

# Vulcan Energy Resources

## 2022 Corporate presentation

Q1 2022

Dr. Francis Wedin



**VULCAN ENERGY**  
**ZERO CARBON LITHIUM™**





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**At Vulcan, we strongly believe in our Zero Carbon Lithium™ Project**, its technical and economic potential, and the positive impact it could have on the world. We are trying to build a new type of project – integrating geothermal renewable energy, lithium extraction and lithium chemicals refining, without burning fossil fuels.

However, our project is highly complex and involves many known and unknown risks, some of which are beyond our control. We detailed a number of these risks in our Equity Raising presentation dated 14 September 2021 and in our ASX Announcement "Positive Pre-Feasibility Study" dated 15 January 2021<sup>1</sup>. We believe that we have the right measures in place to mitigate these risks, and the right team to execute on the project.

As with all new projects, we have made various assumptions in the technical and economic studies undertaken in relation to our Zero Carbon Lithium™ Project, including with respect to factors such as lithium grade, heat of the brine, lithium recoveries, permitting, and geothermal brine flow rates. We believe that these assumptions are reasonable, and have been made having regard to accepted practice and utilising Vulcan's in-house scientific team, along with the oversight of independent, third-party consultants. However, as with all assumptions, there is no guarantee that these assumptions will ultimately turn out to be correct, and we will continue to review and revise our assumptions and do our best to explain them as we progress our project.<sup>1</sup>

Our planned timeline to commercial production is a target. We are working hard to meet it, and we believe it is achievable, but the risk of delay in the timeline to commercialisation is significant.

This is a highly complex project which has never been attempted before. We want you to be aware of the risks, understand the assumptions, and know there might be delays but promise that we will keep you updated.

Being the first is hard, but it is exciting.

We are proud to share our journey with you, towards the decarbonisation of lithium and energy in Europe, but please be aware of the risks.

### IMPORTANT INFORMATION

#### Summary Information


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Note 1: Refer to heading "Investment Risks" and "Forward Looking Statements" on page 3. In addition, please refer to the ASX Announcements dated 15 December 2020 (entitled "Updated Ortenau Indicated and Inferred Resource") and 15 January 2021 (entitled "Positive Pre-Feasibility Study") which refer to the Company's Mineral Resources and Ore Reserves (respectively) included in the Presentation, available on [www.v-er.eu](http://www.v-er.eu). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcements and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcements continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented in this Presentation have not been materially modified from the original market announcements.



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## Forward-looking statements

This Presentation may contain certain forward-looking statements. Often, but not always, forward-looking statements can be identified by the use of forward-looking words such as "may", "will", "expect", "intend", "plan", "estimate", "target", "propose", "anticipate", "continue", "outlook" and "guidance", or other similar words. Such forward-looking statements may include, but are not limited to, statements regarding: the proposed use of funds; estimated mineral resources and ore reserves; expected future demand for lithium products; planned production and operating costs; planned capital requirements; planned strategies and corporate objectives; and expected construction and production commencement dates.

By their nature, forward-looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause actual results, performance and achievements to be materially greater or less than estimated, including those generally associated with the lithium industry and/or resources exploration companies such as those in the "Risk factors" section of the September ERP, the risks contained in the ASX Announcement "Positive Pre-Feasibility Study" released to ASX on 15 January 2021 and the "Risk factors" section of the Equity Raising Presentation released to ASX on 2 February 2021 (together the "**Previous Disclosures**").

These factors may include, but are not limited to, changes in commodity and renewable energy prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development (including the risks of obtaining necessary licenses and permits and diminishing quantities or grades of reserves), political and social risks, changes to the regulatory framework within which Vulcan operates or may in the future operate, environmental conditions including climate change and extreme weather conditions, geological and geotechnical events, environmental issues, the recruitment and retention of key personnel, industrial relations issues and litigation.

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## Ore Reserves and Mineral Resources Reporting

It is a requirement of the ASX Listing Rules that the reporting of ore reserves and mineral resources in Australia comply with the Joint Ore Reserves Committee's Australasian Code for Reporting of Mineral Resources and Ore Reserves ("**JORC Code**"). Investors outside Australia should note that while ore reserve and mineral resource estimates of the Company in this document comply with the JORC Code (such JORC Code-compliant ore reserves and mineral resources being "Ore Reserves" and "Mineral Resources" respectively), they may not comply with the relevant guidelines in other countries and, in particular, do not comply with (i) National Instrument 43-101 (Standards of Disclosure for Mineral Projects) of the Canadian Securities Administrators (the "Canadian NI 43-101 Standards"); or (ii) Industry Guide 7, which governs disclosures of mineral reserves in registration statements filed with the US Securities and Exchange Commission ("**SEC**"). Information contained in this Presentation describing mineral deposits may not be comparable to similar information made public by companies subject to the reporting and disclosure requirements of Canadian or US securities laws. In particular, Industry Guide 7 does not recognise classifications other than proven and probable reserves and, as a result, the SEC generally does not permit mining companies to disclose their mineral resources in SEC filings. You should not assume that quantities reported as "resources" will be converted to reserves under the JORC Code or any other reporting regime, or that the Company will be able to legally and economically extract any such resources.

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# Vulcan: goal to become world's first Zero Carbon Lithium™ & renewable energy company



Goal to become world's first integrated Zero Carbon Lithium™ and renewable energy company



Geothermal energy & lithium production in Germany



Proposed dual revenue Green energy & lithium



In the heart of the fastest growing lithium battery market in the world<sup>1</sup>



Largest JORC lithium Resource in Europe<sup>2</sup>



Potential for very low OPEX operation



Strong cash position



Team of leading experts



Project supported by the EU



**ENERGY BUSINESS**  
In production. Aiming to be a significant renewable heat & power producer



**LITHIUM BUSINESS**  
Developing substantial lithium chemicals production





## Bringing the Zero Carbon Lithium™ Project to fruition; 2021 milestones



### Pre-Feasibility Study

Post-tax NPV €2.1b  
(full project; phased)



### Lithium offtakes

- Volkswagen Group
- Stellantis
- Renault Group
- Umicore
- LG Energy Solution

*Renewable heat offtakes in progress*



### \$320m capital raised

Goldman Sachs and  
Canaccord



### First battery quality

lithium hydroxide  
monohydrate from pilot  
plant, developed  
in-house by Vulcan



### Team growth

Incl. acquisition of  
geothermal geology and  
engineering businesses



### Central Lithium Plant

Secured site at one of  
the largest chemical  
parks in Europe



### Additional permits & 3D seismic data

Growth of largest lithium  
resource in Europe



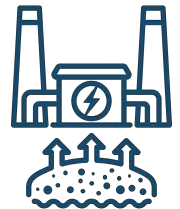
### Electric drill rigs

Acquired a scarce,  
strategic asset for  
Vulcan



### Frankfurt Exchange

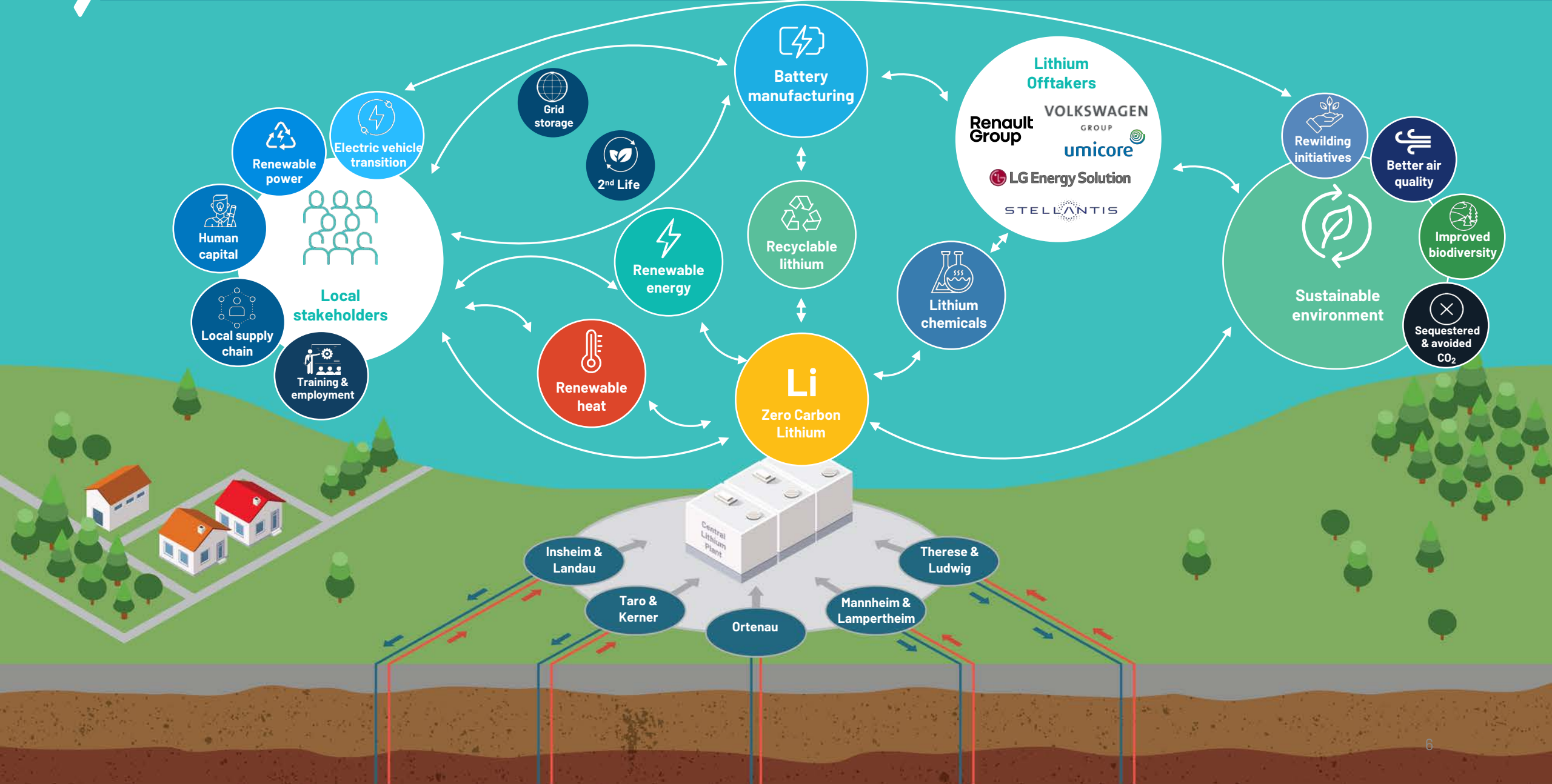
Appointed Berenberg to  
sponsor full regulated prime  
standards listing



### Geothermal plant acquisition

Vulcan becomes  
renewable energy  
producer

# Circular economy: Vulcan's assets and technologies work in harmony with the environment by harnessing its natural energy to create lithium with a zero-carbon footprint







Right place, right time  
for fully integrated renewable energy  
and sustainable lithium chemicals  
business in Europe



VULCAN ENERGY  
ZERO CARBON LITHIUM™



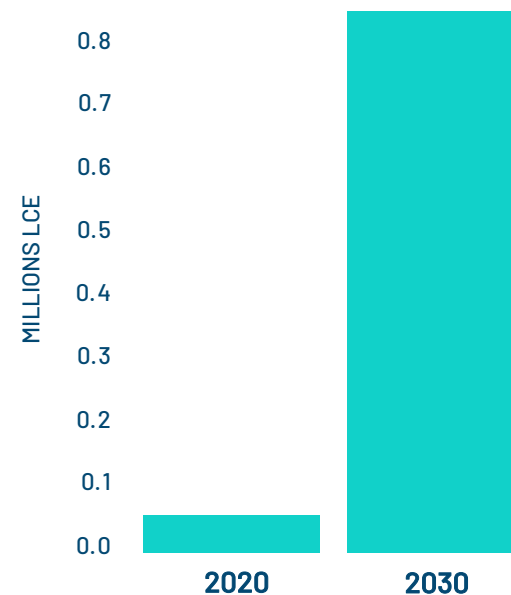
# How to support 30 million EVs by 2030 in the EU?

1,000GWh Lithium-ion  
Battery capacity by 2030<sup>1</sup>



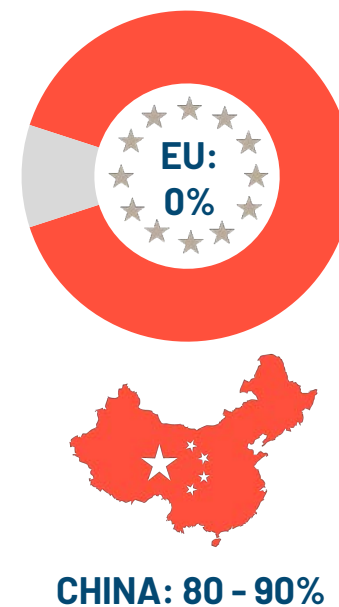
Source: Public announcements

EU: fastest growing  
Lithium market in the world<sup>2</sup>



Source: Based on LiB capacity, Benchmark Minerals & Roland Berger

Zero local supply  
of lithium hydroxide



Source: Bloomberg

Note 1: Refer to Appendix 5 for further details on EU lithium-ion battery capacity  
Note 2: Based on electric vehicle sales and lithium-ion battery production growth



## Auto battery and cathode-makers committing to carbon neutrality

### RENAULT GROUP

'Reducing carbon footprint is not just reducing vehicle emissions while they are being operated, but also [...] from the company's resource extraction and production processes through to the end of the vehicle's life cycle'.



'Road to carbon neutrality: With our suppliers, we work in partnership to implement responsible procurement practices, to ensure sustainable progress throughout the entire supply chain, with specific emphasis on the wise use of natural resources and reduced environmental impacts'.



'LG Energy Solution commits to be 100 percent carbon neutral by 2030. LG will set an example in cutting carbon emissions through battery production and promote the expansion of EVs'.



'Umicore commits to carbon neutrality for its Scope 1 and Scope 2 GHG emissions by 2035 ... Umicore pledges that its future growth, whether organic or through M&A, will be entirely carbon neutral'.



'By 2025, the company aims to reduce the carbon footprint of cars and light-commercial vehicles across the entire value chain by 30 percent compared to 2015 – and by 2050 to make the entire Group's balance sheet CO<sub>2</sub> neutral. The goal: a green zero'.

**Current lithium production has a significant environmental footprint:**



\*Source: Minviro

# International and European agreement and regulation supporting renewables and electrification of transport

## Glasgow Climate Pact



Calls upon Parties to accelerate the development, deployment and dissemination of technologies, and the adoption of policies, to transition towards low-emission energy systems, including by **rapidly scaling up the deployment of clean power generation and energy efficiency measures**, including accelerating efforts towards the phasedown of unabated coal power and phase-out of inefficient fossil fuel subsidies<sup>1</sup>

## German Federal coalition



Coalition agreement<sup>2</sup> includes:

- Order to secure the goal of climate neutrality
- Make greater use of the potential of geothermal energy for energy supply
- Generate 50% of heat in a climate-neutral way by 2030
- Significantly expedite planning and permitting processes
- All new cars sold to be electric by 2035.

