Exclusive

Lithium firms depleting vital water supplies in Chile, analysis suggests

By Ben Heubl

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Evidence uncovered by E&T appears to show that lithium-mining company SQM is playing a direct role in damaging the local environment in Chile's Atacama salt flats, as its activities reduce water levels in an already dry region, with severe effects on local communities, protected lagoons and areas of alluvial muds.

As worldwide battery demand is expected to triple and reach a value of $100bn by 2025, failing to boost lithium supply could make or break the global electric vehicle supply chain and jeopardise global climate efforts, a new investigation by *E&T* finds.

To ensure supply, lithium mining must increase or otherwise a deficit may harm progress, warn experts. Most of the world's lithium production takes place in South America, where 70 per cent of global reserves are concentrated. Chile, accounting for 38 per cent of the production, is in a difficult spot. Firms are doing their best to exploit reserves, but environmental concerns increasingly challenge their endeavours.

Import and export of lithium carbonates

%, 2017

Source: OEC • For all imports, the rounding causes inaccuracies in adding up to exactly 100%

Since the lithium rush started, corporations like Sociedad Química y Minera de Chile (SQM), a multibillion-dollar Chilean chemical company, as well as US-headquartered Albemarle Corporation, bet on one effective way to extract lithium from the Atacama salt flats: lithium extraction from brine.

A method dating from the 1950s, it has encountered more and more scrutiny because it affects surrounding water reserves and could affect the climate. With pressure on Chile's lithium demand and anticipated regulatory hurdles, the price of lithium has skyrocketed, according to data by the US Geological Survey (see chart).

Lithium price boom

Price annual average battery-grade lithium carbonate dollars per metric ton2

Source: US Geological survey

What is lithium extraction from brine?

The way lithium is ‘water-mined’, says Ingrid Garcés, a researcher from Chile’s University of Antofagasta and chemical civil engineer, is by pumping saline groundwater up from the subsurface. The brine contains around 0.15 per cent lithium, and is pumped through a cascade of ponds where impurities or by-products are precipitated by solar evaporation, wind, and chemical additives.

The problem with this comparatively cheap method is that up to 95 per cent of the extracted brine water is lost to evaporation and not recovered, researchers estimate. As the brine water is in hydrodynamic relation with its surroundings, the water-intensive mining process in this extremely arid region causes aquifers to deplete and affects the water balance. This is leading to continuing outcry among local communities living in close proximity to the Atacama salt flat.

Area of lithium mining between 1997 and 2017

Mining Area (km2)

From 1997–2017, lithium mining operations are estimated to have expanded from 20.54 km2 to 80.53 km2, effectively quadrupling over the course of the past two decades (with a noticeable push between 2009 and 2013)

Source: Wenjuan Liu et. al; paper: "Spatiotemporal patterns of lithium mining and environmental degradation in the Atacama Salt Flat, Chile"

Cristina Dorador, a Chilean biologist who studies microbial life in the Atacama desert, says, “San Pedro de Atacama and other small towns are drying out”. Also drying out is Peine, a small township declared a National Monument in 1982 and situated only a stone’s throw away from gigantic lithium-brine mines.

“It is a paradox in Chile. On one side we are talking about decarbonisation, [to mitigate] climate change and the loss of biodiversity and on the other side we exploit the environment for resources to power the electric mobility revolution that supports climate change,” Dorador says.

E&T, in collaboration with satellite analytics firm SpaceKnow, has been able to produce further quantitative evidence that lithium brine mining efforts between 2015 and 2019 by SQM took a heavy environmental toll on a fragile water ecosystem within the Atacama salt flats.

The analysis found a strong inverse relationship between water reservoir levels at SQM's ponds and the lagoons. As water levels in SQM's ponds increased, those in the lagoons would drop. SQM's second pond (see graphic) correlated with water reservoirs in alluvial muds. The firm's first pond (see graphic) is linked to the fragile lagoons of the Soncor area, part of the Los Flamencos National Reserve. It is an important nesting ground for Andean flamingos. The statistical analysis can also prove causality, confirming that as brine extraction operation expanded, nearby areas suffered environmental degradation (see methodology notes).

While anecdotal evidence from local community members is abundant and mounting and researchers have long had some inkling of the environmental damage, few gathered quantitative evidence on specific damage until recently. Open-source satellite imagery and machine learning have helped to change that.

