To Secure Energy Needs, the U.S. Must Reshore Vital Resources

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Table of Contents

Overview

By simplifying and regionalizing its supply chains, the United States can secure its production networks against logistical and security hazards, reduce costs, and hedge against inflation.

Offshoring — the desire to find the cheapest possible location to source, refine, or produce a good — is laden with controversy. Since the mid-20th century, "offshoring" has been a corporate buzzword synonymous with driving more substantial profit margins and damaging the American job market by outsourcing most manufacturing work. However, recent events have caused or revealed flaws in the offshoring-centric business model. The COVID-19 pandemic, Russia's war in Ukraine, and growing security concerns with China are the most prominent of a long list of incidents that strained or even broke the long and impossibly complicated supply chains that resulted from the better part of a century of offshoring.

Economics drives offshoring. Supported by shipping costs that become negligible at scale, an ocean patrolled by the U.S. Navy, and a long list of countries with complementary interests, offshoring became the norm for the most developed world. Many in the developing world benefited from this system because it provided them with opportunities for specialization and expansion that could never have otherwise existed; many others endured slow economic growth and poor or inhumane working conditions due to exploitation by more wealthy (or more savvy) trade partners.

Under the circumstances that prevailed from the end of World War II to the beginning of the COVID-19 pandemic, offshoring was the world's most efficient production model and would have remained so under ideal circumstances. However, recent events reveal several crucial flaws in the offshoring model, resulting in shortages, economic uncertainty, and record-high inflation.

Nearshoring

Despite the merits of offshoring, much of the world has decided that its flaws outweigh its strengths. Both private and public interests are investing enormous amounts of time and capital in what many are referring to as "reshoring" but what may be more aptly termed "nearshoring." Nearshoring is the more strategic version of offshoring. It often reverses decades of deeply ingrained offshoring business practices by shifting production back home or to strategic partner countries. Nearshoring tempers the classical economic ideals of free trade and comparative advantage with strategic planning to mitigate the risks of long, complicated supply chains that involve less reliable countries.

As nearshoring considers security, economic efficiency is no longer the sole concern, which inevitably leads to higher prices for the goods, at least in the short term. The short-term economic pain of shifting production is borne in pursuit of increased efficiency in the future and reduced risks associated with more complicated or less secure supply chains.

Because of the challenges associated with the process of nearshoring, it is necessary to prioritize the resources most integral to national security and the continued functioning of the economy. Resources like semiconductors, rare earth minerals, and energy are receiving the most attention from governments and firms as they are vital to producing almost every other good in the economy.

20th Century Globalization

The 1944 Bretton Woods Conference advanced the world's economy into the modern system by establishing the World Bank and the International Monetary Fund (I.M.F.). The system set up at the Bretton Woods conference also established the dollar's gold value. It pegged other world currencies to the dollar, effectively establishing the U.S. dollar as the currency of international trade and the world reserve currency. The Bretton Woods system and the U.S. Navy patrolling the world's oceans set the stage for globalization and how it functions today. For the first time, shipping was safe and cheap. The world's large economies had economic and political incentives to cooperate as a single, asset-backed, universally accepted currency existed.

Trade became simpler by adopting the U.S. dollar as the medium of international exchange, and foreign countries became more dependent on the U.S. Until the late 1940s, the most significant trade barriers had been expensive shipping costs, shipment security, and complicated or expensive exchange methods. But with these barriers removed almost at once, the economic paradigm of the entire world shifted towards a new strategy: globalization.

"The USS John Finn passed through the Strait of Taiwan in January 2024 following Taiwanese presidential and parliamentary elections to demonstrate the "United States' commitment to upholding freedom of navigation for all nations as a principle," according to a statement from the fleet's commander."

Source: Sea Power- The U.S. Navy and Foreign Policy

The economic concept of comparative advantage took over, leading to high-value-added economies like the U.S. and those of Western Europe to outsource most of their low-skilled labor work to economies with cheaper labor. Since shipping was more affordable and safer than ever, countries moved their production from decentralized locations near the final consumers to a much smaller number of large producers in regions with relatively cheap labor, such as China and other parts of Southeast Asia.

