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The Lithium Triangle: The Case for Post-Pandemic Optimism



Patricia I. Vásquez

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. *Chile and Argentina are the world's second- and fourth-largest lithium producers, respectively, and Bolivia holds the world's largest lithium resources that have yet to be commercially*

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developed.¹ Outside the Lithium Triangle, Mexico is thought to hold the world's largest lithium deposits from clay, and Peru and Brazil have found lithium in hard rock.

These lithium resources offer promising opportunities for economic development for the LTCs, but there are also enormous challenges. So far, each country has adopted different approaches to the development of their lithium industry. High barriers to entry in Chile and a statist approach in Bolivia have slowed lithium investments. By contrast, Argentina's more investor-friendly approach resulted in the arrival of some of the world's largest lithium companies in recent years.

After dedicating time and effort to jumpstarting its battery manufacturing industry, Bolivia failed in its attempt.

LTC governments have been exploring opportunities for adding value to their lithium assets by moving beyond the mere production of raw lithium and into the manufacturing of complex products, such as lithium-battery powered electric vehicles (EVs) and rechargeable lithium-ion batteries.² At the same time, governments in Latin America have been slowly joining the global transition to electric mobility, and they are at different stages in the design of policies, laws and incentives that will govern vehicle electrification.

While the LTCs hold a lead upstream, the domestic manufacturing of EVs and rechargeable lithium-ion batteries at a commercial scale would require navigating steep learning curves, as countries attempt to move up the lithium value chain. The LTCs are

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- 1 United States Geological Survey, *Mineral Commodity Summaries 2020* (Washington: U.S. Department of the Interior, 2020), <https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf>.
 - 2 "Bolivia presenta el primer vehículo eléctrico de fabricación nacional," *Bolivia.com*, September 26, 2019, <https://www.bolivia.com/actualidad/nacionales/auto-electrico-fabricado-en-bolivia-242445>; Matias Alonso, "Petrel, el fabricante argentino de aviones ya prepara una inversión con motor eléctrico junto con la Universidad de La Plata," *La Nación*, August 14, 2020, <https://www.lanacion.com.ar/tecnologia/petrel-fabricante-argentino-aviones-prepara-version-motor-nid2421362>.



Photo Credit: Shutterstock.com

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. *That recognition led European countries and the United States to expedite plans to reduce their dependence on China for lithium downstream processing, in anticipation of a surge in demand this decade. The European Union included lithium among its list of critical raw materials, and the U.S. Senate introduced legislation that addresses supply chain weaknesses exposed by COVID-19.*⁴

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 Ricardo Lagos has urged.⁶ That approach could help spread the risk of venturing into a new and rapidly evolving industry, flattening the learning curve and attracting greater investment. It would also permit Lithium Triangle

3 "How lithium-rich Chile botched a plan to attract battery makers," *Reuters*, July 17, 2019, <https://www.reuters.com/article/us-chile-lithium-focus/how-lithium-rich-chile-botched-a-plan-to-attract-battery-makers-idUSKCN1UCOC8>; "Evo Morales, 'el golpe del litio' y las luchas internas en Bolivia," *Forbes Centroamérica*, December 28, 2019, <https://forbescentroamerica.com/2019/12/28/evo-morales-el-golpe-del-litio-y-las-luchas-internas-en-bolivia/>.

4 U.S. Senate Committee on Energy and Natural Resources, "Murkowski's Mineral Bill included in Recovery Legislation," July 27, 2020; European Commission, *Study on the EU's List of Critical Raw Materials*, Final Report, 2020.

5 PNUMA, *Movilidad Eléctrica: Avances en América Latina y el Caribe y Oportunidades para la Colaboración Regional 2019* (Programa Naciones Unidas para el Medio Ambiente, 2019) <http://movelatam.org/transicion/>.

6 "The Emergence of Covid-19 in Latin America and the Caribbean and the New International Context," webinar, Inter-American Development Bank, June 22, 2020.

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.

Abundant Resources

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). *Yet by 2018, long before the novel coronavirus, production started to fall, prices experienced a downward spiral.* 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.

