VULCAN ENERGY RESOURCES
Zero Carbon Lithium™

Largest JORC Lithium Resource in Europe

Vulcan Zero Carbon Lithium™ Project

Highlights

- Maiden Mineral Resource Estimation completed at the Vulcan Lithium Brine Project, in the Upper Rhine Valley of Germany
- Total Inferred Mineral Resource of **13.2 Mt of contained Lithium Carbonate Equivalent**, at a lithium brine grade of 181 mg/l Li.
- Vulcan is now **the largest JORC-compliant Lithium Resource in Europe** by a considerable margin; a **globally significant lithium brine resource**
- Maiden Mineral Resource Estimate calculated on just one of the five licence areas within the Vulcan Project, majority of exploration licence areas remain as future "upside"[1]
- Resource being incorporated into Scoping Study, due Q1 2020.
- With COP25 announcing Climate Emergency "at the point of no return", Vulcan is **leading the industry** with **its Zero Carbon Lithium™** Project.

Vulcan Energy Resources Ltd. ("Vulcan", "VUL", "the Company") is pleased to announce the completion of the maiden Mineral Resource Estimate for its Ortenau licence within the Vulcan Lithium Project, in the Upper Rhine Valley of South-West Germany, which has been compiled using the guidelines provided by the 2012 JORC Code. The Inferred Mineral Resource Estimate for the brine has been calculated at **13.2 Mt of contained LCE**, at a lithium brine grade of 181 mg/l Li, average porosity of 9.5% and lower cutoff of 100 mg/l Li. Europe's other JORC-compliant lithium resources in Europe include European Metals' Cinovec, at 7.17 Mt LCE, Rio Tinto's Jadar, at 6.24 Mt LCE, Infinity Lithium's San Jose at 1.68 Mt LCE and Savannah Resources' Barroso at 0.71 Mt LCE, all hard-rock projects[2].

Managing Director, Dr. Francis Wedin commented: *"Vulcan's Maiden Mineral Resource Estimate, on just <u>one</u> of the licence areas within the Vulcan Project, elevates us into becoming a globally significant lithium project. It also shows the potential for the Vulcan Project to be a primary source for the burgeoning European battery industry's lithium hydroxide needs, via a low-impact, **Zero Carbon Lithium™** process powered by and sourced from geothermal wells. This comes at an opportune time, as we enter a period where Europe is forecast to dwarf China's growth in demand for lithium hydroxide in Europe as part of the transition to electric vehicles, but with currently only high carbon emission sources of lithium hydroxide available to cathode and battery manufacturers."*

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[1] See ASX VUL announcement 20/08/2019
[2] See Appendix Two; includes some higher-confidence categories of resource

ASX Release
4 December 2019
ASX: VUL
FRA: 6KO

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.

Access agreement in place with German geothermal operator at **producing plant**

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

Corporate Directory

Managing Director
Dr Francis Wedin

Chairman
Gavin Rezos

CTO Geothermal
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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JORC 2012 Mineral Resource Estimate

The Vulcan Project is located within the Upper Rhine Graben of southwestern Germany, which is characterised as a Cenozoic graben, that is basin-filled with Permian to Tertiary sedimentary rocks and Quaternary surficial deposits. The Lower-Middle Buntsandstein Formation aquifer, which is the focus of this News Release and maiden resource estimation, overlies the crystalline Palaeozoic basement in a package of Permian-Triassic sedimentary rocks. The Buntsandstein Formation is dominated by sandstone and forms an aquifer that underlies all five Vulcan Property Exploration Licences. The Buntsandstein Formation aquifer varies in thickness between the Vulcan Property licences with a mean thickness in the Ortenau licence of 394 m. Recent German Government policy emphasizes conservation and promotes the development of renewable sources. Consequently, emphasis on stratigraphically deep geothermal wells in the Upper Rhine Graben has created access points to acquire deep, geothermally heated, lithium-enriched brine associated with the Buntsandstein Formation sandstone aquifer and Permo-Triassic strata sitting on top of the crystalline basement. To verify historical geochemical analysis of the Buntsandstein Formation brine, which yielded an average lithium concentration[3] of 158 mg/l Li, Vulcan conducted a 2019 data compilation and brine sampling program. This work consisted of:

1. A geological compilation and subsurface review of the Buntsandstein Formation stratigraphy toward development of a three-dimensional geological model;

2. An assessment of the hydrogeological conditions underlying the Vulcan Property; and

3. Analysing Buntsandstein Formation brine samples from Property-neighbouring geothermal wells to verify historical Li-brine geochemical results in the vicinity of the Vulcan licences.

The three-dimensional geological modelling was completed by APEX Geoscience Ltd. (APEX) who conducted due diligence reviews to validate cross-sections created by GeORG (GeORG project, in cooperation with Landesamt für Geologie, Rohstoffe und Bergbau, Baden-Württemberg) from seismic data, which were used as the basis for the subsurface model. The hydrogeological assessment was conducted by Dr. Michael Kraml of Geothermal Engineering GmbH in Karlsruhe, Germany, using publicly available information and geothermal and basin geology knowledge. The geochemical analytical work was completed by independent university laboratories (University of Heidelberg and University of Karlsruhe), and an accredited commercial laboratory (AGAT Laboratory in Edmonton, AB). The average lithium content from brine collected by Vulcan from three geothermal wells located throughout the Upper Rhine Graben and proximal to the Ortenau licence was 181 mg/L Li (n=13 total metal analysis by ICP-OES[4]).

One of the five Vulcan Project licences (Ortenau) has been assessed for the resource modelling and estimation. The resource area is confined to the Buntsandstein Formation sandstone aquifer domain underlying the Ortenau Licence. The maiden Vulcan lithium-brine resource estimation was conducted in consideration of, and in accordance with JORC (2012). Statistical analysis, three-dimensional (3-D) modelling and resource estimation was prepared by APEX and Mr. Eccles, M.Sc. P. Geol. of APEX reviewed all work and takes responsibility for the maiden resource estimation. The workflow implemented for the calculation of the Vulcan lithium-brine resource estimations was completed using the commercial mine planning software MICROMINE (v 18.0).

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[3] See ASX VUL announcement 20/08/2019
[4] See ASX VUL announcement 2/12/2019

Critical steps in the determination of this Inferred Vulcan Li-Brine Resource Estimate included:
1) definition of the geometry and volume of the Buntsandstein Formation aquifer domain;
2) hydrogeological characterization of the specific yield, or in the case of the confined aquifer, the average effective porosity;
3) calculating the total volume of *in situ* brine; and
4) determination of the concentration of lithium within the brine and at the Ortenau licence.

The Buntsandstein Formation aquifer represents a large-scale aquifer that is bound by two aquitards (subject to fracture zones that could form hydraulic connections in the strata overlying, and including, the crystalline basement). The average effective porosity of the Buntsandstein Formation within the URG and the Ortenau Licence is 9.5%. The porosity determination benefited from evaluating over 300 measurements of effective porosity from core and outcrop analysis, and total porosity from wireline well log data, located throughout the URG. Geothermal projects in the Upper Rhine Graben have documented sufficiently high flow rates (>50 L/s) within fault zones associated with the Buntsandstein Formation and the underlying crystalline basement. These structural sub-domains within the Buntsandstein Formation represent key determinants for locating zones of high fluid flow. The 3-D models created for the Ortenau licence shows that the licence was deliberately targeted by Vulcan for its high degree of faulting, and the Competent Person reasonably assumes that the licence could have high fluid flow potential within the Buntsandstein Formation aquifer.

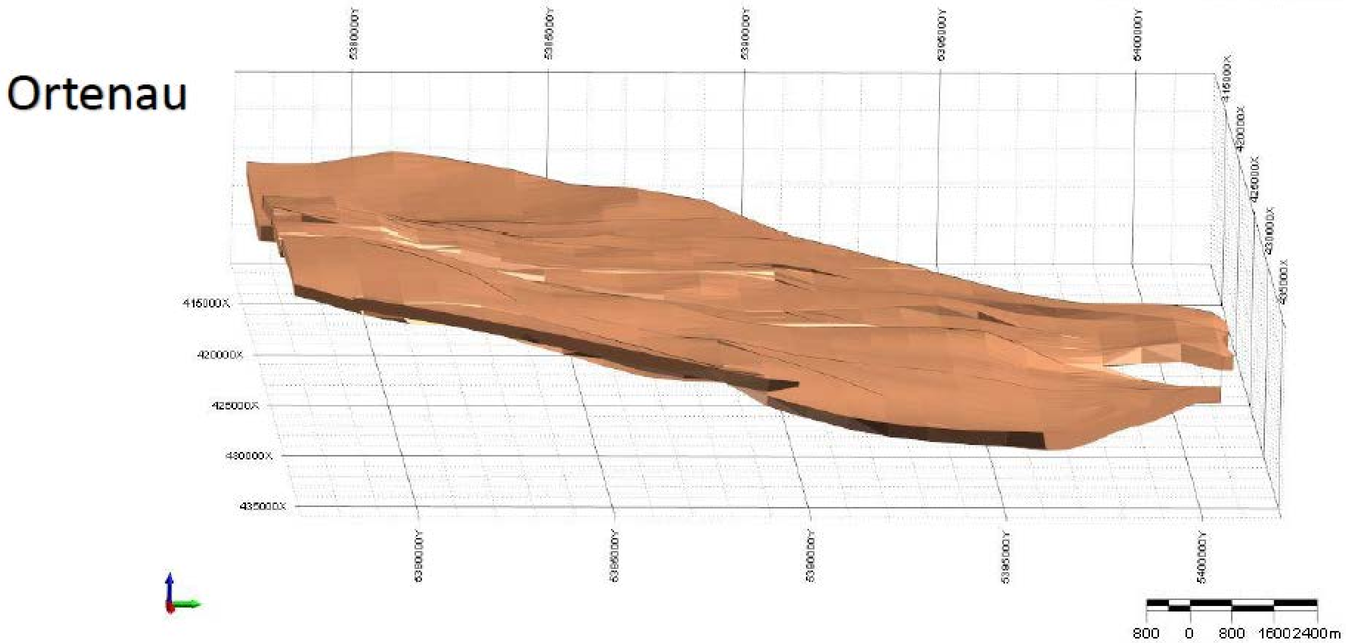


Figure 1: Oblique view of the 3-D models for the Ortenau resource area with zero vertical exaggeration. The model has been clipped to the Ortenau Licence boundary.

A lower cutoff of 100 mg/L Li is used in this Li-brine resource estimation. It is the opinion of the Competent Person that this cutoff is acceptable because:
1) confined aquifer deposits traditionally have lower concentrations of lithium (in comparison to unconfined lithium-brine salar and hard rock lithium deposits), and
2) numerous commercial, academia and independent laboratories are now experimenting with rapid lithium extraction techniques using low lithium concentration source brine.
The resource estimation presented in this report is presented as a total (or global value), and was estimated using the following relation in consideration of the Buntsandstein Formation aquifer domain within the Ortenau licence,

or resource area: *Lithium Resource = Total Volume of the Brine-Bearing Aquifer X Average Porosity X Average Concentration of Lithium in the Brine.*

The maiden Inferred Vulcan Li-Brine Resource at the Ortenau Licence is estimated at 2.48 million tonnes of elemental Li (see Table 1). The total lithium carbonate equivalent (LCE) for the main resource is 13.23 tonnes LCE.

Table 1: Maiden Inferred Vulcan Li-Brine Resource Estimate of lithium-bearing brine within the Buntsandstein Formation aquifer domain at the Ortenau Licence.

Reporting Parameter	Value
Aquifer Volume (km3)	**144.489**
Brine Volume (km3)	**13.726**
Average Lithium Concentration (mg/L)	**181**
Average Effective Porosity	**9.50**
Total Contained Elemental Li Resource (Tonnes)	**2,484,000**
Total Contained LCE Tonnes	**13,225,000**

Note 1: Mineral resources are not mineral reserves and do not have demonstrated economic viability.
Note 2: The weights are reported in metric tonnes (1,000 kg or 2,204.6 lbs). Numbers may not add up due to rounding of the resource values percentages (rounded to the nearest 1,000 unit).
Note 3: The total volume and weights are estimated at average porosities of 9.5%.
Note 4: The Vulcan Li-brine Project estimation was completed and reported using a lower cutoff of 100 mg/L Li.
Note 5: In order to describe the resource in terms of industry standard, a conversion factor of 5.323 is used to convert elemental Li to Li_2CO_3, or Lithium Carbonate Equivalent (LCE).

Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no guarantee that all or any part of the mineral resource will be converted into a mineral reserve. While it would be reasonable to expect that most of the Inferred Mineral Resources would upgrade to Indicated Mineral Resources with continued exploration, due to the uncertainty of Inferred Mineral Resources it should not be assumed that such upgrading will always occur. There is no direct link from an Inferred Mineral Resource to any category of Ore Reserves. The Vulcan Lithium-Brine Project is an early stage project. The Company has yet to conduct bench-scale test work but has contracted Hatch and Jade Cove Partners to consult on engineering work that includes: 1) lithium plant design; 2) an economic scoping study; and 3) directing lithium extraction process test work that involves a combination of the selective absorption and lithium hydroxide production techniques.

A generalized process flowsheet of Vulcan's model to derive *zero-carbon lithium*™ hydroxide from the Vulcan Property and the Buntsandstein Formation aquifer is presented in this document along with risks, uncertainties and mitigation strategies, as they pertain to process operations associated with extracting lithium-from-brine in conjunction with geothermal production in Appendix 1 of this news release. The Vulcan Lithium-Brine Project has reasonable prospects for eventual economic extraction based on aquifer geometry, brine volume, brine composition, hydrogeological characterization, porosity, potential for brine access and extraction methods, and fluid flow.

