

WHITE PAPER ON

MINING DEVELOPMENT AND ENERGY PLANNING

IN LATIN AMERICA AND THE CARIBBEAN



olacde





Energy unites us

CREDITS

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Glossary & Abbreviations

Ag	Chemical symbol for silver
Al	Chemical symbol for aluminum
Au	Chemical symbol for gold
CAPEX	Capital Expenditure
CO2	Carbon dioxide
COCHILCO	Chilean Copper Commission
Cu	Chemical symbol for copper
ECLAC	Economic Commission for Latin America and the Caribbean
ESMAP	Energy Sector Management Assistance Program
Fe	Chemical symbol for iron
GEC	Global Energy and Climate Model
IDB	Inter-American Development Bank
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
LAC	Latin America and the Caribbean
Li	Chemical symbol for lithium
Mo	Chemical symbol for molybdenum
MWe	Megawatts electric
NCRE	Non-Conventional Renewable Energy Sources
NDC	Nationally Determined Contributions
Ni	Chemical symbol for nickel
OG	Multilateral Organizations / International Financial Institutions
OLACDE	Latin American and Caribbean Energy Organization
ONS	Operador Nacional do Sistema Eléctrico
OPEX	Operational Expenditure
PEA	Preliminary Economic Assessment
PPA	Power Purchase Agreement
RIGI	Large Investment Incentive Regime (Argentina)
SEIN	National Interconnected Electric System of Peru (Perú)
SIN	National Interconnected System
Sn	Chemical symbol for tin
TL	High-Voltage Transmission Line
UN	United Nations
USGS	United States Geological Survey
WB	World Bank
WEF	World Economic Forum
Zn	Chemical symbol for zinc

Contributors

The preparation of this White Paper was made possible thanks to the commitment, technical expertise, and strategic vision of an extensive network of specialists from the public sector, international organizations, civil society groups, industry associations, corporate operators, and consulting firms linked to the regional development of mining and energy. Through technical contributions, specialized studies, executive dialogues, interviews, and comprehensive peer-review processes, these institutions and professionals contributed perspectives, empirical evidence, and sector knowledge that enriched the contents of this publication.

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Development Lies Beneath Our Feet

Andrés Rebolledo Smitmans
Executive Secretary
OLACDE

The global energy transition represents one of the greatest economic and industrial transformation opportunities for Latin America and the Caribbean. The foundations of the new decarbonized economy are not abstract: they rest upon the critical minerals hosted within our territories and on the availability of secure, competitive, and increasingly clean energy for their extraction, processing, and transformation under rigorous environmental and social benchmarks.

Our region commands an exceptional strategic position. We hold a globally significant mineral resource endowment, one of the cleanest and most renewable power generation matrices on Earth, and vast potential to continue integrating cost-effective clean energy sources. This convergence provides an opportunity far broader than supplying raw materials: it will enable us to advance toward more sustainable mining operations, attract long-term capital investments, build technical and technological capabilities, and foster industrial value chains that deliver greater domestic value addition across our countries.

Seizing this opportunity requires aligning two agendas that remain inextricably linked: mining planning and energy system planning. New mining developments will demand infrastructure, firm capacity, and high power reliability; concurrently, the expansion of renewable energy capacity and high-voltage transmission networks will benefit substantially from closer coordination with territorial mining master plans. For our nations to enhance their competitiveness and ensure the energy transition remains genuinely sustainable, this relationship must be approached as an integrated equation for development.

This is where regional integration assumes decisive strategic importance. Cross-border power interconnections, coordinated energy planning, modernized and convergent regulatory frameworks, and the deployment of binational productive and infrastructure corridors can unlock larger investment flows, reinforce system reliability and resilience, and allow Latin America and the Caribbean to harness its comparative advantages and industrial complementarities more efficiently.

Connecting our mineral wealth with the region's clean energy potential and industrial capabilities also presents a platform to generate high-quality employment, cultivate technical knowledge, accelerate technology transfer, and deploy infrastructure that drives territorial development.

This White Paper is an invitation to advance decisively in that direction. From OLACDE, we present this work to governments, the private sector, academia, and civil society as a contribution to regional dialogue and the consolidation of a shared vision for the future of mining and energy. We trust that its findings, data, and policy proposals will help harmonize public

decisions, strengthen multilateral cooperation, and transform our natural endowments into sustainable drivers of investment, innovation, formal employment, and shared prosperity across Latin America and the Caribbean.

Resources are found. Development is built.

Gaston Siroit
Director, OEMLAC
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For more than fifty years, we have worked alongside our Member States on the primary energy challenges facing Latin America and the Caribbean, with a long-standing historical presence across the electricity, oil, and gas sectors. This marks the first time that OLACDE has published a White Paper dedicated specifically to the mining sector.

Why? Because the global context has fundamentally shifted. Mining has moved to the absolute center of international energy policy and geopolitics. Electrification, utility-scale renewables, energy storage, and industrial digitalization have unleashed exponential demand for critical minerals. Simultaneously, supply chain security has become an urgent strategic priority for sovereign governments, global corporations, and international financial institutions alike.

In this operating environment, Latin America and the Caribbean has a defining role to play. Our region concentrates a substantial share of the raw materials the global economy will require over the coming decades. Yet resource endowment alone has never guaranteed sustainable development or economic growth. Converting subsoil wealth into capital deployment, modern infrastructure, and quality employment requires forward planning, cross-sector coordination, and a long-term strategic horizon.

That is the core purpose of this report. The clean energy transition requires minerals, but producing those minerals demands energy infrastructure: generation capacity, transmission corridors, and supply systems engineered to support industrial loads. The availability, cost, reliability, and carbon intensity of that power will determine the commercial viability and global competitiveness of these assets.

Planning mining development requires anticipating industrial power demand; planning energy systems requires knowing where new mining clusters will emerge and what infrastructure will be needed to power them. This nexus speaks directly to OLACDE's core capabilities and to a concrete institutional reality: in more than 50% of our Member States, energy ministries are Ministries of Mines and Energy or integrate both portfolios under a single institutional roof.

Throughout its chapters, this White Paper navigates the shifting global mining landscape, regional pipelines and project portfolios, the mining-energy-infrastructure nexus, and the direct perspectives of the leaders currently defining the future of the sector.

When we embarked on this project, we did not know precisely how far the initiative would take us. Along the way, partners, operational experiences, and strategic perspectives joined

the effort, enriching the analysis and, at the same time, underscoring how much remains to be incorporated. We also recognized that a first edition could hardly capture the full diversity of our region. Inevitably, there are stakeholders yet to be engaged, case studies yet to be shared, and debates yet to be opened. Therefore, rather than a limitation, we view this as an open invitation: to those not yet represented within these pages, we look forward to welcoming you in future editions. A regional agenda of this magnitude demands broad participation, active cooperation, and—as a dear friend once taught me—perhaps more leadership and fewer individual leaders.

Presented in Santo Domingo, Dominican Republic, within the framework of the XI Energy Week, this White Paper brings together empirical data, operational track records, project pipelines, and, above all, the voices of the decision-makers facing these challenges on the ground. I want to express my deepest gratitude to the governments, mining and energy operators, multilateral organizations, development banks, and technical specialists who contributed their knowledge and expertise to make this collective endeavor possible. And, most especially, my sincere thanks to the team within OLACDE who joined me in this venture and helped turn it into a reality.

We do this, moreover, in a complex year. A year marked by the ongoing war in Ukraine, tensions surrounding the Strait of Hormuz, renewed fragilities across global supply chains, and also a football World Cup that, for the author of these lines, is no small matter. A 2026 in which energy, natural resources, and geopolitics have returned decisively to center stage.

Latin America and the Caribbean possesses the resources, the engineering expertise, the companies, and the public institutions. Above all, it has an extraordinary window of opportunity ahead. The task before us is to convert that opportunity into structural development.

With this White Paper, OLACDE seeks to advance that shared goal: moving toward a unified regional approach where mining expansion and energy planning are treated as two inseparable parts of the exact same conversation.

CHAPTER 1

STRATEGIC CONTEXT



1.1. Introduction

The global energy transition is driving unprecedented demand for critical minerals required to expand renewable energy, electric mobility, energy storage systems, and advanced technological industries. In this context, mining has acquired a strategic status for worldwide energy security and industrial competitiveness.

Latin America and the Caribbean holds a privileged position in this scenario. The region concentrates approximately 60% of global lithium reserves and more than 30% of global copper reserves, alongside significant resources of silver, nickel, graphite, and rare earth elements (USGS, 2026). However, geological endowment alone is no longer sufficient to guarantee the development of new projects. Global competition for capital demands increasingly competitive conditions regarding infrastructure, sustainability, regulatory stability, and access to cost-effective energy.

According to the International Energy Agency, global lithium demand will increase more than 3.5-fold (353%) by 2040, while the copper market will face severe supply constraints if new capacity is not brought online in the coming years (for copper, demand is projected to rise by 7 million tonnes by 2040, creating a primary supply deficit close to 25% by 2035) (IEA, 2026).

This trend consolidates Latin America and the Caribbean's strategic importance as an essential supplier of critical energy transition minerals. The projected mining expansion over the coming decade will entail a growing demand for electricity, infrastructure, and associated industrial services. According to OLACDE projections, mining electricity consumption across Latin America and the Caribbean is set to expand by 51% by 2034, driven primarily by copper and lithium developments.

Consequently, energy has transitioned from being merely an operational input to becoming a decisive driver of investment viability. Building generation plants, transmission lines, and strategic support facilities requires planning horizons that match those of large-scale mining operations. When these planning processes advance without coordination, project risks, capital expenditures, and execution schedules escalate significantly.

This White Paper is based on a foundational premise: Latin America and the Caribbean's geological potential can only translate into sustainable economic growth, quality employment, and foreign direct investment if energy infrastructure expands at the pace demanded by the mining sector. Integrated planning across mining, energy, and infrastructure is therefore an essential condition for strengthening regional competitiveness and seizing the opportunities presented by the global energy transition. The analysis and proposals presented in the subsequent chapters are grounded in this strategic approach.

1.2. Architecture and rationale of the White Paper

This White Paper organizes its analysis around a core question: What energy conditions are required to transform the mineral potential of Latin America and the Caribbean into competitive, sustainable projects capable of driving the clean energy transition?

To answer this question, the report moves from the strategic context and regional resource endowment to the structural conditions enabling new project execution. Its framework links resource assessment and power demand with infrastructure planning, technological breakthroughs, and cross-sector stakeholder perspectives.

Figure 1 outlines this rationale, illustrating how each chapter articulates within a logical sequence: from context and resource endowment, through energy demand and project development criteria, to industry perspectives and the formulation of an actionable regional roadmap.



Figure 1: Architecture of the White Paper

Source: Authors' elaboration.

EXPECTED OUTCOME

Convert the geological potential of Latin America and the Caribbean into competitive, sustainable projects and investments through integrated energy planning that drives the region's socioeconomic development.

Mining competitiveness in the 21st century no longer depends solely on geology; it relies on the capacity to plan the energy supply and infrastructure required to deliver projects.

1.3. From geological advantage to a regional development opportunity

*In collaboration with ALMA
(Latin American Mining Alliance)*



Latin America and the Caribbean stands before a historic opportunity. The global energy transition and broad industrial digitization are fundamentally reshaping the demand for strategic minerals, placing the region in a position of undeniable geopolitical relevance. However, possessing a privileged geological base is merely the starting point; the true challenge lies in converting subsoil resources into capital investment, industrial value chains, technological innovation, and concrete socioeconomic benefits for local communities.

From the perspective of the Latin American Mining Alliance (ALMA), geology does not determine ultimate success. Our region's competitive edge will depend on its ability to develop these resources responsibly, efficiently, and sustainably, underpinned by robust institutions, transparent regulatory frameworks, modern infrastructure, technical capacity building, and long-term relationships of trust with local stakeholders.

International markets require exponentially growing volumes of copper, lithium, and critical raw materials to support global electrification, renewable installations, grid networks, utility-scale storage systems, and advanced technology applications. Simultaneously, supply chain security has become a paramount priority for governments and multinational corporations worldwide. While our region maintains a commanding position, external demand will not translate automatically into new operational capacity.

Latin America competes globally for capital, technology, engineering talent, and regulatory certainty. Consequently, predictable regulatory regimes, legal stability, administrative agility, and the ability to permit and build projects within reasonable timeframes are just as decisive as ore grade in final investment decisions.

The regional pipeline is tangible. Latin America and the Caribbean hosts an estimated mining project portfolio of USD 293 billion, with nearly one-third concentrated in Peru and Chile. In Chile alone, projected investments through 2032 exceed USD 104 billion. These figures confirm that the principal bottleneck is not an absence of viable projects, but rather the establishment of the institutional, technical, and logistic prerequisites needed to build them, generate formal employment, scale domestic supply chains, and foster territorial progress.

Achieving this objective requires synchronizing development cycles. Commissioning a major mine requires extended time horizons encompassing exploration, feasibility engineering, environmental licensing, community consultations, financing, and EPC construction. Likewise, commissioning high-voltage transmission lines or utility-scale clean generation plants requires planning, permitting, and construction cycles of comparable duration. When these timelines advance out of phase, high-grade resources and capital commitments can stall due to a lack of shared infrastructure.

For this reason, ALMA views the mining and energy industries as interdependent sectors. Expanding mineral production without planning the corresponding power supply is tech-

nically unfeasible. Mining demands baseload, cost-competitive, low-emission electricity, which necessitates early and ongoing coordination among regulators, miners, generation utilities, transmission operators, institutional investors, and host communities. The region possesses an exceptional structural advantage: it holds the critical minerals required for global decarbonization and commands power grids with extraordinary renewable generation potential. The imperative is to bridge these two assets through productive investment, common-user infrastructure, continuous innovation, and stable rules.

The energy transition is also redefining industrial competitiveness. Decarbonization has evolved from an environmental compliance metric into a commercial requirement for accessing international markets, project financing, and global value chains. The region has achieved tangible milestones via long-term renewable power purchase agreements (PPAs), operational energy efficiency, and site electrification. The next step is scaling these mechanisms, transferring best practices across jurisdictions, and accelerating technology adoption tailored to local operating environments.

Furthermore, the critical minerals agenda must extend beyond raw extraction and export. The region must progress—in line with national capacities—into higher-value stages of the supply chain through domestic supplier development, applied research, workforce training, and technology transfers. Mining must operate as a sustainable catalyst for broader industrial and technological modernization.

Regional integration is central to this effort. ALMA's core mission is to align industry experience, disseminate best operational practices, elevate sustainability benchmarks, and build a unified regional voice that positions Latin America and the Caribbean as a reliable, transparent, and responsible partner. Shared challenges in permitting, infrastructure, power supply, talent acquisition, community engagement, and combating illegal mining require coordinated solutions.

In this context, streamlining administrative approvals with absolute transparency is an urgent priority. Modernizing the permitting framework does not mean weakening environmental or social criteria; it requires technically equipping state agencies so compliant projects obtain prompt decisions and legal certainty.

Private investment relies on stable legal frameworks, but it depends above all on social trust. Relationships with local communities must not begin as a formal licensing hurdle or in response to disputes; they must be established during early-stage exploration through continuous presence, transparent dialogue, and respect for sociocultural realities. Territorial planning must look beyond the mine's life cycle, promoting quality education, high-skilled local employment, regional procurement, and community infrastructure in partnership with authorities, academia, and civil society.

Modern mining must demonstrate its net value through measurable outcomes. Social legitimacy is sustained over time through verified data, transparent indicators, end-to-end mineral traceability, and reporting on environmental impacts and shared economic benefits. Concurrently, civic outreach and public education are essential to foster a mature public dialogue regarding the industry's contributions.

The region must also take decisive action against illegal and informal mining. This issue extends beyond environmental degradation: it compromises public safety, weakens the rule

of law, exploits vulnerable populations, and distorts the market for formal operators that adhere to stringent sustainability standards.

Latin America and the Caribbean cannot afford to simply ride another external commodity cycle. Success will depend on converting this window of opportunity into long-term capital deployment, resilient shared infrastructure, human capital development, and clean industrial capacity. By integrating mining, clean energy, territorial planning, competitiveness, and good governance, the region can transform its subsurface endowment into a permanent foundation for sustainable socioeconomic development.

1.4. The region at the epicenter of the transition and geopolitics

In collaboration with Governance Action Hub &



Andean Link Engagement



Strategic minerals

The energy transition is reshaping both global energy systems and the material supply chains required to build them. The scaling of renewable energy, electric vehicle manufacturing, battery storage, high-voltage transmission, and digital data infrastructure is accelerating global demand for critical raw materials, turning their availability into a matter of industrial security and technological sovereignty.

In this operating environment, minerals such as copper, lithium, nickel, graphite, cobalt, niobium, and rare earth elements have transcended their status as base commodities. The concentration of mining and, particularly, chemical refining within a small cluster of nations has turned supply chain diversification into a national security priority across the world's leading economies.

The United Nations Secretary-General's Panel on Critical Energy Transition Minerals¹ has emphasized that the core challenge is not merely securing physical supply, but ensuring that resource development fosters sustainable development, supply chain resilience, and an equitable distribution of economic benefits.

Latin America and the Caribbean: Strategic hub in global value chains

Our region occupies a strategic position within this framework, combining world-class reserves and production capacity with exceptional renewable power potential. This structural alignment enables the region to meet critical mineral demand while playing a stabilizing role in diversifying global supply networks.

1 The United Nations Secretary-General's High-Level Panel on Critical Energy Transition Minerals report, released in September 2024, establishes seven guiding principles and five actionable recommendations to ensure critical mineral value chains support an equitable energy transition, sustainable development, human rights, environmental integrity, and global supply resilience. Available at: <https://www.un.org/sg/en/content/sg/state-ments/2024-09-11/secretary-generals-message-the-launch-of-the-panel-critical-energy-transition-minerals-report>

The regional footprint in global supply is substantial:

Mineral	Approximate share of LAC in global production	Main producing countries
 Copper	≈40%	Chile, Peru and Mexico
 Lithium	≈25%	Argentina and Chile
 Silver	>50%	Mexico, Peru, Bolivia and Argentina
 Niobium	>90%	Brazil
 Molybdenum	≈40%	Chile and Peru

Table 1: Latin America and the Caribbean Mining Market Share

Source: Authors' elaboration based on IEA, Global Critical Minerals Outlook 2026.

These market shares show that the region's importance extends beyond mineral reserves. Latin America and the Caribbean is an established global producer across multiple critical inputs, making it an essential partner for diversifying concentrated international supply chains.

The strategic challenge is translating this extraction strength into broader economic value. Regional output remains concentrated in extraction and basic concentration, while downstream refining and transformation capacities remain constrained. The IEA estimates the region accounted in 2025 for roughly 26% of global copper refining, 10% of cobalt refining, and 7% of rare earth refining, with zero commercial capacity in battery-grade graphite processing (IEA, 2025).

Mineral	Approximate share of regional refining
 Copper	26%
 Cobalt	10%
 Rare earths	7%
 Graphite	0%

Table 2: Regional Share in Critical Mineral Refining

Source: Authors' elaboration based on IEA, Global Critical Minerals Outlook 2026.

This processing bottleneck represents both an economic vulnerability and an industrial opportunity. Expanding domestic refining and precursor manufacturing would allow the region to retain more value locally, foster specialized technology ecosystems, and supply diversified feedstocks to global end-users.

LAC Share in Global Production



Figure 2: LAC Share in Global Mineral Production

Source: Authors' elaboration.

Regional Share in Refining



Figure 3: Regional Share in Global Refining Capacity

Source: Authors' elaboration.

The economic upside of downstream value addition

The economic upside of moving downstream is substantial. Under baseline projections by the IEA, the value of critical minerals extracted across Latin America and the Caribbean is set to reach approximately USD 185 billion by 2035. If the region were to systematically expand local refining, this economic output could climb to roughly USD 220 billion annually (IEA, 2026b).

A usd 35 billion economic value-add opportunity by 2035

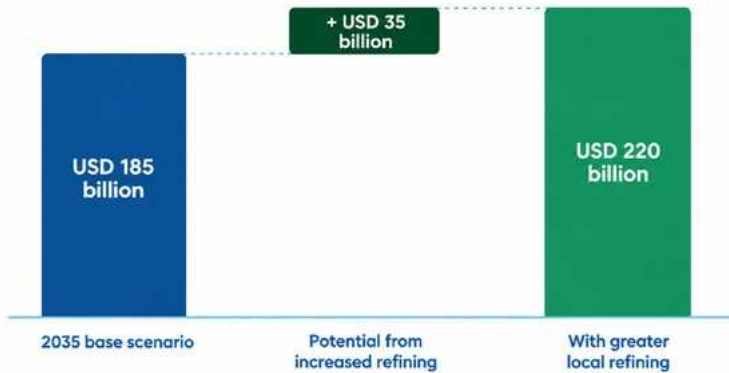


Figure 4: Regional Economic Potential to 2035

Source: Authors' elaboration based on IEA, Global Critical Minerals Outlook 2026.

Value addition carries significant geopolitical relevance: scaling midstream processing capacity allows Latin America and the Caribbean to mitigate international dependency on single-origin bottlenecks, reinforcing its position as a diversified, ESG-compliant supplier of processed materials.

From geological advantage to competitive advantage

Resource endowment alone does not guarantee industrialization. Regional economic history demonstrates that the core challenge consists of converting resource wealth into competitive enterprises, productive diversification, and sustainable development.

The energy transition elevates market standards: modern mining competitiveness depends on integrating mineral assets with reliable clean power, multi-user infrastructure, modern technology, structured finance, clear legal frameworks, and local engineering capabilities.

Here, Latin America and the Caribbean holds an operational advantage: **nearly 70% of the region's electricity is generated from renewable sources** (primarily hydropower, supported by accelerating solar and wind buildouts). This clean generation profile lowers the Scope 2 emission intensity of local mining, providing a distinct commercial asset in markets applying carbon border adjustments and strict traceability metrics.

However, this advantage cannot be leveraged without matching grid infrastructure. Mining expansion requires generation, high-voltage transmission lines, industrial water desalting and transport, heavy logistics, and specialized port infrastructure deployed within timelines aligned with mine construction schedules.

Future regional competitiveness will depend on four cross-cutting enabling conditions:



Figure 5: Enabling Conditions for Mining Competitiveness in LAC

Source: Authors' elaboration based on ALE / GAH, IEA, and regional official data.

The convergence of mining, energy, and territorial planning

This new scenario is generating a convergence between agendas that, for decades, evolved relatively independently. Mining increasingly requires reliable and competitive energy to develop new projects, while the expansion of energy technologies depends on the minerals supplied by the mining industry itself.

The relationship is not limited to energy. Decisions regarding mining and infrastructure have a territorial dimension, as it is at the territorial level where natural resources, electricity grids, water, infrastructure, communities, investment, and productive development converge.

Integrated planning across mining, energy, and infrastructure makes it possible to anticipate these interdependencies, reduce risks, and prevent a lack of capacity in any of these components from limiting the implementation of strategic projects.

This convergence is also reshaping public policies across the region. Chile has advanced a National Critical Minerals Strategy and a National Lithium Strategy; Brazil has incorporated critical and strategic minerals into its mining planning; and Argentina has developed instruments to attract large-scale investment and strengthen coordination around the development of lithium and copper². Although national approaches differ, there is a common trend toward greater coordination among mineral resources, investment, industrial capabilities, and technological development.

² RIGI: Incentive Regime for Large Investments, established under the Bases Law (Law No. 27,742).

A strategic window for the region

The energy transition opens up an opportunity for Latin America and the Caribbean that goes beyond its traditional role as a supplier of raw materials. The region can contribute to diversifying global supply chains while strengthening its own industrial, technological, and energy capabilities.

The challenge is to transform a geological advantage into a regional competitive advantage. To achieve this, it will be necessary to coordinate mineral resources, energy, infrastructure, technology, investment, and productive capabilities within a long-term vision.

“The region must not only ask how much it can produce, but also how much value it can capture and what conditions it needs to do so in a competitive and sustainable manner.”

1.5. Beyond the resource: Energy as a competitive advantage

Collaboration with the
World Economic Forum



Energy is not only an enabling condition for the development of new mining projects, but also a factor that can determine their competitiveness, sustainability, and ability to generate value. In this regard, the energy transition presents a dual opportunity for the region: to leverage its endowment of energy and mineral resources while developing systems capable of converting these natural advantages into infrastructure, investment, and long-term productive activity.

Energy is no longer simply an input to economic activity; it is becoming a strategic determinant of competitiveness. Countries that can provide secure, affordable, and increasingly clean energy are better positioned to attract investment, support industrial growth, and develop the infrastructure required by the next wave of economic activity. Competitive advantage lies not only in possessing energy resources, but in the capacity to convert them into reliable, resilient, and economically productive systems.

The World Economic Forum's 2026 Energy Transition Index (ETI) underscores this shift. Energy security is increasingly understood as extending beyond the mere availability of fuel: it depends on the diversity of supply, the reliability of electricity networks, access to critical minerals, infrastructure flexibility, and the ability to absorb external shocks. The 2026 Strait of Hormuz crisis, which affected approximately 19% of global LNG trade (IEA, 2026c) and forced ASEAN economies to absorb an estimated additional energy cost of USD 3.4 billion per month, demonstrated how quickly supply constraints can affect households, businesses, and national economies (WEF, 2026). Countries that integrate resilience into the design of their energy systems are better positioned to sustain investment and economic activity.

This is particularly relevant at a time of accelerating demand. Global electricity demand grew by 3% in 2025 (IEA, 2026), with emerging economies accounting for approximately 80% of that increase (IEA, 2025). AI-related investments reached USD 1.5 trillion in 2025, a 50% increase compared with 2024, while data centres require large volumes of reliable electricity (Gartner, 2025). Countries with strong grids, available clean power, and the ability to connect new projects quickly will be more attractive locations for digital infrastructure and energy-intensive industries. Conversely, countries unable to expand their transmission capacity risk missing investment opportunities, even where natural resources are abundant. Globally, more than 2,500 GW of clean energy projects remain stalled in grid connection queues (IEA, 2026).

From resource endowment to productive capacity

Renewable resources can provide an important foundation for competitiveness, but resources alone do not guarantee economic value. Countries also need the institutions, infrastructure, capabilities, financing, and innovation required to develop those resources at scale: the dimensions of transition readiness assessed by the ETI. All of these dimensions either declined or stagnated globally in 2026, marking the first broad deterioration in enabling conditions in more than a decade (WEF, 2026).

Brazil illustrates how institutional and operational capabilities can amplify the advantage of natural resources. Its structurally clean power mix, strong biofuels sector, and competitive auction framework have steadily attracted private capital, supporting long-term grid expansion despite the short-term fluctuations recorded in its readiness indicators in 2026.

Chile reinforces this lesson from a complementary perspective. The sustained deployment of renewable energy over the past decade—supported by competitive auctions and long-term power purchase agreements—has transformed its electricity mix and now provides a measurable buffer against international energy price volatility, with new renewable capacity having grown significantly in recent years.

Both cases share the same underlying logic: the value of renewable resources is amplified when supported by predictable market arrangements and infrastructure capable of delivering energy reliably to consumers and industry (WEF, 2026).

However, resource endowments and energy security are not interchangeable. Countries with abundant domestic resources may still face weaknesses in reliability, infrastructure, or economic diversification, while import-dependent countries are not necessarily disadvantaged if they have strong system management and diversified supplies. The relevant question is not simply whether a country has energy resources, but whether it can manage complexity and convert energy into dependable economic value.

Critical minerals and investment

Critical minerals connect the energy and industrial transitions in ways that make them inseparable. Lithium, cobalt, nickel, graphite, manganese, and rare earth elements are increasingly strategic assets for clean technology manufacturing, technological security, and national security (IEA, 2025c). The 2026 ETI introduced a Clean Energy Technology Minerals Supply Chain Exposure indicator, reflecting the growing importance of securing access to these materials as a key component of transition readiness (WEF, 2026). Countries that develop processing capacity, build strategic partnerships, and create investable conditions across the value chain are able to capture greater value from their geological endowments.

The 2026 ETI shows that capital is available—global energy investment reached a record USD 3.3 trillion in 2025, of which USD 2.3 trillion was directed to clean energy (IEA, 2025)—but it is increasingly concentrated in markets perceived as lower risk and with greater capacity to deliver projects (WEF, 2026). Therefore, improving the conditions for attracting and executing investment is as important as increasing the volume of investment itself. Energy must also be integrated into broader development strategies, including industrial policy,

infrastructure planning, and workforce development. Without these connections, low-cost energy may provide short-term relief without generating sustained productivity gains or higher-value economic activity.

For Latin America and the Caribbean, this perspective reinforces a central conclusion of this White Paper: mining competitiveness cannot be analyzed separately from energy planning. The availability of competitive, low-emissions energy, together with the capacity to expand grids, connect new projects, and reduce supply risks, will increasingly determine the region's ability to transform its mineral wealth into investment, production, and value added.

Energy as a platform for competitiveness

Energy is becoming a platform for competitiveness. Countries that combine clean, reliable, and affordable electricity with infrastructure, institutions, capabilities, and innovation can move beyond the export of raw materials and capture greater value in emerging industries. The strategic objective is not simply to secure energy supply, but to build an energy system that drives economic dynamism, resilience, and long-term national advantages.

1.6. Leading the next wave of mining investments

In collaboration with CAF (Development Bank of Latin America and the Caribbean)



The timely availability of energy, water, logistics, and transport infrastructure constitutes one of the most decisive factors in transforming the geological potential of Latin America and the Caribbean into viable, bankable, and executable mining projects. In the case of critical and strategic minerals associated with the energy transition, the existence of mineral resources, even when they are of significant scale, does not by itself guarantee the development of new projects. The viability of a mining initiative increasingly depends on whether the territory possesses the necessary enabling conditions: reliable basic services, adequate connectivity, firm and competitive energy, water security, efficient access to ports, roads, and railways, as well as storage infrastructure and logistics systems capable of sustaining large-scale operations over several decades.

In this sense, enabling infrastructure operates as a feasibility filter. The absence of sufficient and competitive energy can compromise both mining operations and the development of downstream processing and refining stages, particularly for minerals whose advancement along the value chain demands intensive consumption of electricity, industrial heat, or the availability of fuels and reagents. In the same way, water constraints can limit the expansion of extractive projects, increase environmental mitigation costs, or demand solutions of greater complexity, such as desalination, reuse, long-distance water transport, or integrated water resource management systems. In turn, logistics and transport gaps directly impact capital and operating expenditures, construction schedules, supply chain reliability, and the ability to access international markets competitively.

The territorial challenge and the need for advance planning

These conditions are particularly relevant for Latin America and the Caribbean, where several districts with high mining potential are located in isolated, mountainous, arid areas, or far from industrial centers and export ports. In these contexts, infrastructure cannot be conceived as an element following discovery or an investment decision, but rather as a prerequisite for territorial competitiveness.

The lack of advance planning tends to shift costs onto the mining project that, by their nature, often correspond to public or quasi-public goods: access roads, electric transmission lines, multi-purpose water infrastructure, logistics corridors, border crossings, specialized ports, or industrial support systems. When these costs are fully internalized within a single project, its expected profitability decreases, investor risks escalate, and the realization of opportunities is delayed or blocked.

For this reason, advance planning of enabling infrastructure is essential to reduce risks and improve the bankability of new projects. A strategy that coordinates the mining portfolio

with the infrastructure pipeline at an early stage allows for identifying bottlenecks, prioritizing investments, organizing public intervention, and attracting private capital under frameworks of greater certainty. Likewise, it enables a shift from a reactive logic—in which infrastructure is designed on a case-by-case basis and often belatedly—to a territorial and programmatic logic, based on mining districts, productive corridors, and shared platforms. This approach can generate economies of scale, reduce duplications, improve territorial acceptance, and facilitate the integration of small, medium, and large projects onto a single service base.

Shared infrastructure and value chain development

Shared infrastructure also acquires a strategic dimension for the development of regional value chains. The transition from primary extraction to processing, refining, or component manufacturing requires more complex industrial conditions: clean and firm energy, access to industrial water, availability of chemicals and reagents, laboratories, specialized services, digital connectivity, logistics capabilities, and human capital. Without that base, downstream progress loses competitiveness against jurisdictions that already have integrated industrial parks, efficient ports, technology clusters, and coordinated public support schemes. Consequently, closing infrastructure gaps not only enables mining projects, but also expands the possibilities for value addition, productive diversification, and territorial linkages.

From the perspective of integrated planning, public policy, and development financing, the challenge lies in anticipating where infrastructure can unlock portfolios of projects rather than just individual initiatives. This entails identifying territories with resource concentrations, assessing their energy, water, and logistics gaps, estimating future demand for services, defining governance models, and structuring financial instruments capable of mobilizing public, private, and multilateral investment. Strategic infrastructure funds for mining districts, integrated planning mechanisms, shared infrastructure schemes, public-private partnerships, and regional information platforms can play a decisive role in reducing uncertainty and accelerating investment decisions.

Priority action strategies and instruments

To operationalize this approach, three priority strategies stand out:

A first strategy is to structure infrastructure master plans for priority mining districts, integrating energy, water, road access, railways, ports, digital connectivity, and industrial services. These plans must be based on current and potential project portfolios, rather than isolated initiatives, in order to size infrastructure to economies of scale and aggregate demand. The identification of mining-logistics corridors—between extraction areas, processing plants, border crossings, and ports—would allow for prioritizing investments with greater systemic impact.

A second strategy is to mobilize specific financial instruments, with public, private, and multilateral participation, to support studies, engineering, financial structuring, and initial in

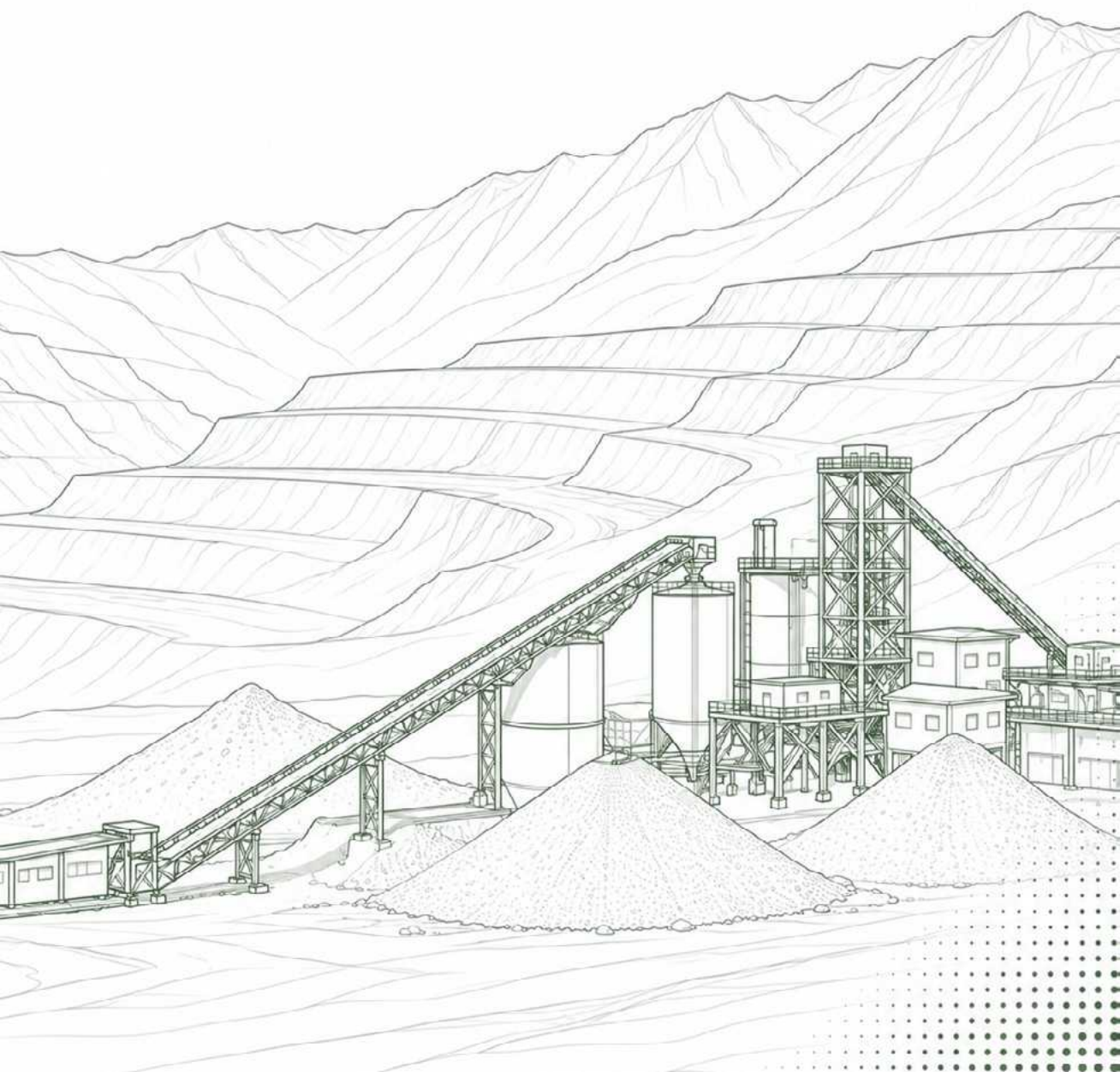
vestments in critical assets such as roads, energy, electric transmission, water infrastructure, logistics platforms, and specialized ports. Their value lies in reducing early-stage uncertainty, accelerating project maturation, and improving bankability.

Finally, it is essential to promote shared and multi-purpose infrastructure schemes—such as transmission lines, desalination plants, aqueducts, treatment plants, railway corridors, logistics hubs, and port terminals—to distribute capital costs, avoid redundant duplications, improve the efficiency of territorial ordering, and generate direct benefits for local communities, surrounding industry, and other productive sectors.

In summary, enabling infrastructure is a core component of mining viability and not an accessory complement. The region possesses significant geological potential in critical minerals, but its realization will depend on the ability to transform that potential into competitive projects through early, coordinated, and territorially sustainable investments. Planning energy, water, logistics, and transport before bottlenecks become restrictive allows for reducing risks, improving systemic competitiveness, increasing project bankability, and creating conditions so that geological wealth translates into effective production, value addition, and long-term regional development.

CHAPTER 2

THE NEXT GENERATION OF MINING PROJECTS



2.1. Overview of mining in Latin America and the Caribbean

In collaboration with  **NRGI**

Mining-energy governance: towards socio-environmental development and the decarbonization of mining value chains in Latin America

Latin America occupies a central position in the global energy transition. The region concentrates a significant share of global reserves of copper, lithium, nickel, and other minerals classified as “critical” for decarbonization technologies: electric vehicle batteries, wind turbines, solar panels, and power transmission infrastructure. According to the USGS, Chile accounts for 24.9% of global lithium reserves and Argentina for 11.9%. Regarding copper, Chile holds 18.4% of world reserves and Peru 8.7%. In turn, Brazil holds 23.9% of global graphite reserves and ranks as the country with the second-largest rare earth deposits in the world, with 24.7% of reserves (USGS, 2026a), (USGS, 2026b).