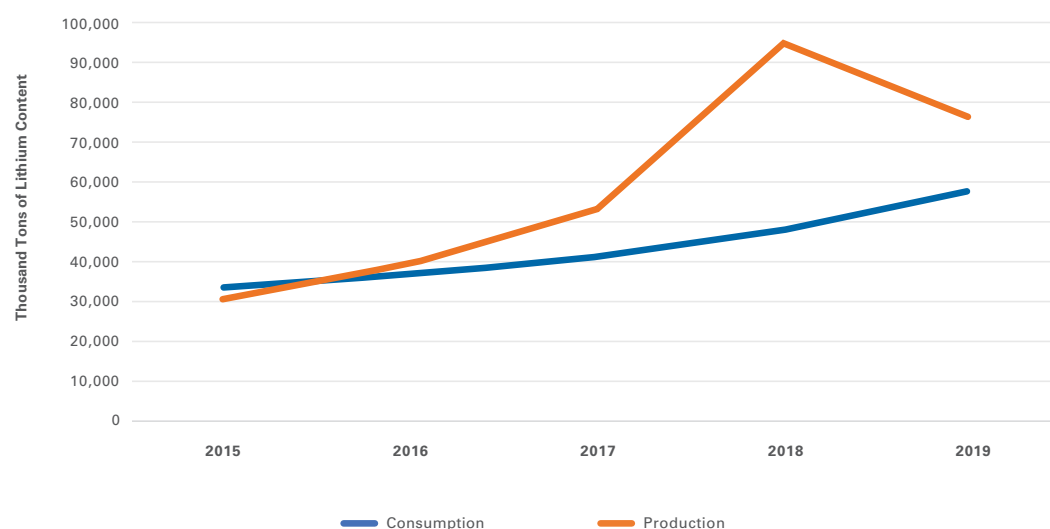
7 United States Geological Survey, *Mineral Commodity Summaries 2020* (Washington: U.S. Department of the Interior, 2020), <https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf>.

8 Ibid.

9 Roskill, *Lithium: Outlook to 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," *Financial Times*, July 12, 2019, <https://www.ft.com/content/6b9e3bdc-a480-11e9-a282-2df48f366f7d>; "China Cuts Electric-Car Subsidy, Shares of Top EV Makers Drops," *Bloomberg*, March 26, 2019, <https://www.bloomberg.com/news/articles/2019-03-26/china-scales-back-subsidies-for-electric-cars-to-spur-innovation>.

Figure 1: **World Lithium Production**



Source: Author, with data on production from United States Geological Survey, British Geological Survey, UKRI and World Mining Data, as quoted by BP Statistical Review of World Energy (2020); Consumption data: United States Geological Survey.

The global lithium resource base surged from 13 million tons to 62 million tons from 2007 to 2018.¹¹ However, only a small portion has been certified as reserves, meaning they can be commercially exploited using existing technologies. As shown in Figure 2, practically all of Chile’s lithium resources are commercially viable: 8.6 million out of 9 million tons. However, Argentina, like Australia, is producing only a small portion of its known lithium deposits. *The LTCs hold a large portion of global lithium resources but have relatively low participation in world production.* Among the world’s largest lithium producers, Argentina and Chile show the lowest share of annual production versus total reserves.¹²

As of 2019, Bolivia displaced Argentina to become the country with the largest lithium resources in the world, according to the USGS Mineral Commodity Summary 2020.¹³ Lithium resources in Bolivia went from 9 million metric tons in 2018 to 21 million tons in 2019, following a new resource certification of the Uyuni salt-lake by a U.S. company,

11 United States Geological Survey, *Mineral Commodity Summaries* (Washington: U.S. Department of the Interior: 2008); United States Geological Survey, *Mineral Commodity Summaries* (Washington: U.S. Department of the Interior: 2019).

12 Martín Obaya and Paulo Pascuini, “Estudio comparativo sobre los modos de gobernanza del litio en Argentina, Chile, y el Estado Plurinacional de Bolivia” (unpublished manuscript, Santiago: ECLAC, 2019).

