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New challenges in the extractive industries in LATAM to enable the global energy transition

Options for a region rich in minerals and thirsty for water

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Mina en los altos Andes de Perú , con vista a un lago, terrazas de excavación y equipo de minería comercial, Perú Sudamérica.

Index

I. Context

Currently, one third of the world population lives in areas with limited access to water for human consumption[1]. But despite abundant water resources, this figure accurately the situation in Latin America (LATAM). The region faces large asymmetries between water availability and demand location. The largest water resources in the region are mostly located in inland protected zones and rural areas, while urbanization and industrial activities are concentrated on coasts and central areas. For example, Peru has 90% of its total industry located on the Pacific coast, a region that contains only 1% of the country's available water. In LATAM, water management and water rights allocation are the main drivers behind increasing conflicts with mining companies in areas facing water scarcity[2].

Growing water demand in highly industrialized areas exacerbates the need to increase access to unconventional water resources in LATAM. The main aquifers in South America are threatened by overexploitation and pollution due to agriculture and mining activities, affecting nearly 60% of total water resources. In some countries, farmers have had to replace water-intensive crops with less profitable options, which limits value chains in rural areas[3].

While LATAM countries depend heavily on the extraction of natural resources, the region nevertheless lacks the infrastructure to handle increasing water shortages and meet the rising demand required to support fast-growing economic activities and services in local communities. Thus, over the last decade, water stewardship has gained prominence as an operating philosophy in extractive industries (Fraser and Kunz, 2018). This approach goes beyond mining operations and identifies opportunities to improve coexistence between companies and communities sharing water rights and environmental responsibilities (Hamilton, 2019). In 2014, two thirds of the world's largest mining companies experienced severe water scarcity (Toledano and Roorda, 2014), which has led to conflicts with surrounding communities and increased operational expenses for auxiliary water services.

Mining operations have unique water interdependencies that are distinct from other industrial systems (Kunz and Moran, 2021). Mineral extraction from underground and open pit mines requires water to transport raw materials, remove dust, wash

1 https://www.unicef.org/es/comunicados-prensa/1-de-cada-3-personas-en-el-mundo-no-tiene-acceso-a-agua-potable
2 Observatory of Latin American Mining Conflicts, 2022
3 World Water Council, 2022 https://www.worldwatercouncil.org/fileadmin/wwc/News/WWC_News/water_problems_22.03.04.pdf

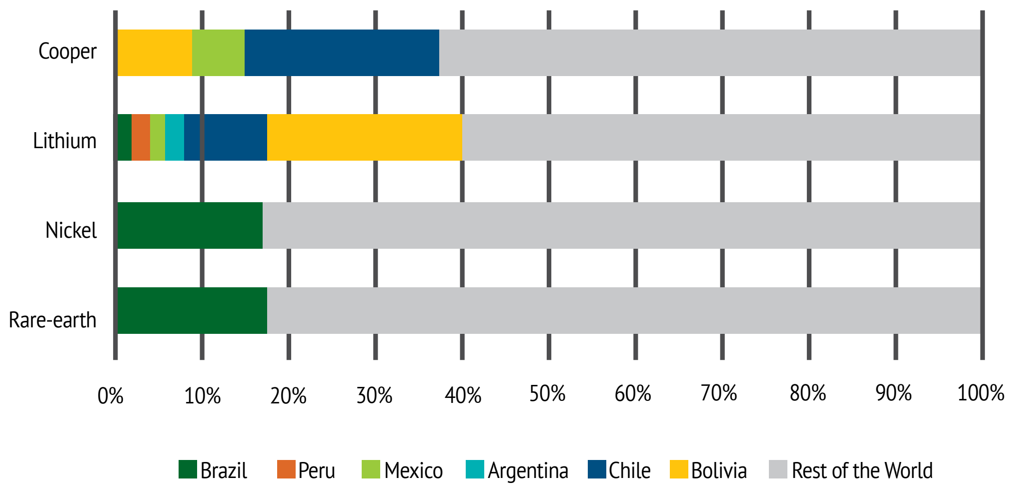
equipment, and cool pumps and drills, while mineral treatment uses water to separate mineral deposits from other materials.