Global demand for energy transition minerals will continue to grow, and governments have responded by fast-tracking permits and expanding production. Argentina, under the Large Investment Incentive Regime (RIGI), has approved 23 projects valued at USD 49,000 million, primarily in mining (copper and lithium, in addition to steelmaking and gas). Chile (Cochilco, 2025) records investment commitments of USD 104,549 million for the coming decade, and Peru (MINEM, 2026), USD 64,075 million. This acceleration of investments responds to the growing need for clean energy generation and electric mobility; more recently, it is compounded by the combined effect of data centers for AI and the expansion of power grids.

Despite its dynamism, the mining industry faces major challenges. In Latin America, it has traditionally been organized around exports, attracted by economic and fiscal revenues: both access to reserves and infrastructure investment decisions have been driven by the objective of facilitating extraction. This vision, focused almost exclusively on the economic dimension, has historically generated severe social tensions, because the institutions and governance mechanisms required to address social and environmental impacts, distribute benefits, and foster sustainable development were not consolidated.

A paradox emerges here. The sector that supplies the inputs for the low-carbon future is, in turn, one of the most energy-intensive industrial activities, accounting for 9% of regional electricity demand, with 122,256 GWh consumed in 2024, and is projected to grow by 51% by 2034 (OLACDE, 2026). This introduces two additional hurdles to socio-environmental challenges. On the one hand, it can exacerbate tensions across mining territories. On the other hand, it can hinder the maximization of benefits through downstream value addition. In both instances, enhanced mining-energy governance would help resolve these tensions and steer the sector toward more sustainable and inclusive development.

The challenges of territorial mining governance in a context of high energy demand

Natural resources do not generate development on their own: it is determined by decisions regarding their exploitation, where they are and are not extracted, under what conditions extraction takes place, who participates in setting the rules, and what is done with the generated revenues, among others. Mining governance resides within these decisions (NRGI, s.f.-a), and it is precisely here where Latin America and the Caribbean faces its principal gaps.

The first gap is who decides and how it is decided where extraction takes place. The region requires territorial planning that clearly demarcates zones suitable for mining and exclusion areas, agreed upon with the communities inhabiting those territories—particularly indigenous peoples—through early consultation processes. This not only safeguards local populations: it also provides predictability to investors and reduces the risk of conflict. A study by Davis and Franks for the Corporate Social Responsibility Initiative at the Harvard Kennedy School (Davis, 2014) estimated that a one-week delay in production can cost a world-class mining project (projects with capital expenditures between three and five billion dollars) approximately twenty million dollars per week, primarily due to delayed production and sales caused by temporary shutdowns. Compared to that figure, consultation and trust-building from the exploration phase constitute an investment, not a burden. The current context introduces further urgency: copper extraction is advancing toward fragile ecosystems such as the Amazon, and the fact that 50% of global lithium extraction takes place in areas of high water stress demands clear boundaries (NRGI, 2024). Socio-environmental standards are not an obstacle to the energy transition; they are an integral part of it.

The second gap is the distribution of benefits, and it operates on two levels. Internationally, the region remains overwhelmingly a supplier of raw materials without value addition, perpetuating export dependency. Moving toward domestic suppliers and more sophisticated value chains requires industrial policies that bridge gaps in technology, scale, and market access. Chile has made significant progress in this area but faces major hurdles: its 8,428 mining suppliers register annual sales exceeding twenty billion dollars, yet only 7.6% of them export (SUBREI, 2024), (Cochilco, 2023).

Domestically, an adequate royalty and tax regime is necessary but insufficient: it is vital to ensure that populations in mining areas gain access to employment, innovation, and productive diversification, beyond the mere transfer of revenues to the central state or subnational governments. The governance of mining value addition requires distribution mechanisms and effective community participation in the design and execution of projects, and not solely during their approval phase.

Both gaps are underpinned by a deeper institutional weakness. What delays projects is not excessive environmental stringency, but implementation bottlenecks and the lack of institutional capacity in this domain. For example, the NRGI Resource Governance Index (NRGI, 2021) documents, for the mining industry within the scope of mine closure and rehabilitation, an exceptionally wide disparity between the legal framework indicators (scored at 86 points) and their practical implementation or enforcement (which attains a score of just 14

points)—the widest gap across the entire assessment tool. Peru has issued only three mine closure certificates despite having an operative legal framework for more than 20 years (Revista Minería, 2026); in Mexico, more than half of the projects evaluated between 2018 and 2024 remain without resolution, confirming that the bottleneck stems from administrative capacity, not regulatory surplus. Added to this is a transparency deficit: while all 18 evaluated countries mandate environmental impact assessments, fewer than two-thirds require their public release and only one-third disclose them in full—a gap that fosters administrative discretion and creates room for corruption.

The energy transition introduces an additional layer of complexity to the governance of the mining sector on the ground. The expansion of mining operations and renewable energy projects sited within extractive districts unfolds predominantly in remote territories, frequently strained by severe water stress. A mining operation may ultimately end up competing for access to water, energy, or infrastructure against host communities and other productive sectors, starting with agriculture. This is not only a source of social conflict: it is a developmental contradiction. A sector called upon to drive national economic growth would end up undermining the essential productive base. The case that best illustrates this dynamic is La Guajira, in Colombia. While it is a major producer of coal for export and thermal generation, as well as a region with enormous wind power potential, it ranks second worst in electricity coverage: 54.3% of households, compared to a national average of 93.1% (UPME, 2024). Even if mining is not the root cause of that disparity, it is at the very least questionable that energy access for the local population was not prioritized. In Chile, in May of this year, an environmental court partially annulled the environmental approval of a mining project and ordered a reassessment of its desalination plant, following claims submitted by Aymara associations and local artisanal fishermen (Tribunal Ambiental, 2026).

Water, energy, and mining are already converging on the ground. What is missing is for them to converge earlier, during planning, rather than later, in court. This demands strengthening consultation and participation processes as well as regulatory frameworks. Treating energy as an exclusive requirement of the mining company, while bypassing the population within the area of direct influence, turns energy-mining expansion into a renewed driver of social unrest.

Even so, decarbonizing mining also presents an opportunity. If energy and mining are articulated cohesively, mining activity could anchor access to cleaner, more affordable energy across extractive territories by underwriting investment in transmission and renewables, while simultaneously equipping regions to transition toward more diversified local economies. In 2015, the World Bank outlined this premise for Guinea: integrating mining projects into the national grid, rather than permitting off-grid self-generation, would yield USD 640 million in savings and bring electricity to at least 5% of the population (Banco Mundial, 2015). There is extensive literature on shared-use infrastructure, including contractual provisions requiring operators to generate surplus power for third parties (CCSI, 2022). The challenge lies in establishing a broader mining-energy perspective, grounded in strategic agreements where mining capital expenditure complements investment in energy and public infrastructure, enabling integrated territorial development.

Comprehensive mining-energy planning and decarbonization are no longer optional

Mining expansion relies heavily on energy, and its structural weight varies across countries: across the region, the mining sector accounts for roughly 9% of total electricity consumption, whereas in Chile and Peru it represents around 37% in each country (OLACDE, 2026). Furthermore, the consumption curve is steepening. Regional mining electricity demand is projected to expand by 51% toward 2034, exceeding 184 TWh (OLACDE, 2026). In Chile, copper mining consumes electricity and diesel in comparable proportions, with its aggregate demand accounting for one-third of the nation's total electricity and diesel consumption (Cochilco, 2024). Moreover, Cochilco projects that this electricity demand will increase from 27.6 TWh in 2025 to 33.2 TWh in 2034; a 20% increase that outpaces projected output growth (just 8.3%), reflecting the reality that each ton of fine copper requires more energy than in the past due to declining ore grades and the growing reliance on desalinated seawater.

For this reason, the energy transition also mandates that the mining industry itself decarbonize. Chile has achieved notable progress: today, 78% of the electricity consumed by the mining industry is supplied by renewable sources (Reporte Minero, 2025b); However, the sector still faces the unresolved task of substituting and decarbonizing fossil-fuel-intensive processes such as haulage, desalination pumping, and industrial processing, a technological and financial challenge of major proportions.

One of the main governance challenges is the institutional disconnect between national mining planning and national energy planning. Mining operations (in northern Chile, southern Peru, or northwestern Argentina) are frequently located in areas with constrained grid infrastructure, compelling companies to resort to isolated self-generation or invest in dedicated transmission lines. In Chile, NovaAndino—the public-private partnership between Codelco and SQM to develop the Salar de Atacama through 2060—must construct its own transmission assets to guarantee supply (SEA, 2026). In practice, because mining expansion is decided within bodies separate from those that plan power generation and transmission, energy supply and transmission networks advance with disparate priorities and timelines. The result is project delays, bottlenecks, cost overruns, and improvised workarounds that are misaligned with decarbonization goals.

Strengthening the mining-energy nexus requires integrated planning instruments that treat mining power demand as a core variable within national energy plans, rather than as an exogenous factor. Brazil has begun addressing this disconnect explicitly: its Ten-Year Energy Expansion Plan (PDE)—which serves as an official benchmark for government and industry regarding energy supply investments—estimates that, between 2024 and 2034, the volume of minerals required by the power matrix will expand by 54%, while total installed capacity will increase by 35%. This reflects that the transition toward renewable sources, particularly solar and wind, demands significantly greater mineral resources than conventional energy sources (EPE, 2025).

The inclusion of mining in energy planning is even more crucial for maximizing economic benefits through value-addition and industrialization policies. The sector's emissions pro-

file explains why: non-coal mining accounts for approximately 0.54% of global Scope 1 and Scope 2 emissions, whereas primary metals processing concentrates 8%. Combined, mining and metals constitute the sixth-largest source of greenhouse gas emissions on the planet (ICMM, 2026). The bulk of the value chain's emissions is concentrated in smelting, which demands massive, stable, and continuous baseload electricity.

Furthermore, adding value shifts the socio-environmental governance challenge from the mine site to industrial processing plants, smelters, and chemical refineries, which require substantial volumes of power and water. Siting these industrial facilities adjacent to extractive operations further increases the demands placed on environmental licensing and community consultation.

Territories with major mining-energy developments require far more effective coordination to advance toward sustainable extraction and downstream value creation. Mining-energy investments can complement broader infrastructure outlays to render operations both efficient and sustainable; equally, they can lay the groundwork for diversified regional development, utilizing mining logistics and energy availability to enhance economic complexity across host territories.

The accelerating global demand for critical minerals offers Latin American producing countries another strategic opportunity to capture and redistribute economic value, provided that production growth does not carry an unbearable socio-environmental toll that jeopardizes local ecosystems and communities. Mining-energy governance constitutes the cornerstone of this nexus between minerals, water, and energy, and it must be forged through integrated planning and constructive dialogue with communities, public authorities, and key stakeholders across mining territories.

2.2. Critical minerals driving the next wave of investments

In collaboration with  **ASGMI**
Asociación de Servicios
de Geología y Minería
Iberoamericanos

Latin America and the Caribbean holds one of the world's most significant geological endowments to meet the growing demand for minerals associated with the energy transition and new technologies (USGS, 2026c); (Zappettini, 2005). The diversity of the region's geological environments; from the Precambrian cratons of Brazil to the Andean axis, the Caribbean island arcs, and the metallogenic systems of Mexico; translates into a broad availability of critical and strategic minerals (Zappettini, 2005); (Zappettini, 2020).

This geological advantage becomes particularly relevant within a context of expanding global demand. However, the existence of resources does not, by itself, determine the materialization of new investments. Installed productive capacity, the level of subsurface knowledge, the existence of projects at different stages of development, and the conditions required to transform resources into competitive operations are equally decisive factors.

In order to gauge the scale of this opportunity, the Association of Ibero-American Geological and Mining Surveys (ASGMI) integrated information on mining operations, deposits, and projects from continental databases and benchmark geological and mining sources. The analysis considers 1,801 deposits identified in South America (Ferreira da Silva et al., 2025) (Zappettini, 2005) and 185 deposits in Central America and the Caribbean (Zappettini, 2020) complemented by official data from the Mexican mining sector (Perez, 2025) (SGM, 2025). This approach allows for distinguishing between currently installed mining capacity and the potential that has yet to be converted into new projects.

An established productive base

The region's position does not start from scratch. The presence of hundreds of active mining operations demonstrates that a significant portion of its geological potential has already been transformed into productive capacity, technical expertise, and associated infrastructure (Ferreira da Silva et al., 2025).

Mexico constitutes one of the main anchors of this productive base. It is the world's leading silver producer, accounting for around 24% of global output, and maintains a prominent position in gold, copper, zinc, and lead (USGS, 2026c). Its mining tradition and the presence of large copper porphyry systems and epithermal deposits also provide a platform for continuing to develop new resources (SGM, 2025).

In South America, more than 500 metalliferous mineral mines are identified, with Brazil, Chile, and Peru ranking among the main producers (USGS, 2026). The Amazonian and São Francisco cratons sustain large-scale production of iron, manganese, gold, and bauxite; whi-

le the Andean axis concentrates a significant share of global copper, molybdenum, silver, tin, and lithium output (Zappettini, 2005).



Figure 6: Map of main active mines in LAC
Source: Ferreira da Silva et al., 2025; Zappettini et al., 2020.

Central America and the Caribbean display a smaller productive scale, yet feature relevant specializations. Jamaica and the Dominican Republic stand out in bauxite production, while Cuba maintains a track record associated with the extraction of nickel and cobalt. Taken together, these precedents show that the region combines mature mining districts with territories where geological knowledge and exploration activities still have ample room for expansion.



Figure 7: Map of mineral deposits in LAC

Source: Ferreira da Silva et al., 2025; Zappettini et al., 2020.

Minerals with highest investment potential

Crossing geological availability with the needs of emerging technologies makes it possible to identify a group of minerals that will capture much of the exploration and investment interest over the coming decades:

- **Copper, silver, and zinc:** Copper occupies a central position due to its role in electrification, power grids, and energy infrastructure. South America has 281 major copper deposits identified in the analyzed databases (Ferreira da Silva et al., 2025), in addition to Mexico's substantial endowment (Perez, 2025). Silver and zinc complement this potential, both because of their industrial applications and their occurrence in the region's polymetallic systems.
- **Lithium:** The expansion of batteries makes lithium one of the fastest-growing strategic minerals. South America hosts 45 major lithium-bearing deposits (Ferreira da Silva et al., 2025), including the massive Andean brine systems and pegmatite deposits in the Brazilian Shield. The combination of resources, operating experience, and new projects positions the region as one of the primary expansion hubs for this mineral.

- **Nickel, cobalt, and bauxite:** These minerals remain vital for energy technologies, alloys, and diverse industrial applications. In Central America and the Caribbean, numerous occurrences are identified in association with lateritic deposits developed over ultramafic belts, particularly in Cuba, the Dominican Republic, and Guatemala. Brazil complements this potential with significant nickel resources.
- **Manganese and antimony:** The presence of deposits of these minerals opens up additional exploration opportunities, especially in territories where mining activity has not yet reached the scale of the premier copper, lithium, or iron districts. In Central America and the Caribbean, 40 manganese occurrences and 23 antimony occurrences are cataloged, while South America records 62 manganese deposits in the analyzed datasets.
- **Rare earth elements and niobium:** These minerals represent an especially critical frontier for advanced technologies. Brazil holds a preeminent global position due to the presence of niobium and the rare earth potential associated with carbonatite complexes and alkaline systems across the Brazilian Shield, among them Seis Lagos.

Four major opportunity domains

The distribution of resources and the degree of maturity of mining activities allow for distinguishing four major geological-mining domains across Latin America and the Caribbean. This zoning does not imply rigid borders; rather, it highlights distinct opportunity profiles for exploration and capital investment:

1. **Mexico:** a mature mining platform. Mexico combines high productive capacity with an extensive inventory of resources and projects. Its output of silver, gold, copper, and zinc is globally significant, supported by a longstanding mining tradition, well-developed infrastructure, and deep cumulative expertise. Ongoing exploration and new project development can broaden this base, including the potential associated with lithium (SGM, 2025).
2. **Central America and the Caribbean:** new exploration frontiers. The region features a geology associated with island arcs, ophiolites, and tropical weathering profiles. Although its productive scale is smaller, opportunities exist in nickel, cobalt, bauxite, manganese, antimony, copper-zinc, and rare earth elements. For these territories, the challenge lies in transforming fragmented geological potential into deeper subsurface knowledge and technically and economically viable projects (Zappettini, 2020).
3. **The South American cratons:** mineral diversity and frontier potential. South America's ancient Precambrian shields represent one of the world's primary foundations for iron ore and niobium production, while also hosting opportunities in rare earth elements, nickel, manganese, graphite, and pegmatite-hosted lithium. Their vast territorial expanse and the lower exploration density in certain areas provide significant room for new geoscience campaigns and resource development (Ferreira da Silva et al., 2025)

4. The Andean axis: copper and lithium as growth engines. The Andes mountain range hosts some of the world’s premier copper and silver districts and constitutes one of the foremost global frontiers for lithium brine development. Complementing these resources is the potential of undiscovered or undeveloped copper porphyries. Chile, Peru, Argentina, and Bolivia concentrate much of this opportunity, standing as a priority geography for the next generation of capital deployment (Zappettini, 2005).

From geological potential to investment

The geological map of Latin America and the Caribbean reveals a rare convergence: world-class mining districts with existing infrastructure and production, alongside extensive under-explored areas where opportunities to expand subsurface knowledge and delineate new projects remain broad.

Mexico possesses a substantial exploration and development pipeline backed by sizable reserves of copper, zinc, lead, and silver. In South America, beyond the projects currently undergoing exploration and feasibility studies, more than 200 abandoned deposits and over 100 idle sites have been identified. A portion of these legacy assets can offer additional investment opportunities, particularly through tailings reprocessing technologies, secondary mineral recovery, or novel extraction techniques.

This combination of operational assets, development projects, and untapped geology allows for approaching the upcoming investment cycle from a broader perspective than simply opening greenfield deposits. The opportunity also encompasses brownfield expansions, asset restarts, frontier exploration, and the commercial development of critical minerals that have historically held a minor share in the regional productive matrix.

Geological-mining domain	Critical minerals of greatest interest	Current production capacity	Future potential
 Mexico	Ag, Cu, Zn, fluorite	Global silver producer and relevant player in Cu, Au and Zn	Broad exploration pipeline and Cu and Zn resources; lithium potential
 Central America and the Caribbean	Ni, Co, Al, Mn, Sb, Cu-Zn, REEs	Primarily bauxite and nickel-cobalt	New opportunities in VMS, Mn, Sb and rare earths
 South American cratons	Fe, Nb, REEs, Ni, Mn, Li, graphite	Global leadership in iron and niobium, especially in Brazil	Frontier for REEs, lateritic nickel, graphite and pegmatite-hosted lithium
 Andean Belt	Cu, Li, Ag, Sn, Sb, Zn, Mo	Global leadership in copper, silver and molybdenum, and high lithium production	New copper projects and large lithium brine resources

Table 3: Critical minerals zoning in Latin America and the Caribbean
Source: Authors’ own elaboration based on Ferreira da Silva et al. (2025), Perez (2025), SGM (2025), USGS (2026), Zappettini (2005), and Zappettini et al. (2020). (2025), USGS

The overarching conclusion is that Latin America and the Caribbean's advantage lies not merely in the gross tonnage of minerals in its subsoil, but in the combination of geological resources, operating expertise, and tangible headroom for new capital allocation. The challenge consists of transforming that endowment into competitive projects equipped with reliable energy, shared infrastructure, skilled capabilities, and robust institutional conditions.

This perspective provides the structural foundation for the remainder of the chapter: identifying which minerals hold the greatest upside and mapping where they are concentrated allows decision-makers to anticipate where future investments will land, what infrastructure they will require, and which territories must prepare to support their execution.

2.3. Where will the next mining projects be located?

*In collaboration with **PLUS**mining*

Mining investment in the region

As a first step to assess the scale of the mining sector in Latin America and the Caribbean, one can analyze the estimated capital investment in projects supported by formal development studies. These range from early-stage diagnostic assessments (scoping) and Preliminary Economic Assessments (PEA) to pre-feasibility and feasibility stages. To complement this forward-looking perspective with investments nearing execution, projects currently under construction are also considered. Under this framework, and covering projects in copper, gold, silver, zinc, lead, lithium, iron ore, and rare earth elements, 338 initiatives are identified across the region. Collectively, these projects represent an expected construction investment or estimated upfront CAPEX of approximately USD 329 billion, underscoring the magnitude of the regional mining portfolio currently in development.

As shown in Figure 8, expected investment displays a pronounced geographical concentration. Chile, Argentina, and Peru together account for approximately 83% of total upfront CAPEX, with Chile alone concentrating roughly 45%. This distribution is heavily tied to copper, which accounts for around 70% of regional upfront CAPEX and reaches shares close to 80% in Chile and Peru, and 68% in Argentina. Chile stands out both for the scale of its portfolio, which substantially exceeds those of Argentina and Peru, and for the magnitude of its copper assets, which collectively represent around BUS\$119 in expected upfront investment.

At the same time, the breakdown by commodity reveals meaningful distinctions across jurisdictions and outlines distinct investment profiles. Argentina stands out for the weight of lithium, with nearly USD 19 billion in upfront CAPEX, surpassing even Chile, which reinforces its position as one of the primary growth poles for this mineral. Brazil presents a fundamentally different profile, dominated by iron ore, whereas Mexico displays a portfolio relatively more diversified across copper, gold, and silver. Colombia and Ecuador, by contrast, maintain significantly smaller pipelines, demonstrating that, at least under current market expectations, the next wave of major regional mining investments will continue to be led by the Andean economies.

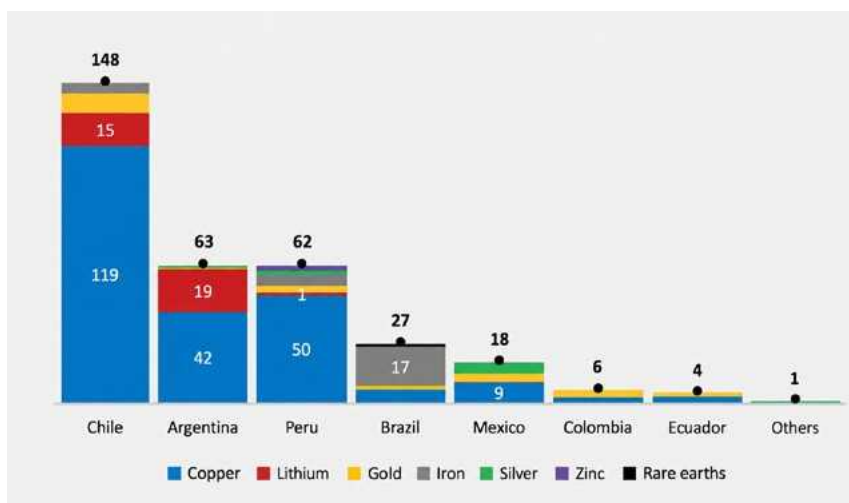


Figure 8: Expected upfront CAPEX by country and main commodity [BUS\$]

Source: Plusmining, 2026.

As illustrated in Figure 9, the concentration observed at the country level is mirrored at the subnational scale, particularly along the Andean corridor. The Andes of Chile, Peru, Argentina, and Ecuador thus form the primary mining development axis in the region. Antofagasta, Atacama, and Tarapacá in Chile; San Juan and Salta in Argentina; and Apurímac, Cajamarca, and Arequipa in Peru stand out prominently, several of them ranking among the top ten subnational jurisdictions with the highest expected upfront CAPEX. This concentration is largely driven by copper, as major cupriferous projects are situated along the mountain range, leveraging one of the world's premier metallogenic belts for this metal. Ecuador, despite hosting a smaller pipeline, also integrates into this axis through copper and gold assets, reinforcing the Andean character of future regional mining capital allocation.



Figure 9: Expected upfront CAPEX map by region

Source: Plusmining, 2026

Note: Includes copper, gold, silver, iron ore, zinc, lithium, and rare earth elements projects.

As shown in Figure 10, the composition of upfront CAPEX by project type also reflects substantial differences in the maturity of each country’s mining industry. Chile exhibits an asset base clearly oriented toward brownfield projects: of the BUS\$148 in upfront capital considered, approximately BUS\$111 corresponds to expansions or operational replacements at existing operations, whereas roughly BUS\$37 is associated with greenfield developments. This is consistent with a mature mining industry operating an extensive base of installed infrastructure that creates continuous opportunities for capacity expansions, mine life extensions, and asset optimization.

In contrast, countries with less developed mining jurisdictions or a smaller baseline of operating assets, such as Argentina, display a much higher share of greenfield capital expenditure, accounting for approximately BUS\$47 out of a total BUS\$63. This pattern is also evident in Brazil, Mexico, Colombia, and Ecuador. Peru occupies an intermediate position, combining a substantial greenfield pipeline with a solid core of brownfield projects tied to established operations.

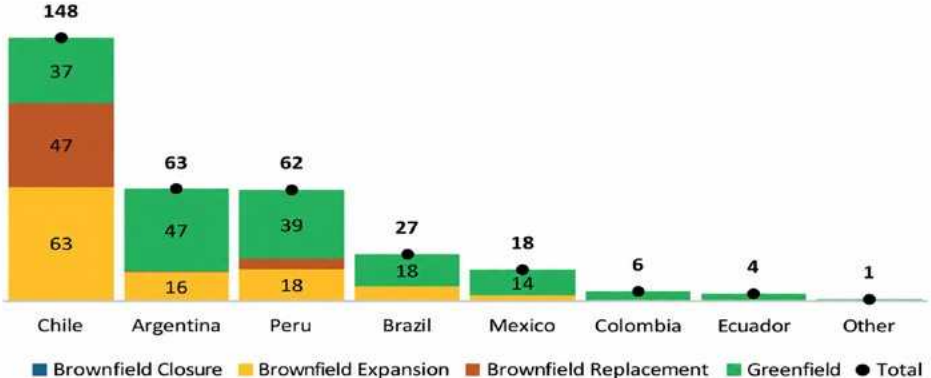


Figure 10: Upfront CAPEX by country and project type [BUS\$]

Source: Plusmining, 2026

Note: Includes copper, gold, silver, iron ore, zinc, lithium, and rare earth elements

As seen in Figure 11, the timeline of CAPEX deployment indicates that the majority of the pipeline will require several years before commercial execution. Although upfront capital of roughly BUS\$74 is concentrated between 2026 and 2029, primarily linked to projects already under construction or in the feasibility stage, more than three-quarters of total CAPEX is slated for commissioning from 2030 onward. The single largest block corresponds to projects with expected commissioning dates beyond 2034, representing approximately BUS\$117 (36% of the total), which confirms that a substantial portion of the regional pipeline entails long-term development horizons.

This multi-year distribution is directly correlated with project development stages. Assets with near-term commissioning dates are predominantly under construction or undergoing bankable feasibility studies, whereas toward 2032-2034 and especially beyond 2034, the relative weight of initiatives in pre-feasibility, PEA, and scoping stages increases significantly.

In fact, of the CAPEX scheduled for post-2034 delivery, approximately BUS\$67,6 corresponds to projects in pre-feasibility and another BUS\$27,9 to PEA and scoping stages. Consequently, a significant fraction of identified investments remains contingent upon technical de-risking, permitting approvals, project finance closing, and final investment decisions (FID), which introduces an inherently higher degree of execution uncertainty.

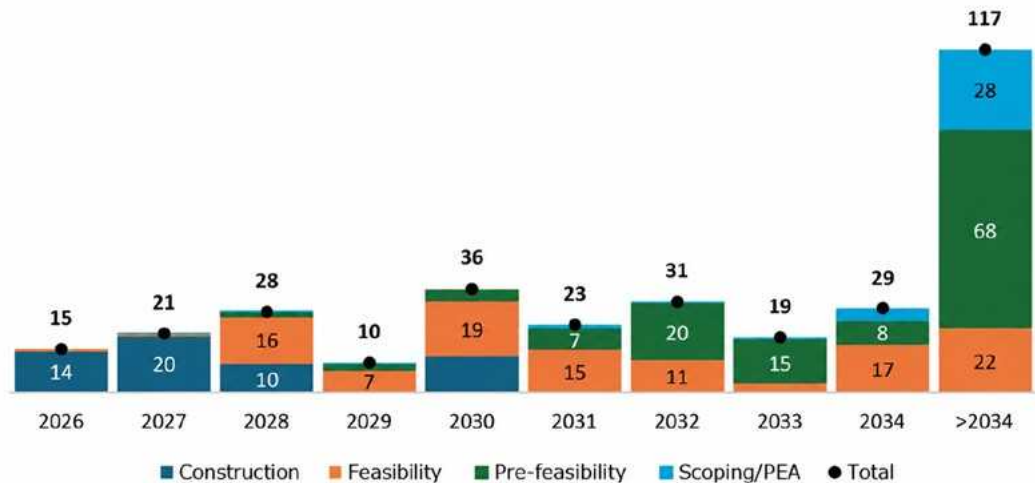


Figure 11: Upfront CAPEX by year

Source: Plusmining, 2026

Note 1: Includes copper, gold, silver, iron ore, zinc, lithium, and rare earth elements projects.

Note 2: Commissioning years represent Plusmining estimates based on study progress, permitting, construction status, and social or regulatory constraints, and may differ from company-announced schedules.

Major mining projects in the region

Figure 12 identifies 43 mining megaprojects whose commissioning could materialize over the coming decade. For this purpose, megaprojects are defined as initiatives with an estimated upfront CAPEX of at least MUS\$1.500. Of this total, 52% corresponds to brownfield developments. Furthermore, a clear predominance of copper-related projects is observed, with Chile, Peru, and Argentina concentrating a substantial share of these initiatives and positioning themselves as the primary drivers of this regional investment pipeline.



Figure 12: Regional mining megaprojects

Source: Plusmining, 2026

Note: Table A.1 in Annex I provides detailed country-level project breakdowns, including operator, ownership, primary commodity, upfront CAPEX, and expected commissioning.

Copper production outlook in the region

The heavy concentration of the regional investment portfolio in copper assets makes it particularly relevant to evaluate how these projects could alter primary copper output over the next decade. Considering that this metal accounts for nearly 70% of estimated upfront capital in the region, the following analysis examines projected production trajectories and key country-level trends. As illustrated in Figure 13, Latin American copper production could expand from approximately 9.5 MtCu in 2025 to 13.4 MtCu by 2035, representing an increase of nearly 41%.

Chile would remain, by a wide margin, the leading regional producer, with output approaching 6.5 MtCu toward 2035. Unlike other jurisdictions, its growth would not rely primarily on greenfield discoveries, but on a vast portfolio of expansions, debottlenecking, and operational continuity initiatives across existing world-class districts. Prominent examples include the Centinela Second Concentrator (currently under construction), the Escondida concentrator replacement megaproject, the El Abra expansion, and potential operational integrations between Collahuasi and Quebrada Blanca, as well as between Andina and Los

Bronces. Peru, for its part, would retain its position as the region’s second-largest copper producer, reaching approximately 3.5 MtCu in 2035, underpinned by a balance of greenfield developments and brownfield expansions. In the near term, key projects include Tía María, Corocohuayco Integration, and Mina Justa Subterránea, while larger-scale initiatives such as Sulfobamba, Los Chancas, Cotabambas, La Arena II, and Los Calatos could enter commercial service over the following decade.

One of the most consequential structural shifts would be the consolidation of Argentina as a large-scale copper producer. The country could transition from practically zero commercial production today to exceeding 1 MtCu per year toward 2035, propelled by greenfield megaprojects such as Vicuña, Los Azules, and Taca Taca. Panama could also re-emerge as a notable producer if Cobre Panamá resumes operations between 2027 and 2028, progressively recovering annual volumes near 350 ktCu. In Mexico, where Southern Copper retains a leading market footprint through Buenavista del Cobre and the La Caridad-Pilares complex, production growth is projected to be more moderate. Brazil, conversely, could experience a more substantial expansion, anchored primarily by Vale’s growth pipeline in Carajás and other base metal assets. Finally, Ecuador already hosts Mirador as an active large-scale mine—with expansion plans that could significantly increase its nominal capacity—alongside long-term geological upside from new world-scale discoveries over the next decade. Taken together, these emerging production centers would progressively distribute regional growth beyond traditional producers Chile and Peru, diversifying the geographical sources of Latin American copper supply.

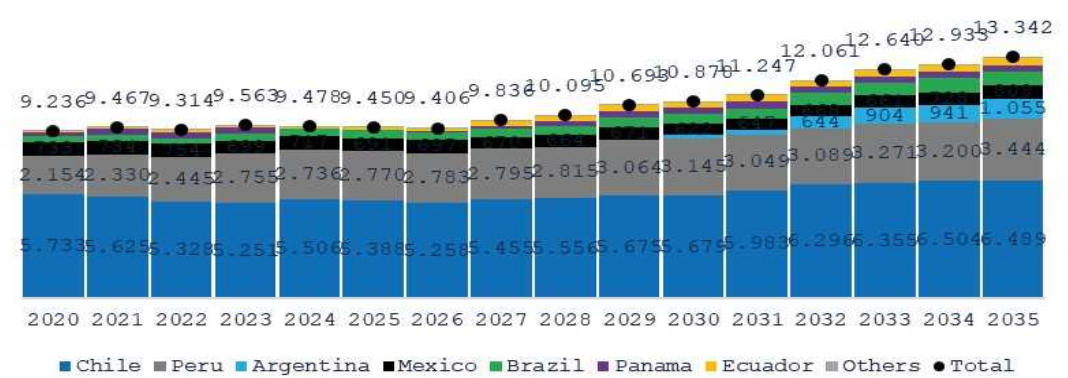


Figure 13: Mine copper production forecast in LAC
Source: Plusmining, 2026

As shown in Figure 14, regional production growth will depend increasingly on the commissioning of new projects rather than on existing baseline capacity alone. While output from operational mines is projected to decline gradually from roughly 9.5 MtCu in 2025 to 7.4 MtCu in 2035, this depletion would be more than offset by new capacity coming from brownfield and greenfield projects. Specifically, brownfield expansion and replacement

projects would collectively contribute nearly 3.2 MtCu by 2035, highlighting the critical role of extending operational lifespans, replacing depleted reserves, and expanding throughput at major operating assets. Compounding this dynamic is a pivotal expansion in greenfield projects, whose aggregate contribution would rise from marginal levels today to approximately 2.8 MtCu by 2035. Consequently, achieving the projected regional output target of approximately 13.4 MtCu will depend on whether a meaningful fraction of the portfolio currently under study and development successfully advances into full construction and commercial production.

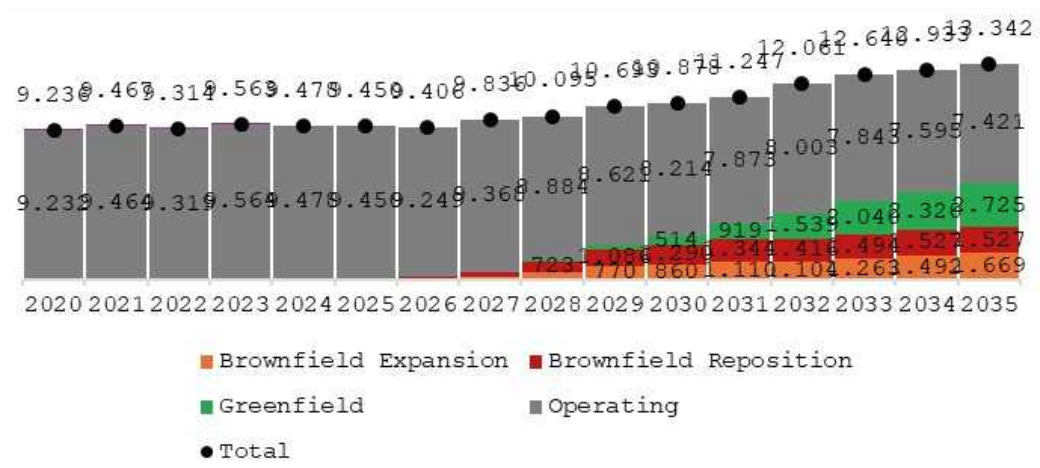


Figure 14: Mine copper production by project type in LAC
Source: Plusmining, 2026

2.4. Conditions for mining competitiveness

In collaboration with



John T. Boyd Company
Mining and Geological Consultants

From geological potential to investment

The availability of mineral resources, the strategic relevance of specific raw materials, and the existence of a substantial project pipeline do not, by themselves, guarantee that the next wave of mining investment will materialize in Latin America and the Caribbean. Between subsurface geological potential and commercial production lies a complex architecture of enabling conditions that determines how predictable, competitive, and attractive deploying long-term capital is within a given jurisdiction.

In the technical and economic evaluation of mining projects—such as that routinely conducted by specialized industry firms like John T. Boyd Company (BOYD)—most operational and engineering challenges find viable solutions within measurable risk and cost parameters. However, complexity increases substantially when transitioning from the scale of an individual site to the macroeconomic, regulatory, and territorial context of a country or the region as a whole. In this domain, where national regulatory sovereignty governs, the viability of investments demands rigorous analytical tools to evaluate the overall business environment.

At the regional scale, it is essential to complement the inventory of geological resources and project pipelines with a systematic assessment of the operating environment. Unifying criteria, agreeing on indicators, and tracking their evolution over time enables the formulation of timely and effective public policy interventions.

A methodological alternative is the use of soft competitiveness tools. This dimension encompasses the set of institutional, regulatory, infrastructural, and managerial factors that—without altering a country's baseline geological endowment—can be administered and refined through concerted decisions to reduce country risk, enhance predictability, and catalyze productive investment.

Latin America and the Caribbean stands before a major opportunity to turn mining into an engine for investment, growth, and productive integration over the coming decades. The energy transition, the restructuring of global supply chains, the growing demand for strategic minerals, and the drive to diversify sourcing locations create favorable conditions for the region. To capitalize on this opportunity, the challenge lies not only in quantifying mineral reserves, but in consolidating the institutional, energy, and operational conditions that make sustainable development possible.

Competitiveness beyond mineral resources

Traditional industry assessments often associate competitiveness almost exclusively with geological wealth and ore grade. However, corporate and financial decision-making evaluates a significantly broader spectrum of variables before committing capital to a jurisdiction. In this context, it is fundamental to distinguish between two categories of determinants:

- **Structural competitiveness:** Encompasses factors that countries can modify only marginally or over very long horizons, such as natural geological endowment, geographical location, or physiographic territorial conditions. While the generation of pre-competitive geoscientific data is a core public responsibility, the mere existence of a deposit does not guarantee capital inflows.
- **Soft or manageable competitiveness:** Covers the set of conditions that depend directly on public policy, institutional quality, and public-private coordination: regulatory strength, permitting efficiency, fiscal stability, shared-use infrastructure availability (energy, water, logistics), skilled human capital, and territorial governance.

