EV Adoption Analytics

Analyst: Ujjwal Deepak Chavan

Role: Aspiring Data Analyst

Project Period: November 2025

Tools Used: Excel/CSV, SQL, Power BI, Power Query, Data Modelling, DAX Calculations.

Project Overview:

This project analyzes the rapidly growing trend of Electric Vehicle (EV) adoption across major Indian states using SQL, and Power BI. A synthetic dataset (2023–2025) containing EV registrations, charging infrastructure, fuel prices, and demographic indicators was created to derive actionable insights. SQL was used for running analytical queries. Power BI dashboards visualize state-wise EV penetration, manufacturer dominance, charging station density, and month-wise growth trends. The project highlights key drivers of EV adoption and identifies regions with high potential for infrastructure expansion. It serves as a complete end-to-end data analytics case study for strategic decision-making in the EV ecosystem.

Objective:

The key objectives of this project are:
1. To analyze the year-wise growth of EV adoption across major Indian states.
2. To identify significant EV categories and leading manufacturers.
3. To assess the sufficiency and distribution of EV charging infrastructure.
4. To determine the relationship between fuel prices and EV adoption.
5. To build interactive, data-driven dashboards for insights using Power BI.

Significance:

The transition to Electric Vehicles is essential to reduce carbon emissions, fuel dependency, and environmental pollution. Understanding regional EV adoption patterns enables policymakers, manufacturers, and infrastructure providers to make well-informed decisions. This project delivers insights that support planning of new charging stations, identifying consumer trends, and projecting future EV market growth.

Data Dictionary:

Datasets	Key Columns
EV Registrations	Reg_ID, State, District, Vehicle_Type, Manfacturer, Model, Price, Battery Capacity, Range_KM, Registeration_Date.
Charging Stations	Station_ID, State, City, Charger_Type, Latitude, Longitude.
Fuel Prices	State, Price_Date, Petrol_Price, Diesel_Price.
Demographics	State, Population, Per_Capita_Income.

5. SQL Analysis:

Important SQL Queries for Insights:

1. **EV adoption trend (month-wise):**

   ```
   SELECT
       Month(Registration_Date) AS Month,
       Month_Name(Registration_Date) AS Month_Name,
       COUNT(*) AS Total_EVs
   FROM EV_Registrations
   GROUP BY Month, Month_Name
   ORDER BY Month;
   ```

2. **State-wise adoption:**

   ```
   SELECT
        State,
        COUNT(*) AS EV_Count
   FROM EV_Registrations
   GROUP BY State
   ORDER BY EV_Count DESC;
   ```

3. **Top Manufacturers:**

```
SELECT
        Manufacturer,
        COUNT(*) AS Total_Sales
FROM EV_Registrations
GROUP BY Manufacturer
ORDER BY Total_Sales DESC;
```

4. **Fastest growing EV category:**

```
SELECT
        Vehicle_Type,
        COUNT(*) AS Total
FROM EV_Registrations
GROUP BY Vehicle_Type
ORDER BY Total DESC;
```

5. **Correlation between fuel price and EV adoption:**

```
SELECT
    FP.State,
    AVG(FP.Petrol_Price) AS Avg_Petrol,
    COUNT(EVR..Reg_ID) AS EV_Count
FROM Fuel_Prices  AS FP
JOIN EV_Registrations AS EVR
ON FP.State = EVR.State
GROUP BY FP.State;
```

