# XtraLit

# Novel Ion-Exchange Sorbent and Technology for the Direct Extraction of Lithium from Brines with Medium and Low Concentrations

BRINE RIS

eit RawMaterials
Connecting matters

Co-funded by the European Union

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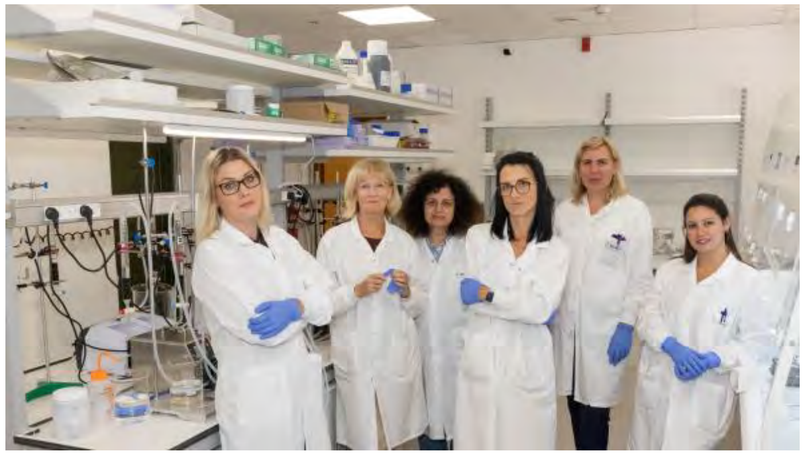
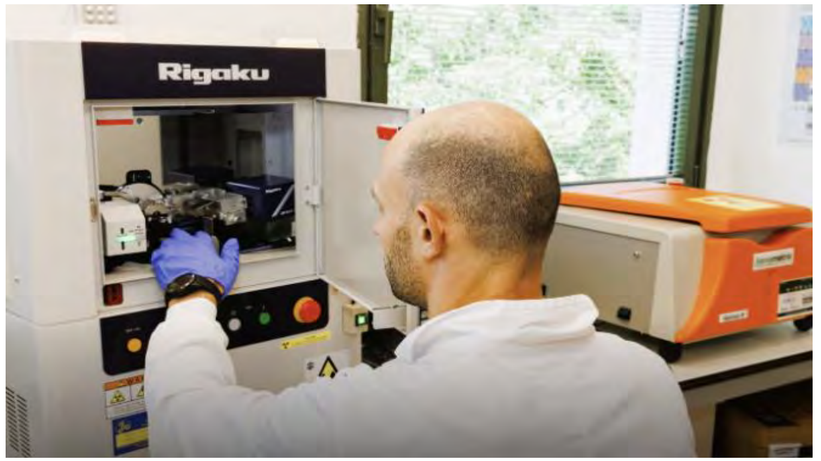
**Geothermal Lithium Networking Event**
Wroclaw, 4 December 2024

