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IMPACT OF ELECTRIC VECHILES ON OTHERS VECHILES

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ABSTRACT

Electric vehicles (EVs) are a promising technology for achieving a sustainable transport sector in the future, due to their very low to zero carbon emissions, low noise, high efficiency, and flexibility in grid operation and integration. This chapter includes an overview of electric vehicle technologies as well as associated energy storage systems and charging mechanisms. Different types of electric-drive vehicles are presented.

These include battery electric vehicles, plug-in hybrid electric vehicles, hybrid electric vehicles and fuel cell electric vehicles. The topologies for each category and the enabling technologies are discussed. Various power train configurations, new battery technologies, and different charger converter topologies are introduced.

Electrifying transportation not only facilitates a clean energy transition, but also enables the diversification of transportation's sector fuel mix and addresses energy security concerns. In addition, this can be also seen as a viable solution, in order to alleviate issues associated with climate change. Furthermore, charging standards and mechanisms and relative impacts to the grid from charging vehicles are also presented.

INTRODUCTION

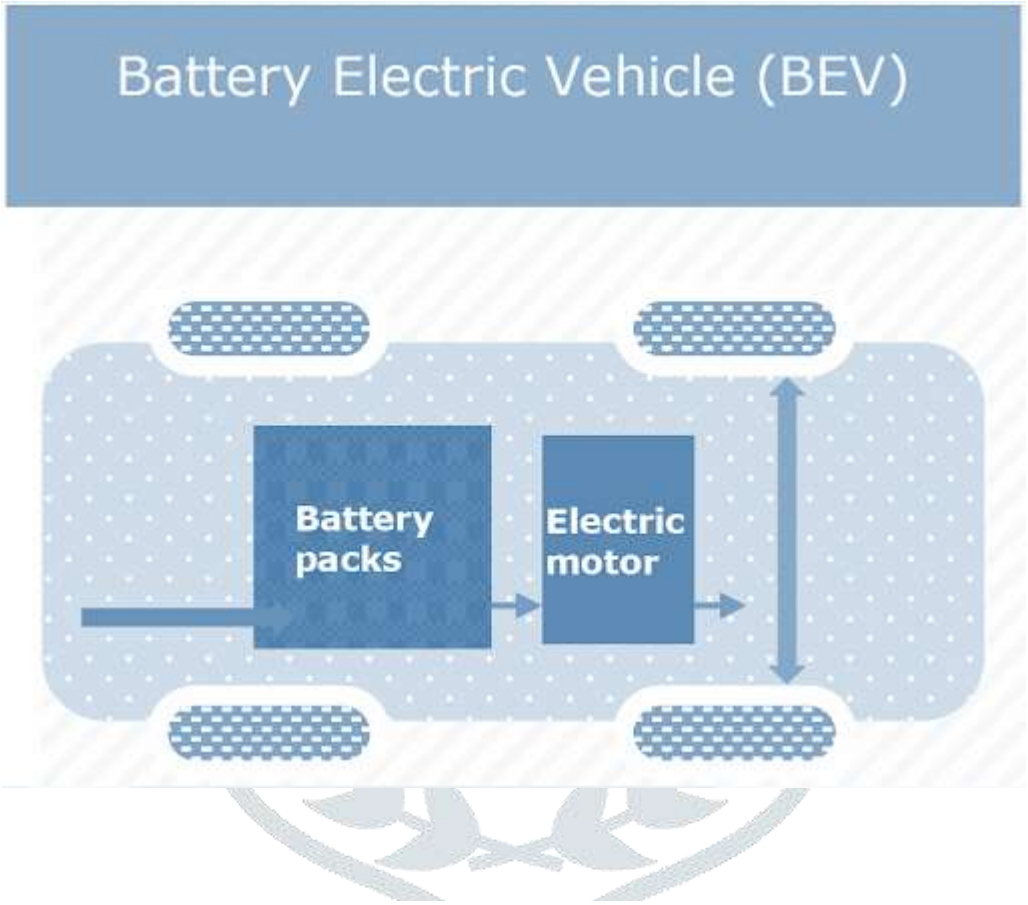
WHAT IS AN ELECTRIC VECHILES?

An electric vehicle (EV) is one that operates on an electric motor, instead of an internal-combustion engine that generates power by burning a mix of fuel and gases. Therefore, such as vehicle is seen as a possible replacement for current-generation automobile, in order to address the issue of rising pollution, global warming, depleting natural resources, etc. Though the concept of electric vehicles has been around for a long time, it has drawn a considerable amount of interest in the past decade amid a rising carbon footprint and other environmental impacts of fuel-based vehicles**.**

TYPES OF ELECTRIC VEHICLES

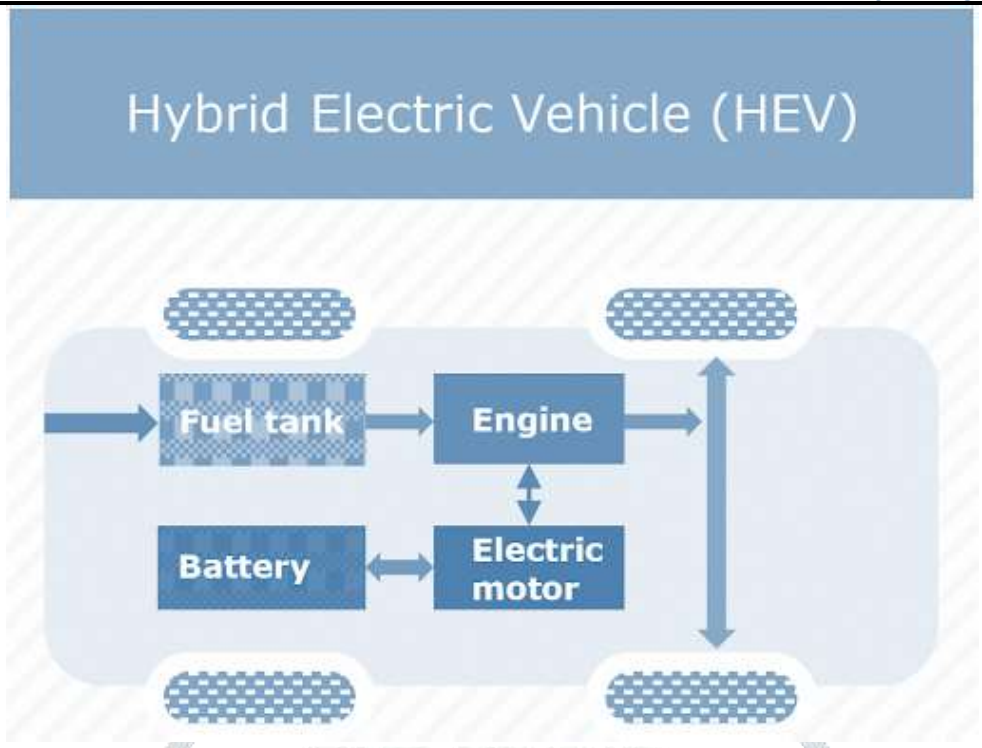
Battery Electric Vehicles (BEVs):

BEVs are also known as All-Electric Vehicles (AEV). Electric Vehicles using BEV technology run entirely on a battery-powered electric drivetrain. The electricity used to drive the vehicle is stored in a large battery pack which can be charged by plugging into the electricity grid. The charged battery pack then provides power to one or more electric motors to run the electric car.



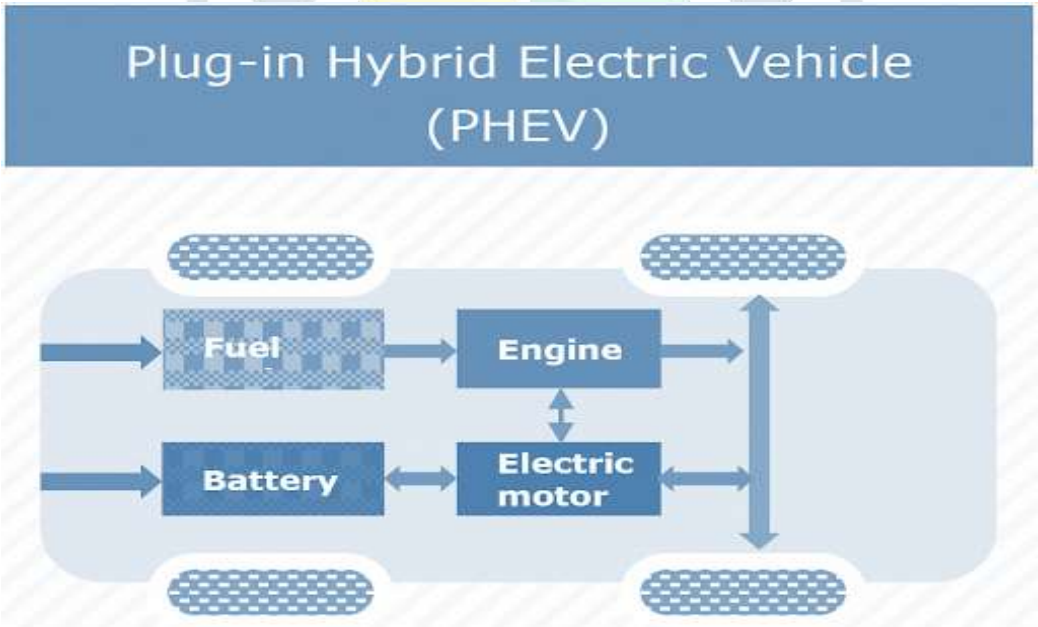
Hybrid Electric Vehicle (HEV):

HEVs are also known as series hybrid or parallel hybrid. HEVs have both engine and electric motor. The engine gets energy from fuel, and the motor gets electricity from batteries. The transmission is rotated simultaneously by both engine and electric motor. This then drives the wheels.



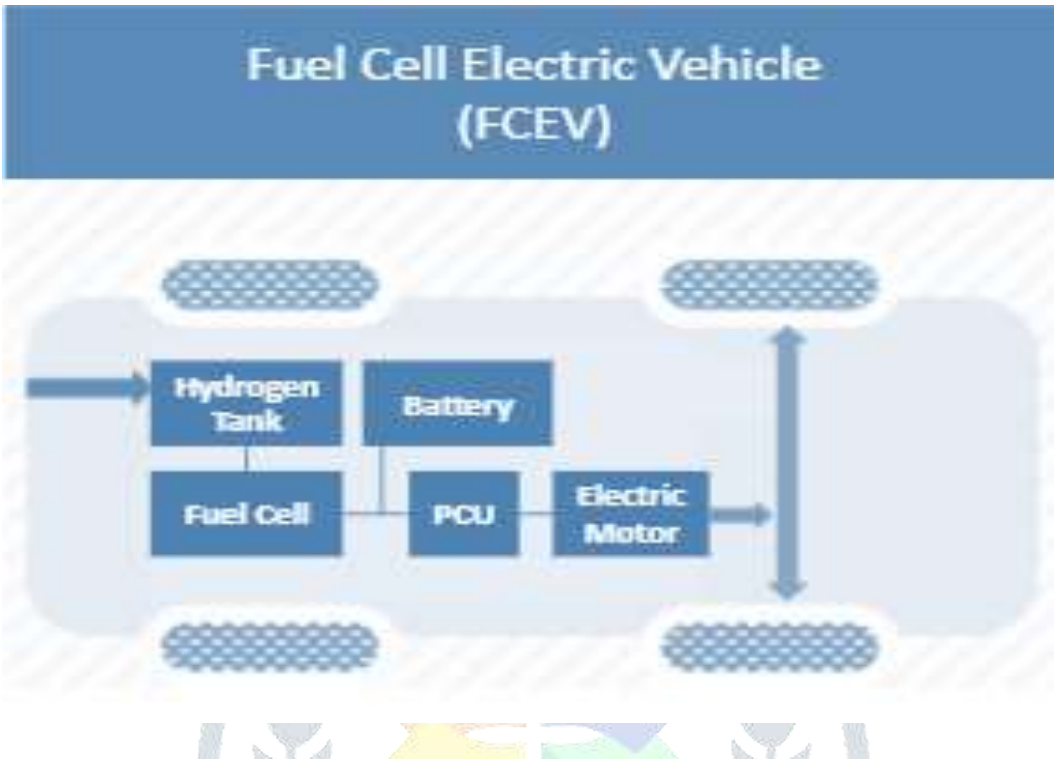
Plug-in Hybrid Electric Vehicle (PHEV):

The PHEVs are also known as series hybrids. They have both engine and a motor. You can choose among the fuels, conventional fuel (such as petrol) or alternative fuel (such as bio-diesel). It can also be powered by a rechargeable battery pack. The battery can be charged externally.



Fuel Cell Electric Vehicle (FCEV):

FCEVs are also known as Zero-Emission Vehicles. They employ 'fuel cell technology' to generate the electricity required to run the vehicle. The chemical energy of the fuel is converted directly into electric energy.



HOW DO ELECTRIC CARS WORK?

Electric cars function by plugging into a charge point and taking electricity from the grid. They store the electricity in rechargeable batteries that power an electric motor, which turns the wheels. Electric cars accelerate faster than vehicles with traditional fuel engines – so they feel lighter to drive.

How does charging work?

You can charge an electric vehicle by plugging it into a public charging station or into a **home charger**. There are plenty of **charging stations around the UK** to stay fully charged while you're out and about. But to get the best deal for home charging, it's important to get the right **EV electricity tariff**, so you can spend less money charging and save more on your bill.

EVs and their range

How far you can travel on a full charge depends on the vehicle. Each model has a different range, battery size and efficiency. The perfect electric car for you will be the one you can use for your normal journeys without having to stop and charge up halfway through.

What types of electric cars are there?

There are a few different types of electric vehicle (EV). Some run purely on electricity, these are called pure electric vehicles. And some can also be run on petrol or diesel, these are called hybrid electric vehicles.

- **Plug-in electric** - This means the car runs purely on electricity and gets all its power when it's plugged in to charge. This type doesn't need petrol or diesel to run so doesn't produce any emissions like traditional cars.
- **Plug-in hybrid** - These cars mainly run-on electricity but also have a traditional fuel engine so you can use petrol or diesel too if they run out of charge. When running on fuel, these cars will produce emissions but when they're running on electricity, they won't. Plug-in hybrids can be plugged into an electricity source to recharge their battery.
- **Hybrid-electric -** These run mainly on fuel like petrol or diesel but also have an electric battery too, which is recharged through regenerative braking. These let you switch between using your fuel engine and using 'EV' mode at the touch of a button. These cars cannot be plugged into an electricity source and rely on petrol or diesel for energy.

How to charge an EV?

You can charge an electric vehicle either by plugging it into a socket or by plugging into a charging unit. There are plenty of charging stations around the UK to stay fully charged while you're out and about. There are three types of chargers:

Three-pin plug - a standard three-pin plug that you can connect to any 13-amp socket.

Socketed - a charge point where you can connect either a Type 1 or Type 2 cable.

Tethered - a charge point with a cable attached with either a Type 1 or Type 2 connector.

How long does it take to charge an electric car?

There are also three EV charging speeds:

- **Slow** - typically rated up to 3kW. Often used to charge overnight or at the workplace. Charging time: 8-10 hours.
- **Fast** - typically rated at either 7Kw or 22kW. Tend to be installed in car parks, supermarkets, leisure centers and houses with off-street parking. Charging time: 3-4 hours.
- **Rapid** - typically rated from 43 kW. Only compatible with EVs that have rapid charging capability. Charging time: 30-60 minutes.

How far can you travel on one full charge?

An EVs range is dependent on the battery size (kWh). The higher the EV battery kWh, more power, the further you travel. Here are examples of how far some electric cars charge will go:

- **Volkswagen e-Golf - range: 125 miles** - equivalent to a journey from Bristol to Snowdonia National Park.

- **Hyundai Kona Electric - range: 250 miles** - equivalent to a journey from London to the Lake District.

- **Jaguar I-Pace - range: 220 miles** - equivalent to a journey from Edinburgh to Birmingham.

Challenges of Owning an EV in India

EV cost and battery cost:

The cost is the most concerning point for an individual when it comes to buying an electric vehicle. However, there are many incentives given off by central and state governments. But the common condition in all policies is that the incentives are only applicable for up to a certain number of vehicles only and after removing the discount and incentives the same EV which was looking lucrative to buy suddenly becomes unaffordable.

Beta version of vehicles:

Right now, both the technology and companies are new to the market and the products they are manufacturing are possibly facing real costumers for the first time. And it's nearly impossible to make such a complex product like an automobile perfect for the customers in the first go, and as expected the buyers faced many issues. Vehicles like RV400, EPluto 7G, Nexon all them has to update their vehicle up to a very high extent after customer feedback and reviews.

Lack of EV charging infra:

One of the most common challenges associated with owning an electric vehicle is range anxiety. The lack of a robust and widespread charging infrastructure adds to the misery of an EV owner. Even though EV sales are seeing an uptick off late, they are being used for intra-city travelling. However, the long-haul travel issue will soon need to be addressed to increase the utilization limits of fleets and allow people to travel across city limits.

A few Indian state governments have proactively floated tenders for the installation of public EV charging stations and dozens of CPO start-ups have mushroomed all over the country. However, most of this infrastructure development is limited to Tier-1 cities and within city limits only. It's the classic Chicken and Egg problem. People don't buy EVs as the charging infrastructure isn't there and charging infra isn't an attractive business model as there aren't enough EVs on the road.

No dedicated parking spots:

The EV charging conundrum is nothing but a parking issue. In India, not every 4-wheeler owner has access to a dedicated parking spot. Even in a large residential complex, many residents have opted for open or uncovered parking slots. So, how do they setup their OEM supplied charging station or charger?

Organizations who don't have dedicated parking spots will face this problem. State governments are launching policies for most residential, commercial and workplace buildings to make provisions for EV chargers. Even our public roads don't have a regulated parking system where Govt. or Private organizations can set up mass charging stations. But this is a space that is currently serviced by Charge Point Operators that run a petrol bunk like system but with EV charging stations.

Lack of Standardization:

If you know your EV terminologies, you would have heard about different charger connector types. The most common ones are

- CCS / CCS Type 2
- Bharat AC-001/Bharat DC-001
- CHAdeMO
- GB/T
- Tesla Chargers

The EV connector type is provided on the car and on the EV Charger as well. Currently, in India, all standards are being adopted and this creates a problem with supply of EV charging stations. Most cars support the CCS/CCS Type 2 charging connector standard; yet some brands follow GBT or Bharat AC/DC 001 standards.
If the government decides on implementing one standard, then auto OEMs and EVSE providers can focus on the production of just one type of product. This results in faster manufacturing, reduced lead times and the creation of a standardized charging network system that is compatible with all EVs.

Power infra upgrades:

So, what does it take to install an EV charger at your premises? If all infrastructure requirements are met, it can be as simple as taking the charger out of the box, installing it, and switching it on. But you need to consider the power requirements as well. Most residential users need to determine their sanctioned load, spare capacity, and the power intake requirements of the EV charger. If there is a mismatch, then they will need to apply for increased load. This costs money. For example, if your sanctioned load is 5kW and you want to install a 15kW DC charger then your present load would not be able to accommodate the charger's power requirements.

But there is one solution to this. Residential complexes and other buildings need to look at installation common use charging stations within their premises. A complex will have a high sanctioned load and will be able to accommodate EV charging. Apart from that, you don't need to install chargers in hundreds of parking slots for everyone.
Another challenge is for an EV owner staying in a house with no power backup and frequent power cuts. In the event of a power loss, you won't be able to charge the EV. To fix this, you can look at solar installations for power supply. Or during an emergency, a diesel generator can be used to power the EV charger.

Lack of service options:

Most of us at some point of time would have faced a vehicle breakdown. And thanks to large availability of skilled/unskilled auto service technicians, the problem would have been taken care of. However, with EVs this system becomes redundant as of now. Yes, an EV has lesser moving parts when compared to an ICE vehicle, but the technology is something our informal service network has no knowledge. Getting stranded in the middle of nowhere can leave you in spot. Even though most Auto OEMs have extensive service and dealer networks across India, their EV Service network is yet to reach a substantial level.

Logistics companies running large EV fleets will be in constant need of servicing, repair, and maintenance of their vehicles. In the absence of an efficient service network, most fleet companies would delay EV adoption. However, to tackle this issue many Auto companies are offering on-road assistance, towing services and some are also looking at portable, on-the-road charging options for their consumers.

Future of electric vehicles in India

India offers the world's largest untapped EV market, especially in the two-wheeler segment. With several automakers rolling out EV vehicles at a rapid pace, the penetration of these vehicles has increased significantly in the past few years. As per a recent study, electric vehicles (EVs) market is expected to be worth around at least ₹475 billion by 2025. The penetration of electric two-wheelers is projected to reach up to 15% by 2025 from 1% currently.

As business activities gain pace and the Indian economy rebounds its way in 2022, the auto industry is set to enter a new phase of growth, innovation and investment. However, the road to the future of EV is battling various challenges. While the government is aggressively promoting EV adoption in India, the inadequate infrastructure, lack of high performing EVs and high upfront cost is causing a major hindrance for its mass adoption.

EV revolution is presently focused on metros where the consumer has range anxiety because of a daily travel of 100km, whereas the actual consumer is in tier-II and tier-III, where the travel radius is 15-20km; here a consumer can ride 150-180km after electrification without the worry of a recharge or looking for a swapping station.

There are a range of potential market barriers that limit the ability of EV industry to rising demand an underdeveloped charging ecosystem continue to impede a higher penetration in the two-wheeler consumer segment. The absence of robust manufacturing ecosystem for the materials associated with the EV revolution, coupled with the concentration of the supply chain in certain regions, is likely to draw these issues into still sharper focus in the coming years.

The government introduced a slew of measures in line with ‘Make in India’ campaign to incentivize manufacturers to produce components locally and build a structured policy framework as India is heavily dependent on China for lithium supply chains constraining the widespread deployment of EVs. Recent policies that were introduced, including battery swapping policy, aimed at an encouraging move towards green energy generation and decentralization of energy distribution is likely to create a well-established EV infrastructure across the country, while instilling customer confidence in riding EVs on Indian roads. The battery swapping model for supplying power has side-stepped the lack of charging infrastructure but the future is likely to see a mix of both models.

However, India does not have infrastructure or technology to manufacture chips or Lithium-Ion Cells; until we have the basic infrastructure in place it is a challenging road ahead, with increase in dollar prices and volatile import situation due to rising tensions.

Currently, the EV market is fragmented with independent dealerships which make it difficult to create proper infrastructure for second-hand sales. Moreover, warranties, quality and strength of the vehicle vary significantly. Vehicles many times lose form because of rough use, or the battery degrades. At

present there is hardly any formal infrastructure for sale of used vehicles. Shortage of global semiconductors further creates supply chain issues and promote localization of commodities for automotive OEMs (Original Equipment Manufacturer).

BARRIERS OF ELECTRIC VECHILE IN INDIA

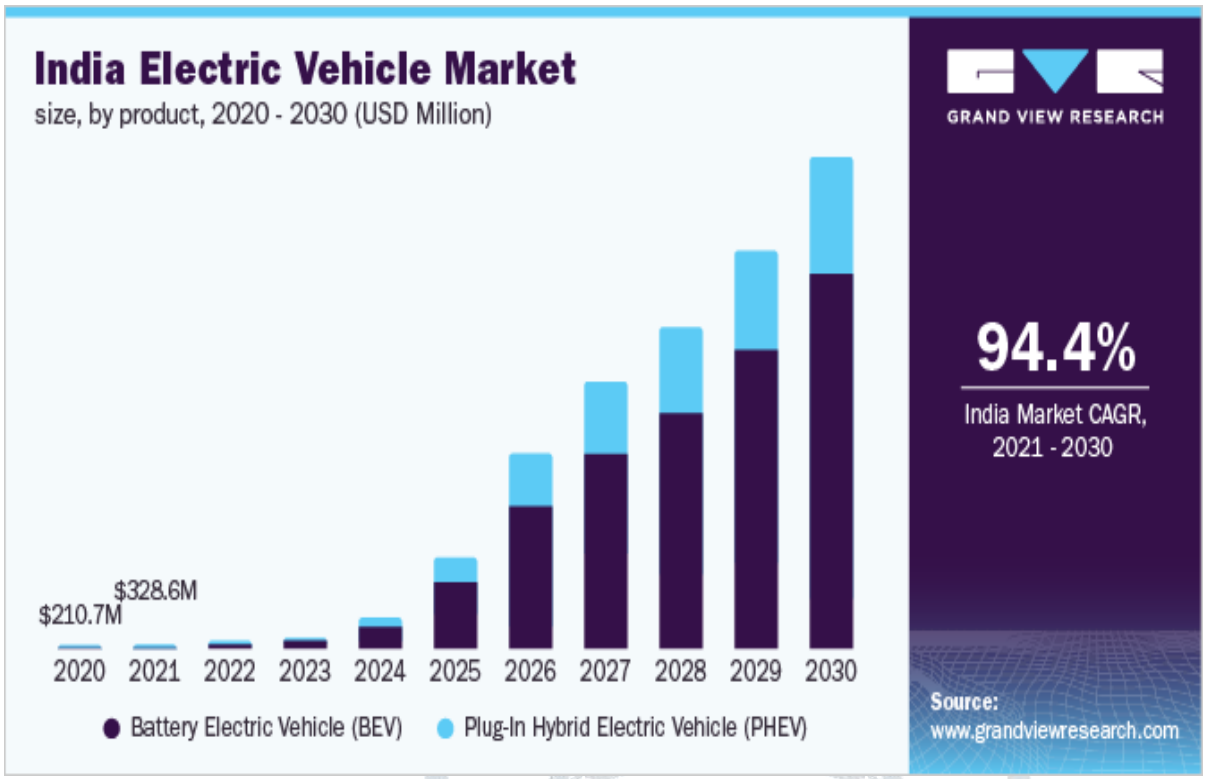
The ever-growing global concern on climate change caused due to vehicular greenhouse gas emission coupled with the depletion of natural resources is driving global economies towards the adoption of alternate fuel technology. Electric vehicles (EV) are positioned as an alternate green and clean technology which potentially can enable the efficient transition to sustainable low-carbon emission transportation system and preservation of natural scare resources. Despite announcing favorable policy measures to encourage EV adoption, the multiplicity of potential barriers with mutual interaction has resisted its penetration in several countries.

Though researchers have identified the barriers, but the question “How EV barriers mutually interact among themselves?” has remained largely unanswered in empirical research. Unpacking the relationship within barriers will empower manufacturers, policymakers in strategic planning, and devising suitable measures in controlling the Barriers.

A hybrid two-phased multi-criterion decision making (MCDM) tools are applied. Firstly, quantitatively BWM (Best-Worst Method) is applied in ranking and prioritizing the important barriers/sub-barriers. The obtained sub-barriers are then analyzed to establish a mutual relationship using interpretive structural modelling (ISM). This study has been conducted for the Indian EV context with a focus on technological, infrastructural, financial, behavioral, and external barriers. Ranking and prioritization of EV barriers provides a framework for decision-makers to focus on high-priority barriers/sub-barriers in addressing them through preferential resource allocation.

The strength of the relationship among barriers to EV adoption was established based on corresponding driving and dependence power. The research finding suggests that EV barriers such as performance and range, the total cost of ownership, shortage of charging infrastructure, lack of consumer awareness about EV technology are critically influential in driving EV adoption. Our research contributes to building an improved understanding of the multifaceted nature of EV barriers and its inter-dependencies in policy and decision making.

ANALYZING PRESENT TREND OF EV IN INDIA



India's electric vehicle market size is expected to reach USD 152.21 billion by 2030. The market is expected to expand at a CAGR of 94.4% from 2021 to 2030. The stringent regulations being drafted by the Indian government in response to the rising levels of vehicular emissions and the growing demand for environment-friendly vehicles are expected to drive the growth of the market over the forecast period. The efforts being pursued by the government to develop sustainable charging infrastructure in India also bodes well for the growth of the market.

Although the electric vehicle market in India is in its nascent stages at present, it is poised to emerge as one of the leading electric vehicle markets in the world. The Indian government has been pursuing consistent and committed efforts and has already drafted dedicated EV policies and rolled out various demand and supply incentives as part of the efforts to encourage the adoption of e-mobility across various market segments.

For instance, India's Department of Heavy Industry (DHI), under the National Electric Mobility Mission Plan (NEMMP) 2020, has formulated the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme to support the development of both Hybrid Vehicles (HV) and Electric Vehicle (EV) markets as well as that of their manufacturing eco-systems. The growing popularity of electric vehicles is prompting the leading automotive manufacturers to launch electric vehicles in India. For instance, in October 2019, Maruti Suzuki, a leader in the conventional vehicle market, announced plans to launch electric vehicles for personal use for the Indian market in the following years. Similarly, in August 2021.

Tata Motors launched the Tata Tigor EV in the Indian market. As the market continues to evolve and the consumer preference continues to shift from conventional vehicles to electric vehicles, more and more conventional vehicle manufacturers are expected to launch electric vehicles in the Indian market, thereby driving the growth of the market over the forecast period.

The outbreak of the COVID-19 pandemic triggered a global economic slowdown. The electric vehicle market is particularly vulnerable to any global economic slowdown owing to its reliance on global sourcing for the core battery technology. Moreover, the initial purchase price of electric vehicles tends to be higher than the gasoline-fired and hybrid vehicles, which particularly restrains the adoption of electric vehicles among price-sensitive customers.

However, the Indian electric vehicle (EV) market was unaffected by the outbreak of the pandemic. In India, the registration of new electric passenger cars increased by 109% y/y in 2020, with 5,905 new vehicle registrations noted during the year. India Electric Vehicle Market Report Highlights

In terms of product, the BEV segment dominated the market in 2020 and is anticipated to value at USD 116.80 billion by 2030. This can be attributed to the increasing preference of consumers towards EVs over ICE vehicles and restrictions on vehicular CO2 emissions.

The passenger cars segment is expected to expand at the highest CAGR of around 106% over the forecast period. The growth can be attributed to increasing investments by the government in EV infrastructure, along with tax benefits offered to consumers.

The rising popularity of electric vehicles is prompting the leading automotive manufacturers to launch electric vehicles in India, which is anticipated to create growth opportunities for the market in the country.
Companies Mentioned:

Audi AG
BMW AG
Hyundai Motor India.
Jaguar Land Rover Limited
Mahindra & Mahindra Ltd
Mercedes - Benz AG
MG Motor India Pvt. Ltd.
Olestra Greentech Limited
Tata Motors
Toyota Motor Corporation

OBJECTIVE OF ELECTRIC VEHICLE

There are many objectives of electric vehicles (EVs) over conventional petrol or diesel cars. Cheaper to run the cost of the electricity required to charge an EV is around 40% less than the cost to use petrol for a similar sized vehicle driving the same distance. The cost will be lower if you charge your EV from your solar PV system or at free charging stations.

A Battery Electric Vehicle (BEV) has fewer moving parts than a conventional petrol/diesel car. Servicing is relatively easy, less frequent and overall cheaper than a petrol/diesel vehicle.

All EV batteries degrade (become less efficient). Most car manufacturers warrant EV batteries to not degrade below a certain level for around eight years. It may become necessary to replace a battery in an EV in the time you own it.

Plug-in Hybrid Electric Vehicles (PHEVs) also have a petrol or diesel engine that needs servicing, so a PHEV will cost more to maintain than a BEV Cheaper to register The Queensland Government provides a discount on stamp duty for the purchase of an EV, plus ongoing discounts on registration.

Better for the environment Less pollution: By choosing to drive an EV you are helping to reduce harmful air pollution from exhaust emissions. An EV has zero exhaust emissions, but still creates a degree of greenhouse gas emissions when it is charged from the electricity grid.

Renewable energy: If you have a solar PV system and charge your EV during the day, you can reduce your greenhouse gas emissions even further. Another way is to purchase Greenpower from your electricity retailer. Then, even if you recharge your EV from the electricity grid, your electricity is coming from renewable energy sources.

Better for our health Reduced harmful exhaust emissions is good news for our health. Better air quality will lead to less health problems and costs caused by air pollution3. EVs are also quieter than petrol/diesel cars, which means less noise pollution.

Better for the network If EV charging is managed effectively, mainly outside peak electricity demand periods, it will help us to create a flatter electricity network demand profile over a typical 24-hour period. This will help us to:

better utilize the electricity network help EV owners avoid higher-cost charging periods help the entire electricity system work more efficiently help support the integration of more small and large-scale renewable energy systems into the electricity grid.

Better for our energy security on a national level, EVs can help with Australia's liquid-fuel energy security. At present, Australia is highly dependent on other countries for petroleum imports. EVs are easy to power from local and renewable energy sources, reducing our dependence on foreign oil. EV's will be unaffected if fuel supplies to Australia are ever disrupted or fuel costs increase significantly.

CONCLUSION

The progress that the electric vehicle industry has seen in recent years is not only extremely welcomed, but highly necessary in light of the increasing global greenhouse gas levels. As demonstrated within the economic, social, and environmental analysis sections of this webpage, the benefits of electric vehicles far surpass the costs.

The biggest obstacle to the widespread adoption of electric-powered transportation is cost related, as gasoline and the vehicles that run on it are readily available, convenient, and less costly. As is demonstrated in our timeline, we hope that over the course of the next decade technological advancements and policy changes will help ease the transition from traditional fuel-powered vehicles.

Additionally, the realization and success of this industry relies heavily on the global population, and it is our hope that through mass marketing and environmental education programs people will feel incentivized and empowered to drive an electric-powered vehicle. Each person can make a difference, so go electric and help make a difference!

We have seen massive changes, particularly in terms of technology, but also in terms of people's attitude towards cars' environmental impacts and other mobility solutions, from the first electric car established in 1837 up to the present time. Although the electric vehicle market is currently a lucrative goal for companies and start-ups in India, several

obstacles still remain to be addressed in order for EVs to be ready for mass adoption. High-cost barriers include, for example, manufacturing electric vehicles domestically.

Similarly, battery manufacturing is essentially a costly venture. The Indian Government must concentrate its energies on promoting technological disruption to resolve these challenges. The government would also need to provide enhanced tax incentives and subsidies to potential car owners and suppliers in order to quicker adoption of EVs.

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