13 United States Geological Survey, *Mineral Commodity Summaries* (Washington: U.S. Department of the Interior: 2020), <https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf>.

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: World Lithium Resources versus Reserves (metric tons, 2020)

Country	Resources*	Reserves**
Bolivia	21,000,000	N.A.
Argentina	17,000,000	1,700,000
Chile	9,000,000	8,600,000
Australia	6,300,000	2,800,000
China	4,500,000	1,000,000

Source: Author, with data from United States Geological Survey, Mineral Commodity Summaries, February 2020.

*Resources with potential for being developed in the future.

**Reserves identified as economically viable to be developed today, with current technologies.

Peru could soon also enter the top tier of South America’s lithium countries. A preliminary economic assessment of the Falchani project earlier this year said that the hard rock lithium development could become the sixth largest in the world once its resources are deemed commercially recoverable.¹⁵ Falchani is located in Peru’s southeastern Puno region and it is operated by Canadian company Plateau Energy Metals.

COVID-19 further prolonged the low-price environment that had dampened new production and investments in new projects in previous years. Prices for the lithium carbonate produced by the LTCs were down 40 percent in July 2020, resulting in

14 Gobierno del Estado Plurinacional de Bolivia, “Bolivia es el mayor poseedor de litio del mundo con 21 millones de toneladas en Uyuni” (Ministerio de Energía, February 21, 2019), <https://www.minenergias.gob.bo/2019/02/21/bolivia-es-el-mayor-poseedor-de-litio-del-mundo-con-21-millones-de-toneladas-en-uyuni/>.

15 “Plateau Energy Metals Announces Filing of Technical Report for the PEA on the Falchani Lithium Project in Peru,” Plateau Energy Metals (Press Release), March 20, 2020, <https://www.globenewswire.com/news-release/2020/03/21/2004373/0/en/Plateau-Energy-Metals-Announces-Filing-of-Technical-Report-for-the-PEA-on-the-Falchani-Lithium-Project-in-Peru.html>.

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

Not All Lithium is Created Equal

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 (*salares*) 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.

In the case of hard rock, there are more than 100 different types of minerals that might contain lithium. But production comes mostly from spodumene, a mineral derived from pegmatite rock that is known for its high lithium content.¹⁸ Pegmatite lithium deposits are mined using conventional open-pit or underground mining technologies. Once removed from the ore, the lithium is heated and crushed into a powder, then combined with chemicals, concentrated and refined to produce battery compounds, mainly lithium carbonate and lithium hydroxide.

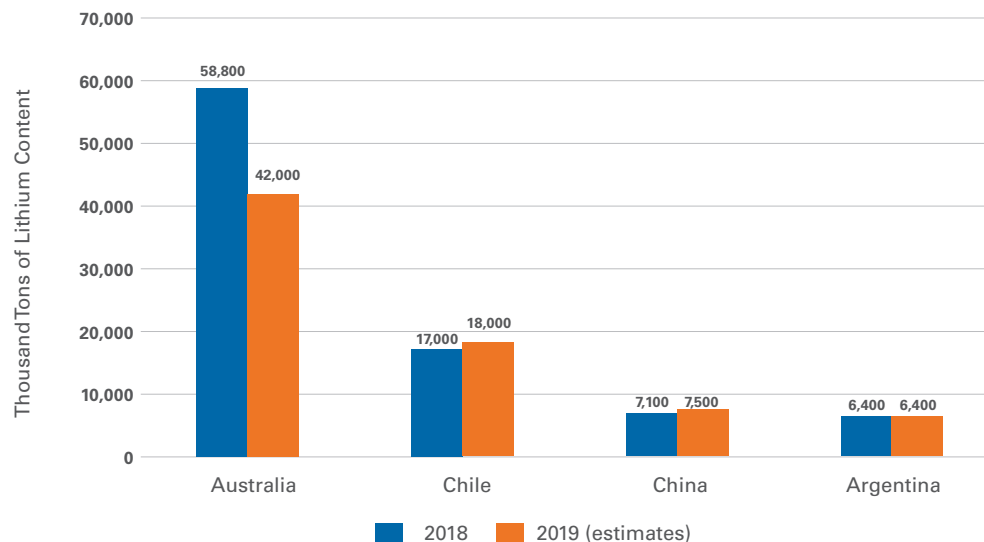
Australia is the world's largest producer of lithium, followed distantly by Chile, China and Argentina (see Figure 3). The bulk of world lithium production in 2019 came from six hard-rock operations in Australia, two brine projects each in Argentina and Chile and one brine and one hard-rock development in China.