## Green supply chain



- New EU Battery Regulation
- Carbon Border Adjustment Mechanism
- Battery Passport
- ISO/TC 333 Lithium



We are 100% dependent on lithium imports.  
The EU, if finding the right environmental approach, will be self-sufficient in a few years, using its resources.  
**Thierry Breton - EU commissioner**

## Local supply chain



- European Battery Alliance
- Critical Raw Materials List
- EIB new energy lending policy
- European Raw Materials Alliance

Refer to Appendix 7: The new EU Battery Regulation

<sup>1</sup>[https://unfccc.int/sites/default/files/resource/cop26\\_auv\\_2f\\_cover\\_decision.pdf](https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf)

<sup>2</sup>Koalitionsvertrag 2021 – 2025 zwischen der Sozialdemokratischen Partei Deutschlands (SPD), BÜNDNIS 90 / DIE GRÜNEN und den Freien Demokraten (FDP)

Photo: Bloomberg



# Delivering the Zero Carbon Lithium™ Project



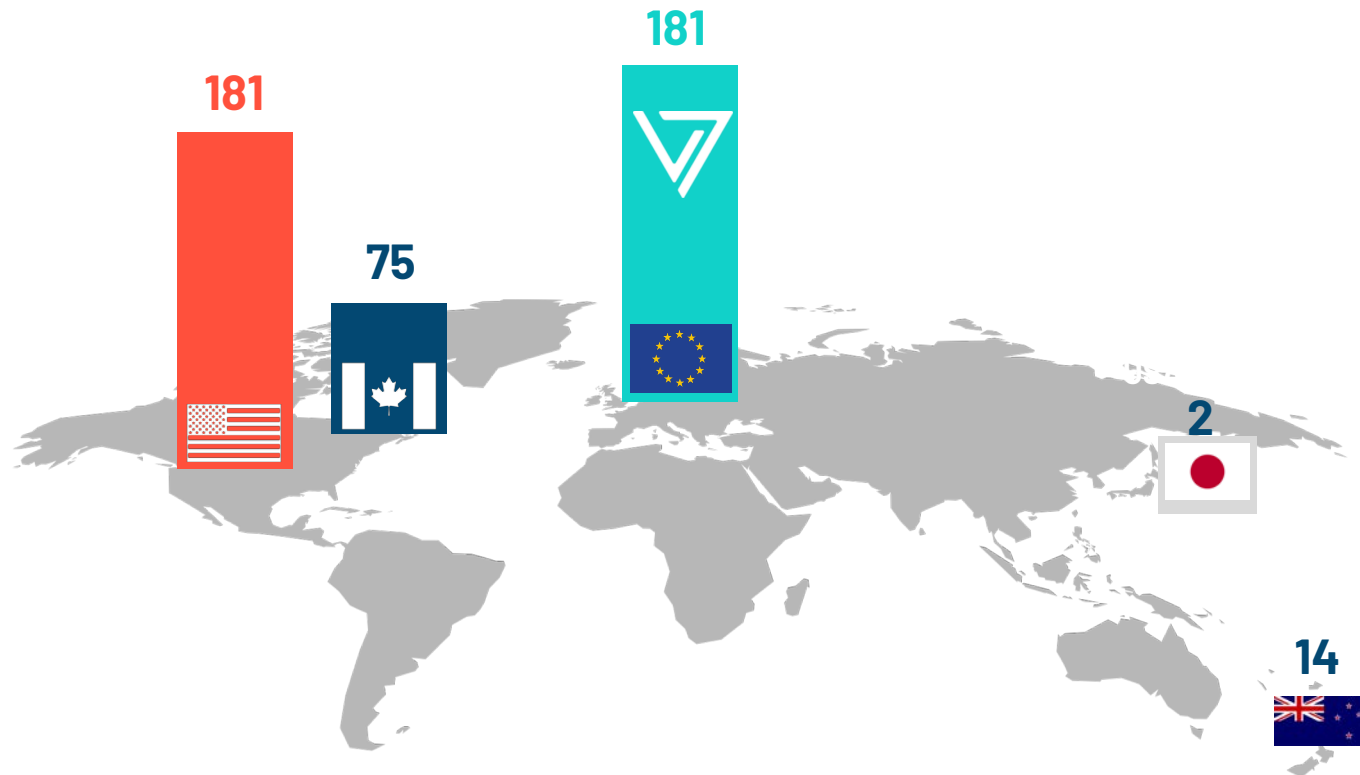
VULCAN ENERGY  
ZERO CARBON LITHIUM™





## We scoured the globe to find the right conditions for our Zero Carbon Lithium™ development

Lithium concentration  
In brine (mg/L Lithium)



We had the lithium and geothermal expertise to know that a Zero Carbon Lithium™ Project was possible using modern extraction methods, provided a geothermal brine reservoir could be found that had the following conditions:

- 1 Renewable heat
- 2 High lithium grades
- 3 High brine flow rate potential

Our initial research showed that this could be done in just two places:

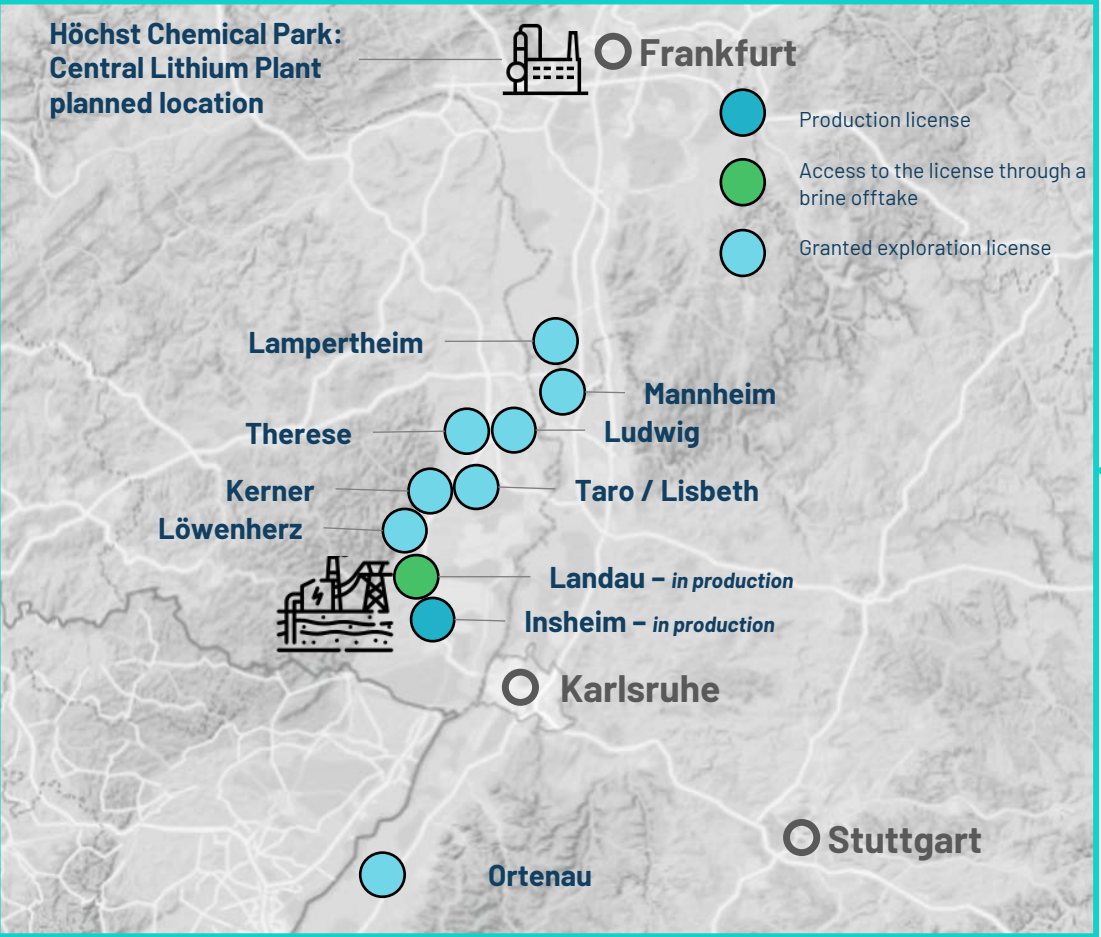
- 1 The Upper Rhine Valley in Germany
- 2 The Salton Sea in California

We chose Germany and Europe.



# Largest lithium resource at the centre of the fastest growing market in the world

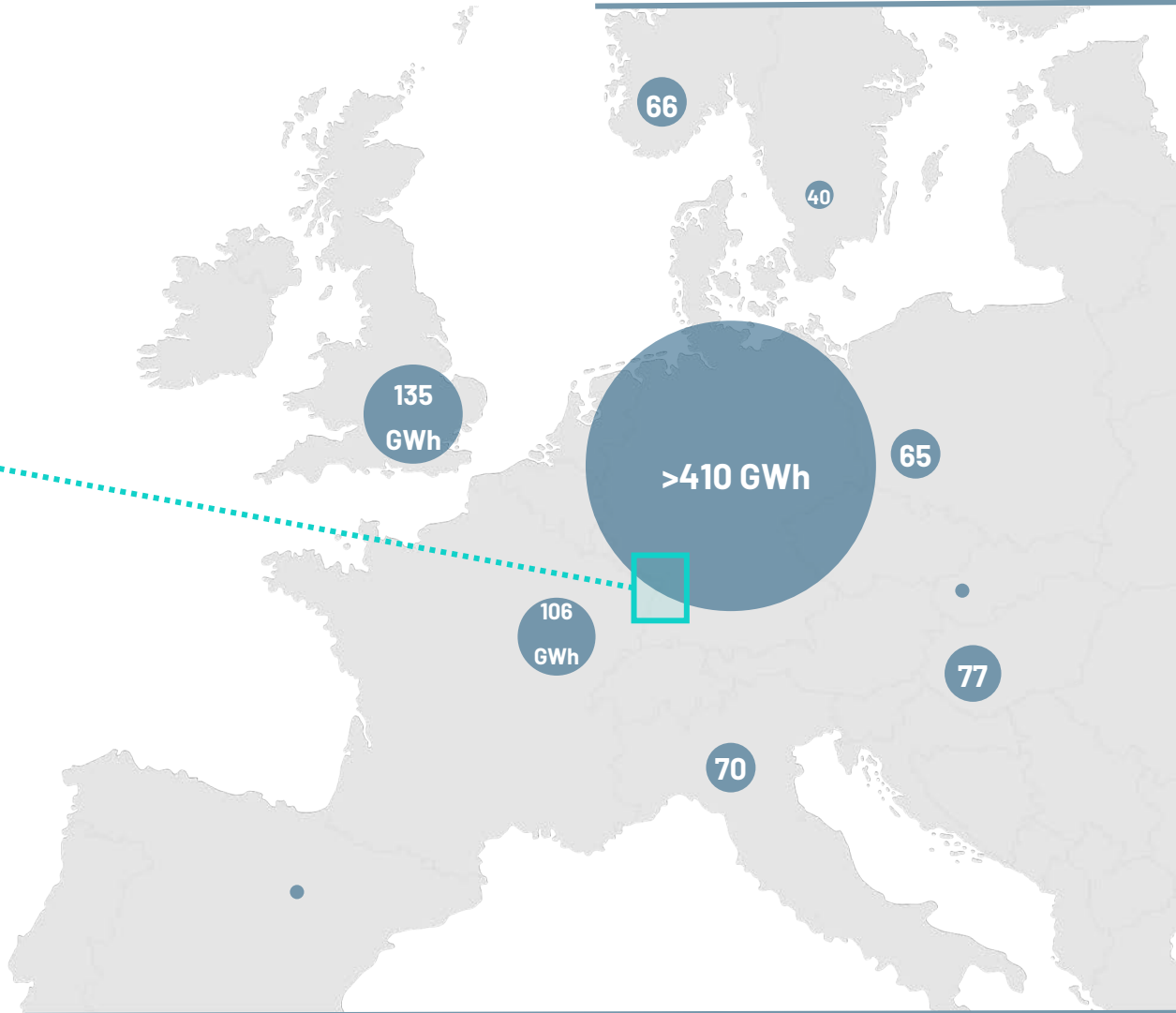
## Largest lithium resource in Europe: 15.85Mt LCE



Significant potential to scale up modular production as market grows:  
advantage over mined sources

Note 1: Appendix 2: Largest JORC lithium resource in Europe; Appendix 3: Lithium focused peers with comparable project size and stage for project size comparison,

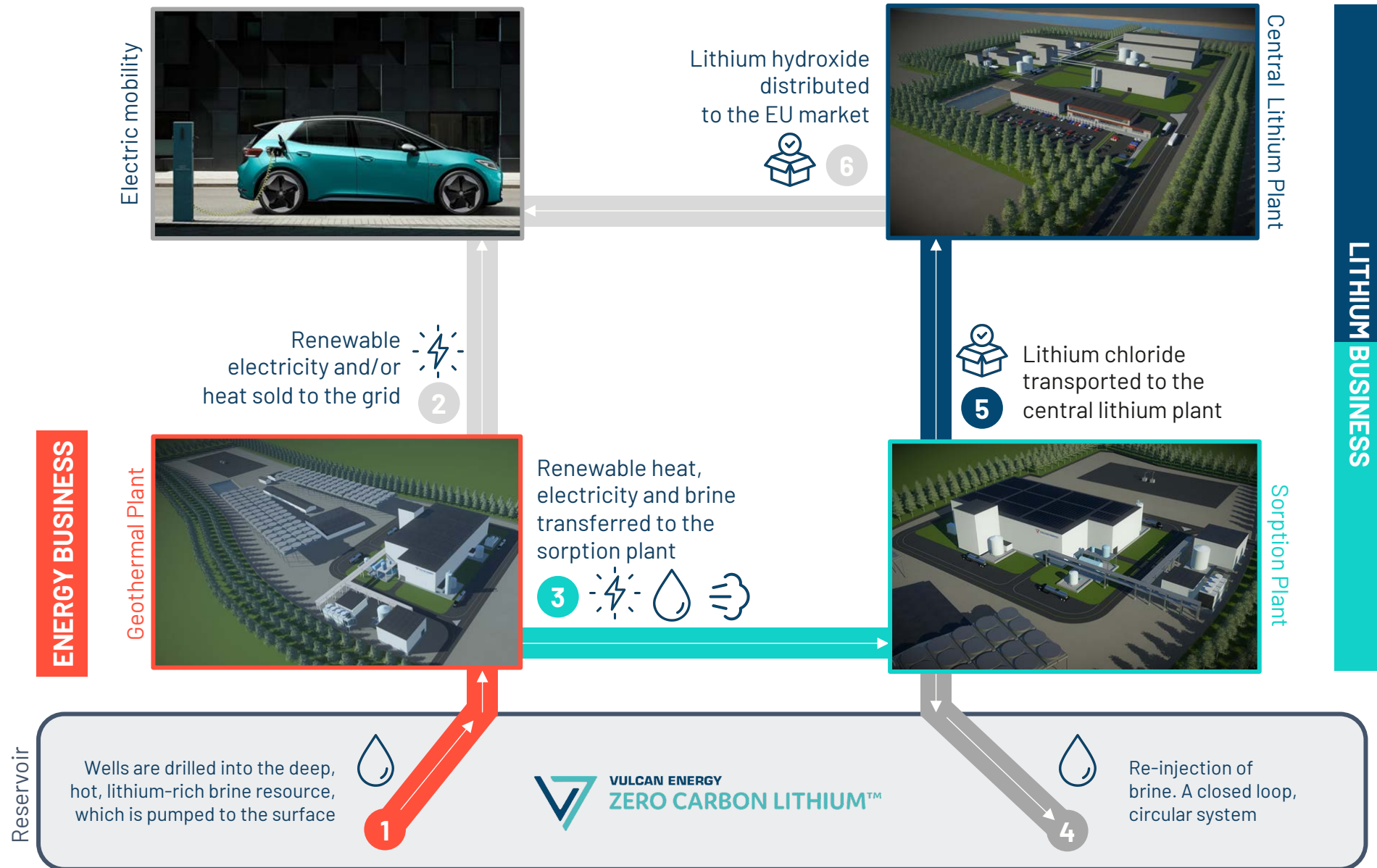
## European battery manufacturing projects in GWh capacity – November 2021



Source: Batterynews.de



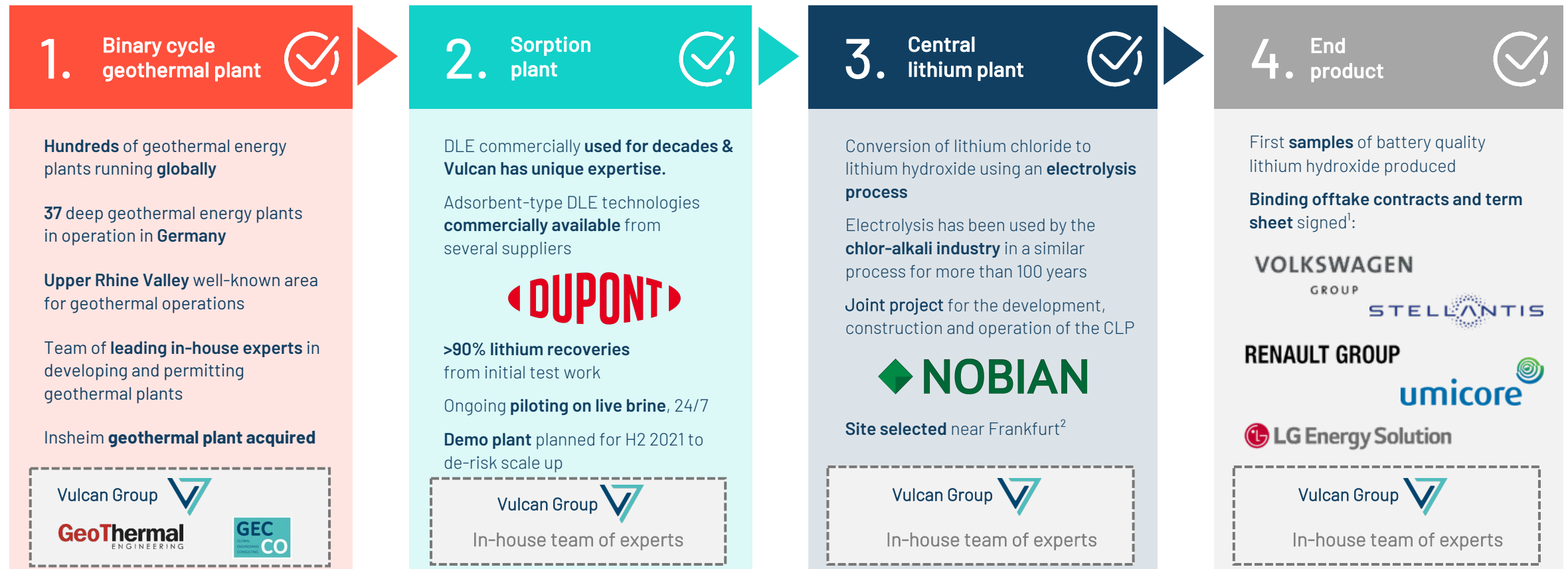
# Vulcan's renewable energy and lithium chemicals project



# Commercially available technologies combined and adapted to be fossil-free

Our process incorporates technologies with commercial analogues across the world.

