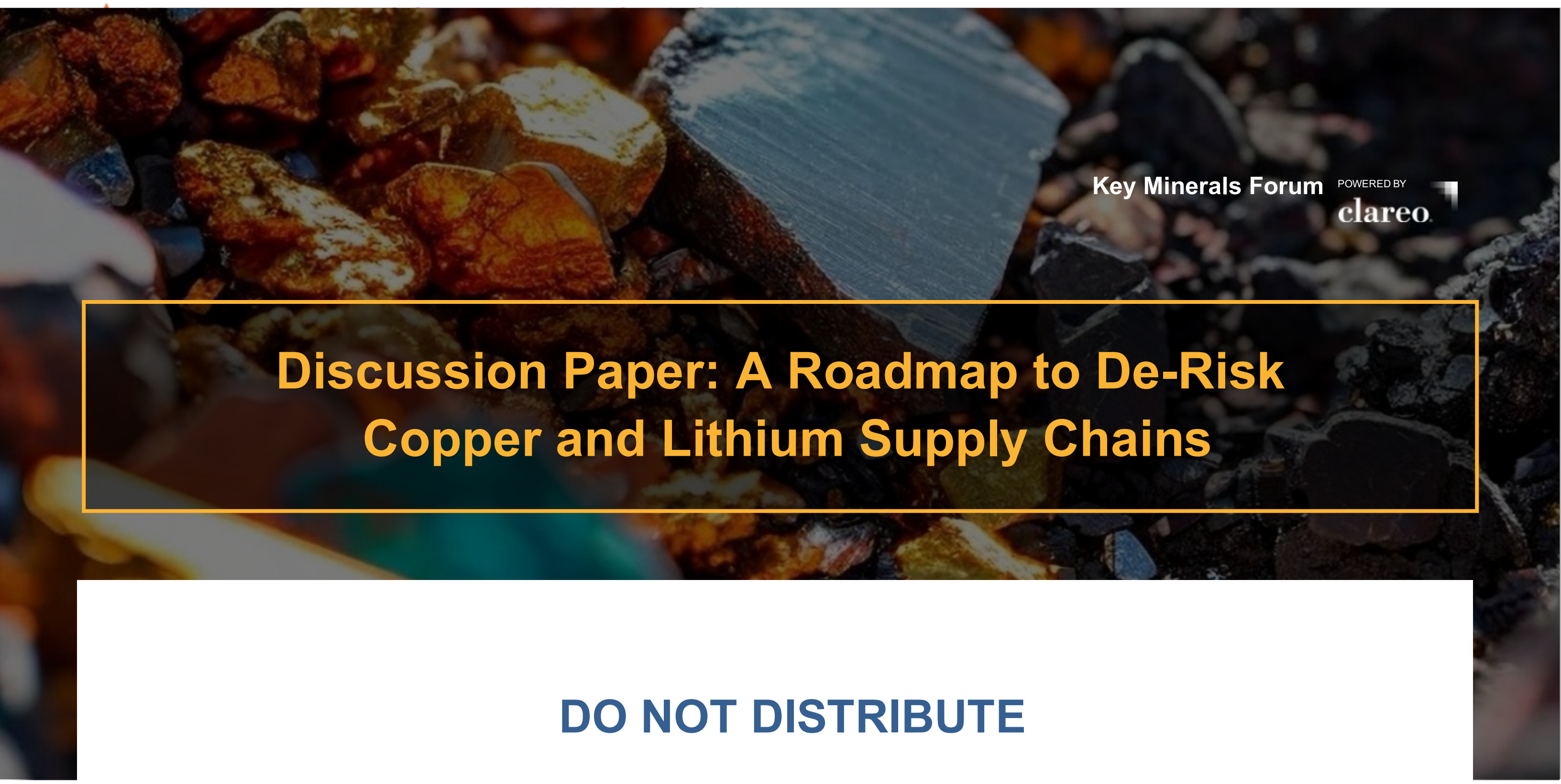

Key Minerals Forum POWERED BY clareo

Discussion Paper: A Roadmap to De-Risk Copper and Lithium Supply Chains

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Introduction

Context

This document was prepared by the Key Minerals Forum (KMF) at the request of United States (US) Senate and House Committee and caucus staff, as a key first step towards understanding how to secure minerals supply chains, as recommended in the KMF Business Blueprint, released in October 2024. The roadmap outlines how to:

1. Derisk the copper and lithium supply chains for both extraction and processing; and
2. Develop an approach for the US Government (USG) where the US can compete against China

The United States remains significantly exposed in global copper and lithium supply chains at precisely the moment these minerals are becoming more essential—and more contested—than ever. China currently has a supply chain choke point for many minerals that, if leveraged, can cause major disruptions. Prominent examples of these choke points include nickel (dominating extraction via Indonesia, cratering the price of the metal with oversupply), lithium (dominating processing, and thereby controlling the price), and rare earth elements (REEs) (dominating both extraction and processing, outright banning export of the minerals). US vulnerability in lithium is defined by acute concentration in China, which dominates over 70% of global midstream processing—creating a chokepoint in an otherwise geologically diverse market. In copper, the issue is different: while China still refines around half of global supply, the deeper risk is a structural global shortage, as too few new projects are coming online to meet surging demand.

To date, fragmented approaches, underpowered or ineffective tools, and insufficient collaboration with mineral-rich nations have hampered USG attempts to address critical minerals supply risks. Meanwhile, the People's Republic of China (PRC) continues to exert market control across midstream and downstream segments, locking in advantage through pricing levers, long-term infrastructure investment, and tightly coordinated diplomacy (i.e., Belt and Road Initiative (BRI) activity, as well as non-BRI diplomatic investment). In this context, "America First" approaches risk undermining "derisking" efforts by alienating countries whose cooperation is essential to long-term supply security and diversification.

This paper aims to inform and support Congressional staff, the Executive Branch, and allied stakeholders and countries (e.g. the Quad and the G7) as they explore a more competitive and collaborative US approach to derisking these commodities (and, eventually, others). The roadmaps build on a series of closed-door interviews with mining company executives, private investors, and officials from copper- and lithium-rich nations. These conversations focused on identifying risks in the copper and lithium value chains and the unique opportunity for the US to reframe its engagement. It is clear that in the future, the US must act with a collaborative approach (vis-a-vis both minerals-rich jurisdictions *and* foreign-owned mining companies from allied countries) when crafting its critical minerals policy.

Resource-rich nations have expressed desire to partner with the US if it brings long-term commitment, transparent capital, and a shared vision for developmental enablement beyond simply bringing a mine online. The US must improve its investment and engagement policies with this in mind. The US is currently framed as a transactional access-seeker. However, it may become a long-term partner in collaborative, mutually beneficial development that meets the respective goals of the US, mineral-rich countries (or those with important mineral processing/refining sectors), and the mining sector.

This is the first in a series of Discussion Papers that KMF will develop for specific minerals. Copper and lithium were chosen as the first minerals to analyze because they are:

1) Central to essential supply chains (defense, energy, transportation, manufacturing, etc.)
2) Very difficult to substitute with other minerals
3) Vulnerable to either
    a. Manipulation (lithium's concentration of processing and low-price / oversupply environment deterring Western extraction and processing), or
    b. Supply shortages (copper's forecast supply deficit of up to 10 million tons by 2035; that's a roughly 20% shortfall against expected demand)[1]

Who Was Consulted and Key Insights

This paper is based on interviews with the CEOs, External Affairs leads, and Chief Commercial Officers of the mining companies that dominate the copper and lithium industries; ministerial-level ambassadors from the five countries that dominate each mineral; investors; and law and policy experts. These interviews were supplemental to ongoing conversations with the full Key Minerals Forum ecosystem (information on which can be provided at request).

Miners, investors, and foreign governments consistently pointed to a need for:

- Adaptable and different types and levels of support from the USG, dependent on the company (and mineral) archetype; one size does NOT fit all
- Visible, coordinated, and respectful international engagement from the US at a company and country level to derisk projects and bring them online more quickly
- Predictable price and long-term capital support mechanisms to level the playing field
- Infrastructure enablement and quicker permitting timelines to derisk projects and bring them online in a timelier manner
- Community engagement to derisk projects and bring them online more quickly and standards support to level the playing field

[1] S&P

- Downstream value capture
- Not having to pick sides between the US and China; China isn't going anywhere

Miners, investors, and foreign governments also provided critical input on US copper and lithium strategy. The paper unpacks the context behind quotes like these from key stakeholders:

- *"Why should I take time out of my day to discuss USG involvement, though? USG conversations are always just that: talk. Nothing ever materializes." – an African Ministry of Mines*
- *"There's a Brazilian saying… A dog with two owners… dies of hunger." – In reference to lack of USG coordination on minerals*
- *"Where governments can unlock and enable multi-user infrastructure, that creates a massive multiplier effect and builds a lot of goodwill." – Miner*
- *"We prefer to cooperate with the US than with the CCP…but Chinese enterprises are more aggressive to make business inside the country. There are very few American enterprises trying to do the same, which leaves space [for the CCP]." – Ministry of Mines*
- *"What would make the US a more attractive long-term partner for resource development? Only interest - this is all we need." – Ministry of Mines*
- *"Don't ask us to choose—show us why the US is the better partner." – Ministry of Mines*
- *"DFC has unlocked a lot of these investments… Absent that, these projects wouldn't have been developed. But more often than not the US comes in too late—needs to come in earlier and support in the risky times." – Investor*
- *"We [Western miners and processors] incur higher costs, and we have higher costs of capital. There needs to be some sort of support to make us competitive, because the model is that it's a western-world, capitals system. Shareholders require returns." – Miner*[2]
- *"The West has a responsibility to ensure energy security… What [China] learned along the way is that the secondary benefit is dominance. We cannot afford to get this wrong—and the clock is ticking." – Miner*

Their insights and inputs have directly shaped the roadmap and recommendations outlined in this report. For a detailed discussion of these insights and testimonies, see Appendix (Insights from the Field: What We Heard).

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[2] Neal Froneman, CEO of Sibanye-Stillwater via Financial Times

Finally, before the US can definitively strategize on derisking copper and lithium supply chains, it must first define what a manageable level of supply chain risk is. Again, one size does not fit all with respect to an acceptable level of risk for different minerals—each mineral poses a unique set of supply chain challenges based on geological abundance, China's share of processing, etc. Each mineral's supply chain must be examined accordingly before effective strategies may be set.

