

## **Green Solution?? – The Case of Electric And Hybrid Vehicles**

**By**

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### **Abstract**

Currently India is positioned the fourth in the list of countries having the largest emission of greenhouse gases (GHG) globally. 13% of the energy linked CO<sub>2</sub> emissions are accounted for by the transport sector (INCCA, 2010). There exist opportunities so as to alleviate the GHG emissions and improve the sustainability to transport growth and climate compatibility by the alignment of the agendas of development and climate change. The National Action Plan for Climate Change (NAPCC) has recognized that there can be a reduction in the emissions from transport by the adoption of an approach of sustainability through a blend of measures, like the augmented use of public transport, greater infiltration of bio-fuels and enhancement of the energy efficiency of transport vehicles.

**Keywords:** Electric car, environment, climate,

The rising environmental awareness and witnessing the adverse effects of climate change, initiatives for the advancement of environment friendly mobility solutions inclusive of electric vehicles are being supported by governments in India. The announcement of the National Electric Mobility Mission Plan (NEMMP 2020) was made so as to encourage the use and the manufacture of Electric Vehicles (EVs) in India with the intention to moderate the undesirable environmental impacts of vehicles and to improve energy security (GoI 2012). It is with reference to this that EVs are anticipated to play a very vital role in the transition of India to a low carbon state. EVs could have encouraging consequences in the areas of national energy security, native air quality and GHG alleviation. Over a period of time, EVs may well be the facilitator for the increase in the share of renewable energy in the electricity sector.

To compensate for the shortcomings of electric vehicles with reference to the range, the weight and the time taken for charging, it has to be endeavored to bring about acquaintance towards the use of electric vehicles in niche markets and situations where these shortcomings can be controlled and influenced with the help of design. Electrification of vehicles is easily accepted and initiated in confined and restricted spaces like industry campuses, airports and gated communities. As compared to traditional vehicles, electric vehicles are not restricted by any major physical technological constraints and hence the criteria for design would require being use focused be it psychological, physiological, contextual, environmental or cultural. The visual look up of electrical vehicles could be and would require being rather special as compared to what can be witnessed in the current cars/hybrid vehicles, in order to highlight the distinctiveness of this class of products.

## OBJECTIVES

The case aims to shed light on the EV landscape in the current scenario, advances in the EV markets, the continuing research and refer to the prospects of EV technology. This study presents the scenario and presents a basis on which electric vehicles can have a role as an option for sustainable mobility in India.

## INTRODUCTION

An electric motor replaces the gasoline engine in powering an electric car. The electric motor receives its energy from a controller, which is responsible for the regulation of power which is connected with the usage of the accelerator pedal by the driver. The energy stored in the rechargeable batteries is used by the electric car (electric vehicle or EV) and these rechargeable batteries are charged by the use of regular domestic electricity. In contrast to a hybrid car which is basically operated by gasoline and makes use of a battery so as to develop and increase efficiency; an electric vehicle is motorized fully and entirely by electricity. History has witnessed that the adoption and acceptance of EVs has been restricted and conservative due to the limitation of the driving range prior to the need of being recharged, longer time required for recharging, and the absence of commitment by the automakers to manufacture and promote electric cars which have similar if not more comforts as compared

to gasoline powered cars. Nevertheless changes have taken place. With advancement in battery technology-simultaneous increase in energy storage and reduction in cost-leading automakers pioneered a new generation of electric cars.

The agenda of electric transport is being motivated by concerns of energy security and oil prices.

One-third of the entire consumption of crude oil is accounted for by the transport sector and in excess of 80% of this consumption is accounted for by road transportation. India's crude oil consumption keeps on exceeding the demand. It is estimated by The National Electric Mobility Mission Plan (NEMMP) that by the year 2020 92% of the crude oil being consumed will be imported. Electric transport is being looked at as an alternative to reduce the demand of crude oil. The uptake of Electric Vehicles can assist in the reduction of the overall oil deficit and/or divert crude to invigorate the energy intensive export sectors like agriculture, manufacturing and mining.

