



Luxembourg, 11.12.24

**Public**

## Environmental and Social Data Sheet<sup>1</sup>

### Overview

|                      |   |
|----------------------|---|
| Project Name:        | ZERO CARBON LITHIUM   |
| Project Number:      | 2020-0749   |
| Country:             | Germany   |
| Project Description: | <i>The project intends to produce 24 kt/yr of battery-quality lithium hydroxide, by combining extraction from the underground brine with associated geothermal plants under a closed fluid cycle, a lithium extraction plant and a refining plant. In addition, the project will produce electricity to cover most of its own consumption and heat for district heating in nearby towns, thereby targeting net-zero emissions. The project will be mostly located in the Upper Rhine Valley of Germany.</i> |

EIA required: yes

Full EIA required by authorities once project reaches 10 million cubic meters annual production threshold (extraction of lithium rich brine water). At current development phase, EIA not yet required. Project is being processed based on screen-out decisions by Competent Authority. Separate ESIA and consultations with local stakeholders carried out by project promoter. Link to ESIA has been published in EIB's Public Register.

Invest EU sustainability proofing required: yes

Project included in Carbon Footprint Exercise<sup>2</sup>: yes

### Environmental and Social Assessment

#### Environmental Assessment

The project intends to produce 24 kt/yr of battery-quality lithium hydroxide, by combining extraction from the underground brine with associated geothermal plants under a closed fluid cycle, a Lithium Extraction Plant (LEP) and Organic Rankine Cycle Plant (ORC) together comprising the Geothermal Lithium Extraction Plant (GLEP) all connected via an Interconnecting Pipeline & Power (ICPP) with a length of approx. 16 km. A separate lithium hydroxide refining plant (CLP) will also be built. In addition, the project will produce up to 560 GWh of heat per year and up to 275 GWh of electricity to cover most of its own consumption and heat for district heating in nearby towns, thereby targeting net-zero emissions. The project will be mostly located in the Upper Rhine Graben of Germany, which is one of Europe's largest lithium resources. One component of the project is located in an industrial park near Frankfurt.

<sup>1</sup> The information contained in the document reflects the requirement related to the environmental, social and climate information to be provided to Investment Committee as required by the Invest EU Regulation and it represents the equivalent of the information required in the template of the InvestEU sustainability proofing summary

<sup>2</sup> Only projects that meet the scope of the Carbon Footprint Exercise, as defined in the EIB Carbon Footprint Methodologies, are included, provided estimated emissions exceed the methodology thresholds: 20,000 tonnes CO<sub>2</sub>e/year absolute (gross) or 20,000 tonnes CO<sub>2</sub>e/year relative (net) – both increases and savings.



Luxembourg, 11.12.24

The main competent authority for the upstream components of the project is the Mining Authority (Landesamt für Geologie und Bergbau Rheinland-Pfalz), which has confirmed that according to current legislation, the Project is permitted and built under a series of individual Preliminary EIAs at this stage and only triggers a full EIA in the future under the Act on the Assessment of Environmental Impacts (*Gesetz über die Umweltverträglichkeitsprüfungs* or *UVPG*), to assess production volumes exceeding 10 Mm<sup>3</sup> of brine per annum, and when the Project is largely already built. Up until this point, assessment of environmental and social impacts is undertaken on specific project components in a stepwise and iterative process under various pieces of German legislation, mainly the German Federal Mining Law (*Bundesberggesetz* or *BbergG*). For the other components, namely the various facilities, the authorities are City of Landau (ORC Plant, ICPP), Struktur- und Genehmigungsdirektion (SGD) Sud (GLEP), Rhineland-Palatinate Mining Geology State Office (GLEP), Regierungspräsidium Darmstadt (CLP).