This lithium-brine mineral resource has been prepared by a multi-disciplinary team that include geologists, hydrogeologists and chemical engineers with relevant experience in the Buntsandstein Formation brine geology/hydrogeology and Li-brine processing. There is collective agreement that the Vulcan lithium-brine project has reasonable prospects for eventual economic extraction, and the author, Mr. Eccles P. Geol. takes responsibility for this statement.

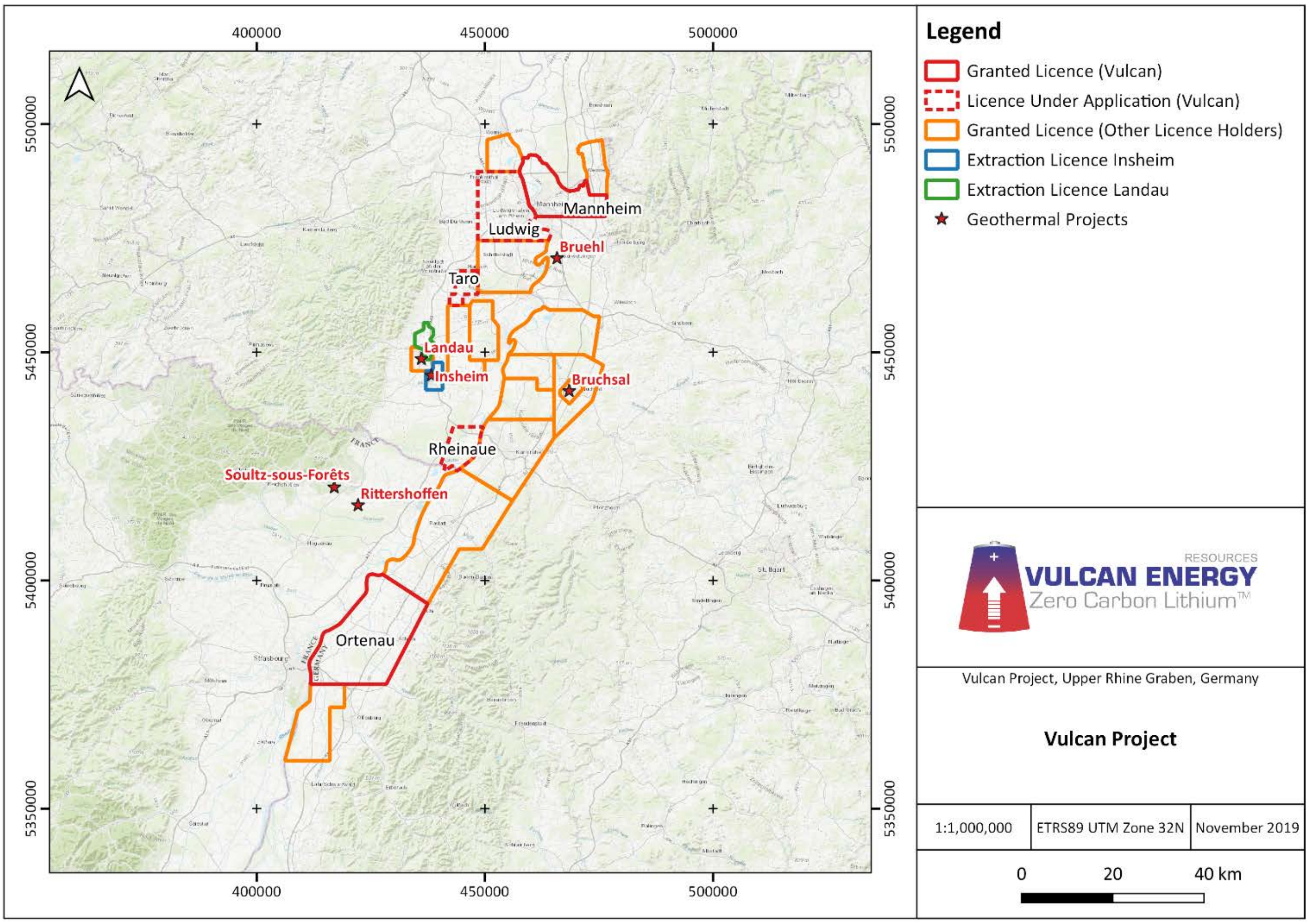


Figure 2: Vulcan Project licences, showing location of Ortenau licence.

Vulcan Project Summary: Unique Zero-Carbon Lithium™ Production

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, on track for completion Q1 2020, and is targeting initial commercial production by 2023.

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

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

Europe's Largest JORC Lithium Resource

Recent JORC Mineral Resource Estimate 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/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 the European way, from renewable energy-producing geothermal brine wells rich in Li.

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.

Unprecedent 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.

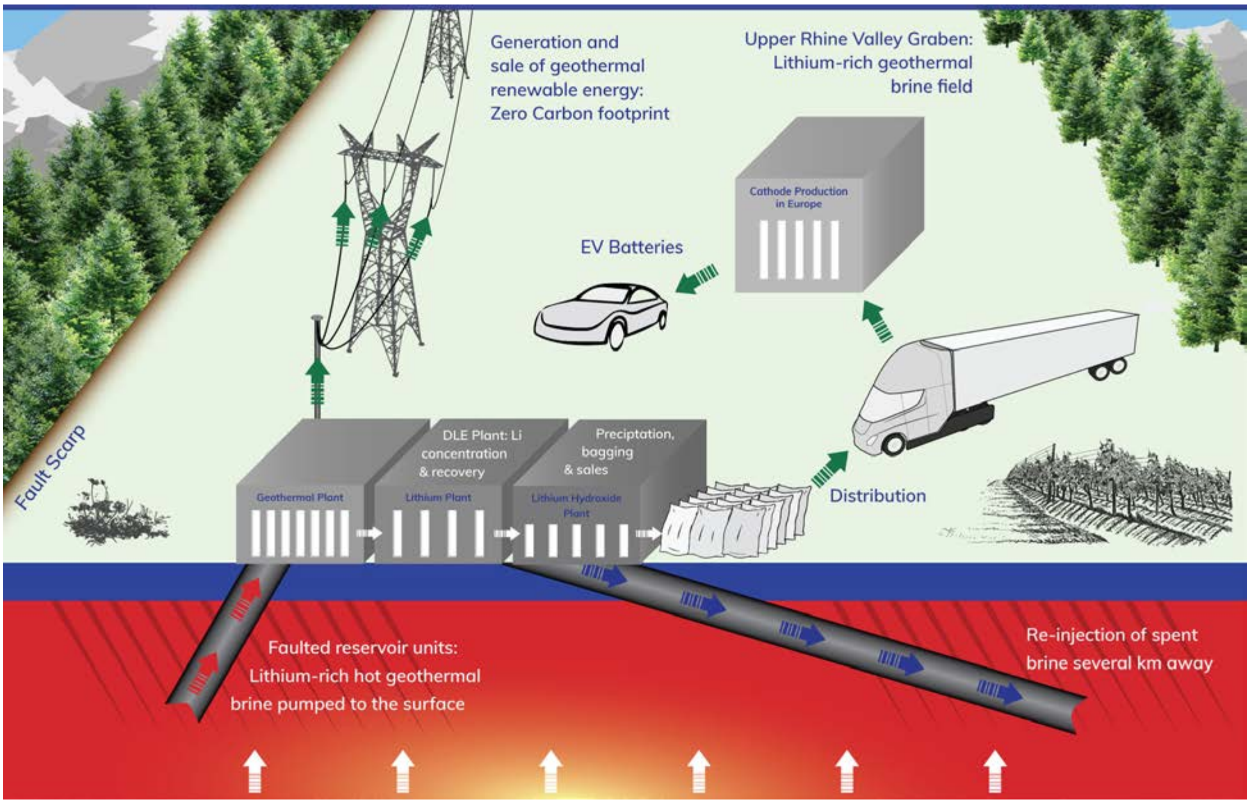
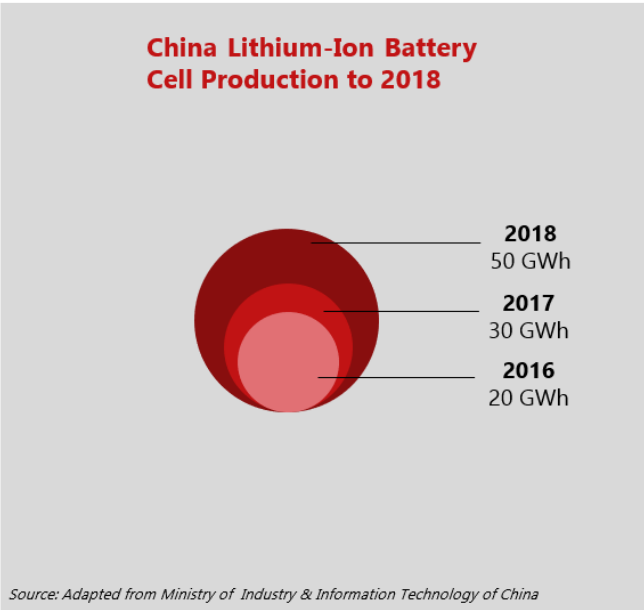


Figure 3: Schematic of the Zero Carbon Lithium project

Unprecedented Demand for Lithium in Europe - The Next 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 larger scale.**
- "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).

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.



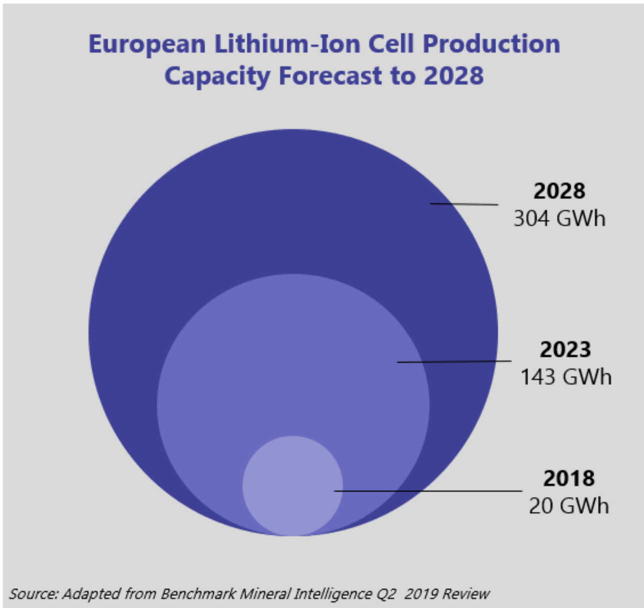


Figure 4: Forecast battery production in EU and associated lithium demand[5]

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[6], and the goal of producing net zero carbon BEVs as delivered to the customer.

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[5] See VUL Presentation 4/12/19

[6] Volkswagen ID presentation, 2019

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. The EU has declared a climate emergency and aims to cut 55% of emissions by 2030, net zero by 2050. Currently, there is no "zero carbon" lithium chemical product in the world, since all current extraction, processing and transport routes are very carbon intensive. 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.

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.

The world's conventional lithium supply chains are not geared towards low carbon intensity production, so Europe will need to build its own.

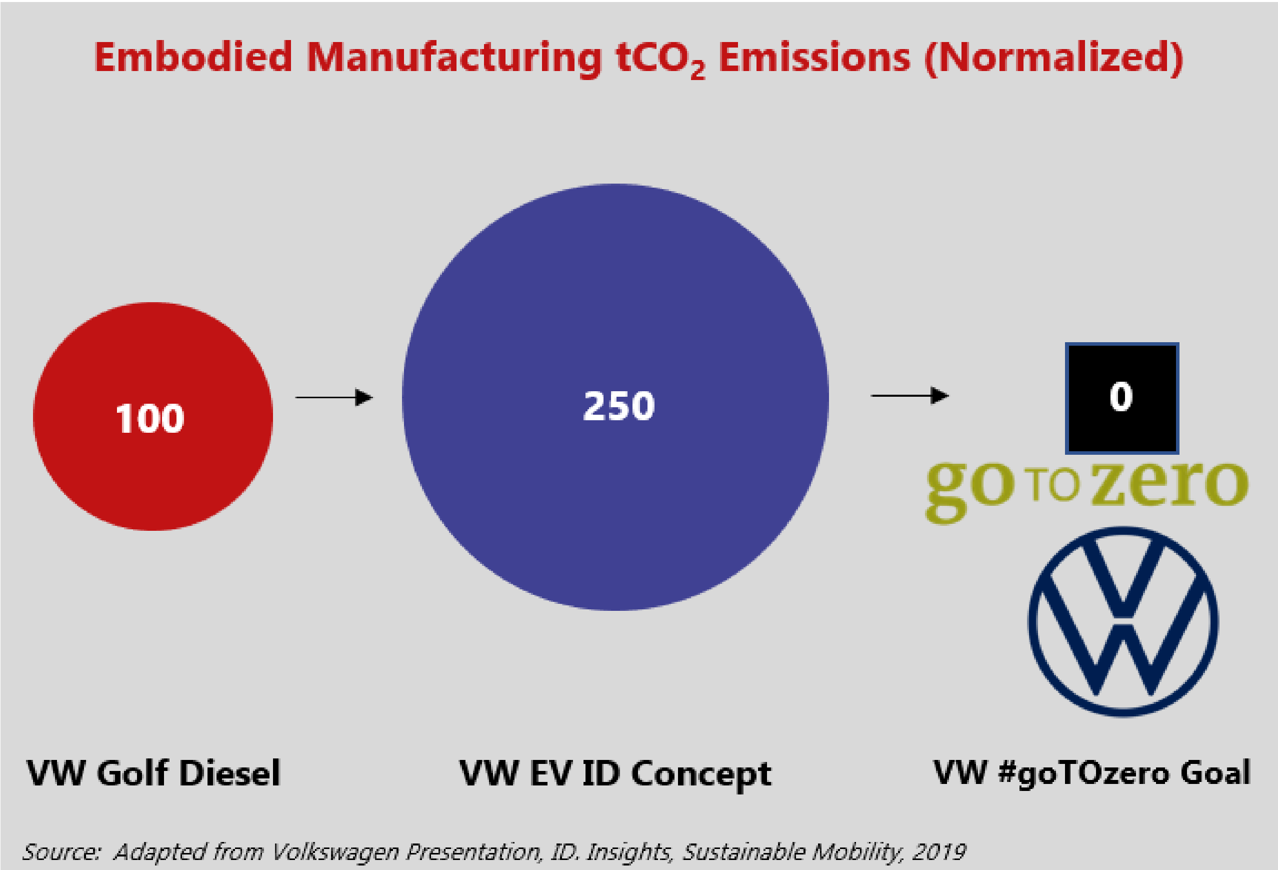

Figure 5: EVs' carbon problem, and the industry goal to fix the problem

The Solution: Vulcan's Zero Carbon Lithium™ Project

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.