Executive Summary

The US is not doing nearly enough to secure critical mineral supply chains. There is high-level discussion and a plethora of reports and recommendations, but no effort to pragmatically address this by listening to the key companies and countries that dominate these minerals to identify a plan of action. One official at an African Ministry of Mines questioned USG efforts as entirely "talk" without action:

"Why should I take time out of my day to discuss USG involvement, though? USG conversations are always just that: talk. Nothing ever materializes." – an African Ministry of Mines

Unlike prior efforts, this paper builds on discussions with exactly those key companies and countries to provide a clear, actionable framework to reduce strategic vulnerability in copper and lithium—two minerals foundational to modern energy, defense, and industrial systems. In lithium, China's dominance of midstream processing has created an immediate chokepoint, enabling price suppression and deterring Western investment. In copper, a looming shortfall is driven by insufficient new projects, lengthy permitting timelines, and fragile above-ground conditions (community and indigenous relationships, surface disturbance, water, environmental challenges, and so on).

We **interviewed** key government officials, mining executives, and investors—all of whom emphasized the need for the US to lead with trust, consistency, and long-term partnership. This paper includes a wide range of tools that were surfaced in interviews and policy review; not all are appropriate in every context. We recommend prioritizing interventions based on three criteria: (1) the nature of the supply chain risk (e.g., price volatility vs. infrastructure gaps; extraction vs processing), (2) the mineral and mining company archetype (e.g., high-volume copper vs. fragile midstream lithium), and (3) the degree to which the private sector can solve the problem unaided. The most promising tools are those that close viability gaps without distorting markets—especially in cases where Chinese industrial policy has permanently altered the investment landscape. The US must adopt tools that actively shape—not just respond to—mineral markets. **These tools and mechanisms are relevant depending on the class, or archetype, of mining company and mineral the US is aiming to support. This looks like:**

Finance and Market-Correcting Tools	**Contracts-for-Difference** (CfDs): Stakeholders noted the potential role of price stabilization tools like CfDs (preferably time-bound) in de-risking private investment during market downturns
	Strategic Reserves: Stockpile storable minerals to reduce volatility and support domestic players
	Production Tax Credits (PTCs): Offset structural cost disadvantages for US and allied processing
	Blended Capital Vehicles: Match Development Finance Corporation (DFC)/ Export-Import Bank (EXIM) financing with private capital to fund shovel-ready upstream and midstream projects
	Demand Guarantees: Milestone payments or offtake agreements[3] to reduce risk, unlock project finance
Standards, Trade, and Labeling	**Sectoral Agreements**: Align labor, trade, and other norms with allies to promote trusted trade flows
	Trusted Origin Labeling: Create system that recognizes responsibly sourced copper and lithium
	Phased Sourcing Mandates: Gradually increase required share of allied mineral sourcing for original equipment manufacturers (OEMs)
Diplomacy Approaches, Permitting Enablement, and Demand Coordination	**Embassy Envoys and "Air Cover"**: Deploy specialized envoys and interagency country-specific know-how to help US and allied countries' companies navigate host-country permitting, political dynamics
	Cross-Agency Embassy Teams: Embed Department of Energy (DOE), US Agency for International Development (USAID), and other experts within embassies to streamline support for priority mineral projects
	Low-Profile Wins: Expand permitting assistance, community engagement tools, embassy envoys, and technical deployment (through agencies like State and DOE) carry low political risk but high impact
	Foster Predictable Demand Signals: Facilitate more coordinated demand signals[4] across key downstream buyers—such as automakers and battery manufacturers—to give upstream suppliers clearer visibility into long-term needs and justify new supply chain investment

The 'Miner Archetypes' and 'Mineral Archetypes' are defined later in these pages as part of KMF's Mineral Resilience Framework. Across interviews, three tools consistently emerged as high-impact and broadly supported: strategic infrastructure investment, targeted permitting and community engagement support, and time-limited production tax credits for midstream processing.

[3] All mechanisms involving demand signaling or offtake should preserve full buyer autonomy and be structured to support—not distort—market behavior.

“Junior miners run out of money because the process is too long…Community challenges drive the long time frames.” – Ministry of Mines

Other mechanisms (such as powerful price support tools like CfDs are included here for consideration, too, but these three represent clear early candidates for USG deployment.

Copper- and Lithium-Specific Approaches

- **Copper:** Fast-track investment and approvals for large, long-lead projects in high-potential regions; expand global refining capacity outside China, including in the US, Latin America, Africa, and allied nations; lighten the burden of adversarial trade tactics by reducing tariffs on allied copper producers to preserve essential copper trade flows and enable greater midstream investment and integration
- **Lithium:** Stabilize pricing through CfDs, strategic reserves, or other mechanisms; accelerate buildout of Western conversion capacity, including lithium carbonate and hydroxide (used in electric vehicle [EV] and other high-density batteries)[5]; provide long-term offtake certainty to de-risk private investment
- **For both:** Establish sectoral agreements with key countries, including Chile, Australia, Canada, Peru, and other large producers (e.g., Zambia[6]) to align on targeted operational, trade, and investment norms

Getting this right signals leadership. The US has the tools to lead, but not yet the mindset, coordination, or directive. Bold, well-coordinated action in copper and lithium will unlock private capital, reinforce allied partnerships, and set a new precedent for global minerals engagement. The time to move is now—before chokepoints harden and supply risks deepen.

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[4] Coordination mechanisms should be voluntary and market-compatible—aimed at improving transparency of future demand, not distorting buyer autonomy (i.e., not *restricting* who OEMs can source minerals from) or pricing.

[5] Lithium hydroxide can be produced directly from spodumene ore or converted from brine-derived lithium carbonate.

[6] We cite Zambia as an example of a copper-producing nation worth investing in because, while the country has deep ties with geopolitical rivals, Zambia enjoys relative political stability, few investor-state disputes, and momentum in terms of macroeconomic stability –all of which reduce underlying supply chain risk. Zambia’s inclusion is not a call for immediate capital deployment but a suggestion for long-term risk management. Engaging early with countries like Zambia may help preempt deeper entrenchment by actors that don’t share US strategic or ESG values.

With greater coordination and a more deliberate posture, the US can help close critical investment gaps, support enabling infrastructure, and build enduring partnerships that benefit both American industry, US and allied countries' mining companies, and producing countries. That includes using price and capital instruments—like contracts-for-difference, production tax credits, and strategic reserves—to stabilize markets and de-risk investment. It includes embedding diplomatic and technical support early, through embassy envoys and programs like Minerals Security Partnership (MSP) within the State Department and others within DOE, Department of Defense (DOD), etc. And it means working with allies on common standards, sourcing expectations, and infrastructure development.

A. Towards a Mineral Resilience Framework

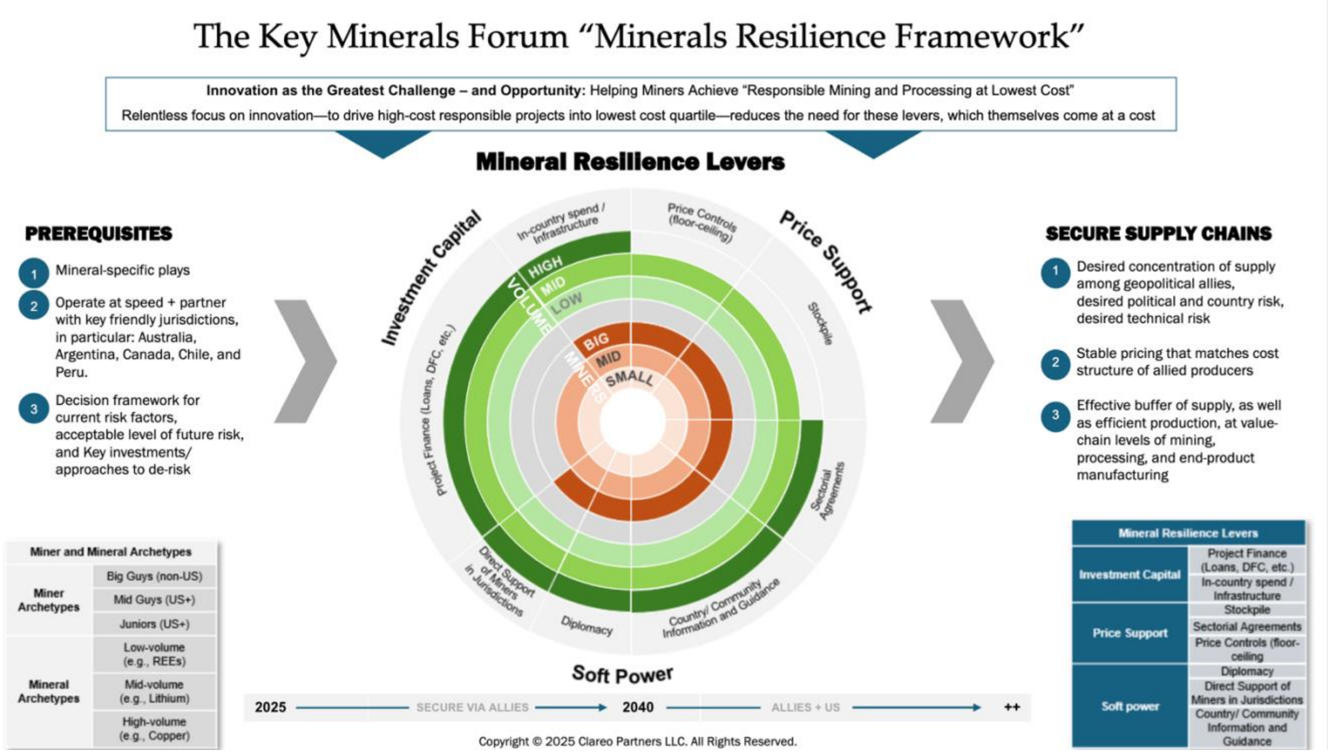
A major gap in US minerals policy—**a massive blind spot**—is the absence of a framework to define acceptable supply chain risk by commodity and stage. Not all vulnerabilities carry equal weight—upstream concentration in a high-risk country may be manageable for an abundant mineral, but dependence on a single country like China for refining creates far greater exposure. A model that sets risk-tolerance thresholds, accounts for strategic end-use dependencies, and reflects both partner-country needs and Western miners' realities would allow the US to focus interventions on managing real, risk-adjusted exposure rather than pursuing abstract decoupling.

