



ELECTRIC VEHICLES SALES BY STATE IN INDIA

(USING PYTHON, MATPLOTLIB, SEABORN)

DEEPAK SEN

INTRODUCTION

Why EV Sales Are Important in India :

India is at a turning point in its transition to sustainable transportation. The rise in electric vehicle (EV) sales is driven by the need to reduce air pollution, oil dependency, and carbon emissions while boosting economic growth and innovation. With increasing urbanization and fuel prices, EVs offer a cleaner, more cost-effective alternative to traditional vehicles.

1. Environmental Impact :

- India is home to 22 of the world's 30 most polluted cities. Shifting to EVs can significantly cut carbon emissions and improve air quality.
- Unlike petrol and diesel vehicles, EVs have zero tailpipe emissions, reducing harmful pollutants like CO₂, NO₂, and PM2.5.

2. Energy Independence

- India imports over 85% of its crude oil, spending billions of dollars annually.
- EVs, powered by renewable energy sources like solar and wind, can reduce oil dependency and strengthen energy security.

3. Economic Growth & Job Creation

- The EV industry is generating new jobs in battery manufacturing, charging infrastructure, and vehicle production.
- Startups and global companies are investing in India's EV sector, boosting innovation and local production.

4. Cost Savings for Consumers

- EVs have lower running costs compared to petrol/diesel cars, as electricity is cheaper than fossil fuels.
- Government subsidies and tax benefits make EVs more affordable for buyers.

EV Growth Trends in India :

- **Rapid Growth:** India's EV market grew by **over 150% in the last two years**, with more than **1.5 million EVs sold in 2023** alone.
- **2-Wheelers Leading the Way:** **Electric scooters and bikes** account for over **60% of EV sales**, driven by affordability and convenience.
- **Rising EV Adoption in Cities:** Delhi, Maharashtra, and Karnataka are leading in EV registrations due to strong policies and infrastructure.
- **Expansion in Charging Infrastructure:** Over **10,000+ new charging stations** were installed in the last year, reducing range anxiety.

Government Policies Boosting EV Adoption :

FAME II (Faster Adoption and Manufacturing of Electric Vehicles) Scheme

- ₹10,000 crore allocated for EV subsidies, reducing prices for consumers.
- Incentives for **electric two-wheelers, three-wheelers, and buses**.

PLI (Production-Linked Incentive) Scheme

- ₹18,000 crore incentive for battery and EV manufacturing.
- Encourages global and Indian manufacturers to invest in EV production.

State-Level Incentives

- **Delhi:** No road tax & registration fees for EVs.
- **Maharashtra & Gujarat:** Direct subsidies on EV purchases.

Target for 2030

- **EVs to make up 30% of all vehicle sales.**
- 100% electrification of **public transport and government fleets.**

OBJECTIVE

This project aims :

- To **analyze and forecast EV sales across Indian states**, helping businesses, policymakers, and investors make **data-driven decisions** to accelerate EV adoption.
- **Uncover Market Trends** – Identify the states leading in EV adoption and those lagging behind.
- **Analyze Consumer Preferences** – Understand how vehicle **class, category, and type** influence purchasing patterns.
- **Actionable Insights** – Provide recommendations to **boost EV penetration** and make India a global EV hub.
- **Predict Future Sales** – Build a **machine learning model** to forecast EV demand based on historical trends.

DATASET INFORMATION

The dataset contains the following columns:

- **Year:** The year of the sales.
- **Month Name:** The month in which sales occurred.
- **Date:** The specific date of the sales.
- **State:** The state in India where the sales occurred.
- **Vehicle Class:** The class of the vehicle (e.g., sedan, SUV, etc.).
- **Vehicle Category:** The category of the vehicle (e.g., commercial, passenger).
- **Vehicle Type:** The type of the vehicle (e.g., 2-wheeler, 4-wheeler).
- **EV Sales Quantity:** The quantity of EV sales.

EV_Dataset.csv: Contains state-level data on EV sales, including vehicle types and categories, offering a comprehensive view of EV distribution across Indian states.