Regions began to specialize more than ever before in specific spaces. The U.S. and E.U. focused on design and professional services, China specialized in mineral production and lower-end manufacturing and assembly, and smaller East Asian players like Taiwan and South Korea focused both on the design and manufacturing of high-end technology, to name a few. Countries could develop comparative advantages, allowing them to benefit from trade regardless of how "developed" their trade partners considered them. Rich countries benefited from cheaper manufacturing and minerals, while less developed countries profited from trade deals that paid them more than they would otherwise make.

This system allowed firms and states to focus primarily on economic efficiency, disregarding factors like proximity, trade route security, and transportation and transaction costs that had defined trade for so long. Goods and resources could be sourced wherever in the world was cheapest, leading to drastic drops in production costs.

This system would be ideal in a perfect world, like one that exists in an economic model. But economic models have always had trouble simulating the real world. Price theory remains just a theory when it fails to account correctly for the influence that a monsoon, a trade war with China, or a clog in the Suez Canal will have on the supply of vital goods with inelastic demand. The assumption of ideal conditions, or the impossibility of adequately predicting just how un-ideal the conditions will be, is why globalization will always look better on paper than in practice.

Recent Events

From 2019 to 2023, unprecedented events altered the world economy. One catastrophe quickly followed another, creating a prolonged uncertainty not experienced in recent memory.

The COVID-19 pandemic, Russia's invasion of Ukraine, and other events sent supply shocks throughout the global system, revealing vulnerabilities in the long, complicated, and fragile supply chains.

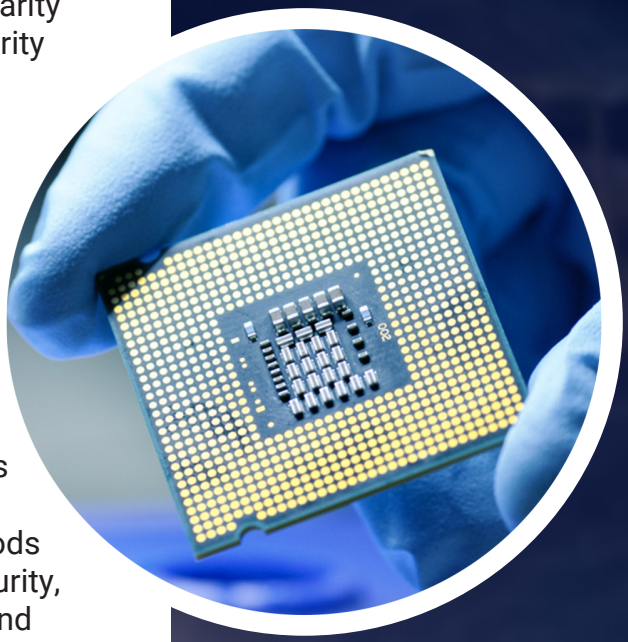
The pandemic resulted in countless shortages of vital goods that could only be produced onshore, or not at all, with more money than most could afford. The global chip shortage has led not only to increases in the prices of goods directly affected, like smartphones and computers but also to the prices of almost every other good and service imaginable, as everything relies on computers in one way or another. Only several years after the shortage began, consumers saw personal computer and smartphone prices recede to pre-pandemic levels.

More than anything else, the pandemic illustrated how the low prices that the world grew accustomed to relied on the maintenance of the fragile status quo. A status quo seemed attainable once more at the beginning of 2022, as the pandemic ceased to dominate every facet of life. Then, Russian President Vladimir Putin invaded Ukraine, sending financial markets into an all too familiar free fall and threatening the supply of another vital resource: energy.

Before it invaded Ukraine, Russia was the third largest oil exporter by volume in the world. Russia's invasion of Ukraine and the subsequent economic sanctions on Russia threatened the world's oil supply. Oil prices skyrocketed to their highest level in a decade, manifesting directly in the prices of gasoline, which grew noticeably higher by the day at the beginning of the invasion. However, like semiconductors, oil is a fundamental resource that almost all other resources rely on. Because oil is necessary for producing so many different goods, a shock to the oil supply led to a shock in the supply of everything from groceries to building materials.

