

Electric Revolution:
A State-wise Analysis of Electric Vehicle
Adoption in India

Velani Harsh Sureshbhai
(Student Id: 202319025)



Indian Institute of Remote Sensing
(M.Sc. Agriculture Analytics)

Module Name: - Programming for Geodata Processing

ABSTRACT

The project contains an analysis of Electric vehicle registration in India (2015-2023). This is done using Python Programming language with the help python libraries such as NumPy, Panda, GeoPandas, matplotlib, Pyplot, and Plotly.

Data contains State-wise Yearly registration of vehicles running with all the fuel type from 2015-2023. According to data, the vehicle registration in India is increasing with good pace over the past few years. From 2021 to 2023 vehicle registration is increased from 18.878 to 23.855 million.

I have attempted various visualization related to vehicle registration based on fuel type. The questions are:

1. Percentage share of vehicle registration by Petrol, Diesel, Electric, CNG and other minor Fuel types.
2. Indian Map showing colour gradient based on Total Number of Vehicle Registration.
3. Top 10 States with Electric Vehicle Registration in India 2015-2023.
4. Trend of Electric and Total Vehicle Registration in India from 2015-2023.
5. State-wise Total Vehicle Registration with respect to Fuel Type.
6. State-wise Yearly number of Electric Vehicle Registration.
7. Subplots based on each fuel type showing Trend of Vehicle Registration 2015-2023.

Here, totally I have used 3 datasets, Vehicle Registration in India 2015-2023, Indian shape file and another car dataset. Firstly, I cleaned the datasets by filling the nan values by 0 and also dropped the unwanted columns from the data frame of pandas. And then I made different data frames to plot different graphs to visualize the data more insightful and attractive.

1. Introduction and Datasets:

❖ **Data Source:** I found the Vehicle registration data from official website of Ministry of Road Transport & Highways (MoRTH), Government of India. Data contains State-wise Yearly Registration of Vehicles based on their Fuel Type from 2015-2023.

❖ **Data Source link:**

1) Vehicle registration data is taken from official website of Government of India, Ministry of Road Transport & Highways (MoRTH) Government of India.

vahan.parivahan.gov.in

2) Car dataset from Kaggle

[Kaggle car dataset](#)

This dataset contains information about the total number of Vehicle Registration in India State-wise from 2015-2023 based on Fuel Type of Vehicles. This data contains fuel types Like CNG Only, Diesel, Diesel/Hybrid, Dual Diesel/Bio CNG, Dual Diesel/CNG, Dual Diesel/LNG, Electric, Ethanol, Fuel Cell Hydrogen, LNG, LPG Only, Methanol, Petrol, Petrol/CNG, Petrol/Ethanol, Petrol/Hybrid, Petrol/LPG and Solar. This dataset contains 333 rows and 21 columns.

❖ **Hypothesis:**

- According to the article Maharashtra secured 2nd rank in India for ev vehicle registration.
- Total EV sales jumps 49 percent to 1.529 million units in 2023.
- Increase in Electric Vehicle Registration will affect Other Fuelled Vehicle Registration.

❖ **Data Cleaning and Filtering:**

Datasets contains huge amount of Nan (Not Applicable) values but those NR value we convert into zero (0) and dropped the unwanted columns from the dataset. And filtering is done wherever it was needed.

❖ **Research Questions:**

News Article: Articles are taken from Times of India and The Economic Times respectively talk about increase in Electric Vehicles Registration in last few years.

- 1) According to one of the articles of Times of India, it claims that Maharashtra secured rank 2 in India, has the most e-cars and e-bikes approximately around 4 lakhs in numbers.

[Times of India](#)

- 2) One of the articles of The Economic Times claims in month of January 2024, that EV sales jumps 49 percent to 1.529 million units in 2023: FADA (Federation of Automobile Dealer's Association).

