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Electric Mobility Adoption in India: Emergence, Challenges and Implementation Roadmap

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Abstract

The purpose of this research is to develop an integrated framework for promoting e-mobility in India. Although the concept of e-mobility is in the nascent stage, its importance in reducing emission of greenhouse gases and making environment sustainable couldn't be over emphasized. Literature review on key drivers and challenges related to e-mobility in India reveals that former outweighs the latter comprehensively. The article delves deep into various aspects of e-mobility using various secondary data sourcesin order to propose an integrated framework emphasizing upon the development of holistic e-mobility ecosystem in the country. It traces the policy initiatives taken by the government of India and suggests the various efforts further need to be put in this regard. Study finds that close coordination between different government departments along with the striking a fine balance with the industry holds the key for e-mobility success in India.

Keywords: *Automobile, Electric vehicles, e-mobility, Environment, Government, Innovation, Strategy, Sustainability*

Introduction

Leaving behind the initial disappointment, electric mobility (E-mobility) has gained unprecedented momentum in the last 5 years (acatech 2010). In this research paper, we trace the development and trajectory of electric mobility and analyse the various factors which have helped the electric mobility to cross its threshold and emerge as a preferred option for sustainable transportation. The principal thesis in this research is the fact that there are many factors both from within the automobile industry and in the larger socio-economic domain that is coming together to provide a new impetus to the electric mobility. Even the government policies and support is playing an important role in widening the scope of electric vehicles across the countries (Hoogma et al., 2002; Geels and Schot, 2007). In order to analyze the supporting factors, this research adopts socio-economic perspective as this approach does not priorities one factor over another (Rip and Kemp, 1998; Geels, 2002,). Another advantage of using this approach is the fact that it considers interrelation between social and economic actors and respects their inexorable relationship (Geels 2005). In fact, this is a kind of approach that is needed to study the emerging area of electric mobility where it is difficult to account one technological or market factor responsible for the change but rather a number of interrelated factors existing mutually are responsible for incremental evolution.

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The research also takes into account the actor-based approach and the various stakeholders involved in the process like customers, dealers, automobile manufacturers, governments, the public at large has also been considered and given full vintage so as to reach conclusive evidence about the evolution of electric mobility. Another advantage of adopting socio-economic perspective is its ability to explain incremental evolution on the one side and accounting radical and innovative changes on the other.

Literature Review

The spurt in the financially sound middle-class across the globe has led to the rise in demand for the cars. These people are willing to spend for individual mobility and owning a car also constitutes a part of their social status. Globally the car ownership rises from 59 million to78 million with China alone registering unprecedented growth from 2 million to 18 million between 2001 and 2010 (OICA, 2010).

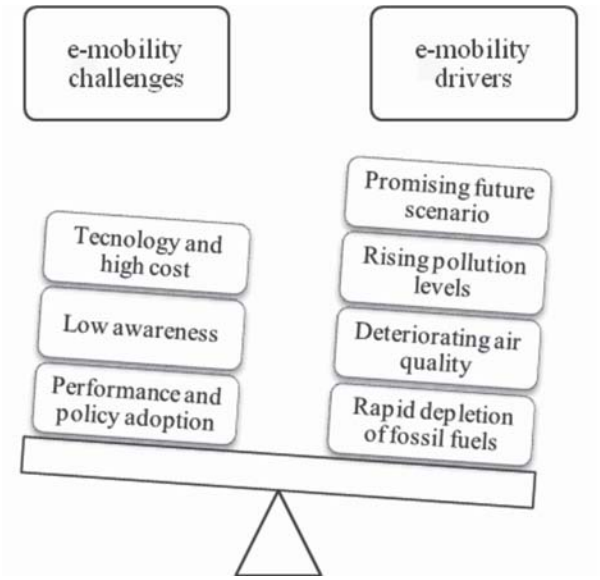

Figure 1: Drivers and challenge for e-mobility

In India too, the flourishing middle-class has catapulted the status of auto industry from nascent to major sector which now contributes 7.1% to overall GDP. Further Indian auto sector accounts for 26% of industry and 49% of manufacturing GDP (SIAM, 2016).In order to substantially reduce the pollution levels, large part of vehicles featuring internal combustion engine (ICE) has to be substituted and it's exactly where electric vehicles comes into picture allowing conventional mobility with ultra-low emissions. As observed by Perez (2004), transition from ICE based mobility to e-mobility requires techno-economic shift which will ultimately replace the older ideas in the interest of more productive and modern practices. In Indian context too, this paradigm shift is absolutely essential and has to be achieved under strict timeline. Leading such a shift and that too under the enormous uncertainty warrants a comprehensive policy framework from government. It's very much evident that well-coordinated efforts are required to establish an integrated e-mobility ecosystem in India. Given the fact that major investments and technological innovations are driven considerably by nature of assumptions policymakers has about present and future, success of e-mobility policy depends significantly on establishment.

