

Brazil in the age of critical minerals: a new energy order

The opportunities and challenges for Brazil to lead the global energy transition and strengthen its role in strategic technologies to attract international investment



Contents



Introduction	03
--------------	----



What are critical minerals?	08
-----------------------------	----



Reserves, trade flows and geopolitical trends	12
---	----



Current demand and future trends	20
----------------------------------	----



Bottlenecks and opportunities for Brazil across the value chain	24
---	----



From commodity exporter to value creator: strategic routes for development	30
--	----



How businesses can stay ahead in a rapidly evolving market	37
--	----



Looking ahead	45
---------------	----



Contacts	47
----------	----



Introduction



Marked by the gradual replacement of fossil fuels with renewable sources and by rising energy efficiency, the world is experiencing an unprecedented phase in the energy transition. This structural shift – accelerated by social pressures, climate commitments, green industrial policies, and transformations in the mobility sector – is triggering a new race for resources. This time, however, the competition is not for oil or gas, but for critical minerals, indispensable inputs for enabling the key technologies of the new energy economy.

According to the International Energy Agency (IEA), global demand for minerals such as lithium, graphite, cobalt, nickel, and rare earth elements is expected to rise sharply by 2040, increasing in some cases by as much as fourfold compared to current levels. Further details on the different degrees of strategic importance and sensitivity assigned to these resources can be found on page 12.

To meet the Paris Agreement goals, the energy sector alone is expected to absorb more than half of the growth in demand for lithium and cobalt, as well as over 40% in the case of nickel. This emerging energy landscape carries profound geopolitical implications, according to the IEA.

Today, the production and processing of many of these minerals are highly concentrated, with China controlling roughly 85% of global rare-earth processing capacity and a significant share of the midstream stages for minerals such as graphite, vanadium, and lithium.

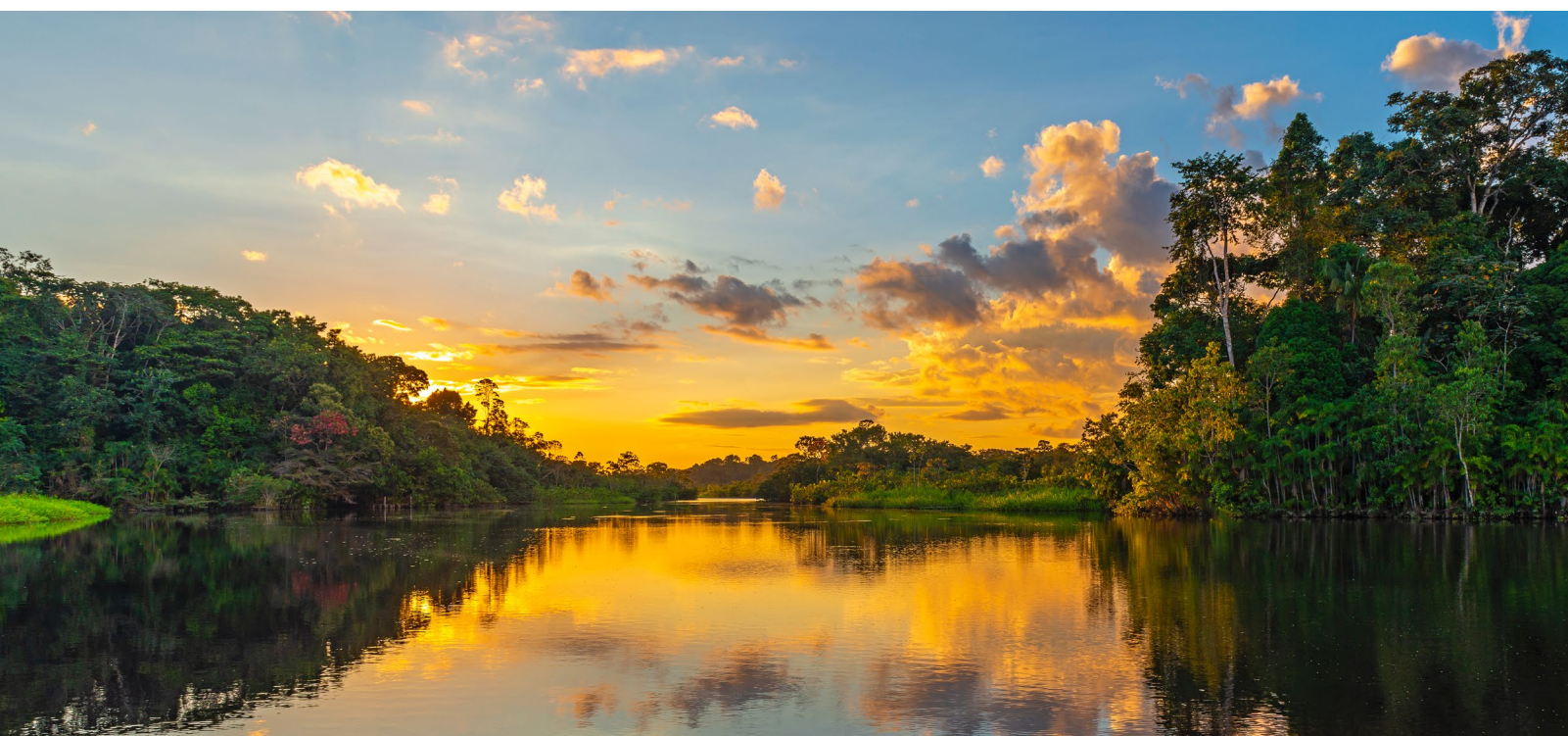
The Democratic Republic of Congo, in turn, accounts for more than 60% of global cobalt production. This level of concentration creates supply-security risks, prompting governments and companies to seek alternative, diversified, and more resilient sources.



In this context, Brazil emerges as a key player.

With one of the world's largest and most diverse geological bases, the country ranks among the top ten producers of nickel, manganese, niobium, iron, and bauxite – and has been expanding its relevance through the rapid growth of its production of lithium, natural graphite, rare earths, vanadium, and copper. Its strong track record in geological research is another strategic asset in this new global landscape.

The 2025 United Nations Climate Change Conference (COP30), in Belém, is expected to further elevate Brazil's international profile in this arena. The event offers an opportunity to discuss not only climate agreements, but also the role of natural resources in the energy transition and in reshaping global industrial value chains.



Turning potential into leadership, however, requires more than mineral wealth. Brazil still faces logistical, regulatory, and technological challenges, as well as the need to create value domestically and transition beyond a primary export model. In this report, we examine how Brazil can position itself strategically, mapping:

- the critical minerals most relevant to the energy transition.
- the country's level of readiness in exploration, production, and industrialization.
- key risks and barriers.
- opportunities for partnerships, innovation, and integration into sustainable and resilient global value chains.



With mounting regulatory, economic, and social pressures, Brazilian mining companies are reinventing their business models to create value in new ways while becoming more effective, secure, and strategic suppliers. Brazil has the potential to become a benchmark in this new energy order, with gains for its economy, diplomacy, and international reputation.”

Daniel Martins,
partner and Energy and Utilities Leader, PwC Brazil

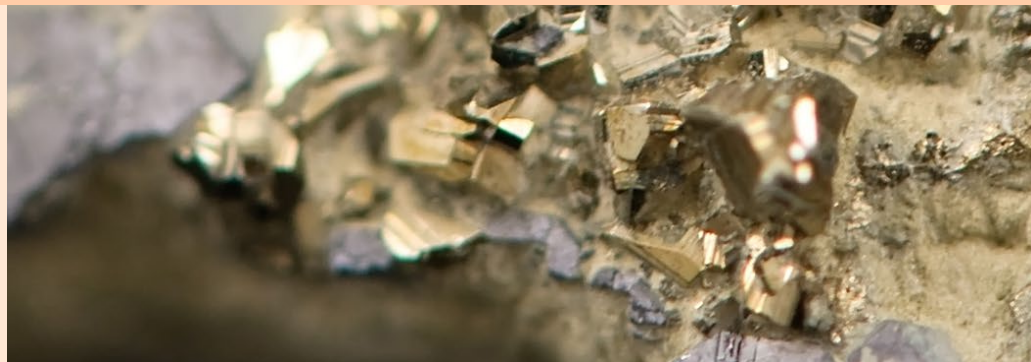


If we look ahead to Brazil's role in this new global order, it becomes clear that our resources can be central to economic growth and to expanding the country's credibility and regional influence. This also means recognizing the role of the industry in other key areas of society, such as urban mining (recycling), transportation, and aerospace. It further requires leveraging technology, including artificial intelligence, to advance productivity and sustainability.”

