

Green Fair Energy transition?

Challenges for equitable, inclusive, sustainable, transparent & environmentally responsible lithium mining

This document offers reflections on lithium mining in Argentina, its socio-ecological implications, information visibility and stakeholder participation. Recommendations are given for a better governance of the resource, to be included in a proposal of legislation for the regulation of lithium exploitation, from the perspective of sustainability and equity of the decarbonization process

As the need to mitigate climate change and move away from the economy's dependence on fossil fuels has initiated a global transition to more sustainable or zero-carbon energy sources, lithium is seen as a key element in the production of green technologies that contribute to this transition. For many decades, the natural resources sector has been one of the main drivers of economic growth in Latin America and the Caribbean. South America, and more specifically the countries of the lithium triangle, play a key role in providing the raw material base for the global energy transition. Argentina is currently positioned as one of the world's leading lithium producers, with its reserves located mainly in the Puna salt flats in the provinces of Salta, Catamarca and Jujuy. Lithium could become a development engine for the region. However, to ensure that supplies are secure and sustainable enough to support transitions to clean energy, governments will need to implement effective policies and regulations within a strategic framework for lithium exploitation that clarifies the role of government and private companies and balances economic, environmental and social objectives. In Argentina this must be done with adequate federal coordination and in a context of economic, social and environmental sustainability of the sector, to ensure effective governance of the resource.

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Introduction

In a global context of climate change impact mitigation, carbon emissions reduction and transition to new clean and renewable energy matrices, South American countries are key players in the global green agenda. On the one hand, the economies of the countries of the Global North have begun the transition towards sustainable consumption models based on renewable energies. On the other hand, this change in the energy matrix translates into a growing demand for minerals and metals from the countries of the Global South, which make this transition possible. This is why many governments are advocating the exploitation of natural resources as a path to development.

Lithium is a key element in the energy transition path. This metal, a non-renewable and finite resource, is of interest to the many industries seeking to adapt to this new scenario of decarbonization, especially for its capacity to store electrical energy and electromobility. Indeed, the main demand for lithium is mainly linked to the production of batteries for consumer electronics and the automotive industry, where the number of electric vehicles has increased tenfold in recent years, especially in developed countries. Forecasts tell us that it will continue to increase over the next two decades, especially as the world moves towards the elimination of net carbon emissions by 2050. The World Bank (2020) projected that annual demand for lithium for use in energy technologies by 2050 will be 488% of 2018 production, which was equivalent to 2 million LCE. Thus, if this use represented approximately 90% of lithium demand by 2050^{1,2}. According to *Bloomberg New Energy Finance* (BNEF), by 2040 around 31% of the world's passenger car fleet will be electric, and by 2030 global lithium demand will exceed 10 million metric tons³.

Lithium fever is now stronger than ever. There are many expectations for lithium, which at the same time generate many challenges in different areas. Will Latin American lithium be able to feed the global energy transition and, in turn, will the producing countries be able to take advantage of the lithium cycle?

A comprehensive and multifactorial analysis of the extractive system is needed to answer these questions. The potential impacts accompanying the energy transition require a holistic approach, analyzing the socio-ecological systems, the extractive process itself, the regulatory norms and the collective participation of the actors involved throughout the chain. The large supply in the South and the large demand in the North recreate and reproduce the pattern of North-South disparities, which raises a number of equity issues that do not guarantee justice in the whole process. Thus, **lithium has a dual nature**. On the one hand, it is at the **center of global energy geopolitics a nivel global** as a technological cornerstone of the transition. On the other hand, from the local perspective, the regulation of its extraction must be based on a political process that involves weighing multiple interests to different degrees, including the exchange of information, transparency in energy investment opportunities, knowledge of environmental aspects and territorial intervention, the implementation of financial commitments and mechanisms that ensure effective governance for the sustainable development of the resource.

¹ World Bank (2020), *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition*, Washington, D.C., World Bank Publications;

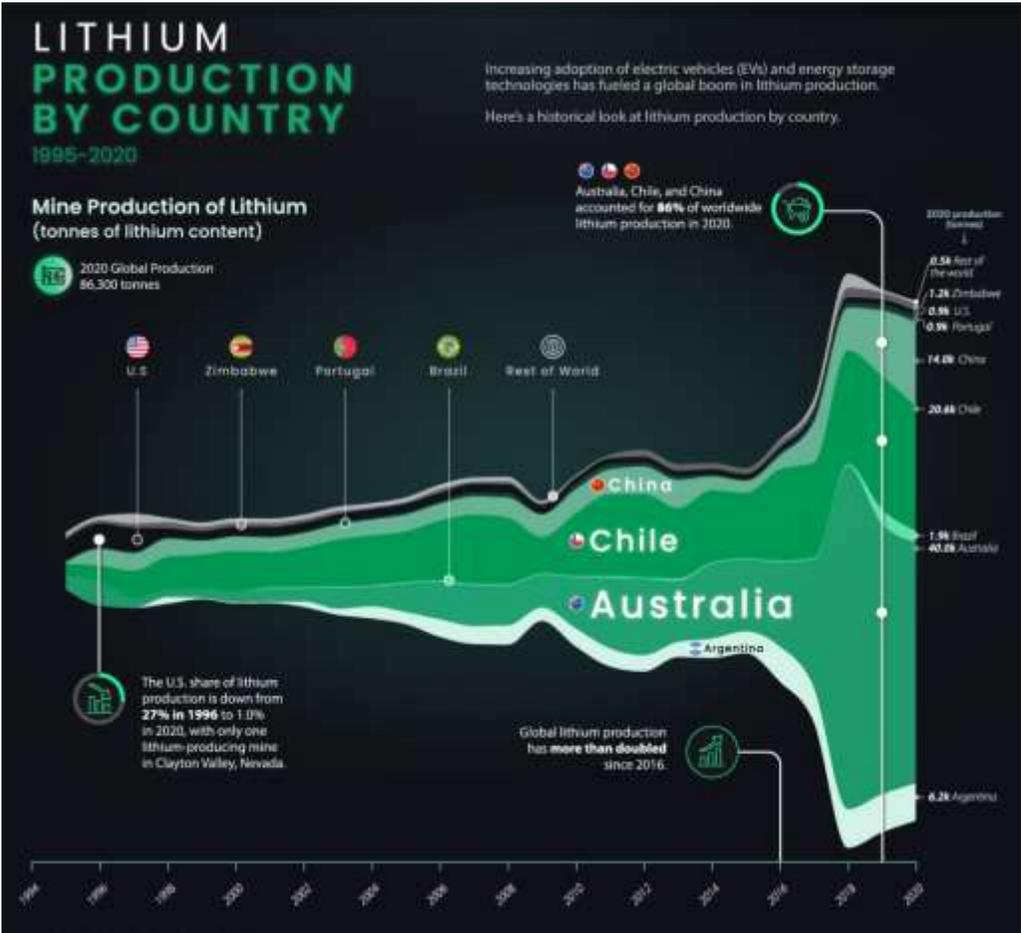
² CEPAL, N. (2022). *Economic Survey of Latin America and the Caribbean 2022: Trends and challenges of investing for a sustainable and inclusive recovery*. ECLAC.

³ *Electric Vehicle Outlook 2021, Executive Summary* (BNEF [Blomberg New Energy Finance], 2021)

In this regard, is it possible to ensure that the extraction of a terrestrial resource is both inclusive and responsible for the environment and the territories? Can we think of building a just and ecological energy transition? It is up to the producer countries to promote effective governance instruments so that these aspects are not left unnoticed.