The term “soft” does not denote secondary importance; it describes those factors over which the state and industry have full agency for active management and continuous improvement. It is precisely in this domain where diagnostic frameworks such as the Smart Mining Index (SMI)[®]—an internationally structured methodology developed by BOYD and Quantil—provide a structured analytical model for Latin America and the Caribbean.

Measuring the enabling environment

The Smart Mining Index (SMI)[®] was designed to measure, in a standardized and objective manner, the factors that influence the investment attractiveness of a mining jurisdiction. Unlike other international indices based predominantly on subjective perception surveys, this framework integrates quantitative variables and verifiable data.

The methodology covers ten interrelated dimensions that shape investment decisions and project viability:



Figure 15: Smart Mining Index® dimensions

Source: Authors' own elaboration based on John T. Boyd Company & Quantil (2016).

These dimensions approach competitiveness as a systemic phenomenon. A jurisdiction may host world-class deposits while simultaneously facing transmission bottlenecks, water governance deficits, or severe administrative delays that stall operations or inflate capital costs.

Rigorous measurement enables precise diagnosis of which elements in the operating environment act as investment catalysts and which function as barriers to be dismantled.

From comparative analysis to continuous improvement

The value of a shared regional methodology does not lie in establishing a static league table of countries, but in providing an instrument for diagnostic assessment and public policy management.

Country-level variables are scored on a normalized scale (0 to 10) and weighted using multi-criteria decision techniques, such as the Analytic Hierarchy Process (AHP). This avoids assigning identical weight to factors with disparate impacts on investment decisions and establishes clear technical and regulatory priorities. Regional consensus around these indicators does not seek to rigidly homogenize national legal frameworks, but rather to establish a common technical language to measure gaps and evaluate the tangible impact of reforms.



Figure 16: Continuous improvement cycle

Source: Authors' own elaboration based on the SMI® methodological approach (John T. Boyd Company).

The approach operates through a continuous cycle: **Measurement ► Gap identification ► Solution exchange ► Improvement implementation ► Periodic reassessment**. In this manner, a regulatory reform or the commissioning of a trunk transmission line is assessed not merely by its formal enactment, but by its verifiable capacity to shorten timelines, deliver legal certainty, and enhance territorial competitiveness.

Converting national experiences into regional intelligence

The heterogeneity of Latin America and the Caribbean represents a strategic asset when supported by effective channels for knowledge transfer. If a country succeeds in digitizing and streamlining sector-specific permitting, coordinating transmission grid expansion with its mining pipeline in a timely manner, or executing successful early socio-environmental engagement models, those practices can serve as benchmarks for other jurisdictions.

Countries in the region will continue to legitimately compete for foreign direct investment, but technical cooperation elevates the competitive standard across the regional bloc as a whole. More transparent jurisdictions with predictable rules and robust infrastructure collectively lower the cost of capital and improve the regional risk profile.

Furthermore, a common methodology makes it possible to move beyond isolated project-level assessments to plan cross-border logistics corridors, mining districts, and shared industrial clusters. This integrated approach is essential for the next generation of copper and lithium developments, whose scale will require shared solutions in power transmission, desalination, freight transport, and industrial utilities.

Toward a regional platform for mining-energy competitiveness

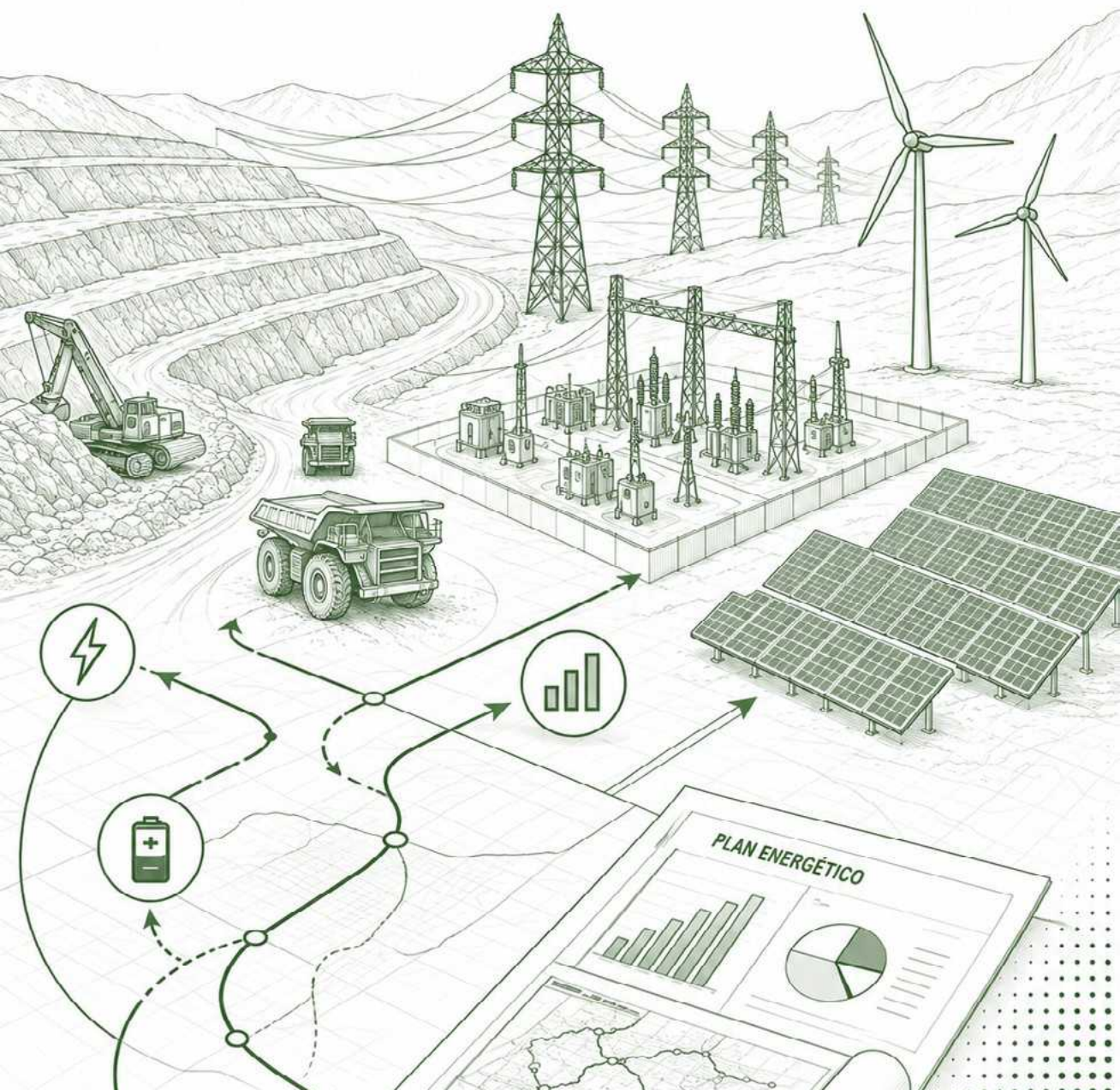
The deployment of standardized competitiveness methodologies enables the transition from isolated indicators to a **dedicated regional platform for managing the mining-energy enabling environment**.

In this agenda, multilateral organizations and regional integration bodies play a pivotal coordinating role: facilitating inter-institutional technical dialogue, advancing methodological consensus, and supporting governments in translating diagnostic assessments into concrete infrastructure programs and regulatory modernization agendas.

Latin America and the Caribbean already possesses world-class geological assets and one of the cleanest power matrices globally. The current challenge consists of building upon that foundation an institutional, regulatory, and infrastructural advantage that ensures sub-surface potential is transformed into sustainable, competitive projects fully integrated into the region's socioeconomic development.

CHAPTER 3

ENERGY PLANNING FOR MINING DEVELOPMENT



3.1. Energy demand of the next generation of mining

The next generation of mining projects will not only redefine which minerals Latin America and the Caribbean will produce, but also where, when, and on what scale the energy systems that supply them will need to expand. The expansion of mining activity anticipated over the coming decade entails new generation, transmission, and grid connection needs, particularly in territories where mineral resources and energy potential are situated far from primary load centers.

In this context, energy becomes a decisive factor for the technical and economic viability of mining projects. Securing a reliable, competitive, and progressively cleaner supply will be a necessary condition for transforming mineral resources into new productive capacity.

This challenge takes on an added dimension due to the alignment of development timelines across both sectors. A mine, a transmission line, a substation, or a new power plant can require several years from initial planning to commercial operation. When these decisions are taken independently, a risk emerges that energy infrastructure may not be available once the mining project is ready to enter production. Planning both processes jointly helps close this gap and turns expanding mining demand into an early signal to guide timely energy investments.

An expanding mining electricity demand

The expansion of the next generation of mining projects will exert an increasing impact on the electric power systems of Latin America and the Caribbean. Mining currently accounts for approximately 9% of regional electricity demand, and according to OLACDE projections, its consumption is set to rise from 122,256 GWh in 2024 to 184,147 GWh in 2034, representing a cumulative increase of 50.6% (OLACDE, 2026).

This implies adding approximately 62 TWh of incremental electricity consumption over a single decade, an amount comparable to the annual consumption of a national power system of significant size. This figure does not merely represent an increase in electricity demanded by mining: it serves as a critical indicator of the scale of investments that must be assessed across generation, transmission, connection capacity, and associated network infrastructure.



Figure 17: Key indicators of mining electricity demand

Source: Authors' own elaboration

The magnitude of this expansion displays distinct characteristics across countries. Mining's share of national electricity consumption is determined both by the total size of each grid and by the relative weight of mining within its productive structure.

In Peru, mining accounts for approximately 37% of national electricity consumption, while in Chile it reaches around 35%. In Panama, this share stands near 18%. In larger economies, such as Brazil and Colombia, it represents approximately 8%, and in Mexico, close to 5%. These contrasts illustrate that mining's energy relevance cannot be judged solely by its percentage share: even in systems where its relative weight is lower, the absolute volumes of electricity required remain substantial.

Uneven growth across countries

These disparities become even more apparent when examining projected electricity demand growth toward 2034. Argentina exhibits the largest relative growth, with an estimated increase of 428%, driven primarily by the commissioning of new lithium and copper projects. Guyana records projected growth of 205%, while Peru is expected to achieve a 95% increase, built upon an already mature mining baseline.

These growth rates must be interpreted alongside the absolute scale of the electrical loads. A high percentage increase over a modest baseline does not necessarily translate into the largest additional infrastructure requirements. For this reason, effective planning must simultaneously evaluate the growth rate, the absolute volume of new demand, and its territorial footprint.

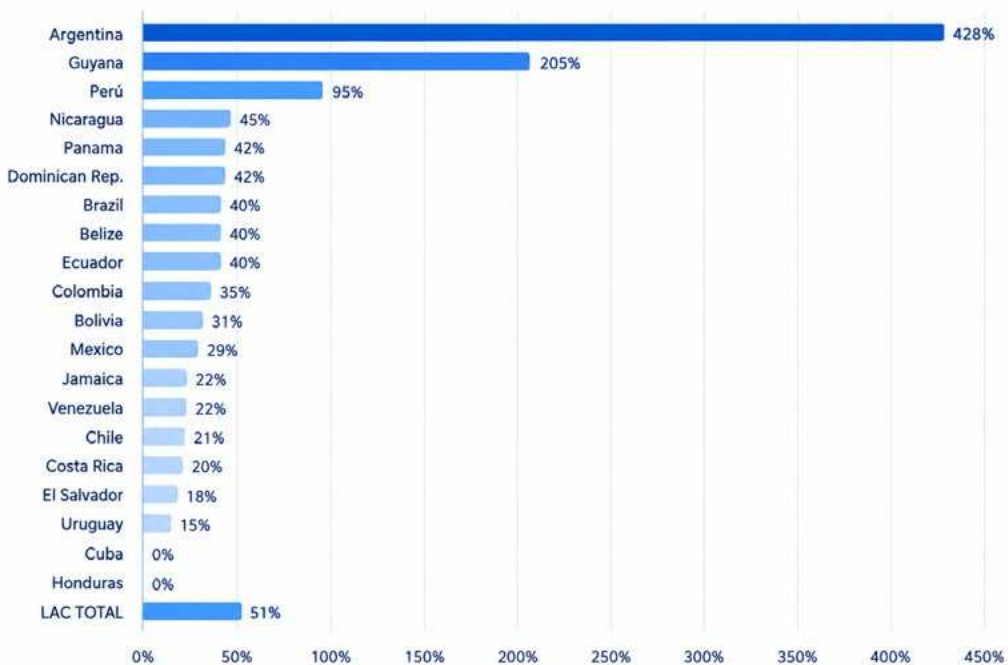


Figure 18: Projected growth of electricity demand

Source: Authors' own elaboration.

The spatial distribution of this expansion creates different operational challenges depending on each market's level of maturity. Certain countries will need to build out greenfield infrastructure to accompany mining developments into remote regions where transmission grids remain limited. Others must expand and upgrade existing corridors to accommodate incremental loads on networks where mining already accounts for a major share of aggregate demand.

“There is no one-size-fits-all energy infrastructure solution for regional mining growth. Practical requirements will depend on the scale of individual projects, their geographic location, available headroom in existing systems, and the projected expansion of the power supply.”

The mining portfolio as a driver of new demand

The trajectory of projected electricity demand is directly tied to the regional pipeline of mining projects. OLACDE's survey on the energy demand of major mining projects identifies over 200 initiatives across Latin America and the Caribbean, spanning varying levels of technical maturity and probability of entering commercial operation.

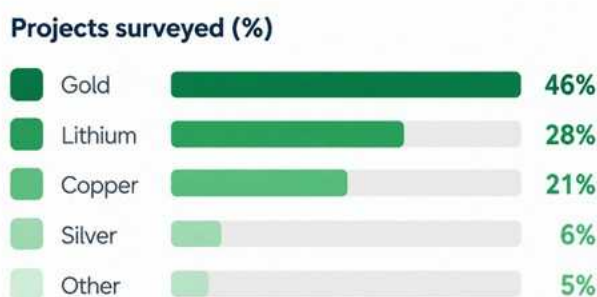


Figure 19: Project portfolio breakdown

Source: Authors' own elaboration based on OLACDE (2026), Energy Demand Database for Major Mining Projects in LAC.

Within the surveyed universe, 75 projects are currently in operation or undergoing expansion, 26 are classified as advanced projects—comprising initiatives under construction, feasibility, or advanced exploration—and 12 projects remain under care, maintenance, or temporary suspension. These varying stages of development provide visibility not only into the potential volume of new demand, but also into its projected implementation horizon.

The project portfolio is notably concentrated in minerals vital to the energy transition. Copper and lithium will play a pivotal role in shaping future electricity demand due to the high energy intensity of extraction, crushing, grinding, concentration, and refining processes, alongside water pumping, treatment, and, for specific lithium assets, direct extraction technologies.

Advanced-stage projects therefore provide an essential planning signal for the power sector. Their anticipated commissioning over the next decade can translate into large, geographically concentrated industrial loads whose integration requires forward-looking evaluations of available generation, transmission capacity, and substation interconnection points.

From the mining portfolio to power sector planning

The core challenge for the coming decade lies not merely in holding mineral reserves, but in establishing the infrastructure conditions needed to convert those reserves into operational capacity.

Commissioning a new mining project frequently requires a combination of dedicated generation capacity, transmission grid expansions, substations, interconnections, and, in certain regions, complementary water and transport logistics. These investments must be anticipated well in advance, as their construction lead times are comparable to those of the mining operations themselves.

When these planning agendas proceed without coordination, infrastructure deficits can become a binding bottleneck to project commissioning, creating operational delays, higher interconnection expenses, and constraints on sector growth.

Conversely, embedding mining project pipelines into power system planning processes generates early visibility regarding where, when, and by how much electricity demand will expand. This facilitates the proactive identification of strategic transmission corridors, critical grid substations, and future generation needs before physical network constraints materialize.

Coordinating these sectors does not require merging mining and energy decisions into a single institutional body. It requires, fundamentally, improving the quality, timeliness, and territorial resolution of the data used to inform capital investment decisions. For mining companies, this provides greater certainty regarding future power availability; for electric systems, it offers clearer signals regarding the location and scale of prospective loads; and for governments, it establishes a solid analytical foundation for prioritizing public and private infrastructure outlays.

Projections designed to support strategic planning

OLACDE's projections are not a simplistic extrapolation of historical consumption trends. The analytical framework synthesizes data from national energy balances, official power expansion plans, macroeconomic forecasts, and active mining project pipelines, complemented by customized methodologies adapted to data availability and institutional frameworks across countries. Technical Note No. 17 establishes the quantitative and methodological foundation for these calculations.

This approach generates a spatially and temporally resolved estimate of future industrial loads associated with mining developments. Its primary value for long-term planning lies not merely in projecting aggregate electricity volumes, but in pinpointing where and when new power requirements will concentrate on the ground.

In this respect, mining demand shifts from being a passive variable that merely follows economic activity into an active input for planning energy infrastructure. Systematically integrating project-level data, processing technologies, geographical coordinates, and commissioning schedules allows public and private capital to target generation, transmission, and connection investments more effectively. This coordination reduces project delivery risks and prevents power grid bottlenecks from constraining the next generation of mining projects

“Regional mining competitiveness in Latin America and the Caribbean will not depend solely on the location of its subsoil reserves, but on its capacity to anticipate and supply the energy required to bring them into production.”

3.2. Enabling infrastructure for mining development

*In collaboration with the
French Development Agency*



The expansion of generation and transmission accompanies the growth of mining demand and constitutes a highly relevant factor in guaranteeing a reliable, competitive, and timely electricity supply. In this context, energy infrastructure must be understood as enabling infrastructure for the development of new mining projects, whose planning requires anticipating the trajectory of demand and the geographic location of future capital investments.

Critical minerals are essential for the energy transition, forming part of batteries, electric motors, and power transmission and distribution grids. Latin America and the Caribbean, and Argentina in particular, hold significant reserves of these minerals. However, transforming this resource endowment into production and sustainable development requires strengthening public and private capabilities to support the expansion of activity with adequate infrastructure and under the highest environmental and social standards.

Energy infrastructure to support mining development

The availability of energy infrastructure conditions the progress of numerous mining projects from their earliest stages. High-voltage transmission lines make it possible to connect demand centers with energy generated from renewable sources and, in larger systems, help absorb the variability of these generation profiles. At the same time, a robust transmission network is vital to support the development of strategic sectors, including mining.

This challenge becomes particularly relevant in regions where renewable generation potential and mineral resources are located far from major consumption centers. In certain areas, existing transmission capacity acts as a binding constraint on the integration of new renewable generation. The expansion and modernization of grids can simultaneously contribute to integrating larger volumes of clean energy and creating the necessary conditions to meet the future growth of mining demand.

The planning of these investments must therefore be carried out with sufficient advance notice and in coordination with productive development strategies. Energy infrastructure should not be incorporated merely as an ex-post response to a mining investment decision, but as part of broader territorial planning that anticipates generation, transmission, and supply requirements.

The Argentine case: infrastructure, knowledge, and capabilities

Argentina serves as an illustrative case of this relationship between mineral resources, the energy transition, and enabling infrastructure. The country concentrates around 20% of global lithium resources, ranks among the top four countries in terms of reserves, and is the fifth-largest global producer. To this is added significant copper potential, particularly in the Cuyo and Northwest regions.

Since 2018, the AFD Group has supported Argentina’s energy transition through three complementary entities: the French Development Agency (AFD), focused on the public sector; Proparco, for private sector investment; and Expertise France, for technical cooperation. Collectively, the Group has committed EUR 389 million to the energy transition in Argentina, with 100% of its projects aligned with the Paris Agreement.

Its intervention combines infrastructure financing with knowledge generation and institutional strengthening, operating upstream of extractive operations.

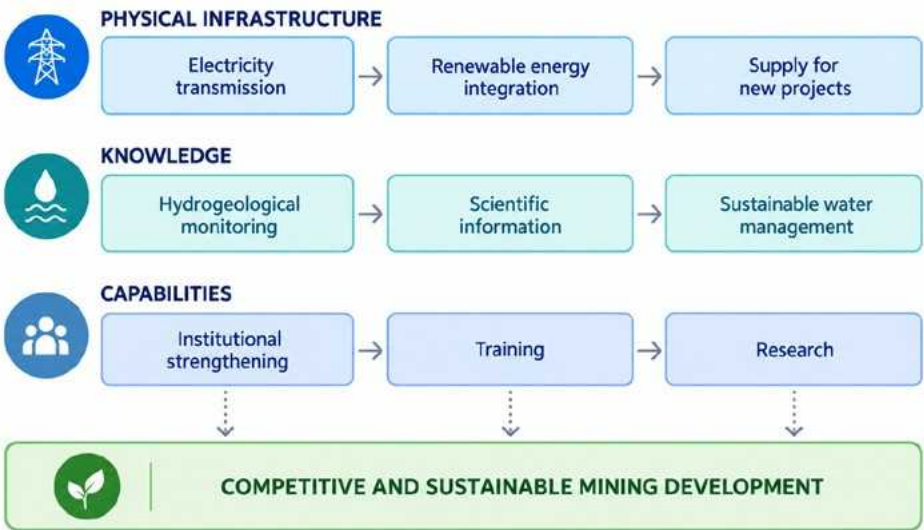


Figure 20: Competitive and sustainable mining development

Source: Authors’ own elaboration based on AFD.

In the power infrastructure domain, the AFD, jointly with the European Investment Bank (EIB), is financing the expansion and modernization of the high-voltage transmission grid through a EUR 200 million program. These capital investments enable connecting renewable electricity generated by solar and wind farms to consumption centers, whose deployment in certain regions is constrained by network saturation. In addition, the Group is studying, alongside provincial governments, new transmission lines in districts with strong mining potential.

Practical experience shows that transmission expansion can fulfill a dual role: accommodating power demand growth associated with new productive activities while simultaneously facilitating greater integration of renewable sources into the grid.

Water as enabling infrastructure

The infrastructure required for critical mineral development is not limited to the power system. Specifically, in brine-based lithium extraction, detailed knowledge regarding the availability and hydrodynamics of water resources constitutes a fundamental pillar of adequate environmental management.

In this area, the AFD is supporting the provinces of Salta and Catamarca through an EUR 800,000 non-reimbursable grant, mobilizing the expertise of the BRGM (France's national geological survey) to strengthen hydrogeological monitoring in salars.

The objective is to generate deeper scientific knowledge regarding the availability and dynamics of water resources, equipping provincial authorities to plan lithium development with superior environmental and territorial governance tools. The generation of reliable scientific baseline data strengthens public decision-making and helps align mineral resource development with the protection of ecosystems and host communities.

Strengthening institutional capacity to accompany investment

Physical infrastructure and scientific knowledge demand, in turn, institutional capabilities that enable translating data into long-term policies and regulatory decisions. In this regard, a EUR 5 million program funded by the European Union and implemented by Expertise France supports the institutional strengthening of provincial agencies, vocational training, and applied research.

This initiative is framed within the Global Gateway strategy and the Team Europe approach, complementing the physical infrastructure operations deployed by the AFD Group. This coordination makes it possible to address in an integrated manner dimensions that often advance in silos: capital investment in infrastructure, knowledge generation, and building the public sector capabilities needed to manage productive development.

An integrated view of enabling infrastructure

The Argentine experience illustrates a central premise for the next generation of mining projects: competitiveness depends not only on the availability of subsoil mineral resources, but also on the ability to anticipate and coordinate the structural conditions that enable their extraction. This is an operational approach that the AFD Group also replicates in other countries across the region, such as Bolivia, Brazil, and Mexico.

The expansion of power transmission corridors, hydrogeological baseline research, and institutional capacity building are components of a single integrated agenda. When these dimensions are planned proactively and in a coordinated fashion, uncertainties are reduced, capital allocation is optimized, and more predictable conditions are created for project development.

For Latin America and the Caribbean, where a significant portion of prospective mining projects will be sited in territories requiring new infrastructure and capabilities, this experience offers a relevant lesson: planning before investing ensures infrastructure accompanies mining expansion rather than becoming a structural bottleneck to growth.

3.3. Coordination between energy planning and mining development

Mining and the electric power sector share long-term investment horizons, require substantial capital outlays, and operate across the same territories. Historically, however, both sectors have been managed through misaligned institutions, regulations, and timelines.

This lack of coordination generates direct risks for project delivery. Data on prospective mining operations—their geographic location, production scale, execution schedules, and power requirements—constitutes an indispensable input to size power generation and transmission infrastructure in a timely manner. Concurrently, the availability of firm capacity and competitive tariffs determines the commercial profitability and commissioning timelines of mineral deposits.

For this reason, inter-sector coordination must begin well before the construction phase. Incorporating mining projects early into energy planning scenarios allows system operators to identify transmission bottlenecks on high-voltage grids and schedule infrastructure outlays without operational delays.

From the mining project to energy infrastructure

Effective coordination requires formal and continuous information-sharing channels connecting ministries of mining and energy, regulatory authorities, transmission system operators, mining operators, and power developers.

The objective is not to alter the legal competencies of individual agencies, but to consolidate a technical planning cycle that periodically updates demand forecasts and synchronizes investment decisions.

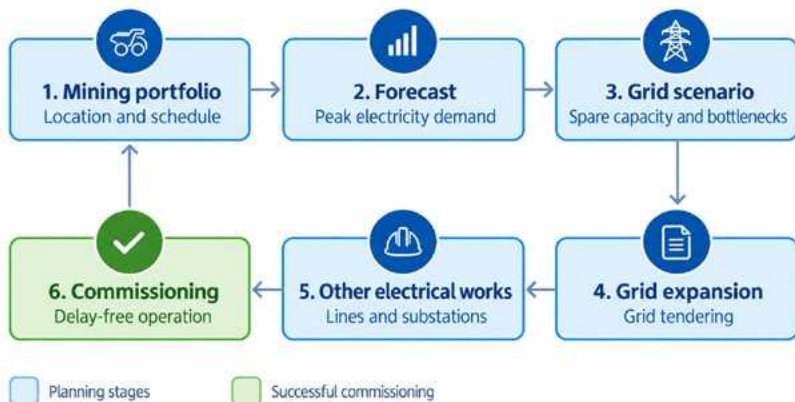


Figure 21: Integrated coordination cycle between mining and energy

Source: Authors' own elaboration.

This approach enables a shift from a reactive paradigm, where infrastructure is built only after new industrial demand has already materialized, to a prospective framework, where the anticipated development of the mining sector serves as a direct input for power system planning.

Coordination experiences across the region

Several Latin American countries have already established institutional mechanisms linking mining intelligence with power sector planning.

In Chile, the Chilean Copper Commission (Cochilco) periodically prepares the official ten-year electricity demand projection for copper mining (Cochilco, 2025). This forecasting model not only quantifies the requirements of greenfield assets and brownfield expansions, but also models the structural impact of declining ore grades on comminution and the growing reliance on seawater desalination. The electric power demand associated with desalination plants and high-altitude water pumping systems has become a critical consumption driver. The outputs of these projections are formally transferred to the National Energy Commission (CNE) and the National Electric Coordinator (CEN) as inputs for the Annual Transmission Expansion Plan, ensuring that the National Electric System (SEN) tenders and commissions trunk grid infrastructure in the northern mining hubs well in advance.

In Peru, inter-institutional coordination operates through a formal mechanism connecting the Ministry of Energy and Mines (MINEM) and the Committee for the Economic Operation of the System (COES). The prioritized pipeline of mining investment projects, categorized by technical maturity levels (feasibility, construction, and expansions), is integrated on a binding basis into the formulation of the Transmission Plan (COES, 2024). This process enables the system operator to run power flow simulations and anticipate the 500 kV and 220 kV transmission reinforcements required to supply the main mining corridors across central and southern Peru. Consequently, transmission congestion risks on high-voltage lines are mitigated, and grid interconnection lead times for large-scale copper and polymetallic developments are substantially shortened.

These experiences prove that effective coordination does not mandate a uniform institutional blueprint across jurisdictions. The fundamental requirement is ensuring that data on mining expansion reaches energy planning authorities in a timely manner, while power system constraints are simultaneously incorporated into project development decisions.



Figure 22: Regional mining-energy coordination

Source: Authors' own elaboration based on institutional data from Chile, Peru, and OLACDE.

From national coordination to regional cooperation

The need for coordination takes on an additional dimension when project footprints and infrastructure systems cross national borders. The distribution of mineral reserves, logistics corridors, and power transmission networks does not conform to administrative boundaries. Regional cooperation can therefore broaden the portfolio of alternatives available to meet demand growth and enhance system resilience.

Through the Regional Energy Planning Council and the Regional Energy Planners Forum (FOREPLEN), convened jointly with ECLAC, OLACDE has been fostering technical convergence among national planning entities to bolster security of supply and accelerate renewable integration.

In terms of physical infrastructure, OLACDE's Regional Indicative Power Interconnection Plan identifies 16 priority interconnection projects, totaling:



Figure 23: Power interconnection projects

Source: Authors' own elaboration.

The contribution of regional interconnections

Aspect	Description
 Supply resilience	Enable complementary hydroelectric, solar and wind generation among neighboring countries, ensuring continuous 24/7 power for mining operations.
 Capital efficiency	Reduce the need to build redundant reserve capacity or isolated diesel-fired thermal generation.
 Market scale	Facilitate clean energy purchase agreements (PPAs) at more competitive prices in border areas with high geological potential (e.g., Puna and the Andean Region).

Figure 24: Contribution of regional interconnections

Source: Authors' own elaboration based on the Regional Indicative Power Interconnection Plan for Latin America and the Caribbean (OLACDE, 2025).

These international interconnections facilitate a more efficient utilization of the region's diverse energy resources, eliminate redundant reserve capacity outlays, and enhance overall power system resilience amid accelerating demand growth.

Coordination as a competitive advantage

Coordinating mining and energy planning does not mean overriding national sovereignty or imposing an identical institutional model across countries. It means, fundamentally, enhancing the quality and timeliness of the technical data used to guide capital deployment.

For mining projects, this provides greater certainty regarding the future availability of firm power and grid capacity. For power systems, it delivers clearer locational signals concerning the magnitude and timing of incoming industrial loads. For governments, it enables prioritizing public and private capital outlays toward the infrastructure assets that deliver the greatest systemic impact on economic development.

In an international market marked by intense competition to attract critical mineral investments, this forward-looking capacity becomes a cornerstone of regional competitiveness.

“Planning power infrastructure in a timely manner ensures the transmission grid acts as a bridge for mining development, rather than its bottleneck.”

3.4. Infrastructure challenges for competitive mining

In collaboration with **PLUS**mining

Energy challenges of mining in Latin America and the Caribbean

While Latin America and the Caribbean holds an exceptional position in global mineral supply, the mere existence of resources does not guarantee that a mine will ultimately be built. Water access, logistics, permitting, financing, and, increasingly decisively, power supply must first be resolved.

The relationship between mining and electricity stems from a fundamental baseline condition: a mine is established where the deposit is located, not where the power grid offers optimal conditions. Consequently, many projects are sited in high-altitude Andean environments, the Puna plateau, arid deserts, or Amazonian basins, far removed from urban centers and generation hubs. Even when a power line exists nearby, it may lack the transmission capacity required to serve a new industrial operation. The core challenge, therefore, lies not merely in generating additional electricity, but in transporting it to the project site and delivering it reliably, with required power quality, and precisely on the scheduled commercial startup date.

The scale of this challenge is evident in the analyzed portfolio. Although expected investment is substantial approaching BUS\$329, energy consumption does not depend solely on the dollar value of capital deployed, as it varies according to commodity, deposit characteristics, extraction methods, and end products. In iron ore mining, the sheer tonnage of rock that must be extracted, crushed, classified, and hauled dominates operational requirements, making the uninterrupted operation of primary crushers, overland conveyors, processing plants, freight rail, and port terminals indispensable. In copper and gold, by contrast, declining ore grades require moving and grinding significantly greater rock volumes to yield the same ton of refined metal, whereas lithium brine processing combines deep-well pumping, chemical separation, reagent handling, and, depending on the flowsheet, specific thermal energy inputs. These structural variances preclude any automatic translation of unit electricity costs from one mining operation to another.

Despite these process differences, large-scale mining operations share a common operational requirement: the need for continuous, uninterrupted baseload operations (24/7). A mine and its processing plant routinely operate around the clock; a power outage does not merely curtail output during the blackout itself. It halts SAG and ball mills, slurry pumps, underground mine ventilation, distributed control systems, maintenance workshops, water treatment facilities, and accommodation camps, requiring complex, step-by-step restart protocols to restore process equilibrium safely. High-value capital equipment, operating personnel, specialized contractors, and invested capital remain immobilized during downtime. The economic cost encompasses lost production volumes, impaired asset utilization, and, across specific metallurgical circuits, the loss of operational stability.

This imperative for continuous operation explains why electricity must be analyzed in conjunction with other critical inputs. Water sustains mineral processing and dust suppression; fuels power heavy haulage fleets and auxiliary generation; and highways, pipelines, maritime ports, or freight rail lines enable inbound reagents and outbound concentrates to circulate. When public infrastructure lacks sufficient capacity, projects are forced to construct dedicated capital assets, such as industrial aqueducts, seawater desalination plants, high-voltage transmission lines, dedicated substations, or captive power plants. Across multi-billion-dollar investments, these utility assets represent substantial capital outlays that can alter total project CAPEX, modify execution sequencing, and determine final investment decisions.

The multi-decade operational lifecycles of modern mines further amplify this challenge. A large copper or iron ore mine may operate for thirty, fifty, or more years, during which power requirements must be reliably met across brownfield expansion phases, extended droughts, generation plant outages, competing load growth, and ongoing technological disruption. At the same time, developing a high-voltage transmission line can require more years than constructing the mine itself, owing to route engineering, easement negotiations, environmental impact assessments, community consultations, financing, and construction. If both sectors proceed without coordination, a completed mine may sit idle awaiting transmission access, or a newly built line may remain underutilized if mining milestones are delayed. For this reason, power system planning must be initiated years in advance.

Industrial decarbonization introduces an additional layer of complexity. Major mining companies have adopted voluntary corporate targets for greenhouse gas reductions and net-zero operational footprints. Purchased grid electricity is accounted for as Scope 2 indirect emissions, while diesel consumed by haul trucks and heavy equipment represents Scope 1 direct emissions. This framework drives two simultaneous operational shifts: mining houses procure renewable energy contracts to decarbonize their electricity footprint and, in parallel, electrify heavy mobile equipment previously powered by fossil fuels, transferring substantial energy demand directly onto the transmission grid. A renewable generation matrix therefore constitutes a tangible competitive asset only when it can deliver firm, uninterrupted power directly to the mine's point of connection.

The region begins this process from a favorable baseline. As illustrated in Figure 25, 69% of the electricity generated across Latin America and the Caribbean during 2024 originated from renewable sources, nearly double the global average reported internationally. Hydroelectric generation represented 45% of total regional output; natural gas, 25%; wind power, 12%; and solar PV, 7%. The remainder was distributed among bioenergy, coal, nuclear power, oil derivatives, and geothermal energy. However, this regional aggregate does not reflect uniform conditions across individual countries, nor does it guarantee hourly power availability. A heavy reliance on hydroelectricity, for instance, makes hydrological rainfall patterns and multi-year droughts a critical system vulnerability in countries such as Ecuador and Colombia.

Renewable sources: 69%

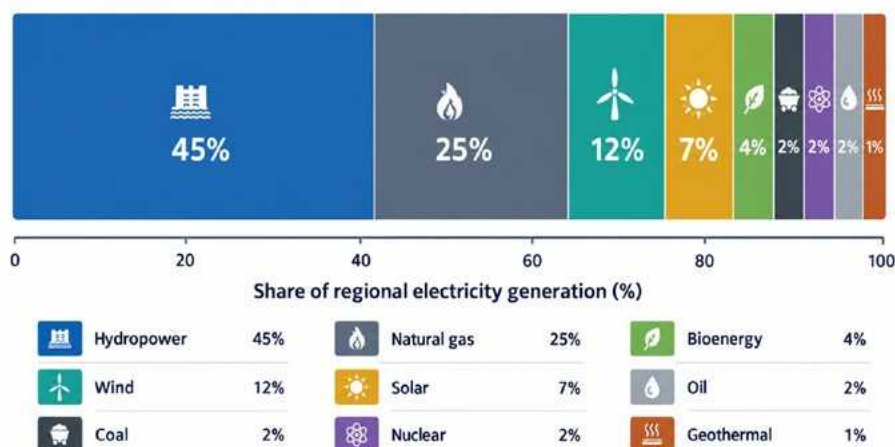


Figure 25: Latin America and the Caribbean electricity generation mix (2024)

Source: Plusmining 2026

Note: Values reflect aggregate regional gross generation, not nominal installed capacity.

The mining project portfolio outlined in Section 2.3 grounds this systemic challenge in concrete industrial developments. A representative cross-section of world-scale copper megaprojects reveals electrical connected load requirements ranging from tens of megawatts to several hundred megawatts per asset, accompanied by requirements for high-voltage transmission circuits, switching substations, and, in certain remote geographies, captive generation assets. The portfolio matrix in Annex II correlates expected investment timelines for major regional copper projects with the power delivery infrastructure that must be energized for these operations to achieve commercial startup.

Energy and infrastructure challenges across major regional jurisdictions

The major mining nations of Latin America and the Caribbean exhibit distinct institutional and physical models governing the mining-electricity nexus. Chile, Peru, and Brazil possess mature, large-scale extractive industries, whereas Argentina and Ecuador hold a substantial portion of their growth potential in greenfield projects awaiting initial construction. Mexico and Colombia operate expansive national interconnected grids that nonetheless face localized transmission bottlenecks in remote mining basins, while Panama represents the unique experience of a world-class copper complex developed with dedicated captive thermal generation.

Chile

Chile concentrates the most significant mining capital portfolio in the region. With USD 148 billion (BUS\$148) in identified CAPEX, it accounts for 45% of the regional total, supported by a world-leading copper industry, specialized engineering ecosystems, and decades of commercial power contracting experience. Its primary operating districts and prospective pipelines are concentrated across the northern regions—principally Antofagasta, Atacama, Tarapacá, and Coquimbo—where physical distances, hyper-arid desert terrain, and high Andean elevations dictate infrastructure design. Industrial seawater desalination introduces an additional power load: electricity is consumed at coastal intake and reverse osmosis facilities, as well as in high-pressure pumping stations lifting water thousands of meters to high-altitude mountain operations.

Current operating conditions reflect a prolonged structural evolution. For decades, northern mining operations drew power from the Northern Interconnected System (SING), an isolated, fossil-fueled grid independent from the central-southern system (SIC). The physical interconnection of both grids was commissioned in November 2017, establishing the unified National Electric System (SEN). Prior official cost-benefit assessments estimated net economic benefits near USD 1,100 million (MUS\$1.100) and price reductions for large customers of approximately USD 17/MWh in the Norte Grande and US\$9/MWh in the central-southern zone. While these savings do not represent direct reductions in mine construction CAPEX, they illustrate the economic efficiency gained by merging previously fragmented power markets. Stable, baseload mine electricity demand also anchored bankable, long-term power purchase agreements (PPAs), underwriting the financing of new generation assets and transmission corridors (Ministerio de Energía de Chile, 2015); (Ministerio de Energía de Chile, 2017).

