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Future of Electronic Vehicles in India: Review and Scope

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ABSTRACT

The global automotive industry is on the verge of disruption. Digitization, increasing automation and new business models has revolutionized other industries, and the automotive industry will be no exception to such a revolution. The Indian automotive industry has started to experience the effects of this global disruption. This paper outlines the importance and imminence of the disruption, the drivers of electric vehicle penetration and the implications for all stakeholders, especially auto component manufacturers. Acknowledging the upcoming disruption and reinventing the business accordingly is the key to managing the changes that lie ahead.

Keywords: Autonomous driving, Smart Mobility.

1. INTRODUCTION

Smart Mobility:

Four technology-driven trends—electrification, shared mobility, connectivity and autonomous driving—are leading the automotive industry to this disruption. These trends will shift markets and revenue pools, change mobility behaviour and build new avenues for competition and cooperation. Globally, revenue pools from conventional sources such as one-time vehicle sales and aftermarket sales could continue to grow at their current pace (low single-digit growth depending on geography).

The real growth ahead lies in services, which are poised to grow by an average of up to 40 percent per annum globally. Electrification—an attractive solution to growing levels of vehicle pollution in metropolises—is of particular importance to India today. The automotive industry is already feeling the effects of electrification or e-mobility, both globally and in India. By 2030.

Electrification could lead to electric vehicles (EVs including Battery Electric Vehicles, Plug-in Hybrid Electric Vehicles and Hybrid Electric Vehicles) holding a substantial share (up to 50 percent of new vehicle sales in a breakthrough scenario) of the global automobile sector1. If India sees a similar momentum, it will significantly impact manufacturers across the automotive value chain.

Earlier in 2017, former Power Minister Piyush Goyal announced the aspiration to not sell a single petrol or diesel car in the country by 2030. While global EV sales remain low, examples from other countries indicate that four factors—a mix of push and pull—could determine the pace of EV penetration in India:

Regulations and incentives: Many countries have promoted e-mobility through a range of incentives, but these alone did not drive EV penetration. A supportive ecosystem that also establishes strict regulations on carbon emissions and regulations driven by strategic intent (e.g., reduce current account deficit and geographic dependence driven by crude oil) indirectly prompts the higher adoption of EVs.

Technology: As a large component of the overall EV costs, high battery prices impact manufacturing and sales. Improved technology can reduce battery costs, increase efficiency and improve driving range, making EVs more accessible and attractive to potential customers.
Infrastructure: Easy and affordable access to charging infrastructure—both standard AC charging as well as rapid DC charging—is a key to meeting customer needs.
Customer demand: Participants in two industry roundtables organized by the McKinsey Center for Future Mobility in Delhi and Chennai cited high upfront acquisition cost as the top deterrent to EV penetration3. Creating a pull among customers by creating an economical cost proposition will be crucial in encouraging customers to invest in EVs.
The government: By defining the regulations on emissions and fuel efficiency, clarifying aspirations, strategic intent and direction, exploring incentives and subsidies, it can support EV adoption and focus on developing a supportive ecosystem.
The power, fuel and charging infrastructure companies: By laying down a foundation of support, innovating on business models (e.g., leasing of batteries, swapping infrastructure, deploying fast chargers), making the economics of (fast) charging infrastructure work, providing stable power supply and grid stability, they can enable easy and rapid charging and drive EV adoption.

The automotive industry: By changing the product and component mix bringing EV components and vehicles to life, building the right talent pool and skill set, improving the performance of batteries and electric vehicles and building scale, the industry can drive the EV disruption in India.

2. ELECTRICAL VEHICLES IN INDIA

4 key measures of Electrical Vehicles in India:

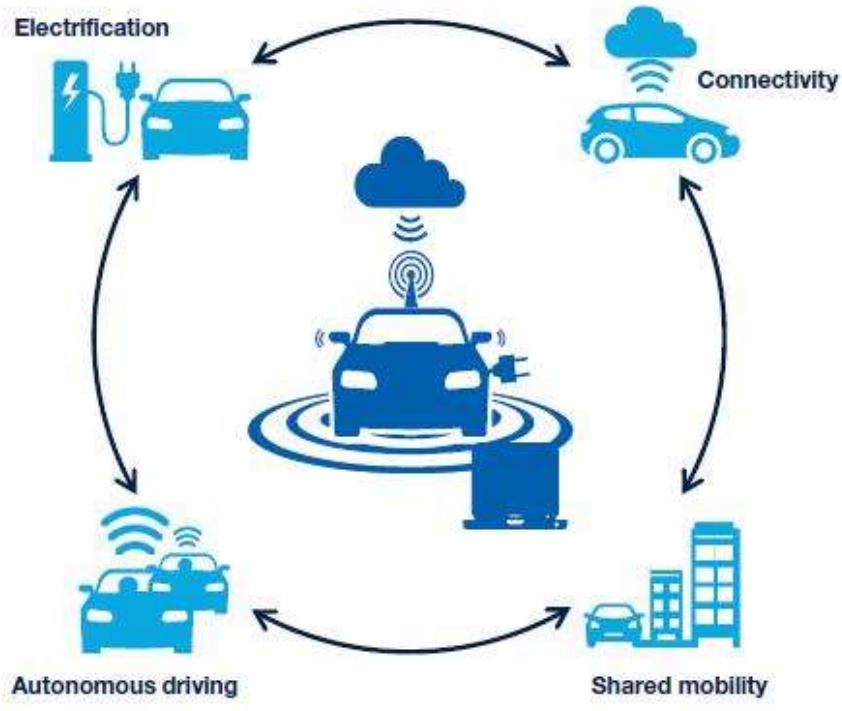

Fig 1 lifecycle of future automotive industry

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Electrification: In 2030, the share of EVs could range from 40 to 50 percent of new vehicle sales. Adoption rates could be the highest in developed, dense cities with strict emission regulations and higher consumer incentives (tax breaks, special parking and driving privileges, discounted electricity, etc.). Penetration may be slower in small towns and rural areas with less charging infrastructure and a higher dependence on driving range. Continuous improvements in battery and charging technology could minimize such local differences, and EVs are expected to gain more market share from conventional vehicles

Shared mobility: Mobility options like car-sharing, bike-sharing, ride-sharing (carpooling and vanpooling) and on-demand ride services are gaining significant traction in metropolises. Shared mobility offers easy, on-demand availability, the flexibility to choose vehicle type as per need and freedom from parking hassles. It also cuts down costs related to car ownership, such as maintenance, service and insurance. In the US, the percentage of vehicle miles travelled in ridesharing cars stood at 1 percent in 2016.

Connectivity: Automotive connectivity comprises four relevant functional groups— in-car content and services (e.g., navigation or entertainment), vehicle relationship management (e.g., remote diagnostics), insurance (e.g., telematics-based insurance solutions) and driving assistance (e.g., semi-autonomous driving features) The market for fully or partially integrated in-car infotainment systems could grow from 18 million units in 2015 to 50 million by 2025 given the convenience offered by such systems.

Autonomous driving: Various global automakers and technology companies are pursuing and investing in the creation of autonomous-driving vehicles. Traditional vehicle manufacturers, too, are already taking a slightly different track in their development processes, working independently and with leading suppliers to develop and begin implementing technologies that augment driver behaviour. OEMs across the world are doing this by adding incremental autonomous functions as driving technology and infrastructure improve over time. If autonomous driving takes off in a big way, with supportive regulations, up to 15 percent of all new vehicles sold globally in 2030 could be fully autonomous. In India, however, the government is currently cautious of self- or autonomous-driving cars due to concerns that these may hurt employment opportunities. A change in the government's position in the future may shift the relevance of this global trend for India.

The transition to EVs could be very quick in India. As seen in developed economies like the US and Germany, around 30 to 45 percent of vehicle buyers already consider EV as an option while choosing a car18. By 2030, xEVs could hold a substantial share—up to 50 percent in breakthrough scenarios—of passenger vehicle sales in major global geographies.

Enhancements to EV technology could help improve battery prices, charging time and driving range, all changes that will encourage the faster adoption of EVs. As a large component of the overall EV costs, high battery prices impact manufacturing and sales. Between 2011 and 2016, global battery pack prices dropped sharply from approximately INR 50000 per KWH to USD 15000 per KWH . This also led to higher battery-operated EV (BEV) and PHEV sales, especially in Europe and China24. The Indian Department of Energy expects battery prices to continue falling, and to be around 10000 INR per KWH by 2022.