Lithium mining economic-productive overview

World lithium reserves (known exploitable deposits) are mainly concentrated in three major areas: in **Australia** (the largest producer), **China** and in the countries known as the **lithium triangle** or **circumpunian** region (**Argentina, Bolivia and Chile**), where approximately 60% of the world's resources are found (USGS, 2023). Due to the exceptional **geochemical** and morphological characteristics of the triangle's endorheic basins, the **world's largest lithium reserves** in salt flats - salt lakes with high dissolved solids content - are found here (Meixner *et al.*, 2020;2022).



Source: Based on BP Statistical Review of World Energy 2022, <https://www.visualcapitalist.com/sp/charted-lithium-production-by-country-1995-2020/>. March, 2023

With increasing extraction pressure over the last decade, the lithium triangle has positioned itself in the global spotlight and as an energy supplier to the European Union. Indeed, around 70% of the world's lithium comes from this region: Chile is the leading producer of lithium from brine, while Bolivia is preparing to inaugurate the first lithium carbonate production plant. However, it is China that dominates the global lithium chain, controlling around 60% of global processing.

In Argentina, lithium is located in the salt flats of the Puna region, in the northwestern Andes, at more than 3500 meters above sea level, distributed in the provinces of Jujuy, Salta and Catamarca. Currently, only two companies in the country – which announced a merger agreement, **NewCo**, by the end of 2023 – produce and export lithium carbonate (in the Olaroz salt flat in Jujuy and in the Hombre Muerto salt flat, on the border of Salta and Catamarca). However, there are 8 projects in advanced exploration and upcoming construction (April 2023 data). It is expected that in the second half of 2023, production will also start in the Cauchari Olaroz salt flat, in Jujuy. In general, Argentina has 60 projects in the pipeline, in salt flats throughout the country: in the three provinces mentioned above and also in La Rioja, San Juan and the Patagonian area. In 2022, Argentina produced 6,200 tons of lithium (USGS, 2023), which was a net increase in exports of 65%, while year-on-year exports grew by 235%, equivalent to almost \$700 million. This is just over a quarter of Chile's production, but according to estimates, Argentina could displace Chile as the second largest lithium producer in the next five years, as it has become a magnet for investors. In fact, The Economist magazine defined Argentina as the next major lithium exporter by the end of 2022⁴.

In **Argentina** there is **no specific regulatory framework** for the exploitation of lithium and its by-products, but it is regulated by that of the mining activity as a whole, which is based on three regulatory pillars - enacted in the 1990s -: article 124 of the Constitution of the Argentine Nation, the Mining Code (1886, amended in 1997) and the Mining Investment Law 24.196 (1993). The first one tells us that the provinces have the original domain of natural resources, in a federal framework that, among other aspects, governs taxes and environmental laws. There is no other framework in force than that, given by the National Constitution. In fact, in the lithiferous provinces, metal exploitation has positioned itself as a key axis in their regional development strategies, since they are the ones that also manage the concessions and royalties; and there are great expectations to generate local growth through important international investments. The strategy to attract investors in Argentina, which has been multifactorial, is based on the other two pillars. On the one hand, the Law offers two types of incentives to mining ventures: **fiscal stability** (guaranteed fiscal stability for 30 years) and **tax benefits** (income tax deduction, early VAT refund, among other tax exemptions). The exploitation concession is granted for an unlimited period of time, with a modest **mining royalty** (necessary to dispose of the subsoil and carry out the exploitation) and **provincial royalties** equivalent to 3% of the value of what is extracted at the mine mouth - the price of the gross product, after deducting the production costs declared by the company -.

Although the exploitation of lithium in Argentina is associated with the promise of recovering foreign currency, fiscal revenues from mining activity are based on the collection of income tax, export duties (4.5% for lithium), and the aforementioned royalties. In addition to other possible variable contributions

⁴ <https://www.economist.com/the-americas/2022/11/15/argentina-could-help-the-world-by-becoming-a-big-lithium-exporter>

depending on the province. At a national level, mining exports currently represent only a little more than 4% of Argentina's total exports.

However, with a rising price per ton of lithium, the national government (which regulates the percentage of foreign currency generated by exports of mining products) recently eliminated the rebate paid to lithium companies - the current investments are from mining companies from the United States, China, Australia, Canada, France and Japan, which already extract and export lithium carbonate or chloride, and which have presented projects to expand exploration and exploitation. This was a compensation for exports since 1998 and was intended as an "incentive" when lithium did not have the current market and demand. Thus, companies have stopped charging a bonus of between 2.5% and 5% of the exported value. The mining sectors and business chambers have seen this measure as a change in the rules of the game, which increases the indirect tax burden and will have an impact on competitiveness vis-à-vis other countries and on the predictability and positioning of Argentina as an exporting node. At the same time, the Government is moving forward with a bilateral free trade agreement with the United States for Argentine lithium, within the framework of the inflation reduction law recently approved in the United States, which provides for the largest investment in history to face the climate crisis.

On the other side, the countries that share the triangle, Bolivia and Chile, have been discussing for some time the need and possibility of industrializing their enormous lithium reserves, but on an elementary political and legal principle: the declaration of a **strategic natural resource**, which prevents the free concession of its deposits. Since, as mentioned above, the Argentine federal system delegated to the provinces the competences to manage the exploitation of lithium, this discussion **does not take place in Argentina** at the national level. Lithium is neither a declared strategic nor a critical resource. Although it is true that the provincial legislatures of two provinces have declared lithium as a strategic resource (Jujuy and La Rioja), such declarations are not legally valid, and therefore lack effectiveness, since they do not suspend or modify the current **regime of free mining concessions**. This situation reopened the debate on the role that the national State should play in the development of the exploitation of the resource. In this regard, there is great polarization among mining and political sectors on the feasibility of nationalizing the exploration and exploitation of lithium reserves. However, this would go against the Constitution and would imply a whole reform of the Mining Code and the Investment Law, among other modifications; as it would be in the case of Salta, where the lithium concession depends on the judicial sphere and has the character of a sentence. It would also leave in limbo those already granted and would imply outlining a compensation or indemnification scheme for the companies that are already legally established in the deposits.

Chile has more than forty years of experience in lithium regulation. The declaration of lithium as a strategic resource has prevented, until today, the advance of unlimited concessions in time; and the development of lithium is strictly controlled through the establishment of production quotas. So far, lithium mining companies in Chile have paid variable royalties between 6.8% and 40% of the export price of the metal. In addition to contributions to local community projects, allocating a percentage of their income to the indigenous community development of the Council of Atacameño Peoples (the case of Albemarle and SQM). In May 2023, a long-awaited mining tax reform was approved in Chile that will increase state revenues from copper and lithium production. In the case of lithium, the canon would be adjusted to mineral prices so that it increases the State's share when prices are high and reduces the burden on investors when prices are low.

As part of its national lithium strategy, Chile announced in April 2023 the participation of the State in the entire production cycle of this mineral through a national company, with a greater presence in exploration, exploitation and value-adding activities; through agreements with the companies that are currently operating. However, mining executives and analysts believe the strategy unveiled last month will have the opposite effect, further eroding the attractiveness of the world's second-largest lithium producer as an investment destination, to the benefit of Australia and Argentina⁵.

In **Bolivia** control of the resource, as well as its exploitation, remains in state hands. Although it should be stated that the country does not produce lithium carbonate on an industrial scale (it plans to do so in the second half of 2023), but only produces it in a pilot plant. As in the Chilean case, in Bolivia the regime for the exploitation of evaporite resources, with lithium as the main resource, has a specific character. This differentiates both regimes from the Argentine regulatory framework..

