Ageli, two experts coopering to produce lithium with low environmental impacts from geothermal brine in the French Upper Rhine Graben

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MESSE OFFENBURG

ageli ALSACE GEOTHERMIE LITHIUM

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es eramet

INTRODUCTION

- The Ageli project
- Industrial partnership
- Background of the project
- Technological process
- Scheldule and organisation
- Current outcomes

01

THE AGELI PROJECT

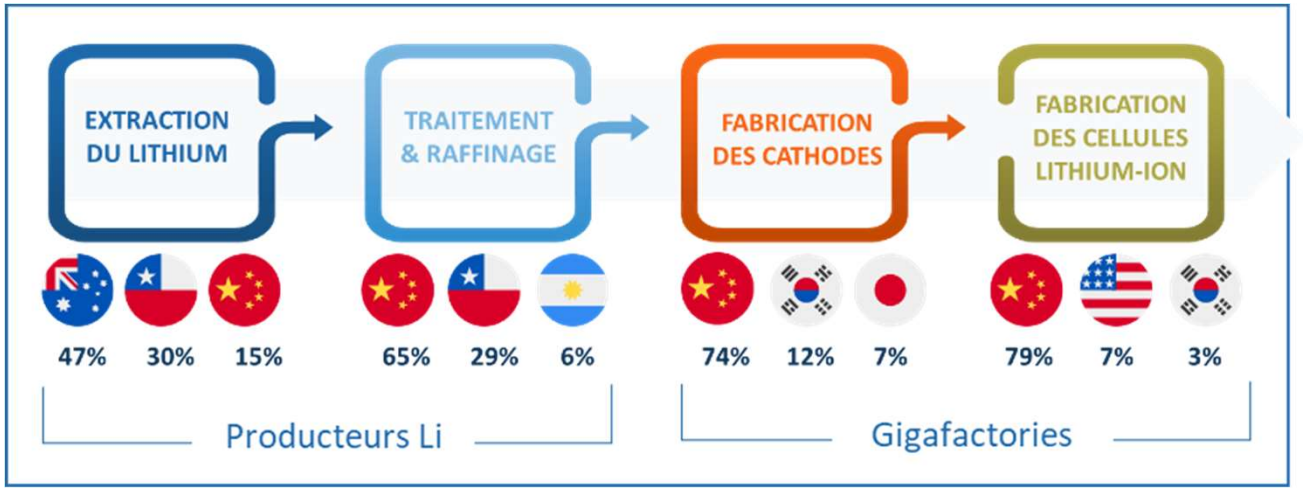
Contribution to the French & European critical raw material independency

0 kt LCE

Lithium production in France in 2023

> 10 kt LCE

Minimum forecast annual production of battery-grade lithium by 2030



Lithium > batteries" transformation chain, players and associated market shares in 2022[1]

- Ageli will support the ramp-up of battery Gigafactories by 2030
- Contributing to more than 10% of French Lithium demand (100kt LCE/year) by 2030
- Securing part of the supply chain for around 250,000 electric vehicles