Patrícia Seoane,
partner and Mining and Metals Leader, PwC Brazil



What are critical minerals?



The transition to a low-carbon economy depends on technological innovation, policy decisions, financial capital, and mineral resources. Electric vehicles, wind turbines, smart grids, and storage batteries all require a set of minerals with specific properties – such as electrical conductivity, thermal stability, light weight, or magnetism – whose supply today is limited, highly concentrated, and vulnerable to unstable geopolitical dynamics.

In this context, it becomes increasingly important to understand the different degrees of sensitivity and strategic relevance assigned to these resources, which are classified as critical, strategic, and rare:



Two main factors determine the degree of criticality of a mineral:

- its economic importance to vital industrial value chains; and
- the risk of supply disruption, whether due to geographic concentration of production, technical limitations in extraction and processing, or regulatory instability.

As economies accelerate their energy transitions, the importance of critical minerals is set to grow – along with the need for industrial policies, trade agreements, and regulatory frameworks that ensure more resilient, transparent, and sustainable supply chains.

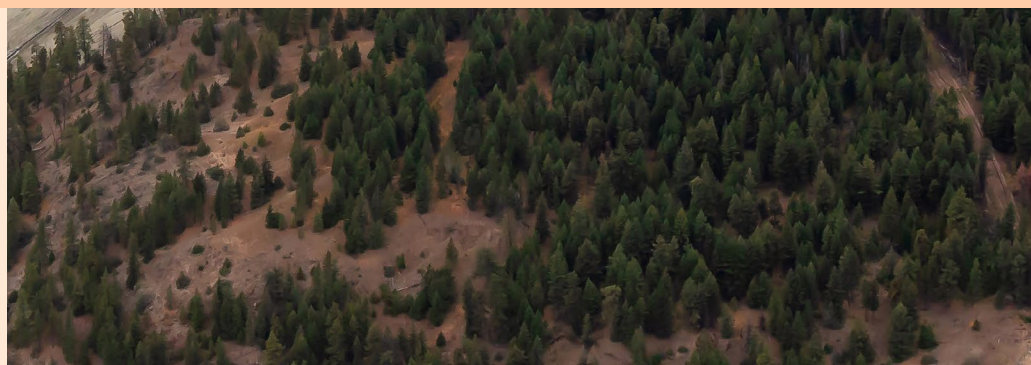
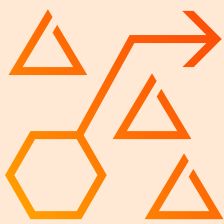
Although the composition of critical mineral lists varies across countries and economic blocs, there is a common core of recurring elements whose role has become essential to the energy transition, digitalization, and industrial security. Among them are:

Mineral	Main Application
Lithium (Li)	Key element in lithium-ion batteries used in electric vehicles and stationary energy-storage systems. Demand is expected to increase by more than 40-fold by 2040, according to the IEA, driven by global fleet electrification.
Cobalt (Co)	Used in lithium-ion battery cathodes due to its high energy density and thermal stability. Global production is highly concentrated in the Democratic Republic of Congo.
Copper (Cu)	Essential for electrification due to its high electrical conductivity. Found in motors, cables, transformers, and charging infrastructure, copper is one of the physical pillars of the energy transition.

Mineral	Aplicação principal
Graphite (C)	Main material for lithium-ion battery anodes. It can be natural or synthetic; the supply chain is highly concentrated in China, which dominates both production and refining.
Manganese (Mn)	Used in steel alloys and emerging battery chemistries such as LMO and NMC. Poised to become a key element in the next generation of more affordable batteries.
Nickel (Ni)	Employed in metal alloys and high-performance batteries for electric vehicles, especially in NMC chemistries. Growing demand for higher-energy-density batteries reinforces nickel as a strategic input.
Rare Earths	Group of 17 elements, with neodymium, praseodymium, dysprosium, and terbium being most critical for the energy transition. Essential for permanent magnets in wind turbines and high-performance electric-vehicle motors.
Vanadium (V)	Used in vanadium redox flow batteries (VRFB) for stationary renewable-energy storage. Offers long lifespan and stability for grid applications.



Reserves, trade flows and geopolitical trends



Understanding where reserves are located, who controls production, who relies on imports, and what global trends are emerging is essential to positioning Brazil strategically in this landscape.

Critical minerals are unevenly distributed globally. Countries with geological advantages and an established mining tradition hold significant reserves and attract the geopolitical interest of major powers.

Location and reserve volumes

Mineral	Main countries with significant reserves
Lithium	Chile, Australia, Argentina, China, Brazil
Cobalt	Democratic Republic of the Congo, Australia, Russia, Cuba
Copper	Chile, Peru, China, Democratic Republic of the Congo, United States
Graphite	China, Mozambique, Brazil, Tanzania
Manganese	South Africa, Australia, Brazil, Gabon
Nickel	Indonesia, Philippines, Australia, Russia, Brazil
Rare earths	China, Brazil, Vietnam, Russia, India
Vanadium	Australia, Russia, China



Lithium

- Global lithium reserves (measured and indicated) total around 115 million tonnes of lithium metal equivalent (or broader resource estimates).
- In the country ranking, Chile holds approximately 9.3 million tonnes of reserves (between 8% and 10% of the total), followed by Australia, Argentina, and China.
- Brazil has measured and indicated reserves of roughly 1.3 million tonnes of lithium metal equivalent (around 5% of the global total).¹
- A recent discovery in Germany (Altmark, Saxony-Anhalt) identified estimated resources of 43 million tonnes of LCE (lithium carbonate equivalent), which could shift part of Europe's position in the battery supply chain.²

Cobalt

- Global cobalt reserves are estimated at 11 million tonnes
- The Democratic Republic of Congo concentrates between 50% and 60% of these reserves.
- Other countries with relevant reserves include Australia, Indonesia, Cuba, the Philippines, and Russia.³

Rare earths

- Known global reserves of rare-earth oxides exceed 90 million tonnes. China leads with approximately 44 million tonnes, followed by Brazil (21 million tonnes) and India (6.9 million tonnes).⁴

¹ United States Geological Survey. Lithium – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-lithium.pdf>. Accessed on: 04 Oct. 2025.

² Dakss, O. "Germany Discovers Major Lithium Reserves: What It Means." Newsweek, 29 Aug. 2025. Available at: <https://www.newsweek.com/germany-discovers-major-lithium-reserves-what-it-means-10802660>. Accessed on: 04 Oct. 2025.

³ United States Geological Survey. Cobalt – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-cobalt.pdf>. Accessed on: 04 Oct. 2025.

⁴ United States Geological Survey. Rare Earths – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-rare-earths.pdf>. Accessed on: 04 Oct. 2025.

Nickel

- Global reserves exceed 130 million tonnes, with Indonesia alone holding nearly half of the total. Brazil contributes approximately 16 million tonnes.⁵

Graphite

- China dominates reserves, with around 81 million tonnes identified, followed by Brazil with 74 million tonnes (26% of the global total).⁶

Vanadium

- Known global vanadium reserves total around 18 million tonnes. The main holders of these reserves are Australia, with 8.5 million tonnes, Russia (5 million), China (4.1 million), and, on a smaller scale, South Africa (430 thousand tonnes) and Brazil (120 thousand tonnes).⁷



⁵ United States Geological Survey. Nickel – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-nickel.pdf>. Accessed on: 04 Oct. 2025.

⁶ United States Geological Survey. Graphite – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-graphite.pdf>. Accessed on: 04 Oct. 2025.