In recent months **Peru** is taking a more active role in trying to attract investment in lithium mining. In fact, it currently has a project to develop lithium-rock exploration in the Puno region. Its approach so far has been market-friendly and without the development of state-owned mining companies. However, a fixed royalty of 10% on lithium (and uranium) profits was proposed and not a variable one as until now which ranged between 1% and 12%. This measure will probably improve revenue stability (the government is guaranteed 10% of profits) and reduce the administrative burden of applying a variable rate; however, on the other hand, investment decisions will be affected by eliminating the factor of adaptation to fluctuations in profitability.

In **Mexico**, the national government recently signed a **decree nationalizing lithium**, thus reserving the competence for its exploitation exclusively to the Mexican State⁶. This establishes the existence of a dual legal regime for lithium in this country: the concessions already granted will be regulated and monitored by the Ministry of Economy, on the one hand, and the State, through a state-owned company, will be in charge of exploration and exploitation since the reform, on the other hand. With the nationalization of lithium, López Obrador seeks to create a state-owned company to exploit lithium and not only extract it, but also process it to manufacture batteries, mainly for electric cars.

Australia has positioned itself as the world's leading lithium exporter. And its production continues to grow⁷. Its production commitment is combined with an interest in increasing its participation along the value chain and becoming a producer of electric batteries by 2030. In Western Australia, where lithium mining is predominant, the Mining Amendment Regulations were introduced in 2020 to amend the 1981 Mining Regulations and incentivize lithium production. With respect to participation, the royalty paid on lithium in Australia ranges from 7.5% for ore (unprocessed), 5% for concentrates and 2.5% for chemicals. In other words, the more value you add to your product, the less royalty you pay, which has been an incentive for companies to increase investments.

⁵ <https://www.ft.com/content/6cbc4d6f-fc7f-4039-93fc-bf64421984bc>

⁶ <https://latinamericanpost.com/43577-lithium-takes-its-place-in-the-world-as-a-strategic-resource-is-it-time-to-nationalize-it>

⁷ <https://www.industry.gov.au/sites/default/files/2022-12/resources-and-energy-quarterly-december-2022.pdf>

Socio environmental concerns

Although lithium mining constitutes a potential development opportunity for the region, in practice - like other types of extractivism - it involves a biophysical intervention in different territories, each with its own ecosystemic, socio-cultural, political and economic characteristics. Lithium exploitation zones are not empty areas, but coincide mostly with ancestral territories inhabited by indigenous peoples who have demonstrated in defense of their territory (Pragier et al., 2022). In these areas, the impacts of lithium activity are linked to **ecological** (mainly generated by overconsumption of water in extremely arid territories) and **community** problems.

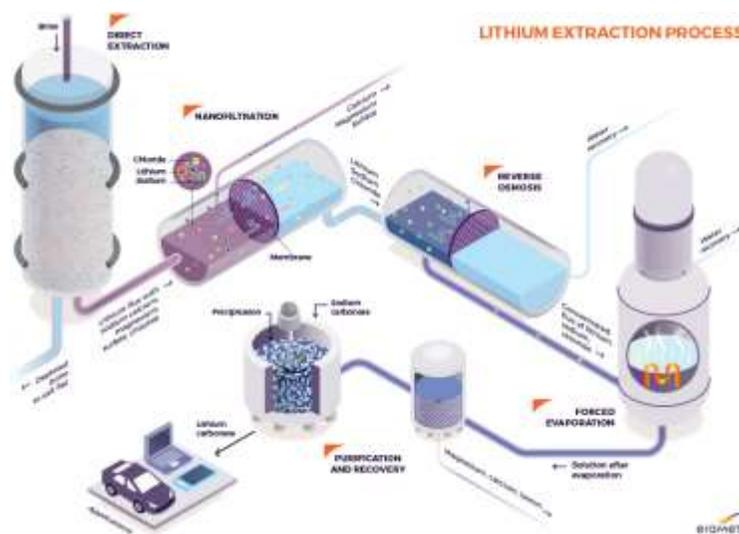
The main environmental impact relates to **water**. In fact, lithium mining is considered water mining. The extraction of lithium deposits is currently carried out through a process of pumping the brine, in which it is concentrated by evaporation in solar ponds (evaporitic process). And this brine is extracted at a much faster rate than the natural water recharge time of the salt flats.

Regarding the water issue, there are two key aspects of production *per se*. **Firstly**, as we have said, the process requires large quantities of fresh water. Water evaporates in the middle of a desert. Precisely, there are doubts about whether over-extraction of water can generate local climatic changes and modify the natural evaporation rate of the system, thus affecting water sources for human or agricultural use. In fact, several authors have addressed in recent years the environmental impacts associated with water use and the negative effects this could have on local communities and on the natural dynamics of the salar basins (Alam & Sepúlveda, 2022; Ejeian et al., 2021; Marazuela et al. 2019a, 2019b, 2020; Steinmetz et al., 2018). It is also debated whether the extracted groundwater may be fossil water, i.e., millennial water that was captured and stored in climatic conditions much wetter than the present and which will not be recharged with the current level of precipitation, altering the balance of the entire hydrological system (Anlauf, 2016). However, through their sustainability reports, lithium extraction companies assure that they do not generate significant impacts on nature, often being endorsed by state and municipal authorities when granting environmental operating licenses, despite the fact that the projects may have technical inconsistencies and shortcomings.

Reduced water levels have also been reported indirectly through changes in **flora** and **fauna** (Marconi, Arengo & Clark, 2022). The decline of the flamingo population to historic lows in the Salar de Atacama, is linked to the reduction of surface water, especially in winter (Gajardo & Redón, 2019) and accounts for the affectation of ecosystems, which exacerbates the impact of climate change in these regions. In fact, the national project (not approved) of the **Wetlands Law** in Argentina, for the regulation, protection and conservation of wetlands, contemplated salt flats as high altitude wetlands, which should be included under the protection categories.

In addition to issues related to the impact on water resources, the evaporite extraction method also generates noise, dust and solid waste, such as impure sodium, magnesium and calcium salts, which accumulate in stockpiles (environmental liabilities) located around the salt flats and can move with the wind, affecting flora and fauna.

Secondly, the development of new evaporation projects is having difficulties in meeting the growing world demand, driven by the electric battery industry. Not only because the construction of solar evaporation pools usually takes between 7 and 10 years, but also because each production process takes about 18 months, depends largely on weather conditions and only manages to recover between 30 and 40% of the lithium content. This is why, although the companies leading lithium production from brines plan to expand their production using the same traditional solar evaporation techniques, the major industrial powers that are currently competing for leadership in the energy transition are promoting the development of **new direct extraction techniques** (non-evaporitic), which also promise to be cleaner and more efficient (Calvo, 2021). In fact, the government of Luis Arce in Bolivia presented a strategic alliance with China for the development of projects under a direct extraction technique, a faster and more efficient method than the traditional one, although with less productive path.



Source: ERAMET. Available on <https://www.eramet.com/en/eramine-world-class-lithium-production-project>; May, 2023

These non-evaporitic techniques promise to solve the environmental, technical and economic deficiencies of the current practice. However, the real environmental impact of this technique in the industrial process (Vera et al., 2023), which goes from the pumping of the brine to the production of the pure solid lithium product (this type of technique also consumes brine, uses fresh water and produces waste), has not yet been proven.