Dorador adds that the evidence was obvious. Many flamingos reportedly left the lagoons. Understanding what happens with microorganisms is a bit more complicated, but they would basically exhibit the same symptoms and diagnosis: "There is no recharge of the water in the Atacama salt flat. Much of the water is being evaporated in the process. This isn't sustainable".

San Pedro-based Ramón Morales Balcázar from the Plurinational Observatory Of Andean Salt Flats - a network of people from the communities, NGOs and research universities in the region - says the only way to challenge the loss of water is by drastically cutting water extraction by the companies operating in the region.

Government figures issued by the Comité de Minería No Metálica (the Nonmetallic Mining Committee) confirm that the current extractive development in the Basin of the Atacama salt flat provokes hydrological imbalances. With a brine output of 8,842 litres per second, and a recharge capacity of 6,810 litres per second, it was found be more than 2,000 litres per second above a rechargeable threshold.

Adding to the concerns is the ambition by Chile's government to open up more land to brine mining, says Balcázar. "There are actually 59 salt lets in Chile and the ministry of mining is now calling for their exploitation, as soon as possible. That is really worrying to us."

Balcázar is not alone in his apprehensions. Sergio Cubillos, heading Chile's indigenous council, told Bloomberg that the government is encouraging more and more companies to come to explore and mine lithium. Capacity to oversee all of this would be nonexistent.

E&T has learned from a source that only last week, the Servicio de Evaluación Ambiental, Chile's environmental assessment service, permitted the company Wealth Minerals Chile SpA, a natural resources company concentrating on developing lithium brine property packages in Chile, to explore the northern part of Salar de Atacama. The location would lie near a Ramsar site – defined as a wetland site designated to be of international importance under the Ramsar Convention – as well as based near tourist attractions where water supply is critical to provide local people with income.

At the beginning of August, state-owned Codelco (National Copper Corporation of Chile) and mining and metals company Minera Salar Blanco announced an agreement to explore the possibility of developing a lithium project at the Maricunga Salt Flat (see image). *E&T* was told that this happened without any consultation with the indigenous Qulla communities. The corporations are also allowed access to a national park area, the Nevado Tres Cruces (a massif of volcanic origin in the Andes Mountains, see map) as well as a Ramsar site, including Laguna Negro Francisco and Laguna Santa Rosa (map).

In Balcázar's view, this could lead to consideration of "legal ways to protect indigenous rights, as well as social protests", similar to those that took place in 2018 after the announcement of the deal between CORFO and SQM, he told *E&T*.

A comprehensive research study that was published this year supports the findings of *E&T*'s investigation and the satellite analysis. Wenjuan Liu and her research colleagues at the School of Sustainability at Arizona State University found that lithium mining in the area bore strong negative correlations with the vegetation and soil moisture – meaning, the more mining, the rarer plants and water become in the soil.

Arguably not 100 per cent caused by brine mining – a booming tourism industry and a slight population increase also contributed – the research identified lithium brine mining activities as one of the major stresses affecting local environmental degradation. Two decades, 1997-2017, were studied, recording soil moisture, vegetation and temperature. An expansion of lithium brine mining area of one square kilometre was found to correspond to a significant decrease in the average level of vegetation and in soil moisture.

Other environmental consequences are observable in changes in the region's microclimate. When climate changes, natural disasters can strike more often. At the beginning of the year, the area encountered a period of devastating rains, most untypical for the arid area. Ironically, the amount of water precipitated was insufficient to recharge the aqua-reserves, but did cause destructive floods, Balcázar recalls. "San Petro was isolated for almost a month in February due to flooding. The water is now coming also with a lot of salts, with heavy metals, which are naturally present in the environment. It is also affecting the communities that live in these territories", he told *E&T*.

A temperature rise over the course of two decades was observed that may be connectable to the rise in mining activities in the Atacama salt flat. Daytime land surface temperatures were found to have increased considerably from approximately 28.4°C to 32.9°C in the summer. Winter daytime temperatures climbed to 14.1°C, from 8.3°C in 1997.

Francisco Mondaca, coordinator of environmental issues at the Atacama People's Council, says mining companies' assessments of their environmental impacts do not take account of warming temperatures which accelerate the drying process, (according to a report by Bloomberg).

How do these trends link to climate change? In a report published in early August by the Intergovernmental Panel on Climate Change (IPCC), researchers presented themselves as highly confident in their assumption that current levels of global warming are associated with moderate risks from increased dryland water scarcity; soil erosion; vegetation loss; wildfire damage; permafrost thawing; coastal degradation, and tropical crop yield decline – many symptoms found by researchers in the Atacama salt-flat mining area.

