

A Review on Electric Vehicles Challenges in India and A Case Study

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Abstract : The development of electric vehicles (EV's) has been chosen as the strategy for the solution of rising air pollution and the energy consumption all over the world. Over the years, the exploitation and pollution of natural resources have created the need for renewable and environment-friendly products. One of these products is Electric Vehicles. Electric Vehicles are the replacement for petroleum-based vehicles. They are one of the emerging technologies as well as eco-friendly and viable. Many countries around the globe have implemented this technology and are contributing towards amelioration of the environment. We are going to see challenged faced in India over implementing electric vehicles.

IndexTerms - Pollution, Electric Vehicle, Eco-Friendly, Lithium Battery.

I. INTRODUCTION

Carbon emissions from vehicles quantity for a typical traveller vehicle are 4.7 metric tons each year. The largest human supply of carbon emission is from combustion of fossil fuels. The use of non-renewable and polluting sources for the production of energy has taken environmental pollution to a whole new level. The increasing global warming has an impending need on us to stop the use of non-renewable resources and reduce carbon emissions. Since the commercial age, the atmospheric carbon content is rising. The development of electrical engine in vehicles has created a replacement for the inner combustion engines paving approach for the electrical Vehicles (EV). EVs have been adopted by many countries since it development creating a positive impact on the environment. We square measure currently about to see the opportunities and challenges close at hand over implementing electrical vehicles in India. Types of Electric Vehicles are

1.1 Ground Vehicles

- Battery Electric Vehicles (BEVs)
- Hybrid Electric Vehicles (HEVs)
- Rail borne Electric Vehicles
- Space Rover Vehicles Estimation of MSW Generated Within the City

1.2 Airborne Vehicles

- Manned & Unmanned Electric Aerial Vehicles

1.3 Seaborne Vehicles

- Electric Boats

1.4 Battery Electric Vehicles (BEVs)

Battery Electric Vehicles are complete electric vehicles that are powered by only electricity and do not include a petrol/diesel engine, fuel storage or exhaust pipe. They use electric motors and motor controllers for propulsion. They do not have an internal combustion engine. They charge the battery through external charging outlet and hence also known as "Plug-in Electric Vehicles (PEVs)". There are various types of BEVs such as electric cars, buses, bikes, scooters, trucks and trains. They even include fewer parts than those used for those vehicles based on internal combustion engines. They even produce fewer noises compared to their counterparts.

1.5 Hybrid Electric Vehicles (Hevs)

A hybrid electrical produces a lot of less emission than those made by pure gasoline based mostly hybrids rising fuel economy performing at most potency. There are also Plug-in Hybrid Vehicles (PHEVs). They even manufacture fewer noises than pure hybrid vehicles. Hybrid electrical Vehicles aren't pure electrical vehicles since they use a mix of burning engine and electrical propulsion systems. These mainly include cars, buses and trucks. The latest models use technologies that specialize in rising efficiencies like regenerative brakes that convert mechanical energy of car into electrical energy to charge the battery and alternative systems such as start-stop system, which switches off the engine at idle and restarts when needed to reduce idle emissions and motor-generator.

II. ADVANTAGES OF USING ELECTRIC VEHICLES

2.1 Cheaper to operate

EVs are cheaper to operate since they have high efficiencies and fuel economies thereby reduce cost for the owner. The electricity to charge an EV is about one third as much per kilometer to purchase fuel for vehicle [1].

2.2 Cheaper to maintain

BEVs have less moving parts than those had by conventional combustion engine vehicles. There is less servicing and no expensive systems such as fuel injection and exhaust systems, which are not needed in an EV. PHEVs have petrol engine and need servicing hence costing more than BEVs but they also have an electric propulsion system, which requires less moving parts leading to less depletion of petrol engine parts [2].

2.3 Environment Friendly

EVs are less polluting, as they have zero exhaust emissions [3]. If you opt to use renewable energy to charge your EV, you can reduce greenhouse gas emissions even more. Some EVs are made of eco-friendly materials such as the Ford Focus Electric, which is made of recycled and bio based materials and the Nissan Leaf, which is partly made of recycled plastic bottles, old car parts and second hand appliances [4].

2.4 Health Benefits

The reduced harmful emissions will lead to better air quality, which is good for our health. EVs are also produce much less noise compared to petrol/diesel-based vehicles [3].

2.5 Safer

EVs have a low center of gravity thereby making them less likely to capsize. They also have low risk of fires and explosions. Their body construction gives them more durability hence making them safer during collisions [5].