⁷ United States Geological Survey. Vanadium – Mineral Commodity Summaries 2025. Reston, Virginia: USGS, 2025. Available at: <https://pubs.usgs.gov/periodicals/mcs2025/mcs2025-vanadium.pdf>. Accessed on: 04 Oct. 2025.

Production and exports: concentration and asymmetry

Global production of critical minerals is highly concentrated. A few countries hold dominant positions not only in extraction, but also in refining and midstream processing:

- China accounts for more than 50% of the production of 18 critical minerals and controls a large share of the refining and processing of rare earths, graphite, vanadium, and intermediate stages of lithium and cobalt value chains.
- The Democratic Republic of Congo (DRC) is responsible for more than 60% of global cobalt production, yet still relies on external refining, limiting its ability to capture value locally.
- Australia leads lithium extraction in spodumene form (with production estimated in the tens of thousands of tonnes).
- Indonesia and the Philippines remain the main producers of nickel from laterite deposits, contributing a significant share of the 3.7 million tonnes of global output in 2024.

This concentration creates dependency and vulnerability to external shocks. For example, in 2023, China implemented export restrictions on refined graphite and gallium – strategic inputs for batteries and semiconductors – in response to trade disputes with the United States and the European Union.

In 2025, China imposed restrictions on rare-earth exports – essential for advanced technologies – in retaliation against new U.S. tariffs. With 91% of global rare-earth refining concentrated in China in 2024, the issue became a strategic topic in negotiations between the United States and Brazil.⁸

This underscores how control over more advanced stages of the mineral value chain can be leveraged as a geopolitical tool.

⁸ IEA. Global Critical Minerals Outlook 2025 – Overview of Outlook for Key Minerals. Available at: <https://www.iea.org/reports/global-critical-minerals-outlook-2025/overview-of-outlook-for-key-minerals>. Accessed on: 03 Nov. 2025.

Importers of critical minerals

Major industrialized economies rely on imports of critical minerals to secure their green-reindustrialization agendas, energy transition plans, and technological competitiveness. This dependency is driving policy initiatives focused on supplier diversification and vertical integration of supply chains.



European Union

The EU is among the largest importers of lithium, graphite, rare earths, and cobalt – key raw materials essential for batteries, permanent magnets, and the electrification of transportation. The growing emphasis on the European Green Deal and the Critical Raw Materials Act reflects the bloc's efforts to reduce reliance on China, diversify supply chains, and attract advanced refining and manufacturing projects to Europe.



United States

The U.S. classifies critical minerals as national security assets and is taking direct steps to reduce its external dependence. For instance, in 2025, the Department of Energy (DOE) negotiated the acquisition of a 5% stake in the Thacker Pass lithium project (with Lithium Americas) as a condition for a federal loan of US\$2.26 billion – marking a shift in mineral-security strategy.⁹

In parallel, the Trump administration has also signaled interest in equity participation in geostrategic rare-metal projects – for example, its expressed interest in acquiring stakes in rare-earth ventures in Greenland.¹⁰

⁹ Reuters. "US government to take 5% stake in Lithium Americas and joint venture with GM, source says." Reuters, 30 Sept. 2025. Available at: <https://www.reuters.com/business/autos-transportation/us-government-take-5-stake-lithium-americas-joint-venture-with-general-motors-2025-09-30/>. Accessed on: 04 Oct. 2025.

¹⁰ Reuters. "Trump administration eyes stake in Critical Metals Corp developing Greenland rare earths mine." Reuters, 03 Oct. 2025. Available at: <https://www.reuters.com/business/trump-administration-eyes-stake-company-developing-greenland-rare-earths-mine-2025-10-03/>. Accessed on: 04 Oct. 2025.



Japan and South Korea

Both countries are highly industrialized but have limited mineral resources, leading them to import large volumes of nickel, graphite, and rare earth elements to sustain their battery, semiconductor, and advanced electronics supply chains. Their strategies include forming alliances with producing nations (such as Indonesia, Brazil, and African countries), investing in refining outside China, and pursuing international cooperation to recycle materials and develop alternatives.



India

Amidst rapid industrial and urban expansion, India primarily imports copper, lithium, and graphite to support its infrastructure needs, electric mobility, and solar energy development. The country has sought to expand supply agreements with Latin American and African nations while simultaneously accelerating efforts to map its own reserves to reduce external exposure.



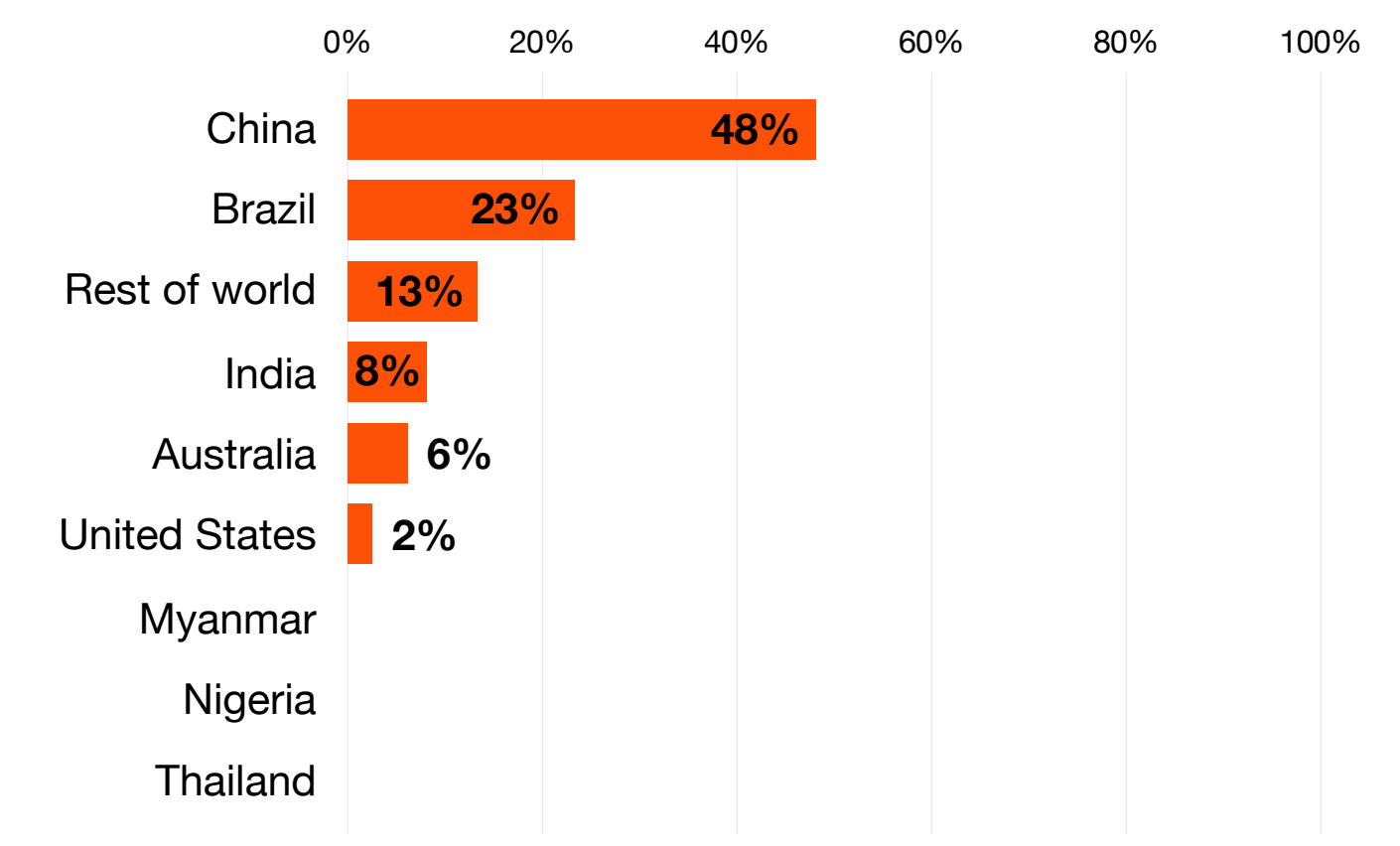
Mineral security is power

The growing dependence of major industrialized economies on critical minerals underscores the strategic importance of countries with reserves and production capacity, such as Brazil.