Regionalization Today

The deglobalization trend has grown in popularity over the last few years due to increased security and decreased shipping and manufacturing costs. For decades, it has been a running joke that China produces everything the U.S. consumes, from clothes to toys. While this perception has some truth, it is a one-dimensional way of considering supply chains. It is so complicated that it takes professionals from all countries to manage them properly.



China produces a significant portion of goods for the U.S., but only some are subject to regionalization. The determiners of these goods are a combination of national and global security, comparative advantage between countries, and the elasticity of demand.

While economic regionalization is happening in almost every good and service market in the world, a few markets are getting much more news coverage than the rest, as well as more government subsidization and institutional support. Resources that receive this support do so due to their integral position in the world economy and their interdependence on each other.

For this paper, we are focusing on semiconductors, rare earth minerals, and energy.

The vital importance of these resources to the global economy and national security is evident. These resources are interdependent on one another: rare earth minerals are necessary for both traditional and renewable energy production, mining and refining rare earth minerals require a great deal of energy, and none of the above can be acquired without a myriad of semiconductors.

Simply put, rare earth minerals are necessary for producing energy and semiconductors, energy is needed for producing rare earth minerals and semiconductors, and semiconductors are essential for producing rare earth minerals and energy. These three resources are vital for U.S.

national security and the global economy to function at every level.

The Chips & Science Act

One of the most prominent examples of reshoring is the CHIPS and Science Act of 2022. Semiconductors, or computer chips, are among the most essential resources in the modern world. Every electronic device, from calculators to smartphones to electric cars, requires at least one, and often up to several dozen, of these little pieces of silicone. The entire modern infrastructure of the world is entirely dependent on semiconductors.

As many of the world's most advanced chip designers, including Intel, Nvidia, and AMD, are based in the U.S., the U.S. leads the world in semiconductor design. However, because of the complicated process, semiconductor production requires input from numerous parties worldwide and a supply chain that touches almost every continent. Currently, semiconductors have one of the most complex and fragile production processes.

The semiconductor supply chain begins in the U.S., where most of the world's most advanced chips are designed. The U.S. dominates the chip design market, with seven of the ten largest semiconductor companies based stateside. After the design phase, there is the front-end manufacturing phase, which involves mining silicon in different parts of East Asia and fabricating silicon wafers in Taiwan and South Korea. While performed primarily in Taiwan and South Korea , the front-end fabrication process requires equipment from all over the world, including doping materials from the U.S., photoresist processing equipment from

