

# Insight into Electric Vehicle Niche

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**Abstract**—In today's world where every country is having a concern about pollution and its alarming effect, India is also planning and trying to reduce its total projected carbon emission by 1 billion tonnes till 2030, to achieve its goal of net-zero carbon emission by 2070. In this process, the automobile sector plays an important part, as 8-10% of the pollution in India is the result of automobiles running on the roads. As a solution, Electric vehicles are taking over the market. So, to change the older hydrocarbon-based fuel vehicles into electric vehicles we require a strong hard and soft Infrastructure. In this paper, we are showing some methods by which we can have a strong soft infrastructure that can help in transition of the older era of vehicles into a new one of EV in India. Here we have designed a purpose build dashboard that helps in tracking, analysing, and evaluating the EV's demographical data. The EV's demographical data includes; charging station statistics, battery characteristics, energy consumption analysis, characteristics, and route profile. We use the leveraged technology of AI and ML along with data analytics and visualization to make EV's all in one dashboard. The dashboard will give information starting from EV's vehicle sales, charging location, even in the market along with the sales of different EV's also general news on the technology updates and general instructions for EV buyers, we list different schemes of different state governments for the state buyers and developers, also for collection and monitoring of the data we also have a savings calculator for the government and the general user to see that what amount they save and how much carbon emission they have prevented, this will lead to proper tracking of each and everything from a government perspective and also for the general user to have ample of knowledge about EV, its technology, types and the active charging facilities in the regions around them. By doing so we can predict the future savings and also track and have visual data to refer and also government can see the growth in the sector. This will strengthen the infrastructure and help build a new era of EVs in India.

**Keywords**—Dashboard, Electric Vehicle, Analysis of sales, Data Analysis. Data Visualization Business analysis, AI, ML, Green Energy

## I. Introduction

The growing levels of pollution across the world have raised an urge to adopt policies that can control it. The automobile emission accounts for major contributors of CO<sub>x</sub> and NO<sub>x</sub> fumes to the atmosphere. Hence, there is a need to adopt cleaner fuels and stop burning of petrol and diesel. With the advancement in the industrial revolution the demand and usage of vehicles have increased immensely. The expected demand for vehicles has gone up from 750 million in 2010 to 1.5 billion in 2050.[1] The development in the sector of electric vehicles brings in an opportunity to improve the economies of the developing countries along with environmental aspect. The limited conventional fuel industry has a restricted employment opportunity. However, the electric vehicle industry in total is estimated to create ample employment opportunities. With this motive, even the Indian government has taken several steps to encourage the evolution of the Electric Vehicle industry in India. The policies such as the FAME-II scheme provide attraction to foreign investors for direct investment.[2] The analysis done by CEEW-CEF [3] has stated that India will achieve a conversion target of 70 percent of the commercial vehicles and 30 percent of the private vehicles. The government is putting in all efforts to encourage local manufacturers and start-ups to improvise the EV industry in the country itself. This would help in avoiding foreign imports and provide employment opportunities to the population of the country. The growth of sales of Electric vehicles over the past few years is evident. Major challenges faced by adoption of Electric vehicles are range prediction, duration of charging the batteries, cost of EV and lastly the lack of infrastructure. Currently the researchers need to work on these aspects. These would prove to be the deciding stones of the future. Here we have stated a thorough analysis of various sectors of EV. The first analysis is about the sales of EV across the country. Secondly, the route profiling and charging station.

