RESOURCES

VULCAN ENERGY

Zero Carbon Lithium™

December 2019 Project Update
ASX: VUL
FRA: 6KO

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Competent Person Statement

The information in this report that relates to Mineral Resources are based on, and fairly reflects, information compiled by Mr. Roy Eccles P. Geol. and Mr. Steven Nicholls MAIG, who are both full time employees of APEX Geoscience Ltd. and deemed to be both a ‘Competent Person’. Both Mr. Eccles and Mr. Nicholls have sufficient experience relevant to the style of mineralization and type of deposit under consideration and to the activity which they are undertaking to qualify as Competent Person as defined in the 2012 Edition of the Australian Code for the Reporting of Exploration Results, Mineral Resources, and Ore Reserves (JORC Code). Mr. Eccles has reported to the scientific community, and as a geological consultant on exploration and resource related lithium-brine work, since 2010, specializing in confined, subsurface lithium-brine deposits in the Western Canada Sedimentary Basin, and the southern United States. Mr. Eccles and Mr. Nicholls consent to the disclosure of information in this report in the form and context in which it appears.

World-Class, 2020s-Ready Lithium Project

RESOURCES
VULCAN ENERGY
Zero Carbon Lithium™

World's First & Only Zero-Carbon Lithium™ Process

Co-generation of geothermal energy from production wells will power lithium extraction. Unique process will satisfy EU requirement for ISO-compliant, zero carbon Electric Vehicle (EV) raw materials supply chain.

Europe's Largest JORC Lithium Resource

Recent JORC Mineral Resource Estimate[1] 13.2 Million Tonnes of contained Lithium Carbonate Equivalent (LCE). Large enough to be Europe's primary source of battery-quality lithium hydroxide.

Most Optimally Positioned for Supply Chain Security & Footprint Reduction

Located in Germany, in the centre of the European lithium-ion battery industry. Removes dependence on South America and China for this designated Critical Raw Material. Removes carbon footprint of supply chain.

Europe's Lowest Impact Lithium Project

No hard-rock mining, no evaporation ponds required in Vulcan's Zero Carbon Lithium™ process. Instead lithium extraction fit for Europe & the modern world, from renewable energy-producing geothermal brine wells rich in lithium.

Europe's Most Rapidly Advancing Lithium Project

Maiden Resource completed in just three months. Recent agreement with major German utility provides access to existing wells and potentially a fast-track to production. Targeting production in 2023.

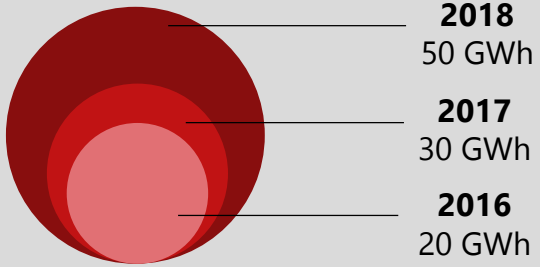
Unprecedented Demand Forecast for Lithium Hydroxide in Europe

Ramp-up of lithium-ion battery manufacturing for auto industry in Europe in 2020s forecast to dwarf China expansion of 2016-18. Zero local supply of battery quality lithium hydroxide.

[1]Refer VUL Announcement 04/12/2019. The Company is not aware of any new information or data that materially affects the information included in the announcement.
All material assumptions and technical parameters underpinning the Mineral Resource Estimate in the relevant announcement continue to apply and have not materially changed.

Unprecedented Demand for Lithium in Europe - The Next China?

China Lithium-Ion Battery Cell Production to 2018

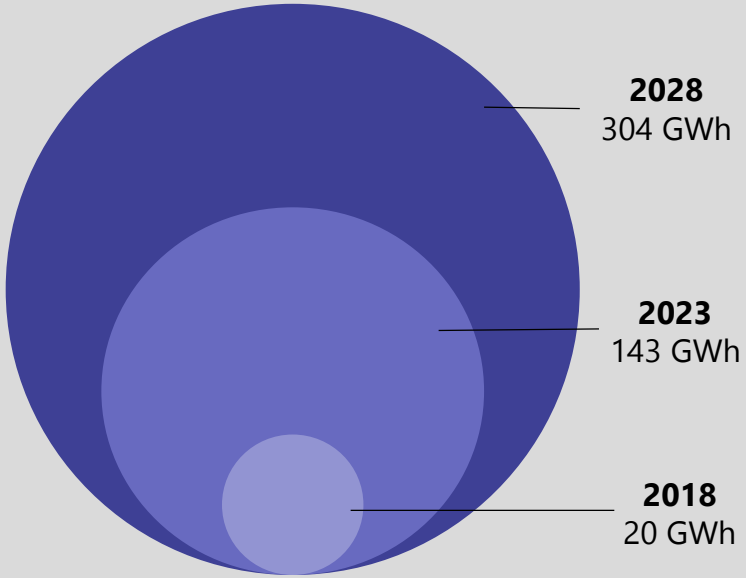


Source: Adapted from Ministry of Industry & Information Technology of China

In the 2010s, China experienced the world's highest growth in lithium-ion battery production for electric vehicles. It caused a lithium supply shortage & 300% lithium price spike.

In the 2020s, the same is forecast to happen in Europe, on a much larger scale.