> ***"100% of the world's most advanced (below 10 nanometers) semiconductor manufacturing capacity is currently located in Taiwan (92%) and South Korea (8%). These advanced chips are essential to America's economy, national security, and critical infrastructure."***
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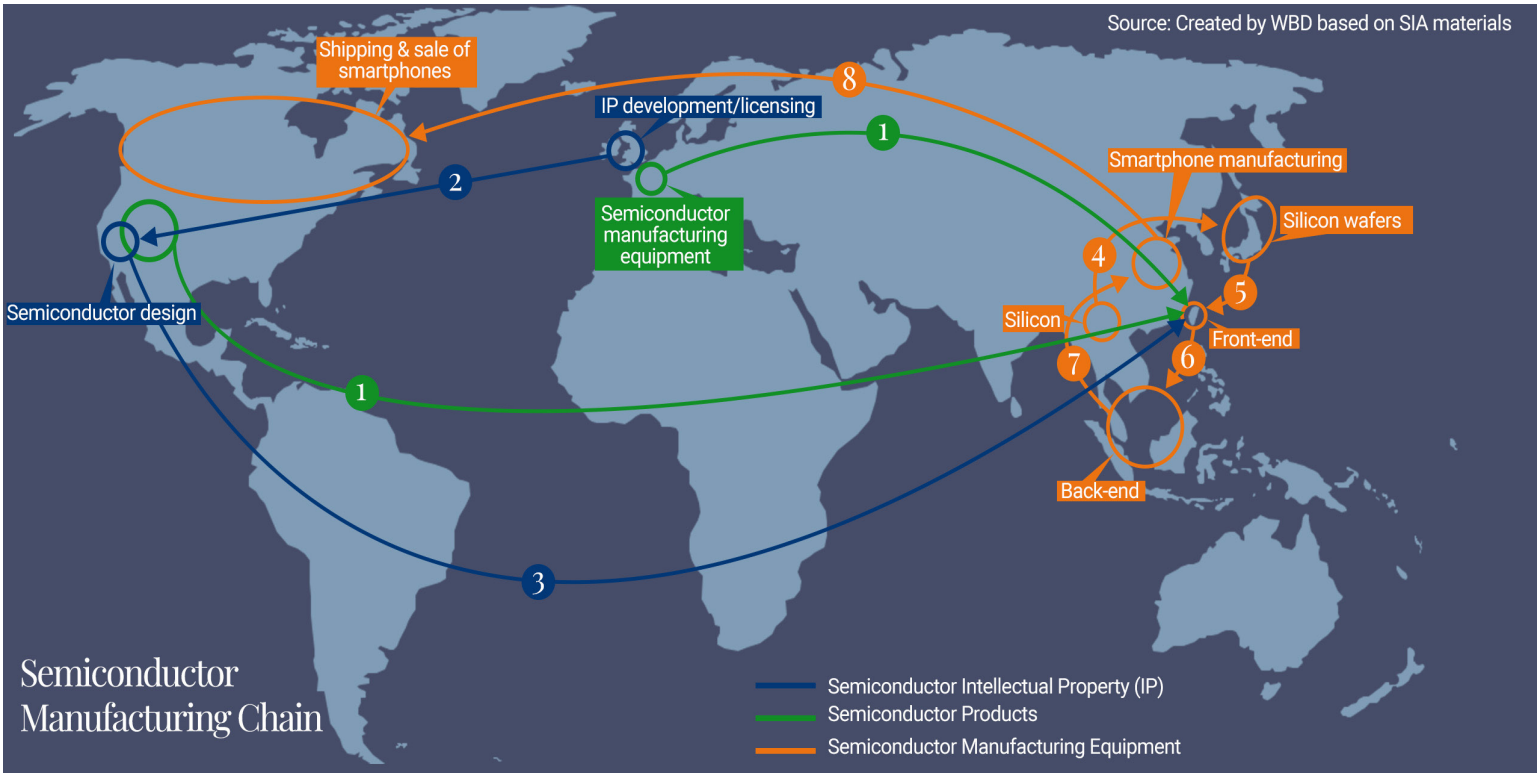
> ***Source: Strengthening the Global Semiconductor Supply Chain in an Uncertain Era***



Japan, and E.U.V. lithography machines from the Netherlands.

After completing the front-end manufacturing, the back-end process begins. The back-end process takes place in Taiwan and South Korea and involves assembling and testing the chips. This fabrication stage requires photoresist and photomask materials from Japan, specialty gases from Europe, and a lengthy list of other materials from worldwide.

The precarious nature of the process becomes even more apparent when considering that a tiny island off the coast of China produces over 60 percent of all semiconductors and over 90 percent of the most advanced semiconductors in the world: Taiwan. As the home of TSMC (Taiwan Semiconductor Manufacturing Company), which controls more than half of the global semiconductor production market, Taiwan is one of the most critical regions in the global economy. TSMC, unlike many of its American competitors, focuses solely on the production of semiconductors rather than their design, allowing them to dominate the chip fabrication market and produce chips for competing firms such as Nvidia and AMD.

TSMC's incredible growth and unmatched efficiency bring certain risks along with it. Aside from being the leading global manufacturer of semiconductors, Taiwan sits at the center of an increasingly heated geopolitical standoff between the U.S. (and much of the democratic world) and China. China considers Taiwan subject to the Chinese Communist Party (C.C.P.), while Taiwan, since 1996, has acted as an independent democracy, holding its elections and maintaining its military. The U.S. unofficially recognizes Taiwan as an independent country, supplying military support and threatening to defend Taiwan in the event of a Chinese invasion.

Taiwan is also geographically significant because of its proximity to China and Japan. Taiwan's allies, Japan and the U.S., have prevented Chinese naval expansion into the Pacific Ocean, reducing hostilities between China and other Pacific island countries. If Tawain fell under Chinese control, the C.C.P. would significantly control more of the Pacific Ocean and many of the world's busiest trade routes.