Water supply risks affecting mining operations are related to local weather patterns, which are increasingly altered by climate change (Kunz and Moran, 2016; Northey et al., 2016). Water supply is recognized as a key business risk not only for large-scale mining companies but also for other industries along the extractive sector value chain (Toledano and Roorda, 2014). In 2020, a survey of manufacturing and commodity companies traded in global stock markets concluded that water risks cost fivefold the expenses associated with mitigating them[4].

LATAM has a well-established mining industry, creating added value in the region's GDP through income from taxes, direct and indirect jobs, and the ability to attract investments for expanding operations. In countries such as Chile, Brazil, and Peru, mining is among major economic pillars, representing on average 10% of the countries' GDP in 2020[5]. The same year, Bolivia's extractive industries contributed 5% of the total GDP, while the figures for Mexico and Argentina register at 2.5% and 1%, respectively. In 2020, these countries together contributed approximately 44% of total global copper production and 27% of lithium production. Considering current mineral reserves (see Figure 1) and demand growth projections through the year 2030, production is expected to grow at an average rate of 33% for copper and 130% for lithium per year (Jones et al., 2021). The increased adoption of low-carbon technologies to accelerate the implementation Paris Agreement pledges will be one of the main drivers of growing mineral demand over the next three decades.

4 Carbon Disclosure Project, CDP, 2021. https://cdn.cdp.net/cdp-production/cms/reports/documents/000/005/577/original/CDP_Water_analysis_report_2020.pdf?1617987510
5 Data from central banks of Chile, Peru, and Brazil, 2021

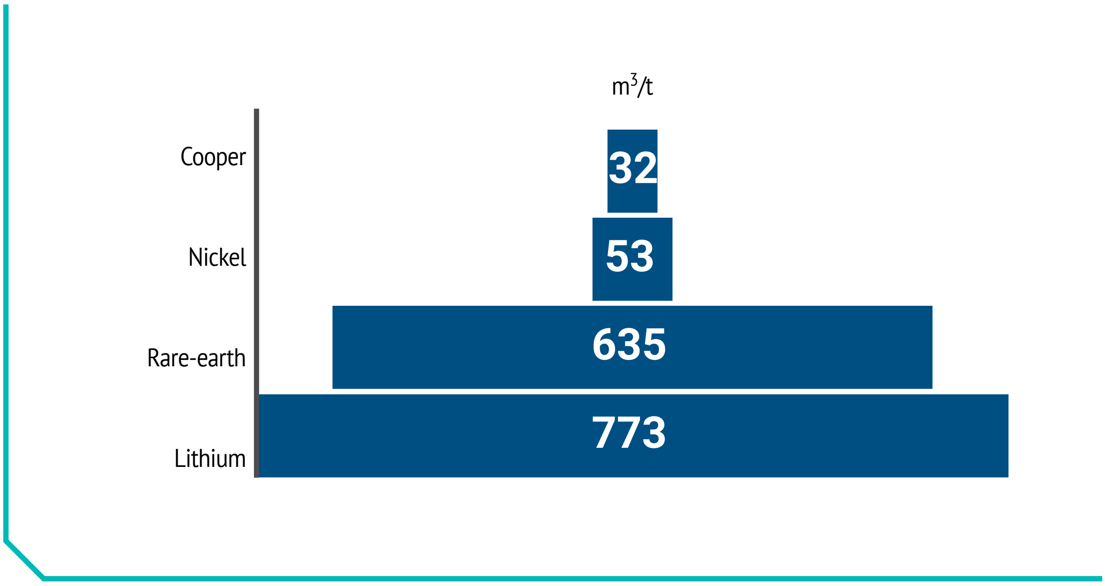
FIGURE 1. **Share of Global Mineral Resources per Country, 2020 (%)**



Source: Own elaboration based on Mineral Commodity Summaries 2022 (USGS).

The Paris Agreement is helping to accelerate the global energy transition and increase mineral demand in the region. The modernization of energy technologies and the process of electrification to displace fossil fuel consumption require minerals such as copper, lithium, nickel, cobalt, and rare-earth metals to manufacture new technologies, like energy-efficient devices and renewable energy infrastructure. Evidence of LATAM's readiness to expand extractive operations includes the creation of enabling conditions to guarantee sustainable growth while minimizing environmental impacts and enhancing dialogues with local communities to find crosscutting solutions that can increase water availability. Since minerals have different water intensities along the value chain (see Figure 2), ad-hoc strategies are needed to address challenges faced in the varying methods used for each mineral and in local operational conditions, including community-related engagements.

