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The Roosevelt Project

Phase 3: Case Studies on Iron and Steel, the Electric Grid, and Critical Minerals

Synthesis Report

Massachusetts Institute of Technology

HARVARD UNIVERSITY

The Roosevelt Project:
A New Deal for Employment, Energy, and Environment

Phase III Roosevelt Project Case Studies

- Crossed Wires: A Salata Institute-Roosevelt Project Study of the Development of Long-Distance Transmission lines in the United States
- Iron and Steel Decarbonization by 2050: An Opportunity for Workers and Communities
- Revitalizing America's Critical Mineral Industry: Fair Trade, Economic Security, and Community Resilience

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Revitalizing America's Critical Mineral Industry: Fair Trade, Economic Security, and Community Resilience

About the Roosevelt Project

The Roosevelt Project takes an interdisciplinary approach to understanding and managing the challenges of transitioning toward a deeply decarbonized U.S. economy, aiming to minimize worker and community dislocation while enabling at-risk regions to capture new opportunities for growth. Phase One developed the project's analytical foundation through cross-cutting studies on workforce transitions, community resilience, and policy design for a low-carbon economy. Phase Two applied this framework to four regional case studies—Southwest Pennsylvania, the Industrial Heartland, the Gulf Coast, and New Mexico—conducted with local partners to assess how industrial legacies, labor markets, and policy environments shape equitable decarbonization. Phase Three extends this work by examining U.S. industrial policy frameworks for the energy transition through three national case studies on the electric grid, decarbonized steel, and metals and mining, addressing how to expand transmission equitably, decarbonize heavy industry, and secure critical minerals supply chains. The project, initiated by former U.S. Energy Secretary Ernest J. Moniz, engages faculty and researchers across MIT and Harvard in economics, engineering, sociology, urban studies and planning, and political science.

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Revitalizing America's Critical Mineral Industry: Fair Trade, Economic Security, and Community Resilience

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1. Introduction

The Roosevelt Project is a multi-year research initiative led by the MIT Center for Energy and Environmental Policy Research (CEEPR) in partnership with Harvard University. Launched in 2018, it set out to understand the economic and social challenges of deep decarbonization in the United States and to design policies that could support a just and durable energy transition. Named after three prominent Roosevelts in American history, Teddy (for his dedication to the environment), Franklin (for his signature New Deal), and Eleanor (for her social justice advocacy), the project examined how climate policies interact with industrial competitiveness, workforce opportunities, and regional development, with particular attention to communities historically dependent on fossil fuels or energy-intensive manufacturing. By combining technical, economic, and social science expertise, it has sought to identify practical pathways that could deliver emissions reductions while advancing equity and prosperity.

The third phase of the Roosevelt Project built on this foundation by adopting a sectoral focus, concentrating on three areas of the economy that will be essential to a successful energy transition: the electric grid (perhaps the leading infrastructure needed for decarbonizing energy); iron and steel (an energy-intensive essential commodity); and critical minerals (currently irreplaceable ingredients for a number of clean energy technologies). In each of these sectors, persistent challenges—ranging from planning and permitting bottlenecks to global competition, capital investment barriers, and import dependencies—threaten to slow or reverse progress toward decarbonization. To evaluate these challenges and outline innovative policy solutions, the project featured case studies aimed at identifying the right balance of environmental priorities, social equity, and economic competitiveness, recognizing that a just transition would remain out of reach without policies that simultaneously advanced these goals.

Since the Roosevelt Project originally launched to address these questions, the world has faced far-reaching shocks that have reshaped policy priorities. The COVID-19 pandemic and the Russian invasion of Ukraine have exposed vulnerabilities in supply chains and heightened geopolitical tensions. China's dominance in key areas of the global economy, underpinned by extensive state support and problematic trade practices, exacerbates concerns about the competitiveness of U.S. manufacturing and the need to secure reliable supplies of critical materials and components. Recent political priorities in the U.S. have increased barriers to international trade, precipitated shifts in international alliances, and injected significant policy uncertainty into energy transition investments.

Taken together, these developments have reinforced the importance of U.S. business leadership in sustaining industrial competitiveness, diversifying supply chains, and ensuring affordable and reliable access to clean energy. Recent years have seen a growing role for government intervention in the economy, including a surge in industrial policies to support strategically important sectors. In the process, decades of liberalized trade and international business integration have given way to a more fragmented and contested global economy. The recommendations emerging from the Roosevelt Project reflected this evolving context, emphasizing the need for policies that link decarbonization to energy security, resilience, industrial strength, and social equity and workforce needs.