# XtraLit Laboratory and R&D Facilities in Rehovot, Israel

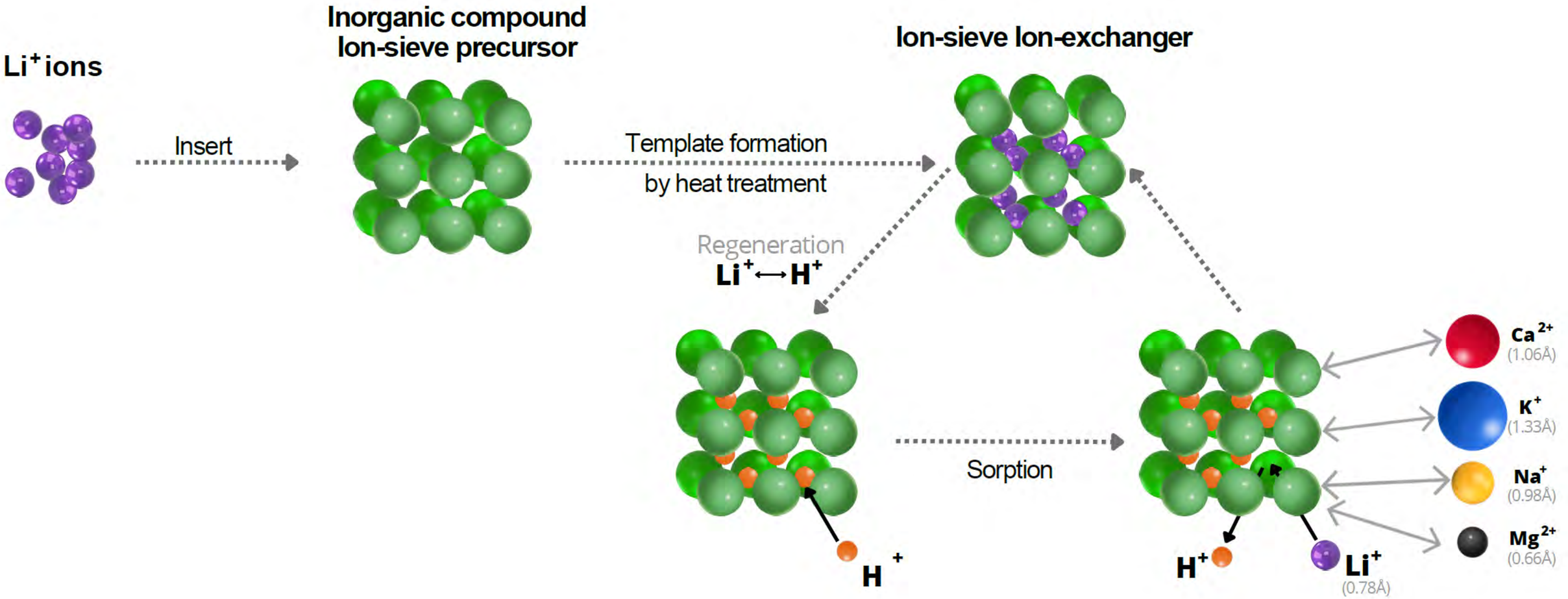
## Laboratory Facilities

## Research & Development Team





# Hight selective lithium ion-sieve sorbent and DLE ion-exchange technology

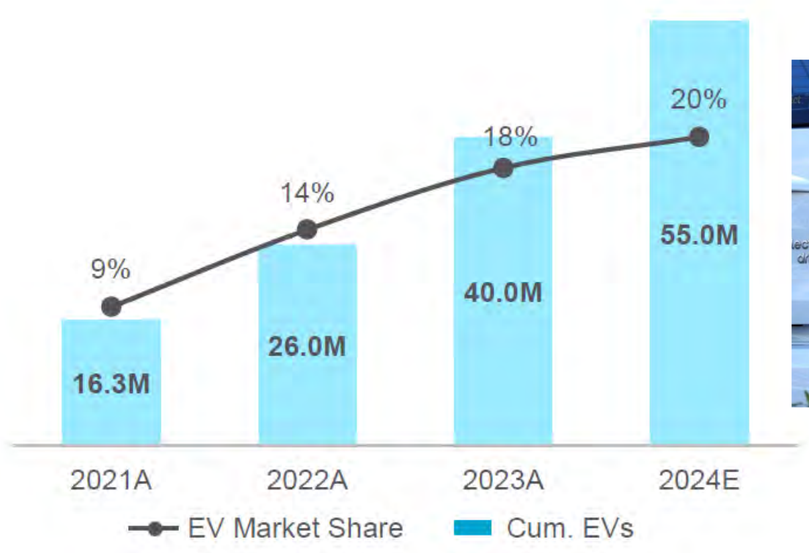


# Electric Vehicles Continue to Gain. Lithium Supply will be in Large Deficit Without New Sources.

## Electric Vehicles Gain Ground

- EVs market steadily grows at ~50% per year CAGR.
- EVs are steadily gaining in market share at ~3.7% per year.
- Each EV consumes ~50kg of Lithium Carbonate.
- Growth in Lithium needed.

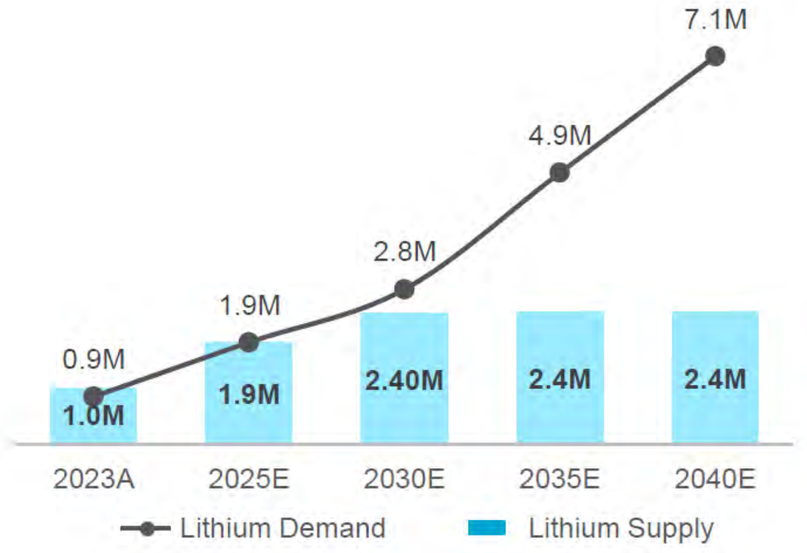
***Cumulative EVs & Market Share***[1] *(In million electric vehicles)*