Dr Rich Crane, a lecturer in sustainable mining at the University of Exeter's Camborne School of Mines, cautions that these brine ponds - effectively working as salt pans - not only result in huge amounts of potentially useful groundwater being lost to the atmosphere, but also require large areas of land for such evaporation. This results in widespread habitat removal. The irony, he says, lies in the fact that "the very regions where such brine ponds are so effective, i.e. those which have low rainfall, are often by definition those which can be water-scarce".

Records for 2018 issued by the Comité de Minería No Metálica shows that the companies' pumping efforts are not illegal, just astonishingly high. Not only brine water but also fresh water is being vacuumed up from the subsurface at a great rate - especially in the case of copper mining, which takes place not far from the brine extraction mines and uses huge amounts of fresh water.

As part of the production process, copper-rich rocks are crushed into a dust that's mixed with water to flow through giant pipes. The water is then mixed with chemicals to separate the copper from the slurry.

How much water and brine can mining companies extract?

Sweet-water rights mostly owned by mining companies (litres/second)

"The current extractive development in the Basin of the Atacama Saltflat provokes hydrological imbalance" (Ramón Morales Balcázar)

Source: Comité de Minería No Metálica (2018) • *Quantity unknown for Hotels

Despite watertight water-pumping rights, the corporations' alibi for causing damage has flaws. Brine water is typically 70 per cent water, 30 per cent salt. Despite this, the Law of Mining (Código de Minería) defines it not as water but as a mineral. The definition would require reformulation to see any progress in water loss, Balcázar argues. The presence of bacteria and other living organisms in the brine sustaining life should count as a scientific argument to 'prove' that salty water is still water, he says.

The history of how SQM and Albemarle acquired extraction rights is long. Handed to SQM during a period of dictatorship, they were not given under the current environmental law, says Balcázar. He also laments that the members of the local community were not consulted about the rights to operate near their territories.

Albemarle's mineral extraction rights with respect to the Salar de Atacama in Chile cover an area of around 16,700 hectares. They are based on a long-term contract with the Chilean government, which was originally entered into in 1975 by one of the company's predecessors. It was subsequently amended and restated, according to the company's latest annual report. Nonetheless, moving forward quickly appears difficult. At present, researcher Garcés told *E&T*, Albemarle's quota increase is delayed because its carbonate plant is not fully operational.

SQM

Comparably little has changed on SQM's brine pond property between 2015 and 2019, as the following interactive graphic shows:

The case of SQM appears to be slightly different from Albemarle's. The company is known to have influence in government circles, but Chilean newspaper *La Nacion* has reported several cases where people associated with the company have faced investigation or trial on matters such as tax evasion and bribery. In 2017, the US Securities and Exchange Commission said SQM had agreed to pay more than $30m to resolve parallel civil and criminal cases, finding that it violated the Foreign Corrupt Practices Act by making improper payments to Chilean political figures and their associates.

There is also a question of whether SQM knew about the damage its brine pumping operation had on freshwater reserves before independent studies reviewed it. SQM claimed in earlier reports that lakes and salt flats were separate, isolated water systems and that brine and freshwater would not blend. Without an independent report, this was taken as the truth until recently, when SQM acknowledged that there was some interaction between the systems. The truth, that the two water systems do indeed mix - brine and fresh water - which according to research jeopardises nearby freshwater reservoirs, came only to light after independent scientific studies began to publish their own results. However, Garcés says "it is possible" that SQM could have been aware of the fact earlier than independent reviews, given that the company had studied the area in detail.

Under the brine extraction rights, Albemarle's environmental impact appears the lesser of two evils. SQM can pump much more - around 1,700 litres per second, compared with Albemarle's 400.

Now a new letter to the Chilean ministry of mining has warned of the inconclusive results issued by SQM's lithium-mining operation. The letter sent by a chemical engineer to the ministry and seen by *E&T* warns authorities that SQM's records for production would not correspond to the actual figures delivered. At the time of writing, the ministry has not yet responded to the letter, *E&T*'s source claims.

In other words, parts of the total lithium extracted by SQM, numbers for the raw mineral and the final product simply don't add up. The difference would be worth several billion dollars. Balcázar, who came across the letter, has not seen any response from the ministry, so far.

Researcher Ingrid Garcés is worried. "This is very serious," she says. On the question of whether the Chilean government should impose harsher regulatory measures on the exploitative water pumping practices by SQM and Albemarle, Garcés says there should be sanctions and prosecutions and any

penalties should be exemplary. She has little hope this will happen under the current government: “It is unlikely, as it was under the previous one”.

