Transformational Agreement with Major German Utility at Vulcan Zero Carbon Lithium™ Project

Highlights

- MoU agreement signed 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 direct access to lithium-rich, **producing brine operations** neighbouring Vulcan's existing project area without needing to drill a geothermal well
- 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
- Exploration results from well re-sampling in Upper Rhine Valley **expected imminently**, to be used in Vulcan's maiden mineral resource estimate

Vulcan Energy Resources Ltd. ("Vulcan", "VUL", "the Company") is pleased to announce the signing of a Memorandum of Understanding (MoU) with Pfalzwerke geofuture GmbH, part of the German utility Pfalzwerke Group. The MoU constitutes an initial collaboration period, during which Pfalzwerke geofuture will supply live brine and well data from its operational geothermal power plant, for Vulcan to use in its PFS.

A legal Joint Venture (JV) will then be established, under which Vulcan will earn up to 80% of the lithium rights at Insheim by completing a DFS for lithium extraction. The Insheim plant is currently pumping lithium-rich brine[1] to the surface for energy generation, but not processing and extracting the lithium, before the brine is reinjected into the reservoir. As part of this DFS, Vulcan will construct and implement a demonstration plant at Insheim. Following completion of the DFS, Pfalzwerke geofuture can then choose to co-contribute to the construction of a commercial-scale lithium plant on site, or dilute interest to a royalty on lithium production.

Managing Director, Dr. Francis Wedin commented: *"Partnering with the Pfalzwerke group, a well-respected German utility, is a transformational step for the company. It brings our goal of producing a **Zero Carbon Lithium™** hydroxide product in Germany much closer to becoming a reality. We now have access to a lithium-rich, producing geothermal brine operation, so that feasibility studies and potentially first lithium production can be achieved in a much shorter timescale, without the immediate need to drill our own geothermal wells. We look forward to a long and mutually productive relationship with Pfalzwerke geofuture."*

[1] Refer announcement 20/08/2019

ASX Release
26 November 2019
ASX: VUL

Highlights

Large, lithium-rich geothermal brine field, in the Upper Rhine Valley of Germany.

Aiming to be the world's first **Zero Carbon Lithium™** producer.

Strategically located at the heart of the EU auto & Li-ion battery industry.

Fast-track development of project under way, targeting production of lithium hydroxide by 2023.

Corporate Directory

Managing Director
Dr Francis Wedin

Chairman
Gavin Rezos

In-Country Principal
Dr Horst Kreuter

Non-Executive Director
Patrick Burke

Fast Facts

Issued Capital: 48,500,002
Market Cap (@16.0c): $7.8m

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About Pfalzwerke geofuture & Insheim

Pfalzwerke geofuture GmbH is the owner-operator of the Insheim geothermal plant, which has been operating successfully for seven years. Pfalzwerke geofuture is 100%-owned by Pfalzwerke Gruppe. Founded in 1912, Pfalzwerke Gruppe is a German and international energy provider with annual revenue in excess of €1.5 billion. Pfalzwerke Gruppe and its subsidiaries and partners offer solutions for all aspects of electricity and heating. The company is increasing its share of renewable energy sources such as photovoltaic, biomass, geothermal and wind power. With approximately 430,000 private and 20,000 business customers, as well as power supplies to 60 municipalities, Pfalzwerke Gruppe is one of the most important energy supply companies in Germany.

The Insheim plant operates with a thermal water temperature of 165^{o}C, producing a maximum of 4.8 MW_{el} power and 10 MW thermal energy. The plant receives a feed-in-tariff of €0.25/kWh under the EEG (German Renewable Energy Act). The plant can supply around 8,000 households with electricity and 600-800 households with heat.

Currently, brine is pumped up, energy produced and the brine re-injected with no extraction of lithium from the lithium-rich fluids. The agreement with Vulcan allows both parties to potentially extract value from the lithium contained within the brine. The plant has a very small footprint and operates in harmony with its local surroundings (Figure 1). This is a testament to the potential of geothermal wells to service Europe's battery-quality lithium needs, with zero carbon footprint, without the requirement for environmentally and socially undesirable hard-rock mining.