Also linked to the environmental issue, the activities generate **social or community impacts**. In the arid territories where lithium is found, access to water is key for **local communities** and their livelihoods. The way of life and identity of the communities involved are linked to the natural environment, with their own traditional economic strategies, their own spiritual and religious perception of the spaces within the ecosystems and an established community organization. The salt flat constitutes their identity and cultural history, takes on a spiritual character and integrates the living space (Argento & Zicari, 2018). The arrival of lithium mining affects, in many cases, displacing the main activities, such as grazing lands that have been used for generations, or the salt harvesting activity that in an artisanal way is carried out by

community cooperatives (Göbel 2013; Gundermann, H. & Göbel 2018). The social impact of lithium mining is thus linked to a dispute over territorial management.

Both types of concerns, environmental and social, translate into concrete demands and claims by local populations, which will be addressed below. These claims are usually based on arguments based on the labor and human rights involved - such as the right to a healthy environment –.

Conflict, participation, negotiation and governance

The extractive boom in Argentina has not only generated impacts but has also evidenced the **lack of participation** of communities in decision-making, as well as limitations in the availability, accessibility and/or **absence of reliable environmental information** that would allow local populations and other civil society to dimension those impacts (Baspineiro et al., 2020; Carranza et al. 2020; Clavijo et al., 2022; Liu et al., 2019; Mignaqui, 2019).

Specifically, communities in the territory demand the right to information and the right to **participation** and involvement in decision-making. Both aspects are closely related insofar as access to environmental information is the basis for the realization of participation and consultation processes (OECD, 2019). The requirements of availability and access to information, as well as the requirements of public participation are particularly relevant aspects since they are encompassed in the concept of "access rights", following the denomination adopted by the Escazú Agreement⁸. The reality is that **participative mechanisms**, in addition to being a legal requirement, are the **tools** through which citizen involvement is implemented, providing spaces to promote the environmental and social sustainability of activities, in this case mining activities.

In general, the veracity and transparency of the information disseminated by mining companies in the lithium triangle is constantly questioned by civil society (Babidge, 2015). This is particularly relevant as it characterizes and conditions the perception of the activity by citizens, but particularly by the communities living in the area of influence of the exploitation projects and whose absence is at the **basis of socio-environmental conflict**. Argentina is an extreme case worldwide⁹ due to the frequency with which socio-environmental conflicts related to mining end with the cancellation of projects and/or the generic prohibition of certain types of activities (Walter and Wagner 2021). According to data from the Observatory of Mining Conflicts in Latin America (OCMAL, 2019), Argentina is the country with the fourth highest number in absolute terms of mining conflicts registered in the region, with metalliferous mining projects concentrating the highest escalation. The emergence and mediatization of these conflicts have focused on the access and territorial control of natural resources, in a context of a strong asymmetry of power (Svampa, 2019); since the vast majority of indigenous territories face very high degrees of economic, political and climatic vulnerability.

In Argentina, the perspective of many communities is clear: they neither share nor benefit from current approaches to resource exploitation; they feel that while civil society participates at the margins, decision

⁸ The **Escazú Agreement** is the first regional environmental agreement in Latin America and the Caribbean. It was approved in Escazú, Costa Rica, on March 4th, 2018, and Argentina approved it in 2020 through Law 27566.

⁹ <https://ejatlas.org/>

making in natural resource governance, both globally and locally, is determined primarily by market forces that prescribe where and for what purpose land should be used and materials extracted, leaving little room for meaningful influence.

Local populations denounce and express their concerns about the advance of mining operations in their territories, generating their own discourses and strategies in response to lithium mining. These discourses and actions are undoubtedly the result of the historical accumulation of local claims and demands against conventional mining in the region, to which is added, today, a perception of subjugation by the lithium industry. Initially, the **expectations** about the potential foreign currency income, provincial revenue, job creation and economic growth were deeply felt by the population, in addition to being the key axis in the regional development strategies of the governors. However, in the territory we find a wide range of **local perceptions**, ranging from the acceptance of mining activity to the search for mere economic compensation, through the rootedness to the indigenous worldview in which human beings are part of nature, and which seeks to protect that relationship over any economic activity. In general, these perceptions are categorized into two polar responses to the installation of lithium mining: **rejection** or **acceptance** of the projects (or authorization under certain conditions of modifications to the original project). In the configuration of the different conflicts, we found that there is no unified discourse on the part of the communities affected by lithium mining; while some are concerned about water scarcity and contamination, to others "it seems to them the price to pay" for the economic benefits provided by the companies (FARN, 2017). However, there are some factors that **organize the different responses** or reaction to lithium mining, which have to do in part with the organization and autonomy¹⁰ of the communities. Such as the characterization of the community itself (that they perceive themselves as a mining town or that they have collective ownership of the land). Also key are the previous experiences of these communities (in their relations with mining companies and with the State) and other factors that have to do with their first approach to the companies, together with the previous information they may have.

With respect to the latter, the first stages of implementation of the mining company, where the company obtains the **social license**¹¹ to operate, are crucial. In addition to being a right for local people and an obligation for companies, this is a fundamental step that reduces investment risk and lays the foundation for sustainability, mutual social and economic benefit, and growth.

All the countries of the *triangle* have national and international regulations that guarantee the collective rights of indigenous peoples. In Argentina, the communities have specific rights granted by the national Constitution, which in its 1994 reform established the ethnic and cultural pre-existence of the communities of indigenous peoples and the right to be consulted - free, prior and informed consultation (**FPIC**) - on the activities carried out in the territories they inhabit, as established in Convention 169 of the International Labor Organization (ILO). In addition, their legal status, community possession and ownership of the lands they traditionally occupy and their participation in the management of their natural resources are recognized. FPIC must be guaranteed by the State. However, although it is enforceable according to Argentina's constitutional norms, its application is **not regulated in national legislation**. Also, the United

¹⁰ The communities have the support of a state agency, INTA technicians, social workers or members of programs linked to family agriculture and socio-community development, who work to empower the communities by rethinking the historical role of the State.

¹¹ Social license is the expression of opinion by members of a community in favor of a certain high-impact activity in their territory. It can occur inside or outside governmental institutions. This is a sociological construction, lacking a legal definition (Gómez, 2017).

Nations Declaration on the Rights of Indigenous Peoples and the General Environmental Law are tools for the implementation of citizen participation, which provides spaces to promote the environmental and social sustainability of mining activities.

Despite these legal guarantees, the communities denounce that the **consultation instances** are generally **not applied correctly**; and when they are applied, there is a lack of dissemination of environmental information, absence of state representatives, and use of technical language that makes it difficult for local communities and the rest of the civilian population to understand environmental issues (Escosteguy et al., 2022; FARN, 2019; Mignaqui 2019, 2020; Porta, Miguel & Díaz 2020). Often the processes of participation and relations with companies are unilateral, without involving the community in basic aspects such as the design of the participation activities or the way in which they want to receive the information provided by the companies (Marchegiani, Hellgren & Gómez, 2019). And the fairness of the consultation is compromised by the limits imposed on access to transparent information and barriers to participation by all local stakeholders.

Project **acceptance**, when it occurs, usually takes place within the framework of a negotiation that is generally conducted according to informal rules. This implies from broad agreements with the company's proposals to recurrent renegotiations regarding the distribution of benefits and other aspects of the activity in the territory. Thus, the agreements established in the territory do not have a common pattern and depend on the relationship with each community. They are often affected by exogenous factors, unknown to the communities themselves, such as power relations, governance and international rights, which places the local population at a disadvantage in negotiations. The companies take on an **employer role** where they hire a large percentage of men from the communities to work directly or indirectly for the company. Other members provide services to the company such as catering, laundry, logistics and lodging. Another business strategy is related to providing material **benefits**, individually or to particular communities (also under the umbrella of social license or shared value). In this context, the communities receive an economic fee from the mining company for the "use" of the territory. In general, companies and the state find that economic demands are usually easier to negotiate and satisfy than community demands for recognition and redistribution of rights and autonomy. The main actor targeted by the latter is the state, which has the power to recognize the right of communities to make decisions about their territory (Pragier, 2019). At this point, a complete cadastral registry of the communities and lands inhabited by them appears as a key to balance the economic and negotiation asymmetries between the local population and the mining companies¹².