Summary

- Unique flowsheet developed by Vulcan, making use of **binary cycle geothermal electricity & heat** to create a **Zero Carbon Lithium™ product.**
- De-risked Direct Lithium Extraction (DLE) process to produce LiOH•H2O 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.
- 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•H_2O.**
- Excess **power will be sold** at a Feed-in-Tariff of €0.252/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.

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.

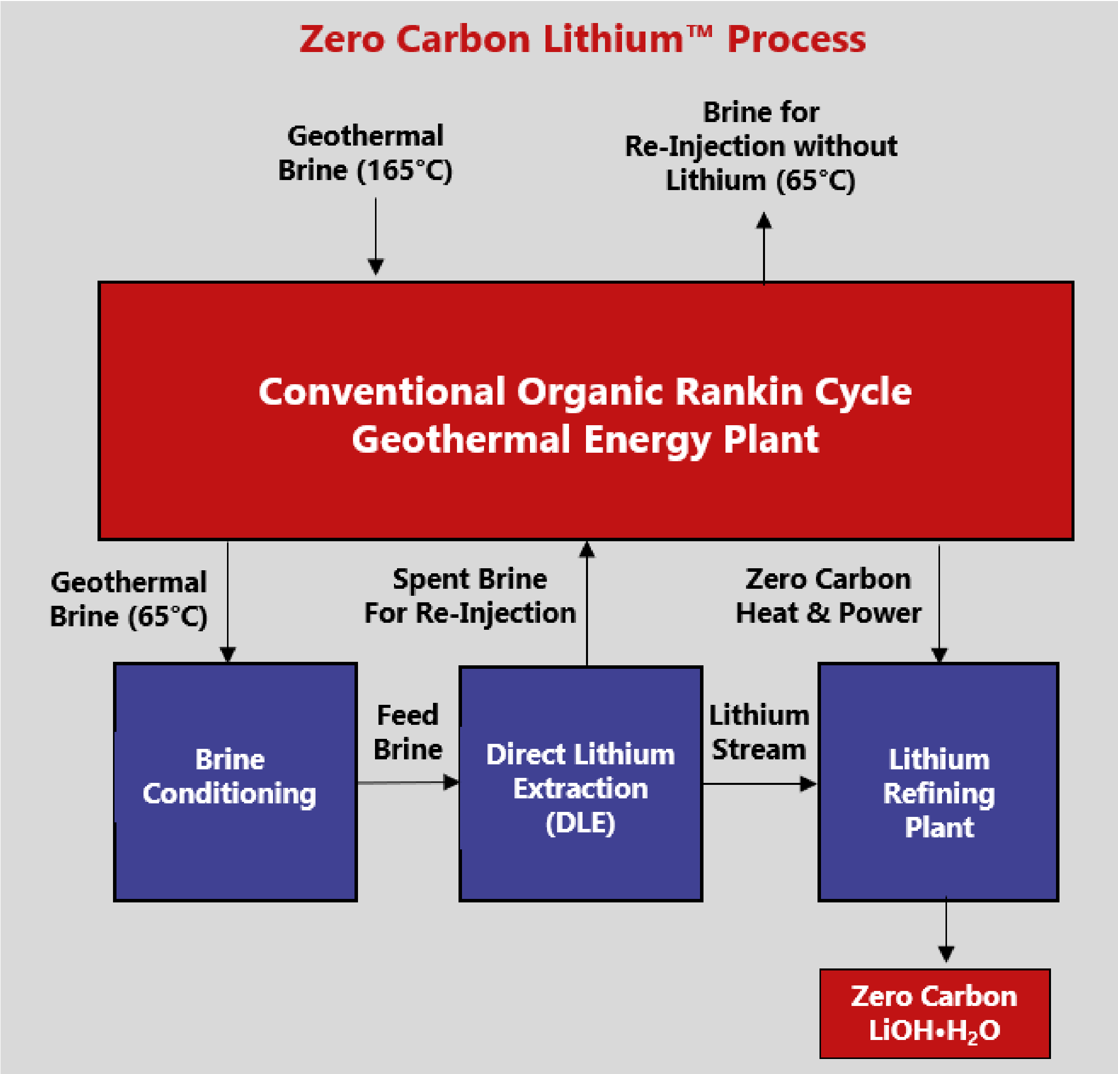

Figure 6: Vulcan's Zero Carbon Lithium™ process

Independently Verified Zero Carbon Credentials: World First

Independent studies by Minviro 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.

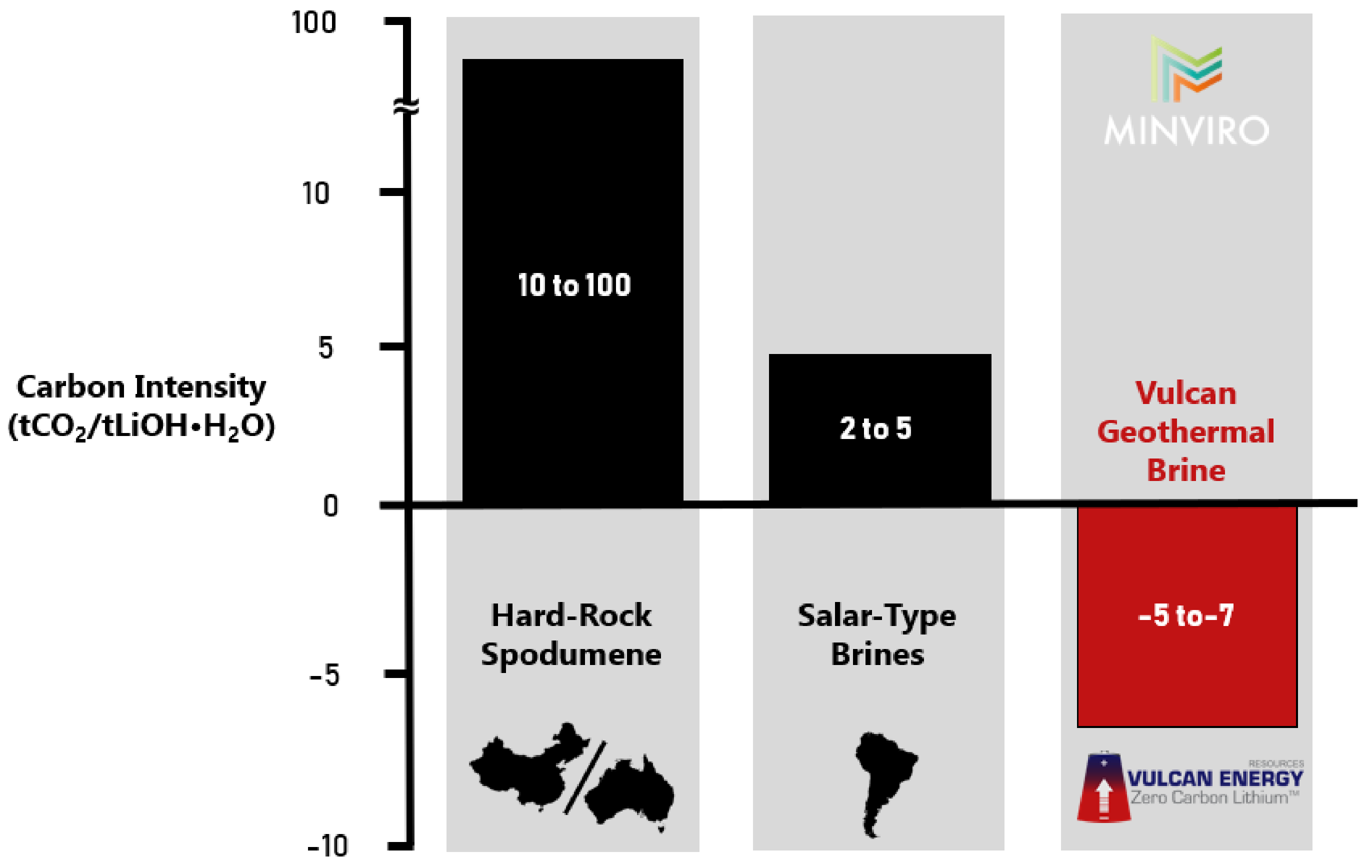

Figure 7: CO_2 footprint of lithium sources relative to Vulcan Zero Carbon Lithium™ Project[7]

[7] See VUL Presentation 16/10/19

Vulcan Project, Germany: Strategic Location, Large License-Holding

Summary

- 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.
- 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.

The **Vulcan Zero Carbon Lithium™ Project** is situated within one of the most well-studied and well-explored graben systems 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 licence landholding within this brine field.

Importantly, as well as being European, the project is just 60km away from Stuttgart, the home 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.

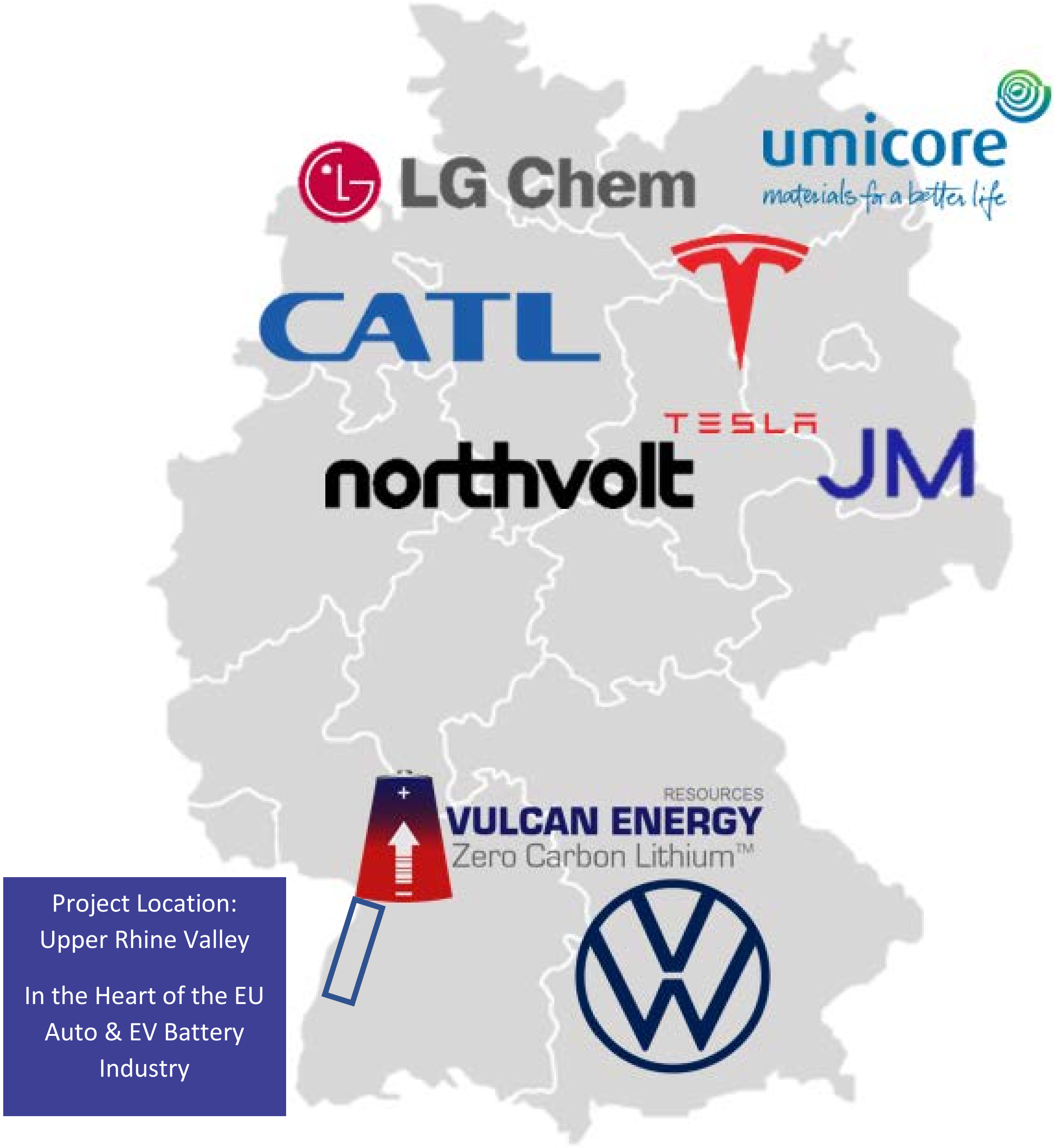

Figure 8: Vulcan Zero Carbon Lithium™ Project Location

German Utility Partnership: Shortcut to Development

Summary

- 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.

