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EXPLORING THE POTENTIAL OF LITHIUM RESOURCES IN KASHMIR:

Opportunities and Challenges

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Introduction

As the need for electric vehicles and other clean energy technologies has increased, lithium has assumed a greater significance. There has been evidence of lithium deposits in the Jammu and Kashmir area of northern India in recent years which may have enormous economic repercussions for the nation. In the Salal-Haimana region of Jammu & Kashmir, the Geological Survey of India (GSI) has found a large finding of lithium deposits. The GSI has for the first time identified inferred lithium resources of 5.9 million tonnes. Lithium is a crucial component of batteries used in electric vehicles, cell phones, and other modern gadgets. The mines are still just beginning their exploration. As metal is a key ingredient in the creation of rechargeable batteries for electric cars and other clean energy technologies, the discovery of lithium has the potential to transform the world's energy sector completely. India may become a significant player in the expanding lithium industry, which is now controlled by nations like Australia and Chile, thanks to the substantial deposits in Kashmir.

The finding has raised tensions in the already contentious area. There have been intermittent outbreaks of violence and strife for decades as both India and Pakistan have claimed the region. Lithium's discovery has further complicated the conflict because both nations are now vying for control of this precious natural resource.

It is crucial to keep in mind that the removal of lithium from earth may have negative effects on the ecosystem, such as land degradation and water contamination. To safeguard the environment and the rights of residents, and development of the lithium deposits in Kashmir should be properly planned and regulated.

The Importance of Lithium for Clean Energy

Lithium plays a crucial role in the transition towards a cleaner and more sustainable energy system. Electric cars (EVs) and hybrid-electric vehicles both depend on lithium-ion batteries (HEVs). These cars' battery packs, which include thousands of lithium-ion cells and serve as the vehicle's energy storage system, are used to power the vehicles. The demand for lithium is anticipated to increase as the market for EVs and HEVs expands. Renewable energy sources like wind and solar

power only produce electricity when the sun is out or the wind is blowing, hence they are intermittent. Lithium-ion batteries are an essential instrument for balancing the power grid and guaranteeing a steady and dependable energy supply because they can store extra electricity produced during periods of peak production and release it during times of high demand. Moreover, energy storage systems for residential and commercial buildings employ lithium-ion batteries. When the sun isn't out, these devices may store any extra solar energy produced during the day and release it at night. By doing this, it becomes easier to rely less on the grid and utilise more renewable energy to power buildings and houses. Lithium-ion batteries may be used for energy storage, which can assist in lowering greenhouse gas emissions. We can lessen our reliance on fossil fuels and lower the emissions caused by conventional energy sources by increasing the quantity of renewable energy utilised to power the grid.

In stationary energy storage applications like grid-scale storage systems, lithium-ion batteries are also utilised. By supplying extra power during periods of high demand and relieving grid stress during periods of low demand, these technologies can aid in grid balancing. By doing so, you can prevent blackouts and guarantee a steady supply of power. The lithium-ion battery cathode, which is in charge of storing and releasing energy, contains lithium as a major component. Lithium-ion batteries' energy density and performance are always being enhanced by developments in battery technology, which increases their effectiveness and lowers their cost. The market for electric vehicles is expanding, boosting lithium demand. The International Energy Agency predicts that by 2030, there will be 145 million electric vehicles on the road, up from 5.1 million in 2018. To fulfil demand, there will need to be a large rise in lithium output. Other clean energy technologies, such as grid-scale energy storage systems and renewable energy storage systems, also heavily rely on lithium. The demand for lithium is anticipated to increase as these technologies continue to advance and are used by more people.

The move to a cleaner, more sustainable energy system depends heavily on lithium. The market for electric vehicles is expanding, renewable energy sources are becoming more prevalent, and energy storage technologies are becoming more advanced thanks in large part to lithium-ion batteries. Lithium will become more and more in demand as these technologies become more widely used, making it a crucial part of the clean energy revolution. Rechargeable batteries used in electric cars, energy storage devices, and portable gadgets are produced in large part using

lithium. The demand for lithium is anticipated to drastically increase as the world transitions to a cleaner, more sustainable energy future. Some predictions state that by 2025, the demand for lithium will have tripled globally.

