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Study of E Vehicles: New Way for Pollution Free Automobile Industry

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Abstract:
E vehicles are being in highly demanded by the customers. Government policies are guiding force to purchase the e-vehicles. Government itself gives subsidies to purchase the vehicles. Subsidies are the biggest motivator for the customers to purchase the e- vehicles. Such vehicles are pollution free vehicles. Hence the customers are turning towards the e vehicles to purchase. Researcher has tried to find out the available infrastructure to charge these vehicles. Charging stations are falling short to the number of e – vehicles.
In India, transport electrification over the next decade is expected to be driven by light electric vehicles, comprising two-wheelers (scooters, motorcycles) and three-wheelers (passenger and cargo). Apart from these, cars and light commercial vehicles are the other key vehicle segments being electrified. Electric buses will also be present in significant numbers.
An electric vehicle (EV) is an automotive vehicle that uses one or more electric motors for propulsion. It can be powered by a collector system, with electricity from engine sources, or it can be powered autonomously by a battery.
Key Words: E Vehicles, Subsidy, Charging Stations, Government policies etc.

Introduction:

Government incentives to increase adoption were first introduced in the late 2010s, leading to a growing market for the vehicles in the 2010s. Increasing public interest and awareness and structural incentives, such as those being built into the green recovery from the COVID-19 pandemic, is expected to greatly increase the electric vehicle market.

EV charging requirements depend on the specifications of EV batteries, as power must be supplied to the battery at the right voltage and current levels to permit charging. Typical capacity and voltage of EV batteries vary among the different EV segments like 2-wheeler, 3-wheeler, compact SUV, Large SUV, etc.

EVs release no tailpipe air pollutants; however, EVs are charged with electricity that may be generated by means that have health and environmental impacts, and the air emissions associated with manufacturing an electric vehicle can be greater than those of manufacturing a conventional vehicle.

In 2020, before the COVID-19 crisis, the growth of EV vehicle around the world is 36%, with 3 million new unit deliveries. The COVID-19 pandemic had limited domestically produced electric vehicles due to the shutdown of manufacturing facilities and lockdowns. However, as restrictions eased, EV witnessed optimistic growth as consumers became inclined toward affordable eco-friendly transportation supported by governments incentives. This trend was set to continue in 2021, with 4 million units (5% of all vehicles). Although COVID-19 has impacted the current sales, it has also proved how big is the impact of the fuel road transport to the overall pollution. Now, we realize how important is to care our environment. The total electric vehicle stock was forecasted to be 13 million (9.2%), and this

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trend will continue to rise for upcoming years. This growth will be influenced by several factors, according to specialist firms and pacesetters in the sector.

The automotive sector in India is dominated by two-wheelers i.e., scooters, motorbikes and three-wheelers included autos and rickshaws that play a significant role in last-mile mobility in the country. Rising government emphasis and focus on private and government players partnership to enhance EV ecosystem in the country. Increases investments and product on public passenger vehicle so that people can adopt EVs in future, subsequentially government promote EV vehicle in renewable energy and green mobility projects.

To promote EVs in India government take some initiative such as:

- Electric vehicles on Indian roads are low-speed electric scooters (less than 25km/hr) that do not require registration and licenses.
- Almost all electric scooters run on lead batteries to keep the prices low, however, battery failures and low life of batteries have become major limiting factors for sales besides government subsidies.
- Government sees a great opportunity with EVs in reducing the Carbon footprint, making air pollution free, dependence on Crude oil imports, creating jobs and building a new Technology knowledge hub in India.

Concept & significance of study:

An electric vehicle operates on an electric motor instead of an internal combustion engine, which is powered by electric supply from battery. Therefore, an electric vehicle is seen as a possible replacement for gasoline or fossil fuel like petrol and diesel which create huge amount of air pollution as well as noise pollution.

The scope of the report covers types of electric vehicle based on power different power source and vehicle type based on capacity and size. Also, this study shows the varieties of EV charging station compatible with life style and various equipment, facilities, sources require to make EV charging station.

Significance of study shows that why should public go for the Electric Vehicle instead on conventional vehicle, such that adoption of EV reduces total running cost, reduced pollution, support green mobility, etc.

Objective of the Study:

- To understand the adoptability of electric vehicles in India by ensuring safe, reliable, accessible and affordable charging infrastructure and ecosystem.

- To study preparedness of the electrical distribution system to adopt EV charging infrastructure.