The project will consist of the following components:

| Component  | Location  | Status  | Screening decisions  |
|--|---|---|--|
| Well sites (7, including 2 existing) with altogether 28 wells<br>1.1. Schleidberg<br>1.2. Trappelberg<br>1.3. 40 Morgen<br>1.4. Hasenberg<br>1.5. Spreissgraben<br>1.6. Landau<br>1.7. Insheim | Landau-Insheim  | 1.1. Under construction<br>1.2. –<br>1.3. –<br>1.4. –<br>1.5. –<br>1.6. Operational,<br>1.7. Operational        | 1.1. Screened out<br>1.2. Screened out<br>1.3. –<br>1.4. –<br>1.5. –<br>1.6. Already operational<br>1.7. Already operational |
| Interconnecting Pipeline & Power (ICPP) with length of approx. 16 km   | Landau-Insheim  | Pipeline route alignment will mainly follow parcel boundaries 1.5m underground. Route alignment still underway. | Not yet available  |
| Lithium Extraction Plant and Organic Rankine Cycle Plant (ORC) together comprising Geothermal Lithium Extraction Plant (GLEP)  | Industrial park D12 – Gewerbepark Messengelände Süd-Ost, Landau |   | Not needed for LEP as per State Office for Geology and Mining (LGB)<br>For ORC plant: Not yet available                      |
| Insheim Geothermal Plant (4.3 Mwe);  | Insheim   | Operational   |  |
| Central Lithium Plant (CLP)  | Hoechst industrial park near Frankfurt                          | Applications for the CLP under the Federal Building Act and Immission Control Act                               | Not yet available  |



Luxembourg, 11.12.24

|  |  |  |  |
|--|--|--|--|
|  |  | were submitted on 4 March 2024 and are under review. |  |
|--|--|--|--|

The Insheim Geothermal Power Plant is an existing facility. The GLEP will be established in a commercial area south of Landau and near the also existing Landau well site. Additionally, the GLEP site selection is strategic as the planned pipeline route mainly crosses agricultural land, minimizing environmental and logistical challenges. The CLP site is within an industrial park.

#### Environmental Impact Assessment

A project with potentially adverse effects on the environment during construction, modification, and operation is required to have an Environmental Impact Assessment (Umweltverträglichkeitsprüfung: UVP) conducted under oversight of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection as instructed in the Act on the Assessment of Environmental Impacts (UVPG<sup>3</sup>). Germany has transposed the EIA Directive into national law by means of UVPG. There are two types of assessments under the UVPG: a full environmental impact assessment (Umweltverträglichkeitsprüfung: UVP) and a preliminary environmental assessment (Umweltverträglichkeitsvorprüfung: UVP-V). Both the UVP and UVP-V are assessments of the potential environmental impact of a project and are not permits themselves. These assessments influence the overall permitting process.

For mining projects, including deep geothermal projects, the regulations of the Ordinance on the Environmental Impact Assessment of Mining Projects (Verordnung über die Umweltverträglichkeitsprüfung bergbaulicher Vorhaben: UVP-V Bergbau) also apply.

Non-binding guidelines related to EIA have also been established at the state level and include more specific input pertaining to applications and interpretations of new EIA regulations.

Typically, geothermal facilities require construction and water law permits; a permit following the Federal Mining Act (Bundesberggesetz or BbergG) is also needed. Geothermal drilling at depths greater than 100m must follow mining law/regulations, as specified by § 127 of the Federal Mining Act (BbergG). A preliminary EIA (Umweltverträglichkeitsvorprüfung: UVP-V) must be carried out by mining authorities for borehole drilling and extraction or exploration of mineral resources.

#### Water

No adverse effects on the ecological status or on the objective of achieving good ecological status of surface or ground water (as required by the Water Framework Directive 2000/60) are expected from the Project's effluents. All the streams within the area of influence are already modified.

At the well sites, hot brine (~165°C) is pumped from deep underground with most of the thermal energy transferred from the brine to industrial water. The various drill sites will be connected to the GLEP via interconnecting pipeline and power (ICPP) system. The brine is circulated from the well sites to the Lithium Extraction Plant (LEP, which is part of the GLEP) and then back to the well sites to be re-injected deep underground i.e. in the same depth and reservoir than from being produced.