The increase in the cost of petroleum products for consumers will cause a switch towards fuel efficient vehicles. The forecast in USD of global crude oil prices ranges from \$120, \$190 (bottom line case) and \$270. For the consumer in India, this will lead to increase in the retail petrol price from INR 67.24 per liter in 2012 to INR 80 per liter o INR 132 per liter by the year 2020. The consumer shift towards increasingly efficient internal combustion engines, electric 2 wheelers and hybrid cars has already begun even as a few municipal government departments are exploring a fleet of vehicles that are CNG-Electric hybrids. Continued increase in the price of fuel will reinforce the justification for clean options of mass transport and fire up the demand for Hybrid/Electric vehicles.

#### ELECTRIC CARS – HOW THEY FUNCTION

The definition of 'Electric Vehicles' is – Vehicles which use an electric motor for propulsion (Simpson, 2011). The electricity required to operate the motor could be supplied either through transmission wires, as it is done in electric locomotives, trams and metro trains, or electricity can be supplied through one or s series of connected batteries as it is done in electric bikes and cars or on board generation of electricity can be done with the use of a fuel cell.

- The pollution created by electric cars is much lesser as compared to gasoline powered cars and hence electric cars are an alternative which is environmentally friendly, particularly in cities.
- Media coverage about hybrid cars invariably has mention about electric cars also.
- Electric cars operate only on electricity. The propulsion is enabled by single or multiple electric motors which are powered by packs of rechargeable batteries.
- It could take anywhere between 4 to 8 hours to fully charge a battery pack. In the case of a 'quick charge' that is upto 80% capacity could take 30 minutes.

#### ELECTRIC CARS – INDIA SCENARIO

With the growth of environmental awareness and witnessing the unfavourable effects of climate change, the Indian Government and various state governments are voicing support for various initiatives for the buildup of environment friendly technologies; which could enable the reduction of the carbon footprint being emanated from India. One of the primary factors influencing this change is 'Regulation'. Since March 2007, in the larger consumer units, it has been made obligatory to conduct Energy Audits. In 2006 a programme for appliances to be energy-labeled was initiated and subsequently there has been the introduction of comparative star-based labeling. By signing the agreement on Climate Change in Copenhagen, India has shown its commitment to aggressively pursue this policy. Insistence on energy efficiency and incentives by way of offering cheaper loans to urban transport authorities are the prime features of the "Urban Renewal" programme of the Government of India. Promotion of the use of solar energy for generation of power and further applications is done by The National Solar Mission. These issues are being taken up seriously by the Indian industrial sector also. Indian companies too have Energy efficiency, topmost in their agenda. Larger automobile companies have either started the journey towards developing electric vehicle technologies and/or are procuring the smaller electric vehicle manufacturers, so as to get ready for the future. One significant and real time example is that of the recent purchase of Reva Electric Car Company (Bangaluru) by auto giant Mahindra & Mahindra.

It has been predicted by the India National Electric Mobility Mission Plan that, 5 to 7 million Electric Vehicles will be running the roads by the year 2020. Prospects for Electric Vehicles

in India exists in the emerging for wheeler market and it is motivated by the low penetration of hybrid/electric vehicles, forecasts of increasing oil prices, and an inundated and increasing demand for personal passenger cars. The Electric Vehicles alludes to Hybrid vehicles, Plug-in Hybrid vehicles and Electric vehicles with an assortment of two wheelers, passenger cars and four wheelers or fleet vehicles.

Nevertheless the Electric Vehicle passenger car demand continues to be weak, since any of the potential savings of fuel does not adequately offset the high purchase price the consumer has to pay. In the interim, the case of emissions reduction of electric vehicles will not be existent in India if renewable energy is not made use of to power the Electric Vehicles.

Up till now Electric Vehicles have remained at the perimeter. Nonetheless, improving technology and battery development are increasing the attractiveness of EVs in the eye of the consumer primarily because of improving convenience and affordability. Penetration of EVs has already commenced in the Indian market, in quite a few Indian cities. Considering the well set automobile manufacturing industry in India, the anticipated increase in the demand for transport and the current attention being received by electric vehicles, India has great prospects of developing a domestic industry for Electric Vehicles and surface as the frontrunner in the global Electric Vehicle manufacturing marketplace.

#### ELECTRIC V/S GASOLINE CARS

The external view of the electric vehicle is similar to that of the regular gasoline powered vehicle; the only difference is that in the electric vehicle there is no tail pipe. The internal is quite the contrary. As per the Advanced Transportation Consortium based in California (CALSTART), three fourths of the component parts of electric vehicles would vary from that of gasoline powered vehicles. There are quite a few components in the electric vehicle that perform the similar tasks as that of the common components in the gasoline powered vehicles.