1. IEA Analysis based on S&P Global (USGC 2023)– Benchmark Mineral Intelligence – ERAMET Research

2. A standard 70 kWh electric car battery - type NMC 811 - contains 40 kg LCE

AGELI PROJECT:
Local & responsible production of low-carbon geothermal lithium

ENERGY TRANSITION

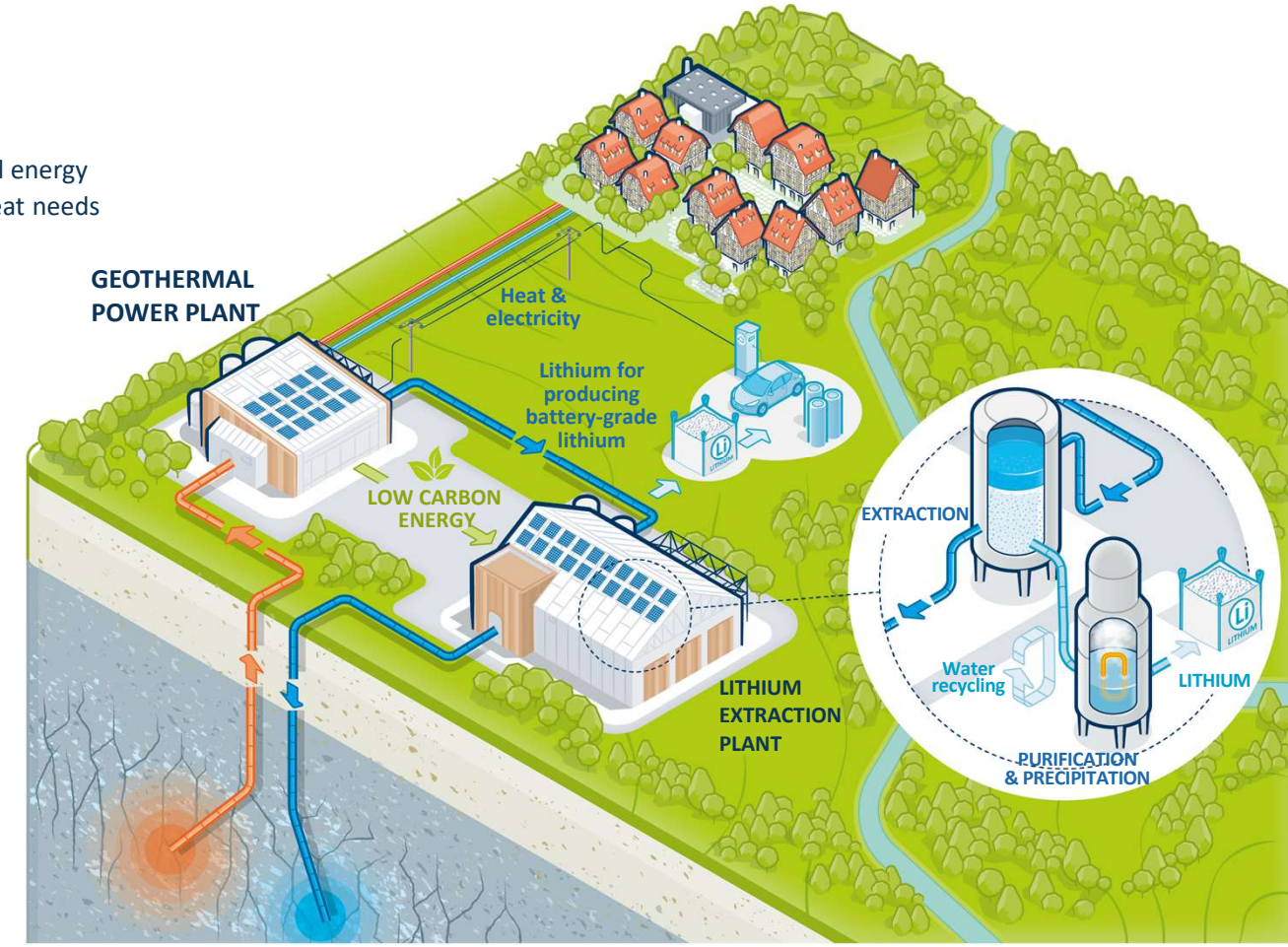
- Four to five geothermal plants in operation by 2030
- Production of 1000 GWh_{th} renewable energy using geothermal energy
- Reliable and cost-effective energy meeting the carbon-free heat needs of industries and communities

INDUSTRIAL DEVELOPPMENT

- Production of over 10 kt/year of lithium carbonate battery grade
- One Downstream lithium plant
- Development and validation of an innovative lithium extraction process

SOCIAL & ENVIRONMENTAL RESPONSIBILITY

- About 100 employments
- Low carbon footprint energy (<5 g/kWh of heat)
- Short chain and low carbon Lithium carbonate battery grade
- Acceptability and consultation at the heart of the project



02

INDUSTRIAL PARTNERSHIP

The Ageli project: A partnership of two industrial experts

ERAMET

Global mining player specializing in energy transition metals

Memorandum of understanding, signed on 01/25/2023

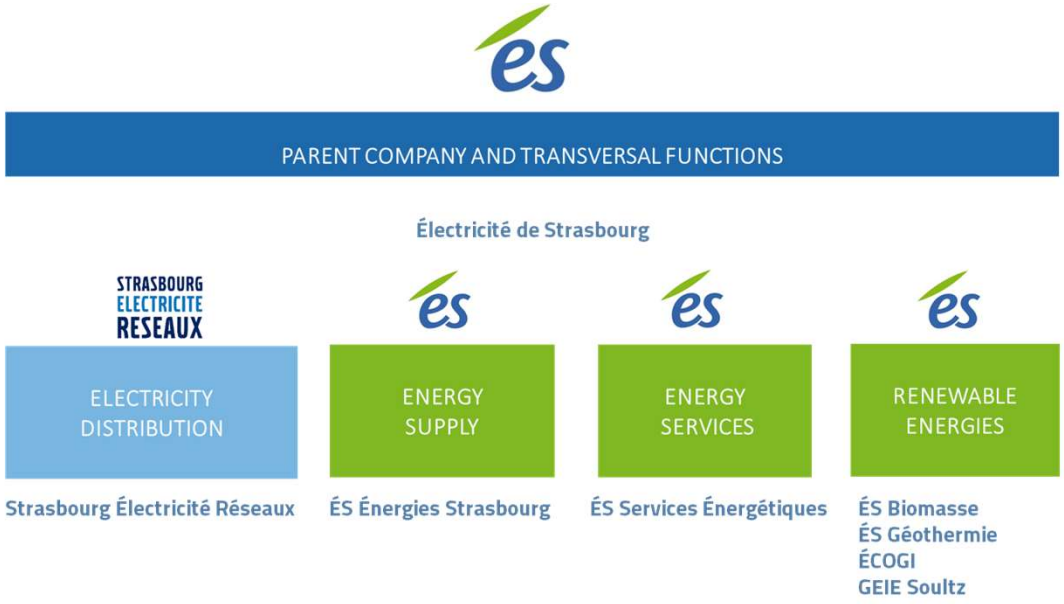
ÉLECTRICITÉ DE STRASBOURG

Energy group in energy production and distribution

- A strong partnership between two French players with recognized expertise: Eramet and Électricité de Strasbourg
- A project to develop and industrialize a process with low environmental impacts for extracting and refining over 10 000 t/an of lithium carbonate battery grade from Alsace's geothermal brines