6. Power BI Dashboard Development (ETL to Dax Calculation):

Step 1: Importing Data

1. Open Power BI Desktop.
2. Click Home → Get Data → Text/CSV.
3. Browse and select the datasets.
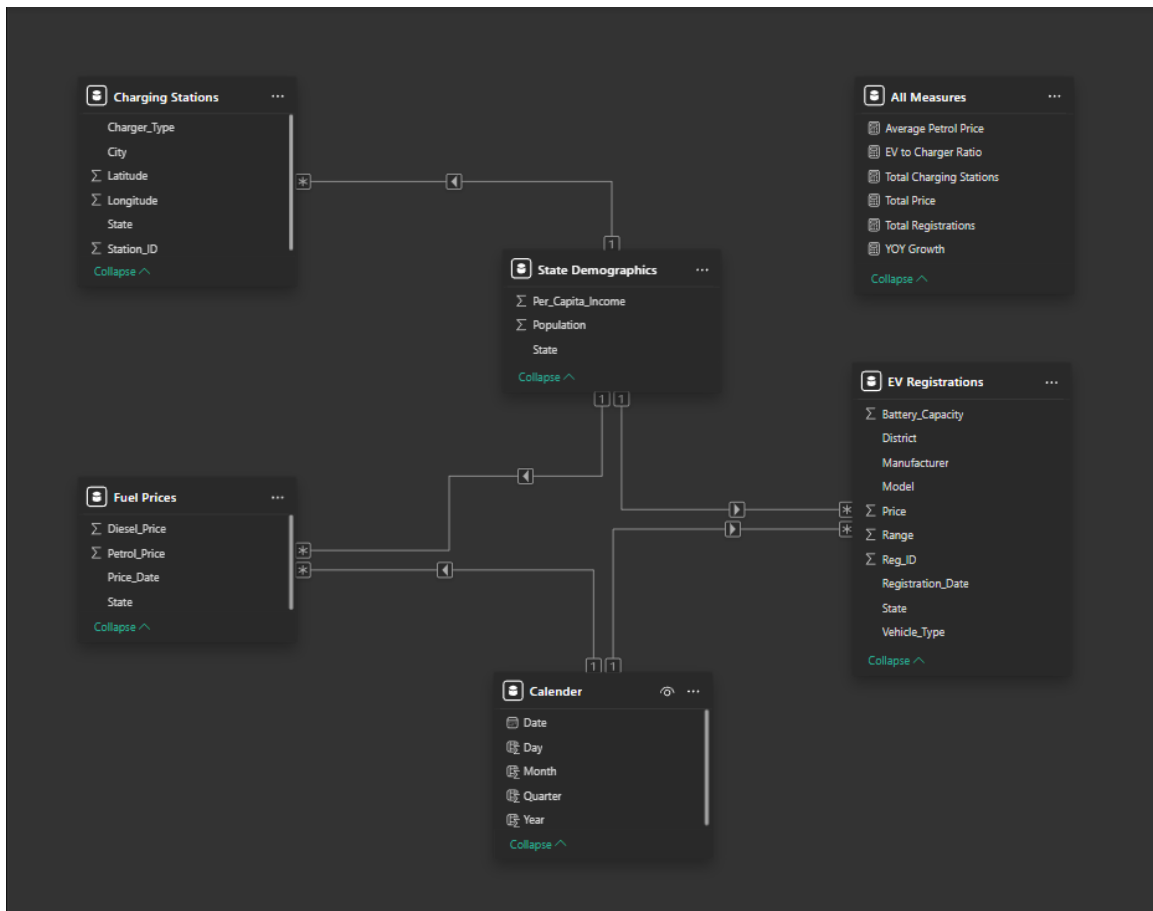4. Load them into Power BI using Transform Data to clean before loading

Purpose: Ensures every file is connected properly and ready for transformation before modelling.

Step 2: Data Transformation (Power Query Editor)

1. Open Power Query Editor – click Transform Data on the Home ribbon.
2. Inspect each dataset to verify column names, data types, and null values.
3. After verifying, click Close & Apply to load cleaned tables into Power BI.

Purpose: The Power Query Editor acts as your ETL tool (Extract → Transform → Load). A well-structured ETL process ensures your visualizations are reliable.