To guide strategic decision-making across tools, minerals, and jurisdictions, the US needs a clearer framework for when and how to intervene in critical mineral supply chains. KMF's **Mineral Resilience Framework (MRF)** encapsulates these approaches. This framework reflects five realities:

- **Not all miners are created equal.** The majors are established multinationals with ample access to capital but significant risk to manage across assets all over the globe; others are capital-starved juniors, seeking investment to fuel risky, early-stage projects.
- **Some tools work across the board—others are mineral-specific.** Strategic reserves or price floors, for example, may be better suited to lithium than copper.
- **Different segments of the value chain carry different risks.** Upstream concentration may be tolerable if midstream is secure—but midstream or downstream bottlenecks (particularly those dominated by China) present more systemic risk.
- **The US will need to operate at speed, in partnership with allies.** Tools must be deployed flexibly, through public-private vehicles and coordinated diplomacy, in both domestic and international contexts.
- **Innovation is the key** to reduce reliance on these tools, which themselves come with costs to drive to lowest cost responsible extraction and processing.

Based on these realities, we've organized this into one **Mineral Resilience Framework.**

The KMF Mineral Resilience Framework



This framework can be used by US agencies to triage opportunities, determine which interventions are warranted for which minerals and miner archetypes, and allocate resources accordingly. For example:

- **Lithium:** small-volume, midstream-constrained, investment-fragile → benefits from targeted price support and demand visibility tools in down-market conditions. Focus on making processing outside of PRC either a rational economic choice or a palatable strategic investment
- **Copper:** high-volume, long-cycle, permitting-constrained → needs infrastructure, permitting alignment, country- and province-level commercial and operational intelligence to ensure projects come online faster all over the world; and trade tools to ensure that finished copper products can flow efficiently and affordably back to the US

Applying this framework into US minerals strategy would enable more targeted, effective policymaking—and ensure that tools are applied where they will have the greatest strategic return. For more detail, see the appendices.

A Roadmap to De-Risk Copper and Lithium Supply Chains

I. The US Must Act Differently to Compete

The global critical minerals market struggles to support major new and impactful projects. Market shaping activities by state actors distort the market and that can only be balanced with government action and support. **How does a market-based system compete with a government force that can afford to be unprofitable long enough to choke supply—and is decades ahead strategically? To win in that environment, mining and refining companies need tailored government support.** The US must stop waiting for markets to signal investment and instead shape those signals—deliberately and with urgency. That means aligning industrial tools, deploying diplomatic weight, and building economic models that reward risk-taking in the right places in partnership with allied mining companies and countries.

Driving the need for collaboration with allies, **the mining sector is dominated by non-US companies mining non-US mineral deposits**. For copper and lithium extraction, not considering Foreign Entities of Concern like Russia and China, key players include allies such as Canada, Australia, Chile, Peru, and the UK (where many mining companies are headquartered).

The US, in its collaborations with the Quad and the G7, has stated its intent collaborate with allies to derisk critical minerals supply chains. With the release of the Critical Minerals Action Plan, the G7 stated that it planned to build standards-based markets, mobilize capital and enable investments, and promote innovation. Additionally, the Quad promised to work toward securing and diversifying critical mineral supply chains in coordination with private sector partners, streamlining investments with the release of its Critical Minerals Initiative. While these strategies are well-meaning and effective in theory, they risk more of the same: high level, MOU-style “intentions”—all talk, no action.

Below, we propose detailed, actionable roadmaps for derisking copper and lithium supply chains, streamlined using approaches we think are priorities for delivering on levers in the MRF for each commodity. Beyond the tools included in the roadmaps, there are other options one can design for USG price support and capital investment in minerals projects. We detail these in the appendices.

The paper reflects an aggregation of insights from miners, governments, and investors. Not every tool here is appropriate in every situation. Instead, the paper outlines a menu of options—many of which are already used in other sectors—for policymakers to evaluate and adapt, guided by strategic need and context. Some tools—such as contracts-for-difference or strategic stockpiling—are already used in analogous markets like energy and defense. But they must be designed with tight fiscal guardrails, time-bound horizons, and clear ROI thresholds to avoid the pitfalls of permanent subsidy, misallocated resources, or market distortions.

The tools in the following roadmaps are not randomly assigned. Each commodity faces distinct structural barriers: copper is delayed by permitting and infrastructure; lithium is paralyzed by price volatility and midstream concentration. Accordingly, we propose targeted tools that match the root cause. In copper, the focus is on timelines, trust, and trade. In lithium, it's on stabilizing price expectations and unlocking midstream investment. These aren't one-size-fits-all tools—they're tailored interventions grounded in each market's vulnerabilities.

A. Roadmap for Copper

Copper is a long-cycle, capital-intensive commodity. Mines take 20-30 years to permit and develop. Supply is globally distributed but bottlenecked by midstream refining (50% in China). However, the main challenge in copper is simply bringing more copper mines online quickly, because of risks that derail projects (permitting hurdles, underinvestment in enabling infrastructure, community conflict, etc.).

Tool Category	Description	Strategic Rationale
Standards and Trade	**Sectoral Trade Agreements (by country):** Negotiate copper-focused agreements with Chile, Peru, Australia, and Canada to align on permitting, trade norms, environmental and labor standards, and mutual recognition of compliance systems (e.g., Copper Mark). See detail below.	Copper faces permitting and jurisdictional fragmentation more than price volatility. Trade agreements are a diplomatic tool to reduce project friction, accelerate timelines, and embed shared environmental and social standards—without distorting market pricing or imposing mandates. We need to urgently begin to bridge the supply gap posed by the looming copper famine.
Public-Private Finance	**Blended Capital Vehicles for Extraction:** Leverage DFC/EXIM and copper-focused private funds to finance high-trust projects at speed, particularly in permitting-stalled or infrastructure-poor jurisdictions.	Most copper investment is delayed not by price risk, but by political and project complexity. Blended capital enables faster capital deployment for strategic projects without overcommitting public funds or distorting investor signals.
Price and Capital Tools	**Production Tax Credits (PTCs) for Refining:** Offer per-ton tax credits for refined copper produced in the US or allied nations to offset cost disadvantages and stimulate non-China refining capacity.	Unlike lithium, copper prices are relatively stable. A floor price mechanism (like a CfD) would distort global markets. A targeted, per-unit incentive like a PTC addresses one clear weak point—midstream refining economics in Western and allied jurisdictions—without disrupting upstream dynamics or global trade flows.
Infrastructure and Partnership	**Minerals Infrastructure Facility:** Invest in shared infrastructure—e.g., rail, power, and water—in jurisdictions like Peru and Zambia, where stranded deposits face non-geological barriers.	Infrastructure gaps—not commodity price—are what stall high-potential copper deposits. Coordinated investment can unlock entire mining corridors, reduce time-to-market, and compete with BRI infrastructure offerings from China. Rail is the primary example, but others (energy, water, ports) are relevant, too.

Tool Category	Description	Strategic Rationale
Diplomatic Tools	**Embassy Envoys and USAID-style Corps:** Deploy sector-specific diplomatic and technical teams to support permitting, community engagement, and project de-risking from day one.	Copper projects often fail due to social license issues and fractured stakeholder engagement. This tool fills a key non-financial gap—building trust, smoothing political risk, and accelerating project timelines with minimal fiscal cost.

Detail: Sectoral Trade Agreements (by Country) as the Foundation

The US should work with key copper-producing governments—such as Chile, Peru, Australia, and Canada—to negotiate sectoral trade agreements[7] that align on norms around trade, operations, and other performance measures related to copper (and eventually lithium). These agreements would serve as the foundation for a "trusted corridor" of copper supply. Such agreements could include the following:

Permitting and Investment Streamlining: Coordinate permitting processes, local procurement rules, and cross-border investment standards to reduce complexity and transaction costs for copper projects.

Trade Norms and Reciprocity: Align on tariff structures, export policies, and access to domestic markets—minimizing friction for copper products that originate within the agreement zone.[8]

- Could include **mutual recognition of compliance standards**, allowing faster movement of copper concentrate, refined metal, and semi-finished goods.

Trusted Origin Certification: Jointly align around a "Trusted Copper" labeling or traceability framework (analogous to "Fair Trade" or "Organic"), building downstream confidence in ethical sourcing and opening access to OEM and government procurement markets. There are effective frameworks available today, such as Copper Mark.

Environmental and Social Performance: Establish a shared baseline for emissions, water use, community engagement, labor practices, and indigenous rights in copper production and processing. This allows companies to invest confidently across jurisdictions, avoids a "race to the bottom" among participating jurisdictions, and helps consumers trace responsibly sourced material.

R&D and Infrastructure Coordination: Include provisions for joint investment in refining technologies, carbon-efficient infrastructure, and workforce development programs—particularly in midstream processing, where scale and cost have favored Chinese actors.

While discussed in the lithium roadmap below, the following tools were deliberately excluded from the copper roadmap for strategic reasons:

[7] A Sectoral Trade Agreement is a type of narrow free trade agreement among major producing countries covering a specific sector to enhance trade liberalization and cooperation.

[8] These trade norms should not affect downstream buyer autonomy or restrict procurement flexibility.

- **Contracts-for-Difference (CfDs):** Copper markets are relatively deep and liquid. Most projects are *delayed*, not *deterred*. CfDs would distort global pricing (and potentially hinder miners' and commodity traders' ability to effectively hedge or capture upside) without solving copper's core bottlenecks: permitting, infrastructure, community risk.
  - **Strategic Reserves / Stockpiling:** Copper's physical properties (bulk, long shelf life) make it technically storable, but global copper inventories are already sizable. Stockpiling would have minimal effect on long-term supply security and carries high fiscal cost.
  - **Procurement Aggregation / Demand Guarantees:** Copper does not face the same OEM-centric bottlenecks as lithium. Demand is broad, diversified (construction, grid, motors), and relatively predictable. The problem is supply-side risk, not demand uncertainty.

B. Roadmap for Lithium

Lithium is geologically abundant but midstream-fragile. China dominates refining and conversion, which has allowed for deliberate over supply that resulted in low prices and is deterring investment despite strong demand. Western economics are broken: high Capex, volatile prices. New supply—whether mines or Western processing operations—won't emerge without price certainty and flexible off-take guarantees that do not tie up too much upside.