The target formation for the brine production and injection is the Buntsandstein Formation, which is at depths of between approximately 2,500 m and 3,500 m below ground level. Thus, the brine is not considered ground water, which is found at depths of between 1-140 meters in the area since the brine and the near-surface groundwater are isolated by more than 2,000 m thick mainly clay-rich sedimentary barrier. Special care will be taken to ensure there is no contamination of ground water from the drilling, production and injection process. The geothermal brine wells will be constructed with telescopic steel casing which will be cemented in place. These measures will prevent brine from coming into contact with the near-surface

<sup>3</sup> Gesetz über die Umweltverträglichkeitsprüfung – UVPG



Luxembourg, 11.12.24

groundwater and aquifers. To protect the environment and prevent water contamination, the well sites will be constructed with liquid-proof asphalt, ensuring that hazardous liquids cannot seep into the ground. The area also includes a separate drainage system where rainwater is channelled into a retention or buffer tank. Further detail on ground water is provided in the special operating plan for Schleidberg well site which delineates the design measures and monitoring that will be employed at the well site to protect the near-surface groundwater aquifers from contamination (i.e. drilling to 140 m). This method of aquifer protection should be transferrable to all well sites. Similarly, permitting applications under the Immissions Control Act require the promoter to demonstrate how impacts to groundwater will be mitigated.

The transport of geothermal energy requires that the planned industrial water pipeline is filled at the first time of use with water of sufficient quality. For this purpose, a well for the abstraction and use of fresh groundwater is planned on the site of the geothermal power plant. Minor amounts of groundwater during production will be added to make up for losses in the system.

The Project's surface facilities operates as a closed loop system. This means that no brine or non-condensable gases should leave the cycle. Instead, the brine with dissolved gases is injected into the reservoir via an wells. The promoter's process is designed to minimize waste, and any residual waste disposed of at certified landfill sites.

#### Seismic Risk

Per promoter's information, subsurface sector best practices will be applied as part of their well completion, drilling and operational strategies, in order to mitigate any potential induced seismicity above allowable thresholds from the project. The promoter for example committed to avoid directly injecting into the basement and envisages to locate a certain number of injectors in the matrix rather than in fault zones, if injectivity is proven in the matrix. A seismic monitoring system mandated by the authorities will be installed for continuous and real-time detection of any induced seismic events, both by the authorities and the promoter (from separate different monitoring networks), in order to apply remediation measures shall seismicity magnitudes reach the limits imposed by the regulation traffic light system.

#### Biodiversity

The ESIA reports findings from field surveys, conducted by Institut für Naturkunde in Südwestdeutschland from 2018 to 2022 to support regulatory approvals, that identified several species of conservation concern and some subject to special protection under EU directives and federal law – including the crested skylark, Eurasian buzzard, Eurasian skylark, northern wheateater, hazel dormouse, and sand lizard. The ESIA considered none of the species identified restricted in range or previously unknown in the district.

Well sites and the connecting pipeline are planned to be installed in modified habitat (urban and agricultural) thus avoiding overlap with any protected areas. However, five Natura 2000 sites were identified during the studies within the vicinity of the project, but only two close enough to experience potential indirect impacts. The pipeline planned from the existing Landau well site to the planned GLEP at Landau is located in close proximity (~50 m) to the Natura 2000 site 'Standortübungsplatz Landau' but no direct impacts are expected. Measures will be put in place to avoid adverse indirect impacts such as noise, vibration and light during construction and during the operation phase of the GLEP.

#### Landau site:

1. Standortübungsplatz Landau: distance of ~50 m from pipeline, 100 m from GLEP. Potential indirect impacts (noise and vibration)
2. Bellheimer Wald mit Queichtal: within a distance of ~1.2 km from the GLEP
3. Erlenbach und Klingbach: within a distance of <500 m from the drill site at '40 Morgen'. Potential indirect impacts (noise and vibration)



Luxembourg, 11.12.24

CLP site at Industrial Park Hoechst:

4. Schwanheimer Wald: within a distance of ~1.4 km from the lease plot
5. Schwanheimer Düne: within a distance of ~700 m from the lease plot

**Climate Assessment**

Rhineland-Palatinate is one of the regions most affected by climate change in Germany, with annual temperature rising by around 1.7 degrees Celsius over the last 130 years and increasing frequency of extreme weather events such as storms, high and low water levels, and periods of drought.

