

CLIMATE CHANGE, ENERGY AND ENVIRONMENT

LITHIUM AND SOCIO-ECOLOGICAL TRANSITION IN SOUTH AMERICA

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Lithium batteries, apart from being an essential supply for the functioning of several appliances of everyday use, fulfil a fundamental role when projecting an energy transition which would allow for the drop of fossil fuel use along the way and thus mitigate climate change.

The Andean salt flats of Argentina, Bolivia and Chile play a central role since they concentrate 68% of the proven reserves of the chemical element. The existence of the raw material has sparked the desire of large global corporations.

Lithium tenure in our region opens up a wide range of difficulties about the multiple aspects concerning policies of post-development. Facing this context, the purpose of this document is to address the following points: the legal-political framework of the resource in South America, the situations of extraction and the possibilities of assuming growth in the lithium value chain.

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1

INTRODUCTION

Socio-ecological transition represents a way to dramatically transforming the situation into which global environmental change has thrust us and the inequalities and inequities prevailing at a global scope. Like a sphere inside itself, energetic transition is a pillar in that mutation as well. Fossil fuel combustion (oil, gasoline, carbon) represents 67.3% of greenhouse effect gases emissions (Bajzelj *et al*, 2013) and is at the base of the current “consumerist metabolism” and of the productivist network steering our complex civilization –yearly fossil power is approximately forty times bigger than the one displayed by the 7,530 million humans. Indeed, we live in an “energetic oasis”, closer to disappearing by the minute, given the fact that in the last three hundred years we have consumed the energy humankind had accumulated for millions of years. This landscape has been called Anthropocene by 1995 Chemistry Nobel Prize winner, Paul Crutzen, since humankind has become a geologic force, capable of shaking to the ground the entire planetary physiognomy.

Energetic transition, in its most basic of meanings, consists in steering our societies toward a post-fossil pattern, in which renewable energies prevail, together with a renewed energy infrastructure, electromobility at large scale. Lithium batteries have a key role to play here, as they guarantee for these processes to be possible or, at least, foreseeable. Lithium’s physical and chemical singular properties make it attractive for a large number of applications: in formulations of lubricant fats, in the preparation of very light and resistant alloys, in additives to cements and ceramics, in refrigeration and air purifying systems in closed spaces, in widely distributed drugs of worldwide use, in nuclear energy, among others. However, the arrival of lithium batteries as the most efficient energy storing device in the last decades, and vital in post-fossil society, makes this application the most promising. Lithium gives mobility to things, it works as reservoir of renewable electricity (electricity is either consumed or dissipated and cannot be stored anywhere, while fossil fuel is potential energy) and it supports electromobility (bikes, motorcycles, cars, trucks, trains, and

the list goes on). In fact, we are immersed in a time signalled by the “great acceleration” in which global environmental change has thrown us, and the acute inequities in getting access to finite resources and, in the best possible scenario, a socio-ecological transition should be approached, pursuing the mitigation of these evident dangers. Along this line as well, the new energy paradigm appears as a privileged vector to think alternatives to development in contemporary conditions.

Only five years ago, lithium technology consolidation as a prime electricity reservoir was not absolutely clear, but it is a fact that it has strengthened its presence lately, ever since its adoption by the automotive industry to traction the new electromobility (Fornillo, 2015). Undoubtedly, the country which has most thoroughly understood the weight of the new energetic paradigm is the People’s Republic of China, mainly because after the 2008 global economic crisis it decided to dominate it fully under a strong incentive from the State. To the extent that the Asian axis with China as its central pivot has become the main producer and consumer of solar panels and wind turbines, as well as lithium batteries and electric cars. In this sense, China has decided to enter the biggest global industry, the automotive industry, by means of what is new: electric cars. It is no coincidence, therefore, for the Asian axis to have become the main lithium consumer, since it refines and processes it, while it seeks to obtain new tenures and rises as the main battery producer, too.

European countries have found themselves compelled to refrain themselves from competing with one another, or dominating markets individually. Instead, they seem to seek cooperative logics in view of the challenges they face. This is a tactic that seems to replicate, in the lithium battery arena, what was already rehearsed in other areas such as high-speed trains or the European flagship project Airbus. With that aim, in early 2019, Germany and France’s Economy Ministers announced a common productive strategy for the European Union. Its goal was the creation of “new” industrial champions

and the opening chapter of this continental horizon is consolidating the manufacture of electric batteries. The United States' situation, especially since Trump's administration, seems more inclined to insisting on the old recipes so that the country would not be left lagging behind: confronting challenge with development incentives for some technology businesses via Federal Government subsidies and expenditure and embarking in protectionism towards a redemptive commercial war, all of which without renouncing to their militarism at defending their areas of influence or delaying Asian power expansion. Thus, we find ourselves facing an inter-imperial competition or one among dominant countries, in which there is something else at stake: the control, hegemony and capacity of using the new electric technology.

Now, in this global scenario, South America comes in and not only South America in general but in particular, the altiplano area shared by Argentina, Bolivia and Chile and finds it with 68% of the existing lithium reserves in salt flats, the ones with the easiest and most profitable extraction. Clearly, the existence of the raw material has sparked the desire of large global corporations dedicated to mining, the automotive industry, chemical trade and frontier-technologies, to achieve a decisive presence in the access and control of lithium reserves. Turning our region into a sacrifice zone to guar-

antee the transition of the global centre, which outsources environmental costs to the periphery and creates neodependence in the emerging technological pattern, would not make for a laudable destiny. The presence of the raw material in the American subcontinent is an evident possibility of calibrating which is the destiny of north-south relations, of the network of value chains, of the possibility of the global south participating in the socio-technical structure yet-to-come on the basis of "local technological frontiers".

