PROJECT CASE STUDY

COUNTRY	REGION	YEARS	BUDGET	EU GOAL 2021-2023
FRANCE	ALSACE	2019-2021	€3.9 M	40 GWH LITHIUM BATTERY PRODUCTION CAPACITY (3 GWH IN 2020)

Alsace • Towards a Made-in-Europe production of low-carbon lithium with the EuGeLi project

Since 2020, lithium has been included in the list of "critical metals" drawn up by the European Union. While the geological risk for lithium is low, it is susceptible to economic, geopolitical, and industrial risks. The EuGeLi (European Geothermal Lithium Brine) project offers a local lithium supply model in Europe that is inexpensive in energy terms. Eramet Ideas and IFP Énergies Nouvelles (IFPEN) have developed a method of extracting lithium directly from geothermal brine waters in Soultz-sous-Forêt, in Alsace. The pilot project was launched in January 2019 and achieved its first success in May 2021 by creating the first kilogramme of battery-quality lithium carbonate from geothermal energy in Europe.

A project at the heart of Europe

EuGeLi is the result of a partnership between Eramet and Électricité de Strasbourg accompanied by a consortium of numerous industrial and research actors: IFPEN, Chimie Paris Tech, BASF (The Chemical Company), Eifer (European Institute for Energy Research), VITO (Vision on Technology) and Vrije Universiteit Brussel (VUB). 85% of its 3.9 million euro budget was financed by EIT Raw Materials (an EU body) following a call for projects launched in 2019.

The Rhine Trench, on the border between France and Germany, has significant geothermal resources over a stretch of more than 300 km, with an energy potential of around 350 GW per year. The lithium present in this area comes from frictions between the rocks which are rich in it, and the underground water in which it is found dissolved.

This type of lithium resource has been little exploited until now because the quantities present in the Alsatian subsoils remain well below those of the main reserves such as the "Lithium Triangle" in Latin America. Geothermal brines represent only 1% of lithium resources, but the development of these local unconventional deposits can address a strategic challenge. Dozens of battery production plant projects developed in the region are dependent on lithium imports from Latin America, Australia, or China.

The demand for electric batteries, of which lithium is a principal component, is set to grow, both because their opportunity cost increases thanks to increasingly competitive usage costs, and because of European measures such as emissions standards, voted in 2019, or the ban on the sale of internal combustion engines from 2035 onwards, voted in June 2022.

Extracting lithium from water without evaporating it

The extraction of lithium involves either mining, with its severe environmental impact, or the evaporation of geothermal waters. The latter constitutes an indirect loss of energy because the particular conditions of these waters allow geothermal power stations to convert the water's thermal energy into electrical energy. The goal of this project is to extract lithium dissolved in subterranean water without resorting to evaporation, and thus allow water to be reinjected into the underground layers and the geothermal power plant.

To achieve this, IFPEN and Eramet have developed a solid crystalline material in the form of granules which selectively extract lithium like a sponge. The geothermal water flows through a tube holding this absorbent material and exits the tube free of the ore. It the absorbent material is then rinsed with fresh water to recover the lithium and form a solution which will be filtered and evaporated to yield the lithium carbonate used by battery assemblers.

This process has already been tested in Argentina, extracting lithium from a salt flat. The challenge here was to adapt this process to the temperature and pressure of Alsatian geothermal brines, respectively 80 °C and 20 bars. The success of this EuGeLi pilot project was thus to be able to use this process under the conditions to which geothermal water is subjected, and recover 90% of the lithium; the evaporation method, by contrast, recovers 40 to 50%.

The extraction procedure does not release CO_2 and the lithium treatment operations do not consume much energy. Together with the losses, the energy used to pump the water amounts to about a quarter of the total electrical energy produced by the power station. The lithium extraction process optimises the use of this energy.