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ELECTRIC VEHICLES – CHANGING ENVIRONMENT FOR INDIAN AUTOMOTIVE INDUSTRY

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ABSTRACT:

Environmental & Climate Change Considerations and Crude Oil Volatility is driving the Global Automotive Industry towards the Battery operated Electric Vehicles (EVs). The EV's are also now gaining the attention across India with the policies of Indian Government encouraging penetration of EVs.

One of the most critical and key factor for successful penetration for EVs in India will be undoubtedly the development, supply and cost of Lithium Ion Batteries. Currently the EVs are costlier than conventional Internal Combustion (IC) engine vehicles. Lithium Ion Batteries constitute about 1/3rd of total Costs of an EV. Lithium Ion Batteries will be the most critical factor in the entire supply chain of EV Ecosystem which would decide the EV Industry future. The development and establishment of Automotive Lithium Ion Battery Industry in India will go long way in larger and quicker penetration of EVs.

As of now, India largely depends on countries such as China, Japan & South Korea for importing Li-ion batteries. However, the scenario is changing and the Indian Automotive Industry and Battery Industry are seeking solutions considering various scenarios. Emerging Scenarios are: Import of cells from renowned Lithium ion Battery Manufacturer across globe and setting of plants in India for assembling these cells into Battery Packs, the vertical integration of a renowned Lithium producer, Lithium Ion battery producer and an automobile manufacturer in a single company, tie up of an automobile manufacturing company with renowned Lithium ion Battery Manufacturers for setting up plant in India, the expansion of a Lithium Ion battery producer into automobile production and establishment of EV manufacturing units in India by EV multinational by way of Joint Ventures and collaborations.

The paper highlights the Critical role of Lithium ion Battery for an EV, discusses current key players in Lithium Ion Battery supply chain beginning with Lithium suppliers, Lithium ion Battery Manufacturers, reviews the current Indian scenario with these aspects and attempts to project best possible scenario for penetration of EVs in India.

Keywords: *Changing Environment, Electric Vehicles, Lithium Ion Battery and Penetration of EVs*

1. Introduction

The Indian Electrical Vehicle Industry has begun to flourish. As far as Electric 2 Wheelers, Cars and Buses are concerned, while in FY 16-17, over 25,000 electric

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vehicles were sold. In FY 17-18, the sale of Electric vehicles reached 56,000 . Electric Rickshaws are also penetrating Indian markets is huge numbers. Annual sales of Electric Rickshaw is expected to increase about 9% by 2021[1].

Environmental & Climate Change Considerations and Crude Oil Volatility is driving the Automotive Industry towards the Battery operated Electric Vehicles (EVs). One of the most critical and key factor for successful penetration for EVs in India will be undoubtedly the development, supply and cost of Lithium Ion Batteries. Currently the EVs are costlier than conventional IC engine vehicles. Lithium Ion Batteries constitute about 1/3rd of total Costs of an EV.

As of now, India largely depends on countries such as China, Japan & South Korea for importing Li-ion batteries. However, the scenario is changing and the Indian Automotive Industry and Battery Industry are seeking solutions considering various scenarios such as import of cells of Batteries and setting of assembling units in India, Vertical Integration of Key players in the Battery & EV supply chain, Joint Ventures and collaborations between Lithium miners , Cell , Module and Battery pack integrators and Vehicle Manufacturers and setting of vehicle manufacturing plants by EV multinationals in India . The development of this kind of set-ups for production of Lithium Ion Batteries in India and EVs is highly essential for deeper, quicker & larger penetration of EVs in India.

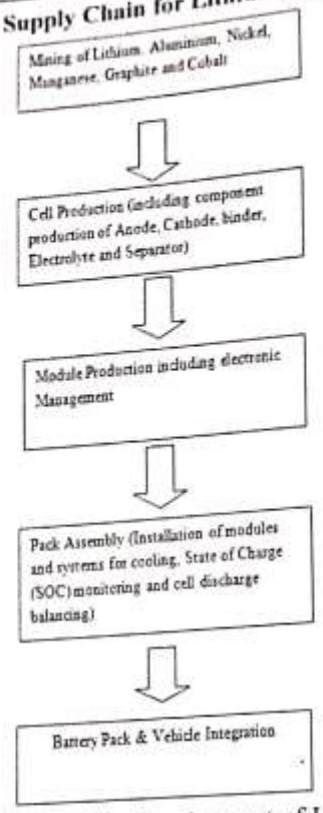
2. Lithium Ion Batteries - Critical Aspect for an EV