Below are brief summaries of and recommendations from each sectoral study finalized during the third phase of the Roosevelt Project.

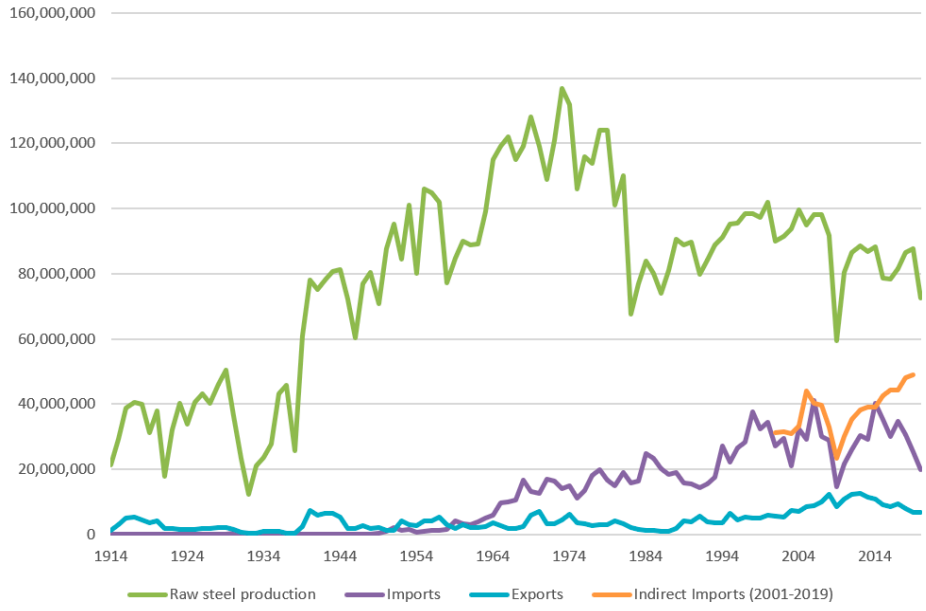
2. Steel Modernization and Competitiveness

America's Advantage in Clean Steel

Steel has long been central to U.S. economic strength and national security. It underpins manufacturing supply chains, defense procurement, and critical infrastructure. However, domestic production peaked a half century ago (see Figure 1).

At the same time, steelmaking is one of the most carbon-intensive industries worldwide. The United States enjoys a comparative advantage: its steel is already among the cleanest globally, due to decades of investment in electric arc furnaces, a gradually decarbonizing electricity supply, and more efficient processes. On average, American steel emits less than half the carbon dioxide per ton of production compared to the global average. This advantage, however, is not guaranteed. As China and other competitors accelerate deployment of advanced steel technologies—including hydrogen-based direct reduced iron and carbon capture for blast furnaces—the U.S. risks losing its lead unless it invests in modernization now. Maintaining competitiveness will require policies that align industrial strategy, workforce development, and national security objectives.

Figure 1: U.S. raw steel production, imports, and exports since 1914.



Source: World Steel in Figures, 2023.

Tariffs as a Modernization Tool

One tool is already in place. Section 232 tariffs, justified on national security grounds in 2018 and continued by both the Biden and second Trump administrations, have curbed unfair imports and reduced the carbon intensity of U.S. steel consumption by shifting demand toward cleaner domestic production. Revenues from these tariffs—roughly $1.5–$2.5 billion annually—could provide a

reliable source of funding for modernization. Directing these funds toward deployment of next-generation technologies would allow U.S. producers to integrate hydrogen-based direct reduction, carbon capture, and electrolytic steelmaking into existing systems before such technologies become widespread overseas. Used in this way, tariffs would not merely protect the industry; they would strengthen it, positioning U.S. producers as the low-cost, first movers in the emerging global market for low-carbon steel.

An Office of Steel Modernization

Institutional support will also be critical. The creation of a new Office of Steel Modernization within the Department of Energy, advised by Commerce, Treasury, Labor, industry, and labor unions, would ensure strategic oversight of these investments. This office would direct tariff revenues toward projects with the highest impact on competitiveness and national resilience, while maintaining a level playing field between integrated producers and electric arc furnace operators. It would also coordinate with other agencies on infrastructure needs, from low-carbon power supply to carbon capture and storage pipelines. By establishing a durable institutional framework, the U.S. can avoid the boom-and-bust cycles that have historically plagued industrial policy in steel.