Step 3: Data Modelling

1. Go to Model View (left sidebar).
2. Create relationships:
   - State Demographics [State] → EV Registrations [State]
   - State Demographics [State] → Charging Stations [State]
   - State Demographics [State] → Fuel Prices [State]
3. Confirm all relationships are One-to-Many (→).
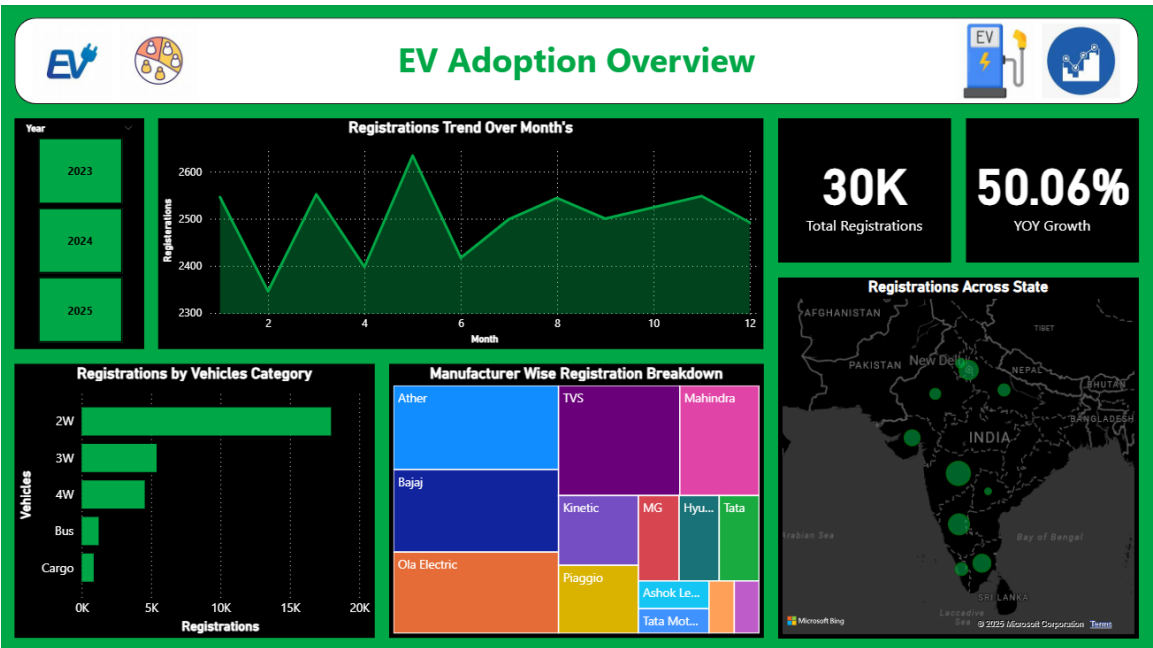
Step 4: Creating Measures (DAX Calculations)

Create new measures under a "All Measures" table:

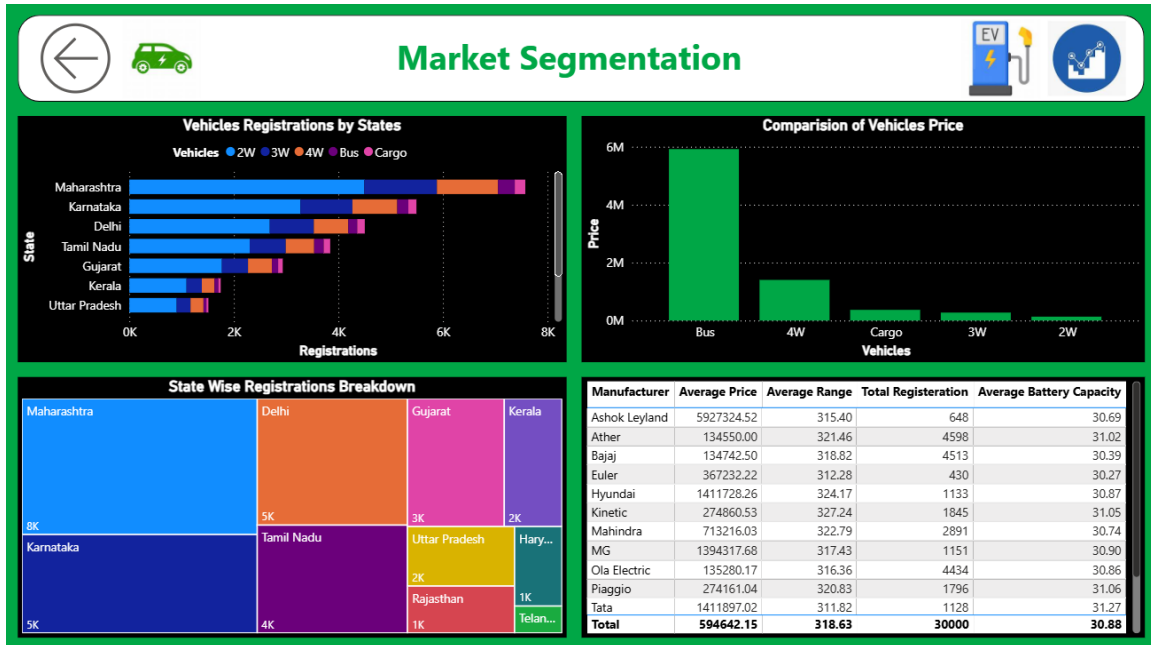| Measure Name	DAX Formula
Average Petrol Price	AVERAGE ('Fuel Prices'[Petrol_Price])
EV to Charger Ratio	DIVIDE (COUNT ('EV Registrations'[Reg_ID]), COUNT ('Charging Stations'[Station_ID]))
Total Charging Stations	COUNT ('Charging Stations'[Station_ID])
Total Price	SUM ('EV Registrations'[Price])
Total Registrations	COUNT ('EV Registrations'[Reg_ID])
YOY Growth	VAR CY = [Total Registrations] VAR PY = CALCULATE ([Total Registrations], SAMEPERIODLASTYEAR ('EV Registrations'[Registration_Date])) RETURN DIVIDE (CY-PY, PY)