Indeed, lithium tenure in our region opens a wide range of issues on the multiple aspects related to post-development policies, some of which will be analysed in detail here: the legal and political conditions acting as frames to the resource in South America particularly in countries with the biggest reserves and in Brazil, and the extraction situations and the possibilities of assuming a growth in the lithium value chains. Further, although there will be no in-depth analysis of two main dimensions, namely the environmental issue or the role of communities and local populations inhabiting the territories, there will be a brief mention to them. Lastly, we will offer some conclusive words in which we run a diagnostics on the obstacles and perspectives related to the matter of lithium, on the way towards a mutation of the energy vector, as a base to the South American socio-ecological transition.

2.

LEGAL AND POLITICAL OUTLINE AND EXTRACTIVE HISTORICITY. STRATEGIC RESOURCE?

The fact that lithium is a resource of the first order for the conformation of the future society allows for a consideration on the way in which local administrations handle these horizons and how they think about them. The legal and political situation in the three countries in the “Lithium Triangle” is really very diverse, which responds to both historical determinations and contemporary junctures. In Chile, lithium was declared strategic by Pinochet in 1979, preventing its free allocation, given its central role in nuclear energy. This cause is analogous to what happens in Brazil, where lithium was declared strategic together with other minerals considered “carriers of the future”, a policy that restricts local reserves exploitation and even hinders imports. Similarly, the strategic status applies as well in the case of Bolivia, but here the denomination is recent, and framed in the context of more State interference in the control and special treatment of certain natural resources, ever since Evo Morales’ presidency. Lastly, in Argentina, only the province of Jujuy has declared lithium a strategic resource, but this denomination does not in practice alter substantially the bulk of national regulations strengthened throughout the neoliberal era, nor determining the treatment of minerals. There is, therefore, a plurality of meanings of what is “strategic” which is necessary to deconstruct.

At the first framework level of the legal-political approach to the treatment of the mineral there is an over-determination of the resource’s type of exploitation model. In Bolivia, Salar de Uyuni has been typified as the one with the highest resources in the world, and in the year 1988, the American company Lithco tried to secure its exploitation. But the stark resistance from the Potosí population opposed a contract which they judged by all means detrimental and anti-economic, bringing down this possibility for good. Toward the end of president’s Sanchez de Lozada’s first administration, in 1997, by means of Law 1777, the Mining Code is reformed and the area where Salar de Uyuni is located ceases to be a State-owned reserve. Once over Sanchez de Lozada’s second presidency, following his escape and during the

administration of his successor, Carlos García Mesa, in the face of popular pressure, Law 2560 is passed, which re-establishes the Salar’s previous national status. This dynamics reviewed in the case of Bolivia represents the historical background that made lithium become a deeply rooted social problem, and the initial condition for the trade union structure of the Federación Regional Única de Trabajadores del Altiplano Sur (Regional Federation of Workers of the South Altiplano, or FRUTCAS) to present to the executive power the political party Movimiento Al Socialismo, in 2007, the project to promote lithium under State control.

Chile’s neoliberal dynamics supposed that the State would gradually let go of their tenures while an increasing interference of private initiative took place in salt flats extraction, and thus the presence of two companies consolidated gradually, Rockwood/ Albemarle and SQM, both of them among the biggest lithium exporters worldwide. In Chile, there are three ways of exploiting lithium without the need for change in the existing “strategic” regulation: State exploitation, contracts of a special nature called Contratos Especiales de Operación del Litio (Special Contracts for the Operation of Lithium, or CEOL), and direct contracts between State and private companies. The first possibility has not ever been put into practice despite the fact that Chile is the first country in the “Lithium Triangle” to determine constitutionally that lithium would be a strategic resource reserved to the State. The contracts labelled CEOL are a modality which is not being applied at present but was tried to be put in operation during the first presidency of Sebastián Piñera (2010 – 2014), and were rendered without effect due to irregularities on the part of SQM, the company to which the contract had been awarded¹. This type of contract is based on the premise that the

1 “Subsecretaría de Minería emite decreto que invalida definitivamente licitación del litio” (“Mining Subsecretariat Passes Decree Invalidating Lithium Bids for Good). Newspaper *La Tercera* (20/10/2016).

State does not have the infrastructure to be in charge of exploitation and opens the possibility for private interests to make it real, corresponding to treasury to take care of royalties and other conditions. Finally, the third modality represents the contract mechanism that the Chilean State, through *Corporación de Fomento de la Producción* (Production Development Corporation, or CORFO) government agency of multisectorial scope in charge of incentives to the local production has made with the US-company Rockwood/ Albemarle and with SQM, historically run by Pinochet's son in law, Julio Ponce Lerou. In turn this third option has the particularity of not being typified in a single contract form between State and private business, but having, instead, a varying nature, adjustable in a great deal of its conditions according to the market's characteristics the company's, the mineral's, etc. at the moment of the negotiation. Thus, despite being a resource reserved to the State since 1979, in practice, CORFO has gradually let go of its tenures.