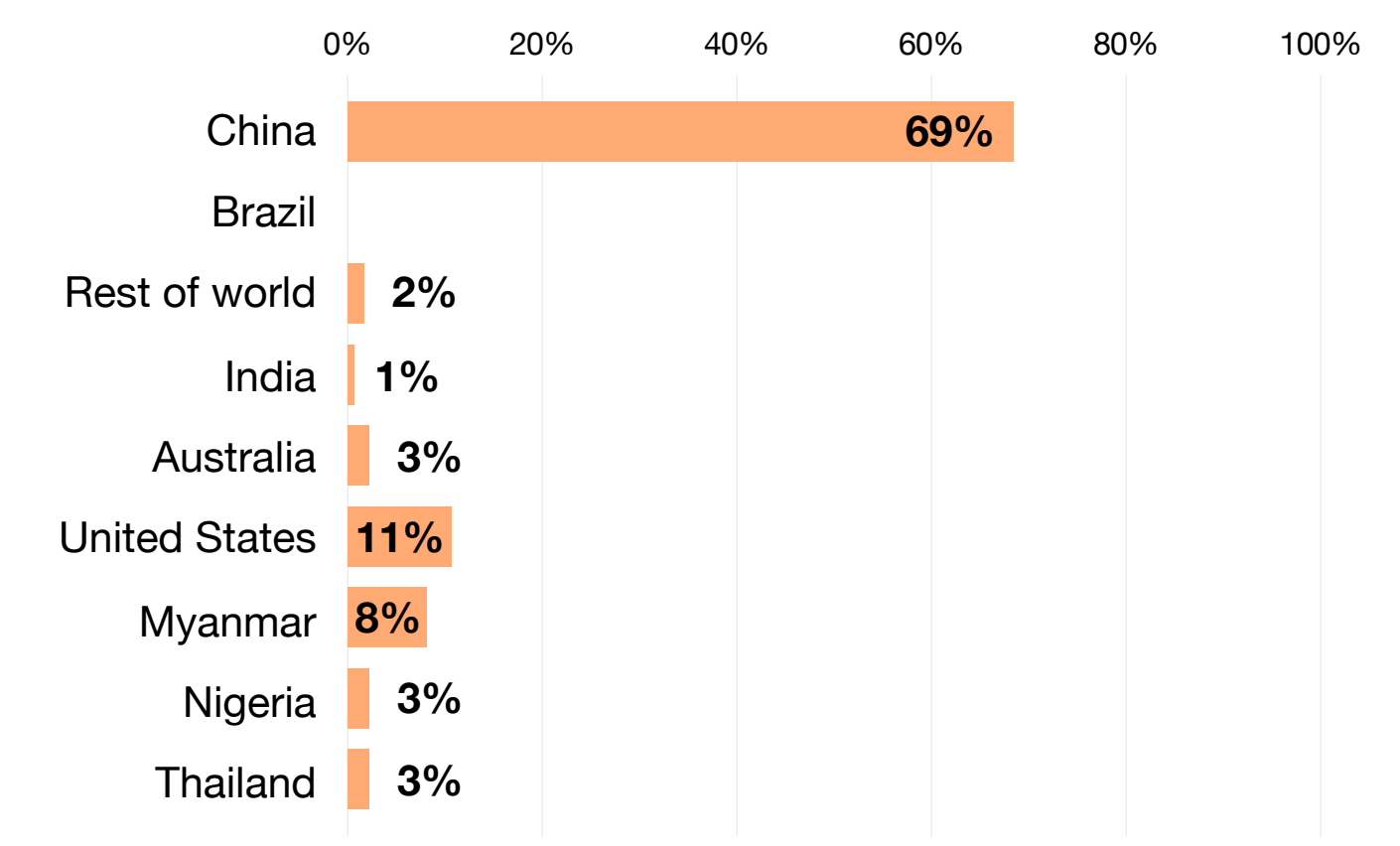
More than simply suppliers of commodities, these nations have the opportunity to position themselves as relevant geopolitical players – offering secure supply, meeting ESG standards, and building long-term partnerships for the green economy.

Geographical mismatches between rare earth reserves and production

Share of global reserves



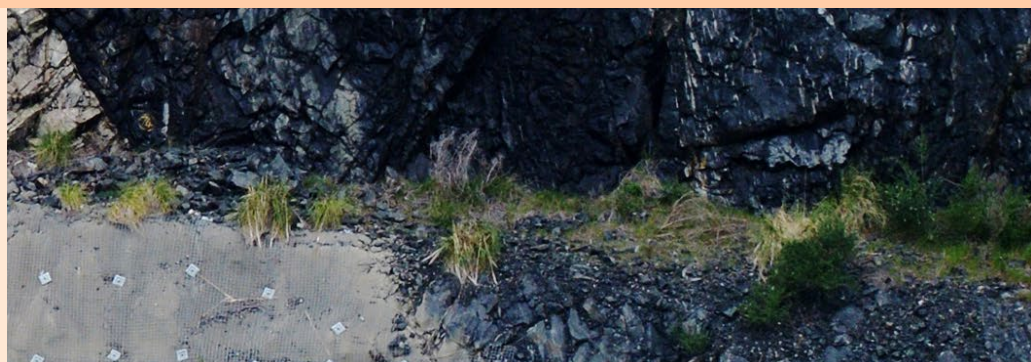
Share of global mine production



Source: United States Geological Survey.



Current demand and future projections



The future of mining will be shaped by those able to anticipate the major transformations already underway. According to PwC analysis, seven megatrends will define the sector through 2035 – from accelerated urbanization to the convergence of automation, the energy transition, and strategic industrial policies. The table below summarizes these dynamics.

Key forces shaping the mining sector in the next decade

Force/trend	Expected impacts
Population growth and urbanization	The global urban population is expected to double by 2050. This will increase per-capita demand for minerals, even with gains in efficiency and recycling. Greater value will be placed on mineral supply linked to urban infrastructure and global consumption.
Energy transition	The main driver of demand for critical minerals. Supply expansion is expected through new projects under development, aiming to meet growing needs for clean technologies such as batteries, solar panels, and wind turbines.
Environmental and climate impacts	Extreme climate events –such as droughts, floods, and rising sea levels – will impact logistics and mining operations. At the same time, demand for minerals driven by climate adaptation and clean technologies will increase. Arctic regions may gain geopolitical and mineral relevance.
Technology, innovation and automation	The adoption of autonomous vehicles and remote-operation technologies will bring productivity, safety, and resource efficiency gains. Existing mines will adopt innovations selectively. More efficient and remote-operated equipment will transform operations and management.

Force/trend	Expected impacts
Human capital	Workforce profiles will evolve. Increased use of AI and remote operations will require highly skilled and digitally capable workers. Office-based roles will expand in relation to physical labor. Attraction of younger talent and diversity is expected to grow.
Access to finance	Investor base will broaden and diversify, including new public- and private-sector profiles. Non-traditional investors may enter the sector due to opportunities arising from the energy transition and geopolitical repositioning.
Government policy and regulation	Resource nationalism will strengthen. Effective policies and regulations will be crucial to securing supply and promoting sustainable sector development. Collaboration among governments, companies, and communities will be key to unlocking investment.

Source: PwC analysis, [Mine 2025](#).

Sectors driving demand growth

Strategic sectors heavily influence the accelerated demand for critical minerals. One of the main drivers is electric mobility: each electric vehicle can contain up to 200 kg of minerals such as lithium, nickel, cobalt, and graphite – essential for battery performance and durability.¹¹

¹¹ World Bank. Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition. Washington, DC: World Bank, 2020. Available at: <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099052423172525564>. Accessed on: 04 Oct. 2025.

Another emblematic example is the wind sector – turbines with permanent magnets, used in higher-capacity projects, can require up to 600 kg of rare earth elements such as neodymium and dysprosium per unit.¹²

Stationary energy storage, which is crucial for ensuring grid stability amid growing deployment of intermittent renewable sources like solar and wind, also depends heavily on battery technologies based on lithium, vanadium, or sodium.