## II. Literature Review

The growing air pollution across the world has raised many concerns. The environmentalists are even discussing that if the pollution is not controlled, soon earth will be left with no oxygen supply. A study shows that fossil fuel emissions are the major contributor towards air pollution being caused. Hence, there's a need to adopt cleaner fuels. This brought Electric Vehicles into picture.[4] Countries such as the UK and France have planned to ban the usage of fossil fuel vehicles by the end of 2040. Also, a survey shows that everyone would have shifted to EV by the end of 2035 in these countries.[5] According to the statistics India is considered to be the fourth largest emitter of the poisonous Green House Gases. INCCA, 2010 report showed that 13 % of the total Carbon dioxide emission of India is from vehicles. The automobile industry is thus a major contributor to the air pollution being caused due to greenhouse gases emission.[6] Keeping up with the pace of development in the EV domain, India has also taken steps in order to incorporate Electric Vehicles in the lives of its citizens. The National Electric Mobility Mission Plan 2020 (NEMPP 2020) has been brought up by the Indian government and they have provided a detailed report on EV. This plan was launched on January 9, 2013 by the Prime Minister of India. Although currently not much involvement is seen in buying and selling of Electric Vehicles, the government is pushing hard to bridge the usage of fossil fuel vehicles to Electric Vehicles A lot of

research has been done regarding the barricades in the path of development of Electric vehicles. Initially, when Electric vehicles were introduced in the Indian market their cost was very high. The lack of charging infrastructure, lack of EV maintenance equipment and limitations of battery capacity are a few of the mentioned barricades. EV is a completely new concept for Indians; hence they are lacking the confidence to invest in buying, selling and manufacturing EV. The government can rebate these by introducing policies such as tax reduction and subsidies to buyers and manufacturers.[7]. A few concepts regarding Electric vehicles are still vague. The FAME India Scheme had been brought up as an initiative to encourage the manufacturers to select India as a ground for manufacturing electric and hybrid vehicles. Faster Adoption and Manufacturing of Electric (& Hybrid) Vehicles in India was a scheme launched by the Department of Heavy Industry on 13th March 2015. Phase 1 was unfolded on 1st April, 2015 for a span of two years. On completion of the first two years, a thorough revision of experiences and outcomes were done. A revised FAME India scheme was then implemented in order to establish a huge market for Electric Vehicles across the country.[8][9]

**Table 1.**Summary of existing work

Refer-ence No.	Observations
[4]	<ul style="list-style-type: none"> <li>Hybrid car technology uses the gasoline and electric technology to reduce air pollution, and save oil.</li> <li>Hybrid car technology can act as a bridge between fully electrical era and current scenario.</li> </ul>
[5]	<ul style="list-style-type: none"> <li>The automobile industry is important and plays a pivotal role in country's economic and industrial development.</li> <li>Indian automobile policymakers must act on it to take advantage of growth in this sector as a lot of national fuel can be conserved by using these electric vehicles along with reduced emissions.</li> <li>Indian automotive industry has become a favourable investment destination by global auto industry major manufacturers.</li> </ul>
[6]	<ul style="list-style-type: none"> <li>Information on India's emissions of Greenhouse gases (Carbon Dioxide [CO<sub>2</sub>], Methane [CH<sub>4</sub>] and Nitrous Oxide [N<sub>2</sub>O]) emitted from anthropogenic activities at national level from: ,, Energy; ,, Industry; ,, Agriculture; ,, Waste and the total amount of it.</li> </ul>
[7]	<ul style="list-style-type: none"> <li>Different type of issues like charging facilities, inappropriate feeders for the charging stations.</li> <li>Fundamental challenges with EVs are the lack of a suitable energy storage system and an efficient battery management system that could support the competitive mileage when compared to traditional fuel-based vehicles, as well as the lack of a high-performance fast charging facility</li> </ul>
[10]	<ul style="list-style-type: none"> <li>Different type of problems and solution related to electric vehicles due to motors.</li> <li>Shows different motor control strategies and different kind of methods and control strategies to help improving the range and reducing the cost of ev's.</li> </ul>
[13]	<ul style="list-style-type: none"> <li>Delhi-Chandigarh in India has become one of the first Indian ev's friendly highway with a near perfect charging ecosystem.</li> <li>Observed the influence of the charging infrastructure, charging station placement and type of chargers plays an important role in the ev's sale increment.</li> <li>Three models are implemented: a simple model with a charging threshold and two more sophisticated models where the driver takes the current trip distance and existing CS locations into account</li> <li>Algorithm for charging station placement has been simulated and analyzed based on the charging behavior.</li> <li></li> </ul>
[14]	<ul style="list-style-type: none"> <li>The growth of electrical vehicles has decreased by the years due to the impact of the pandemic and the disadvantages caused by it.</li> <li>There is a huge dip in the global sales of the ev's</li> <li>The dynamics of ev's sells in about 15 countries with market growth, regional demand, leading manufacturers, and topnotch models</li> </ul>
[15]	<ul style="list-style-type: none"> <li>China having future approach have certainly showed growth in their electric vehicles sale aby innovating, investing and increasing the r</li> </ul>