If the company FMC gave up trying to establish itself in Bolivia, it was because it managed to do so in Salar de Hombre Muerto, Argentina. The researches carried out since the 1960s by geologist Luciano Catalano on behalf of the National State, and that had resulted in the discovery of lithium among other minerals, ended up in the hands of FMC, who acquired the rights of exploitation and started extraction in 1998. In this case, lithium is treated like any other mineral, therefore we encounter a legal model that facilitates the petition of a tenure where an exploitable resource is supposed to exist in exchange for the payment of a very modest royalty. Thus, all the surface of the salt flats is tendered for concession or "petitioned" by big extractive firms associated to lithium petitioners, or by "junior firms", or by local or national elites, who expect to sell their mining possessions to some of the big global firms. What is thus created is a "real-estate financial" market, based on the transferring and commercialisation of mining property. In broader terms, there is a sort of legal corset in Argentina, formed by Article 124 of the National Constitution (which grants the provinces the individual control over their resources, hindering a national, unified policy, and favouring the negotiation capacity of transnational companies), by the Mining Code and by the *Ley de Inversiones Mineras* (Mining Investment Act), which offers an innumerable amount of economic, environmental and legal benefits to the investing firms. The fact that resources belong to the provinces, and that they be commercialised and transferable, in accordance with the Mining Code, and highly profitable for exploitation thanks to a mining investment act filled with exemptions, reimbursements to exports and subsidies, while at the same time, the same provinces –

who cannot exploit resources– tend to find their coffers empty, stimulates them to exacerbate an inter-provincial competing model so as to attract investment. We may refer to a legal-legislative triad that obturates the consolidation of a vision of development that may go beyond the exclusively economicist vision of associating the concept to the supposed foreign currency income, which is actually out-coming rather than in-coming. Argentina is a country which wanted to climb up in the value chain and it relies on the scientific resources to do so, but its legal-economic frame does not make it easy at all, and it has not sought for real solutions to accomplish that either.

Brazil, a case that has seldom been looked into, is different from its regional peers because local lithium exploitation is from stone instead of salt flats. Initially, it was carried out by the State and never produced lithium at "battery purity grade" (99.97% purity), so that its extraction finds itself in the lubricant, glass and ceramics markets. In 1998, Brazil passes a new National Constitution, which impacts on the treatment of minerals. Articles 21, in its section XXII, and Article 177 establish: "It is a monopoly of the State to research, explore, enrich, reprocess, industrialize and commercialize nuclear minerals and its derivatives, lithium among them². Additionally, as from 1989 onwards, several legal mechanisms were created (for instance, Decree 2413, issued on December 4, 1997) protecting activities involving industrialization, imports and exports of lithium minerals, of organic and inorganic chemical products, and even of the different compositions manufactured on the basis of lithium. In this way, any commercialisation must be authorised by the *Comisión Nacional de Energía Nuclear* (Nuclear Energy National Commission), which also oversees development and records the companies working with the raw material. More contemporarily, the Federal Government has also started to regulate incentives and transitory dispositions on the country's production and technological development of lithium. A case in point: the *Secretaría de Asesoramiento de la Defensa Nacional* (National Defence Advisory Secretariat) established the increase on custom tariffs on imports for internally existing products, or cancelled the tariff preference agreement with Chile within the *Asociación Latinoamericana de Integración* (Latin America Association for Integration) which allowed for and privileged lithium carbonate imports from this country, only in case of scarcity or lack of the national product (Marques, 1996).

² Constitution of the Federal Republic of Brazil. (Brazil, 1988)

In short, South America presents a unique frame in relation to lithium's legal-political dimension, where the resource is generally typified as "strategic", except in Argentina, a scenario that opens the door to a differential treatment in relation other resources. This distinction does not immediately suppose a direct path to lithium articulating with perspectives related to new visions of local development, but somehow enables the generation of a unique policy toward the resource. The intensity of these institutional policies is unequal. While

in Argentina the typification of the resource as strategic in Jujuy does not overcome the national complete lack of attention, in Chile it has enabled the elaboration of public planning from the capital centre of Santiago but this has not prevented the predominance of extracting firms, in Bolivia it involved a decisive State-centred policy and in Brazil, an inertia related to the nuclear past but that hypothetically would open the door to other possibilities, completely inexistent at present, clearly. Let us look closer, then, at the actual production scenario.

3

CURRENT SITUATION OF THE EXTRACTIVE AREA

The current situation of the extraction activity is very different in each of the South American countries who own lithium, a fact that gives away the atomization of regional policies and the absence of common perspectives. Chile is a country that has been making changes in the way the lithium issue has been treated without radically altering it. Truth is that the identifying of lithium with a strategic resource, the public debate around the lithium issue, the upcoming deadline of the extraction period agreed with companies years ago, the State's perception of owning a raw material that required a special treatment and, mainly, the gigantic corruption scheme which compromised SQM (accused of violating rules of environmental regulation, of tax-payment, bribing members of the entire political arch, etc.) led to the modifying of the lithium policy. With that aim, Bachelet's administration (2014 - 2018) summoned a Comisión Nacional del Litio (National Lithium Commission) which, by the end of 2015, issued a series of suggestions for the executive power to implement new policy. The most innovative edges proposed by the Commission were not taken into account, but the situation of lithium treatment was modified. The Executive Power renegotiated contracts with both extraction companies, first with Rockwood/ Albemarle and then with SQM, which supposed a growth in royalties obtained by the State (it announced the expected collection was of 10,000 million USD between years 2017 and 2030). It also established that 25% of lithium was to be consumed in the internal market at preferential price for the growth of the value chain and that a portion of the earnings was allotted to research and to the communities surrounding the salt flat. In exchange, SQM and Albemarle obtained the extension of the period and an increase in lithium extraction quantity, as well as the stability in their operations. As we will see, the direction taken by the lithium policy on CORFO's behalf related to a wider attempt at steering the country toward a market-based energetic transition.