FIGURE 2. Water Consumption per Mineral, 2020



Source: Own elaboration based on water indicators from the International Energy Agency, 2020[6].

Data limitations make the water diagnostic process more difficult. Although local information is outdated and is not of the quality needed to estimate present and future water availability, projections of mining operations in Chile, Peru, Brazil, and Bolivia suggest that growing mining companies must invest in water infrastructure to overcome water-related risks. These countries have widely adopted water-efficient processes, but these are not enough to guarantee the sustainable development of mineral production to supply the global energy transition (Jones et al., 2021).

Extractive processes with high water footprints increase environmental and social risks. Among the minerals shown in Figure 2, growing lithium operations have conflicted with local communities overusing water-intensive evaporation techniques that accelerate the exhaustion of water resources in the "lithium triangle" area[7]. Similarly, the deployment of copper operations in the last three decades places this industry's operations among the activities likely impacting current water availability, particularly in arid climate zones, such as in northern Chile.

Despite the challenges to increasing water access, the interdependence between economic development, local communities, and the mining business represents

6 Water use for selected minerals: https://www.iea.org/data-and-statistics/charts/indicators-for-water-use-for-selected-minerals

7 Surface located in the territories of Argentina, Bolivia and Chile that accounts for 58% of the world's lithium resources. US Geological Survey 2021

an opportunity for partnerships that can increase water security. This technical note focuses on identifying opportunities to create public-private alliances with extractive industries and promote investments in water infrastructure (preferably shared property) with the objective of increasing the water sources and capacity underpinning the region's sustainable development and its competitive advantage in global markets.

Experiences Developing Shared Water Infrastructure

New water infrastructure developed by or in collaboration with extractive industries exhibit three common elements. First, most initiatives are driven by the private sector and supported by internal policies aligned with the 2030 Agenda for Sustainable Development (adopted by the United Nations in 2015) and best practices on sustainable mining. Second, mining companies are constantly testing new technologies to reduce water consumption and access alternative water sources to gain competitive advantage. Third, private investment in data gathering and labor capacity to identify optimal business models that encourage partnerships can be a mechanism for promoting co-responsibility, improving return on investment, and strengthening water security. The experiences below describe the key operational conditions and stakeholder coordination efforts that were necessary to realize investments in water infrastructure.

Perú

The Vizcachas Dam was developed under a shared-value scheme with Anglo-American and leveraged private investments for USD $300 million. Besides supplying water to Anglo-American mines (Quellaveco Copper Mine[8]), the dam also sustains agricultural activity in Moquegua. The project components included actions to support agribusinesses in the modernization of irrigation technologies and capacity building to improve crop productivity (e.g., avocado, apricot, oregano, and olive). Around 80% of the water feeding the dam is comprised of sanitized water from the Titire River that is not suitable for human consumption or agriculture due to its natural boron and arsenic content[9]. Under the Moquegua Local Water Authority's control, the dam will also help regulate water flows in the Titire and Vizcachas Rivers to help maintain their fragile ecosystems. This project resulted from extended dialogues with local stakeholders to reach agreements related to water resources and environmental and social commitments to be implemented during the project's life cycle[10].

8 Anglo-American. Sustainability Report 2021. https://www.angloamerican.com/~/media/Files/A/Anglo-American-Group/PLC/investors/annual-reporting/2022/aa-sustainability-report-full-2021.pdf
9 Anglo-American Peru, 2022. https://peru.angloamerican.com/es-es/quellaveco/medio-ambiente1/agua-transformamos-y-optimizamos-procesos
10 Anglo-American Peru, 2022. https://peru.angloamerican.com/es-es/quellaveco/mesa-de-dialogo

The Cerro Verde Mining (operated by Freeport) also participates in a shared-use water infrastructure project in Peru. The company committed to the construction of a wastewater treatment plant in La Enlozada in exchange for obtaining a percentage of the treated water for its mining operations. The plant has been in operation since 2015 and has increased wastewater treatment from 10% to 95%, allowing Cerro Verde to increase its copper production. Currently, Cerro Verde has an agreement with Arequipa's water utility (SEDAPAR) to operate and maintain water treatment facilities (Fraser, 2017). SEDAPAR implemented a strategy to strengthen dialogues with farmers and water supply companies in the province of Arequipa, define a shared vision plan on water management, and finance plans to develop shared water infrastructure.