	&d in this sector way before everyone.
[17]	<ul style="list-style-type: none"> <li>• The grid to vehicle and vehicle to grid has become the new research area</li> <li>• A scalable EV population simulator, namely ePopSimulator, has been presented as a test and deploy environment for demand-side management strategies.</li> </ul>

## Analysis and Discussion

The current demand is to analyze and study the current requirements of people along with the demand of nature. Electric vehicles are a new concept for people. The EV sector is facing a lot of challenges to secure its place in the market [10]. Here we gathered some data related to EV sales and the location of charging stations [11][12]. These collected data were plotted on streamlit. Here we gathered a few observations and inferences.

### A. ELECTRIC VEHICLE SALES



Figure 1. EV Sales Analysis (till 2020 and further developing)

A rapid increase in the sales of Electric vehicles has been observed. As mentioned in [13], there were 1.1 million Electric passenger vehicles sold. This was 57% more than the vehicles sold in 2016. The majorly selling EV segments are that of two and three wheelers. The current policies of the government aim in major adoption of Electric Vehicles for public services. The four-wheeler sales still remain stagnant with a sale of just 2000 units in 2018 [14]. The sales are observed to increase till 2018 in the Figure 1. The EV sales went a little down due to COVID19 (Fig. 1). The financial crisis among the buyers reduced the dealings of Electric vehicles. As there was a drop in the prices of petrol and diesel, the electric automation technology was identified costlier [15]. Although the picture after the advent of COVID19 may not seem very much in favor of EV, still they brought in new opportunities. The lockdown phase enlightened people about the perks of a cleaner environment. Electric mobility found a boost from the government of India with newer policies. 50% of the urban population is expected to use electric mobility by 2050. The calculated average sales for EV sales are 5448 per month (Fig. 1). This is bound to rise as people are choosing more of cleaner environment.

### B. CHARGING STATION LOCATION

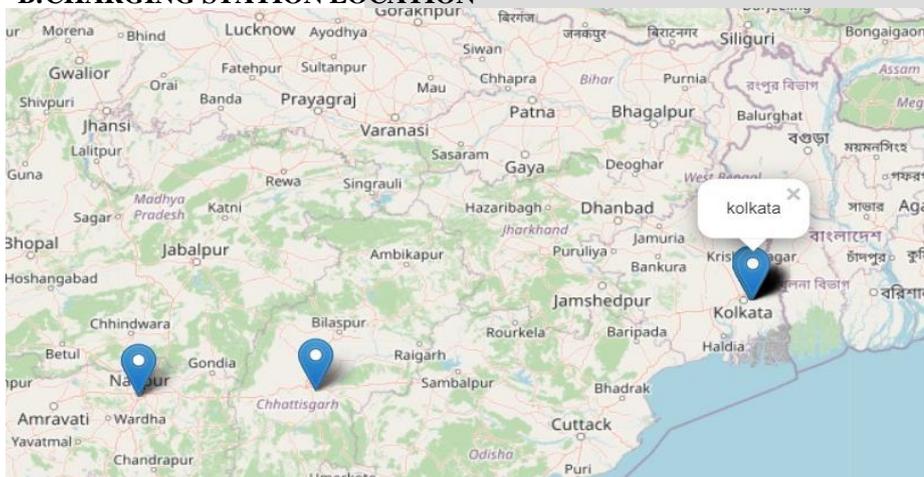


Figure 2. Location of Charging Stations (till 2020)

