

# Vulcan Energy Resources Limited: December Quarterly Activities Report

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## Quarterly Activities Report December 2022

[Vulcan Energy Resources Ltd.](#) (Vulcan; ASX: VUL, FSE: VUL, the Company) continued to operate its commercial renewable energy plant successfully and deliver on its strategy to develop the Zero Carbon Lithium&TRADE; Project during the December 2022 Quarter ("the Quarter"). Key highlights during the Quarter include Vulcan achieving operational advancements in successfully demonstrating its own in-house lithium extraction sorbent, VULSORB&TRADE;; and producing the highest grade, lowest impurity lithium hydroxide (LiOH) from its pilot plant, as the Definitive Feasibility Study (DFS) for Phase One approaches its conclusion.

### Highlights:

#### Renewable energy operations

• Produced 6,350 MWh of gross baseload, renewable energy from Vulcan's operational geothermal wells and plant at Natür<sup>3</sup>Lich Insheim, at an average selling price of €-0.26/kWh, helping Germany to respond to the energy and climate crises.

#### Phase One integrated Zero Carbon Lithium&TRADE; and renewable energy Project development

- Vulcan received approval from the state authority in Rhineland-Pfalz, Germany, for the Operating Plan for Vulcan's lithium extraction Demonstration Plant (Demo Plant). On-site works are ongoing, and once operational, expected by mid-year, it is intended that the Demo Plant will train Vulcan's team in a pre-commercial setting prior to commercial plant construction and operation.
- Vulcan's Pilot Plant successfully produced the data required for Vulcan's Phase One DFS, after thousands of hours of operation, having successfully operated since April 2021.
- The Phase One DFS is progressing and is on track for finalisation in Q1 2023, after which the project will move into a bridging phase, toward ordering long lead commercial equipment.
- Vulcan successfully developed, tested, and demonstrated its own in-house lithium extraction sorbent, VULSORB&TRADE;; for sustainable lithium extraction from the Upper Rhine Valley Brine Field and Vulcan's Zero Carbon Lithium&TRADE; Project. Vulcan announced it had produced the highest grade, lowest impurity LiOH from its Pilot Plant, located at its commercially operational geothermal renewable energy plant, at its Zero Carbon Lithium&TRADE; Project.
- Vulcan executed two agreements to expand its development footprint around its core, Phase One area.
- 3D seismic works in the Phase One area were completed successfully. A Resource update is expected imminently.
- Vulcan's transition and focus on project execution capability development for Phase One continued, led by Deputy CEO Cris Moreno, who was appointed during the Quarter. Recruitment continues to gather momentum to this end, with over 200 personnel now in-house.

#### Phase Two and future project pipeline

• 3D seismic survey works commenced on the ground in one of Vulcan's planned Phase 2 lithium and

geothermal energy development areas in the Mannheim district of the Upper Rhine Valley Brine Field. These works followed prior approval of the main operating plan by the state directorate. The results will be used in feasibility studies for Phase 2, which plans to incorporate the Mannheim area.

• Vulcan announced it had started several initiatives to expand its Zero Carbon Lithium & TRADE; business into France, specifically Alsace; this is a natural extension of the Upper Rhine Valley Geothermal Lithium Brine Field. Vulcan's previous work on the French side of the border indicated high lithium grades in Alsace brine of 214 mg/L Li and low impurities (inc. Si, Mn, Fe) (see ASX 10 March 2021), suggesting brine composition in Alsace is materially similar as the brine composition across the border at Vulcan's operations in Germany, meaning Vulcan's sustainable lithium production process is applicable across the whole field.

#### Other

- Vulcan changed its financial year end from June 30th to December 31st, effective from July 1st, 2022. The change of financial year now aligns with the German financial year, following the Company's listing on the Frankfurt Stock Exchange (FSE) regulated market in the Prime Standard market segment.

#### Subsequent to the Quarter:

- Sustainalytics, a Morningstar Company that is a leading independent ESG and corporate governance research, ratings and analytics firm, delivered Vulcan's first publicly available ESG Risk report in January, giving Vulcan an overall low ESG Risk Score of 16.8, which puts Vulcan in the top 2<sup>nd</sup> percentile of all chemicals companies, and 1<sup>st</sup> among peers of equal market capital size, surveyed by Sustainalytics. This demonstrates Vulcan's industry leading ESG management and performance.
- Vulcan recently signed a Binding Term Sheet with Stellantis for the first phase of a multiphase project aimed at decarbonising the energy mix of the Rüsselsheim auto manufacturing site in the Upper Rhine Valley, Germany, through the development of new geothermal projects.