> ***"The CHIPS and Science Act will strengthen American manufacturing, supply chains, and national security and invest in research and development, science and technology, and the workforce of the future to keep the United States an industry leader in nanotechnology, clean energy, quantum computing, and artificial intelligence."***
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> ***Source: White House Briefing Room***

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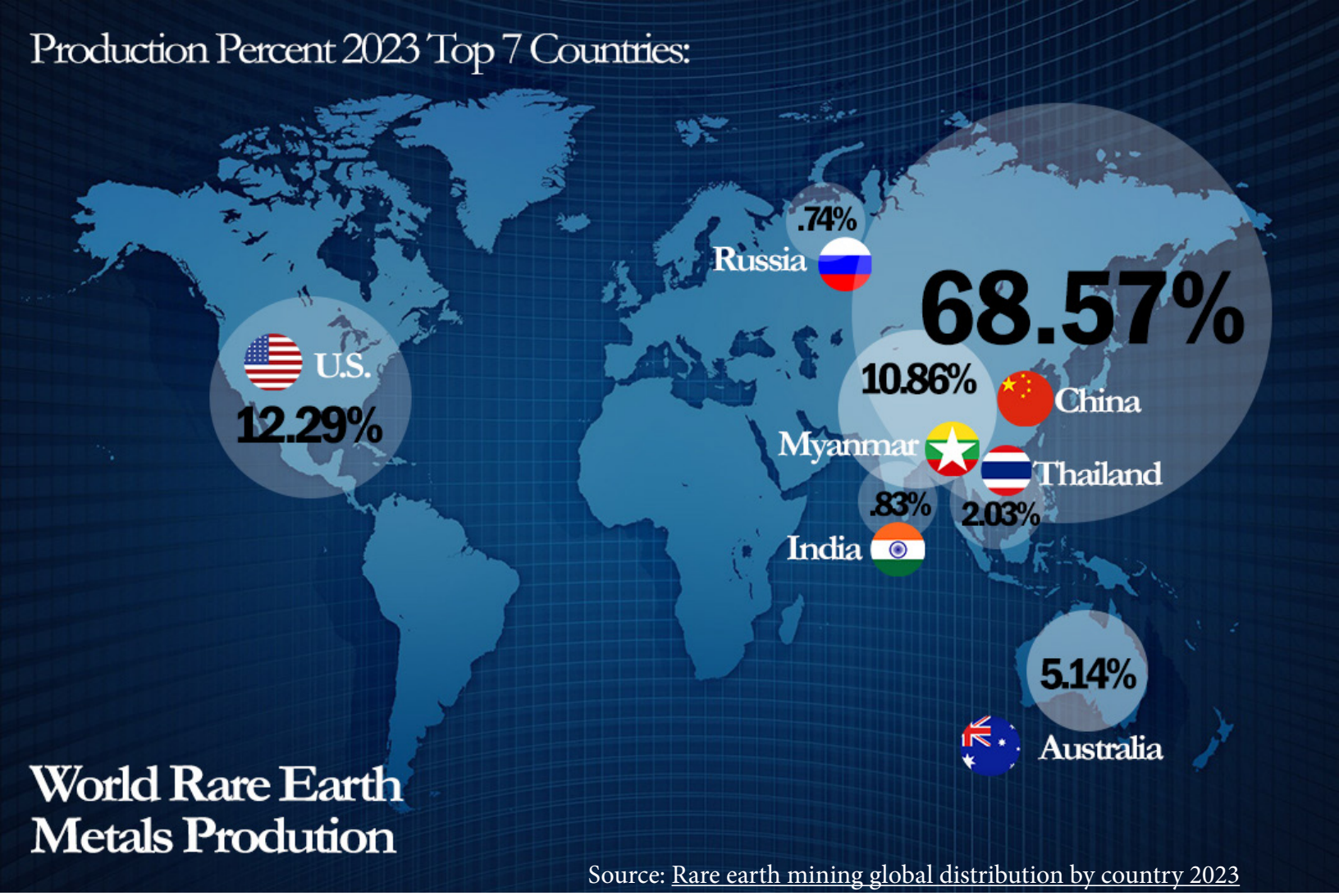
Any of these factors would warrant a more strategic, regionalized approach to semiconductor supply chains, from the unsustainable and fragile complexity of existing supply chains to the concentration of semiconductor manufacturing in a hotly contested island. These factors, however, make the CHIPS and Science Act vital to U.S. national security and economic survival. Because everything from gaming computers to fighter jets uses chips, the U.S. considers them a matter of national security. In a digital age, it is only possible to maintain national security by accounting for this vital resource.