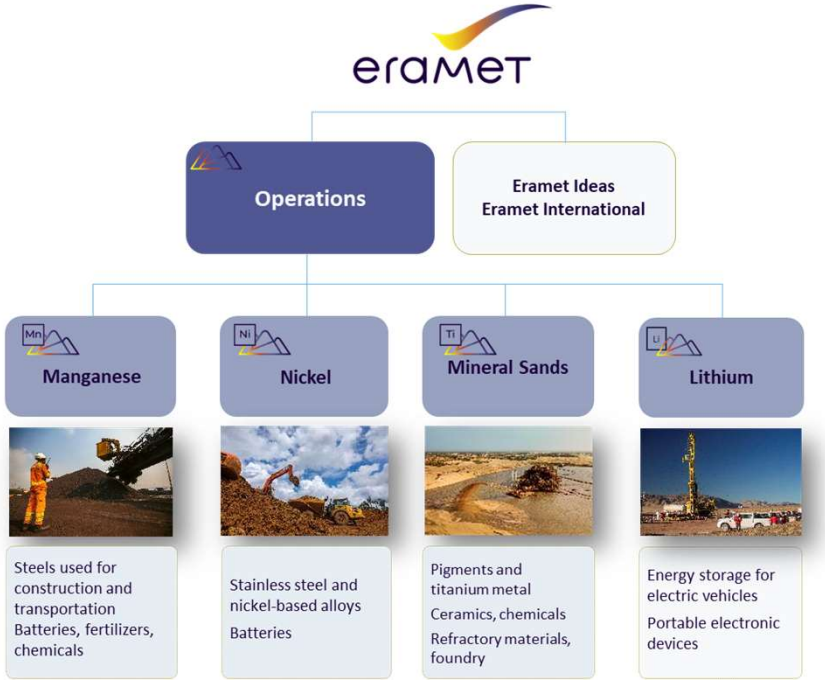
Électricité de Strasbourg (ÉS), a pioneering company in the energy transition in Alsace

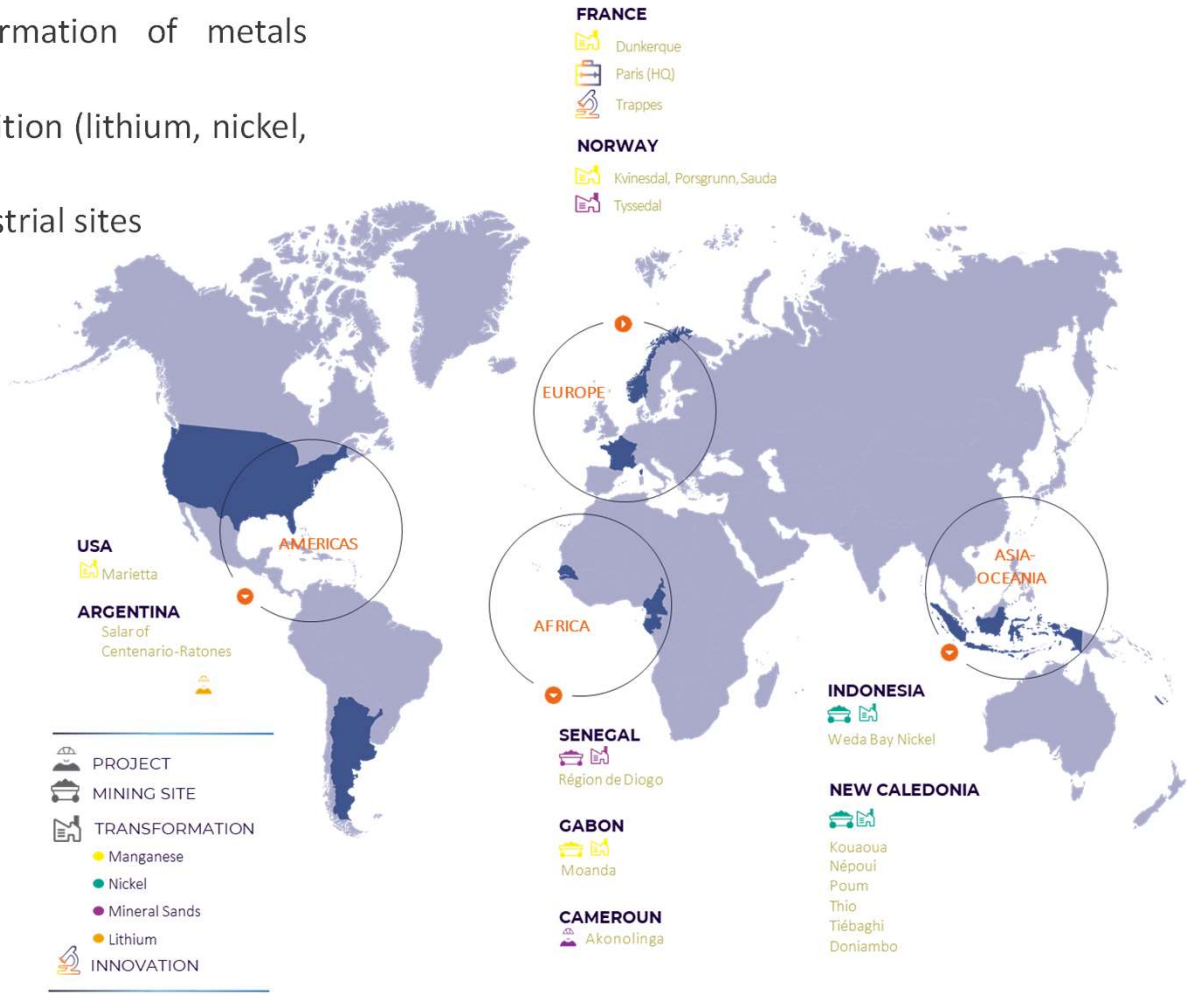
- ÉS, a 125 years old company
- First regional multi-energy company in Alsace, belonging to EDF at 88.5%
- Involved in the energy transition in Alsace
- Shareholder of 2 geothermal power plants in Soltz-Sous-Forêts and Rittershoffen
- Knowledge of the geology of northern Alsace
- Support from its subsidiary ÉS Géothermie (ÉSG)