In Bolivia, ever since the State took control over the lithium issue in 2007, the project has been growing steadily until the conformation, a decade later, of the firm Yacimientos Litíferos de Bolivia (Bolivian Lithium Sites, or YLB). In this decade, the evaporation ponds have

been emplaced, and there has been a search for the most adequate technique to extract lithium from the Salar de Uyuni. Techniques have varied in time as a first one "the chloride line" threw away magnesium available for commercialisation and would produce a large amount of waste. The current technique, "the sulphate line", aims to avoid both mishaps, by adding the calcium oxide at the end instead of the beginning of the process³. At present, the potassium extraction facilities are finished, so that production at a large scale will be initiated, and the expectation is that along the year 2019, the lithium carbonate production plant will also be finished. However, an alarm has been raised lately on the efficiency of the last technique in use, since it would allow for less carbonate extraction than what was projected (15,000 t/year) something that may complicate the launching of the project. A key part of the Bolivian bet consists in the country being able to start production at a certain scale and in a sustainable way. Nevertheless, the particularity of the Bolivian attempt is noteworthy, in which scientific thought, the attempt at lithium production, the insistence on the part of public policy, all come to wish to rehearse a different option from the neoliberal demand of leaving the entire productive network solely in the hands of the market forces.

It is clear that Argentina has another model, one which tended to consolidate itself deeply ever since the administration of Mauricio Macri, at a time when only two exploitations were actively operating: Orocobre in the province of Jujuy, and FMC in Catamarca. At that point, the withholding in mining exports on the first period of the administration, and its declared adhesion to a market-based model, in addition to the existing payment facilities of every kind awarded by the political-legislative

³ In the case of the Salar de Uyuni where up to this day only one pilot plant is operating and no massive production takes place the high concentrations of magnesium in brines implied a bigger amount of use of calcium oxide in comparison with its peers, which generates more waste in the form of sludge and ended being uneconomic for the project. For this reason the technique of "chlorides" was substituted by the "line of sulphates", which consists in adding the calcium oxide at the end of the evaporation and compound concentration process in ponds, by using smaller quantities of calcium oxide and by making good use of sludge in the production of plaster.

mining scenario, fostered the massive arrival of extraction initiatives in the hands of transnational companies. And even more so, if the strict restrictions existing in Chile and Bolivia are to be considered.

Given this fact, more than 50 projects are active in Argentina at different exploitation stages, coming from the most varied countries, and under the most dissimilar logics, due to the possibilities they rely on for extracting the raw material and exporting it, without further ado. The last of the reports produced by the State illustrated that due to the more than 40 projects of lithium extraction from brines in different phases, Argentina's extraction capacity would increase from the slightly over 30,000 t of 2016 (and about 37,500 t in 2017) to a yearly 195,000 t by 2022, so that the group of companies based in the territory would become the biggest exporting enclave worldwide. This landscape is not a coincidence but rather the effect of the inexistence of a policy articulated around the lithium issue, since it appears as the most attractive country for the transnational companies demanding the resource to secure their provisioning just like that.

Finally, in Brazil, in the context of the new Constitution and legislation, more restrictive toward imports, and the shutting down of the *Nuclemón* operation, towards late 1980s the *Companhia Brasileira de Lítio* (Lithium Brazilian Company, or CBL) is created. The company starts operating in 1990 seeking to produce lithium carbonate, together with some sub-products. It later thrives to incorporate other compounds, such as lithium chloride, butyl-lithium, and metallic lithium, among others. Brazilian lithium production has remained stable at about 200 t/year, representing less than 0.6% of the worldwide total. Brazilian lithium is found mainly in the State of Minas Gerais and the company CLB is devoted to the subterranean work on pegmatites in the municipality of Araçuaí e Itinga, to then transfer the spodumene concentrate to the plant *Divisa Alegre*⁴. In there, it is transformed into lithium carbonate and hydroxide, which is industrially consumed in the country for the manufacture of glass, ceramics and aluminium (Ribeiro de Castro *et al*, 2013). In the last years, the prices payed by companies consuming the lithium hydroxide and carbonate in Brazil report a value 250% higher than the agreed on values in the international market, without considering that carbonate produced in the country does not present the necessary purity for the production of lithium-ion batteries, as has been mentioned before.

1 There are some studies on the socio-environmental casualties generated by CLB at both facilities, so much in the management of effluents on the Araçuaí River, as in the different damages in *Divisa Alegre*. In: www.verbetes.cetem.gov.br/verbetes/ExibeVerbetes.aspx?verid=177e lithium value chain.

In 2016, the *Companhia de Investigações de Recursos Minerais* (Research in Mineral Resources Company) published an evaluation on lithium potential in Brazil, in the area of *Medio Rio, Jequitinhonha*, north east of Minas Gerais, confirming the existence of resources. The report, which was part of the *Plan Nacional de Minería 2030* (2030 National Mining Plan) and the *Plan de Aceleración del Crecimiento del Gobierno Federal* (Acceleration Plan for the Growth of the Federal Government), indicated too that, within the amounts of world reserves, Brazil presented a peak from 0.5% to 8% in March 2017. The news was presented with great enthusiasm to several national and international investors⁵. In reference to that, geologist Marcelo Esteves de Almeida Chief of Special Projects and Strategic Minerals Division in response to this growth in lithium tenure expressed: "Reserves still maintain at about 0.4% (containing approximately 48,000 t of LiO₂) from the acknowledged total worldwide, without taking Bolivia into consideration. Our reserves have not reached 1% level, let alone 8%. What I believe must have happened was the media's exaggeration in the interpretation of the official data provided by the government (...) there is an expectation of a substantial increase in reserves for the next years which could, hypothetically, reach 8% of world reserves" (Interview to Almeida, 2018). Brazil's singularity consists therefore, on being a traditional producer of lithium in small quantities and for its classical use in industry, without reaching battery degree and without thinking, for the time being, about them.

At the bottom part of the lithium value chain, the destination of the tax collection from the resource varies from one country to the other. In Argentina, earnings from lithium exploitation is minimal, to make matters worse, until not long, companies received a 3% exports reimbursement which was higher than the 2% royalties. In Chile, after years of not counting on a substantial collection, a new contract aims at changing this scenario, although voices are beginning to be heard which resist these payments on behalf of the very companies. In Bolivia, the entire surplus product would remain in the country, but it has yet to emerge. In addition, the associated works that allow for the first part of the process are minimal. At this point, the caution for earnings not to be outsourcing co-exist with the need for that to be carried out in a strong sustainability environment, while the central purpose is to relate lithium to the new energetic paradigm, and to the development and innovation spheres, because even the market of the raw material is neither deep nor widespread.