European Lithium-Ion Battery Cell Production Forecast to 2028



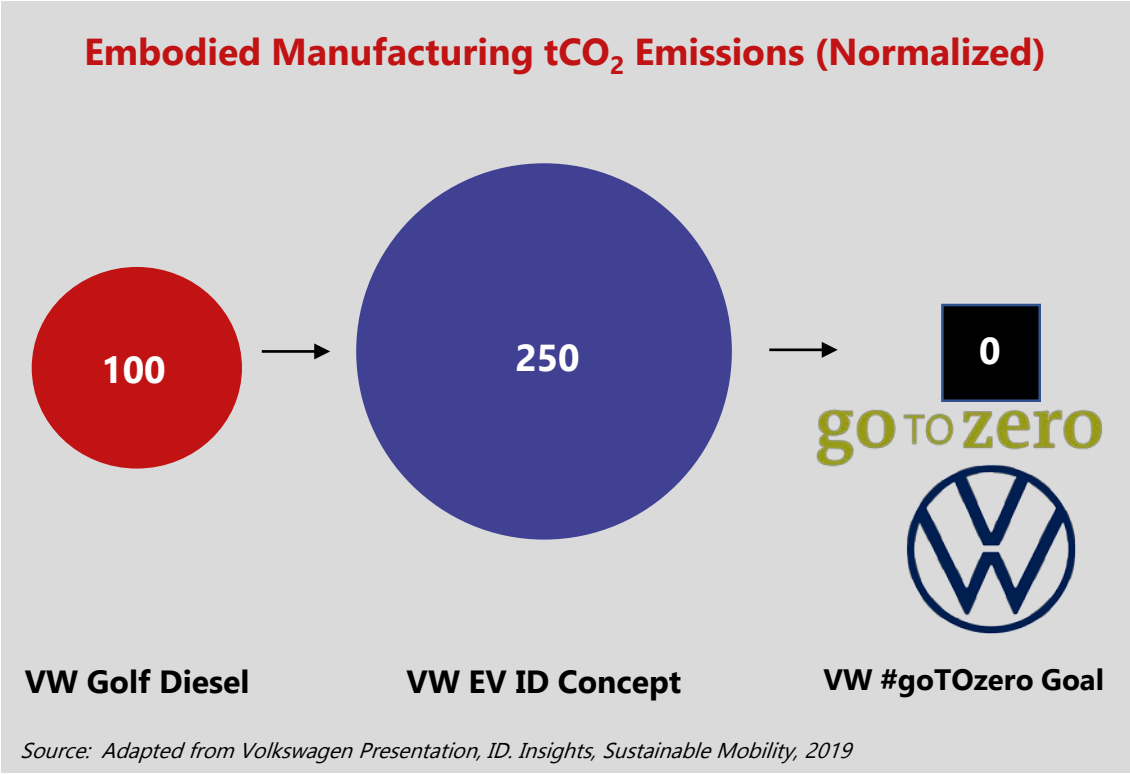
Source: Adapted from Benchmark Mineral Intelligence Q2 2019 Review

"European battery cell production capacity is set to increase rapidly in the coming decade. Europe currently has no commercial lithium production or refining capacity of its own to meet this demand, but plans are afoot to change this."

– Benchmark Mineral Intelligence (2019)

Unprecedented Demand for Zero Carbon Lithium Sources

- EV raw material supply chains have a carbon footprint problem.
- Volkswagen placing **great importance on having a CO_2-neutral production supply chain** for its new EV line-up, with sustainability metric for suppliers on par with price.
- Other European OEMs following suit.
- The European Commission has flagged **"CO_2 Passports"** for electric vehicles, which will detail their full CO_2 impacts.
- EU has declared a climate emergency and aims to **cut 55% of emissions by 2030, net zero by 2050.**
- The world's conventional lithium supply chains are not geared towards low carbon intensity production, so **Europe will need to build its own.**



Source: Adapted from Volkswagen Presentation, ID. Insights, Sustainable Mobility, 2019

"Volkswagen's delivery promise: CO_2-neutral production including supply chain"

"Sustainability as selection criteria on par with quality and price"

Summary: Lithium Supply Chain Not Up to European Standards

Salar Brine Supply Chain

- South American brine operations **thousands of kilometers away** from Europe resulting in high CO_2 intensity shipping product & processing reagents.
- South American evaporation process **high CAPEX**, **up to 18 months** to produce product, vulnerable to **weather events**, challenging to provide **consistent product.**

Spodumene Mine/China Convert Supply Chain

- Hard rock operations are **high OPEX and high CO_2 footprint** due to coal use in spodumene conversion in China, also thousands of kilometers from Europe.
- China **not building conversion capacity fast enough,** leading to bottleneck.

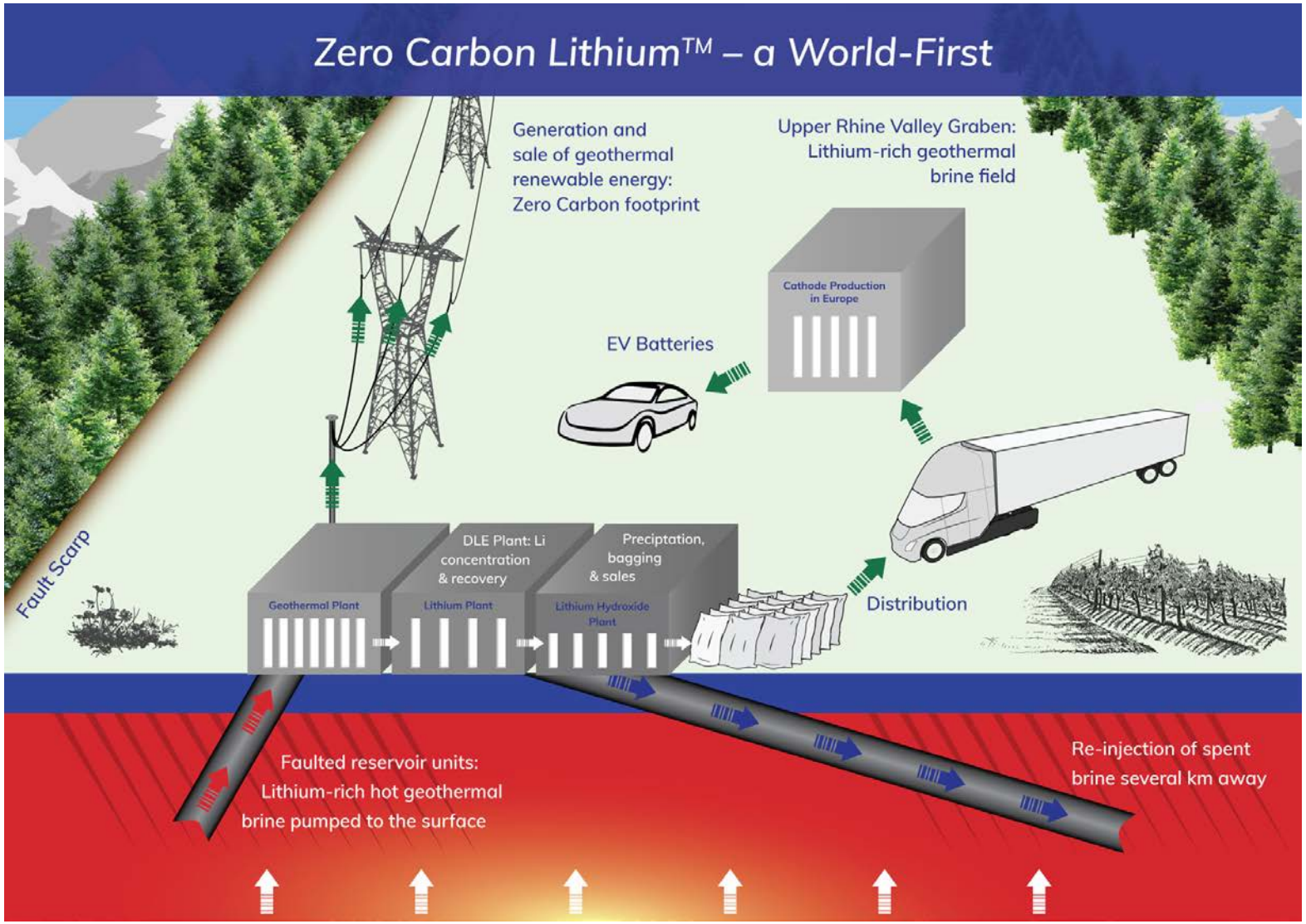
European Lithium Supply Chain

- **Unprecedented push** from battery/cathode makers and OEMs to ramp up lithium-ion production forecast to need 150ktpa LCE demand in EU for battery production, by 2023, **290ktpa by 2028.**
- **Zero EU production** of battery-quality lithium hydroxide. **Severe** battery-quality lithium supply **shortfall** in Europe with slated battery and EV manufacturing.