Figure 1: Well and geothermal plant at Insheim, showing small footprint and harmony with local surroundings

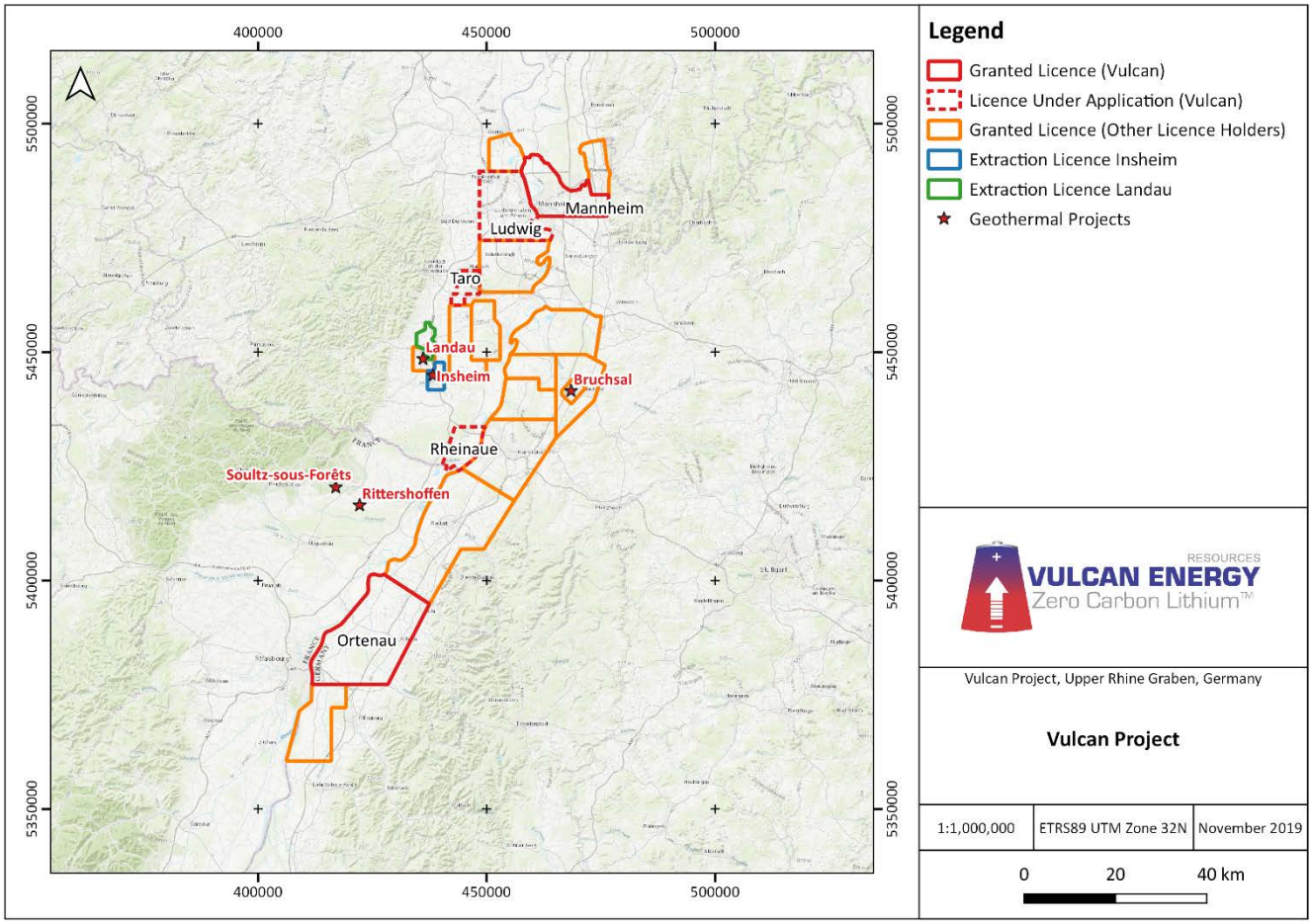


Figure 2: Vulcan Project licenses, showing position of Insheim plant and extraction license