Eramet, a key stakeholder in the responsible mining of metals

- A major player in the extraction and transformation of metals (manganese, nickel, ilmenite and zircon)
- Developments in critical metals for the energy transition (lithium, nickel, cobalt)
- 10,000 employees, 15 countries, 17 mining and industrial sites





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PROJECT BACKGROUND

Centenario, a world-class lithium deposit in Argentina

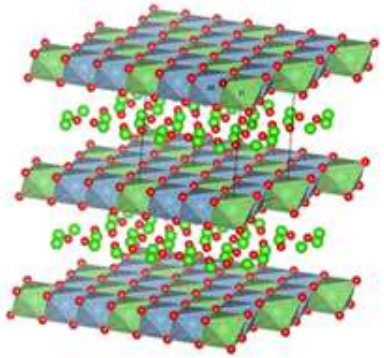
- Salar located in North Argentina
- Exploration started in 2009
- 10 years of R&D + 4 years of continuous demoplant operation on site to develop an in-house Direct Lithium Extraction process
- Reserves' lifetime > 40 years
- On going construction of the plant, start-up mid-2024
- Annual production target by 2025: 24 kt LCE

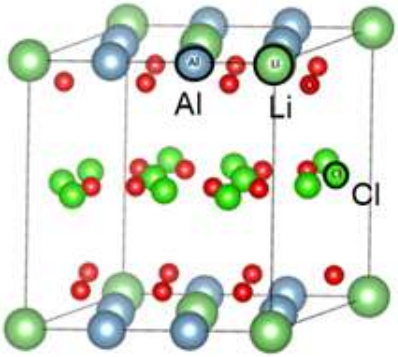
An in-house Direct Lithium Extraction (DLE) technology

A proprietary lithium sorbent co-developed with IFPEN

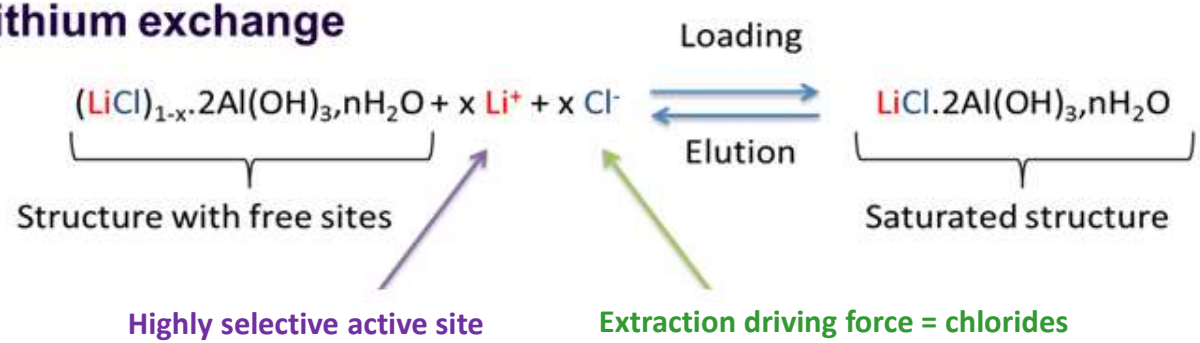
Proven industrial process over 20-years (Al-based Li sorbent)