Figure 9: Insheim plant, showing harmony with local surroundings

For and on behalf of the Board

Mauro Piccini

Company Secretary

For further information visit www.v-er.com

Disclaimer

Some of the statements appearing in this announcement may be in the nature of forward-looking statements. You should be aware that such statements are only predictions and are subject to inherent risks and uncertainties. Those risks and uncertainties include factors and risks specific to the industries in which Vulcan operates and proposes to operate as well as general economic conditions, prevailing exchange rates and interest rates and conditions in the financial markets, among other things. Actual events or results may differ materially from the events or results expressed or implied in any forward-looking statement. No forward-looking statement is a guarantee or representation as to future performance or any other future matters, which will be influenced by a number of factors and subject to various uncertainties and contingencies, many of which will be outside Vulcan's control.

Vulcan does not undertake any obligation to update publicly or release any revisions to these forward-looking statements to reflect events or circumstances after today's date or to reflect the occurrence of unanticipated events. No representation or warranty, express or implied, is made as to the fairness, accuracy, completeness or correctness of the information, opinions or conclusions contained in this announcement. To the maximum extent permitted by law, none of Vulcan, its Directors, employees, advisors or agents, nor any other person, accepts any liability for any loss arising from the use of the information contained in this announcement. You are cautioned not to place undue reliance on any forward-looking statement. The forward-looking statements in this announcement reflect views held only as at the date of this announcement.

This announcement is not an offer, invitation or recommendation to subscribe for, or purchase securities by Vulcan. Nor does this announcement constitute investment or financial product advice (nor tax, accounting or legal advice) and is not intended to be used for the basis of making an investment decision. Investors should obtain their own advice before making any investment decision.

Competent Person Statement:

The technical information that forms the basis for this News Release has been prepared and reviewed 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 and Mr. Nicholls consent to the disclosure of information in this News Release in the form and context in which it appears.

Appendix One

Summary of Resource Estimate and Reporting Criteria

As per ASX Listing Rule 5.8 and the JORC 2012 reporting guidelines, a summary of the material information used to estimate the Mineral Resource is detailed below (for more detail please refer to Table 1, Sections 1 to 3 in Appendix 3).

Property Location and Description

The Vulcan Property is comprised of 5 separate and non-contiguous Exploration Licences within the Upper Rhine Valley of southwest Germany that include: Mannheim; Ludwig; Taro; Rheinaue and Ortenau. The Vulcan Lithium Project is strategically located at the heart of the European auto and lithium-ion battery manufacturing industry. Collectively, the licences encompass 788.19 square kilometres (78,819 hectares) and occur within the German states of Baden-Württemberg and Rheinland-Pfalz near the cities of Mannheim and Karlsruhe, Germany and the France-Germany border city of Strasbourg.

Vulcan has acquired the Vulcan Property brine and lithium rights through direct application to the mining authorities of Rheinland-Pfalz and Baden-Württemberg. The Mannheim and Ortenau Exploration Licences have been granted pursuant to the Germany *Federal Mining Act* for the purpose of commercial exploration of mining-free mineral resources: geothermal, brine and lithium. The Ludwig, Taro and Rheinaue Exploration Licences are in application as of the Effective Date of this Technical Report and have been applied for by Global Geothermal Holding UG a contracted partner of Vulcan.

The granted and in-application Exploration Licences are held 100% by Vulcan Energy Resources, or Vulcan Energy Resources has an earn in right to own 80%, respectively.

Geology and geological interpretation

The Property is located within the Upper Rhine Graben of southwestern Germany, which is characterized as a Cenozoic graben, that is filled with Triassic to Paleogene sedimentary rocks. The Lower-Middle Buntsandstein Sub-Group aquifer, which is the focus of this News Release, overlies the crystalline Palaeozoic basement in a package of Permian-Triassic sedimentary rocks. Between periods of active tectonism, Triassic and Jurassic sediments were deposited during relatively dormant tectonic periods onto the Western European Platform. The Lower Triassic Buntsandstein Group is subdivided into three subgroups representing a sedimentary cycle, respectively:

- Lower Buntsandstein
- Middle Buntsandstein and the
- Upper Buntsandstein.

Those three major sedimentary cycles at the southern margin of the Germanic Basin (URG area) consist of two progradational fluvial cycles followed by retrogradation of the fluvial system. The first cycle already started during the Upper Permian. The top of this cycle is marked by coarse sands or conglomerates ("Eck'sches Konglomerat)". The second progradational cycle is also marked by a conglomerate at its top ("Hauptkonglomerat"). Horizontally stratified fine sandstones at the base ("Plattensandstein", "Zwischenschichten") as well as siltstones and mudstones towards the top ("Rötton", "Voltziensandstein") represent the subsequent retrogradational cycle. This part of the

Upper Buntsandstein is already affected by temporary marine ingressions and passes into the shallow marine Muschelkalk carbonate succession. The lowermost Lower Buntsandstein Subgroup (Calvörde Formation of the standard stratigraphy) represents an aquitard characterised by a terrestrial lacustrine/floodplain depositional setting. Above this, the uppermost Lower Buntsandstein and all members of the Middle Buntsandstein Subgroup form aquifer rocks that were deposited in a terrigenous fluvial to lacustrine environment dominated by braided river sediments and sandflats with eolian to dune facies interbedding. This aquifer forms the primary target aquifer that is being assessed in this News Release.

The top of the Buntsandstein indicates a general deepening to the North in the URG that is believed to be in relation with the graben tilting. North of the Vulcan Property, the Buntsandstein Formation is not present in the northern URG because the sedimentary rocks have been eroded prior to rifting of the northern part of the graben. The target Buntsandstein Formation aquifer underlies all 5 Vulcan Property Exploration Licences. The Buntsandstein Formation aquifer varies in thickness between the Vulcan Property licences, being 394m at Ortenau.

Historical geochemical analysis of Buntsandstein Formation brine from wells neighbouring the Vulcan Property yield an average lithium concentration of 158 mg/L Li. Recent German Government policy emphasizes conservation and promotes the development of renewable sources. Consequently, emphasis on stratigraphically deep geothermal wells in the Upper Rhine Graben has created access points to acquire deep, geothermally heated, lithium-enriched brine associated with the Buntsandstein Formation sandstone aquifer and Permo-Triassic strata sitting on top of the crystalline basement.

2019 Exploration Programme

Vulcan conducted a 2019 data compilation and brine sampling program that consisted of:

1. A geological compilation and subsurface review of the Buntsandstein Formation stratigraphy toward development of a three-dimensional geological model;

2. An assessment of the hydrogeological conditions underlying the Vulcan Property; and

3. Analyzing Buntsandstein Formation brine samples from Property-neighboring geothermal wells to verify historical Li-brine geochemical results.

The three-dimensional geological modelling was completed by APEX who conducted due diligence reviews to validate seismic cross-sections provided by GeORG. The hydrogeological assessment was conducted by Dr. Kraml using publicly available information. The geochemical analytical work was completed by independent university laboratories (University of Heidelberg and University of Karlsruhe), and an accredited commercial laboratory (AGAT Laboratory in Edmonton, AB).

The average lithium content from brine collected by Vulcan from four geothermal wells located throughout the Upper Rhine Graben and proximal to the Ortenau licence was 181 mg/L Li (n=13 total metal analysis by ICP-OES).

Approvals to analyse the brine were acquired by Vulcan from the respective geothermal operators. Retained samples from the Brühl geothermal well were also analysed. A description of the sample numbers, well locations, and sample points is presented below.

At surface, the sampled Insheim well is situated within Vulcan's project area of interest, as per the Memorandum of Understanding recently signed with Pfalzwerke geofuture GmbH[8]. The other wells are situated in the Upper Rhine Valley outside the Vulcan project area. In this instance, the wells were sampled because of the lack of accessible wells that penetrate deep-seated brine-saturated sandstone aquifers underlying the Vulcan's licences. Based on the knowledge that: 1) deep-basin URG brine is lithium-enriched as per historical documentation; and 2) confined aquifers in a graben system can have massive spatial extent with homogeneous to semi-homogeneous lithium-in-brine concentrations, it is assumed that the Li-brine content of neighbouring wells are a good proxy of the lithium content in Triassic aquifers underlying the URG and the Vulcan project licences. Two separate geothermal wells were analysed as part of Vulcan's 2019 sampling program: Landau and Insheim. Retained samples from Brühl geothermal well were also analysed for verification purposes. Samples at the Landau and Insheim geothermal operations were collected at two different sample points within the geothermal facility: the hot and cold circuits located on either side of the heat exchanger. Hence a total of five brine samples were collected by Vulcan. Brine samples were taken directly from the geothermal brine circuit at Landau and Insheim, whereas archivally collected brine samples obtained by Vulcan from GeoThermal Engineering GmbH, Vulcan's local consultant, were analysed from the Brühl well. In addition to the brine samples, a sample blank (composed of deionized water with no lithium) and a standard sample (a laboratory created Li-brine standard) were inserted into the sample stream at each sample site. Lastly, three aliquots of brine were collected at each sample point for various analytical work (i.e., anion chemistry and trace elements by total metal and dissolved metal analysis). Consequently, a total of 26 brine samples (and/or aliquots) were collected by Vulcan during their 2019 brine sampling program in the URG. The brine samples were analyzed at 3 separate laboratories: University of Karlsruhe and University of Heidelberg in Germany, and AGAT Laboratories in Edmonton, AB Canada.

Total metal and dissolved metal ICP-OES results are presented in the Table 4, observations of which are presented as follows:

- The total average lithium content of the brine analyzed by total metal ICP-OES is 181 mg/L Li. The total average lithium content of the brine analyzed by dissolved metal ICP-OES is 173 mg/L Li.
- The highest average inter-lab lithium content of the geothermal wells sampled is sample MK-3 (Insheim geothermal well) with an average of 194 mg/L Li followed by: sample MK-1 (Landau; 187 mg/L Li) and sample MK-5 (Brühl; 104 mg/L Li).
- The fact that brine collected from sample sites at the hot and cold circuit sites of the Landau and Insheim geothermal plants returned similar lithium values is encouraging because the test suggests that almost no lithium is lost during the geothermal processing.
- The Brühl well sample site contained the lowest lithium value; this could relate to the fact that Brühl represents a production test sample, hence may include some amount of contamination with non-lithium-bearing fluids. All other wells sampled by Vulcan are from geothermal operations, which would have a comparatively purified production circuit. Further testing is required.

[8] VUL ASX announcement 26/11/2019

- An assessment of the analytical results from the three laboratories used to analyse the Vulcan brine samples showed that there is very good data quality for Landau and Insheim (i.e., low coefficient of variation, or RSD%). Unfortunately, Vulcan was unable to analyse archived brine from the Brühl well at all three labs, due to the limited volume of brine available. However, reliable literature data exist for the production wells and is comparable to Vulcan Li-brine analytical results. For example,
    - Samples MK-1 and MK-2 from Landau well Gt La1 yielded an average of 187 mg/L Li. In comparison, brine from the same well yielded historical values[9] of 179 and 182 mg/L Li.
    - Samples MK-5 from the Brühl GT1 well had 104 mg/L Li; in comparison historical sampling contained 118 mg/L Li.
    - Sample MK-2 and MK-4 from the Insheim production well contained 183 and 194 mg/L li); in comparison, historical sampling yielded 168 mg/L Li.