U.S. trade partners have criticized the CHIPS Act. Trade and finance ministers from Germany, the Netherlands, and French President Emmanuel Macron have accused President Biden of engaging in protectionism and damaging transatlantic trade relations. These European leaders and others worldwide are concerned that the subsidies will give American firms an unfair competitive advantage over international firms. In response, and to bolster its semiconductor production capacity, the E.U. passed its version



Source: Rare earth mining global distribution by country 2023

of the CHIPS Act, known as the European CHIPS Act, with a similar structure and intention.

Despite the criticism, the U.S. is quickly implementing the CHIPS Act and reshoring numerous manufacturing jobs stateside. There are plans to build new semiconductor fabrication plants, also known as fabs, in over a dozen states. Intel and TSMC are building the most notable new fabs in Oregon and Arizona. The CHIPS Act is projected to create or reshore roughly 642,000 manufacturing jobs to the U.S. economy and numerous support activities to facilitate the transition. To meet the employment demand, boot camps near the semiconductor sites train workers in chip fab manufacturing skills.

To protect national security and the resiliency of supply chains, CHIPS funds may not be provided to U.S.-sanctioned countries, and entities designated in 10 U.S.C. 4872(d) are prohibited from receiving CHIPS funds.

Reshoring and securing the chip manufacturing process will take many years and require unprecedented logistical analysis and supply chain management. The process will call on many more economic actors than chip companies. It will require state and local governments, shipping companies, regulatory agencies, consulting firms, staffing agencies, independent manufacturers, universities, and others to collaboratively facilitate one of modern history's most significant production shifts. In 2022 China produced 70 percent of the world's rare earth minerals . The U.S. came in a distant second place at 14.3 percent, with other countries, often Chinese-owned, producing most of the remaining rare earth metals. This trade imbalance includes differing comparative advantages between economies and government incentives and regulations.

Unlike China, the U.S. and the E.U. adhere to stricter mineral mining and processing due diligence requirements and regulations, which

protect domestic workers and ecosystems from exploitation and destruction and strive to reduce carbon emissions. This results in a split system of mineral production in the world: one stream from wealthy and heavily regulated countries and one from exploited workers in poor countries.

While well-intentioned, labor and environment protections effectively preserve local ecosystems at the expense of foreign ecosystems. In other words, the regulations did not reduce the total amount of mining; instead, they shipped it offshore to satisfy the constant global demand for these minerals.

This imbalance leaves the U.S. vulnerable to supply chain collapses, as seen during the pandemic, and national security threats. Like semiconductors, rare earth minerals are vital to the economy and U.S. national security. In response to this risk, the Biden administration has acted to secure future U.S. mineral supplies.

Executive actions include a $35 million award to M.P. Materials, a U.S. mining company, to process and refine rare earth minerals in the U.S. Tax incentives also encourage more investment in domestic production and refinement of rare earth minerals.

The Mining Law of 1872 remains the prevailing legislation regarding mining on federal public lands. The Biden administration has committed to modernizing the rules and regulations regarding mining on federal public land to meet the United States' economic, strategic, and climate goals.

The U.S. Department of Defense also secures America's mineral supply chains by contracting with the Albemarle Corporation (a U.S.-based lithium mining company) to expand domestic lithium production. The agreement involves using $90 million from the Inflation Reduction Act to support Albemarle's reopening of their Kings Mountain, NC lithium mine. The Kings Mountain mine is estimated to be operational between 2025 and 2030, helping secure the domestic lithium supply for years to come. This lithium will be vital in securing American energy and mineral independence and supporting the transition to green energy.

There are many reasons to focus on regionalizing and reshoring mineral production and refinement, including increased security, simpler and more efficient supply chains, and reduced dependency on foreign-produced rare earth minerals. As the U.S. secures its mineral supply chain over the coming years, its economy will grow more efficiently and be less susceptible to short-term shocks like those experienced during the pandemic and after.