What is unique about us is the proposed combination of these different steps, and our **strict exclusion of fossil fuels to power our process.**




















Note 1: Refer to slide 21 for further details regarding the Company's offtake arrangements

Note 2: Refer to Appendix 9 for more information on the location of the CLP



# Global DLE assets and projects

Company	Livent	Lanke Lithium	Zangge Lithium	Jintai Lithium	Eramet/ Tsingshan	Standard Lithium	Vulcan Energy	Rio Tinto	CTR	Energy Source Minerals	Berkshire Hathaway	Lake Resources/ Lilac	Compass Minerals	E3 Metals
Asset name	Hombre Muerto	Qinghai	Qinghai	Qinghai	Centenario-Ratones	Smackover	Zero Carbon Lithium™	Rincon	Hell's Kitchen	ATLiS	Salton Sea	Kachi	Great Salt Lake	Clearwater Lithium
Country														
DLE technology	Sorption	Sorption	Sorption	Sorption	Sorption	IX	Sorption	Sorption	IX	Sorption	IX	IX	IX	Ion Exchange
DLE provider	Proprietary	Undisclosed	Undisclosed	Undisclosed	Proprietary	Proprietary LiSTR	Undisclosed	Axion	Lilac	Proprietary ILiAD	Proprietary	Lilac	Undisclosed	Proprietary
Stage	Production	Production	Production	Production	Construction	Demo	Pilot	Pilot	Offsite pilot	Pilot	Pilot	Offsite pilot	Pilot	Pilot
Resource (Mt LCE)	Undisclosed	Undisclosed	Undisclosed	Undisclosed	10	3	16	12	3	Undisclosed	Undisclosed	4	2	7
Geothermal	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✗	✗	✗
Start date	1998	2017	2018	2019	2024	tbc	2024	2025	2024	2024	tbc	2024	tbc	2025
Capacity (ktpa LCE)	20	20	20	7	24	21	40	50	20	20	90	25	20-25	20
Ownership	Public	-	-	-	Public	Public	Public	Public	Private	Private	Public	Public	Public	Public
Significant Investments					Tsingshan \$375M 11/2021	Koch \$100M 11/2021	Institutional Investors \$230M 2021	Rio Tinto \$825M 12/2021	GM \$?M 07/2021			Lilac Up to \$50M 09/2021		
Offtakes (announced publicly)		✗	✗	✗	✗	✗		✗		✗	✗	✗	✗	✗

Refer to Appendix 10: DLE Projects and Assets – References



### Laboratory work



- Lab and pilot studies for DFS active since April 2021, generating data for DFS
- Expanded laboratory to be opened in early 2022

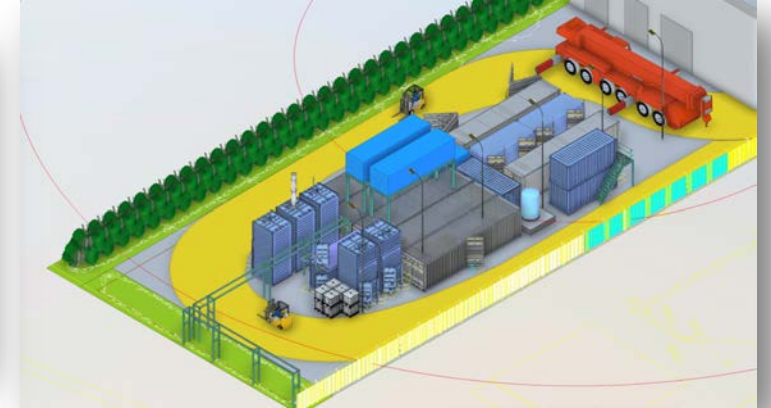
### Pilot plant operations



Images of lithium hydroxide monohydrate from Zero Carbon Lithium™ project

- Pilot Plant 1, located at an operational geothermal plant, with “live” geothermal brine
- Plant is focused on:
  - Brine pre-treatment
  - Lithium extraction
  - Post treatment to return brine to same state
- Multiple sorbents from commercial providers have been successfully tested, including from DuPont and others, providing optionality
- Scale-up of piloting continuing during 2021-22
- Rapidly growing team on pilot and lab sites in Germany

### Demonstration (Demo) plant



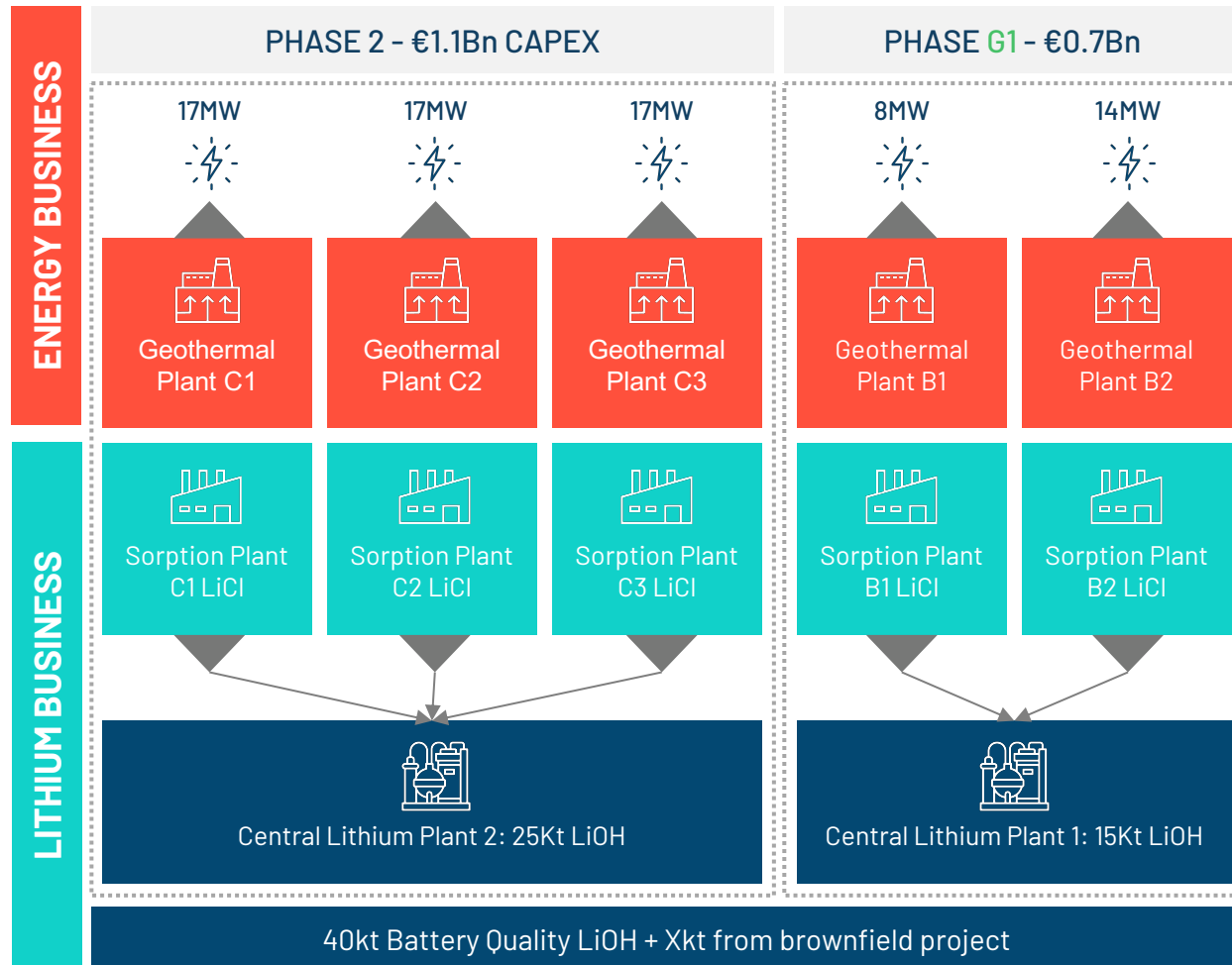
Rendering of Vulcan's Demo Plant, major skids ordered and currently under construction.

- Demo Plant fully integrated with all process steps including electrolysis
- DLE at site with “live” geothermal brine
- Conversion to LHM in a chemical park (same as commercial plant design)
- All recycles to be included
- Enables the Vulcan team to run the full process onsite and provide training prior to commercial operation
- Major skids ordered and under construction
- The DLE section of the Demo Plant is targeted to commence operation on in Q2 2022, and will represent an approximately 1:200 scale of the first commercial plant.

# Our combined greenfield and brownfield projects to add more capacity

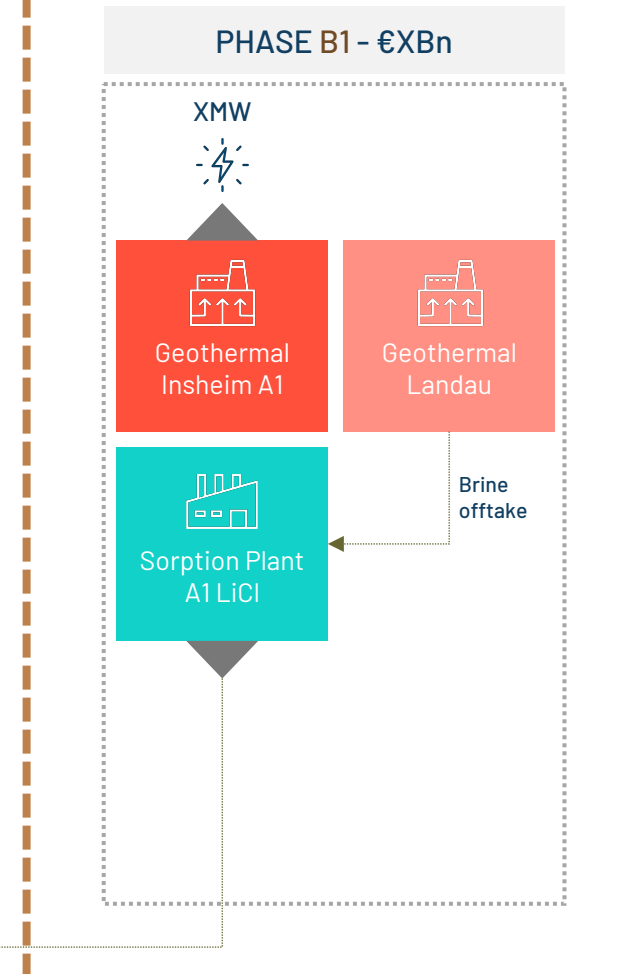
## GREENFIELD PROJECT DEVELOPMENT

Target metrics from Pre-Feasibility Study, subject to modifications in the DFS:



## BROWNFIELD PROJECT DEVELOPMENT

Target metrics to be informed in the DFS



## ADDITIONAL LICENCES

Available to add capacity

>1,000km<sup>2</sup> of licenses in the Upper Rhine Valley presenting opportunities to develop additional assets

Mannheim Granted	Lampertheim Granted
Kerner Granted	Löwenherz Granted
Therese Granted	Ludwig Granted
New application	New application
New application	Etc.



# Proposed dual purpose renewable energy and battery chemicals project

## BROWNFIELD PROJECT DEVELOPMENT

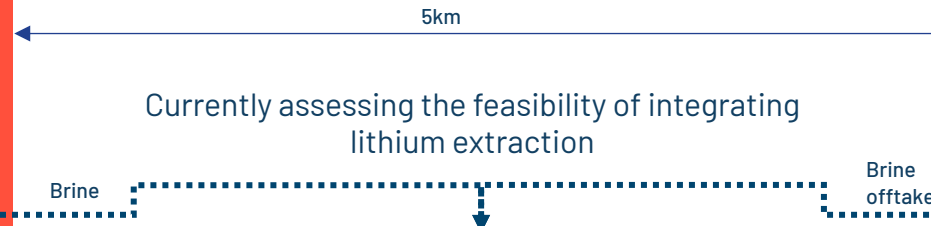
Target metrics to be informed in the DFS

### PHASE B1 - €XBn



**Geothermal Plant Insheim (A1)**

- Vulcan acquired Insheim in Dec 2021
- Current technical ability to produce up to 4.8MW power or 28.5MW thermal energy
- Aiming to upgrade capacity and increase brine flow rate
- Indicated Mineral Resource of 0.7Mt Lithium Carbonate Equivalent @181 mg/l Li
- FY2020 revenues €5.8M
- Feed-in Tariff in place



**Sorption Plant A1 LiCl**



**Central Lithium Plant 1**

combining greenfield and brownfield projects



**Geothermal Plant - Landau**

- Vulcan executed a 20-year brine offtake agreement with geox GmbH, subject to financing a third well
- Expected brine volume from the production well of at least 100 l/s
- Existing production well at Landau has the tested ability to produce at a rate of over 100 l/s, but an additional re-injection well is planned to help accommodate this flow

## Dual revenues: energy and lithium

### ENERGY BUSINESS



**Decarbonising the grid**

**Grid**



**Coal phase-out in Germany**

**Industries**



**Bans for fossil heating systems**

**Cities**



**Renewable Electricity:**  
Geothermal energy in the form of electricity is sold to the grid

**Feed-in Tariff: €0.252 /KWh**  
Guaranteed for 20 years for new projects

**Renewable Heat:** Energy in the form of heat can be sold to several public and private customers via pipes, proximity is a requirement

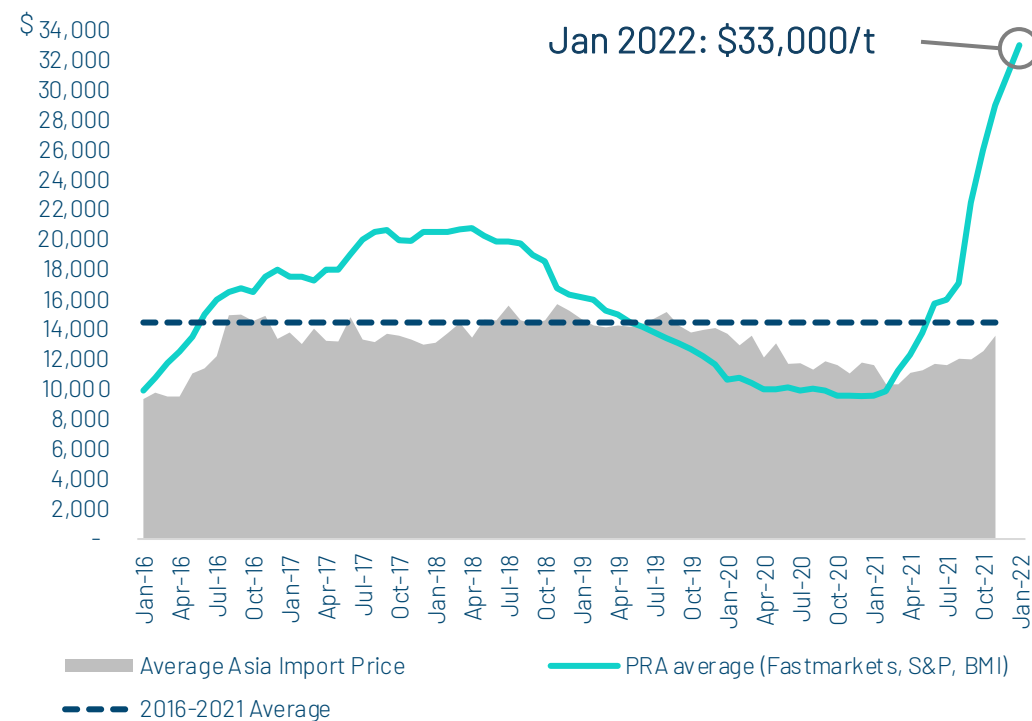
Heat offtake negotiations with local stakeholders under way



Vulcan Energy's 100% owned NaturLich Insheim, an operational geothermal renewable energy power plant in the Upper Rhine Valley, Germany.