## Lithium Reliant on Battery Demand

- Batteries and EVs demand for Lithium will increase to ~3x by 2030.
- Need to add 1.9 million tonnes of Lithium to current production.
- New Lithium projects required to fill a $6bn gap in market

***Lithium Demand & Supply*** *(in MT of Lithium Carbonate Equivalent (LCE))*




(1) According to IEA, Global EV Outlook 2023 report published in April 2023.
(2) According to IEA, Global Critical Minerals Outlook 2024 report published in May 2024.

# Direct Lithium Extraction (DLE) Addresses Market Problem. New and High-Quality Sources at Lower Cost.

| | Hard Rock Mining | Brine Evaporation | DLE |
|---|---|---|---|
| Applicable Source | Hard Rock | Brine | Salars, Lakes & Waste Waters |
| Production Time | Weeks | Months | Hours |
| Lithium Recovery Rate | 60 – 80% | 40 – 60% | 80 – 95% |
| OPEX / Tonne | $8 – 10/kg | $4 – 8/kg | $3.5 – 5/kg |
| CAPEX / Tonne Capacity | $50 – 80/kg | $40 – 70/kg | $20 – 70/kg |
| Land Requirement | High | High | Very Low |
| Water Consumption | High | High | Low |
| Energy Consumption | High | Medium | Low |

Notes: According to XtraLit analysis.

## DLE Technology Advantages

- **New Lithium Sources** (salar, lakes and geo brines & waste waters)
- **Efficient Production** (immediate Lithium recovery at higher rate)
- **Lower OPEX** (lower OPEX cost due to process simplicity)
- **Lower CAPEX** (lower upfront cost due to reduced footprint)
- **Protects Environment** (lower land, water and energy consumption)
- **Less Pollutive** (less harmul emissions & waste)

# XtraLit's Novel Sorbent and DLE System. Reduces OPEX and CAPEX of Lithium Projects.

**High Lithium Capacity**
(10x higher than competition. Requires less contact time and sorbent volume)

**Rejects Impurities**
(10x higher than competition. Reduces impurities content in eluate)

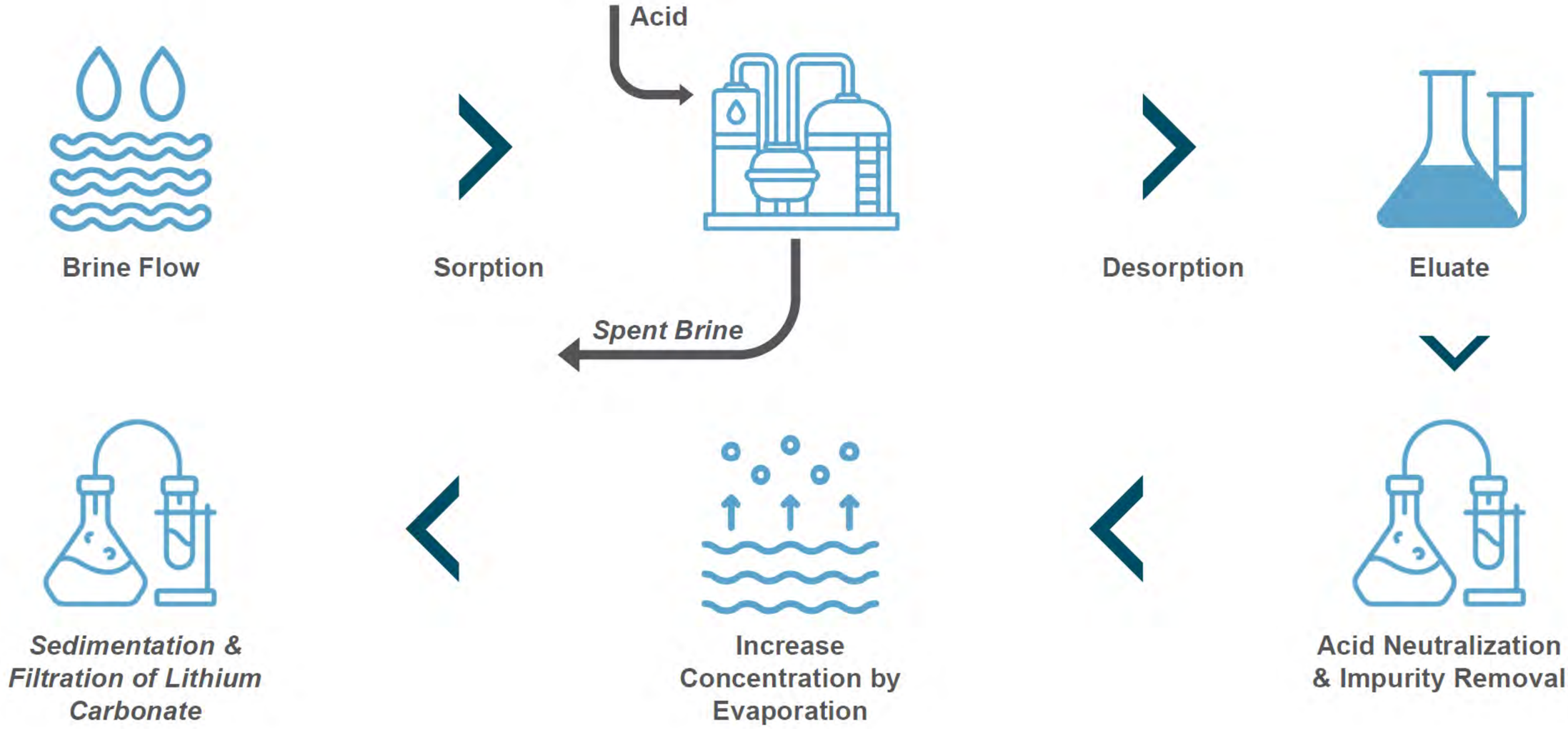
**Produces High Quality Eluate**
(Over 4,000 ppm Lithium content in eluate. Does not require additional processing)