The United States

LResolution Copper, owned by Rio Tinto and BHP, is developing shared-use water infrastructure to recover, treat, store, and reuse water from closed mines in the state of Arizona. In 2009, the company implemented a strategy to identify economies of scale and leverage investments for water infrastructure[11]. Shareholders in water infrastructure include irrigation companies and water utilities responsible for transporting recovered water to final users (agriculture, municipalities, and commercial buildings). The project includes a pipe system for transporting treated water to the Resolution Copper mines and water storage facilities for immediate use.

Chile

In 2020, the BHP Group sourced 87% of its water from desalination plants. The company gained water independence after the implementation of a water management strategy that included the definition of a roadmap to develop desalination plants and strengthen the dialogue with local community affairs representatives. In 2018, the BHP Group opened the largest desalination plant in South America, with the capacity to treat 2,500 liters per second and transport the treated water 180 km to reach La Escondida mine at 3,200 meters above sea level (González and Onederra, 2021). Antofagasta Minerals also installed desalination plants with similar characteristics to supply 45% of its total water consumption at the Centinela and Antucoya mines in 2021[12].

11 Michael Matichich, Marek Mierzejewski, Bill Byers, Dan Pitzler, Sartaz Ahmed, and CH2M HILL, "The Changing Value of Water to the US Economy: Implications from Five Industrial Sectors," CH2M Hill (September 17, 2012)

12 Antofagasta Minerals. Sustainability Report 2021. https://www.antofagasta.co.uk/media/4345/antofagasta-sustainability-report-2021-spanish.pdf

Shared-use infrastructure allows for economies of scale and enhances risk management capabilities. When ownership models are underpinned by special financing vehicles operating as a utility with multiple shareholders, the exposure to commodity price fluctuations is reduced and the cost of capital diminishes. Furthermore, long-term development strategies benefit from the coordination of public and private water investment plans to minimize environmental impacts, optimize infrastructure, and strengthen dialogue with local communities. Extractive industries can also increase the strategic value of certain assets and reduce political risks[13]. Besides lowering capital costs, aligning mining-related investments in shared water infrastructure with the goals and interests of surrounding peri-urban or rural locations can improve relations between extractive companies and local communities. Political risks might also be reduced when multiple companies and communities rely on shared infrastructure, as governments are less likely to change water provision to multiple user groups rather than to a single company or sector.

Creating Public-Private Partnerships (PPPs) with Extractive Industries

Understanding the water uses and economic activities of stakeholders allows negotiations to be framed in ways that can help develop shared-use water infrastructure. Potential partners must ensure that dialogues include all parties' interests, build trust, and aim to achieve a development strategy and roadmap that define rules, commitments, and timeframes. The elements discussed below describe key considerations for unlocking alliances with extractive industries.

Adding Commercial Value to Data

Mapping water resources, consumption, and final uses and adding commercial value to this information helps clarify and highlight the value of water for different stakeholders, demand fluctuations and projections, and potential economies of scale. On average, water infrastructure represents 10% of mining assets[14] and this figure will continue to increase as pressure on water resources grows. Thus, mining companies, local businesses, and the public sector can benefit from engaging in the development of shared-use facilities that have a wider scope on the integration of water sources and multiple users with the potential to reduce capital and operating costs (CESCO, 2021).