Agreement Terms

The structure of the agreement is as follows:

Initial Collaboration Period

- Vulcan to conduct a PFS involving pilot testwork of the lithium extraction at the Insheim plant, as well as engineering, geological and financial studies.
- Pfalzerke geofuture to provide geothermal plant data and brine prior to re-injection, necessary for processing testwork.

Joint Venture Period

- Legal JV to be established for the lithium production project at the Insheim plant. Vulcan to have initial 0% JV interest, full expenditure responsibility and management control of the lithium project.
- Vulcan to build and implement a demonstration plant to test enrichment on site under the conditions of the operating geothermal plant. Vulcan to conduct a DFS for lithium production at the plant.
- On successful completion of the DFS, Vulcan will be deemed to have earned up to 80% JV interest in the lithium rights at Insheim.

- On successful completion of the DFS, a commercial extraction plant may be built on site to start the production of lithium from the enriched brine. The plant can be financed by both parties on a pro rata basis, otherwise Pfalzwerke geofuture can elect to be diluted using an industry standard formula, to a non-dilutionary 2.5% net profits royalty on lithium production.

All terms of the agreement are binding on the legal JV being established.

Figure 3: Joerg Uhde, CEO of Pfalzwerke geofuture, at the Insheim plant with the Vulcan Board and management team

Vulcan Project Summary: Unique Zero-Carbon Lithium™ Production

World-first unique process to satisfy car manufacturers' stated desire for zero carbon Battery Electric Vehicle (BEV) raw materials supply chain.

Potentially the Largest Lithium Project in EU & one of the Largest in the World

Recent JORC Exploration Target 10.73-36.20 Million Tonnes Contained Lithium Carbonate Equivalent (LCE)

Secure Domestic Lithium Supply for EU

Auto industry and governments determined to reduce key threat of security of supply and reliance on China

First Lithium Brine Project in EU

Ultra-low impact, recent precedent for permitting wells in region with widespread social acceptance

Accelerated Path to Production

Agreement with Pfalzwerke geofuture allows access to operational geothermal brine plant

The **Vulcan Zero Carbon Lithium™ Project** is aiming to be Europe's and the **world's first Zero Carbon Lithium™ project**. It aims to do achieve this by producing **battery-quality lithium hydroxide** from hot, sub-surface geothermal brines pumped from wells, with a renewable energy by-product fulfilling all processing energy needs. The Vulcan Zero Carbon Lithium™ Project is strategically located, within a region well-serviced by local industrial activity, at the heart of the European auto and lithium-ion battery manufacturing industry, just 60km from Stuttgart. The burgeoning European battery manufacturing industry is forecast to be the world's second largest, with currently zero domestic supply of battery grade lithium products. The Company is concluding a Scoping Study at the project and is targeting a maiden JORC resource during Q4 2019.