Vulcan's Managing Director and CEO, Dr. Francis Wedin commented, "The progress made during the last quarter of 2022 is testament to our rapidly growing team, who are working hard to execute on Phase One of our Zero Carbon Lithium & TRADE; Project, which aims to provide domestic lithium production for the auto industry, as well as renewable heating production on a larger scale for Europe, from 2025. We believe the Zero Carbon Lithium & TRADE; Project is crucial for Europe, and will help to alleviate the energy crisis, support the decarbonisation of energy and lithium production, and mitigate the lithium supply issues for the of the European auto industry.

"As well as obtaining key approvals for our Demo Plant, we demonstrated our own in-house lithium extraction sorbent, which is an important asset for Vulcan, and produced our highest-grade lithium hydroxide to date from our Pilot Plant, which has just under two years of successful operation. The DFS for Phase One is on track for delivery this Quarter, after which we will enter a bridging phase towards ordering long lead items for our commercial lithium plant.

To this end, we welcomed Cris Moreno as Deputy CEO during the Quarter. Cris comes from a highly successful background of large-scale international project execution and delivery in the energy and lithium battery sector, and is focused on leading the build out of our project execution capability towards our targeted start of commercial lithium production in 2025."

Vulcan's Deputy CEO Cris Moreno said, "I'm very excited to have joined the Vulcan team. Our immediate focus is the delivery of Phase One of our Zero Carbon Lithium & TRADE; Project. Aimed to be the world's first, our project is unique, integrating geothermal energy and lithium production innovatively and circularly, ensuring we deliver carbon-neutral, domestically sourced energy, and lithium from Europe, for Europe".

#### Safety

Vulcan prioritises the health, safety and wellbeing of the Vulcan team, contractors, and stakeholders. Vulcan is pleased to announce that there were no HSE-relevant safety incidents during the December Quarter. In November Vulcan employed a dedicated HSEQ Manager. Their initial action items were to develop a full contractor training process as well as assist with ISO15001:2015, Occupational Health and Safety certification, to compliment already achieved ISO 14001 and 9001 certifications. Vulcan will continue to remain focused on adding ongoing safety improvements and embedding safety procedures as the Company transitions into the execution phase of the Zero Carbon Lithium&TRADE; Project.

### Renewable energy operations

Vulcan's operating geothermal renewable energy plant, Natur<sup>3</sup>Lich Insheim generated €1.64 million revenue for the Quarter. During the period, the power plant fed approximately 6,350 MWh of renewable electricity into the grid, supplying 7,500 households with power, and avoiding CO<sub>2</sub> emissions, helping Germany to respond to the energy and climate crises in Europe.

Figure 1: Natur<sup>3</sup>Lich Insheim - Vulcan's operating geothermal renewable energy plant

### Phase One integrated Zero Carbon Lithium&TRADE; and renewable energy Project development

Vulcan received approval from the state authority in Rhineland-Pfalz, Germany, for the Operating Plan for Vulcan's lithium extraction Demonstration Plant (Demo Plant). On-site works are ongoing, and once operational, expected by mid-year, it is intended that the Demo Plant will train Vulcan's team in a precommercial setting and improve operational readiness prior to commercial plant construction and operation, with initial Phase One commercial production targeted for end 2025.

Figure 2: Onsite works for Vulcan's Lithium Extraction Demo Plant.

During the Quarter, the team moved into an expanded laboratory, to further deepen their understanding of lithium processing and to optimise the process to inform the Definitive Feasibility Study (DFS). With its state-of-the-art equipment for wet and solid-state analyses, including full in-house inductively coupled plasma optical emission spectrometry (ICP-OES) and Ion chromatography (IC) analytical capability, the new laboratory has enabled Vulcan to expand its core competencies and centralise its proprietary lithium processes and deliver the required information for the Phase One DFS.

A highlight during this period was the successful development of Vulcan's own in-house lithium extraction sorbent, VULSORB&TRADE;. The team has successfully demonstrated multi-cycle sorption tests on Upper Rhine Valley geothermal brine using multiple commercially available and in-house aluminatebased sorbents. All sorbents have demonstrated >90% lithium recovery, in line with the assumptions used in the Pre-Feasibility Study. Data from VULSORB&TRADE; has been incorporated into the DFS.