The Potential of Lithium Reserves in Jammu and Kashmir

Lithium deposits in Jammu and Kashmir promise a lot and will be a crucial source for the advancement of sustainable energy technology in India and beyond. To guarantee that the environmental and social effects of mining are minimised and that local people profit from the development of this resource, a sustainable and responsible lithium mining sector will need to be carefully planned and managed. Lithium deposits in Jammu and Kashmir may total up to 5.9 million tonnes, according to certain estimations. This would not only lessen the nation's reliance on lithium imports but also open up new business opportunities in the mining and processing industries.

The Economic Benefits of Developing a Lithium Industry

The growth of the lithium sector in Jammu and Kashmir will have a positive impact on the national economy. Jammu and Kashmir will open up new employment prospects with the development of the lithium industry. Competent staff would be needed for lithium mining and processing, which will create employment opportunities. Also, the growth of businesses connected to lithium, including battery manufacturing, may lead to the creation of more employment possibilities. The establishment of a lithium industry in Jammu and Kashmir will promote regional economic expansion. Lithium mining and processing would necessitate infrastructure spending on things like highways, electricity grids, and water supplies.

Lithium mining and processing will bring in revenue for the local government through taxes. Which can be used for the betterment of public services like healthcare, education, and infrastructure development. With the development of the Lithium industry in Jammu and Kashmir, there will be chances for India to export lithium to other nations in the region and beyond as the demand for lithium rises, notably in the electric car and renewable energy industries. Creating a lithium industry in Jammu and Kashmir may aid economic diversification. Jammu and Kashmir's economy currently relies heavily on agriculture and tourism. By developing a lithium business,

the area would have a new industry, lessening reliance on these industries and strengthening the local economy.

The growth of the lithium sector in Jammu and Kashmir might have a positive impact on the local economy. They include the expansion of the economy, the creation of new jobs, a rise in tax income for the government, an increase in exports, and economic diversification. However, to guarantee that local populations profit from the use of this resource and to reduce any unfavourable environmental and social effects of mining, it will be crucial to create a sustainable and responsible lithium sector.

For India's economy, the growth of a local lithium sector in Jammu and Kashmir will be very advantageous. Lithium mining and processing need specialised equipment and knowledge, which might draw outside investment and provide employment in the area. The rise of India's electric vehicle industry, which is a top objective for the government as it works to cut carbon emissions and meet its renewable energy targets, might also be aided by creating a lithium industry.

Challenges & Impacts

Pegmatites, which are known to have some of the biggest and highest-grade lithium resources in the world, are where most of the lithium deposits in Kashmir are to be found. Lithium is frequently found in pegmatites together with other rare minerals and metals such as tantalum, niobium, beryllium, and rare earth elements.

Processing Challenges: The abundance of other minerals, such as feldspar and quartz, which can obstruct the separation of lithium minerals, makes it more difficult to collect lithium from pegmatites in Kashmir. Thus, creating effective and affordable processing methods is crucial for the economic utilisation of Kashmir's lithium deposits.

Environmental and Social Impacts: In Kashmir, the discovery and exploitation of lithium deposits can have adverse effects on the environment and society, including the uprooting of local populations, the destruction of natural ecosystems, and the tainting of water supplies. For reducing these effects and maintaining the welfare of regional residents and the environment, responsible and sustainable mining operations are crucial.

The Limitations of Developing a Lithium Industry

While creating a lithium industry in Jammu and Kashmir might have positive economic effects, several obstacles must be overcome.

Environmental impact: Lithium mining and processing may have a substantial negative influence on the environment, including habitat damage, deforestation, and water contamination. Lithium mining may be energy and water-intensive, which could have a negative influence on the environment. To reduce their negative effects on the environment, mining and processing operations must be carried out responsibly and sustainably.