Scope of the Study:

- The Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) clearly states that human activity is causing unpredictable and sometimes irreversible climate change. The reports state that the impact of climate change is already evident like increasing temperature, more droughts and floods, more extreme weather events,

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rising sea levels, and ocean acidification. These changes are causing serious problems for livelihoods and wellbeing of people all around the world.

- According to the World Health Organisation (WHO), India has the world's worst air quality. In 2020, even during the Covid crisis with national and state lockdowns, 36 cities out of 50 cities which had unhealthy levels of air quality were from India. The vehicular pollution arising from the increasing stock of private vehicles, especially internal combustion engines (ICEs) has contributed significantly to the deterioration of air quality in Indian cities. This has led to India becoming third-highest oil consuming and greenhouse gas emitting country worldwide. Additionally, nearly two-thirds of deaths in India can be attributed to emissions coming from internal combustion engine (Diesel) vehicles. The scope of the study is identified after and through the study is conducted. The study has been conducted with the help of structured questionnaire.

Limitations of the study:

- The information and research are recently done so it is difficult to find out exact solution and need of purchasing the electric car.
- Limited amount of data behind who actually have an electric vehicle, because according to e-vahan portal India has around 9.66 lakh EVs only.
- The exact data about the topic is difficult to collect and analyse due to lack of accurate information and unavailability of valid sources of data. The exact amounts were not available in secondary data research so the analysis may differ slightly from the real data.

India's EV Charging Industry

Electric car related business opportunity is EV charging station. Electric car charging stations can be developed and installed as per the standards accepted in the area where it is installed.

There are three types of charging station we have made.

A. AC Home based Charging stations
B. AC Destination based Charging station
C. DC High Power Public Charging stations

There are certain needs or facilities to be at charging station such as Wash Rooms, refreshments, rest rooms, hotels and restaurants so that people can spend their time while their EV car is getting charged. EV charging station management and repair would be a profitable. If number of charging stations increase, the possibilities to start and run a complete charging station management is high. A group of different charging stations might be installed together so that a greater number of vehicles can park and charge there.

TYPES OF CHARGERS

A. AC Charger
B. DC Charger

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1. AC Charger

In AC charging, the conversion of the electrical current to DC happens inside the EV Cars. All EVs come with preboard chargers capable of converting the current before supplying it to the car's battery. AC chargers are more common in the EV ecosystem because they are comparatively less expensive to produce, install, and operate.

Further, they may be sub-categorised into:

Type 1: Slow AC charging,

Slow AC charging is simple home sockets-based charger which can be directly put into the 15Amper power socket used for AC charging.

Basically, it is portable charger which car manufacturing companies give with the car. It would be 3.3KWatt capacity charger and can Tata Power Nexon EV in 9-10Hr and MG ZS in 1820Hr.

Fig: Portable AC 3.3kW Charger

Type 2: Fast AC charging

Fast AC charger, which are faster wall-box chargers having power capacity of 7.4 - 10KWatt and can charge Tata Nexon EV in 4Hr and MG ZS in 6Hr from 0 to 100% of charger specially installed for EVs.

Fast AC charger are specially installed where people can spend more than 3-4 Hr such as Offices, Home, Cinema and residential places.

Fig: AC 7.4kW Type II Charger

2. DC Fast Charger

DC chargers is suitable for conversion of current from AC to DC outside the vehicle. This transformation takes place inside the charger itself with the help of rectifier. DC is then directly fed into the EV, for being charging. These chargers require a lot more power

from the grid nearly 125 A and have capacity of 25-50kWatt and are much more expensive to produce as well as to install the charge and operate. To reduce time for charging it need a larger converter present inside the charger in charging stations, as compared to AC portable charger comes with the car.

As a result, a higher output of power is provided to the EV battery in lesser time. If you think about Tata Nexon EV which have 30kWatt battery capacity can charge in 60min and MG ZS in 75min to complete charge.

TYPES OF EV CHARGING CONNECTOR

Similar to phone charging cables, car charging cables also have two connectors, one that plugs into the vehicle socket and the other into the charging point itself.

- AC type charging of Electric vehicles have **Type 1** or **Type 2** socket for slow or fast charging.
- DC type charging of EV have **CHAdeMO** (Charge de Move) and **CCS** (Combined Charging System) for DC rapid charging. CHAdeMO is equivalent to "charge for moving,"
- Most of AC Type 2 charger socket will have a cable attached and all DC rapid charging stations have a cable attached with mostly a CHAdeMO and a CCS connector.
- Most EV drivers prefer a portable charging cable with that because sometime if they don't get charger point, they can charge from any socket matches their vehicle's Type 1 or Type 2 socket.