**High Sorbent Durability**
(Low active material dissolution. Does not require frequent sorbent replacement)

**Adaptable to Processing System**
(Works in variety of processes. Lower equipment requirements and capital cost)

**Competitive Sorbent Cost**
(Low cost of sorbent purchasing. More efficient media at a cheaper price)

## Complements the Lithium Extraction Process. Increased Efficiency and Lowers Cost.



# Improves ESG Credentials and Addresses Regulator Concerns. Lower Water, Energy and Land Usage.

## XtraLit Advantages

### Low Land Requirement
(low lease payments and simplified are land permitting)

### Returns Brine to Source
(simplifies permitting for multi-use sources and water-level continuous areas)

### Low Energy Use
(lower energy OPEX and associated infrastructure costs)

### Less Waste & Ground Contamination
(no harmful tail products or chemical leakage to local environment)

### ESG Rules Compliance
(meets all ESG and water use requirement in sensitive areas)

### Responsible Lithium Mining
(ethical and sustainable extraction of lithium with preservation and rehabilitation)

## Methods Comparison

| | Brine Evaporation | Hard Rock Mining | XtraLit DLE |
|---|---|---|---|
| **Water Use** ($m^3$ / t LCE) | 600 t | 1,080 t | **80 t** |
| **Land Use** ($m^3$ / t LCE) | 3,000 **$m^3$** | 400 **$m^3$** | **7 $m^3$** |
| **Waste Product** (t / t LCE) | 150 t | 60 t | **2** t |
| **Energy Use** (GJ / t LCE) | 60 **GJ** | 130 **GJ** | **32 GJ** |
| **Emissions** (t / t LCE) | 4 t | 8 t | **1** t |

# Applicable to a Broad Range of Brine Sources and Process Configurations.

## Applicable Brine Sources & Processing Methods

### Brine Sources

**Salt Lakes**
(20 - 80 mg/L Lithium)

**Medium Conc Salars**
(100 – 500 mg/L Lithium)

**O&G Produced Water**
(20 – 200 mg/L Lithium)

**Geothermal Brines**
(5 – 200 mg/L Lithium)

### Brine Processing Methods

**Continuous Stirring Tank Reactor (CSTR)**

**Static Columns**

**Fluidized Bed Reactor**

**Continuous Stirring Reactors**

Notes: According to XtraLit analysis.