5 "Brasil tem 8% das reservas de lítio do mundo". News portal *Notícias de Mineração, Brazil* (31/3/17).

4

TECHNOLOGICAL POLICIES, UNCERTAIN TRAILS

A key element in the lithium issue is found in the strong efforts made by countries in order to be able to participate in the coming to life of the new energy paradigm, that is, the technological vector extending from the raw material extraction technique to the diverse edges comprised in its technological value chain, especially batteries. In Chile's case, the lithium issue in relation to the manufacturing of energy cells starts very early on, over four decades ago, leveraged by the presence of Chilean researchers in different international innovation hubs. What seems particularly noteworthy is that quite far in time, in the year 1983 even before lithium-ion batteries had been invented, Miguel Córdoba wrote in his article "Litio: bases para una estrategia de desarrollo", published in magazine *Creces*, the warning on the need of using lithium as a witness case for a policy aiming at growing in natural resource value chains and preventing the country's historical woes due to saltpetre and copper. This enthusiastic beginning will gradually eclipse itself more sooner than later, as the very same magazine *Creces* will attest after having supported avant-garde trends so much: it edited four articles about lithium in the three years between 1983 and 1986 but only published that same amount in the following thirty years. In the early 1970s, the State had a significant presence in the area of research, through its Comité de Sales Mixtas (Mixed Salts Committee) which will later be dissolved to the pace of the privatization of the extraction area, to which the most relevant investigations and explorations will move (SQM, for instance, issuing more than 17 international patents)

In spite of the strong restart to research on lithium as of 2010, after two sombre decades, following the global importance acquired by lithium and the attention universities begin to give it, the renegotiation of contracts with the extractive firms was the most serious attempt at changing the situation. After the trail of agreements, in which CORFO was in charge of assuming management of the lithium policy, a core point was to rise the Instituto Solar Minero de Chile (Solar Mining Institute of Chile), now called Instituto Tecnológico de Energía So-

lar, Minería de Bajas Emisiones y Materiales Avanzados de Litio y otros minerales (Technological Institute of Solar Energy, Low Emission Mining and Advanced Materials of Lithium and Other Minerals). Emplaced in Antofagasta, to be officially opened during the year 2019, its budget circa 200 million USD it partially comes from the dividends that SQM and Albemarle will have to pay out (24 million USD), and it seeks to trace synergies with multiple universities and also with mining companies. The Institute does not consist in an academic or university space, but in a technological and industrial centre: "It is about evaluating the possibilities of industrial escalation, and that must happen next to where opportunities are; i.e. where sun, lithium and copper mining are", as CORFO'S former vice-president Eduardo Bitran declared. At the same time, CORFO made an agreement with the University of Chile that determined the existence of cobalt the country, an element used in batteries today and that is more strategic than lithium, as its production is done almost exclusively in Africa (Townley *et al*, 2018). The strategy bears certain integrity in its search for attraction of private investment and generation of an economic environment that is stimulus for the formation of a sort of "energy valley", by means of a preferential supply of raw materials, which would be the case if in a position to offer lithium, copper and cobalt. In tune with global productive trends, Bitran expressed that Chile had to articulate together clean energies, electromobility, digital revolution and industry 4.0, in a context of systemic innovation, disruptive technologies and fourth industrial revolution, in pursue of making mining sustainable (mining being the most important energy consumer in Chile with 36% of the total, and main contributor to the Chilean State with 21%) (Bitran, 2017; Balance Nacional de Energía or BNE, 2016).

That said, the core pattern of the State is tinged with the historical neoliberal mandate aimed at creating the conditions for international production companies focused on the green industry to base their offices in the country and invest in it, or for Chilean businesses to partici-

pate in the global value chains. The weight sustained by the predominance of the mere logic of capitals is viewed in the state of fragility in which new agreements find themselves towards the end of 2019. As an example, after the renegotiation, 25% of produced lithium had to be commercialised in Chile at preferential price to be open for bids, with the aim of producing active component (the physical-chemical component that batteries use, with which their cathodes, anodes and electrolytes are comprised). For this process, three companies were selected (the Korean business Samsung-Posco, China's Sichuan Fulin Transportation Group Co. and the Chilean Molybdenum). However, these companies have backed out from the project, demonstrating the relative weight of the raw materials price when it comes to determining the localization of the production of batteries. But at the same time, another cause is that extraction companies claim that they are in no condition to increase production so as to supply the established 25% at preferential price, or that they do not count on the hydric resources to do that. Even Albemarle has questioned the way in which the royalties that they have to pay generally are calculated⁶. The Chilean State's plan in the long run, which considers itself modern and in tune with the current technological times, has come across obstacles that may turn it into an illusion veiling the clearest exports of the raw material.