The location of charging station is one of the major problems faced by EV markets. With the market shifting towards electric mobility, various charging methods have been developed. Charging station infrastructure and its route profiling poses another problem. After considering various parameters, the location of charging stations has been proposed by [16] using ODI matrix. The

technique is based on a p-dispersion constraint and an adaptation of the traditional fixed charge placement model. The findings suggest that this technique might aid in the future installation of charging stations on a large scale in cities. With the inauguration of first solar electric vehicle charging station at Karnal Lake resort, Delhi- Chandigarh highway becomes first EV friendly highway. This charging station is capable of charging all types of battery types. It's located at the midpoint of the highway and is hence most efficient. The government is planning on much more advancement within a year. Individual charging poles are being planned to be installed. There are very few charging stations currently available in India (Fig 2.). Therefore, the lack of charging station infrastructure has posed one of the major challenges in the adoption of Electric Vehicle across the country. The charging of EV can be done using public charging or home charging.

**Public Charging:** Bharat EV guidelines propose that electricity be invoiced and money be collected when charging outside the house. From time to time, the power utilities may seek to manage the amount of power consumed by these chargers.

**Home Charging:** The 230V/15A single phase plug, which can supply up to 2.5KW of electricity, is commonly used with home private chargers. As a result, only up to this rate may the cars be taxed. Home-metering includes invoicing for electricity. This will continue until a policy is developed to charge residential customers for EV use differently. Bharat EV Specs further suggests that both ends use the IEC 60309 Industrial-connection.

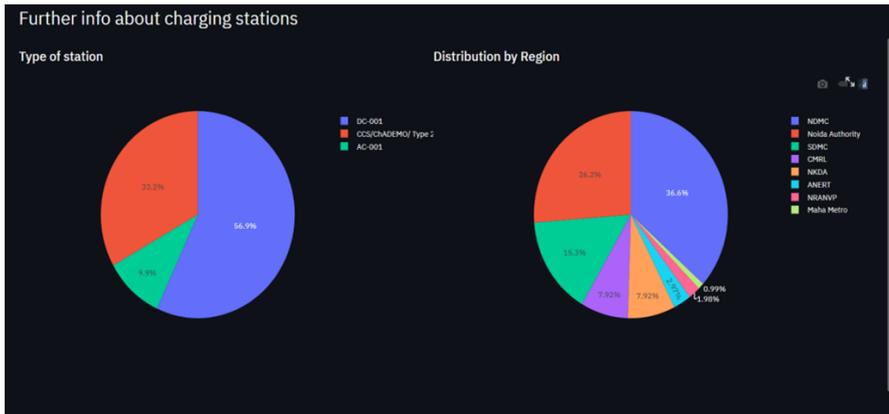


Figure 3. Various proprietors of charging stations across India.

The proportion of charging stations charger type present across the country is DC-001, AC-001 and Type 2 AC. The unequal distribution is another hurdle to overcome. The charging connector types vary in various vehicles. Our country has different operators providing charging station infrastructure across various states. According to the available data, the charging station infrastructure are being provided by NDMC, Noida Authority, SDMC, CMRL, NKDA, ANERT, NRANVP and Maha Metro. These are only few of the companies. Others include Tata power, Reliance, etc. The distribution (Fig 3.) shows that most of the charging station is provided by NDMC in Delhi- Noida region. The location of this charging station needs to be done in a planned manner. The government should take the authority to plan the route profiling and location of charging stations.