In October the Vulcan chemical engineering team successfully produced the highest grade, lowest impurity LiOH to date from its Pilot Plant. The LiOH was produced from Vulcan's lithium extraction pilot plant, located at Vulcan's commercial geothermal renewable energy plant in the Upper Rhine Valley Brine Field (URVBF) in Germany, with downstream electrolysis processing offsite, as per Vulcan's planned commercial Zero Carbon Lithium&TRADE; Project. The latest material produced graded 57.1% LiOH, easily exceeding the best-on-the-market battery grade specification of 56.5% LiOH required from offtake customers. Impurities

were well below market specification minimums. The lithium chloride extracted by the sorbent in the pilot plant was recovered with water and sent offsite, where it was purified and concentrated by a third-party provider to prepare the lithium chloride for electrolysis to produce lithium hydroxide solution. The solution was then crystalized to produce battery grade lithium hydroxide monohydrate.

The embodied renewable heat within Vulcan's brine should enable Vulcan to use the commercially proven sorption method of lithium extraction at relatively low cost, which produces a very high purity LiCl product, which in turn enables the use of Li electrolysis to directly produce very high grade, low impurity LiOH. Vulcan's Pilot Plant has been successfully operating since April 2021 and has now produced sufficient data to complete Vulcan's Phase 1 Definitive Feasibility Study (DFS), which is scheduled for Q1 '23.

The Phase One DFS is progressing and is on track for finalisation in Q1 2023, after which the project will move into a bridging phase, toward ordering long lead commercial equipment. This DFS is for Phase One renewable energy and lithium production. Vulcan's multi-disciplinary team is aiming to increase production for Phase 1 relative to previous PFS assumptions with the business to scale up as Europe's demand for sustainable, locally sourced lithium grows.

3D seismic works in the Phase One area were successfully completed during the Quarter, to assist with refining of the field development plan. As part of its data gathering and interpretation, and towards the Phase One DFS, Vulcan is undertaking a Resource update, which is expected imminently.

Figure 3: URVBF showing license areas and key operations areas making up Vulcan's integrated renewable geothermal energy and Zero Carbon Lithium&TRADE; business. The map is not to scale and is a high level, visual representation of Vulcan's license area.

#### Phase One: Project Execution Delivery Capability

Vulcan appointed Cris Moreno as Deputy Chief Executive Officer (Deputy CEO), effective from 1 November 2022, based in Europe. Mr. Moreno is an energy and chemicals industry executive with over 20 years' experience in successfully delivering major capital projects, including in the lithium chemicals, cathode and LNG sectors. With unique experience in the development and execution of both LNG projects, which share many similarities in infrastructure development principles with Vulcan's geothermal renewable energy developments, and lithium hydroxide and cathode plant projects in Europe, Mr. Moreno is well positioned to complement Vulcan's leadership team, and is focused on developing Vulcan's project execution delivery capability, toward Phase One execution.

To this end, Vulcan's recruitment continues to gather momentum, focused on transitioning to a project execution company, with just around 200 personnel in-house as at 31 December. Subsequent to the end of the Quarter, Vulcan also acquired a drilling labour hire company, Comeback Personaldienstleistungen GmbH ("Comeback"), adding a further ca. 60 personnel to Vulcan's in-house development drilling team. Vulcan is targeting operational readiness for Phase One development drilling by mid-year, with rig refurbishment progressing well.

#### Phase Two and future project pipeline

3D seismic survey works commenced on the ground in one of Vulcan's planned Phase 2 lithium and geothermal energy development areas, in the Mannheim district of the Upper Rhine Valley Brine Field. These works followed prior approval of the main operating plan by the state directorate. The results will be

used in feasibility studies for Phase 2, which plans to incorporate the Mannheim area. Vulcan has a renewable heat offtake agreement with MVV, the municipal energy supplier for the City of Mannheim.

#### Financial position

The Company remains in a strong financial position with  $\hat{a}$ ,-134.1 million cash on hand at the end of the December Quarter. The Company received revenues from Natür<sup>3</sup>Lich Insheim power plant of  $\hat{a}$ ,-1.64 million plus VAT. Cash outlays during the Quarter related to:

- Phase One DFS engineering, most notably Hatch costs;
- On site works of the Sorption Demo Plant and ordering of CLP Demo Plant equipment;
- Natür<sup>3</sup>Lich Insheim power plant production costs;
- Refurbishment of electric drill rigs; &bull; Exploration costs and;
- Corporate costs.

#### Additional ASX Disclosure Information

ASX Listing Rule 5.3.1: Exploration and Evaluation expenditure during the Quarter was  $\hat{a}$ ,-4.6 million. Expenditure was on engineering studies towards the Phase One DFS for the Vulcan Zero Carbon Lithium&TRADE; Project, the successful completion of 3D seismic works in Phase One area, and interpretation of seismic data. Interpretation costs include capitalised costs from VES where time was allocated to Vulcan license areas.