The Bolivian has sought to intervene and grow in the manufacture of lithium-ion batteries. In the area of Palca, located in Potosí, there is ongoing present operation of a battery assembly plant (not production plant), purchased to the Chinese Linyi Gelon New Battery Materials Co. for a cost of 2.5 million USD. This plant enables the acquiring of expertise in the treatment and commercialisation of batteries. The pluri-national Bolivian government has thrived to react against the biggest obstacles with which the Bolivian project is faced: the initial weaknesses of the industrial network and the little development of the country's scientific-technical grid. The testimonies of those in charge of "Phase III", operating just now and the one corresponding to the manufacture of batteries, highlight the importance of knowledge, technology and innovation. So they mention the launching of the Centro de Investigación en Ciencia y Tecnología de los Materiales Evaporíticos de Bolivia (Centre for Research in Science and Technology of Materials and Evaporitic Resources of Bolivia) in Palca with the purpose of increasing local production of knowledge (Interview to Pozo and León, 2017). Now, in May 2018, YLB has embarked in a public-private joint venture with the German company ACI System, where

the Bolivian state owned company will have 51% of participation, obtaining a potential market with which it did not seem to count on (Andrade, 2017). The proposal accepted to ACI System foresees the investment of 1,300 million USD the Bolivian counterpart is valued in about 900 million USD, from which 50% have already been executed in preliminary phases for the establishment of a centre that will include production plants for lithium hydroxide, for cathodes, and for lithium-ion batteries of different size and power, the latter of which will be mainly targeted at the European market, and will use as main supply the lithium carbonate that a State-financed factory will produce.

Initially, the dimensions of the Bolivian bet which has the final aim of a utility of 1,000 million USD yearly contrast with the one that Jujuy has the possibility to carry out, and even with the private structure pursued in Chile. The challenge of this bet in the field of value growth is to be able to exercise a real geo-economic influx against the historical weight of German industry, always prepared for innovation gains to fall on their side. In parallel, in the year 2019, Bolivia has announced an agreement with the Chinese consortium Xinjiang TBEA Group-Baocheng, in order to form a partnership that will industrialize reserves of lithium and other minerals from the salt flats in Coipasa and Pastos Grandes, with an estimated investment of 2,300 million USD. But the particularity of this case is that the State company YLB will have stockholder participation in the lithium battery plant in China. In practice, Bolivia distances itself from the regional neoliberal tradition which deprives public institutions from economic guidance, but inscribes itself in the country's own historicity of public hegemony over central resources, a core perspective since the revolution of 1952. What is about to be seen is if the country can have enough boost and capacity so as to insert itself in the way in which a global geopolitics is projecting it, a politics of instability and competitiveness.

In Argentina, the first solid scientific encounter with lithium batteries takes place between the years 2005 and 2006, when the Comisión Nacional de Energía Atómica (National Commission for Atomic Energy) is commissioned the manufacture, testing and control of the battery of an Argentine satellite, SAC D. The United States would then launch it into space, following an existing binding agreement between both countries. But the intervention of the State will not be consolidated before the symposium on lithium use, under the title "Utilización integral de litio en Argentina. Ciencia, tecnología e innovación al Servicio del Desarrollo", carried out in Jujuy's capital city, San Salvador de Jujuy, in 2011. That period gave birth to the first communion among

⁶ "How lithium-rich Chile botched a plan to attract battery makers", Reuters News Agency (17/7/19).

the Ministry of Industry (or MinI), the Ministry of Science and Technology, researchers from the axis La Plata-Córdoba, and the companies Plaka and Probattery, to assemble in the country the batteries that State distributed computers would use, computers assigned by the government to state-financed schools through the education program Conectar Igualdad, the first step in dominating the technology that goes “from the salt flat to the battery”. A second complementary experience was the one fostered by MinI in 2012, consisting in formally articulating scientists with the great electronic companies based in Tierra del Fuego Province, in order to have the total production process carried out in the country, especially the cells, the battery “core”. Although initial conditions seemed optimal and a certain degree of articulation among market, industry, science and politics could be appreciated, the obstacles opposed to these projects were numerous. Among them, the difficulty in meeting deadlines in the delivery of the batteries, the rejection on the part of the grand companies in Tierra del Fuego to sustain the bet economically, the resulting neglect on the part of the Ministry of Industry, and the lesser support in taking an industrial leap on the part of the Ministry of Science. In other words, the weakness of the State when running the different actors’ behaviours (Fornillo, 2015). That was the last time in which Argentina’s national State issued a policy in which ministries were coordinated and a technological projection was given to the “lithium issue”.

At present, only the government of the Province of Jujuy would seem to be aiming at actions tending to integrate vertically the value added chain, although it finds itself limited by its provincial budget, the almost null participation from the State, and being subordinated to the logic of private companies. In practice, it has been linked to an Italian business (SERI-group) and announced repeatedly that there will be growth in the value added chain but, for the time being, these are initiatives lacking any materiality. Yet, there is a specificity in Argentina and it is the existence of a great deal of research hubs in different provinces devoted to the lithium issue. In fact, the Consejo Nacional de Investigaciones Científicas y Técnicas (National Scientific and Technical Research Council, or CONICET) exhibits its

listing of more than 200 researchers on the field. However, since there are no initiatives devoted to the growth of the lithium value chain, neither public nor private, this knowledge ends up becoming “applicable non-applied knowledge”. Ultimately, the map of actors committed to the adding of value to lithium in Argentina is, as can be seen, skimpy to say the least. A careless national government, a local government in Jujuy who is playing its own game in relation to uncertain foreign capitals, a series of medium and small businesses announcing projects to the extent of their possibilities, a Science Secretariat which year after year has addressed the subject once and again but always contributing in a crippled way, without a bet of certain weight, namely scientist devotes to fulfilling their scientific role and generating approached and contact to be able to “transfer” that knowledge to the industrial sector. If Argentina does not have a strategic national policy on lithium, Jujuy, in its structural loneliness, has been able to do little so far.

