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Achieving Self-Sufficiency In India's Electric Vehicle Ecosystem: The Road To Aatmanirbharta

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Abstract

One of the biggest worldwide concerns at the moment is environmental degradation. Governments around the world have recently turned their attention to growing the electric vehicle (EV) ecosystem in developing nations in an effort to lessen environmental damage. The main goal of this article is to analyse the EV ecosystem in India. According to the study, even if EV sales are rising by triple digits, a strong support system has not yet been established. Interestingly, India has a woefully low ratio of EV sales to public charging outlets. India needs to make investments in cutting-edge technology like fast charging infrastructure and lithium cell manufacturing if it wants to become a leader in the EV sector. Research and development (R&D) must also be given top priority if self-reliance Aatmanirbhar is to be achieved in the EV ecosystem.

Key Words: Degradation, ecosystem, lithium cell, public charging outlets

Introduction:

The largest worldwide problem at the moment is environmental pollution. The main cause of air pollution is toxic emissions from internal combustion engines. Global warming is being caused by rising CO2 concentrations along with other greenhouse gases (GHGs) released by human activity. Electric vehicles (EVs) are being aggressively promoted worldwide in an effort to address environmental concerns (ECs) and the detrimental impacts of emissions from fossil fuels. Electric motors provide the power for EVs, which are then maintained by rechargeable batteries or other portable energy storage systems. Due to their

excellent energy efficiency, these cars emit fewer greenhouse gases (GHGs) and produce less noise pollution.

Types of electric vehicles

Electric vehicles (EVs) can be categorized into different types based on their power source and drivetrain technology. Here are the main types:

1. Battery Electric Vehicles (BEVs)

- Fully electric, powered only by a rechargeable battery.
- No internal combustion engine (ICE) or fuel usage.
- Example: Tesla Model 3, Tata Nexon EV.

2. Plug-in Hybrid Electric Vehicles (PHEVs)

- Combine an internal combustion engine with an electric motor and a rechargeable battery.
- Can run on electricity for a certain range before switching to fuel.
- Example: Toyota Prius Prime, Volvo XC90 Recharge.

3. Hybrid Electric Vehicles (HEVs)

- Use both an ICE and an electric motor, but cannot be plugged in to recharge.
- Battery is charged through regenerative braking and the ICE.
- Example: Toyota Camry Hybrid, Honda Accord Hybrid.

4. Fuel Cell Electric Vehicles (FCEVs)

- Generate electricity using hydrogen fuel cells.
- Only emissions are water vapor.
- Example: Toyota Mirai, Hyundai Nexo.

5. Extended-Range Electric Vehicles (EREVs)

- A type of PHEV where the gasoline engine acts as a generator to extend battery range.
- Example: BMW i3 REx, Chevrolet Volt.

The below table shows the electric vehicle sales all over the world from 2011 to 2022.

Table No. 1 Sales of Electric Cars around the World 2011-2022

Year	BEV	PHEV
2011	39,000	0
2012	58,000	60,000
2013	1,10,000	91,000
2014	2,00,000	1,30,000
2015	3,30,000	2,20,000
2016	4,60,000	2,90,000
2017	7,60,000	4,20,000
2018	14,00,000	6,50,000
2019	15,00,000	5,80,000
2020	20,00,000	9,70,000
2021	46,00,000	19,00,000
2022	73,00,000	29,00,000

Source: Global EV Data Explorer

Due to material and energy density restrictions, current EV battery technology produces heavier vehicles with lower ranges than internal combustion engine vehicles (ICEVs). Furthermore, even with government subsidies, the price of batteries adds to the overall cost of EVs for consumers, and the manufacture of these vehicles depends on the availability of occasionally limited resources. All of these constraints work together to limit the broad use of battery-electric technology, especially in the field of heavy-duty vehicles.

Given the numerous issues caused by the use of fossil fuels, including their rapid depletion, growing energy costs, the environmental impact of motor vehicles, and worries about climate change, it was determined that India needed to switch to electric mobility (Aijaz, 2022). An estimated 375 million tonnes of direct CO2 emissions, or almost 10% of India's total GHG emissions, are expected to come from the country's transport sector in 2022. Road transport accounts for over 90% of these emissions, with aviation and railroads coming in second and third, respectively (Natarajan, 2022) [3].

In response to alarming environmental problem, and to facilitate greater adoption of EVs by removing barriers Department of Heavy Industry introduced National Mission for Electric Mobility (NMEM) in 2012

Literature Review:

The auto industry is preparing for a revolution. Individual transportation habits have to alter in response to the increase in the price of fossil fuels and the environmental effects of their emissions. Internal combustion engines are driving the industry's steady transition to electric automobiles. A quarter or so of greenhouse gas emissions come from the transport industry. Globally, automobiles are the main source of greenhouse gas emissions, with China accounting for 25.9%, the USA for 13.87%, and India for 7.45% **(Khurana, Kumar, & Sidhpuria, 2020). [2].** Thus, it is thought that lowering the use of fossil fuels through the implementation of electrified powertrain technologies like fuel cell electric vehicles (FCEV), battery electric vehicles (BEV), and hybrid electric vehicles (HEV) will lead to a more sustainable future. Research and development of BEV technologies has become increasingly important in order to improve BEV performance and ensure its competitiveness, since there appears to be a more significant shift towards BEV development and roll-out (**Pesyridis et al., 2022) [4].**

