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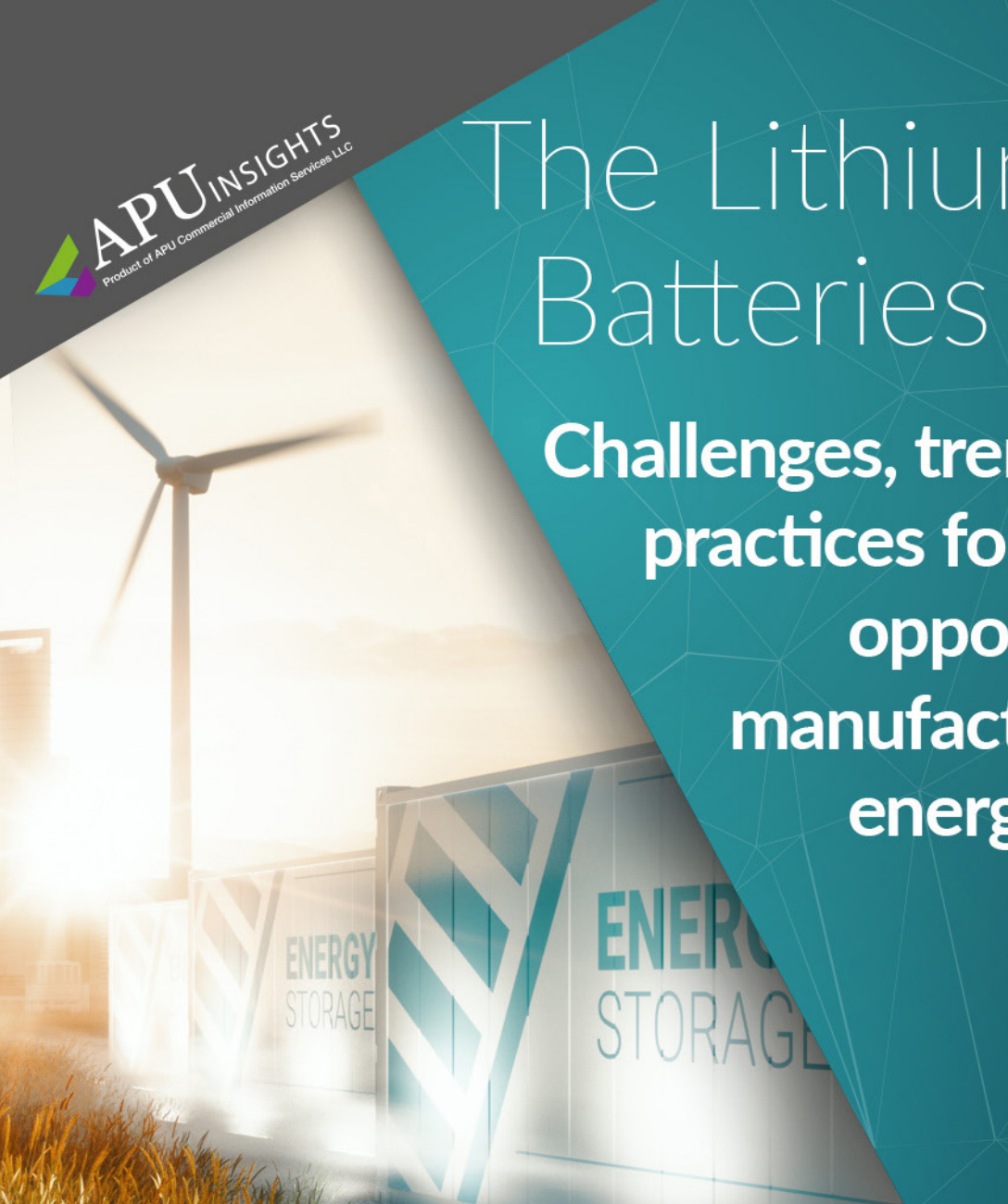
The Lithium – Ion Batteries Market

Challenges, trends and best practices for investment opportunities in manufacturing and energy sector



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THE TECHNOLOGY OF LITHIUM-ION BATTERIES IS OFTEN THE SOURCE OF ENERGY FOR MANY ELECTRONIC DEVICES, INCLUDING MEDICAL ONES.