The accelerated integration of renewable energy advanced upon this unified grid. In 2025, solar PV and wind generation accounted for 38% of total generation; when combined with conventional hydroelectricity, clean sources supplied roughly two-thirds of gross output. The Atacama Desert's exceptional solar irradiance, favorable wind resources, southern hydropower, and baseload mining procurement contracts explain much of this rapid transition (Coordinador Eléctrico Nacional, 2026a); (Ministerio de Energía de Chile, 2026).

However, this renewable expansion has not eliminated physical system constraints. Solar electricity is generated during daylight hours and remains concentrated in the northern desert, while high-voltage transmission transfer capacities do not always allow this surplus energy to be dispatched to central load centers. In 2025, the Independent System Operator (CEN) recorded 6,205 GWh of renewable energy curtailments, clean power that was available for production but had to be curtailed because the transmission system lacked real-time transfer or absorption capacity (Coordinador Eléctrico Nacional, 2026b). While this volume does not imply that all curtailed energy could have been absorbed directly by mining sites, it highlights the operational gap between contracting paper renewable energy on an annual balance sheet and having continuous clean power delivered to a specific industrial meter.



Figure 26: Monthly renewable energy curtailment in Chile (2025)

Source: Authors' own elaboration based on data from the Coordinador Eléctrico Nacional (Chile), 2026.

The operational response combines utility-scale battery energy storage systems (BESS) and high-voltage transmission lines. By the close of 2025, approximately 1,700 MW of BESS capacity was operational, with 600 MW in testing and nearly 4,500 MW under active construction. In parallel, the Kimal-Lo Aguirre HVDC transmission line is advancing to span approximately 1,346 km between Antofagasta and the Santiago metropolitan area. While these capital assets will alleviate transmission curtailments and optimize northern solar dispatch, they require timely execution alongside local network reinforcements across regional sub-transmission grids. Until these bulk transmission assets enter commercial service, the system remains dependent on conventional thermal generation during evening peak and low-generation hours, preserving exposure to imported fossil fuel price volatility (Coordinador Eléctrico Nacional, 2026a); (Ministerio de Energía de Chile, 2026).

Chile presents a mature mining-energy ecosystem facing structural grid challenges. Its strengths lie in decades of operating track record, deep power contracting markets, and world-class renewable potential. The current priority consists of expanding transmission and storage capacity, guaranteeing firm power delivery during critical non-solar hours, and reducing the total delivered cost of energy at the mine gate.

FEATURED CASE STUDY

Puerto Mejillones: Shared-use infrastructure for a mining district

The Mejillones Port Complex illustrates how territorial infrastructure planning supports an integrated mining basin. Sited in the Antofagasta Region near major global copper operations, the complex handled 5.8 million tonnes of bulk and containerized cargo in 2024 and maintains an installed throughput capacity exceeding 8.5 million tonnes per year across its deep-water terminals (Complejo Portuario Mejillones, 2024).

Since 2003, the phased expansion of Puerto Angamos, Terminal Graneles del Norte, and associated industrial platforms has been underpinned by cumulative capital investments exceeding USD 300 million, dedicated to expanding ship loading capacities, optimizing logistics, and supporting regional mining growth.

The operational track record of Mejillones confirms that enabling infrastructure creates superior value when engineered for an entire productive district rather than for an isolated project. Concentrating industrial operations and shared logistics within a common corridor unlocks economies of scale and prevents capital-intensive duplicate outlays.

The strategic lesson for the region: Anticipating shared infrastructure requirements and coordinating their commissioning alongside mining expansions turns common-user assets into a durable competitive advantage for the host basin.



Argentina

Argentina holds the potential to become one of the premier global copper jurisdictions over the coming decade, yet the vast majority of its resource portfolio remains in development. Official data released in 2026 identifies 117.9 million tonnes of copper resources, 19.97 million tonnes of reserves, USD 42,200 million (MUS\$42,200) in project CAPEX, and an annual production potential of 1.6 million tonnes of fine copper (Secretaría de Minería de Argentina, 2026). While these metrics do not guarantee that every asset will advance to commercial startup on schedule, they demonstrate that the domestic power sector must prepare to supply an industrial customer base of a fundamentally different scale than that of today.

Geography constitutes the initial bottleneck. In the Argentine Northwest (NOA)—comprising the provinces of Jujuy, Salta, Catamarca, and La Rioja—high-altitude lithium salts and large-scale copper porphyries such as Taca Taca are located across the Puna plateau. Further south, the province of San Juan hosts world-scale copper deposits, including Los Azules, El Pachón, and the Vicuña district along the high Andean border with Chile. These remote mountain districts are located far from major consumption centers along the central coastline and Buenos Aires. The aggregate power requirement is substantial: industry assessments in 2026 indicate that developing four premier copper megaprojects in San Juan alone will require roughly 1.5 GW of incremental capacity, largely serving high-altitude operations disconnected from existing high-voltage corridors. Given the territorial scale and the size of these industrial loads, building bespoke, dedicated transmission connections for each mine would be cost-prohibitive. System planning must prioritize multi-user utility corridors designed with expandable capacity over time.

Argentina's national power grid is anchored by natural gas, conventional hydropower, nuclear generation, and an expanding renewable fleet. This structural diversification is an asset, and several prospective mining basins are situated adjacent to high-yield solar and wind resources. The principal vulnerability lies in bulk transmission capacity. In May 2025, the national government unveiled a transmission expansion master plan projecting 5,610 km of new high-voltage lines—a 38.3% expansion of the national grid—requiring more than USD 6,600 million (MUS\$6,600) in capital expenditure. Official diagnostic studies noted that over the preceding decade the national high-voltage grid expanded by just 8%, while peak electricity demand increased by 20% (Secretaría de Energía de Argentina, 2025).

This disparity between demand growth and transmission buildout generates financing and scheduling challenges. If high-voltage transmission lines are structured only after a mining project achieves final investment decision, network commissioning will lag behind mine readiness; conversely, building corridors in advance without committed anchor off-takers risks stranding capital assets. Cross-border integration with Chile can supply Argentine natural gas, enable clean electricity exchanges, and optimize regional network use, though it does not eliminate the need for internal high-voltage transmission lines reaching isolated mining districts (Ministerio de Energía de Chile, 2026); (Secretaría de Energía de Argentina, 2025).

The Argentine challenge does not stem from a deficit of primary energy, but from the need to convert natural gas, wind, and solar resources into continuous power delivered to deve-

loping mining basins. Achieving this requires modular transmission designs, open-access regulatory frameworks, and fair-share cost-allocation rules for incoming industrial users. Sized properly, mining load demand can underwrite transmission lines that supply industrial sites while reinforcing provincial distribution grids.

Ecuador

Ecuador possesses an emerging industrial copper and gold sector, meaning that each newly commissioned large-scale mine produces a discernible shift in total national power demand. Large operations such as Mirador and Fruta del Norte are located in the southeastern Amazonian foothills of the Cordillera del Cóndor, whereas the Cascabel porphyry project is located in Imbabura province in the north. These remote districts do not coincide with primary generation plants or domestic load centers. As a result, power supply arrangements for single mining operations quickly expand into strategic system-wide considerations for the national grid.

Ecuador's generation matrix depends predominantly on run-of-river hydroelectricity. While this delivers low operating emissions during normal hydrological periods, it leaves the national power system exposed during severe dry seasons (*estiaje*) when thermal replacement capacity is constrained. The National Electricity Operator (CENACE) attributed system deficits in 2023 to a combination of severe hydrological droughts, fuel supply bottlenecks, unscheduled thermal outages, domestic demand growth, and physical capacity limits on cross-border transmission with Colombia and Peru. These constraints recurred in 2024, triggering rolling industrial and residential blackouts. The operational problem stemmed from the compounding effect of low river inflows, unavailable thermal generation, equipment failures, and import constraints (CENACE, 2025).

Immediate emergency measures included restoring decommissioned thermal units, procuring floating or containerized emergency generation, and accelerating generation tenders targeted for 2026 and 2027. While these additions expanded reserve margins, they underscored the structural capacity gap facing incoming loads. The planned expansion of the Mirador copper complex and the development of Cascabel represent individual power demands near 180 MW each by 2034. Combined, they represent approximately 360 MW of continuous base load, requiring firm power generation and dedicated high-voltage transmission circuits into mining districts (Ministerio de Ambiente y Energía de Ecuador, 2026).

During negotiations in 2026, the national executive proposed that both megaprojects cover their power needs through off-grid captive generation, including discussions for a dedicated hydroelectric facility for Mirador. While the regulatory framework permits private self-generation, mandating captive generation without a transparent grid capacity allocation risks overburdening project balance sheets. Sponsoring companies would be forced to internalize the full CAPEX of dedicated generation, transmission lines, backup generation, and operational maintenance, transferring power system utility risks onto the mining asset. The planned 500 kV international transmission interconnection with Peru can provide stability during domestic power deficits, but only when Peru generates exportable surpluses and Ecuador's transmission network can dispatch those flows to mining loads (Ministerio de Ambiente y Energía de Ecuador, 2023); (CELEC, 2026).

Before resolving project-level mine connections, Ecuador must secure national generation capacity during hydrological dry seasons and establish stable regulatory frameworks that allow mining capital to co-fund grid expansions without bearing the sole financial burden of system-wide generation deficits.

Peru

Peru ranks alongside Chile and Brazil as one of the premier, long-standing mining jurisdictions in Latin America. Aggregate electricity consumption across the mining and primary processing sector is projected to expand by 85% by 2034 (OLACDE, 2026). Much of this copper production is concentrated across the central and southern Andean corridors, located at high altitudes and far from coastal industrial centers. Consequently, the existence of an established national grid does not eliminate the need for new high-voltage transmission lines, step-down substations, road access, and industrial water infrastructure to accommodate sector growth.

The National Interconnected Electric System (SEIN) is supported by a diversified generation portfolio combining conventional hydroelectricity, natural-gas-fired thermal plants (anchored by Camisea), and expanding solar and wind capacity. This structural balance provides firm system adequacy; Peru's core energy challenge does not stem from a national power generation deficit. Rather, the primary bottleneck consists of delivering transmission capacity directly to the mine gate within construction timelines that match mine engineering schedules.

Mountain geography complicates transmission delivery. A single high-voltage transmission line must traverse rugged terrain, crossing communal lands, private properties, and sensitive ecological zones that lie well beyond the mine's environmental footprint. These transmission corridors require their own environmental impact studies, right-of-way easements, community approvals, and sector permits.

When these timelines diverge, the operational consequences are severe. A fully constructed mine and concentrator cannot commence commercial production if the transmission line or interconnecting substation experiences delays, stranding invested capital and delaying cash flows. Conversely, constructing transmission lines too far in advance risks underutilizing transmission assets if the anchor mining project faces social disputes, permitting delays, or financing roadblocks.

Peru retains structural advantages through operating track record, an integrated national power pool, and competitive industrial electricity rates. To realize these advantages, grid connection must be treated as an integral component of mine planning from initial engineering scoping. Synchronizing construction schedules across the mine, line, and substations, while establishing regulatory mechanisms to share transmission capacity across multiple operators within a shared mineral basin, minimizes delays and prevents duplicate infrastructure outlays.

Brazil

Brazil is a global iron ore producer that also operates world-class assets in copper, gold, bauxite, nickel, and emerging critical minerals. Its primary extractive corridors are situated across the state of Minas Gerais and the northern Carajás complex in Pará, tied to heavy-haul railway systems and deep-water maritime terminals. The logistical scale of bulk iron ore extraction requires mines, beneficiation plants, slurry pipelines, freight railways, and port loading facilities to operate as an uninterrupted industrial system. Vale produces roughly three-quarters of national iron ore output, exceeding 300 million tonnes annually; its operational choices shape the energy and emissions profile of the Brazilian mining industry (Vale S.A., 2026); (USGS, 2026).

The national electricity platform is a foundational asset. Brazil generated 751.3 TWh in 2024, with 88.0% of supply supplied by renewable generation. Hydroelectric plants accounted for 56.8% of total generation, while utility-scale wind delivered 107.7 TWh and solar PV contributed 70.7 TWh. Furthermore, industrial self-generators (autoprodutores) produced 157 TWh, equivalent to 20.8% of gross national generation, consuming 83.2 TWh behind the meter within their own facilities. The National Interconnected System (SIN) connects the vast majority of the country, enabling cross-regional power transfers, sophisticated bilateral contracting, and combinations of grid power with captive renewable plants (EPE, 2025).

Operational challenges emerge where mines are located within geographic areas nominally covered by the SIN but sit distant from high-capacity transmission nodes, or when operations are sited near isolated microgrids (Sistemas Isolados) in the Amazon basin that rely on fossil fuel generation. In Pará and remote frontier regions, expanding high-voltage transmission requires traversing rainforest terrain, crossing indigenous territories, and managing complex environmental permitting. Delays in transmission interconnections impact the entire logistics supply chain, where pit operations, electric railway corridors, and automated port terminals depend on continuous baseload electricity.

The mining industry has leveraged bilateral PPAs and equity investments in generation to utilize the clean grid. Vale reported that since 2023, 100% of the electricity consumed across its Brazilian operations is sourced from renewables through captive power assets, joint ventures, and long-term PPAs. While this strategy eliminated Scope 2 emissions from purchased power, direct Scope 1 emissions from heavy haulage trucks, diesel locomotives, and pelletizing furnaces remain a core decarbonization challenge (Vale S.A., 2024).

Brazil combines favorable conditions for low-carbon mining with logistical and geographical challenges. Strategic priorities center on advancing transmission reinforcements for northern mining basins in Pará and distinguishing between projects connected to the SIN and those operating within isolated systems. Operational risks remain low across well-integrated SIN corridors, but escalate when geographic distance and local grid bottlenecks prevent assets from tapping into the national renewable platform.

Panama

Panama represents a distinct case study within this comparative assessment. The Cobre Panamá mine operated as the country's dominant mining development, constructing an integrated infrastructure platform that included a dedicated port facility and a 300 MW captive coal-fired power plant. Sized to power high-altitude mill grinding and concentrator circuits, captive power generation was incorporated as a core pillar of the project's engineering design. This operational history highlights that a mine may secure self-sufficient power capacity while remaining vulnerable to institutional, social, and legal disruptions.

Panama's national power grid blends hydroelectricity and thermal generation alongside solar and wind capacity. In 2023, approximately 43.6% of installed national capacity was hydroelectric and 35.5% thermal. The Cobre Panamá captive thermal plant insulated the operation from domestic grid capacity limits and stabilized large industrial loads. However, it also introduced reliance on imported thermal coal, complex maritime logistics, and high fixed maintenance expenditures for two generation units, resulting in ongoing carrying costs and carbon liabilities even during extended operational shutdowns (ASEP, 2025); (First Quantum Minerals Ltd., 2025).

The operational shutdown did not stem from power delivery constraints. In November 2023, the Supreme Court of Justice declared Law 406 unconstitutional, voiding the concession contract executed between the national government and the operating company. The surrounding dispute involved legal questions regarding contract legitimacy, the distribution of economic rents, environmental impacts, public consultation, and institutional trust (Órgano Judicial de Panamá, 2025); (Ministerio de Ambiente de Panamá, 2025).

The strategic lesson for the region is that while captive off-grid power generation can resolve physical power reliability and load constraints, it cannot substitute for valid statutory permits, legal certainty, and social license to operate. Future policy scenarios must address the project's legal status, the operational future of the thermal power plant, and potential fuel-switching or grid-integration pathways.

Colombia

Large-scale mining in Colombia is distributed across thermal coal, gold, ferronickel, and an emerging pipeline of copper assets. Operating sites are spread across distinct physiographic regions with varying infrastructure and power access, meaning there is no single national mining-energy bottleneck. However, three operational realities recur: national generation depends heavily on hydrological inflows, new generation plants and transmission lines face execution delays, and territorial permitting affects both mining operations and their transmission hookups.

The National Interconnected System (SIN) relies predominantly on reservoir-backed and run-of-river hydroelectricity. During the 2024 El Niño cycle, water inflows dropped below historical averages, driving wholesale spot market electricity prices higher and prompting operational measures to preserve reservoir levels. While the power system avoided widespread load shedding, this hydrological shock demonstrated that a clean, hydro-dominated

grid requires thermal backup and firm capacity reserves during multi-year droughts (XM S.A. E.S.P., 2025).

At the asset level, the central engineering challenge is delivering power to the mine site. Proximity to an existing transmission line does not guarantee interconnection feasibility, as regional substations often require bay expansions or circuit upgrades. The Alacrán copper project, for example, projects a peak electrical demand of 38.4 MW, requiring a 110 kV transmission line spanning 41 km alongside upgrades at the host substation. The Gramalote gold project evaluated a different setup, selecting a 44 MW captive natural gas generation plant to supply an estimated 30 MW load, despite the presence of regional transmission circuits and a substation roughly 30 km away. This comparison shows that project developers must evaluate capital expenditure, permitting lead times, and continuous reliability when choosing between grid interconnection and captive on-site generation (Cordoba Minerals Corp., 2024); (B2Gold Corp., 2025).

The Colombian challenge operates across two distinct scales. At the national level, authorities must manage hydrological volatility and ensure utility-scale generation and transmission projects enter service on schedule. At the mining district level, operators must navigate territorial permitting, local transmission links, and backup generation tailored to site-specific conditions. Assessing both dimensions prevents operators from treating national reserve margins or nearby transmission lines as an automatic guarantee of mine-gate power reliability.

Mexico

Mexico possesses a mature and diversified mining sector. The states of Sonora, Chihuahua, Zacatecas, Durango, and Baja California concentrate much of national copper, gold, and silver extraction alongside heavy industrial loads. These northern mining jurisdictions are located far from central load centers and host exceptional solar irradiance. This profile creates opportunities to procure clean energy, while increasing competition for transmission headroom and substation capacity across northern grids.

The national power planning framework shifted in 2025. The National Electric System Development Program (PRODESEN) was replaced by the Electric Sector Development Plan (PLADESE), which established a binding centralized planning regime. This regulatory shift opened an adjustment period for industrial off-takers seeking clarity on which transmission projects will proceed, their targeted in-service dates, and available capacity across regional nodes. This visibility is critical across the North and Northwest regions, where official planning reports document persistent transmission congestion and transformer overloads. Siting a new large-scale mine often requires financing transmission and substation expansions, particularly when interconnecting heavy industrial loads at capacity-constrained grid nodes (SENER, 2025); (CENACE, 2024).

The 2025 Electric Sector Law maintains several procurement structures for large industrial off-takers. A mining operation may procure energy through qualified suppliers, participate directly as a wholesale market participant, or develop isolated or grid-connected self-consumption solutions, subject to statutory permits and wheeling contracts. In practice, mining

solutions often combine grid interconnection, long-term bilateral PPAs, captive on-site generation, and battery storage systems (Cámara de Diputados de México, 2025).

Mexico features established supplier ecosystems, a large domestic power market, and an expansive transmission network. Its primary mining-energy bottleneck is regional: executing priority transmission upgrades across northern corridors, improving node-specific capacity transparency, and providing regulatory certainty for interconnection and self-supply schemes. Without this planning, local solar potential will not automatically translate into firm power delivered to remote mining sites around the clock.

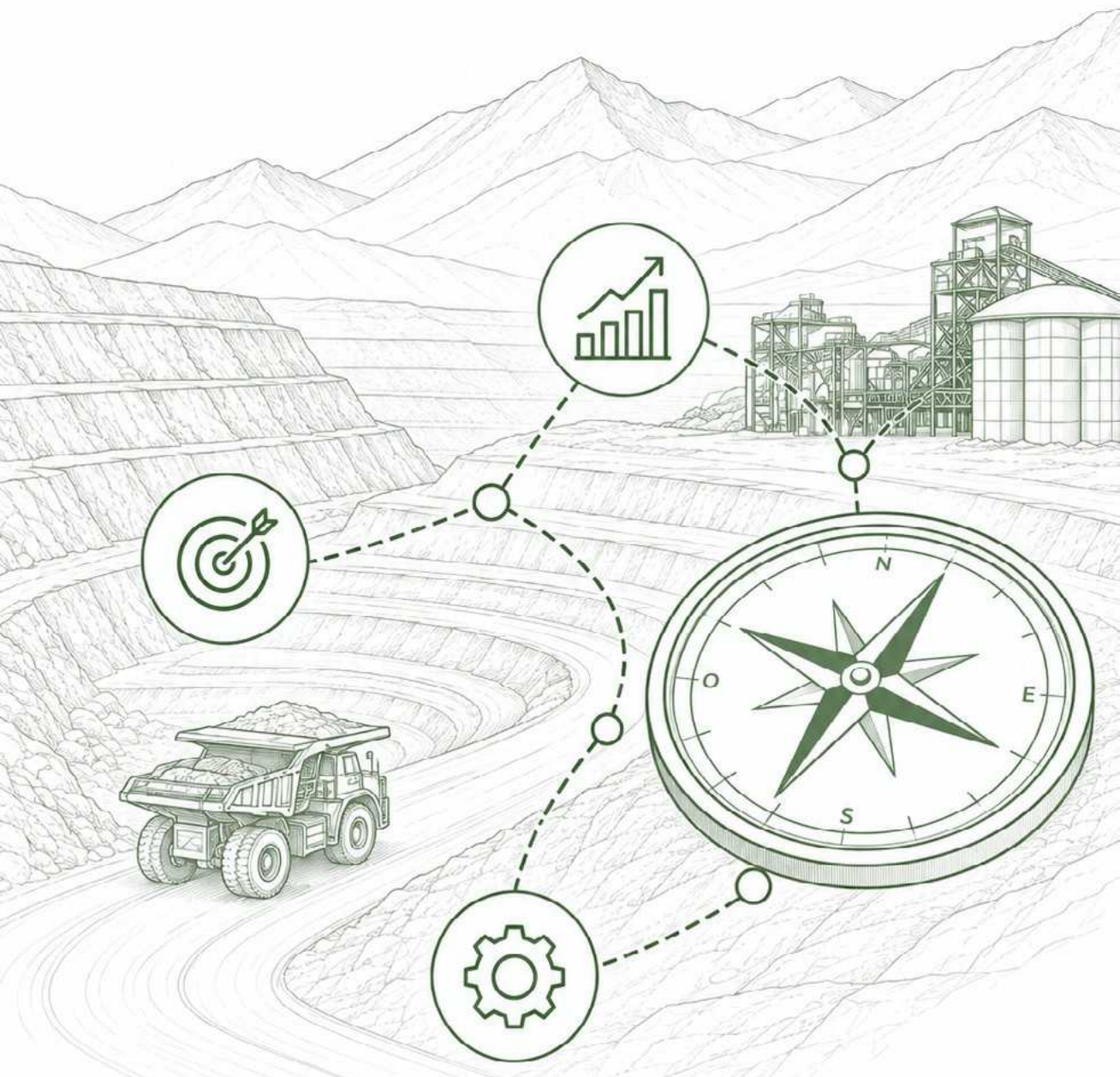
Comparative synthesis and policy conclusions

This regional review demonstrates that the concept of an energy bottleneck encompasses distinct operational challenges across jurisdictions. In Ecuador, the core issue is securing firm power adequacy across all months of the year. In Chile, constraints center on high-voltage transmission bottlenecks, utility-scale storage integration, and delivered power costs. In Argentina and Peru, priorities involve financing transmission corridors and synchronizing interconnection lead times with mine construction. Brazil, Colombia, and Mexico require subnational analyses, as aggregate national averages obscure localized transmission deficits in remote mining basins. Panama stands apart, having developed a captive thermal generation plant whose operational continuity was halted by institutional and legal factors (see comparative analysis in Annex III).

The comparison highlights three patterns that should be assessed together. First, electricity available in a country does not necessarily translate into supply at the mine, as the local grid may lack sufficient capacity or require an additional transmission line. Second, timing matters as much as quantity, since infrastructure that comes online after the power plant does not address the project's needs. Third, energy autonomy also entails costs, as an on-site power plant adds fuel requirements, operating costs, emissions, and the risk of maintaining a stranded asset if the mine is delayed or suspended. Therefore, the central question is whether electricity can reach the project, meet its demand continuously, and do so within a cost and timeframe compatible with the investment.

CHAPTER 4

FROM STRATEGY TO ACTION



4.1. Renewable energy for competitive mining

Power supply has become a strategic component for mining competitiveness. The region presents distinct pathways for integrating renewable energy, ranging from long-term power purchase agreements and self-generation to the deployment of dedicated new capacity and regional electrical interconnections. Looking forward, the expansion of mining demand will require closer coordination between new project developments and the planning of the generation capacity and transmission grids required to supply them.

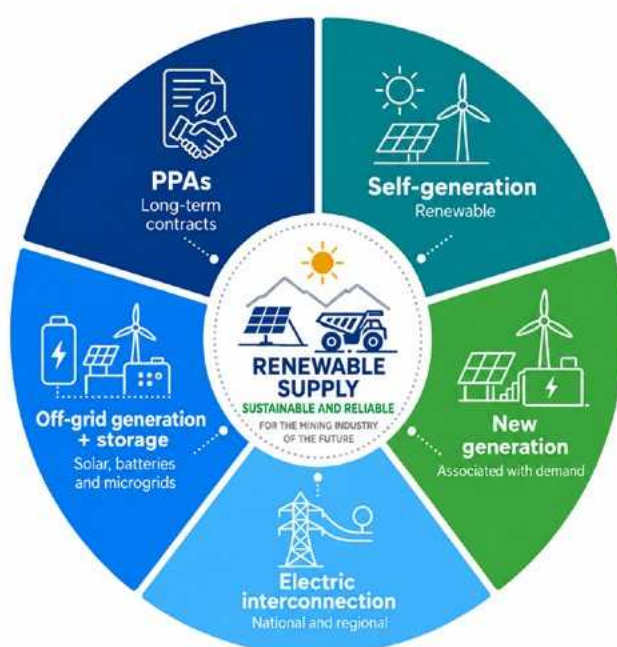


Figure 27: Pathways for renewable power supply in mining

Source: Authors' own elaboration.

From the power grid to energy strategy

Large-scale mining represents an increasingly critical load for the electric power systems of Latin America and the Caribbean. The sector accounts for approximately 9% of regional electricity consumption, and its demand could grow by 51% toward 2034 if the projected pipeline of projects materializes (OLACDE, 2026). This growth requires securing an electricity supply that is reliable, cost-competitive, and aligned with energy transition objectives.

In this context, electricity procurement has transitioned from an operational purchasing decision to a core pillar of corporate competitiveness and decarbonization strategies. Long-term power purchase agreements (PPAs) enhance supply predictability and facilitate the financing and deployment of new renewable capacity (IEA, 2023). The region exhibits various operational strategies: replacing fossil-fuel-based supply contracts with dedicated solar and wind PPAs, developing or equity-partnering in captive renewable assets, and executing cross-border interconnections to displace diesel self-generation at remote sites.

These solutions mitigate greenhouse gas emissions and reduce corporate exposure to international fuel price volatility. Integrating industrial mining loads into national and regional power system planning will be vital to guarantee a reliable, competitive supply consistent with the clean energy transition.

Utility-scale renewable electricity

The shift in BHP’s power supply in Chile began in 2019, when a process was launched to replace existing fossil-fuel supply contracts at Escondida and Spence with electricity from renewable sources. This commercial strategy resulted in four long-term contracts: 3 TWh per year with Enel Chile for 15 years, and an additional 3 TWh per year with Colbún for 10 years, with phased commencement between 2021 and 2022 (BHP, 2021).

The initiative combined environmental and economic objectives. Since 2022, Escondida and Spence have been supplied 100% by renewable electricity, avoiding approximately 3 million tonnes of CO₂ per year compared to the displaced fossil supply contracts. This eliminated virtually all Scope 2 indirect emissions associated with the electricity supply of both operations.

The renegotiation of these power agreements also yielded a 22% reduction in unit electricity costs compared to the previous contracting scheme. At Escondida, this clean power strategy operates in tandem with the use of desalinated seawater to meet the operational water needs of the site, linking two critical inputs for large-scale copper production.



Figure 28: Power supply evolution at Escondida and Spence

Source: Authors’ own elaboration based on BHP (2020), Breaking the water-energy nexus, and corporate operational reports.

“Long-term PPAs represent an effective mechanism to abate emissions linked to electricity consumption while enhancing the predictability and cost competitiveness of energy supply across large-scale mining operations.”

Captive renewable generation

Sol do Cerrado is one of the largest solar PV complexes in Latin America and the Caribbean. Located in Jaíba, Minas Gerais, it comprises 17 photovoltaic sub-parks containing roughly 1.4 million solar panels, reaching an installed nominal capacity of 766 MWp. The complex was developed by Vale to supply a portion of the electrical load demanded by its operations in Brazil and is connected, via dedicated transmission infrastructure, to the National Interconnected System (SIN), coordinated by the National Electric System Operator (ONS).

The project achieved commercial startup in November 2022 and reached full nameplate capacity in July 2023, following an investment of approximately R\$ 3,000 million (USD 590 million). At full capacity, Sol do Cerrado can supply roughly 16% of Vale's total electricity consumption in Brazil and abate approximately 134,000 tCO₂e annually. The infrastructure package includes an on-site step-up substation and a 15-kilometer, 230 kV transmission line interconnecting the complex to the grid (Vale S.A., 2023).



Figure 29: Sol do Cerrado solar complex (Brazil)

Source: Authors' own elaboration based on Vale (2023, 2024), operational reports, and ONS.

In 2023, Vale achieved 100% renewable electricity consumption across its Brazilian operations, two years ahead of its original 2025 target. Sol do Cerrado forms part of a captive renewable generation portfolio of approximately 2.6 GW, which also incorporates hydroelectric and wind power assets.

“Captive renewable generation represents an alternative pathway for heavy industrial consumers, operating as a complement to corporate PPAs, and allows mining companies to embed generation assets directly into their long-term power supply strategy.”

New mining demand as an enabler of renewable capacity

Quellaveco is one of Peru’s premier copper mines, located in the Moquegua region and operated by Anglo American in partnership with Mitsubishi Corporation. The project required an upfront capital investment of approximately USD 5,500 million and began operations in 2022, with a nameplate output capacity of around 300,000 tonnes of copper per year over its first decade. In 2024, the operation directly employed 1,183 workers and sustained over 9,400 indirect jobs, establishing itself as a foundational copper operation in the country.

Its power supply strategy was structured prior to commercial startup: in April 2021, during the construction phase, Anglo American executed an agreement with ENGIE Energía Perú ensuring that the mine’s power demand—then estimated at 187 MW during its operational phase—would be supplied entirely from renewable sources.

This agreement was directly linked to the construction of the Punta Lomitas Wind Farm, located in Ocucaje, Ica. The facility is equipped with 50 Siemens Gamesa SG 5.0-145 MKII wind turbines, each with a rated capacity of 5.2 MW and a rotor diameter of 145 meters. Collectively, the wind installation totals 260 MW, serving as the anchor renewable asset supplying Quellaveco’s electrical load.



Figure 30: Renewable generation for large-scale mining

Source: Authors’ own elaboration based on Anglo American (2025) and ENGIE Energía Perú (2023, 2024).

The wind farm entered commercial operation in June 2023, accompanied by two substations and 60 km of high-voltage transmission lines connecting the plant to the National Interconnected Electric System (SEIN). Siting and building Punta Lomitas represented a capital expenditure of roughly USD 300 million and currently avoids approximately 230,000 tonnes of CO₂ emissions annually. ENGIE highlights that Punta Lomitas became Peru’s first large-scale renewable facility developed entirely through a bilateral contract between two private corporations, without government auctions or state subsidies.

Since April 2023, Quellaveco has supplied 100% of its electricity consumption with non-conventional renewable energy, primarily from Punta Lomitas. In 2024, the site procured 1,252,191 MWh of renewable electricity from the grid and generated an additional 257 MWh through captive solar PV installations. As a result, Anglo American reported that Quellaveco's electricity consumption generated zero Scope 2 greenhouse gas emissions during that year. The operation also utilizes 127 smart meters to track and optimize power consumption in real time (Anglo American, 2024).

“This case demonstrates how the early contracting of power demand from a prospective mining operation can mobilize private capital into greenfield generation and bulk transmission capacity. Synchronizing mining and energy planning provides visibility into the requirements of large offtakers, facilitates infrastructure investments, and underwrites the expansion of mineral production with new clean energy assets.”

Regional electrical integration

Veladero is an open-pit gold and silver mine operated by Barrick in joint venture with Shandong Gold, located in San Juan Province, Argentina, at an elevation exceeding 4,000 meters above sea level near the border with Chile. The mine commenced commercial production in 2005 and, due to its remote Andean location and the absence of a grid connection to the Argentine transmission system, historically relied on captive diesel-fueled thermal self-generation.

In 2022, Veladero energized a cross-border electrical interconnection with Chile that restructured its power architecture. The infrastructure project required an investment of approximately USD 54 million and comprised a 14.4 km, 220 kV high-voltage transmission line supported by 48 towers, two transformer substations, and an internal 8.8 km, 23 kV medium-voltage network to distribute power to the process plant, workshops, primary crushers, and accommodation camp. The interconnection allows importing up to 25 MW from Chile's National Electric System (SEN). The Argentine regulatory permit authorized an initial eight-year import term for a maximum capacity of 25 MW (Barrick Gold Corporation, 2022).



Figure 31: Veladero cross-border grid interconnection

Source: Authors' own elaboration based on Barrick Gold Corporation (2022) and reports from the Argentine Secretariat of Energy.

The historical dependence on diesel self-generation involved complex fuel logistics up to a high-altitude mountain site. Prior to the interconnection, approximately eight fuel tanker trucks arrived at Veladero daily, according to statements by Marcelo Álvarez, then Executive Director for South America at Barrick. The company estimated that the new power connection would displace approximately 23 million liters of diesel fuel annually, curtailing both emissions from on-site power generation and the safety and logistics risks of transporting fuel to the mine.

Replacing captive diesel generation with electricity imported from Chile allowed the operation to draw from a power system with an increasing share of renewable generation. Upon energizing the transmission line, Barrick estimated an emissions reduction of approximately 100,000 tCO₂e per year. The transmission asset crosses the international border via the Paso del Guanaco Zonzo at approximately 4,490 meters above sea level, forming part of the Lama International Interconnection Power Transmission System.

“The Veladero case illustrates a practical alternative for remote, cross-border mining operations: regional electrical integration can expand supply options beyond the domestic grid, reduce reliance on isolated fossil-fuel generation, and leverage existing energy infrastructure and generation capacity in neighboring jurisdictions.”

Renewables and storage for continuous supply

The transition of the power supply at Quebrada Blanca, Teck’s copper operation in the Tarapacá Region of Chile, began more than a decade ago. In 2013, Teck and AES Andes executed an initial solar power contract that enabled the development of a 21 MW photovoltaic plant. In 2020, a subsequent contract added 118 MW of renewable generation capacity to meet more than half of the electricity requirements of the QB2 expansion project.



Figure 32: Power supply at Quebrada Blanca

Source: Authors’ own elaboration based on Teck Resources Limited (2026) and AES Andes.

The supply transition was finalized through an additional long-term agreement signed in 2022. The 17-year contract secured another 1,069 GWh per year of clean electricity, enabling Quebrada Blanca to achieve a 100% renewable power supply starting in 2025. Today, the operation consumes more than 2,000 GWh annually—representing approximately 2% of Chile’s total electricity demand—supplied through a balanced combination of solar PV, wind generation, and battery energy storage systems (BESS).

The environmental impact is significant: Teck reports an annual emissions reduction of approximately 1.6 million tonnes of CO₂ compared to historical coal-based supply. In 2024, prior to finalizing this transition, only 40% of the electricity consumed by Quebrada Blanca came from renewable sources; by year-end 2025, Teck achieved a 100% renewable electricity supply across all of its Chilean operations (Teck Resources Limited, 2026).

“This experience highlights how a phased procurement strategy—integrating long-term bilateral contracts, complementary renewable technologies, and battery storage—can effectively decarbonize power-intensive mining expansions.”

Renewable generation for remote operations

Ganfeng Lithium’s Mariana Project is located in the Salar de Llullaillaco, Salta Province, Argentina, at approximately 3,750 meters above sea level. With estimated resources of 8.12 million tonnes of lithium carbonate equivalent (LCE), commercial production commenced in February 2025 following a three-year construction period. The project’s first phase has an installed nominal capacity of 20,000 tonnes per year of lithium chloride and an estimated mine life of 40 years.

The isolated geographic location posed a critical energy challenge. Mariana is located approximately 95 km from Tolar Grande, the nearest settlement, and an eight-to-ten-hour drive from the city of Salta. Given the absence of nearby grid infrastructure, Ganfeng engineered an off-grid solar power system designed to operate independently from the national transmission network.

The off-grid facility features 120 MW of solar photovoltaic capacity, scalable up to 150 MW, paired with utility-scale battery storage supplied by Ganfeng LiEnergy. The installation is engineered to provide baseload electricity to the brine extraction and chemical plant, as well as the on-site camp accommodating approximately 500 workers (Ganfeng Lithium Latinoamérica, 2025).



Figure 33: Off-grid renewable power system at the Mariana Project

Source: Authors' own elaboration based on Ganfeng Lithium Latinoamérica (2025, 2026) and Ganfeng LiEnergy.

The project also presents a notable vertical integration model within the lithium value chain: Ganfeng operates across mineral extraction, chemical processing, battery cell manufacturing, and energy storage systems. Consequently, Mariana integrates lithium production, solar generation, and battery storage into a unified industrial and energy strategy.

“The Mariana project showcases an operational blueprint for isolated assets: embedding dedicated power infrastructure directly into project feasibility and design. On-site renewable generation combined with energy storage reduces exposure to external infrastructure gaps and secures operational self-sufficiency.”

Will there be sufficient renewable power for the next generation of mining?

The projected growth of mining across Latin America and the Caribbean will demand substantial volumes of incremental electricity, frequently in regions distant from bulk transmission grids. Securing competitive, reliable, and low-emission electricity will be decisive for the economic viability and competitiveness of incoming mining assets.

The operational case studies analyzed illustrate a diverse toolkit: corporate PPAs, dedicated greenfield power plants, on-site captive generation, and cross-border interconnections. However, every pathway requires more than raw renewable potential; it demands generation adequacy and high-voltage transmission lines to deliver power directly to emerging demand centers.

This dynamic underscores the necessity of integrating prospective mining loads into energy system planning at early stages. Where several mining developments cluster within a shared

territory, anticipating aggregate power demand facilitates the planning of multi-user transmission corridors and shared utility assets, capturing economies of scale and preventing grid constraints from stalling investment decisions. Regional electricity interconnections provide an additional strategic dimension. The Andes–Cobos international transmission line between northern Chile and Argentina (operated as InterAndes) serves as a working precedent for cross-border power trading, demonstrating the value of leveraging complementary generation profiles across national borders.

In other geographic settings, extending the national transmission grid may prove technically unfeasible or commercially prohibitive. For isolated sites, power infrastructure must increasingly be treated as an integral component of the mine’s capital design. Blending solar and wind generation, battery energy storage systems, microgrid controls, and firm backup units enables remote mines to operate with high operational autonomy while minimizing the logistics costs of transporting liquid fossil fuels.

The overarching challenge for the region is not merely installing gross renewable capacity. It consists of synchronizing the development schedules of mineral deposits, mine expansions, clean generation assets, and high-voltage networks. Developing a world-class mine and building the power infrastructure required to supply it take years of planning and construction. Anticipating where, when, and how much electricity prospective mining assets will require is vital to ensure that the power grid functions as an enabler rather than a bottleneck, allowing the mineral potential of Latin America and the Caribbean to translate into actual productive capacity.

4.2. Decarbonization of mining operations

From decarbonization strategy to mine site operations

Once the decarbonization of the electricity supply has been addressed, a substantial share of mining emissions remains tied to fuel consumption in haul trucks, heavy mobile equipment, and auxiliary vehicles, turning mine site operations into the next frontier for emissions reduction.

Corporate strategies demonstrate that no single technology fits all operational environments. Grupo México’s decarbonization roadmap combines the electrification of haul trucks and heavy equipment, fuel substitution, and energy efficiency. By 2035, the company plans to electrify approximately 20% of its current haul truck fleet, avoiding around 170,000 tCO₂e (Grupo México, 2025).

Technology alternatives include direct battery electrification, trolley assist systems, low-emission fuels, and hydrogen fuel cells. Their implementation depends on the operational parameters of each site and requires evaluating equipment specifications, electrical infrastructure, charging systems, and the availability of emerging fuels.

The region is already advancing multiple operational pathways, from battery-electric buses in underground mines to materials handling systems that reduce or eliminate reliance on heavy haulage fleets. The following case studies illustrate how these solutions are being integrated into mining operations across Latin America and the Caribbean.

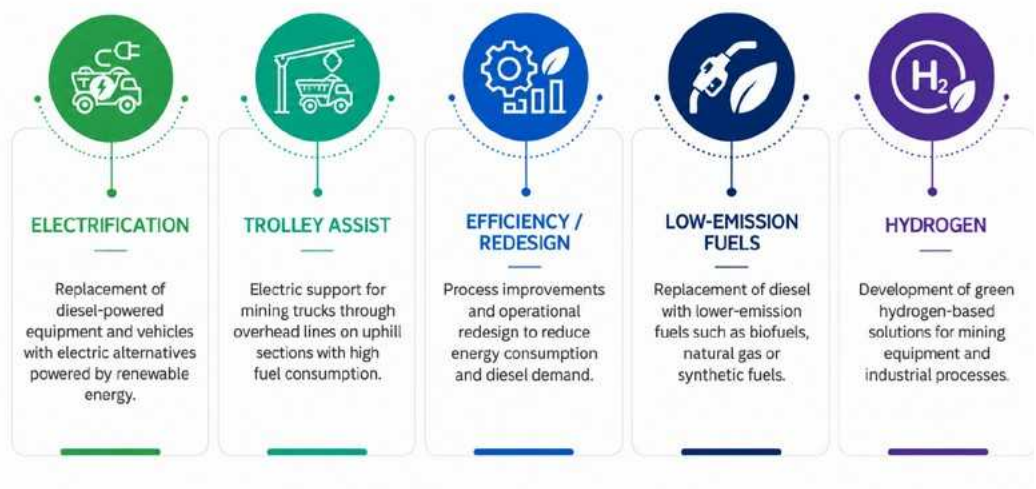


Figure 34: Decarbonization of mining operations

Source: Authors’ own elaboration based on IEA (2026) and regional mining sustainability reports.

Electromobility in underground mining



El Teniente, operated by Codelco in the O'Higgins Region of Chile, is the largest underground copper mine in the world and a foundational benchmark in Chilean mining history. Industrial exploitation began in 1905, and after more than a century of continuous operation, the mine encompasses over 4,500 km of underground tunnels. The industrial complex comprises the underground mine, the Colón concentrator, and the Caletones smelter, primarily producing refined copper alongside molybdenum and other commercial by-products.

Figure 35: Geographic location of El Teniente Division
Source: Authors' own elaboration based on Codelco territorial cartography (2024).

Its operating scale and operational track record have turned El Teniente into an active testing ground for deploying new technologies in underground mining. The operation has advanced in mine automation and equipment tele-operation, including autonomous haulage trucks monitored from on-site control rooms and the Integrated Operations Center in Rancagua. This technological roadmap extends directly to electromobility, targeting reductions in fuel consumption, greenhouse gas emissions, and occupational exposure across underground galleries (Codelco, 2023).

In this framework, Codelco initiated pilot trials with electric personnel buses at El Teniente in 2020. The initiative expanded from 7 initial units to a dedicated fleet of 104 electric buses—comprising 32 Tricahue buses (44-passenger capacity) and 72 Quetehue units (24-passenger capacity)—connecting surface facilities with underground working headings over operating ranges close to 200 km (Codelco, 2023b); (Reborn Electric Motors, 2024).

Displacing conventional diesel buses saves approximately 1.1 million liters of fuel and avoids roughly 2,800 tonnes of CO₂ annually. In an underground mine environment, fleet electrification delivers substantial local co-benefits: it reduces ambient noise, eliminates diesel particulate matter and combustion gases, and lowers underground ventilation power requirements.



Figure 36: Impact of El Teniente's electric fleet
Source: Authors' own elaboration based on Codelco (2023c).

This electrification strategy has expanded from personnel transport into heavy production and support equipment. El Teniente has deployed trials with electric light-duty utility vehicles, battery-electric LHD loaders, concrete mixers, and auxiliary equipment, advancing the validation of battery technologies across tasks traditionally reliant on diesel engines.



Figure 37: Technical specifications of Tricahue buses

Source: Authors' own elaboration based on Reborn Electric Motors (2024).

The deployment at El Teniente is part of Codelco's corporate-wide electromobility program. The state-owned enterprise currently operates a fleet of 250 electric buses deployed across its Chuquicamata, Andina, El Teniente, Salvador, and Radomiro Tomic divisions, a fleet Codelco identifies as the largest electric bus deployment in the Chilean mining industry. This phased expansion across multiple operating divisions highlights how battery-electric mobility is achieving commercial scale in mine site personnel transport.

“Electromobility can scale from personnel transit to primary production equipment in underground operations, simultaneously reducing fuel consumption, underground ventilation loads, and greenhouse gas emissions.”

Producing more with less

Vale is a global mining enterprise and one of the world's leading producers of iron ore, with primary operational assets located in Brazil. The Carajás complex in Pará State anchors the company's Northern System, representing one of the premier iron ore mining basins globally. Within this operating jurisdiction, Vale operates the Serra Sul Complex in the municipality of Canaã dos Carajás.

The S11D Eliezer Batista Complex represents the largest capital asset developed by Vale and a strategic milestone for the Brazilian iron ore sector. Originally engineered for a nominal capacity of 90 million tonnes per year, S11D reached record output of 86 million tonnes in 2025. Vale is currently advancing the Serra Sul +20 project, which will expand complex capacity to 120 million tonnes annually.

A central process innovation integrated into S11D's original design was the truckless continuous mining system, which replaces traditional heavy off-highway diesel trucks with an automated, continuous crushing and overland conveyor network. Instead of hauling run-of-mine ore using diesel equipment, the operation employs electric face shovels, mobile in-pit

crushers, and approximately 9 km of high-capacity conveyor belts. Vale calculated that an equivalent conventional open-pit mine of comparable scale would require an active fleet of approximately 100 ultra-class haul trucks.

Eliminating this diesel haulage fleet reduced fuel consumption across the materials handling system by approximately 77%. According to Vale's engineering estimates, associated direct annual greenhouse gas emissions fell from 146,300 to 33,700 tonnes of CO₂, also representing a 77% reduction. This setup presents a structural alternative to direct vehicle fuel switching: redesigning the underlying mining process to eliminate fossil-fuel-intensive materials haulage at the source.



Figure 38: Operation of a truckless materials handling system

Source: Authors' own elaboration.

“Mining decarbonization does not depend solely on dropping in low-carbon fuels or retrofitting mobile fleets. Re-engineering extraction and haulage flowsheets can curtail diesel demand and operational emissions at the design stage.”

Electrification of mineral haulage

Escondida, operated by BHP in the Atacama Desert 170 km southeast of Antofagasta, is the largest copper mine in the world. Sited in northern Chile, the operation began commercial production in 1991 and has since produced over 34 million tonnes of fine copper. Today, it accounts for approximately 20% of Chilean copper production and roughly 5% of global output.

BHP holds a 57.5% controlling interest in Minera Escondida, in joint venture with Rio Tinto (30%) and JECO Corporation (12.5%). The site operates two open pits feeding three large concentrator plants and two leaching facilities. Its operational scale—producing in excess of one million tonnes of copper per year—makes Escondida a relevant benchmark for decarbonizing heavy haulage in open-pit mining.

In 2024, Minera Escondida submitted an Environmental Impact Assessment for the installation of an electric trolley assist system at the Escondida Norte pit. Trolley assist technology allows diesel-electric haul trucks to connect directly via pantographs to an overhead catenary power line along designated uphill ramps, where diesel consumption and mechanical strain are heavily concentrated. Along these loaded uphill sections, trucks draw electrical power directly from the overhead line to drive their electric wheel motors, bypassing the onboard diesel engine.

The capital project encompasses dedicated high-voltage distribution lines and an electric substation within and surrounding the Escondida Norte pit, representing an estimated capital investment of USD 250 million. Beyond reducing diesel fuel consumption and operational emissions, BHP indicates that electric trolley assist increases loaded haulage speeds on adverse grades, improving fleet cycle times and mine productivity.

Unlike a total fleet replacement with battery-electric trucks, trolley assist focuses grid power delivery on the most energy-intensive segments of the haulage cycle. This enables operators to curtail diesel use by retrofitting existing diesel-electric truck fleets and infrastructure, providing a scalable pathway toward lower-emission open-pit haulage.

“Electric trolley assist accelerates the decarbonization of heavy haulage without requiring the immediate turnover of entire fleet inventories. By deploying grid power to high-drag uphill haul routes, it progressively displaces diesel consumption and operational emissions while building the electrical distribution capacity required for future full-electric fleets.”

4.3. Innovation for more efficient and sustainable mining

In collaboration with Anticipa Consulting  **ANTICIPA**
CONSULTING

& Anabática Renovables **ANABÁTICA**

Mining, renewable energy, and regional integration: the case of Chile

Innovation in mining is not limited to technologies deployed within an operation: it also encompasses new ways of supplying it with energy, developing infrastructure, and linking it with electric power systems. The Chilean case offers an especially relevant experience in this regard.

Chile's energy transition has not only integrated renewable energy into its power mix at scale; it has also learned, over 15 years, to supply an energy-intensive industry whose operation is continuous and strategic for its economy: large-scale copper mining.

This learning curve unfolds while the mining industry itself is transforming. The Chilean Copper Commission (Cochilco) notes that electricity consumption in large-scale mining is set to rise by 20.2% by 2034 compared to 2025, increasing from 27.6 to 33.2 TWh. Compounding this is the expanding use of seawater for desalination, driven and supplied by renewable energy, an industrial process that will demand around 5.4 TWh in 2034. Mining will therefore be increasingly electric, not less (Cochilco, 2025).

The positive dimension is an accelerated pace of decarbonization. Cochilco projects that by 2030, 98.6% of the electricity consumed by copper mining in Chile will originate from renewable sources (Cochilco, 2025).

This shift is already evident in commercial contracts. Large-scale mining has ceased procuring unmanaged renewable energy and now contracts dispatchability: in 2025, Codelco awarded a total of 1.5 TWh per year of renewable supply with storage, with deliveries commencing in 2026 and terms of up to 15 years (Reporte Minero, 2025a), and the Chilean market recorded in 2026 the largest PPA for nighttime supply backed by battery systems, for around 1 TWh annually (pv magazine Latinoamérica, 2026). Furthermore, the requirements of the mining offtaker exceed raw megawatt-hours and include continuous baseload for grinding circuits and desalination, the phased electrification of mobile fleets, and the certified traceability of clean power demanded by international copper and lithium markets. The mining power supply contract has thus evolved into a structured financial and physical product featuring discrete time blocks, firm capacity, and verified sustainability attributes.

Here lies the regional opportunity. Mining nations such as Peru and Argentina—where the Vicuña district (Lundin Mining and BHP) was admitted in 2026 into the Large Investment Incentive Regime (RIGI) with a projected capital expenditure near USD 9,700 million (Infobae, 2026)—face comparable challenges regarding electrification, industrial competitiveness, and operational decarbonization. In northern Argentina, this demand is already pulling infrastructure forward: YPF Luz and Central Puerto agreed to develop the electrical intercon-

nection for mining projects across the Puna plateau, with an initial 140 km transmission line expandable to 350 km and up to 400 MW, representing an estimated investment between USD 250 and USD 400 million (Reporte Minero, 2025b). Chile offers established technical, regulatory, and contractual know-how, alongside an electric power platform developed over more than a decade of sustained investments.

An opportunity opens for the regional electric power industry, extending from importing engineering talent and expertise to the strategic, complex scenario of cross-border grid interconnections. Chile already utilizes the Andes–Cobos international interconnection to exchange electricity with Argentina and export daytime solar surpluses that would otherwise be curtailed (Reporte Minero, 2026c). In February 2026, AES Andes submitted a formal request to expand that export capacity from 80 MW to 250 MW, a proposal currently under regulatory review (Redimin, 2026). Chile and Peru maintain an active bilateral study agreement for the Tacna–Arica interconnection, while regulatory harmonization advances under the framework of the Andean Electrical Interconnection System (SINEA).

Deeper regional integration would make it possible to capitalize on accumulated operating experience, optimize resource allocation, avoid duplicate infrastructure, and productively dispatch energy surpluses. From Anabática Renovables—with deep technical expertise in the operational complexities of supplying clean power to mining sites—and Anticipa Consulting—holding specialized knowledge of the enabling socio-environmental and contractual frameworks for these projects—there is clear conviction that the next leap consists not simply of generating more renewable energy, but of bridging the technical expertise, energy resources, transmission grids, mining demand, and professional talent that the region already commands.

This restructuring of the energy landscape is matched by operational transformations within the mines themselves, where technology makes it possible to meet higher production targets while satisfying increasingly rigorous efficiency and environmental standards. The operational case of Novandino in the Salar de Atacama illustrates this evolution across resource stewardship and industrial processes.

Novandino: innovation for more efficient and sustainable mining



The experience of Novandino in the Salar de Atacama and its chemical refinery in Antofagasta (formerly SQM Lithium) represents an emblematic benchmark of productive decoupling in lithium mining: increasing extraction and refining volumes to supply the energy transition while systematically reducing net pressure on water resources and brine aquifers.

In 2025, the operation consolidated an annual production of around 237,000 tonnes of LCE (Lithium Carbonate Equivalent), recording an annual water consumption of 3.7 million cubic meters. This operational performance is backed by auditable reduction targets for extraction within the salar basin relative to authorized regulatory thresholds:

Operational indicator	Environmental target / Progress through 2025	Final committed target
Annual lithium production (2025)	~237,000 t	300,000 t LCE by 2027/2028
Annual water consumption (2025)	3,7 m ³	Closed-loop optimization
Freshwater withdrawal RCA limit: 240 L/s	55% reduction	Zero withdrawal Milestone planned for mid-2030
Brine extraction RCA limit: 1,700 L/s	37% reduction	50% reduction Committed by 2028

Table 4: Key operational indicators of Novandino Litio 2025
Source: Authors’ own elaboration based on operational data and environmental targets from Novandino Litio (2025, 2026).

Achieving these performance targets combines closed-circuit infrastructure, real-time tele-metric monitoring, and IRMA 75 international certification. Looking toward the 2030s, the “Salar Futuro” technology roadmap will formalize the complete phase-out of continental water extraction through the deployment of advanced technologies—such as membrane nanofiltration, mechanical evaporation, and direct lithium extraction (DLE)—enabling operational water recycling and controlled reinjection of spent brines, all powered by renewable electricity.

In this way, Novandino establishes an operational benchmark in water governance where the expansion of mineral supply and the preservation of the hydrogeological equilibrium of the basin remain fully aligned.

4.4. Energy and water as a competitive advantage

In collaboration with **BHP**

Transforming water and energy supply for responsible and competitive copper mining

BHP is a global natural resources company with over 140 years of history. It has operated in Chile since 1991, maintaining a copper-focused portfolio centered on Escondida and Spence—strategic assets to meet the growing demand driven by electrification and the energy transition.



(Minera Escondida, Región de Antofagasta, Chile).

BHP en Chile

Key indicators for fiscal year 2026



Figure 39: BHP ESG indicators

Source: Authors' own elaboration based on operational data and BHP sustainability reports (2024, 2025).



Figure 40: BHP sustainable performance

Source: Authors' own elaboration based on data from Cochilco (2024, 2025) and BHP corporate reports (2025).

Water: from the aquifer to the Pacific

A structural transformation for a critical resource

BHP Chile has carried out a structural transformation in its water stewardship, transitioning from the use of continental water to supply sourced from desalinated seawater. This strategic decision alleviates pressure on vulnerable aquifers, reinforces operational resilience, and enables more competitive copper production in the world’s most arid desert.



Figure 41: Continental water decoupling (BHP)

Source: Authors’ own elaboration based on operational data and BHP sustainability reports (2024, 2025).

Evolution of Water Management

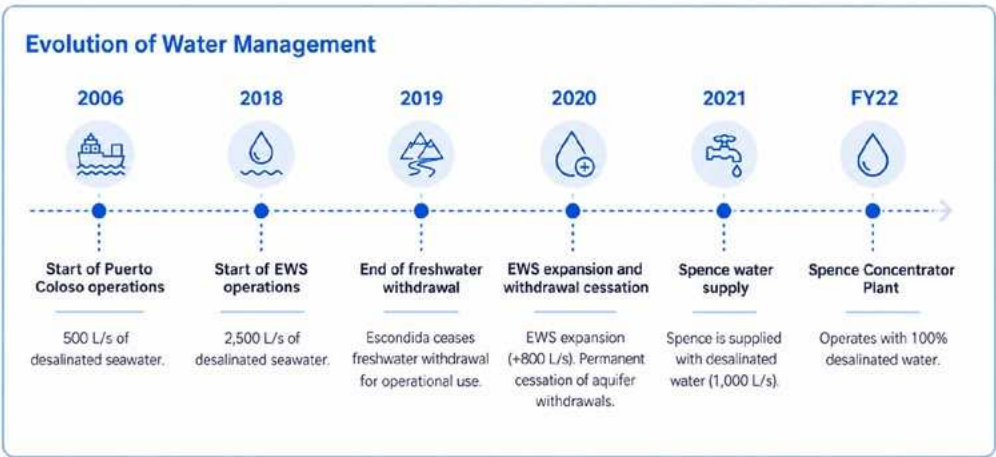


Figure 42: Water transition at BHP (2006-2022)

Source: Authors’ own elaboration based on BHP (2022, 2025), Breaking the water-energy nexus, and Minera Escondida operational balances.

Seawater infrastructure and water stewardship

BHP in Chile operates large-scale seawater desalination and conveyance infrastructure in the Antofagasta Region, positioning itself as a regional benchmark for water solutions in copper mining.

Infrastructure components

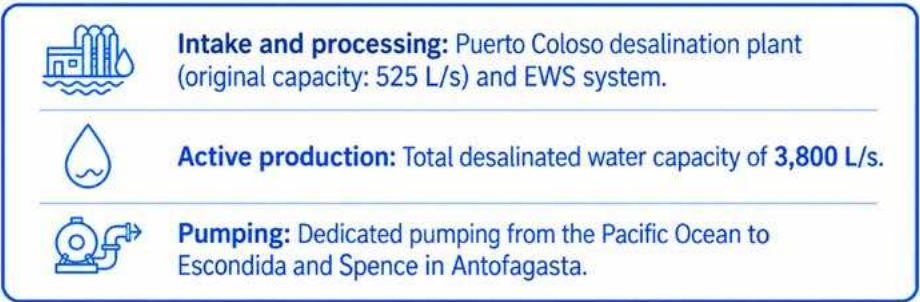


Figure 43: HP desalination system in Antofagasta
Source: Authors’ own elaboration based on technical data from BHP Minerals Americas (2024, 2025) and Minera Escondida.

Why does it matter?



Figure 44: BHP Projects in Chile
Source: Own elaboration based on technical data from BHP Minerals Americas (2024, 2025) and Minera Escondida

- **Protection of vulnerable aquifers:** Alleviates water stress across high-Andean basins, safeguarding groundwater resources for local communities and desert ecosystems.
- **Operational resilience:** Secures the continuity of copper production against climate change, mitigating scarcity risks and competition for continental freshwater sources.
- **Future growth planning:** Provides a sustainable, predictable, and competitive supply model that decouples mine expansion plans from freshwater use.
- **Sustainable discharge to the ocean:** Returns brine concentrate to the sea under rigorous environmental benchmarks, utilizing submarine outfalls engineered for rapid saline dilution.

Energy: from fossil contracts to 100% renewable

A strategic decision securing competitiveness and decarbonization

BHP in Chile transformed its power supply strategy, achieving 100% renewable electricity across its operations in 2024. This shift reinforced its cost competitiveness, cut emissions, and aligned its copper output with the requirements of the global energy transition.

The transition was completed through long-term renewable power purchase agreements and the early termination of fossil-fuel-based contracts, reflecting a strategic commitment to capturing long-term environmental, operational, and reputational benefits.



Figure 45: Solar plant for BHP

A strategic decision with financial and climate impact



Figure 46: Decarbonization of BHP in Chile

Source: Authors' own elaboration based on corporate information from BHP Chile and RENOVA certification.

Demand context: BHP’s electricity demand in Chile has expanded alongside the scale of its operations and project development pipeline, requiring secure, cost-competitive, and low-emission power solutions.

Looking ahead: the next decarbonization frontier

BHP’s progress in seawater desalination, renewable power, and emissions reduction outlines a clear path toward its 2030 Social Value targets. In Chile, these initiatives reinforce the capacity to produce copper in a competitive and responsible manner, aligned with the expectations of host territories, international markets, and systemic challenges such as the clean energy transition, industrial decarbonization, and digitalization. This commitment is articulated in our Social Value Framework, which comprises five pillars whose progress metrics are published in annual performance disclosures (see accompanying figure).



Figure 47: Planet, people, and prosperity

Source: BHP Minerals Americas (2025). Social Value Framework.

4.5. Repurposing of mining assets for territorial resilience

In collaboration with
Resiliencia y Territorio



The analyzed cases demonstrate various ways in which technological innovation, the restructuring of energy supply, resource-use efficiency, and infrastructure integration can contribute to more competitive and sustainable mining. However, this transformation does not conclude when extraction ceases.

The closure and post-closure phases of an operation can also represent an opportunity to repurpose existing assets and build new territorial capabilities, integrating environmental, energy, social, and financial goals. In this regard, the following proposal sets forth how assets remaining after mine closure, from energy infrastructure and disturbed land to local institutional and technical capabilities, can help create new sources of value and territorial resilience.

From mine closure to energy that sustains the territory

Mine closure is conventionally viewed as a liability: a collection of environmental and social obligations that the operating company must manage and eventually decommission. This framework presents a different perspective. Closure also leaves tangible, usable assets, disturbed land footprints, power transmission infrastructure, and established territorial relationships, which, managed through an appropriate methodology, can yield a positive net environmental, energy, and social dividend over the long term.

The model rests upon three integrated pillars: Nature (carbon, water, and biodiversity), Energy (renewable power generation and the repurposing of mining grid infrastructure for host communities), and a Social and Financial component grounded in building local institutional capacity capable of operating and sustaining the first two over time. The Energy pillar represents the most differentiated element, proposing a progressive framework where the host community assumes a partial and gradually increasing tariff for electric power services. This structure avoids both the paternalistic dependency created by complete subsidies and the socioeconomic exclusion that immediate full retail tariffs would impose on vulnerable households. Supported by blended finance vehicles, this mechanism enables sustainable, long-term community energy access.

The proposal establishes a five-phase roadmap spanning pilot site selection to the consolidation of autonomous local institutions capable of administering sustainable financing instruments, such as biodiversity bonds, blue bonds, green loans, and blended finance. Drawing from this framework, comparable international benchmarks and an implementation roadmap are presented to advance the model from concept note to operational pilot.



Roughly **300 GW** of solar PV potential exists across closed or closing coal mines globally, an amount equivalent to approximately 15% of total installed global solar capacity (Global Energy Monitor, 2024).

Mine closure as a strategic inflection point

Mine closure is a dynamic, evolving process throughout the life of a project. The post-closure stage is governed by the statutory commitments codified in the formal mine closure plan (the primary regulatory instrument governing the process) and by corporate commitments, which are frequently aligned with international mining standards such as The Copper Mark, IRMA, or ICMM guidelines.

Globally, numerous mining operations will transition into closure or post-closure phases over the coming decade. In Latin America, approximately 13 major operations report a remaining life of mine of less than 10 years, six of which have no approved expansion projects³. How this process is governed, whether as administrative compliance or as an opportunity for territorial development, will determine whether the region inherits a legacy liability or a productive asset that sustains host communities once the company exits the site. It also represents an opportunity to consolidate community trust in corporate environmental stewardship and social performance.



Approximately **311** open-pit coal mines closed globally since 2020 could host an aggregate 103 GW of solar PV capacity; an additional 185 GW is technically viable across mines scheduled to shut down before 2030 (Global Energy Monitor, 2024).

The fundamental objective of mine closure is to restore the ecosystem to conditions equal to or better than its pre-mining baseline. This opens a tangible opportunity to deliver a net-positive contribution to nature and local ecosystems: improving the ecological functionality of the territory, reinforcing ecosystem services such as hydrological regulation and carbon sequestration, and repurposing operational energy infrastructure for the direct benefit of neighboring communities. Indeed, contributing to power generation in host territories is an established operational practice before and during extraction. Commercial agreements between mining companies and power generators already exist to supply electricity to surrounding communities, in some instances under formal tariff mechanisms.

However, the challenge of mine closure is neither purely technical nor exclusively financial: it is fundamentally institutional. International experience documented by the World Bank across mine closure and just transition processes shows that, absent capable local institutions to maintain operations over time, even technically sound closure plans lose operational continuity once the operating company curtails its site presence.

³ Comprehensive official inventories of mines nearing closure remain limited; available estimates are derived from ICMM global datasets and internal life-of-mine modeling across active Latin American mining assets.

The closure and post-closure period typically spans 10 to 15 years, providing an adequate window to build resilient local governance bodies that have learned through implementation to manage territorial assets for the benefit of the community, balanced with other regional stakeholders. Valuable experiences exist across Latin America where grassroots community organizations have formed to manage water, land, and local infrastructure assets.

Pillars of territorial resilience

The model establishes a mining-energy territorial resilience framework built upon three mutually reinforcing pillars, with local governance serving as the connecting foundation that secures operational continuity:

- **Nature:** Carbon capture and storage, water resource management, and ecosystem and biodiversity restoration. It represents the technical baseline: what natural capital was restored and its economic value.
- **Energy:** Renewable generation sited on post-closure land footprints and the repurposing of operational electrical infrastructure for community use, supported by a tariff mechanism that ensures partial cost recovery and operational viability.
- **Social and financial:** Developing local institutional capabilities capable of administering sustainable financing mechanisms—supported by the operating company—to ensure the ongoing stewardship of the first two pillars.

The three overarching objectives guiding this framework are: (i) systematically assessing the impacts, risks, and opportunities for territorial resilience arising from mine closure; (ii) identifying the social management requirements needed to transform closure into an environmental and social resilience process; and (iii) identifying opportunities to generate sustainable renewable power from closure activities, transferring technical, energy, and operational capabilities directly to host communities.



Figure 48: Territorial resilience model

Source: Resiliencia y Territorio.

Nature: recovery and creation of natural capital

The environmental risk and opportunity assessment centers on three fundamental dimensions of closure and post-closure: carbon capture and storage, water resource stewardship, and ecosystem restoration alongside biodiversity valuation. The objective is to determine the net contribution of post-closure stewardship to territorial resilience, measuring progress toward corporate decarbonization goals, verifying restored water quality, and quantifying the economic value of the generated natural capital.

The proposed key performance indicators reflect the specific ecological, climatic, and hydrological realities of high-Andean operating environments: low atmospheric pressure, high solar ultraviolet radiation, wide diurnal temperature fluctuations, small and vulnerable catchment basins, shallow organic soils, and sensitive high-altitude wetlands (bofedales).

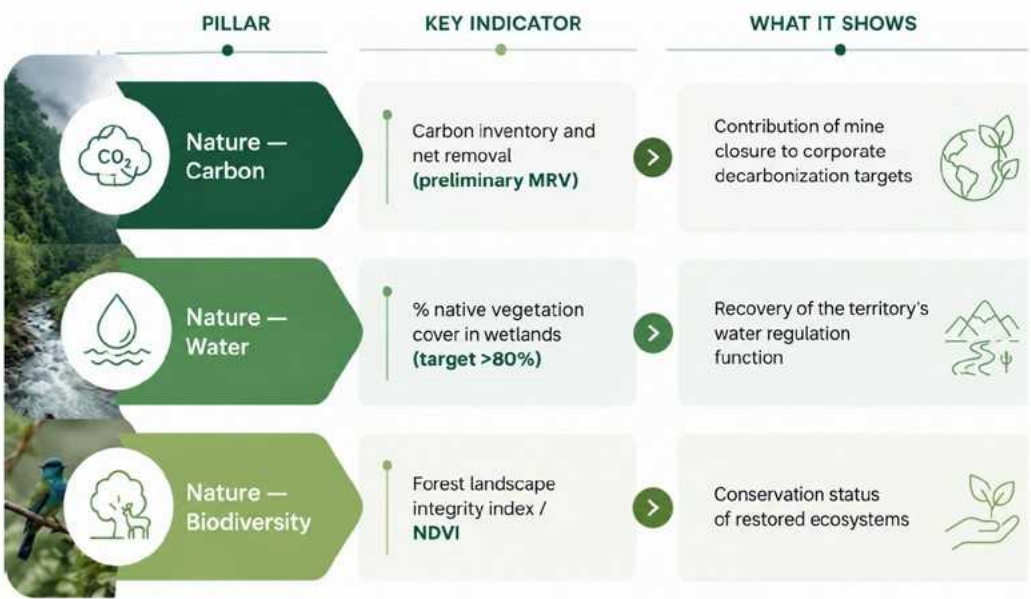


Table 5: Ecological performance indicators in post-closure

Source: Resiliencia y Territorio.

Note: The comprehensive indicator framework across carbon, water, and biodiversity is detailed in Annex IV.

Energy: asset repurposing and infrastructure valorization

Mine closure leaves more than an environmental footprint to remediate: it leaves tangible energy assets. Substations, high-voltage transmission lines, and power supply contracts that supported commercial production—alongside disturbed land such as remediated tailings storage facilities, stabilized waste-rock dumps, and plant pads—possess high potential for renewable energy development or direct repurposing for community electrification. Supported by sound management and local institution building, these energy assets can become a recurring source of revenue and services for the locality over the medium term.

Additionally, this platform provides a foundation for accessing and understanding biodiversity credit and carbon offset markets, mechanisms that require longer preparation periods and ongoing technical advisory for local organizations.

Two intervention pathways



Table 6: Repurposing pathways for mining energy assets
Source: Resiliencia y Territorio.

Financial sustainability: structuring a partial payment mechanism

Securing the financial viability of community energy services requires establishing a partial tariff paid by end-users to support ongoing operations and maintenance (O&M). This design avoids both full grant subsidies—which fail to foster local ownership or build maintenance reserves—and full commercial rates from day one, which would exclude lower-income households. The tariff structure blends four core components:

Tariff Component	Who Pays	What It Covers
Tiered Social Tariff	Households, basic consumption block	Basic operating costs, with cross-subsidies from the excess-consumption block.
Commercial Tariff / Anchor Users	Irrigated agriculture, agribusiness, tourism	A large share of the investment return through long-term contracts.
Concessional Financing (Blended Finance)	Multilateral banks, climate funds, company	System CAPEX, so the tariff does not have to recover asset depreciation.
Sale of Environmental Attributes (I-REC / Carbon)	Voluntary market	Additional revenue that reduces the final tariff for the community.

Table 7: Community energy tariff and financing structure
Fuente: Resiliencia y Territorio.

Regulatory gaps as a policy opportunity

In Peru, for instance, the regulatory framework governing distributed generation has yet to clearly define compensation mechanisms for surplus power injected into the distribution grid, while maintaining a technical cap of 200 kW per installation. While this regulatory vacuum introduces design challenges for pilot deployments, it also provides an opportunity: the pilot asset can function as an empirical test case to inform regulatory design using real-world field data

Social and financial component: local institutional governance

This framework aims to enhance the social, economic, and financial viability of closure, improving the resilience of biotic and abiotic ecosystems. It leverages available public policies, international cooperation programs, and multilateral finance—including green bonds and nature-based solutions—to maximize environmental benefits and manage natural capital as an enduring economic asset for host communities.

The initial step involves mapping local stakeholders who can participate in medium- and long-term operating models. This requires evaluating local governance levels, grassroots organizations within the direct area of influence, existing community capital, and local economic flows. This diagnostic establishes the baseline, identifies gaps in administrative and technical management capabilities, and structures a capacity-building roadmap to transition the management of future facilities to local entities.

Once local baseline capacities are established, they are mapped against market opportunities. It is critical that community organizations understand the financial instruments that could sustain their operating model—such as biodiversity credits, blue bonds, and green loans—and, with private-sector technical advisory, execute a structured plan to manage these mechanisms effectively.

As its governance matures, this community entity assumes operational oversight of the Energy asset and other marketable natural assets—avoiding the creation of parallel administrative structures—becoming an eligible counterparty for climate funds, development finance institutions, and buyers of carbon credits or renewable energy certificates (I-RECs). Achieving this level of governance is demanding in remote mining districts, which often face high poverty rates and limited technical training. To address this reality, the framework separates two operational functions within the community entity: administrative-financial management and technical facility operations.

These capacities follow distinct developmental paths depending on the site. For example, in a rural power substation, financial training programs may have established sound accounting capabilities within the community, while technical electrical maintenance capacity may still be absent. This requires a phased support strategy, providing specialized technical assistance during early operating phases until local self-sufficiency is achieved.

Roadmap: from concept note to implementation

The model is executed across five sequential phases, with workstreams that can advance concurrently once the initial pilot is validated:

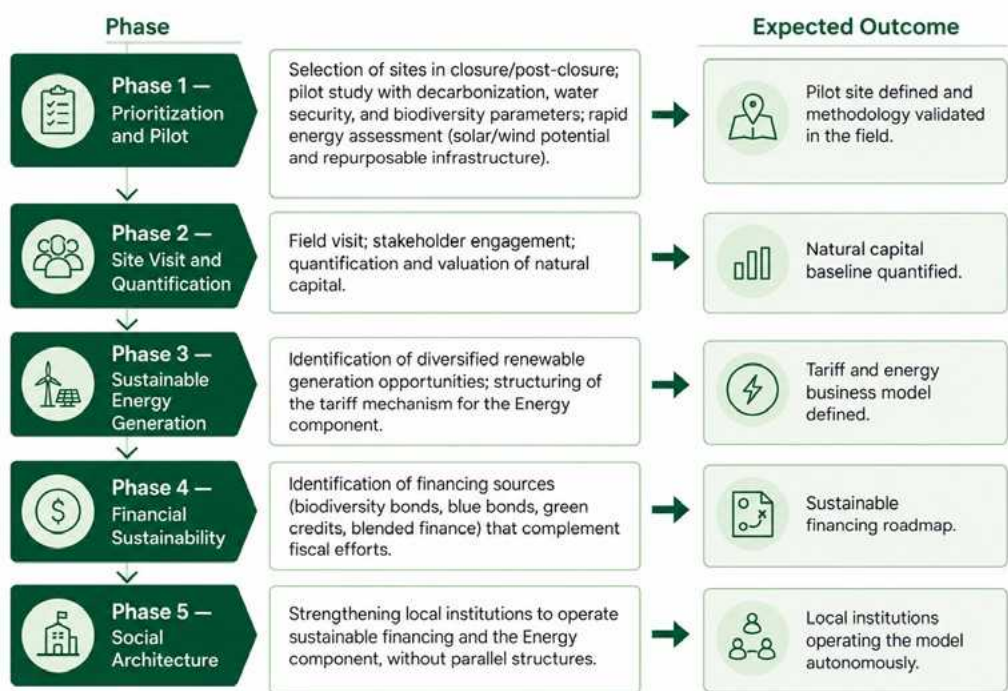


Table 8: Post-closure implementation roadmap
Source: Resiliencia y Territorio.

Site evaluations incorporate the economic valuation of ecosystem services (carbon, water, and biodiversity) across the closure footprint, alongside a risk-and-opportunity assessment aligned with existing public and private capital investment programs. The initial pilot serves as a benchmark to build a standardized, scalable methodology applicable across an operating company’s broader post-closure portfolio.

Why now: the business and investment case

For a mining company, this model mitigates residual closure risks: it converts a statutory liability into an asset that delivers verifiable social value and strengthens corporate ESG ratings with institutional investors and insurers. For development banks and climate finance facilities, it provides an investment vehicle with verifiable impacts (renewable power generation, local employment, ecosystem restoration) in remote geographies where commercial capital rarely flows.

The required market instruments already exist and continue to expand: blended finance facilities for emerging-market energy infrastructure, biodiversity bonds, blue bonds, high-integrity carbon credits, and International Renewable Energy Certificates (I-RECs). In most mining basins, the missing element is not capital demand, but rather mature local institutions capable of serving as eligible counterparties to receive and manage these funds—precisely the institutional capacity that Phase 5 of this model builds out.

4.6. Regulation for a new relationship between mining and energy

In collaboration with
Jerónimo Carcelén Pacheco

PPU | Philippi
Prietocarrizosa
Ferrero DU
& Uria
El estudio Iberoamericano

In the past, it was common for energy corporations—then primarily focused on oil and gas—to maintain mining operations within their asset portfolios. Over time, these companies divested those extractive divisions to concentrate on their core business models or reoriented their capital toward the development of renewable energy projects.

The global energy transition, the electrification of the economy, and the accelerated growth of electromobility are fundamentally transforming this historical relationship between mining and energy. In this new landscape, both sectors are forging an increasingly tight alignment, driven by the surging demand for critical minerals—such as copper, lithium, nickel, cobalt, and rare earth elements—which have become strategic raw materials for the manufacturing of battery cells, electric power transmission grids, energy storage systems, digital technologies, and data centers.