### LITHIUM BUSINESS

#### Lithium hydroxide prices



Source: Trade statistics compiled from Global Trade Atlas®, Benchmark Minerals (2016-2017), Fastmarkets (2017-2022)



## Securing long term lithium supply contracts

### Cathodes



- Binding lithium hydroxide offtake agreement
- Initial **5-year term**, starting in **2025**, which can be extended by further 5 years
- Minimum of **28,000t** and a maximum of **42,000t** of battery grade lithium hydroxide

### Lithium-ion batteries



- **Binding lithium hydroxide offtake term sheet**
- Initial **5-year term**, starting in **2025**, which can be extended by further 5 years
- LGES to purchase up to **10,000tpy** of battery grade lithium hydroxide

### Electric vehicles

#### RENAULT GROUP

- Binding lithium hydroxide offtake agreement
- Initial **5-year term**, starting in **2025**, which can be extended by further 5 years
- Minimum of 28,000t and a maximum of 42,000t of battery grade lithium hydroxide



- **Binding lithium hydroxide offtake agreement**
- Initial **5-year term**, starting in **2026**
- Minimum of **81,000t** and a maximum of **99,000t** of battery grade lithium hydroxide

#### VOLKSWAGEN

GROUP

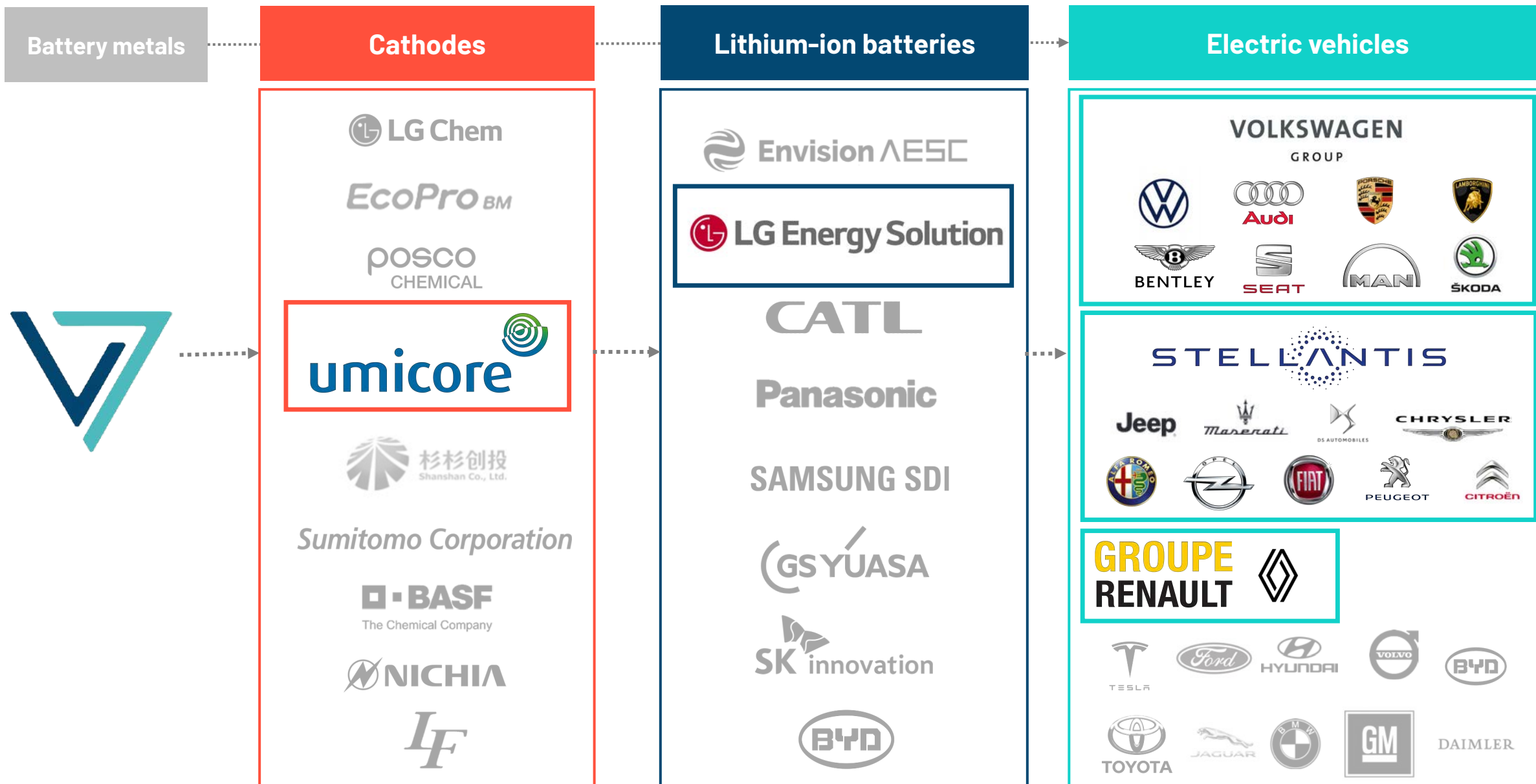
- **Binding lithium hydroxide offtake agreement**
- Initial **5-year term**, starting in **2026**
- Between **34,000t** and **42,000t** of battery grade lithium hydroxide



Vulcan Energy signed a binding lithium offtake agreement with Umicore Group in October 2021. Vulcan's VP Business Development, Vincent Ledoux Pedailles, second from left, pictured with representatives from Umicore.

Note 1: Refer to Vulcan Investor Centre for ASX announcements relating to each offtake agreement; <https://v-er.eu/investor-centre/>

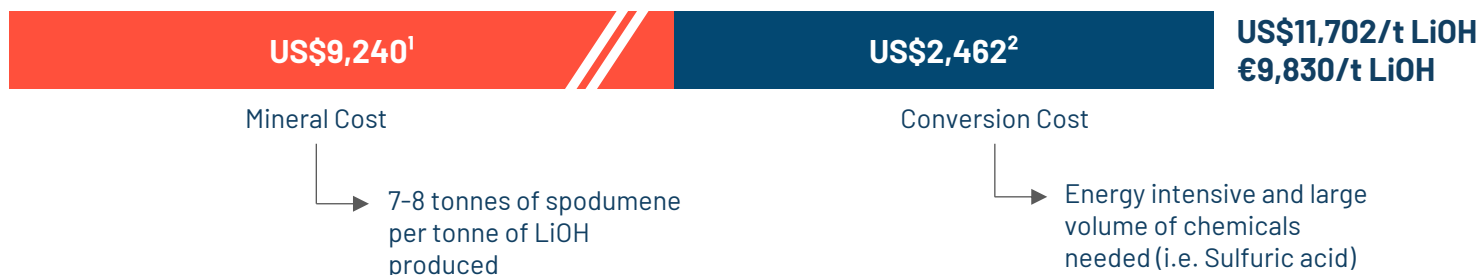
# Vulcan will supply leading actors across the lithium-ion battery supply chain



# Potential for very low OPEX operation

## Select South American brine and Australian/Chinese mineral conversion vs Vulcan's process

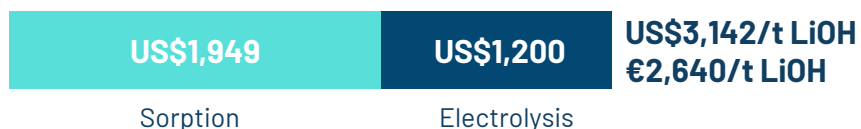
### LiOH VIA HARD-ROCK PROCESSING



### LiOH VIA BRINE PROCESSING



### VULCAN'S PROCESS<sup>5</sup>



Note 1: S&P Global Platts, 27 August 2021, 6% Spodumene Concentrate FOB Australia: \$1,320/mt

Note 2: Kidman Resources PFS announcement, October 2018, contingency on Refinery OPEX of 15%. Cash operating cost including royalties.

Note 3: Cash operating costs lithium carbonate, Orocobre 2021 Annual report

Note 4: Orocobre 2020 Corporate Presentation - Naraha Lithium Hydroxide plant, Japan

Note 5: Refer to Appendix 11-13 for further details regarding Project economics and production capacity

Note 6: Figures in this slide assume an exchange rate of €0.84/US\$1.00

Note 7: Vulcan notes that the comparison operating cost figures above are actual results from lithium hydroxide projects that are currently in production, whereas the above data for Vulcan's process is based on estimates in the PFS. As the Project is still at an early exploration and development stage, there is a high level of inherent uncertainty associated with the Project. A comprehensive list of risks is flagged in the PFS under "Project Risks and Opportunities"

## Feedstock

Vulcan's "feedstock" is expected to be low cost and have a dual purpose: lithium extraction and energy production in the form of renewable electricity.

## Processing

Vulcan plans to use sorption to isolate lithium as opposed to using large volumes of chemicals such as sulfuric acid to dissolve a rock feedstock or soda ash for brine. Vulcan intends to use low-cost energy coming from its geothermal operation.

## Upgrading

Vulcan plans to use electrolysis to upgrade chloride into a high purity hydroxide using renewable energy. No heavy reagent usage such as sodium hydroxide or lime.



**It doesn't need to cost more to be green**





## Robust target project financials and production metrics from PFS

### ENERGY BUSINESS



**74MW Power\***

\* Renewable heat sales to also be examined in DFS

**€0.7Bn NPV** Pre-tax

**€0.5Bn NPV** Post-tax

**16% IRR** Pre-tax

**13% IRR** Post-tax

**€226M CAPEX** Phase I

**€0.066/KWh OPEX**

**Payback: 6 years**

### LITHIUM BUSINESS



**40,000tpy LiOH**

**€2.8Bn NPV** Pre-tax

**€1.9Bn NPV** Post-tax

**31% IRR** Pre-tax

**26% IRR** Post-tax

**€2,681/t LiOH OPEX**

**€474M CAPEX** Phase I

**Payback: 4 years**



**BNP PARIBAS** appointed as Financial Advisor toward financing the Zero Carbon Lithium™ Project

## Working hard to de-risk the project further and address all identified risks

Risk	Mitigation
Availability of key equipment	Vulcan has agreed to acquire two electric drill rigs, re-purposed from the oil and gas industry, which can reach the target depths required to reach the deep geothermal reservoir in the Upper Rhine Valley. Vulcan is developing its own in-house drilling unit, VERCANA, which will provide approximately 30 jobs locally. This will be a strategic asset, as decarbonisation efforts in Germany and Europe continue to accelerate, and demand for renewable heat increases.
Brine flow rates	Vulcan uses modern geothermal industry best practice by incorporating 3D seismic data and analysis into its geological modelling to target high-flow fault zones, and factors in state-of-the-art techniques to increase flow, such as double completion of wells and multi-reservoir completion, using the experience of its technical team.
Resources/Reserves	Vulcan utilises the considerable local geological expertise of its team, as well as state-of-the-art 3D seismic data, to construct the most accurate models it can. Vulcan reports on its estimates of Mineral Resources and Ore Reserves in compliance with the JORC Code, the ASX Listing Rules and applicable regulation. Vulcan's resource estimates and reserves are signed off by independent external consultants APEX Geoscience Ltd. and GLJ Ltd. respectively.
Sorption	We are testing multiple alumina-based sorbents at our pilot plant to find the best fit. Similar approaches are used at multiple locations around the world with existing lithium production. This and other types of similar DLE techniques are being used in numerous new lithium developments worldwide. We are adapting this technology to fit with our geothermal brine, in collaboration with companies such as Dupont, and with the experience of our team. Critically, we are testing on "live" geothermal brine, which so far has produced encouraging results.
Permitting	We will continue to keep our stakeholders updated on the timetable, and if anything changes, we will inform the market. We have a team of experts in geothermal development who have developed numerous projects in the past. We have received encouragement from state and federal governments that renewable energy project permitting times will be reduced as a priority, and domestic production of strategic raw materials will also be prioritised.
Social acceptance	This is normal and we will work to address these concerns. Vulcan has an experienced public relations team. We use geothermal industry best practice, and we are commencing community engagement in the various areas where we intend to develop projects. We think that by clearly and transparently explaining our process to develop renewable heat and power, combined with sustainable lithium extraction, we will achieve stakeholder acceptance.



# Community engagement: building trust and understanding



VULCAN ENERGY  
ZERO CARBON LITHIUM™



# Materially improving the global battery chemicals supply chain



Process development and R&D development of world's first lithium and renewable energy co-production process in Pre-Feasibility Study: Zero Carbon Lithium™.

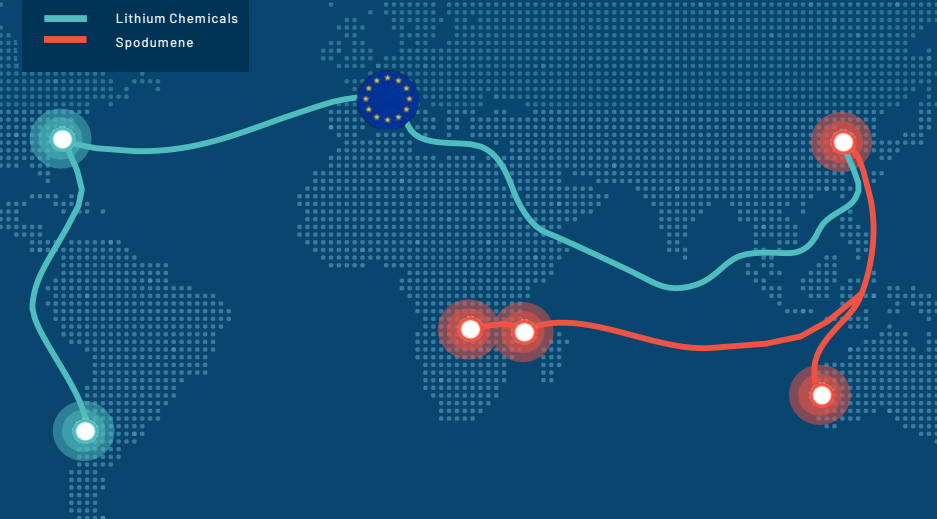
Life cycle assessment shows leading environmental credentials including negative carbon footprint (Scope 1, 2, 3) for planned lithium production, a world first.

Working with Circular to achieve world's first lithium traceability and dynamic CO<sub>2</sub> measurement across supply chain.

Admission to Global Battery Alliance toward advancing battery materials traceability and transparency.

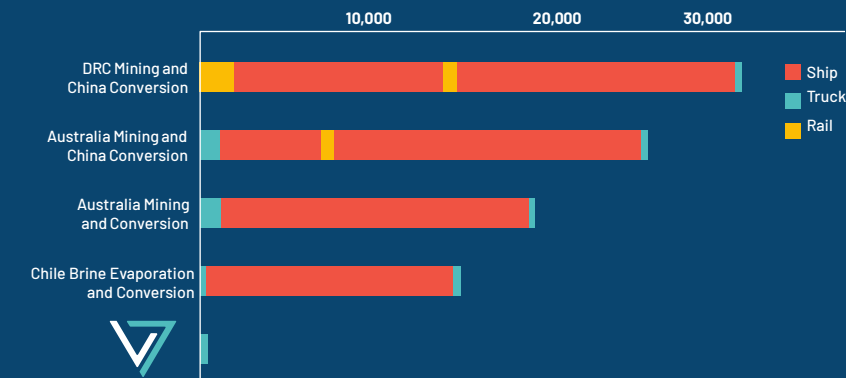
**CARBON NEUTRAL NOW, AND IN THE FUTURE.**

Refer to Appendix 17: Vulcan & Circular to establish world-first full lithium traceability & transparency across the EU supply chain



## Transport Distances for Different Lithium Chemicals

Transport Distances for Different Lithium Chemicals



**As well as having a carbon neutral process, the Vulcan Zero Carbon Lithium™ Project also intends to reduce the transport distance of lithium chemicals into Europe to almost zero, compared with Europe's current options which are geopolitically undesirable and/or have a large carbon footprint of transport.**

# Leading environmental credentials

Per tonne of lithium hydroxide produced

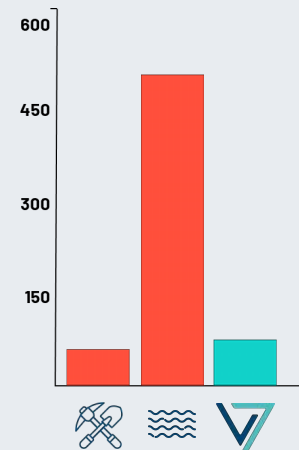
## CARBON EMISSIONS (Scope 1,2,3)

Tonnes CO<sub>2</sub>



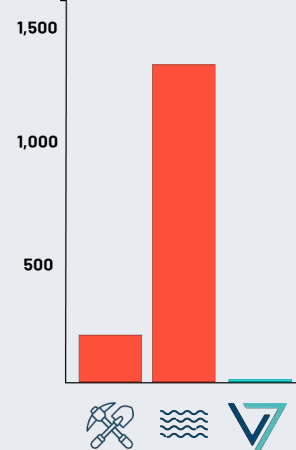
## WATER CONSUMPTION

m<sup>3</sup>



## LAND USE

m<sup>2</sup>



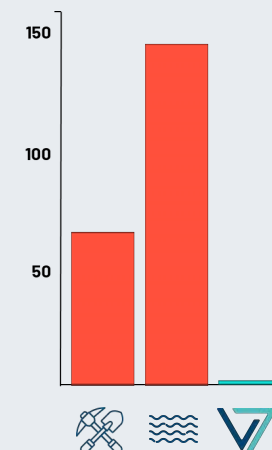
## REAGENTS CONSUMPTION

Tonnes



## WASTE GENERATION

Tonnes



 **Hard rock mining**  
60% of world lithium production

 **Evaporation ponds**  
40% of world lithium production

 **VULCAN ENERGIE**  
**ZERO CARBON LITHIUM™**

**Goal to have the lowest  
environmental footprint of any  
lithium project globally**

## Four pillars of community engagement

### Public affairs



- Discuss and exchange ideas regularly with political representatives
- Recent meetings with CDU and the Greens
- Presentations for members of the state parliaments
- Introduction of Vulcan and questions and answers in the municipal councils

### Media engagement



- Raise awareness through in-depth reporting
- Interviews with national and international magazines, TV Stations, Radio broadcasts
- Background-stories in the Laboratory/ Pilot Plant

### Community outreach



- Community roadshows, school presentations, discussion forums
- Recent events include booth at Inno Energy's The Business Booster in Berlin
- Info-Community Hotline
- Website with milestones and updates
- Sponsoring of environmental events

### Partnerships/ cooperation



- Conduct research projects with universities and colleges, as well as renowned research institutions
- Cooperate with renewable energy networks/ battery and raw material alliances
- Engagement in regional technology networks



# Government support for geothermal technology and the expansion of renewable energy projects

## Germany's new Federal Coalition targets<sup>1</sup>

- ✓ Committed to phase out coal by 2030
- ✓ End sales of new combustion engines by 2035
- ✓ End power generation from gas by 2040

## State government of Baden-Württemberg

- Launched a task force aimed at halving the planning and approval timeline for the commissioning of new projects<sup>2</sup>.
- Greens-CDU Coalition in Baden-Württemberg, stated in their Coalition Contract<sup>3</sup>:

*"We support sustainable approaches for the extraction of lithium in the Upper Rhine Graben."*

*We want to demonstrate the possibilities of deep geothermal energy through initial large-scale projects, which are being closely supported by the state government, the licensing authorities and the research community, and then take the step toward widespread application. The "Deep Geothermal Roadmap" is to be continued in this spirit.*

## Engaging with government



Dr Horst Kreuter, Vulcan Germany CEO meeting with Greens leader Winfried Kretschmann



Thorsten Weismann, Vulcan COO, meeting with CDU representatives

<sup>1</sup><https://www.reuters.com/business/cop/exclusive-germanys-government-in-waiting-agrees-phase-out-coal-by-2030-sources-2021-11-23>

<sup>2</sup><https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/task-force-soll-ausbau-erneuerbarer-energien-beschleunigen/>

<sup>3</sup>[https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/210506\\_Koalitionsvertrag\\_2021-2026.pdf](https://www.baden-wuerttemberg.de/fileadmin/redaktion/dateien/PDF/210506_Koalitionsvertrag_2021-2026.pdf)

The right team  
for the job



VULCAN ENERGY  
ZERO CARBON LITHIUM™



# Vulcan – Zero Carbon Lithium™ Team



**Thorsten Weimann**  
Chief Operating Officer

Expert in geothermal and drilling technology, with more than 25 years of professional experience.



