More Reporting Clarity Can Help Fund U.S. Lithium Growth

Reese Epper
Graduate Research Assistant at the Payne Institute for Public Policy, Colorado School of Mines, U.S.A.

Brad Handler
Program Manager, Sustainable Finance Lab, Payne Institute for Public Policy, Colorado School of Mines, U.S.A.

Ian Lange, Ph.D.
Director, Mineral and Energy Economics Program, Colorado School of Mines, U.S.A.

Southern Arkansas, once a hotspot for oil production in the early 1900s, is now making headlines for an energy boom of the new century. This time around it's Lithium. ExxonMobil recently announced plans to produce lithium extracted from brine-rich aquifers deep underground in what is known as the Smackover formation, aiming to capitalize on its core drilling and chemical processing capabilities (ExxonMobil, 2023). Other oil and gas giants such as Chevron and Occidental are undertaking similar initiatives. All of these are made possible by a suite of technological advancements in a process known as Direct Lithium Extraction (DLE) (Lorinc, 2023).

There is another, less heralded, parallel between the two energy booms. Just as a regulated reserve reporting update helped spur investors to U.S. oil and gas production nearly 15 years ago, recent regulatory changes to resource and property disclosures in the mining sector could similarly catalyze investment in lithium extraction today.

DLE's Potential

As a major input for Electric Vehicles (EVs), lithium demand is expected to grow by as much as 40-fold by 2040 from today; this is driving increasing interest and adoption of DLE across the industry (IEA, 2021). Auto industry giants such as General Motors and Tesla have recently announced long-term forward offtake agreements with firms involved in Direct Lithium Extraction (GM, 2021; *Reuters*, 2023). While DLE, and particularly the use of selective absorption, is not new—having been first implemented on a commercial scale in Argentina in 1998—its economic viability appears more promising due to projected growth in lithium demand and prices (Livent, 2023).

At its core, DLE uses advanced filtration techniques to separate particles of the silvery-white metal from its aqueous solution in a process both much faster and up to twice as productive as conventional solar evaporation ponds for brine-based resources (Farahbakhsh *et al*., 2024). Thus, DLE operators can also respond swiftly to fluctuations in future demands, minimizing market volatility along the way.

FastMarkets, a commodity price reporting agency, estimates DLE will contribute to 13% of the world's production by 2030, highlighting its critical role in meeting decarbonization milestones (Scheyder, 2023). Moreover, DLE enables the diversification of the global lithium supply by making known lithium

mineralizations economically viable, countering current reliance on the concentrated operations in Chile, Australia, and China.

DLE's impact may be the most profound in North America, where brine concentrations are generally lower (Munk *et al*., 2016). Greenfield DLE project proposals across the continent have surged in recent years, leading analysts at Goldman Sachs to liken what DLE's role in the energy transition to what "shale did for oil" because of its potential to access previously uneconomical resources (Farahbakhsh *et al*., 2024). Currently, all DLE efforts in North America, such as Standard Lithium's Lanxess Project or E3 Metals' Clearwater Project, are still navigating their pilot stages.

Yet it is worth noting that the future of DLE, while promising, faces significant uncertainties, especially in the United States. Legal setbacks in the Smackover region and the recent lithium price slump are among the challenges that threaten the timeline for projects to reach production (Scheyder, 2024; *Carbon Credits*, 2024). Critics of the technology also challenge the claims of its lower environmental impact, a major selling point for DLE (Vera *et al*., 2023). As projects reach their operating phase, their ability to substantiate environmental benefits will prove critical in attracting "green" investment.

Supportive Reporting

Companies looking to develop lithium in the U.S., particularly those smaller than the oil majors, will need to attract capital to fund their investments. That task appears a little easier following the SEC's enactment of the Modernization of Property Disclosures for Mining Registrants amendment in 2021 under standard S-K 1300 (SEC, 2018). The amendment is designed to improve the transparency and detail of mineral resources and reserves disclosures. It expands the required breadth and depth of technical and economic reporting for mining properties, making it easier for investors to understand the operational specifics, geological conditions, and technological maturity of mining operations. As a result, companies are presenting a clearer picture of the full potential and risks of new mining projects, including the possibility and impact of using emerging technologies like Direct Lithium Extraction.