Consequently, the regulatory frameworks governing mining can no longer be analyzed in isolation from the energy sector. Both activities form part of an increasingly integrated value chain oriented toward industrial decarbonization and sustainable development.

This convergence represents a major economic opportunity for Latin America and the Caribbean, a region that concentrates a significant share of global copper and lithium reserves, alongside extensive resources of nickel, graphite, and rare earth elements.

However, transforming the region's geological potential into operational projects requires far more than the mere physical presence of mineral deposits in the subsoil. It demands stable public policies, strong institutions, transparent rules of the game, and effective coordination among mining, energy, environmental, and territorial authorities. International experience demonstrates that capital deployments across mining and energy are capital-intensive, operate under long-term development horizons, and remain highly sensitive to regulatory uncertainty. For this reason, regulatory stability is just as decisive as the grade and quality of the available mineral resources.

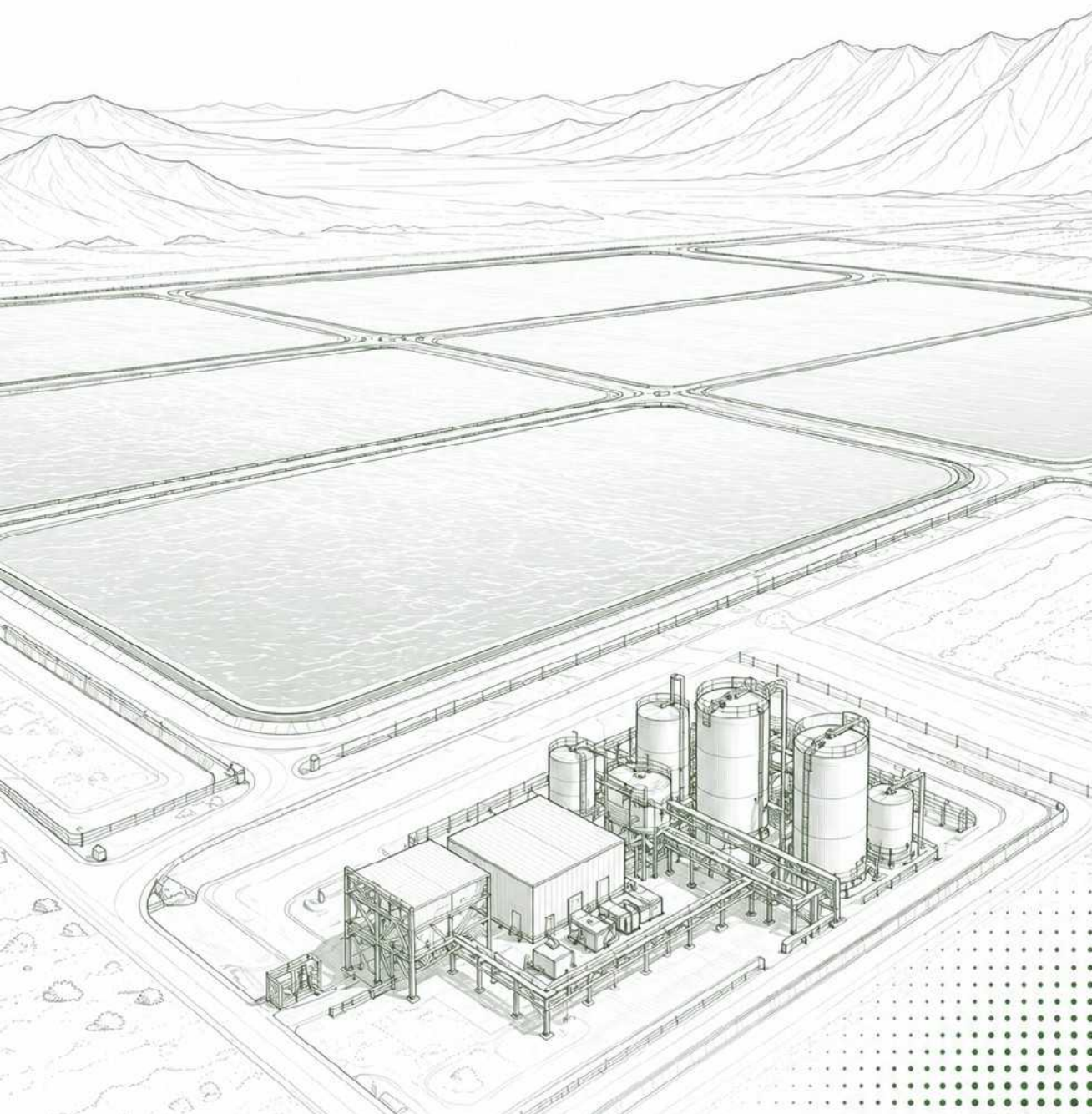
In this context, one of the primary challenges for the region consists of developing modern, technically robust, and predictable regulatory frameworks capable of supporting project delivery and guaranteeing fair conditions for accessing energy infrastructure. This entails the definition of clear technical standards, streamlined environmental impact assessment procedures, structured social engagement mechanisms, and non-discriminatory conditions for accessing critical infrastructure, such as high-voltage transmission lines and energy storage systems. The core objective must be mitigating development risks for investors while ensuring that project execution fully complies with rigorous environmental and social standards.

In this manner, the convergence between mining and energy offers the region an oppor-

tunity to transition from an economic model based predominantly on raw mineral exports toward a more sophisticated participation in global value chains. This entails not only scaling up critical mineral output, but also fostering the production and manufacture of active battery materials and electromobility components, deploying specialized engineering and technology services, and advancing critical mineral recycling to strengthen the circular economy.

CHAPTER 5

SECTOR PERSPECTIVES



5.1. Trends and challenges

The preceding chapters have examined the primary structural transformations reshaping mining and energy across Latin America and the Caribbean: the surging demand for critical minerals, the expansion of project pipelines, rising industrial electricity requirements, and the imperative to anticipate investments across generation, transmission, and enabling infrastructure.

The next step is to incorporate the direct perspective of the key actors shaping this landscape. The strategic choices that will define the next generation of mining projects depend not only on subsurface geology or market demand forecasts, but also on the institutional, corporate, and technical capabilities available to turn that resource potential into viable, bankable operations.

In this context, OLACDE convened representatives from sovereign governments, mining corporations, international organizations, and specialized advisory firms to gather their strategic perspectives on the primary challenges and opportunities facing the region toward 2040.

The purpose of this chapter is not to present isolated opinions, but to identify overarching trends, points of policy convergence, recurring operational bottlenecks, and action priorities to complement the quantitative assessments detailed in earlier sections.

The contributions are organized across four complementary perspectives:

- **Authorities:** The strategic view of active government ministries and public agencies responsible for formulating public policy, enacting regulatory regimes, and leading national sector planning.
- **Industry:** The operational, commercial, and engineering track record of corporate operators that develop mineral deposits and execute multi-decade capital allocation decisions.
- **Public management experience:** Retrospective assessments, governance evaluations, and institutional lessons learned from former ministerial authorities who led regulatory reforms, territorial dialogues, and administrative restructuring processes.
- **International organizations and consultancies:** Comparative economic, regulatory, and market intelligence provided by multilateral institutions and specialized firms analyzing commodity trends, resource governance, and enabling competitiveness environments.

In this way, the chapter seeks to answer a central question:

What conditions will be necessary for Latin America and the Caribbean to transform their mining potential into competitive and sustainable projects, supported by energy systems prepared to accompany their development?

The energy transition is simultaneously reshaping mineral markets, energy systems, and investment conditions. For Latin America and the Caribbean, this process creates significant opportunities, but also presents new challenges in terms of coordination, competitiveness, and execution capacity.

The perspectives gathered by OLACDE complement the analysis developed in this White Paper from a different dimension: the experience of actors who face these challenges in practice.

Rather than anticipating a single vision of the sector’s future, this section seeks to identify the main issues around which the regional debate is currently structured.

 Mining and Energy as Interdependent Industries	How is the relationship between mining development and energy planning changing? What new forms of coordination will be needed?
 Infrastructure and Planning	How can the generation, transmission, water, transport, and logistics needs associated with new projects be anticipated?
 Decarbonization and Innovation	What technologies and strategies can enable more efficient, competitive, and low-emission mining operations?
 Regional Cooperation	In which areas can coordination among countries generate advantages that would be difficult to achieve individually?

Table 9: Key thematic pillars of the regional dialogue
Source: Authors’ own elaboration.

This dialogue will make it possible to contrast the projections and analyses presented above with the experience of actors directly involved in the transformation of the sector.

The following sections present these perspectives separately. The objective is not to homogenize the positions of the participants, but to bring their experiences and views into dialogue, identifying both shared challenges and differences in approach that can enrich the discussion on the future of the region’s mining and energy sectors.

Ultimately, the synthesis of these perspectives will serve as an input for the following chapter, which is devoted to defining a regional roadmap to move from diagnosis to action.

5.2. The voice of the authorities



*In collaboration with the Ministry of Energy
and Mines of the Dominican Republic*

GOBIERNO DE LA
REPÚBLICA DOMINICANA
ENERGÍA Y MINAS

Dominican Republic: a mineral opportunity requiring strategic selectivity

For the Dominican Republic, the global energy transition presents a strategic opportunity that must be evaluated through its baseline conditions: an island state characterized by a constrained landmass, high population density, and ecologically sensitive ecosystems, alongside notable geological diversity and mineral potential of growing regional relevance.

Situated on the island of Hispaniola, the Dominican Republic hosts deposits of gold, silver, nickel, copper, bauxite, limestone, and marble, as well as prospective occurrences of minerals central to industrial decarbonization, such as rare earth elements, cobalt, and associated lateritic nickel mineralization.

This profile establishes a central governance question: how can the country leverage geological potential to support economic development without compromising hydrological security, biodiversity, or host community welfare?

From the Dominican institutional perspective, the answer does not lie in converting mining into the dominant driver of the national macroeconomy, but in developing a selective, high-value mining sector focused on operations whose environmental footprints can be managed and whose contribution to domestic development is verifiable.

A constrained territory facing rising global demand

Territorial geography constitutes the primary condition governing any national extractive policy. Spanning roughly 48,671 km² and home to more than 11 million citizens, the country maintains an average population density near 230 inhabitants per square kilometer. Its mountainous topography, compact hydrological catchments, and short distances from upland watersheds to coastal margins mean that environmental impacts within upstream ecosystems can translate rapidly downstream. Consequently, every potential mining footprint must coexist with competing land uses: commercial agriculture, international tourism, urban development, critical infrastructure, and ecological conservation.

This territorial reality does not preclude mining development, but it establishes rigorous standards for project execution. With nearly one-quarter of the national land area classified under formal protected-area regimes, cross-sector territorial zoning is essential to define where extractive activities can proceed and where they must be excluded.

This geographic reality provides an opportunity to construct an extractive model tailored to an island economy: moving away from raw volume extraction toward technical excellence, rigorous environmental oversight, and domestic value capture.

Geological endowment and emerging vectors of the energy transition

Dominican mining has historically centered on gold, copper, zinc, and nickel. However, the global clean energy transition is redefining the strategic value of this geological endowment. Electric transport, power transmission grids, battery storage, solar modules, and wind turbines demand substantial volumes of copper, nickel, cobalt, and rare earth elements. In this shifting landscape, mineral deposits that previously held localized economic interest take on broader geopolitical significance.

The Dominican geological inventory encompasses multiple prospective environments:

- **Nickel laterites:** Concentrated along the margins of the Bonao and La Vega Real valleys, presenting confirmed potential for associated cobalt exploration.
- **Copper and polymetallic sulfides:** Associated with porphyry and volcanogenic massive sulfide (VMS) deposits, notably within the Maimón Formation, the Cordillera Central, and the Sierra de Yamasá.
- **Rare earth elements:** Located within the Sierra de Bahoruco in Pedernales Province, where ionic and hard-rock concentrations are undergoing exploration and technical characterization.
- **Industrial minerals:** Extensive reserves of limestone, gypsum, marble, and aggregates underpinning domestic civil construction and national transport infrastructure. Geological occurrence, however, should not be equated with economically mineable reserves. For this reason, a core public priority is advancing pre-competitive geoscientific mapping to delineate deposits that can be developed into viable projects compatible with national socio-environmental baselines.

Four pillars for territorial-based mining governance

To operationalize these principles, the Dominican Republic has established four strategic pillars to guide responsible mining development.

1. Evidence-based territorial planning

Project approvals must evaluate subsurface geology alongside water availability, ecosystem integrity, community demographics, agricultural activities, and climate vulnerabilities. This framework requires binding exclusion zones covering headwater basins serving public aqueducts, designated national parks, and strategic aquifer recharge zones. Extractive activities must be restricted to jurisdictions where industrial impacts can be contained, moni-

tored, and reclaimed. Spatial land-use planning must precede project licensing rather than reacting to it ex-post.

2. World-class environmental standards

Within an island environment, rigorous environmental management is a fundamental condition of project bankability. Core requirements include closed-loop industrial water circuits, tailings storage facilities engineered to international safety standards under real-time telemetric monitoring, progressive land reclamation, and fully liquid financial guarantees dedicated to mine closure. Strict operational limits must be enforced on fugitive dust, noise, and freshwater extraction, especially near urban and agricultural centers. Environmental liabilities must be internalized from day one and not transferred to future generations.

3. A modernized social contract with host communities

High population densities make continuous engagement between mining operations and neighboring communities unavoidable. Relationships with host territories must be anchored in shared responsibility and tangible socio-economic benefits. This requires prioritizing skilled local hiring, developing domestic supply chains, and directing territorial royalties toward healthcare, technical education, municipal infrastructure, and regional economic diversification that outlives the mine. Early participatory consultation mechanisms are essential to provide communities with verified technical data and enable their input on local development plans.

4. Capturing fair national value

Mineral deposits are exhaustible, and commercial market cycles for critical commodities are cyclical. The national strategy must balance fiscal prudence with the capability to capture market upside during sustained price rallies. This framework demands stable tax and royalty regimes that secure equitable state revenues while maintaining long-term competitiveness for capital deployment. Looking forward, the state may evaluate sovereign wealth structures to channel windfall mineral revenues into clean energy infrastructure, public education, and long-term economic development.

Strategic selectivity as a development model

The Dominican Republic does not possess the land area or resource scale to base its macroeconomic growth on raw mineral extraction. However, this territorial limit can anchor a differentiated strategy: supporting a select portfolio of high-standard projects with robust community linkages and verifiable contributions to national development. The challenge consists of targeting opportunities where economic and strategic returns justify land intervention, and where operational risks can be governed transparently.

The energy transition opens an opportunity for nations hosting reserves of copper, nickel, cobalt, and emerging critical minerals. The Dominican Republic can participate in this shifting landscape not by competing on gross extraction volumes, but by demonstrating that

high-quality mineral projects can be deployed in jurisdictions where freshwater reserves, fragile ecosystems, and host communities are central planning considerations.

A viable mining framework for an island state

The public debate must move beyond a binary divide between total resource extraction and outright operational prohibition. The relevant question is identifying which model of mining remains compatible with island territory constraints and long-term development aspirations.

The strategic answer lies in selectivity, technical rigor, and transparency. This involves developing mineral deposits where compelling economic benefits exist, while safeguarding irreplaceable natural assets: freshwater reserves, native forests, vulnerable ecosystems, and community livelihoods. In a global economy requiring expanding supplies of copper, nickel, and critical minerals, the Dominican Republic's opportunity lies in treating environmental responsibility as a driver of competitiveness, and operational selectivity as a long-term development strategy.

Brazil: toward a policy of mineral sovereignty, industrialization, and a just energy transition



*Institutional contribution from the
Ministry of Mines and Energy of Brazil*

Brazil conceives critical and strategic minerals beyond a primary supply agenda: they represent an opportunity to connect the country's geological potential with an integral strategy for economic development, industrial transformation, technological innovation, energy security, food security, and a just and sustainable energy transition. This ambition builds on an established mineral economy: the sector accounts for nearly 4% of national GDP, supports around 230,000 direct jobs and more than 832,000 indirect jobs, and produces close to 80 different mineral substances.

Electrification, digitalization, and the deployment of renewable energy increase the demand for mineral inputs, while geopolitical tensions and the concentration of global value chains place resilience and supply security at the center of international debate. For Brazil, the strategic question transcends the mere expansion of extraction volumes; it lies in how these resources can generate knowledge, investment, industrial capabilities, technology, qualified employment, and sustainable development. Therefore, the country seeks to progressively strengthen its participation in higher value-added stages, recognizing that geological potential alone does not automatically translate into productive capacity.

One of the central challenges is expanding the knowledge of the mineral heritage. The continental dimensions of the country require continuous investment in geological mapping, geophysical and geochemical surveys, and exploration. Improving the quantity, quality, and availability of pre-competitive geological information is essential to reduce uncertainty and support better public and private decisions.

Financing exploration constitutes another priority challenge. In 2023, investment in non-ferrous mineral exploration in Brazil totaled approximately USD 384.7 million, of which USD 215.2 million corresponded to major mining companies and USD 104.5 million to junior companies. Compared to more mature jurisdictions, there is ample room to expand the participation of junior companies and specialized investors in early stages. This requires not only better baseline information, but also financial instruments capable of mobilizing risk capital and granting guarantees so that projects can advance from exploration to development.

The challenge continues after discovery. Brazil currently has a pipeline of 105 mapped projects and initiatives in the mining sector and related fields, representing approximately USD 82.5 billion in estimated investments and around 518,000 potential jobs. This pipeline reflects both the magnitude of the opportunity and the necessity of ensuring adequate conditions for energy, infrastructure, logistics, technology, and long-term financing.

In response to these challenges, Brazil is moving forward in formulating its National Policy for Critical and Strategic Minerals, designed to articulate mineral development with industrial, technological, energy, infrastructure, sovereignty, and sustainability goals. Its objectives include:

- Expanding geological knowledge of mineral resources.
- Increasing responsible domestic exploration and production.
- Developing the mineral processing industry and strengthening technological capabilities.
- Reducing external vulnerabilities in minerals essential to strategic sectors.

The framework also includes priority treatment for strategic projects within the applicable regulatory regime, federal-subnational coordination, research and development (R&D&I), workforce training, and attracting responsible investments.

A decisive dimension is the structuring of financing and guarantee instruments through public banking and development agencies. Given that risks differ across the value chain—exploration involves geological uncertainty, innovative processing routes carry technological scale-up risks, and industrial plants demand high upfront capital—risk mitigation mechanisms act as catalysts to mobilize private, public, and multilateral capital toward final investment decisions.

This strategy underpins the concept of sovereignty held by Brazil: the capacity to determine the responsible use of its resources and decide at which stages of the chain to participate. This vision is complemented by an openness to responsible investment, international financing, and technological partnerships. Depending on the competitiveness of each chain, value addition encompasses beneficiation, chemical processing, refining, recycling, intermediate materials, and components for batteries, permanent magnets, electric mobility, and clean technologies.

Brazil is already implementing concrete financial instruments to operationalize this strategy:

- **Investment Fund in Participations (FIP) in Strategic Minerals:** Structured to mobilize around USD 400 million in venture capital for exploration, project development, and new mining operations linked to the energy transition and food security. It will support between 15 and 20 mid-tier and junior companies, with a contribution from the National Bank for Economic and Social Development (BNDES) of up to USD 50 million, alongside national and international investors.
- **Joint BNDES and Finep Call:** Geared toward strategic mineral processing with a fund of approximately USD 1.0 billion in credit lines and non-reimbursable grants. The initiative received 124 business plans totaling USD 15.0 billion, of which 56 proposals (amounting to nearly USD 10.0 billion) advanced in the selection process.
- **Investment Platform for Climate and Ecological Transformation (BIP):** Connects strategic projects with global capital. The mining sector accounts for 32% of its total portfolio, with 9 confirmed projects representing around USD 8.8 billion in potential investment

battery-grade lithium, cobalt and nickel sulfates, copper sheets, and rare-earth oxides, metals, and alloys for permanent magnets and electric motors.

- **Capital markets and tax incentives:** In 2025, the Ministry of Mines and Energy authorized access to incentivized corporate debentures with tax benefits for cobalt, copper, lithium, nickel, and rare earth element (REE) processing projects. Eligibility is targeted at strategic materials such as battery-grade lithium carbonate and hydroxide, cobalt and nickel sulfates, copper foil, and rare earth oxides, metals, and alloys for permanent magnets and electric motors.

Mineral development and energy planning converge directly. As electro-intensive activities, the competitiveness of mining and processing depends on the reliability, cost, and carbon footprint of energy. With approximately 90% of its electricity originating from renewable sources, Brazil provides one of the cleanest matrices in the world for mineral processing. Solar and wind expansion, combined with the regulatory framework for low-emission hydrogen, strategically positions the country to supply intensive industrial processes and certify supply chains under rigorous environmental standards.

At the same time, long-term competitiveness requires cooperation among companies, universities, and research centers to optimize processes, increase input efficiency, and promote circularity. This must advance alongside environmental protection, respect for human rights, community dialogue, and the efficient management of water, soil, and waste.

On the external front, Brazil fosters balanced partnerships with producing and consuming countries, multilateral banks, and industry. For the country, resilient supply chains must recognize that security of supply for consumer economies is just as legitimate as value addition, industrial development, and technological capabilities for producing nations.

This principle is central to Latin America and the Caribbean. The region brings together an exceptional geological endowment, clean energy matrices, and developing industrial capacities. Greater regional cooperation can enhance the exchange of geoscientific information, shared infrastructure, innovation, and cross-border productive integration, while respecting the sovereign strategies of each country.

Brazil's long-term objective is not merely to extract higher volumes of minerals, but to transform its geological heritage into knowledge, technology, industrial capacity, and sustainable development, consolidating mining as a permanent platform for economic progress and integration into the global energy transition.

Peru facing the global energy transition: from mining strength to new value chains



Institutional contribution from the Directorate of Mining Promotion, Ministry of Energy and Mines (MINEM) of Peru

Peru builds from an established position on the global mining map. Its endowment of copper, silver, zinc, molybdenum, and tin, alongside emerging opportunities in lithium and rare earth elements, constitutes a strategic advantage amid growing global demand for critical minerals. The challenge for the coming decades is not merely to increase production, but to transform this geological strength into higher value added, enabling infrastructure, and energy integration capable of sustaining a new phase of mining development.

Global demand redefining the importance of minerals

The electrification of transport, the expansion of electric power grids, data centers and artificial intelligence, defense, and industrial decarbonization are reshaping the demand outlook for critical minerals. According to the International Energy Agency (IEA, 2026b), under net-zero emissions transition scenarios, demand for these minerals could roughly triple by 2030 and quadruple by 2040.

Projections based on IEA scenarios estimate demand increases by 2050 of up to 17 times for lithium, 4.6 times for rare earth elements, and 3.1 times for copper (CEPAL, 2024). In parallel, analysts emphasize that expanding infrastructure tied to artificial intelligence and data centers could add several million tonnes to global copper demand toward 2040 (S&P Global, 2025).

This transformation increases the strategic value of countries that combine mineral resources, productive capacity, relative stability, and export infrastructure. In this landscape, Peru possesses a particularly favorable baseline.

An established mining base and a new critical minerals frontier

Copper occupies the center of this position. In 2025, Peru produced approximately 2.77 million fine metric tonnes (FMT) and holds between 100 and 120 million tonnes in reserves, according to estimates by (MINEM, 2025) and the (USGS, 2025). This positions it as the country with the second-largest copper reserves in the world after Chile, and as the third-largest global producer, behind Chile and the Democratic Republic of the Congo. The country's objective is to reclaim second place in production through projects such as Tía María, La Granja, Michiquillay, Cotabambas, Haquira, Zafranal, and Los Chancas.

Peru's standing is also significant in other minerals. The country holds the world's largest silver reserves, with approximately 120,000 tonnes (USGS, 2025), and recorded a 9.3% pro-

duction growth during the first half of 2025 (MINEM, 2025). It is also among the leading global producers and reserve holders of zinc and molybdenum, while tin production remains concentrated in Puno, primarily at the San Rafael mining unit (MINEM, 2025), (USGS, 2025).

In emerging minerals, lithium represents a new frontier. The Falchani project in Puno contains estimated resources of around 9.5 million tonnes of lithium carbonate equivalent (LCE) and, if its reserves are confirmed, could position Peru among the four countries with the largest reserves in the world (MINEM, 2025). Rare earth elements remain in the exploration phase and show favorable indications in Puno, Cusco, Huancavelica, and Apurímac, although further geological research is required to determine their commercial viability (MINEM, 2025).

 Copper	• 3rd-largest producer and 2nd in reserves	• Main driver of mining expansion
 Zinc	• Among the leading producers and reserve holders	• Strengthening of polymetallic mining
 Tin	• Among the leading producers	• Production concentrated in Puno
 Rare Earths	• Geological potential under exploration	• Knowledge development and exploration

Table 10: Peru on the map of critical and strategic minerals

Source: Directorate of Mining Promotion, MINEM.

From geological advantage to an investment platform

Peru’s mining strength is complemented by a substantial investment and exploration portfolio. There are currently 66 mining projects distributed across 19 departments, while the exploration portfolio comprises 69 initiatives totaling approximately USD 757 million (MINEM, 2025).

To this are added cost advantages—with copper operations situated in the first or second quartiles of the international cost curve—access to Pacific ports, and extensive experience accumulated over more than a century of mining activity. The country also features international operators, specialized suppliers, technical universities, and sector-specific human capital, preserving favorable investment conditions within the region (Fraser Institute, 2024). This combination provides an advantageous platform for attracting new investments, in a context where the financing gap for critical minerals could reach approximately USD 1.7 trillion in the coming years (MINEM, 2025).

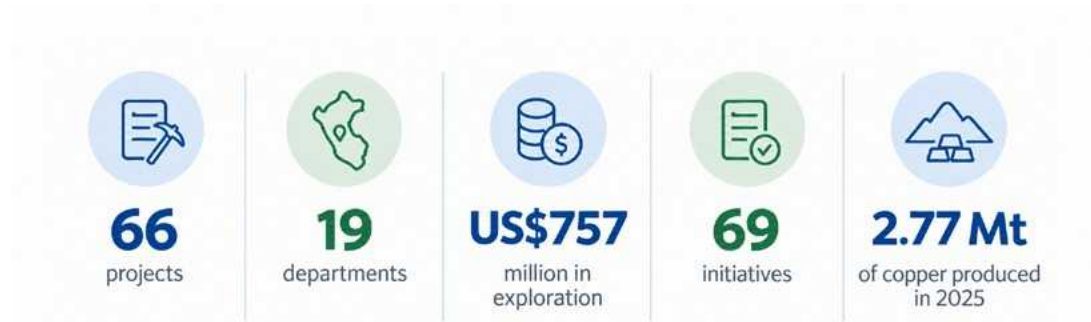


Figure 49: Peru's mining opportunity in figures

Source: Authors' own elaboration based on data from the Directorate of Mining Promotion, MINEM.

The next challenge: retaining greater value in the territory

The next stage raises a different question: not only how much Peru produces, but how much value it succeeds in retaining from what it produces.

A significant portion of Peruvian copper is exported as concentrate to be processed in other countries, limiting local capture of economic and industrial benefits (IEA, 2026b). Moving toward higher levels of industrialization requires evaluating new smelting and refining capacities, as well as opportunities to produce cathodes, wire rod, cables, and other components. In this regard, Southern Copper announced an investment of approximately USD 1,350 million for a new smelter and refinery in the southern part of the country (Southern Copper Corporation, 2024).

Capturing value can also rely on new opportunities linked to recycling, the circular economy, process digitalization, traceability, and environmental, social, and governance (ESG) certifications, which are increasingly demanded by international buyers.

Energy as a condition for new Peruvian mining

Mining expansion and industrialization alter the sector's energy requirements. Greater operational electrification, the phased substitution of fossil fuels, water pumping and treatment systems, and potential new processing facilities require energy planning capable of anticipating project locations and development trajectories.

Peru has an electric matrix balanced by hydroelectric and thermal generation, alongside significant potential for solar and wind generation. The challenge lies in articulating these resources with an adequate transmission network, storage, and long-term supply contracts that provide mining projects access to competitive, lower-emission energy. Energy planning must therefore accompany the expansion of the mining portfolio and the eventual installation of new processing capacity from early stages.

Enabling infrastructure: energy, water, and connectivity

The mining project portfolio, estimated at approximately USD 64 billion (MINEM, 2025) and heavily concentrated in copper initiatives, demands infrastructure that extends beyond deposit access.

Energy, power transmission, water, highways, railways, ports, and digital connectivity form part of the same enabling infrastructure. In particular, water security will be decisive for new projects through storage, reuse, and technologies that improve resource-use efficiency. Developing this infrastructure requires sustained public-private coordination so that capital investments anticipate the needs of future mining hubs and reduce bottlenecks that could constrain project delivery.



Figure 50: From resources to markets

Source: Authors' own elaboration based on data from the Directorate of Mining Promotion, MINEM.

A public policy agenda toward 2035–2050

Capitalizing on this opportunity requires simultaneous progress across five fronts:

- 1. Enabling new investments:** Through the consolidation of the Digital Mining Single Window and the structured reform of the formalization process (REINFO), with strict statutory deadlines and robust institutional oversight (IPE, 2024).
- 2. Expanding subsurface knowledge:** Strengthening INGEMMET and prioritizing pre-competitive research on lithium, rare earth elements, and strategic minerals such as uranium.
- 3. Preparing infrastructure and energy:** Expanding power transmission, storage, water security, and connectivity across zones with mineral potential.
- 4. Capturing greater value:** Promoting smelting, refining, and intermediate manufacturing capabilities, alongside auditable traceability systems and ESG standards such as The Copper Mark and IRMA.

5. Building regional complementarities: Especially with Chile and the Andean region, leveraging geographical and logistical proximity for market access to global consumers.

Peru facing a geopolitical window of opportunity

The drive for diversified supply chains by major consuming economies opens an opportunity for Peru to evolve from a primary exporter into a strategic partner within resilient industrial networks. Together with Chile and other regional partners, Peru can leverage its Pacific position to advance cooperation frameworks that progressively incorporate higher levels of processing at the source.

The 2035–2050 horizon offers the potential to consolidate the country as a regional critical minerals hub. Peru's primary asset remains its geological strength, but its next competitive advantage will depend on its capacity to convert that wealth into value, industry, and territorial development. In this process, energy ceases to be an isolated input and becomes the structural condition for its future viability and competitiveness.

5.3. The voice of the industry

BHP: Decarbonization of large-scale mining

René Muga

Vice President of Corporate Affairs
and Communications LATAM



Question 1. Decarbonization of large-scale mining

BHP has taken on a leadership role in the decarbonization of mining, establishing ambitious targets to reduce its operational emissions. Drawing from the experience of your operations in Latin America, what have been the primary factors enabling progress in this process, and what challenges do you consider must still be overcome to accelerate the transition toward low-emission mining?

BHP's decarbonization strategy is guided by clear public targets: reducing operational greenhouse gas emissions—Scope 1 and Scope 2 across operated assets—by at least 30% by fiscal year 2030, relative to a fiscal year 2020 baseline, and achieving net-zero operational emissions by 2050. In Latin America, and particularly in Chile, this objective is strategic due to copper's fundamental role in electrification, digitalization, and the global energy transition.

In Chile, BHP has operated with a 100% renewable electricity supply since fiscal year 2022, secured through long-term contracts. In fiscal year 2024, this supply represented 6.8 TWh of renewable electricity and contributed to reducing operational emissions at Escondida and Spence by approximately 70%, displacing nearly 3 million tonnes of CO₂ per year.

These advances have been made possible by a combination of strategic decisions, operational discipline, and technological innovation: competitive clean energy contracts, new solar generation and storage solutions, and the progressive development of alternatives to curtail diesel use in mining equipment and throughout the value chain.

The primary challenge is accelerating solutions that are scalable, competitive, and reliable for energy-intensive operations, while maintaining security of supply and effective coordination among companies, technology providers, host communities, and authorities.

Question 2. The water-energy nexus

Reducing continental water consumption represents one of the primary challenges for large-scale mining. Drawing from BHP's experience, how can water security strategies be reconciled with efficient energy management, particularly in operations incorporating large-scale desalination and conveyance processes?

For large-scale mining, water security is an essential condition for operating responsibly in regions facing high water stress, such as northern Chile. The challenge lies in relieving pressure on continental freshwater sources without compromising competitiveness or operational reliability, embedding the integrated management of water, energy, and infrastructure from the design phase onward.

BHP has invested nearly USD 4 billion over the past 15 years to expand the use of desalinated water and eliminate reliance on continental aquifers. Escondida operates exclusively with desalinated water, supported by a plant with a maximum capacity of 3,800 liters per second⁴ and conveyance systems that transport water from the coast to operations situated more than 3,000 meters above sea level. At Spence, the concentrator also operates exclusively with seawater.

Desalination has become enabling infrastructure for sustainable mining development, but it entails higher energy demands associated with intake, treatment, and high-pressure pumping. Therefore, reconciling water security with energy efficiency requires optimizing processes, increasing recirculation rates, enhancing pumping efficiency, and advancing energy storage and management solutions.

Experience demonstrates that the path forward is not treating water and energy as disconnected challenges, but as an integrated system: producing more copper with less hydrological pressure, lower energy intensity, and greater collaboration with technology partners, authorities, communities, and the broader industry.

⁴ Refers to total installed nominal water capacity (total water capacity) reported in the BHP Annual Report (Form 20-F), (BHP, 2025).

Question 3. Latin America in the energy transition

As one of the world's leading producers of copper and other strategic minerals, how does BHP view the role of Latin America and the Caribbean in supplying critical minerals for the energy transition? What conditions do you consider priorities for the region to strengthen its competitiveness and consolidate its leadership in the coming decades?

BHP's growth strategy is directly tied to megatrends such as electrification, decarbonization, urbanization, and digitalization. Within that context, copper occupies a strategic position: BHP estimates that global copper demand could grow by around 70% toward 2050, exceeding 50 million tonnes annually. Latin America, particularly Chile and Peru, plays a central role due to its resource base, operating track record, specialized human capital, and proven capacity to develop world-class operations.

For BHP, seizing this opportunity demands growing responsibly: investing in high-quality assets, extending the operational life of existing facilities, improving productivity, and deploying technologies that mitigate environmental impacts while increasing operational efficiency.

To consolidate its leadership, the region must enable responsible, timely, and competitive projects, strengthening permitting processes, infrastructure, talent development, innovation, and trust-based relationships with communities and host territories. The ultimate objective is for Latin America to responsibly supply the critical minerals the world requires for the energy transition, generating durable economic and social value across the countries where it operates.

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Novandino Litio: Resource efficiency, governance, and the future of sustainable lithium in brines

Carlos Díaz

CEO of Novandino
Litio Spa



Question 1. The public-private partnership as an operational and corporate model

Following the creation of Novandino Litio in 2025 as a result of the partnership between Codelco and SQM, what have been the primary challenges and lessons learned from the integration process? From your experience, what insights can this new stage offer to the development of future lithium projects in Latin America and the Caribbean?

Novandino Litio was created through the strategic alliance between SQM and Codelco to provide operational continuity to one of the world's most significant lithium operations in the Salar de Atacama, with an operational horizon extending to 2060.

The challenge has not merely been integrating a new corporate structure, but doing so without disrupting operational continuity, commercial reliability, or the technical expertise accumulated over three decades of commercial production.

In this regard, Novandino represents a public-private partnership model designed to preserve the industrial and commercial track record developed by SQM, while integrating stronger state participation through Codelco.

The most vital lesson is that a competitive lithium project today cannot rely solely on the quality of the geological resource. It demands clear rules, robust governance, industrial capability, long-term capital deployment, territorial social license, and an auditable, transparent narrative regarding how extraction is conducted.

Our ambition is defined: producing more lithium, producing higher-quality lithium, and producing increasingly sustainable lithium to power the global energy transition.

For prospective lithium projects in Latin America and the Caribbean, our operational experience points to three critical conditions:

1. Securing continuity and regulatory stability to attract long-term capital investments;
2. Embedding environmental, social, and transparency benchmarks from the design phase;
3. Forging trust-based relationships with host communities, regulators, commercial clients, and financial backers.

Within an industry marked by commodity price volatility and stringent supply chain traceability mandates, corporate credibility becomes just as decisive as production capacity.

Question 2. Technological innovation and the Salar Futuro project

The lithium industry is undergoing a period of rapid technological transformation. From Novandino Litio's perspective, what innovations will have the greatest impact on productivity, energy efficiency, and operational sustainability over the coming years?

Global demand for lithium will continue to expand, but the central question today is not merely how much tonnage the industry can produce, but how it produces it. At Novandino, we operate one of the premier lithium reserves globally in the Salar de Atacama, employing a brine-based flowsheet that harnesses natural solar evaporation to concentrate lithium-rich brines before transporting them to our chemical complex in Antofagasta—the largest lithium refinery in the world—where we process them into battery-grade lithium carbonate and lithium hydroxide.

We are part of an industrial value chain foundational to the clean energy transition. That position carries a clear responsibility: delivering the volume and chemical specifications required for global decarbonization while systematically curtailing pressure on natural resources.

Continuous innovation has been an operational cornerstone, anchoring our long-term market leadership and advancing our primary mandate: producing more with less. In concrete terms, this means:

1. Expanding production volumes;
2. Lowering natural resource consumption intensity; and
3. Elevating our environmental performance while preserving long-term cost competitiveness.

This strategic ambition underpins our Salar Futuro project, which establishes a holistic framework for integrating emerging technologies such as membrane nanofiltration, mechanical evaporation, and direct lithium extraction (DLE), enabling industrial water recycling and the controlled reinjection of spent brines.

These technologies are not merely experimental concepts: several systems supporting Salar Futuro are already operational within our Antofagasta chemical refinery, where they were integrated into proprietary circuits to achieve the chemical purity and recovery efficiencies demanded by global tier-one battery supply chains.

In July of this year, Salar Futuro was formally submitted to the Environmental Impact Assessment System (SEIA) and is currently undergoing regulatory review. We anticipate securing environmental approval toward 2029, clearing the path for progressive project commissioning beginning in 2031.

Finally, at Novandino, technological innovation must be paired with operational flexibility: combining and adjusting distinct processing modules to align with changing market dynamics and the unique hydrogeological conditions of the Salar de Atacama. Every salt flat exhibits distinct geological, chemical, and hydrological properties; the operational capability to adapt flowsheets to those parameters constitutes, in itself, a strategic competitive advantage.

Question 3. Water and energy

Lithium extraction faces the twin challenge of reducing freshwater consumption while meeting accelerating global demand for critical minerals. From your experience, how can these objectives be reconciled, and what technological developments are most promising in achieving this balance?

Our operating experience in the Salar de Atacama proves that decoupling production growth from natural resource consumption—specifically brine extraction and freshwater use—is technically achievable. Between 2016 and 2025, we reduced continental freshwater intensity per tonne of LCE by more than 80%. Over that same timeframe, finished production expanded substantially.