Working of EV Charger:

Working of Electric Vehicle Charging station

- The electric car charging station is made up of many electric vehicles charging devices, each of which is made up of a transformer, capacitor, and a control unit with a high-quality CPU and inbuilt memory for the station's software.
- The charging station includes a charging wire and connector that connects to the car through an appropriate plug and a stand that fits the vehicle's charging port.
- An adequate distribution and control panel, which fundamentally has additional safety and fail-safe systems necessary to manage suitable electric load, transfers the electrical power received from the grid to an electric car charging unit.
- The electrical power is given to the electric car charging machine, which uses its transformer set to change the input AC voltage to the appropriate value, which is determined by the user's selection of the charging level
- One of the slow chargers provides 110-120V AC alternating current at the charger point and second slow type charger provides 220 to 240V AC at the charger point. Third type of charger requires a three-phase input AC supply that is then passed through a transformer, rectifier and reducing circuit to produce the DC power supply that is supplied to the charging point.

PROCESS OF INITIATING CHARGING

- The charger is design such that, which based on unmanned charger, results required no dedicate person for initiate the charging.
- The person who owns the EV car open dedicated authority mobile application and directly scanned QR code or select particular charger model.

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- Either select cost based or unit-based charging, both options could be there.
- Then Unlock the Charging Gun from the charger & connect to EV. Then pay amount for initiating charging and tap on Initiate.
- Charging would stop automatically after the entered Amount or Unit is consumed.
- Or charging can be stopped in between by pressing "Stop Charging" in mobile app.
- As charging is completed application as well as charger shows indication that your charging is done and person can unplug the charger.

Government Recommendations for Installing Electric Vehicle Charging Stations

The Central Government of India has released the following recommendations for the establishment of electric vehicle charging stations in India:

- It has been mandatory to provide an electric car charging station every 3 kilometres in cities and 25 kilometres on highways, and 100 kilometres on roads for heavy-duty vehicles.
- Power Ministry of India has made it license-free for anybody to set up an Electric Vehicle charging station in India.

Setting up an electric vehicle charging station needs the following infrastructure:

- A transformer, substation equipment, and safety equipment are being installed.
- 33/11 KV cables and accompanying line and metering equipment for installations.
- Civil works for making foundation.
- Land area for car charging and vehicle entry and exit.
- All charger models must be installed following local and international requirements.

Other basic requirements:

- Sufficient human resources, including technicians.
- Drinking water.
- Washrooms.
- Snacks counter, refreshment (optional).

Why should we adopt EV vehicles?

1. Lower running costs

The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle. Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel. Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements.

Using renewable energy sources can make the use of electric vehicles more eco-friendly. The electricity cost can be reduced further if charging is done with the help of renewable energy sources installed at home, such as solar panels.

Low maintenance cost

Electric vehicles have very low maintenance costs because they don't have as many moving parts as an internal combustion vehicle. The servicing requirements for electric

vehicles are lesser than the conventional petrol or diesel vehicles. Therefore, the yearly cost of running an electric vehicle is significantly low.

Zero Tail-Pipe Emissions

Driving an electric vehicle can help you reduce your carbon emission because there will be zero tailpipe emissions. You can reduce the environmental impact of charging your vehicle further by choosing renewable energy options for home electricity.

4. Petrol and Diesel use is destroying our planet

The availability of fossil fuels like petrol and diesel is limited, and their use is destroying our planet. Because of them toxic emissions are producing from long period of time and hazardous effects on public health. The emissions impact of Electric Vehicles is much lower than petrol or diesel vehicles. From an efficiency perspective, electric vehicles can covert around 60% of the electrical energy from the grid to power the wheels, but petrol or diesel cars can only convert 17%-21% of the energy stored in the fuel to the wheels. That is a waste of around 80%.

Fully electric vehicles have zero tailpipe emissions, but even when electricity production is taken into account, petrol or diesel vehicles emit almost 3 times more carbon dioxide than the average EV. To reduce the impact of charging electric vehicles, India is ambitious to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by the year 2030. Therefore, electric vehicles are the way forward for Indian transport, and we must switch to them now.

Electric Vehicles are easy to drive and quiet

Electric vehicles don't have gears and are very convenient to drive. There are no complicated controls, just accelerate, brake, and steer. When you want to charge your vehicle, just plug it in to a home or public charger. Electric vehicles are also quiet, so they reduce noise pollution that traditional vehicles contribute to.

Convenience of charging at home

Imagine being at a busy fuel station during peak hours, and you are getting late to reach your workplace. These problems can easily be overcome with an electric vehicle. Simply plug your vehicle in at your home charger for 4-5 hours before you plan to go. If you are able to get a charger where you park at home, it is very convenient to plan your journeys in advance.