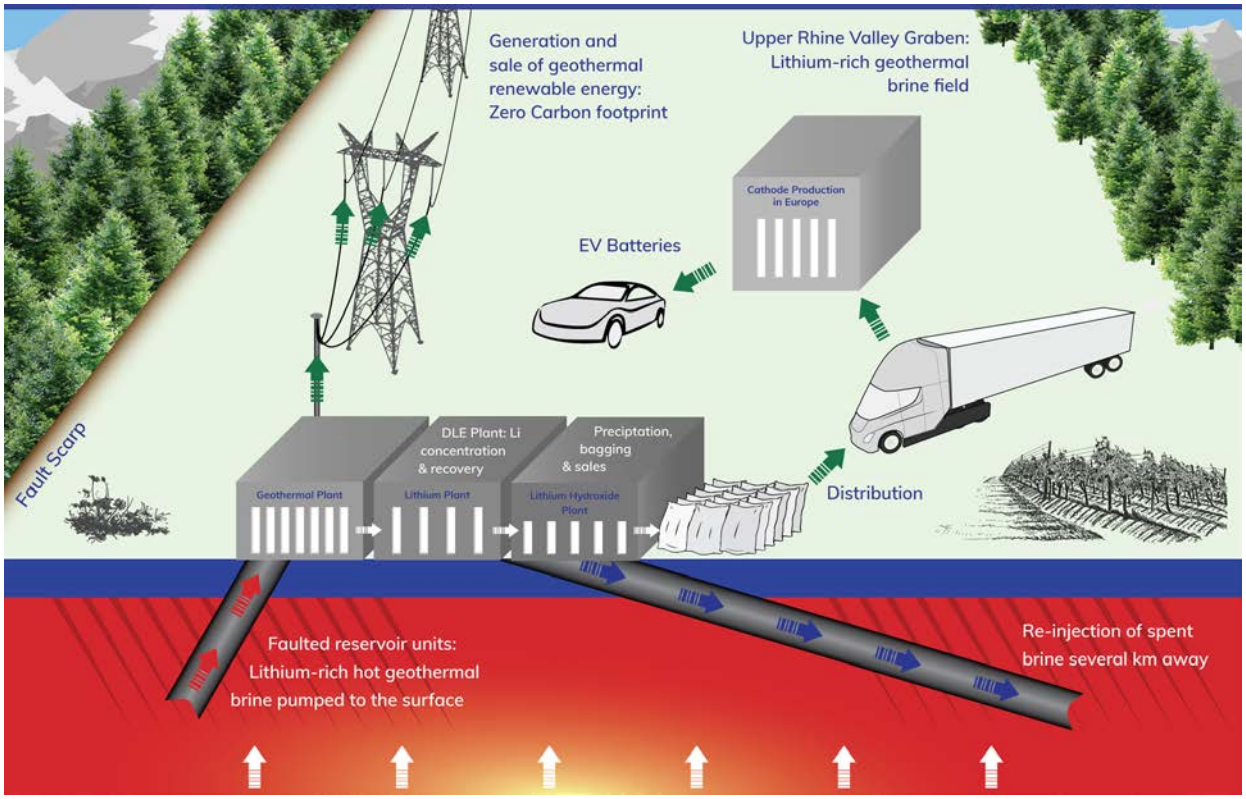


Figure 4: Schematic of the Zero Carbon Lithium project

Why Vulcan? Zero Carbon Supply Chains Required

BEV raw material supply chains have a carbon footprint problem, producing more CO_2 during production than Internal Combustion Engines (ICE). Car manufacturers are actively trying to reduce the carbon footprint of their battery supply chains to bolster the credibility of their BEV offerings. This will enable them to avoid financial emissions penalties and obtain premium pricing for lowest carbon footprint in production. Volkswagen, among others, is placing great importance on having a CO_2-neutral production supply chain for its very extensive new EV line-up, with a raw materials purchasing metric for sustainability put on par with price[2], and the goal of producing net zero carbon BEVs as delivered to the customer.

The European Commission is following suit, recently flagging that "CO_2 Passports" will be issued to BEVs detailing the full CO_2 footprint of each battery. The aim is to differentiate EU lithium-ion battery and BEV production, by producing uniquely low CO_2 products. High cost to offset CO_2 footprint of current lithium supply chain

Currently, there is no "zero carbon" lithium chemical product in the world, since all current extraction, processing and transport routes are very carbon intensive.

