Lithium (Li), a non-renewable earth metal, is mined around the world for Lithium-Ion Batteries, at the expense of:

1. **Water Usage** - 2 million liters of water used for 1 ton of Lithium.
2. **CO2 Emissions** - 15 tonnes of CO2 for 1 ton of Lithium.
3. **Soil, Land, Air and Water Contamination** - Threat to indigenous communities.

**FIGURE 1 - ENVIRONMENTAL IMPACTS OF LITHIUM MINING, [BBC.COM]**

- **Emission of CO2** (per tonne of Lithium): Hard rock mining - 15,000 kg, Underground reservoirs - 5,000 kg, Geothermal water - 0 kg.
- **Use of water** (per tonne of Lithium): Hard rock mining - 120 m³, Underground reservoirs - 469 m³, Geothermal water - 3 m³.
- **Use of land** (per tonne of Lithium): Hard rock mining - 464 m², Underground reservoirs - 3,124 m², Geothermal water - 1 m².

**Source:** Mindtree

**FIGURE 2 - INCREASING DEMAND OF LITHIUM [STATISTA.COM]**

1. Lithium demand is rising exponentially.
2. Lithium is in the epicenter of battery systems.
3. Battery Systems are used in Electric Vehicles (EVs) and grid scale energy storage.
4. Batteries facilitate a net-zero future.
5. Renewable energy implementation will be limited without batteries.

**SUSTAINABILITY DEVELOPMENT GOALS (SDGS)**

- **6. CLEAN WATER AND SANITATION**
- **7. AFFORDABLE AND CLEAN ENERGY**
- **13. CLIMATE ACTION**

The solution to the Lithium mining problem should be one which doesn't **contaminate water**, doesn't **emit carbon** and is still relatively **affordable**.
Eliminating lithium mining - reduced water wastage
Reduced water, land and air contamination
90% extraction efficiency with negligible loss in absorption capacity over cycles
Clean energy generated and passed to the grid
Reduced carbon emissions from conventional methods
Overall, lithium extraction becomes environmentally-friendly

In context: $\frac{0.0005\, \text{kg}}{\text{liter}} \times \frac{420\, \text{liters}}{s} \times 91\% = \frac{0.19\, \text{kg}}{s}$ of Lithium absorbed

It takes 42s to absorb enough Lithium (8kg) for one EV battery.
The correlation between the Li deposits and the geothermal energy production shows the potential to scale this technology and extract Li at each of those locations. Given the high impact and return on investment of the above solution, governments are supporting this project to reach the net-zero target increasing the feasibility of installation.

**CHALLENGES**

**Economical and social:** Heavy monetary investment to set brine and factories. Geothermal exploration can be expensive. Both can become cheaper over the long run and if done on a large enough scale. Geographical relocation of communities and land to install plants.

**Technological:** Salt ions in brine interfere with extraction process, however, current research is improving those methods.

**FUTURE PROSPECTS**

Alongside Li, other metals such as Nickel and Cobalt which are required for battery production can also be extracted from geothermal brines. Additionally, instead of using coal energy, geothermal energy can now be used by the battery manufacturing factories to reduce the total emissions in the manufacturing process.