C. EV EXPENDITURE V/S CONVENTIONAL FUELVEHICLE

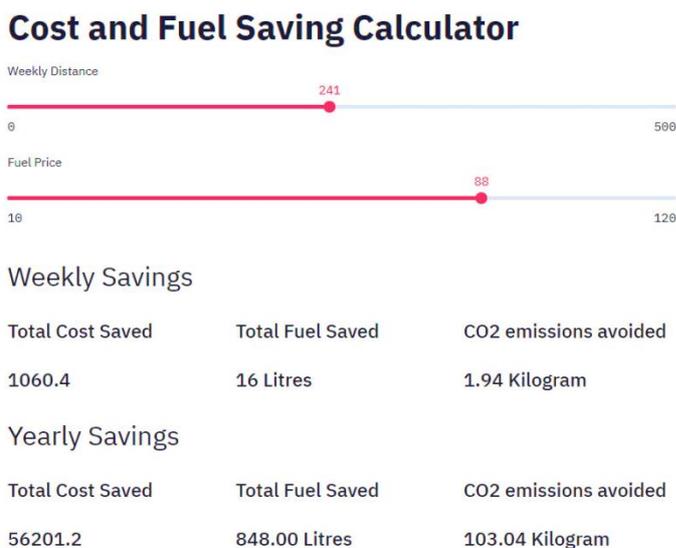


Figure 4. Cost and Fuel saving calculation.

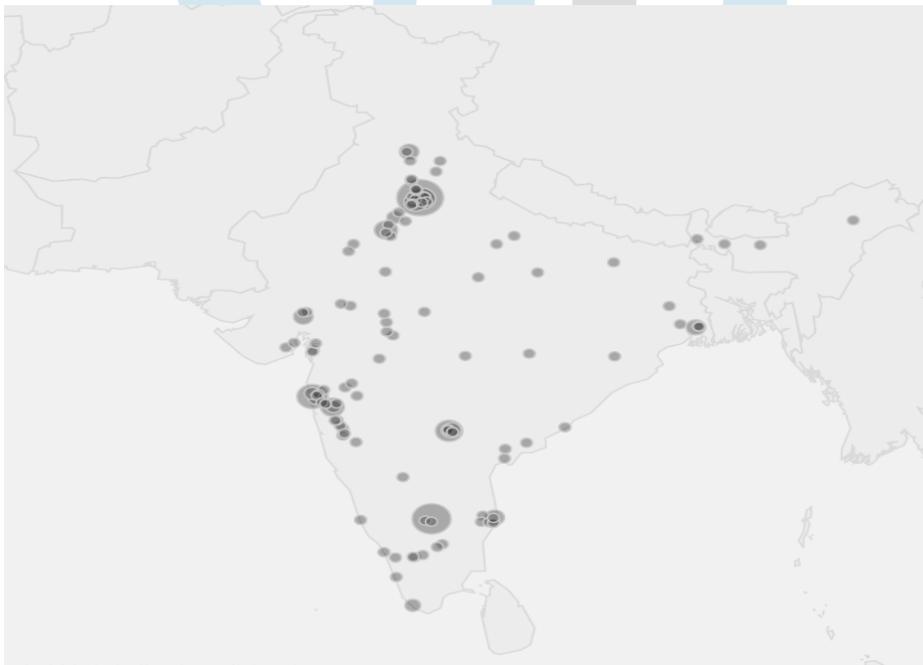
The shift towards cleaner fuel is not only good for environment but is also pocket-friendly for individuals. The one-time investment is currently more expensive than that of the conventional fuel vehicles, but in the long run EV are less costly. A calculator

comparing the amount spent weekly on fuel vehicles and Electric vehicles is demonstrated in (Fig 4) [17]. The user inputs weekly distance to be 241km and Fuel price in his state to be Rs88 to 98. The calculator evaluates how much fuel and money is saved if the user is using Electric Vehicle. The carbon emission avoided is also calculated. Therefore, usage of electric mobility can save 56000Rs yearly and reduce the CO<sub>2</sub> emission by 100Kg per user. This would reduce the greenhouse gases immensely. A picturesque view was observed when vehicles were reduced on the road due to lockdown across the country. The reduction in pollution was very much visible.

