Benchmarking Opportunity in Transition-Critical Mineral Markets

By Jonah Allen and Eduard Nilaj

Introduction

Producer countries seeking to turn transition-critical mineral booms into lasting development outcomes must navigate market volatility, complexity, and uncertainty. The recent rise and crash of lithium prices underscores how quickly market realities can outpace expectations; in Brazil and Ghana, over-optimistic projections and plans have translated into deflated public revenues and challenged downstream ambitions. Given these challenges, JFI is developing a suite of tools to reduce information asymmetries and support policymakers in assessing and managing market risks. We've begun with the *Mineral Market Dashboard*, which benchmarks varying projections for transition-critical mineral market growth and maps the distribution of historical production and current estimated resources and reserves to enable more grounded discussions on the scale and distribution of opportunity.

Context on lithium development in Brazil and Ghana

The lithium market in the summer of 2022 was burning hot. Market prices for lithium carbonate were skyrocketing, up 65 percent from the year prior and nearly 700 percent from 2020. The much-anticipated growth, driven by electric vehicles and their lithium-ion batteries, was materializing and taking off. Future growth forecasts were optimistic, too, buoyed by recent major climate policies, including the Inflation Reduction Act in the US and Fit for 55 in the European Union. Prospective miners of all sizes raced to cash in, and a flood of junior lithium companies worldwide sought new investments—among them Sigma Lithium of Brazil, Atlantic Lithium of Australia, and Piedmont Lithium of the US. Seeing the opportunity to capitalize on new demand, countries with rich lithium deposits made strides to streamline permitting, shore up lithium-specific taxation regimes, and encourage investment within their borders. From Chile to Zimbabwe, such measures reflected a strong desire to avoid the extractivist legacies of past commodity booms, which left lasting environmental damage but few enduring benefits for surrounding communities, and to turn the lithium rush into meaningful local development outcomes. For many resource-rich countries, this new wave of investment entailed not only expanding into downstream industrial processes but also cementing the potential for mineral development to benefit local populations by delivering jobs, infrastructure, and long-term value rather than just export revenue.

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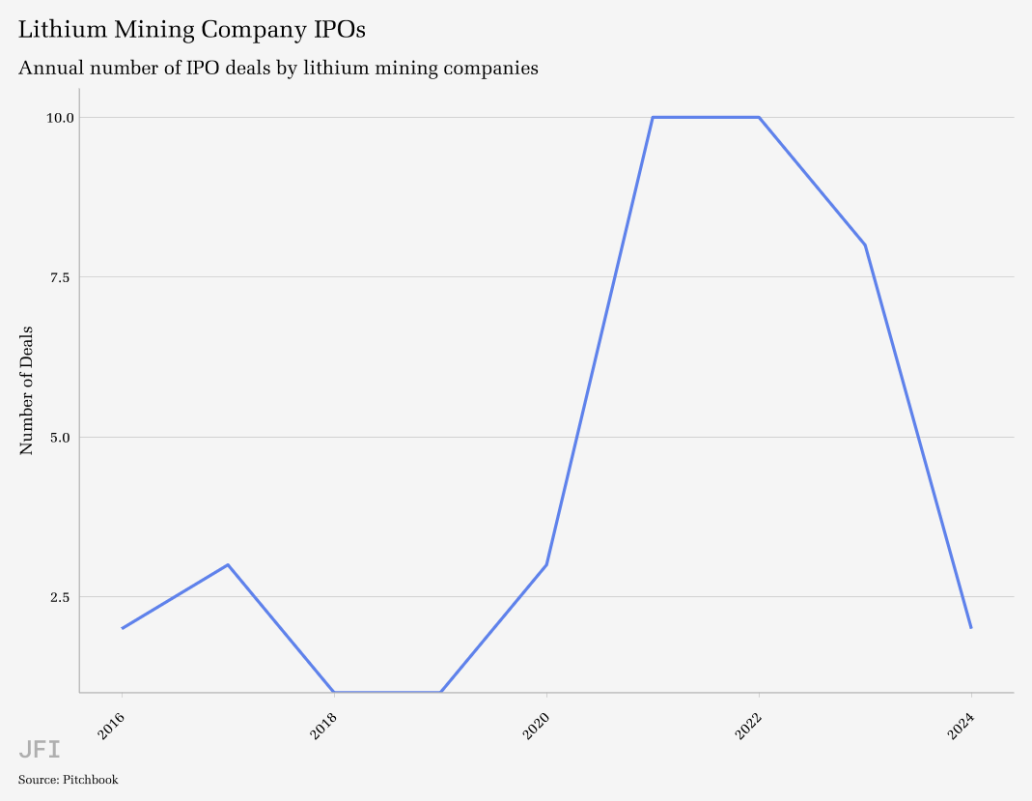