Supply Deficit Looming. Only High CO_2 Products. The market is ripe for disruption.

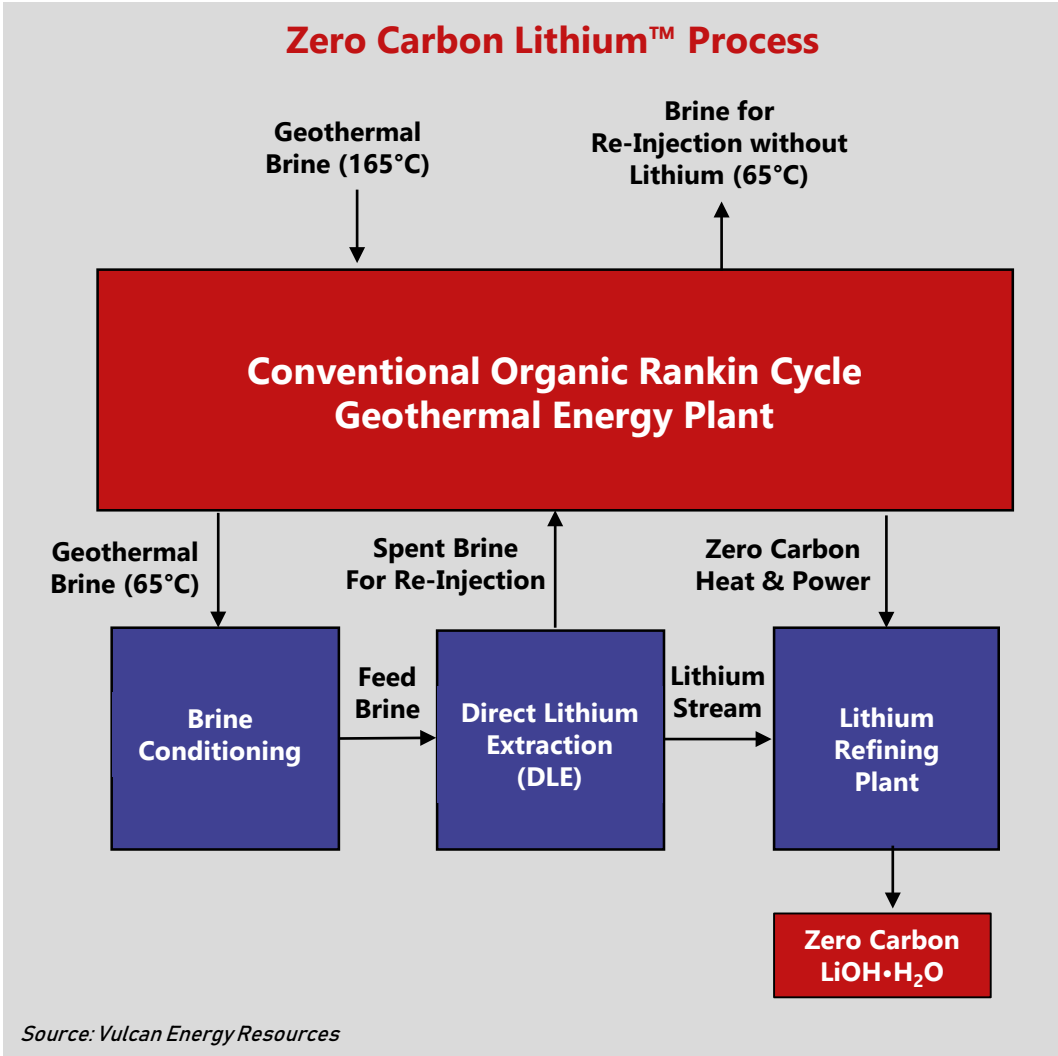
Our Solution: Vulcan's Zero Carbon Lithium™ Project

- Very large, lithium-rich geothermal brine field in **Upper Rhine Valley (URV) of Germany** in the heart of the EU's battery "mega-factories".
- Production wells to be drilled into high flow rate, lithium-rich brine reservoir, including Buntsandstein (+2,000m depth).
- **Unique Vulcan flowsheet integrates:**
  - Geothermal energy production,
  - De-risked Direct Lithium Extraction (DLE) process to produce $LiOH \bullet H_2O$ from the brine,
  - Zero carbon electricity generated and used to produce premium, **Zero Carbon Lithium™** with no gas input.
- Spent brine re-injected into reservoir with no evaporation losses.