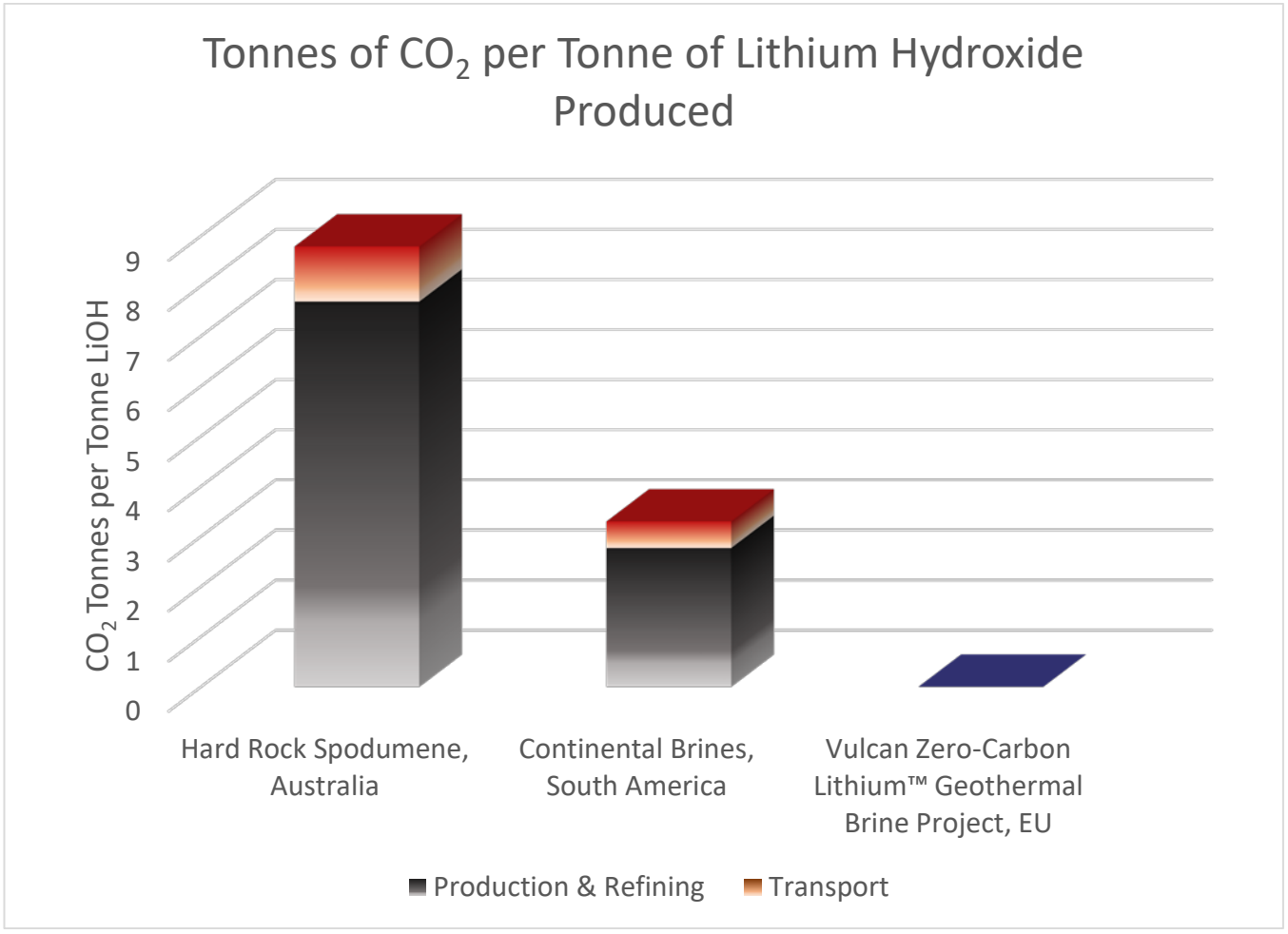


Figure 5: CO_2 footprint of lithium sources relative to Vulcan Zero Carbon Lithium™ Project[3]

[2] Volkswagen ID presentation, 2019
[3] See VUL Presentation 16/10/19

Why Vulcan? Lithium Supply Chain Problematic

Hard-rock lithium production has a high OPEX and high CO_2 footprint due to its inherent energy requirement for mining, crushing and processing to producing battery quality lithium chemicals, as well its transport distance to major global markets. A processing bottleneck has also developed for spodumene concentrate going through lithium refinery plants in China, creating downward pressure on concentrate prices.