ASX Listing Rule 5.3.2: Development expenditure during the Quarter was  $\hat{a}$ ,-11.4 million. Expenditure related to construction of the Sorption Demo Plant, purchase of equipment for the CLP Demo Plant and refurbishment costs for Vulcan's two electric drill rigs. Expenditure also related to design engineering costs which included capitalised costs from VEE where time was dedicated to Vulcan's Sorption Demo

#### Plant.

ASX Listing Rule 5.3.3: One exploration license in the Upper Rhine Valley was granted designated Waldnerturm, increasing the Company's license area in the Upper Rhine Valley Brine Field (URVBF) by 20.44km<sup>2</sup>. During the Quarter, Vulcan executed two agreements to expand its development footprint around its core, Phase One area. One agreement was with Geysir Europe GmbH, for the establishment of a 51:49 Joint Venture (JV) company (51% Vulcan) for a new geothermal development in the Landau-Sued license neighbouring Vulcan's Natür<sup>3</sup>Lich Insheim operation. Vulcan's 51% interest is contingent on execution of the first new geothermal well in the JV. Vulcan already has a brine offtake agreement with Geysir, for the existing geothermal wells and plant in the same license, which is separate to the JV. The second agreement is with Geo Exploration Technologies GmbH ("GET"), for Vulcan to develop new geothermal-lithium brine projects in the northern half of the "Rift" license also neighbouring Natür<sup>3</sup>Lich Insheim, designated "Rift Nord". GET will retain a royalty on lithium production which will be dependent on a lithium sales pricing mechanism, and a royalty on the proceeds from the sale of electricity and district heating. Together, these agreements are designed to complement lithium-bearing geothermal brine production in Vulcan's Phase One area around Vulcan's Insheim license.

ASX Listing Rule 5.3.5: Payments to related parties of the Company and their associates during the Quarter per Section 6.1 of the Appendix 5B total  $\hat{a}$ ,-128,000. This is comprised of an allocation of the Managing Director remuneration of  $\hat{a}$ ,-21,000, Non-Executive Director fees of  $\hat{a}$ ,-90,000 as well as consulting fees of  $\hat{a}$ ,-17,000 to JRB Consulting, a company related to one of the Non-Executive Directors, in respect of a Board mandated review of the company's ESG reporting. Please see the Remuneration Report in the 2022 Annual Report for further details on Director's Remuneration.

Payments to related parties of the Company and their associates during the Quarter per Section 6.2 of the

Appendix 5B totalâ, -82,000. This amount is an allocation of the Managing Director's remuneration for work done on exploration activities associated with the VulcanZero CarbonLithium&TRADE;Project. Please see the Remuneration Report in the 2022 Annual Report for further details on Director's Remuneration.

Vulcan Zero Carbon Lithium&TRADE; Project Granted Licenses

NAME	STATE	AREA (HA)	AREA (KM²)	TYPE	EXPIRY DATE (MM/YYYY)	
Upper Rhine Valley Geothermal-Lithium Brine Field						
Insheim	Rheinland-Pfalz	1,900	19.00	Production license	11/2037	100%
Ortenau	Baden-Württemberg	37,410	374.10	Exploration License	06/2023	100%
Mannheim	Baden-Württemberg	14,449	144.49	Exploration License	06/2024	100%
Lampertheim	Hessen	10,803	108.03	Exploration License	07/2024	100%
Lampertheim II	Hessen	198	1.98	Exploration License	07/2024	100%
Waldnerturm	Baden-Württemberg	2,044	20.44	Exploration license	12/2024	100%
Taro/Lisbeth	Baden-Württemberg	3,268	32.68	Exploration License	TAR 08/2025 LIS 09/2024	100%
Ludwig	Rheinland-Pfalz	9,634	96.34	Exploration License	12/2024	100%
Therese	Rheinland-Pfalz	8,112	81.12	Exploration License	12/2024	100%
Kerner	Rheinland-Pfalz	7,226	72.26	Exploration License	12/2024	100%
Löwenherz	Rheinland-Pfalz	7,543	75.43	Exploration License	12/2024	100%
Landau-Sued	Rheinland-Pfalz	1,941	19.41	Production license	N/A	Brine o project
Flaggenturm/ Fuchsmantel	Rheinland-Pfalz	14,114	141.14	Exploration License	FLA 12/2024, FUC 07/2023	100%
Ried	Hessen	28,992	289.92	Exploration License	07/2025	0% 50% in owners receive license
Rift-Nord	Rheinland-Pfalz	6,183	61.83	Exploration License	06/2027	
Cesano Field						
Cesano	Italy	1,146	11.46	Research Permit	01/2025	100%* 50:50 c