Vulcan's Unique Zero Carbon Lithium™ Integrated Flowsheet

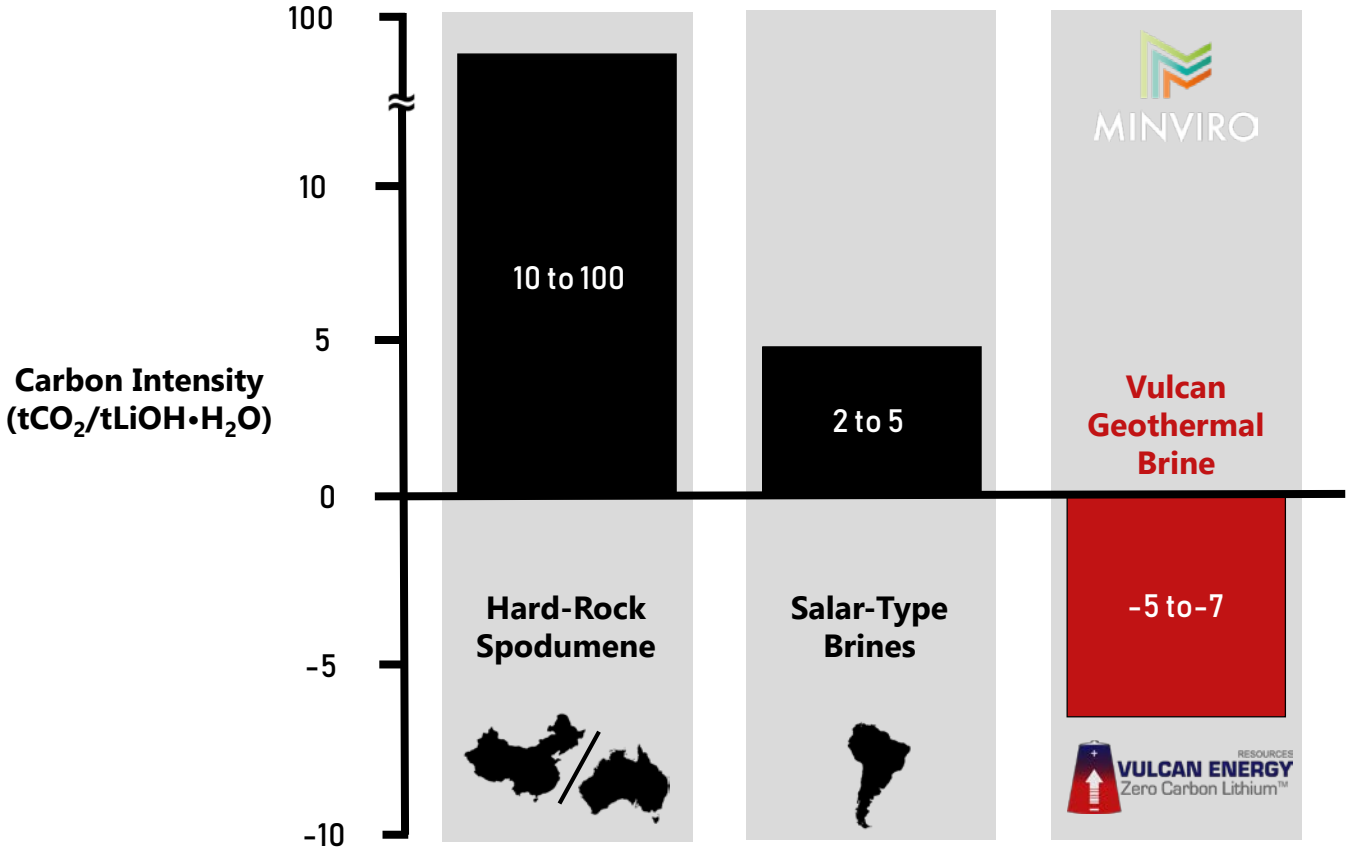
- Unique flowsheet developed by Vulcan, making use of **binary cycle geothermal electricity & heat** to create a **Zero Carbon Lithium™ product.**
- DLE from geothermal brines de-risked by multiple projects.
- Processing time **hours instead of months**, not dependent on weather like South American brines.
- Creates high purity, high concentration solution that is easily converted on site into **battery quality $LiOH \bullet H_2O$.**
- Excess **power will be sold** at a Feed-in-Tariff of €0.25/kWh, displacing coal and decarbonizing the German electric grid.
- No need for high energy mining, crushing, grinding and conversion processes used in hard-rock lithium deposits.



Source: Vulcan Energy Resources

Independently Verified Zero Carbon Credentials: World First

Minviro Independent ISO 14044 Study on Vulcan & Peers (Preliminary)



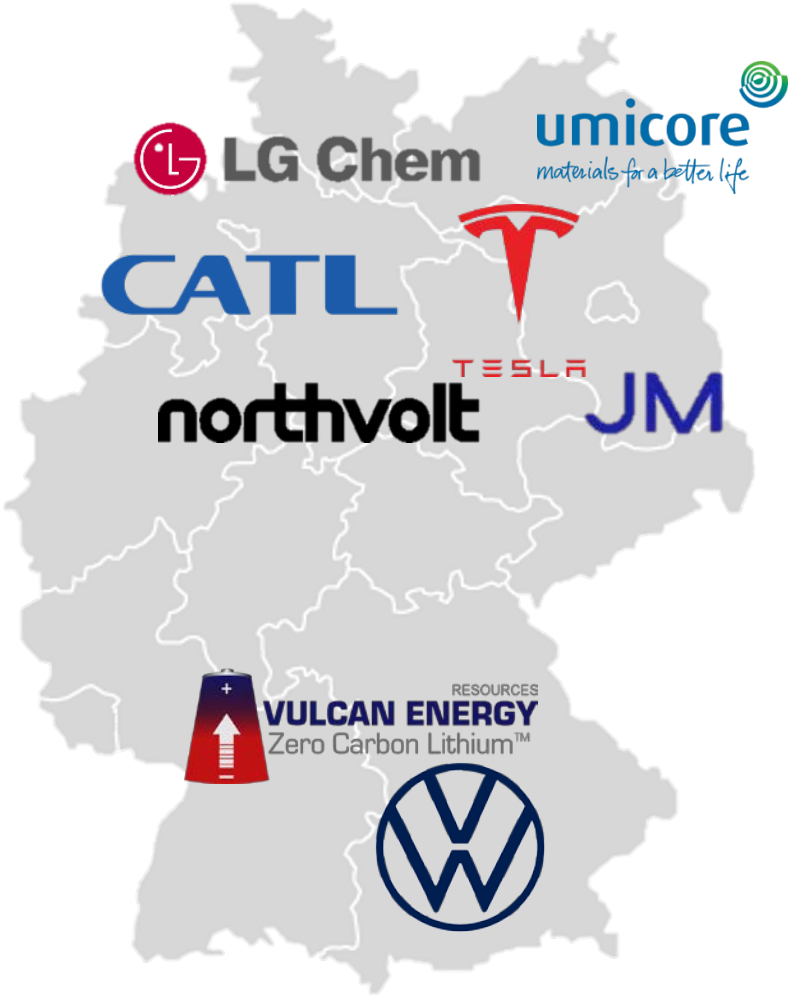
Source: Minviro Ltd & Vulcan Energy Resources

- Spodumene converted by fossil fuel-fired processes and lithium products transported from South America will **always emit significant quantities of CO_2** to sell their lithium products in Europe.
- Models indicate that Vulcan's lithium hydroxide product will have a net **negative $tCO_2/tLiOH•H_2O$** impact, **decarbonizing** both the European power system and lithium supply chain simultaneously.
- Vulcan's **Zero Carbon Lithium™** branded products will be premium, peerless & disruptive in the European market.