Battery prices in India currently follow global price trends; several drivers could reduce global costs further, by as much as 50 percent between 2016 and 2021 :

Growing demand: Global output demand is expected to be more than 4 TWH in 2025. Growing scale could push down battery costs. The current average capacity utilization of manufacturers and upstream suppliers is less than 50 percent. As battery manufacturers start exploring high volume sourcing of critical components, they could achieve economies of scale sooner rather than later, resulting in lower battery costs.
Technological improvements: Advancements in cathode material and anode technology could improve energy density, prolonging battery life. Improved batter efficiency may also encourage EV adoption, eventually reducing costs.

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Market dynamics: Several factors will come into play as industry competition intensifies—cost-competitiveness between players, the search for cheaper raw material, new entrants with niche expertise like non-lithium battery technology, and indigenization of technology. All of these could reduce manufacturing costs, lowering battery prices in turn.Picking up on the promising future of EVs, the private sector is also exploring opportunities in developing battery technology. In 2017, three multinational companies have announced a joint venture to manufacture lithium-ion batteries for EVs in India with an initial investment of INR 1,200 cr.

3. FUTURE OF ELECTRIC VEHICLES IN INDIA

The government could play a vital role in driving EV penetration. Given that electrification could help meet emission targets and reduce dependence on crude oil imports, EVs have become a part of mission documents for many governments globally. Any country determined to support EV adoption should focus on developing a supportive ecosystem, much like Norway has done. The Indian government in particular could focus on three areas: Environmental targets and strategic intent: The Indian government's current CO2 emission target (based on the Paris Climate Treaty) is to maintain 113 g/km by 2021; the average fuel efficiency target, in line with the Corporate Average Fuel Consumption (CAFC) standard, is 22 km/litre by 2022. The government also has a long-term strategic focus on reducing crude oil imports and the implied dependence on certain trade partners.

A consistent and stable government policy on emission regulations and well defined strategic targets on crude oil substitution could offer much needed long-term clarity to the automotive industry, enabling companies to plan pipelines in advance. The government could also set up committees to provide guidance as and when industry stakeholders need any support to achieve their targets. As it drives EV penetration through policy and long term direction, the government could also define its level of participation in the means employed to meet the policies and targets. Globally, most governments define regulations and targets that are technology agnostic, and the industry chooses a portfolio of technologies to ensure compliance.

Incentives and subsidies: Currently, the TCO economics of EVs do not work for either the customer or the charging infrastructure providers. The government might need to drive adoption, as seen in the case of Norway, through a variety of avenues like upfront or recurring incentives, tax breaks, funding for infrastructure and innovation, support for technology localization and skill development. The Indian government launched the FAME (Faster Adoption and Manufacturing of [Hybrid and] Electric Vehicles) India scheme in April 2015 to support the development of the hybrid and EV market and manufacturing ecosystem through subsidies. Of the total Phase 1 allocation in FAME, only around 25 percent has been used by August 2017. FAME also underwent changes midway—the NITI Aayog took it over from the Department of Heavy Industries and mild hybrids were removed from the scheme's coverage list.

There is no denying that e-mobility is here and now, and that its growth could impact auto component manufacturers in India in a big way. It is imperative for auto component manufacturers to start preparing for the ensuing disruption. They could consider a threestep roadmap to smoothly transition into the EV way:
Acknowledge and move fast: While three-wheelers and buses are expected to be electrified in the first wave, the second wave will see scooters, taxis and small and light commercial vehicles going the EV way. This will eventually be followed by private cars and other vehicle segments. As a result, there could be a gradual transition away from ICE vehicles across various segments giving auto component suppliers some time to transition to a different product mix. However, as the supply–demand balance shifts, auto component manufacturers need to brace for significantly lean operations in ICE vehicle components.
Re-invent the business, including collaborating with OEMs/other manufacturers across the global industry: It might be a big challenge for an individual player to take control of the EV market. Auto component manufacturers could benefit by collaborating among themselves and with OEMs to chart out their EV path, and accordingly define individual strategies. It might be timely to get started on this, as the prudent players have already started forming partnerships. As automotive players in India seek the best business model, it is important to remember that models that have worked in the past and in other geographies may not necessarily be the best solution for markets in India.

Build the right assets and skills to serve the needs of the new age industry: Auto component manufacturers could need access to new assets (e.g., new prototyping and testing facilities) and skills (across diverse functions like engineering, sourcing, marketing, investments/M&A) in order to thrive in the new ecosystem. It is imperative that they think about it and chart out detailed plans to build or acquire such assets and skills.