III. TIMELINE OF ELECTRIC VEHICLE

- 1832 – Robert Anderson develops First Crude Electric Vehicle.
- 1890 – William Morrison develops first successful electric vehicle in the USA .
- 1899 – Electric Cars gain popularity
- 1900 – Electric Cars are the trend
- 1901 – The World First Hybrid Electric Car, the “Lohner – Porsche Mixed” is created by Ferdinand Porsche.
- 1908 – The Ford Model T is introduced by Henry Ford.
- 1912 – The Electric Starter is introduced.
- 1920 – 1935 – Decline in electric vehicles due to use of crude Texas Oil as fuel
- 1960s – Interest in electric vehicles regain as Fuel prices soar 1971 – First Manned Electric Vehicle for the moon, NASA’s Lunar Rover is developed.
- 1973 – Many Automakers explore alternative options to fuel
- 1974 – Sebring Vanguard introduces the “Citi Car”. [3]
- 1979 – Interest in Electric Cars fade due to drawbacks
- 1990 – Clean Air Amendment Act is passed .
- 1992 – Energy Policy Act is passed [4].
- 1996 – General Motors launch EV1 [5].
- 1997 – Toyota produces the first mass produced hybrid, the ‘Prius’ [5].
- 2006 – TESLA announces production of luxury electric cars
- 2008 – TESLA produces its first electric vehicle, the Roadster with range of 244 miles per charge[6].
- 2009 – US Energy Department invests in nation-wide charging infrastructure [6].
- 2010 – General Motors introduce first Plug In Hybrid, the Chevy Volt [7].
Nissan introduces LEAF, an all electric, zero emission cars [8].
- 2012 – TESLA introduces Model S with battery range of 270 miles per charge [9].
- 2013 – Cost of Electric Vehicle Batteries drop by 50% [9].
- 2014 – TESLA announces plan to build ‘Gigafactory’ and double worlds 2014 battery production figures [7].
- 2016 – BMW Group, Daimler AG, Volkswagen Group with Audi and Porsche along with Ford Motor Company (European Division) agree to build ultra fast charging sites across Europe by 2020 [3].
- 2017 – Toyota announces sales of 10 million hybrids since production of ‘Prius’.
- 2019 – Expected date by which Swedish Automaker Volvo announces to produce only electric and hybrid cars [3].
- 2020 – China’s expectation of 10% of auto imports and production will be only electric vehicles [8].
- 2025 – Expected date by which Norway and Netherlands plan to ban sales of petrol and diesel cars [7].
- 2030 – Expected date by which India plans to promote an all-electric car fleet [7]. Also, China expects to limit its carbon emissions, hence affecting sales of petroleum-based cars [6].
- 2040 – Expected date by which Britain and France announce plans to ban sales of all new petroleum based vehicles [5].
India’s Progress with Implementation of Electric Vehicles The Government of India has embarked on a mission to create revolution in renewable energy in the country by planning a movement involving transformation to Electric Vehicles by 2030[7]. It is expected to cut its oil purchases by some \$60 billion, reducing emissions by 37% and curb demand for road infrastructure within the next 12 years [9]. India currently has around 1.3 billion people with around 21 million vehicles sold annually [7].

IV. CHALLENGES

There are various challenges for EV’s as listed below:

4.1 Cost of EVs

- The EVs cost should be reasonable and the EVs produced should hold proper value for money.

4.2 Efficiency of EVs in India

- In India the EVs on an average provide around 120 km on a full charge in turn making them unsuitable for long drives .
- EVs in India lack speed, which may turn off buyers. The top two India made EVs have speed of 85 km/h.

4.3 Demand of EVs

- Increase in demand will help in achieving vision 2030.
- Increase in demand of EVs will lead to increase in requirement for energy and raw materials to for the battery.

4.4 Vehicle Quality

- Good vehicle quality will lure more customers.
- Better quality vehicles ensure trust among customers.

4.5 Batteries

- The batteries used by electrics are cars made up of nickel, aluminum, cobalt, graphite and lithium, which are all rare earth materials.

- The availability of these materials is scarce and the amount of these materials available may not be able to produce enough batteries to power the expected amount of electric vehicles to be produced.
- The increasing demand for lithium around the globe given its scarcity on the Earth's surface will make it challenging to meet India's EV requirement.

4.6 Electricity Generation

- There must be enough electricity generation capacity to meet the increasing demands for charging infrastructure and local consumer utilization.
- There is presently shortage of electricity in many parts of India and a major part of energy generation of the country is still dependent on fossil fuels .

4.7 Anti – EV Elements

- Anti – EV activists, supposedly fringe elements hired by oil companies or fossil fuel dealers try to thwart growth of EVs. Amsterdam recently witnessed an Anti – EV vandalism case involving damaging of 2 TESLAs .

4.8 Demand of Global Energy

- Any decrease in demand for oil by India and China will have wide geopolitical ramifications as the two countries together account for half of 1% growth in global energy demand in 2016 [6].

4.9 Availability of Land

- Availability of land to setup charging stations in urban areas where land scarcity is present is a difficult task.
- Moreover, a substation nearby is a requirement for a charging station.

V. CASE STUDY- AIRCRAFT TOW TRACTOR

One case study was developed through a project for the ‘design of electric aircraft tow tractor’ [14].

An aircraft tow tractor tows the aircraft from runways to the tarmac or apron, and back. Presently it's extremely fuel gulping and polluting vehicle, as it has to have weight (added through ballast) for traction to tow the heavy aircraft. Making it electrical, can offer many fold advantages, which will be elucidated in the case study presentation. The disadvantage of an electrical vehicle is that it's significant, which is a positive aspect for an aircraft tow tractor. Cheaper, heavier and dependable lead acid batteries will be used as their high weight will produce a plus. The flying field may be a confined space; hence they vary of the vehicle needn't be massive. Intermittent usage (as it's not used all the time) of such vehicle will enable it to maneuverer to the charging stations a lot of typically to urge charged. The structure of this vehicle needn't be economical and high-ticket (as in monocoque vehicles), but inefficient, heavy, rugged and less expensive. What we tend to see here is that each one the inherent disadvantages of an electrical vehicle can be reborn into advantage during this state of affairs.

Similar advantage will be created in varied degrees in industrial campuses, gated communities, tiny urban clusters and equally known things, with vehicles for various usage and wherever short vary is good enough.

VI. CONCLUSION

In this paper we have discussed the types of EV's , Timeline of EV's and Challenges for EV's in India. The India's obligation towards many environment friendly agreements has given it a situation where it is prompted to implement vision 2030. The implementation of EVs in India aims primarily to reduce greenhouse gas emissions and cut oil expenses. The vision 2030 put forth by the Indian Government is an ambitious and difficult task. The Government ought to build the foremost out of the opportunities offered and notice appropriate ways that to tackle the challenges at hand over the implementation of EVs.

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