13 Columbia Center on Sustainable Investment, "A Framework to Approach Shared Use of Mining-Related Infrastructure," 2014
14 IFC-ICMM, 2017. Shared Water, Shared Responsibility, Shared Approach: Water in the Mining Sector

Assessing Best Practices for Shared Ownership and Financing Schemes

In LATAM, the number of cases of companies developing water infrastructure on their own are overwhelmingly higher than the number of shared use projects. Despite the latter approach's demand for higher levels of investment, industries tend to see developing their own infrastructure as simpler to implement and sometimes more efficient. To increase alliances with extractive industries, policymakers and other interested parties must prove that shared-use schemes carry less risk and offer more transparency for water infrastructure development and operation. When financing, water infrastructure stakeholders must overcome at least two obstacles: (1) identifying the most appropriate ownership and operation model and (2) clearing the indebtedness capacity of shareholders. These two elements will define the options for access to capital, capital costs, and debt financing.

Governance of Shared Water Infrastructure

Governance in the context of shared infrastructure must set guidelines for operating, financing, and defining water rights. Enforcing shared water infrastructure rules requires a regulatory or operator entity responsible for overseeing the facilities and water rights. These duties might be performed by community representatives, government institutions, or even private companies. Good governance must guarantee that water infrastructure operates free of conflicts of interest and promotes the creation of policies and regulations that better integrate the role of government. The participation of local community representatives in the decision-making process encourages them to take ownership of water infrastructure plans that favor sustainability and can improve relationships between companies and communities (Azhar and Sánchez, 2017).

The Economic Value of Water

Estimating water's economic value can help in understanding current and future opportunity costs for stakeholders facing limited access to water services. Water value might change depending on the type of users, direct and indirect uses, means of extraction and transportation, and cultural principles[15]. Estimations water value can include five areas: in situ water resources; water infrastructure (storage, distribution, supply, reuse); water services (drinking water and sanitation); contribution to socioeconomic activity (agriculture,

15 World Water Assessment Program – UNESCO, 2006

energy, industry, among others); and sociocultural values, including recreational and religious aspects (UNESCO, 2021).

Regulated Water Markets

Working under a regulatory framework, water markets can encourage the adoption of efficient mechanisms to attract investments in water infrastructure[16]. Key water market benefits might include the reallocation of water rights toward highly productive territories with greater water scarcity, efficient users, and territories with greater economic contributions (Donoso, 2004). This mechanism internalizes the opportunity cost of water access for all users and encourages the adoption of efficient technologies for water conservation. Essential conditions to establish water markets include monitoring water resources; protecting intangible water rights; and regulating water rights, transferability, and externalities, among others.

Upgrading Measurement and Quality Control Technologies

Gathering data from smart measurement and control technologies guides decision-making processes and the preparation of water management strategies (Pernick et al., 2021). In the last two decades, one fourth of mining companies worldwide have doubled their investments in smart technology to increase production yields and optimize water management performance[17]. Real-time information on water demand allows synergies to be identified across multiple user groups in order to develop shared infrastructure and improve water demand planning. Innovation in water demand modeling and business opportunities might result from collaborations with the private sector, technology providers, universities, and research centers[18]. Circular mining also contributes to reducing the consumption of continental water by reusing water or replacing it with desalinated water. Additionally, countries can promote sustainability initiatives for the recovery of valuable resources from mining waste[19].

Sustainability and Competitiveness Goals

As environmental, social, and governance (ESG) factors are gaining prominence among investors, shareholders, and stakeholders, local governments can encourage setting ambitious goals across industries to increase commitments

16 California State – US, Australia, Canada, and Chile
17 Digital Transformation Initiative Mining and Metals Industry, World Economic Forum and Accenture (2017)
18 Inter-American Development Bank, 2018. https://blogs.iadb.org/innovacion/es/en-busca-de-una-mineria-innovadora-y-sustentable-en-latinoamerica/
19 https://www.cmp.cl/capmineria/planta-magnetita/2018-09-25/111131.html

aligned with the 2030 Agenda for Sustainable Development. The increased emphasis on ESG factors in economic activities might favor corporate moves to invest in shared-use infrastructure. Governments can promote the achievement of higher ESG ratings and enable access to capital at lower costs, including the preferential treatment of green bonds or loans. Multiple public and private institutions operating in the region promote and provide financing mechanisms for ESG investments in infrastructure. Specifically, multilateral banks support the advancement of national development strategies aligned with Sustainable Development Goals. For example, the IDB created the IndexAmericas in 2017 to encourage corporate commitment to ESG issues and has issued several publications ranking the 100 most sustainable companies operating in LATAM[20].