4. Electric Vehicles as Energy Storage

Plug-in electric vehicles – including electric-only plug-in electric vehicles and plug-in hybrid electric vehicles (PHEVs) are expected to become much more common in upcoming decades. Presumably a significant portion of charging of electric-only and PHEV vehicles (collectively referred to as plug-in EVs or just EVs) will occur at night and during weekends, when electricity value and price are low or relatively low and while passenger vehicles are not needed/used.

However, at least some EV charging will be needed during the day and even during peak demand periods when the grid is already providing the maximum amount of power. If EV charging occurs in parts of the grid that do not have sufficient capacity "head-room" to accommodate the extra power needs, then there are two basic alternatives. First, the utility could increase the amount of generation, transmission and distribution (GT&D) infrastructure to add needed capacity. The second alternative is to install distributed energy resources (DERs) including distributed generation and storage. To achieve the desired effect, the DER capacity must be installed electrically downstream from congestion points to serve the added on-peak demand locally.

Coincidentally, depending on the circumstances and after addressing a range of issues and details, idle EVs that are mostly or fully charged and that are connected to the grid (e.g., at charging stations at work) could be used to provide some of the necessary power, locally.

Growing use of EVs has important implications for the electricity grid. EVs will use a growing amount of electric energy – resulting in more generation operation with a commensurate increase of generation fuel use and air emissions. They will require additional capacity to make, transmit and deliver additional energy, especially during the electric grid's peak demand times (times when end-users' maximum power draw on the grid occurs).

So, not only would additional generation be needed – to produce the power – the transmission and distribution (T&D) systems will also have to be upgraded and enhanced, mostly by adding more capacity to transmit and deliver the additional electricity during the grid's peak demand times.

Given the expected proliferation of EVs, there is growing focus by utilities, regulators, policymakers and legislators on development of plans to accommodate the added electric demand that charging during on-peak times will add to the non-EV demand.
An alternative to the conventional GT&D response is to add distributed electricity storage at or near EV charging stations. Doing so reduces the amount of GT&D capacity needed on-peak to serve the EV charging-portion of the total peak demand. And, the storage is charged using low priced, off-peak energy when generation fuel use and air emissions are lowest (on a per kilowatt-hour basis).

Whatever the response to the EV challenges, Smart Grid will play a role. It will provide the monitoring, communications, control, and computational capabilities to accommodate fast EV charging during peak demand periods in the most efficacious way attainable.

Using electricity storage for EV charging has some notable synergies with other benefits. For example, distributed storage for EV charging could be part of a localized strategy to integrate distributed photovoltaics and to provide very reliable electrical service in specific parts of the grid. Also, charging at night when demand for electricity is low would increase GT&D utilization, thus reducing the utilities' overall cost-of-service.

5. EV AND ELECTRICITY STORAGE MARKET INTERACTIONS

Notably, EVs which are connected to the grid could be used in lieu of or in conjunction with electricity storage in emergencies or extreme supply shortages, to supply power to the grid. This application is known as vehicle-to-grid or V to G. So, though challenges remain, it is possible that EVs could be a non-trivial electric supply resource during rare times when the grid is undergoing an emergency. Further, EVs may complement or compete with electricity storage.

When EVs proliferate significantly, purchase of energy at night, during off-peak times, to charge EVs may increase off-peak energy prices enough to reduce the benefit for some grid-related storage uses, especially energy time-shift and TOU energy cost management. The proliferation of PEVs and PHEVs could also lead to economies of scale and lower prices for advanced batteries and battery systems, including system management and grid integration (i.e., monitoring, control, communications, interconnection, and computer algorithms).

The nexus of EVs and electricity storage nexus is an interesting one. EVs and storage may complement each other and they may be competitive. But electricity storage seems to be a key element of the response to challenges that will arise when EV charging during on-peak hours becomes more common.

CONCLUSION AND OBSERVATION

The move to e-mobility is inevitable. It brings with it challenges and opportunities for the automotive industry and the broader ecosystem to capitalize on new technologies, and, in the process, reap substantial economic benefits and reduce dependence on fossil fuels. Concerted efforts by key stakeholders can help EVs become a self-sustaining and profitable market in the near-term future.

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