Structure





Lithium exchange



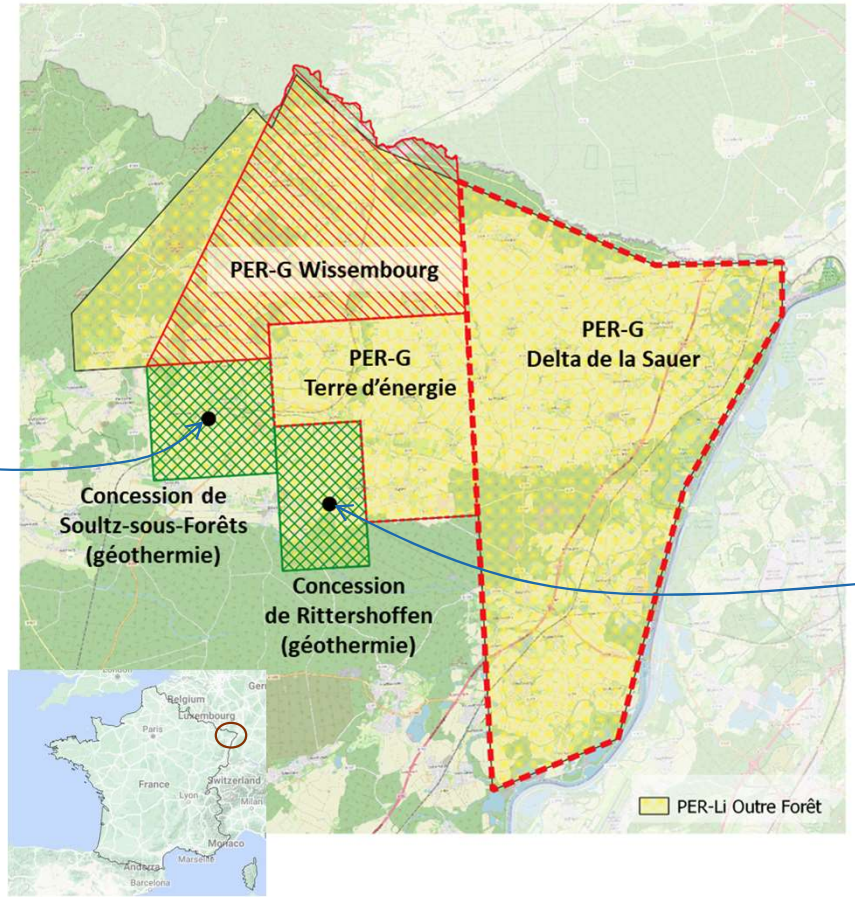
- 90% lithium recovery yield of the DLE unit
- High selectivity for Lithium
- Regeneration with water
- 12 patents

Geothermal plants in operation in the French Upper Rhine Graben

GEIE EMC - Soultz-sous-Forêts

Electricity generation since 2016
3 wells in operation at a depth of **5 km**
Reservoir: **fractured granite**
Temperature: production 150°C / reinjection: 65-80°C
ORC capacity: 1.8 MW electrical
2 200 tons CO_2 saved / year

1st kg of Li carbonate produced end 2021



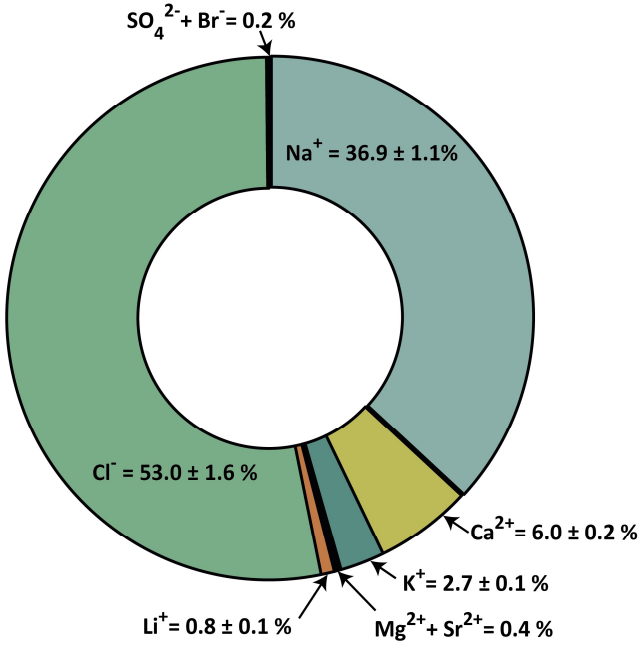
ECOGI - Rittershoffen

Heat generation since **2016**
2 wells in operation at a depth of **2.5 km**
Reservoir: **standstone & fractured granite**
Temperature: production 168°C / reinjection: 85°C
Capacity: 24 MW thermal
43 000 tons CO_2 saved / year

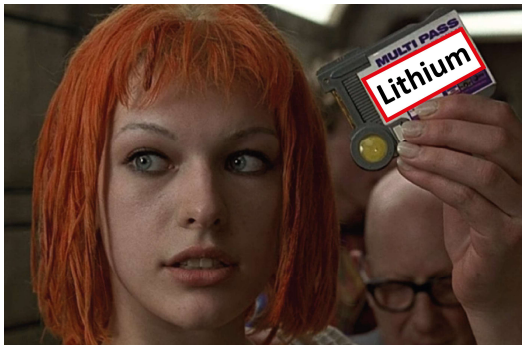
1st TWh of heat produced by the end of 2022

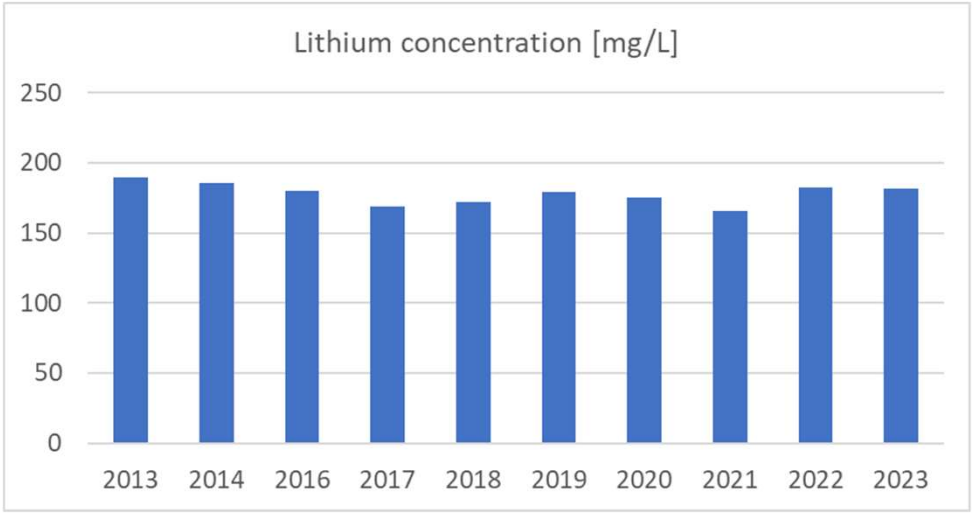
Lithium concentration in the geothermal brine