India's worldwide pledge to achieve net-zero emissions by 2070 by lowering the emissions intensity of its GDP by 45% by 2030 India's most recent Nationally Determined Contributions (NDCs) to the United Nations Framework Convention on Climate Change (UNFCCC) contain these goals. According to the Paris Agreement **(Aijaz, 2022) [1]** or the 21st session of the Conference of the Parties (COP 21), India hopes to strengthen its role in the international response to the challenges posed by climate change by implementing such measures.

The ecosystem supporting EVs has benefited greatly from Budget 2022–2023. Compared to prior years, the amount of money allotted to the Faster Adoption and Manufacturing of Electric Vehicles in India (FAME-India) Scheme has tripled. Later, NITI Aayog, the finance minister, declared that standards for battery switching and interoperability would be developed. To promote the production of electric vehicles, it has also been suggested to create a special mobility zone for zero-emission vehicles in urban areas and to lower customs tariffs on minerals needed for domestic battery manufacturing (**Natarajan, 2022).**

Objective of the study:

It is evident from the literature review above that a significant push towards electric vehicles is essential to address environmental concerns. In order to increase the sales of electric vehicles, the Indian government also implemented a number of laws and initiatives. To determine the prospects and obstacles for electric vehicles in India, it is crucial to research the ecosystem of these vehicles, from battery production to the installation of public charging stations.

Research Methodology:

The data has been collected from a variety of papers, government-published articles, newspaper stories, etc. Additionally, tables, graphs, and visual aids are used to display the gathered data. The research conducted was **descriptive** in nature and based on reliable and authentic secondary data sources.

Analysis & Interpretation:

The Indian government has been actively promoting the sale of electronic vehicles in the nation in recent years. The following are some of the main ways that the government supports the electric vehicle ecosystem: various subsidies, information portals, and assistance to create domestic technology for electric vehicles.

FAME I: The FAME I program for electric vehicles has been launched by the Indian government. The program is in effect from 2015 until 2019. The goal of this program is to lessen reliance on fossil fuels and address the problem of vehicle emissions. It highlights the need for the government to provide public and private transportation that is both affordable and environmentally friendly for the general public. Additionally, the government focusses on developing technology, creating demand through pilot projects, incentives, and charging infrastructure in Indian society, and bringing society up to date with modern standards.

FAME II: In 2019 and 2024, the Indian government will put this FAME II into effect. The government's primary goal in this FAME II is to promote the quicker adoption of electric and hybrid vehicles. It emphasises the need to electrify public transport, including shared transport, so it chose to concentrate on providing upfront incentives for EV purchases and installing charging infrastructure in a few cities and along major highways.

E-Amrit portal: E-Amrit is a one-stop destination for all information on electric vehicles—gives information for the adoption of EVs, their purchase, investment opportunities, policies, subsidies. The portal has been developed and hosted by NITI Aayog under a collaborative knowledge exchange programme with the UK government and as part of the UK–India Joint Roadmap 2030, signed by the Prime Ministers of the two countries. E-Amrit intends to complement initiatives of the government on raising awareness on EVs and sensitizing consumers on the benefits of switching to electric vehicles. In the recent past, India has taken many initiatives to accelerate the decarbonisation of transport and adoption of

electric mobility in the country. Schemes such as FAME and PLI are especially important in creating an ecosystem for the early adoption of EVs.

Public charging stations: According to data from the Bureau of Energy Efficiency (BEE), as of March 21, 2023, there were 6586 Public Charging Stations (PCS) operating nationwide, 419 of which were located along national highways. The construction of charging infrastructure has been allotted Rs. 1000 Cr. under phase-II of the FAME-India Scheme. In 68 cities throughout 25 states and UTs, the Ministry has authorised 2,877 EV charging points. Furthermore, phase-II of the FAME India Scheme has approved 1576 charging stations spread across 16 highways and 9 motorways.

Electric vehicle sales in India:

In India sales number of EVs are growing at a heathy speed. Two-wheelers and passenger car segment is showing double digit growth. Few states transportation department are slowly adopting electric buses for intra city as well as intercity routes.

Table No. 2 Electric Vehicle Sales in India

Fiscal	Units sold	YoY growth (%)
FY 2023	11,71,944	155%
FY 2022	4,58,746	222%
FY 2021	1,42,314	-18%
FY 2020	1,73,545	18%
FY 2019	1,46,938	52%
FY 2018	96,512	73%
FY 2017	55,871	245%
FY 2016	16,198	590%
FY 2015	2,347	-11%
FY 2014	2,627	
Total	**22,67,042**	

Source: www.vahan.com compiled by autocar professional

From the above table it is clear that electric vehicle sales in India witnessing a spectacular growth in recent times, in financial year 2022 EV sales observed 222% growth and financial year 2023 also seen 155% sales growth.

