Labour Bulletin for additional details on Work Safety. Sep 12, 2021. https://clb.org.hk/en/content/work-safety?utm.

as reject child and forced labor. The arrangements should also ensure that capital investments are coming to the U.S. to foster economic growth and build up the domestic industrial base.

Existing trade agreements can also be leveraged to improve U.S. access to secure mineral commodities. The upcoming review of the United States-Mexico-Canada Agreement (USMCA) provides an opportunity to include specific provisions that advance this goal. Canada is the largest trade partner of the U.S., produces thirteen critical minerals, and is a top supplier of aluminum, terrarium, and other mineral inputs for EV battery production in the U.S.

Reduce Regulatory Uncertainty

While the U.S. attracted almost 20 percent of the world's total mining investment in previous decades, the duplicative, inefficient, and costly permitting framework in this country has now created a lack of confidence in the U.S. as a viable mining jurisdiction in which to invest hundreds of millions of dollars upfront.[195] Bringing a new mine online in the U.S. can take well over a decade, with recent data indicating an average of 29 years from first discovery to first production.[196] The unpredictability built into the permitting system today creates uncertainties and risks for investors. These factors place the U.S. at a competitive disadvantage to the rest of the world and hinder the creation of industrial and manufacturing jobs in the U.S. Moreover, this unpredictability pushes mining activities to parts of the world with minimal requirements for environmental, ethical, and labor protection.

ZETA commends recent actions by the Trump Administration, adding ten key mining projects to the fast-track permitting program. Under title 41 of the Fixing America's Surface Transportation Act (FAST-41), the Federal Permitting Improvement Steering Council (Permitting Council) provides focused permitting support to infrastructure projects, like critical mineral extraction and processing, and improves efficiency through facilitated coordination across federal agencies. The new "transparency project" category coming out of the Executive Order, "Immediate Measures to Increase American Mineral Production," adds a new ability to cut the regulatory red tape and increase accountability to accelerate projects to strengthen U.S. mineral supply chains.

Furthermore, the Administration can further streamline critical mineral security by harmonizing the USGS's list of "critical minerals" and the DOE's list of "critical materials." The current inconsistency between the two lists excludes important mineral commodities from the benefits offered exclusively to critical minerals. Maximizing responsible and timely production of the full range of mineral commodities will be key to meeting the growing demand for advanced

[195] Nolan, Richard. "Testimony of Rich Nolan, President & CEO National Mining Association before the United States House of Representatives Committee on Natural Resources." February 28, 2023. https://naturalresources.house.gov/uploadedfiles/testimony_nolan.pdf.
[196] Bonakdarpour, Mohsen, Hoffman, Frank, and Rajan, Keerti, "Mine development times: The US in perspective," S&P Global, June 2024, https://www.reuters.com/markets/commodities/us-mine-development-timeline-second-longest-world-sp-global-says-2024-07-18/.

technologies across sectors, including EVs, defense, healthcare, consumer electronics, and many other crucial applications.

Additionally, like numerous other industries across the U.S., aspects of EV production are adversely impacted by the unpredictable timelines and lack of transparency throughout the National Environmental Policy Act (NEPA) permitting process. In particular, this often lengthy and burdensome process impacts mineral development projects, many of which are located on or near federally owned land in the western U.S.. ZETA encourages the Administration to work with Congress to find a balanced approach to improve timelines and transparency in NEPA reviews while maintaining stringent environmental standards. Only then will there be true permitting certainty for the ongoing development of mineral production projects, which are so vital to the domestic supply chain of EVs and dozens of other advanced technological applications.

ZETA urges Commerce in its investigation to continue to consider ways to leverage the FAST-41 program and other permitting reforms that help support the growing American industrial and manufacturing base.

