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Joint Press Release ›

Sustainability in focus: Lithium for batteries from the Upper Rhine Plain

Research project uses geothermal energy to extract lithium – with funding from the German Federal Ministry for Economic Affairs and Energy

Karlsruhe. Demand for lithium is growing globally. The metal is in particularly high demand for electric mobility. To meet the rising demand trend, one idea under discussion for some years is to capture lithium from geothermal energy plants. One of the pilot projects already being implemented is located in Germany's Upper Rhine Plain. The German Federal Ministry for Economic Affairs and Energy is now funding UnLimited, a joint project led by EnBW Energie Baden-Württemberg AG to set up a pilot plant at the geothermal power facility in Bruchsal together with Karlsruhe Institute of Technology (KIT) and partners BESTEC, HYDROSION and the University of Göttingen.

Germany has so far met all of its lithium needs from imports, but demand is rising steadily as lithium-ion batteries are also required in large quantities for mobile and portable applications. Geothermal plants around the world reveal in some cases sizeable levels of lithium in deep geothermal waters. The question is how to get it out. The UnLimited project aims to develop the technical and economic basis for extracting lithium from hot geothermal waters in Germany.

Domestic production opens up alternatives for supply chains

At the Bruchsal geothermal plant, which EnBW has operated together with the Bruchsal municipal utility since 2010, geothermal water is extracted for heat and electricity and subsequently returned to the subterranean reservoir. Based on the water throughput, an estimated 800 tonnes of lithium chloride are extracted and returned in each year of operation. In a joint project, EnBW and KIT developed a laboratory-scale process for sustainable extraction of lithium dissolved in geothermal water.

"The laboratory trials give us reason to be optimistic. We have been able to show that it is technically feasible in principle. The next step is to test the technical implementation in field conditions and to determine the economic viability on a larger scale," emphasised Dr. Thomas Kölbel, Group expert for geothermal energy at EnBW. "Our Bruchsal plant operates in a closed loop. This means neither gases nor liquids are released into the environment. And we now aim to show that we can implement sustainable and environmentally compatible extraction on an industrial scale."

"The water extracted in Bruchsal is relatively rich in lithium, with about 150 mg per litre," says Jochen Kolb, Professor of Geochemistry and Ore Geology at the KIT Institute of Applied Geosciences. While it will not produce the volumes needed nationwide in Germany, he said, domestic extraction opens up alternatives for supply chains and for reducing the

environmental impact. "The benefits include short transportation distances, flexibility compared to other suppliers, security of supply and extended supply chains," Kolb said. "We are using geothermal water more efficiently as a resource, and that has the added effect of a potential economic boost for geothermal energy.

Efficient use of lithium contained in geothermal waters

Previous studies have shown elevated levels of lithium in geothermal waters in the North German Basin and the Upper Rhine Plain. Geothermal water with a temperature of between 160 and 180 degrees Celsius is extracted from layers between 3,000 and 5,000 meters below the surface and then passes through a heat exchanger. It is there that the researchers have inserted a lithium ion screen that operates in parallel to the heat exchange from geothermal energy. "An economically viable extraction process offers an opportunity to raise the profitability of geothermal energy plants," says Kolb. In the laboratory, the processes are about 85 to 95 percent efficient; the target in the real-world laboratory is around 70 percent efficiency.

Bruchsal could extract lithium for 20,000 batteries a year

The goal at the end of the collaborative project is to extract lithium from geothermal water on a pilot scale while the plant continues to produce geothermal energy. A geothermal plant in the Upper Rhine Plain raises around 30 to 70 litres of water per second. "For example, that is enough to collect the lithium for a Tesla battery in about 40 minutes," Kolb explains. "Or enough for an e-bike in two minutes." At around 8,000 operating hours a year, the Bruchsal geothermal plant could therefore extract sufficient lithium to produce around 20,000 batteries.

"Based on an intensive reservoir analysis, together with our project partners, we aim to demonstrate that lithium extraction from geothermal water is sustainable and hence also economically viable," says Dr. Jochen Schneider, Managing Director of Hydrosion GmbH. "But another important point is that the lithium is up to quality and that no harmful waste is released into the environment. Lithium extraction from a renewable energy source must meet the highest environmental standards and the public must be provided with transparent information about the process."

In order to estimate the volume of lithium in the geological subsurface, it is essential to know the release processes for lithium in the geothermal reservoir and the size of the reservoir (the circulation volume). To quantify the lithium load, applied geoscientists from the University of Göttingen use methods that investigate hydrogeochemical processes at the boundary between the solid rock and the circulating fluid. This is done among other things by looking at the distribution of stable lithium isotopes.

The UnLimited project is being funded by the German Federal Ministry for Economic Affairs and Energy (BMWi) for four years. "The project cost is about €3.4 million. We are delighted that BMWi is supporting the UnLimited project with a contribution of €2.7 million," say the project partners.

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