# In-House Engineering and Partners Networks. Capable to Execute Complex Projects.

## Package for Project Execution

### In-House Lab

- Professional R&D laboratory
- Over 30 full-time employees
- More than 12 PhD holders
- State of the art equipment

### Piloting

- Dedicated piloting & engineering team
- Over 2 active pilot units today
- Over 6 completed pilots
- Two CSTR pilot units and six column units

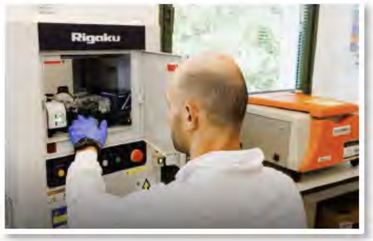
### Engineering Partners

- Supported by Tier-1 industry consultants
- Completed one Pre-Feasibility study
- In progress on Scoping Study
- Understanding on modular carbonation

### Project Partners

- Access to unique sources and jurisdictions
- Lithium industry veteran partners
- Specialist capital providers based
- R&D and engineering partner network

**Laboratory:**




**Pilots:**

**Consultants:**

HATCH

FLUOR Zelandez

proxa
future focused

**Partners:**

USmag MANASEER Magnesia

HALLIBURTON

LB LithiumBank

MOLGROUP

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# Commercial Scale Sorbent Production Today in Israel. Supply Expansion in Europe .

## Current Plant

- **Industrial Sorbent Plant in Israel**
  (fully operating commercial plant located in Ashekolon, Israel industrial area)
- **Current Capacity 100 kg per day**
  (member of new technology development programme with engineering support)
- **Capacity Expansion Options**
  (land and permitting allows expansion to 200 kg per day with minimal equipment investment)
- **Equipment and Permitting in Place**
  (full chemical and waster permitting and equipment in place for resin production)
- **Quality Control & Batch Certification**
  (standard testing of each Sorbent batch with certified specification sheet)

## Expansion in Europe 2025 - 2026

- **Sub-Contract Production in Romania**
  (agreement with local chemical resin producer)
- **Phase I Capacity 500 kg per day**
  (purchasing agreement for Sorbent produced, expected in 2025)
- **Capacity Expansion to 1,000 kg per day**
  (additional investment in equipment with infrastructure fully in place)
- **Fully Ready Industrial Site**
  (high grade equipment and full and waste treatment permitting portfolio)
- **Product Quality & Agreement**
  (XtraLit certification and testing of every batch produced to ensure quality adherense)

