

## **Graphene and aluminum batteries as alternatives in electric vehicles in Indian automobile market**

**Dr. Ashok G. Matani**

Associate Professor - Department of Mechanical Engineering,  
Government College of Engineering, Amravati – 444604 [M.S.] India,  
Email: [dragmatani@gmail.com](mailto:dragmatani@gmail.com), [ashokgm333@rediffmail.com](mailto:ashokgm333@rediffmail.com)

### **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 EVs by 2020 as the first step to attain the larger vision of EVs 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 subsidizing local companies, pushing them at the forefront of electric mobility technologies. Some of the other measures announced by China include 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. announced that it 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 have shown interest in making electric vehicles setting up charging stations and developing storage solutions respectively.

**Keywords:** Harmful effects of air pollution, Electric mobility technologies, Renewable power, Graphene-based batteries, Super capacitors.

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

Batteries 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, according to Bloomberg. Though the cost of electric battery has declined recently, it still remains on the higher side. However, its operating cost per kilometer 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 aluminum 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.

### **Government of India encouraging electric vehicles**

The Union Budget for FY 2017-18 has allocated INR 795 crores for developing electric vehicles. The electric vehicles market is growing worldwide fuelled by stricter environmental measures, technology improvements and cost reduction in energy storage. India has in its hands a lifetime opportunity to make a remarkable contribution towards a sustainable future. The Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) scheme proposes long-term tax holidays for domestic manufacturing and heavy duties on equipment imports. The proposal provides for compulsory sourcing of minimum 50% domestic content for electric vehicles in the first year, 60% in the second year and 70% in the third year. Currently, local content in electric vehicles is at about 35% as most companies import batteries that account for a major cost of electric vehicles. Local auto makers, however, said moving to high local content with incentives and tax breaks was not difficult. India electric vehicle market is projected to grow at a CAGR of over 37%, during FY2018-FY2023. Robust market growth is anticipated on account of rising number of government initiatives such as incentive schemes to encourage adoption of environment-friendly electric vehicles, growing consumer inclination towards electric vehicles, concerns over harmful effects of air pollution, and huge investments by various OEMs for developing more affordable and premium electric vehicles in the coming years.

### **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.