Securing Supply Chains and Energy and Workforce Needs

Modernization will also depend on secure inputs and energy access. The steel industry cannot decarbonize without abundant, affordable supplies of low-carbon electricity and prime scrap. Ensuring these inputs requires investment in transmission infrastructure, recycling systems, and regional energy planning. Supply chain resilience will be strengthened by prioritizing domestic sourcing of raw materials and intermediate products, reducing dependence on imports from potential strategic adversaries. As in other industrial sectors, workforce readiness will be critical: modernization should be paired with technical training and apprenticeships to build the labor pool needed to operate advanced processes and maintain competitiveness in global markets.

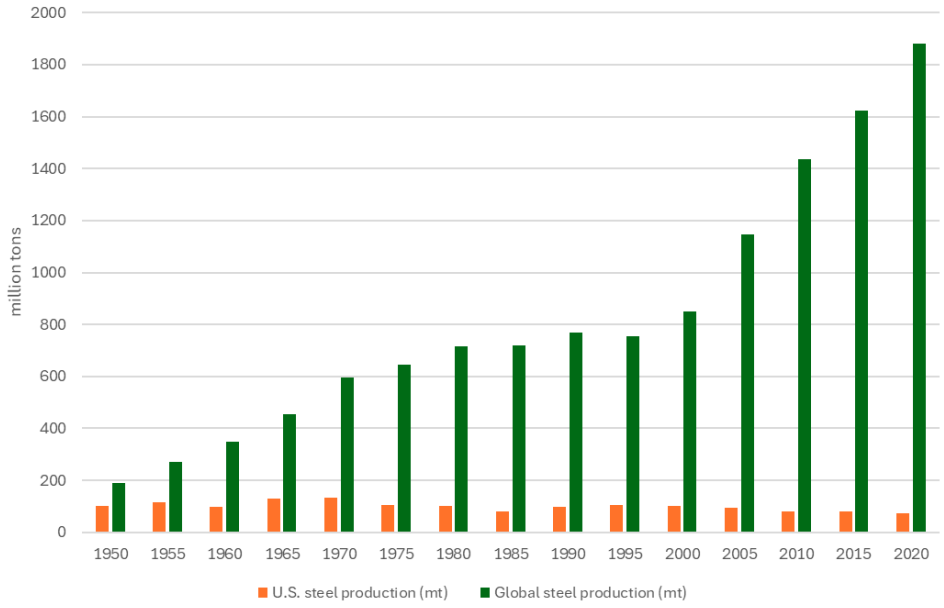
Communities as Partners in Modernization

Finally, modernization must engage the workers and communities most affected. Steel plants remain anchors of local economies, providing above-average wages and stable employment. Decarbonization investments offer opportunities to improve air quality and health outcomes in fence line communities, while also securing jobs for future generations. Companies should be required to involve labor unions and community representatives in the planning and implementation of modernization projects, ensuring accountability for outcomes. Community Benefit Agreements (CBAs) can codify commitments on job quality, training, and environmental performance, making modernization a shared project between industry and the people who rely on it. This approach not only strengthens community resilience but also builds the social license needed for transformative investments. In this way, the modernization of steel can advance industrial competitiveness, secure national security priorities, and deliver tangible benefits to American workers and communities alike.

What's at Stake

The stakes for U.S. steel are both economic and geopolitical. Without decisive modernization, the United States risks losing its comparative emissions advantage and ceding ground to foreign producers—especially China—that are rapidly deploying advanced technologies and capturing market share (see Figure 2). If that happens, American workers and communities will face further plant closures and job losses, and the nation will become increasingly dependent on imports for a material essential to defense and infrastructure. By contrast, if tariff revenues are harnessed strategically, if modernization is coordinated through an enabling institutional framework, and if workers and communities are engaged as partners, the United States can entrench its global leadership in low-carbon steel. In a volatile global trade environment, where tariffs and subsidies are reshaping supply chains, the cost of hesitation is high: failure to act now would leave the U.S. a technology taker rather than a technology maker. The moment to invest is limited, but the benefits it could deliver—industrial competitiveness, national security, and community stability—would endure for decades.

Figure 2: Steel production in the United States and worldwide since 1950 (in million metric tons).



Source: World Steel in Figures, 2023.