# Completed On-Site Pilots

## Dead Sea Pilot (Ongoing)




## Intrepid Potash Pilot (2Q 2024)

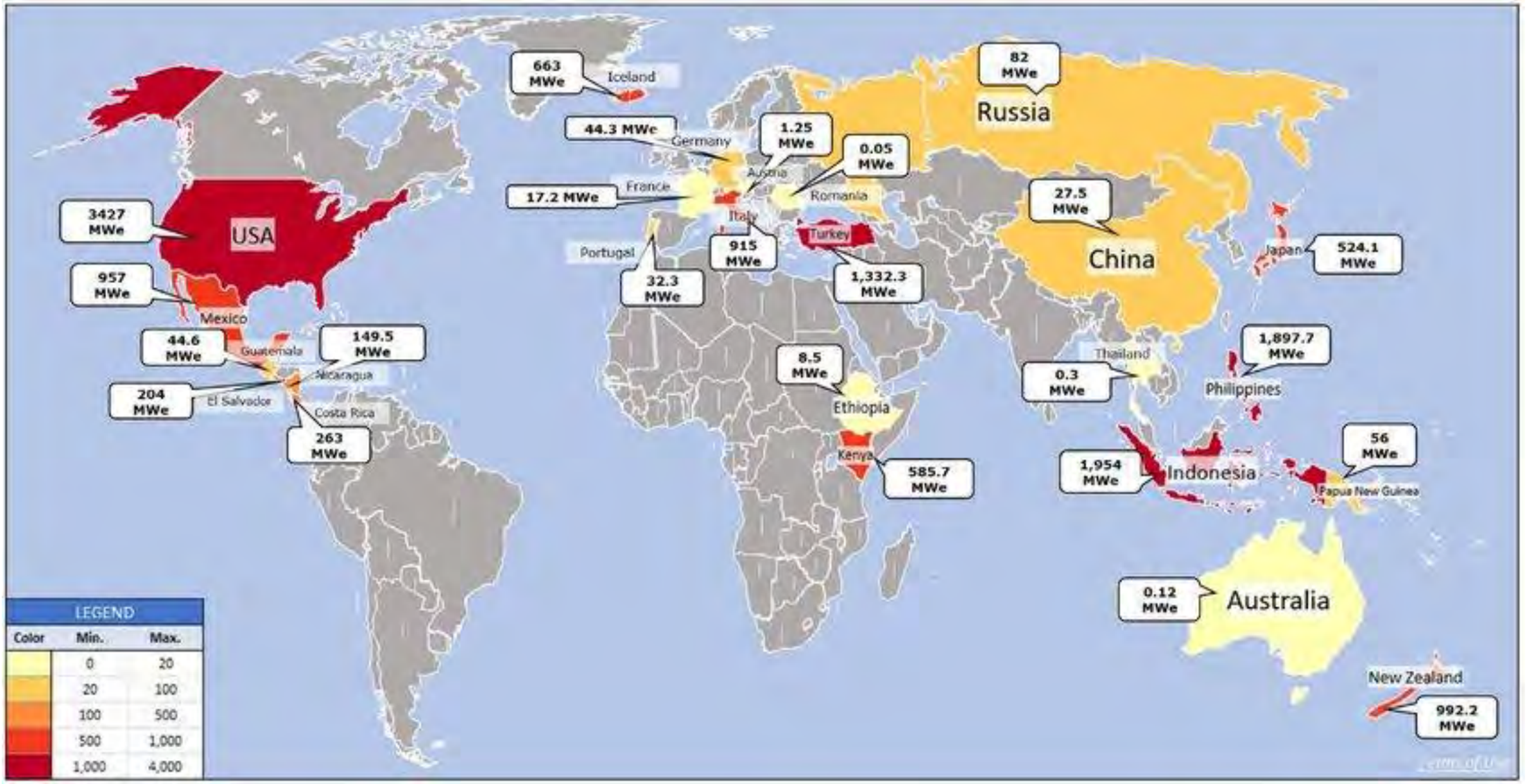



## Turkey Geothermal Plant Pilot (3Q 2023)




# Global Geothermal Installed Capacity Map

Turkey is among 5 countries in the world with >1GW installed geothermal capacity. 4th in the world, 1st in Europe.