In the case of **rejection**, it is usually based on the questioning of the legitimacy of the bidding process for lithium exploitation, in which indigenous consultation has not been carried out. The scenario of community rejection of mining usually stems from concerns about socio-environmental impacts, perception of competing economic models, or weak institutional links with distrust in institutional quality

¹² The National Institute of Indigenous Affairs, through the Directorate of Lands and National Registry of Indigenous Communities, would be responsible for arbitrating all available mechanisms to comply with the constitutional imperative that states: "...to recognize the community possession and ownership of the lands they traditionally occupy, and to regulate the delivery of other lands suitable and sufficient for human development, none of which shall be alienable, transferable or subject to liens or seizures. To ensure their participation in the management of their natural resources and other interests affecting them". Article 75, inc. 17 National Constitution. In fact, the Directorate is in charge of carrying out the **National Program for the Territorial Survey of Indigenous Communities**, through which the technical, legal and cadastral survey of the territory is carried out.

and capacity to ensure sustainability and socio-environmental responsibility (Pragier, 2019). Communities that reject the implementation of new projects defend their means of production and subsistence (Torres-Wong & Jimenez-Sandoval, 2022) and, as mentioned above, demand the establishment of strategic environmental planning and management that takes into account the protection of both natural resources and local communities, greater **transparency of information** on lithium projects, and the application of FPIC based on international conventions.

In the provinces where lithium mining is being carried out, we find different scenarios. In Catamarca, for example, lithium extraction until very recently had **not** faced great **opposition** from the citizens, mainly because the degree of knowledge of the population regarding this type of mining and its impacts were **unknown** (Gonzalez and Snyder, 2021). However, from 2019 onwards, opposition from the communities began as a result of two circumstances: on the one hand, a triggering conflict based on the increase of the water use canon by the Livent mining company (with the approval of the province of Catamarca); on the other hand, the complaint of the lack of a consultation instance that would have granted the social license and, therefore, an illegal advance of the projects. At this point, it should be noted that these demonstrations did not have a national or international scope. Certainly this has nothing to do with the remote location of the deposits in Catamarca, but rather with the silencing of these situations in the mainstream public media and in the more mediatic environmental judicial panorama, which contributes to the lack of involvement of society in mining issues.

In Jujuy province, however, the **conflicts have been there from the beginning**. In the Guayatayoc-Salinas Grandes basin, since the arrival of the companies in 2010, a group of 33 communities that inhabit these territories within the boundaries of both provinces - Salta and Jujuy - rejected the entry of lithium mining, promoting an organizational process for the defense and management of the territory. It should be noted that the salt extracted from Salinas Grandes is suitable for domestic consumption and in the communities near the salt mines, such as Cerro Negro or Cobres (Salta), and at that time there were already **cooperatives** and small **family businesses** that packaged the salt for subsequent commercialization.

However, the conflict was not only generated by pre-existing economic interests, but also revolved around the demand for the implementation of a prior consultation regarding the use of the salar and territorial self-determination. The communities demanded more information regarding environmental impacts, first from the Jujuy Mining Court and then requested the support of governmental and non-governmental organizations working in the area, as well as independent professionals who lent their services and expertise. The conflict escalated from the provincial to the national level, and given its interjurisdictional nature, an amparo action was filed before the Supreme Court of Justice of the Nation demanding prior consultation on the concession, in accordance with applicable national and international regulations (Svampa and Viale, 2020). In turn, at the international level, they filed appeals before the UN Permanent Forum on Human Rights in Geneva and the Inter-American Commission on Human Rights, starting to work together with environmental protection foundations and human rights NGOs for the elaboration of the First Indigenous Consultation Protocol of Argentina (Svampa and Viale, 2020).

Legal counseling was a determining factor in the actions, given that the articulation of these professionals with the demands of the community members, contributed to the development of a strategy in which the assumption of **legal mechanisms** stands out, as a tool for the defense of indigenous rights,

territory and compliance with previously sanctioned consultation mechanisms (Argento & Zícarí, 2018). This close and rapid **articulation** between legal actions at the national level and interventions at the international level by indigenous populations is unprecedented in northwestern Argentina (Göbel, 2013) and meant a halt to negotiations with the mining company until the 33 communities of the basin drafted and approved a regulation for free, prior and informed consultation (Pragier, 2019).

On the other hand, the company Sales de Jujuy SA (with a consortium of companies including JEMSE, the state company of Jujuy), which produces lithium from the exploitation of the Olaroz salt flat, carried out a strategy that undoubtedly represented a change compared to other interventions, where the communities had not been previously informed about the projects (Deluca and Pragier, 2017). The key probably lay in the company's **community relations** capabilities and the development of the **shared value model**¹³. A series of actions linked to community support and assemblies were deployed to communicate the lithium exploitation project. The Environmental Impact Assessment (EIA)¹⁴ was presented with the activities and associated risks. In turn, Sales de Jujuy takes on an employer role, as a large percentage of the men in the community work directly or indirectly for the company (FARN, 2017). Another key aspect also, common to both Catamarca and the people of Salinas Grandes, is that almost all of the communities of influence in the Sales de Jujuy project hold **community land titles**, which accounts for a certain degree of indigenous self-organization and a management of the bureaucratic structure of the State (Pragier, 2019).

The **political mobilization** of local communities has been and continues to be an important basis for demanding that companies implement transparent mechanisms. It is true that, on the one hand, conflict has made it more complex to establish agreements between companies, governments and communities to promote projects with a social license. But on the other hand, corporate practices have necessarily been reconfigured and environmental regulations have become effective. Companies, together with provincial governments, have incorporated participatory mechanisms for resource governance, such as **participatory environmental monitoring**, which includes members of the communities (Godfrid et al., 2020). This is a participatory mechanism through which members of the communities surrounding the lithiferous exploitations participate in the environmental monitoring of different parameters to control the quality of natural surface and groundwater, soil and air. In general, these monitoring activities are supervised and accompanied by members of the mining enforcement and control authorities of each province. However, it should be noted at this point that it is the companies and not the States that lead the articulation processes with the communities (Escosteguy et al., 2022). Although initially welfare was one of the paradigms of community-company relations in these territories, nowadays companies' structure more regular, planned actions in tune with some local demands, within their corporate social responsibility programs, thus establishing local development programs. However, a long-term development **planning strategy is still lacking**.

Australia is a paradigmatic case due to the absence of conflict in the installation of lithium rock mining. This has to do precisely with the self-perception of the communities as a mining town and because the activity is understood as beneficial due to the economic incentives it generates. In addition to rigorous

¹³ Shared value refers to the set of business practices that, from their conception, have the dual purpose of providing profits for the organization and improving the social, environmental or economic conditions of a specific population related to the company.

¹⁴ General Environmental Law provides that any work or activity within the national territory that is likely to degrade the environment, any of its components or significantly affect the quality of life of the population will be subject to an EIA procedure prior to its execution (art. 11).

environmental practices (minimization of risks and impacts, both perceived and academic) and an effective and constant dialogue between companies and communities (Bastida et al., 2023). This may be one of the keys to resolving conflicts before they escalate.

