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ЛИТИЙ КАК ОСНОВНОЙ РЕСУРС ЦИФРОВОЙ РЕВОЛЮЦИИ

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LITHIUM AS A KEY RESOURCE FOR THE DIGITAL REVOLUTION

Introduction

Lithium is one of the most important resources of mankind, as it is used in a huge number of areas due to its useful properties. Lithium is required in the manufacture of all kinds of equipment, devices and cars, plays an important role in metallurgy for the creation of alloys, and is often used in construction. No less important is the role of lithium in the nuclear industry and medicine. However, the most well-known area of application of this metal is the creation of lithium-ion batteries, and there are not many analogues of this technology as of 2024.

Lithium-ion batteries (Li-ion) have become a key component of modern energy storage technology due to their unique properties. Lithium, as the lightest and most electrochemically active metal, is an ideal element for creating batteries with high energy density. It has allowed the development of compact and efficient batteries that are used in most mobile devices such as smartphones, laptops, tablets, and smart watches. As one of the fastest growing segments of the technology market, the lithium-ion battery market is estimated at $50 billion.

In defining the relationship between lithium and the financial sector, we will highlight the following main areas:

1. Lithium-ion batteries make up the bulk of electric vehicle batteries. In 2022, about 60% of lithium was used in electric vehicle batteries.

2. Lithium is used in mobile phone, tablet, and laptop batteries (roughly the same as electric vehicle batteries, but data varies due to the large number of different models).

3. Lithium is used in stationary energy storage systems to store energy from renewable sources (solar panels and wind turbines, specific data is not available in the report).

4. Some medical devices, such as defibrillators and implantable devices, may also use lithium-ion batteries. The percentage of lithium may vary, and specific data depends on the type of device.

In the future, we will refer to official statistics on the production and consumption of lithium from the website of the US Geopolitical Service, which compiles annual reports in this area. The reports for 2022-2024 were studied; they contain such information as world lithium reserves, production and reserves of this metal, processing, and global trends were also highlighted. Thus, the global use of lithium by 2024 was distributed in such a way that 87% of lithium goes to the creation of batteries, 4% - to ceramics and glass, and less than 1% of all lithium reserves are currently allocated to medicine and other industries.

World lithium reserves, production and reserves

In 2021, global lithium resources were estimated at 89 million tons, by 2023 the number had grown to 105 million tons. First of all, let's identify the countries with the largest lithium reserves. The Lithium Triangle is a region at the junction of Bolivia, Argentina and Chile, where the world's largest reserves of lithium are located, used to produce batteries, including for electric vehicles and other green energy technologies.

Bolivia has the world's largest lithium reserves, concentrated in the Salar de Uyuni, the largest salt flat on the planet, covering an area of about 10,500 km². This unique natural formation has become not only a tourist attraction, but also an object of serious industrial interest. Lithium, which is extracted from mineral-rich brines, is a key resource for the global battery industry.

In 2023, a new lithium deposit estimated at 2 million tons was discovered in the Potosi region, revising Bolivia’s total reserves to number one in the world, reaching 23 million tons. In December 2023, the first lithium processing plant, owned by the state-owned company YLB (Yacimientos de LitioBolivianos), created in 2017, began operations near the deposits. However, mining and processing are still on a small scale, and the industry is in its early stages. The country has entered into agreements with the Chinese consortium CBC and the Russian company Uranium One to use a new technology called direct lithium extraction (DLE), which promises to reduce the consumption of water, a critical resource in the region. However, despite government assurances that the new technology is safe, there are serious concerns among locals. In 2023, protests erupted in the town of Villa Mar against Uranium One’s lithium mining operations. Residents of the region are afraid for their future because lithium mining requires large volumes of water, which could worsen the already difficult situation in the arid region. Climate change, particularly reduced rainfall, is increasing local concerns that their traditional way of life will be threatened.

Chile, the third largest member of the Lithium Triangle, has been mining lithium in the Atacama Desert since the 1980s. Chile’s lithium reserves are estimated at 11 million tons, making the country a key player in the global market. However, lithium mining in Chile is also associated with environmental concerns. Local residents have expressed dissatisfaction with the deterioration of the ecosystem and concerns about water conservation. The water volume in the San Pedro River has been significantly reduced, dropping from 1,200 to 350 liters per

second since 2008. These changes are causing serious concern for farmers and herders whose livelihoods directly depend on water resources.