Zero Carbon Lithium™ Products: Premium, Peerless and Disruptive

Most Optimal Positioning for Europe's Lithium Supply Chain

- Lithium hydroxide is a "semi-bulk" commodity. Vulcan's short distance to markets is a major cost advantage as well as carbon advantage.
- **Strategic, secure** domestic supply for EU OEMs at a time of global trade insecurity.
- Located in Germany just 60km from Stuttgart; the centre of the burgeoning European lithium-ion supply chain.



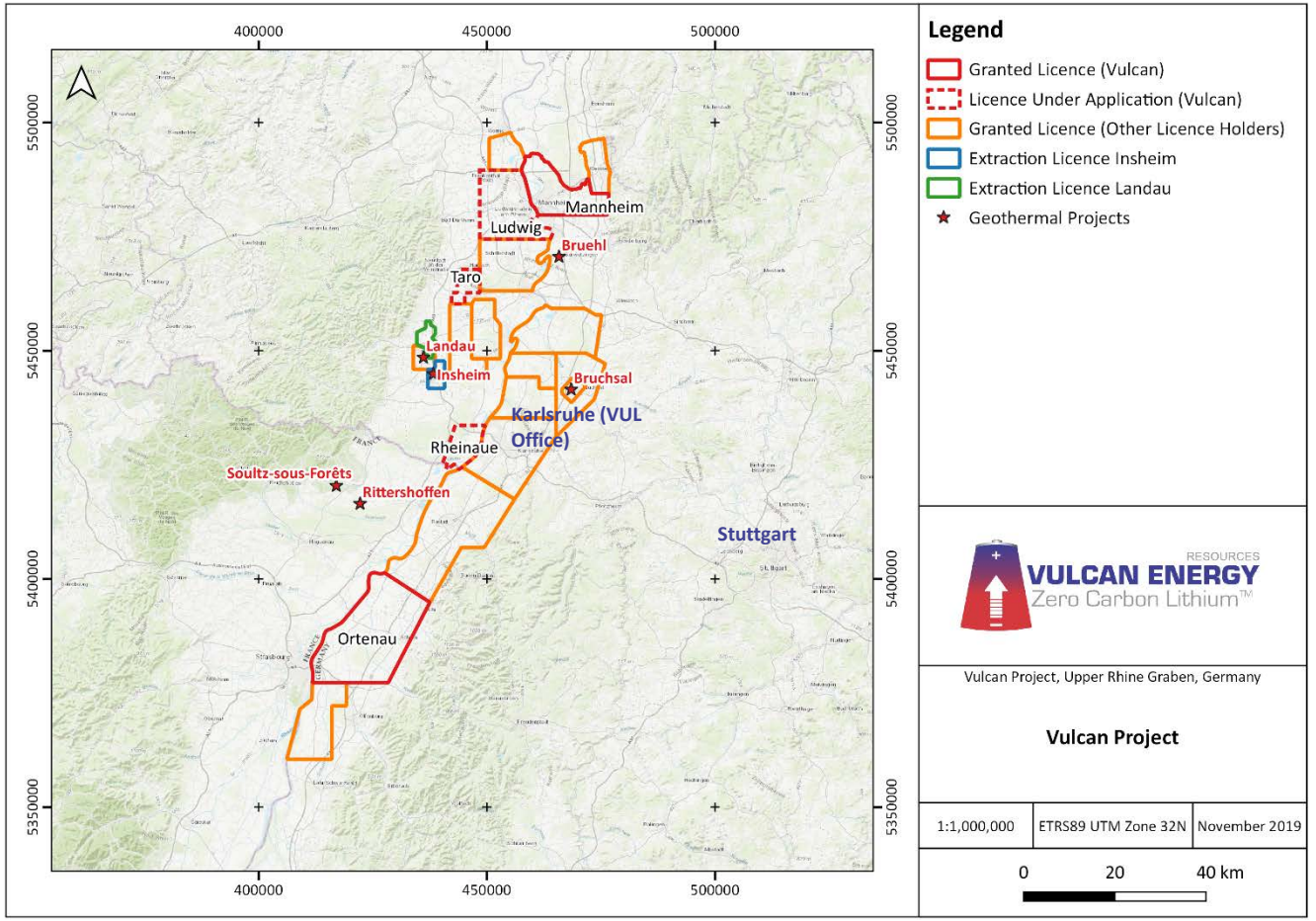
In the News, Just in November 2019:

- **European Investment Bank unlocks €1 trillion** of climate action and environmentally sustainable investment to 2030
- **BMW** orders **>€10B-worth** of lithium-ion battery cells
- **Pallinghurst & Traxys** to invest $2bn in battery materials, **focus** on ethical jurisdictions inc. **EU**.
- **Northvolt triples** planned **lithium-ion** production to **150 GWh** by 2030.
- **Tesla** announces Gigafactory 4 to be located near Berlin, **Germany**
- **VW ups investment to €60B** on switch to electric vehicles, will produce 75 different electric models.

References: Umicore announcement -

Very Large, Strategic Project Area

- Most well-explored graben system in the world: large quantities of existing 2D and 3D seismic data to **shortcut development timeline.**
- **Dominant** license landholding in lithium-rich brine field - ~ 800 km^2 of license area.
- Thousands of historical wells and multiple operating geothermal wells in the region provide **a wealth of data** and **readily accessible brine**.
- Geothermal brine production socially & environmentally accepted in region with vineyards and communities next to existing operations.



German Utility Partnership: Shortcut to Development

- MoU agreement signed in November 2019 with subsidiary of **German utility Pfalzwerke Group – Pfalzwerke geofuture**, for JV at **operational** Insheim geothermal plant to produce lithium hydroxide.
- **Transformational** agreement for Vulcan, gives access to lithium-rich, **producing brine operations** neighbouring Vulcan's existing project area.
- Potential to **significantly short-cut** timescale to production of **Zero Carbon Lithium™** hydroxide.
- Vulcan to earn up to **80% of lithium rights** at Insheim by completing Pre-Feasibility (PFS) and Definitive Feasibility (DFS) studies.
- Pfalzwerke Gruppe is a German and international energy provider with annual revenue in excess of €1.5 billion.
- Insheim geothermal plant (shown) a shining example of geothermal best-practice, **operating in harmony with local community and environment for 7 years**.