Tool Category	Description	Strategic Rationale
Price Tools	**Contracts-for-Difference (CfDs):** Some stakeholders proposed time-limited floor price guarantees to de-risk lithium refining investments. While complex, these tools could catalyze projects in down markets if designed with fiscal discipline and sunset provisions.	Lithium markets are highly volatile, deterring investment amid long-term demand. CfDs offer a way to mitigate price collapse risk and enable financial close, particularly in Western jurisdictions where cost structures are high and capital is risk averse.
Public-Private Finance	**Rapid Deployment via NEDC:** Use the National Energy Dominance Council to fast-track funding and permitting for conversion facilities in the US and allied countries. **USG-operated tolling facilities:** As a fallback, the USG could operate tolling plants in the event of persistent private market failure.	The primary barrier to new lithium processing capacity is not geological—but economic. These tools enable faster project delivery, especially for critical midstream assets, by coordinating permitting and funding across agencies. Tolling plants act as a strategic safety valve where market failures persist.
Demand Anchors	**Advance Market Commitments:** Secure public or OEM-backed offtake agreements for responsible, compliant lithium to unlock processing and mining investment. **Strategic Reserves:** Launch a reserve that purchases spodumene or lithium carbonate during downturns to buffer producers and dampen volatility.	Both tools send predictable demand signals into volatile markets, making long-term project financing viable. AMCs reduce offtake risk; reserves smooth price cycles. Together, they help derisk investment in upstream and midstream segments currently shaped by Chinese price suppression.

Tool Category	Description	Strategic Rationale
Infrastructure and Partnership	**Strategic Infrastructure Support:** Invest in brine resource infrastructure—evaporation ponds, US direct lithium extraction (DLE) technology, pipelines, and power—in Argentina, Bolivia, and Chile. Extend to spodumene processing in Australia and domestic capacity.	Lack of enabling infrastructure remains a bottleneck to new production in high-potential jurisdictions. US and allied infrastructure investment not only accelerates project timelines but also creates deeper bilateral ties and reduces the appeal of Chinese-backed capital.
Standards and Trade	**Phased Sourcing Mandates:** Incentivize OEMs to gradually increase lithium sourced from trusted jurisdictions, creating a forecastable demand path. **Trusted Origin Labeling:** Develop an ESG-aligned lithium standard to meet compliance requirements and build downstream buyer confidence.	Western producers face higher costs related to labor, permitting, and other responsible practices, but lack market recognition for these practices. These tools reward compliance, create commercial differentiation, and align industrial sourcing with national security and climate objectives—without requiring blanket bans or hard decoupling.

The following tools were deliberately excluded from the lithium roadmap for strategic reasons:

- **Production Tax Credits (PTCs) for Refining**: Lithium price volatility, not steady cost disadvantage, is the core barrier to Western refining investment. A fixed-per-ton credit would fail to address collapse risk in down markets and could over-subsidize during price spikes, making price-stabilizing tools like CfDs more effective.
- **Procurement Aggregation / Broad Demand Pooling**: Lithium demand is already concentrated in a small set of OEMs and battery manufacturers, which can provide targeted offtake support. Aggregating procurement more broadly would add little value and could introduce unnecessary market distortion compared to structured Advance Market Commitments.
- **Sectoral Trade Agreements (by Country)**: Unlike copper, lithium's primary choke point is midstream processing, not permitting, investment, or community conflict among producers. While trade coordination has benefits, it is less urgent for unlocking new supply than direct investment, price-stabilizing mechanisms, and strategic infrastructure partnerships.

C. Shared Approaches: Cross-Cutting Tools for Both Copper & Lithium

Some tools will have broad application across copper and lithium—and should be designed for scalability.

Tool	Description	Applicability Across Copper & Lithium
Minerals Infrastructure Facility	A permanent vehicle (potentially within DOE, DFC, or EXIM) to co-invest in shared-use infrastructure—rail, power, water, ports—linked to critical minerals projects.	Both copper and lithium face above-ground constraints: remote deposits, limited power access, lack of shared infrastructure. This facility supports enabling systems that are too expensive or uncertain for private actors to build alone—unlocking uneconomic assets in both markets.
Embassy-Based Diplomatic Teams	Cross-agency minerals-focused envoys embedded in key embassies (e.g., Lima, Santiago, Lusaka, Canberra) to coordinate permitting, community engagement, and political strategy.	Both minerals face permitting and political risk, especially in Latin America and Africa. Dedicated teams can accelerate early engagement, improve project timelines, and signal US commitment—without needing Congressional appropriations or statutory change.
Trusted Origin Labeling	A government- or industry-backed system to certify ESG-compliant and geopolitically secure supply chains (e.g., Copper Mark, Lithium Mark equivalents).	Helps Western producers of both metals get credit for responsible practices. It also aligns with OEM compliance requirements and consumer trust goals in both battery and grid sectors.
Bipartisan National Security Messaging	Position mineral investments not as "green" or "industrial policy," but as essential to energy security, defense, and economic competitiveness.	Avoids politicization of funding mechanisms, builds bipartisan support, and makes tools like PTCs, embassy envoys, and infrastructure investment more durable politically.

Finally, the copper and lithium strategies need to have a singularly focused and dedicated director with full authority, responsibility, and accountability for the execution of this strategy. It cannot be a widely distributed leadership.

"There's a Brazilian saying… A dog with two owners… dies of hunger." – In reference to lack of USG coordination on minerals

See the appendices for detailed descriptions of tool kits for a) protecting against market-shaping in critical minerals, and b) de-risking projects and bringing more projects online sooner.

II. What's at Stake

Copper and lithium sit at the heart of modern industrial strategy. Copper enables electrification—from grid expansion to EV motors—while lithium powers the battery economy, which is much larger than just EVs. Global supply chains for both have inherent supply risks and are open to manipulation. Copper faces structural underinvestment in new supply to meet projected demand increases, both public and civil-society aversion to new mines, long permitting timelines, and geopolitical exposure in key jurisdictions. Lithium, while geographically widespread, is nearly monopolized by China in processing and pricing, with market signals broken and ex-PRC private investment retreating.

Without US intervention, allies will remain reliant on Chinese-controlled systems, and companies from allied countries (that dominate mining) will continue to lose ground to Chinese counterparts. Because demand for critical minerals is rising rapidly, even if the US and its allies ramp up deals and investments and grow Western minerals supply in absolute terms, China's share of global processing may remain flat or even grow. Worse yet, if we "*only*" maintain status quo, we continue to lose ground.

"The West has a responsibility to ensure energy security… What [China] learned along the way is that the secondary benefit is dominance. We cannot afford to get this wrong—and the clock is ticking." – Miner

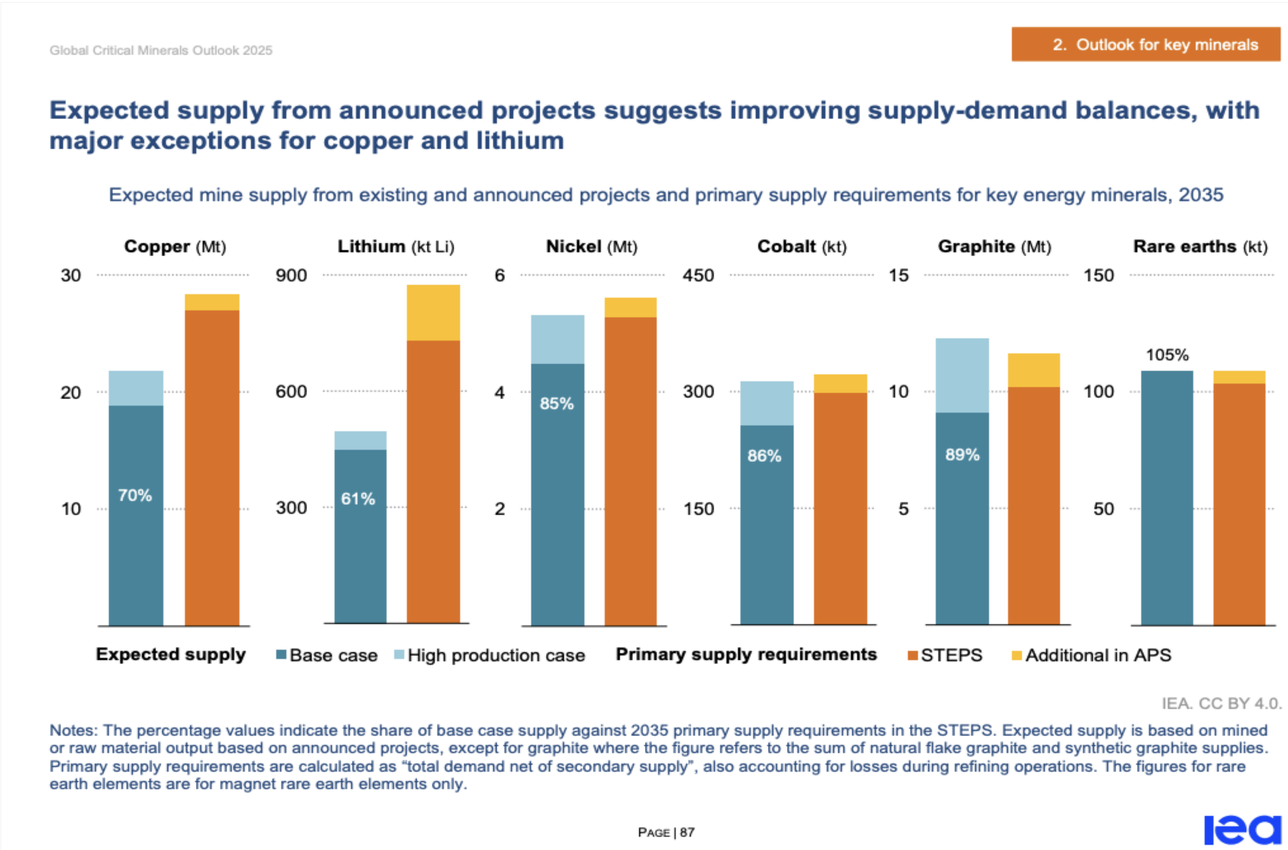


Figure: Projected Supply-Demand Gaps for Key Energy Minerals by 2035. Copper and lithium stand out as *the largest supply gaps* among energy minerals with projected supply falling well short of 2035 demand—highlighting the urgent need for targeted US strategy. Note: In this chart, the IEA lists lithium supply and demand in *lithium metal content*; it is more common to quantify lithium production and consumption in lithium carbonate equivalent (LCE), since that is the form that it is usually traded in. On an LCE basis, the lithium supply and demand values shown in this chart would be roughly 2,750 kt LCE and 4,750 kt LCE, respectively. Source: [IEA](IEA).