16 Nicolás Saldías, "Can South America's Lithium Industry survive Covid-10?" Wilson Center, July 31, 2020, <https://www.wilsoncenter.org/blog-post/can-south-americas-lithium-industry-survive-covid-19>.

17 Roskill, "Covid-19 could wipe out US\$1 billion of lithium supply in 2020," Green Car Congress, April 14, 2020, <https://www.greencarcongress.com/2020/04/20200414-roskill.html>.

18 R.K. Evans, "Lithium," in *Critical Metals Handbook*, ed. A.G. Gunn (John Wiley & Sons, 2014).

Figure 3: **Lithium Production by Country**



Source: USGS Mineral Commodity Summaries, February 2020.

The largest pegmatite mine in operation is in Greenbushes, Australia.¹⁹ The potential for pegmatite-based lithium production is immense: countries like the United States, Canada, Ireland, Finland and the Democratic Republic of Congo all hold sizable pegmatite lithium deposits.²⁰ In South America, there are five pegmatite projects in initial stages in Argentina, the abovementioned operation in Peru and one under development in Brazil's southeastern state of Minas Gerais, by Canadian Sigma Lithium.²¹

Argentina and Chile are the world's leading producers of lithium from brines. Among the LTCs, Argentina has the largest portfolio of projects: 19, of which two are in operation and the rest in advanced stages of development. In addition, 20 other lithium projects are at an early exploration phase.²² With COVID-19, the country entered into a long quarantine period, and companies were forced to slow down operations or even bring

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- 19 The mine is owned by Talison Lithium, a joint venture between China's Tianqi Lithium and U.S.-based Albemarle.
 - 20 "Lithium," British Geological Survey (Nottingham: Natural Environment Research Council, 2016).
 - 21 A. López, et al. *Litio en la Argentina: Oportunidades y desafíos para el desarrollo de la cadena de valor* (Presidencia de la Nación, BID, 2019).
 - 22 Presidencia de la Nación, *Advanced Lithium Projects in Salars* (Buenos Aires: Ministerio de Producción y Trabajo, Subsecretaría de Desarrollo Minero, 2019), <http://cima.minem.gob.ar/assets/datasets/2019-04-15%20Advanced%20Lithium%20Projects-%20Argentina.pdf>.

operations to a halt and freeze plans to expand capacity. One company, French Eramet, canceled its lithium project in Argentina altogether, citing economic uncertainty due to the pandemic.²³

Figure 4: **Advanced Lithium Projects in Argentina**

Project	Salt Lake	Operator	Company	Province	Status
Olaroz	Salar de Olaroz	Sales de Jujuy	Orocobre (67.5%)-Toyota Tsusho (25%)-Jemse (8.5%)	Jujuy	Production
Mina Fénix	Salar del Hombre Muerto	Minera del Altiplano	Livent	Catamarca	Production
Caucharí-Olaroz	Salar de Caucharí	Minera Exar	Lithium Americas (45.75%)-Gangfeng (45.75%)- JEMSE (8.5%)	Jujuy	Construction
Kachi	Salar de Carachi Pampa	Morena del Valle	Lake Resources (AU)	Catamarca	Advanced Exploration
Sal de Oro	Salar del Hombre Muerto	Posco	Posco Argentina	Salta	Advanced Exploration
Salar de Pular	Salar de Pular	Pepinnini Minerals	Pepinnini Minerals	Salta	Advanced Exploration
Rincón Lithium	Salar del Rincón	Argosy Minerals	Argosy Minerals	Salta	Advanced Exploration
Río Grande	Salar de Río Grande	Lithea Sucursal Argentina	Pluspetrol	Salta	Advanced Exploration
Salar del Rincón 2	Salar del Rincón	Pepinnini Minerals Ltd.	Pepinnini Minerals Ltd.	Salta	Advanced Exploration
Pastos Grandes	Salar de Pastos Grandes	Proyecto Pastos Grandes	Millennial Lithium Corp.	Salta	PEA (Preliminary Economic Assessment)
Salar del Hombre Muerto Norte II	Salar del Hombre Muerto	NRG Metals	NRG Metals	Catamarca	PEA (Preliminary Economic Assessment)