Social impact: The growth of a lithium business may have negative social effects on nearby communities, such as community uprooting, loss of livelihoods, and social unrest. To build a lithium business, it is crucial to interact with local people and make sure that their interests are taken into consideration.

Infrastructure: Jammu and Kashmir would need to invest a lot of money in infrastructure, such as roads, power supplies, and water supplies, to develop a lithium industry. The lack of infrastructure and remoteness of the area might make it difficult for a lithium business to grow there.

Political instability: Politically sensitive Jammu and Kashmir has a long history of violence and turmoil. Political unrest in the area may have an impact on the growth of the lithium business, causing setbacks and disruptions.

Economic viability: The cost of production and the demand for lithium on a worldwide scale will determine if a lithium business in Jammu and Kashmir is economically viable. The establishment of a lithium factory in Jammu and Kashmir could not be economically feasible if the demand for lithium declines or the cost of manufacturing is too high.

Many obstacles stand in the way of Jammu and Kashmir's lithium industry's development, including infrastructure needs, political unpredictability, and economic viability. To guarantee that the growth of the lithium sector is sustainable and beneficial to regional populations, these issues must be carefully planned for and managed.

Lithium mining and processing can have major negative effects on the environment and society, which must be properly regulated. Lithium mining may cause the depletion of groundwater supplies and the emission of hazardous compounds, which may be detrimental to nearby ecosystems and populations. Lithium deposits in Jammu and Kashmir must only be developed in ways that are sustainable and ethical. To guarantee that the negative effects of lithium mining on the environment and society are kept to a minimum and that local populations are involved in the decision-making process, the government and mining firms will need to collaborate.

Social Impact Assessment

In Kashmir, lithium mining has the potential to have a big social impact, both good and bad. The following are a few possible societal repercussions of lithium mining in Kashmir:

Employment Opportunities: Lithium mining may result in both skilled and unskilled labour possibilities for the local populace. The growth of mines and associated infrastructure may also result in job openings in the transportation, food and lodging, and security industries.

Economic Development: Lithium mining may boost other economic activities like tourism, agriculture, and manufacturing, which will help the region's economy. Building up the region's infrastructure, including its roads, railroads, and ports, may help with commerce and investment.

Loss of Livelihoods: Traditional livelihoods like farming and fishing may be lost as a result of lithium mining, which may cause social unrest and economic hardship. The loss of a source of income may also result in increasing social inequality and poverty.

Health and Safety Risks: Lithium mining can put the surrounding community at risk for serious health and safety issues, including exposure to hazardous chemicals, dust, and noise pollution. The local population's health may be impacted by accidents and injuries caused by mining operations.

Social Conflict: Lithium mining may cause social unrest, especially if the local populations believe their needs and concerns are not being sufficiently considered. Increased socioeconomic inequality and antagonism between various populations can also result from mining activity.

To reduce the detrimental social effects of lithium mining, it is crucial to engage the local community in the decision-making process and establish suitable mitigation strategies. This might involve activities like community involvement, consultation, and participation, as well as the creation of initiatives for the social and economic advancement of the neighbourhood. Also, it is essential to make sure that mining operations are carried out sustainably and responsibly, taking the necessary precautions to reduce any possible harm to the environment and nearby populations.

Market Opportunities

The development of electric cars and renewable energy technologies is predicted to dramatically raise the demand for lithium on a worldwide scale in the upcoming years. Jammu and Kashmir may have the potential to profit from this expanding market by developing a lithium industry. Following are a few possible markets for a lithium industry in Jammu and Kashmir:

Electric vehicles: Lithium-ion batteries are a fundamental component of electric cars, and demand for electric vehicles is likely to expand quickly in the future years. Jammu and Kashmir might have the chance to supply lithium for the manufacture of electric car batteries if a lithium industry is developed there.