Copper is mined globally, yet more than half of its concentrate is refined in China.[9] The US depends on imports for nearly half of its refined copper production (with more than half of all non-US refined copper coming from China, Russia, or Iran).[10] Long permitting timelines threaten new capacity even where resources exist. Political risk in key jurisdictions—including Peru, Bolivia, the Democratic Republic of Congo, and other parts of sub-Saharan Africa—adds further fragility to supply. There is also a dangerous complacency regarding copper in the US, which includes narratives such as "we can solve the problem if we just recycle more", and the proposition of new domestic mines. **These do not fill the gap**: secondary production (recycling) is too small, and domestic mines will take far too long to develop.

Case Study: Cobre Panamá – A Lesson in Copper Supply Fragility

The Cobre Panamá mine, owned by Canadian First Quantum, debuted in 2019 as one of the world's largest copper operations, producing around 330,863 tons of copper in 2023, equivalent to roughly 1.5% of global copper supply.[11] However, a wave of mass protests over environmental concerns, union-led blockades, and a Supreme Court ruling that deemed its operating contract unconstitutional forced a full shutdown in November 2023.[12] The impacts rippled beyond Panama: the loss of this single project pushed a geopolitically important mine offline in less than five years, at a time when new copper capacity is already scarce and global demand is intensifying. Panama's GDP contracted sharply, and the country lost nearly 5% of national output tied to the mine, while global markets felt a tightening in copper availability.[13] The mine remains closed as of July 1st, 2025, despite a groundswell of efforts to reopen it.[14]

Cobre Panamá is not an outlier—it highlights systemic vulnerability across copper projects in jurisdictions vulnerable to social and political disruption. Its suspension illustrates how community conflict can instantly destabilize a project that underpins both local economies and global supply chains. Appropriate USG agencies—particularly State/embassies, USAID, and DOE—could have played a more active role collaborating with the mining company and the government in community relations, helping to establish transparent benefit-sharing frameworks, maintain environmental safeguards, and support dialogue with local groups. Early US diplomatic engagement and technical assistance might have helped build social license, aligning local benefits and reinforcing political stability—ultimately preventing the shutdown and preserving a vital source of copper.

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[9] IEA

[10] Copper Development Association

[11] Financial Times

[12] Reuters

[13] AP

[14] Mining.com

Lithium is geologically diverse and widely distributed. Large brine deposits span South America's Lithium Triangle (Argentina, Bolivia, Chile), while hard rock sources dominate in Australia. But lithium is also found in Canada, the US, parts of Africa, Europe, and China—often in forms and geologies suited to modern extraction techniques. Despite this diversity, nearly all lithium conversion to battery-grade chemicals occurs in China, which controls over 70% of global midstream processing—and 75% of value-added steps like lithium battery production (CATL a 35% share alone).[15] This chokepoint gives China the ability to suppress prices, steer supply chains, and deter private investment elsewhere.[16]

Chinese control over lithium processing gives it powerful leverage over global pricing. By flooding the market during periods of oversupply, China can drive down prices to levels that make it nearly impossible for Western or allied midstream projects to attract financing.[17] These price swings undermine the economics of new refining capacity outside China—especially in jurisdictions with higher environmental, labor, and permitting standards. The result is a vicious cycle: volatile prices discourage investment, leading to continued reliance on Chinese processing, which in turn reinforces China's market dominance.[18] These dynamics have led some stakeholders to call for time-limited price stabilization mechanisms to unlock Western investment—but such tools must be carefully scoped and cost-controlled.

Chinese price suppression isn't accidental—it's strategic. Because China maintains tight vertical integration across the battery supply chain, from lithium processing to cell and pack manufacturing, it can absorb temporary losses in upstream segments (lithium mining and processing) to protect and strengthen its dominance in downstream sectors (battery and EV manufacturing). By pushing lithium prices below break-even levels for Western processors, China both deters competition and ensures a steady flow of low-cost inputs for its battery industry. This integrated model allows China to prioritize long-term market control over short-term profitability—an advantage Western markets, with fragmented supply chains and investor-driven timelines, struggle to match.

> *"We [Western miners and processors] incur higher costs, and we have higher costs of capital. There needs to be some sort of support to make us competitive, because the model is that it's a western-world, capitals system. Shareholders require returns." – Miner*[19]

[15] Organization for Research on China and Asia

[16] Atlantic Council

[17] Trading Economics. China's market shaping was a primary driver of recent price swings from over $80,000 to in 2022 to current prices nearing $8,000.

[18] Atlantic Council

[19] Neal Froneman, CEO of Sibanye-Stillwater via Financial Times

US complacency regarding lithium stems from 1) the incorrect assumption that the US can rely on a broad and diverse set of domestic resources (most of which are non-economic at current prices), as well as 2) an industry cohort (OEMs) which is generally happy with lower market prices. Domestic lithium seeing real positive movement is limited to deep brines in the Smackover Formation, spanning an area between east Texas and southern Arkansas, as well as the Carolina-Tin belt (e.g., Kings Mountain) and some Nevada regions (e.g., Silver Peak).

Despite vastly different methods of production, market dynamics, and geography/geology, copper and lithium share these vulnerabilities:

Midstream bottlenecks	Both are heavily dependent on China for refining and processing—China controls over 50% of copper smelting and over 70% of lithium conversion. This creates a chokepoint regardless of upstream diversity.
Permitting and project delays	In both minerals, long and uncertain permitting timelines delay projects and undermine investor confidence. This is true in jurisdictions as diverse as the US, Australia, Peru, and Argentina.
Infrastructure constraints	Many high-potential deposits, especially in Latin America and Africa, lack adequate infrastructure (e.g., roads, power, water) for cost-effective development. This deters investment and adds time and complexity.
Community and social license risks	From Panama to Argentina and beyond, both commodities face growing local resistance, often due to water usage, land access, or perceived lack of shared economic benefit.
Need for blended finance to close the viability gap	Neither commodity is attracting adequate private capital into high-risk, high-impact parts of the supply chain without public support. This is especially true for refining and infrastructure.

A Massive Blind Spot: Defining Acceptable Risk

One of the biggest gaps in current US minerals policy is the absence of a clear mechanism to assess what level of supply chain risk is manageable—by commodity, and by stage (e.g., upstream vs. processing vs. manufacturing). Different minerals present different geopolitical exposures, and not all supply chain vulnerabilities are the same or carry equal consequences. For example, while upstream concentration in a high-risk country might be manageable for a geologically abundant mineral, overreliance on a single country—such as China—for midstream or processing creates outsized strategic risk.

As of now, the USG has no answer (or method to answer) questions like:

- How much Chinese share in refining is tolerable for lithium vs. copper?
- What political risk exposure is acceptable in upstream jurisdictions like DRC or Argentina?
- Which segments (e.g., concentrate production, refining and conversion, manufacturing) are essential to secure domestically or with close allies?

A more sophisticated model is needed—one that incorporates risk tolerance thresholds, strategic end-use dependencies, the different needs of the mineral rich countries and the western miners competing with China, and feasibility of ally-based sourcing. Such a framework would allow the US to prioritize interventions based not on abstract decoupling goals, but on real risk-adjusted supply chain exposure. It would also enable better resource allocation, sharper diplomacy, and clearer messaging to the private sector.

Currently, no one in the USG can deliver objectively and mathematically what a "secure" supply chain *actually is*. By commodity, the USG must understand the acceptable level of supply risk—whether from underdeveloped supply chains or geopolitical risks.

High-Level Friendshoring Playbook

1. Understand production now and into the future, overlayed with levels of Chinese (or other FEOC) control and at which part of the value chain
2. Determine what level of FEOC control and hence risk the USG is willing to accept
3. Chart the course to close the gap
   - Invest (dollars and diplomatic energy) in extraction where commodity exists
   - Invest (dollars and diplomatic energy) in processing where extraction occurs or mid-stream already exists
   - Invest dollars where the end market exists

Note: KMF has been requested to conduct commodity-level working sessions with key miners and members and their staffs to understand supply security requirements, challenges, and pathways to de-risking supply of key industrial minerals.

Lithium Example

Li

- Overall production expected to increase dramatically, but 90% of lithium processed in China
- USG can manage risks effectively if no more than, e.g., 67% is processed in China
- Facilitate investment in, e.g., Australian or Argentinian lithium mines and brines
- Building processing infrastructure in, e.g., Bolivia to strengthen its economy and build trust; or expand existing mid-stream activity in, e.g., Taiwan or Korea
- US, EU, and other ex-PRC/ex-FEOC EV and battery manufacturing hubs

Source: Clareo Analysis

This effort **informs every other building block** of an aligned, coherent, competitive USG minerals strategy—from **short-term reactions** to economic events to a **long-term approach** to geopolitical interactions. For example, had it known what a secure nickel supply required and had a "rapid response" mechanism, the USG may have acted differently during the 2023-24 shuttering of the Australian nickel sector.

Source: Key Minerals Forum *Business Blueprint*. October 2024. Available upon request.

The stakes demand precision—not just about what minerals are critical, but where and how they are most at risk. Some of the tools discussed—like contracts-for-difference, strategic reserves, or demand guarantees—come with real tradeoffs. They can be expensive, difficult to link to market movements that are also impacted by other factors and may lack natural exit ramps if not carefully designed. That's why it is critical for the USG to develop a more rigorous, analytical framework to assess where supply chain risk is truly intolerable—and where public intervention can deliver the greatest strategic return. This means asking: How much concentration is acceptable? Which chokepoints are most vulnerable to disruption? Where is private capital most constrained—and why? **Without such clarity, there is a real danger of overreach or underperformance. With it, the US can deploy finite resources with precision**—targeting tools only where they are needed most, and sunsetting them when market conditions allow.

III. Conclusion

The US faces a pivotal moment in shaping the future of critical minerals. Copper and lithium are at the center of a global shift toward electrification, renewable energy, battery storage, and strategic industrial resilience (as well as defense applications). Yet despite their importance, both supply chains remain vulnerable—defined by chokepoints in processing, underinvestment in infrastructure, and heavy exposure to geopolitical and market volatility.