23 “Eramet halts Argentina lithium project on coronavirus crisis,” *Reuters*, April 8, 2020, <https://www.reuters.com/article/health-coronavirus-eramet-argentina/update-1-eramet-halts-argentina-lithium-project-on-coronavirus-crisis-idUSL8N2BW27L>.

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 Pozuelos	Lithea Sucursal Argentina	Pluspetrol	Salta	PEA (Preliminary Economic Assessment)
Mariana	Salar Lullaillaco	Litio Minera Argentina	Gangfeng (82.75%-International Lithium Corp. (17.25%))	Salta	PEA (Preliminary Economic Assessment)
Sal de Vida	Salar del Hombre Muerto	Galaxy Resources Limited	Galaxy Resources	Catamarca	Feasibility
Salar Centenario-Ratones*	Salar de Ratones	Eramine Sudamerica	Eramet	Salta	Feasibility
Tres Quebradas (3Q)	Laguna de Tres Quebradas	Liex SA	Neo Lithium Ltd.	Catamarca	Prefeasibility
Salar del Rincon	Salar del Rincon	Rincón Mining Limited.	Rincón Ltd.	Salta	Feasibility

Source: Author, with data from Presidencia de la Nación, Secretaría de Energía and Ministerio de Producción y Trabajo.

*Project suspended due to COVID-19.

In Chile, two companies produce lithium from the Atacama salt flat, SQM and Albemarle. The Atacama holds an estimated twenty percent of the world's lithium reserves and around 80 percent of Chile's.²⁴ Both companies have sustained output during COVID-19, although that could change as the pandemic persists and workers become infected. Chile is exploring as many as 25 other brines in search of additional sources of lithium. In the case of Bolivia, as noted, the country has yet to produce lithium at a commercial scale from its Uyuni salt flat resources.

Figure 5: **Advanced Lithium Projects in Chile**

24 Minería Chilena, *El litio en Chile y el mundo; Proyecciones hacia 2025* (Santiago: Grupo Editorial Editec, 2018).

Project	Salt Lake	Operator	Company	Province	Status
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

Source: Author, with data from Cochilco, Mercado Internacional del Litio y su Potencial en Chile, (Santiago: DEPP (28), 2018).

Lithium Development in the Lithium Triangle: A Winding Road

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 project expansion and new developments was already slowing in the LTCs.²⁵ Morgan Stanley, for example, had a pre-pandemic bearish outlook, with a predicted 30 percent fall in the price of lithium carbonate originating in South America by 2025, from around \$11,000/ton to \$7,200/ton by 2025.²⁶

A second challenge is the rapidly evolving lithium battery technology. In upstream lithium extraction, brine-based production remains more cost-efficient and less environmentally disruptive than hard rock extraction, which could give South American producers

25 "Lithium's Price Paradox," Benchmark Mineral Intelligence, July 30, 2019, <https://www.benchmarkminerals.com/lithiums-price-paradox/>.