About Vulcan

Founded in 2018, Vulcan's unique Zero Carbon Lithium&TRADE; Project aims to decarbonise lithium production, through developing the world's first carbon neutral, zero fossil fuels business, with the co-production of renewable geothermal energy on a mass scale. By adapting existing technologies to efficiently extract lithium from geothermal brine, Vulcan is aiming to deliver a local source of sustainable lithium for Europe, built around a net zero carbon strategy with a strict exclusion of fossil fuels. Already an operational renewable energy producer, Vulcan will also provide renewable electricity and heat to local communities.

Vulcan's combined geothermal energy and lithium resource is the largest in Europe, with license areas in the Upper Rhine Valley, Germany, and in Italy. Strategically placed in the heart of the European electric vehicle market to decarbonise the supply chain, Vulcan is rapidly advancing the Zero Carbon Lithium&TRADE; Project to ensure timely market entry, with the ability to expand to meet the unprecedented demand that is

building in the European markets.

Guided by our Values of Integrity, Leadership, Future-focused and Sustainability, and united by a passion for environmentalism and leveraging scientific solutions, Vulcan has a unique, world-leading scientific and commercial team in the fields of lithium chemicals and geothermal renewable energy. Vulcan is committed to partnering with organisations who share its decarbonisation ambitions and has binding lithium offtake agreements with some of the largest cathode, battery, and automakers in the world. As a motivated disruptor, Vulcan will leverage its expert multidisciplinary team, leading geothermal technology and position in the European EV supply chain to be global leaders in the production of zero fossil fuel, carbon neutral lithium, while being nature positive. Vulcan aims to be the largest, most preferred, strategic supplier of lithium chemicals and renewable power and heating from Europe, for Europe; to empower a net zero carbon future.

#### Corporate Directory

Managing Director-CEO Dr. Francis Wedin  
Deputy CEO Cris Moreno  
Chairman Gavin Rezos  
Non-Executive Director Ranya Alkadamani  
Non-Executive Director Annie Liu  
Non-Executive Director Dr. Heidi Grön  
Non-Executive Director Josephine Bush  
Non-Executive Director Dr. Günter Hilken  
Non-Executive Director Mark Skelton

Executive Director, Germany Dr. Horst Kreuter

Company Secretary Daniel Tydde

For and on behalf of the Board

Daniel Tydde | Company Secretary

Media and Investor Relations contact

Germany:

Mareike Inhoff, PR Manager | [minhoff@v-er.eu](mailto:minhoff@v-er.eu) |

Doreen Rientiet, DWR Eco, | [rientiet@dwr-eco.com](mailto:rientiet@dwr-eco.com) |

Australia:

Annabel Roedhammer, Head of Investor Relations | [aroedhammer@v-er.eu](mailto:aroedhammer@v-er.eu) | +61 (0) 428 520 107

Please contact Vulcan's Legal Counsel Germany, Dr Meinhard Grodde, for matters relating to the Frankfurt Stock Exchange listing on mgrodde@v-er.eu

#### Reporting calendar

Vulcan has changed its financial year end from 30 June to 31 December, effective from 1 July 2022. The change of financial year end will align Vulcan with the German financial year, following the Company's listing on the regulated market of the Frankfurt Stock Exchange (FSE), in the Prime Standard market segment.

30 January 2023	December Quarterly
22 March 2023	Annual Report
28 April 2023	March Quarterly
28 July 2023	June Quarterly
15 September 2023	Half Year Report
27 October 2023	September Quarterly

#### 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.

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Competent Person Statement:

The information in this report that relates to Mineral Resources and Ore Reserves (respectively) of the Company's Zero Carbon Lithium™ is extracted from the ASX announcements made by Vulcan on 15 December 2020 ("Updated Ortenau Indicated and Inferred Resource") and 15 January 2021 ("Positive Pre-Feasibility Study"), which are available on [www.v-er.eu](http://www.v-er.eu). The information in this report that relates to Insheim's Mineral Resources is extracted from the ASX announcement made by Vulcan on 20 January 2020 ("Maiden Indicated Resource Insheim Vulcan Zero Carbon Lithium"), which is available on [www.v-er.eu](http://www.v-er.eu). The Company confirms that it is not aware of any new information or data that materially affects the information included in the original market announcements and that all material assumptions and technical parameters underpinning the estimates in the relevant market announcements continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Person's findings are presented have not been materially modified from the original market announcements.

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