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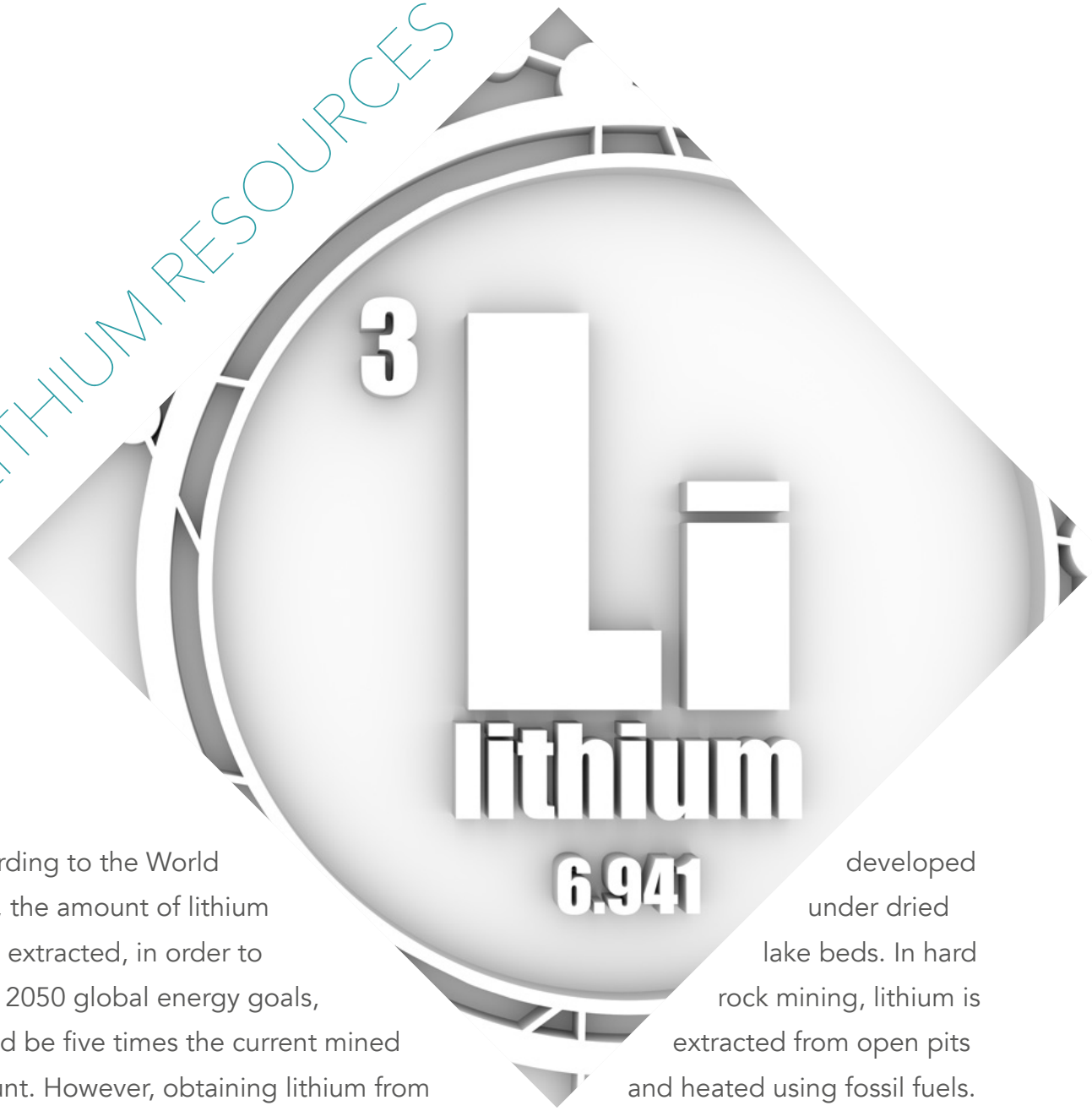
The

present energy scheme, based mainly on carbon, has affected the environment, culture and economy, in a negative way. Whilst population grows and energy demand rises, continuing depletion of fossil fuels and climate change drive the need for supplementary, sustainable