Challenges for E-mobility in India

Considering the overarching theme of e-mobility, the complexity of the situation in Indian context is even more evident (refer fig 2). The shining example of the city of Amsterdam which has established electric charging network of over 400 stations can be a guiding example for the indian policy Framework. The principle obstruction in the wide adoption of e-mobility not only in India but across the globe is the poor battery performance of the electric vehicles. Despite years of innovation and Research and Development, the output is not something that is very much desirable and still requires considerable improvement before the electric mobility becomes a mainstay in the transportation sector. Small and lightweight batteries quickly run out of the charge and in order to overcome the range anxiety, use of the heavy battery is required which in turn increases the gross weight of the car and blunts the performance. Researchers are still to arrive at the optimum combination of battery weight and range which will bring together best of both worlds.

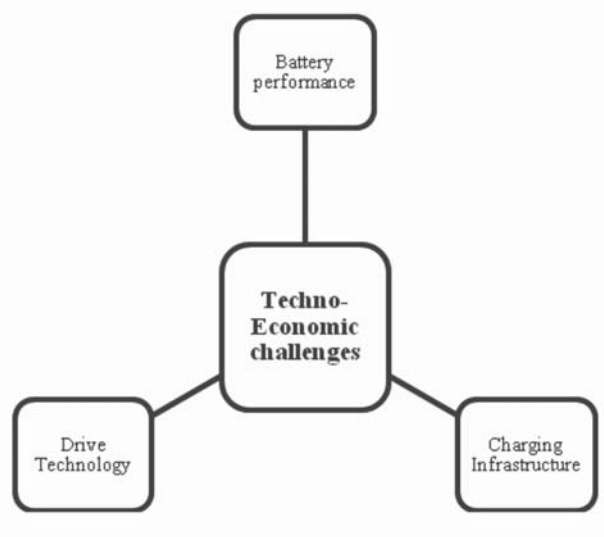

Figure 2: Techno-economic challenges for E-mobility

The second main challenge manifests in the form of lacking charging infrastructure and although charging can be done at home or workplace, there is absolute need of strong public charging infrastructure system across the country. The shining example of city of Amsterdam which has established electric charging network of over 400 stations can be a guiding example for the Indian policy Framework. (Van den Hoed et al., 2013). In India however the charging stations are almost non-existent at public place and owners of e-vehicles have option of only private, in-house charging.Public charging can be offered at public places like fuel stations, airports, public parkingalthough the provision requires considerable investment and has many implications for already inhabited areas (Bundesregierung 2009; Buttner 2012). Besides, the public charging stations, more sophisticated technique involves the creation of magnetic field for wireless energy transfer. The technique known as electromagnetic induction creates magnetic field through the use of induction loops (e-on 2016). Although very efficient in charging, the method is out of feasible options in Indian context owing to high cost and complex technology involved (EPRI 2011). The concept of e-mobility calls for entirely new interface between e-vehicles and mobility planning which goes beyond the incremental improvements. The evolution of such interfaces

require radical alterations in both policy and business domains. Further, this will also affect the attitude of masses towards concept of mobility. Drive technology is the third main challenge which is although not as complex as the battery issue but still requires considerable innovations to layout a new Framework for driving the electric vehicles. In fact, when compared to the conventional vehicles electric drive requires less moving part and accordingly, the cost required for transferring the drive from the motor to the wheels will be less than the ordinary vehicles. However, the development of electric drive Technology depends squarely upon the evolution of battery Technology which is far more difficult and requires some more time before we reach an optimum combination of battery performance and drive Technology.

Roadmap for E-mobility adoption

Electric vehicles are getting more attention and prominence from both policymakers and consumers owing to variety of reasons including emergence of innovative technology, encouraging government policies, and overall support for pouring in to help owners purchase and maintain electric vehicles. Having said that, scaling up of electric vehicles penetration in India requires dealing with four major barriers - infrastructures, market and competitiveness, technology, and policy related issues (refer fig 3).