This paper does not suggest that every tool be deployed simultaneously or indiscriminately. Rather, we believe the US needs to develop a more coordinated strategy that applies the right tools to the right bottlenecks, with urgency. That requires clarity about what problems we're trying to solve—and a willingness to use the playbook that China has already proven works: price support in key markets[20], public-private capital where risk is mispriced, and diplomatic cover where permitting and politics stall progress.

This paper has laid out a clear message: the challenge is not just one of access to resources, but of alignment—between public and private investment, between upstream producers and downstream users, and between US policy and the broader development goals of mineral-rich nations. In too many cases, US engagement has come late, moved slowly, or lacked the tools to compete with more coordinated global actors.

The necessary tools for the US to engage and eventually compete with global actors already exist. With improved coordination and a more intentional approach, the United States can assist with the closure of key investment gaps, can provide support for enabling infrastructure, and can forge lasting partnerships that benefit both American and international industry in resource-producing nations. The US may achieve this with the targeted use of price and capital tools—such as contracts-for-difference, production tax credits, and strategic reserves—where market shortcomings are clear and the solutions can be tailored to address them. The US should also embed diplomatic and technical engagement early, through embassy envoys and programs like the State Department's MSP, as well as initiatives within DOE, DOD, and other agencies. Additionally, the US should work in close collaboration with allies on shared standards, sourcing requirements, and infrastructure development.

The path forward must be framed as an exercise in collaboration. Countries have made clear they are looking for partners who bring long-term commitment, transparent capital, and a shared vision for development beyond the mine. US strategy must reflect that—not just through rhetoric, but through the structure of its investments and the nature of its engagement.

[20] China has already demonstrated how powerful market-shaping tools can be—not to stabilize markets, but to distort them in service of industrial dominance. The US must learn from this—not by copying China's intent, but by understanding the tools and deploying them transparently and strategically to restore viable investment conditions and rebalance the playing field.

Appendices

The Key Minerals Forum

The Key Minerals Forum (KMF) is an informal coalition formed by Clareo, a global strategy and innovation consulting firm focused on solving complex challenges in the mining and energy sectors, in March 2024 to address the minerals supply chain, deepen USG understanding of mining, and develop a competitive, comprehensive strategy on mining and minerals, internationally and domestically.

The KMF ecosystem is composed of a group of Congressional leaders across both parties, key Senate and House committees and caucuses, mining company leadership, key industry groups, and an expanding ecosystem of environmental group leaders, indigenous group leaders, think tank leaders, and current and former senior-level government executives in this space.

As an informal coalition, KMF does not advocate for the interests of specific firms or projects.

KMF is distinguished from its peers in that it is not “of the industry” (not a long-time mining lobbyist) but has extensive industry experience and has been asked to participate in numerous policy conversations across the minerals landscape. KMF has deep and high-level mining sector contacts and expertise.

IV. Insights from the Field: What We Heard

Throughout our conversations with miners, investors, and foreign governments, they each frequently expressed vital needs for:

- Differing types and levels of USG support depending on the mining company archetype; one type/level of support does not fit the needs of each miner
- US engagement and coordination at appropriate levels with companies and resource-producing countries
- Mechanisms to support long-term capital and ensure predictable price of resources
- Enablement of quicker permitting and necessary infrastructure
- Engagement with communities and support for industry standards

A. Country Perspectives

Across the board, governments urged a **shift away from transactional relationships** and rhetorical posturing and **toward mutually beneficial, long-term economic partnerships.** Country officials emphasized that successful mineral development is inseparable from broader development goals. A recurring theme was the desire for **infrastructure investment**, including railways, water storage, and power transmission, **which could serve multiple mining projects/companies, as well as non-mining sectors** (e.g., the railways and other infrastructure in the Lobito Corridor; see the appendices for a detailed case study of the USG investments in the Lobito Corridor).

"Where governments can unlock and enable multi-user infrastructure, that creates a massive multiplier effect and builds a lot of goodwill." – Miner

Desire for Downstream Value Capture

One of the strongest messages across jurisdictions was the desire for **downstream value capture**. Countries want more than royalties; they want refineries, tech transfer, job creation, and industrial linkages that outlast the life of the mine. For example, Chile is pursuing a clean lithium strategy that includes incentivizing value-added manufacturing (transitioning away from evaporation ponds). As an example, Albemarle's lithium production in Chile operates under a unique agreement with Chile's Production Development Corporation (CORFO) that mandates selling a minimum of 25% of its lithium carbonate equivalent (LCE) output at a preferential price to companies committed to developing value-added lithium products—such as cathode materials or battery components—within Chile.[21] In this case, the goal (tying resource extraction to downstream industrial development and broader economic diversification) is achieved with some **flexibility**. In the absence of these types of agreements, countries will be tempted to pursue more rigid pathways (i.e., banning the export of the mineral, requiring miners to build in-country processing plants) resulting in a greater advantage for China, who can better accommodate such rigid requests.

Preference for Visible, Coordinated, and Respectful International Engagement

Governments also signaled a preference for partners that offer **visible, coordinated, and respectful engagement**. US presence is welcomed—but too often it comes late, is spread thin, or lacks clarity of purpose. Compared to Western companies, Chinese companies have developed a deeper on-the-ground presence in mineral-rich jurisdictions (national and provincial)—not through formal diplomatic channels, but via persistent corporate outreach.

"We prefer to cooperate with the US than with the CCP…but Chinese enterprises are more aggressive to make business inside the country. There are very few American enterprises trying to do the same, which leaves space [for the CCP]." – Ministry of Mines

That is, Chinese embassies do not outperform US embassies in terms of engagement with ministries of mines, but Chinese mining firms frequently engage directly with ministry officials. By contrast, Western engagement often stops at the diplomatic level, with active involvement from the ambassadors of high-consumption economies (e.g., Australia, UK, Japan) but limited sustained engagement with corporate executives or international CEOs. This leaves a critical gap in perception and influence—one that the US could fill through more **direct, high-level corporate engagement** that signals strategic interest and long-term partnership. As one official put it:

> *"What would make the US a more attractive long-term partner for resource development? Only interest - this is all we need." – Ministry of Mines*

Officials **praised USAID for its unique operational expertise** in navigating complex jurisdictions, especially in Peru's Amazon region. With decades of experience managing aid programs, USAID had developed deep relationships with indigenous communities and built credibility in areas where state control and trust in external actors is low. In regions where conventional mining engagement strategies often stall—due to fragmented governance, cultural complexity, or historical grievances—USAID's presence often accelerated project viability by aligning local support, facilitating permitting, and mitigating social conflict. This kind of activity should be more explicitly connected to a strategic minerals agenda, positioning it not just as a development actor, but as a critical enabler of responsible resource mobilization.

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[21] CORFO

The recent dismantling of USAID is just one of several ways in which **US policy is hobbling the USG's capacity to support Western miners** and bolster copper and lithium supply chains. Another example is the State Department's plans to shutter dozens of embassies and Commerce Department's significant staff reductions.[22,23] The most obvious example is trade; tariffs (e.g., Section 232 on copper, Section 899 of "Big Beautiful Bill") and "America First" rhetoric are viewed as inconsistent with calls for allied supply chain cooperation. Section 899, while ultimately scrapped, has raised concerns with minerals-rich allies about potential future trade actions.[24]

Quicker Permitting Timelines are a Must

Officials from Peru, Chile, and Australia also pointed to **permitting timelines** as a major obstacle to bringing projects online in their own jurisdictions. Permitting often extends beyond 2–3 years—compounded by coordination gaps across national, regional, and local authorities. Lack of cross-jurisdiction alignment on permitting (which could be achieved via, e.g., sectorial agreements) exacerbates delays.

Governments Don't Want to Pick Sides

Lastly, **China isn't going anywhere**. While there is growing concern over China's dominance and skepticism of the returns on BRI investments, **governments are not looking to pick sides**. Rather, they seek credible alternatives. As one official put it:

> *"Don't ask us to choose—show us why the US is the better partner." – Ministry of Mines*

B. Company and Investor Perspectives

There are three mining-company archetypes in the private sector, each with different needs:

- **The "Big Guys":** need "soft power," not capital; diversified across metals; often vertically integrated across various portions of the supply chain; global remit
- **The "Mid Guys":** need financial support to fund mining projects and make processing facilities profitable in the West; often single-commodity companies; often more regional or country-specific
- **The "Small Guys":** need capital injections for exploration and early production that are not tied to financially disadvantageous offtake agreements. In Canada and Australia, these companies are referred to as "juniors"

22 NYTimes

23 Government Executive

24 Conversations with Silverado Policy Accelerator

From miners across all three tiers, the message is clear: US engagement matters—but only if it's aligned, visible, and financially and commercially meaningful.

Companies operating in South America and Africa emphasized that **"soft power" diplomacy, embassy visibility, and interagency coherence** are among the most valuable contributions the USG can make. To do this well, the US needs to take a page from the oil and gas playbook and **put technically competent people in place for long time periods, in-country. This could include regional, sector-specific State Dept. minerals liaison officers who works with multiple regional embassies.**[25]

All three archetypes stressed that current market signals are not enough to justify investment in domestic processing or frontier jurisdictions. Several highlighted the role of strategic reserves and contracts-for-difference (CfDs) as effective demand anchors. These mechanisms were seen as critical to offsetting price volatility, especially in lithium, where recent price collapses have forced production slowdowns and shelved projects. (See appendices for more detail on such mechanisms.)

Mining executives and investors described a global market in which Chinese players enjoy structural advantages—not just from lower costs, but from vertically integrated industrial policy and deep government backing. **Therefore, USG involvement must move metals markets toward a level playing field**.

Investors pointed to a clearly visible **lack of coordination** in the US approach. DFC, EXIM, MSP, DOD, and DOE programs are **too slow, too siloed, or too small** to meet the scale of the opportunity. There is high interest in blended finance vehicles—structures where public capital takes early risk and unlocks larger volumes of private equity or debt. Firms noted that DFC-backed investments have shifted risk profiles enough to make marginal projects viable. However, they cautioned that USG timelines and performance metrics[26] must match market urgency.

"DFC has unlocked a lot of these investments… Absent that, these projects wouldn't have been developed. But more often than not the US comes in too late—needs to come in earlier and support in the risky times." – Investor

Other key takeaways include:

[25] Conversations with Silverado Policy Accelerator

[26] Optimizing for results, not just enforcing a process.