In addition, the electrical and digital infrastructure that underpins both electrification and global connectivity requires large volumes of copper and aluminum – used in cables, transformers, data centers, and telecommunications systems.¹³ These sectors concentrate demand growth and increase pressure for resilient, traceable, and environmentally responsible supply chains.

Projections for 2040: scenario aligned with the Paris agreement (IEA, 2022)¹⁴

Mineral	Projected increase in demand by 2040
Lithium	Demand may rise up to 42 times compared with 2020
Nickel	Demand expected to increase 20–25 times
Cobalt	Demand expected to increase 20–25 times
Graphite	Demand may quadruple
Rare earths	Demand expected to more than triple for applications in wind turbines and electric motors

Note: These values vary according to the level of global climate ambition and the deployment of technologies such as solid-state batteries, recycling, and hybrid vehicles.

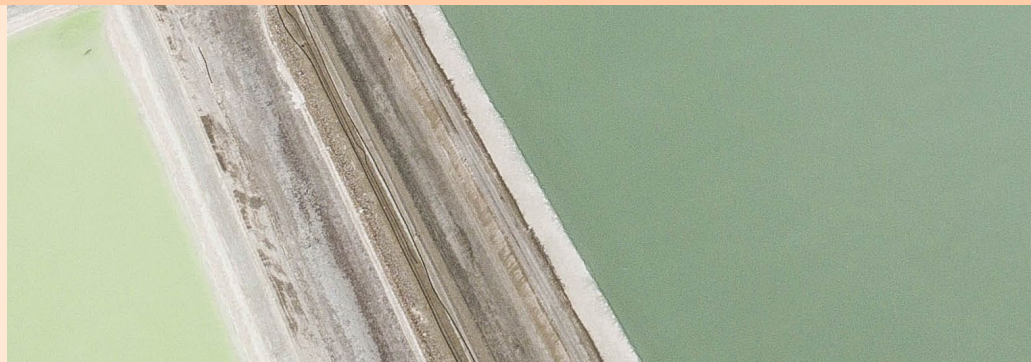
¹² International Energy Agency (IEA). The Role of Critical Minerals in Clean Energy Transitions. Paris: IEA, 2021. Available at: <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>. Accessed on: 04 Oct. 2025.

¹³ International Energy Agency (IEA). Electricity Grids and Secure Energy Transitions. Paris: IEA, Revised version November 2023. Available at: <https://iea.blob.core.windows.net/assets/ea2ff609-8180-4312-8de9-494bcf21696d/ElectricityGridsandSecureEnergyTransitions.pdf>. Accessed on: 04 Oct. 2025.

¹⁴ International Energy Agency (IEA). The Role of Critical Minerals in Clean Energy Transitions. Paris: IEA, 2021. Available at: <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>. Accessed on: 04 Oct. 2025.



Bottlenecks and opportunities for Brazil in the value chain



Industrialized nations have advanced policies aimed at strategic resource independence, seeking to diversify suppliers and foster local or regional value chains with higher value added.

Within this new framework, the value of critical minerals shifts from extraction to refining, processing, and technological integration. It is a complex chain – capital-intensive, regulation-heavy, and knowledge-driven – and it is along these stages that strategic positions in the new global energy order will be defined.

From mine to market: six interdependent stages



Prospecting and geological exploration: this stage involves geophysical mapping, drilling, and economic, technical, and environmental feasibility studies.

In Brazil: there is strong technical expertise within institutions such as the Geological Survey of Brazil (SGB/CPRM). However, private investment in mineral exploration has been low, especially for non-traditional minerals such as rare earths. There is a need for incentive programs, geological data sharing, and transparency, as well as regulatory certainty in the permitting process.¹⁵



Mineral extraction (mining): corresponds to the removal of ore from the ground.

In Brazil: the country is competitive on several fronts – ranking among global leaders in iron ore, niobium, bauxite, copper, manganese, and now lithium (with accelerated growth in the Jequitinhonha Valley). Nonetheless, the dominant logic remains export-driven and concentrated on primary commodities.



Beneficiation: involves crushing, grinding, concentration, and separation of useful minerals.

In Brazil: capacity in these stages is present, but installed capability remains limited for minerals requiring more complex processing – such as rare earths, which demand separation of elements with very similar physicochemical properties.

¹⁵ Martins, Colbert; Lima, Paulo César Ribeiro; et al. Minerais estratégicos e terras raras. Brasília: Câmara dos Deputados / Centro de Estudos e Debates Estratégicos, 2014, pp. 145–146. Available at: <https://portaldaminerao.com.br/wp-content/uploads/2014/05/minerais-estrategicos-e-terras-raras.pdf>. Accessed on: 04 Oct. 2025.



Refining and chemical processing: conversion of concentrates into pure industrial compounds (oxides, carbonates, or metals).

In Brazil: this is the main bottleneck. A significant portion of the extracted material is exported in its raw or concentrated form for refining in countries such as China and South Korea. For example, lithium extracted in Brazil was, until recently, exported as spodumene concentrate with low added value. China, in turn, dominates this stage globally, with 70% of lithium refining, 78% of cobalt, and more than 91% of rare earths.¹⁶



Manufacturing of components and industrial products: this is the stage where value is multiplied, including batteries, permanent magnets, conductive wires, and speciality alloys.

In Brazil: there is industrial presence in electro-intensive and steelmaking sectors, but minimal activity in advanced manufacturing linked to critical minerals. The battery value chain, for example, is still emerging and lacks a structured connection with local mining.



Recycling and reprocessing: an emerging and increasingly strategic stage to reduce dependence on primary mining.

In Brazil: still at an early stage. The reverse chain for batteries is underdeveloped, and there is no structured public policy to support the recovery and reuse of components containing lithium, cobalt, or rare earths.

¹⁶ International Energy Agency (IEA). Global Critical Minerals Outlook 2025 – Overview of Outlook for Key Minerals. Available at: <https://www.iea.org/reports/global-critical-minerals-outlook-2025/overview-of-outlook-for-key-minerals>. Accessed on: 03 Nov. 2025.

The cost of fragmentation

Brazil remains highly concentrated in the first two stages of the value chain. This limitation weakens its ability to capture economic and strategic value, effectively exporting opportunities that are realized by countries with greater industrial and technological capacity.

The scarcity of refining facilities and limited investment in research, development, and materials engineering hinder technological advancement. The lack of integration between mining and industrial policy, combined with logistical bottlenecks in producing regions – such as restricted access to energy, rail transport, and digital connectivity – further erodes competitiveness.

Also weighing on performance is the absence of a robust international strategy to engage in global alliances focused on resilient and sustainable value chains.



Potential and differentiators

Despite existing obstacles, Brazil holds a unique position on the global map of critical minerals. With its remarkable geological diversity and vast territorial extent, the country boasts a strong portfolio of natural resources.

In lithium, Brazil is already among the world's five largest producers, with the Jequitinhonha Valley in Minas Gerais standing out. Domestic production is expected to grow exponentially through 2030. The same applies to natural graphite, for which Brazilian reserves are among the largest worldwide, although local industrialization – such as spherical graphite production – remains incipient.



For rare earths, Brazil has large deposits in states such as Goiás, Minas Gerais, and Bahia, but it has not yet mastered the separation and purification stages. Vanadium and nickel also present strong potential, particularly given the projected demand for flow batteries and electric vehicles.

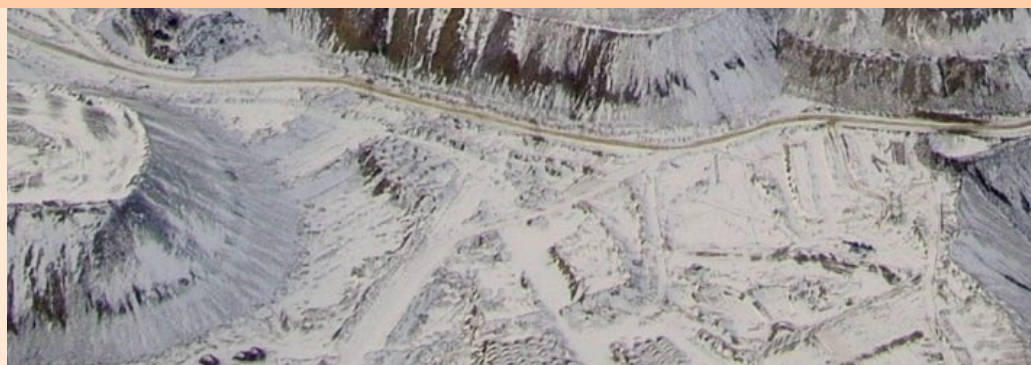
However, resource abundance does not automatically translate into geopolitical or industrial leadership. Potential must be converted into strategy.

