

## **Aluminium and Graphene batteries as alternatives in electric vehicles in Indian automobile industries**

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### **Abstract**

The automobile sector has a significant role in the government's plan to raise the share of manufacturing in India's GDP from 15 per cent now to 25 per cent by 2022. A major thrust will be needed from the government to sell 6 million electric vehicles by 2020 as the first step to attain the larger vision of electric vehicles for all by 2030. India's electric vehicles industry is nascent with just 0.1 per cent global market share. In comparison, China is a world leader with over 50 per cent global annual market share. China is spending largely on subsidising local companies, pushing them at the forefront of electric mobility technologies. Some of the other measures announced by China includes research funding and rules framed to discourage vehicles running on fossil fuels. China is also making it mandatory for car makers to manufacture a certain percentage of electric vehicles annually. Some of the global automotive players like Tesla Inc. and Toyota Motor Corp. have shown interest in the Indian electric vehicles market. Nissan also plans to bring its bestselling electric vehicle Leaf to India. Suzuki Motor Corp. would form a joint venture with Denso Corp. and Toshiba Corp. to produce lithium ion batteries for electric vehicles in India with an initial capital expenditure of USD 184 million. Large Indian corporate like BHEL, PGCIL and Vedanta Group are making electric vehicles setting up charging stations and developing storage solutions respectively.

### **Graphene and aluminium battery developed as alternatives**

Batteries being the largest component in an electric vehicle accounts for nearly 50 per cent of the total cost of an electric vehicle. Prices of lithium-ion batteries used by most electric vehicles have dropped 73% over the last six years. Though the cost of electric battery has declined recently, it still remains on the higher side. However, its operating cost per kilometre driven is lower. India does not have any lithium deposits. While this does present a challenge to setting up a viable battery manufacturing plant in India, it also means that companies must look for other options to power such vehicles. R&D labs across the world are working in this direction. Stanford University researchers have developed an aluminium battery that could reduce charging time for a car to a few minutes. Developments in Graphene-based batteries / super capacitors which can be 50-100 times the power density of lithium battery and 5-10 times its energy density is expected to extend range and life while reducing time to charge. Professor Ashok Jhunjhunwala of the Indian Institute of Technology, Madras had taken special efforts for the government and private sector companies in acquiring lithium fields across Chile, China, Argentina, Australia and Bolivia. Also, choice of technology in terms of energy storage devices like batteries, capacitors and super capacitors needs to be evaluated. Significant research is being conducted to identify alternatives to lithium ion. With all its advantages, Graphene is also being developed as an alternative.

### **Conclusions**

India's energy import bill is expected to double from around USD 150 billion to USD 300 billion by 2030. The shift to electric vehicles will also help reduce India's energy imports where it looks to cut oil import bill to half by 2030 and reduce emissions as a part of its commitment to the Paris climate treaty. The growth in sale of electric vehicles will lead to more demand for power, especially renewable energy. This will help tackle intermittency issues of renewable power and reduce reliance on imported oil. Shifting to EVs will also check pollution in India. As part of its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change, India plans to reduce its carbon footprint by 33-35 per cent from its 2005 levels by 2030. A report by the NITI AYOOG suggests that adoption of electric vehicles and shared vehicles could save a whopping USD 60 billion in fuel costs. This would also aid in cutting down as much as 1 Giga ton of carbon emissions by 2030.

**Keywords:** Lithium ion batteries for electric vehicles, carbon emissions, Paris climate treaty, energy storage devices, renewable energy.