Stabilize Existing Incentive Structures for Domestic Demand and Manufacturing of Processed Minerals and Derivative Products

As part of this investigation, the Department of Commerce, under Clause 3 (d)(iii) in the Presidential Proclamation, is directed to explore "policies to incentivize domestic production, processing, and recycling."[197] ZETA commends the Administration's recognition of the strategic importance of processed critical minerals and derivative product supply chains, including batteries and EV manufacturing and recycling.

The suite of tax credits uplifting the domestic EV industry seek to reclaim the entire value chain while supporting innovation and defending American-made products' environmental, labor, and safety record.

The Section 45X tax credit reduces battery module and cell manufacturing costs, attracting private capital to domestic projects and bringing manufacturing capacity online. The increasingly stringent domestic sourcing and foreign entity of concern (FEOC) requirements tied to Section 30D tax credit eligibility have motivated automakers to ensure that American-made EVs are increasingly free of Chinese materials, incentivizing domestic manufacturers to sign supply agreements with mineral and component producers in the U.S. and allied nations.

[197] Executive Order. Ensuring National Security and Economic Resilience Through Section 232 Actions on Processed Critical Minerals and Derivative Products. April 15, 2025. https://www.whitehouse.gov/presidential-actions/2025/04/ensuring-national-security-and-economic-resilience-through-section-232-actions-on-processed-critical-minerals-and-derivative-products/.

When used together, these credits create an interdependent ecosystem of incentives tailored to every segment of the EV supply chain, driving domestic private-sector investment and shepherding the U.S. into a position of economic and industrial strength. Weakening or eliminating these credits hampers America's ability to scale a secure EV supply chain oriented towards our nation and countries that share our democratic values.

Qualified manufacturers seeking vehicle eligibility for the Section 30D credit must meet increasingly stringent content requirements for sourcing battery components and critical minerals either domestically or from free trade agreement countries. Because both requirements must be met for an EV to be eligible for the full credit, significant new investment is being generated to scale domestic critical mineral production, battery manufacturing, and recycling to maximize the impact of the Section 30D credit. The Section 45X and Section 48C credits find their effectiveness in enabling the domestic manufacturing investment contingent on the demand for products bolstered by the Section 30D credit:

- The Section 30D statute, as written, requires vehicles to be assembled in North America in order to be eligible for the credit.
- Vehicles lose eligibility if their battery components are sourced from a FEOC. As of 2025, all materials deemed practical to trace also adhere to FEOC restrictions, with any violations resulting in a loss of eligibility.
- In addition to robust FEOC restrictions, by 2028, qualified vehicles must have 100 percent of their battery components manufactured or assembled in North America, and 80 percent of the critical minerals must be sourced domestically or from a U.S. trade ally, ensuring that the U.S. and key partner countries are to benefit from growth in the sector.

Section 30D derisks upstream investments by sending a predictable demand signal for domestically manufactured and sourced end products. This enables 45X to build domestic critical mineral, battery components, and battery recycling supply chains at scale. Moreover, 30D alone has been a primary driver in significant private investment in the upstream, particularly in the raw materials sector.

Invest in American Critical Minerals and Materials Research and Development

The U.S. should continue to invest aggressively in funding for research and development (R&D), target incentives and public financing for demonstrating and scaling up commercial production of next-generation batteries, and batteries, and protect the domestic market for innovative technology through public procurement that will use public procurement to create protected markets for innovative technologies to gain a market foothold.[198] ZETA encourages the Trump

[198] Sirbaram, Varun; Gordon, Noah; Helmeci, Daniel. "Winning the Battery Race: How the United States Can Leapfrog China to Dominate Next-Generation Battery Technologies." Carnegie Endowment. October, 21, 2024.

Administration to take advantage of already authorized authority: The Infrastructure Investment and Jobs Act of 2021 allocated significant authority for DOE to support domestic production of advanced batteries, battery recycling, and lithium carbonate production. In 2024, DOE announced $3 billion in funding across 25 projects to support new commercial-scale domestic facilities to extract and process lithium and other critical minerals, manufacture key battery components, recycle batteries, support next-generation battery manufacturing, and develop new technologies to increase U.S. lithium reserves. ZETA urges the Trump Administration to prioritize the continued deployment of grants that drive American technological innovation and reduce our import dependence.