## DISCUSSION

The current phase is a very critical period for the electric mobility market. There is a need to attract the customers to buy the EVs and stop using the conventional fuel vehicle. This would help in creating a cleaner environment for the future generations. Conventional fuel vehicles are providing various features to attract the buyers. It's high time that implementations of machine learning and artificial intelligence be involved to enrich the features of electric vehicles. A dashboard consisting of various information regarding EV at one place would be a good leverage to attract the buyers. The dashboard can consist a list of location of charging stations. The GPS modeling can be used to suggest the user about the nearest charging station, availability of connector, connector type and cost. The AI can be used to make prediction regarding the range of EV based on the current charge in the vehicle. A tab can contain all the government policies related to EV of each state. Another tab can be created demonstrating the list of Electric vehicles available in the market, its features and the pricing. All these should be made available to attract customers. The people should feel satisfied with the service provided by the electric mobility sector. The government also plays a crucial role in encouraging the sales of cleaner fuel vehicles and developing the required infrastructure. Together all these factors would shape the future of electric mobility in our country. For example, when we compare the EV scenarios in 2 states of Gujarat and Delhi, we found the following difference: -

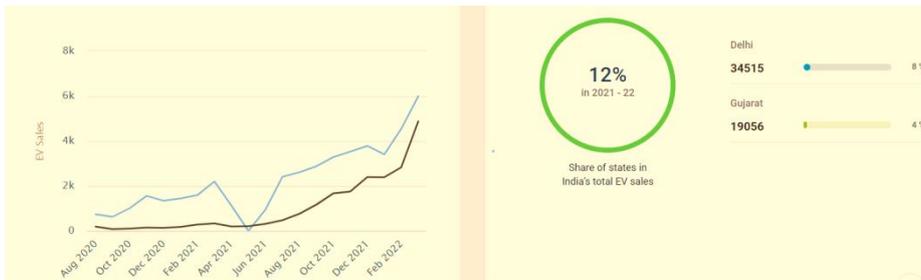
- A. Delhi has its own transportation nodal agency for e-vehicles under the transportation department of government of Delhi where as if we see that Gujrat government doesn't have any special agency with respect to electrical vehicles.
- B. Delhi had started to subsidize on buying manufacturing and on charging stations earlier so they see the results in the further years of 2020-22, whereas Gujarat government didn't have any capital subsidies till early 2020 but after the new Gujarat electric vehicle policies 2021 the sales have surge at a good amount.
- C. Also, we see that the charging infrastructure in Delhi and its surrounding highways is quite stronger than the state of Gujrat which has also a huge impact on the sales of EV's in the state. As no buyer would like his or her vehicle to be stopped in between the rout and if stopped to be taken care of by the government facilities of charging or mobile charging station in the shortest time possible, as not to have any discomfort.



**Figure 5.** Charging station density

We can clearly see in (Fig5) the density of the charging stations distributed across India in which we can clearly see its quite dense in Delhi compared to Gujrat

- D. So, by this we can clearly see that if the people see the benefits and are provided with one it will be easy to transfer from fuel-based vehicles to electrical vehicles,



**Figure 6** Comparison of Gujarat and Delhi Electric vehicle sales

## V. Conclusions

The analysis and the discussion along with different observations has helped us to come to a conclusion stating that the global picture of EV is very bright with most of the European countries mostly converted to the Electric vehicle friendly environment along with the good ranging and efficient EV and have tackled the problems and are still doing so in the efficient manner. The picture in India is quite average in terms of electric vehicles sale, electric vehicles technologies, and the infrastructure required for an electric vehicle friendly environment. Although the initial steps to conquer the problems including the promotion's and indulging the leveraged technologies has been already taken and the work is going on a considerable amount of pace toward having a bright future and replacing the traditional trend of fossil fuel vehicle into the EV and hence reducing the environmental degradation by the government but the thing is that the public will also have to adapt to the new technology as soon as possible so that the future goal can be achieved. The proposed dashboard will inclinedly help the country, users, and the government as well the investors in getting an accurate information, data related to the electric vehicles sale, previous track, developed technologies, effectiveness of government policies, also will help in developing a charging infrastructure with helping in resolving most of the problems with a statistical visualized data's regarding most of the aspects in the sector of electric vehicles in the country just like tcs did for irctc, it will create a competitive atmosphere between the states and with the basic knowledge of electric vehicles all the misconception in public mind will be waved off which will help India become one of the leading electrically lead automobile country .

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