Due to the location and geographic features of the Project components, the relevant climate hazards for the Project will relate to water scarcity and extreme heat for all the Project components. For the GLEP in Landau and the CLP in Höchst urban floods are relevant. River floods are not considered as only small streams are present within the Aol of the project components near Landau. Additionally, the CLP in Höchst is located outside the boundaries of areas affected by extreme floods, so river flooding is not considered relevant for this evaluation.

**EIB Paris Alignment for Counterparties (PATH) Framework**

As a single owner Special Purpose Vehicle (SPV) the borrower is in scope of the PATH framework but screened-in for high vulnerability and meeting requirements.

**EIB Carbon Footprint Exercise**

Estimated emissions savings are 336 kilotonnes of CO<sub>2</sub> equivalent per year. The absolute emissions are related to the net power consumption of the project, which is about 266 GWh/yr and the grid factor for Germany is 319 gCO<sub>2</sub>/kWh. The relative emissions are calculated based on alternative production of Lithium, which is about 15 tonnes of CO<sub>2</sub> per tonne of LiOH. In addition the project is progressively supplying heat to a district heating system under development. In the first 10 years of commercial operation, the project will supply about 450 GWh of heat on average per year, which replaces individual gas burners with an emission factor of 216 gCO<sub>2</sub>/kWh.

For the annual accounting purposes of the EIB Carbon Footprint, the project emissions will be prorated according to the EIB lending amount signed in that year, as a proportion of project cost

**Social Assessment**

There are some commercial buildings and wastewater plants within the project's area of influence in Landau and Insheim and there are residential buildings near the GLEP D12 site, Hasenberg well site, Insheim Geothermal Plant and well site, and Trappelberg well site. However, almost all these sites are along or near the border of the development areas. Only a residential building about 130m away from the Insheim Geothermal Plant lies along the fence line of the existing plant area. The CLP at the industrial park in Frankfurt is located at a considerable distance from the nearest settlements, which helps ensure minimal impact on local communities. Furthermore, there are no sensitive social receptors, such as schools, or hospitals, in the vicinity of the CLP.

The ESIA asserts that social impacts are largely positive in nature due to renewable energy provision (heat and power) to local communities and the creation of job opportunities. Notwithstanding this, the following social impacts are noted: (i) some land areas used for leisure and tourism, namely near the Landau D12 (GLEP) site and 40 Morgen, that may be impacted by visual impacts and (ii) when activities commence there will be an increase in traffic or the



Luxembourg, 11.12.24

disruption of access to transport infrastructure. Noise and traffic management plans and mitigations will be in place prior to construction.

Archaeological soundings were conducted at the 40 Morgen drill site which is known to be in an area of archaeological findings. Based on preliminary assessments, this specific site area is assumed to have remnants mainly from the Stone and Iron Ages and is thought to have previously been a dump site. A total of 121 archaeological features were discovered. Among these, 18 were identified as prehistoric and 5 as Roman Imperial, while one contained modern materials. Prehistoric finds included pottery fragments and hut clay, while Roman finds included pottery and brick fragments. To manage any future potential chance finds, a heritage management plan and chance finds procedure should be prepared in accordance with the requirements of the Monument Protection Act (DSchG) and the land development plan of the City of Landau.

The local authorities confirmed that the project enjoys strong support from both the authorities and majority of local stakeholders. Geothermal energy projects have been developed in the past and inhabitants in and around Landau and Insheim are familiar with them. Access via the project to geothermal district heating at a lower expense and low carbon footprint are especially enticing to the stakeholders. Some opposition from a handful of citizens' groups opposing deep geothermal drilling and the related seismicity risk has been noted.

Germany, being an EU country and having strong legal framework protecting the rights of community members and safety of workers, ensures all works related to the project have to be properly permitted before any activity can proceed. The land required for the Project is held by both public municipalities as well as private owners and is either currently owned by the Promoter or in the process of being acquired.