Vulcan Resource Size: World Class

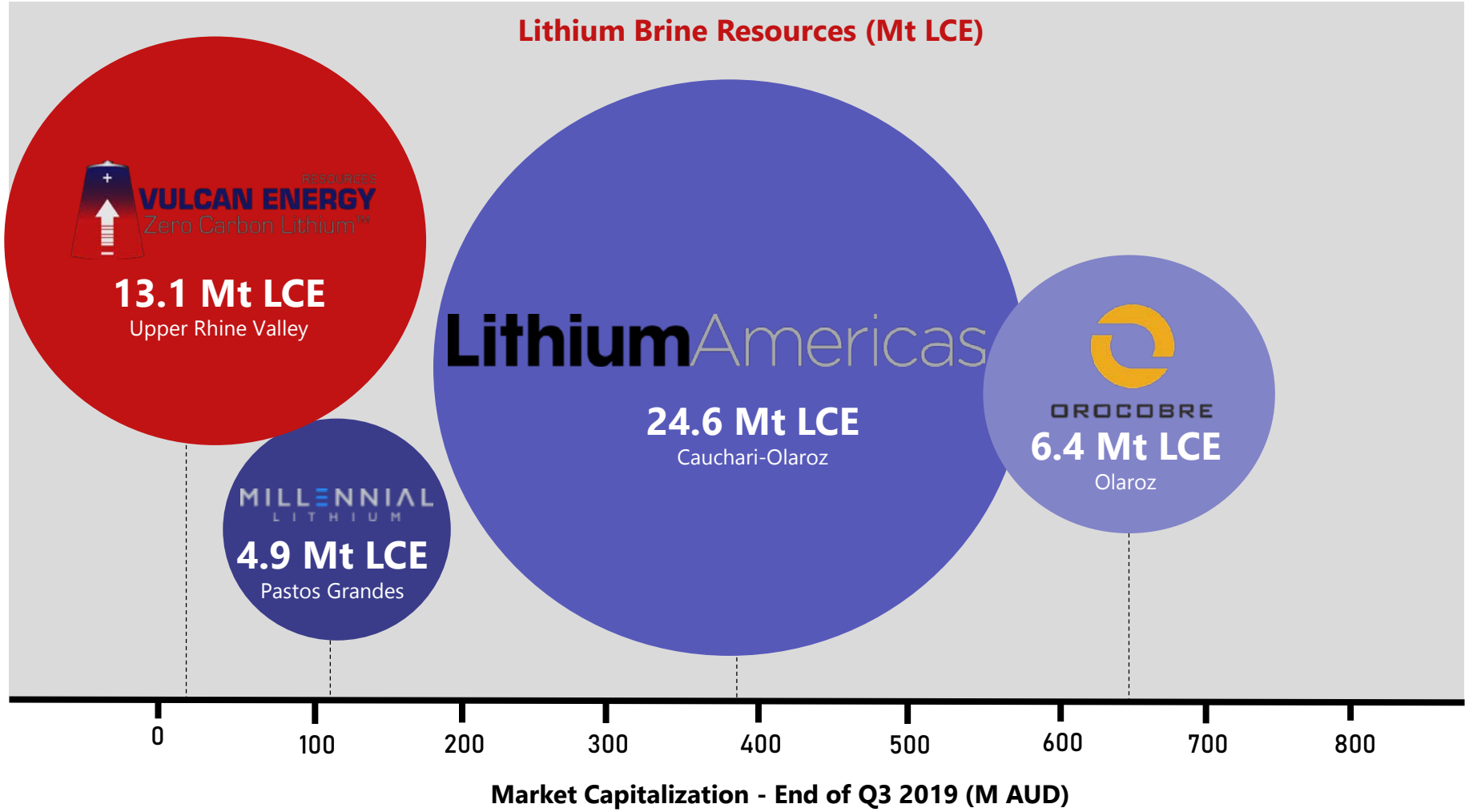
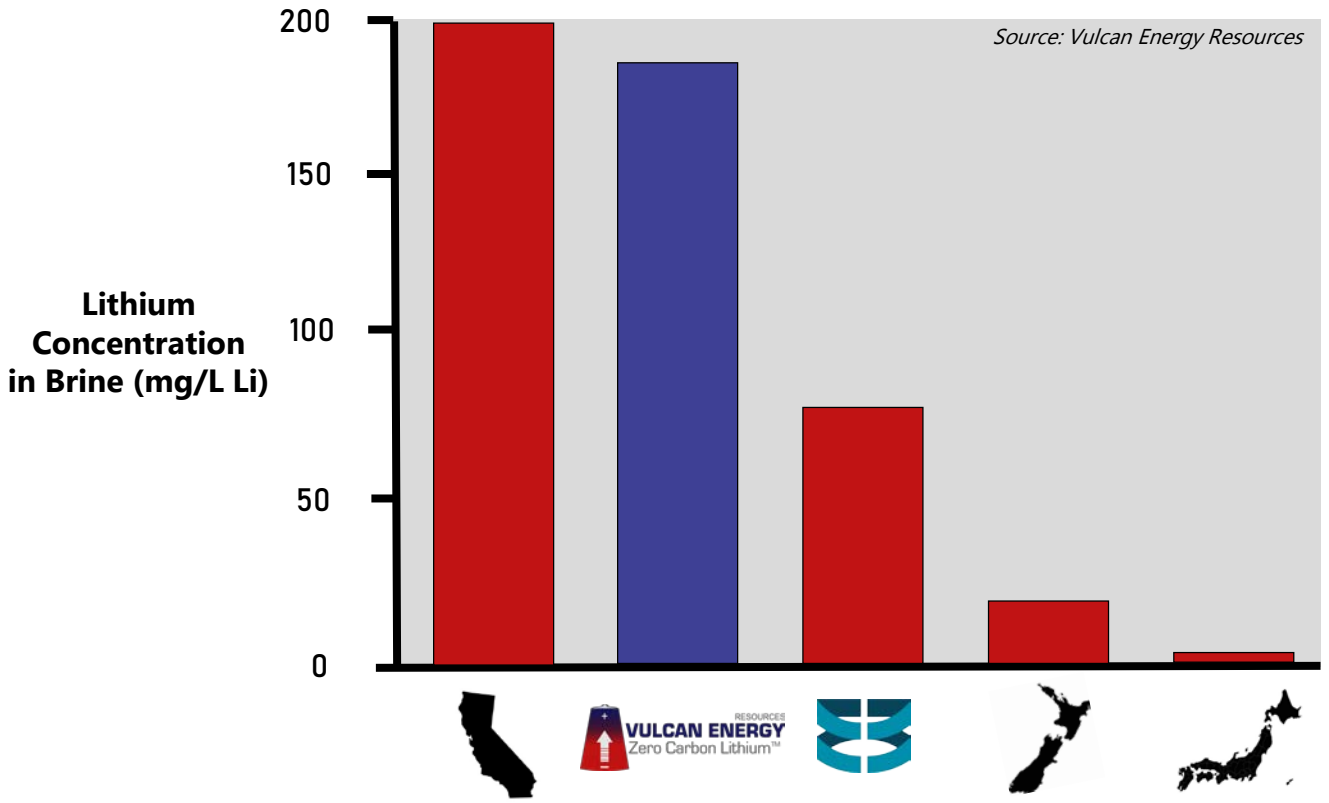


Chart compares resources from companies at different stages of development as detailed in Appendix 1, with Vulcan Lithium Project which is a 100% Inferred Mineral Resource as per VUL ASX announcement 04/12/2019. The Company is not aware of any new information or data that materially affects the information included in the announcement. All material assumptions and technical parameters underpinning the Mineral Resource in the relevant announcement continue to apply and have not materially changed. Market capitalisations converted to A$m as at 3 December 2019.