[1] Greim, P., Solomon, A. A., Breyer, C., (2020, September). Assessment of lithium criticality in the global energy transition and addressing policy gaps in transportation. Nature Communications, 11(1), 1-11.

energy sources, based on renewable energy (RE). Such a trailblazing shift demands pioneering ideas and technologies, including electrical energy storage systems for stationary grid applications in the power sector and mobile battery electric vehicles. Bearing in mind the required exceptional quantities in order to achieve a global energy transition, it is reasonable to question the resource availability and accessibility. Following this concern, one element gains popularity in the manufacturing and energy world, lithium (Li). Due to its characteristics, along with its storage and flexibility properties, lithium is involved with many technological innovations, such as the lithium-ion (Li-Ion) battery, which takes on a fundamental role in fully RE systems[1].

LITHIUM RESOURCES



According to the World Bank, the amount of lithium to be extracted, in order to meet 2050 global energy goals, should be five times the current mined amount. However, obtaining lithium from the conventional sources has a major negative footprint towards the environment, including CO2 emissions, as well as water and land depletion. Lithium is mainly sourced from hard rock mines, or underground brine reservoirs, developed under dried lake beds. In hard rock mining, lithium is extracted from open pits and heated using fossil fuels. This erodes the landscape, while it necessitates a large amount of water as well. According to a research from the Vulcan Energy Resources energy company, for every ton of extracted

lithium, 15 tons of carbon emissions are released in the atmosphere. The second conventional source of lithium, from underground reservoirs, requires even more water for the extraction process, driving concerns about the sustainability of utilizing such resources.

An innovative and more sustainable lithium source, from geothermal waters, found in Cornwall, UK, in Germany and in the US; these resources have a very small environmental footprint, related to the conventional ones, with very low carbon emissions. Geothermal brines are hot, concentrated saline solutions, circulated throughout hot rocks and enriched with several elements, including lithium. The brine in the Cornwall, for example, has concentrations of up to 260 milligrams per liter, flowing at a rate of between 40-60 liters per second. That amount is enough for a typical smartphone battery (2-3g) passing through the production process.

Technological advances are a significant tool in order to extract lithium from saltwater. The most popular is a technique called Direct Lithium Extraction (DLE), which has been implemented by numerous companies in the US, Germany and New Zealand. Based on a research from Jade Cove, a San Francisco advisory firm, there are approximately 60 sub-techniques of DLE technology, although the core process includes methods such as nanofiltration or ion-exchange resins, which are used as filter to separate lithium chloride from the other salts in the water. The lithium chloride is then purified and concentrated to produce lithium hydroxide, which is used to make batteries.

In the US, William Stringfellow, Director of the Ecological Engineering Research Program at Lawrence Berkeley National Laboratory, is conducting research on the different methods for extracting lithium from brine. One approach is to use solvents designed to collect lithium ions, while others include the use of membranes that only allow lithium ions to pass, and electrochemical separation, where lithium ions are drawn to charged electrodes.

Except for the UK, there are two other important geothermal fields, the Salton Sea and the Rhine Valley. The first is a shallow

[2] Early, C., (2020, November). The new 'gold rush' for green lithium. BBC.

lake in the center of California and the second largest geothermal field in the US, named "lithium valley". The California Energy Commission has estimated that the field could provide 40% of global lithium demand. The latter is in Germany and consists the center of the country's emerging geothermal lithium industry. Its lithium concentrations reach the amount of 181 milligrams per liter.

Ultimately, there may be a few years before the global zero carbon emission goal is achieved when extracting lithium, but it has the potential to become the powerful future example of a mineral, obtained in a sustainable way[2].

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