[The Economic Times](#)

❖ **Research Question:**

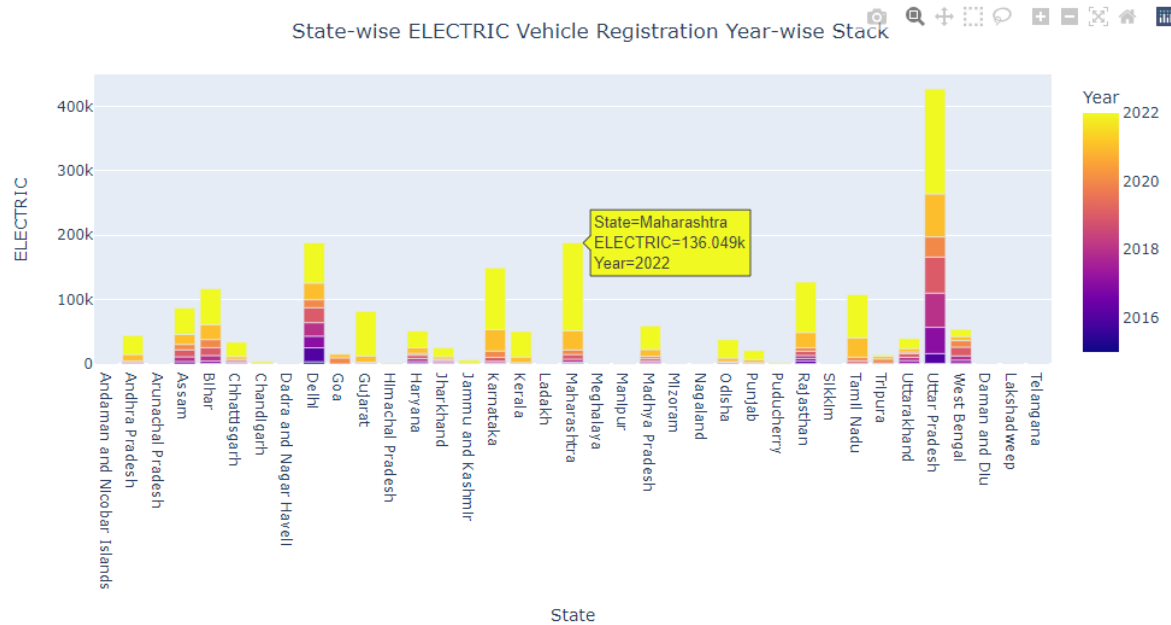
- I. Trend analysis of Electric Vehicle Registration in India State-wise.
- II. To prove both the above claims in news articles.

❖ **Analysis:**

First of all, I read the excel file of vehicle registration using Pandas data frame and cleaned the data by filling the nan values with zero (0) values. And then dropped the unwanted columns from the data and inserted the new column named Total Vehicles Containing the total number of vehicles row-wise.

QUE: 1

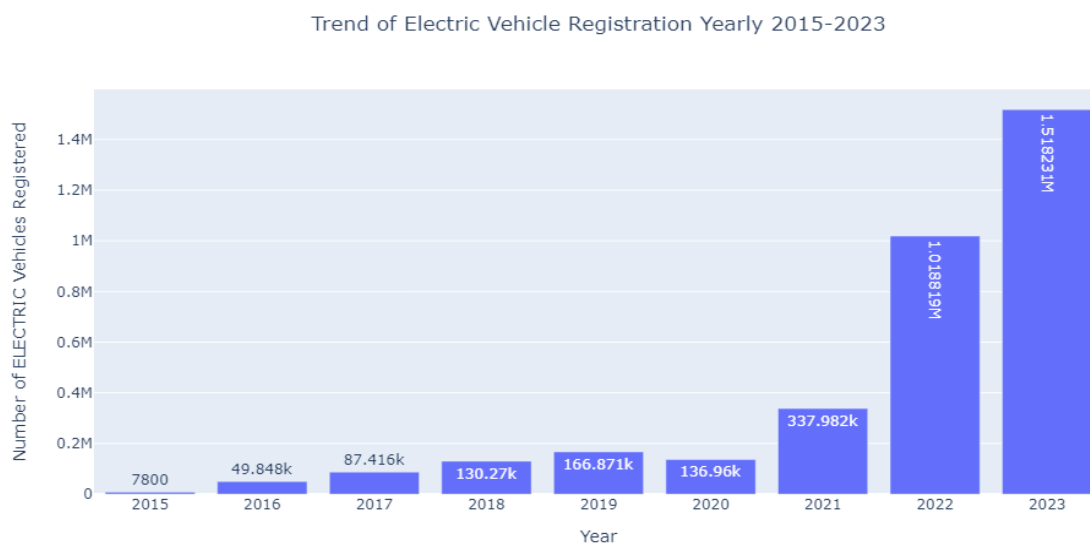
Maharashtra secured rank 2 in India, has the most e-cars and e-bikes approximately around 4 lakhs in numbers.