Lithium Ion Batteries will be the most critical factor in the entire supply chain of EV Ecosystem which would decide the EV Industry future. Two fundamental characteristics that make Lithium Ion Batteries superior are Power Density and Energy Density. For Automotive EV applications it is desirable to have both high power density and high energy density to make it competitive with Internal Combustion (IC) engine vehicles. While High power density is required to have powerful vehicle, High energy density is essential for higher range in km per charge. Lithium ion Batteries are advantageous in this regard. Lithium is light-weight. It can be easily fabricated into large battery packs for use in Electric Vehicles. One more important characteristic of Lithium ion batteries is that they are reusable, as they can be extracted from depleted batteries and recycled for use in new batteries. Given the above advantages, the types of EV batteries currently being considered by Industry globally are predominantly Lithium Ion based Batteries. The most prominent technologies are Lithium ion–Phosphate (LFP), Lithium- Nickel- Cobalt –Aluminum (NCA), Lithium-Nickel-Manganese Cobalt (NMC), Lithium-Manganese-Spinal (LMO) and Lithium Titanate (LTO) Batteries. The Indian Electric Vehicle manufacturers are mainly considering Lithium ion phosphate (LFP) and Lithium- Nickel- Cobalt –Aluminium (NCA) batteries.

3. The Emerging Scenarios for Lithium Ion Batteries

The Figure 1 below depicts the typical Supply Chain for Lithium-Ion- Battery manufacturing.

Figure 1: Supply Chain for Lithium Ion Battery



For the EV industry to flourish in India, Development of Lithium Ion Battery Industry will be critical. Many companies ranging from automobile manufacturers, automobile component manufacturers to power and energy providers are rolling out plans to make Lithium Ion Batteries locally in India to cash on the wave for Electric Vehicles in India. Potential for Lithium Ion Battery makers is going to be tremendous in the years to come.

Scenarios which are emerging are: Import of cells from renowned Lithium ion Battery Manufacturers across globe and setting of plants in India for assembling these cells into Battery Packs; The vertical integration of a renowned Lithium miner , Lithium Ion battery producer and an automobile manufacturer in a single company; Tie up of an Automobile Manufacturing Company with renowned Lithium ion Battery Manufacturers for setting up plant in India; The expansion of a Lithium Ion battery producer into automobile production and establishment of EV manufacturing units in India by EV multinational by way of Joint Ventures and collaborations.

Before we touch upon the emerging Indian scenario, it is important to touch upon the prevailing global scenario beginning with production of Lithium, which is discussed below.

Global Scenario

The graph 1 below depicts the countries with the largest lithium resources worldwide.

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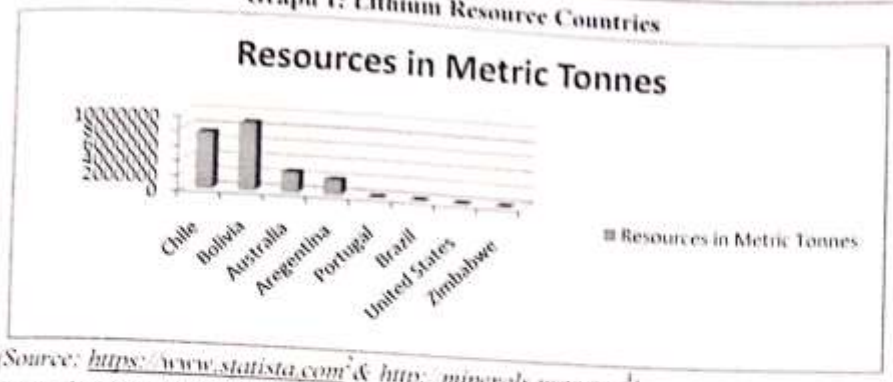
Graph 1: Lithium Resource Countries



(Source: https://www.statista.com[2] & http://minerals.usgs.gov[3])

As can be seen from above , the world's top 4 lithium-rich countries are Bolivia , Chile, Australia and Argentina. The region comprising Chile, Bolivia and Argentina is known globally as 'Lithium Triangle'. The Lithium Triangle is known for its high quality salt flats including Bolivia's Salar de Uyuni, Chile's Salar de Atacama, and Argentina's Salar de Arizaro. The Lithium Triangle is understood to hold over 75% of existing known lithium reserves globally.

The first step involved in Lithium Battery Supply chain is extraction and mining of Lithium. Lithium salts are extracted from water in mineral springs, brine pools, and brine deposits. Lithium is also produced from hard rocks. Extraction of Lithium from sea brine is less expensive, as compared to that from hard rock[4]. The commercialization of Lithium production has begun.