No noise pollution

Electric vehicles have the silent functioning capability as there is no engine under the hood. No engine means no noise. The electric motor functions so silently that you need to peek into your instrument panel to check if it is ON. Electric vehicles are so silent that manufacturers have to add false sounds in order to make them safe for pedestrians.

COMMON MYTHS FOR ELECTRIC VEHICLE

A. Electric vehicles are uneconomical:

Fact: Electric vehicles are more economical when you consider fuel cost and maintenance costs.

Every new technology follows an economic path where the initial price is higher. This reaches a maximum and then decreases when people adopt this technology commonly. Electric vehicles are the same, but the higher price points are quickly changing as

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the costs go down. To help with high initial costs, many subsidies and incentives are offered by the government.

. It takes too long to charge

Fact: Cars spend over 90% of the time parked. You can plug in your car in this downtime at home to charge it. If you need to charge quickly on the road, fast and rapid chargers are entering the Indian market. Some electric vehicles can charge from 20% - 80% in about half an hour on these chargers.

The time of electric vehicle charging depends upon the type of charger used. As per the Bureau of Energy Efficiency, currently available electric vehicles across vehicle segments (2-wheeler, 3-wheeler, 4-wheeler) can be charged from 0%-80% in around 1 – 5 hours from Slow/Moderate chargers while using Fast chargers, electric vehicles can be charged in less than 1 hour. Fast chargers are mainly used to charge electric 4-wheelers with bigger batteries.

Electric Vehicle batteries will only last a few years

Fact: Electric vehicle batteries last for several years, and many of them will have a life beyond that of the vehicle for storing energy.

The fear of the short life span of batteries arises when we start comparing it with the batteries of our smartphones. The batteries used in electric vehicles are superior and designed to offer a long service life. Many manufacturers are providing warranties of 5 to 8 years on batteries.

The Emission impacts of an electric vehicle are more than a petrol or diesel vehicle

Fact: Electric vehicles typically have a smaller carbon emission than Petrol and Diesel

Vehicles, even when accounting for the electricity used for charging and the carbon footprint of manufacturing batteries.

Electric vehicles can convert about 60% of the electrical energy from the grid to power at the wheels. Conventional petrol vehicles can only convert almost 20% of the energy stored in petrol to power at the wheels. Even CNG engines are not entirely clean as they emit ammonia and produce particulate emissions.

Electric vehicles have very low range

Fact: The range of electric vehicles is enough for the typical daily mileage of the average Indian driver.

It’s natural for drivers to be concerned about How many kilometres can battery supposed to reach at charging station, but as electric vehicles become more at common place and EVs range is also increasing. The electric vehicles currently available can easily accommodate the average daily mileage of Indian drivers.

Electric vehicles are slow and have bad performance

Fact: Electric vehicles perform better Than petrol or diesel vehicles because they are more efficient and have better acceleration.

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Electric vehicles are powered by an electric motor that generates torque instantly without any gears. As soon as you push down the accelerator, the electric vehicles will accelerate from stationary without lag.

. India's electricity grid is not suited for electric vehicles

Fact: Electric vehicles result in a reduction of life-cycle carbon dioxide emissions even with the current Indian grid fuel mix.

India has committed to having 175 GW of installed Renewable Energy (RE) capacity by 2022 and up to 450 GW by 2030. The current weighted average emission factor of the country for the national grid has been nearly constant over the past few years at 0.82 tCO2 / MWh (as of 2018-19).

India's electric vehicle charging stations are not enough

Fact: When you need to charge while on the road, you'll find 1640 stations in India available for the public and residential use. If you can install a charger at home where you park, you can charge your vehicle conveniently there.

There are already 1640 charging stations in India with more and more providers, both public and private, entering the space. Measures have been taken by the government to ensure public charging infrastructure penetration further increases.

- Charging infrastructure shall be provided for electric vehicles at 20% of all 'vehicle holding capacity'/'parking capacity' at the premises.
- The building premises will have to have an additional power load, equivalent to the power required for all charging points to be operated simultaneously, with a safety factor of 1.25.
- Electric vehicles get damaged in waterlogged areas and are dangerous to charge in the rain
- **Fact:** An undamaged electric vehicle will have water ingress protection. This means that its electrical components are well-sealed and extremely unlikely to provide an electrical hazard. All electric vehicles come with compliance to an Ingress Protection (IP) as standard. Most of the electric vehicles have an IP67 rating or more; here 67 represents the protection against two elements - dust and water. To give you reference, anything past 67 is generally used for specialized equipment such as submarines. Thus, your electric vehicle will not have any malfunction and will not conduct electricity in and around water if it has not been previously damaged.