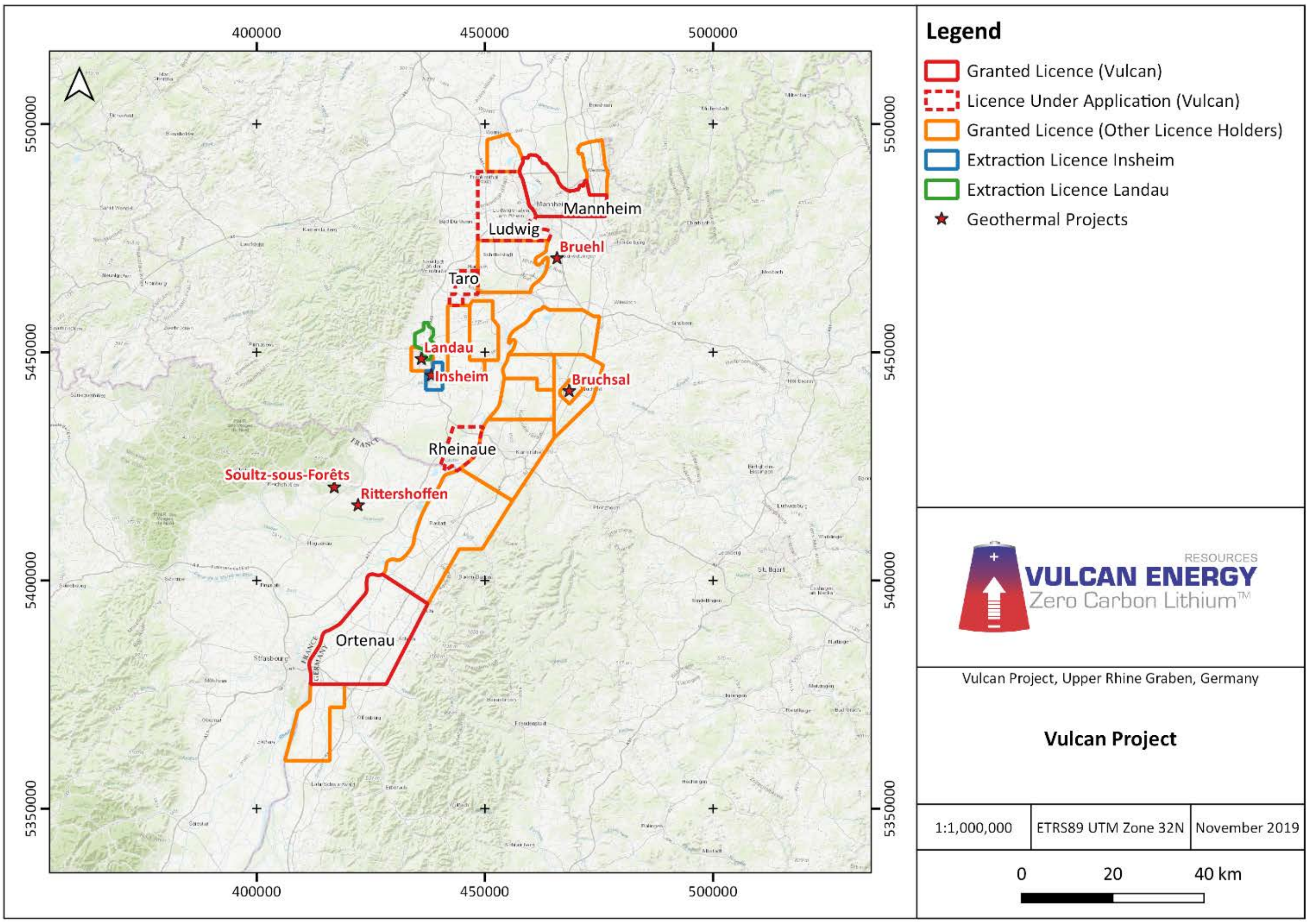

Figure 10: Vulcan Project licences, showing location of geothermal wells (Insheim, Brühl, Landau) that were sampled by Vulcan as part of the Company's 2019 brine sampling program.

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[9] See VUL announcement 20/08/2019

Table 2: Geothermal Well and Brine Sample Location Descriptions.

Sample ID	Sample type/media	Sample location (easting)	Sample location (northing)	Sample location name	Sample location well id	Sample point (hot or cold side of circuit)	Sample date	Formation aquifer sampled (fault/fractures)
MK 1-001-a	Brine	3436152	5450302	Landau	Gt La1	Hot side	8/10/2019	Buntsandstein & Granite
MK 1-001-b	Brine	3436152	5450302	Landau	Gt La1	Hot side	8/10/2019	Buntsandstein & Granite
MK 1-002	Brine	3436152	5450302	Landau	Gt La1	Hot side	8/10/2019	Buntsandstein & Granite
MK 2-001-a	Brine	3436152	5450302	Landau	Gt La1	Cold side	8/10/2019	Buntsandstein & Granite
MK 2-001-b	Brine	3436152	5450302	Landau	Gt La1	Cold side	8/10/2019	Buntsandstein & Granite
MK 2-002	Brine	3436152	5450302	Landau	Gt La1	Cold side	8/10/2019	Buntsandstein & Granite
MK 3-001-a	Brine	3438343	5446624	Insheim	GTI2	Cold side	8/10/2019	Muschelkalk & Buntsandstein
MK 3-001-b	Brine	3438343	5446624	Insheim	GTI2	Cold side	8/10/2019	Muschelkalk & Buntsandstein
MK 3-002	Brine	3438343	5446624	Insheim	GTI2	Cold side	8/10/2019	Muschelkalk & Buntsandstein
MK 4-001-a	Brine (archived sample)	3438343	5446624	Insheim	GTI2	Hot side	10/05/2017	Muschelkalk & Buntsandstein
MK 4-001-b	Brine (archived sample)	3438343	5446624	Insheim	GTI2	Hot side	10/05/2017	Muschelkalk & Buntsandstein
MK 4-002	Brine (archived sample)	3438343	5446624	Insheim	GTI2	Hot side	10/05/2017	Muschelkalk & Buntsandstein
MK 5-001-a	Brine (archived sample)	3465862	5472347	Brühl	GT1	Production test	30/03/2013	Muschelkalk & Buntsandstein
MK 5-001-b	Brine (archived sample)	3465862	5472347	Brühl	GT1	Production test	30/03/2013	Muschelkalk & Buntsandstein
MK 5-002	Brine (archived sample)	3465862	5472347	Brühl	GT1	Production test	30/03/2013	Muschelkalk & Buntsandstein

Table 3: Well details. The geothermal wells are typically collared with zero orientation and vertical dip (-90 degrees); however, due to the well length (often >2,200 m), switches to smaller diameter drill rods at depth, and drill methodologies to angle into near vertical fault zones, the wells commonly end up being deviated at depth. Of known well survey examples, the wells can deviate horizontally up to approximately 950 m. The total vertical depth of the wells sampled varies between 3,000 and 5,000 m depth.

					Surface orientation [1]		
Sample location Geothermal Plant name	**Sample location well id**	**Sample location (easting, WGS84, Z32)**	**Sample location (northing, WGS84, Z32)**	**Collar elevation (m asl)**	**Well orien-tation (degrees)**	**Well dip (degrees)**	**Total vertical depth (m)**
Landau	Gt La1	436152	5450302	149.0	0	-90	3,045
Insheim	GTI2	438343	5446624	138.4	0	-90	3,686
Brühl	GT1	465862	5472347	98.3	0	-90	3,285

[1] The wells are deviated at depth and the well deviation surveys/profiles is not known.

Table 4: Summary of the lithium ICP-OES analytical results from Vulcan's 2019 brine sampling program. A) Lithium analyzed by total metals ICP-OES; and B) Lithium analyzed by dissolved metals ICP-OES. RSD% is standard deviation/mean x 100.

A) Sample ID	**Sample location**	**Sample point (hot or cold side of circuit)**	**Karlsruhe University (mg/l Li)**	**Heidelberg University (mg/l Li)**	**AGAT Laboratories (mg/l Li)**	**Average (mg/l Li)**	**RSD%**
MK 1	Landau	Hot side	181	182	198	187	5.1
MK 2	Landau	Cold side	178	179	205	187	8.2
MK 3	Insheim	Cold side	181	185	215	194	9.6
MK 4	Insheim	Hot side	181	175	194	183	5.3
MK 5	Brühl	Production Test	104	/	/	/	/

B) Sample ID	**Sample location**	**Sample point (hot or cold side of circuit)**	**Karlsruhe University (mg/l Li)**	**Heidelberg University (mg/l Li)**	**AGAT Laboratories (mg/l Li)**	**Average (mg/l Li)**	**RSD%**
MK 1	Landau	Hot side	175	179	197	184	6.4
MK 2	Landau	Cold side	183	184	173	180	3.4
MK 3	Insheim	Cold side	180	180	176	179	1.3
MK 4	Insheim	Hot side	175	176	161	171	4.9
MK 5	Brühl	Production Test	107	/	/	/	/

Table 5: Summary of the lithium ICP-MS analytical results from Vulcan's 2019 brine sampling program. These analyses were conducted at the University of Karlsruhe.

Sample ID	Location	Sample Point	Lithium (mg/l) analysed by total metals	Lithium (mg/l) analysed by dissolved metals
MK 1	Landau	Hot side	189	184
MK 2	Landau	Cold side	182	180
MK 3	Insheim	Cold side	184	179
MK 4	Insheim	Hot side	179	185
MK 5	Bruhl	Production Test	114	114

Figure 11: Sampling in progress

Estimation Methodology, Cut-off Grades & Classification Criteria

Vulcan's Lithium Brine Project is an early stage exploration project. One of the 5 Vulcan Property licences has been assessed for the resource modelling and estimation process in this Technical Report (Ortenau). The resources are confined to the Buntsandstein Formation sandstone aquifer domain within the boundaries of the Ortenau licence. The maiden Vulcan lithium-brine resource estimations were conducted in consideration of, and in accordance with JORC (2012). Statistical analysis, three-dimensional (3-D) modelling and resource estimation was prepared by APEX under the supervision of Mr. Eccles, M.Sc. P. Geol. who reviewed all work and takes responsibility for the maiden resource estimation. The workflow implemented for the calculation of the Vulcan lithium-brine resource estimations was completed using the commercial mine planning software MICROMINE (v 18.0).

Critical steps in the determination of this Inferred Vulcan Li-Brine Resource Estimate include: 1) definition of the geometry and volume of the Buntsandstein Formation aquifer domain; 2) hydrogeological characterization of the specific yield, or in the case of the confined aquifer, the average effective porosity; 3) calculating the total volume of in situ brine; and 4) determination of the concentration of lithium within the brine and at the Property. The Buntsandstein Formation aquifer represents a large-scale aquifer that is bound by two aquitards (subject to fracture zones that could form hydraulic connections in the strata overlying, and including, the crystalline basement). The average effective porosity of the Buntsandstein Formation within the URG and the Property is 9.5%. Geothermal projects in the Upper Rhine Graben have documented sufficiently high flow rates (>50 L/s) within fault zones associated with the Buntsandstein Formation and the underlying crystalline basement. These structural sub-domains within the Buntsandstein Formation represent key determinants for locating zones of high fluid flow. The 3-D models created for the Ortenau licence shows that the licence was deliberately targeted by Vulcan for its high degree of faulting, and the Competent Person reasonably assumes that the licences could have high fluid flow potential within the faulted Buntsandstein Formation aquifer. A lower cutoff of 100 mg/L Li is used in this Li-brine resource estimation. It is the opinion of the Competent Person that this cutoff is acceptable because: 1) confined aquifer deposits traditionally have lower concentrations of lithium (in comparison to unconfined lithium brine salar and hard rock lithium deposits), and 2) numerous commercial, academia and independent laboratories are now experimenting with rapid lithium extraction techniques using low lithium concentration source brine. The resource estimation presented in this News Release is presented as a total (or global value), and was estimated using the following relation in consideration of the Buntsandstein Formation aquifer domain within the Ortenau licence, or resource area:

Lithium Resource = Total Volume of the Brine-Bearing Aquifer X Average Porosity X Average Concentration of Lithium in the Brine.

The maiden Inferred Vulcan Li-Brine Resource at the Ortenau Licence is estimated at 2.48 million tonnes of elemental Li (see Table 1). The total lithium carbonate equivalent (LCE) for the main resource is 13.23 tonnes LCE.

Extraction and Metallurgical Methods and Parameters

Vulcan's Lithium-Brine Project is an early stage project. The Company has yet to conduct bench-scale test work but has contracted Hatch and Jade Cove Partners to consult on future engineering work that includes:

1. Lithium plant design; 2. An economic scoping study; and 3. Directing lithium extraction process test work that involves a combination of the selective absorption and lithium hydroxide production techniques.

Hatch is a global multidisciplinary management, engineering and development consultancy principal with experience in the mining and metals, energy, and infrastructure sectors, and unique experience in lithium and geothermal plant engineering design. A generalized process flowsheet of Vulcan's model to derive zero-carbon lithium (LiOH•H2O) from the Vulcan Property and the Buntsandstein Formation aquifer is presented in this News Release. The process flowsheet has three main components: 1. A brine conditioning process to remove deleterious metals/elements is implemented to raise the pH and oxidation-reduction potential (ORP) of the brine as it enters the Direct Lithium Extraction (DLE) Plant. 2. The DLE plant removes >85% of the lithium from the brine in less than an hour while leaving >99.9% of all other impurities. The brine is sent back to the geothermal plant and after conditioning re-injected into the geothermal reservoir. A new beneficiated lithium stream with significantly higher Li concentration is formed for further processing. 3. A series of chemical operations convert the lithium stream into battery quality lithium hydroxide using conventional processes that have been previously demonstrated at commercial scale. An estimated 98% of water is recycled with no toxic waste produced and no gases are emitted. Heat and power from the geothermal plant circuit are not affected. No fossil fuels are burned during lithium hydroxide processing, thereby eliminating direct carbon emissions.

Risks and Uncertainties

Vulcan's Lithium Brine Project represents an early stage exploration project. An obvious uncertainty as discussed throughout this News Release relates to the lack of current access to brine within the boundaries of the Ortenau licence. This has led to several assumptions in the resource estimation process including Li brine concentration and average porosity of the Buntsandstein Formation. Because brine cannot currently be sampled from the Buntsandstein Formation aquifer underlying the Ortenau licence (i.e. there are no wells that penetrate the deep-seated Buntsandstein Formation), the Competent Person relied on geochemical data associated with Vulcan's 2019 brine sampling that included, off-licence, but proximal geothermal well locations. While there was a significant amount of effective porosity measurements on Buntsandstein Formation sandstone from drill cores, none of the wells were collared within the boundaries of the Ortenau licence. In the CP's experience, confined aquifers in sedimentary basins can have massive spatial extent and with homogeneous to semi-homogeneous lithium-in-brine concentrations. So, it is the CP's opinion that the Li-brine content of neighbouring wells are a good proxy of lithium in the Buntsandstein Formation aquifer domain. There are, however, always local chemical variations due to numerous geological factors. In addition, porosity and permeability can be highly variable in most shoreface depositional settings, particularly those that contain diagenetic and secondary cements. Hence, any advancement in resource classification at the Vulcan Property should involve access to brine and well core or well log information within the licence to properly assess lithium concentrations and hydrogeological conditions as part of the resource calculation.