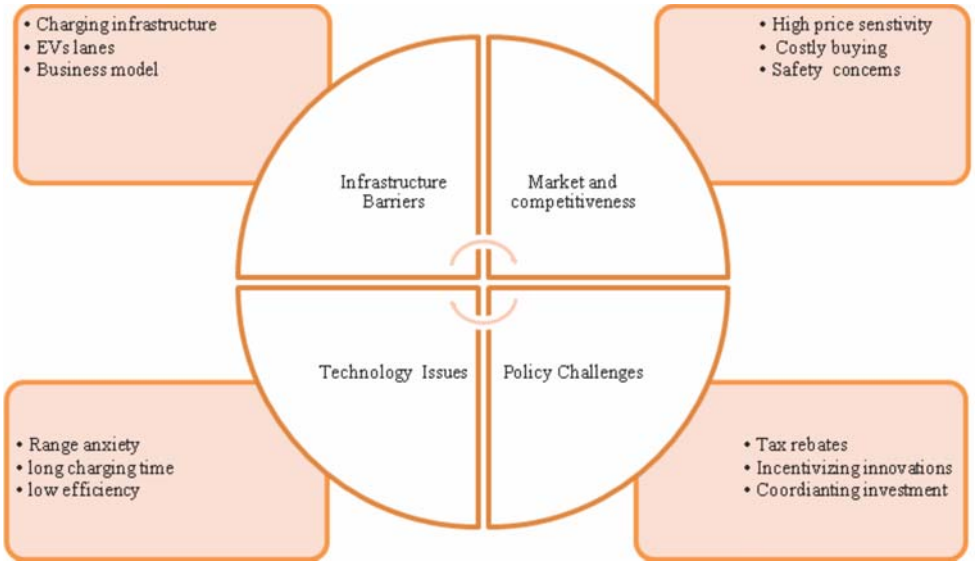

Figure 3: Four key areas for roadmap implementation

Issues related to infrastructure barriers largely include absence of charging infrastructure, lack of dedicated electric vehicles lanes, and non-existent electric vehicles business model. There needs to be a big push on the front of developing charging infrastructure which will act as solid bedrock for enhancing appeal of electric vehicles. Dedicated separate lanes for electric vehicles, especially for slow moving two-wheeler and bicycles will be helpful in facilitating electric vehicles movement on the road. Similarly in order to ease charging anxiety, battery charging stations and swapping points must be made available at various commercial and public places. A business model in this regard which facilitate renting of electric vehicles and swapping of fully charged battery for discharge ones will also prove helpful in expanding base of electric vehicles in India.

High price sensitivity of the Indian market present a biggest challenge for the electric vehicle manufacturers as the initial cost of electric vehicles are 30-40% more than their fossil-fuel

powered counterparts. Safety concerns are also big hindrance as Indian customers are still sceptical about overall security of driving and maintaining electric vehicles. Further the perception of poor performance and impracticality need to be tackled before electric vehicles can enjoy same respect as their fuel-powered counterparts in the eyes of prospective buyers.

On the technology front, electric vehicles needs to evolve holistically as the current rate of innovations are not able to keep up the pace with the users' requirements. Limited range of electric vehicles and long time to charge the battery are the major concerns manufacturers have to address before these vehicles can become part of mainstay line-up. Also, there is pressing need to make batteries more efficient and cost-effective while keeping the overall kerb-weight as low as possible. The Challenges of the policy front are multi-pronged. Not only the government need to proactive and institute practices for promoting electrical vehicles in India but also has to work as a catalyst for stimulating various technical and innovative solutions related to e-mobility. Accomplishing all these challenging tasks within the framework of constitution and competing interests is indeed a tasking goal and requires a firm commitment on part of government.

References

- acatech (2010) Wie Deutschland zumLeitanbieterfu¨rElektromobilita¨twerdenkann. Acatechbezieht Position, no. 6. Fraunhofer IRB Verlag, Stuttgart.
- Bundesregierung (2009), German federal government's national electromobility development plan. Berlin.
- Buttner Von, R. (2012) Elektroautos: Fu¨rchteteuchnicht!. Spiegel Online, 4 January, available at: http:// / www.spiegel.de/auto/aktuell/0,1518,806020,00.html accessed on April 16, 2016
- e-on (2016), electric vehicles ahead, http://www.eon.com/en/business-areas/sales/mobility/e-mobility.html, accessed on April 22, 2016
- EPRI (2011). Estimating the Costs and Benefits of the Smart Grid: A Preliminary Estimate of the Investment Requirements and the Resultant Benefits of a Fully Functioning Smart Grid. Palo Alto, Electric Power Research Institute (EPRI) http://www.rmi.org/Content/Files/EstimatingCostsSmartGRid.pdf accessed on May 3, 2016
- Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy 31 (8/9), 1257–1274.
- Geels, F., 2005. Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective. Technological Forecasting & Social Change 72 (6), 681–696.
- Geels, F., Schot, J., 2007. Typology of sociotechnical transition pathways. Research Policy 36 (3), 399–417.
- Hoogma, R., Kemp, R., Schot, J., Truffer, B., 2002. Experimenting for sustainable transport, The Approach of Strategic Niche Management. SPON Press, London, New York.
- OICA (2010) Production statistics, http://oica.net/category/production-statistics/ accessed on June 18, 2016
- Pe´rez, C. (2004) Technological revolutions, paradigm shifts and socio-institutional change, in: E. Reinert (ed.) Globalization, Economic Development and Inequality: An alternative perspective (Cheltenham and Northampton), 217–242.
- Rip, A., Kemp, R., 1998. In: Rayner, S., Malone, E.L. (Eds.), Technological Change. Human Choice and Climate Change, Volume 2. Batelle Press, Columbus (OH), pp. 327–399
- SIAM (2016), http://www.siamindia.com/economicafairs.aspx?mpgid=16&pgid1=22&pgidtrail=23 accessed on March 20, 2018
- Van den Hoed, R., Helmus, J.R., de Vries, R., and Bardok, D. (2013). Data analysis on the public charge infrastructure in the city of Amsterdam. EVS27 Symposium Barcelona, Spain, November 17-20, 2013.