- As in the example of USAID above, many USG agencies—State, DOD, DOE—possess **deep technical knowledge, community engagement expertise, and regulatory insight that can de-risk mining projects** in complex environments. By proactively offering this know-how, the US can help miners navigate permitting and local partnerships—lowering barriers to entry and accelerating project timelines. In addition, the Department of the Interior (DOI) (via US Geological Survey [USGS]) has deep technical knowledge regarding mineral resource geology and characteristics which can be effectively leveraged.
- **Cost structures** for lithium (and copper to a lesser extent) refining outside China are **not competitive without targeted support**. **Capex** and **Opex** play a role in undermining any investment proposal, as Western lithium refineries cost up to three times as much to build than their Chinese counterparts and Operating costs for facilities outside China face 200% higher operating costs.[27] **Vertical integration**, as discussed above, also contributes to this, as Chinese midstream players use their dominant position in lithium processing and **access to low-cost capital** to drive down global prices for lithium (and thereby provide advantage to Chinese battery and EV manufacturing sectors), making new investments in allied nations unviable under current economics. These dynamics create a classic market failure. **Without tools like price supports, PTCs, and blended finance, Western refiners cannot compete**—despite demand growth and national interest in diversification. To put it another way – a continued reliance on a domestic mineral supply chain that lacks USG incentives and financial support will lead to continued failure in metals supply.
- **Price stabilization.** Some stakeholders viewed price stabilization as urgent—suggesting tools like CfDs or strategic stockpiles[28] to help restore investment viability. Such mechanisms can powerfully level the playing field but require careful design to avoid unintended fiscal or market consequences. See appendices for a detailed discussion of such tools.
- **Long permitting processes** and **lack of community engagement** can kill projects. Even with capital, many projects stall due to social license or regulatory complexity. US programs like USAID (now dismantled) and DOE can play a unique enabling role supporting mining companies. (See above for a discussion of USAID's previous contributions).
- **Accelerating innovation** in extraction and processing is essential to building globally competitive, responsible mineral supply chains. Proposed US lithium projects highlight the challenge:
    - **Co-location isn't enough:** Even with mine-to-plant proximity, Western producers face steep Capex and high operating costs that strain project economics

[27] Driven by higher energy costs, environmental standards, labor expense, permitting delays, and regulatory compliance.

[28] Stockpiles are most effective not just as emergency reserves—but as price stabilizers during gluts and investment signals during downturns. While their role for minerals is different than for petroleum (where any disruption to supply is swiftly reflected in economic activity downstream), the concept can be tailored to lithium or copper in ways that help unlock capital and insulate allied markets from price volatility (especially low-price environments that discourage investment).

  - **Capex support helps but doesn't solve the problem:** Upfront financing can de-risk development, but it doesn't address persistent cost disadvantages

- **Price support mechanisms are essential:** High-cost producers need tools like contracts-for-difference or demand guarantees to weather market troughs and compete with lower-cost imports
- Although companies are not asking the USG to operate mines, some of those consulted in the course of researching this paper suggest **USG-operated PPP tolling facilities** for processing of lithium as a first-order action, if market failures continue to preclude the construction and operation of such plants in the West and given the significant vulnerability processing represents in building out a resilient lithium supply chain
- **Only innovation delivers long-term viability:** Technologies that improve energy efficiency, boost recovery rates, or enable modular, flexible processing are the path to sustainable cost reductions and cost-competitive operations
- While public subsidies — such as Capex grants and price support mechanisms — can help jumpstart high-cost domestic operations, they must be structured as **temporary bridges**, not permanent lifelines. These bridges only succeed if they lead to **cost-competitive production**, ideally within the **lowest global cost quartile**. Ultimately, public support must be **coupled with a clear innovation agenda** — ensuring today's investments create resilient, competitive supply chains for tomorrow.

Companies are not asking the USG to pick winners or operate mines. What they need is a clear signal that the US intends to compete seriously in the global minerals race—not just rhetorically, but through true partnerships, sustained investment, smart risk-sharing, and visible presence where it counts.

V: Tools to Protect Against Market-Shaping in Critical Minerals

The following mechanisms represent a toolkit the USG can deploy to reduce investment risk and reshape distorted market signals in copper and lithium supply chains. These analogs are drawn from proven policy instruments used in adjacent sectors and are ready for adaptation.

1. Contracts-for-Difference (CfDs)

Analog: UK Renewable Energy CfDs[29]
The UK model guarantees a "strike price" for electricity. If the market falls short, the government pays the difference; if it exceeds, producers repay. This model unlocked investment in offshore wind and stabilized long-term pricing.

Application to Minerals: The US could guarantee a minimum price for domestically refined lithium or processed copper, giving miners and processors the revenue certainty needed to justify large upfront investments. Pairing with an upside cap ensures fiscal responsibility.

Example of CfDs for Lithium Conversion

A company wants to build a $400M lithium hydroxide refinery in the US. Investors are hesitant because lithium prices are volatile, and Chinese refiners often flood the market to suppress prices.

The CfD is structured as follows. The USG sets a "strike price" of $22,000/ton for battery-grade lithium hydroxide (based on breakeven economics + modest return). The market reference price is determined monthly using an index. Other design features include:

- Capping subsidies (e.g., $150M/year max)
- Include US sourcing criteria
- Sunset after 7–10 years or when price volatility stabilizes

[29] United Kingdom Department of Energy Security and Net Zero

	Units	Market Above Strike	Market Below Strike	Market Below Strike - High Production, Cap Triggered
Market price	$/ton	25,000	16,000	16,000
Strike	$/ton	22,000	22,000	22,000
Difference	$/ton	3,000	(6,000)	(6,000)
Tons	tons	20,000	20,000	27,500
Repayment (Subsidy)	$	60,000,000	(120,000,000)	(150,000,000)

Result: The CfD creates predictable cash flow and reduces financing costs. Government only pays when prices are low—and recoups when prices rise.

Some market participants—particularly investors and junior miners—identified CfDs as one potential tool to stabilize investment conditions in low-price environments. However, any such tool would need to be tightly designed, fiscally bounded, and subject to rigorous review before deployment.

Critics have noted that such tools risk becoming expensive or difficult to sunset without strong guardrails.

2. Strategic Reserve & Stockpiling Contracts

Analog: US Strategic Petroleum Reserve (SPR)[30]
The SPR creates a buffer for oil markets by buying low and holding strategic stockpiles. It serves as both a supply stabilizer and a backstop for producers during downturns.

Application to Minerals: The US could create a strategic reserve of spodumene or lithium carbonate, purchasing material at target floor prices. This approach absorbs surplus, anchors domestic demand, and reduces price volatility without distorting the entire market. Note that DOD already has the tools available and mindset to advance a broader stockpile or reserve effort.

3. Production Tax Credits (PTCs)

Analog: Renewable Energy PTCs and Australia's Critical Minerals PTC[31]
Production tax credits have been instrumental in scaling clean energy deployment by reducing effective cost of output.

[30] Columbia School of International and Public Affairs Center on Global Energy Policy

[31] Australian Taxation Office

Application to Minerals: The US could issue per-ton PTCs for refined lithium, copper cathodes, or key intermediates. This would directly reward domestic production and close the competitiveness gap with lower-cost Chinese producers, especially during early-stage capacity buildout.

Example Margin Impact from PTCs for Copper Smelting/Refining

Item	China	US Refiner (without PTC)	US Refiner (with $200/t PTC)
Operating Cost (refined)	$500	$700	$700
Market Price (Copper LME, $/t)	$8,500	$8,500	$8,500
Gross Margin	$8,000	$7,800	$7,800
PTC Benefit	$0	$0	$250
Effective Margin After PTC	$8,000	$7,800	$8,050

4. Advance Market Commitments (AMCs) & Offtake Agreements

Analog: GAVI vaccine AMCs; mining OEM offtake contracts[32]
AMCs create guaranteed markets for socially valuable goods by pre-committing government demand. In mining, OEMs often de-risk projects by signing long-term offtakes.

Application to Minerals: US agencies (e.g., DOE, DOD) could act as buyers of last resort for lithium hydroxide or copper cathodes meeting ESG criteria. Alternatively, a set of aligned, independently negotiated OEM commitments—potentially supported by government convening or facilitation—could help provide the price and volume predictability needed to enable project financing.

Example of AMC/Offtake Agreement in Copper

A US-friendly copper project in Peru plans to produce 100,000 tons of copper cathode/year but struggles to reach financial close. Price volatility and lack of committed buyers make banks wary of lending.

Copper prices are $8,500/ton today but could fall below $6,000/ton (as they have in past cycles).

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[32] World Health Organization; Fastmarkets

Without an AMC, investors assume price risk, pushing up the required rate of return or killing the deal altogether.

With an AMC / Offtake Agreement, the US Department of Energy (DOE) offers a 10-year commitment to purchase up to 50,000 tons/year at a floor price of $7,500/ton, provided the copper meets ESG and non-Chinese origin criteria. Separately, US OEMs (e.g., Ford, GE) agree to offtake another 30,000 tons/year, potentially enabled by a shared framework or convening mechanism that helps reduce transaction complexity.

With 80% of future production now pre-committed, the bankability of the project is now dramatically improved. The remaining 20% can be sold on the open market, giving the miner upside exposure.

Cost to government (worst case). Government only steps in if prices fall below $7,500—minimizing cost if the market remains healthy. If prices drop to, say, $6,000/ton, government pays a $1,500/ton subsidy for 50,000 tons = $75M/year. But only if that floor price is triggered.

5. Inducement Prizes and Milestone Payments

Analog: DARPA and ARPA-E innovation models[33]
These agencies reduce early-stage technical risk by offering milestone payments for predefined breakthroughs (e.g., improved efficiency, cost thresholds).

Application to Minerals: The US could incentivize the development of low-cost, low-impact refining technologies or first-of-a-kind processing infrastructure. Milestone rewards could be tied to cost parity, ESG metrics, or processing throughput milestones.

6. Feed-In Tariffs (FiTs) for Minerals

Analog: Germany's Energiewende and solar FiTs[34]
FiTs guarantee above-market prices for renewable energy, enabling capital formation in high-risk markets.

Application to Minerals: A fixed-rate purchase program for refined lithium or copper from domestic facilities could simulate this effect. While politically more sensitive than CfDs, FiTs are administratively simpler and useful in the early phase of industry buildout. Both mechanisms involve significant public exposure and would require clear exit strategies and budget controls.

