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A Brief study of EVs in Indian Market

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Abstract

The environmentally-friendly electric vehicles market is advancing in the world and also in the Indian market. A new industry is transforming the automobile industry by creating and innovating new models of cars and bikes. The electric vehicle market is growing rapidly and with new pricing models, the growth is predicted to get bigger.

All existing automobile is aware of this change and is trying to change new hybrid or electric vehicle models. Developed countries such as the United Kingdom and France intend to ban the sale of diesel and petrol vehicles starting in 2040 and Analysts predict that five years before the deadline, Europe's new car sales will be completely electric. Countries such as Norway are making rapid progress in the electric vehicle sector. In Norway, about 30% of new automobile sales in December 2017 were powered by electric batteries.

Energy experts predict that the Chinese and Indian markets may drive vehicle demand and that electric vehicle development will be high in these countries' political interests due to lower carbon emission challenges. As the electric vehicle market grows, more businesses are planning to install charging stations for their vehicles.

Introduction

In the past few decades, the world has faced environmental issues, one of the biggest challenges to deal with is air pollution, and some of the important factor which is responsible for the fossil fuels used by vehicles. We can't deny the fact automobile industry plays a major role in the world economy by becoming the backbone. In this era, we have made a remarkable technological upgrade to solve the biggest challenges in the present century.

EVs (Electric Vehicles) have become the alternative to tackle this problem. Developed countries have already begun to replace the market of fossil fuel used vehicles with EVs.

India the 5th biggest market in the automobile sector in the world has a huge potential for the Electric vehicles market and as per research market has to grow 43% rate CAGR.

electric vehicles are the future of the automobile industry, in India like tata, Hyundai big giants have started the transformation from diesel to EV. (Sondagar, 2021)

Literature Review

- According to the research conducted by J Kester, L Noel, GZ de Rubens, and BK Sovacool, EV's are a significant tool for decarbonizing transportation, providing a variety of co-benefits such as reduced local pollution, noise emissions, and oil dependency. Price, range, infrastructure, and technological uncertainty are just a few of the roadblocks to a speedier adoption of these cars. To overcome these obstacles, there has been a widespread appeal for public support, as well as a growing body of research, largely survey and choice experiment studies, demonstrating which policy tools are beneficial, with variable results. According to recent studies, there is a dearth of qualitative research on EV adoption policy. The study is based on 227 expert interviews conducted across five Nordic nations. It examines EV policy recommendations made by and for cities, governments, and businesses. The findings emphasise the relevance of price, infrastructure, and stable policies, as well as local policy flexibility and public awareness efforts.
  (J Kester, L Noel, GZ de Rubens, and BK Sovacool, 2018)

- 'A survey on EVs by VedantSingha VirenderSingh S.Vaibhav Elsevier B.V.,' according to a research report by Elsevier B.V. India's EV trends were examined, with the goal of having 100 percent EVs by 2030. Electric vehicles have a lot of potential for lowering carbon emissions and air pollution. To improve the acceptance of EV technology, further efforts are required. Local OEM battery manufacturing facilities will be beneficial to the adoption. The availability of charging infrastructure is crucial for the adoption of electric vehicles.
  According to a study conducted, India's car market would be 100 percent electric by 2030. (SonaliGoel, RenuSharma, and Akshay Kumar Rathore, 2021)

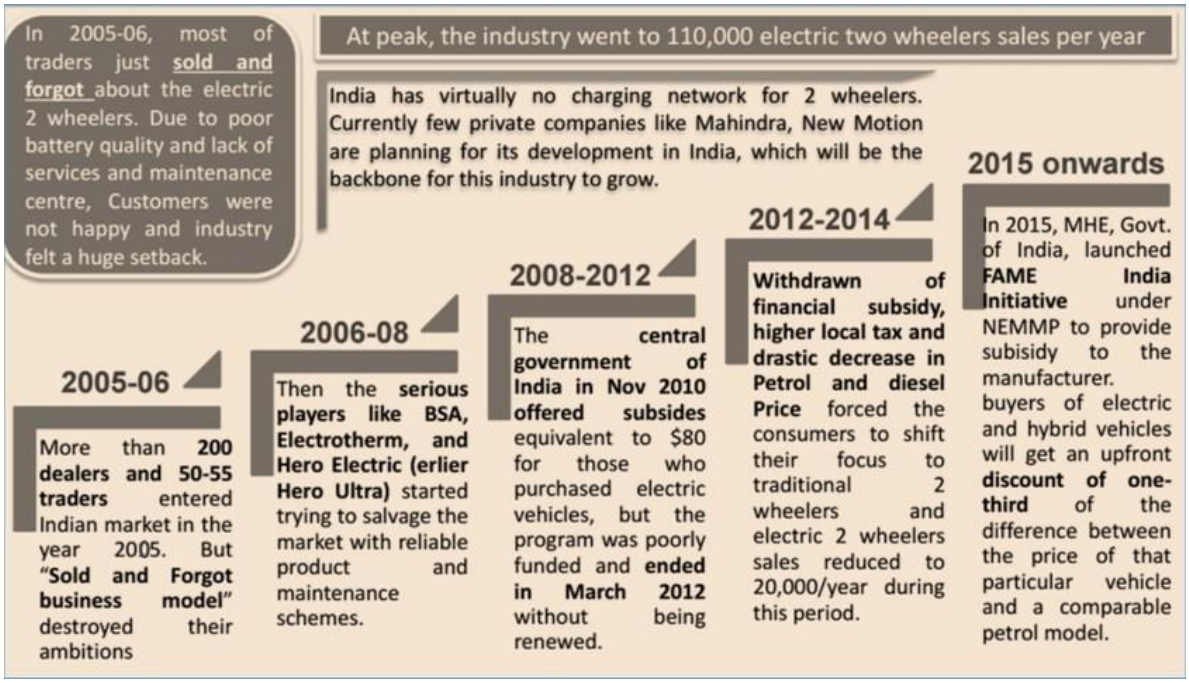
- The policy structure of India was investigated in order to hasten the adoption of electric vehicles. The Indian government's recent measures and various incentives may help to boost battery technology. The battery electric vehicle has the potential to cut carbon dioxide emissions from the light-duty vehicle fleet while also reducing reliance on fossil fuels. Barriers can be handled from a number of angles, including the market, technical regulation, and infrastructure. Vehicle-to-Grid is a critical component of energy security, renewable energy, and addressing global warming concerns.(ELSEVIER,2021)

History of EVs in India

1996: Scooters India Pvt Ltd, Lucknow, created the 1st electric vehicle, the 3-Wheeler VIKRAM SAFA, and roughly 400 cars were produced and sold. These cars were powered by a 72-volt lead-acid battery.

2001: Mahindra was an early adopter of electric cars in India. In 2001, the business released the first electric car, the Mahindra Reva, as one of the first significant makers of electric automobiles. The Mahindra Reva is India's first all-electric vehicle.

2005-2015:



2017: In 2016-17, over 500,000 e-rickshaws were sold throughout India. This market is expected to increase at a rate of more than 30-35 per cent from 2017 to 2020. The majority of these e-rickshaws now operate in Delhi.

2022- Some of the major players in the electric vehicle in the four-wheeler segment are Mahindra electric, TATA Motors, Hyundai and Ashok Leyland. For 2wheeler Hero, Okinawa, Ather Energy, Ampere vehicles, Pure EV and OLA. (Anzar, 2019)

Charging stations Network in India

Details of EVCS/ PCI as on 30th June 2020 under the jurisdiction of discoms/ licensee/ PSUs

Sl. No.	State/ UTs	Name of Discom	No. of Charging Stations/ PCI
		BRPL	14
		BYPL	8
		TPDDL	1
		NDMC	55
	Total Delhi		**78**
		DHBVN	1
		UHBVN	0
	Total Haryana		**1**
3	Himachal Pradesh	HPSEBL	**12**
4	Jammu & Kashmir		*

5	Ladakh		*
6	Punjab	PSPCL	0
		Ajmer VVNL	0
		Jaipur VVNL	0
		Jodhpur VVNL	0
	Total Rajasthan		**0**
		UPCL	1
		UREDA	1
	Total Uttarakhand		**2**
	Chhattisgarh	CSPDCL	1
		JSPL	0
	Total Chhattisgarh		**1**
10	Goa		**0**
		UGVCL	*
		PGVCL	*
		DGVCL	*
		MGVCL	*
		TPL-D	3
	Total Gujarat		**3**
12	Madhya Pradesh	MPPKVVCL	3
		MPMKVCL	0
		MPPoKWVCL	0
	Total Madhya Pradesh		**3**
		MSEDCL	26
		BEST	30
		Tata Power	10
		Adani Electricity	6
	Total Maharashtra		**72**
		APEPDCL	23
		APSPDCL	410
	Total Andhra Pradesh		**433**
		BESCOM	126
		CESC	0
		GESCOM	0
		HESCOM	0
		MESCOM	0
	Total Karnataka		**126**
		KSEBL	**2**
		KDHPCo. (P) Ltd.	**0**
	Total Kerala		**2**
17	**Puducherry**		**0**
18	**Tamil Nadu**	TANGEDCO	**0**

19	**Telangana**	TSPDCL	160
		TSNPDCL	*
	Total Telangana		**160**
		NBSPDCL	0
		SBSPDCL	0
	Total Bihar		**0**
21	**DVC**		**0**
		JBVNL	26
		TSUIS/ JUSCO	0
	Total Jharkhand		**26**
		WBSEDCL	0
		CESC	7
	Total West Bengal		**7**
24	**Sikkim**		*
25	**Arunachal Pradesh**		*
26	**Assam**	ASPDCL	**1**
27	**Manipur**		*
28	**Meghalaya**		*
29	**Mizoram**		*
30	**Tripura**		*
31	**Lakshadweep**		0
32	**Andaman Nicobar**		*
	Total		**927**

(Bhawan & Marg, 2022)

Types of Electric Vehicles

Hybrid Electric Vehicle (HEV) – To minimize the fuel consumption the HEV is a combination of the conventional internal combustion engine of an electric motor and a battery pack.

HEVs do this by employing an electric motor to power the vehicle under instances in which an ICE is most wasteful, such as while accelerating from a standstill. Hybrids may also prefer the ICE unit when doing so is more efficient, such as while driving at highway speeds.

HEV technology fills up the battery via 'regenerative braking' and starts the electric motor system when situations are favourable, eliminating the need for drivers to check the charge or plug the cars into electrical outlets.

Plug-in Hybrid Electric Vehicle (PHEV) – It is almost similar to the previous one like combines an ICE with a battery and an electric motor, but still there are some differences.

Because the electric system conducts a majority of the heavy lifting when driving, PHEVs often feature bigger battery sizes and more strong and more efficient electric motors than hybrids. This implies that PHEVs can be primarily driven on electricity, with the ICE turned off.

PHEV is very useful because it can easily run-on Petrol/Diesel or with the battery charge alone.

Battery Electric Vehicle (BEV) – BEV is considered an all vehicle or fully electric vehicle. BEVs are entirely electric, with the electric motors receiving power from the battery packs. BEVs are absent of any sort of ICE.

Because BEVs run entirely on electricity, they have substantially greater capacity batteries and kWh outputs than equivalent combination and plugging hybrid EVs. Because of the additional battery technology, BEVs often cost more compared to others. (E-AMRIT, 2019)

Types of Batteries

In the last couple of years, almost every industry has seen some form of innovation revolutionize it. Similarly, in the vehicle business, a similar revolution was brought about by battery-powered cars.

Given the pollution caused by conventionally driven automobiles, the automotive industry was quick to adapt to the changes brought on by electric motors. Several types of batteries have been used in electric cars over time, with lithium-ion being the most popular. A few characteristics of each type of battery used in an electric automobile are listed below.

- **Lithium-ion Battery:**

This is the industry's most widely used electric car battery. This is the industry's most widely utilized electric car battery. When it comes to high temperatures, the battery surpasses the competition. This is primarily used because of its highly energetic ratio, which is an important factor in electric vehicle batteries.

The important components of the Li-ion batteries can get recycled. This is advantageous for electric vehicles because they are designed with the goal of preserving the environment in mind. These are mostly seen in PHEV and BEV vehicles.

Parameters:

Li-ion batteries offer the highest energy density of any battery technology available today (100-265 Wh/kg or 250-670 Wh/L). Li-ion battery cells can give up to 3.6 volts, which is three times more than Ni-Cd or Ni-MH batteries. This means they can supply a lot of current for high-power applications, which is a good thing. Li-ion batteries are also low-maintenance, as they don't need to be cycled on a regular basis to keep their life. Li-ion batteries have no memory effect, which is a harmful phenomenon in which a battery can'remember' a decreased capacity after repeated partial discharge/charge cycles. In addition, Li-ion batteries have a low self-discharge rate of 1.5-2 percent each month.

- **Hybrid Nickel-Metal (NIMH) battery:**

There is another variant of batter is a Hybrid Nickle metal battery which contains battery-powered and fuel-powered engines. This type of battery does not require any outer source charge. These batteries have a much better lifecycle than Li-ion Batteries. The reason for this is charging of a battery is depend on the regenerative barking speed and wheels of the car. These batteries have a high discharge rate as compared to other batteries and are quite expensive.

Reason for using this battery for a lesser chosen option for a car whose batteries need to be charged from an outer source. This only reason this battery is used in hybrid cars.

Parameters:

NIMH batteries offers energy density of any current battery technology (40-120Wh/Kg). It has a power density of 300-1000 W/kg and a volume density of (140-400 Wh/L). Having a self-discharge rate of 30% each month is also a plus.

- **Lead-Acid Battery:**

Lead-acid is one of the oldest types of rechargeable batteries. When compared to other NIMH or lithium batteries, these are heavier and lose capacity. However, the automobile companies use these batteries because its cheaper than other batteries. Although there are a few initiatives in the works, SLA batteries are not yet present in consumer electric vehicles. This type of battery is mostly used as a supplemental storage system for commercial vehicles. Another advantage of these batteries is that they are recyclable.

Parameters:

Lead-acid batteries offers energy density of any existing battery technology (between 30 and 40 watt hours per kilogramme). It has a volume density of 60-75 Wh/L and a power density of 180 W/kg. Every month, self-discharge rates range from 3 to 20%.(Pawar, 2021)

Current Issues for EV

No Proper Charging Infrastructure: The most difficult task for India in terms of service connectivity would be the establishment of charging infrastructure, namely level 2 charging at the public level. The charging time for regular charging is a severe issue because it ranges from six to eight hours, however for rapid DC charging, the greatest variables that might pose a problem are cost and high renewable energy.

A Very High Cost: The price of EVs is quite expensive, owing mostly to the high cost of Li-ion batteries. The batteries are imported and expensive, costing around $275/KWh in India. This, along with the 18% GST and the scarcity of lithium in India, increased the price of batteries even higher. In the case of four-wheelers, most Electric vehicles in India have a range of 200 - 300 km and cost high as Rs 14 - 20 lakhs, which does not provide a cost-benefit over higher-range automobiles in the same budget range.

Very few Renewable Energy Sources: In India, the majority of power is generated by coal-burning, which emits a significant quantity of greenhouse gases. The adoption of EVs and charging network would significantly increase power consumption, rendering the entire purpose of introducing Electric Vehicles to reduce Carbon emissions pointless if all of this electricity is generated by burning coal. Furthermore, India's distribution businesses are in debt but are unable to meet the country's energy needs effectively. If electric Vehicles were to join the equation, the abrupt surge in power demand would place a further strain on these corporations. Furthermore, other factors might influence the cost of power as well as the consumption of the system. (Financialexpress, 2019)

Suggestions

Higher Subsidy: If the goal is to be met, the government's assistance is required. Support is essential for both customers and producers. Manufacturers have the key to bringing about the needed transformation, which they can and will only do provided the government gives the necessary incentives. The same is true for consumers; the government should provide some sort of subsidy, tax relief, or another type of higher incentive to encourage them to choose EVs.

Relaxation to setting up charging Stations: The government might also offer incentives to individuals who agree to set up publicly allow charging stations to be installed in their garages, similar to Public Call Office. Incentives such as workplace charging, cheap tax, parking fees-free, reduce road tolls, special transportation lanes, and free battery charging sites might be supplied in line with Norway's goal of attaining 50 per cent electrification by 2025. India, like Denmark, might begin imposing a surcharge on polluting automobiles and providing incentives for renewable energy vehicles.

Focus on Battery Swapping stations: The embryonic notion of battery swapping is one area where India's EV infrastructure developments diverge from those of more developed nations. The battery is one of the costliest components of any EV, with prices rising dramatically as storage capacity increases. Because of their affordability, 2 and 3 wheeled vehicles account for more than 80% of India's local vehicle sales. To ensure that electrification of this critical fleet does not make 2 and 3 wheeled vehicles incredibly expensive, the government is attempting to motivate the sale of vehicles with lesser, less expensive batteries, while also ensuring users have enough range by allowing them to swap their low charged batteries for fully charged one end route.

Conclusion

As is obvious from the facts and data provided, e-mobility remains a faraway goal for the government. It will be difficult, but not impossible, to meet the deadline that has been established. In the future, e-vehicle will not be a luxury, but rather a need for existence, because pollution levels are worrisome, and the only answer is green energy sources and transmission. Without government participation and assistance, the endeavour is impossible. People must be educated on the benefits of EVs as well as the hazards of pollution created by ICE and then only government can accomplish their mission

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