The energy transition and the redesign of global supply chains have created a rare window of opportunity, but also a point of inflection: Brazil must decide whether it will remain an exporter of commodities or position itself as an industrial protagonist in the green economy.

Brazil's competitive advantages	Structural bottlenecks and challenges
Large and diversified geological base, with favorable conditions for open-pit mining.	Lack of refining and chemical-processing plants for strategic minerals.
Predominantly renewable energy matrix, which can serve as a competitive advantage for low-carbon minerals.	Weak integration between mining and advanced manufacturing, resulting in export of concentrates and import of higher value-added components.
Relative institutional and democratic stability compared with other major producing countries (e.g., Congo, Indonesia, Philippines).	Bureaucracy and slow environmental licensing processes, coupled with regulatory uncertainty in exploration areas.
Industrial presence in energy-intensive sectors (such as steelmaking, metallurgy, pulp & paper, and chemicals), which can be leveraged to absorb part of domestic mineral processing.	Absence of a structured industrial policy for critical minerals, unlike peers such as the US, Canada, Australia, and the European Union.
Established export logistics infrastructure (railways and ports in the Southeast and Northeast), with room for expansion.	Insufficient investment in R&D and metallurgical development, particularly in advanced beneficiation and recycling stages.



From commodity exporter to value creator: strategic routes for development



A national strategy regarding critical minerals can follow two paths. The first approach is to maintain the current model, centered on exporting concentrates with minimal processing. This route requires less capital, faces lower regulatory complexity, and offers faster financial returns. However, it generates few skilled jobs, captures limited value, and leaves the country vulnerable to international market volatility.

The second path is more strategic and involves verticalizing mineral value chains domestically – from chemical refining to the manufacturing of technological components. This approach fosters the creation of highly skilled jobs, stimulates research and innovation, increases tax revenue, and positions Brazil as a reliable and sustainable supplier of advanced materials and critical mineral feedstocks.

The difference in added value is significant: a tonne of spodumene concentrate with 6% lithium content can be exported for approximately US\$900¹⁷ while battery-grade lithium hydroxide can exceed US\$8,000 per tonne.¹⁸ Choosing between exporting ore and exporting innovation will shape Brazil's revenue profile and strategic position in the 21st century.

Indonesia is a striking example of how to turn reserves into industrial value. Between 2019 and 2024, the country attracted more than US\$2.3 billion in investment to establish around 60 nickel-processing plants, consolidating its position as a key link in the global battery supply chain.

¹⁷ ScrapMonster. Spodumene Li₂O 6% min Prices – CIF China, 16 Sept. 2025. Available at: <https://www.scrapmonster.com/metal-prices/spodumene-li2o-6-min-price/795>. Accessed on: 05 Oct. 2025.

¹⁸ LME and Fastmarkets MB. "LME Lithium Hydroxide CIF." London: London Metal Exchange. Available at: <https://www.lme.com/en/Metals/EV/LME-Lithium-Hydroxide-CIF-Fastmarkets-MB#Price+graph>. Accessed on: 05 Oct. 2025.



With strong geological, energy, and environmental fundamentals, Brazil is well-positioned to follow a similar path. The challenge now is to act fast enough to capture this moment.

Brazilian government actions: regulation and market signals

In recent years, the Brazilian government has sent positive signals and strengthened recognition of the strategic importance of critical minerals. Key advances include the incorporation of these minerals into the Brazilian Mineral Policy (PNM 2050), with a focus on elements such as lithium, rare earths, niobium, cobalt, copper, and manganese.

A dedicated Interministerial Committee for the Energy Transition (Cite) and the National Hydrogen Program were also established, reinforcing the interdependence between energy and strategic minerals on the federal agenda.

At the regional level, the Lithium Valley Program, coordinated by ministries and state governments, has mobilized investment to develop an integrated lithium value chain in Minas Gerais.



Results are already visible: in 2024, production in the Jequitinhonha Valley surpassed 944,000 tonnes (almost twice the volume recorded in 2023), attracting approximately R\$6.3 billion in investment and generating thousands of jobs.¹⁹

Additionally, the Geological Survey of Brazil has expanded its technical mapping of deposits and reserves with strategic potential, generating valuable data for investors and policymakers.

On the international front, Brazil has participated in forums such as the G20 and the IEA, underscoring the need to diversify supply chains and promote sustainable practices in the mineral sector.

¹⁹ Government of Minas Gerais. Jequitinhonha colhe resultados econômicos com o Programa Vale do Lítio. Secretaria de Desenvolvimento Econômico de MG (SEDE/MG), 2025. Available at: <https://desenvolvimento.mg.gov.br/inicio/noticias/noticia/3138/jequitinhonha-colhe-resultados-economicos-com-o-programa-vale-do-litio>. Accessed on: 05 Oct. 2025.

Despite progress, Brazil still needs to invest in a robust and coordinated national strategy that keeps pace with the global transformation. The absence of mechanisms such as tax incentives linked to value-added activities, local-content targets in sectors like batteries and permanent magnets, and bilateral agreements to secure access to strategic markets leaves the country vulnerable to remaining merely a raw-material exporter. This position could undermine its ability to play a leading role in the new green economy.

Strategic industrial chains for Brazil's repositioning

Building a critical-minerals industry in Brazil depends on identifying sectors that can drive value creation within the country.

The challenge is to develop industrial chains that can absorb extracted or refined inputs and convert them into high-value products and technologies with international relevance. Three sectors stand out for their strong synergy with Brazil's mineral base and for their central role in the global energy transition:

1.

Batteries and energy storage

The battery industry drives demand for critical minerals, including lithium, nickel, cobalt, graphite, and vanadium. Although cell and battery-pack production is still concentrated in Asia, there is potential to localize strategic stages in Brazil, particularly in cathodes, anodes, and power electronics.

This could reduce logistics costs, ensure supply security, generate skilled employment, and utilize available infrastructure and clean energy in regions such as the Southeast and Northeast.

2.

Electric mobility

The electrification of the automotive industry presents a historic opportunity for Brazil to reposition itself. Companies such as BYD, GWM, and Volkswagen have already announced plans in the country. Demand for critical minerals (including copper, rare earths, lithium, nickel, and semiconductors) also requires industrial development.

With a coordinated industrial policy, skilled workforce development, and attraction of manufacturers, Brazil can advance in the production of motors, inverters, batteries, and electronics. The formation of regional clusters with strong local content can accelerate this transition.

3.

Electronics and technology

Brazil already has an established industrial base in electronics, primarily concentrated in the Southeast and the Manaus Free Trade Zone. Integrating mineral and electronics supply chains would reduce external dependence and strengthen supply security.

Local production of higher-value components that depend on minerals such as copper, tin, nickel, rare earths, and lithium would position the country as a competitive player in connectivity and industrial digitalization.



Pathways to leadership: policy, infrastructure and incentives

The Brazilian Mining Institute (Ibram) estimates that critical mineral projects should receive around R\$100 billion in investment between 2025 and 2029.²⁰ To ensure that this capital translates into structural gains, key initiatives include:



Stable and aligned regulation. Clear, modern, and harmonized regulation across federal and state levels can reduce risk and attract long-term investment. It is also essential to integrate environmental, social, and technical requirements with international standards for traceability and ESG practices.



Industrial zones and infrastructure. Developing mineral-industrial zones with logistical, tax, and regulatory incentives can accelerate productive verticalization.