Here, in the above graph, EV vehicle registration is 136.049k in Maharashtra after Uttar Pradesh with 277.935k in the year 2023. Hence Maharashtra is at second rank after Uttar Pradesh.

QUE: 2

EV sales jumps 49 percent to 1.529 million units in 2023.

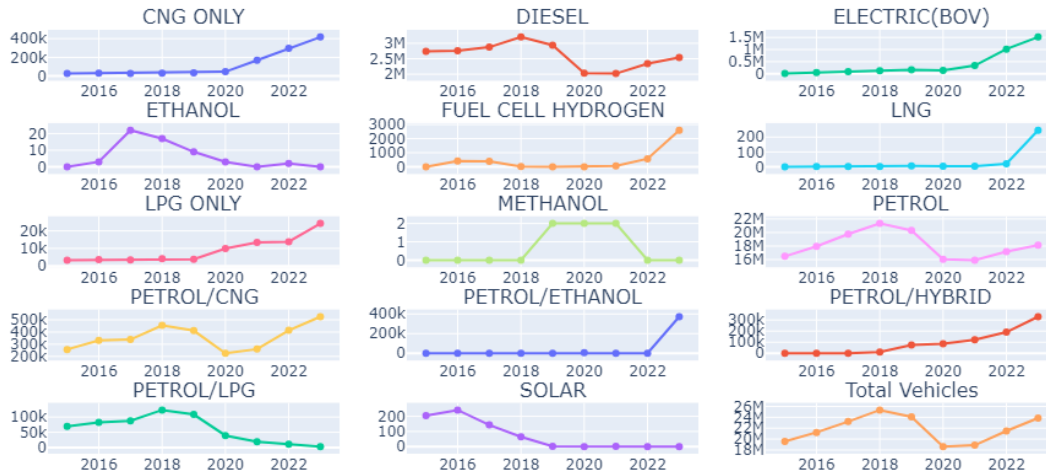


From the above graphs, I can prove the second claim that the EV sales has been increased by approximately 50 % in 2023 from the previous year 2022 with 1.018819 million to 1.518231 million.

QUE: 3

Correlation of vehicle registration based on Fuel Type

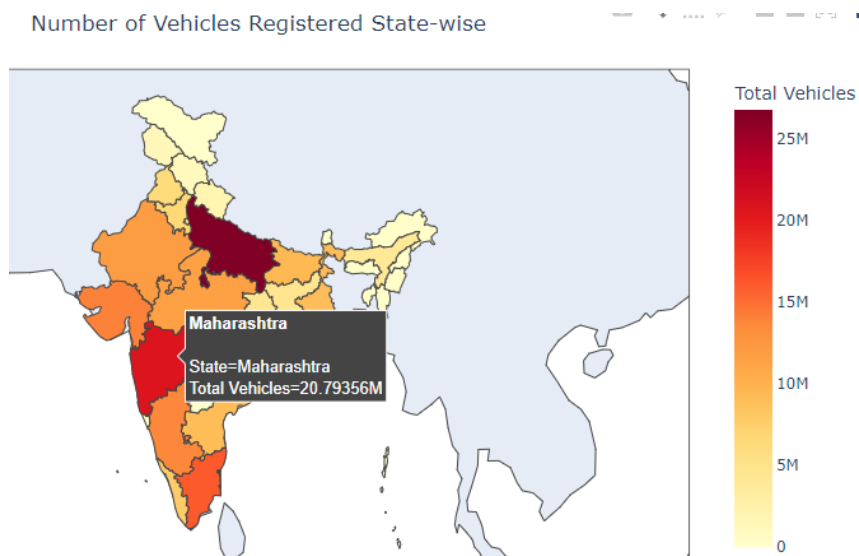
Subplots based on Fuel type showing Trend of Vehicle Registration 2015-2023