Vulcan Project Lithium Grades, Heat & Brine Flow Rate: Rare



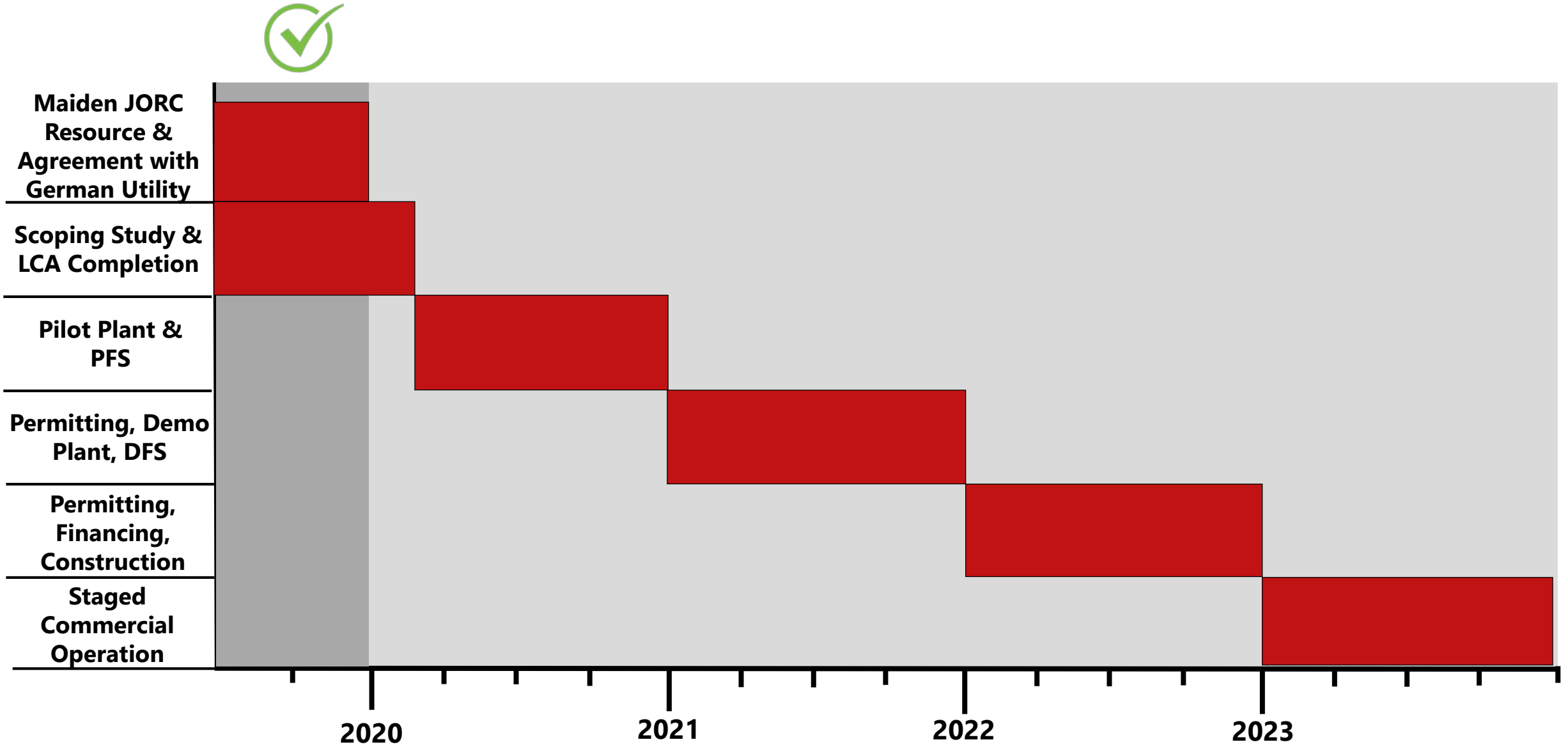
- Upper Rhine Valley geothermal brine field exhibits Li values **one to two orders of magnitude greater** than typical geothermal brines[1]: up to 210 mgLi/L, average of 181 mg/L Li.
- Typical geothermal brine fields have lithium values in the order of 1-10 mg/L Li.[1]
- Only other known geothermal field with similar lithium grades & flow rate is **Salton Sea, California**.[1]
- E3 Metals in Alberta, Canada is developing their project with just a 75 mg/L Li brine.
- Areas with heated brines are common, but the **fluids are rarely also both lithium-rich & high flow rate**.
- **Same order of magnitude of lithium grade** as South American Li salar brines, but with **processing advantage of readily available heat & power.**

[1]See Appendix 2

Direct Lithium Extraction: Widespread Adoption Underway

- DLE used at **Livent**'s Hombre Muerto operation in Argentina for **25 years producing consistent product.**
- Sept 2019, **E3 Metals** received a $5.5M investment from Livent (one of world's largest lithium producers), to developer their DLE technology to produce $LiOH \bullet H_2O$ from an Alberta petrobrine with grades of 75 mg/L Li (less than half Vulcan's grade).
- **Controlled Thermal Resources** is advancing a battery quality lithium carbonate project using DLE in the Salton Sea, California with similar grades to Vulcan's brine.
- **Simbol Materials** rejected a takeover offer of **US $325M from Tesla** for their technology to extract lithium from Salton Sea geothermal brines.
- In December 2019, **Standard Lithium** commissioned their demo plant using DLE to produce lithium chemicals from the Smackover brine formation in Arkansas, USA.
- **Berkshire Hathaway Energy** with $91B in assets is also seeking to produce battery quality lithium chemicals from geothermal brines using DLE in the Salton Sea.
- **EnergySource Minerals** publicly announced in 2019 their Salton Sea DLE pilot plant was running smoothly and they were scaling up.
- **Sunresin's** Zangge DLE Lithium Project is **fully operational** in China, expanding to 10ktpa.