These zones should be located near major deposits (such as the Lithium Valley), have access to renewable energy, and be connected to efficient transport systems (railways, highways, ports). Infrastructure investment is fundamental to securing international competitiveness.



Transition-oriented financing. Dedicated credit lines from BNDES, Finep, and multilateral banks – particularly those tied to the energy transition – can mobilize early-stage investments with technological risk and medium-term returns. Additionally, international funds must be engaged to finance projects that are traceable, sustainable, and have a positive impact.

²⁰ NN Brasil. IBRAM: minerais críticos no Brasil vão atrair mais de R\$ 100 bi até 2029. 05 Aug. 2025. Available at: <https://www.cnnbrasil.com.br/economia/macroeconomia/ibram-minerais-criticos-no-brasil-vao-atrair-mais-de-r-100-bi-ate-2029>. Accessed on: 05 Oct. 2025.



Industrial policy with clear targets. Setting progressive local-content targets in sectors such as batteries, electric vehicles, and renewable energy equipment can stimulate the localization of critical segments of the value chain. Just as the European Union and North America have adopted origin requirements to access subsidies, Brazil can adopt incentives linked to domestic value addition in strategic minerals. Industrial policy should be flexible, yet results-driven.



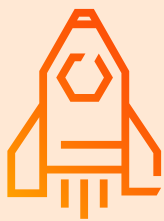
Strategic international partnerships. To accelerate technological development and secure access to premium markets, Brazil should prioritize bilateral and multilateral agreements that focus on critical minerals.



Cooperation with countries such as Germany, Japan, South Korea, the United States, and India can generate synergies in research, skills development, standardization, and traceability. COP30 presents a crucial geopolitical opportunity to position Brazil as a strategic partner in sustainable and diversified supply chains.



How businesses can stay ahead in a rapidly evolving market



The critical minerals market is experiencing rapid expansion and consolidation, leaving little room for strategic inaction. Major global players are moving to secure reserves and integrate the value chain, highlighting the increasingly geopolitical and industrial nature of the sector.

Rio Tinto, Albemarle, BHP, Glencore, China Northern Rare Earth, and Ganfeng Lithium are examples of companies that are diversifying geographies, verticalizing operations, and forming strategic partnerships with automakers and governments.

At the same time, automakers such as Tesla, Ford, GM, and Volkswagen are signing direct supply contracts, while Asian companies like BYD are expanding the vertical integration of battery chains beyond China. This environment has also attracted sovereign funds and development banks such as KfW and JOGMEC, reinforcing the global competition for strategic assets.

M&A in mining: capital is moving – and fast

Against this backdrop, Brazil has returned to investors' radar. Between 2021 and 2024, the mining mergers and acquisitions market grew at an average annual rate of 26%, significantly above the global average. This movement was driven by factors such as the growing demand for energy-transition metals, excess post-pandemic liquidity, a favorable macroeconomic environment, and the search for low-carbon assets.

Despite a temporary slowdown in 2024, the upward trend remains clear: M&A has become essential to securing reserves, expanding refining capacity, and integrating advanced industrial stages linked to the energy transition. This trend is reflected in the growing number of domestic and international companies positioning themselves in critical-mineral projects with transformative potential in Brazil.

Some of the key deals that signal Brazil's repositioning in global value chains in recent years include:



- **Atlas Lithium.** Received US\$30 million from Mitsui & Co. to advance the Neves Project in Minas Gerais. The agreement includes an offtake contract for 15,000 tonnes in Phase 1 and 60,000 tonnes per year in Phase 2, in addition to expanding the exploration area by roughly 540 km².²¹
- **Sigma Lithium.** Secured BNDES financing of R\$486.7 million to build a sustainable lithium beneficiation facility at the Grota do Cirilo project in Itinga (MG). The total planned investment is R\$492.4 million and will enable an increase in production capacity from 270,000 to 520,000 tonnes per year of lithium concentrate.²²
- **Lithium Ionic.** Obtained an exploration license in Minas Gerais in 2023, expanding its footprint in the Jequitinhonha Valley. Its flagship asset is the Bandeira Project, with an estimated net present value of US\$1.3 billion, planned production of 178,000 tonnes per year of spodumene concentrate, an internal rate of return of 40%, and operating costs around US\$444/t.²³
- **CBMM.** Invested R\$230 million in R&D in 2023, including an industrial plant for niobium oxide now operational (3 kt/year) for battery applications.²⁴

²¹ Atlas Lithium. Atlas Lithium secures US\$30,000,000 strategic investment and offtake agreement from Mitsui. 28 Mar. 2024. Available at: <https://www.atlas-lithium.com/news/atlas-lithium-secures-us-30000000-strategic-investment-and-offtake-agreement-from-mitsui/>. Accessed on: 05 Oct. 2025.

²² Agência de Notícias BNDES. BNDES aprova R\$ 486,7 milhões para Sigma Lithium beneficiar lítio de forma sustentável, 29 Ago. 2024. Available at: [https://agenciadenoticias.bndes.gov.br/industria/BNDES-aprova-R\\$-4867-milhoes-para-Sigma-Lithium-beneficiar-litio-de-forma-sustentavel/](https://agenciadenoticias.bndes.gov.br/industria/BNDES-aprova-R$-4867-milhoes-para-Sigma-Lithium-beneficiar-litio-de-forma-sustentavel/). Accessed on: 05 Oct. 2025.

²³ Lithium Ionic. Lithium Ionic Files NI 43-101 Technical Report for the Bandeira Lithium Project Feasibility Study. 11 Jul. 2024. Available at: <https://www.lithiumionic.com/resources/news/nr-20240711.pdf>. Accessed on: 05 Oct. 2025.

²⁴ CBMM. 2023 Sustainability Report. Available at: <https://cbmm.com/relatorio-sustentabilidade/assets/files/cbmm-sustainability-report-2023.pdf>. Accessed on: 05 Oct. 2025.

In addition to these established investments, a new generation of rare-earth and strategic mineral projects is now under development in Brazil. These initiatives, led by both domestic and international companies, have the potential to position the country as a significant hub in global value chains.

Pipeline of rare earth and critical mineral projects in Brazil



State	Project / Status
Amazonas	Academic research and INB studies; occurrences in sands and clays; early-stage.
Pará	Exploratory studies; potential associated with bauxite and laterites.
Rondônia	Historical occurrences; former monazite production; ongoing mineral-sand prospecting.

State	Project / Status
Goiás	Serra Verde – most advanced rare-earth project (ionic clays); in commissioning phase.
Minas Gerais	Caldeira – ionic-clay rare-earth project; pre-feasibility stage. Colossus – over 200 Mt of rare-earth-rich clays; production targeted for 2026. Araxá – high-potential niobium and rare-earth project.
Bahia	Rocha da Rocha – hosts 18 minerals classified by the U.S. as strategic; pilot plant expected in 2026.
Espírito Santos	Coastal-sand occurrences; heavy-mineral by-products (ilmenite, rutile, zircon).



Project (State)	Company	Details
Colossus (MG)	Viridis Mining (VMM)	Holds initial reserves exceeding 200 million tonnes of ionic clays rich in rare earth elements, one of the largest deposits of its kind outside China. Targeting production readiness in 2026, with a focus on neodymium and praseodymium – essential for permanent magnets used in electric vehicles and wind turbines.
Caldeira (MG)	Meteoric Resources (MEI)	One of the largest ionic-clay rare earth deposits outside China, with probable reserves of 103 million tonnes at 4,091 ppm rare earth oxides, with emphasis on neodymium and praseodymium for permanent magnets. Estimated NPV of US\$1.3 billion, IRR of 39%, and initial CAPEX of US\$357 million. Target start of production: 2028.

Project (State)	Company	Details
Araxá (MG)	St George Mining (SGQ)	Acquired in February 2025, focused on niobium and rare earths. High-grade mineralization has been confirmed at the surface; ongoing drilling and processing tests are underway. The company has announced partnerships to develop industrial applications, including permanent magnets.
Rocha da Rocha (BA)	Brazilian Rare Earths (BRE)	Covers more than 1 million hectares of high-prospectivity areas and hosts 18 critical minerals designated as strategic by the U.S. government. Tests indicate simple, low-cost processing. Pilot plant expected to begin operation in Camaçari in 2026. The site has access to roads, clean hydropower, and a port within a 200 km radius.