South American lithium brine operations make up the balance of current production. Because of their distance to market, remoteness and substantial use of reagents from North America, there is a substantial CO_2 footprint inherent in these operations also. These operations can also be very slow and unreliable in terms of producing battery quality lithium chemicals, as the evaporation process makes them vulnerable to weather events. The evaporation can also cause stresses on local environment and communities.

In parallel with this, there is an unprecedented ramping up of lithium-ion and associated cathode production in Europe. Forecasts show that the European Union (EU) is set to require the equivalent of the entire current global battery quality lithium demand by the mid-2020s, with 2023 being the main inflection point. There is currently zero EU production of battery-quality lithium hydroxide, let alone a CO_2-neutral product. A severe battery-quality lithium chemical supply shortfall is thus developing in the EU.

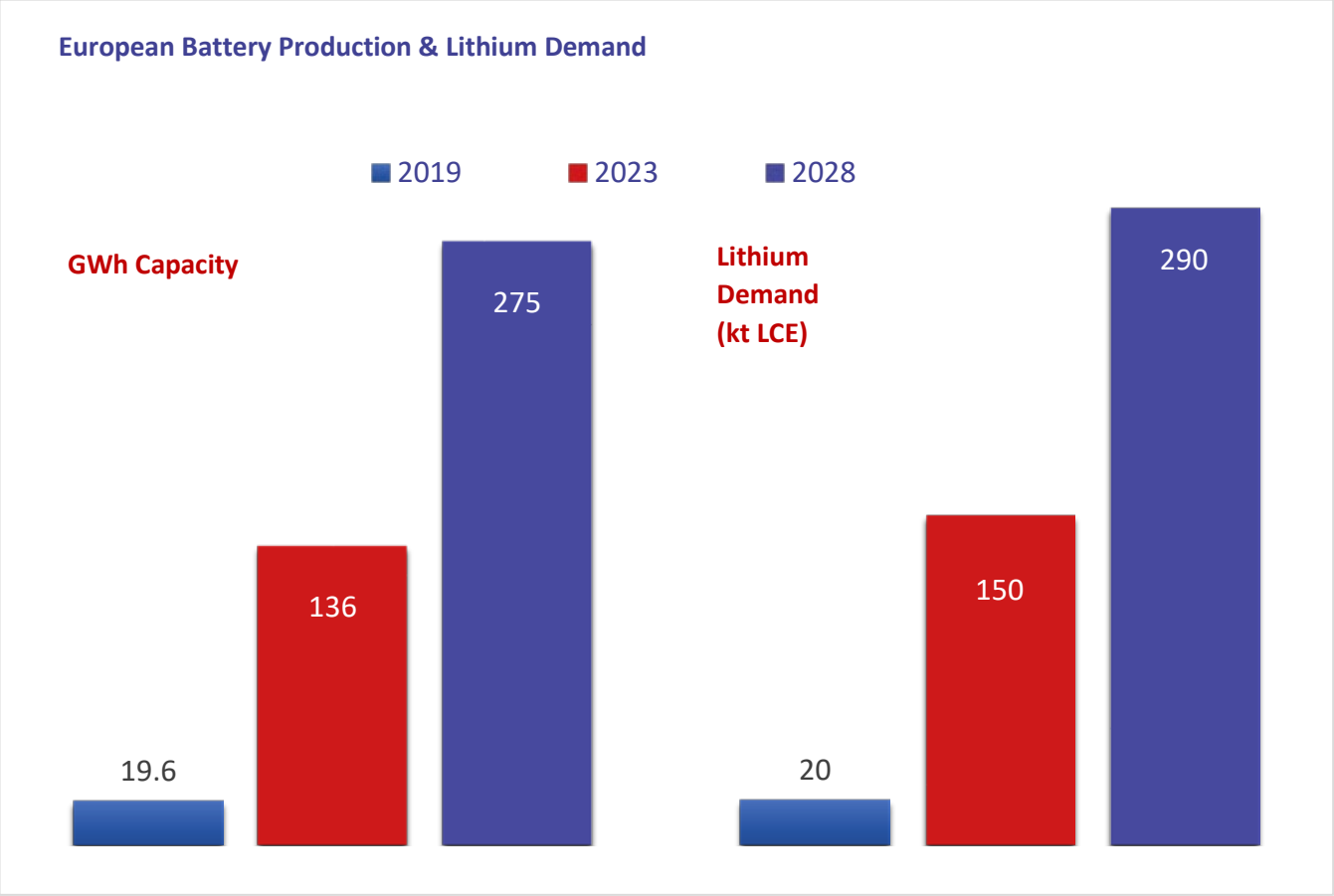


Figure 6: Forecast battery production in EU and associated lithium demand[4]

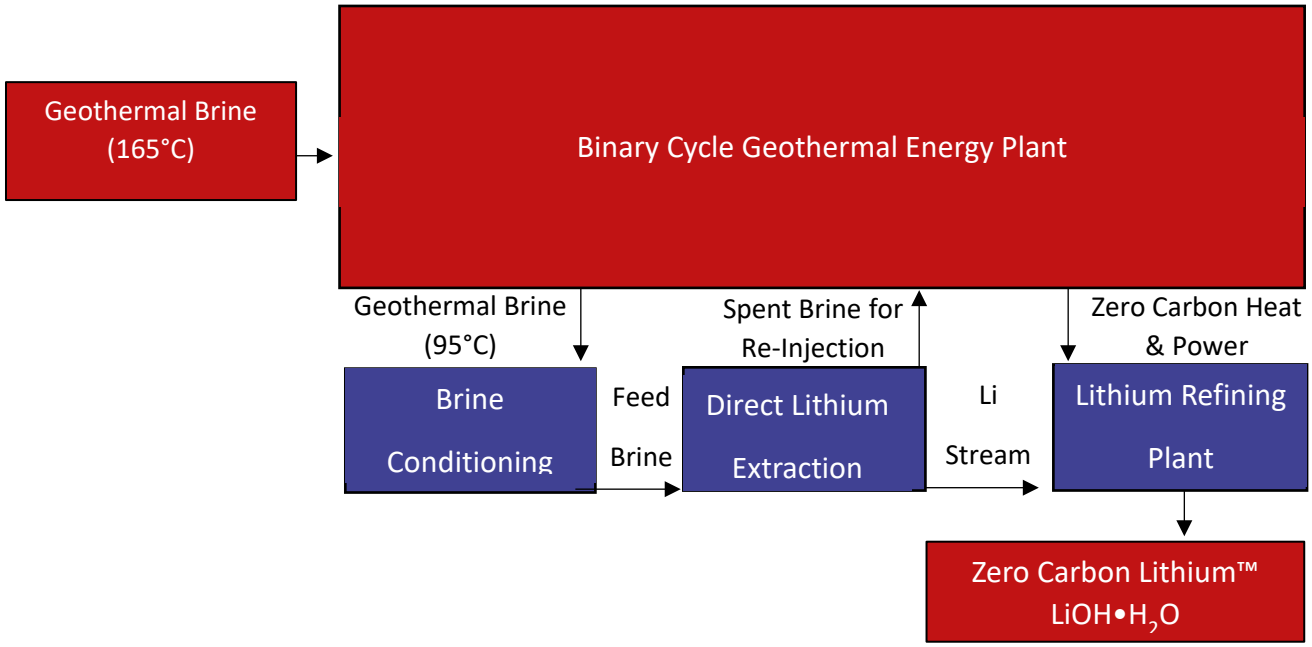
[4] See VUL Presentation 16/10/19

Premium, Peerless & Disruptive Solution: Zero-Carbon Lithium™: Vulcan Project, Germany