JFI with data from Pitchbook

In Brazil, Sigma Lithium spent much of the 2010s consolidating mineral rights around the Jequitinhonha Valley, a region tucked into the northeast corner of Minas Gerais state that contains 85 percent of Brazil's deposits. The valley was largely overlooked at the time as existing operations were small-scale and mostly supplied the domestic market. By 2021, Sigma had drilled to define known reserves, pitched investors on their planned production facilities, and raised sufficient capital for mine development. Around a wave of new lithium market entries, Sigma stood out. Its flagship Grota Do Cirilo project was slated to be "quintuple zero," achieving goals for low carbon, low water use, and low toxicity. Sigma's objective was to develop the valley's lithium resources efficiently and sustainably while creating opportunity and minimizing risks for the local community. Policymakers moved to support them, and in 2022 the Bolsonaro Administration lifted export restrictions on lithium. In May 2023, a month after Grota Do Cirilo entered production, InvestMinas—Minas Gerais' investment and foreign trade promotion agency—rebranded the region as Brazil's "Lithium Valley" to recognize its strategic importance for local industrial development. A day later, Sigma's CEO Ana Cabral-Gardner, speaking at Nasdaq's opening bell ceremony in New York alongside the Governor of Minas Gerais and the Deputy Minister of Mines and Energy in Brazil, highlighted the project's potential to attract downstream processing industries and develop a sustainable lithium supply chain in Brazil, calling on the Lithium Valley "to bring prosperity to the people of Vale do Jequitinhonha by growing the lithium industry while ensuring the social economic development of the entire region."

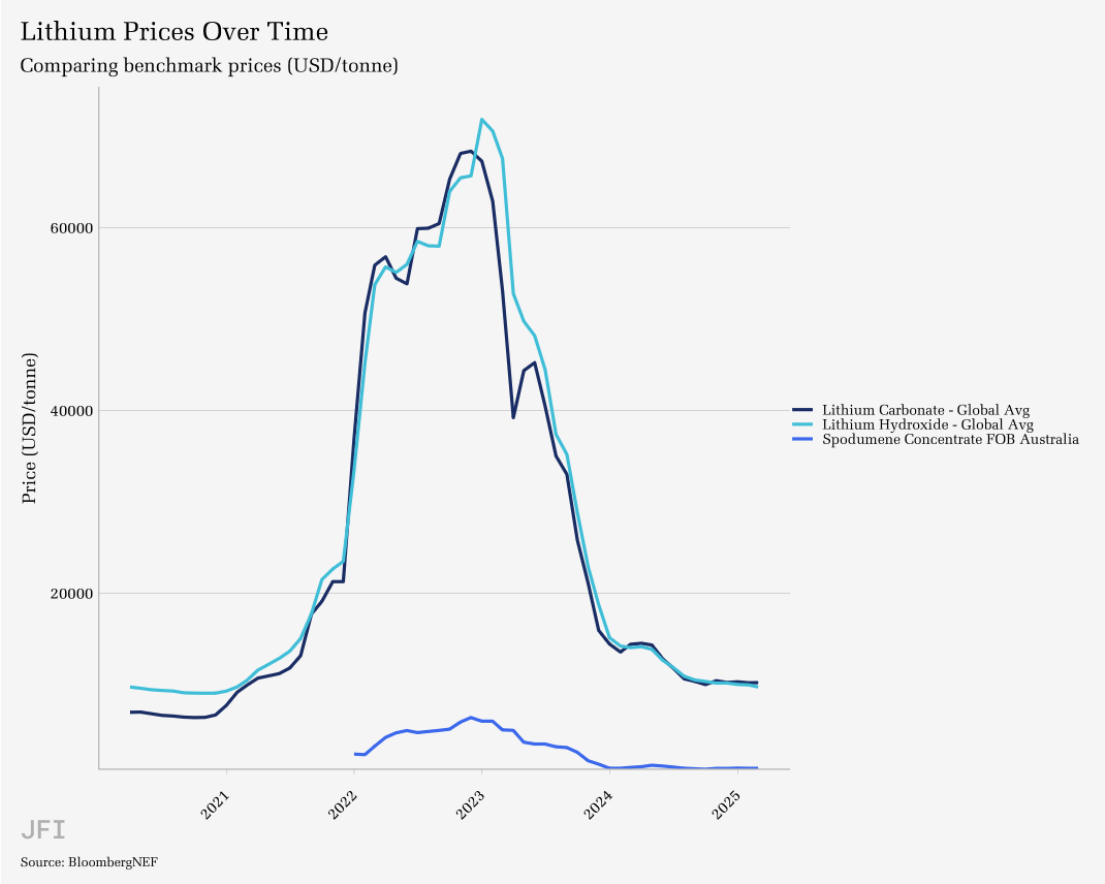
While Sigma targeted the opportunity to sell beneficiated spodumene to China for refining, state officials were focused on the potential to expand the region's presence further down the lithium value chain. A small domestic precedent already existed: Companhia Brasileira de Lítio has operated in the Jequitinhonha Valley since 1991, processing around 2,000 tons of lithium chemicals annually (just 4 percent of its 45,000-ton spodumene output) to serve the domestic market. InvestMinas aimed to build on this foundation and support not only expanded extraction but also local processing, R&D, and industrial integration, positioning the Lithium Valley to eventually produce lithium carbonate for export and play a larger role in global supply chains.

Across the Atlantic, Piedmont Lithium and Atlantic Lithium were partnering to develop a greenfield deposit in Ewoyaa, Ghana, a rural region with strong infrastructure linkages. The development opportunity for Ghana was clear: its government had negotiated a uniquely favorable fiscal regime for the project, and the mine was key to the country's broader ambitions to build a value-added minerals sector. While 50 percent of Ewoyaa's output was committed to Piedmont's planned processing facilities in Tennessee, Atlantic Lithium announced intentions to establish downstream processing capacity locally, creating the potential for Ghana to advance into the midstream. In support of this plan, Ghana's Minerals Income Investment Fund (MIIF) would eventually secure a 5 percent stake in the project, in line with the stated vision of "establish[ing] itself as a leading hub in Africa in the EV supply chain."