Prior to this amendment, U.S. reporting did not allow mineral resource disclosure, limiting early project investment. Now, declarations of resources can stimulate investment into the technologies that transform these resources into economically viable reserves. In many ways, this regulation resembles the SEC's 2009 Modernization of Oil and Gas Reporting amendment in that it allows the industry to reflect technological advancements (through how resources and reserves are evaluated and disclosed) (SEC, 2008). This amendment allowed shale, which had been previously not considered reportable, to be included in economically producible reserves. Similarly, unconventional brines, not yet declared as reserves, are now detailed extensively, which allows investor assessment of future potential, and supports investment in DLE. As the oil and gas reporting helped to usher in massive capital raise for U.S. shale development, it is hoped that so too might denoting prospects for unconventional lithium projects encourage capital to flow to these projects.

The advantage of SK-1300 — its capacity to accommodate detailed reporting — also presents a challenge as it introduces a level of inherent uncertainty that both the industry and investors must carefully navigate.

In a 2021 report, Alex Grant, co-founder of Lilac Solutions, commented that unconventional brines "are still a little bit more wild west, compared to salar type brines" traditionally used in Argentina and Chile, adding that DLE firms are proceeding with a wide range of reserve assessment methodologies "because they have to" (Jefferies University, 2021).

With that said, it is reasonable to imagine that investor sophistication in evaluating unconventional brines and extraction methods will rise as more projects progress. More project experience will also likely bring with it some standardization as the industry socializes how to present information to investors (just as shale oil development brought with it enhanced investor focus on completion techniques). In sum, the reporting can continue to lay the groundwork for fuelling much needed investment into lithium development for decades to come. What is evident is that the flexibility inherent in SK-1300 to declare reserves has not stopped viable operations in emerging unconventional places, and potential growth in U.S. firm's capabilities to produce lithium.

References

Carbon Credits, 2024, "Why Lithium Prices are Plunging and What to Expect," February 8. Accessed via website: https://carboncredits.com/why-lithium-prices-are-plunging-and-what-to-expect on May 3, 2024.

ExxonMobil, 2023, "ExxonMobil Drilling First Lithium Well in Arkansas, Aims to be a Leading Supplier for Electric Vehicles by 2030," November 13. Accessed via website: https://corporate.exxonmobil.com/news/news-releases/2023/1113_exxonmobil-drilling-first-lithium-well-in-arkansas on May 3, 2024.

Farahbakhsh, J., Arshadi, F., Mofidi, Z., Mohseni-Dargah, M., Kök C., Assefi, M., Soozanipour, A., Zargar, M., Asadnia, M., Boroumand, Y., Presser, V. and A. Razmjou, 2024, "Direct Lithium Extraction: A New Paradigm for Lithium Production and Resource Utilization," *Desalination*, Vol. 575, April 16. Accessed via website: https://doi.org/10.1016/j.desal.2023.117249 on May 3, 2024.

GM [General Motors], 2021, "GM to Source U.S.-Based Lithium for Next-Generation EV Batteries Through Closed-Loop Process with Low Carbon Emissions," July 2. Accessed via website: https://investor.gm.com/news-releases/news-release-details/gm-source-us-based-lithium-next-generation-ev-batteries-through on May 3, 2024.

IEA [International Energy Agency], 2021, "Mineral Requirements for Clean Energy Transitions," May. Accessed via website: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/mineral-requirements-for-clean-energy-transitions on May 3, 2024.

Jefferies University, 2021, "Jef U | Clean Energy: Direct Lithium Extraction Techniques and Developments," September 28. Accessed via website: https://javatar.bluematrix.com/links2/secure/PDF/5c36dbd9-9c9e-4848-ad3e-22e29cfb445d on May 3, 2024.