Another noteworthy point of differentiation between the electric vehicles and the gasoline powered vehicles is related to the quantity of moving parts. There is only a single moving part in the electric vehicle and that is the motor; on the other hand the gasoline powered vehicle has a large number of moving parts. The smaller number of moving parts in electric vehicles facilitates a further differentiator – the lesser requirement of periodic maintenance and increase in reliability.

In the gasoline powered vehicles there is a requirement of extensive vehicle maintenance ranging from regular and periodic oil change, replacement of filter, intermittent tune ups, upkeep of the exhaust system and the situational replacement of components like the water or fuel pump, the alternator and so on.

The electric vehicle is more consistent and the need for periodic maintenance is negligible. It has a lesser requirement of maintenance and this automatically leads to lower maintenance costs. The electric motor in the electric vehicles has only a single moving part which is the shaft, which in itself is very reliable and hence the requirement for maintenance is very less or almost absent. Other parts like the controller and the charger which are electronic mechanisms with absence of any moving parts again need very less or no maintenance. The high-tech Lead Acid Batteries of electric vehicles are sealed and are free of maintenance. But one point of contention is that these batteries have a limited life and there is a need of periodic replacement of the batteries. With the continuous research work is being done towards the development of improved batteries that will not only broaden the assortment of electric vehicles but will also increase the performing age of the battery pack which may lead to the elimination of replacing battery packs during the life time of the vehicle.

## FOR AND AGAINST

### FOR

#### Silence and Speed

A single ride in an electric vehicle powered by a battery is enough to comprehend and appreciate the improvement in the quality riding of an Electric Vehicle. An electric car is very silent and it running is very effortless and smooth. In comparison majority of the conventional cars feel like noisy metal boxes and also feel obsolete. What comes as a revelation is the elevated torque presented by the electric vehicles. Putting pressure on the accelerator instantly transmits power to the wheels, presenting an invigorating driving experience.

#### Charging at Home

Visualize the time where you would not need to go to the petrol/diesel outlet again. All you need to do is to get into your parking, reach out for the plug and position it into the charging inlet. How convenient is that? And all this take just a few seconds of your time. By the time you are ready to leave the next morning you would be having a car totally geared up to cover about 100 miles or even two times that, depending on the type or model of the electric car. That is more than sufficient for all except probably people travelling interstate. The activity of charging the vehicle might be complicated for people living in apartments, but the access to public or workplace charging and multi-family charging points is continually improving.

#### Economical Operation

Almost all through the globe, electricity is omnipresent and economical which is a major cost advantage as compared to petroleum. Considering the substantial efficiency of electric cars as compared to the traditional gasoline powered cars, the cost per mile to the fuel of an Electric Vehicle is almost a third or a quarter as compared to the cost of gasoline (comparing on the basis of cost to mile). Furthermore exhaust systems are absent in electric cars and these cars do not require change of oil and hence cost of maintenance is reduced. All that us required for the proper maintenance of your electric car is the regular rotation of the tyres and ensuring that they are appropriately inflated.

#### No Exhaust and Emission

Most of the reliable researchers are of the belief that electric cars, even in regions that are coal-dependant, have a lesser impact on the environment as compared to the conventional vehicles. In areas which have a strong network and mix of renewable sources like hydro, solar and wind energy; or for electric car owners who have solar systems at home, the benefits related to emissions for them are remarkable. It is expected that there would be analysts who would oppose this argument. But it is indisputable that electric vehicles do not have exhaust or tailpipes, and as a result present a valid advantage in the improvement of the air quality for us, our family and the community.

People who purchase electric vehicles have knowledge about the features and the procedure of using it.

The customers are usually upscale and they use the electric vehicles as a second or a third vehicle for family members.

The market for second/third cars is growing in the upscale customers and the women in the family have a inclination towards electric vehicles due to the ease in handling.

The dealer network is now growing (especially after the acquisition of 'REVA' by Mahindra & Mahindra).