The Company believes that the solution lies in the **Vulcan Zero Carbon Lithium™ Project.** This comprises a very large, lithium-rich geothermal brine field in the Upper Rhine Valley of South-West Germany, in the heart of the EU's battery "giga-factory" production.

The Zero Carbon Lithium™ production stems from a clever, unique process:

1. Standard geothermal production wells will be drilled into high flow rate, lithium-rich brine reservoir units, including the Buntsandstein unit. Geothermal energy wells have been successfully doing this for decades in the Upper Rhine Valley, so there is strong precedent. The heated brine is pumped up and produces geothermal energy via a binary cycle plant, which emits no CO_2.
2. Usually the spent brine would then be re-injected into the reservoir. In the Vulcan process, the spent brine gets diverted through a Direct Lithium Extraction (DLE) plant, where the vast majority of the lithium is extracted in less than an hour, while leaving other impurities. The brine is then re-injected into the reservoir minus the lithium. A new lithium stream of much higher concentration is formed for further processing and nothing is added to the brine. Livent has used a similar process to produce LiOH•H2O from Argentine brine for over 30 years. Importantly, such technologies have been successfully tested in California for the Salton Sea geothermal lithium field, which has similar brine characteristics to the Upper Rhine Valley brine, meaning a similar process can be used. Vulcan will fast-track project development through its relationships with the most successful groups in the DLE industry who have already de-risked the methods used.
3. A series of chemical operations convert the lithium stream into battery quality lithium hydroxide using conventional processes all previously demonstrated at commercial scale. Water is recycled, no toxic wastes are produced, and no gases are emitted. Heat and power from the geothermal plant are used, meaning no fossil fuels are burned, eliminating carbon emissions from lithium hydroxide processing. On top of being a zero-carbon product, it is expected that the Vulcan flowsheet will be a very low cost LiOH•H2O operation.



Vulcan Project, Germany: Location, Location, Location

The **Vulcan Zero Carbon Lithium™ Project** is situated within one of the most well-studied and well-explored graben basins in the world. This means that the lithium-rich brine in the field is very well understood, and large amounts of seismic and geochemical data are readily available, reducing the need for exploration time and spend. Drilling data and existing wells are also available and can be used to shortcut project development. Based on historical data, the Upper Rhine Valley brines have been shown to have grades in the same order of magnitude as typical South American salars, in the hundreds of ppm Li, but with the advantage of readily available heat and power. Commonly, grades are >150mg/l Li in the Upper Rhine Valley at the depths targeted, with grades sometimes up to 210mg/l Li. The means that the Upper Rhine Valley brine field is one of the only geothermal brines in the world, the Salton Sea in California being the other main example, with both high flow rates and lithium grades within the brine reservoir. The Vulcan project represents a dominant license landholding within this brine field.

Importantly, as well as being European, the project is just 60km away from Stuttgart, the major centre of the German auto-industry. It is perfectly placed to reduce the transport footprint of lithium chemicals down to almost negligible amounts, both from a carbon cost and direct financial cost perspective. In addition, existing and recently permitted geothermal operations within the area are testament to the social and environmental acceptance of drilling geothermal wells within the region, in contrast with hard rock mining projects elsewhere in Europe. Indeed, the Insheim geothermal operation, which is the subject of Vulcan's MoU with Pfalzwerke geofuture, is surrounded by vineyards, showing the harmony of such operations with local communities.

Figure 7: Vulcan Zero Carbon Lithium™ Project Location

For and on behalf of the Board

Mauro Piccini

Company Secretary

For further information visit www.v-er.com

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