Final remarks

Considering the above, it is clear that it is essential to create a strategic regulatory framework for the exploitation of lithium that clarifies the role of the government and private companies and balances economic, environmental and social objectives. Even more so due to the fact that in the lithium-bearing provinces, lithium exploitation has positioned itself as a key axis in their regional development strategies and yet there are no regulations that specifically regulate it. The productive activities linked to lithium mining are practically in the hands of the private sector and there is a lack of public policy to address the social, economic and environmental challenges that occur, many of which have been addressed in this document.

As already mentioned, there is **no law in the country that regulates the exploitation of lithium** and this lack of regulation determines a high degree of uncertainty in the development of the activity. However, lithium regulation is either already a reality or a trend in the different producing countries. Argentina has a historic opportunity in the energy transition to strengthen governance frameworks on critical minerals. However, it is lagging behind in terms of a regulatory framework that acts as a beacon for the development of an effective strategic plan. And that regulatory framework and planning needs to be immediate to deal with fast-moving realities. Not only for the exploitation of the resource, but also to constitute a solid base from which to discuss issues such as the industrialization of lithium and the future development of the **value network**.

From the above analysis it is clear that, in addition to the legislative vacancy, lithium production as it exists today, has to face a process of transformation, improvement of efficiency and reduction of environmental impact, as well as conflict. Specifically, two of the obvious impediments to reach a general consensus regarding the development of lithium mining, and which are also the basis for rejection, are: the perception of environmental aspects and the way in which public participation is carried out in relation to the granting of environmental licenses for projects, particularly in places where native communities coexist with the activity.

Based on this diagnosis, what is proposed is to improve the governance of the activity through the improvement of the legislative precept that regulates the exploitation of the activity: included below are different proposals that are considered should be included in a comprehensive and **specific law for the exploitation of lithium** and its derivatives (hereinafter referred to as the **Lithium Law**). It is not the intention here to present a proposed law per se, but rather the **key points** that it should contain, based on the analysis and comparative experiences in the region.

The first challenge is to safeguard the federal framework. This aspect is essential, since Argentina's federal scheme means that there is an overlapping of norms of both the national and provincial States: the basic legal rule is the Mining Code, which together with the federal laws determines its regulation as regards the aspects that determine its exploitation in terms of investment promotion, free competition,

determination of minimum environmental budgets and setting of export duties. At the same time, mining regulation is transversally crossed by environmental regulation, which, based on Article 41 of the National Constitution, provides for a concurrent competence for the enactment of rules, with the nation being in charge of the enactment of minimum environmental protection standards, and the provinces, of the complementary rules of those. Provincial laws regulate the procedural aspects for the granting of permits and concessions, establish the specific environmental regulations that complement the national minimum requirements, and ensure compliance with the consultation processes. This is why, in practice, the regulation of the local impacts of the activity remains in the provinces' hands¹⁵.

Accordingly, the provinces should be the ones to establish a unified regulatory framework to establish a specific regime for the exploitation of evaporite resources, with lithium as the main resource, as well as in the other two countries of the triangle. This must be done taking into account the national and provincial competences, attending both to a good vertical articulation with the State, and to an appropriate scheme of horizontal coordination with the provinces of the lithium region - overcoming the possible competences that may occur between them - if it is intended to legislate and execute an efficient Lithium Law. Without prejudice to this, it is also necessary to coordinate and incorporate business organizations and private investment.

The Federal Environmental Council (COFEMA), an organization for the coordination and elaboration of a coordinated environmental policy between the Federal Government and the Provinces, has demonstrated the feasibility of coordinating interjurisdictional policies. This figure can serve as an example for the coordination of a law between the different levels of government. Of course, certain coordination failures were detected, as well as the existence of conflicts between the different jurisdictions.

Notwithstanding the above, for the exploration, exploitation and use of the lithium resource, with a concept of sustainable development, a very wide field is opened for the **federalism of agreement**, through the use of interjurisdictional relations and entities.

Although the National Lithium Roundtable - made up of the provinces of Jujuy, Salta, Catamarca, the National Secretariat of Strategic Affairs and the national company Y-TEC - stated that they are currently working on the drafting of a bill for the industrialization of lithium and the adaptation of the tax collection scheme to the value added level, through the modification of royalties and export duties; crucial issues such as the **generation and visibility of environmental information as well as the institutionalization of community consultation**, are still up in the air. That is why the key points presented below to be included in a lithium exploitation law, broadly speaking, revolve around **access and transparency of information** (to improve access to information available to civil society), **environmental and tax aspects**, and the **institutionalization of spaces for dialogue and early participation**. It is understood that there may be other aspects that should also be included and regulated in the **Lithium Law** but that are not covered in this analysis.

¹⁵ Article 41 of the National Constitution, incorporated in the 1994 reform, establishes that all inhabitants have the right to a healthy, balanced environment, suitable for human development and for productive activities to satisfy present needs without compromising the needs of future generations, and have the duty to preserve it. It also specifies that it corresponds to the Nation to dictate the norms that contain the minimum protection budgets; and to the provinces to dictate the necessary norms to complement them without altering local jurisdictions.

Identification of the main management issues: Policy recommendation

1. Establishment of a system for the generation and visibility of environmental data. The inclusion in the Lithium Law of a **Lithium mining environmental transparency tracking platform** is proposed. A tool to prevent environmental information generated in the field of lithium mining from being dispersed and decentralized without constituting a real input for political advocacy. It is designed as a public-private articulation platform, where provincial governments (public sector) can regulate and establish guidelines for better performance.

The idea is to include in the Law the **obligation to generate and facilitate documentary, geospatial and statistical information of an environmental nature** -through interoperability mechanisms or direct registration in its computer applications-; the incorporation of environmental standards; and the incorporation of effective processes for the evaluation, control and dissemination of such data. This facilitates the systematization, access and distribution of environmental information. At this point it is worth remembering that the importance of having public environmental information is embodied in the enactment of the Law of Minimum Requirements for the Regime of Free Access to Environmental Public Information (No. 25,831). In addition, there is a law (27275) on the right of access to public information and promotion of citizen participation and transparency in state management, which supports this proposal. Moreover, this right took another dimension after the ratification by our country of the Escazú Agreement (Law No. 27,566). And as has been analyzed in this document, access to environmental information related to the projects constitutes a central dimension of the conflict around lithium extraction. Therefore, access to such information may be a solution before the aggravation of the conflict. However, so far, there is no correspondence in practice of an integrated system of environmental information and statistics.

Consequently, this tool has a duality such that, on the one hand, it is nucleating: it includes in a single site all environmental **information on lithium projects**, generated in the three areas involved: private (thus changing the fact that, in practice, companies benefit from the leverage and the lack of requirements by the provinces and this information does not reach the civilian population), public (state, provincial and local) and science and technology. It will be built to provide access to all the information generated by the different services that make up the environmental institutional framework for lithium mining.

On the other hand, the platform constitutes a unified environmental **mining regulatory directory** for the provinces: it is also conceived as a regulatory framework for access to environmental information, insofar as it is a space for a unified compilation of regulations applicable to mining activity in environmental matters, including codes, laws, decrees and resolutions of the different jurisdictions involved. Both the province of Salta and the province of Jujuy have precedents on this point, with digital access to the regulatory compendiums specifically referred to the management and protection of the environment, with direct relation to the mining activity¹⁶.

¹⁶ Digesto Normativo Minero Ambiental de la Provincia de Salta (March 2023) with the inclusion of the regulations specifically referred to the management and protection of the environment that are directly related to the mining activity. Jujuy (February 2023) updated the provincial regulations on Environmental Protection for Mining Activities (decree 7751-DEyP-2023).