3. Enabling Grid Expansion and Reliability

Strengthening the Grid in an Uncertain Post-IRA Environment

The Inflation Reduction Act (IRA) and the Infrastructure Investment and Jobs Act (IIJA) represented the most ambitious federal push for clean energy in U.S. history. They catalyzed private and public investment in renewable generation, advanced manufacturing, and electrification. Yet today their future is uncertain. Key provisions of the IRA have been repealed or face attempted repeal, accelerated sunsets, and implementation freezes. Grant programs have been slowed or cancelled, guidance is being rewritten, and tax incentives once considered durable have been substantially curtailed. Of course, elements could reappear as the political environment shifts.

This uncertainty alters the playing field but not the stakes. When the IRA and IIJA were first modeled, most forecasts assumed flat or even declining electricity demand, with efficiency gains offsetting new loads. But with the explosive growth of AI, data centers, and electrification, demand is now projected to rise sharply for the first time in decades. This means transmission is not only needed to integrate clean energy—it is essential to keep pace with rapidly expanding demand. Every year lost to permitting delays deepens the risk of supply shortfalls, higher consumer costs, and widening inequities.

A National Vision That Communities Can Believe In

The federal government has never truly articulated a coherent national vision for transmission. In contrast, one state, Texas, could build a complex set of transmission lines, CREZ, in less than a decade to move a large amount of wind energy from West Texas to load centers (see Figure 3). Instead, regional projects emerge piecemeal, with benefits that are diffuse and costs that are local. This dynamic feeds opposition: communities are asked to bear the burdens of new lines without any guarantee that they will share in the benefits. In practice, this means that local politics can derail investments of national importance.

The remedy Is a national vision that situates transmission and values affordability, resilience, national security, and job creation. That vision must also confront today's political reality: with IRA incentives curtailed and skyrocketing demand, the case for transmission must be made in terms of reliability, cost control, and fairness. Communities need a clear narrative: why a line through their backyard matters, and how they will share in its rewards. Without that story, opposition fills the void, and projects stall.

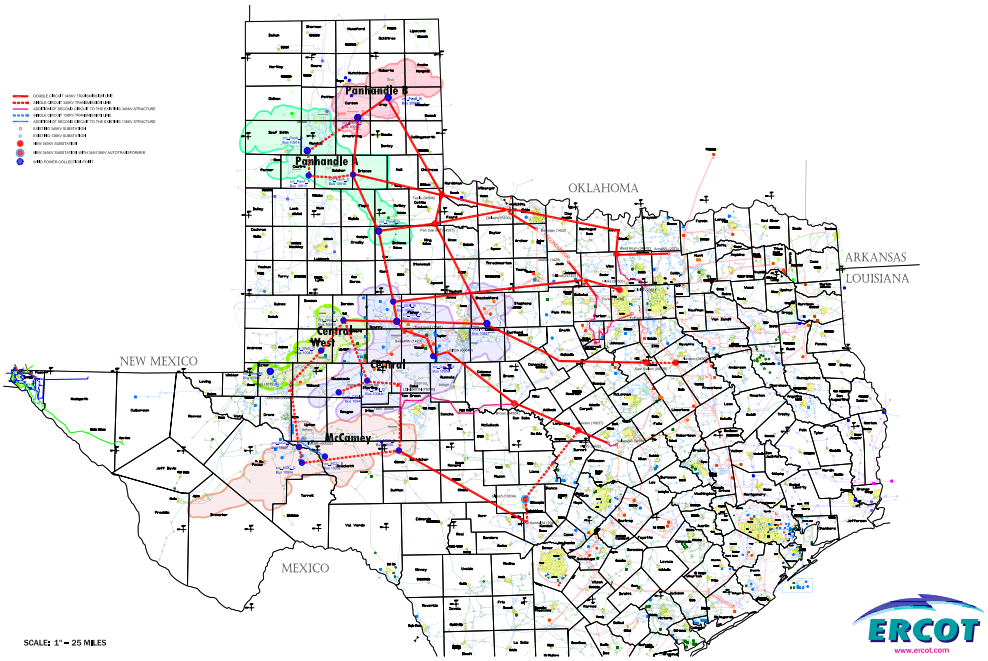
Planning and Permitting that Work

Permitting reform is often cast as a trade-off between speed and safeguards. But the truth is more complicated. Current processes are slow without being equitable. They duplicate reviews, fragment authority across states, and invite endless litigation, all while doing little to guarantee that burdens and benefits are distributed fairly.