Import Necessary Libraries and Loading Dataset

Importing the necessary libraries

✓
Os

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

Load the dataset into dataframe

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```
[7] df = pd.read_csv('/content/Electric Vehicle Sales by State in India.csv')
df.head()
```



	Year	Month_Name	Date	State	Vehicle_Class	Vehicle_Category	Vehicle_Type	EV_Sales_Quantity
0	2014.0	jan	1/1/2014	Andhra Pradesh	ADAPTED VEHICLE	Others	Others	0.0
1	2014.0	jan	1/1/2014	Andhra Pradesh	AGRICULTURAL TRACTOR	Others	Others	0.0
2	2014.0	jan	1/1/2014	Andhra Pradesh	AMBULANCE	Others	Others	0.0
3	2014.0	jan	1/1/2014	Andhra Pradesh	ARTICULATED VEHICLE	Others	Others	0.0
4	2014.0	jan	1/1/2014	Andhra Pradesh	BUS	Bus	Bus	0.0

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```
[32] df.tail()
```



	Year	Month_Name	Date	State	Vehicle_Class	Vehicle_Category	Vehicle_Type	EV_Sales_Quantity
96840	2023	dec	2023-12-01	Andaman & Nicobar Island	MOTOR CAR	4-Wheelers	4W_Personal	1.0
96841	2023	dec	2023-12-01	Andaman & Nicobar Island	MOTOR CYCLE/SCOOTER-USED FOR HIRE	2-Wheelers	2W_Shared	5.0
96842	2023	dec	2023-12-01	Andaman & Nicobar Island	OMNI BUS	Bus	Bus	0.0
96843	2023	dec	2023-12-01	Andaman & Nicobar Island	THREE WHEELER (GOODS)	3-Wheelers	3W_Goods	0.0
96844	2023	dec	2023-12-01	Andaman & Nicobar Island	THREE WHEELER (PASSENGER)	3-Wheelers	3W_Shared	0.0

Concise Summary of The Dataset

✓ [21] df.shape
0s

↗ (96845, 8)

✓ [34] df.index
0s

↗ RangeIndex(start=0, stop=96845, step=1)

✓ [22] df.columns
0s

↗ Index(['Year', 'Month_Name', 'Date', 'State', 'Vehicle_Class',
 'Vehicle_Category', 'Vehicle_Type', 'EV_Sales_Quantity'],
 dtype='object')

✓ [23] df.info()
0s

↗ <class 'pandas.core.frame.DataFrame'>
RangeIndex: 96845 entries, 0 to 96844
Data columns (total 8 columns):

#	Column	Non-Null Count	Dtype
0	Year	96845 non-null	float64
1	Month_Name	96845 non-null	object
2	Date	96845 non-null	object
3	State	96845 non-null	object
4	Vehicle_Class	96845 non-null	object
5	Vehicle_Category	96845 non-null	object
6	Vehicle_Type	96845 non-null	object
7	EV_Sales_Quantity	96845 non-null	float64

dtypes: float64(2), object(6)
memory usage: 5.9+ MB

✓
0s



```
df.describe()
```



	Year	Date	EV_Sales_Quantity
count	96845.000000	96845	96845.000000
mean	2018.622768	2019-01-28 11:00:33.641385728	37.108896
min	2014.000000	2014-01-01 00:00:00	0.000000
25%	2016.000000	2016-08-01 00:00:00	0.000000
50%	2019.000000	2019-02-01 00:00:00	0.000000
75%	2021.000000	2021-09-01 00:00:00	0.000000
max	2024.000000	2024-01-01 00:00:00	20584.000000
std	2.895581	NaN	431.566675



Data Cleaning & Preprocessing :- Checking Null Values and Cleaning

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#Checking Null Values

```
df_null_value = df.isnull().sum()  
print(df_null_value)
```



```
Year          0  
Month_Name    0  
Date          0  
State         0  
Vehicle_Class 0  
Vehicle_Category 0  
Vehicle_Type  0  
EV_Sales_Quantity 1  
dtype: int64
```

✓
0s

[22] # Cleaning Null Values

```
Cleaning_Nullvalues = df.dropna(inplace = True)
```

Checking Duplicate Values



```
# Checking Null Values After Cleaning  
df.isnull().sum()
```



	0
Year	0
Month_Name	0
Date	0
State	0
Vehicle_Class	0
Vehicle_Category	0
Vehicle_Type	0
EV_Sales_Quantity	0
dtype: int64	

✓
0s



```
# Checking Duplicate Value  
df[df.duplicated(keep = False)]
```



Year	Month_Name	Date	State	Vehicle_Class	Vehicle_Category	Vehicle_Type	EV_Sales_Quantity
------	------------	------	-------	---------------	------------------	--------------	-------------------



Data Transformation

```
[24] # Year Dtype is Float so converting in INT  
df['Year'].astype(int)
```



	Year
0	2014
1	2014
2	2014
3	2014
4	2014
...	...
96840	2023
96841	2023
96842	2023
96843	2023
96844	2023

96845 rows × 1 columns

✓
0s



```
# Date is given in object so changing in Datetime Format  
pd.to_datetime(df['Date'], errors = 'coerce')
```