## **Public Consultation and Stakeholder Engagement**

The promoter has initiated numerous stakeholder engagement sessions and outreach efforts to date via social media, advertisement in the local newspapers, the information centres in Landau and Karlsruhe, and an information truck showcasing their 3D seismic mapping activities and to inform the local public about the project progress in general. There is also a visitor centre at the Insheim Geothermal Plant. Once production reaches 10 million m<sup>3</sup> per annum, the promoter must have in place an approved EIA and related stakeholder consultation as per the EIA directive. However, as the German authorities do not at this development stage recognise the need for a full EIA, EIB along with other potential financiers requested the promoter to prepare an Environmental and Social Impact Assessment (ESIA) by an external consultant to align as closely as possible with the expected full EIA. For consultation, the ESIA was published on the promoter's website on 16 September 2024 along with a Non-Technical Summary and Stakeholder Engagement Plan as well as a web form seeking feedback on the ESIA allowing the public to comment on the risks identified in the ESIA and measures to address the risks. The ESIA includes a Stakeholder Engagement Plan and grievance mechanism. A documented stakeholder consultation meeting open to local stakeholders will need to be carried out focusing on risks and mitigation measures identified in the ESIA and documenting questions raised and responses in addition to the on-line consultation described above.





Luxembourg, 11.12.24

## Other Environmental and Social Aspects

The holding company Vulcan Energie Ressourcen GmbH received ISO 14001:2015 Environmental Management System (EMS) in 2023 and ISO 9001 Quality Management System (QMS) certification in 2022.

Closure plans for Project components regulated under the Mining Act (LEP, well sites, ICPP, and the Insheim and Landau plants) should become progressively more detailed over the life of operations. The CLP is regulated in the lease contract with the chemical park operator, Infracor.

The promoter is taking industry-standard measures to inhibit buildup of scaling and metal-rich sulfide deposits. However, areas with larger deposits of NORM (Naturally Occurring Radioactive Material), such as heat exchangers and filters tend to have increased radiation levels compared to the local background due to the presence of scaling deposits. The promoter will develop and adopt a waste management plan for safe handling and disposal of NORM and other hazardous waste.

With regards to ancillary facilities, a geothermal power plant and geothermal well in Landau is planned to be connected to the project. This plant is currently operated by geox gmbh,, however an agreement has been signed for Vulcans 100% acquisition of geox GmbH (Geox). This geothermal plant has been operational from 2007-2014 and is currently shut down for workover. The promoter will use only those facilities already assessed and licensed by German authorities.

Whilst Germany is aligned with EU Directive 2011/92/EU, currently the various project components have not triggered a full EIA under German legislation, and this is unlikely to occur until the Project is almost fully constructed and in operation.

## Conclusions and Recommendations

The German permitting process requires that the promoter first demonstrate the full production capacity of the lithium brine resource, i.e. once all infrastructure has been constructed and completed, before full production permits are issued. Consequently, permitting is an ongoing and iterative process that is part of the normal course of project execution for this style of project in Germany.

Sustainability proofing conclusion: The project has been assessed against the InvestEU sustainability proofing requirements based on the ESIA report, the Independent Environmental and Social Review (IESR), and environmental permits and additional conditions imposed by the competent authorities. It can be concluded that the project is consistent with the InvestEU sustainability proofing requirements and the proposed mitigation measures are expected to mitigate the residual impacts in compliance with the applicable EU legislation. The following conditions have to be met by the promoter:

Conditions to be fulfilled before disbursement related to the relevant components:

- Provide decision of SDG Sud on the ORC Plant
- Provide decision of Regierungspräsidium Darmstadt on the CLP
- In-person stakeholder consultation of the ESIA

Undertakings:

- Share with the Bank any updates from the relevant competent authorities regarding permits or screen-out decisions.
- Continuous monitoring of construction works by an ecological specialist



Luxembourg, 11.12.24

- Install appropriate wildlife fencing along the project perimeter during construction where site infrastructure (i.e. the planned pipeline) will be located near to the Natura 2000 site 'Standortübungsplatz Landau'
- Compile and implement a suitable Invasive Alien Plant (IAP) species control plan
- Develop a Traffic Management Plan
- Develop and implement a waste management plan for NORM and other hazardous waste.
- Develop a chance finds procedure for culturally important artifacts