Counting on important lithium reserves is by no means a necessary condition to participate in the technologies it enables, as South Korea, the technologic giant, can vouch for, not having a gram of lithium. Although Brazil has little lithium to count on, its investigations on the resource are very vast in number. Concretely, it has issued more academic publications than the three countries in the “Lithium Triangle” altogether, but this knowledge is atomised, disjointed and unrelated to the productive network, at least so far. It is noteworthy that the Brazilian automobile industry, a key one in one of the few countries in the region presenting the most of opportunities to consolidate, looking into the future, its techno-industrial base, is completely overdetermined by its central headquarters, so that it is not in their plans to produce electromobility (Toyota, for instance, will produce a hybrid model running with electricity and biofuel but its innovation and development centre and the 10 base models are launched in China). The political steering does not foresee a growth in this point, either. The program Rota 2030, passed during the de facto presidency of Michel Temer (2016-2018), mainly consolidates and benefits automobile transnational industry on fossil combustion based in Brazil.

5

BRIEF MENTION OF THE SOCIO-ENVIRONMENTAL SITUATION

With respect to the socio-political situation of those who participate in the lithium situation, a salient point leads once more to respect to the effective sovereignty of the communities and populations where lithium is extracted. The situation is deliberately serious in Chile, where the accumulated years of extraction by SQM and Rockwood/Albemarle have weakened, divided and eroded the community network, commodified the right to decide on the environment and the treatment of resources. In Argentina, there is a similar situation but in a more drastic manner, since companies only produce an immaterial form of corporate responsibility as a mode of division to cooption and disregard the need of having prior consultations, which are on the other hand free and well-informed. In addition to this, in this country only some communities own property titles on their lands and do not participate in decision-making processes, or the earnings, or the administration. Resistance to lithium extraction even acquired here some national scope when projects of lithium extraction from stone were reactivated in the provinces of San Luis and Córdoba, expanding the “mining frontier” which, in this case, implies the dangers of traditional mining, namely, the presence of explosives and chemicals in the environment. In Bolivia, the situation is partially different as a great deal of the social organizations fostered the lithium project from the very beginning, mainly the peasant unionism movement gathered in FRUTCAS and close to the structures of Evo Morales’ movement. This is not the case of indigenous organizations such as CONAMAQ (National Council of Ayllus and Markas of Qullasuyu) who has land-titlings in Potosí and does not present an automatic relation to the capital city’s central power. Once the project has expanded substantially, it leaves a question unanswered on the actual participation of the communities settled very close to the salt flat, of the benefit for them, and of the environmental consequences on their living-space.

We have verified that environmental policies leave vast areas of improvement in all three countries and the figures on water consumption represent a concern of the

first order. The vulnerability in which the entire ecosystem could end up turning the “Lithium Triangle” into a “sacrifice area”. If by year 2022, fresh water consumption were around 98,072,229,600 litre of fresh water yearly, as our stipulations foresee, it all indicates that life in the place will disappear⁷. The Andean region of the puna is an arid zone and the symptoms of a deliberate scarcity of water are already evident: Chile is one of the few countries in the world if not the only one who has turned water into a good equivalent to any other given one, and the scarcity of the resource is not a potentiality but an absolutely provable fact, since the mines from the north must desalinate sea-water in order to continue operating, as they have exhausted the naturally fresh resource. In Bolivia, in turn, State control has not stopped to evaluate a substantial ecological risk consideration, in spite of the State’s relation to a part of the local communities, and uncertainty extends when it comes to the consequences on the socio-ecological environment. This State presence in the Andean-Amazonian country should be a vehicle to enable an improved capacity at tending to the environmental situation, at least considering that in Argentina it is not even possible to access the exploitation areas to carry out hydrological studies without the forever-non-existent permit of the extractive firms. Concretely, there are techniques that consume very little water the so called “cones technique”, of Bolivian patent, is one of them and their general development must be a priority, together with the obligation of implementing them, in the same way as it is not necessary to become lithium extractive countries which facilitate the north’s global transition while the quantity of lithium required for our endogenous innovation processes is minimal. In any case, extraction should never be carried out disregarding the will of the local population.

⁷ For more precise data on the environmental situation, see Romeo, G. (2019) “Riesgo ambiental e incertidumbre en la producción del litio en salares de Argentina, Bolivia y Chile”. In Fornillo, 2019.

6

ENERGY TRANSITION AND POST-DEVELOPMENT

As has been traditional in Chile for almost half a century, ever since the State, due to its constitution, has adopted a “subsidiary” place to the market, what has started was a kind of “passive revolution” or “conservative innovation”. It consists in catching revenue, making use of the mineral for the growth in the secondary economy value chain of chemistry in the hands of private actors at a large scale, and generating a control over an exhausted environment that tends crack or commodify the needs of local communities. At the same time, Chile has foreseen the need of embarking in an integral addressing of the new energy paradigm, nonetheless in its own terms. In the north of the country it aims to emplace a kind of “energy valley”, in which mining, solar radiation at great scale, and lithium coexist as a profile of future development, under the dynamics of an enterprise incubator surrounding renewable technology. Thus, under an energy system in the hands of global corporations and lacking of an important fossil production, Chile is the privileged example of the market transition in South America. If it is possible to consider that it is characterised by a profile of conservative cut, it is because it establishes the structural conditions of a “modernization” cemented on the over-exploitation of resources under the supposition that this perspective is synonymous to a project of a country, while it does so through a mode of accumulation which sooner or later strengthens neodependence incrementing the country’s historical inequities. Therefore here, energetic transition is in motion pivoting towards the decided centrality of an expanded accumulation. In practice, the perspectives of growth in the lithium value chain have been obstructed and there may even be some difficulty to collect royalties.