Challenges in the Field of PPPs

The key factors for increasing alliances mentioned above shape the objectives countries must achieve to create favorable conditions for investments in water infrastructure. However, the achievement of alliances with extractive industries faces additional barriers related to internal decision-making processes. Hurdles include dilemmas around participation with the public sector in shared investments, negotiation and compensation processes, the competitive nature of the mining business, and the strategic management of company assets.

Dilemmas of participating in Shared Use

Ownership and water rights are decisive factors for assessing the benefits of developing shared-use infrastructure. Governments can support the deployment of shared-use water infrastructure by unbundling ownership from mining concessions and infrastructure operations. Thus, a third party can manage water infrastructure even if a mining company is acting as an anchor developer during the early stages of a project.

The benefits of new water capacity must be maximized for multiple users and operated at maximum levels. However, scarce competition and market control over water services might create a profit center, affecting supply costs and increasing political risks. Extractive industries might see shared-use water infrastructure as an opportunity to reduce political risks and capital costs while enhancing their relationships with local communities. In this context, management concessions carry the risk of mining companies exerting their

20 https://www.iadb.org/es/noticias/producto-asociado-indice-de-sostenibilidad-corporativa-se-lanza-en-mercado-mexicano

monopoly power, and thus a strong regulatory system is needed to guarantee shared use and ensure that the infrastructure is designed with additional capacity to accommodate such shared use[21]. The dilemma of implementing sharing can be summarized as follows:

- Separation of ownership between the mine and the infrastructure: reduced risk of monopoly, higher price of access to infrastructure for the anchor project.
- Integration of ownership between the mine and the infrastructure: higher risk of monopoly and difficult to regulate; lower price of access to infrastructure for the anchor project.

Negotiation and Compensation

Water infrastructure development and operations must yield a reasonable return on investment to attract capital and guarantee sustainability. Furthermore, profit distribution among shareholders must be predictable for the owners of water resources, investors, and utilities. In practice, the importance of income from operations leads most negotiations to concentrate on fulfilling minimum business conditions for the extractive industries to approve their participation in shared-use projects. Negotiating fiscal and nonfiscal obligations might receive different reactions within a country; therefore, decision-makers must guide an agile and inclusive dialogue to prioritize the key aspects that can enable agreements. Financial institutions might consider tax revenues the most important point in negotiations, while development agencies direct their focus to local content provisions and value chain in order to increase economic development. At the macroeconomic level, the higher the capital costs and social value of water infrastructure, the greater the need for its development and the justification for negotiating tax exemptions—as long as economies of scale make the additional water capacity cheap and there is a market for this capacity.

Local authorities' bargaining power changes across countries and communities. However, governments should understand and balance the conditions that imply additional costs and regulations that might make the infrastructure development unfeasible. Due to this issue, countries should avoid information asymmetries in relation to water resources, development and operation costs, and projected cash flows under different operational scenarios. Negotiating minimum business conditions with extractive industries is a complex task,

21 Columbia Center on Sustainable Investment, "A Framework to Approach Shared Use of Mining-Related Infrastructure," 2014

particularly in the context of concession contracts when circumstances may change. As such, negotiations might benefit from coordinated planning efforts for water infrastructure expansion.

Competitive business

Large extractive businesses have a competitive nature that should not be underestimated. Reaching agreements about investments in shared water infrastructure is not a guarantee that rival mining companies will join a water project without clear rules and policies for operation and access for third parties. Situations affecting agreements may arise in the following scenarios:

- Large companies compete to meet different quality standards. If a second mining company offering a product with similar characteristics improves its performance thanks to sharing water infrastructure, the first mining company may lose its competitive advantage in the market.
- Decision-making to participate in shared infrastructure comes from the corporate level instead of local evaluations that might show the feasibility of local operations.
- Mining companies use their power over water services to acquire mining concessions at a lower price in areas with limited access to water, as this affects technical and economic feasibility.
- Access to water unlocks large-scale mining projects, affecting market prices. Therefore, leading mining companies may prefer to restrict regional production in order to drive prices higher[22].