Warning signs of water scarcity problems in the Atacama salt flat were visible to companies six years ago, but were largely ignored, as a government inspection report showed. 32.4 per cent of the native Algarrobo trees *prosopis chilensis* on SQM’s property - a drought-tolerant species, sending their roots deep into the underground to survive - were found dying as early as 2013 due to the effects of water shortages.

Large Prosopis chilensis tree in the Talampaya National Park, La Rioja, Argentina

Nowadays, to overturn negative public sentiment, it appears Albemarle’s strategy is to hand out money to municipalities, local universities and communities, Balcázar says. “In this way, Albemarle is very different [from SQM]. They give money to all these communities in the Atacama salt flat, so they can solve basic problems inherited from centuries of systematic abandonment and discrimination by the State”.

This practice effectively replaces the role of the state, he argues, with the effect that the government loses control over what mining companies actually do. With no government accountability for the damage, “and no actual chance to say no to these projects”, he says, communities are made responsible for controlling and monitoring the levels of water and the operations of the mining projects with the very money the companies give them.

“Although participation and access to first-hand information by local communities is their indisputable right, it is a state duty to look after and ensure water for future generations”, Balcázar adds.

Garcés takes a similar view, warning that the Chilean state is failing in its duty to oversee and protect assets that belong to all Chileans. “How is it possible that we have a General Water Directorate in the region with one inspector?“ she asks. *E&T* has been told that the directorate has now added two more inspectors.

Garcés asserts that compensation payments paid [by Albemarle] to the local communities are not fair. “It is a major fallacy to think so. The income from extractive activities is not distributed equally among the Chilean population due to structural problems; moreover the money given to local communities, as has happened in many other cases in the country, can be used at will and there is no public control on its use or distribution, which may provoke conflicts and divide the population of San Pedro de Atacama”, she said.

Albemarle would reach agreements with communities through signing a value agreement, she explains. Three per cent of the sales would be directly paid to communities. This does not solve the structural problem of uneven distribution of wealth in the country - caused by exploitation of minerals - and payments given directly to communities might be unequally distributed. By talking to several community members, “money provided does not end up fairly in locals’ pockets”. One scenario possible, she says, is that a lack of control by the state might lead to corruption and could spark disputes.

Risks and hurdles for brine mining in Atacama salt flat

There are financial and environmental problems concerning land use. Dr Crane points out that “such [evaporation] pools can require an operation time of several years and as such can be susceptible to the inherent boom-and-bust nature of the mining industry: if the lithium price were to undergo a significant downturn then there could be a major problem”.

At the end of last year, the Chilean environmental regulators rejected plans by Albemarle to expand its output from the Salar de Atacama salt flat, according to filings with Chile's Environmental Assessment Service. Albemarle did not present the "details necessary to rule out significant adverse impacts on the quantity and quality of renewable natural resources, including the soil, water and air."

Andrew Miller, head of price assessments at Benchmark Mineral Intelligence, confirms the commotion in the market: "On the supply side, extending the production for these companies was challenged by regulators". Companies in Chile tried to expand their production around 2016 and 2017 but various government agencies in Chile challenged them.

Economic challenges as well as regulatory challenges may lie ahead. Brine grew to be the primary source for lithium production for a generation because it is a low-cost source. Despite the extraction and evaporation process being cost-effective for now, changes in demand in the future could present issues for the producers' bottom lines.

Miller explains that the two main chemicals resulting from lithium extraction are lithium carbonate and lithium hydroxide. Brine mining is most competitive for lithium carbonate. This would still be the primary chemical on the market – still, a lot more lithium carbonate is produced than lithium hydroxide. The crucial question from a battery standpoint is whether there will be a shift towards cathode chemistries more dependent on lithium hydroxides.

Lithium hydroxide is not where brine extraction and the likes of SQL and Albemarle would excel, says Miller. This is because an additional step is required in the process. "They have to produce lithium carbonate first and then convert it to lithium hydroxide, adding additional costs and pressure on the costs curve".

This raises questions on how responsive supply can be to the big surge in demand expected in the market, Miller says. It appears certain that hard-rock lithium mining will grow ever more dominant. This is confirmed by data from the US Geological Survey.