## AGAINST

### Restricted Range

One of the most common factors that is discussed in the Electric Vehicle debate and in fact is considered to be the 'In Thing' is the factor of 'Apprehension of Range'. This apprehension about the range basically refers to the concern that arises due to the fact that almost all of the affordable electric cars have a coverage range of 130 to 160 kilometers and it takes hours to get fully recharged. Electric Vehicle backers will contend that 160 kilometers at one go is more than enough for most driving scenarios. Hence it is contended that almost all the drivers of electric cars seldom (almost never) experience anxiety regarding Restricted Range. But it is also a fact that the cost of batteries of electric cars and their range is positively improving year by year, what with the arrival of Electric Vehicles with 320 kilometer plus range, towards the latter part of 2016. Nevertheless, but for the fact that you are driving an electric vehicle with an engine that extends the back-up range, you would require to accurately plan; ensuring that the routes outside of the expected local driving are inside range (or provide for recharge time).

### Extended Time to Refuel

Anxiety about the range is directly coupled with concerns related to the extended amount of time it takes for the refueling of an electric car. From a source of electricity of 240 volts Electric Vehicles can usually append about 35 to 40 kilometers of range from an hour of charging. Thus even though you would not be able to quickly go down to the petrol/diesel station and add on a few hundred kilometers of range and though numerous road trips are not prudent, drivers adding specific amounts of kilometers on their vehicles will not be handicapped by the hours of recharging time as long as they keep it in mind that they should plug in the vehicle before they go to sleep.

### Excess Cost

The price range of the present yield of electric cars is in the range of \$30,000 to \$40,000. This is considerably quite expensive when compared to similarly equipped, small to medium sized gasoline powered vehicles. In view of the same, there is no doubt that Electric Vehicles are certainly expensive. Nonetheless, these comparisons of cost generally do not consider quite a few factors, which include incentives usually valued at \$10,000; economic and inexpensive lease rate which go down low at \$199/month; decreased cost of maintenance; experiencing luxury and facilities exceeding those available in the cheap gasoline models.

#### Deficiency in Consumer Choice

The limited plug-in vehicles existing in the market are by and large, pure electric compact cars and midsize plug-in hybrid sedans. The range is rapidly intensifying by way of plug-in hybrid SUVs, a plug-in minivan and the Tesla Model X, an all electric SUV. Quite a few large automakers have set assertive targets of introducing at least a dozen if not more, plug-in models in the next few years, with the promise of introducing electric models in varied segments. The trend of offering electric version of the attractive models already existing; instead of offering electric-only models might look exceedingly ultramodern to the average buyers.

In India the electric vehicle still does not have a value proposition as a first car due to its high pricing when compared to the traditional petrol car.

The public is of the opinion that electric vehicles have lesser power and higher cost.

Electric Vehicles are directly compared with high performing petro cars (which is not a fair comparison).

Deficiency of spare parts and skilled technicians for the purpose of maintenance.

The local manufacturing of electric vehicle components is very less (motors, controllers as well as batteries especially the Li-on batteries are imported from countries like China, Taiwan and USA).

#### CONCLUSION

A global sale of over 2 million highway legal electric passenger cars and light utility vehicles (PEVs) has been done as of December 2016. This collection of electric cars represents only

0.15% of the total of 1.4 billion motor vehicles running the global roads by the end of 2016. This was an increase from 2015 when it was 0.1%. The milestone of one million in sales of electric vehicles was achieved in September 2015. This was two times faster, as it took almost 5 years for the PEV segment to accomplish one million in sales and it took a little more than 9 years for HEVs to accomplish one million in sales. Analysis of global sales shows that in electric cars the plug-in hybrids have been excessively and aggressively sold wherein the pure electric vehicles made up 61% of the global collection of two million light-duty plug-in vehicles running the global roads by the close of 2016.

In the Indian market the success of electric cars is dependent on certain consequences. If there is expansion in the charging network, additional people will be positive towards the purchase of electric cars. If there is an increase in demand then manufacturers will be able to invest in the manufacturing of electric vehicles and the government needs to be lenient in taxing these vehicles so as to provide them with motivation to produce electric vehicles.

This cloud has a silver lining. Majority of the car manufacturers are equipped with the electric car manufacturing platforms. Furthermore given the fact that Electric Vehicles have lesser number of moving parts, manufacturing the vehicles after the production lines are set up could in fact be much easier in comparison to fossil-fuel powered cars.

Questions:

1. How is the current demand for electric vehicles, especially in India?
2. Does the case for Hybrid, Plug in and Electric passenger cars in India, work... as yet?
3. Are Electric Vehicles clean?
4. What will be required so as to bring clean cars in a big way to India?

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