Reform should aim to shorten timelines without cutting corners. That means mandating interregional planning so that benefits are accounted for across multiple states, not just within their borders. It means streamlining approvals while requiring meaningful equity reviews. And it means giving the federal government

clear backstop authority for strategically important projects, just as it exercises for natural gas pipelines. If the rules stay as they are, we will continue to measure progress in decades, not years—and the grid will remain a bottleneck.

Figure 3: Competitive Renewable Energy Zones Transmission Optimization Study.



Source: ERCOT, 2008.

Research That Solves Real Problems

The federal research enterprise has traditionally focused on technical feasibility—how to make transmission lines more efficient, how to integrate renewables at higher shares. But the obstacles today are not only technical. They are practical and political. Projects run aground because landowners object, states fight over costs and benefits, or communities see no upside.

The Department of Energy (DOE) and the national labs should shift their next phase of research toward deployment under uncertainty. That means studying co-location with highways and rail corridors, undergrounding in sensitive geographies, and the real-world costs of HVDC deployment. It also means analyzing models for community benefit agreements, so that states and utilities can point to proven frameworks rather than reinventing them line by line. In the wake of political reversals, research should serve governors, mayors, and county commissioners as much as engineers.

Communities as Partners, Not Obstacles

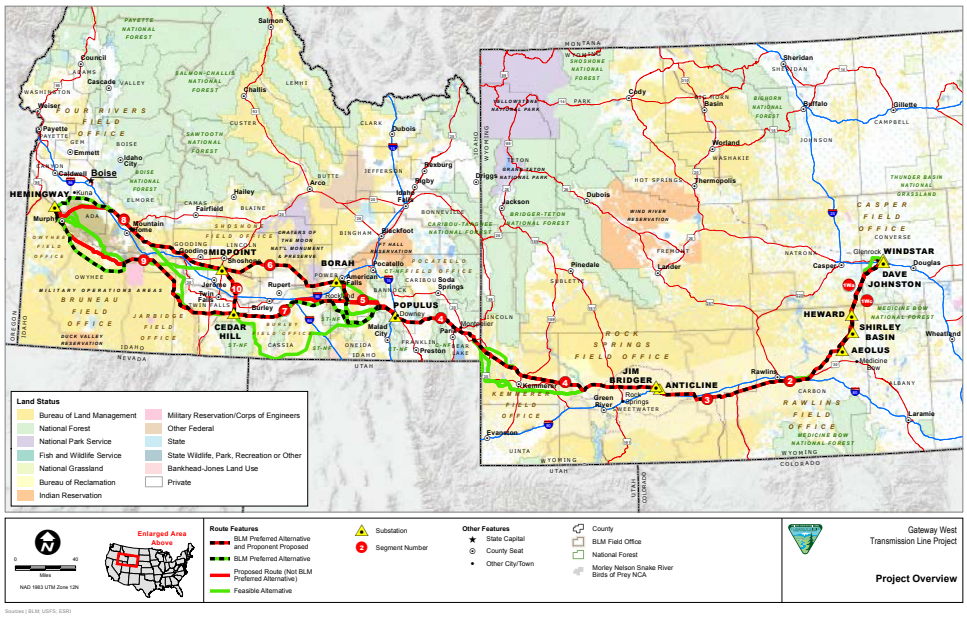
Transmission has become a flashpoint because communities feel imposed upon. The NECEC line in Maine was stopped by referendum. Grain Belt Express was delayed for years by landowner opposition and that delay had a compounding effect when a DOE loan commitment was withdrawn. The Gateway West transmission line serving several Western states (see Figure 4) faced wave after

wave of litigation and has been coming into operation in segments over many years. These are not isolated stories—they are the norm under current practices.

A different approach is possible. When communities are engaged early, transparently, and treated as partners, projects move faster. When they are offered real benefits—tax revenue, broadband access, workforce development—opposition softens. And when equity is built into the process—ensuring that rural, tribal, and low-income voices are heard, and that costs and benefits are fairly distributed—support becomes durable.

This is not about buying consent. It is about recognizing that communities bear real costs, and that fairness demands they also share in the rewards. Developers, regulators, and regional operators need to change their mindset: communities are problem-solvers, not roadblocks. Federal incentives, especially in a world where IRA support has been curtailed, should reinforce this approach, rewarding projects that build trust and deliver tangible local benefits.

Figure 4: Gateway West Transmission Line Project Project Overview.



Source: BLM/USFS/ESRI, 2012.