**Markus Ritzauer**  
Chief Financial Officer – Germany

Markus has over 20 years' experience in finance roles within the chemicals industry.



**Dr Stephen Harrison**  
Chief Technical Officer

CTO of Simbol Materials for seven years (2008-2015), where he led the scientific and engineering teams through a rapid process development.



**Beate Holzwarth**  
Chief Communication Officer

Beate has over 20 years' experience in various communication and marketing roles within Mercedes-Benz Cars and Daimler Trucks.



**Vincent Ledoux-Pedailles**  
Vice President – Business Development

Vincent has over 10 years of commercial experience in the chemicals and mining industry. Vincent was previously Executive Director – Corporate Strategy at Infinity Lithium Corporation,



**Rob Ierace**  
Chief Financial Officer – Australia

Robert is a Chartered Accountant and Chartered Secretary with over 20 years experience, predominately with ASX and A listed resource and oil and gas exploration and production companies.



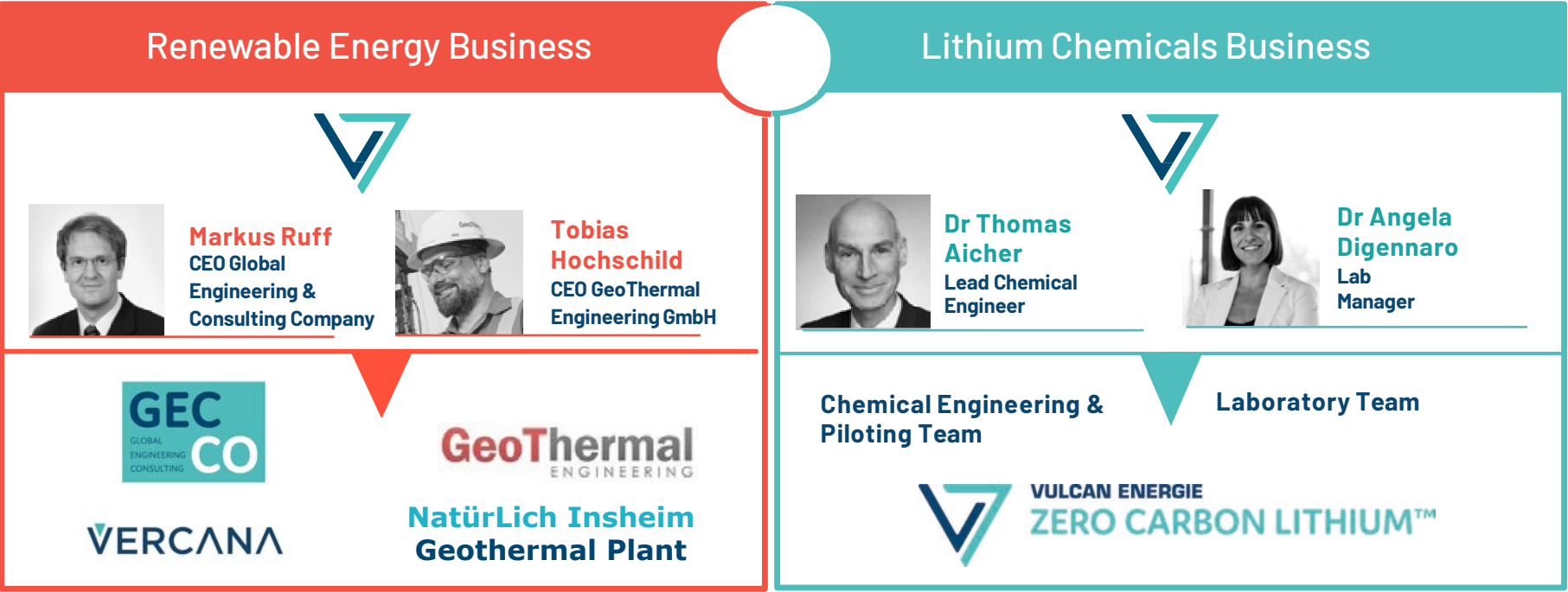
**Daniel Tydde**  
Company Secretary & In-House Legal Counsel

Daniel is an experienced corporate lawyer with over 15 years' experience across a wide range of corporate, commercial and finance areas.



**Jess Bukowski**  
Public & Investor Relations Manager

Jess has extensive experience advising top 20 ASX companies on communications, media and investor relations including six years with Fortescue Metals Group.



~95 people



Leading engineering teams



40% female workforce

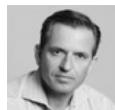


## Vulcan – Zero Carbon Lithium™ Board



**Dr. Francis Wedin**  
Managing Director &  
Founder-CEO

Founder of Vulcan Zero Carbon Lithium™ Project. Lithium industry executive since 2014. Previously Executive Director of ASX-listed Exore Resources Ltd. Track record of success in lithium industry as an executive since 2014, including the discovery of three resources on two continents. PhD in Geology, MBA in Renewable Energy, global experience in battery metals sector.



**Gavin Rezos**  
Chair

Executive Chair/CEO positions of three companies that grew from start-ups to the ASX 300. Extensive international investment banking experience. Investment banking Director of HSBC with senior multi-regional roles in investment banking, legal and compliance functions. Currently Chair of Resource and Energy Group, principal of Viaticus Capital, Non-Executive Director of Kuniko Limited and Non-Executive Chair Resources & Energy Group Limited.



**Dr. Horst Kreuter**  
Co-Founder, Board Advisor  
& Exec Director Germany

Ex-CEO of Geothermal Group Germany GmbH and GeoThermal Engineering GmbH (GeoT). Co-Founder of Vulcan Zero Carbon Lithium™ Project. Successful geothermal project development & permitting in Germany and worldwide. Widespread political, investor and industry network in Germany and Europe. Based in Karlsruhe, local to the project area in the Upper Rhine Valley.



**Annie Liu**  
Non-Executive  
Director

Former Tesla Head of Battery and Energy Supply Chain. Led and managed Tesla's multi-billion-dollar strategic partnerships and sourcing portfolios that support Tesla's Energy and Battery business units including Battery, Battery Raw Material, Energy Storage, Solar and Solar Glass, including raw materials sourcing efforts such as lithium for battery cells. 20 years' experience with Tesla and Microsoft.



**Dr. Heidi Grön**  
Non-Executive Director

Dr. Grön is a chemical engineer by background with 20 years' experience in the chemicals industry. Since 2007, Dr. Grön has been a senior executive with Evonik, one of the largest specialty chemicals companies in the world, with a market capitalization of €14B and 32,000 employees..



**Josephine Bush**  
Non-Executive Director

Member of the EY Power and Utilities Board. Led and delivered the EY Global Renewables and Sustainable Business Plan and spearheaded a series of major Renewable Market Transactions. Successfully advised on the first environmental yieldco London Stock Exchange listing, Greencoat UK Wind PLC. Ms. Bush is a Chartered Tax Advisor, holds an MA Law degree from St Catharine's College, Cambridge, and brings a wealth of experience in ESG strategic advisory.



**Ranya Alkadamani**  
Non-Executive Director

Founder of Impact Group International. A communications strategist, focused on amplifying the work of companies that have a positive social or environmental impact. Experience in working across media markets and for high profile people, including one of Australia's leading philanthropists, Andrew Forrest and Australia's former Foreign Minister and former Prime Minister, Kevin Rudd.



**Julia Poliscanova**  
Special Advisor

Senior Director with the EU's Transport and Environment. Instrumental in shaping policies around EU vehicle CO<sub>2</sub> standards & sustainable batteries. On the steering committee for the Battery CO<sub>2</sub> Passport program of the Global Battery Alliance. Previously worked for the Mayor of London and in the European Parliament following EU legislation on renewables, energy efficiency and sustainable transport.



**Vulcan is leading the way with a 67% female Board composition**



VULCAN ENERGIE  
ZERO CARBON LITHIUM™

# Delivering the Zero Carbon Lithium™ Project

CO<sub>2</sub>-free Lithium  
aus Deutschland.



VULCAN ENERGY  
ZERO CARBON LITHIUM™

# Vulcan Group: integrated, in-house capability to execute on our strategy

## Vulcan's expertise and assets

### Renewable energy



**Gec-co** Above-surface geothermal engineering team



**GeoT** Sub-surface geothermal & engineering team



**Insheim** geothermal renewable energy plant



**VERCANA** Deep geothermal rigs & team



Exploration data packages acquired



Multiple geothermal-lithium brine licences  
Multiple renewable energy projects in development across multiple licences

### Lithium



Fully equipped in-house lab with team



Operational pilot plant



Chemical engineering team



Demonstration plant under construction

### Sustainability



Carbon neutrality commitment during development and operations



Life Cycle Assessment and global study on the environmental footprint of lithium hydroxide production



Supply chain traceability and CO<sub>2</sub> measurement

### Finance



Strong cash position



A\$320 million capital raising in 2021



Low cost and resilient financials

### Customers



Four definitive lithium offtake agreements



One lithium term sheet



Multiple heat offtakes in discussion

## Independent expertise



HATCH

DUPONT

NOBIAN



Capital raisings  
Financing advisors  
Listing advisors



Customers

VOLKSWAGEN GROUP

umicore

Renault Group

STELLANTIS

LG Energy Solution

## Industrial ecosystem



Bundesverband Geothermie



InnoEnergy



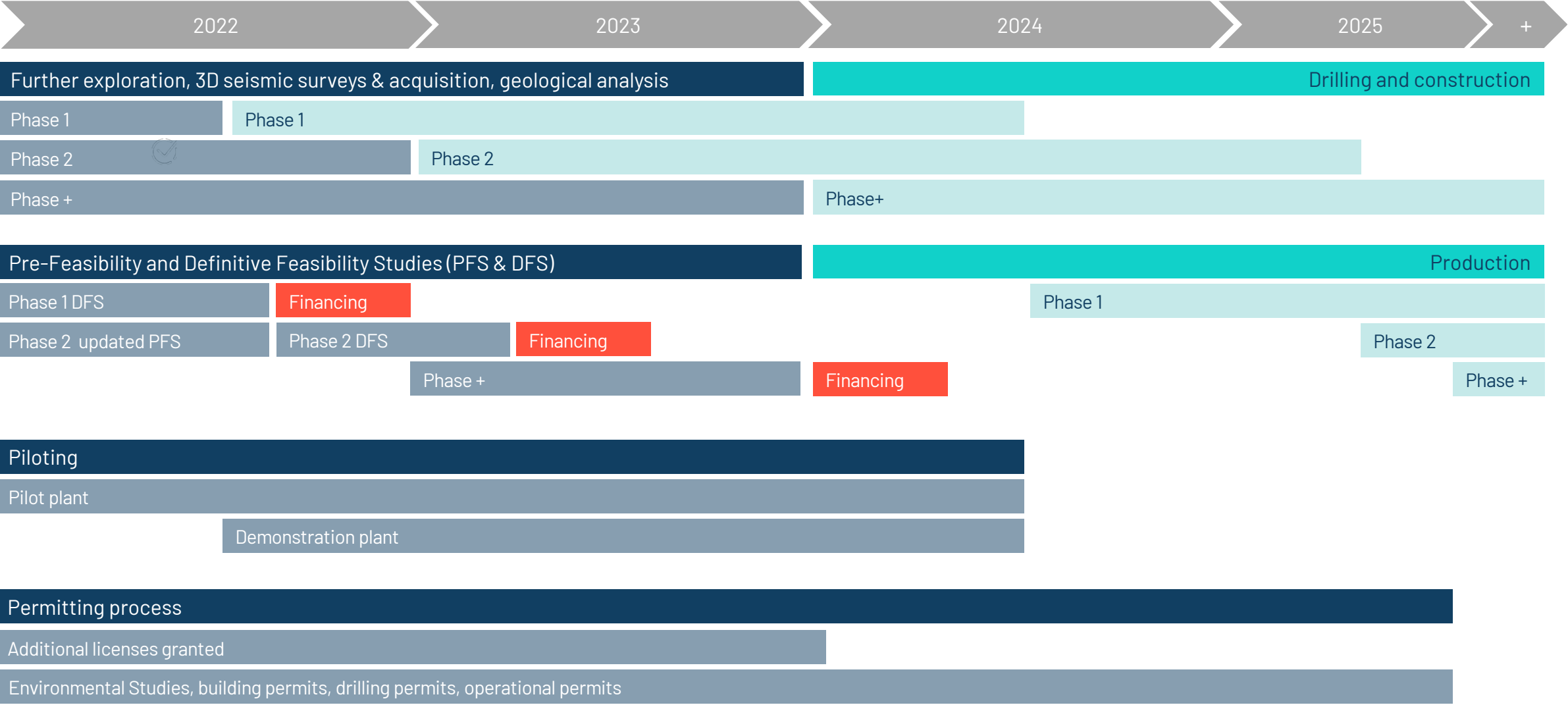
automotive engineering network







# Target project timeline





# Share price and capital structure

## ASX : VUL

Shares on Issue 131,607,598

Performance Shares\* 91,174

Performance Rights 8,656,324

Market Capitalisation at \$10.030 (undiluted) ~\$1.32B

Cash Position (as of 30 September 2021) ~\$290M

Top 20 Shareholders ~53%

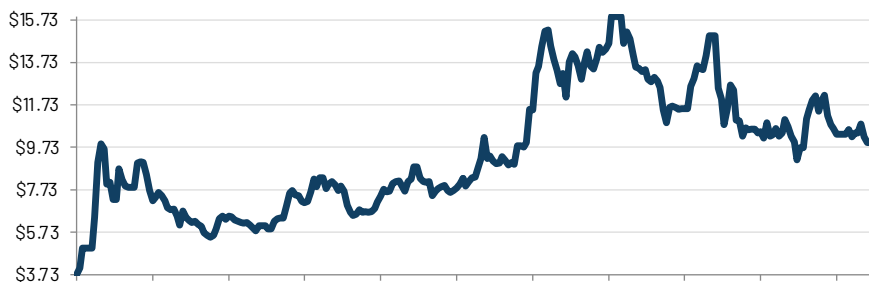
Management (undiluted) ~19%

## Frankfurt: 6KO

### Key Shareholders

Dr. Francis Wedin	12.51%
Gavin Rezos	5.77%
Hancock Prospecting Pty Ltd	5.64%

VUL share price (7 January 2021 – 7 January 2022)



\*Refer ASX Announcement 6 July 2021 for further details.