- Li is the 5th element (in molar concentration) in the brine
- Concentration at Soultz since 2016: 174 ± 14 mg/L
- Concentration at Rittershoffen since 2014: 182 ± 14 mg/L



Molar percentage of the elements present in Soultz brine (2016 –2022)



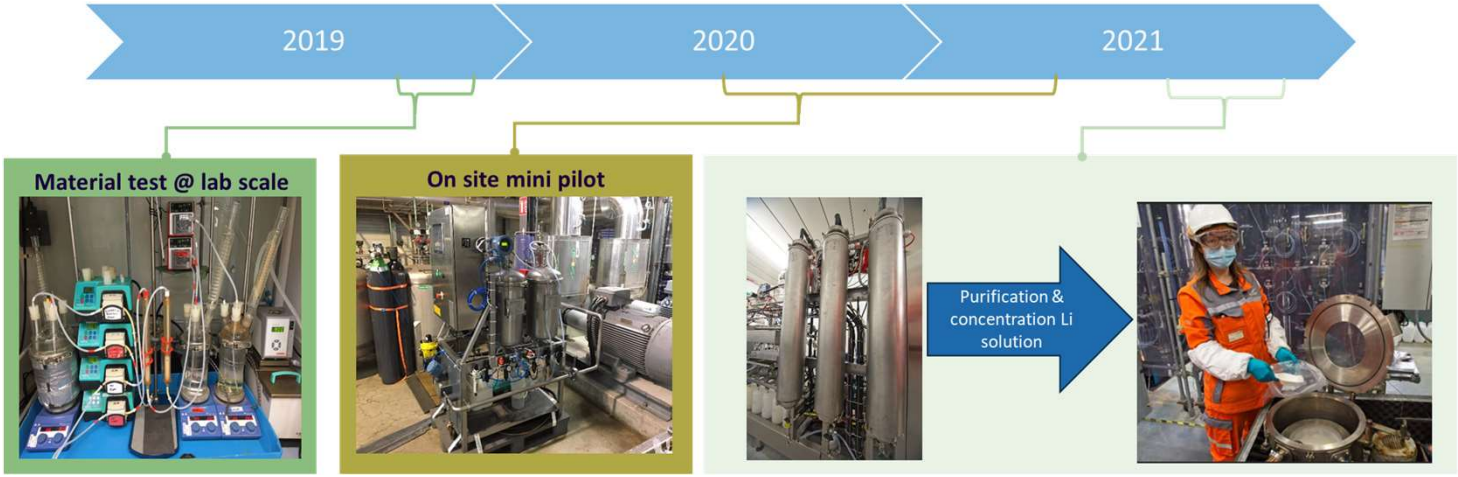


EuGeLi, from laboratory to pilot operation (2019 – 2021)

- EuGeLi : European Geothermal Lithium Brine
- Project period: January 2019 - December 2021
- Budget: 3.9 M€, 85% funded by EIT-Raw Materials
- Assessing geothermal lithium resources
- Develop the direct extraction process (DLE)
- Testing DLE pilots in operating conditions (temperature & pressure)
- Production of the first kg of battery-grade lithium carbonate from the Upper Rhine Graben