Incentives that Match the Challenge

One of the starkest omissions in the IRA was the absence of direct incentives for transmission. Renewable generation received production and investment tax credits. Transmission, by contrast, was left to fend for itself.

Congress should correct this imbalance—but now must do so in a political environment where tax credits themselves are under attack. That means considering alternatives: direct appropriations, bond financing, state-federal cost-sharing compacts, or incentives framed in terms of resilience and national security. Where tax credits are viable, they should reward not only high-impact projects but also those that demonstrate robust community engagement and equitable benefit-sharing.

Supply Chains and Workforce for the Long Haul

Even if permitting and politics were solved tomorrow, the United States would still face a bottleneck in equipment and workforce. Transformer shortages are already delaying projects. HVDC equipment is heavily imported. The workforce that designs, builds, and maintains the grid is aging.

Addressing these gaps requires investment in domestic manufacturing and in people. Congress should fund domestic production of key components and expand training through community colleges, apprenticeships, and universities. Special attention should go to communities most affected by the energy transition—coal regions, industrial towns, disadvantaged areas—so that grid modernization also means new opportunity. In a post-IRA environment, these programs may need to be shielded by bipartisan "resilience and jobs" framing to survive politically.

What's at Stake

The stakes are clear. If reforms stall and incentives collapse, clean energy investments will pile up behind transmission bottlenecks, consumer costs will rise, and reliability will decline. If reforms succeed—even in an uncertain post-IRA environment—transmission can become the backbone of a clean, affordable, and equitable energy system.

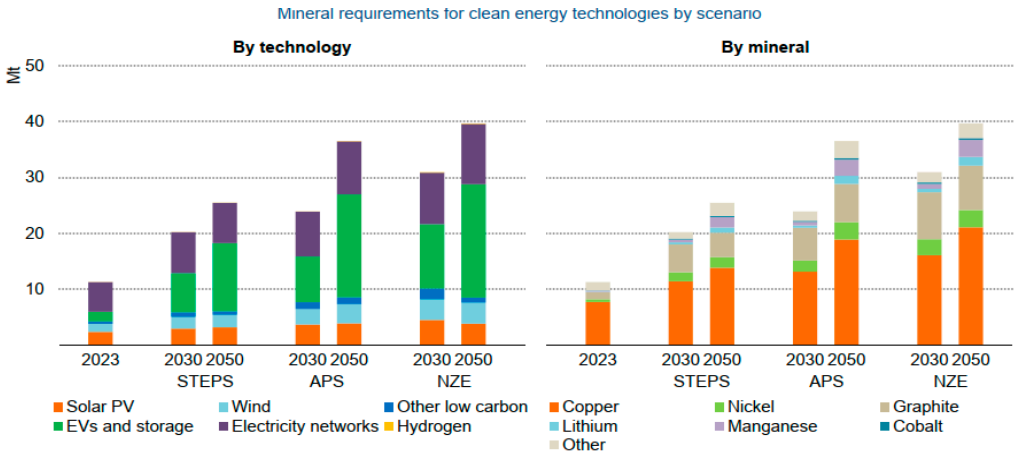
The difference between these futures is not technology. It is political commitment, institutional design, and public trust. Transmission is where the energy transition will be won or lost. We can continue with business as usual—measuring delays in decades, fighting over siting project by project—or we can recognize that this is a national challenge that demands a national solution. The IRA and IIJA provided tools, but the roller-coaster of U.S. energy policy has eliminated some and dulled others. But the need for a stronger, fairer, and faster grid endures.

4. Critical Minerals Security and Permitting Reform

The Strategic Importance of Critical Minerals

The global energy transition has heightened the strategic importance of critical minerals such as lithium, cobalt, nickel, copper, and rare earth elements (see Figure 5). These inputs are indispensable for manufacturing electric vehicles, batteries, renewable power technologies, and advanced defense systems. Yet today, U.S. supply chains rely heavily on imports from politically unstable countries or potential adversaries (see Figure 6). This dependence poses risks to national security, industrial competitiveness, and energy reliability. Diversifying and strengthening domestic supply chains for critical minerals is therefore an urgent priority. Achieving this goal requires a combination of streamlined permitting, investment in processing and recycling, robust community engagement, and strengthened partnerships with allies.

Figure 5: Mineral demand for clean energy technologies doubles or nearly triples between today and 2030 under projected climate scenarios.



Source: IEA, 2024.