In January 2023, however, four months before Grota Do Cirilo entered production and one year before Atlantic Lithium's Ewoyaa mine was initially planned to break ground, lithium prices began to slip. Demand growth had been overestimated greatly, with signs of a mismatch between ambitious supply buildouts and slower-than-expected uptake emerging. EV sales growth was softening globally; subsidy rollbacks, inflation, and consumer hesitation over charging infrastructure and battery range were dampening enthusiasm. Battery manufacturers and automakers anticipated future price declines and began drawing down existing inventories rather than locking in new long-term contracts at elevated prices. Meanwhile, new supply from Australia and China was entering the market faster than anticipated, contributing to a growing surplus. BNEF was now projecting overcapacity in the lithium market lasting until 2030 at the earliest.[1,2] Prices are yet to recover; the ensuing months spelled disaster for lithium producers globally, which are still struggling to stay afloat. Of the nearly 400 lithium projects with known activity status in S&P's mining project database, only 12 percent are currently operating in advanced production stages.[3] The global average of benchmark prices for lithium carbonate fell from a high of $68,366 per ton to $10,238 at the time of writing, about 15 percent of their

[1] Yiyi Zhou, "Lithium Prices, Oversupply Squeeze China's Battery Margins," *BloombergNEF*, April 24, 2023.
[2] Jiayan Shi, "EV Battery Glut Set to Endure as China Meets World's Needs," *BloombergNEF*, August 7, 2023.
[3] The statistic includes lithium projects globally that were last updated in January 2022 or later and have a known activity status and development stage in S&P's database. Projects classified as "advanced production stages" include those marked as Operating, Construction Started, Construction Planned, or Commissioning. Only projects with both non-missing activity status and development stage fields were included in the denominator (n = 394). Projects labeled as Inactive, On Hold, Care and Maintenance, or in early-stage exploration were not considered "advanced."

average value in December 2022; spodumene concentrate (what Grota Do Cirilo and Ewoyaa extract), fell from $6,400 per ton to only $840 per ton, 13 percent of its value at peak.



JFI with data from BloombergNEF

Sigma and Atlantic are both weathering this storm, but it has put ambitions for local value capture and supply chain investment to the test. While Sigma has remained on track with production targets and is consistently producing at capacity, it has been selling its 5.5 percent lithium concentrate at a fraction of the prices forecasted in its January 2023 Technical Feasibility Study. The municipalities of Araçuaí and Itinga, where Grota Do Cirilo is located, had based their expectations of potential royalty payments on the figures quoted in Sigma's feasibility study: the equivalent of about USD$21 million in the first and second year of production, tied to Sigma's expectation of nearly $1.6 billion in gross revenues in both years, and Brazil's 2 percent royalty on gross revenue, 65 percent of which is then allocated to the municipality where extraction occurs. However, these projections relied on a sale price for their lithium concentrate averaging at $5,774 per ton in year one and $6,075 in year two, nearly 700 percent higher than SC6 benchmark prices today. The implication is that, according to data from the National Mining Agency, Araçuaí and Itinga received the equivalent of only about USD$1.8 million in 2023 and $2.5 million in 2024 in royalty payments from Sigma Lithium—only about a tenth of the value projected in the

cashflow model of the technical feasibility study. Both mayors expressed this shortfall to JFI during our visit to the valley in February 2024.

The unrealized $20 million per year would have greatly benefitted the Lithium Valley, which has another moniker: the Valley of Misery. The Jequitinhonha Valley is one of the poorest regions in the country and faces acute food scarcity. Past local commodity booms in lumber production, diamond, and gold mining in the previous two centuries translated not to lasting development outcomes but instead legacies of environmental degradation that continue to pose challenges to local agriculture and the livelihoods dependent on it. For its part, Sigma's aim to minimize their environmental footprint while bringing growth to the region seems to have been successful; in becoming one of the largest employers in the valley, it has consistently prioritized local hiring and skills training through partnerships with public and private institutions, and maintained strong community engagement and support for public services and local infrastructure.[4] Royalty payments, however, offer municipalities the chance for self-determined investment in social and public capital; royalty revenues are flexible, locally directed, and essential for building the kind of structural change that outlasts any single project or boom.

Sigma has, impressively, been able to survive without acquisition (it considered several offers throughout 2024), meet its production targets, and even expand production. More broadly, however, the market volatility has put the State's aspirations for downstream processing to the test. Companhia Brasileira de Lítio has announced plans to "double mining capacity and triple lithium chemicals production," and research partnerships have been formed with institutions such as SENAI (Serviço Nacional de Aprendizagem Industrial) to support local lithium processing and battery manufacturing capabilities. SENAI operates multiple research initiatives in Minas Gerais, including collaborations focused on mining innovation, permanent magnet production, and lithium-ion battery development. Whether these initiatives will materialize into expanded processing and meet the objectives to establish the Lithium Valley within the international value chain is yet to be seen.