To sum up, the data that will be dumped are, among others: norms, regulations, reports, environmental and monitoring reports and studies, open data, territorial information, the list of public authorities that have information of environmental content and that must be publicly accessible; in addition to the data that have already been generated in the Federal Environmental Monitoring Network (FEMA Network), which began to be developed in 2017, an initiative of the MAyDS, aimed at compiling data generated by different state and private agencies and integrating them into an information platform. An example that can serve as a basis for this platform can be the **SIACAM**¹⁷ platform (Information System Open to the Community on Mining Activity in Argentina), promoted in 2022 by the Secretariat of Mining, under the Argentinean Ministry of Economy, which publishes economic, geological, geographic, social, health and environmental aspects of mining in the country. Currently, regarding environmental data, the data (Environmental Status Reports published on the platform) are not complete or updated¹⁸, but it is considered a good initial prototype. Another valuable precedent to incorporate in this platform is the National Roundtable on Mining Open to the Community (**MEMAC**), presented in 2022 as an instance of public, open and transparent dialogue. Still in its infancy, it appears to be more of a space for the preservation and justification of the interests of transnational mining capital, although without effectively including the inhabitants.

The platform will be managed in coordination by the Ministries of Environment of the littoral provinces and the National Ministry of Environment. The information will be available to the civilian population, thus guaranteeing their right to access environmental information.

A challenge for the future is the generation of incentives for the jurisdictions to make the information available and the integration of economic and environmental data (Argentina Productiva 2030, 2023).

2. Incorporation of the participation and consultation rights of local indigenous communities in the Lithium Law. It is appropriate and necessary to ensure the participation of indigenous communities through the FPIC procedure, in accordance with the provisions of Convention 169 Art. 6 of the International Labor Organization (ILO), ratified by National Law 24.071, and the National Constitution in Art. 75 inc. 17. In addition, the General Environmental Law provides that consultation procedures must be mandatory for the authorization of those activities that may generate significant negative effects on the environment, and that the provinces must regulate these provisions at the local level. Likewise, consultation is part of the EIA, which methodologically proposes the inclusion of the public.

It should be noted that this proposal is directly related to the previous one in that access to environmental information is the basis for carrying out consultation processes and stakeholder participation (OECD, 2019).

As seen in this analysis, indigenous communities have the right to be consulted - free, prior and informed consultation, **FPIC**, prior to any decision that may affect them. However, despite being established by a specific regulatory framework, there are currently no guidelines that define the integration of the FPIC process, in addition to the fact that its implementation and development is not regulated and, although the provincial frameworks recognize the rights involved in the decision-making process that affect the

¹⁷ <https://www.argentina.gob.ar/produccion/mineria/siacam>

¹⁸ <https://www.argentina.gob.ar/produccion/mineria/sistema-de-informacion-abierta-la-comunidad-sobre-la-actividad-minera-en/reportes>

territories and living conditions of indigenous peoples, it has been observed that its **application** varies in each province.

With all of the above, what is proposed is to unify a **standardized methodology** in procedural matters to carry out the FPIC process, as well as the regulation of the consequences of carrying out the process and not obtaining consent (social license).

A key aspect is that, for effective involvement, it is necessary to take into account the adaptation of the resulting plans to the local context and the representativeness of the stakeholders in order to strengthen the legitimacy of the process. In line with this, the case of Salinas Grandes was described, where the communities of the basin defined an appropriate consultation procedure, in accordance with their culture and community organization. Well, it should be defined in the Lithium Law that they will be the ones to choose the way in which this process will be carried out within their own times and structures of community organization, without prejudice that the provincial State will be in charge of its conduction, who must have the leadership and not the companies, as it is the case now.

There is an abundant number of documents that systematize recommendations and criteria for the implementation of consultation processes and public participation, and that can serve as a guide to elaborate this point in the Lithium Law (Administración de Parques Nacionales, 2021; MAyDS (2021)). It would also be essential to coordinate with the expertise of different actors that have already been involved in these processes (members of organizations, community and environmental lawyers, territorial technicians, scientists and other decision makers).

So far, only Catamarca has formally approved a modality for implementing citizen participation that includes participatory community environmental oversight and monitoring, the figure of public consultation, dialogue tables, training of environmental inspectors for water monitoring, among others, for the different stages of mining activity. In the case of Jujuy, in theory, there is a regulation that explicitly integrates the FPIC process to the EIA of mining activity projects.

Without any prejudice to this, other different participatory management mechanisms can also be included, such as dialogue roundtables and collaboration spaces, collaborative agreements for territorial development; in such a way that dialogue between the plurality of actors and interests linked to mining is encouraged and included in these.

It should be noted that in other countries, such as Canada, **dialogue forums** have been included in the regulatory framework itself for the environmental assessment of projects; seeking on the one hand to obtain the social license to operate, but on the other to promote with these tools of citizen participation the networks of real collaboration between the State, the companies and the local communities, improving the coexistence of the interested parties.

To carry out this proposal, a fund should be envisaged to **finance support** for the different actors involved in the process; a dispute resolution system; an accreditation system for facilitators and mediators; and an index that feeds back into the system, measuring the quality of the dialogue between the parties. This point could be addressed with the enactment of a Law on Minimum Requirements for the Implementation

of Free, Prior and Informed Consultation, which would ensure a floor of requirements to be met by local legislations..

3. Include the Strategic Environmental Assessment (SEA)¹⁹ tool in the Lithium Law. The SEA is an environmental management tool that allows the incorporation of the environmental variable, and sustainability in general, in a transversal way to public policies, at different levels, through a methodological procedure that is not excessively complex. It allows policy decisions and development plans to be permeated by environmental criteria, usually absent in this type of discussions. In this way, it is possible to evaluate not only the immediate causes of socio-environmental impacts, but also the structures behind them that generate them on a recurrent basis.

This type of assessment should be taken into account as an instance prior to making decisions regarding specific projects, in order to prevent or mitigate the environmental effects and social impacts that could be generated by decisions in the framework of sustainable development (Marchegiani, 2018).

The SEA is an improvement on the Environmental Impact Assessment (EIA), which does not sufficiently consider indirect, cumulative, synergistic and different time scales impacts; due to the short implementation and operation periods of individual projects, it is difficult to consider wider geographical areas and longer periods in the EIA; and it does not lead to a comprehensive analysis of sustainability, since its main objective is essentially not sustainable development but the evaluation of a particular project (Bibiloni et al., 2020).

In summary, there is currently no tool in the legislation that allows early evaluation of governmental planning with a preventive approach, both for adverse and residual impacts, as well as for alternatives and possible development options, from the highest levels of public decision-making, prior to the project's life cycle. The SEA aspires to be a tool that provides transparency and accessibility to the public while making the planning process more effective, reducing costs, time, and potential conflicts. Likewise, as a tool of greater territorial and temporal scope, it allows for a more complete analysis of cumulative and synergistic impacts.

The SEA also emphasizes participatory aspects, as it promotes the participation of key stakeholders, which generates greater transparency in decision-making (SAyDS, 2018). Its implementation should also stipulate the inclusion of a follow-up stage, in which its implementation is kept monitored, and in which adjustments can be applied.

Thus, an expected product of the SEA, then, could be a document that synthesizes guidelines for the prioritization and environmental feasibility of projects in the region. Consequently, the incorporation of this procedure will establish the priority of generating environmental baselines (a point that will be addressed below) in order to establish and monitor over time what the socio-environmental impacts are.