Purpose: DAX measures make reports dynamic and scalable. Instead of static calculations, DAX ensures automation across filters and dates.
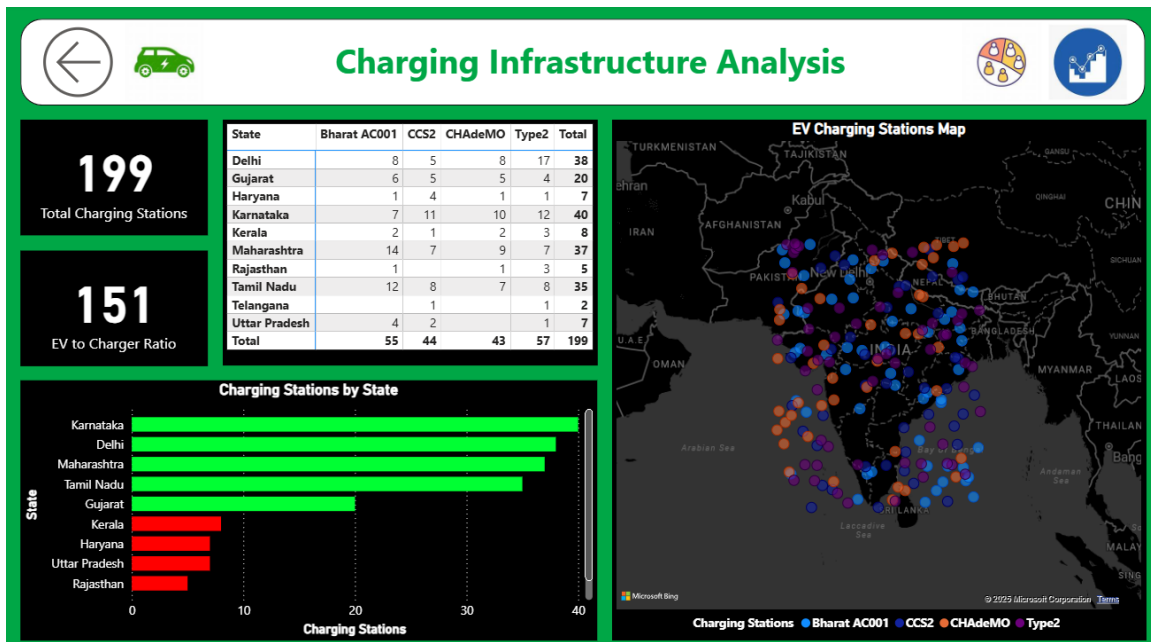
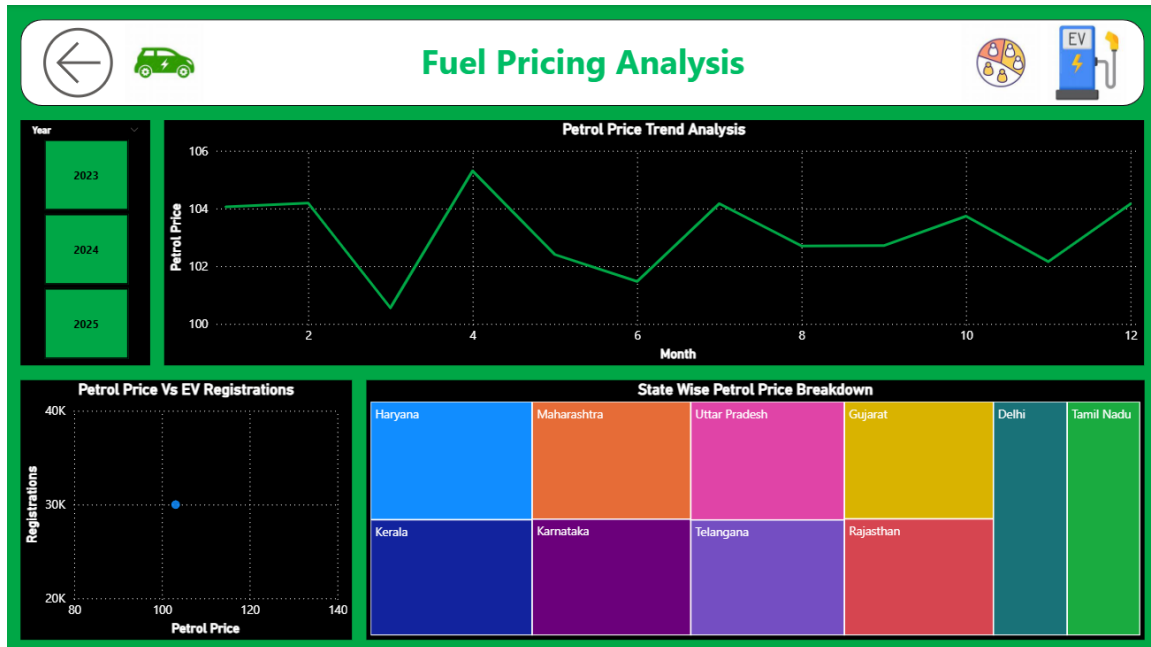# Data Insights and Recommendations:

Insights:

- From 2024-2025, EV adoption is increased by **50.06%** YoY.
- 2W dominate around **60%** of market Share.
- 3W and 4W show strong growth due to improved affordability.

Market Segmentation

Vehicles Registrations by States

Comparision of Vehicles Price

State Wise Registrations Breakdown

Manufacturer	Average Price	Average Range	Total Registeration	Average Battery Capacity
Ashok Leyland	5927324.52	315.40	648	30.69
Ather	134550.00	321.46	4598	31.02
Bajaj	134742.50	318.82	4513	30.39
Euler	367232.22	312.28	430	30.27
Hyundai	1411728.26	324.17	1133	30.87
Kinetic	274860.53	327.24	1845	31.05
Mahindra	713216.03	322.79	2891	30.74
MG	1394317.68	317.43	1151	30.90
Ola Electric	135280.17	316.36	4434	30.86
Piaggio	274161.04	320.83	1796	31.06
Tata	1411897.02	311.82	1128	31.27
Total	**594642.15**	**318.63**	**30000**	**30.88**

- States like **Maharashtra, Karnataka, Delhi** and **Tamil Nadu** show highest adoption.

Charging Infrastructure Analysis

199 Total Charging Stations

151 EV to Charger Ratio

State	Bharat AC001	CCS2	CHAdeMO	Type2	Total
Delhi	8	5	8	17	38
Gujarat	6	5	5	4	20
Haryana	1	4	1	1	7
Karnataka	7	11	10	12	40
Kerala	2	1	2	3	8
Maharashtra	14	7	9	7	37
Rajasthan	1		1	3	5
Tamil Nadu	12	8	7	8	35
Telangana		1		1	2
Uttar Pradesh	4	2		1	7
Total	55	44	43	57	199

Charging Stations by State

EV Charging Stations Map

- Some high-adoption states like **Gujrat, Uttar Pradesh** and **Kerala** lack adequate charging stations.

- Higher fuel prices correlate with higher EV adoption.

Recommendations:

- Expand charging infrastructure in high-growth but low-density states.
- Promote affordable 2W EVs to accelerate rural and semi-urban adoption.
- Increase government incentives for 4W EVs to boost sales.
- EV companies should focus on Maharashtra, Karnataka, Delhi, Tamil Nadu and Gujarat for maximum ROI.
- Expected adoption growth: **30–40% YoY.**

Conclusion:

This project provides valuable insights into India's evolving Electric Vehicle ecosystem. By analyzing EV registrations, fuel prices, charging infrastructure, and demographics, the study identifies emerging market trends and improvement areas. The insights help governments, automobile manufacturers, and charging service providers plan effectively for the future of sustainable transportation.