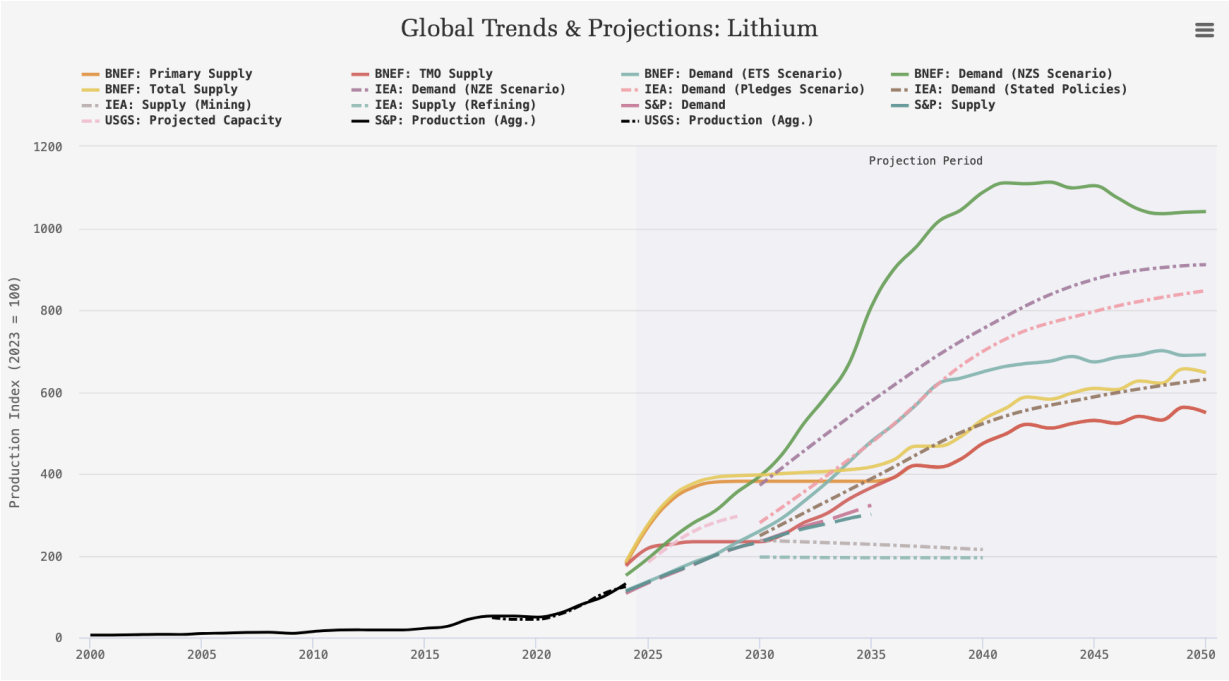
An even more challenging story unfolded for Atlantic Lithium's Ewoyaa project in Ghana. Like many other junior lithium miners over the past two years, Atlantic Lithium has repeatedly pushed back the mine's start date. It was originally planned to start production in mid-2024, but more recent targets reference the end of 2026 for initial operations and 2027 for full capacity; Atlantic Lithium recently announced that it is ready to break ground on construction. Eager to begin generating cashflow, the company has also downgraded on-site processing to a lower concentration spodumene product, which will of course sell for less, before adding more sophisticated processing once it has the revenues. Further, with pressure from shareholders, including Piedmont, Atlantic Lithium has sought to sell forward the remaining 50 percent of Ewoyaa's output to raise funds, invariably at the expense of developing processing and refining capacity from the project within Ghana. The implication is that Ghana initially expected to receive royalties from the project last year, but now won't receive them until next year at the earliest, and at a significantly reduced

[4] Recent research from three universities in Brazil and the London South Bank University calls into question the sustainability of Sigma's processes and accuses the firm of greenwashing.

royalty base, both from suppressed market prices and the reduced sales price of lower quality product. In the long term, the ability of Ghana to move downstream based on Ewoyaa's production and establish Ghana within the global EV supply chain is in question. Further, analysis from the Natural Resource Governance Institute suggests that the opportunity costs of doing so far outweigh the potential benefits.

These episodes highlight the complex challenges of transforming temporary booms in commodity sectors into durable solutions that drive long-term investment, growth, and prosperity, despite how often the potential to do so is touted. They also highlight a key misalignment between the role of investors, the miners, and state actors in resource-rich countries seeking to retain more local value from extraction. Across commodities, miners are incentivized to present the *best-case scenario* of project outcomes to effectively raise capital and support for project development; doing so is the industry norm, especially for junior miners without cashflows seeking to break into the industry with promising undeveloped projects like Sigma and Atlantic. Companies can navigate headwinds as they arrive, with the capital they've secured. Local policymakers, however, seeking to plan effective public programs utilizing revenues and long-term development from temporary commodity projects, must be able to reference the *worst-case scenarios* and everything in between. Being able to reference independent and reliable forecasts, or at the minimum, compare producers' forecasts against benchmarks, is essential for local entities' ability to budget social projects effectively.

For these reasons, JFI is developing tools and research to support policymakers in host countries, at all levels, to more accurately plan across future outcomes. We've begun by developing the *Mineral Market Dashboard*, which we will use to inform and orient interlocutors on the universe of transition-critical mineral market growth projections (which vary considerably), as well as producer countries' past, current, and potential future positioning across these markets. The dashboard is intended to create products that can ground and benchmark development ambitions tied to these commodity markets, which are often over-hyped at the expense of achieving realistic and durable outcomes, and inform discourse on the scale of opportunity available to producer countries from transition-critical mineral market growth.



