Latin American Program
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T e - T e:

The Case for Post-Pandemic Optimism

TRIANGLE INITIATI

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The world is in the midst of a renewable energy revolution, with lithium an essential element for efficiently storing energy. South America's vast lithium resources place the region in a unique position to capitalize on emerging innovations. Since the turn of the last century, there has been a dramatic increase in the global use of rechargeable batteries for mobile devices, electric vehicles and, more recently, energy storage for the rapidly expanding renewable energy sector. The expansion of energy storage is comparable in scale and scope to the steam engine and fossil fuel-powered industrial revolutions that profoundly reshaped human civilization over the past two centuries.

At the center of the energy storage revolution is lithium. The so-called Lithium Triangle countries (LTCs) —Argentina, Bolivia and Chile— hold the world's largest lithium resources extractable from brines, equivalent to more than half of global lithium resources. t t ' - f t - t t . , respectively, and Bolivia holds the world's largest lithium resources that have yet to be commercially

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still evaluating the pros and cons and the prospects of venturing into the downstream segment of the lithium industry. A few attempts failed recently, including unilateral efforts by Chile and Bolivia to undertake domestic lithium battery production.[3]

For now, the lithium value chain remains scattered, with mining concentrated mainly in South America and Australia and lithium processing dominated by China. The COVID-19 pandemic revealed the world's heavy reliance on China for essential medical equipment and the risks associated with that dependency during a crisis.

The devastating economic fallout from COVID-19 introduced new challenges for the LTCs, interrupting production, postponing investment and reducing demand. Nevertheless, a recent United Nations report highlighted electric mobility as an up-and-coming sector in Latin America that could be instrumental in generating green jobs during a post-coronavirus economic recovery.[5] Timing will be key for the LTCs to position themselves at the forefront of the global lithium sector, amid growing upstream competition and global downstream developments.

Equally important for the LTCs will be their approach to challenges such as price volatility, political and economic uncertainties, evolving technologies and social and environmental concerns. As lithium production rises in the LTCs, the region's governments should consider potential regional mechanisms to coordinate their responses to these challenges, as former Chilean President Ricardoucif LCh (o demd.83 0 0 5.83 416.938397.708506 0.7)Tj1060 0 10

governments to ride a potential post-pandemic wave of investments in renewable energy, as countries in Europe and beyond pledge to stimulate economic recovery through a rapid transformation to renewable energy.

Ab e c e

Global lithium resources increased substantially in 2019, to about 80 million tons, as a result of continuing exploration.[7] That year, the three LTCs together held more than half of global resources, or 47 million tons (see Figure 2). World production, by contrast, decreased by 19 percent, to 77,000 tons of lithium content from 95,000 tons in 2018, due to excess supply and lower lithium prices.[8]

In 2019, rechargeable battery manufacturing accounted for 54 percent of global lithium demand.[9] Over the next decade, growth in lithium-ion-battery demand is expected to be driven mainly by EVs. In the long run, as the use of renewable energy sources increases, large lithium-ion batteries will also be instrumental for storing excess power generated from wind, solar and other renewable energy sources.

Global lithium production intensified in recent years, due to expectations of high demand growth over the next decade and relatively high prices from 2016 to 2017, (see Figure 1). . t 201 , f t , t t t t f , . The price drop was expected to persist for years, held down by oversupply and uncertainty about the pace of growth of the EV market, especially after China's 2019 decision to discontinue subsidies to EV manufacturers.[10] Global consumption, by contrast, has been steadily increasing in recent years, although at a slower pace than previously expected.

7 United States Geological Survey, t 2020 (Washington: U.S. Department of the Interior, 2020), https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf.

8 Ibid.

9 Roskill, t t 2030, 17th ed. (London, Roskill: 2020); Lithium is also used to a lesser degree in manufacturing ceramics and glass, lubricating greases and polymer production, among other uses, including for medicine.https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/mcs-2019-lithi.pdf

10 "Morgan Stanley Forecasts 30 Per Cent Drop in Lithium Prices by 2025,"

Figure 1: W c

according to the Bolivian government.[14] But Bolivia has yet to determine the extent to which its large resources can be commercially developed.