Livent and Integral Consulting Inc., 2023, "Resource and Reserve Report: Pre-Feasibility Study, Salar del Hombre Muerto," February 21. Accessed via website: https://livent.com/wp-content/uploads/2023/06/2023-Livent-Resource-and-Reserve-Report-Salar-del-Hombre-Muerto.pdf on May 3, 2024.

Lorinc, J., 2023, "Big Oil Is Getting Serious About Lithium," *Bloomberg*, August 9. Accessed via website: https://www.bloomberg.com/news/newsletters/2023-08-09/big-oil-is-getting-serious-about-extracting-the-lithium-found-in-its-fields on May 3, 2024.

Munk, L. A., Hynek, S. A., Bradley, D. C., Boutt, D., Labay, K. and H. Jochens, 2016, "Lithium Brines: A Global Perspective," Chapter 14 in *Reviews in Economic Geology*, Vol. 18, pp. 339-365. Accessed via website: https://geoinfo.nmt.edu/staff/mclemore/teaching/documents/14_Munketal.pdf on May 3, 2024.

Scheyder, E., 2023, "Insight: Inside the Race to Remake Lithium Extraction for EV Batteries," *Reuters*, June 16. Accessed via website: https://www.reuters.com/markets/commodities/inside-race-remake-lithium-extraction-ev-batteries-2023-06-16 on May 3, 2024.

Scheyder, E., 2024, "America's Lithium Laws Fail to Keep Pace with Rapid Development," *Reuters*, March 25. Accessed via website: https://www.reuters.com/markets/commodities/americas-lithium-laws-fail-keep-pace-with-rapid-development-2024-03-25 on May 3, 2024.

SEC [U.S. Securities and Exchange Commission], 2008, "Modernization of Oil and Gas Reporting," December 31. Accessed via website: https://www.sec.gov/rules/2008/12/modernization-oil-and-gas-reporting on May 3, 2024.

SEC, 2018, "Modernization of Property Disclosures for Mining Registrants: A Small Entity Compliance Guide," October 31. Accessed via website: https://www.sec.gov/corpfin/secg-modernization-property-disclosures-mining-registrants on May 3, 2024.

Vera, M.L., Torres, W.R., Galli, C.I., Chagnes, A. and V. Flexer, 2023, "Environmental Impact of Direct Lithium Extraction from Brines," *Nature Reviews Earth & Environment*, Vol. 4, February, pp. 149-165. Accessed via website: https://www.nature.com/articles/s43017-022-00387-5 on May 3, 2024.

Author Biographies

REESE EPPER
Graduate Research Assistant at the Payne Institute for Public Policy, Colorado School of Mines

Reese Epper is a Graduate Research Assistant at the Payne Institute for Public Policy and a graduate student in the Mineral and Energy Economics Program at the Colorado School of Mines. His research focuses on sustainable finance in the critical minerals space. He holds a Bachelor's degree in Business Analytics from the University of Denver and previously worked as a consultant at Deloitte.

BRAD HANDLER
Program Manager, Sustainable Finance Lab, Payne Institute for Public Policy, Colorado School of Mines

Brad Handler is the Program Manager of the Sustainable Finance Lab at the Payne Institute for Public Policy of the Colorado School of Mines. His research focuses on developing financial mechanisms and using markets to aid in decarbonization, with an emphasis on the extractive industries. Handler has had articles published in outlets including the *Financial Times*, *Washington Post*, *Carbon Economist*, and *Denver Post*. Previously, he was an equity research analyst at investment banks including Jefferies and Credit Suisse.

IAN LANGE, Ph.D.
Director, Mineral and Energy Economics Program, Colorado School of Mines

Dr. Ian Lange is director of the Mineral and Energy Economics program at the Colorado School of Mines. He is a member of the Colorado Governor's Revenue Estimating Advisory Committee. Previously Dr. Lange served as a Senior Economist for Energy at the Council of Economic Advisors for both the Trump and Biden administrations as well as spending time at the U.S. Environmental Protection Agency and the U.S. Department of Energy.