Global Lithium Projections Comparison (Indexed) within JFI's Mineral Market Dashboard *(Data: BNEF, IEA, S&P Global, USGS).*

Forecasting mineral market growth

Understanding the volatility of transition-critical mineral markets requires grappling with the limitations of existing forecasting approaches. Scenario models, mine-level forecasts, and equilibrium models each serve distinct purposes and reflect different assumptions, and thus all come with their unique sets of strengths and weaknesses. Unfortunately, these models are frequently misunderstood or misapplied in public discourse and policy planning, and depending on the objectives of the user, can be manipulated. Most rely on deterministic frameworks that present single-outcome projections, offering limited insight into the range of possible futures or the uncertainty inherent in fast-evolving markets and the real world. The outputs of the Projections tab of the Dashboard address this challenge by offering a structured, side-by-side view of leading deterministic forecasts. While true stochastic modeling remains rare and resource-intensive, comparing a curated range of high- and low-bound projections benchmarks assumptions and assesses the plausible spread of outcomes. This approach doesn't eliminate uncertainty, but provides a practical, accessible second-best for policymakers planning amid volatile and fast-moving market conditions.

Projecting mineral market growth—and its fiscal and industrial implications for producer countries—is an extremely difficult endeavor. Even the most sophisticated market analysts, financial institutions, and research centers struggle to produce accurate and consistent forecasts; the strengths and limitations of the varying methodologies employed are closely guided by their intended use cases. At the highest level, global mineral demand is most

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often projected through scenario-modeling frameworks, like those developed by the International Energy Agency, Bloomberg New Energy Finance, S&P Global, and others. These scenario models represent how different policy choices, technological adoption rates, and climate ambitions might influence the future mix of end-use sectors such as transportation and electricity supply. Then, based on the mineral intensity of technologies meeting this demand, the models "solve" for mineral demand growth under each scenario model. Scenario models map well to policy and market dialogues, are easy to compare across pre-defined futures, and are generally more intuitive. However, scenario models are very sensitive to their assumptions. They may ignore price feedbacks, may insufficiently constrain supply, or underrepresent the importance of substitution and innovation effects, like the declining role of cobalt in lithium-ion battery chemistries due to human rights concerns and expensive, geographically concentrated supply, or emerging alternative battery technologies altogether. The most aggressive growth and price scenarios, which miners tend to favor in their feasibility studies, often embed optimistic assumptions about the policy or market environments, and can, in practice, overshoot reality substantially, as seen with lithium.

On the supply side, some of these providers also offer detailed mine-level forecasts that aim to aggregate existing and prospective production capacity to estimate future output. Supply-side forecasts are often the backbone of investor analysis and short-to-medium-term supply outlooks, and are essential for analysts' conclusions on whether markets will be over- or undersupplied. While they are granular and grounded in project-specific data, like permitting timelines, production costs, and technical feasibility, they are sensitive to assumptions around financing and construction, and may inaccurately estimate actual delivery timelines, especially in volatile or high-risk markets like transition-critical minerals. It is also, of course, difficult to predict whether a specific project will be scrapped entirely, and to keep abreast of every active mining concession and project globally.

Thus, these demand-side scenario models and supply-side mine forecasts often operate as separate analytical layers. Demand scenarios project theoretical requirements based on macro trends, while supply models quantify deliverable capacities rooted in physical realities. When the separate layers are not linked, it can create analytical blind spots: supply forecasts may not account for rapid demand accelerations from aggressive climate policies, while demand scenarios might overlook hard constraints in project lead times or geopolitical risks to mining infrastructure. Market analysts typically compare these parallel tracks to identify mismatches, but critical feedback loops, such as price volatility altering both mineral substitution trends and project financing viability, can be under-modeled. Ultimately, this bifurcated approach overlooks the fact that these interdependent systems are shaped by unpredictable human and market behaviors—a nuance often unappreciated by the consumers of model outputs. Because these products are often proprietary, the models themselves can be a black box, making it difficult to validate or clarify the extent to which layers influence one another.

Academics and macroeconomic institutions, meanwhile, tend to favor partial and general equilibrium modeling, which link feedback loops more closely. These models attempt to

simulate market dynamics by incorporating price feedback, trade flows, substitution and learning effects, policy interventions, and other elements. In theory, these models allow for richer treatment of endogenous variables, such as how producers and consumers respond to price signals and how technologies may evolve. In practice, they are limited by data availability, can make strong assumptions about elasticity and agent behavior, and can treat mining as a stylized input-output system, abstracted from the messiness of real-world politics, permitting, and supply chains.

Crucially, scenario modeling, mine forecasts, and equilibrium models are not competing modeling approaches but are rather intended to meet distinct objectives and inform different types of decisions in separate contexts. Scenario models intended for strategic planning and agenda-setting allow users to consider the implications of varying future states of the world. Mine-level supply forecasts support operational and financial decisions that depend on concrete project-level timelines and risk assessments, and can complement scenario models to identify and discuss potential market shortfalls statically. Equilibrium models, on the other hand, are intended to explore theoretical relationships and economic mechanisms, such as substitution, trade, and price formation, by simulating how interconnected markets adjust to shocks or policy changes. They are particularly valuable for testing the internal logic of economic systems and assessing how different assumptions influence outcomes across sectors.

Unsurprisingly, investors tend to favor mine-level forecasts and scenario models while academics require equilibrium models. The policy sphere may utilize any of these forecasts, depending on the use case, but a key concern arises when model use does not align with design. Academic models are sometimes called on to quantify future market size, despite being built to capture high-level relationships under idealized assumptions, rather than to make accurate predictions for real-world markets. And while production forecasts and scenario modeling can be valuable approaches, they are easily manipulated, and often opaque and proprietary; these vulnerabilities are especially acute when institutional or commercial incentives create pressure for more favorable assumptions. These mismatches—between what a model is built to do and how its outputs are interpreted—can lead to false confidence or poor decision-making, particularly in complex and fast-moving sectors like critical minerals.

Model Type	Description	Intended Use Cases	Strengths	Key Limitations
Scenario Modeling	Demand projections under defined futures, short- to long-term.	Policy analysis, strategic planning, public narratives, goal-setting, etc.	Aligns well with policy and market dialogues; easy to compare across scenarios, and is more intuitive.	May assume unconstrained supply, omit price feedback, or underestimate substitution and innovation effects. Projections from proprietary services lack transparency and are difficult to validate. Can be used to support preferred narratives, making aggressive

				scenarios manipulable.
Mine-Level Supply Forecasts	Short- to medium-term supply projections.	Strategic planning, project finance, investor due diligence, etc.	Granular, project-level detail; essential for market balance analysis; widely used by investors.	Sensitive to assumptions about financing, permitting, and construction; may overestimate delivery timelines. Methods are often proprietary and not standardized; difficult to validate.
Equilibrium Models	Simulating market interactions and trade flows for medium- to long-term projections.	Academic research, system exploration, stress-testing under complex dynamics, etc.	Incorporates price feedback, substitution, trade, and policy response; models endogenous behavior.	Built primarily for theoretical exploration, not forecasting; may oversimplify sectors like mining. Use in policy or finance contexts can be misleading. Even when methods are transparent, abstraction makes validation challenging.

Finally, all three of these modeling approaches are often deterministic but can also be stochastic. Deterministic models define a single outcome or pathway based on fixed assumptions, while stochastic models allow for randomness in key inputs or relationships and produce a distribution of possible outcomes rather than a single forecast. In principle, stochastic modeling should be the gold standard for planning under uncertainty, as it better captures the volatility and unpredictability of mineral markets, and more broadly, the real world. Stochastic models allow analysts and policymakers to test a range of inputs, such as prices, project delays, or technology uptake, and see how different combinations play out across time. However, in practice, stochastic models can be more resource-intensive and may be more difficult for audiences to interpret or compare across use cases. Still, being able to reference a curated set of deterministic projections—especially the highest and lowest bounds—is a powerful second-best approach. This is precisely the purpose of the Projections tab of the *Mineral Market Dashboard*, which enables us to assess how different institutions are modeling market growth and to benchmark the scale and timing of expectations across plausible scenarios.

Implications for producer countries

In the long run, the extreme rise and fall in lithium prices over the past couple of years may ultimately be a symptom of an expanding market finding its footing. As new technologies emerge, demand expectations evolve, and as more capital flows into refining and production capacity, prices may settle into a more stable range. Market exchanges and public auctioning, which are essential for global price transparency, have only recently emerged for the lithium sector and are still maturing; widespread adoption will bring clarity. However, for producer countries seeking to build stable revenue streams or develop downstream industries, long-term optimism for market development is difficult to reconcile with near-term shortfalls and budgetary constraints. Subnational governments at

the municipal and state level are responsible for managing infrastructure, services, and investment plans today, not in 2030. Their planning depends on royalty revenues that fluctuate with international prices and often reflect decisions made beyond their control.

As of now, prices have not recovered, the state of suppliers remains in question, and consistent and rapid advancements in battery technologies have important implications for material mixes and intensities. This leaves all actors—miners, investors, governments, and analysts—facing a future defined more by uncertainty than clarity. Further, even the most established commodity markets are inherently volatile, being sensitive to a suite of risks and uncertainties that range from the natural (geological variability, extreme weather), to project-level (spikes in water or energy costs, social resistance), to domestic and international policy (fiscal regime changes, trade policies, political instability), to name a few.[5] Increasing (and inconsistent) tariff policies and trade tensions globally will only magnify these uncertainties. Producer countries must be equipped with robust strategies to navigate the volatility that defines commodity markets (see our previous report, Mineral Wealth and Electrification, for a detailed discussion).

Setting aside market uncertainty, royalty revenues are sensitive to policy decisions made at the federal level and beyond the control of subnational governments, which can have major implications in large countries such as Brazil. Contract terms, specific deductions allowed (such as on transportation or processing), and loose guidelines on transfer pricing (the price of goods and services sold between entities of the same multinational company, often across borders) are typically negotiated and governed at the national level but have key implications for local governments. Not to mention the seemingly innumerable design pathways for royalty regimes (also discussed in Mineral Wealth and Electrification), and decisions on how revenues are distributed. Understandably, national governments may favor foreign investment or downstream industrial objectives that reduce the effective royalty base for local governments. The implication is that even with high mineral endowments and active mining, many producing regions could see limited public revenues, undermining their ability to use extraction as a springboard for broader development goals.

The recent boom-and-bust cycle in the lithium market serves as a potent case study of how initial projections collide with the complex realities of market adoption and supply responses, leading to dramatic price corrections. This forecasting challenge isn't unique to lithium; it plagues the entire transition-critical minerals sector and commodity markets more broadly. As the experiences in Minas Gerais and Ewoyaa demonstrate, the gap between the optimistic scenarios often required to secure investment and the inherent volatility of commodity markets can create significant obstacles for effective development planning. When local governments anchor budgets to peak projections, subsequent market downturns can jeopardize essential public programs and undermine the goal of leveraging resource wealth for lasting community benefit.