This performance is the result of continuous improvements in metallurgical recovery rates, real-time process telemetry, holistic brine management, alternative chemical routes, and overall system efficiency. In fact, more than one-third of our current output is produced through these novel processing circuits.

A concrete example is the commercial production of lithium sulfate from high-sulfate brines using a proprietary, patented process engineered in and for the Salar de Atacama (with an operational capacity of 50,000 tonnes in 2025). This flowsheet enables the valorization of previously discarded salt stockpiles and historical process streams, converting them into an active feedstock for battery-grade lithium carbonate and hydroxide.

These technical milestones are reinforced by our commitment to open transparency: Novandino provides operational and environmental performance data through a publicly accessible online monitoring portal, allowing stakeholders to review key operational metrics in real time, including gross brine extraction rates and freshwater consumption.

Looking ahead, the most promising technological developments are those that complement the thermodynamic efficiencies of natural solar evaporation while providing enhanced process control, higher recovery rates, and superior resource-use efficiency.

→ The guiding operational principle is producing more lithium with less continental water, lower brine extraction intensity, and a minimized carbon footprint.

Our binding sustainability commitments include: A 50% net reduction in brine extraction by 2028 (to 822 l/s); and phasing out 100% of continental freshwater extraction by the mid-2030s.

This approach is not solely technical; it is territorial. Actively listening and responding to the priorities of local communities across the Salar de Atacama is an indispensable pillar of our sustainability governance. Transparent, ongoing dialogue with indigenous communities, respect for ancestral cultural values, and joint local value-creation initiatives have been instrumental in advancing capital innovation projects such as Salar Futuro.

Question 4. Energy planning for lithium growth

Expanding lithium output requires larger volumes of electric power. From Novandino Lito's perspective, what are the primary challenges to ensure that power sector planning, transmission buildout, and mining project pipelines advance in a synchronized manner across Latin America and the Caribbean?

Energy represents a defining input governing both the cost competitiveness and emissions profile of the lithium industry. The Salar de Atacama provides an exceptional natural advantage: the highest lithium brine grades globally paired with natural solar evaporation, allowing production at one of the lowest operational carbon intensities in the global mining sector.

However, that advantage presents an engineering trade-off: the advanced processing flowsheets that allow us to minimize water consumption and maximize lithium recovery demand significantly higher continuous electrical loads. Consequently, their net environmental dividend depends directly on securing a clean, reliable, and cost-competitive power supply. For this reason, Salar Futuro incorporates the preferential procurement of renewable electricity alongside the construction of dedicated high-voltage transmission lines.

In Chile, the rapid growth of renewable generation has established favorable conditions for deploying electrified processing routes and lowering the carbon intensity of mining assets. The forward challenge consists of ensuring that transmission grid infrastructure expands in lockstep with process innovation and productive capacity additions.

The regional challenge extends beyond adding renewable generation capacity: it requires transporting bulk power to remote operating sites and integrating transmission lines across sensitive territories where host communities, fragile ecosystems, and multiple land uses coexist. This calls for early territorial planning, multi-stakeholder participation, regulatory predictability, and public-private execution.

We have experienced this operational reality directly with our heavy-duty battery-electric haulage fleet, which transports concentrated brine between the Salar de Atacama and the Antofagasta refinery—a round trip of nearly 500 kilometers—making it the longest heavy-haul electric freight route in Chile. Navigating this demanding terrain required rigorous field testing and custom high-power charging infrastructure, proving that energy planning succeeds only when rooted in the physical realities of mine site logistics.

Question 5. The future of lithium across the region

Latin America and the Caribbean holds a major share of the world's lithium resources. From your perspective at Novandino Litio, what conditions are necessary for the region to consolidate its market leadership and strengthen its contribution to the global energy transition?

Latin America concentrates more than 50% of global lithium resources and roughly 40% of proven reserves. This provides an unrivaled geological foundation. However, geological endowment alone never guarantees long-term market leadership. The decisive factor will be our institutional capacity to transform subsoil wealth into bankable, technically viable, environmentally rigorous, and socially legitimate operations.

At Novandino, we aim to contribute to this regional agenda by leveraging the operational track record built over more than thirty years of commercial production, operating under the highest domestic and international standards:

Our Salar de Atacama asset is audited under the Initiative for Responsible Mining Assurance (IRMA), the most rigorous independent mining standard globally. To date, the Salar de Atacama remains the only lithium operation in the world to achieve the IRMA 75 level of performance. During 2026, we initiated a new independent re-audit process, reaffirming our commitment to transparent continuous improvement.

We recognize that stakeholder expectations continue to increase. Those heightened standards, alongside our corporate ambitions, drive us to continually evaluate our processes, deploy new technologies, and raise our operational benchmarks.

For the region, the opportunity consists of establishing global leadership not merely by holding critical mineral tonnage, but by proving our capacity to engineer mining and energy solutions that accelerate global decarbonization while demonstrating technical excellence in how raw materials are extracted and refined.

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5.4. The public management experience

From competition to complementarity: a regional vision of mining

Aurora Williams Baussa

former Minister of Mining
of the Republic of Chile

Question 1. Territorial dialogue and indigenous consultation: good faith as the foundation of legitimacy

Within the framework of the implementation of the National Lithium Strategy in Chile, twelve indigenous consultation processes were advanced across prioritized salt flats, eleven of which concluded successfully. What were the methodological and institutional keys to building effective dialogue with communities, and what lessons from this experience can serve as a benchmark for mining development in Latin America and the Caribbean?

The deployment of the National Lithium Strategy in Chile was based on a phased approach to participation. In an initial stage, a broad citizen consultation process was conducted across six regions to gather civil society perspectives and ensure that public policy explicitly incorporated territorial retribution and development. Subsequently, to delineate the specific areas for mining intervention, official geological data provided by Sernageomin was cross-referenced with an open market consultation conducted under strict confidentiality standards. This methodology made it possible to identify 12 priority territories with concrete private investment interest and an effective presence of indigenous communities.

Conducting the indigenous consultation processes across these twelve salt flats demonstrated that the relationship with communities cannot be conceived as a time-bound administrative procedure, but rather as a living, dynamic, and permanent process. In an extractive industry whose operational lifecycles span thirty to forty years, territorial governance demands continuous update mechanisms, given that community dynamics, local leadership, and surrounding needs evolve over the decades.

Advancing and concluding eleven consultations involved direct engagement with more than thirty communities from diverse ethnic groups, such as the Colla, Likanantai, Quechua, and Aymara. This diversity proved that relationship-building processes do not allow for homogeneous or standardized approaches, even within the same indigenous group. It is essential to understand, respect, and internalize the customs, traditions, and decision-making mechanisms specific to each territory. The pace of the process does not respond to schedules set by authorities or the market, but to the deliberative timelines of community

assemblies, where proposals must be consulted, debated internally, and resolved in accordance with their own traditional governance.

“The speed of decisions is not what you want; it is that of the consultation, it is what the territory has. At times we wanted things to move faster, but the territory told us: we are going to consult the assembly and come back.”

A decisive institutional factor lay in establishing permanent territorial teams specialized in indigenous consultation, guided by the unrestricted principle of good faith. To build and preserve trust, turnover among professionals in charge of dialogue was avoided, guaranteeing stable state interlocutors who accompanied the process from beginning to end. Under the Chilean regulatory framework, prior indigenous consultation constitutes an inescapable legal requirement for the validity of administrative acts and operating contracts. This experience confirms that social legitimacy and rigor in early agreements are the foundational and indispensable pillar for making any critical minerals project technically and legally viable.

Question 2. Shared infrastructure and interministerial coordination across territories

The expansion of lithium and copper mining demands massive investments in logistical, water, and energy infrastructure, often in remote areas where local communities face severe basic service deficits. How should the state, companies, and territories coordinate so that these projects catalyze direct improvements in access to essential services rather than deepening existing social gaps?

Modern mining development is predominantly located outside urban perimeters, in isolated geographic environments where local populations experience historical deficits in infrastructure and essential social services. Siting global-scale operations in territories with critical basic needs introduces a structural asymmetry that erodes coexistence and social legitimacy if not addressed comprehensively.

Given this complexity, governance cannot be restricted to the sectoral management of the Ministry of Mining. It requires permanent interministerial coordination with portfolios such as Public Works, Health, and Education, combining cabinet-level decision-making bodies with territorial committees led by local authorities to address urgent operational needs. Transparent dialogue with communities must not be limited to the extractive agenda; it must address the priority requirements of the surrounding environment, such as access to drinking water, ancestral water spring rights, and the reinforcement of public health infrastructure.

“It is not just any energy: it has to be sustainable energy so that the footprint allows positioning the mineral as a greener mineral that opens markets for you. If we are trying to confront climate change, it cannot be with the tools of the past”

In this framework, public-private partnerships are indispensable for accelerating solutions that the state does not always manage to deliver with the required speed. Through private sector financing and technical design of works, such as rural health clinics and drinking water treatment plants, the enabling infrastructure of mining projects becomes a public good that leverages direct territorial well-being. Indigenous consultation must be conducted strictly by the state under the principle of good faith, but the execution of multi-purpose infrastructure requires active shared responsibility between the public sector and operating companies.

“It appears extremely inequitable that you want to place a global mining activity in a territory while, on the other hand, the community lacks very basic things. You cannot just arrive in the territory to talk about what you want to talk about: you have to broaden the scope and understand that the community will raise very legitimate public service needs.”

Question 3. Interministerial coordination and grid planning to 2034

During your tenure leading the Ministry of Mining, the technical report on electricity consumption projections in mining toward 2034 was promoted. Since Mining and Energy constitute two independent ministries within the Chilean state structure, how was institutional coordination structured to plan the electric grid using these data, and what strategic value does the publication of granular energy projections for the mining sector hold for regional countries?

The institutional separation between the ministries of Mining and Energy in Chile does not imply isolated management. On the contrary, coordination between both portfolios is essential, especially considering that mining accounts for more than 30% of the country's electricity consumption. Public administration requires recognizing that no portfolio is independent of the rest and that interministerial coordination is necessary to address challenges comprehensively.

In this structure, the Chilean Copper Commission (Cochilco) plays a strategic role as a specialized agency for the mining sector. In addition to analyzing markets, prices, trends, and developments, it studies the critical inputs required by mining, including energy and water resources. In this regard, Cochilco serves as “our eyes on the market” and produces public studies that anticipate sector needs and provide information for planning and decision-making.

“Cochilco is our eyes on the market. Just as it studies prices, trends, and market developments, it also analyzes critical inputs: energy and water resource demand. It produces public studies available on its website that examine energy needs for coming years.”

Energy planning takes on particular relevance given the characteristics of Chilean mining. It is an industry with long-standing operations, where aging deposits and declining ore grades increase energy intensity. Producing an additional unit of copper can require more energy than previously produced units. This trend is observed both in large existing operations, such as Escondida with more than 35 years of operation, and in Chuquibambilla, which exceeds 100 years and transitioned from an open pit to an underground operation.

At the same time, developing new exploration and production projects creates expanding energy demand. However, it is not merely a matter of having more energy available. The energy utilized must allow for mineral traceability and contribute to reducing their environmental footprint. “It cannot be just any mining”: access to sustainable energy thus becomes a factor of competitiveness, capable of positioning Chilean minerals as lower-carbon products and broadening their market access opportunities.

This experience provides a relevant reference for countries across the region. Having mining-specific energy projections allows authorities to anticipate needs, guide investments, and align energy planning with the evolution of mining projects. In an environment of growing global mineral demand, driven by both the energy transition and emerging tech

nologies, this coordination will become increasingly strategic for regional mining development.

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Diversification, decarbonization, and mining infrastructure

Augusto Cauti Barrantes

former Vice Minister
of Mines of Peru

From a traditional mining basket toward the minerals of the future

Question 1. Diversification of Peru's mineral basket

From your perspective on the sector and public policy, how do you assess the potential to diversify Peru's mineral basket, and what regulatory and institutional conditions do you consider necessary for the country to develop new deposits competitively?

Peru has a long history of extracting minerals such as zinc, lead, tin, copper, gold, and silver. On this foundation, human and technical capabilities related to mineral discovery, exploration, and exploitation have been developed. However, its geological potential, particularly along the Andes mountain range, could be revisited through new prospecting and exploration campaigns targeted toward minerals required by the energy transition, such as lithium, nickel, cobalt, rare earth elements, and uranium.

To harness this potential, it will be necessary to generate stronger incentives for exploration investment and promote the use of new technologies capable of identifying resources even in previously explored areas. This, in turn, requires strengthening governance conditions to support these emerging technical and human capabilities.

Another challenge is optimizing the distribution of the mining canon. The proposal to move toward a “mining canon 2.0” aims to translate these fiscal revenues into tangible, visible results for communities located near operations, helping to reduce social conflict.

Diversification should also extend into downstream stages of the value chain. Rather than limiting itself to the extraction and export of concentrates, Peru could establish greater incentives and conditions to advance toward industrialization processes that enable greater local value capture.

Finally, it is necessary to strengthen a social contract with host territories through consultation and dialogue mechanisms suited to each phase of mining activity. Exploration and exploitation activities present distinct characteristics and impact levels, therefore requiring differentiated engagement mechanisms. Early, informed, and genuine dialogue, accompanied by clear and stable rules, is fundamental.

“The geological potential exists, has always existed, and remains latent for these new metals, but it requires more appropriate governance.”

Question 2. Decarbonization and competitiveness

Peru holds a substantial mining project portfolio, and mining accounts for more than a third of national electricity demand. How do you view the capacity of mining companies in Peru, and also in Latin America and the Caribbean, to accelerate their decarbonization through renewable energy contracts and electrification without compromising operational competitiveness against system costs?

Growing global mineral demand is accompanied by an increasing requirement for minerals to be produced through cleaner operations. In this process, energy and transportation play a fundamental role.

Peru has a solid generation base of hydropower and natural gas, but ample room remains to develop solar and wind resources, particularly in areas with the potential to supply mining projects. The Peruvian mining pipeline, estimated at USD 64 billion, represents an opportunity for new projects to integrate renewable energy sources from their initial design.

To advance in this direction, it will be necessary to improve competitiveness and lead times associated with permitting and environmental instruments, while structuring incentives through green funds, sovereign funds, or other competitive allocation mechanisms to mobilize capital when private appetite is insufficient.

The transition also requires reinforcing transmission infrastructure, especially because many mining operations are located in remote and isolated areas. Added to this is energy storage, which is essential to ensure reliability in a grid with higher renewable penetration. In Peru, this area still faces regulatory challenges that must be addressed to accompany the future evolution of the energy system.

Question 3. Infrastructure and productive corridors

For this upcoming mining portfolio in Peru to finally materialize, it is essential to anticipate generation assets, transmission lines, and logistical connectivity. Drawing on your industry experience, what do you consider to be the priority infrastructure investments that the state and the private sector must jointly advance to unblock the main productive corridors in Peru and across the region?

Infrastructure is a fundamental condition for Peru's mining pipeline to develop competitively. Of the approximately USD 64 billion in identified projects, around 70% corresponds to minerals such as copper, whose demand could require nearly doubling over the coming decades.

Priority investments encompass energy, water, transport, and communications. In water management, it is necessary to build storage and dam infrastructure, promote water reuse, and strengthen oversight to safeguard the quality of resources shared by mining and other productive activities, such as agriculture.

In transport, many operations are located in mountainous areas far from maritime ports. Therefore, improving road networks and assessing rail solutions to transport minerals more competitively is key. Simultaneously, ports require expansions and upgraded capacity to connect production with international markets.

These investments are not necessarily part of the core mining business and therefore demand coordinated action between the state and the private sector. Long-term planning must anticipate project requirements and create the conditions for infrastructure investments to support their execution.

In this regard, public-private coordination, appropriate incentives, and regulatory stability and clarity are fundamental elements to convert the project pipeline into concrete capital investments.

“Coordination and planning are key.”

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5.5. The knowledge of international organizations and consultancies

Critical minerals, value chains, and regional cooperation

Anis Nassar

Head of Critical Minerals at the
World Economic Forum (WEF)



Question 1. Value chains, processing, and regional competitiveness

Latin America and the Caribbean holds a leadership position in critical minerals such as copper and lithium; however, possessing the geological resource does not automatically guarantee greater development. From the global perspective of the WEF, what conditions does the region require to advance in value addition (processing, technology, services, and manufacturing) while maintaining international competitiveness?

Latin America and the Caribbean faces a historic opportunity in the face of accelerating global demand for strategic minerals destined for energy transition technologies, advanced manufacturing, and high-tech applications. The region constitutes a mining powerhouse, with economies such as Chile and Peru at the forefront of extraction technologies. Nevertheless, the global imperative to diversify supply is not limited to extraction, but points critically toward refining and chemical processing stages.

Currently, the regional landscape is heterogeneous: while in lithium approximately 80% of extracted output undergoes local processing and chemical transformation, in copper the level of domestic processing sits significantly below 30%. Decades ago, the region processed and smelted between 60% and 80% of its production, but the deployment of massive industrial capacity from Asia profoundly altered the economic conditions of the global market.

To reverse this asymmetry and make local processing economically viable, regional collaboration is the primary structural enabler. No single country can sustain the entire productive chain in isolation; broad industrial ecosystems must be formed to guarantee a secure, continuous supply of competitive energy and mineral concentrates. Rather than engaging in zero-sum competition among neighboring countries, the region must design innovative financial instruments and integrate industrial capabilities.

“The diversification the world demands today, is not only at the extraction stage, but also in refining and processing. For the economic equation to work, regional collaboration is one of the essential levers: large industrial ecosystems are needed that collaborate rather than compete.”

Question 2. Attracting investment and long-term enabling conditions

The development of mining projects requires massive capital investments, long gestation horizons, and legal certainty in the face of rapidly expanding global demand. Based on the global work of the WEF, what are the key conditions that regional countries must establish to attract long-term investment and ensure sustainable, competitive projects?

In international capital markets, a sustained trend shows foreign direct investment concentrating predominantly in megaprojects exceeding one billion dollars, which account for more than 60% of major investment flows. This concentration highlights a pronounced appetite within the international community to finance large-scale assets, provided that operating environments structurally mitigate execution risks.

The financial viability of these capital investments does not depend exclusively on the quality of the mineral deposit or the corporate operator. It depends on a robust enabling environment that guarantees timely access to critical infrastructure: clean energy matrices, water treatment and supply systems, and cross-border logistics platforms.

To mobilize capital at scale across processing and refining links, scale and interregional collaboration are decisive. World-scale mining projects demand blended finance structures and public-private partnerships that share pre-competitive risks. Predictable rules of the game and integrated planning across the industrial ecosystem are the conditions that ultimately tip the balance toward a favorable final investment decision in the region.

“ The international community’s interest in investing in megaprojects is present, but the economic viability of those initiatives does not depend solely on the mine, but on the entire enabling environment: energy availability, water infrastructure, and greater regional collaboration to provide the required scale.”

Question 3. Integrated energy planning, corridors, and decarbonization

As mining output expands and pursues lower emissions, it demands higher electrical power and transmission grid capacity. What are the most effective mechanisms to coordinate the mining portfolio with energy planning and ensure that grid capacity is available on time without slowing the clean electrification of the sector?

Mining maintains a tight interdependence with the energy sector: it is simultaneously the supplier of minerals indispensable for decarbonization technologies and an electro-intensive user absorbing roughly 9% of regional energy demand. In Andean productive chains, where deposits are sited in high-altitude, difficult-to-access terrains, the availability of firm power and transmission capacity directly determines whether a project is viable or financially infeasible.

Faced with this challenge, continuous coordination between mining authorities and energy ministries is critical. Planning under an approach of clusters and infrastructure corridors makes it possible to anticipate nodes where demand will concentrate, deploying transmission and transport networks that cross administrative boundaries.

Regional experience demonstrates that frameworks such as the Capricorn Bioceanic Corridor optimize mineral transport costs by approximately 35%, while simultaneously generating direct benefits for other industries and local communities. Sharing high-voltage transmission lines, highway networks, and logistics platforms distributes capital expenditure and accelerates the electrification of mine operations, ensuring that new assets do not remain locked into residual fossil fuel consumption.

“The provision of power and transmission in remote operations can determine whether a project is viable or not. It is crucial to conceive integrated mining and energy corridors under long-term planning: when you share energy, roads, and infrastructure, you optimize resources and the benefit extends across the entire economy.”

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Mining and energy as engines of regional integration and development

Juan Carlos Guajardo

Founder and Executive Director
of Plusmining

PLUSmining

Question 1. Development lead times and conditions for mining investment

Mining projects in Latin America face development processes that can extend for more than a decade. What explains these timeframes, and what conditions should be modified to accelerate the commissioning of new projects?

Large-scale mining projects require capital investments of several billion dollars and pass through multiple study stages designed to ensure that risks are controlled. Due to their inherent complexity, these are processes that take several years.

Added to this complexity are challenges that have deepened across Latin America, particularly regarding environmental permitting and relationships with local communities and indigenous peoples.

Nevertheless, positive signals are evident. Across the countries of the region, there is growing awareness that minerals represent an exceptional economic opportunity. The energy transition, technological change, artificial intelligence, and structural transformations in the global economy are reshaping demand and placing minerals at the core of the geopolitical agenda.

This juncture can open a new investment cycle, provided that countries succeed in improving the regulatory, environmental, and social conditions that govern development lead times.

“There has not been an opportunity like this in more than a century, where mineral resources become a central component of global economic development.”

Question 2. Energy as a strategic factor for mining

Without mining there is no energy transition, but neither is there mining without energy. How do you assess the importance of energy planning for the development of new mining projects, and what opportunities exist to advance toward shared solutions?

Energy is a central component of the mining production process. The extraction and processing of ore require materials movement, comminution, and other highly energy-intensive processes. Furthermore, the growing demand for minerals will require the exploitation of lower-grade resources, which will increase processing requirements and, therefore, energy demand.

“Mining and energy are part of the same process.”

This reality makes it essential to anticipate where the main energy requirements will be located and what opportunities exist to develop shared infrastructure or mining-energy corridors. This requires granular information on the location, intensity, and trajectory of demand.

At the same time, the mining industry is beginning to explore new business models. Facing rising capital costs and project execution complexity, operating companies seek to transfer portions of infrastructure development to specialized third parties, preserving their capital for the core mining business.

This process can foster greater diversification and sophistication across the mining-energy ecosystem, opening new spaces for power utilities, technology suppliers, and shared-use infrastructure.

“Without energy there is no mining. Energy has been, is, and will continue to be increasingly important.”

Question 3. Regional integration and Latin America's competitive advantages

Can this transformation become an opportunity for regional development? Where do you see Latin America's primary competitive advantages and the potential to move toward deeper integration?

Regional integration can serve as a catalyst to accelerate development processes. In the face of increasingly complex projects and the imperative to compress timelines, cross-border cooperation can enable the sharing of infrastructure, capabilities, and knowledge.

The case of Argentina and Chile is illustrative. A significant portion of Argentina's mining portfolio is located in close proximity to the border with Chile, opening an active debate on connectivity routes to international markets: either across the Atlantic or through deeper integration with the Pacific and Chilean port and rail infrastructure.

The question is not merely where to produce, but how to build the most efficient infrastructure and value chains to develop those resources.

This integration can also expand economic opportunities beyond extraction. The technological, financial, and commercial sophistication of mining activity generates value chains capable of driving new domestic industries and technical services.

Latin America also possesses mineral potential far broader than the current concentration in copper and lithium. Gold, silver, zinc, iron ore, and other minerals have a substantial footprint across the region, while rare earth elements could unlock a new industrial frontier linked to magnet-based technologies.

“On many occasions, integration and cooperation provide a path that compresses time.”

Capitalizing on this opportunity requires moving past a fragmented perspective and advancing toward closer coordination among public entities, private corporations, and international organizations. The magnitude of these challenges demands aggregating capabilities and engineering collective solutions

“We should not look for messianic leaders. This is built by bringing actors together.”

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Mining, water, and energy as a single system: Clear rules and planning for the transition

Ana Carolina González Espinosa

Ana Carolina González Espinosa,
Latin America Director and Senior Program Director
at the Natural Resource Governance Institute (NRGI)



Question 1. Territorial governance and value addition

In a context of growing global demand for copper, lithium, and other critical minerals, what do you consider to be the main governance gaps currently facing Latin America and the Caribbean in developing these resources responsibly? Where do you see the greatest opportunities for improvement?

The existence of natural resources alone does not guarantee socioeconomic development; the decisive factor lies in the governance that determines where and how extraction takes place, under what rules, and toward what destination the revenues are directed. In Latin America and the Caribbean, the first major gap lies in early territorial planning and land-use zoning. It is essential to agree with local communities and indigenous peoples on suitable zones and exclusion areas, preventing the extractive frontier from expanding into fragile ecosystems or salt flats facing severe water stress, since addressing the climate crisis cannot come at the expense of biodiversity.

The second structural gap corresponds to the effective distribution of generated benefits. The region cannot continue to be confined to its historical role as a raw-material provider without local transformation; it requires industrial policies aimed at creating supplier ecosystems, transferring technology, and diversifying mining economies. Furthermore, this dividend must be directly felt within producing territories through tangible mechanisms for economic participation, employment, and public services, overcoming the traditional shortcomings of royalty regimes.

The main opportunity for improvement lies in transforming two decades of lessons learned in public participation and prior consultation into an articulated regional standard. In the face of an international market establishing new rules for traceability and sustainability in clean energy supply chains, countries must avoid a race to the bottom in regulatory requirements and present their own technical and strategic position at global negotiating tables.

“Mining or the existence of natural resources alone does not bring development (...). What brings development are the decisions made around mining: where it is extracted, how it is extracted, who defines those rules, and how the revenues are used.”

Question 2. Institutional capacity, lead times, and socio-environmental standards

The region needs to accelerate the development of new mining projects, but also strengthen its environmental and social standards. Based on NRGi's experience, what institutional and regulatory changes could help improve project lead times and predictability without weakening environmental protection mechanisms and community participation?

Accelerating capital investment and strengthening socio-environmental standards are not conflicting goals; what delays projects is not environmental rigor, but the lack of clear rules and the weakness of state technical capacities to resolve administrative filings. The answer is not deregulation, but technically reinforcing regulatory and oversight agencies, equipping them with concrete risk-mitigation instruments—such as mandatory financial guarantees, environmental insurance, and mine closure funds—that provide certainty to local populations and financial predictability to operating companies.

“In resolving global warming, we cannot end up affecting another pillar that sustains life on the planet: biodiversity.”

Furthermore, closing the implementation gap between legal frameworks and their actual enforcement is essential, complementing territorial planning with high levels of transparency. Publishing environmental impact assessments and mitigation plans in full is vital to reduce administrative discretion and prevent corruption networks in concession awards, keeping regulatory decisions from becoming vulnerable to litigation, social mobilization, or undue interference.

Finally, regulatory frameworks must move beyond treating public consultation and citizen participation as a mere initial administrative formality. Dialogue must occur early and be maintained throughout the entire project lifecycle through tools such as participatory environmental monitoring and the co-management of territorial agreements. For these commitments to remain sustainable over time, a permanent state presence in the territory is required to ensure compliance and prevent future conflict.

“Developing new mining projects and strengthening socio-environmental standards are not two opposing things; they go hand in hand. What ultimately delays a project is not environmental requirements, but the lack of clarity in the rules of the game.”

Question 3. Integration and mining-energy governance

The expansion of critical minerals mining also entails greater generation, transmission, and energy infrastructure requirements. How should sectoral governance evolve so that decisions regarding mining development and energy planning are better coordinated? What risks emerge when both processes proceed in silos?

It is imperative to transition toward integrated governance where mining, energy, and water are understood as a single system. The global energy transition demands critical minerals, but extracting and processing them requires increasing volumes of electricity and seawater desalination, demanding higher firm capacity per unit of output due to declining ore grades.

“Water, energy, and territory are already meeting at the same table. What is missing is for them to meet earlier during planning, rather than later in court.”

Planning these areas in isolation creates two severe risks. On the territorial front, mining operations can enter into direct competition with communities and agricultural activities for essential resources, deepening socio-environmental tensions and development contradictions in areas with basic service deficits. On the climate front, a lack of coordination slows sectoral decarbonization and increases the carbon footprint of downstream stages such as smelting, precisely where the region seeks to add local value.

To avoid transmission bottlenecks and emergency reliance on fossil fuels, mining development plans and transmission expansion programs must intersect on a binding basis across all levels of government. When this coordination takes place early, mining acts as a strategic investment anchor to deploy electric grids and renewable energy assets that expand access and lower energy costs for local communities.

“We have to start conceiving mining-energy governance rather than two separate governances (...); water, energy, and mining are a single system and not three different files.”

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Territorial governance, shared value, and mining-energy integration



Mario Huapaya

Andean Linked
Engagement, ALE



Mario Picón

Governance Action
Hub, GAH

Question 1. Critical minerals and regional positioning

Today we see very strong global competition for access to copper, lithium, and other critical minerals for the energy transition. Faced with this scenario, what institutional capabilities and public policy agreements does Latin America and the Caribbean need to consolidate in order to strengthen its position in global value chains and actively participate in the decisions that will define the future of these markets?

Latin America has widely recognized mining potential, which today translates into concrete lithium, copper, and nickel projects. Added to this is a growing advantage: the conditions for producing these minerals are increasingly favorable due to the relatively clean composition of the regional energy matrix and its vast renewable potential.

However, the challenge should not be limited to how much mineral volume the region can produce and export. The central question is what position Latin America wants to occupy in the new economy and how it can capture greater value from its resources.

“We have to focus as a region on what position we want to occupy in this new economy.”

To move in that direction, Huapaya identifies four priority capabilities: having clear and legitimized mining, energy, and industrial policies; accelerating the execution of critical mineral projects and associated infrastructure; expanding access to knowledge so that citizens and non-technical stakeholders can understand and seize opportunities; and strengthening regional coordination to move from agreements expressed in forums to concrete joint projects.

From a governance perspective, Picón argues that the region also faces an opportunity to overhaul traditional ways of managing natural resources. The accumulated issues of conflict, distrust, and transactional relationships make it necessary to build new models centered on the development of territories and the people who live in them.

International experience shows, moreover, that reaching agreements does not depend exclusively on governments. Coordination among companies, civil society, and communities can generate new counterweights and points of convergence to define more sustainable development models.

Question 2. Governance and territorial development

On-the-ground experience shows that dialogue tables among companies, governments, and communities often fail to translate into concrete development improvements. Drawing from the work of ALE and GAH in the region, what conditions are necessary to move from dialogue forums to effective joint implementation mechanisms that generate sustainable benefits for territories?

Dialogue has lost legitimacy in some territories because it was historically used to stall conflicts, de-escalate violent situations, or postpone decisions. In response, the proposal is to change its function:

“We must place dialogue as a tool and not as an end.”

This implies abandoning a purely transactional logic and defining concrete objectives that allow collective action to be organized. Instead of abstract agreements on comprehensive development plans, the proposal is to define verifiable priorities, establish goals and instruments to execute them, and respect the decisions and priorities of the territory.

Picón adds that these processes must be designed with durability in mind. Governance cannot depend exclusively on a single authority, public official, or business leader, but must distribute leadership among government, companies, and civil society.

“More leadership, fewer leaders.”

To achieve this, he identifies three necessary transformations: moving toward co-design and co-ownership from the outset, involving traditional authorities and local actors in decision-making and implementation; overcoming paternalism, preventing the company from substituting for the state and instead promoting the strengthening of local governance; and adopting adaptive management capable of guiding shared decisions in complex and uncertain contexts.

“Governance is not an organizational chart: it is actually a living process, capable of guiding shared decisions in complex and uncertain contexts.”

Question 3. Integration across mining, energy, and territorial development

The development of new mining projects requires energy and connectivity infrastructure that, in many cases, must be deployed in territories far from major urban centers. How can coordinated planning between the mining and energy sectors contribute not only to guaranteeing the necessary supply for projects, but also to expanding access to infrastructure and services for communities and productive activities in these territories?

One of the main challenges identified is the disconnection between national energy planning and subnational territorial development instruments. When projects arrive in the territory, they often run up against concerted development plans, catchment-basin dynamics, and productive vocations that were never considered during their system design.

Faced with this gap, the authors emphasize the need to align energy planning with local strategies and existing value chains, strengthen the technical capacities of municipal and corporate teams, and institutionalize multi-stakeholder spaces that allow moving from diagnosis to implementation and monitoring.

Regional experience shows that a lack of coordination can also generate competition between projects and activities that depend on the same resources. The new context requires, instead, integrating mining, energy, and territory.

Infrastructure must cease to be conceived exclusively as an enabler of the mining operation and become an opportunity for territorial development.

“Infrastructure cannot be developed only for the mine; it has to serve the territory first and the mine second, because the mine is part of the territory.”

In this sense, the coordination among mining, electricity, and territory is key to preventing investments from developing in isolation and transforming project-associated infrastructure into an enabler of local capabilities, services, and productive activity.

Latin America must not only decide how much mineral volume to produce, but also what position it wants to occupy in the new economy, how to govern transformation processes, and how to ensure that investments in mining and energy translate into tangible development for territories.

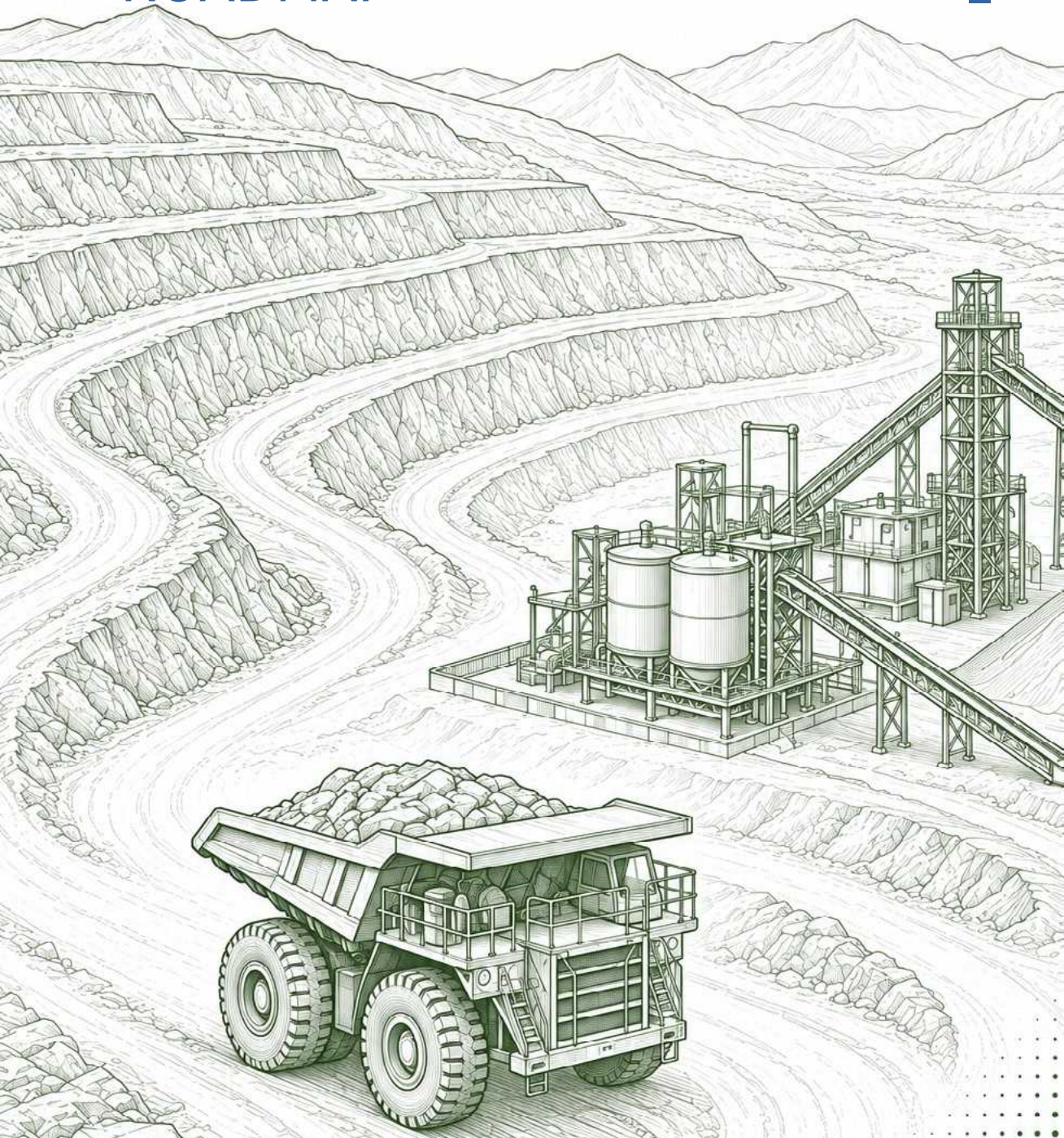
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CHAPTER 6

TOWARDS A REGIONAL ROADMAP



6.1. A shared vision for the region

Latin America and the Caribbean stands before a strategic opportunity: transforming its critical minerals endowment and its energy capabilities into a platform for productive development, investment, and value creation for the coming decades. The global energy transition opens a window of opportunity that, given the scale and diversity of its resources, the region is uniquely positioned to seize.

However, this opportunity will not materialize solely from resource availability. It will require a long-term vision capable of articulating mining development with energy planning, infrastructure, innovation, and territorial development. The competitiveness of new projects will increasingly depend on the ability to anticipate these needs and generate conditions that enable their development in an efficient, sustainable, and predictable manner.

In this context, building a regional agenda should rest on five principles: integrated planning, adequate investment conditions, enabling infrastructure development, greater local value creation across territories, and regional integration. These principles do not imply homogenizing the national mining policies of individual countries, but rather identifying areas where coordination can generate capabilities and advantages that no single country could achieve on its own.

Coordination among governments, companies, international organizations, financial institutions, communities, and knowledge centers will be essential to translate this opportunity into concrete outcomes. A shared vision for regional mining ultimately means transitioning from a perspective centered exclusively on resource extraction to a comprehensive strategy that integrates minerals, energy, infrastructure, investment, innovation, and sustainable development.

6.2. Action priorities

The analysis developed throughout this White Paper demonstrates that Latin America and the Caribbean holds a privileged position to participate in the expansion of global critical mineral demand. However, the availability of geological resources is not sufficient to transform this opportunity into executed, competitive, and sustainable projects. The primary task for the coming decade will be to strengthen the conditions that connect mineral resources, energy, infrastructure, investment, productive capacities, and territorial development.

Based on the main findings of this report, five cross-cutting priorities can be identified to guide public and private action:

1. Strengthen integrated planning across mining, energy, and infrastructure

The expansion of mining activity and the expansion of energy systems follow long-term investment cycles that must be coordinated well in advance. The projected growth in mining electricity demand—estimated at 51% toward 2034 for the region as a whole—makes it especially critical to anticipate where, when, and by how much new loads will grow.

Therefore, mining, energy, and infrastructure planning processes should incorporate permanent mechanisms for information exchange and scenario updates. Mining project portfolios should be factored into generation and transmission planning, while the future availability of energy and infrastructure should be integrated into the evaluation of new projects from an early stage.