Example of Market Stimulation for Lithium Conversion

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[33] National Bureau of Economic Research (via MIT Sloan)

[34] Future Policy

Today's spot market price is roughly $8,000/ton (based on depressed global conditions, heavily influenced by Chinese oversupply). However, Western producers typically need approximately $20,000/ton to break even, due to higher Capex, permitting, labor, environmental standards, and the lack of PRC government support. (Some of those consulted in the course of researching this report suggest break-even pricing for reasonably sized lithium conversation facilities in the West is closer to $30,000/ton.)

Without intervention, no US or allied investor will build new refining capacity — too risky, no way to compete.

With a Feed-In Tariff, the USG offers a 10-year guaranteed purchase price of $22,000/ton for up to 50,000 tons/year from qualified US-based refiners. Private investors now see a predictable revenue stream and are more likely to fund construction. Lenders gain confidence that projects can service debt. OEMs (like GM or Tesla) benefit down the line from having a more secure, diversified supply base.

Cost to government: If the market price remains at $8,000/ton, the government pays a $14,000/ton premium, totaling $700M/year across 50,000 tons. This is expensive — but potentially less than the cost of dependency on PRC.

VI: Tools to De-Risk Projects and Bring More Projects Online Sooner

1. Blended Finance & Public-Private Vehicles

Analog: DOE Loan Guarantee Program (LPO) and Export Finance Models[35]
The LPO supported Tesla's factory at a critical time. Export credit agencies (e.g., Australia's Export Finance Australia) also use government-backed guarantees to enable large infrastructure deals.

Application to Minerals: DFC and EXIM could deploy concessional loans or guarantees in coordination with private capital to finance mineral processing plants, midstream capacity, and enabling infrastructure. A public-private vehicle could pool risk while unlocking scale and speed.

2. Infrastructure and Strategic Partnerships

Analog: Public-Private Infrastructure Investment Models (e.g., Lobito Corridor, Belt and Road); USAID technical assistance programs; Minerals Security Partnership (MSP) infrastructure pledges

Context: Many of the highest-potential copper and lithium resources lie in jurisdictions where enabling infrastructure is either missing or underdeveloped—particularly multi-user roads, ports, energy transmission, and water systems. These are high-cost, high-risk investments that private actors rarely take on alone. Meanwhile, diplomatic visibility and stakeholder alignment are essential to de-risking projects in politically sensitive or socially complex environments.

Proposed Tools and Structures:

- **Minerals Infrastructure Facility:**
  A dedicated US facility—potentially housed within DFC or DOE—could co-finance high-impact infrastructure linked to copper and lithium projects in partner nations. It would prioritize shared-use assets (e.g., transmission lines, port expansions, rail spurs) that benefit multiple users and catalyze broader regional development. This could complement or expand upon the existing Minerals Security Partnership and align with allied initiatives in Peru, Zambia, and Southeast Asia.
- **Embassy Envoys + USAID/DOE Community Corps:**
  Deploying dedicated minerals envoys to US embassies in key jurisdictions would provide "air cover" to private actors—demonstrating official US commitment and helping manage local political and regulatory dynamics. In parallel, a joint USAID and DOE corps could offer technical assistance and community engagement support—helping align permitting, water management, and local workforce development with US ESG standards and host-country priorities.

[35] DOE; Export Finance Australia

Why It Matters:
In interviews, both companies and host governments repeatedly emphasized the catalytic role that infrastructure investment and diplomatic visibility can play. Governments prefer US infrastructure investments to those from China due to transparency and quality—but note that US engagement is often slow or fragmented. Companies noted that permitting delays and lack of local trust are among the top reasons why projects stall, particularly for juniors. Embedding government support early—through envoys and local-facing teams—helps establish trust, manage risk, and reduce timeline uncertainty.

Precedents:[36]

- US investments in the Lobito Corridor (Angola–Zambia–DRC)
- Japan's Ministry of Economy, Trade, and Industry (METI) partnership infrastructure finance model, including Partnership for Global Infrastructure Investment (PGII) and MSP
- USAID/DOE programs supporting hydropower and mini-grid development in Southeast Asia and Africa
- Proposed EU Global Gateway minerals corridors

Case Study: The Lobito Corridor

The Lobito Corridor represents one of the most promising examples of USG investment in enabling infrastructure that supports critical mineral development. Spanning Angola, Zambia, and the Democratic Republic of Congo, the corridor is a strategic logistics route designed to transport copper and other resources from the Central African Copperbelt to Atlantic ports. For decades, this region's mineral potential was constrained by damaged rail infrastructure and elevated transport costs—many deposits stayed stranded or depended on Chinese-built alternatives.[37]

In 2023, the USG—alongside the European Union and African partners—launched a flagship investment through the Partnership for Global Infrastructure and Investment (PGII).[38] This multilateral effort supports the rehabilitation of rail lines, modernization of ports, and development of customs and logistics capacity along the Lobito Corridor. Through a mix of concessional finance, technical assistance, and diplomatic coordination, the US helped create the enabling environment for private capital to follow.

[36] Eurasia Review; OECD ; METI; US Mission to ASEAN; European Commission

[37] OECD

[38] The White House

The corridor is already reshaping the investment calculus in Zambia and the DRC, unlocking new mining activity, creating economic opportunities in underserved regions, and providing an alternative to Chinese-dominated supply chains. Crucially, it also reflects a shift in posture—one where the US is not merely reacting to supply chain risk but actively enabling regional prosperity in a way that aligns US strategic interests with host-country development goals.

For US minerals policy, the Lobito Corridor provides a working model of what it means to lead with infrastructure: de-risking private investment, deepening strategic relationships, and building enduring trust. It shows that when the US shows up early—with capital, coordination, and a long-term view—it can shape outcomes that would otherwise default to competitors.

VII. Navigating Political Volatility: Challenges and Workarounds

The single biggest challenge to effecting these approaches is the lack of one coordinating body for minerals. The current administration must be able to assign responsibility for activation to one authority. As the US enters a period of potential executive branch transition and increasing geopolitical polarization, key elements of the proposed strategy—especially those involving climate-related funding, industrial policy, or multilateral cooperation—could face headwinds from shifting political priorities.

Key Challenges:

- **Funding and Authorization:** Tools like CfDs, tax credits, and new infrastructure facilities may require Congressional appropriations or authorizing legislation, which could be difficult under divided government or changing political leadership.
- **Anti-China Rhetoric vs. Allied Coordination:** Framing mineral strategy too heavily around decoupling may undermine trust with producer nations who do not want to be caught in geopolitical crossfire.
- **Climate and ESG Backlash:** Opposition to environmental or labor standards—especially when seen as "green mandates"—may erode support for aligned sourcing frameworks or ESG-aligned finance.
- **Agency Turf Wars and Coordination Gaps:** Inconsistencies across DOD, DOI, State, DOE, and investment mechanisms like DFC and EXIM can stall deployment, particularly if interagency collaboration breaks down under political pressure.
    - Several stakeholders noted the need for more unified leadership across agencies. One proposal is to empower a single coordinating authority—a National Minerals Council—to align funding, diplomacy, and regulatory support. Others suggested designating DOE, DFC, or a new minerals entity to serve as quarterback for interagency execution. Without clearer roles and streamlined accountability, even well-designed tools risk stagnating in bureaucratic silos.

Strategic Workarounds and Opportunities:

- **Use of Existing Authorities:** Agencies like DFC, EXIM, and DOE already have mandates that allow for minerals-related investment under economic competitiveness, energy security, and export promotion—not just climate. The current administration has shown a willingness to use these vehicles for minerals projects.
- **Bipartisan Framing:** Position minerals investment as a national security and industrial competitiveness strategy—rather than a climate or "green" agenda—can help garner bipartisan support.
- **Private Sector-Led Models:** Leaning into public-private vehicles that can operate with fewer appropriations reduces dependence on annual budget cycles. For example:

- Guarantee-backed funds, where a blended fund with public and private capital makes loans or equity investments in critical mineral projects. If a project fails or underperforms, the USG backstops a portion of the loss
- Milestone-based inducements, where USG payments or incentives are triggered only after specific project milestones are met—rather than given up front. In copper and lithium markets, examples would include the USG committing to fund an amount of Capex only after a lithium refinery reaches commercial operation, or when an allied mining project hits defined permitting and construction targets

- **Allied Multilateralism:** Structuring initiatives as part of multilateral programs (e.g., with Japan, Australia, EU) may protect against abrupt reversals and insulate investments from domestic political shifts.
- **"Low-Profile" Wins:** Some of the most impactful tools—such as embassy envoys (deploying senior, technically informed diplomats or attachés with minerals-specific expertise to key US embassies in mining-rich nations—especially where strategic partnerships are needed), permitting assistance, and technical support through the State Department, DOE, DOD, or others—require minimal political capital but can have outsized impact for miners in the field.

In short, designing a strategy that can survive political volatility requires tactical flexibility, institutional creativity, and a focus on shared interests across political factions—namely, the US desire for economic resilience, energy leadership, and strategic independence.

VIII. Mineral Resilience Framework Detail

Key Considerations	Dimensions
Mineral Archetypes	• High volume (e.g., copper) • Mid volume (e.g., lithium, graphite) • Low volume (e.g., REEs)
Miner Archetypes	• Big Guys (non-US) • Mid Guys (US+) • Juniors (US+)
Intervention Targets	• Upstream (mine) • Midstream (refining/conversion) • Downstream (e.g., battery or OEM-level)
Time Horizons	• Near-term security (2025–40) achieved by collaborations with allied and friendly minerals jurisdictions and multinational/foreign miners • Long-term resilience (post-2040) increasing reliance on domestic production
Tool Categories	• Price support ○ Price signals (CfDs, floor/ceiling bands) ○ Stockpile ○ Trade alignment, sectoral agreements, BLAs, FTAs, etc. • Investment capital ○ Capital support (PTCs, project finance) ○ Infrastructure investment (rail, energy, transmission, roads, water, and so forth) ○ In-country spend (community development, mid- and down-stream processing, etc.) • Soft power ○ Embassy/diplomatic engagement ○ Direct and overt support of miners in challenging jurisdictions ○ In-country know-how, experience, networks
Prerequisites	• Mineral-specific plays • Operate at speed + partner with key friendly jurisdictions, in particular: Australia, Argentina, Canada, Chile, Peru, Zambia • Decision framework for how much risk is acceptable, where to focus de-risking levers, and where to invest