Figure 2: W e c e e e e e e (e c , 2020)

C	e c e *	e e e **
Bolivia	21,000,000	N.A.
Argentina	17,000,000	

companies cancelling projects or postponing planned investment.[16] By some estimates, 2020 lithium production in Argentina and Chile will fall by 35 percent and 20 percent respectively.[17]

N A C e E

Lithium can be found in many places, such as claystone, ocean water and even oil wells. But for now, only two sources of lithium are considered commercially viable: salt lakes ( ) and hard rock deposits. The fastest growing use of lithium is in the production of lithium-ion batteries. Once extracted, lithium is processed from its pure metallic state into chemical compounds —mainly lithium carbonate and lithium hydroxide— that are used to manufacture batteries.

The most common source of lithium from continental salt flats (salares) is found in the Lithium Triangle. The lithium, embedded in brines below the salt flat's exterior, is pumped to the surface using fresh water, then placed in large ponds, where the sun evaporates the water. The remaining lithium is processed to create lithium carbonate, a base compound used to manufacture lithium-ion batteries.

Figure 3: 

Caucharí	Salar de Caucharí	South American Salars	Advantage Lithium (75%)-Orocobre (25%)	Jujuy	PEA (Preliminary Economic Assessment)
Sal de los Angeles	Salar de Diablillos	Potasio y Litio Argentina	NextView New Energy	Salta	PEA (Preliminary Economic Assessment)
PPG	Salar de				

J e	e	O e	C	c e	
Processing Plant Expansion	Salar del Carmen	SQM	SQM	Antofagasta	Construction
Produccion de sales Maricunga	Salar de Maricunga	Simco	Simco	Atacama	Feasibility
Proyecto Blanco	Salar de Maricunga	Minera Salar Blanco	Minera Salar Blanco (30.98%-Ch)- Bearing Lithium (18.02%-CN)-Lithium Power Intl'(51%-AU)	Atacama	Feasibility
La Negra 3	Salar de Atacama	Albemarle	Albemarle	Atacama	Feasibility
Expansion Lithium Carbonate	Salar de Atacama	SQM	SQM	Atacama	Feasibility

De e e e e:

The development of the lithium industry in the LTCs is not without challenges, some structural and others related to the region's policy choices. First, lithium's price volatility makes it difficult for investors to make long-term investment plans. Prior to COVID-19 and the dramatic, global economic slowdown, the price of lithium experienced a significant drop due to oversupply, and investor sentiment soured as lithium producers suffered weaker earnings. Capital investment for pro.9465/l1lithiu8S(esa(eak6Bi7cs og%and wiu8S(2 (f)40 log,)400 0sen(e

a competitive edge over their pegmatite competitors. However, that comparative advantage could be undermined by downstream demand fluctuations (e.g., from battery manufacturers). Lithium-ion batteries are typically manufactured through different combinations of lithium hydroxide or lithium carbonate with other metals, such as cobalt, manganese or nickel. The chemical composition of lithium-ion batteries is evolving towards a higher nickel content, in search of improved performance and duration.[27] Since nickel does not synthesize well with lithium carbonate, battery manufacturers have started to shift their demand away from the lithium carbonate produced by the LTCs in favor of lithium hydroxide.[28]

Forecasts suggest that by 2024, demand for lithium hydroxide could exceed demand for lithium carbonate, which could adversely affect the lithium carbonate-producing LTCs.[29] That said, a booming EV industry resulting in a surge in battery demand might help sustain demand for both compounds. Lithium firms operating in the LTCs have already started to diversify, in preparation for future battery demand transformations. Chile's SQM, for example, formed a joint venture with hard-rock producer Kidman Resources in 2017 to develop lithium hydroxide in Australia. Similarly, Orocobre and Toyota Tsusho are building a lithium hydroxide plant in Japan that will receive lithium carbonate from their Olaroz joint project in Argentina's Jujuy province.