EuGeLi

Funded by



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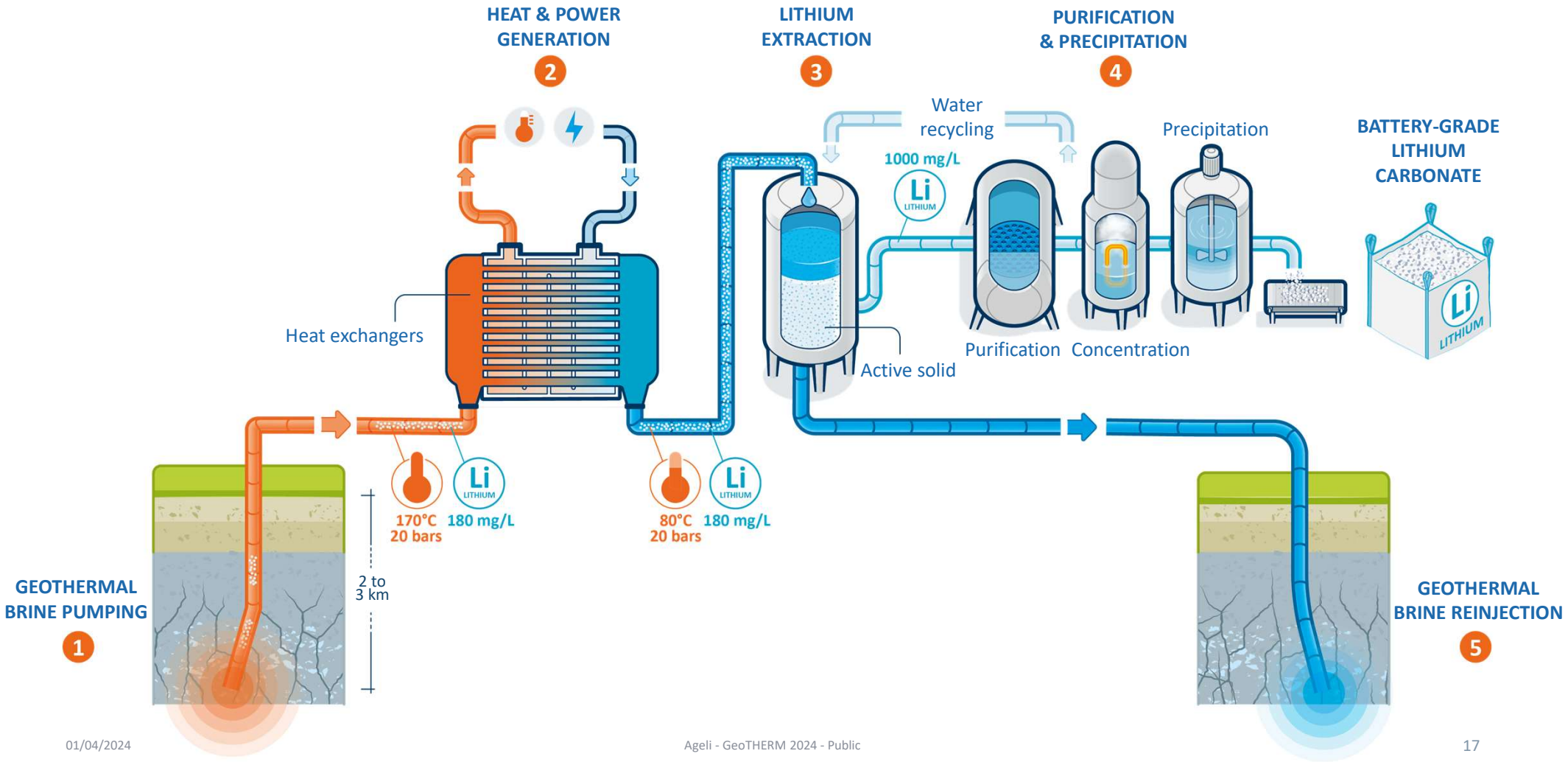
AGELI'S TECHOLOGICAL PROJECT

Innovative process with a very low carbon footprint



Pilot testing in the full-scale plant configuration

Geothermal water recovery from Alsace's underground reservoir

- 80°C and 20 bar pressure
- Chemical composition different from South American Salars

Continuous operation in the industrial mode

- Set-up with 3 columns in series
- Recycling of the production streams

DLE pilot on geothermal brines

Validate **the efficiency** of the process in geothermal conditions through **continuous piloting for at least 6 months**, a first in France.

Ensure **long-term process stability** with a view to industrial scale-up

Improve **active solid**, materials and equipment for optimal lithium extraction under geothermal conditions

05

AGELI'S SCHEDULE AND ORGANISATION

The Ageli project by 2030, from PFS to industrialization

EUGELI - Collaborative R&D project

Evaluate the feasibility of producing battery-grade lithium from geothermal sources and commission a study to establish the various business models.

SCOPING STUDY

Model different production configurations (number of extraction and reinjection wells) and identify the risks associated with the process.