Table No. 3 Segment wise Electric Vehicle Sales in India

Segment	Units
Two- Wheelers	7,20,733
Three- Wheelers	3,99,540
LMV's	39,562
LPV's	7,045
Buses	1,857
HGV's	193
LGV's	592
Others	2,422
Total	11,71,944

Source: ***www.vahan.com compiled by autocar professional***

From the above table it is found that in India out of all the electric vehicle sold, two-wheeler sale is highest that is 7,20,733 units sold in 2022-23 followed by 3,99,540 units of three-wheelers sold. In India in privet vehicle segment 39,562 units of electric LMVs sold in 2022-23 and overall electric vehicle sales stands at 11,71,944 units.

Table No. 4 Top 10 Electric Two-Wheeler Company's Sales in India

Company	Units
Ola Electric	1,51,344
Okinawa Autotech	94,133
Hero Electric	89,165
Ampere Vehicles	83,659
TVS Motors	80,565
Ather Energy	76,277
Bajaj Auto	28,098
Okaya EV	13,069
Revolt Motors	12,887
Pure Energy	11,541

Source: ***www.vahan.com compiled by autocar professional***

Above table shows the top 10 electric vehicle manufacturing companies in two-wheeler segment. This segment has highest competition between the companies. Ola electric is the market leader followed by Okinawa auto-tech and hero electric.

Table No. 5 Top 10 Electric Car Sales in India

Company	Units
Tata Motors	31,203
MG Motors	4,412
BYD India	867
Hyundai Motors	780
Mahindra & Mahindra	396
BMW	382
KIA	311
PCA Auto India	193
Mercedes- Benz India	152
Volvo Auto India	137

Source: www.vahan.com compiled by autocar professional

The above table depicts the top 10 electric passenger vehicle manufacturing companies in 2022-23. Tata Motors is by far a market leader in the segment, they sold 31,203 units. MG Motors India, BYD India, Hyundai Motors India and Mahindra and Mahindra etc

Aatmanirbhartha in the ecosystem of Electric Vehicles in India

The government launched the National Mission on Transformative Mobility and Storage program in an effort to bring about Aatmanirbhartha in the electric vehicle ecosystem. The Mission promotes and advocates for phased manufacturing plans for EVs, EV components, and batteries as well as solutions for revolutionary mobility. In order to localise production along the whole EV value chain, a Phased Manufacturing Program (PMP) will be initiated. The PMP's parameters and specifics will be decided by the National Mission on Transformative Mobility and Battery Storage. With a clear Make in India plan for batteries and electric vehicle components, the Mission will finalise the specifics of the value addition that can be accomplished with each localisation phase. In order to combine several projects to revolutionize mobility in India, the mission will then collaborate with key stakeholders in Ministries, Departments, and the states.

Findings & Suggestions:

India is witnessing study rise in the movement of electric vehicle industry. From the study it is found that electric vehicle sales are showing good year on year growth. Financial year 2022, EV sales observed 222% growth and financial year 2023 it is also seen at 155% sales growth. But public electric charging station is still less in numbers, a total of 6,586 Public Charging Stations (PCS) is operational in the country as on 21st March 2023 and number of charging stations in national highways also very limited which will lead to

the range anxieties among the customers. Future, in India number of electric vehicle manufacturing companies are increasing day by day but they all are dependent on imports when it comes to lithium-ion cells which is critical in battery manufacturing. To improve the electric vehicle ecosystem the following suggestion can be implemented.

- Government needs to focus on increasing the number of charging stations especially in national highways, which will help to reduce range anxieties among the commuters and will encourage peoples to purchase electric vehicle.

- Battery swapping policy announces in the budget need to be adopted on fast-track basis, which will help to encourage electric vehicle sales in the urban areas.
- The validity of FAME-II subsidy is ending on 2024, in order to support electric vehicle its validity need to be extended beyond 2024.
- In order to achieve Aatmanirbhartha in electric vehicle industry lithium-ion cells battery technology is critical. Indian government need to focus on developing these technologies by investing in R&D and supporting privet sector.
- Finally simple government regulations and clear tax policy for electric vehicle as well as for supporting industries will help to better growth in the sector

Conclusion:

Electric vehicles are widely regarded as the future of the automobile industry. To ensure a seamless transition from conventional internal combustion engine (ICE) vehicles to electric vehicles, countries must establish well-developed electric vehicle ecosystems. This necessitates governmental provision of financial and technical support to foster the holistic development of the electric vehicle sector. Key measures include strengthening the manufacturing ecosystem and expanding electric vehicle charging infrastructure. Presently, India relies heavily on other nations for its crude oil requirements, leading to substantial import bills that impede the country's economic growth. Accelerating the adoption of electric vehicles is imperative to address this challenge. Moreover, India possesses abundant lithium reserves, a crucial component in battery manufacturing. Therefore, it is opportune for both the Indian government and private industries to collaborate and spearhead the development of a world-class electric vehicle manufacturing ecosystem. Such efforts will not only cater to domestic needs but also unlock significant export potential, positioning India as a leader in the global electric vehicle market.

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