If they have not already, government agencies, local governments, and the private sector must prepare now for this transition. Planning and strategy are crucial to facilitating this transition.

Energy

The goal of American energy independence is fundamentally connected with energy production and requires complex human and physical capital and natural resources that are currently sourced offshore. Much of the plan for U.S. energy independence relies on developing and advancing technologies currently incapable of efficiently producing energy at scale, such as solar and wind power. Yet much can be accomplished right now.

The Shale Revolution demonstrates what increased energy independence can do for the U.S. For decades, the U.S. depended on foreign oil, leading to reliance on foreign powers. Beginning in 2008 and continuing throughout the 2010s and early 2020s, producing oil and natural gas by drilling horizontally into mountains and hydraulic fracturing turned the U.S. into a net exporter of crude oil. It helped pull the U.S. out of the 2008 Great Recession. In addition to increased security, shale mining added 169,000 jobs to the oil industry between 2010 and 2012. The environmental harm caused by oil is significant, and even most oil companies admit that the future of energy lies with renewable energy. Yet oil remains vital for short-term growth and security.

As the U.S. brings more mining to stateside or regional partners, it will decrease its reliance on oil and other countries for energy needs. The U.S. tackles its energy independence needs from various angles, including the Energy Independence and Security Act of 2022 (EISA). The EISA resolves an unnecessary hurdle towards clean, renewable energy: permitting reform. Permitting for energy infrastructure can be a long, tedious process that stifles clean energy investment and production. The current permitting system requires significant amounts of time, capital, and effort that could be spent on creating and scaling renewable energy. Faster, more streamlined permitting processes help ensure that the time, capital, and effort to make a greener energy

infrastructure supports that specific infrastructure rather than satisfying laborious bureaucratic requirements and delays.

The 2022 Inflation Reduction Act (I.R.A.) also stimulates the reshoring and greening of American energy. The I.R.A. accounts for the world's largest investment in climate and energy through $40 billion worth of loan guarantees from the Energy Policy Act 2005. This financial support will repurpose or replace aging energy infrastructure to reduce greenhouse gas emissions, increase the production of fuel-efficient and electric vehicles through expanding the ATVM loans established under the Energy Independence and Security Act of 2007, and much more. Focused on updating domestic energy infrastructure through low-cost loans, the I.R.A. is another example of the U.S. federal government's extensive support of the green transition and energy independence.

As the U.S. transitions to more secure, domestic energy sources, private companies from every related industry must prepare to facilitate and benefit from this transition. The reshoring of energy production means reshoring hundreds of thousands of jobs directly and indirectly related to the transition. Numerous involved parties, from mining companies like Albemarle to local governments nationwide, must cooperate to take advantage of federal funds. The public and private sectors will need to coordinate and prepare for the compliance requirements that come with federal support, making compliance, reporting, budgeting, and permitting more critical now than ever.

An Interconnected Economy

A ripple effect compounds every disturbance in the energy supply chain. Nearly everything impacts everything in an economy as interconnected as the global economy. In a digitalized world, semiconductors are vital to producing computers, electric batteries, and almost all electronic devices. Shipping, communication equipment, and manufacturing, too, require semiconductors to operate. That means, when the price of semiconductors increases, so do prices of other goods.

The interdependent nature of global resources has been established, with the unfortunate result that when the price of one rises, so does the price of all the others. A fundamental rule of classical economics states that when the price of a component goes up, the price of the final product does as well. While the global economy has generally resulted in lower prices, it has also created a situation where a shock to any of these supply chains anywhere in the world can, and almost certainly will, have ripple effects throughout the entire global economy.

Now more than ever, the U.S. must secure its growing energy and semiconductor needs by reshoring the resources vital to maintaining its supply chains.

How WBD Can Help

Washington Business Dynamics offers a unique and data-driven perspective on logistics and supply chain management. W.B.D. uses proprietary technological and analytic capabilities to improve delivery performance and promote an agile environment for our government and commercial clients. Our supply chain experts are experienced in navigating the compliance and reporting requirements associated with using federal funds.

By identifying bottlenecks, root causes, or opportunities for improvement, W.B.D.'s consultants can help your firm or federal agency build procurement and supply chain resiliency in an interconnected world.