PFS

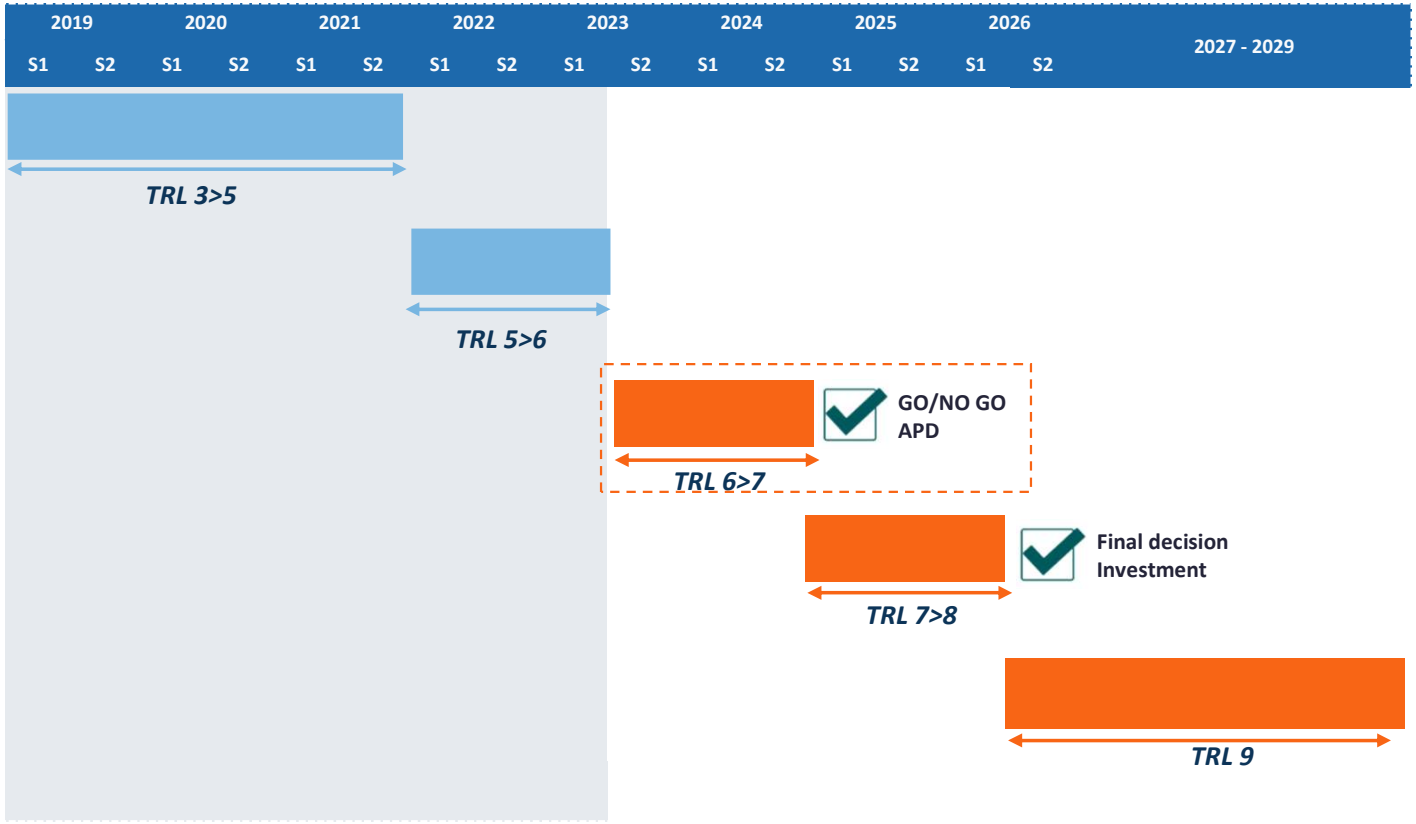
Define the optimal technical configuration of wells and extraction process, adapt and test the process to technical and geological conditions.

DFS

Finalize the technical repository, validate subsurface models (reserves and resources, well geometry), refine economic assumptions, define the project execution plan.

INDUSTRIAL UNIT(S)

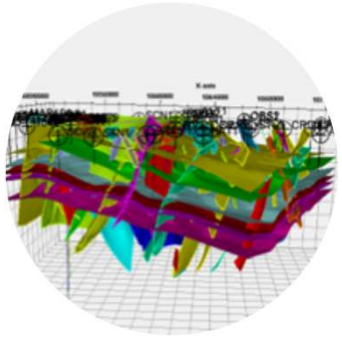
Drilling, construction and commissioning of industrial geothermal lithium production unit(s) with a minimum capacity of 10 kt/year in Alsace.



Project organisation

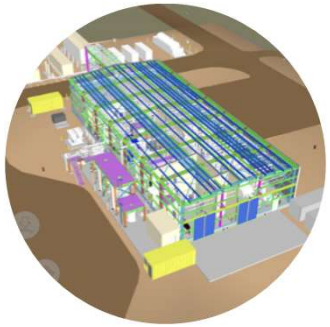
#1 SUBSURFACE ENGINEERING

Evaluate/validate the resource and determine the best development plan (well layout) to bring it into production.



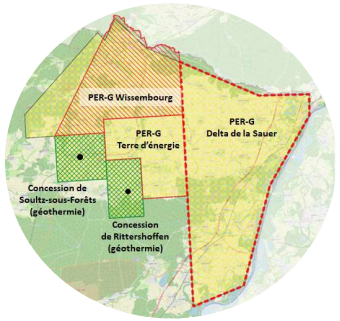
#2 SURFACE ENGINEERING

Design a geothermal-powered Lithium extraction and refining capacity of over 10,000t/year



#3 PERMITTING & ENVIRONNEMENT

Prepare the impact studies and permit applications required to meet the project's ambitions.

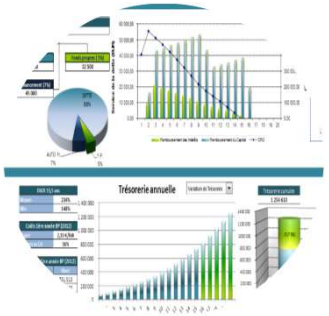


#4 CSR & COMMUNICATION

Maximize the social acceptability of the project's entire local and national ecosystem

#5 FINANCING & BUSINESS PLAN

Ensure the economic feasibility of the project



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CURRENT OUTCOME

Current outcome

- Long term lithium concentration monitoring at Soultz & Rittershoffen
  - Stable concentration
  - 175-180 mg/l
- Ongoing certification ore resource
  - Proven ore resource at Soultz and Rittershoffen
  - Probable ore resource on the rest of the 3D seismic
- Positive results pilot testing at geothermal conditions (pressure, temperature)
- Fruitful industrial partnership

THANK YOU FOR YOUR ATTENTION

QUESTION ?