China, despite its relatively modest lithium reserves – about 7% of the world's total – plays a major role in the global lithium industry due to its dominant position in lithium recycling and lithium-ion battery production. China currently recycles almost half of the world's lithium, making it a key player in the global battery market despite its reliance on imported raw materials. However, China is actively working to reduce this dependence. In early 2024, China's Ministry of Natural Resources announced the discovery of a new lithium deposit in Sichuan province with reserves estimated at 1 million tonnes. In addition, Chinese companies are increasing their presence in countries with large lithium reserves, such as Zimbabwe, Mali, the Democratic Republic of Congo, and Ethiopia. This helps China control the supply chain of raw materials needed to produce the batteries it needs to support its ambitious transition to electric vehicles.

China is investing heavily in developing new lithium mining technologies and working to increase its own reserves and production. This is especially important given the growth of electric vehicles, which account for the bulk of lithium-ion battery consumption. Chinese electric vehicle manufacturer BYD became the largest exporter of electric vehicles in 2023, overtaking Tesla, further increasing the country's demand for lithium. However, experts predict that China may face a lithium shortage in the future. Existing deposits are expected to be depleted by 2040, requiring the discovery of new reserves or increased cooperation with foreign countries. In addition, economic competition with the United States in the high-tech sector is pushing China to improve its energy security and control over critical materials such as lithium.

Australia is the world's largest lithium producer, accounting for almost half of the world's lithium production. The country has significant economically viable lithium reserves, estimated at 6.2 million tonnes. Australia is home to five of the world's ten largest lithium mines, making it a key supplier of the raw material to the global battery industry.

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However, despite its leadership in production, Australia faces some challenges. Firstly, most of Australia's lithium is exported in its raw form rather than processed locally, reducing the added value for the country's economy. In addition, global demand for lithium is growing rapidly, and although Australia has significant reserves, it may struggle to meet this demand in the long term.

Australia and China also work closely together in lithium mining. China's TianqiLithium controls 51% of the world's largest lithium mine, Greenbushes, in Western Australia, with the remaining 49% owned by US company Albemarle. The mine plays a key role in the global lithium supply chain, highlighting the strategic

importance of Australian lithium to China and beyond. As such, Australia and China are at the forefront of the global race for lithium, with Australia focusing on mining and China on refining and battery manufacturing. Both countries are working hard to expand their market share as lithium continues to be a key resource for green energy and the global transition to electric vehicles.

Australia and China therefore lead the global race for lithium, with Australia focusing on mining and China on refining and battery manufacturing. Both countries are working hard to expand their market share as lithium continues to be a key resource for green energy and the global shift to electric vehicles.

Russia has hydromineral resources of lithium discovered in the Soviet period. The most promising of them are the Znamenskoye, Tugurskoye, Omoloyskoye, Balagankinskoye, and Verkholenskoye deposits. In addition, there are prospects for lithium production from associated brines of the Verkhnechonskoye and Yaraktinskoye gas and oil fields with an expected production of 338 tons and 134 tons, respectively. Four basic technologies for cost-effective processing of brines to obtain lithium-containing chemical products have been substantiated: lithium chloride, lithium bromide, and lithium hydroxide monohydrate. Hydromineral resources have also been discovered in a number of other regions of Russia, including the Republic of Dagestan, Arkhangelsk, and Astrakhan Oblasts, where lithium is contained in artesian waters and formation brines of oil and gas fields.

Conclusion

To summarize briefly, it can be said that large countries such as China and Russia, although they have some lithium reserves, often they are not enough for active development of the country, so foreign resources of countries such as Chile, Bolivia, Argentina are used. Over time, the need to create more and more batteries is rapidly growing, which means the need for lithium is growing. Large countries already have lithium processing plants, so they buy up cheap raw materials from other countries. In turn, this creates economic dependence of some countries on others, and in such dependent countries social, economic and environmental conflicts arise.

The ability to secure a sustainable and reliable supply of lithium-ion batteries globally will have a significant impact on various sectors of the global economy, such as the new energy automotive industry. The recovery in lithium demand after the COVID-19 pandemic has led to increased production and the resumption of capacity expansion projects. Lithium supply security has become a technology priority in Asia and Europe. Global lithium resources continue to grow, confirming the sustainable momentum of exploration and development.

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