Fixing the Permitting Bottleneck

Permitting reform is the most immediate challenge. In the United States, it typically takes seven to ten years to permit a new mine, compared to roughly two years in Canada and Australia. This delay not only discourages investment but also encourages larger, riskier projects that can provoke stronger opposition. Reform should focus on shortening timelines without sacrificing environmental safeguards or public engagement. Agencies must be held accountable to review deadlines, duplicative processes eliminated, and interagency coordination improved. Frameworks such as FAST-41, which impose transparency and enforceable schedules, should be expanded to cover more strategic mineral projects. By bringing U.S. permitting closer to international benchmarks, policymakers can unlock domestic resources while maintaining high standards.

Building Trust Through Community Agreements

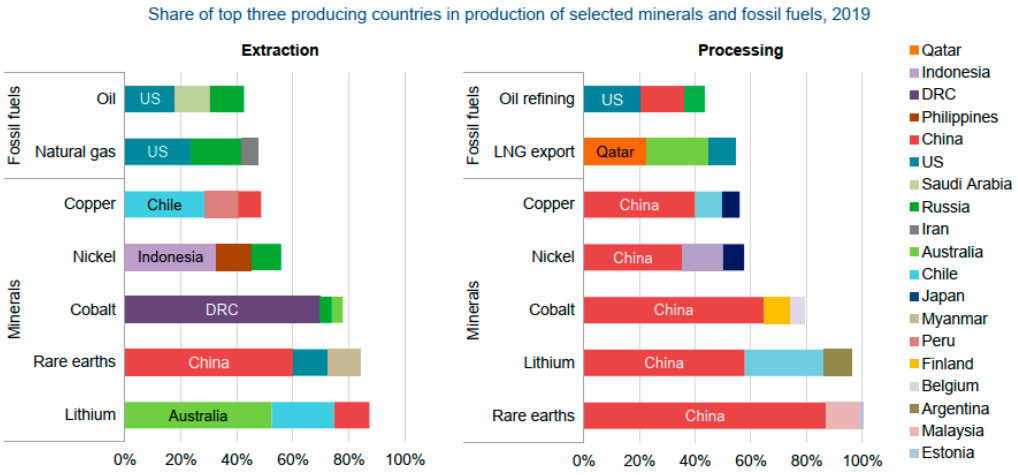
Community engagement must also be central to any reform. Mining projects often face strong resistance from local and tribal communities, particularly where

cultural traditions and livelihoods are at stake. Legally binding Community Benefit Agreements (CBAs) provide a mechanism to secure durable support by guaranteeing local hiring, infrastructure investment, and environmental protections. Successful models, such as Good Neighbor Agreements in Montana, show that binding commitments can reduce litigation, build trust, and align mining operations with community priorities. Making CBAs standard for federally supported or federally permitted projects would not only strengthen social license but also improve the predictability of project development.

Domestic Processing and Recycling Capacity

Domestic capacity for processing and recycling is another critical piece of the puzzle. The United States currently exports much of its raw material for refining abroad, leaving its supply chains vulnerable to geopolitical shocks. Developing U.S.-based refining, separation, and recycling facilities would reduce reliance on foreign suppliers and create high-quality jobs in resource-rich regions. Public–private partnerships can help overcome the significant capital costs associated with these facilities, while also ensuring that emerging technologies in recycling and low-impact processing are brought to scale. Recent proposals in Congress to expand tax incentives for recycling of battery materials and to fund pilot refining facilities indicate growing bipartisan recognition of the issue, though implementation remains uncertain. Success should be a national and energy security imperative.

Figure 6: Current production of numerous minerals critical for the energy transition is more geographically concentrated than that of oil or natural gas.



Source: IEA, 2022.

Allied Partnerships for Diversified Supply

Finally, diversification of supply must extend beyond U.S. borders. No amount of domestic development will fully insulate supply chains from global dynamics. Long-term agreements with trusted allies—such as Canada, Australia, and European partners—are essential for stabilizing prices, sharing and implementing best practices, and ensuring responsible sourcing. These partnerships should also focus on the deployment of advanced mining technologies and the establishment

of shared standards for environmental and labor performance. By embedding critical mineral supply chains in a network of allied nations, the U.S. can both reduce exposure to adversarial suppliers and reinforce its geopolitical alliances.