Renewable energy: Moreover, lithium-ion batteries are employed in renewable energy sources like solar and wind power for energy storage. Demand for lithium-ion batteries is anticipated to increase due to the development of renewable energy technologies, opening up the business potential for the lithium sector in Jammu and Kashmir.

Electronics: Several electronic products, including smartphones, laptops, and tablets, employ lithium-ion batteries. The need for lithium-ion batteries is anticipated to rise along with the popularity of these gadgets.

Medical devices: Several medical equipment, including implanted defibrillators and pacemakers, are made using lithium. While the need for medical devices is anticipated to increase, Jammu and Kashmir's lithium sector may have some chances.

Energy storage systems: The need for large-scale energy storage devices to balance the grid's supply and power demand is growing. These systems rely heavily on lithium-ion batteries, and as

the market for energy storage systems is predicted to expand, Jammu and Kashmir might see prospects in this sector.

Jammu and Kashmir's potential as a source of lithium for a variety of expanding sectors, including electric cars, renewable energy technologies, electronics, medical equipment, and energy storage systems, might be realised through the development of a lithium industry there. Yet, it is crucial to make sure that any expansion of the lithium sector is done sustainably, responsibly, and with consideration for the effects on the environment and society.

Potential Markets

Potential markets for lithium and lithium-based goods span a wide range of sectors, including:

Battery Industry: Electric cars, cellphones, computers, and power tools are just a few examples of items that employ lithium-ion batteries, which are a crucial component. The need for lithium-ion batteries is anticipated to rise dramatically with the rapid expansion of the electric vehicle sector, providing enormous market potential for lithium manufacturers.

Aerospace Industry: For the aircraft sector, lithium is utilised to create lightweight, high-performance alloys. These alloys are utilised in landing gear, wings, and fuselages of aeroplanes.

Glass and Ceramics Industry: Glass and ceramics' characteristics are enhanced by lithium compounds. For instance, lithium carbonate is used to make heat-resistant glass that is used to make cookware and ovenware.

Pharmaceutical Industry: Bipolar illness and other mood disorders are treated with lithium. In the upcoming years, the need for lithium-based medications is anticipated to grow globally, providing a market opportunity for lithium manufacturers.

Lubricant Industry: Grease formulations based on lithium are utilised in a variety of industries, including automotive and industrial. The expansion of the automotive and industrial sectors is anticipated to fuel the growth of the market for lithium-based greases in the upcoming years.

Renewable Energy Industry: For energy storage in renewable energy systems like solar and wind power, lithium-ion batteries are utilised. The need for lithium-ion batteries is anticipated to rise in response to the expansion of renewable energy, offering enormous market potential for lithium manufacturers.

Chemical Industry: Lithium is utilised to make a variety of compounds, including lithium hydroxide and lithium carbonate, which are employed in the creation of lubricants, batteries, and ceramics, among other products.

Several industries, including the battery, aerospace, glass and ceramics, lubricant, pharmaceutical, renewable energy, and chemical sectors are prospective markets for lithium and lithium-based goods. Jammu and Kashmir's establishment of a lithium industry may open up prospects to supply these expanding markets with lithium.

Conclusion

There are possibilities and difficulties in exploring Kashmir's lithium resource potential. Establishing a lithium business in the area will have a positive impact on the local economy by generating income and jobs. In the upcoming years, there will likely be a major rise in the demand for lithium on a worldwide scale due to the development of electric cars, renewable energy sources, and other sectors of the economy. India will benefit from this expanding market and even assume a leading role in the global lithium supply chain by establishing a lithium industry.

There are several obstacles to building a lithium business in Kashmir, including negative social and environmental effects, political unpredictability, and a lack of infrastructure. All lithium industry development must be done ethically and sustainably, considering any potential negative effects on the environment and nearby populations. The lack of infrastructure and political unrest in the area might also hinder the growth of the lithium business. A lithium industry in Kashmir will have a big positive impact on India and help the world transition to a clean and sustainable energy future with careful planning and responsible development.

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