[5] Take a peek at copper futures prices recently, which have been traded on the London Metals Exchange since 1877.

To avoid these pitfalls, planners require insights that capture the full range of risks and also reflect the complex policy designs that can help mitigate them. Yet most existing tools, whether academic equilibrium models or investor-oriented forecasting systems, are poorly suited to this task. Bridging the gap will require not only accessible and public resources that democratize information essential to robust public-planning capacity, but a new generation of tools: ones that help stakeholders understand the full range of potential outcomes in planning not only for best-case scenarios but for the full distribution of risk.

The Mineral Market Dashboard

JFI has developed the *Mineral Market Dashboard* as a first step toward addressing these needs. This platform synthesizes and visualizes data from leading global sources like S&P Global, Bloomberg New Energy Finance, the International Energy Agency, and the US Geological Survey. By analyzing numerous and diverse forecasts, historical production patterns, and resource data within a single interface, the dashboard will enable analysis that critically evaluates the often-conflicting narratives surrounding mineral market futures. Our upcoming publications will be a key resource for policymakers, analysts, investors, and other stakeholders who want to base their strategic decisions on a deeper, more comprehensive understanding of these fast-changing global markets.

Here's how the Mineral Market Dashboard breaks down market dynamics:

1. **Global Projections**: This main panel confronts the forecasting challenge directly by visualizing long-term supply and demand projections (typically through 2050) from multiple authoritative sources. Users can compare distinct scenarios—such as the IEA's ambitious Net Zero Emissions pathway versus its more conservative Stated Policies outlook, or BNEF's different transition models—against the backdrop of historical production trends. All projections are displayed on a common, relative index scale, anchored to a slightly modified public baseline (derived from S&P 2023 production estimates). This approach outlines the range of plausible market trajectories, highlights areas of consensus or significant divergence among forecasters, and provides a crucial benchmark against which specific project or policy assumptions can be assessed. The dashboard also highlights the difficulties and inconsistencies in even estimating *current* market size.
2. **Country Market Share**: The competitive landscape of mineral production is constantly evolving. This panel gives users a dynamic view of how global production patterns have changed over time. Ranging from 2000 to 2024, it depicts how the global market share for specific minerals has been distributed among countries, highlighting long-time leaders, emerging competitors, and potential evolving geopolitics of mineral supply chains.

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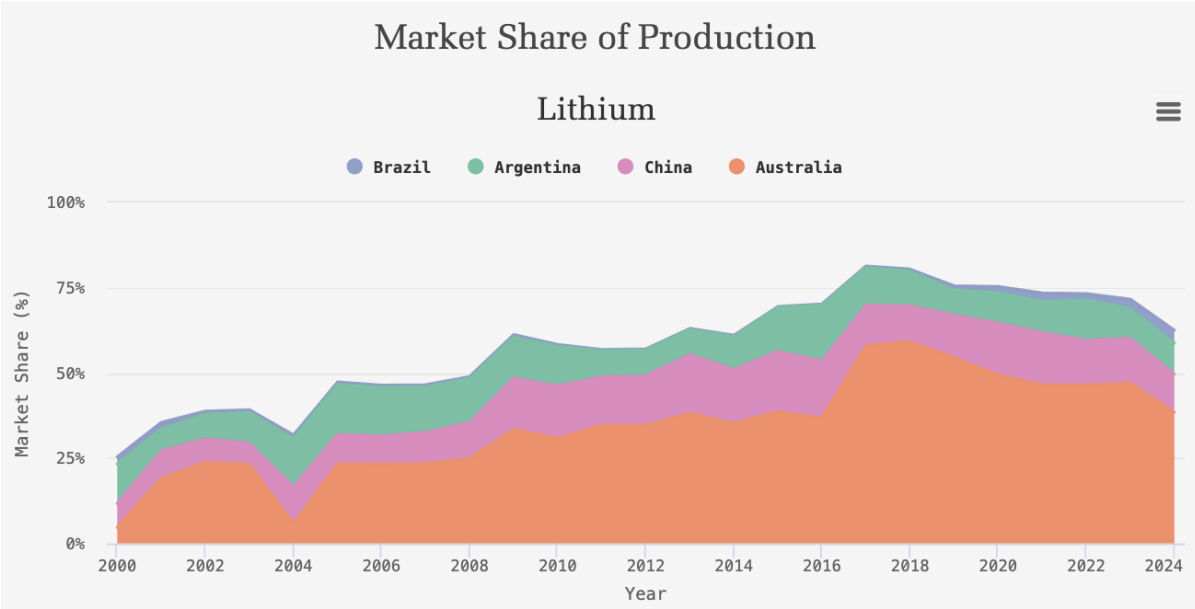
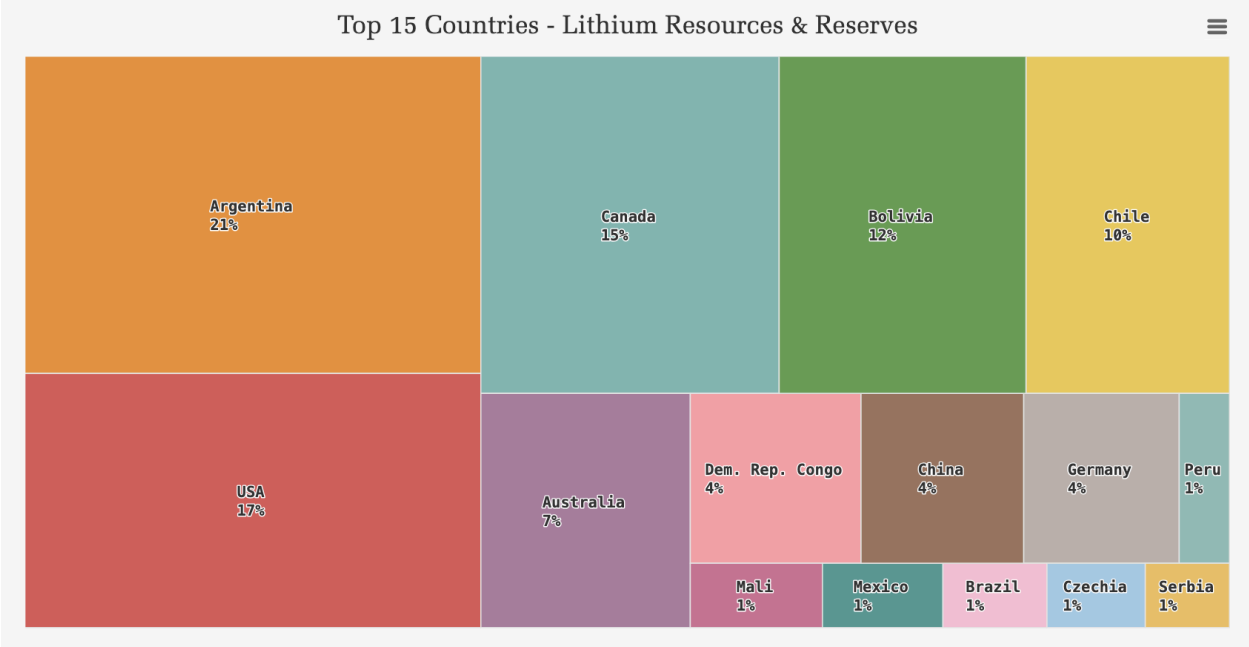