Till recently most of the world's Lithium was produced by companies namely Albemarle from US and Chile , Sociedad Quimica y Minera de (SQM) from Chile and Food Machinery Corporation (FMC) from Argentina . However, the list of the world's top lithium-mining companies has changed in recent years. The companies mentioned above still produce the majority of the world's lithium, but China accounts for a large chunk of output as well. The Asian nation has recently become the fourth-largest lithium-producing country in terms of mine production. Tianqi Lithium and Jiangxi Ganfeng Lithium are the two major Chinese companies involved in Lithium production[5].

The next step involved in supply chain is Cell, Module and Pack assembling followed by battery pack and vehicle integration. Tesla, United States follows the model of Integrated Battery Manufacturing. By mid-2018, battery production at Giga factory of Tesla , the US Electric Car producer reached 20 GWh, making it the highest-volume battery plant in the world. With this high volume of production, Tesla's cost of battery cells is expected to come down. By virtue of this Tesla's products will be able to penetrate the EV market globally.

Tesla's giga factory is followed by Contemporary Amperex Technology Co. Limited (CATL), China, with a capacity of 12 GWh. CATL is followed by Panasonic and BYD. Japan's Panasonic has the production capacity of 10 GWh, and China's BYD comes next with 7.2 GWh. Another China-based maker, Optimum Nano Energy Co. Ltd., and South Korea's LG Chem follows these companies producing 5.5 GWh and 4.5 GWh

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respectively. Some of the other major players involved in the production are Samsung, Toshiba, Denso and Leclanché SA.

Emerging Indian Scenario:

In India, lead-acid battery manufacturer, Exide Batteries, has planned to set up a Lithium Ion Battery plant. It will be a Joint Venture with Leclanché SA, Switzerland. As part of the JV, Leclanché will provide access to its knowhow and intellectual property for lithium-ion cells, modules and battery management systems and Exide Industries will leverage its extensive sales network and brand. The JV's production plant will be based in Gujarat. A module and battery pack assembly line is expected to be operational by second quarter of 2019 and a lithium-ion cell production plant is expected to be in operation by mid 2020. In the intervening period, cells will be sourced from Leclanché's plant in Willstätt, Germany[6].

The Indian vehicle manufacturers are also lining up their plans for production of Lithium-ion Batteries in India. While Maruti Suzuki's parent company Suzuki Motor Corporation (SMC) has tied up with Toshiba and Denso to set up the country's first lithium-ion battery manufacturing facility in Gujarat at an investment of Rs 1150 crore, homegrown auto major Mahindra & Mahindra has firmed up plans to pump in Rs 1000 crore (through its arm Mahindra Electric) to expand electric vehicle manufacturing capacity at its Bengaluru facility, set up a R&D centre and a new battery manufacturing unit in Chakan, Maharashtra . Mahindra has forged an alliance with South-Korea's LG Chem to make Lithium Ion batteries in India[7].

The Bus manufacturers such as Tata Motors limited , Ashok Leyland Ltd , VE Commercial Limited and BYD are also ramping up their plans for manufacturing of Electric Buses.

The other companies such as Exicom, Amaron, Greenfuel Energy Solutions, Trontek, Coslight India, Napino Auto & Electronics, Trinity Energy Systems and Versatile Auto Components have also rolled out their plans to make Lithium Ion Batteries locally. Bharat Heavy Electricals Limited (BHEL) has started talks with a US-based company to form a joint venture in India to manufacture lithium-ion batteries for electric vehicles (EVs).

4. Conclusion

The development & setting up of Lithium Ion Battery manufacturing facilities in India is critical for an EV industry to flourish in India.

It is said that "Lithium" is the next crude oil . Drawing this analogy further, the resemblance of setting up of Lithium Ion Battery manufacturing facilities can be linked with setting up of Crude oil refineries in India. As the crude oil refineries are backbone for efficient and uninterrupted supplies of conventional fuels for operation of IC engine vehicles, so will be the case of Lithium ion Battery manufacturing for penetration & operation of EVs in India.

It will be important for setting up of Lithium Ion Battery manufacturing plants with huge GWh capacities on the lines of Tesla plant in US , and in India , besides setting up of plants having low & medium capacities for the upcoming EV Industry in India .

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Establishment of such facilities will be the key factor going forward. As discussed above, the process has already began to change the environment for Indian Automotive Industry.

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