26 H. Sanderson, "Morgan Stanley Forecasts 30% Drop in Lithium Prices by 2025," *Financial Times*, July 12, 2019. <https://www.ft.com/content/6b9e3bdc-a480-11e9-a282-2df48f366f7d>

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," *Argus Media*, 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," *The London Free Press*, November 21, 2019, <https://lfpres.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 government in November 2019. Mr. Morales, who was granted political asylum in Argentina, had been accused of rigging the elections to obtain a fourth term.³¹ However, the unrest was also fueled by popular discontent over a contract Mr. Morales signed with a German lithium company, ACI Systems, and demands for higher royalties in lithium producing areas. The contract, which envisioned building lithium batteries in Bolivia, was later canceled, but political uncertainty remains, casting a shadow over the country's lithium industry.³² The interim president, Jeanine Áñez, has repeatedly postponed the do-over presidential election, citing COVID-19 concerns.

In addition to political developments, social and environmental demands in LTC production sites also pose challenges to the region's lithium industry. Some lithium projects are already encountering domestic hostility due to concern about the water used for processing the lithium into commercially traded lithium carbonate. The main worries are potential water depletion—particularly in dry regions—and contamination. Indigenous communities and environmental groups in Argentina's Jujuy province, for example, have protested lithium extraction, demanding more information on the distribution of lithium royalties and on possible negative impacts on water supplies. In Chile, a court upheld an appeal by indigenous populations living close to Atacama desert brine operations, who argued that SQM's remediation plan was insufficient to address environmental impacts, including to the region's flamingo colonies.³³

The geologic characteristics of each brine differ, and the environmental and social impacts of lithium extraction and remediation methods vary. Yet existing research on the social and environmental effects of lithium production at local levels remains limited.³⁴ Furthermore, lithium operations in the LTCs are usually close to areas inhabited by indigenous populations, which means they are often subject to unique legal frameworks

31 Organization of American States, *Electoral Integrity Analysis: General Elections, in the Plurinational State of Bolivia* (Preliminary Findings Report to the General Secretariat, 2019).

32 Paola Flores, "Bolivian Lawmakers Approve New Election, Bar Ex-President," *Associated Press*, November 23, 2019, <https://abcnews.go.com/International/wireStory/bolivia-senate-approves-presidential-electional-67253838>.

33 Tom Azzopardi, "Water Use in Atacama Salt Flat Trips up Chilean Lithium Miner," *Bloomberg Law*, December 31, 2019. <https://news.bloomberglaw.com/environment-and-energy/water-use-in-atacama-salt-flat-trips-up-chilean-lithium-miner>; L.M. Lombrana, "Score One for the Flamingos in High Altitude Fight for Lithium Supplies," *BNN Bloomberg*, December 22, 2018, <https://www.bnnbloomberg.ca/score-one-for-the-flamingos-in-high-altitude-fight-for-lithium-supplies-1.1187489>.

34 United States Geological Survey, *Lithium: Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply* (Washington: U.S. Department of the Interior, 2017).

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.

Going it Alone

The LTCs have adopted disparate and unilateral approaches to the lithium sector, with little or no coordination. Not surprisingly, uncoordinated institutional design and policy choices have led to uneven results. Looking forward, the region stands to benefit greatly from collaboration, especially if post-pandemic stimulus programs favor EV adoption and other renewable energy objectives.

Argentina: Argentina has adopted a generally market-friendly approach, which led to a 60 percent increase in production from 2015 to 2017, with exports up 111 percent in 2016.³⁶ Argentina is the number-one supplier of lithium to the United States. In 2019, 53 percent of lithium imports to the United States came from Argentina. Lithium companies have been operating in Argentina for decades, developing projects in high-altitude salt flats located in three Andean provinces, Jujuy, Catamarca and Salta.³⁷ Two projects are in operation, Olaroz and Fenix, located in the provinces of Jujuy and Catamarca, respectively. The pandemic has added new challenges to Argentina's perpetual economic woes by interrupting lithium operations. Post COVID-19, however, Argentina's lithium industry should recover relatively fast, encouraged by a growing commitment to EVs around the world.

Chile: Chile classifies lithium as a strategic resource that can be developed by private firms only under strict conditions, such as production quotas and the obligation to sell 25 percent of domestic output at preferential prices to downstream producers operating in the country.³⁸ Those restrictions explain the relatively low investor interest in Chile

35 For an in-depth discussion of the international legal system that governs consultation with indigenous people, see: P. Vásquez, "Indigenous Peoples and Natural Resource Developments," in *Oil Sparks in the Amazon: Local Conflicts, Indigenous Populations and Natural Resources* (Athens: The University of Georgia Press, 2014).

