

**Technical Article-17**

**LITHIUM RESERVES- JAMMU AND KASHMIR**

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The recent announcement by India's Geological Survey of India on its preliminary exploration of lithium reserves has excited many industries dependent on the scarce alkali metal. According to the Geological Survey of India, it has established “**lithium inferred resources**” – which are calculated based on a physical and chemical study of the surface and samples – along the Salal-Haimana area of Reasi district in Jammu and Kashmir.

The news has given hope to manufacturers of lithium-based batteries, electric vehicles, solar equipment and other industries that are currently dependent on lithium imports from China and other countries. If the metal is available domestically, the battery production cost can come down 5% to 7%. India currently imports all the major components that go into the Li-ion cell manufacturing. “Lithium batteries comprise around 100-200 lithium cells for electric two-wheeler applications. Lithium cells are composed of elements like lithium, cobalt, manganese, nickel, copper, graphite and others. The advantage the domestic market can give us is a stable supply independent of evolving geopolitics.

The ambitious plan of the Indian government to achieve net zero by 2070 can potentially increase the demand for lithium. As the country races to transition to clean energy, there will be a higher need for lithium as electric vehicles and clean energy storage devices are currently dependent on the metal.

According to NITI Aayog, the total electric vehicle sales by 2030 could go up to 80 million. A report from the Central Electricity Authority claims that by 2029-30 India will have 2.700 megawatts of battery storage capacity.

**Finding lithium**

The Geological Survey of India originally mapped and reported the presence of lithium deposits in the region more than two decades ago, in 1999. Mapping by the Geological Survey of India is the very first step toward identifying any mineral. It is followed by the next phase of exploration where the inferred resources are calculated based on a physical and chemical study of the surface and samples.

The country took two decades to move from the **G4 (reconnaissance)** stage, where the mapping of resources takes place, to the **G3 (prospecting)** stage, where quantities are inferred, based on interpretation of geological, geophysical and geochemical results and a deposit is identified which will be the target for further exploration. In the next stage, **G2 (general exploration)**, more studies are done to estimate the minerals' shape, size and grade. And finally, the **G1 stage (detailed exploration)** is where characteristics of the deposit are established with a high degree of accuracy. A decision whether to conduct a feasibility study next, can be made from the information provided by the G1 stage. The Geological Survey of India adopted this classification of mining exploration of the United National Framework Classification for mineral reserves of 2009.

G3 exploration in Jammu and Kashmir is preliminary in nature, where the calculation confidence is low. It needs to be backed by more proof to substantiate the quantum of minerals available at such sites. The current study does not indicate whether metal extraction is possible at the site. Exploratory companies undertake the G2 level of assessment after G3, where the indicative resources are calculated, which tells us how much of the deposit could be mined with more facts. Later in the G1 level, some minor exploratory mining is done to find if the area is ready for mining precisely, and the real 'proved resource assessment' is done at this level.

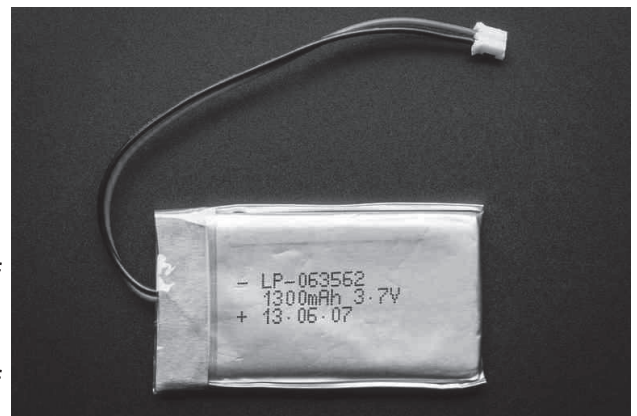


Fig- A lithium-ion battery: Battery manufacturers say that with the potential of domestic reserves of lithium, the battery production cost could come down in India.

Early estimates indicate that the amount of lithium in Reasi could be to the amount of 5.9 million tonnes. As indicated in the 1999 report of the Geological Survey of India, though, the lithium in the Reasi district is mixed with bauxite. The final deposit amount could be less than predicted at the G3 level. The lithium found in Reasi had more than 800 parts per million quality, which hints at a higher level of enrichment. Any lithium mineral with more than 300 per million quality quality is considered of good enrichment value.

Why the progress of exploring such a crucial material, has been slow after 1999, is not clear. The emails sent by Mongabay-India to the Geological Survey of India headquarters in New Delhi, its public relations officer in Kolkata and the department of mines in the Jammu and Kashmir government didn't receive a response at the time of publishing. India also had another claim of lithium deposits, in 2021, when the India's Atomic Minerals Directorate for Exploration and Research claimed to find 1,600 tonnes of the metal in the Marlagalla area in the Mandya district of Karnataka. Lithium reconnaissance resource (found after G4 level of reconnaissance) are also explored along the Saraswati river in the Jodhpur and Barmer districts of Rajasthan in the brines. Lithium is traced and extracted from rocks, clays, sediments and the salty water (brine) on the surface of underground water bodies.

### **Mines to battery**

Energy Programme at the World Resources Institute-India, told Mongabay- India that the recent Geological Survey of India discovery has a long journey before it becomes commercially viable to mine lithium from the region and makes it to the production of lithium-ion batteries.

We have to wait to see how much of this resource is feasible and viable to be commercially extracted. The Geological Survey of India's further study will reveal the quantum of the total reserve. Mining alone would not entail an end to external dependence. Countries like China have developed additional infrastructure and technological expertise, and experience in processing and refining mined lithium to make it ready to be used in batteries. Lithium is known for effectively converting chemical energy into electrical energy due to its high durability, lightweight, and endurance. Unlike Chile, where there are lithium deposits, the Reasi region in Jammu and Kashmir had lithium mixed with other minerals into the rocks. It can lead to more challenges in terms of cost and technology of processing.

India is not habituated to extracting lithium and purifying it. It is mixed with rocks and other minerals. It would require breaking the rocks and removing volatile chemicals with evaporation and magnetic impurities with magnets besides other chemicals and processing. India has never done this, and neither has the best experience, tested technology to rely on, nor established industries for this.

"However, Australia has similar lithium reserves like Jammu and Kashmir reserve, where lithium is mixed with bauxite. We may need technology transfers and tie ups with the lithium metal extraction industry outside."

### **The Himalayan region**

According to the seismic zonation map of India, the whole of Jammu and Kashmir, which lies close to the Himalayas, comes under Zone IV and is also ecologically sensitive. Several international reports in countries where lithium mining takes place have talked about the impact of environmental degradation in such areas. The metal is generally extracted from the brines by direct extraction technology, evaporating the brine, or by surface mining of clay and rocks.

A report published in Nature Conservancy claimed that the proven technologies of lithium extraction through surface mining or brine evaporation would need hundreds of acres of land for extraction and could lead to the complete removal of native vegetation of the area. It also said that such projects are most likely to happen in rural areas and wild zones, affecting the local population and battling for sustainable mining methods for the metal. The Reasi district in Jammu and Kashmir, where the lithium deposits have been discovered, has rural households, vegetation and the Chenab river and tributaries near its hills.

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