Whether or not the days of brine extraction are numbered, companies like US-based Albemarle today increasingly seek to cover their backs by diversifying their portfolios. According to its annual report, Albemarle entered into an agreement to acquire a 50 per cent interest in Mineral Resources Limited's Wodgina Project, located in the Pilbara region of Western Australia, forming a joint venture with Mineral Resources to own and operate the Wodgina Project to produce battery-grade lithium hydroxide. The deal is expected to conclude in the second half of the year.

Australia's share in lithium production soared

Lithium production

In 2016/17, the joint owners of the leading spodumene operation in Australia announced plans to increase capacity and one owner began construction of a lithium hydroxide plant in Australia. To diversify supply, Chile's two lithium producers each announced planned joint ventures with companies in Argentina

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2012 /2019

Missing data expected to remain a problem going forward

One way in which Chile's lithium producers are attempting to appease public concern, as well as that of the regulators, is by increasing lithium output while using less brine. According to Reuters, Albemarle is developing a process to boost Chilean lithium output by 30 per cent without extracting more brine from the Atacama. It would re-inject salts into the ponds to effectively increase the concentration of the white metal in successive evaporative steps.

Garcés remains highly sceptical of the apparent good news. The yield - the amount of lithium extracted from the brine - remains brutally low to the present day, only around 30 per cent in SQM and a little more for Albemarle, is her guess, she told *E&T*. Even this would be hard to judge: "They keep it a state secret". This ambiguity raises questions about how much lithium is really lost to inefficient practice by operators. "Why so much secrecy if it is so easy to calculate it? It is not a matter of secret patented process, either", she says.

SQM was approached by *E&T* but was not immediately available for comments and did not respond to E&T's enquiries.

One of the biggest problems is transparency, say many researchers. The correct calculation of how much water is being lost, according to Garcés, is faulty in so far as actual data is being withheld by companies. "Unfortunately the balances are made theoretically and then you estimate the performance or efficiency of the process," she says.

It has been possible for *E&T* to piece together an estimate of how much water has been lost to the environment due to brine evaporation over the course of the past three decades, 1985-2017. *E&T*'s estimate puts the figure at around 433 billion litres for water lost as a result of lithium exploration over the period. Albemarle's extraction contracts previously belonged to Sociedad Chilena del Litio (today under the name of Rockwood).

If that volume of water was laid out with a kilometre-square footprint across the city of London, the block would protrude nearly half a kilometre into the sky (see graphic), or around four and a half times the height of Big Ben. The amount would also rival the annual fresh water withdrawal rates of small countries like Papua New Guinea or the West Bank and Gaza, according to World Dank data.

E&T's calculations were made on the basis of figures provided by the Nonmetallic Mining Committee as well as calculations for Albemarle's lithium brine production history by the head of the Lithium Committee from IIMCh. It was produced under the assumption that two million litres of water would be evaporated in mining ponds for each tonne of lithium extracted. As the lithium extraction process evaporates around 95 per cent of the brine water, it was possible to compute how much water actually disappeared.

Perhaps even more worrying are extrapolations for the future, based on projections for Albemarle's lithium extraction between 2018 and 2043. 1.5 trillion litres of water may be at stake within the Atacama salt flat, according to the same principle of calculation as above. With SQM pumping nearly four times as much brine as Albemarle, it is not unreasonable to assume that rates could be much higher.

Albemarle Corporation was given the chance to respond to allegations and issued a statement to *E&T* saying it updated its hydrogeological model of the Salar de Atacama in March with the measurements of the last few years, making it the most up-to-date tool that exists, and that it "serves as a basis for authorities, communities and other companies with operations in the area".

While monetary payments were not mentioned in the response, the company confirms it has established a "series of voluntary commitments with the authority to ensure the proper care of the Salar ecosystem" - entailing "a monitoring system of 150 wells in the Salar basin and a permanent plan for water and lake level monitoring, flamingo monitoring and an Early Warning Plan". All of this would be "always available to the authority and the communities," Albemarle said, adding: "we all benefit from sustainable management of the Salar de Atacama."

The state's aspiration to toughen regulation is high but action is scarce. In January, after an investigation proved that SQM did in fact overdraw lithium-rich brine from the Atacama salt flat, the Superintendencia del Medio Ambiente (Chile's environmental regulator) approved a compliance plan including an online system to monitor SQM's extraction rates as well as its use of fresh water alongside its industrial process. Whether this is enough to stop overdrawal of brine and prevent environmental damage, many doubt.

Recent changes by mining companies on how they monitor wells without authorisation, according to Chile's environmental regulator, make it ever more complex to monitor what companies do.