From the subplots, I can say that

- Registration of Diesel fuelled vehicle is decreased with increased in Electric and Petrol/CNG fuelled.
- The last subplot of total vehicle registration shows impact of COVID-19 pandemic by decreasing the overall vehicle sales during 2019, 2020 and 2021.
- By observing the Petrol/CNG and Petrol/LPG subplots, it shows that as Petrol/CNG vehicle registration increased, there is decrease in the Petrol/LPG vehicle registration. The reason may be the easy availability and demanded Petrol/CNG fuel than the Petrol/LPG.
- Petrol/CNG also affects the Petrol vehicle registration, because of the fact that Petrol/CNG gives higher average (km/l) than the Petrol vehicles and also the price per litre of CNG and Petrol are much different.

QUE – 4. Indian Map Showing Vehicle Registration State-wise.

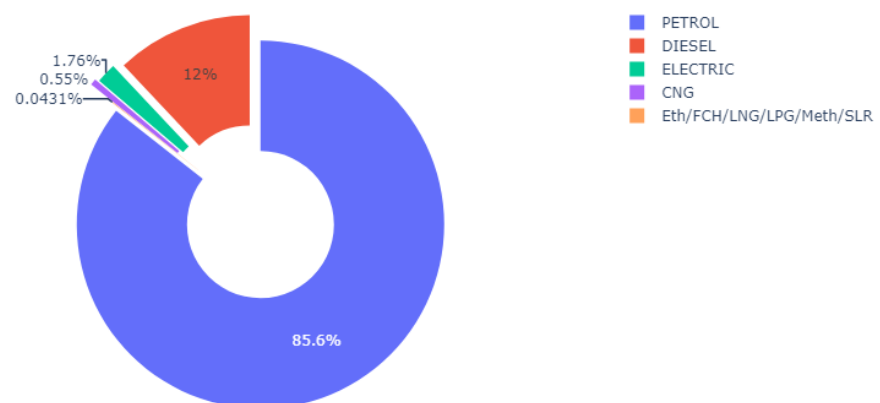


This visualization shows the state-wise Total Number of Vehicle Registration wherever we put the cursor.

Here, I used GeoPandas library to read shape file and visualize the data on Map of India.

QUE-5.

Percentage share of vehicle registration by Petrol, Diesel, Electric, CNG and other minor Fuel types.



From the above chart, I can say that Petrol vehicles registration dominates over all the other fuel type vehicles registration, but from the other visualization, it shows increase in electric, Petrol/CNG

Conclusion:

From the data, I have proved the claims perfectly correct. This is possible because of the genuine data that I got from the Ministry of Road Transport and Highways, Government of India official website. Our dataset almost matches with the claims done in news articles.

From data I can justify that EV sector is growing with a very good pace. Also one of the article in Times of India claims that in India as of August 2023, the overall EV penetration – which is the percentage of EV registrations compared to total vehicle registration in that category had reached 6.5 %. Combinedly, Ladakh, Chandigarh, Chhattisgarh, Assam and Uttar Pradesh had achieved 80% penetration of EV three-wheelers in 2023, while Goa had the highest electric two-wheeler penetration in 2023, at 17%.

From this data, I can conclude that by the coming years, Electric vehicle will dominate over the others which will obviously take time for this. There are many reasons behind this. Some are, least cost per kilometre, higher range with full charge above 400 kms, increase in fuel price, support of government policies on minimising pollution due to vehicles

REFERENCES

- 1) **Vehicle registration data is taken from official website of Government of India, Ministry of Road Transport & Highways (MoRTH) Government of India.**

vahan.parivahan.gov.in

- 2) **Car dataset from Kaggle**

[Kaggle car dataset](#)

- 3) **According to one of the articles of Times of India, it claims that Maharashtra secured rank 2 in India, has the most e-cars and e-bikes approximately around 4 lakhs in numbers.**

[Times of India](#)

- 4) **One of the articles of The Economic Times claims in month of January 2024, that EV sales jumps 49 percent to 1.529 million units in 2023: FADA (Federation of Automobile Dealer's Association).**

[The Economic Times](#)