	Date
0	2014-01-01
1	2014-01-01
2	2014-01-01
3	2014-01-01
4	2014-01-01
...	...
96840	2023-12-01
96841	2023-12-01
96842	2023-12-01
96843	2023-12-01
96844	2023-12-01

96845 rows × 1 columns

```
▶ old_columns = ['Month_Name', 'State', 'Vehicle_Class', 'Vehicle_Category', 'Vehicle_Type']  
df[old_columns] = df[old_columns].astype('category')
```

[+ Code](#)[+ Text](#)

```
[27] df.info()
```



```
<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 96845 entries, 0 to 96844  
Data columns (total 8 columns):  
#   Column                Non-Null Count  Dtype  
---  -  
0   Year                  96845 non-null  int64  
1   Month_Name            96845 non-null  category  
2   Date                  96845 non-null  datetime64[ns]  
3   State                  96845 non-null  category  
4   Vehicle_Class          96845 non-null  category  
5   Vehicle_Category       96845 non-null  category  
6   Vehicle_Type           96845 non-null  category  
7   EV_Sales_Quantity      96845 non-null  float64  
dtypes: category(5), datetime64[ns](1), float64(1), int64(1)  
memory usage: 2.7 MB
```

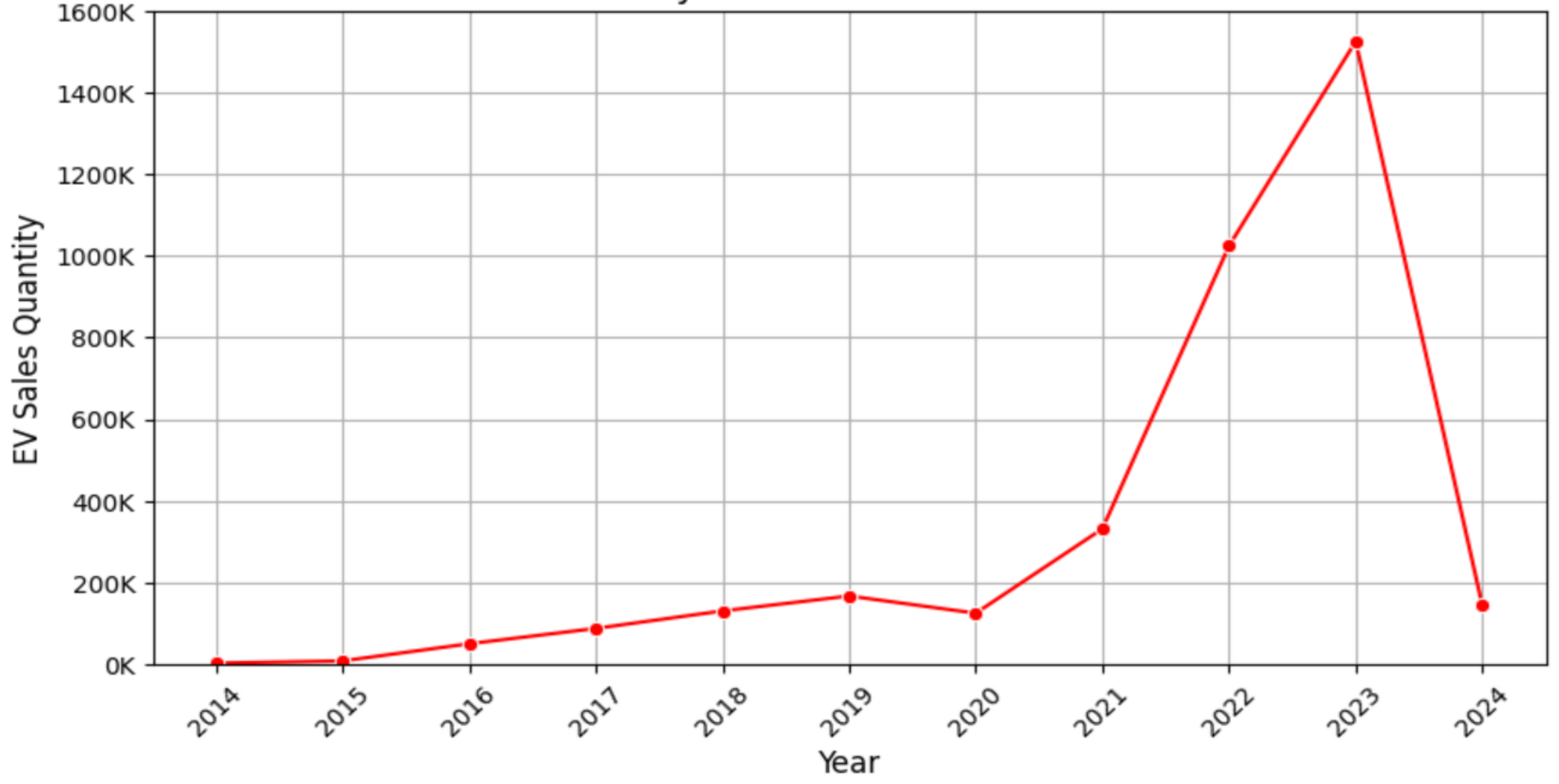

Data Visualization (Using Tableau) :- Yearly EV Sales Trends In India

```
df_grouped = df.groupby('Year')['EV_Sales_Quantity'].sum().reset_index()  
print(df_grouped)
```

	Year	EV_Sales_Quantity
0	2014	2392.0
1	2015	7805.0
2	2016	49855.0
3	2017	87420.0
4	2018	130254.0
5	2019	166819.0
6	2020	124684.0
7	2021	331498.0
8	2022	1024723.0
9	2023	1525179.0
10	2024	143182.0

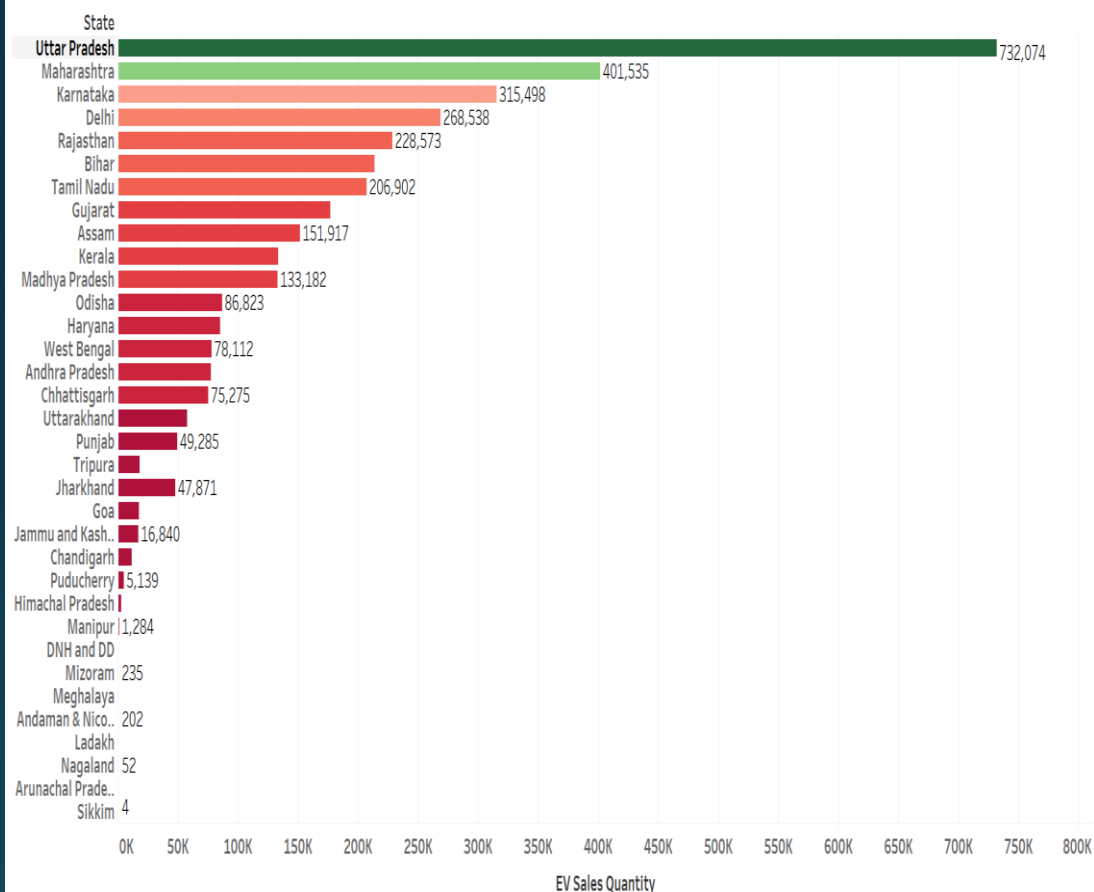
```
plt.figure(figsize=(10, 5))  
  
sns.lineplot(x='Year', y='EV_Sales_Quantity', data=df_grouped, marker='o', linestyle='-', color='r', markersize=6)  
  
plt.xlabel('Year', fontsize=12)  
plt.ylabel('EV Sales Quantity', fontsize=12)  
plt.title('Yearly EV Sales Trend in India', fontsize=14)  
plt.grid(True)  
plt.xticks(df_grouped['Year'], rotation=45)  
# Set Y-axis limits from 0K to 1600K  
plt.ylim(0, 1600000)  
  
# Format Y-axis to show values in 'K' (thousands)  
plt.yticks([0, 200000, 400000, 600000, 800000, 1000000, 1200000, 1400000, 1600000],  
           ['0K', '200K', '400K', '600K', '800K', '1000K', '1200K', '1400K', '1600K'])  
  
plt.show()
```

