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An Overview of Electric Mobility in India: Prospects and Obstacles

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Abstract

In recent decades, overuse of fossil fuels and rising environmental damage have increased the demand for clean and sustainable transport options. One of the most promising options is the Electric Vehicle. Electric Vehicles work as an alternative to petrol and diesel based vehicles. They are clean, modern and cost-effective in the long run. Replacing conventional engines with electric motors can bring down air pollution to a large extent and also help vehicle owners save money. Many nations have already adopted this technology to protect the environment. This paper discusses the prospects and obstacles related to the growth of electric vehicles in the Indian context.

Keywords: Air Pollution; Electric Mobility; Sustainable Transport; Battery Technology

1. Introduction

The heavy dependence on non-renewable energy sources for power generation has badly affected the environment. Rising global warming and increasing carbon dioxide in the atmosphere have made it necessary to move away from fossil fuels. Since the industrial revolution, the level of carbon in the air has been continuously increasing. A normal petrol car releases around 4.6 metric tonnes of carbon dioxide in a year. Burning of fossil fuels is the biggest man-made source of carbon emission. The invention of the electric motor gave an alternative to the internal combustion engine and opened the door for Electric Vehicles (EVs). Many countries have started using EVs and have seen a positive effect on the environment. This study focuses on the possibilities and difficulties India may face while promoting electric mobility.

2. Categories of Electric Vehicles

A. Land Based Vehicles

- Battery Electric Vehicles (BEVs)
- Hybrid Electric Vehicles (HEVs)
- Electric Rail Transport
- Electric Rovers for Space Exploration

B. Air Based Vehicles

- Electric Aircraft - Manned and Unmanned

C. Water Based Vehicles

- Electric Boats and Ships

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2.1 Battery Electric Vehicles (BEVs)

Battery Electric Vehicles run completely on electricity. They do not have a petrol or diesel engine, fuel tank or exhaust pipe. They use an electric motor and a controller for movement. They are charged through an external charging socket, therefore they are also called Plug-in Electric Vehicles. This category includes electric cars, buses, scooters, bikes, trucks and trains. Compared to fuel-based vehicles, they have fewer components and produce very less sound.

2.2 Hybrid Electric Vehicles (HEVs)

Hybrid vehicles are not fully electric because they use both a fuel engine and an electric motor. This group mainly includes cars, buses and trucks. Modern hybrid models use advanced systems like regenerative braking, which converts the kinetic energy of the vehicle into electrical energy to recharge the battery. They also use start-stop technology, which turns off the engine during idle time and restarts it when required. This reduces fuel wastage and emissions. There is another type called Plug-in Hybrid Vehicles (PHEVs), which can be charged from an external source as well. Hybrids produce much less pollution than only petrol-based vehicles and give better mileage.

3. Benefits of Using Electric Vehicles

A. Low Running Cost

EVs are economical to run because electric motors are highly efficient. The cost of electricity required to run an EV for one kilometre is almost one-third of the cost of petrol or diesel for the same distance.

B. Low Maintenance Cost

BEVs have fewer moving parts than conventional vehicles. They do not need servicing of fuel injection systems, exhaust systems or engine oil changes. PHEVs have a petrol engine so they need some servicing, but still their maintenance cost is lower than normal vehicles.

C. Eco-Friendly Nature

EVs do not release smoke from exhaust. If they are charged using solar or wind energy, their total carbon footprint becomes even lower. Some EV models are also made from recycled materials. For example, some cars use recycled plastic bottles and reused parts in their interiors.

D. Health Advantages

Lower emissions mean cleaner air, which is good for human health. EVs also create very less noise pollution, which makes cities quieter and more peaceful.

E. Better Safety

EVs have a low centre of gravity because of the heavy battery placed at the bottom. This reduces the chance of toppling. They also have a lower risk of fire and explosion compared to fuel vehicles, and their strong body structure makes them safer during accidents.