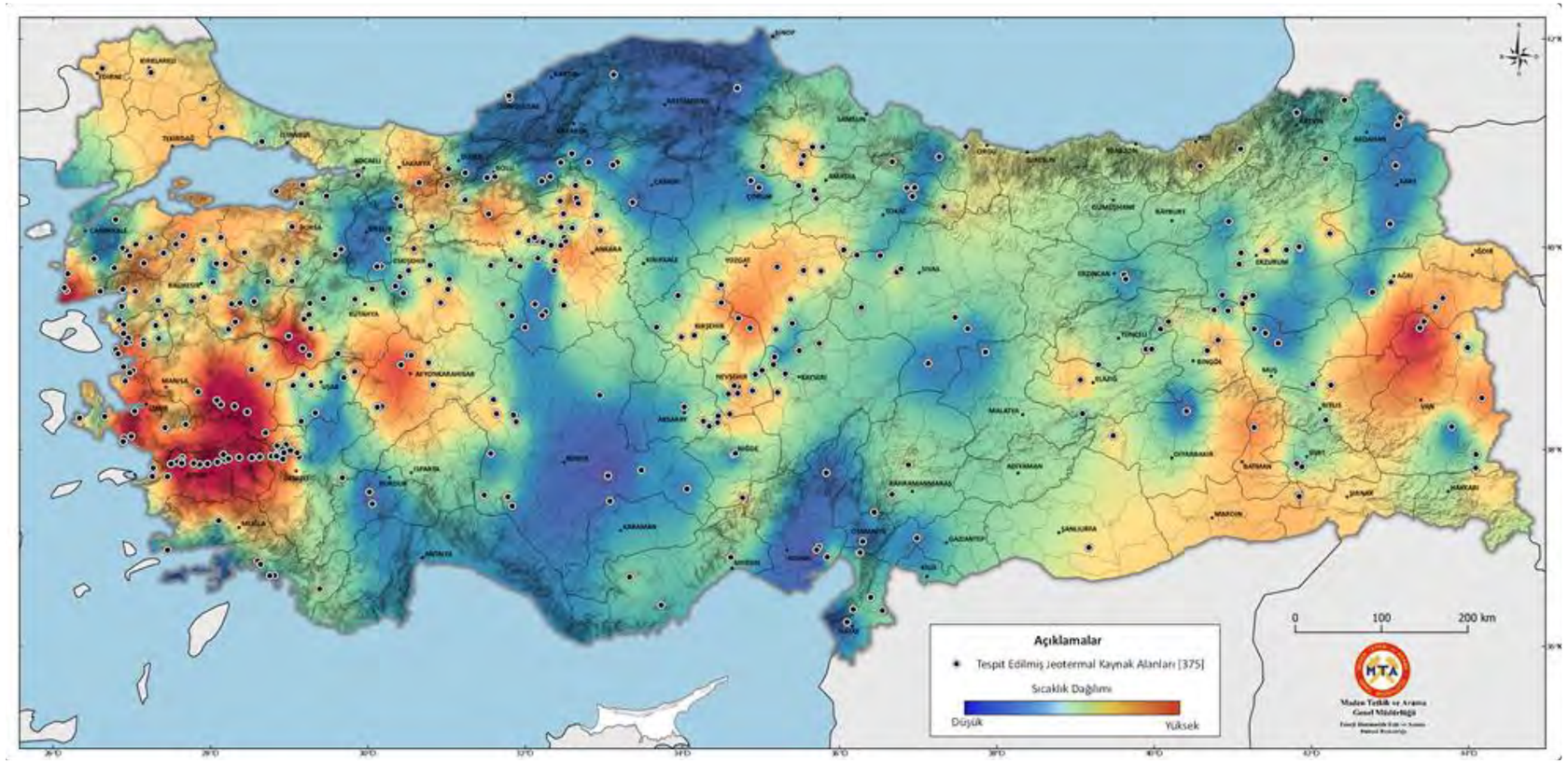



| | |
|---|---|
| USA | 3794 MW |
| INDONESIA | 2356 MW |
| PHILIPPINES | 1935 MW |
| TURKEY | 1691 MW |
| NEW ZELAND | 1037 MW |
| MEXICO | 963 MW |
| KENYA | 944 MW |
| ITALY | 944 MW |
| ICELAND | 754 MW |
| JAPAN | 621 MW |
| OTHERS | 1097 MW |

Proceeding of World Geothermal Congress 2021, Reykjavik, Iceland

# Turkey geothermal map

78% of Turkey geothermal fields are situated in Western Anatolia. The installed capacity 1.7 GWh.




**Power Plants**
**Total 5.000 MWe**
**Geothermal**
**1.676 MWe**

**Greenhouses**
**Total 25.000 acres**
**Geothermal**
**4.350 acres**

**Heating**
**Total**
**5 Million building**
**Geothermal**
**150.000 Building**

Technology for Lithium Extraction in the Context of Hybrid Geothermal Power Mineral Extraction from Geothermal Reservoirs: A Case Study from Western Anatolia

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# Estimated Lithium concentration and extraction Potential in Western Anatolia

**Çanakkale-Tuzla Geothermal Field**
2,93 – 43,94 ppm

**Simav Geothermal Field**
0,176 – 2,64 ppm

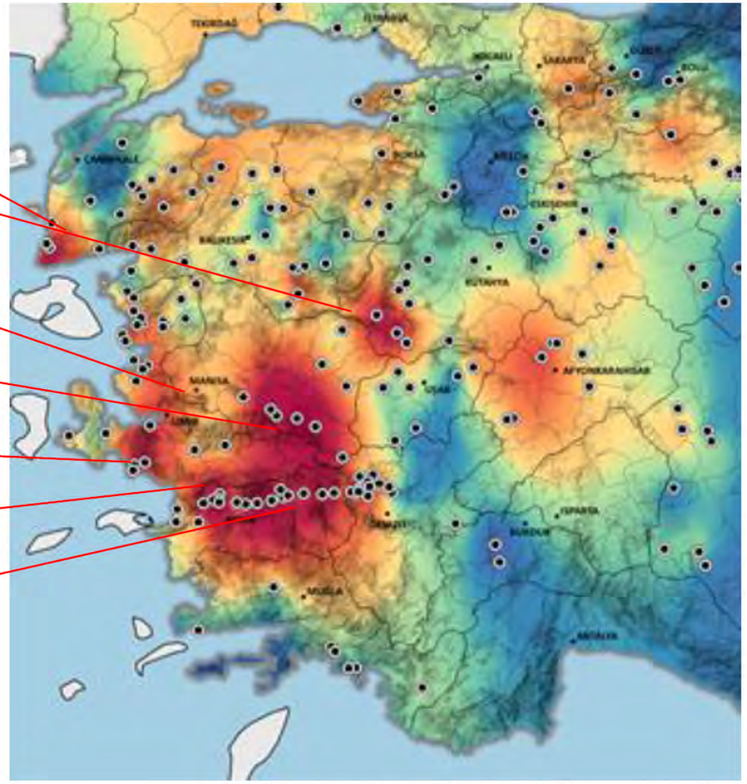
**Salihli Geothermal Field**
0,514 – 7,71 ppm