The CP has used a conservative approach in modelling the aquifer underlying the Vulcan Property licences. That is, APEX has wireframed the Buntsandstein Formation sandstone aquifer domain and used this wireframe – exclusively – in the resource estimation process. As geothermal producers in the URG will attest to, hot geothermal water is being utilized from the Buntsandstein Formation 'and' the underlying Permian sedimentary rocks 'and' fractured portions of the crystalline basement. Hence it is possible that the aquifer communication and dimensions underlying the licences extend to deeper levels than the Buntsandstein Formation aquifer domain that was used to estimate the Li-brine resource in this News Release. Conversely, it is also understood that the geothermal operators purposely target those stratigraphic zones that are structurally altered – as the fracture pattern and disturbance can create zones of high fluid flow. It is important to point out that in this resource estimation, the author has assumed an average porosity for the entire Buntsandstein Formation (9.5%). Any future Li-brine operation, however, may be dependent on localized, or restricted areas, that are dominated by pervasive fracturing and significantly higher porosity. This in turn could reduce the overall horizontal scale of the resource domain, but at the same time, could expand the vertical scale of a new resource domain that correlates with the fracture zone that has elevated porosity, permeability and fluid flow. The largest source of uncertainty in the maiden Inferred Vulcan Li-Brine Resource Estimate is from volumes based on a 3-D geological model that was reliant on the GeORG subsurface geology interpretation. As the resource is calculated using a volumetric approach, any changes to the 3-D model will affect the calculated resource estimate.

Appendix Two

Peer Comparison Data – JORC-Compliant Lithium Resources in Europe

Company	Code	Project	Stage	Resource Category	Resource Tonnes	Resource Grade	Contained LCE Tonnes	Information Source
Vulcan Energy Resources	**ASX: VUL**	**Vulcan**	**Scoping Study Nearing Completion**	**Inferred**	**N/A**	**181 mg/l Li**	**13.2**	**News Release 4/12/2019**
European Metals	ASX: EMH	Cinovec	PFS Complete	Indicated & Inferred	695.9	0.42 % Li2O	7.17	Corporate Presentation Released 20 November 2018
Rio Tinto	ASX: RIO	Jadar	PFS Underway	Indicated & Inferred	135.7	1.86 % Li2O	6.24	Corporate Presentation Released 21 March 2018
Infinity Lithium	ASX: INF	San Jose	PFS Complete	Indicated & Inferred	111.3	0.61 % Li2O	1.68	ASX Announcement Released 22 August 2019
Savannah Resources	AIM: SAV	Barroso	DFS Underway	Measured, Indicated & Inferred	27.0	1.00 % Li2O	0.71	Corporate Presentation Released May 2019

Appendix Three: JORC Table One

JORC CODE 2012 TABLE 1. SECTION 1: SAMPLING TECHNIQUES AND DATA.

Criteria	JORC Code Explanation	Commentary
Sampling techniques	• Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. • Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. • Aspects of the determination of mineralisation that are Material to the Public Report. • In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	• In 2019, Vulcan collected Buntsandstein Formation aquifer brine samples from 3 different geothermal wells in the Upper Rhine Graben area to verify historically reported lithium concentrations of the Buntsandstein Formation aquifer. Brine samples were taken from the brine circulating through the production circuit at 3 of the geothermal wells and at the bottom hole perforation point in the fourth well. Sample Blanks (deionized water with no lithium) and Sample Standards (laboratory prepared brine standard) were inserted into the sample stream. Collectively, a total of 26 brine samples (and/or aliquots) were collected by Vulcan during their 2019 brine sampling program. • Vulcan maintained chain of custody of the brine samples from the geothermal well sample point to the respective laboratories in Germany (University of Karlsruhe and University of Heidelberg). Four brine samples were couriered to the Competent Person, Roy Eccles in Edmonton, Alberta Canada for analysis at a commercial Canadian Laboratory (AGAT Laboratories). • The CP has reviewed the techniques and found the sampling was conducted using reasonable techniques in the field of brine assaying and there are no significant issues or inconsistencies that would cause one to question the validity of the sampling technique used by Vulcan.
Drilling techniques	• Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	• Vulcan has yet to conduct any drilling at the Ortenau licence and is reliant on existing geothermal wells to access brine.
Drill sample recovery	• Method of recording and assessing core and chip sample recoveries and results assessed. • Measures taken to maximise sample recovery and ensure representative nature of the samples. • Whether a relationship exists between	• Vulcan has yet to conduct any drilling and/or drill core sampling at the Ortenau licence and is reliant on existing geothermal wells to access brine. • Brine samples were recovered directly from the flowing brine stream within the geothermal facility brine circuit. The sample

	sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	method and sampling documentation are in accordance with reasonable sampling expectations and Li-brine industry standards. • Archival brine samples were stored at GeoThermal Engineering GmbH in air-tight containers and at approximately 20 °C
Logging	• Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies. • Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. • The total length and percentage of the relevant intersections logged.	• Vulcan has yet to conduct any drilling at the Ortenau licence and is reliant on existing geothermal wells to access brine. Hence, no logging was conducted. • Geothermal (and oil and gas) well logs are proprietary Company-owned information in Germany; however, the CP compiled well information from publicly available manuscripts and reports to ascertain and validate subsurface stratigraphy. • In addition, the project benefited from oil and gas, and geothermal, log data and seismic profile data that has been compiled into 3-D national geothermal information systems. This work was conducted by state geological surveys and coalitions of German Government and academic working groups and include data and interpretations from geophysical seismic sections and more than 30.000 oil and gas wells, geothermal, thermal, mineral water and mining well boreholes in the Vulcan Project area and Upper Rhine Graben. The Vulcan Project particularly benefitted from a 3-D model of the Upper Rhine Graben in which the user can select interpreted cross-sectional slices anywhere within the graben basin.
Sub-sampling techniques and sample preparation	• If core, whether cut or sawn and whether quarter, half or all core taken. • If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. • For all sample types, the nature, quality and appropriateness of the sample preparation technique. • Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. • Measures taken to ensure that the sampling is representative of the in-situ material collected, including for instance results for field duplicate/second-half sampling. • Whether sample sizes are appropriate to the grain size of the material being sampled.	• Three aliquots of brine were collected at each sample point for various analytical work including: anion chemistry; trace metal ICP-OES; and dissolved metal ICP-OES. • At two geothermal plants (Landau and Insheim), brine was collected from the hot and cold circuit sample points to gain an understanding of whether the geothermal plant cycle has any influence on the lithium concentration as the brine cycles through the plant. • A sample blank (composed of ionized water with no lithium) and a standard sample (a laboratory created Li-brine standard) were inserted into the sample stream at each sample site. • The sample sizes were appropriate for industry standard brine assay testing. As the brine was collected from the

		geothermal production brine stream, the brine sample is representative of the brine being drawn from depths associated with the Buntsandstein Formation aquifer.
Quality of assay data and laboratory tests	• The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. • For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc. • Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	• Data verification procedures applied by the CP were performed to confirm the Li-brine mineralization at the Vulcan Property. A brine sample collected by the CP during the site inspection was split and analyzed at 2 separate commercial labs in Edmonton, Alberta Canada (AGAT Laboratory and Bureau Veritas Laboratory). The analytical result of the CP/QP collected samples contained a mean value of 181 mg/L Li substantiating lithium-enriched brine in deep URG aquifer. • As per Vulcan's QA/QC, the Company commissioned the University of Alberta to prepare a laboratory prepared Sample Standard by adding a measured amount of elemental lithium to a saline brine concoction. • A sample blank (composed of ionized water with no lithium) and a standard sample (a laboratory created Li-brine standard) were inserted into the sample stream at each sample site. • The resulting data – as they pertain to the Sample Blank and Standard Sample samples – were excellent and show the analytical data were performed with high precision. The results helped the CP deem the data acceptable for the purpose of estimating a mineral resource. • The lithium content (and trace elements) of the brine samples were analyzed by inductively coupled plasma optical emission spectrometry (ICP-OES), which is a standard analytical technique and industry standard for the measurement of lithium-in-brine. • A split of Vulcan's 2019 samples from MK-1, MK-2, MK-3 and MK-4 was sent by courier to APEX and analyzed at AGAT Laboratories in Edmonton, AB Canada. A comparison of the analytical results between the 3 laboratories yields RSD% values of between 1.3% and 9.6%. It is concluded that there is very good data quality of Vulcan 2019 Li-brine analytical results between the 3 independent labs.
Verification of sampling and assaying	• The verification of significant intersections by either independent or alternative company personnel. • The use of twinned holes.	• Vulcan has yet to conduct any drilling or core sampling at the Ortenau licence. • Data verification procedures applied by the CP were performed on key data

	• Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. • Discuss any adjustment to assay data.	components as they pertain to the mineral resource estimation. • Analytical brine data were prepared by independent and third-party universities and or accredited commercial laboratories. • Data verification procedures applied by the CP were performed to confirm the Li-brine mineralization at the Ortenau licence. A brine sample collected by the CP during the site inspection was split and analyzed at 2 separate commercial labs in Edmonton, Alberta Canada (AGAT Laboratory and Bureau Veritas Laboratory). The analytical result contained a mean value of 181 mg/L Li substantiating lithium-enriched brine in deep URG aquifer. • No adjustments were made, or necessary, to the original laboratory data. • The CP has reviewed all geotechnical and geochemical data and found no significant issues or inconsistencies that would cause one to question the validity of the historical Li-brine geochemical data – and Vulcan's 2019 brine geochemical results – to verify that the Buntsandstein Formation aquifer is consistently enriched in lithium in the deep-seated strata and aquifer underlying the URG and the Vulcan licences.
Location of data points	• Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. • Specification of the grid system used. • Quality and adequacy of topographic control.	• Vulcan has yet to conduct any drilling or core sampling at the Ortenau licence. Brine samples were collected from established geothermal wells (owned by geothermal companies other than Vulcan). The collar locations of the geothermal wells are meticulously documented in the literature. • The grid system used is UTM WGS84 zone 32N. • The surface Digital Elevation Model used in the three-dimensional model was acquired from JPL's Shuttle Radar Topography Mission (SRTM) dataset; the 1 arc-second gridded topography product provides a nominal 30 m ground coverage.
Data spacing and distribution	• Data spacing for reporting of Exploration Results. • Whether the data spacing, and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. • Whether sample compositing has been applied.	• Vulcan has yet to conduct any drilling and/or core sampling at the Ortenau licence. • With respect to the subsurface data, subsurface interpreted geological cross-sections were used to model the Buntsandstein Formation aquifer domain for the licence, or resource, area (Ortenau). Each resource area utilized a separate set of east-west cross-section from GeORG that were spaced approximately 1 km part to

		create the 3-D subsurface model of the Buntsandstein Formation. The orientation of the Buntsandstein Formation is generally flat-lying and continuous in the Licence Fields. • The Buntsandstein Formation has been mapped for approximately 250 km along the north-northeast strike length along the entire Upper Rhine Graben. North of the Vulcan Property, the Buntsandstein Formation is not present in the northern Upper Rhine Graben because the sedimentary rocks have been eroded prior to rifting of the northern part of the graben. While locally there are minor faulting and slight offsets, the horizontal continuity of the sandstone unit is tremendous with the thickness isopach thickening in the vicinity of the Vulcan licences. • To help with due diligence, Vulcan acquired proprietary well log data for the a geothermal well located near the Taro and Rheinaue Licences. A comparison by the CP between the proprietary well log and GeORG cross-sections (and the 3D geological model created by APEX) illustrated a very good correlation for the general stratigraphy and specific vertical characteristics of the Buntsandstein Formation sandstone unit, which has been wireframed and is used in the resource estimation process. • Historical and proprietary lithium concentrations were compiled from throughout the Upper Rhine Valley in wells with highly variable spatial locations. Spacing between wells varied from proximal locations (<1 km) to up to 32 km apart. • At surface, the geothermal wells sampled are situated between 12 and 24 km away from Vulcan's Ortenau licence. In this instance, the wells were sampled because there currently are no wells that penetrate deep-seated brine-saturated sandstone aquifers underlying the licence. Based on the knowledge that: 1) deep-basin URG brine is lithium-enriched as per historical documentation; and 2) confined aquifers in sedimentary basins can have massive spatial extent with homogeneous to semi-homogeneous lithium-in-brine concentrations, it is assumed that the Li-brine content of neighbouring wells are a

		good proxy of the lithium content in Triassic aquifers underlying the URG and the Ortenau licence.
Orientation of data in relation to geological structure	• Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. • If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	• Vulcan has yet to conduct any drilling and/or core sampling at the Ortenau licence. • The geothermal wells investigated as part of data compilation and Vulcan's brine sampling program include vertical wells (zero orientation with a dip of -90, which is perpendicular to the Buntsandstein Formation, deviated at depth to intersect high flow structures). No sample bias is expected. • The 3D geological model created by APEX was created using 49 GeORG cross-sections such that a cross-sectional slice for approximately every 1 km was used to create the geological model. The sectional slices include local and regional faulting. The 3-D geological models were manually adjusted to honor the faulting that was interpreted at each section. This was completed by manually creating triangles that connect the fault on one section to the same location of the fault in a different section (and so on). Care was taken to ensure each model accurately reflected the interpreted cross-sections provided by the GeORG project. • It is well documented that areas of faulting within the Permo-Triassic to basement deep-strata of the Upper Rhein Graben will have some influence on local fluid flow and are therefore targeted by geothermal companies. Zones of high fluid flow would also be targeted for Li-brine exploration.
Sample security	• The measures taken to ensure sample security.	• Vulcan's 2019 brine sampling program was conducted by Dr. Kraml of GeoThermal Engineering GmbH. Dr. Kraml collected the samples and maintained their chain of custody from sample site to delivery of the samples to the University of Karlsruhe and University of Heidelberg for analytical work. In addition, Dr. Kraml couriered brine samples to APEX for analytical work at the Canadian Laboratories; during transport, chain of custody was maintained from Dr. Kraml to the courier to the CP and to the laboratory. • The CP collected 2 brine samples. The only time the samples were out of the possession of the CP is during the flight from Frankfurt to Edmonton (in a locked

		travel bag). The samples were delivered to laboratories by the CP.
Audits or reviews	• The results of any audits or reviews of sampling techniques and data.	• The CP assisted with, and reviewed, the adequacy of Vulcan's sample collection, sample preparation, security, analytical procedures, QA-QC protocol, and conducted a site inspection of the Vulcan Property. • In addition, the CP coordinated discussion and meetings involving methodologies and interpretation resulting from the exploration work to define the geometry and hydrogeological characterization of the Buntsandstein Formation aquifer that form the basis of the resource model.

