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1. Marcellus Shale could supply 40% of US lithium - study

## **Marcellus Shale could supply 40% of US lithium - study**

Energywire

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### **Body**

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By Hannah Northey Wastewater from large oil and gas hubs like the Marcellus Shale could emerge as a major source of lithium for batteries, according to new federal research. Two regions of Pennsylvania that overlay the shale formation could pump out enough lithium-rich wastewater to meet up to 40 percent of the nation's current domestic consumption of the mineral, the study from the Department of Energy's National Energy Technology Laboratory found. Lab researchers said the findings published in Scientific Reports are significant given growing demand for lithium used in batteries for everything from grid storage to laptops to electric vehicles. "This was the first paper to actually show that there is an economic value to extracting lithium" from oil and gas wastewater in Pennsylvania, said Justin Mackey, the project's lead investigator and a contract researcher with NETL. "We just needed to know how much is there, and [whether we] can we count on this lithium source," added Mackey.

"I think we proved that we can." The lab team is planning to conduct similar research to determine how much of the silvery-white metal could be extracted from locations like the Permian Basin in western Texas and southeastern New Mexico, which has the highest-producing oil field in the nation. The study comes amid growing demand for critical minerals - including lithium, nickel, cobalt and graphite. While those materials are needed to make EV batteries, federal officials and companies are exploring ways to avoid the pitfalls of traditional mining, which has historically been tied to environmental degradation, social conflicts and human rights abuses. Companies usually mine hard rock and clay for lithium or access the metal through evaporation using massive ponds. The prospect of cashing in on a voluminous waste stream to extract lithium has also been drawing the attention of major oil companies. Exxon Mobil and Chevron are among the majors working on pilot projects. To conduct the study, Mackey and his colleagues analyzed 515 oil and gas wells in Pennsylvania using chemical and production compliance data reported to the state's Department of Environmental Protection between 2012 and 2023. Mackey said the research was part of the work he did to earn a doctorate at the University of Pittsburgh. The team found wastewater from the wells could yield about 1,160 metric tons per year of lithium, or about half the current U.S. consumption. The results for each well varied by volume and concentration depending on location. The study assumed 100 percent lithium recovery and that extraction processes are more cost-effective than competing uses of water. The study also reported that some of the highest lithium concentrations - a median of 205 milligrams per liter - are in northern-central Pennsylvania, a region that is largely underdeveloped. In comparison, Standard Lithium reported that its first commercial-scale project in Arkansas' Smackover formation produced brine with an average of 208 milligrams per liter of lithium. "The higher-grade Marcellus water is right up there with some of the brines they're targeting to mine," said Mackey. Brent Elliott, an economic geologist and research scientist at the University of Texas' **Bureau of Economic Geology**, agreed lithium extracted from oil and gas wastewater could emerge as a major U.S. source, but said the outcome hinges on whether the process is economic and adequate infrastructure. Most of the technologies needed to extract lithium from this process are at the pilot stage, he said. Tapping into wastewater, he said, makes more sense than opening new mines, a lengthy process that's fraught

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with environmental, social and biological assessments and public pushback. On the flip side, wastewater from oil and gas drilling is already being produced, often in communities with public support. "To me, it's one of the easiest targets for lithium in the U.S.," said Elliott. "It just seems like a much easier target and one with a lot less of the headaches, most of these areas already have buy-in from the community; industries are already there." 'Unreasonable assumption?' Still, extracting lithium from wastewater faces technological and financial hurdles. Cameron Perks, an analyst at the U.K. mining data firm Benchmark Mineral Intelligence, said it's clear that lithium can be extracted from a variety of sources - such as oil fields, geothermal vents and even seawater - even if concentrations of the metal are low. The bigger question, he said, is whether it makes economic sense. Perks also questioned some of the assumptions in the study and noted that while current U.S. annual consumption of lithium sits at 3,000 metric tons, it's expected to grow fourteenfold by 2030 given the demand for the metal in cathodes, the positive side of an EV battery. "A 100% recovery is also a very unreasonable assumption," Perks wrote in an email about the study. Mackey in an email acknowledged demand is increasing and said the estimate was included in a 2023 report from the U.S. Geological Survey. He also defended the report's assumption of complete recovery of lithium, emphasizing that the paper explores the amount of lithium that could potentially be extracted - regardless of technology - from brine that's already been pumped out of the ground. What's more, Mackey said there's a growing list of so-called direct lithium extraction methods that are showing high levels of efficiency. He noted that Standard Lithium in its press release last month, for example, reported a 97 percent recovery rate of lithium from brine. "We feel 100% is the correct way to report the results," said Mackey. Timothy Fox, an analyst at ClearView Energy Partners, said the analysis appears to reinforce a common argument made by the Biden administration about the transferability of technology and supply chains from the oil and gas sector to cleaner resources. Fox noted that Energy Secretary Jennifer Granholm said at the CERAWEEK conference in Houston earlier this year that federal oil and gas leases can be converted to geothermal leases without having to go through any permitting review. "In this context, this study could encourage the Biden Administration to promote lithium production in regions with extensive conventional energy development, thereby addressing concerns that traditional energy communities are being left behind," Fox said. The bulk of the wastewater generated from oil and gas drilling in the Marcellus Shale currently is reinjected during ongoing hydraulic fracturing operations. The study noted that there's about 96 trillion cubic feet of undiscovered gas in the Marcellus, and production in the region could last several more decades. Barbara Kutchko, a co-author of the study with NETL's biochemistry and water team, said that wastewater is typically transported through a network of pipelines to a central facility where it's minimally treated to remove solids before it's reinjected at other well sites. But Kutchko said the lab's research shows lithium yields from Marcellus wastewater "are substantial and could offset associated infrastructure and disposal costs."

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