Border Adjustments to Level the Playing Field

Another promising tool to strengthen mineral security is the introduction of a border adjustment mechanism tied to the environmental and social performance of imports. Such a policy would apply fees or tariffs to critical minerals and processed materials entering the U.S. market if they are produced with higher carbon intensity or weaker labor and environmental safeguards than domestic or allied production. A border adjustment would serve two goals: it would protect domestic producers and processors from unfair competition, and also create incentives for global suppliers to raise their standards. Like the tariffs discussed in the section on iron and steel decarbonization, such a mechanism would yield revenues which could then be channeled into modernization of U.S. mining and processing facilities, investment in recycling, and support for communities and tribes most affected by new projects.

Securing Economic and National Resilience

Taken together, these strategies form a comprehensive approach to critical mineral security. By accelerating permitting, institutionalizing community benefits, investing in domestic processing and recycling, deepening cooperation with allies, and imposing a border adjustment on imports of critical minerals and processed materials, the United States can secure the resource inputs necessary for both the energy transition and national defense. In the current political environment, framing such an instrument in terms of national security, supply chain resilience, and fair competition may make it more viable than climate-driven justifications alone. Without reliable access to critical minerals, supply chain disruptions could stall industrial production, increase costs for consumers, and weaken U.S. global competitiveness. With targeted reforms, however, the U.S. can turn mineral security into a source of economic strength and geopolitical resilience, while recognizing that success will take a sustained effort over many years.

What's at Stake

As in the other two sectors discussed in this synthesis, the stakes in securing critical minerals are significant. Current supply chains leave the United States exposed to geopolitical leverage by adversarial suppliers, vulnerable to natural events and price spikes, and dependent on unstable regions for materials vital to defense and manufacturing. Permitting delays and weak domestic processing capacity compound this vulnerability, slowing projects and forcing reliance on imports. If reforms stall, the U.S. will remain a bystander in a scramble dominated by global competitors, undermining its ability to deliver affordable energy, safeguard national security, and sustain manufacturing jobs. Conversely, streamlined permitting, binding community and tribal agreements, and investment in processing and recycling would allow the U.S. to anchor supply chains at home and with trusted allies, turning resource dependence into strategic strength. At a time when global competition for minerals is intensifying and political divisions in Washington create uncertainty for the long-term policy outlook, the choice is clear: act decisively now to secure supply chains, or face growing exposure to forces beyond America's control.

5. Outlook

The third phase of the Roosevelt Project has highlighted that the challenges of decarbonization are not confined to any single sector. Whether in the electric grid, in the steel sector, or in critical minerals, the obstacles of permitting delays, global competition, and fragile supply chains emerge as recurrent concerns. So do the lessons. Across all three case studies, the need for a coherent national vision, streamlined regulatory processes, meaningful community engagement, and strategic investment in technology and workforce capacity were identified as shared priorities.

The studies showed that decarbonization cannot succeed without a durable, bipartisan policy framework. A unified national strategy—one that treats infrastructure expansion, industrial modernization, and resource security as pillars of competitiveness and national security—is indispensable. In each sector, reforming permitting stood out as a bottleneck that must be addressed: without faster, more predictable review processes, investments in clean generation, advanced steelmaking, or new mining and processing capacity will remain stalled. At the same time, early and sustained engagement with workers and communities is essential to securing durable support and distributing the benefits of transition fairly.

Such a framework is needed for a return to the time when energy policy did not suffer the dramatic swings that regularly characterize the political environment. Such stability is admittedly harder to achieve in a period of transition. However, all three Roosevelt Project phase-three case studies highlight that policy certainty is essential for timely progress.

Financing and institutional design also matter. Revenue streams such as steel tariffs, federal infrastructure programs, and public–private partnerships offer opportunities to mobilize sustained investment if deployed strategically. New or restructured institutions—whether an Office of Steel Modernization, interagency permitting councils, or national commissions—can provide the leadership and coordination needed to keep efforts on track. Finally, all three sectors underscore the urgency of strengthening U.S. supply chains, both by investing at home and by building durable partnerships with trusted allies.

Across all three sectors, the stakes are clear. If policymakers fail to act, bottlenecks will persist, global competitors will outpace U.S. industries, and communities will face greater inequities, potentially exacerbating the wealth distribution gap and sense of political disenfranchisement that have contributed to growing polarization in U.S. politics. If they succeed, however, the energy transition can become a driver of renewed competitiveness, energy security, and shared prosperity. In a moment of geopolitical tension and domestic uncertainty, the Roosevelt Project's findings point to a simple but powerful truth: the future of the U.S. energy transition will depend less on technological possibility than on political commitment, institutional design, and social equity.

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