# Conclusion



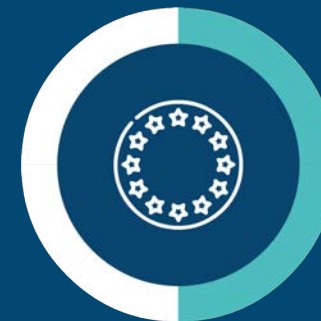
**Goal to become world's first integrated Zero Carbon Lithium™ and renewable energy company**



**Europe's largest lithium Resource<sup>1</sup>**



**Location centre of fastest growing market<sup>2</sup>**



**Supported By EU funding, regulation & initiatives**



**Low cost & resilient financials**



**Strong cash position**



**The right team for the job**



**Rapidly advancing lithium & renewable energy project**

Note 1: Refer to Appendix 4 and 5 for further information

Refer to Appendix 1 :Project description; Appendix 2: Largest JORC lithium resource in Europe; Appendix 3: Lithium focused peers with comparable project size and stage for project size comparison,

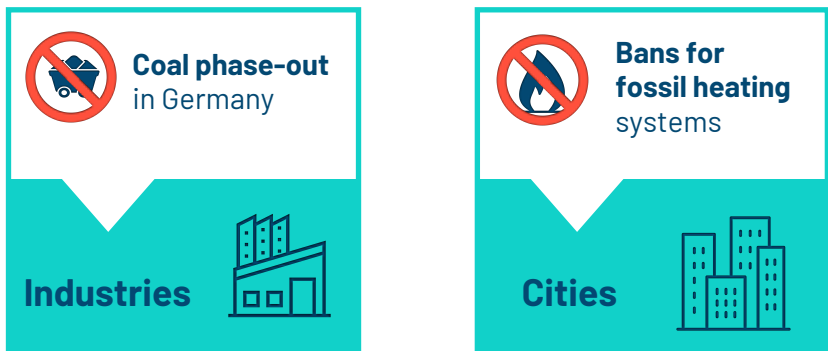




# Appendices

# Appendix 1: Vulcan's integrated renewable energy and lithium project description

## Germany

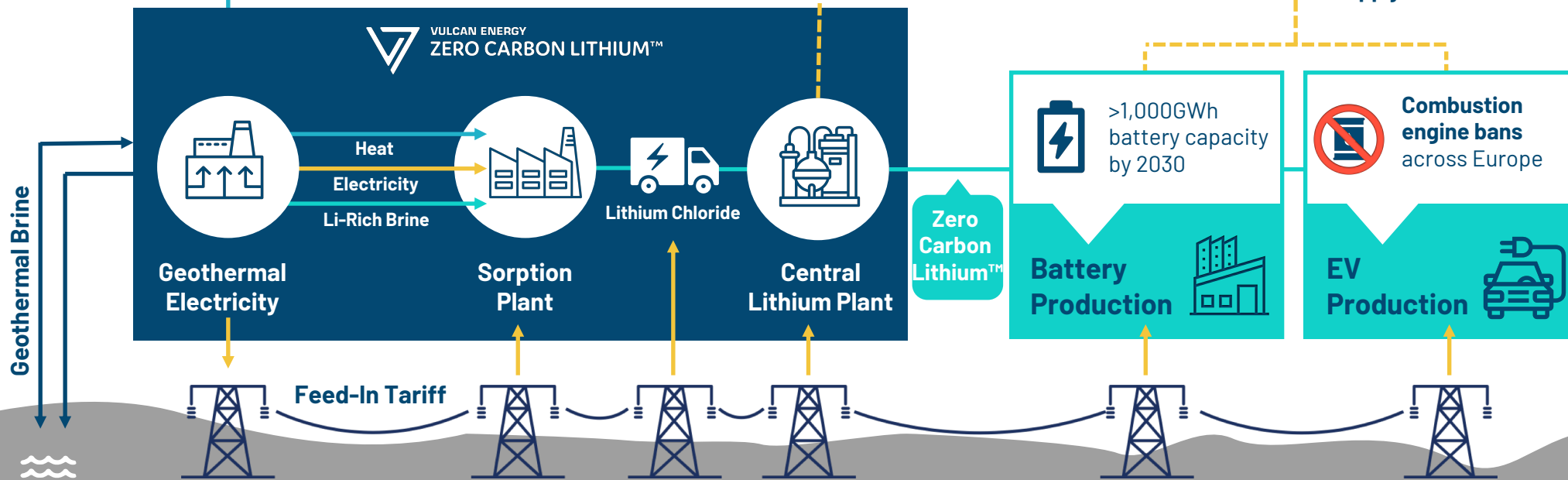


Zero Carbon Heat

## European Union



Lithium-Ion Battery Supply Chain



## Regulations & Initiatives



EU New Battery regulation

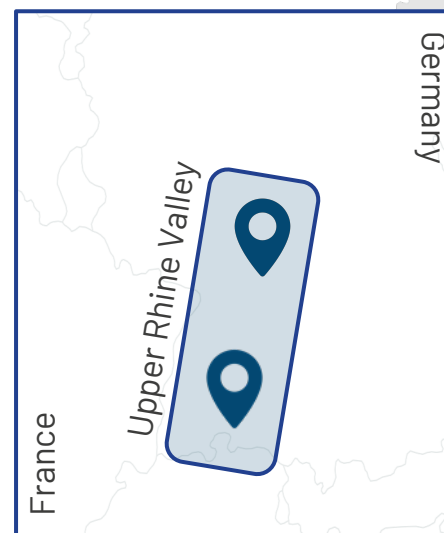
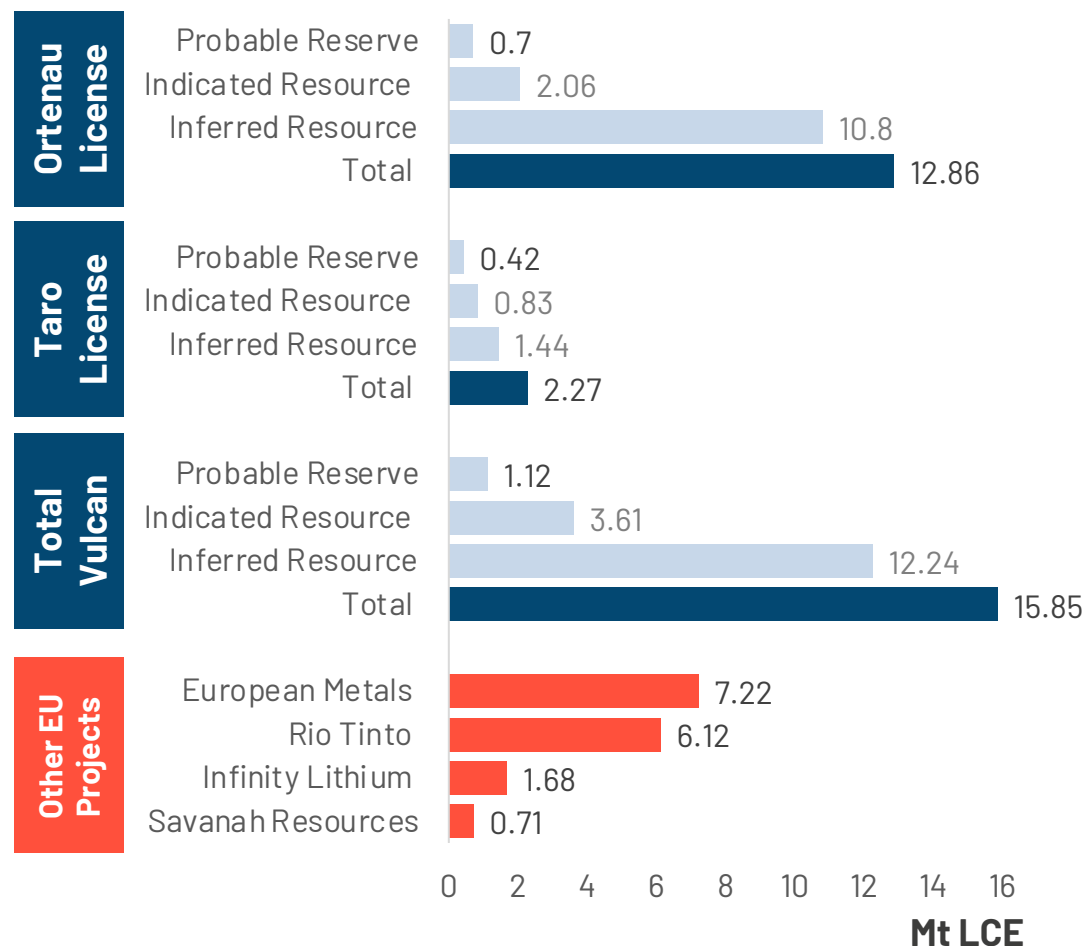
European Battery Alliance

EU Recovery Plan

EU Green Deal

Europe is aiming for carbon neutrality by 2050

## Appendix 2: Largest JORC lithium resource in Europe



- 1 exploitation permit granted
- 8 exploration permits granted and several applications
- Largest lithium resource in Europe: **15.85Mt LCE**

Note 1: Vulcan's URVP Li-Brine resource and reserve area in Europe. Mineral resources are not ore reserves and do not have demonstrated economic viability. Refer to the ASX Announcement entitled "Updated Ortenau Indicated and Inferred Resource" dated 15 December 2020 and the ASX Announcement entitled "Positive Pre-Feasibility Study" dated 15 January 2021, which refer to the Company's Mineral Resources and Ore Reserves (respectively) included in this Presentation, available on the Company's website and [www.asx.com](http://www.asx.com). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcements and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcements continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented in this Presentation have not been materially modified from the original market announcements



## Appendix 3: Europe-focused and DLE lithium projects peer comparison references

Company <sup>1</sup>	Code	Project	Stage	Resource Category	Resources M tonnes	Resource Grade (Li2O)	Contained Mt LCE Tonnes	Information Source
European Metals	ASX: EMH	Cinovec	PFS Complete	Indicated & Inferred	695.9	0.42	7.22	Corporate Presentation July 2021 - Company Website
Rio Tinto	ASX: RIO	Jadar	PFS Complete	Indicated & Inferred	139.3	1.78	6.12	ASX Announcement Released 10 December 2020
Infinity Lithium	ASX: INF	San Jose	PFS Complete	Indicated & Inferred	111.3	0.61	1.68	Company Presentation Released to ASX 16 February 2021
Savannah Resources	AIM: SAV	Barroso	DFS Underway	Measured, Indicated & Inferred	27.0	1.00	0.71	Corporate Presentation September 2021 - Company Website

Company	Project	Stage	Resource Category	Brine Volume	Resource Grade	Contained Mt LCE Tonnes	Information Source
Controlled Thermal Resources	Hell's Kitchen	PEA Completed	Inferred	Unknown	181mg/l Li	2.7	Company Website
E3 Metals	Clearwater, Rocky and Exshaw	PEA Completed	Inferred	5.5 billion m <sup>3</sup>	74.6mg/l Li	2.2	PEA released in December 2020

Elders, W., Cohen, L., (1983) The Salton Sea Geothermal Field, California, Technical Report. Institute of Geophysics and Planetary Physics, University of California

GeORG (2013) Projektteam Geopotenziale des tieferen Untergrundes im Oberrheingraben Fachlich-Technischer Abschlussbericht des INTERREG-Projekts GeORG. Teil 2: Geologische Ergebnisse und Nutzungsmöglichkeiten

Pauwels, H., Fouillac, C., Brach M. (1989) Secondary production from geothermal fluids processes for Lithium recovery 2nd progress report. Bureau de Recherches Géologiques et Minières Service Géologique National

Pauwels, H. and Fouillac, C. (1993) Chemistry and isotopes of deep geothermal saline fluids in the Upper Rhine Graben: Origin of compounds and water-rock interactions. Geochimica et Cosmochimica Acta Vol. 57, pp. 2737-2749

Sanjuan, B., Millot, R., Innocent, C., Dezayes, C., Scheiber, J., Brach, M., (2016) Major geochemical characteristics of geothermal brines from the Upper Rhine Graben granitic basement with constraints on temperature and circulation. Chemical Geology 428 (2016) 27-47

Note 1: Data provided for lithium focused peers with comparable project size and stage and published resource information

Note 2: The Company is not aware of any new information or data that materially affects the information contained in the above sources or the data contained in this Presentation

## Appendix 4: Vulcan supported by EU-backed group

EIT InnoEnergy will marshal its ecosystem and significant EU-wide resources to launch the Zero Carbon Lithium Project forward:

- **Securing project funding**, including the use of applicable EU, national or regional grant schemes, and liaising with EU project finance and development banks.
- Driving relationships with European lithium offtakers, aimed at entering into of binding offtake agreements.
- **Obtaining and fast-tracking necessary licenses.**
- All services are entirely success-based, with no upfront cost to Vulcan.



**May '20**

Agreement signed with EU-backed body to launch Vulcan Zero Carbon Lithium® Project.

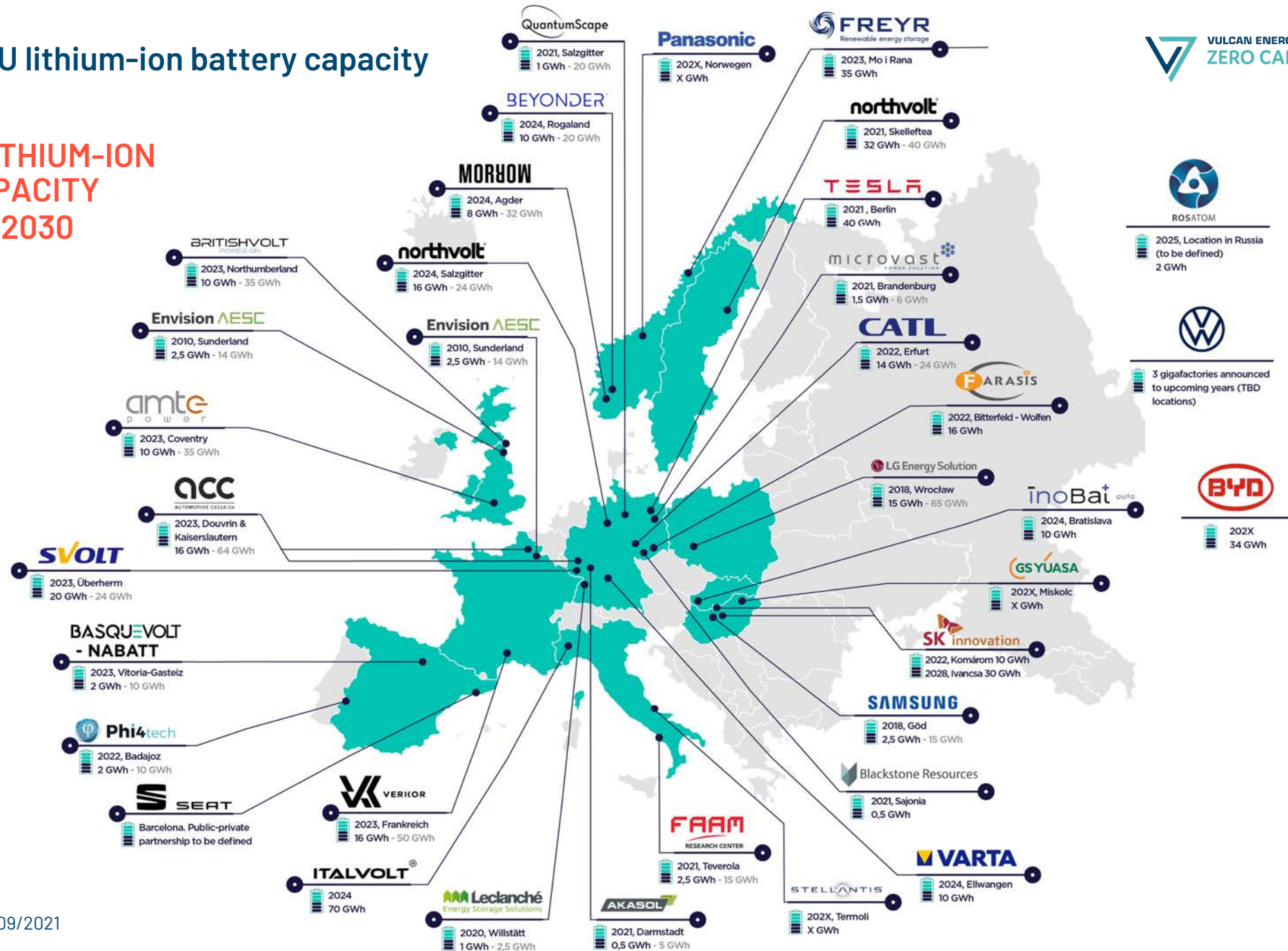
  
European Commission

 **InnoEnergy**  
Knowledge Innovation Community

 **European Investment Bank**

# Appendix 5: EU lithium-ion battery capacity

>1,000GWh LITHIUM-ION BATTERY CAPACITY PLANNED BY 2030



Source: CIC energiGune 09/2021



# Appendix 6: Lithium market dynamics favour sustainable lithium production



## Technology & Costs



"We expect **DLE technology to dominate** the future lithium mining sector. Fitch posits **geothermal lithium extraction** techniques to rise in popularity among Western consumers"<sup>1</sup>



"We could have a European producer [Vulcan] producing at **one of the lowest costs globally**. These are the kind of initiatives we expect Europe to take in order to compete on raw material globally"<sup>2</sup>



"**DLE could offer many benefits** including faster speed to market, as well as lower material costs and water usage. In Germany, Vulcan is pursuing this capability in the Upper Rhine Valley, Europe's largest lithium resource"<sup>3</sup>



## Sustainability



"**Geothermal lithium extraction has a much lower carbon footprint** than both hard rock and brine extraction methods, as well as reduced water usage"<sup>1</sup>



"The more **sustainable lithium producers will become the suppliers of choice** and be seen as less risky by customers and lenders. Country specific sustainability regulation is increasing and will likely lead to restrictions and higher production costs for producers that are less environmentally friendly"<sup>3</sup>



"The drive for **greener cars must be matched by cleaner lithium**"<sup>5</sup>



## Market Balance



"Incorporating the stronger demand outlook combined with limitations on the supply response due to rising product quality requirements is expected to see the lithium market shift from a small surplus in 2021 to a **deficit in 2022 and remain in tight for 2023-2025**, deficits widening each year"<sup>6</sup>



"Beyond 2025, we continue to forecast **significant market deficits**, noting a ~7x increase is required to meet our 2030 demand forecast"<sup>7</sup>

"We continue to expect significant demand growth for LiOH as high-performance ternary cathodes move to **market dominance** in the EV battery sector. We estimate demand to increase by **>850%** by 2030 (from 2021) to 1.1Mt LiOH"<sup>9</sup>



## Prices



"Lithium prices are likely to be impacted by **green premiums** due to heightened **priority of sustainable lithium extraction techniques**"<sup>1</sup>



"Long term Lithium Hydroxide Prices are expected to be around **\$16,000 per tonne**"<sup>1</sup>



"Our long-term assumptions for Li2CO3/LiOH remain at **~US\$15,000/t**"<sup>9</sup>

<sup>1</sup>Fitch Ratings, Fitch Solutions Country Risk & Industry Research, 21 May 2021 <sup>2</sup>BNEF, BNEF Summit, Europe's Formula for Winning the Lithium Battery Value-chain <sup>3</sup>Deutsche Bank, Sustainability Tracker, 17 May 2021 <sup>5</sup>Financial Time, 9 September 2020 <sup>6</sup>Macquarie, Lithium Market Outlook, 12 April 2021 <sup>7</sup>Canaccord Genuity – 10 February 2021 <sup>8</sup>HSBC – 9 February 2021 <sup>9</sup>Canaccord Genuity – 12 August 2021

## Appendix 7: The new EU Battery Regulation

New measures announced in December 2020 including:



**1. Responsible sourcing :** New mandatory procedures to ensure sustainable and ethical sourcing of raw materials such as lithium.