Asset Management

Mining companies developing their own water infrastructure might limit access for third parties. Limited access for third parties occurs particularly when the water infrastructure is strategic for the mining business. Governments leading social and economic development agendas might benefit from promoting shared infrastructure through public-private partnerships involving multiple water users and pursuing agreements to reduce political risks and enhance relationships among stakeholders. Pilot projects may include mining businesses that value the benefits of participating in shared-use projects—for example, mining companies in northern Chile and Mexico and those in the Peruvian Andes facing socio-environmental challenges related to water scarcity, illegal water intakes, and pollution.

22 Columbia Center on Sustainable Investment, "A Framework to Approach Shared Use of Mining-Related Infrastructure," 2014

Water rights framework and regulations

The rules governing water rights are key to influencing investors' decision-making processes. Based on lessons learned from experiences in a number of countries, policymakers might benefit from assigning water rights with the objectives of encouraging shared use, avoiding overruling infrastructure developments, and integrating incentives and actions that address the key construction and operation challenges of water infrastructure.

Final Remarks

Policies aimed at increasing water supply and equitable access to water services should include promoting water conservation actions in final users, ensuring an adequate water rights allocation process, and drafting local regulations for shared-use infrastructure. However, countries should weigh to what extent certain actions policies are sufficient to effectively guarantee water security for communities and growing mining operations and local businesses. Immediate actions to promote progress are summarized below.

- Improve information quality and data access. Limited hydrological data and scarce monitoring of water resources might not only add sustainability risks due to excessive consumption of overexploited water sources but could also lead to unnecessary regulations. Understanding available water resources (e.g., location, seasonality, renewability, and variability) is essential for making effective regulations that balance current and future water consumption with actions related to conservation and the development of new water infrastructure. Countries can update their existing water inventories by including water demand projections, mapping groundwater sources, estimating the quantity and quality of water resources against the current demand of final users, building water balances that include extractive industries and other economic activities, and modelling water availability under certain climatic conditions. Coordination among businesses, communities, and local authorities can facilitate the preparation of water surveys, infrastructure assessments, and long-term planning as well as keep the local community and stakeholders informed.

- Stimulate effective dialogues on shared-use water infrastructure. Community representatives and potential stakeholders developing and managing new water infrastructure must participate in discussions to identify agreeable and mutually beneficial solutions. Local authorities can host discussions among the parties as they aim to achieve the objectives of addressing priority issues, validating information, and reaching agreements with mining companies, government, communities, and other interested parties. Rural and urban water committees can also represent local communities when discussing water infrastructure allocation, water rights, tariffs, and regulations.

- Improve water governance and management. Multiple institutions with power over water management can improve their coordination by preparing a common plan that includes, among other things, strengthening regulatory entities, mapping local resources, modelling current and future water supplies, and renovating infrastructure. Local authorities and extractive industries might work on identifying feasible ownership and financing schemes to develop shared-use water infrastructure. Investment plans for water infrastructure may include priority projects that affect the value of mining concessions.

- Strengthen regulations and ensure compliance. Regulations, minimum performance standards, and compensation actions related to water use set clear rules about the extractive industries and businesses countries are seeking to attract. In this sense, local authorities can support mining companies in making their water strategies consistent with local regulations and environmental and social ecosystems as well as assessing the effectiveness of water policies in promoting low-impact growth instead of obstructing economic development. Regulations seeking to reduce illegal water intake and water pollution, control water rights, and reduce water footprint require oversight agencies to guarantee compliance. Strong regulatory frameworks and regulatory entities that encourage suitable conditions for public-private partnerships might increase investment in shared water infrastructure and minimize supply risks. Periodic regulatory revisions might benefit from including public consultation and discussions with local stakeholders, thus highlighting local considerations about the social and environmental implications related to new rules affecting water use, water rights, and infrastructure. Regulations seeking to reduce illegal water intakes and prevent contamination must be supported by agencies that can ensure compliance with standards. The coordination of national, regional, and local institutions might benefit from the elaboration of regulatory frameworks that enable the creation of public-private partnerships and promote investment under public-private schemes. Finally, the development of new regulations might include dialogues with local stakeholders and public consultations to gather key data on water resources, social aspects, and targeted risks that need to be managed.

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Mine in the high country of the andes mountains in Peru, with view over a lake, terraces of excavation and commercial mining equipment, Peru South America.
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