The Payne Institute for Public Policy
COLORADO SCHOOL OF MINES
EARTH • ENERGY • ENVIRONMENT

PAYNE COMMENTARY SERIES: **COMMENTARY**

Water Security Issues for Lithium Mining in Chile

By Eleanor Igwe

The global consumption of a range of critical minerals is estimated to rise at least sixfold by 2030. Lithium, in particular, saw its demand double from approximately 300,000 metric tons to more than 600,000 metric tons in just the past two years. Due to lithium's central role in electric vehicle batteries, its demand is predicted to continue a steep rise and likely reach the level of two to four million metric tons by 2030. In addition to the stresses this will put on mining production and the environment – issues of water security are likely to become a key challenge.

Even as Australia and the United States work to develop the commercial viability of extraction from rock and clay, it's likely that the Lithium Triangle will remain a large global supplier. Owing to its high concentration of accessible deposits and long-established mining operations, this region spanning a portion of Chile, Argentina, and Bolivia produces more than a third of the world's lithium using brine extraction. The rapid growth in expectations for the area's lithium mining means there is a distinct likelihood that water concerns will grow.

Prior to the start of commercial mining in the Andes, lithium was typically extracted through the expensive process of mining pegmatite (a granite formed from slowly-cooled magma), and then treating it with acid and heat. In the 1980s, Albemarle and SQM began commercial operations using the less expensive process of brine extraction in the Atacama Desert's salt flats. The newer and simpler method relied on pumping underground lithium-brine into above ground ponds and then waiting for up to 95% of the water to evaporate out before harvesting the desired lithium chloride. The mining industry has developed techniques over the years that can reduce the amount of required evaporation, but increased costs and additional pollution remain barriers to more extensive uptake and mining production continues to consume 65% of the area's available water on a yearly basis.

Despite the fact that Chile contains only 20% of the Lithium Triangle's resources, it represents about 80% of its mining production due to a combination of geographic and regulatory advantages. Salar de Atacama, where the majority of Chilean lithium extraction occurs, is one of the driest places in the

world, historically receiving an average of only 2 mm of rainfall per year. The minimal rainfall results in not only faster evaporation and lithium collection for mining companies, but also higher stakes for the region's ecosystem as it depletes the supply for inhabitants and wildlife. While lithium-brine is not fit for human consumption, researchers have shown that 87% of the water that flows in to replace the pumped and evaporated water comes from the freshwater Rio Grande and Toconao.

The regulatory policies that enabled this high level of production are a remnant from the Pinochet regime's privatization of the lithium-brine at the start of commercial mining. Lithium-brine's current classification as a strategic mineral assigns the government property rights which it then licenses to mining companies. The Initiative for Responsible Mining Assurance (IRMA) standards used to verify the sustainability of mining projects underline the importance of water conservation and community engagement, but many argue the standards overlook impact on farther out communities and fail to account for long-term environmental degradation.

The Chilean people have expressed a desire for more control. Mining and water rights were a high-profile issue during the 2020 vote on whether to hold a constitutional convention. A new constitution is yet to be ratified but the growing political sentiment has already affected mining as communities increasingly push back against the approval of new projects and the commencement of lithium mining in other salt flats. As academic research solidifies the understanding that brine is better classified as water, the future of mining production in the region becomes more unclear.

There are several approaches being used to address the risks of reliance on brine extraction in Chile. The U.K. has begun funding efforts to improve safety and increase the rate of lithium recycling in order to reduce demand. The lithium industry has started to explore saltwater mining, an approach that was successfully used in the copper industry to dramatically reduce water usage. New investments in direct lithium extraction also appear to be a promising potential solution. Ultimately, the scramble to find solutions to water depletion underscores the value of research in ensuring that GHG reduction does not create unnavigable environmental or social problems.

The Payne Institute for Public Policy

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

ABOUT THE AUTHOR

Eleanor Igwe
Communications Associate, Payne Institute for Public Policy

Eleanor Igwe has previously worked as a natural gas contractor and a PBS production associate. She holds a degree in engineering from Smith College.

The Payne Institute for Public Policy

COLORADO SCHOOL OF MINES
EARTH • ENERGY • ENVIRONMENT

ABOUT THE PAYNE INSTITUTE

The mission of the Payne Institute at Colorado School of Mines is to provide world-class scientific insights, helping to inform and shape public policy on earth resources, energy, and environment. The Institute was established with an endowment from Jim and Arlene Payne, and seeks to link the strong scientific and engineering research and expertise at Mines with issues related to public policy and national security.

The Payne Institute Commentary Series offers independent insights and research on a wide range of topics related to energy, natural resources, and environmental policy. The series accommodates three categories namely: Viewpoints, Essays, and Working Papers.

For more information about the Payne Institute please visit:
https://payneinstitute.mines.edu/

or follow the Payne Institute on Twitter or LinkedIn: