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A STUDY OF INDIA'S ELECTRIC VEHICLE LANDSCAPE AND CONTEMPORARY REALITIES

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ABSTRACT

Electric vehicles will embrace the upcoming means of transportation and their systems will be adopted by commuters and marketers. There were quite a lot of concerns being addressed by policymakers, researchers, and manufacturers. The alarming levels of population, conventional energy resources, and demand for vehicles make the marketers dire need to plan and work on the options for electrification. The automobile industry could benefit from this opportunity as the EV push in India will open a plethora of opportunities in mobility, infrastructure, and energy. Furthermore, it will open the gates to the OEM markets, and infrastructure market related to EVs. But there were significant concerns for commuters and the makers of EVs which will be the major challenges and issues which need to be addressed. This paper will highlight the facts and some real-time information, based on the desk research using exploratory approach. This study aims to understand the comprehensive overview of electrical vehicles, critical challenges and barriers faced by the stakeholders.

KEYWORDS- Electrical Vehicles, Challenges, barriers and opportunities, India

INTRODUCTION

India's transportation sector utilizes 18% of the country's total energy. This is equivalent to 94 million tons of oil equivalent (MTOE) energy. India's present energy consumption trend continues to demand an approximate 200 MTOE of energy production yearly, by 2030 to meet overall demand of electrical vehicle market. This demand was now need to meet mainly by imported crude oil, which will result in dependency on fluctuating global crude oil prices. The industry emits approximately 142 million tons of Carbon dioxide each year, with the road transport sector accounting for 123 million tons of that total. The global automobile industry is looking for alternative, less energy-intensive, and CO2 emission-free options, India is also heavily investing to attract local and international manufacturers for the electric mobility shift. To foster electric mobility and promote the development of electric vehicles, a phased manufacturing roadmap has been developed, taking into account the current state of the country's manufacturing ecosystem. In the indigenous manufacturing of electric vehicles, assemblies/sub-assemblies, and parts/sub-parts/inputs of the sub-assemblies will be promoted over time through a graded duty structure, which will help to achieve the objective to greatly boost value addition and capacity building in the country.

Due to the increased interest of end consumers in electric vehicle (EV) segments and the government's commitment to electrifying 30% of all transportation by 2030, both local and international manufacturers are establishing production units in India. Over the past decade, the country's central government has launched many promotional campaigns to help encourage the use of electric vehicles (EVs). These efforts include the setting up of public EV charging infrastructure and tax rebates for electric vehicle owners.

Costumers were looking for alternatives as the fuel prices are increasing rapidly and the maintenance cost for internal combustion engine (ICE) cars is high. Electric vehicle has the added benefits as they run on electric motors and has low maintenance cost as compared to

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ICE cars. The future of electric vehicles seems to be very bright as awareness among people for environment-friendly solutions is rising. In recent years, there has been a surge in concern about rising air pollution. In order to reduce crude oil consumption and imports, India's Minister of Road Transport and Highways, Mr. Nitin Gadkari, has set a target of 70 percentage for commercial vehicles, 30 percentage EV sales penetration for private cars, and 80% for two- and three-wheelers by 2030, referencing the urgent need to decarbonize the transportation sector. India's commitment to minimizing pollution and lowering its carbon footprint is also rising. The government aims car manufacturers to shift to electric vehicle production, which will reduce pollution by 37%, save $60 billion in oil costs, and reduce dependency on external fuel imports, thus acting as a shield from vulnerability against currency fluctuations and crude prices.

MOTIVATION AND OBJECTIVES FOR RESEARCH-

This study aims to provide comprehensive facts on the current Indian EV status, including EV deployment and future market trends. This paper also reviews the complete literature on government EV policies and legislature documents promoting EV in India and also real time literature from the latest research papers published in the referred journals. The paper is divided into different sections.

(ref.19)

OBJECTIVES

1. To know the current status of electrical vehicles in India.
2. To understand the challenges faced manufacturer and the customers.
3. To know the future perspectives of electrical vehicle market.

1. RESEARCH METHOD

This paper uses qualitative approach to explore the literature to understand the objectives and get the insights about the topic. The study focuses on the desk research via secondary data to comprehend the facts connected to electric vehicles industry and explore the drivers for market growth of electric vehicles and the restraining parameters for penetrating electric vehicles in Indian market. Desk research study is based on credible published sources like automobile manufacturers associations, government sources, different societies of automobile sectors in India, reports and press release by Indian government, and the EV market reports.

2. ELECTRICAL VEHICLE OVERVIEW IN INDIA-

An electric vehicle (EV) is the one which use the electrical motor rather than an internal-combustion engine. The concept of electric vehicles has been around for a long time, it has received a great deal of attention over the past decade because of the increasing carbon footprints and other ecological effects of fuel-based vehicles.

We all know EV has been the segment where the demand been very robust, but the supplies have been constrained because of one reason or the other and primarily the semiconductor issue and things have been improving daily. That creates demand for people like us where the volume is improving. So in both the segments – be it two-wheelers or the passenger vehicles – we are definitely seeing an uptick in volumes on a month-on-month basis. The general automobile sector and consequently the electric vehicle industry have both been negatively impacted by the COVID-19 pandemic. According to information provided by the Society of Electric Vehicle Manufacturers (SMEV), the number of new electric vehicle registrations fell by 20% during FY21 compared to FY20.

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Electric vehicle usage is now on the rise in India. The demand for personal transportation was growing as a result of the pandemic, and electric two-wheelers are fueling EV growth in India. According to the report by Economic Times, in the first half of FY22, EV sales have increased three times, with over 1.18 lakh electric vehicles were sold. This includes 58,264 electric two-wheelers and 59,808 electric three-wheelers. Furthermore, the growth of internal combustion engine (ICE) vehicles has stagnated. In general, EV supply and demand are increasing in the country.

Lowering battery prices, customer outreach, rising fuel costs, and increased charging infrastructure, have all been recognized as factors driving sales.

India's recent policies to promote the transition to e-mobility are driven by rising pollution, the burden of oil imports, and international commitments to prevent global climate change. India expects to stand benefits on many fronts by switching to electric vehicles (EVs) because India has a relative wealth of renewable energy supplies and a qualified workforce in the technical and manufacturing industries.

Electric Vehicle Market in India till Today 2023-

India has been recognized as one of the prominent regions in the automotive industry globally. Several companies are aggressively establishing manufacturing facilities in India. The India electric vehicle market size was valued at USD 220.1 million in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 94.4% from 2021 to 2030.

The Indian Electric Vehicle Market is Segmented by Vehicle Type (Four-Wheelers, Two-Wheelers (Electric Motorcycles and Electric Scooters), and Three-wheelers), Power Source (Battery Electric Vehicle, Plug-in Hybrid Vehicle, Hybrid Electric Vehicle, and Fuel Cell Electric), and State (Maharashtra, Uttar Pradesh, Tamil Nadu, Rajasthan, Punjab, Karnataka, Delhi, Gujrat, Telangana, Kerala, Haryana, West Bengal, Madhya Pradesh, and Rest of India). The electric vehicle market is witnessing substantial growth owing to the rapidly escalating year-on-year adoption rate of mild-hybrid electric vehicles, favored electric vehicle policies, and improved government initiatives across India. In addition, compared to other segments, electric vehicle demand was less affected during the COVID-19 pandemic.

3. GOVERNMENT INITIATIVES TO INCREASE ADOPTION

In order to foster the widespread adoption of electric vehicles (EVs) in the country, the central government has announced various kinds of promotional initiatives throughout the last ten years, including tax incentives for electric vehicle owners, public EV charging infrastructure construction and the production units.(13) The Indian government has devised many Electric Car policies and initiatives such as National Electric Mobility Mission Plan, FAME-I and II, National Mission for Transformative Mobility and Battery Manufacturing, the Phased Manufacturing Program, Advanced Chemistry Cell Production Linked Incentive Scheme to give the required boost to the sector. (refer Exhibit)

The timelines of the government initiatives are

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Source-https://e-amrit.niti.gov.in/national-level-policy

The Indian government has launched a number of efforts to encourage both the use of EVs and production. The Government works on promotion for the use of electric vehicles all over the India including Maharashtra, Dadar and Nagar Haveli, Daman & Diu and Lakshadweep State/UT. Few are details regarding initiatives taken by the central and the state level government.

1. The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME India) Scheme was initiated in 2015 with the objective to minimize the reliance on fossil fuels and addressing vehicular emissions challenges. Currently, Phase-II of the FAME India Scheme is being implemented for a period of five years beginning April 1, 2019, with a total financial contribution of Rs. 10,000 crores.
2. The Government on 12th May, 2021 approved a Production Linked Incentive (PLI) scheme for manufacturing of Advanced Chemistry Cell (ACC) in the country in order to bring down prices of battery in the country. Drop in battery price will result in cost reduction of electric vehicles.
3. Electric Vehicles are covered under Production Linked Incentive (PLI) scheme for Automobile and Auto Components, which was approved on 15th September 2021 with a budgetary outlay of Rs. 25,938 crores for a period of five years.
4. Ministry of Road Transport & Highways (MoRTH) announced that battery-operated vehicles will be given green license plates and be exempted from permit requirements.
5. MoRTH issued a notification advising states to waive road tax on EVs, which in turn will help reduce the initial cost of EVs. Source- Ministry of Heavy industries.
6. Under the new GST system, GST on EVs is reduced from 12% to 5% against the 28% GST rate with up to 22% for conventional vehicles.
7. The government has proposed the exemption of registration fees for battery operated/electric vehicles to promote eco-friendly vehicles in the country.
8. The Ministry of Power has also allowed the sale of electricity as a 'service' for electric vehicles' charging. It will attract investors into the charging infrastructure.
9. Also, the government has granted an exemption to battery-operated transport vehicles

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and vehicles that run on methanol and ethanol fuels from the requirements of the permit.

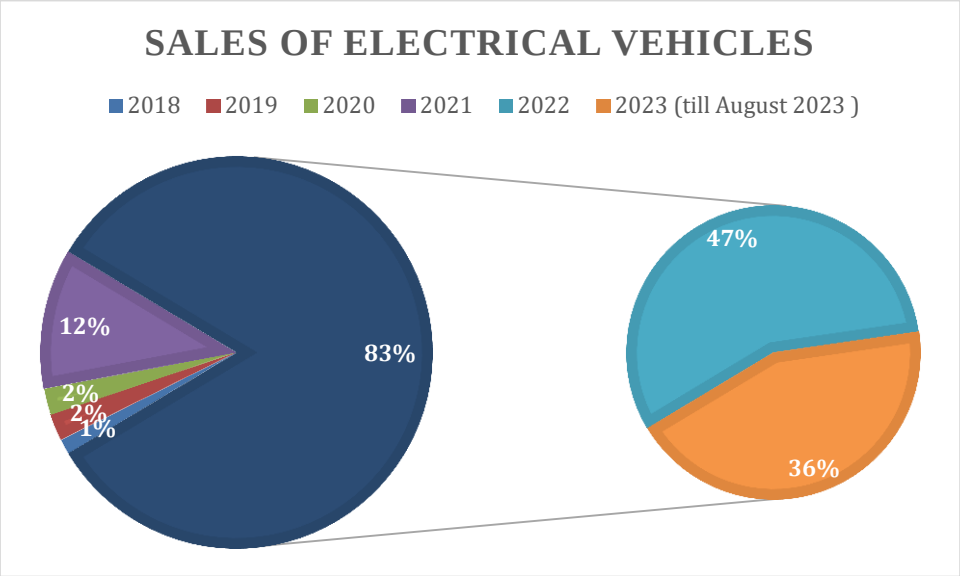
10. The Ministry of Road Transport and Highways has allowed 16-18 years to obtain driving licenses to drive e-scooters.
11. Prime Minister Mr. Narendra Modi announced that India would reduce its estimated carbon emissions by one billion tonnes till 2030 at the COP26 Summit in 2021. India is embracing the electric revolution by encouraging the majority of commuters to drive electric vehicles in toder to accomplish this aim.

4. CURRENT SALES DATA OF ELECTRICAL VEHICLES

The number of electric vehicles currently being used on the roads of India are 13,34,385 in which the states like Delhi having 1,56,393, Karnataka having 1,20,532 followed by Maharashtra 1,16,646 electric vehicles on roads.

The following table and chart give the details about the sales of electrical vehicles-

Vehicle Type/ Year	2018	2019	2020	2021	2022	2023 (till August 2023
Two-Wheeler	17,067	30,389	29,113	1,56,243	6,31,181	4,89,637
Three-Wheeler	1,10,133	1,33,489	90,385	1,58,129	3,50,247	3,00,114
Four-Wheeler	1,047	962	3,207	12,259	33,205	40,186



Source- ELECTRIC VEHICLES (pib.gov.in)

The share of EVs in total auto sales in India surged considerably from 1.75% in 2021 to 6.38% in 2022, demonstrating a rising preference among consumers towards electric vehicles.

Sales Trends- There are many changes are happening in the electric vehicle market which need to grab the attention of the readers, which can be elaborated as follows,

1. As of the conclusion of FY2023, India had sold 23,37,761 units of EVs nationwide. In FY2023, the total quantity of units of electric vehicles sold annually surpassed 12 lakhs. Of those, registered electric two-wheelers (E2W) accounted for over 60% of

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the share, while passenger electric three-wheelers (E3W P) accounted for around 29% of the market.

2. Amongst the states which sold the most electric vehicles (EVs) between FY2014 and FY2022 were Uttar Pradesh, Maharashtra, Delhi, Karnataka, and Rajasthan, with over 50% of the market share. The five largest states selling electric vehicles (EVs) in terms of sales share for FY2023 were Uttar Pradesh, Maharashtra, Karnataka, Rajasthan, and Gujarat.

Data as per the market share and type of electrical vehicle-

1. Sales for the E2W segment increased by approximately 210% in FY2023 compared to FY2022. In FY2023, the top 3 E2W players were Ola Electric, Hero Electric, and Okinawa Autotech, with a combined market share of more than 45% in the registered vehicle category sales.
2. The sales of E-Cars surged by over 150% annually in FY2023 compared to FY2022. Tata Motors earned a major portion of the E-Car market, having over 75% of the total, followed by MG Motor with 10%. The sales of E-Cars surged by over 150% annually in FY2023 compared to FY2022. Tata Motors earned a major portion of the E-Car market, having over 75% of the total, followed by MG Motor with 10%.
3. E-Bus sales grew 62% year over year in FY2023 in comparison with FY2022. The top three E-Bus companies, PMI Electro Mobility, Olectra Greentech, and Switch Mobility (Ashok Leyland), accounted for 74% of all E-bus sales in FY2023.
4. The total sales of passenger and cargo (registered) E3Ws rose by 126% year over year in FY2023 compared to FY2022. In FY2023 Mahindra & Mahindra, YC Electric Vehicle, and Saera Electric held the top three positions in the E3W market, with respective shares of 8.95%, 7.34%, and 5.46%.
5. There are also increase in the battery packs manufacturing and the charge-points installation in and around the cities.

5. DRIVERS OF ELECTRIC VEHICLE ADOPTION

Electrification—an appealing answer to rising levels of vehicle pollution, resource constraints, environmental changes and the demand for electric vehicles in and around India for today and the years to come. Electrification, or e-mobility, is already having an impact on the automotive sector both internationally and in India, as it is becoming a prerequisite.

In India in 2017 government was more aspirant to increase the sale of electrical vehicles and having a dream to sell more EV's as compare to the conventional vehicles by 2030. (ACMA, McKinsey study 2017) There are few push and pull strategies for penetrating the EV's Indian market. The factors which act as divers are

1. Regulations and incentives given by government,
2. The policy makers,
3. Technology- Innovations to EV technology could result in reduced battery costs, faster charging speed and time, and longer driving ranges all of which are going to accelerate the adoption of EVs as high battery costs affect production and sales and account for a significant portion of total electric vehicle expenses.
4. Infrastructure- The availability and caliber of the necessary fast-charging infrastructure are determined by three main factors: cell energy density, charging

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speed, and swappable battery infrastructure. Every single one of these elements is changing daily. For EV users to experience less downtime, the availability of charging infrastructure will be essential.

5. Consumer's demand- The EV industry tries to manufacture vehicles which caters to varied segments in the market. Manufacturer will give relative importance to the budget (price) of customers, giving better after sales support, highest fuel mileage, attractive styling, and best maintains record. These efforts will help the marketer to create more satisfied customers and increase the demand in the market.

In December 2021, India's total High-Speed Electric Two-Wheeler (HS-E2W) sales reached 24,725 units, representing a 10% year-over-year increase and a 444 percent increase in registrations. The top ten players in December 2021 were Okinawa Autotech, Ather Energy, Hero Electric, Pure EV, Ampere Vehicles, Jitendra New EV Tech, TVS Motors, Bajaj Auto, Benling India, Revolt Intellicorp, and Others, representing 94 percent of total registrations.

In December 2021, total sales of electric cars reached 2,522 units, representing a monthly increase of 64% and an annual increase of 410 percent in registrations. Tata Motors played an important role in e-car sales, accounting for 93% of all registrations in December 2021.In December 2021, total sales of electric buses (e-buses) reached 221 units, a 550 percent increase from the previous November 2021. PMI Electro led the way with 47.1 percent of total electric buses sales in December 2021, trailed by Olectra Greentech (26.7 percent), Ashok Leyland (13.1 percent), and JBM Auto (9.5 percent).

In December 2021, totaled 23,373 units were registered Electric three-Wheeler sales - both passenger and cargo representing a 29.8% year-over-year growth. Passenger Electric three-Wheeler sales climbed by 30% month over month, while cargo Electric three-Wheeler (E3W) sales increased by 33% compared to the previous November 2021. In December 2021, the combined sales of the top seven electric 3-wheeler manufacturers in the cargo segments and passengers amounted for 35.5 percent of the whole E3W market. With a 9.8% market share, YC Electric Vehicle leads the market, trailed by Mahindra Electric Mobility (6.4%), Saera Electric Auto (4.6%), Champion Poly Plast (4.6%), Best Way Agencies (3.6%), Dilli Electric (3.6%), and Unique International (2.9 %).

In 2021, India sold 3, 29,190 electric vehicles, a 168 percent rise over the 1, 22,607 units sold previously in 2020. In comparison to 2020, total registered electric vehicle (EV) sales more than doubled in 2021, topping three lakh in 2021. Uttar Pradesh maintains to have the highest monthly registration of EV sales among all states and UTs, accounting for 23% of total sales in India in December 2021, with over 10,000 units sold, making it the first state to do so. Maharashtra has the second-highest sales, with 13%, followed by Karnataka (9%), Rajasthan (8%), Delhi (7%), and Tamil Nadu (7%). In December 2021, passenger-type electric three-wheelers and Electric two-wheelers dominated EV registrations, contributing for 90.3 percent of total registrations for the month. These are followed by e-cars with 5% of total registrations and cargo-type electric three-wheelers with 4.3% in terms of market share.

In addition, EV sales have more than tripled to 1.18 lakh units in the first half of FY22, while ICE (internal combustion engine) car sales have been slowed by a major chip shortage. New electric vehicle launches, led by Tata Motors, as well as electric two- and three-wheelers, have provided the necessary momentum. EV infrastructure is now being developed in cities across the country with public-private partnerships. On-road EV prices have been lowered due to state and federal government subsidies. With companies like Ola Electric joining the space and creating a complete ecosystem, electric two-wheelers are projected to gain momentum faster.

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Because electric three-wheelers are priced similarly to ICE vehicles, they are gaining a lot of traction from logistics partners and e-commerce companies. Increased incentives and policies, as well as the implementation of charging infrastructure, have resulted in an increase in EV sales in some states since January 2022. (Electric vehicle market in India: Evolution, challenges and solutions | The Financial Express, 2022)

6. CHALLENGES FACED BY ELECTRIC VEHICLE MARKET IN THE INDIA

The Electric vehicle industry is in nascent stage still in India which makes it imperative to scout for creating assurance amongst the EV manufacturer and the users. The major impediments for electric vehicle's makers and the customers are related to conscious efforts to induce and promote electrical vehicle adoption in India. The India Electric Vehicle Market was valued at USD 5 billion in 2020 and is expected to reach a whopping USD 47 billion by 2026 while registering a CAGR of above 44% during the forecast period (2021–2026) [4].

The Indian government is offering attractive incentives for the production and purchase of the electrical vehicles to reassure the adoption to anticipate the growth in the near future. The Indian EV market is also evolving fast as close to 0.32 million vehicles were sold in 2021, up 168% YoY.[11] Ongoing electrical vehicle adoption in India is based on the agreement to reduce carbon emissions, to improve the air quality in urban areas and reduce oil imports.[11] By the end of this decade, it's anticipated that more acceptance of new vehicles will be electric vehicles. Still few reasons and challenges are there for the adoption of the electrical vehicles and are been considered while purchasing the EV's. The EV customers are often worried about the vehicle's capability and the challenges they have to tackle after purchasing the vehicle.

Few of the practical constraints which are considered by the customers for adopting electrical vehicles are as follows-

Lack of charging infrastructure:

India is lacking in a charging infrastructure to meet the increasing demand for electric vehicles. India was reported to have 650 charging stations in 2018. In addition to charging stations, there was a lack of private parking spaces which were creating hindrances for electric vehicles adoption, and also the lack of available affordable renewable energy.

Range anxiety:

This was a crucial challenge that made EV manufacturer to take a call on. Consumers are increasingly concerned about the range to be traveled in one charging which results in range anxiety, and the doubt in the minds of consumers that their electric vehicle may not have sufficient range to get them where they need to go.

Consumers were worried about the battery performance and the regularized infrastructure for charging infrastructure. India needs a charging infrastructure like gas stations so that people don't have to worry about running out of energy.

Financial challenges:

Customers purchasing electric vehicles faced a variety of financial challenges, including high interest rates, restricted financing options, high insurance prices, and interest rates for ICE vehicles were low as compared to electric vehicles. For instance, the interest rate on a commercially run electric automobile in Delhi was 14 to 15%, slightly more than the rate on a diesel vehicle (12%).

High Price: The price of electric scooters and motorcycles in India is significantly higher than

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the price range of ICE bikes, and even lower for scooters. The average cost of electric automobiles in India is significantly higher than the average for economical vehicles run on traditional fuel. For example the Tata Nexon price starts from INR 7.19 lakhs, on the other hand, the Tata Nexon EV price starts from INR 13.99 Lakh. The huge price difference discouraged many customers who were interested in buying EVs.

Lack of Standardization- One issue impacting the automaker is the lack of standardization in electric vehicle technologies. Different battery chemistries, charging interfaces, plus powertrain designs are employed by different manufacturers. The development of an interoperable charging infrastructure is impeded by this lack of uniformity, which also makes charging more difficult. To guarantee compatibility and expedite the charging process for owners of electric vehicles, standardization activities are required.

7. WAY FORWARD OR WHAT NEXT OR FUTURE PLANS

The auto industry is expected to embark on a new phase of expansion, innovation, and investment in 2022. With numerous automakers actively launching EV vehicles, the penetration of electric vehicles has surged substantially in recent years and the government is aggressively promoting EV adoption in India. There are a number of possible market barriers that hinder the electric vehicle industry's capacity to meet expanding demand, including an underdeveloped charging ecosystem, which continues to obstruct more penetration in the two-wheeler consumer segment. To achieve a revolutionary shift to electric vehicles, our country must solve the fundamental concerns. The future of electric vehicles is here and it’s here to stay, evolve and widen its reach.

EXHIBITS

ADDITIONAL READING

Despite the country's ambitious goals, India's electric vehicle industry was still in its infancy. India was the world's largest unexplored market, particularly in the two-wheeler sector. Under the automatic route, 100 percent foreign direct investment has been permitted in this sector. The Indian government has created a bunch of opportunities to encourage the adoption and manufacture of electric vehicles in India. Electric vehicles have begun to penetrate the Indian market, supported by the government.

In April 2021, Union Minister Mr. Nitin Gadkari said that India would overtake China as the world's leading EV manufacturer in a few years. "India is making progress in developing electric automobiles. India will eventually become the world's leading manufacturer of electric vehicles. In India, you may find all of the well-known brands. "Electronic mobility will be a critical tool in the development of pollution-free transportation," Gadkari had stated.

In February 2019, the Union Cabinet sanctioned a ₹10,000 crore initiative under the FAME-II scheme. The program was introduced in April 2019 with the goal of promoting the rapid integration of fully electric and hybrid vehicles by providing charging infrastructure and financial incentives for electric vehicle purchases. Though the presence of adequate charging infrastructure one of the essential components for the accelerated adoption of electric vehicles in India, the recent developments to modify the rapid implementation and manufacturing of electric and hybrid vehicles in India (FAME) II scheme to produce electric two-wheelers more cost-effective. As of November 2021, around 1,65,000 electric vehicles had been subsidized under phase two of the FAME scheme, with a demand incentive of INR 5.64 billion. In addition, the initiative has approved 2,877 electric vehicle charging stations, 6,315 electric buses worth INR 5 billion in 68 cities covering 25 states/Union Territories, and 1,576 charging stations for INR 1.08 billion on 16 highways and nine expressways.

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Furthermore, a series of production-linked incentive schemes are aimed at developing a local manufacturing ecosystem to assist in the adoption of electric mobility vehicles. This is accomplished by encouraging new investments in the development of domestic supply chains for essential auto components, products, and technology. The government announced a Production-Linked Incentive Scheme (PLI) on ACC Battery Storage Manufacturing in May 2021, which will encourage domestic battery production and minimize reliance on imports. This will help provide the infrastructure required for the EV industry, lowering the cost of EVs considerably.

The government established a PLI Scheme for the drone and automobile industries on September 15, 2021, with the goal of stimulating high-value and latest automotive technology products and vehicles, such as "green automotive production". Current automakers and also new investors who are not currently in the vehicle or auto parts manufacturing business are eligible to participate in the PLI Scheme for the automobile sector. The scheme has two modules:

Champion OEM Incentive Scheme: Also known as the ‘sales value linked’ scheme, appropriate on hydrogen fuel cell vehicles and battery electric vehicles of all segments.

Component Champion Incentive Scheme: Also known as ‘sales value linked’ scheme, appropriate on semi-knocked down (SKD)/ completely knocked down (CKD) kits, advanced automotive technology components of vehicles, vehicle aggregates of 2-wheelers, 3-wheelers, passenger vehicles, tractors, commercial vehicles, etc.

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