4. Journey of Electric Vehicles - Timeline

- *1832* - Robert Anderson builds an early crude electric carriage
- *1890* - William Morrison builds the first successful electric vehicle in America
- *1899 - 1900* - Electric cars become popular in cities

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- *1901* - Ferdinand Porsche designs the first hybrid car, Loaner-Porsche
- *1908* - Ford launches Model T, petrol cars become cheaper
- *1912* - Electric starter is introduced, petrol cars become easy to start
- *1920 - 1935* - Electric vehicles decline due to cheap Texas oil
- *1971* - NASA uses electric Lunar Rover on the Moon
- *1974* - Sebring-Vanguard launches CitiCar
- *1990* - Clean Air Act is amended in the USA
- *1996* - General Motors launches EV1
- *1997* - Toyota launches Prius, first mass-produced hybrid
- *2008* - Tesla launches Roadster with 244 miles range
- *2010* - Nissan launches LEAF, a fully electric car
- *2012* - Tesla launches Model S
- *2013* - Battery prices fall by almost 50%
- *2016* - European car makers join hands to build fast charging network
- *2017* - Toyota completes sales of 10 million hybrids
- *2020* - China targets 10% electric share in auto production
- *2030* - India aims for a large-scale electric fleet
- *2040* - UK and France plan to stop sales of new petrol and diesel cars

5. India's Steps Towards Electric Mobility

The Government of India has set a target to transform the transport sector by promoting electric vehicles by 2030. This shift can save around $60 billion in oil imports, reduce emissions by 37% and decrease the load on road infrastructure. India has a population of more than 1.4 billion and around 21 million vehicles are sold every year, so the impact of this change will be huge.

6. Opportunities in India

A. Government Support

- In 2015, the FAME scheme was started to encourage manufacturing and use of hybrid and electric vehicles.
- The National Electric Mobility Mission Plan aimed to achieve sales of 6-7 million electric and hybrid vehicles by 2020.
- EESL was given the responsibility to buy 10,000 electric cars to replace government petrol cars.
- Karnataka approved a policy to promote research in electric mobility and to install charging points in major cities.
- Maharashtra became the first state to start an electric mass mobility system and gave tax relaxations on EVs.
- As a part of the Paris Climate Agreement, India promised to reduce its share of global emissions by 2030.
- GST on EVs was fixed at only 5% to 12%, while petrol vehicles attract 28% tax.

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B. Battery Sector

- At present, around 22,000 EVs are sold in India, out of which 2,000 are four-wheelers.
- Battery prices have fallen from $600 in 2012 to $250 in 2017 and are expected to go below $100 in the coming years.
- EV batteries can also support the electricity grid through storage and balancing.

C. Industrial Growth

- Ola started its electric mobility project to build charging infrastructure, e-cabs and e-rickshaws.
- Suzuki announced a $600 million investment for a lithium-ion battery plant.
- Mahindra invested in its EV division to launch electric versions of its popular models.
- Ashok Leyland partnered with SUN Mobility to develop battery swapping for electric buses.
- JSW Energy announced an investment of $623 million in electric cars, batteries and charging stations.
- Volvo announced it will focus only on electric and hybrid models in the future.
- The charging infrastructure market is expected to grow to 90 billion units, offering a big business opportunity.

D. Environmental Need

- Most Indian metro cities suffer from severe air pollution, and vehicles are one of the main causes. Delhi faces heavy smog every winter due to pollution.
- Growing awareness about climate change and pollution is encouraging people to buy EVs.

7. Challenges in India

A. High Purchase Price

The initial price of EVs is still high for an average buyer. For EVs to succeed, they must offer good value for money.

B. Limited Range and Speed

Indian EVs give an average range of 120 km on a full charge, which is not sufficient for long journeys. Their top speed is also around 85 km/h, which may discourage buyers.

C. Low Demand

Demand is still low because of price, range and lack of charging facilities. Higher demand is needed to achieve the 2030 vision.

D. Vehicle Quality and Trust

Customers will buy EVs only if the build quality is good and the vehicles are reliable for daily use.

E. Battery Raw Materials

EV batteries need lithium, cobalt, nickel, graphite and aluminium. These materials are limited in nature and their shortage can affect large-scale production.

F. Power Generation

India still faces power shortage in many areas and a large part of electricity is still generated from coal. More clean power generation is needed to support charging.

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G. Charging Infrastructure and Land

Setting up charging stations in crowded cities is difficult due to lack of free land. A nearby sub-station is also needed for a fast-charging station.

H. Global Energy Impact

A fall in oil demand from India and China can affect global oil prices and politics, as both countries together contribute to a large part of the growth in world energy demand.

8. Conclusion

The main aim of promoting EVs in India is to reduce greenhouse gas emissions and to cut down oil imports. The 2030 target set by the Government is ambitious but achievable if the available opportunities are used properly and the challenges are handled with proper planning. India's commitment to international climate agreements makes it necessary to move faster towards electric mobility.

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