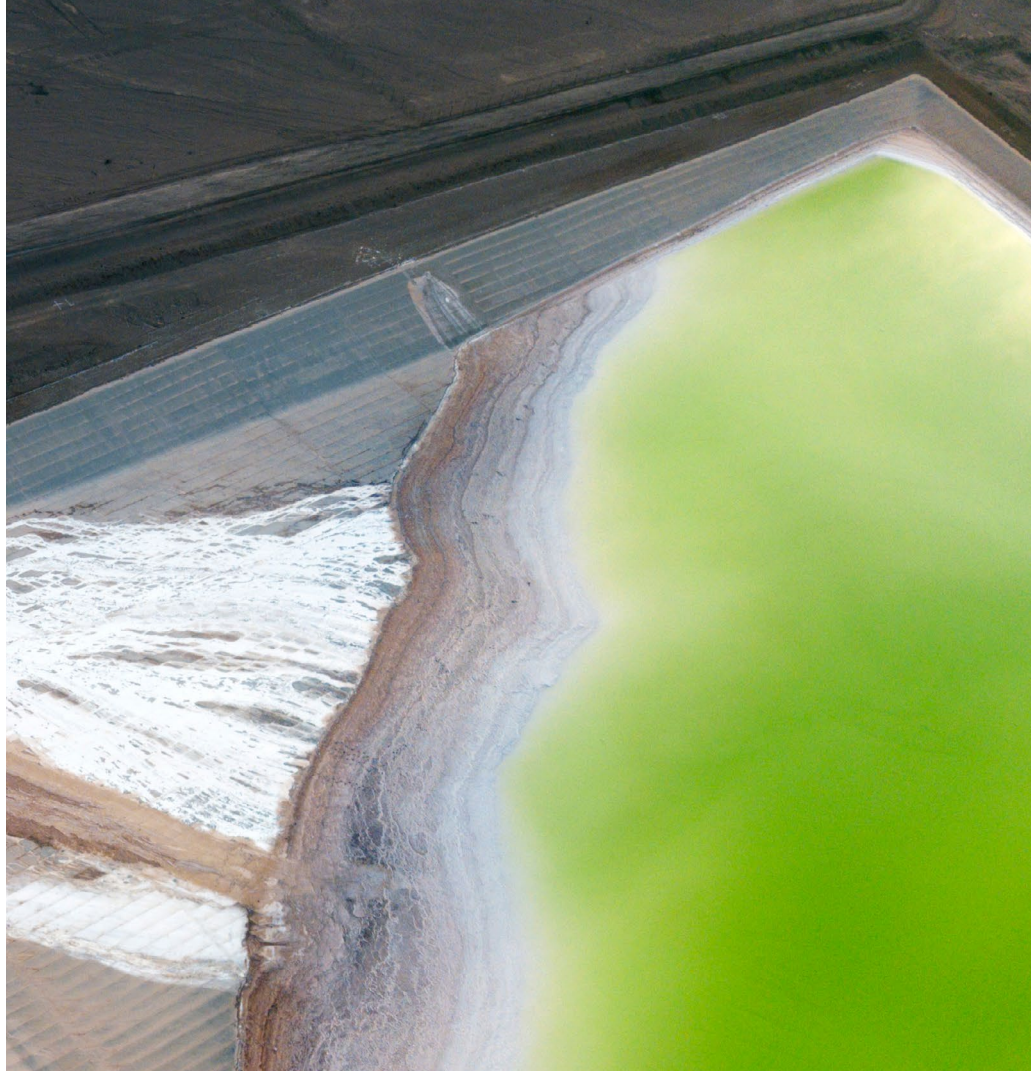
These developments reinforce Brazil’s strategic attributes: they attract foreign capital, validate environmental practices, and position the country as a reliable partner for high-technology industrial value chains.

Brazilian mining companies are also beginning to reposition themselves. Vale is expanding its nickel and copper footprint across different continents in partnership with automakers. CBMM is testing niobium applications in next-generation batteries with Toshiba and Sojitz. Meanwhile, Sigma Lithium is exporting battery-grade lithium to Europe and the United States under advanced ESG standards.



Mergers and acquisitions in the mining sector reflect strong global demand for strategic minerals, resource optimization, and the expansion of production capacity. It is important to highlight the significant potential of Brazil's still-underexplored reserves to attract even more substantial investment and increase the interest of major global companies in the country.”

Leonardo Dell'Oso,
partner and Corporate Finance Leader, PwC Brazil



Looking ahead



Mining in the next decade will be shaped by accelerated urbanization, growing climate pressures, and a more digital workforce. Countries that anticipate the convergence of regulation, technological innovation, and green industrialization will hold a decisive advantage.

Brazil must prepare for this new order, in which access to minerals will be synonymous with sovereignty and industrial power.

Despite recent progress on the international stage, Brazil still has room to strengthen its strategic positioning. Global demand for critical minerals far exceeds supply, while domestic industrialization remains incipient, although visibility is increasing with the COP30. Additionally, Brazil's predominantly renewable energy matrix offers a competitive advantage in meeting low-carbon and traceability requirements.

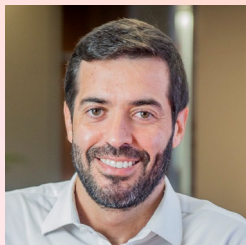
The country stands before a rare opportunity: to be both a mineral powerhouse and a relevant player in building low-carbon industrial chains. However, leadership is not achieved by potential alone – it requires strategy, coordination, and industrial ambition. Brazil must decide whether it will continue exporting the future in the form of raw commodities or take an active role in shaping it, with an intelligent, clean, and integrated mineral industry aligned with the new green economy.



The transformation of critical minerals into innovation, jobs, and added value is not an inevitable trend: it is a choice tied to sovereign development. Brazil boasts mature companies, significant reserves, and an increasingly attractive global market – a rare combination in a rapidly evolving sector.

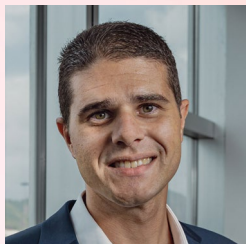
The challenge and opportunity lie in aligning strategic priorities with a long-term industrial vision, participating not only in extraction but also in the technological transformation that critical minerals enable. The window is open – and those who move now can secure durable leadership in the global landscape.

Contacts



Adriano Correia

Partner and Clients & Industries
Deputy Leader
adriano.correia@pwc.com



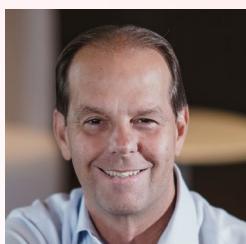
Daniel Martins

Partner and Energy and
Utilities Leader
daniel.martins@pwc.com



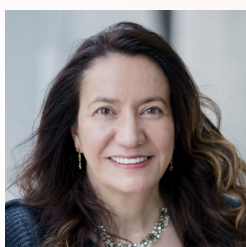
Patrícia Seoane

Partner and Mining and
Metals Leader
patricia.seoane@pwc.com



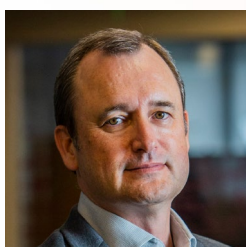
Leonardo Dell'Oso

Partner and Corporate
Finance Leader
leonardo.delloso@pwc.com



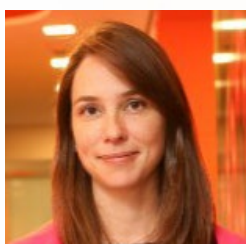
Luciana Medeiros

Partner and Retail and
Consumer Leader
luciana.medeiros@pwc.com



Lindomar Schmoller

Partner and Financial
Services Leader
lindomar.schmoller@pwc.com



Mayra Theis

Partner and Agribusiness Leader
mayra.theis@pwc.com



Follow us



PwC refers to the PricewaterhouseCoopers Brasil Ltda. member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc.com/structure for further details.