JORC Code 2012 Table 1. Section 2: Reporting of Exploration Results.

Criteria	JORC Code Explanation	Commentary
Mineral tenement and land tenure status	• Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. • The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	• The Vulcan Property consists of: 1) two granted Exploration Licences (approximately 51,000 hectares; Ortenau and Mannheim); and 2) three in-application Licence Fields (an additional 27,600 hectares; Taro, Ludwig and Rheinaue). • The granted Exploration Licences (Mannheim and Ortenau) are held 100% by Vulcan Energy. The in-application Exploration Licences (Taro, Ludwig and Rheinaue) have an agreement in place with Global Geothermal Holding (GGH) in which Vulcan can earn a joint venture (JV) interest of 80%. • Licence's Ortenau and Mannheim were granted on 1st of April 2019 and 18th of June 2019 respectively for a period of two years. The licence applications for Taro (submitted 26th of November 2018), Rheinaue and Ludwig (both submitted 24th of April 2019) are expected to be approved this year or in 2020. • The Licences are defined as 'Exploration Licences' and include the exploration rights to brine, hydrothermal and lithium. If required, Exploitation Rights would need be acquired pending the results of Vulcan's future exploration work. The Exploitation Licence is typically smaller in spatial area in comparison to the Exploration Licence and require advanced modelling of the aquifer production and injection wells. • The holder of an exploration licence for commercial purposes shall pay an annual field royalty. The field royalty for the first year the licence is granted shall be EUR$5 per square kilometre or part thereof and shall increase for each subsequent year by EUR$5 per year, not to exceed EUR$25 per square kilometre or part thereof. The expenses incurred for exploration in the exploration licence field during the year shall be deducted from the field royalty for that year. • The holder of an Exploitation Licence shall pay an annual royalty for the freely mineable resources extracted or incidentally extracted from the extraction licence field. A mining royalty must not be paid for resources that are extracted

		exclusively for technical reasons and are not commercially exploited. The mining royalty shall be calculated as ten percent of the average attainable market value of resources of this type extracted under this Act within the assessment period. For resources without any market value, the competent authority shall determine the price on which the mining royalty shall be based in consultation with experts. • Protected areas exist in each of the Licence's and include: water protection areas (Zones I and II), nature conservation areas and Natura 2000 areas.
Exploration done by other parties	• Acknowledgment and appraisal of exploration by other parties.	• The Upper Rhine Graben is being actively investigated for its geothermal potential by multiple companies (other than Vulcan). • Exploration and Exploitation Licences associated with the geothermal work is regulated by the *Federal Mining Act*, which manages and promotes the exploration, extraction and processing of mineral resources in Germany. To the best of the CP's knowledge, the geothermal facilities are compliant with the Act. • A summary of historical brine geochemical analytical results was analysed. Of the 43 historical brine analysis records, Six historical analysis are from the Buntsandstein Formation aquifer and yield a mine brine composition of 158.1 mg/L Li. The historical data are presented in referred journal manuscripts and the CP has verified that the analytical protocols were standard in the field of brine analysis and conducted at university-based and/or accredited laboratories. • The historical geochemical information was used as background information and were not used as part of the resource estimation process.
Geology	• Deposit type, geological setting and style of mineralisation.	• The potential lithium mineralization is situated within confined, subsurface aquifers associated with the Lower Triassic Buntsandstein Formation sandstone situated within the Upper Rhein Graben at depths of greater than approximately 2,000 m below surface. • The Buntsandstein Formation is comprised predominantly of terrigenous sand facies deposited in arid to semi-arid conditions in fluvial, sandflat, lacustrine and eolian sedimentary environments. • The various facies exert controls on the

Criteria	JORC Code explanation	Commentary
		porosity (1% to 27%) and permeability (<1 to >100 mD) of the sandstone sub-units. • Lithium mineralisation occur with brine occupying the Buntsandstein Formation aquifer pore space. • The chemical signature of the brine is controlled by fluid-rock geochemical interactions. With increasing depth, total dissolved solids (TDS) increases in NaCl-dominated brine. Lithium enrichment associated with these deep brines is believed to related to interaction with crystalline basement fluids and/or dissolution of micaceous materials at higher temperatures.
Drill hole Information	• A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes: o easting and northing of the drill hole collar o elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar o dip and azimuth of the hole o down hole length and interception depth o hole length. • If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the Competent Person should clearly explain why this is the case.	• Vulcan has yet to conduct any drilling and/or core sampling at the Ortenau licence. • The news release contains historical, publicly available well collar locations, well descriptions and lithium concentrations. • With respect to geothermal wells that were sampled by Vulcan during their 2019 brine sampling program, the well ID's, coordinates, collar elevations, orientation, dip and total vertical depth are provided in the following table. The geothermal wells were drilled as vertical wells (zero orientation with a dip of -90, which is perpendicular to the Buntsandstein Formation, deviated at depth to best intersect high flow fault structures). The wells are perforated at the extent of their total vertical depth, and via geothermal pumping, draw brine from the area surrounding the end of well upward to the earth's surface; hence a sample width is not applicable due to the draw-down influence of the liquid brine being sampled. A table of well co-ordinates are shown below and also in Table 3 above within the press release.

Sample location Geothermal Plant name	Sample location well id	Sample location (easting, WGS84, Z32)	Sample location (northing, WGS84, Z32)	Collar elevation (m asl)	Well orien-tation (degrees)	Well dip (degrees)	Total vertical depth (m)
Landau	Gt La1	436152	5450302	149.0	0	-90	3,045
Insheim	GTI2	438343	5446624	138.4	0	-90	3,686
Brühl	GT1	465862	5472347	98.3	0	-90	3,285

Criteria	JORC Code explanation	Commentary
Data aggregation methods	• In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated.	• Vulcan has yet to conduct any drilling and/or sampling and is reliant on existing geothermal wells operated by companies other than Vulcan to acquire brine samples for analysis. • The brine geochemical data presented

	• Where aggregate intercepts incorporate short lengths of high-grade results and longer lengths of low-grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail. • The assumptions used for any reporting of metal equivalent values should be clearly stated.	represent raw laboratory values, and weighting average or truncation techniques were applied to the data. • Elemental lithium within the maiden Inferred Vulcan Li-Brine Resource Estimate were converted to Lithium Carbonate Equivalent ("LCE" using a conversion factor of 5.323 to convert Li to Li_2CO_3); reporting lithium values in LCE units is a standard industry practice.
Relationship between mineralisation widths and intercept lengths	• These relationships are particularly important in the reporting of Exploration Results. • If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. • If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	• Vulcan has yet to conduct any drilling and/or sampling and is reliant on existing geothermal wells operated by companies other than Vulcan to acquire brine samples for analysis. • These wells were drilled at zero orientation and -90 dip, deviated at depth to best intersect high flow fault zones. While intersections within these wells would be considered true width, the mineralization being sought is related to liquid brine within a confined aquifer. Consequently, intercept widths is a moot point as the well perforation points would essentially gather mineralized brine from the aquifer at large assuming the pumping rate is sufficient enough to orchestrate drawdown of the brine being sampled.
Diagrams	• Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.	• All appropriate map images, including scale and direction information such that the reader can properly orientate the information being portrayed, are presented within the body of this news release.
Balanced reporting	• Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	• Comprehensive reporting of all Exploration Results is presented in full. • The CP does discuss a single outlier analytical result that does contain lower lithium in comparison to all other samples. The CP discusses pragmatic causes for the low outlier value including contamination and the potential for a zone of low Li-brine mineralization occurring within the Upper Rhine Graben.
Other substantive exploration data	• Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics;	• A substantive amount of historical data was used and include information in relation to the: spatial dimensions of the Buntsandstein Formation aquifer, hydrogeological characterization of the Buntsandstein Formation aquifer, and historical lithium composition of the Buntsandstein Formation aquifer brine. o Spatial dimensions of the aquifer: The

	potential deleterious or contaminating substances.	licence, or resource area, utilized a separate set of east-west cross-section from the GeORG geothermal information, the creators of which utilized an extensive set of oil and gas, and geothermal, well logs and seismic data. A total of 49 cross-sections were used to create the 3-D subsurface model of the Buntsandstein Formation; the cross-sections were spaced approximately 1 km part. o Hydrogeological information: Over 300 and 250 Buntsandstein Formation measurements were used to discuss and define porosity and permeability. o Historical assessment of Li-brine: A total of 43 historical brine analysis records were compiled, including 6 Li-brine analysis from the Buntsandstein Formation aquifer. • With respect to Vulcan's 2019 brine sampling program, a total of 26 analyses were conducted on brine samples from 3 geothermal wells in the Upper Rhine Graben (the analysis included Sample Blanks and Sample Standards). The results of Vulcan's 2019 brine sampling program confirmed the historical geochemical data compiled by the CP.
Further work	• The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling). • Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	• With respect to 2019-2020 recommendations, a two-phase approach is recommended for Vulcan to elevate this project to a higher level of resource classification. • Phase 1 includes: 1) acquisition of existing or new seismic profiles for detailed geological interpretation, including fault zone delineation to depict zones of high fluid flow; 2) securing access to Buntsandstein Formation aquifer brine be it via Property expansion to include existing geothermal wells, or drilling of new deep well, or re-entering oil and gas wells to sample brine for assay and mineral processing test work on the Property; and 3) brine geochemical sampling for assay analysis and securing a bulk brine sample for mineral processing (lithium extraction) test work. • Phase 2 is dependent on the results of Phase 1 and includes: 1) mineral processing test work on brine from the Vulcan Property; and 2) Technical

		Reporting including a potential economic scoping study.

JORC Code 2012 Table 1. Section 3: Estimation and Reporting of Mineral Resources

Criteria	JORC Code Explanation	Commentary
Database integrity	• Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. • Data validation procedures used.	• The review of third-party, government and/or compiled data was conducted by the CP who – to the best of his knowledge – can confirm the data was generated with proper procedures, has been accurately transcribed from the original source and is suitable for use in this News Release. • The CP was able to verify 'lithium-enriched brine' from formation water collected via a geothermal well at the basement-Buntsandstein Formation boundary during a Sep 2019 site visit. • To validate the GeORG information system, the CP contacted the GeORG project Administrator, Günter Sokol, who noted that the GeORG model was created using industry donated seismic sections. In addition, Vulcan acquired proprietary well log data for a geothermal well located near the Taro and Rheinaue Licences. A comparison by the CP between the proprietary well log and GeORG cross-sections (and the 3D geological model created by APEX) illustrated a very good correlation for the general stratigraphy and specific vertical characteristics of the Buntsandstein Formation sandstone unit, which has been wireframed and is used in the resource estimation process. • Lastly, based on the CP's previous experience and research of confined lithium-brine deposits, and sampling and analytical protocols, the CP is satisfied to include these data in resource modelling, evaluation and estimations as part of Vulcan Property lithium-brine resource estimate presented in this News Release.
Site visits	• Comment on any site visits undertaken by the Competent Person and the outcome of those visits. • If no site visits have been undertaken indicate why this is the case.	• The CP conducted a site inspection of the Vulcan Property on September 17, 2019. • The CP drove to and stepped on two of the five Vulcan project sub-properties (Taro and Rheinaue). • The site inspection of the Vulcan Property observed the existing infrastructure at/near the Property licences, including primary and secondary road networks that make the licences accessible and with ease of access to the electrical power grid. • The CP collected two brine samples and