**Alaşehir Geothermal Field**
0,63 – 9,45 ppm

**Seferihisar Geothermal Field**
1,00 – 15,0 ppm

**Germencik Geothermal Field**
1,06 – 15,9 ppm

**Kızıldere Geothermal Field**
0,57 – 8,55 ppm



| | Seferihisar | Alaşehir | Germencik | Kızıldere | Simav | Salihli | Çanakkale | TOTAL (metric tons) |
|---|---|---|---|---|---|---|---|---|
| Lithium | 414 | 723 | 1964 | 986 | 1039 | 5116 | 14572 | **24813** |

Monte Carlo Simulation, P10, 90%

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# Demo-pilot in August 2023. We are in the process of engineering a pilot production facility to be commissioned in 2025 - 2026.

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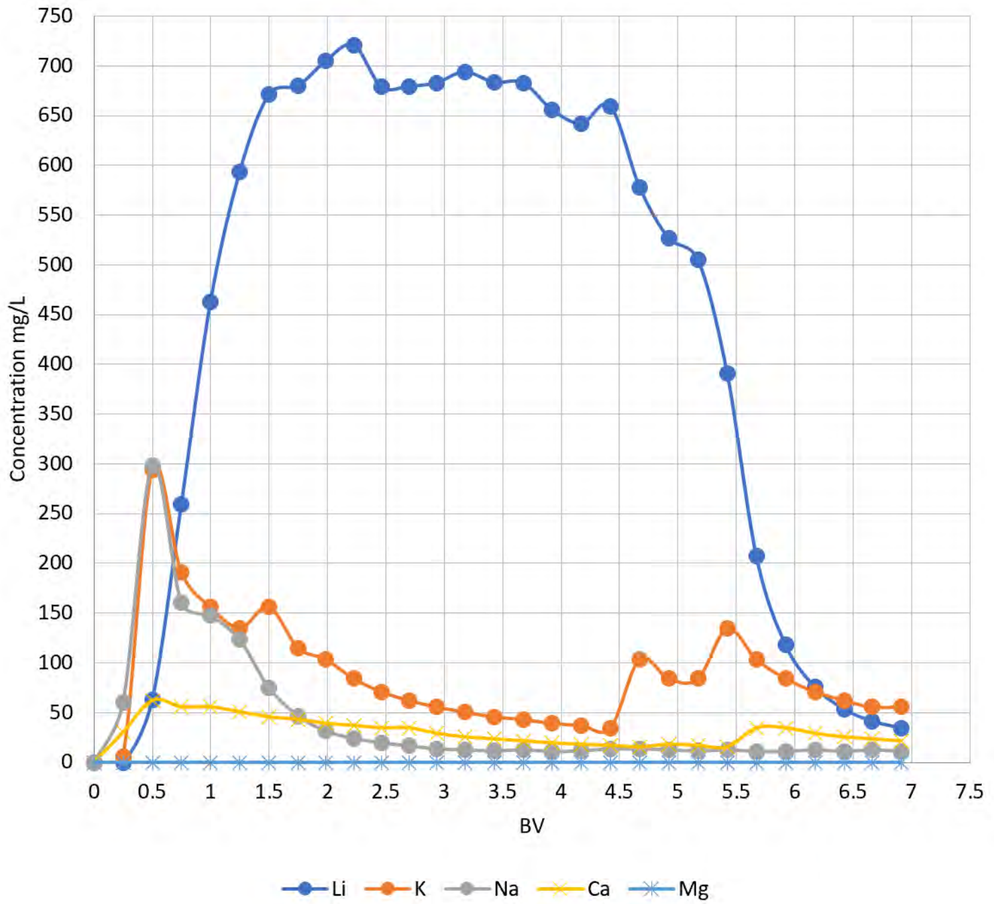
# High selectivity of XtraLit ion-exchange sorbent to Li relative to Na, Ca, and K




| The concentration of elements in geothermal brine, mg/l | |
|---|---|
| Li | 3.5 |
| Na | 1165 |
| K | 149 |
| Mg | 1.4 |
| Ca | 42 |

- Lithium recovery more than 90%,
- The concentration of lithium grew more than 200 times
- The ratio of Li to Na, Ca, K and Mg changed by 2 orders of magnitude .
- Industrial Grade Lithium carbonate of 95 % purity was produced from the obtained lithium concentrate.

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# Thank you for your attention

Contact us


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