The Department of Defense has played an important role in developing U.S. production of aluminum, magnesium, tin, cobalt, graphite, battery-grade manganese, nickel-grade manganese, and REEs for magnets and defense applications. ZETA encourages the Trump Administration to continue leveraging the Defense Production Act to support domestic manufacturing capacity for critical mineral development, particularly those of commodities facing persistently challenging price benchmarks.

Invest in a Next Generation Workforce

As the Secretary investigates ways to ensure national security and economic resilience through Section 232 actions on processed critical minerals and derivative products, consistent with the goals of the President, support for our American miners, students, apprentices, and engineers should be considered. The U.S. faces a midstream workforce challenge caused by a loss of skilled labor in metallurgy, chemistry, and geological engineering. More than half the current domestic mining workforce will need to be retired and replaced by 2029 (roughly 221,000 workers).[199] In contrast, just 312 degrees were awarded in 2022.[200]

Consistent with President Trump's Executive Order 13817, *A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals,* ZETA urges the Administration to support workforce development and talent retention in parallel with trade policies that streamline domestic minerals production. For instance, we recommend that the National Science Foundation prioritize activities authorized in the Chips and Science Act of 2022 Section 10359 for critical minerals, including providing funds on a competitive basis to institutions of higher education or nonprofit organizations to provide training and research opportunities to undergraduate and graduate students to prepare the next generation of mining engineers and researchers.

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https://carnegieendowment.org/research/2024/10/winning-the-battery-race-how-the-united-states-can-leapfrog-china-to-dominate-next-generation-battery-technologies?lang=en.

[199] "The United States Needs More than Mining Engineers to Solve Its Critical Mineral Challenges." Thomas Hale. May 8, 2023. https://www.csis.org/analysis/united-states-needs-more-mining-engineers-solve-its-critical-mineral-challenges

[200] Data USA: Mining & Mineral Engineering. 2025. http://datausa.io/profile/cip/mining-mineral-engineering#:~:text=The%20most%20common%20sector%2C%20by%20number%20of%20degrees%20awarded%20in,(312%20completions%20in%202022).

Furthermore, the Consolidated Appropriations Act of 2021 directed DOE under Section 7002(K) to require the Secretary of Labor and the Director of the National Science Foundation to develop curriculum and an interdisciplinary program for institutions of higher education to strengthen the workforce for exploration and development of critical minerals and manufacturing. The program is intended to be designed to support the critical mineral supply chain and improve the ability of the United States to increase domestic, critical mineral exploration, development, production, manufacturing, research, including fundamental research into alternatives, and recycling. We encourage the Administration to take advantage of these authorized programs to strengthen the prowess of the American mining workforce.

Support for the mineral supply chain workforce will improve topographical, geological, geophysical, and bathymetrical mapping of the U.S. and facilitate mineral exploration and development. ZETA appreciates that Commerce has publicly detailed support for these strategies in accordance with the President's goals of securing critical mineral resources.

VII. Conclusion

ZETA commends the Administration's recognition of the strategic importance of processed critical minerals and derivative product supply chains, including batteries and EV manufacturing and recycling. In considering the imposition of new duties on critical minerals and their derivatives, ZETA urges Commerce to assess the risk of locking U.S. companies out of mineral supply chains without secured or existing alternatives. Reorienting supply chains is costly and can take years. American companies have significantly invested in extracting and processing raw materials, minerals, and their derivative products. Trade policies that aim to expand domestic capacity should not inadvertently burden these investments. Without aggressive federal investment in research and development, project deployment, recycling capacity, and a derivative product domestic demand base, tariffs alone risk further jeopardizing America's ability to compete in this vital market. Thank you for your consideration—we look forward to working with the Administration to decrease U.S. import reliance and enhance U.S. national and economic security