		delivered them to the independent and accredited laboratories in Edmonton, Alberta. Both labs routinely process high TDS brine and perform trace element analysis for lithium. The results (mean of 180 mg/L Li) validated lithium-enrichment of the Buntsandstein Formation aquifer brine in the Upper Rhine Graben.
Geological interpretation	• Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. • Nature of the data used and of any assumptions made. • The effect, if any, of alternative interpretations on Mineral Resource estimation. • The use of geology in guiding and controlling Mineral Resource estimation. • • The factors affecting continuity both of grade and geology.	• An obvious uncertainty as discussed throughout this News Release relates to the lack of subsurface data and current access to brine within the boundaries of the Vulcan Property licences. This has led to several assumptions in the resource estimation process including: o Li-brine concentration: Because brine cannot currently be sampled from the Buntsandstein Formation aquifer underlying, and within, the licence (i.e. there are no wells that penetrate the deep-seated Buntsandstein Formation), the CP relied on geochemical data associated with Vulcan's 2019 brine sampling that included, off-licence, but proximal geothermal well locations. o Average porosity of the Buntsandstein Formation: While there was a significant amount of effective porosity measurements on Buntsandstein Formation sandstone from drill cores, none of the wells were collared within the boundaries of the licence. In the CP's experience, confined aquifers in sedimentary basins can have massive spatial extent and with homogeneous to semi-homogeneous lithium-in-brine concentrations. So, it is the CP's opinion that the Li-brine content of neighboring wells are a good proxy of lithium in the Buntsandstein Formation aquifer domain. • The largest source of uncertainty in the maiden Inferred Vulcan Li-Brine Resource Estimate is from volumes based on a 3-D geological model that was reliant on the GeORG subsurface geology interpretation. APEX attempted to validate subsurface information acquired from GeORG by: 1) contacting the GeORG Administrator; and 2) reviewing proprietary downhole log information acquired by Vulcan. Hence it is the opinion of the CP that the 3-D model used in the resource estimation process is a reasonable representation of the Buntsandstein Formation aquifer domain underlying the Vulcan Property licences. The author also states that any advancement of the resource classification would benefit from a more thorough validation process of the GeORG data to improve the confidence level of the

		deposit's stratigraphy. This includes the acquisition of seismic, wireline well logs, etc. to verify the GeORG geological interpretation.
Dimensions	• The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	• The top of the Buntsandstein Formation within Vulcan's licences is located at depths that range from 1,120 m to 4,910 m below the surface (average 2,910 m from surface). • The Buntsandstein Formation varies in mean thickness between the Licence Fields with the Ortenau having a mean thickness of 394 m. • The volume of the Buntsandstein Formation aquifer domain underlying the Ortenau licence was calculated using the 3-D wireframes created in Micromine. • As the Buntsandstein Formation is horizontally extensive over the entire Upper Rhine Graben, the strike length of the Buntsandstein Formation wireframes was extended over the entire Licence extent for Ortenau. • As the 3-D wireframes are closed solids, the CP calculated the volume of rock they enclose. Buntsandstein aquifer volume at Ortenau = 144.49 km^3 • A mean porosity value of 9.5% is used to define the porosity of the overall Buntsandstein Formation aquifer in this resource estimation. • The brine volume of reach resource area can be calculated by multiplying the aquifer volume (in m3) times the average porosity (9.5%) times the percentage of brine assumed within the pore space (100% as there is no oil and gas within the Buntsandstein in the samples collected by Vulcan). Brine volumes within the Buntsandstein aquifer volume at Ortenau = 13.73 km^3
Estimation and modelling techniques	• The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. • The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data. • The assumptions made regarding recovery of by-products. • Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation).	• This is a maiden Li-brine resource estimate for the Ortenau licence at the Vulcan Property. There are no known previous 'mineral resource' evaluations for Li-brine at the Vulcan Property. • The CP conducted initial estimations in the form of Exploration Targets for all 5 Vulcan Property Licences (see Vulcan Energy Resources Ltd. August 20, 2019 News Release). In this instance, the Ortenau licences were advanced to mineral resource on the basis of: 1) Vulcan's 2019 brine geochemical sampling program, which verified historical Li-brine concentrations in the vicinity of the licences; and 2) the development of a more detailed 3D geological model using GeORG cross-sections at a spacing of approximately 1 km. The other licences remain Exploration Targets and require additional work to increase the confidence level prior to making upgraded or modified statements on the Exploration Targets.

	• In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.
	• Any assumptions behind modelling of selective mining units.
	• Any assumptions about correlation between variables.
	• Description of how the geological interpretation was used to control the resource estimates.
	• Discussion of basis for using or not using grade cutting or capping.
	• The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.
		• The only element being estimated is lithium, and consideration of deleterious elements is beyond the scope of this early stage project and inferred resource estimation.
		• With respect to lithium recovery, Vulcan hopes to develop a rapid extraction technology to extract lithium from the geothermal brine cycle. Vulcan has yet to conduct bench-scale test work but has contracted Hatch and Jade Cove Partners to consult on future engineering work that includes: 1) lithium plant design; 2) an economic scoping study; and 3) directing lithium extraction process test work that involves a combination of the selective absorption and lithium hydroxide production techniques. A generalized process flowsheet of Vulcan's model to derive zero-carbon lithium hydroxide from the Vulcan Property and the Buntsandstein Formation aquifer is presented along with risks, uncertainties and mitigation strategies, as they pertain to process operations associated with extracting lithium-from-brine in conjunction with geothermal production.
		• The workflow implemented for the calculation of the Vulcan lithium-brine resource estimations was completed using: the commercial mine planning software MICROMINE (v 18.0).
		• The resource is calculated using a volumetric approach. Critical steps in the determination of the inferred Vulcan lithium-brine resources include:
		  ◦ Definition of the geometry and volume of the Buntsandstein Formation domain aquifers;
		  ◦ Hydrogeological characterization and an historical compilation and assessment of mean porosity within the Buntsandstein Formation;
		  ◦ Determination of the concentration of lithium in the brine;
		  ◦ Demonstration of reasonable prospects of eventual economic extraction are justified; and
		  ◦ Estimate the in-situ lithium resources of Buntsandstein Formation brine underlying the Vulcan Property licences using the relation:
		Lithium Resource = Total Volume of the Brine-Bearing Aquifer X Average Effective Porosity X Average Concentration of Lithium in the Brine.
		• The geometry and volume of the aquifers were calculated by designing 3-D model that wireframed the outline of the Buntsandstein Formation aquifer for each of the Ortenau

		licence, or resource area. A total of 49 cross-sections were used to formulate the 3-D model. Individual 2-D strings of the Buntsandstein Formation were created by tracing the top and bottom of the Buntsandstein Formation stratigraphy using each cross-section. The 2-D strings were then connected together to create a solid 3-D wireframe of the Buntsandstein Formation aquifer. The 3-D geological models were manually adjusted to honor the faulting that was interpreted at each section. • Buntsandstein Formation sandstone porosity varies widely in the URG, from 1.4% to 24.2%. Hence, the CP uses a mean porosity value of 9.5% (mean of over 300 effective porosity measurements from publicly available reports). This value is considered to represent a conservative, limit of Buntsandstein porosity for use in the resource estimation presented in this report. • The average lithium-in-brine concentration used in the resource estimations presented in this report is 181 mg/L Li and is based on the average of 13 samples collected by Vulcan during the 2019 sampling program and analyzed by trace metal ICP-OES analysis at 3 independent laboratories. • No top cuts or capping upper limits have been applied, or are deemed to be necessary, as confined Li-brine deposits typically do not exhibit the same extreme values as precious metal deposits (and this statement is applicable to the Buntsandstein Formation aquifer Li-brine data in this study).
Moisture	• Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	• Not applicable. The resource is a Li-brine resource.
Cut-off parameters	• The basis of the adopted cut-off grade(s) or quality parameters applied.	• A lower cutoff of 100 mg/L Li is used in this Li-brine resource estimation. It is the opinion of the author that this cutoff is acceptable because: 1) confined aquifer deposits traditionally have lower concentrations of lithium (in comparison to unconfined lithium-brine salar and hard rock lithium deposits), and 2) numerous commercial, academia and independent laboratories are now experimenting with rapid lithium extraction techniques using low lithium concentration source brine.
Mining factors or assumptions	• Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider	• At present, there are no oil and gas, or geothermal wells, that penetrate the deep-seated Buntsandstein Formation aquifer within the boundaries of the Ortenau licence. Consequently, to obtain brine access, Vulcan is either reliant on partnerships with pre-existing

	potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	geothermal companies, and/or drilling or renting their own wells at the Property. • It is the CP's opinion that geothermal facilities and Li-brine extraction operations are a good fit. The Li-brine extraction pilot plant (or commercial operation) could be situated after the heat exchanger, and therefore would not influence the main purpose of the geothermal plant. Assuming the lithium extraction process causes minimal compositional change to the brine, the lithium-removed brine could return to the subsurface aquifer via the reinjection well. Hence it is assumed both companies (geothermal and lithium) are extracting their own commodity of interest with virtually no interference between the two processes. • It is also assumed that Vulcan could drill their own wells and the 3-D geological model completed as part of this report shows there is a high degree of faulting with potential for high fluid flow in the Buntsandstein Formation underlying the Ortenau licence.
Metallurgical factors or assumptions	• The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	• To the best of the CP's knowledge, brine from confined subsurface aquifers has yet to be commercially mined for lithium. This is because a rapid extraction technology – that will replace more traditional beneficiation processes by solar evaporation – is still in development. • Confined aquifer Li-brine deposits traditionally have lower concentrations of lithium in comparison to unconfined Li-brine salars and hard rock lithium deposits. In addition, the aquifer deposits typically occur in areas where solar evaporation is not an option. Consequently, a number of laboratories (commercial, academia, independent) are attempting to develop modern technology that will beneficiate and recover the Li-brine from these types of deposits in real time. The developers are aware that the technology must incorporate lower source concentrations of lithium and are therefore testing Li-brine at low lithium concentrations. Accordingly, there are several laboratories that are experimenting with rapid lithium extraction techniques and/or conduct test work on low lithium source brine, including starting source levels of approximately 50 mg/L Li. • It is the opinion of the CP that it is only a matter of time, funding and test work until the rapid extraction technology becomes commercially viable. For example, European Geothermal Brines Lithium (EuGeLi) is developing the ERAMET and IFPEN direct adsorption lithium extraction processes at the Soultz-sous-Forêts Geothermal Facility, in the URG near the Town of

		Soultz-sous-Forêts and has reportedly extracted 85-90% lithium from brine. In addition, EnergySource Minerals Ltd. has reportedly extracted lithium from geothermal brine projects at the Salton Sea geothermal resource.
Environmental factors or assumptions	• Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	• Recent Government policy emphasizes conservation and hence promotes development of renewable sources, such as solar, wind, biomass, water and geothermal power. It the supposition of the CP that green energy opportunities such as Li-brine projects will be viewed favourable by the German Government. • As per the *Federal Mining Act*, Conditions associated with Vulcan's granted licences include: • Geothermal research within 400 vertical metres below the ground surface is not permitted. • Research is not permitted in water resource protection areas or nature and landscape conservation areas. • Seismic shocks related to the Vulcan project may not exceed limits set out by the Mining Law; and • Consent from affected landowners and authorities is required. • If required, Exploitation Licences would need to be acquired by Vulcan pending the results of Vulcan's future exploration work. The Exploitation Licence is typically smaller in spatial area in comparison to the Exploration Licence and require advanced modelling of the aquifer production and injection wells. Protected areas exist in each of the licences and include water protection areas (Zones I and II), nature conservation areas and Natural 2000 areas.
Bulk density	• Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples. • The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit.	• Bulk density is not applied, or necessary to be applied, to the liquid, brine-hosted resource. • The lithium resource was calculated using the volume of the brine bearing aquifer, the average effective porosity, the percentage of brine in the pore space and the average concentration of lithium in the brine.
Audits or reviews.	• The results of any audits or reviews of Mineral Resource estimates.	• Vulcan's Li-Brine Project is an early stage exploration project. No audits were conducted on the maiden Inferred Vulcan Li-Brine Resource Estimate presented in this report.
Classification	• The basis for the classification of the Mineral Resources into varying confidence categories. • Whether appropriate account has been taken of all relevant factors (ie relative confidence in	• The CP has classified the Vulcan Lithium-Brine Project maiden resource as an Inferred Mineral Resource. The Vulcan Property is an early stage exploration project and there has limited geological sampling and the geological evidence

	tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). • • Whether the result appropriately reflects the Competent Person's view of the deposit.	is sufficient to imply but not verify geological grade or quality continuity. • As per JORC (2012), the Inferred category is intended to cover situations where a mineral concentration or occurrence has been identified and limits measurements and sampling completed, but where the data are insufficient to allow the geological and grade continuity to be confidently interpreted. • It is the opinion of the CP that the project requires further detail to elevate the resource to a higher classification level. This work includes additional geological modelling and verification of the GeORG geological interpretation, and brine sampling within the individual Vulcan Property licences and ongoing brine processing test work toward the development of a modern lithium extraction technology.
Discussion of relative accuracy/ confidence	• Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate. • The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. • These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	• Uncertainty as discussed throughout this report relates to the overall lack of subsurface data and current access to brine within the boundaries of the licence. This has led to several assumptions in the resource estimation process including: Li-brine concentration and average porosity of the Buntsandstein Formation. • Another source of uncertainty in the maiden Inferred Vulcan Li-Brine Resource Estimate is from volumes based on a 3-D geological model that was reliant on the GeORG subsurface geology interpretation. APEX was unable to verify the GeORG cross-sections using abundant existing /and or new seismic data or downhole geophysical surveys to verify the accuracy of the GeORG interpretation. • As the resource is calculated using a volumetric approach, any changes to the 3-D model, the lithium concentration and/or the porosity will affect the calculated resource estimate. • In addition, it is entirely possible that future geological models to advance the deposit and resource classification, use a strategy in which sub-domains of the Buntsandstein Formation aquifer are wireframed to depict localized fracture zones with high fluid flow. This methodology would certainly reduce the overall Inferred Resource Estimate presented in this Technical Report into small Indicated and/or Measured resources.