This coordination must also extend to water, transport, and logistics. Planning these components jointly would make it possible to identify bottlenecks before they become constraints on investment, while directing resources toward territories where they can generate greater economic and social dividends.

2. Establish regulatory and institutional conditions that enable project execution

The region does not merely face the challenge of attracting capital; it must create the conditions for investments to materialize within reasonable timeframes. The analyzed track record shows that the existence of regulatory frameworks does not, by itself, guarantee adequate implementation capacity. Institutional capacity gaps, lack of inter-agency coordination, and uncertainty regarding permitting timelines can elevate project risks and cause delays.

The priority should not be lowering environmental or social standards, but improving the state's capacity to enforce them efficiently, transparently, and predictably. This requires strengthening the technical capabilities of public bodies, simplifying administrative procedures where feasible, establishing clear institutional mandates, and improving public data availability.

Greater regulatory predictability should also be complemented by territorial planning mechanisms and early stakeholder engagement. Embedding environmental, social, and territorial dimensions from initial stages can reduce downstream disputes and build more stable conditions for capital deployment.

3. Anticipate and mobilize enabling infrastructure

Infrastructure must cease to be treated exclusively as an ex-post consequence of mining development and become an integral part of its upfront planning. Access to electricity, transmission lines, water, roads, railways, ports, and digital connectivity can determine the commercial viability of a project, particularly in territories distant from major industrial hubs. This White Paper shows that forward planning makes it possible to identify opportunities for shared-use infrastructure, mitigating capital costs and risks across multiple projects.

A priority line of action consists of formulating master plans for mining districts and corridors that integrate diverse infrastructure needs. These master plans should be built upon aggregated project pipelines and joint demand projections, rather than responding exclusively to isolated, individual initiatives.

Where viable, multi-user solutions—such as shared transmission circuits, water conveyance systems, logistics corridors, port terminals, or industrial utilities—can distribute capital costs, capture economies of scale, and extend benefits to other productive sectors and neighboring host communities.

4. Facilitate investment, innovation, and capacity development

The magnitude of investment required to develop new mining projects and their associated infrastructure demands combining diverse financing sources and mitigating risks during early development stages. Access to multilateral development financing, blended finance instruments, public-private partnerships, and long-term contracting mechanisms can enhance the bankability of strategic projects.

At the same time, future competitiveness will depend on the capacity to integrate technology, digitalization, automation, and environmental and energy efficiency solutions. Innovation must be tied directly to the concrete operational requirements of mine sites and to the development of regional supplier networks.

This requires reinforcing the training of specialized technical and professional human capital, promoting collaboration among corporations, universities, and research centers, and facilitating cross-border knowledge transfer. Building local capabilities will not only meet the employment demands of the next generation of mining, but will also enable the transition toward higher value-added activities.

5. Turn sustainability and regional integration into competitive advantages

Sustainability must be integrated as a central pillar of mining competitiveness. Latin America and the Caribbean commands a distinct structural advantage: approximately 70% of its electricity generation originates from renewable sources, providing a favorable platform to lower the emissions intensity of mining operations. However, this advantage depends on ensuring adequate generation, transmission, and connection capacity to accompany demand growth.

Action must therefore be oriented toward leveraging the complementarities between mineral and energy resources, promoting electrification, renewable energy uptake, resource-use efficiency, and responsible water and land stewardship. Sustainability must be understood simultaneously as an environmental imperative, an operational efficiency driver, and a decisive factor for market access and green financing.

Finally, many of these priorities exceed the unilateral scope of any single nation. The region can unlock greater value through data exchange, methodological harmonization, technical cooperation, cross-border infrastructure deployment, and the articulation of regional value chains. Regional integration does not entail standardizing sovereign national policies, but capitalizing on existing and complementary capabilities.

Together, these priorities point toward a single objective: transitioning from a region that holds strategic mineral reserves to a region that commands the effective capability to develop them. This requires anticipating energy and infrastructure needs, strengthening public institutions, mobilizing capital, developing technical talent, and embedding sustainability and regional integration from the outset. Upon these enabling foundations, a regional roadmap can be constructed to transform Latin America and the Caribbean's geological endowment into an enduring competitive advantage.

6.3. Regional cooperation and integration

In collaboration with the  **WORLD
ECONOMIC
FORUM**

The opportunity presented by the surge in global demand for critical minerals extends well beyond each country's individual capacity to develop its own resources. As value chains become increasingly complex and capital, infrastructure, technology, and workforce requirements intensify, regional scale assumes a decisive role.

Latin America and the Caribbean possesses differentiated geological endowments, comparative advantages in renewable energy matrices, diverse industrial capabilities, and an extensive network of commercial and institutional ties. The strategic imperative lies in connecting these assets. Regional integration prevents countries from having to replicate every link of the value chain in isolation, enabling specialization, the pooling of complementary strengths, and participation in larger, more competitive productive ecosystems.

Advancing Latin America's critical minerals potential for energy and development

This perspective demands a shift from zero-sum competition for foreign direct investment toward a regional complementarity model, wherein geological reserves, enabling infrastructure, supplier ecosystems, technical knowledge, financing mechanisms, and end-markets are articulated across national borders. Regional cooperation does not require all economies to target identical segments of global value chains; instead, it allows each country to deepen activities where it holds distinct comparative advantages while establishing cross-border synergies.

Within this framework, the World Economic Forum (WEF) advanced a dedicated agenda to examine how Latin America can transform its mineral resource base into greater domestic value creation, energy transition opportunities, and long-term sustainable development. Through the Securing Minerals for Energy and Technologies (SMET) initiative and the Advancing Latin America's Minerals Potential for Energy and Development workstream, the Forum convened regional public and private stakeholders to define actionable priorities and implementation frameworks. The community identified six focus areas where coordinated action can help unlock this potential: infrastructure; technology and innovation; financing; policy; social impact; and talent, with greater regional collaboration as a key enabler. Together, these areas provide a practical framework for moving from national approaches towards a more connected regional minerals ecosystem.

A stronger case for regional collaboration

Geopolitical competition, accelerating clean-energy deployment and growing demand for resilient supply chains are increasing interest in diversified sources of critical minerals and new investment destinations. Latin America is therefore gaining importance as a critical minerals partner, creating an opportunity to attract long-term investment and strengthen the region's position in global value chains. Capturing that opportunity, however, will depend not only on resource availability but also on the region's ability to connect resources, infrastructure, suppliers, talent, technology and investment.

Regional cooperation does not require every country to pursue the same position in the value chain. Countries can instead specialize according to their comparative advantages and the value pool associated with each mineral. Some may generate the greatest value by improving upstream productivity and strengthening supplier ecosystems; others may be better positioned to expand processing, technology or manufacturing. A regional approach can connect these differentiated strategies, enabling countries to participate in broader clusters rather than compete on identical activities.

Regional clusters can connect complementary strengths

Cluster-based development can provide the scale and connectivity needed to move beyond isolated national strategies. Integrated clusters can link mining and processing with infrastructure, supplier networks, technology, skills, customers and policy support. This can allow different countries and subregions to contribute complementary capabilities while benefiting from a larger regional ecosystem. The illustrative clusters in the map below show how mineral endowments across Latin America could be connected geographically and by commodity, including an Argentina–Bolivia–Chile lithium triangle cluster, a Brazilian magnets industrial cluster and a Chile–Peru–Andean copper cluster.

Existing mechanisms provide a foundation

Latin America is not starting from zero. Bilateral agreements and intergovernmental forums already provide mechanisms for policy alignment and cross-border coordination. The Chile–Argentina Mining Integration and Complementation Treaty, for example, establishes a framework for cross-border mining activity, while the Vicuña District along the Argentina–Chile border illustrates the type of mineral opportunity such arrangements can support. At the regional level, the Conference of Mining Ministries of the Americas (CAMMA) brings policy-makers together around shared mining priorities.

The opportunity is to translate these mechanisms into more implementation-oriented cooperation. Regional geological data can improve resource mapping and reduce information gaps. Shared or multi-user infrastructure can improve asset utilization and reduce capital burdens. Cross-border logistics corridors can connect inland mineral resources with processing facilities and ports. Regional innovation platforms can pool research and develop

ment, link suppliers with mining companies and support technology pilots across multiple markets. Used together, these mechanisms can connect national strategies to regional value-chain opportunities and help move collaboration from dialogue to delivery.

Priorities for a regional roadmap

A regional roadmap should focus on the practical enablers that make cross-border value chains viable. Infrastructure coordination can reduce logistics costs and better connect extraction with processing and export gateways, while safeguarding protected and biodiversity-sensitive areas. Technology and innovation cooperation can accelerate the testing, validation and commercial deployment of solutions that improve productivity, sustainability and resource efficiency. Financing mechanisms—including multilateral and development finance, blended finance, long-term offtake arrangements and public-private partnerships—can help de-risk projects and mobilize long-term capital.

Policy cooperation is equally important. Greater regulatory clarity, more harmonized customs and transport procedures, and improved access to geological data can reduce uncertainty and delays. Bilateral agreements and regional forums can help governments, companies, financiers and regional organizations align priorities, identify bottlenecks and sequence implementation, but they need to be paired with concrete policy action. Regional strategies should also embed environmental and social considerations from the outset to protect the social license to operate and reduce project risk. Finally, regional skills initiatives focused on technical and digital capabilities can help close talent gaps, strengthen workforce resilience and broaden participation across the minerals value chain.

Taken together, these priorities suggest that Latin America's opportunity lies less in replicating complete value chains within every country than in building a connected regional ecosystem. By combining specialization with shared infrastructure, innovation, financing, policy coordination, strong environmental and social performance, and workforce development, regional cooperation can strengthen competitiveness and support greater long-term value generation from the region's mineral resources.

6.4. Roadmap for competitive and sustainable mining

The preceding chapters demonstrate that Latin America and the Caribbean starts from a strategic position in the transformation of the global economy. The region possesses significant resources of critical minerals, an electric matrix with a high share of renewable sources, and a mining project portfolio capable of accompanying the growth of international demand. However, these assets do not automatically translate into competitiveness.

The next generation of mining projects must develop in a context characterized by higher energy, infrastructure, and financing requirements, alongside growing environmental, technological, and social demands. In this scenario, the ability to anticipate needs, coordinate investments, and generate adequate conditions for project execution will be just as decisive as the availability of geological resources.

The roadmap proposed by this White Paper therefore starts from a central premise: the opportunity for Latin America and the Caribbean consists of transforming its geological advantage into a regional competitive advantage. To this end, it is necessary to advance from an approach centered primarily on resource availability toward a strategy that integrates planning, infrastructure, investment, innovation, sustainability, and regional cooperation.

Six priorities for action

1. Integrate mining and energy planning

The expansion of mining activity and the development of energy systems respond to long-term investment decisions and require planning horizons that, in many cases, overlap. The experience analyzed in this White Paper shows that mismatches between both processes can become a constraint on the commercial startup of new projects.

The first priority therefore consists of systematically incorporating the evolution of the mining portfolio into long-term energy planning processes.

This implies strengthening information-exchange mechanisms among ministries and agencies of mining and energy, planning bodies, power system operators, and project developers. It also entails incorporating mining demand growth scenarios into generation and transmission expansion decisions and establishing mechanisms that allow for periodic projection updates as projects advance through their different stages of maturity.

Greater integration would make it possible to anticipate where, when, and by how much electricity demand will grow, and to guide the investments needed to accompany mining development with greater efficiency.

2. Accelerate the development of enabling infrastructure

The competitiveness of a mining project does not depend exclusively on its productive capacity. Timely access to electricity, transmission grids, water, transport, ports, and logistics services constitutes a necessary condition for transforming a geological opportunity into an effective investment.

The second priority consists of anticipating and coordinating the development of the infrastructure needed to accompany new hubs of mining activity.

This requires early identification of the corridors and territories where new investments will converge, as well as evaluating multi-user infrastructure solutions when economic and territorial conditions permit. It is also necessary to strengthen coordination among energy infrastructure, transport, and logistics, avoiding situations where the expansion of one component becomes a bottleneck for the others.

In cases where projects cross national borders, planning must also incorporate a regional perspective that allows for the identification of interconnection opportunities, logistics corridors, and shared infrastructure.

3. Improve conditions for investment and project execution

The availability of mineral resources does not, by itself, guarantee that projects will ultimately be built. The scale of required investments, long development periods, and the need to coordinate multiple stakeholders make predictability and execution capacity central factors of competitiveness.

The third priority consists of strengthening the institutional, regulatory, and financial conditions that allow potential projects to be transformed into effectively executable investments.

This entails advancing toward predictable regulatory frameworks, efficient permitting processes, and greater coordination among public bodies. It also implies improving the availability and quality of information regarding projects, infrastructure, and energy demand, reducing information asymmetries and facilitating the evaluation of long-term investments.

At the same time, it will be necessary to expand and diversify available financing mechanisms, including public, private, and multilateral instruments capable of adequately distributing the risks associated with infrastructure and mining projects.

Regional competitiveness will depend, in this sense, not only on attracting capital, but on creating the conditions that allow that capital to be transformed into projects executed on time and in proper form.

4. Transform the geological advantage into greater regional value

Latin America and the Caribbean has an exceptional endowment of strategic mineral resources. However, extraction constitutes only one stage of the value chains associated with these resources.

The fourth priority consists of developing productive, technological, and corporate capabilities that allow for capturing a larger share of the value generated by strategic minerals.

This does not mean that every country must reproduce an entire value chain. On the contrary, regional cooperation can enable countries to develop those activities in which they possess greater comparative advantages and connect those capabilities within broader regional chains.

Strengthening mining suppliers, processing and refining capacities, technological innovation, and specialized cluster development can help generate new areas of economic activity and employment, while reinforcing the region's standing in global supply chains.

The priority, therefore, is not merely to produce more minerals, but to build the capabilities needed to convert that production into greater economic and technological value for the region.

5. Incorporate sustainability and innovation as competitiveness factors

The energy transition is also reshaping the conditions under which mining projects are developed and financed. Emissions reduction, resource-use efficiency, water management, ecosystem protection, and community relations take on growing importance for investment viability.

The fifth priority consists of integrating sustainability and innovation from the early stages of project development, rather than treating them exclusively as ex-post requirements.

Process electrification, renewable energy integration, energy efficiency, digitalization, automation, and the development of new technologies can simultaneously contribute to reducing impacts and improving productivity. Similarly, sound environmental and territorial management can mitigate risks, reinforce project legitimacy, and improve access to markets and financing sources.

In this sense, sustainability ceases to be a separate component of mining strategy and becomes a long-term condition for competitiveness.

6. Deepen regional cooperation and integration

The challenges identified in this White Paper frequently cross national borders. Critical mineral supply chains are international; energy infrastructure can connect multiple countries; and technological, financial, and productive capabilities can complement one another across different markets.

The sixth priority consists of strengthening regional cooperation mechanisms that allow for taking advantage of these complementarities.

Cooperation does not require all countries to adopt the same policies or develop identical activities. On the contrary, greater coordination can enable capacity specialization, infrastructure sharing, information exchange, cross-border project development, and the creation of regional innovation and financing mechanisms.

In this framework, regional dialogue and planning bodies provide a foundation upon which to advance toward implementation-oriented initiatives. Information exchange, technical cooperation, methodological harmonization, and the development of infrastructure and integration projects can contribute to building a more connected and resilient regional mining-energy ecosystem.

Regional Roadmap

 Strategic Axis	 Action Priorities	 Time Horizon	 Expected Outcome
 Integrated Planning	Incorporate mining into long-term energy planning and strengthen information exchange across sectors.	Short to medium term	Greater alignment between mining development and energy expansion.
 Enabling Infrastructure	Anticipate investments in generation, transmission, transport, water, and logistics associated with new mining hubs.	Short to medium term	Reduced bottlenecks, connection times, and infrastructure risks.
 Investment and Execution	Improve regulatory, institutional, and financial conditions for long-term projects.	Short to medium term	Greater execution capacity and investment attraction.
 Value Chains	Strengthen processing, suppliers, technology, and clusters in line with each country's comparative advantages.	Medium to long term	Greater capture of economic and technological value in the region.
 Sustainability and Innovation	Accelerate electrification, renewable integration, efficiency, digitalization, water management, and technological development.	Medium to long term	Higher productivity, lower carbon intensity, and greater project resilience.
 Cooperation and Regional Integration	Coordinate information, infrastructure, capabilities, innovation, and supply chains among countries.	Ongoing	Greater complementarity, resilience, and regional integration.

Table 11: Regional roadmap

Source: Authors' own elaboration based on the main findings and proposals developed in this White Paper.

From a geological advantage to a regional competitive advantage

The proposed roadmap does not constitute a one-size-fits-all model for all countries in Latin America and the Caribbean. Geological, energy, institutional, economic, and territorial conditions differ, requiring responses tailored to each national context. However, the identified challenges share sufficient common ground to justify a regional agenda of cooperation and shared learning.

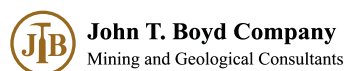
The challenge for the coming decade will therefore be to move from identifying opportunities to their effective execution. Achieving this will require mining and energy planning to evolve in a coordinated manner; infrastructure to anticipate new demands; regulatory and financial frameworks to support long-term capital deployment; innovation and sustainability to be integrated as drivers of competitiveness; and countries to harness their complementarities through deeper regional integration.

Latin America and the Caribbean possesses the mineral resources needed to play a decisive role in the global energy transition. It also holds substantial energy, industrial, and technological capabilities upon which to build. The opportunity lies in articulating these assets within a common strategy that generates greater value, attracts investment, and strengthens the region's sustainable development.

Ultimately, the goal is not merely to produce more minerals. It is to develop a competitive, sustainable, and energy-integrated mining sector capable of generating economic and social value and positioning Latin America and the Caribbean as a strategic partner in the global energy transition.

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APPENDICES

Appendices

Annex I. Mining Megaprojects through 2035

In collaboration with **PLUS**mining

The following table lists mining megaprojects with estimated start-of-production dates through 2035.

Table A. 1 - Mining Megaprojects through 2035

Project Name	Country	Region / Province	Ownership	Primary Mineral	Project Type	Initial CAPEX [USD M]
Continuidad operacional El Abra	Chile	Antofagasta	Freeport-McMoRan (51%); Codelco (49%)	Copper	Brownfield	7,500
Vicuña Fase I	Argentina	San Juan	Lundin Mining (50%); BHP (50%)	Copper	Greenfield	7,051
Hierro Verde	Brazil	Bahia	Brazil Iron (100%)	Iron ore	Greenfield	5,700
Radomiro Tomic II Sulfuros	Chile	Antofagasta	Codelco (100%)	Copper	Brownfield	5,571
Nueva concentradora Escondida	Chile	Antofagasta	BHP Group (57.5%); Rio Tinto (30%); JECO Corp. (10%); JECO 2 Ltd. (2.5%)	Copper	Brownfield	5,150
Nueva Centinela (2da concentradora)	Chile	Antofagasta	Antofagasta plc (70%); Marubeni (30%)	Copper	Brownfield	4,400
Taca Taca Fase I	Argentina	Salta	First Quantum Minerals Ltd. (100%)	Copper	Greenfield	4,232
MARA (Agua Rica)	Argentina	Catamarca	Glencore plc (100%)	Copper	Brownfield	4,000
Vicuña Fase II	Argentina	San Juan	Lundin Mining (50%); BHP (50%)	Copper	Brownfield	3,927
Warintza	Ecuador	Morona Santiago	Solaris Resources (100%)	Copper	Greenfield	3,729

El Arco	Mexico	Baja California	Southern Copper (100%)	Copper	Greenfield	3,537
NuevaUnión Fase I	Chile	Atacama	Newmont Corp. (50%); Barrick (50%)	Copper	Greenfield	3,500
El Galeno	Peru	Cajamarca	China Minmetals Corporation (60%); Jiangxi Copper (40%)	Copper	Greenfield	3,500
Expansión Collahuasi (C20+)	Chile	Tarapacá	Anglo American plc (44%); Glencore (44%); Japan Collahuasi Resources B.V. (12%)	Copper	Brownfield	3,200
Salares Altoandinos	Chile	Atacama	Enami (49%); Rio Tinto (51%)	Lithium	Greenfield	3,200
Los Azules	Argentina	San Juan	McEwen Mining (46.4%); Stellantis (18.3%); Rio Tinto - Nuton (17.2%); Rob McEwen (12.7%); others (5%)	Copper	Greenfield	3,170
Salar de Atacama DLE	Chile	Antofagasta	Albemarle (100%)	Lithium	Brownfield	3,100
Dominga	Chile	Coquimbo	Andes Iron SpA (100%)	Iron ore	Greenfield	3,000
Salar Futuro	Chile	Antofagasta	Codelco (50%+1); SQM (50%-1)	Lithium	Brownfield	3,000
Expansión QBII (210 kt/d)	Chile	Tarapacá	Teck Resources (60%); Sumitomo Metal Mining (25%); Codelco (10%); Sumitomo Corp. (5%)	Copper	Brownfield	3,000
Desarrollo Futuro DMH	Chile	Antofagasta	Codelco (100%)	Copper	Brownfield	2,800

Vizcachitas	Chile	Valparaíso	Los Andes Copper (100%)	Copper	Greenfield	2,770
Los Chancas	Peru	Apurímac	Southern Copper (100%)	Copper	Greenfield	2,600
Michiquillay	Peru	Cajamarca	Southern Copper (100%)	Copper	Greenfield	2,500
Salar del Rincón	Argentina	Salta	Rio Tinto (100%)	Lithium	Greenfield	2,500
La Granja	Peru	Cajamarca	First Quantum Minerals Ltd. (55%); Rio Tinto Group (45%)	Copper	Greenfield	2,400
Laguna Seca Expansión - Escondida	Chile	Antofagasta	BHP Group (57.5%); Rio Tinto (30%); JECO Corp. (10%); JECO 2 Ltd. (2.5%)	Copper	Brownfield	2,351
Santo Domingo	Chile	Atacama	Capstone Copper (75%); Orion Resource Partners LP (25%)	Copper	Brownfield	2,315
Expansión Cerro Verde (420 kt/d)	Peru	Arequipa	Freeport-McMoRan (53.56%); Buenaventura (19.58%); Sumitomo Metal Mining (21.00%); Cerro Verde (5.86%)	Copper	Brownfield	2,100
Extensión vida útil Los Pelambres (EVU)	Chile	Coquimbo	Antofagasta plc (60%); Nippon LP (25%); MMLP Holding (15%)	Copper	Brownfield	2,000
Expansión Sierra Gorda (230 kt/d)	Chile	Antofagasta	KGHM Polska Miedź (55%); South32 (45%)	Copper	Brownfield	2,000
Integración Collahuasi-QB	Chile	Tarapacá	Anglo American plc;	Copper	Brownfield	1,900

			Glencore; Collahuasi Resources B.V.; Teck; Sumitomo Metal Mining; Codelco; Sumitomo Corp.			
Zafranal	Peru	Arequipa	Teck Resources Limited (80%); Mitsubishi Corp. (20%)	Copper	Greenfield	1,900
Expansión Shougang	Peru	Ica	Shougang Group (98.52%)	Iron ore	Brownfield	1,865
Integración Coroccohuayco	Peru	Cusco	Glencore plc (100%)	Copper	Brownfield	1,811
Tía María	Peru	Arequipa	Southern Copper (100%)	Copper	Greenfield	1,802
Lobo Marte	Chile	Atacama	Kinross (100%)	Gold	Greenfield	1,800
Pampa de Pongo	Peru	Arequipa	Zhongrong Xinda Group Co. Ltd. (49%); Jiangxi Copper Group (51%)	Iron ore	Greenfield	1,781
Alemão	Brazil	Pará	Vale (100%)	Copper	Greenfield	1,700
HVL2 - Paipote	Chile	Atacama	Enami (100%)	Copper	Brownfield	1,700
La Arena II	Peru	Apurímac	Panoro Minerals Ltd. (100%)	Copper	Brownfield	1,650
Cascabel	Ecuador	Imbabura	Jiangxi Copper (100%)	Copper	Greenfield	1,554
Reapertura Cerro Colorado	Chile	Tarapacá	BHP Group (100%)	Copper	Brownfield	1,500
Compactos	Brazil	Minas Gerais	Usiminas (70%); Sumitomo Corporation (30%)	Iron ore	Brownfield	1,500

Note: Startup dates correspond to Plusmining estimates.

Source: Plusmining, 2026.

Annex II. Energy demand projection by country

In collaboration with **PLUS**mining

Indicative electrical demand and grid connection challenges for major regional copper projects

Table A. 2 - Electricity Demand from Megaprojects

Project	Country	Indicative Electrical Demand	Primary Grid Connection Challenge
Nueva Centinela	Chile	110.6 MW concentrator; plus pumping and port	Expand the existing electrical connection to supply the new concentrator, water pumping, and port facilities.
Mirador - Phase II	Ecuador	~180 MW total for Mirador I + II	Secure sufficient generation and transmission capacity to supply the expansion.
Collahuasi Expansion (C20+/PG210)	Chile	288–338 MW total peak demand	Reinforce the existing grid and develop a new connection to cover increased consumption at the mine and water system.
Cerro Verde Expansion (420 kt/d)	Peru	~500 MW estimated total peak demand	Upgrade and reinforce existing electrical infrastructure to sustain increased processing capacity.
Sierra Gorda Expansion	Chile	67.7 MW of new load	Increase the capacity of the existing electrical connection to supply the concentrator expansion.
Tía María	Peru	~83 MW implicit average	Complete a new long-distance connection to the national electric grid.
Corocchohuayco Integration	Peru	~39 MW (historical est.)	Extend the Antapaccay-Tintaya electric grid to Corocchohuayco via new transmission infrastructure.
Vicuña - Phase I	Argentina	220 MW operational; 260 MW peak	Significantly extend the high-voltage grid into a remote Andean high-mountain zone.
Santo Domingo	Chile	123 MW peak demand	Secure sufficient supply for the mine, desalination, pumping, and port through new grid connections.
Warintza	Ecuador	236 MW total demand	Construct a new transmission connection to the site and secure firm power supply.
Vicuña - Phase II	Argentina	295 MW operational; 380 MW peak	Further extend Phase I electrical infrastructure to supply Filo del Sol and the broader district expansion.

Cerro Colorado Restart	Chile	~57 MW equivalent average; Mine Area: up to 15.2 MVA	Progressively reinforce the existing connection to support increased production and the new water system.
Taca Taca - Phase I	Argentina	137 MW Phase I; up to 205 MW for expansion	Construct a long-distance connection to the power grid and secure long-term firm supply.
MARA (Agua Rica)	Argentina	~45 MVA average	Repurpose and adapt existing Alumbra electrical infrastructure, extending the 220 kV connection to Agua Rica and ensuring sufficient capacity for the new operation.
La Arena II	Peru	120 MVA of new load (historical est.)	Expand the connection from the existing grid to supply the new concentrator and mining operation.
Cascabel	Ecuador	~90 MW initial phase; ~180 MW at full capacity	Develop sufficient local generation and connect it to the project, maintaining backup from the national grid.
Los Azules	Argentina	36 MW initial net; peak of 129 MW net (157 MW gross)	Extend the electric grid more than 100 km to a remote high-altitude operation.
Vizcachitas	Chile	~139 MW required installed capacity	Construct a new high-voltage connection from the existing grid to the Andean mountain project.
El Arco	Mexico	~250 MW total average (historical est.)	Develop new supply infrastructure in a remote area with limited connection to the national power grid.
Zafranal	Peru	~87 MW	Construct a new connection of nearly 100 km from the existing grid to the mine site.
Radomiro Tomic II Sulfides	Chile	411 MW total according to baseline EIA	Significantly reinforce power supply for concentrator, desalination, and water pumping.
Escondida New Concentrator	Chile	~201 MW maximum demand; ~145 MW average	Construct a new high-capacity connection from the existing grid to supply the new concentrator.
El Abra Operational Continuity	Chile	565 MW additional installed capacity	Develop multiple new electrical connections to supply the concentrator, desalination plant, and pumping system.
El Galeno	Peru	~150 MW demand (historical est.)	Construct a new long-distance connection from the Cajamarca grid to the project.

Note: Figures are indicative and not strictly comparable, as sources report, depending on the project, average or peak demand, operational load, installed capacity, net or gross demand, and total or incremental requirements.

Source: Plusmining, 2026, based on project technical studies, power system operators' filings, and sectoral sources.

Annex III. Regional power challenges by country

In collaboration with **PLUS**mining

Comparative guidance on power system challenges for new large-scale mines.

Table A. 3 - Electricity Challenges by Country

Country	Continuous System Adequacy	Regional Grid Capacity	Mine Gate Interconnection	Condition with Greatest Impact on Competitiveness
Chile	Low-to-medium risk	High due to congestion and curtailments	Medium risk	Transporting and storing renewable energy; reducing delivered electricity costs and exposure to thermal backup.
Argentina	Medium risk	High in the Northwest and Cuyo	High due to distances	Financing infrastructure corridors and coordinating grid expansion, contracts, and commissioning schedules for copper and lithium projects.
Ecuador	High risk	High risk	High if captive self-generation is mandated	Restoring national generation adequacy and defining stable regulatory rules for grid connection or captive generation.
Peru	Low-to-medium risk	Medium across mining corridors	High due to permitting lead times	Coordinating mine, line, substation, and permitting schedules; sharing infrastructure where viable.
Brazil	Low in areas integrated into the national grid; higher in isolated systems	Medium-to-high in Pará and remote areas	Medium risk	Anticipating regional grid reinforcements and distinguishing between grid-connected operations and isolated microgrids.
Panama	Medium risk	Medium risk	Low for the existing operating asset	Resolving the institutional framework and the operational future of the Cobre Panamá power plant.
Colombia	Medium due to hydrological variability and project delays	Medium risk	Variable depending on the project	Managing hydrological dry periods and benchmarking grid connection against on-site self-generation based on total delivered cost.
Mexico	Medium risk	High in the North and Northwest	High for remote projects	Commissioning grid reinforcements and providing regulatory certainty regarding transmission

Note: Table A.3 provides analytical guidance and does not represent an absolute country risk rating, nor does it substitute for a project-specific grid interconnection study. A low level signifies the presence of a relatively solid national baseline, though it does not imply an absence of required investment. A high level indicates that the factor can alter project CAPEX, commercial startup dates, or the bankability of a new large-scale mine.

Source: Plusmining 2026.

Annex IV. Comprehensive post-closure and natural capital framework

In collaboration with Resiliencia y Territorio

Table A. 4 - Comprehensive Key Performance Indicators (KPIs)

Thematic Area	KPI (Indicator)	Target / Unit of Measurement	Indicator Objective
Carbon Capture and Storage	Current carbon stock inventory	tC/ha (aboveground, belowground, and soil biomass)	Quantify carbon currently stored in the ecosystem.
	Estimated net carbon removal (preliminary MRV)	tCO ₂ e/year	Measure post-closure carbon capture and sequestration potential.
Water (Post-Closure Hydrology)	Native vegetative cover in high-Andean wetlands (<i>bofedales</i>)	% cover (target >80%)	Measure ecological restoration and hydrological regulation capacity.
	Hydrological connectivity index	Number of micro-watersheds with continuous dry-season flow	Guarantee hydrological functionality and prevent watershed fragmentation.
	Climate resilience indicator	Real vs. potential evapotranspiration variance (mm/month)	Assess the ecosystem's capacity to maintain water balance under high radiation and thermal variability.
Nature (Biodiversity and Ecosystem Functions)	Restoration and conservation of high-integrity areas	Forest Landscape Integrity Index; Normalized Difference Vegetation Index (NDVI)	Evaluate well-preserved ecosystems with low degradation levels.
	Reduction of areas experiencing rapid integrity decline	Number / hectares of zones at risk of erosion, drought, and wildfires	Identify zones at high risk of degradation or human-induced decline.
	Priority areas for natural resource provisioning	Number of ecosystem services identified	Identify priority areas supporting community use and well-being.
Energy (Repurposing and Energy Access)	Installed renewable generation capacity on closure land	kW / MW and % of technical potential utilized	Quantify the energy asset built or repurposed during mine closure.
	Energy delivered to community and productive off-takers	kWh/year and % replacement of prior fossil fuel sources	Measure community access levels to the generated power.

	Gap between social tariff and full electricity tariff	% covered via cross-subsidies or concessional finance	Evaluate the financial sustainability of the established tariff mechanism.
	Collection rate and financial viability of the community operator	Revenue (tariffs + I-RECs) vs. operations and maintenance (O&M) costs	Assess the financial viability of community-led management of the energy asset.
	Certified avoided emissions	tCO ₂ e/year (I-RECs or supplementary carbon credits)	Quantify climate benefits complementary to the Nature component carbon inventory.
Social Management and Financial Aspects	Stakeholder participation in closure presentations	% / Number of participants per session	Build transparent relationships with host communities to manage realistic expectations.
	Engagement and local ownership in social investment projects	% community participation	Reinforce the social bond between the host community and the mine closure process.
	Budget co-designed with local initiatives	Capital allocated in alignment with municipal development plans and public financing	Align corporate social investments with local community development priorities.
	Financial institutions identified with interest in the transition	Number of institutions identified	Connect local communities with capital providers interested in territorial transition.
	Review of fund qualification requirements (gap analysis)	% compliance with statutory and facility prerequisites	Facilitate community access to external funding and concessional mechanisms.
	Resource management capabilities built	Number of individuals / organizations trained	Build local institutional capabilities for managing post-closure projects.

Source: Authors' own elaboration based on Resiliencia y Territorio.

Annex V. Priority areas for the minerals ecosystem

In collaboration with the World Economic Forum, WEF



Six focus areas for regional action

The community identified six focus areas where regional cooperation can help strengthen Latin America’s minerals ecosystem. The context below has been condensed from the report; the solutions pathways column reflects the strategic priorities defined by OLACDE.

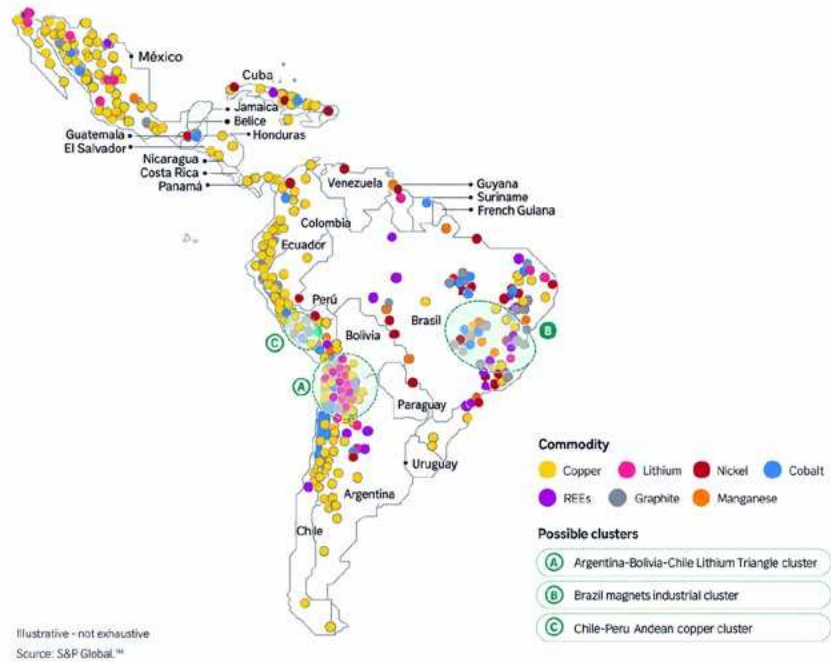
Table A. 5 - Six focus areas for regional action

Focus area	Context	Solution pathways (OLACDE)
Infrastructure	Improve regional connectivity through cross-border logistics coordination, shared use of existing infrastructure, and targeted last-mile links between mining areas, processing facilities, corridors, and ports. Planning should avoid protected areas, national parks, and biodiversity-sensitive areas.	Integrate mining and energy infrastructure planning at the regional level. Identify strategic transport and energy corridors that connect mining areas, processing centres, and markets, while prioritizing multi-use infrastructure and projects with the potential to generate broader territorial benefits. Regional planning mechanisms can help coordinate national, cross-border, and multilateral investment, reduce bottlenecks, and anticipate future capacity needs.
Technology & Innovation	Accelerate adoption of solutions that improve productivity, sustainability, and resource efficiency. Government-backed test beds, pilot programmes, and regional innovation platforms can connect public funding, industry, and academia and help bridge the gap between pilots and commercial deployment.	Build regional platforms to accelerate technology transfer and applied innovation. Connect research centres, universities, mining companies, technology providers, and public institutions to share capabilities, data, and experience and develop replicable pilot projects. Regional cooperation can reduce the cost of experimentation and facilitate the adoption of solutions for energy efficiency, decarbonization, water management, and mining productivity.
Financing	Address financing constraints through stronger de-risking and innovative funding mechanisms. MDBs, DFIs, blended finance, long-term offtake agreements, and public-private partnerships can improve bankability, mitigate risk and price volatility, and mobilize long-term capital.	Link regional projects with financing and risk-mitigation mechanisms. Develop cross-border project pipelines that can be structured in partnership with multilateral development banks, development finance institutions, and private investors. Regional coordination can strengthen project identification and preparation, facilitate blended finance structures, and create sufficient scale to attract long-term capital.
Policy	Create enabling policy environments through regulatory clarity, more harmonized customs and transport procedures, and improved geological data. Bilateral agreements and coordination forums can align priorities and identify bottlenecks, but	Integrate mining, energy, and logistics infrastructure planning at the regional level. Identify strategic corridors connecting mining areas with power generation and transmission, transport infrastructure, processing centres, and markets, while prioritizing multi-use

	need to be paired with concrete policy action.	solutions and projects capable of generating benefits beyond individual mining operations.
Social Impact	Embed environmental and social considerations in project design and regional strategies to maintain social licence, mitigate conflict and regulatory risk, and reduce delays. Strong environmental and social performance can also differentiate the region competitively.	Embed territorial development and social participation from the planning stage. Promote regional approaches that integrate environmental, social, and territorial considerations into project identification and prioritization, rather than treating them solely as mitigation measures. Coordination among governments, companies, and communities can help build legitimacy, reduce conflict, and ensure that infrastructure and investment generate broader benefits for local territories.
Talent	Develop regional workforce and skills initiatives focused on digital and technical capabilities to close talent gaps, build workforce resilience, and expand participation across the critical-minerals value chain.	Develop a regional skills agenda for the new mining economy. Coordinate universities, training institutions, companies, and governments to identify skills gaps and promote regional programmes focused on technical, digital, energy, and management capabilities. Greater mobility and knowledge exchange across countries can expand talent pools and support the development of local capabilities around new projects and value chains.

Regional clusters and mineral connectivity

Figure A.5 - Illustrative regional critical mineral clusters in Latin America and the Caribbean



Source: World Economic Forum and S&P Global.

Online version



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