Following these events, the taking over of Movimiento al Socialismo in Bolivia, after the political cycle emerging strongly in the year 2000, has had special interest in re-situating the State as a leverage to endogenous growth, starting from a perspective of “national-developmental” nature which attempts to situate the country as the energetic lung in the region. Indeed, weaving a lo-

cal articulation between science, industry and politics, the Andean-Amazonian country went on to control the evaporitic resources with the aim of achieving growth in all fields of value. For this purpose, it developed agreement strategies with German and Chinese partners, given the market and technology conditions required for its growth. The difficulty here lies on the technical obstacles that seem to threaten the actual start of scaled production, on the need of not neglecting the premise of the well-being of the environment and of local populations and, lastly, on managing to refrain themselves from being plunged in the dynamics of its bigger partners when it comes to growing in the value chain. The road is nothing but winding, due to the anxiety to start the productive cycles, given the productivist view encouraging the pluri-national country and due to the asymmetry in global geopolitical conditions. Still, the specificity of Bolivia and Chile relies on the fact that they have developed a State policy toward lithium, beyond our personal evaluation on it, as opposed to its neighbouring country.

Indeed, Argentina suffers plainly and simply from an extractivist dynamics, since up to here it has been incapable of intervention with a stronger control on lithium revenues, has left the environmental issue to the will of the extractive companies, it has no knowledge on the effective sovereignty of communities and wastes its scientific network. Despite the fact that a province like Jujuy, tried to treat lithium as a strategic resource, the absence of a national policy, the structural loneliness of the province and, moreover, its articulation with the extractive companies, ends up reproducing without any alterations the general landscape of the country toward the lithium question. All Argentinian salt flats are sought after by foreign firms who do not even produce but reserve themselves the right to control the territory, and for almost nothing. If extraction levels grow, as projections indicate, with the aids granted to the exploitation firms, very possibly the country will become one of the biggest lithium exporters, if not the main one. This fact, far from being an achievement, much on the contrary,

will be the clear confirmation of the over-exploitation of its nature, of outsourcing of earnings while an “infertile surplus” is seen to go by, the condemnation to an unequal exchange in the framework of a green colonialism, and the ultimate impossibility of creating a scientific-technological network to be the base of a socio-energetic transition of local rooting.

The attempts at thinking in an articulation among lithium producers at regional scope, so that, in this way, they could achieve some joint intervention on the world reserves in brines have been, for the time being, definitely left behind. Each of the countries has their own profile on what to do with the “lithium issue”, profiles which end up opposing one another and hampering the opportunities for an association. Despite the border conflict between Chile and Bolivia, there is too subtle an affinity between State control in Uyuni and private investment in Atacama, while neither there is a relation between the latter and the Argentine provinces, who do not even have articulated policies among them, but rather dispute themselves the paradoxical goal of attracting foreign investment with the best of advantages. This heterogeneity of actors and scales makes the chances of a joint action, a sort of OPEC of lithium, appear as a barely realistic vision. Thus, the preponderance of dominant countries, who additionally often operate in blocks themselves, will tend to be the norm in geopolitical terms. Undoubtedly, the technological, industrial and financing capacity of the global centre all affect the lithium market and its entire value chain, therefore it is key to relate to the world, but essentially it is necessary to unfold an autonomous strategy: to selectively detach, withdraw and disconnect oneself from the world market.

In terms of the political dispute, the struggle to control

the “future surplus” offered by the new framework of non-fossil energy in the region will be key: either it will be set apart from our scope, or there will be an influence of the local socio-public forces of production and administration of the new renewable technology; either the energetic system will be democratized and decentred, promoting the public, communitarian and social generation of energy, or a new format of accumulation will be emplaced, a neo-concentrated one in the disaster trail of fossil fuels. But there is more, South America may have a share in the value chains by offering the raw material for a socio-energetic transition carried out at global scope by the central countries, or it may take a bet to empower its own techno-scientific abilities in order to create a green industry on the basis of “local technological borders”. And finally, either our very territories will become sacrifice zones of a new type of green colonialism or there will be a steady consideration on the modes of participation, administration and decision-making of communities and populations with resources, no matter which ones, be it lithium, sun-power, cobalt, wind-power or silicon. Along this way, the technological and public-social abilities serve a key purpose, because lithium today only makes sense if it is considered as a foundation part of a general strategic policy on the new energetic paradigm, at the core of the gigantic scientific-technological network, of electromobility, of industry and infrastructure it entails. Along this path, in terms of the vital creation of an emancipatory narrative for the south, the fair energetic transition is an operative concept capable of displaying in a foreseeable projectable common ground the need for abandoning our extractionist profile of the region, together with the parallel need of creating industrial, technological and social bases of a new type of development, added to the demand of de-commodifying the economy, the social bonds, the biosphere.

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LITHIUM AND SOCIO-ECOLOGICAL TRANSITION IN SOUTH AMERICA

Lithium batteries, apart from being an essential supply for the functioning of several appliances of everyday use, fulfil a fundamental role when projecting an energy transition which would allow for the drop of fossil fuel use along the way and thus mitigate climate change. Lithium gives mobility to things; it works as a renewable reservoir of electricity and supports electromobility.

The Andean salt flats of Argentina, Bolivia and Chile play a central role since they concentrate 68% of the proven reserves of the chemical element. The existence of the raw material has sparked the desire of

large global corporations dedicated to mining, the automotive industry, chemical trade and frontier technology, to achieve a decisive presence in the access and control of lithium reserves. Turning our region into a sacrifice zone to guarantee the transition of the global centre, which outsources environmental costs to the periphery and creates neodependence in the emerging technological pattern, would not make for a laudable destiny.

Lithium tenure in our region opens up a wide range of difficulties about the multiple aspects concerning policies of post-development. Facing

this context, the purpose of this document is to address the following points: the legal-political framework of the resource in South America, the situations of extraction and the possibilities of assuming growth in the lithium value chain. Further, there will be a brief mentioning of the environmental issue and the role of communities and local populations which inhabit the territories. Lastly, a diagnostics will be run on the obstacles and perspectives related to the issue of lithium on the way towards a mutation of the energy vector as a basis of the South American socio-ecological transition.

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