Another hurdle for South America's lithium industry is political and economic unrest, which together with the resulting regulatory uncertainty, make long-term project planning difficult. Argentina's sizeable lithium resources remain attractive for investors looking for new exploration projects. But frequently changing investment terms, partisan tensions and a history of economic crises make Argentina a high-risk investment destination.

In Chile and Bolivia, violent anti-government demonstrations in 2019 threatened lithium investments. In Chile, massive protests over economic inequality temporarily blocked access to lithium operations. Investors in Chile —until recently a country that was beacon of good governance and economic growth in the region— were caught off-guard, and despite coronavirus social distancing measures, protests have resumed.[30] In Bolivia, clashes between protesters and the police left more than 30 dead and led to

27 Battery manufacturers are also trying to rely less on cobalt, which is mainly imported from the Democratic Republic of Congo, where political instability and allegations of child labor in artisanal mines have caused concern.

28 "Lithium hydroxide demand to overtake carbonate: AABC," , January 29, 2019, https://www.argusmedia.com/en/news/1836977-lithium-hydroxide-demand-to-overtake-carbonate-aabc.

29 Ibid.

30 "Lithium Miner SQM Dodges Impact of Chile Protests, Hit by Lower Prices," , November 21, 2019, https://lfpress.com/pmn/business-pmn/lithium-miner-sqm-dodges-impacts-from-chile-protests-hit-by-lower-prices/wcm/495dca06-13d9-48a2-9fab-93d4084abfc2.

the resignation of longtime President Evo Morales and his replacement by a caretaker

that protect the rights of indigenous peoples. The LTCs are signatories to international agreements that require governments to consult with local indigenous communities on developments that affect them.[35] A common claim by indigenous populations living close to extractive operations, such as lithium, is that such consultations are flawed. Such was the case in Jujuy in 2010, when 33 indigenous communities filed a complaint with Argentina's Supreme Court and interrupted local lithium operations.

compared to Argentina. Legal disputes between the government and Chile's two private lithium operators, SQM and Albemarle, did not help. SQM demanded larger production quotas, and Albemarle disputed the preferential price at which it was obligated to sell to downstream producers. By 2018, both disputes had been resolved.[39] However, the differences generated such uncertainty that the three downstream producers that had won the rights to buy lithium from Albermarle backed out. Tensions with private firms dampened investment and output, and by 2017, Australia had displaced Chile as the world's largest lithium producer.[40]

Bolivia: Bolivia's lithium industry is at a much earlier stage of development, with production limited to a pilot project launched in 2013. Another pilot project was launched in 2017 to manufacture batteries. Under Mr. Morales, Bolivia's strategy focused on state control of the lithium value chain, with the exception of industrialization, which could be done in partnership between Yacimientos de Litios Bolivianos (YLB) and a foreign investor. Implementation of Bolivia's lithium strategy suffered delays, mainly due to technical hurdles related to the characteristics of the Uyuni brine, but also due to financial difficulties.[41] Upstream financing is the responsibility of the government, through loans from Bolivia's Central Bank. Bolivia's lithium industry has not advanced much either under the current interim government. Ms. Áñez has changed three YLB executive managers in two months. Disputes between two groups in the lithium producing region and differences with the national government have not diminished, and the pandemic paralyzed any progress.

In all three cases, the authorities have emphasized the importance of lithium for economic growth, but questions about the future governance of the sector linger. Argentina's new government, for example, has not yet announced its lithium development strategy, though an August 2020 report from its embassy in Washington forecast growing lithium demand and predicted Argentina would be "one of the leaders

The LTCs could explore the formation of economies of scale and ultimately develop efficient mechanisms for jointly addressing increasing international competition and the challenges of rapidly evolving technologies. Regional incentives to the development of the downstream lithium industry could be more cost-effective than current unilateral approaches.

For now, COVID-19 has placed South America's lithium industry in a holding pattern. But the LTCs should be ready to move rapidly once demand starts to pick up again, as transportation around the world becomes increasingly electrified.

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