Zero Carbon Lithium®
Lithium Concentration in the Earth

Teng et al. (2004)

<table>
<thead>
<tr>
<th>Region</th>
<th>Li (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seawater</td>
<td>0.2±0.05</td>
</tr>
<tr>
<td>Mantle</td>
<td>1.5±0.5</td>
</tr>
<tr>
<td>Ocean crust</td>
<td>10±2</td>
</tr>
<tr>
<td>Lower continental crust</td>
<td>13±5</td>
</tr>
<tr>
<td>Upper continental crust</td>
<td>35±11</td>
</tr>
</tbody>
</table>
Environmental concerns

Lithium extraction in South America **evaporates** large quantities of water in one of the driest places on earth. This stresses the environment and local communities.

Hard rock mines for lithium are unpopular. Once you mine it, the rock has to be **roasted with fossil fuels** to produce lithium hydroxide. This is very CO2-intensive.
Examples of Geothermal Brines

Worldwide perspective

- 181 mg/l
- 77 mg/l
- 2 mg/l
- 14 mg/l
At the center of fastest growing lithium market

>500GWh Capacity Planned by 2030

Brandenburg, 2021
At least 20GWh

Salzgitter, 2024
16 GWh, LATER 24 GWh

Erfurt, 2022
14 GWh LATER 100 GWh

Sunderland, 2010
2.5 GWh

Willstät, 2020
1 GWh

Germany & France, 2022
16 GWh, LATER 48 GWh

Uberherrn, 2023
24 GWh

Germany, 202X
4 GWh, LATER 8 GWh

Schwarheide, 2022
CATHODE MATERIALS

Bratislava, 2024
10GWh

St Athan Wales, 2023
10GWh, later 35GWh

Skellefteå, 2021
32 GWh LATER 40 GWh

Brandenburg, 2021
RAMP UP TO 8-12 GWh

Bitterfeld, 2022
16 GWh

Wroclaw, 2018
6 GWh, LATER 70 GWh

Konin, 2021
CATHODE MATERIALS

Nysa 2020
CATHODE MATERIALS

Komaron 1 + 2, 2020
7.5 GWh, LATER 23.5 GWh

Göd, 2018
3 GWh, LATER 15 GWh

Mo I Rana, 2023
32+2GWh

Agder, 2024
8GWh, later 32GWh

Norway, TBC
Unknown

Europe, TBC
Unknown
Lithium In Europe

- Hard Rock
- Geothermal Brine

Largest Lithium Resources in Europe

- Vulcan Energy: 16.19
- European Metals: 7.17
- Rio Tinto: 6.24
- Infinity Lithium: 1.68
- Savannah: 0.71

VULCAN ENERGY
Zero Carbon Lithium®
Geography and Geology

Upper Rhine Graben

© Oberrheingraben.de
Geography and Geology

Upper Rhine Graben

© Oberrheingraben.de
Lithium in the Upper Rhine Valley

Location of Lithium Measurements

- Lithium in the brine: **Up to 200 mg/l**.
- Concentration dependant on source, depth and temperature.
- Different approaches for lithium potential.
  - Lithium in place.
  - Project specific potential
    - depending on location!
- BBergG: Mineral resource under the mining law.
- Licenses to extract energy and lithium.
  - Exploration License for Geothermal and Lithium.

Wells in the Upper Rhine Valley with Lithium concentrations > 100 mg/l
Lithium Production from Geothermal Brines

**Vulcan's project**

1. Wells are drilled into the deep, hot, lithium-rich brine resource, which is pumped to the surface.

2. Heat from the brine powers a turbine creating renewable energy, powering the lithium extraction process and feeding the excess energy into the grid.

3. Lithium hydroxide produced, bagged then distributed for the EU lithium-ion battery cathode markets.

4. Re-injection of brine kilometres away. A closed loop, circular system.

**A PERFECT FIT**

**Core Market**

- Zero Carbon Lithium™

**Secondary Market**

- Zero Carbon Heating
- Zero Carbon Electricity

**Market Demands in EU & Germany**

**Vulcan value propositions & revenue streams**
Commercially mature technologies combined

Our process replicates existing operations taking place commercially across the world. What is unique about us is the combination of those different steps.

1. **Binary Cycle Geothermal Plant**
   - Hundreds of geothermal energy plants running **globally**.
   - 37 deep geothermal energy plants in operation in **Germany**.
   - Upper Rhine Valley well-known area for successful geothermal operations.
   - Team of **leading experts** in developing and permitting geothermal plants.

2. **Direct Lithium Extraction Plant**
   - Direct Lithium Extraction commercially **used for decades**.
   - Now operating in **China & Argentina** — accounting for >10% of global lithium production.
   - Adsorbent-type DLE technologies **commercially available** from several suppliers.
   - We’ve achieved >90% lithium recoveries from initial test work.

3. **Lithium Refining Plant**
   - Conversion of lithium chloride to lithium hydroxide is an **industry-standard route**.
   - There are operational plants worldwide doing this.
Carbon intensity

*See Minviro LCA Study, The CO2 Impact of the 2020s Battery Quality Lithium Hydroxide Supply Chain

OUR ZERO CARBON ADVANTAGE

13-15 TONNES*

5 TONNES*

Hard-Rock Spodumene
Refining in China
Coal power
High CO₂

Salar-Type Brines
Significant CO₂
High water consumption

Vulcan Geothermal Brine

“CO₂ emissions from lithium production set to triple by 2025”

*See Minviro LCA Study, The CO₂ Impact of the 2020s Battery Quality Lithium Hydroxide Supply Chain
Thank you

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