LITERATURE REVIEW

- A study of "Handbook of electric vehicle charging infrastructure implementation" 2021, found that Location planning for public charging infrastructure helps identify optimal locations for setting up public charging facilities. Public charging infrastructure should be located in areas with charging demand to ensure high utilization. (NITI Aayog Amitabh Kant, Rancher Singh, 2021)

- The study of "The charging infrastructure for electric vehicle", 2022 found that to enable faster adoption of electric vehicle in India by ensuring safe, reliable, accessible and affordable charging infrastructure and eco-system. (Government of India, Ministry of Power, 2022)

- A study of "electric vehicle charging infrastructure", 2020 found that Electric vehicles (EVs) represent a growing opportunity for discos to capture new sources of demand flexibility while increasing revenue from a customer class that will grow significantly over the next decade. (Garrett Fitzgerald, Jacaranda Ningthoujam, 2020)

- This research paper "electric vehicle consumer awareness and outreach activities", 2017 found that Electric Vehicles is focused on how actions to increase awareness and understanding might influence electric vehicle uptake, we note that a broad array of promotion actions (e.g., financial and non-financial incentives, deployment of charging infrastructure, high model availability, effort to increase awareness and understanding, others) are key to expanding the market. We conclude with the following findings on electric vehicle consumer awareness activities. (Lingzhi Jin, Peter Slowik, 2017)

- The study of "The charging infrastructure for electric vehicle", 2022 found that to enable faster adoption of electric vehicle in India by ensuring safe, reliable, accessible and affordable charging infrastructure and eco-system. (Government of India, Ministry of Power, 2022)

- This research paper "Electric Vehicles in India" 2021 found that high cost is one of the reasons which diverting the customers from purchasing the EVs. To work upon this government has pushed for a wider EV adoption by offering subsidies to commercial vehicles. But electric cars still remain costlier by at le %, mainly due to imported batteries. The Centre's F adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme of 2015 the rolled-out subsidies for electric commercial vehicles. Experts The say the main challenges facing the EV industry are and inadequate charging infrastructure and reliance on imported public components and batteries. But 2020 could change all that. cation Cost of battery imports will come surely come down due to the discovery of lithium reserves in Bangalore. Over the last quarter, manufacturers have announced several new EV models that promise a higher range some substantially more than the 80-90 km an EV gives now, even at this year's Auto Expo at Greater Noida, electric vehicles are clearly the show-stoppers (Satyendra Pratap sing, BHU,2021)

1. Most of the people who own the petrol or diesel car thinks to go for the electric car because they think EVs are eco-friendly and economical to use.
2. Also, many people think to purchase Electric Vehicle because it has low running cost, as petrol and diesel car require Rs.7-10 per km, electric car offers Rs.1 per km. Due to having less reciprocating and vibrating components in EV car, it has low maintenance cost.

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3. As power required for running electric car gets from the dry battery, so emission of Carbon Dioxide is negligible. Also, government is giving some tax and financial benefits, this is also good reason to get electric car.
4. As per survey report, I found that 81% of the respondence are first required an EV charging station where they can charge their vehicle and after that they will purchase electric vehicle. And many of them are interested to charge their vehicle at their home.
5. Main concern and comfortable thing in electric vehicle are its running range, such as Tata Nexon EV offer 220-250km in single charge and MG ZS offers 320-350km in single charge, so manufacturing companies are should launch a vehicle with long range.

CONCLUSION

This research paper explores the role of electric vehicles towards the goal of sustainable mobility in India.

- The development of the battery industry, charging infrastructure and local supply chains are critical for EV adoption. With the objective of transforming India into a manufacturing and exports hub, the government has been promoting the localization of production across the EV value chain.
- Cost of EVs has been estimated, where current product availability is limited, based on the typical range requirement and associated battery cost. Manufacturing of batteries in domestic market and reduce the import can minimise the EVs price.
- EV car sales are relatively low and limited number of EV models, a lack of charging infrastructure and high-cost differentials are the major adoption challenges.
- Commercial users require products with higher range, good speed, widespread service network.
- The feasibility study of public charging stations showed a running of public charging stations as an expensive prospect due to large consumption costs in terms of consuming high-power electricity with minimum time. The public charging stations becomes economically high tariff for customers. However, most vehicle users were not willing to pay more than the household energy rates for public charging.