¹⁹ SEA establishes a strategic territorial management of resources that includes protected areas and land uses, and of course the populations affected by the projects. This assessment tool also considers cumulative and synergistic impacts as well as other socio-environmental variables such as conflicts over water and land use, political and territorial disputes, and permanent local labor occupation.

For practical purposes, at the National Executive Branch level, the SEA is regulated by Resolution No. 434/2019²⁰ and there is also a **methodological guide** for its implementation. At the national level, SEA has been included in the regulation of other sectors such as the Glaciers Law and in environmental laws.

For its implementation, environmental objectives and sustainable development criteria must be clearly defined, in order to establish an action and follow-up plan for the mining policy. In addition to its implementation at the level of the National Executive Branch, it would be required to be included in the Lithium Law, thus ensuring a minimum common scheme of execution.

4. Establishment and improvement of environmental baselines on water issues. This point is designed around two axes. On the one hand: to foresee a part of the budget of the **Lithium Law** to carry out more **hydrogeological research** in the salt flats. Although in general there is no scientific consensus on the impact of lithium mining on local freshwater sources, experts agree on the lack of studies on the totality of the hydrographic basins.

It is suggested that a design of specific baseline studies, necessary for an accurate baseline on the hydrology of the salt flats, carried out by experts, including: accurate hydrogeological modeling, assessment of water flows, precipitation and evaporation records, measurements of aquifers and lake systems, establishment of a sufficient number of observation wells (brine and freshwater) for monitoring over time and even environmental history data (sociohydrogeology) to follow in real time the evolution of phreatic dynamics.

In this regard, as suggested by some researchers²¹, the unit to be considered is the **basin**; and the **studies should be specific and separate in each one**, modeling independently and not extrapolating results, due to the unique hydrogeological characteristics of each one that determines the different possible affectation. This will allow for an integrated and interjurisdictional management vision.

On the other hand, as a second axis, it is proposed that, on a mandatory basis, mining companies **deliver the monitoring data** over time, which they perform in all stages of prospecting, implementation and testing, prior to production at the industrial level. Usually, from the first prospecting to the last production stage, several years go by where the company makes a hydrogeological control and monitoring that derives in a very valuable data set for monitoring over time, but that usually are not delivered with the concession request project.

Currently, in addition, although the models made by the companies have exhaustive hydrological information, they are not useful for a real monitoring of the environmental impacts since they are focused on the operations, at the project level. Therefore, they are not useful to know or predict how this salt flat will behave. Furthermore, these models presented by the companies do not take into account other elements that are also part of the basin and influence the hydrodynamics and impact of the salt flats, such as rivers, water uses or the human component.

The importance of this point lies mainly in the fact that it is essential to have all this data in order to: on the one hand, exercise environmental control, monitoring and follow-up over time, control and a more

²⁰ <https://www.argentina.gob.ar/normativa/nacional/resoluci%C3%B3n-434-2019-331666>

²¹ Marazuela et al., 2020; Vera et al., 2023

exhaustive control of the use and variability of the water component. On the other hand, to be able to have a serious debate on the real impacts of this type of mining and its possible remediation.

Currently, a joint initiative of the Argentine Geological Mining Service (SEGEMAR) with the technical assistance of the United States Geological Survey (USGS) is working on the hydrogeological modeling of three basins in the lithiferous region (Rincón sub-basin belonging to the Cerrada de la Puna Basin, in Salta; Salinas Grandes Basin in Jujuy; and Hombre Muerto sub-basin in Jujuy). This will make it possible to have hydrogeological and hydrological models at the basin level, in such a way that they constitute a robust baseline for the study of the possible environmental impacts that may occur in them.

The management of all the data collected could be in charge of the Mining Environmental Management Unit of each province in coordination with the provincial mining and **energy resources divisions**.

5. Improvements in environmental practices: establish by law a system of incentives for company projects that include an optimization of processes to reduce their environmental impact and improve their efficiency.

Examples of this could be the improvement of extraction techniques or the incorporation of **fresh water recycling** systems or even the replacement of fresh water with desalinated seawater. In addition, other process optimizations such as the reprocessing of the chemical inputs used in production (such as Na_2SO_4 , NaOH and H_2SO_4), to improve the sustainability not only of the extraction process but also of the entire lithium-ion battery supply chain.

Another environmental process optimization that companies can adopt is battery recycling. Interest in this aspect of the global lithium chain has been growing recently²². *Vision for a Sustainable Battery Value Chain in 2030*²³ report, published by the World Economic Forum, predicts that 54% of end-of-life batteries are expected to be recycled by 2030. This could cover 7% of the demand for raw materials used in battery production that year. This is a novel aspect and an alternative to reduce the demand for lithium and to make the future of electric vehicles more sustainable. And this may be a clear opportunity for it to be regulated in Argentina.

6. Modification of the amount and distribution of mining royalties. The point of royalties is the most discussed since it depends entirely on what the companies declare, as there is no effective control in this regard. Moreover, in Argentina there are no official figures on tax collection from the lithium extraction sector (which, in theory, is not considered a commodity), as is the case with the agricultural sector (Jorratt, 2022). It is clear that, as of today, its modification would have to be made either through the reform of the article that sets a ceiling on provincial royalties in the Mining Activity Law, or directly from the provinces through provisions, fees, additions or modification of their tax codes. Therefore, this Lithium Law may be a key space for the implementation of these modifications.

As already explained, although mining royalties are established by the National Government, they are collected directly by the provinces. Without prejudice to this, the proposal presented here is: on the one hand, to increase the percentage of royalties using the gross export value as a measure of turnover,

²² <https://www.thechemicalengineer.com/news/uks-first-industrial-scale-lithium-ion-battery-recycling-plant-to-open/>

²³ https://www3.weforum.org/docs/WEF_A_Vision_for_a_Sustainable_Battery_Value_Chain_in_2030_Report.pdf

following the same model as in the agricultural and livestock sector²⁴. Moreover, establish an annual updating system, according to price and production, as is the case in Chile, for example.

On the other hand, establish a clear system for the allocation of resources from the mining income by incorporating a Mining Royalties Distribution Regime into the Lithium Law. In it, give more prominence to the communities and municipalities located in the department where the mining deposit is located, so that they can propose the infrastructure works, investment projects and productive development projects that they consider to be a priority; These projects must be within the framework of a Strategic Economic Development Plan and adjusted to the amounts of royalties expected to be received during the year (examples of this could be water projects, assistance to producers, projects to diversify the productive matrix of the municipalities to generate development activities outside the mining activity, among others).

Also, in this distribution of royalties, it can be considered to finance **R&D** activities; for the improvement of socio-environmental aspects, and scaling up in the value chain. Either in activities related to the improvement of extraction and processing processes, investment in basic environmental research, as well as in battery production processes. In this way, the linkage of the national research system with lithium extraction and processing activities will be promoted. In this regard, in 2021 the Lithium Mission was created within the Argentine R&D company for the energy industry, Y-TEC, YPF Tecnología S.A., with the aim of developing new technologies for the exploitation of the entire value chain of the resource and to venture into the use of lithium, becoming a tool for the participation of the State and the exploitation of the resource. This year, Y-TEC signed a collaboration agreement with Livent, an American company pioneer in the production of lithium in the country, for the supply of lithium carbonate, which will supply UNILIB, the first technological development plant of cells and batteries in Latin America, which Y-TEC will start up together with the Universidad Nacional de La Plata (National University of La Plata).

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²⁴ Argentina does not reach 400 million dollars per year in lithium exports (data until 2022). This represents less than 2% of soybean revenues.

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