"If you want to exploit, the companies must determine the amount of water they can safely extract without compromising the ecosystem and the wildlife, including the loss of flamingos and other species," Balcázar says.

Another problem for regulators and the public is to access unbiased information. So far, the only information available about the Atacama salt flats are the details shared by the companies. “The state doesn’t have its own models. This is very basic stuff. You cannot exploit something that you don’t know. If you don’t know the real damage, you cannot regulate it. The state wouldn’t respect this principle”, says Balcázar.

However, efforts to monitor adverse effects independently seem to be under way. In May, the Atacama People’s Council built a monitoring station in a lagoon on the salt flat. Its installation was the first in a series - 14 more stations are expected soon - to continuously monitor water levels, as opposed to the once-per-month measurements overseen by mining companies.

Before the Chilean President Sebastián Pinera took office last March - when his administration disbanded a group working on this - the Committee of Non-Metallic Mining began to work on a model that could have allowed the government to independently monitor environmental changes.

How and whether the Chilean government will vindicate its lithium mining ambitions and the effects climate change has in its land in front of a global audience at the upcoming COP 25 - a global climate change conference taking place in Santiago in December - remains to be seen. Microbiologist Dorador asserts that it is an important opportunity for the country, with regard to mining.

Next to climate change and environmental issues, lithium production companies are accused of providing poor working conditions for their staff. On Chile’s brine deposits, workers suffer poor health and safety standards, according to an *E&T* interview with Lisa Belenky, senior attorney at the Center for Biological Diversity, a nonprofit organisation fighting to protect endangered species through legal action and activism.

Solutions to the water evaporation frenzy

Instead of increasing the quota to pump more brine, companies must replace the current evaporation process in the pools with a truly sustainable one, say researchers like Ingrid Garcés.

Answers to the prayers of those asking for a cleaner mining process are in the works. Different technological solutions appear viable in the lab, but many remain very far from being a commercial reality. Dr Crane is confident that science can come up with alternatives: “In academia, there is a lot of research currently being conducted to improve how we can remove lithium from the earth. Solutions include electrodialysis, nanofiltration and adsorption, as well as recent progress in using graphene-based filtration approaches.

”[Some of these techniques] have real potential to herald a new paradigm for the mining industry. If someone can invent a truly cost-effective, environmentally friendly, adaptable and rapidly deployable method to extract the lithium from water, they would be very successful”.

To solve the problem in the Atacama Desert, one may not need to look much further than the United Kingdom. Even without the ultra-dry climate, the county of Cornwall has what it takes, geologists argue. To start with, it has been found to host the fifth-largest lithium deposits in the world. A company called Cornish Lithium is developing a solution that should soon allow the pumping of Cornish geothermal brine and direct extraction of lithium from it in a climate-friendly way, without the use of chemicals, the CEO of the project has assured. Heat extracted from the brine would provide additional benefits. After lithium and energy were extracted, the brine would be cleanly re-injected into the subsurface.

“There is no water loss, there are no chemicals going into the water. The heat brought up with the brine, we can use in an environmental friendly way”, Jeremy Wrathall, CEO of Cornish Lithium, explained.

Such plans for domestic lithium extraction have multiple advantages. Local production could abolish the need to ship lithium around the world and reduce the carbon footprint connected to lithium-ion battery production. It could also help to alleviate the pressures on Chile’s lithium supply and allow the government to regulate Chile’s lithium mining companies without the risk of pushing global battery supply into turmoil.

What Cornish Lithium develops may not immediately bear direct application in the Atacama desert, as easy access to power would be needed. If a geothermal power plant could be connected to the brine extraction, though, self-sufficiency may be in sight, Wrathall says. Some companies in Chile could already explore the idea, but to Wrathall’s knowledge, it is early days for those projects. In contrast, in Europe, a lot more is going on. Alongside Cornish Lithium, an array of other European companies are chasing the idea of domestic lithium extraction.

From a market perspective, new technical developments are crucially needed, according to Benchmark analyst Miller. Even with the investments expected going into the market, he expects an upcoming deficit in 2023. Processes in development that may not be commercial today could add that “critical extra bit to the lithium supply balance in the next couple of years” when the electric vehicle penetration kicks off and lithium demand explodes.

Methodology and comments:

* To bring evidence forward, a satellite imagery analysis model was created to test the relationship between lithium brine extraction between hydration and vegetation levels of nearby lagoons and alluvial muds located in the north of SQMs and Albemarle’s evaporation ponds.

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