Planned Project Timeline: Fast-Track to Production



Vulcan's Board and Management

Dr. Francis Wedin – Managing Director

- Founder of Vulcan Zero Carbon Lithium™ Project. Previously Executive Director of successful ASX-listed Exore Resources Ltd (ASX:ERX). Management experience in resources sector on four continents; bilingual; dual Swedish/EU & Australian nationality.
- At Exore, discovered & defined 2 new JORC lithium resources, on two continents, in under a year, including Lynas Find, now part of Pilbara Minerals' Pilgangoora Project in production (ASX:PLS). PhD & BSc (Hons) in mineral exploration & MBA in Renewables.

Gavin Rezos - Chair

- Executive Chair/CEO positions of two 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 and principal of Viaticus Capital. Previously Non-Executive Director of Iluka Resources, Alexium International Group and Rowing Australia.

Dr. Horst Kreuter – CTO Geothermal

- 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

Patrick Burke – Non-Executive Director

- Extensive legal and corporate advisory experience and over the last 10 years has acted as a director for a large number of ASX, NASDAQ and AIM listed companies.
- Legal expertise in corporate, commercial and securities law in particular capital raisings and mergers and acquisitions

Vulcan's World Class Technical Team

Alex Grant, Jade Cove Partners – Lithium Technology Advisor

- Alex co-founded Lilac Solutions, one of the world's leading DLE technology companies based in Silicon Valley.
- Jade Cove is an independent advisor to multiple lithium development projects around the world implementing advanced technologies for production of battery quality lithium chemical products from unconventional resources.
- Alex has an M.S. and B.Eng. In Chemical Engineering from Northwestern University and McGill University, respectively.

GeoThermal Engineering GmbH – Geothermal Energy

- GeoT performs independent planning and consultancy services for geothermal energy projects worldwide.
- The company is based in Karlsruhe, just 20 minutes from the Vulcan site in the Upper Rhine Valley, Germany.

APEX Geosciences – Mineral Resource Modeling

- APEX has over 20 years of diverse geological consulting experience including modeling of lithium rich geothermal brines, a unique subset of lithium resources.
- They specialize in 3D geological modeling and resource estimation, supporting NI 43-101, JORC, and SAMREC compliant technical reporting.

Hatch Engineering – Technical Reports & Process Engineering

- Hatch is a global industry leading lithium/geothermal power consulting company with over 9,000 staff in 70+ offices around the world.
- The company has unique experience with integrated lithium and geothermal projects.

Proud Members of a Leading-Edge Industry

KLiB
Kompetenznetzwerk
Lithium Ionen Batterien

CRMAlliance
Critical Raw Materials

Bundesverband
Geothermie

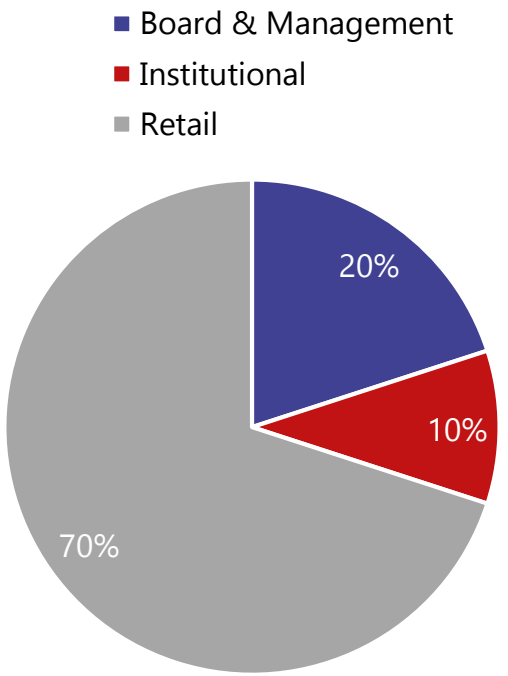
EGEC
GEOTHERMAL

EUROPEAN
BATTERY
ALLIANCE

EBA250
The industrial workstream of
the European Battery Alliance

Capital Structure

ASX : VUL	
Shares on Issue	48,500,002
Options (28.5c expiring in December 2020)	12,687,512
Performance Milestone Shares*	13,200,000
Performance Rights**	6,350,000
Market Capitalization at 16c (undiluted)	~$8M
Enterprise Value at 16c (undiluted)	~$4.2M
Cash Position	~$3.8M
Top 20 Shareholders	~45%
Management (undiluted)	~20%



*Vendor Performance Milestone payments to be made on:
Class A: completion of Scoping Study (4.4M Shares) within 12 months
Class B: completion of Pre-Feasibility Study (4.4M Shares) within 24 months
Class C: securing an offtake or downstream JV partner (4.4M Shares) within 36 months

** 3,750,000 Performance Rights to Viaticus Capital comprising Class D, E and F rights (1.25m each), which vest on the same conditions as above. 2,600,000 Performance Rights comprising 800,000 Class A, 800,000 Class B and 1,000,000 Class C which vest at VUL share price of $0.40, $0.75 and $1.10 respectively.
Refer ASX Announcement 10 July 2019 for further details

Vulcan: A Unique Investment Proposition

World's First & Only Zero-Carbon Lithium™ Process

Agreement with Geothermal Operator to Fast-Track Development

Unprecedented Demand Forecast for Lithium Hydroxide in Europe

World Class Management & Technical Team

Large License Package in Lithium-Rich Upper Rhine Valley

Europe's Largest JORC Lithium Resource

Europe's Most Rapidly Advancing Lithium Project

Most Optimally-Positioned for Supply Chain Security & Footprint Reduction

Premium, Branded Zero Carbon Lithium™ Product

Significantly Undervalued

Appendix 1: Information for Slide 13

Company	Code	Project	Stage	Resource Category	Brine M^3	Resource Grade (mg/l Li)	Contained LCE Tonnes	Information Source
Orocobre	ASX:ORE	Salar de Olaroz	Production	Measured & Indicated	1.8×10^9	690	6.4	Company Presentation 5 May 2014
Lithium Americas	NYSE:LAC	Cauchari-Olaroz, Chile (50% ownership. Thacker Pass not Included)	DFS Complete, Construction Underway	Measured, Indicated & Inferred	7.8×10^9	592	24.6	Resource Statement 7 May 2019
Millennial Lithium	CVE:ML	Pastos Grandes, Argentina	FS Complete	Measured, Indicated & Inferred	2.2×10^9	428	4.9	Resource Statement 31 May 2019

Appendix 2: Information for Slide 14

- 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 Geologiques et Minieres Service Geologique 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 Acro Vol. 51, 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

The Competent Person 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 announcement

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Thank you

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