**2. CO<sub>2</sub> footprint :** All batteries sold in Europe must declare their carbon footprint. This will come in 3-step approach : 1/ Declaration (2024), 2/ Classification (2026), 3/ Threshold (2027). Batteries with the highest carbon footprint will be banned in Europe.



**3. Traceability:** All raw materials used in batteries to be procured according to OECD recognized guidelines for sustainable sourcing. Thanks to blockchain technology, each battery will have a digital passport tracking all components upstream.



**Maroš Šefčovič – European Commission VP :** *“The new EU battery CO<sub>2</sub> regulation will have an immediate impact on the market, which up until now has been driven only by price”.*

**Thierry Breton – EU commissioner:** *“We are 100% dependent on lithium imports. The EU, if finding the right environmental approach, will be self-sufficient in a few years, using its resources”.*

## Other EU measures and initiatives supporting lithium:



EU list of Critical Raw Materials & European Raw Materials Alliance



EIB new energy lending policy supporting projects relating to the supply of critical raw materials



European Battery Alliance

## Appendix 8: Geothermal brine composition comparison

		Upper Rhine Valley Brine	Salton Sea Brine	URV vs SS
Salts (Cations)	Analyte	Mg/kg Value	Mg/kg Value	%
Lithium: Source of revenue	Li	214	213	+1%
	Na	22,231	59,600	-63%
	K	4,878	18,126	-73%
	Rb	30.0	-	
	Cs	16.0	-	
	Mg	99	54	+83%
	Ca	5,195	31,714	-84%
	Sr	276	475	-42%
	Ba	14.4	139	-90%
Anions				
	Cl	60,567	145,000	-58%
	SO4	172	127	+35%
	F	4.7	24	-81%
	Br	288	-	
Metals (Cations)				
Requires additional purification step if high	B	47	401	-88%
	Be	0.0207	0.2	-91%
Can negatively affect DLE if high	Si	67.2	550	-88%
Can negatively affect DLE if high	As	20.3	8.8	+131%
Can negatively affect DLE if high	Mn	24.5	1,563	-98%
Can negatively affect DLE if high	Fe	37.4	664	-94%
Can negatively affect DLE if high	Zn	5.2	492	-99%
	Pb	0.156	108	-100%
Can negatively affect DLE if high	Al	0.014	16	-100%
	Ni	0.188	0.5	-61%
Can negatively affect DLE if high	Co	0.015	8	-100%
	Sb	0.717	6.5	-89%
	Ti	<0.1	-	
	V	0.165	0.6	-71%
	Cr	0.181	2	-89%
	Cd	0.0205	3	-99%
	Mo	0.0124	8	-100%
	Tl	0.328	2	-86%
pH		5.828	4.9	

The Salton Sea in California



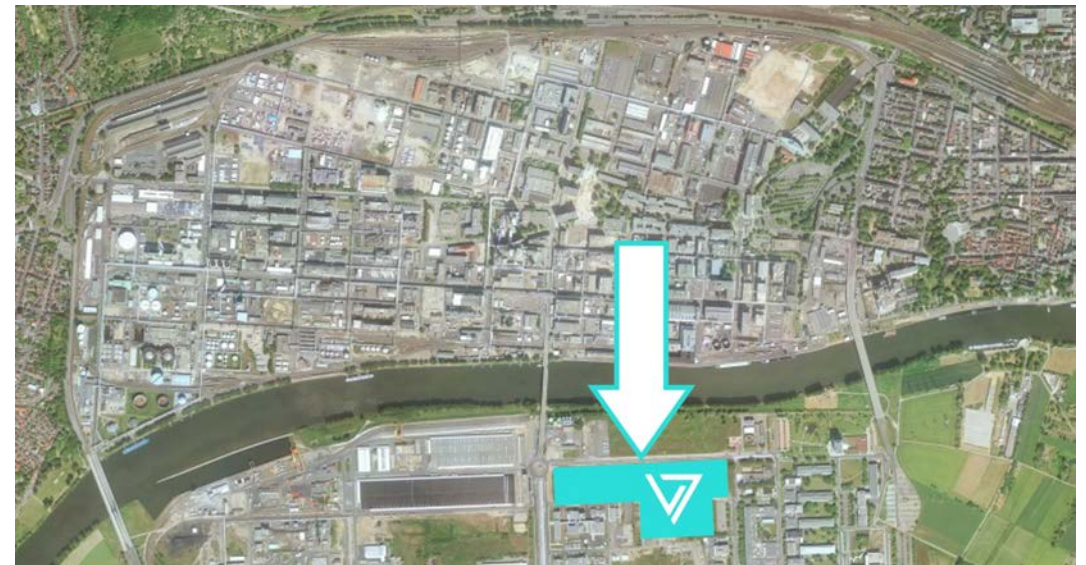
The Upper Rhine Valley in Germany

Note: Refer to ASX announcement of 10 March 2021 “High grade lithium, low impurity results from Vulcan’s 2021 Upper Rhine Valley bulk brine sampling”. Comparison of Vulcan’s January 2021 Upper Rhine Valley sample result analysed at KIT (n=1), compared to Salton Sea brine results (n=unknown) as recorded in publicly available literature (<https://gdr.openei.org/submissions/499> for all multi-element results except silica; US Patent 4429535 for pre-flash silica values). Salton Sea values adjusted by the density 1.25 -> from mg/kg to mg/l.



## Appendix 9: Vulcan secured site for its planned commercial lithium hydroxide plant

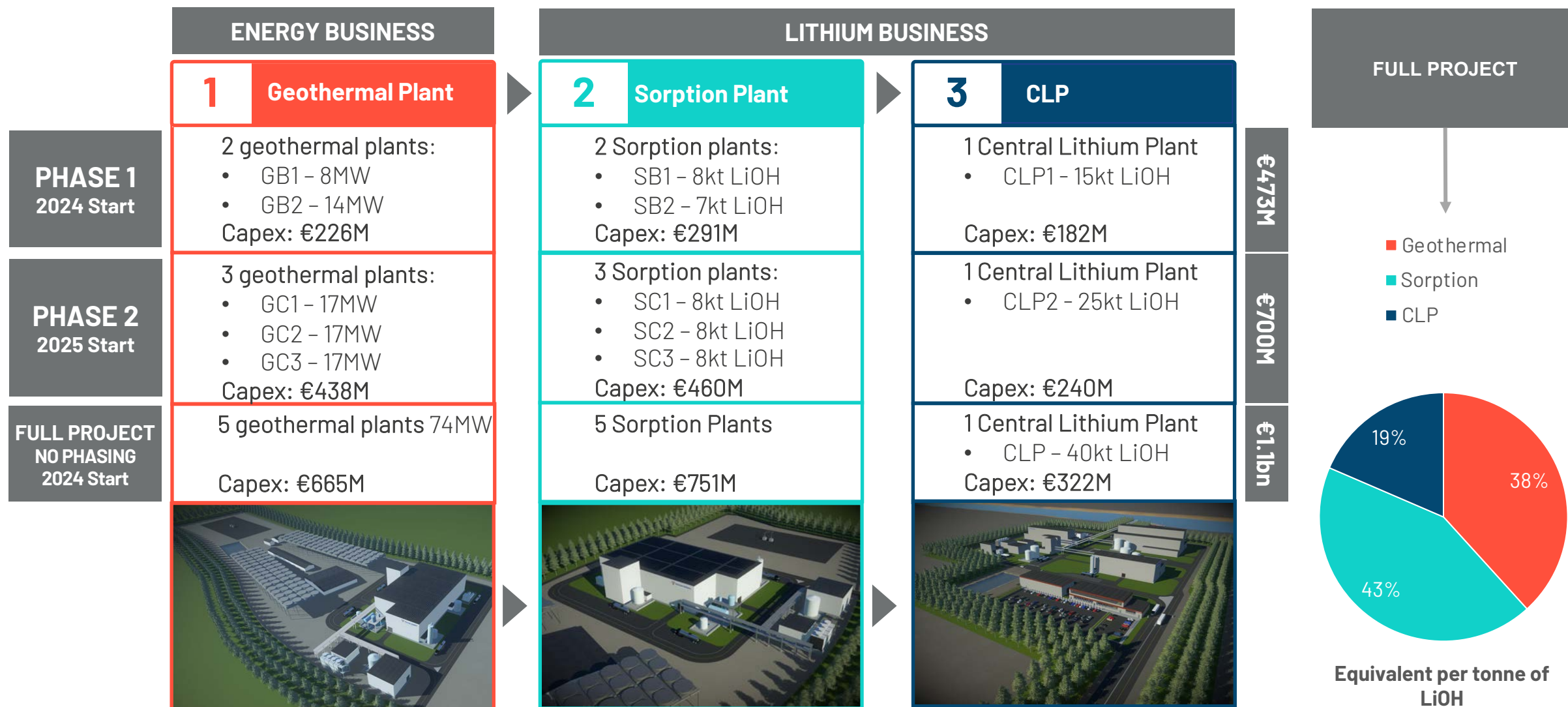
- Vulcan signed an agreement with chemical park management company Infracore, to secure a site for its planned **Central Lithium Plant** (CLP) at the **Höchst Chemical Park**, located just outside of Frankfurt.
- Höchst is **one of Europe's largest chemical sites** and hosts more than 22,000 personnel and 90 companies including Nobian, Clariant, Sanofi and Celanese.
- The CLP is intended as a **processing hub**, processing lithium chloride from multiple combined geothermal and lithium sorption plants into lithium hydroxide monohydrate.
- From the CLP, the lithium hydroxide monohydrate is intended to be transported to Vulcan's European customers in the battery and electric vehicle industry, dramatically **lowering the transport footprint** of the current lithium supply chain.
- The Höchst site features **key advantages** for the project including:
  - proximity to Vulcan's project areas where the integrated geothermal and sorption operations are proposed to be built;
  - multiple low carbon transport modes available (barge, train);
  - availability of renewable power onsite; and
  - the required space and utilities for future phased expansion of the CLP



## Appendix 10: DLE Projects and Assets – References

Livent	<a href="https://s22.q4cdn.com/453302215/files/doc_presentations/2021/11/Livent-Investor-Presentation_for-website.pdf">https://s22.q4cdn.com/453302215/files/doc_presentations/2021/11/Livent-Investor-Presentation_for-website.pdf</a>
Lanke Lithium	<a href="https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/">https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/</a> <a href="http://www.asianmetal.com/news/1665421/Lanke-lithium-plans-to-launch-commercial-production-of-battery-grade-lithium-carbonate">http://www.asianmetal.com/news/1665421/Lanke-lithium-plans-to-launch-commercial-production-of-battery-grade-lithium-carbonate</a>
Zangge Lithium	<a href="https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/">https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/</a>
Jintai Lithium	<a href="https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/">https://www.linkedin.com/pulse/from-catamarca-qinghai-commercial-scale-direct-lithium-alex-grant/</a>
Eramet/Tsingshan	<a href="https://www.eramet.com/sites/default/files/2021-11/IR%20presentation_Lithium_VF.pdf">https://www.eramet.com/sites/default/files/2021-11/IR%20presentation_Lithium_VF.pdf</a>
Standard Lithium	<a href="https://www.standardlithium.com/projects/arkansas-smackover">https://www.standardlithium.com/projects/arkansas-smackover</a>
Vulcan Energy	<a href="https://v-er.eu/wp-content/uploads/2021/12/2021-AGM-MD-presentation.pdf">https://v-er.eu/wp-content/uploads/2021/12/2021-AGM-MD-presentation.pdf</a>
Rio Tinto	<a href="https://www.rinconmining.com/wp-content/uploads/2021/10/Rincon-FINAL-E-210921-FINAL.pdf">https://www.rinconmining.com/wp-content/uploads/2021/10/Rincon-FINAL-E-210921-FINAL.pdf</a>
CTR	CTR's NI 43 101 inferred mineral resource estimate contains ~2.7 million
Berkshire Hathaway	<a href="https://www.ft.com/content/c9760a4e-1a76-11e9-9e64-d150b3105d21">https://www.ft.com/content/c9760a4e-1a76-11e9-9e64-d150b3105d21</a>
Lake Resources/Lilac	<a href="https://lakeresources.com.au/wp-content/uploads/2021/11/Ike_noosa-presentation_12-nov-21.pdf">https://lakeresources.com.au/wp-content/uploads/2021/11/Ike_noosa-presentation_12-nov-21.pdf</a> <a href="http://lilacsolutions.com/2021/09/lake-resources-partners-with-lilac-solutions-for-technology-and-funding-to-develop-the-kachi-lithium-brine-project-in-argentina/">http://lilacsolutions.com/2021/09/lake-resources-partners-with-lilac-solutions-for-technology-and-funding-to-develop-the-kachi-lithium-brine-project-in-argentina/</a>
Compass Minerals	<a href="https://investors.compassminerals.com/investors-relations/investor-news/press-release-details/2021/Compass-Minerals-Identifies-Approximately-2.4-Million-Metric-Ton-Sustainable-Lithium-Resource/default.aspx">https://investors.compassminerals.com/investors-relations/investor-news/press-release-details/2021/Compass-Minerals-Identifies-Approximately-2.4-Million-Metric-Ton-Sustainable-Lithium-Resource/default.aspx</a>
E3 Metals	<a href="https://www.e3metalscorp.com/_resources/presentations/corporate-presentation.pdf?v=0.084">https://www.e3metalscorp.com/_resources/presentations/corporate-presentation.pdf?v=0.084</a>

## Appendix 11: Target project economics from PFS – CAPEX



Note 1: Refer to the Company's ASX announcement entitled "Positive Pre-Feasibility Study" dated 15 January 2021, available on the Company's website and [www.asx.com](http://www.asx.com), for further details.

Refer to the Company's ASX announcement entitled "Positive Pre-Feasibility Study" dated 15 January 2021, available on the Company's website and [www.asx.com](http://www.asx.com), for further details. The Company confirms that all material assumptions underpinning the production targets, and the forecast financial information derived from such production targets, in this Presentation, continue to apply and have not materially changed.



## Appendix 12: Target project economics – possible structures

Full project developed at the same time but **separated** in two different businesses: Energy and Lithium.

### FULL PROJECT - NO PHASING 2024 Start

ENERGY BUSINESS					LITHIUM BUSINESS				
GB1	GB2	GC1	GC2	GC3	GB1	GB2	GC1	GC2	GC3
SB1	SB2	SC1	SC2	SC3	SB1	SB2	SC1	SC2	SC3
CLP					CLP				
74MW					40Ktpy LiOH				

<b>Revenues €M/y</b>	<b>157</b>	<b>500</b>
<b>Net Op. Cash Fl. €M/y</b>	<b>114</b>	<b>394</b>
<b>NPV Pre-tax €M</b>	<b>685</b>	<b>2,802</b>
<b>NPV Post-tax €M</b>	<b>470</b>	<b>1,897</b>
<b>IRR Pre-tax</b>	<b>16%</b>	<b>31%</b>
<b>IRR Post-tax</b>	<b>13%</b>	<b>26%</b>
<b>Payback (year)</b>	<b>6</b>	<b>4</b>
<b>CAPEX €M</b>	<b>665</b>	<b>1,073</b>
<b>CAPEX Geo</b>		
<b>CAPEX Sorption</b>		<b>751</b>
<b>CAPEX CLP</b>	<b>0.066</b>	<b>322</b>
<b>OPEX €/KWh or LiOH€/t</b>		<b>2,681</b>

Phase 1 developed first, **separated** in two different businesses: Energy and Lithium.

### PHASE 1 2024 Start

ENERGY BUSINESS					LITHIUM BUSINESS				
GB1	GB2	GC1	GC2	GC3	GB1	GB2	GC1	GC2	GC3
SB1	SB2	SC1	SC2	SC3	SB1	SB2	SC1	SC2	SC3
CLP1		CLP2			CLP1		CLP2		
22MW					15Ktpy LiOH				

<b>46</b>	<b>187</b>
<b>31</b>	<b>140</b>
<b>155</b>	<b>971</b>
<b>99</b>	<b>644</b>
<b>13%</b>	<b>27%</b>
<b>11%</b>	<b>22%</b>
<b>4</b>	<b>4</b>
<b>226</b>	<b>474</b>
<b>226</b>	
	<b>291</b>
	<b>182</b>
<b>0.078</b>	<b>3,201</b>

Phase 2 developed second, **separated** in two different businesses: Energy and Lithium.