36 Presidencia de la Nación, *Mercado del Litio. Situación actual y perspectivas* (Buenos Aires: Dirección de Economía Minera, Subsecretaría de Minería, March 2017).

37 Presidencia de la Nación, *Informe de Cadena de Valor. Litio* (Buenos Aires: Secretaría de Política Económica, Subsecretaría de Programación Económica, April 2018).

38 R. Perotti and M. Coviello, *Governance of Strategic Minerals in Latin America: The Case of Lithium* (Santiago: ECLAC, 2015).

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 Albemarle 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 on a global scale."⁴² The impacts of expected constitutional reforms on Chile's lithium industry are not clear. And the next government in Bolivia will no doubt implement its

39 Felipe Iturrieta, "Chile's Corfo, SQM Strike Deal in Lithium Dispute," *Reuters*, January 17, 2018, <https://www.reuters.com/article/sqm-arbitration/update-1-chiles-corfo-sqm-strike-deal-in-lithium-dispute-idUSL1N1PC2D6>; Dave Sherwood, "Chile Strikes Deal with Lithium Miner Albemarle in Contract Dispute," *Reuters*, January 24, 2019, <https://www.reuters.com/article/us-chile-lithium-albemarle/chile-strikes-deal-with-lithium-miner-albemarle-in-contract-dispute-idUSKCN1PI32>.

40 British Petroleum, *Statistical Review of World Energy*, June 2020.

41 M. Obaya, *Estudio de Caso sobre la Gobernanza del Litio en el Estado Plurinacional de Bolivia* (Santiago: ECLAC, Documentos de Proyectos, 2019).

42 Embassy of Argentina, "Argentina en Foco" (Washington: August 2020).

own vision for the lithium sector.

Crossroads

The decline in lithium prices and the economic traumas of the pandemic are a logical time for the governments of the LTCs to reexamine their lithium development strategies and consider coordinated approaches to lithium development. Multilateral collaboration is a potentially cost-effective and less-risky approach, particularly if governments intend to tackle battery or EV manufacturing. By collaborating—for example, to divide up research and development tasks or harmonize legal and regulatory regimes to facilitate cross-border investments—the LTCs could create an improved investment climate, reduce the administrative burdens on individual governments and avoid any race-to-the-bottom policies on taxes, royalties and regulation. Likewise, governments could work together to design innovative technology transfer models that could help the region maximize lithium investment and production and perhaps move up the lithium value chain.

A regional approach could also help mitigate occasionally elevated country risk in the Lithium Triangle, which could lower borrowing costs and increase much-needed infrastructure investment. Governments, for example, could explore regional synergies for potential cross-border infrastructure development. For now, inadequate regional infrastructure elevates project costs for investors. Governments are addressing infrastructure challenges individually: Chile installed solar power plants in the Atacama Desert—one of the sunniest places on earth—that benefit lithium projects and send energy southward through newly built transmission lines. In Argentina, Jujuy province is a pioneer in solar energy, which supplies local communities and industrial projects, including lithium production.⁴³

The LTCs could benefit from exploring a shared governance model for the lithium industry based on regionally standardized social and environmental safeguards, including clear terms for local community engagement. Multilateralism could be instrumental in synchronizing environmental and social policies, monitoring lithium extraction, deploying geologic measurements and establishing industry standards. This would reduce monitoring and enforcement costs and would provide firms with a predictable regulatory environment. A shared approach to local community engagement could go a long way in the prevention of disputes with local communities.

A regional vision for the lithium industry could also help shape pragmatic national-level expectations regarding the development of downstream industries in South America.

43 A. Molina, M. Falvey and R. Rondanelli, “A Solar Radiation Database for Chile,” *Scientific Reports* 7 (November 2017), <http://doi.org/10.1038/s41598-017-13761-x>.

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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One Woodrow Wilson Plaza
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