Historical Production Market Share for Lithium (Argentina, Australia, China, Zimbabwe).
Source: JFI Mineral Market Dashboard (Data: S&P Global).

3. **Resources and Reserves**: This panel maps the global concentration of known resources and reserves using S&P Global data. Interactive bar charts and treemaps allow users to visualize which nations possess the largest relative endowments of key minerals suitable for future extraction, offering critical insights into long-term supply potential and resource dependencies.



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Global Distribution of Lithium Resources & Reserves (Top 15 Countries).
Source: JFI Mineral Market Dashboard (Data: S&P Global).

4. **Country Profile & Rank:** For a consolidated view of a nation's standing, this panel provides detailed 2024 rankings for selected countries across multiple critical minerals. The tables present each country's global rank and percentage share for both production and resources/reserves, enabling rapid assessment and cross-commodity comparison of national significance in critical mineral markets.

Country Mineral Rankings (2024)

Brazil

Mineral	Production (% Share)	Production (Rank)	Resources & Reserves (% Share)	Resources & Reserves (Rank)
Aluminum	0.77%	9		
Bauxite	16.86%	2	6.53%	3
Graphite	3.16%	4	0.52%	12
Cobalt	0.13%	19	1.55%	12
Copper	2.14%	12	1.49%	18
Iron Ore	11.72%	2	14.09%	3
Lithium	3.76%	7	0.95%	13
Manganese	0.85%	12	2.62%	8
Nickel	5.63%	6	4.87%	7
Lead	0.76%	17	0.66%	23
Zinc	2.14%	13	1.09%	17
Phosphate			3.39%	7
Tin			5.39%	7

Ghana

Mineral	Production (% Share)	Production (Rank)	Resources & Reserves (% Share)	Resources & Reserves (Rank)
Manganese	5.31%	5	2.10%	10
Nickel	0.01%	46		
Graphite			0.28%	15
Iron Ore			0.16%	29
Lithium			0.14%	25

2024 Mineral Ranking Profile for Brazil and Ghana.
Source: JFI Mineral Market Dashboard (Data: S&P Global).

Pulling together these different views (where markets might be heading, where they've been, where the minerals actually are, and who ranks where today) gives the *Mineral Market Dashboard* a depth that single forecasts lack. Instead of aiming to predict the future, it's meant to give users the information and tools they need to deal with inherent uncertainties. In doing so, we hope to foster a more informed basis for policy dialogue, strategic planning, and development initiatives aiming to build resilience amid the volatility of global commodity markets.

Conclusion

Transition-critical mineral markets offer real promise for resource-rich countries and subnational governments seeking new development pathways. Yet these markets are complex, dynamic, and volatile. When fiscal frameworks are not explicitly designed to account for market complexity and uncertainty, budgets may be built on overly optimistic expectations, development plans can quickly unravel, and the promised economic and social gains for local communities may never materialize. Policymakers in resource-rich countries urgently need more robust, accessible tools and research that reduce information asymmetries and support better decision-making and policy design under conditions of volatility and complexity. The *Mineral Market Dashboard*, and the insights it will enable us to publish, is JFI's first step toward building tools and analysis that enable decision makers to navigate uncertainty, test assumptions, and build more robust development plans for long-term value creation from the boom and bust of commodity sectors.

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