### PHASE 2 2025 Start

ENERGY BUSINESS					LITHIUM BUSINESS				
GB1	GB2	GC1	GC2	GC3	GB1	GB2	GC1	GC2	GC3
SB1	SB2	SC1	SC2	SC3	SB1	SB2	SC1	SC2	SC3
CLP1		CLP2			CLP1		CLP2		
52MW					25Ktpy LiOH				

<b>111</b>	<b>312</b>
<b>83</b>	<b>242</b>
<b>530</b>	<b>1,647</b>
<b>371</b>	<b>1,111</b>
<b>18%</b>	<b>32%</b>
<b>15%</b>	<b>26%</b>
<b>7</b>	<b>5</b>
<b>438</b>	<b>700</b>
<b>438</b>	
	<b>460</b>
	<b>240</b>
<b>0.061</b>	<b>2,855</b>

Note 1: Lithium Hydroxide Battery Quality at €12,542 or US\$14,925/t (assumes exchange rate of €0.84/US\$1.00)

Note 2: Phase 1 relates to Taro license, Phase 2 to Ortenau license

Note 3: Ortenau license is 100% owned by Vulcan. Vulcan has a 100% interest in Taro

Note 4: Refer to the Company's ASX announcement entitled "Positive Pre-Feasibility Study" dated 15 January 2021, available on the Company's website and www.asx.com, for further details.

## Appendix 13: Target project economics – possible structures

Full project developed at the same time and integrated under one business.

	<b>FULL PROJECT NO PHASING 2024 Start</b>
	<b>INTEGRATED BUSINESS</b>
	GB1 GB2 GC1 GC2 GC3
	SB1 SB2 SC1 SC2 SC3
	CLP1 CLP2
	74MW & 40Ktpy LiOH
<b>Revenues €M/y</b>	<b>652</b>
<b>Net Op. Cash Fl. €M/y</b>	<b>507</b>
<b>NPV Pre-tax €M</b>	<b>3,443</b>
<b>NPV Post-tax €M</b>	<b>2,250</b>
<b>IRR Pre-tax</b>	<b>26%</b>
<b>IRR Post-tax</b>	<b>21%</b>
<b>Payback (year)</b>	<b>5</b>
<b>CAPEX €M</b>	<b>1,738</b>
<b>CAPEX Geo</b>	<b>665</b>
<b>CAPEX Sorption</b>	<b>751</b>
<b>CAPEX CLP</b>	<b>322</b>
<b>OPEX €/KWh or LiOH€/t</b>	<b>2,640</b>

Phase 1 developed first and is an integrated business

	<b>PHASE 1 2024 Start</b>
	<b>INTEGRATED BUSINESS</b>
	GB1 GB2 GC1 GC2 GC3
	SB1 SB2 SC1 SC2 SC3
	CLP1 CLP2
	21MW & 15Ktpy LiOH
<b>Revenues €M/y</b>	<b>232</b>
<b>Net Op. Cash Fl. €M/y</b>	<b>171</b>
<b>NPV Pre-tax €M</b>	<b>1,114</b>
<b>NPV Post-tax €M</b>	<b>703</b>
<b>IRR Pre-tax</b>	<b>23%</b>
<b>IRR Post-tax</b>	<b>18%</b>
<b>Payback (year)</b>	<b>5</b>
<b>CAPEX €M</b>	<b>700</b>
<b>CAPEX Geo</b>	<b>226</b>
<b>CAPEX Sorption</b>	<b>291</b>
<b>CAPEX CLP</b>	<b>182</b>
<b>OPEX €/KWh or LiOH€/t</b>	<b>3,139</b>

Phase 2 developed second and is an integrated business

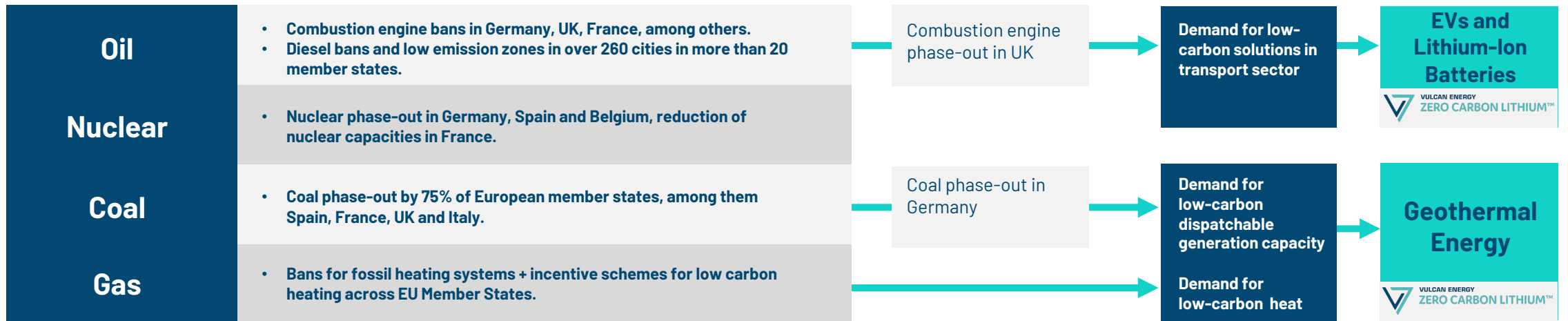
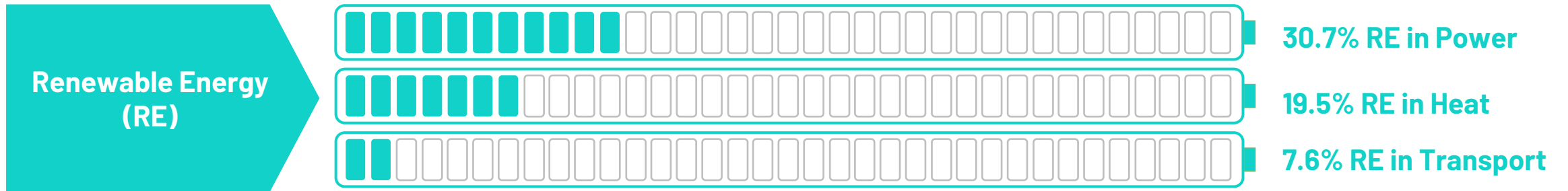
	<b>PHASE 2 2025 Start</b>
	<b>INTEGRATED BUSINESS</b>
	GB1 GB2 GC1 GC2 GC3
	SB1 SB2 SC1 SC2 SC3
	CLP1 CLP2
	52MW & 25Ktpy LiOH
<b>Revenues €M/y</b>	<b>420</b>
<b>Net Op. Cash Fl. €M/y</b>	<b>324</b>
<b>NPV Pre-tax €M</b>	<b>2,145</b>
<b>NPV Post-tax €M</b>	<b>1,403</b>
<b>IRR Pre-tax</b>	<b>27%</b>
<b>IRR Post-tax</b>	<b>22%</b>
<b>Payback (year)</b>	<b>6</b>
<b>CAPEX €M</b>	<b>1,138</b>
<b>CAPEX Geo</b>	<b>438</b>
<b>CAPEX Sorption</b>	<b>460</b>
<b>CAPEX CLP</b>	<b>240</b>
<b>OPEX €/KWh or LiOH€/t</b>	<b>2,792</b>

Note 1: Refer to the Company's ASX announcement entitled "Positive Pre-Feasibility Study" dated 15 January 2021, available on the Company's website and [www.asx.com](http://www.asx.com), for further details

## Appendix 14: The fossil-nuclear era in Europe is coming to an end

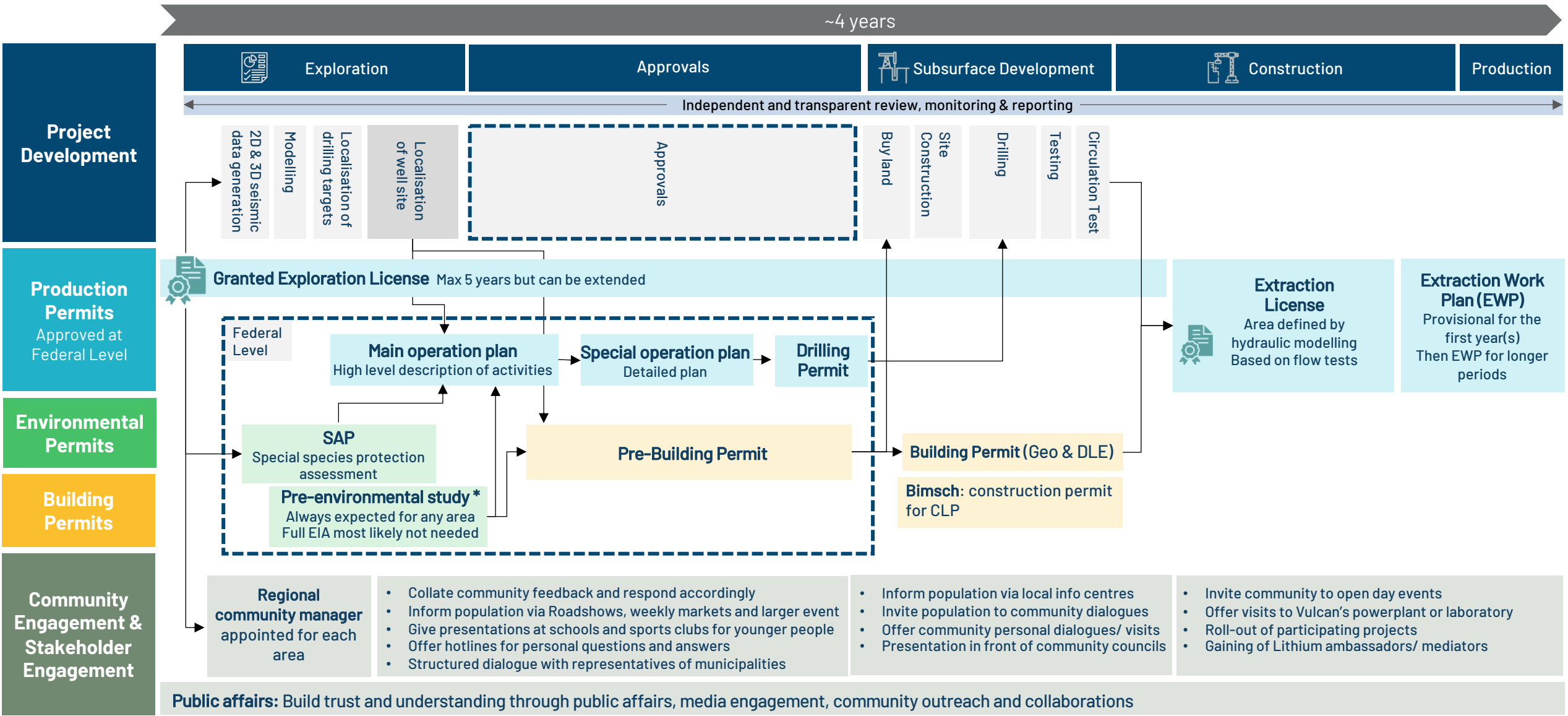


Europe is aiming for carbon neutrality, but the EU's energy transition is far from being complete:





# Appendix 15: Project development timeline: example for one project area



Notes: Not at scale, e.g., at scale approval would be shorter and drilling would be longer. Each project area is unique, timing and plans will vary for each area \*Full Environmental Study only required in protected areas

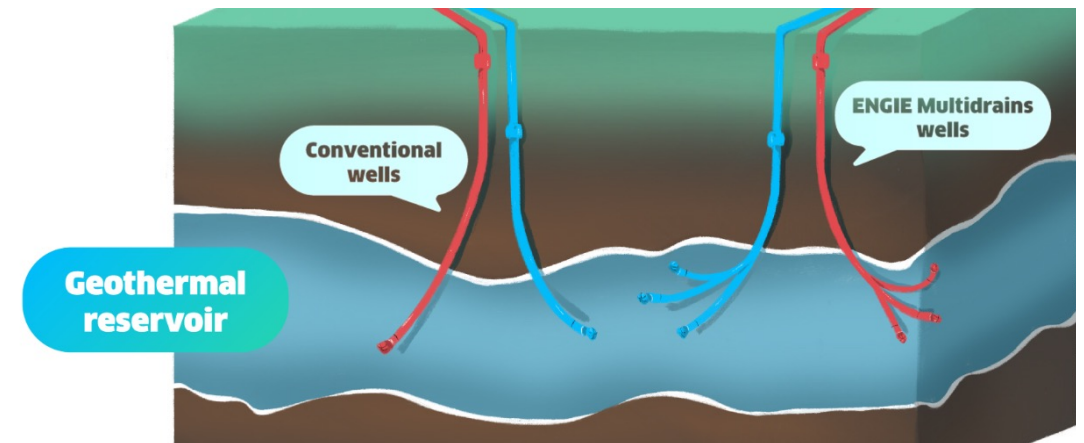
## Appendix 16: Brine flow rates

Until we drill our first wells, risks around flow rate will remain. However, Vulcan believes it has an appropriate level of confidence around its flow rates assumptions, based on the experience of its team, and state-of-the-art scientific tools, data and studies.

1. Vulcan is targeting high-flow fault zones within its sedimentary reservoir units, which are predominantly the Bunter Sandstone, using state-of-the-art seismic data. When exploration for geothermal brines first began in the Upper Rhine Valley, no seismic data was used, or the data was 2D seismic only, to get a picture of the sub-surface. The industry has seen a steady progression of understanding and improvements in exploration over time, including the **use of 3D seismic**, and a corresponding increase in flow rates, as would be expected. 3D seismic is now a standard for geothermal exploration in the Upper Rhine Valley and elsewhere.
2. In our estimation of flow rates, we have conducted detailed studies using modelling information derived from seismic data in our areas. The Upper Rhine is a sedimentary graben system, geologically similar to hydrocarbon systems with **permeable formations confined by impermeable rock**. This differs to other types of geothermal plays, such as volcanic-hosted, where the systems are more complex, in general less permeable and seismic data is less useful.
3. We also factor in techniques well known in the oil and gas industry to increase flow, such as **double completion of wells** and **multi-reservoir completion** as recently promoted by Schlumberger and Engie.

Vulcan has, based on its detailed analysis and the various factors mentioned above, used between 100 and 120l/s as assumed flow rates for its projects in its PFS.

A **public list of flow rates** achieved at deep geothermal wells in and around Germany can be found in a 2014 report compiled for the German Federal Ministry of the Economy (BMWi) at the following link: [https://www.grs.de/sites/default/files/pdf/grs-316\\_teilb.pdf](https://www.grs.de/sites/default/files/pdf/grs-316_teilb.pdf). Wells displaying flow rates at greater than 100l/s are common in the list, including at Brühl in the Upper Rhine Graben, with some projects reaching up to 150l/s.



Source: Engie

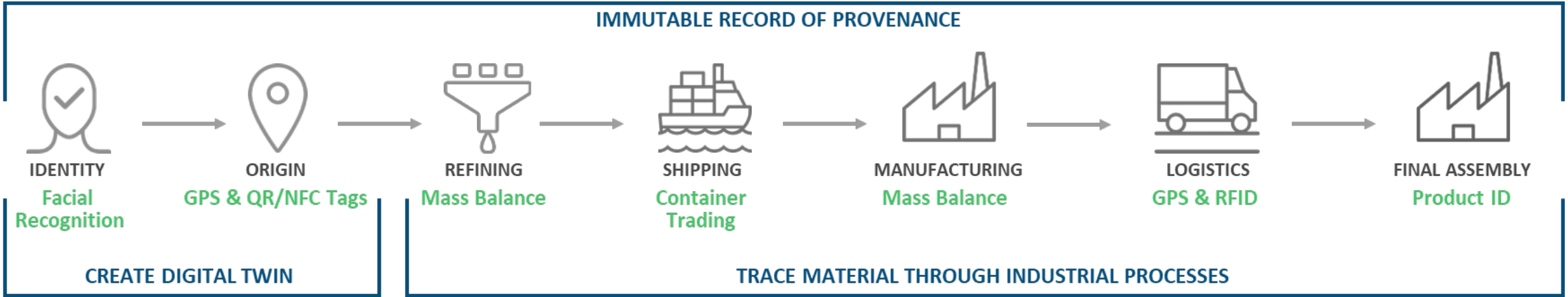
# Appendix 17: Vulcan & Circular to establish world-first full lithium traceability & transparency across the EU supply chain



Circular offers a software solution that enables customers to track raw materials and CO<sub>2</sub> emissions through supply chains to demonstrate responsible sourcing and sustainability.

By applying blockchain, artificial intelligence, machine learning, facial recognition, mass balancing and other technologies Circular makes sure that the digital twin is reliably linked to the physical resource through out its entire journey. This enables:

1. Reputational Protection
2. Proof of compliance with guidelines and regulations
3. Dynamic carbon tracking
4. Reducing due diligence, audits and reporting costs



Example applied to the cobalt supply chain



## Appendix 18: R&D projects



### **Effeo**

Increasing efficiency of geothermal power plants via Project Management Jülich



### **GreGeo**

Aims to develop a new well completion strategy that aims to establish a corrosion-resistant alternative to steel.



### **GEORISK project**

Aims to develop financial schemes and mitigate the impact of the resource risk



### **GeoThermScaling**

Development and evaluation of advanced iron boride-based anti-corrosion coating with high resistance to corrosion and scaling for deep geothermal applications.



### **CROWDTHERMAL**

Empowering the European public to directly participate in the development of geothermal projects with the help of alternative financing schemes (crowdfunding) and social engagement tools.



### **MEET**

Multidisciplinary and multi-context demonstration of EGS exploration and Exploitation Techniques and potentials



### **DGE-Rollout**

Roll-out of Deep Geothermal Energy in Northwest Europe

# Thank you

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