Yearly EV Sales Trend in India

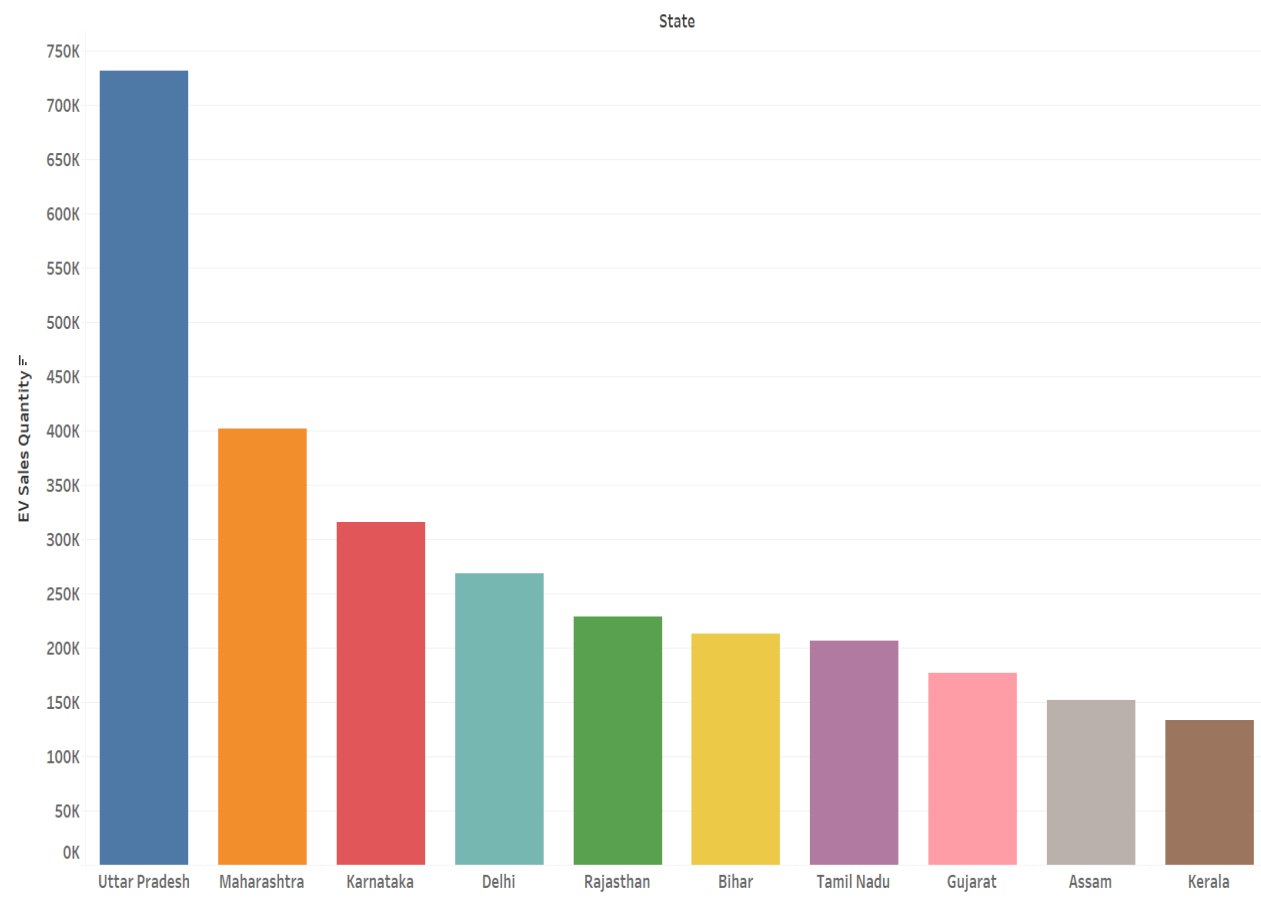


EV Sales By State of India & Top 10 State by EV Sale

"EV Sales Quantity by State: A Comparative Analysis"

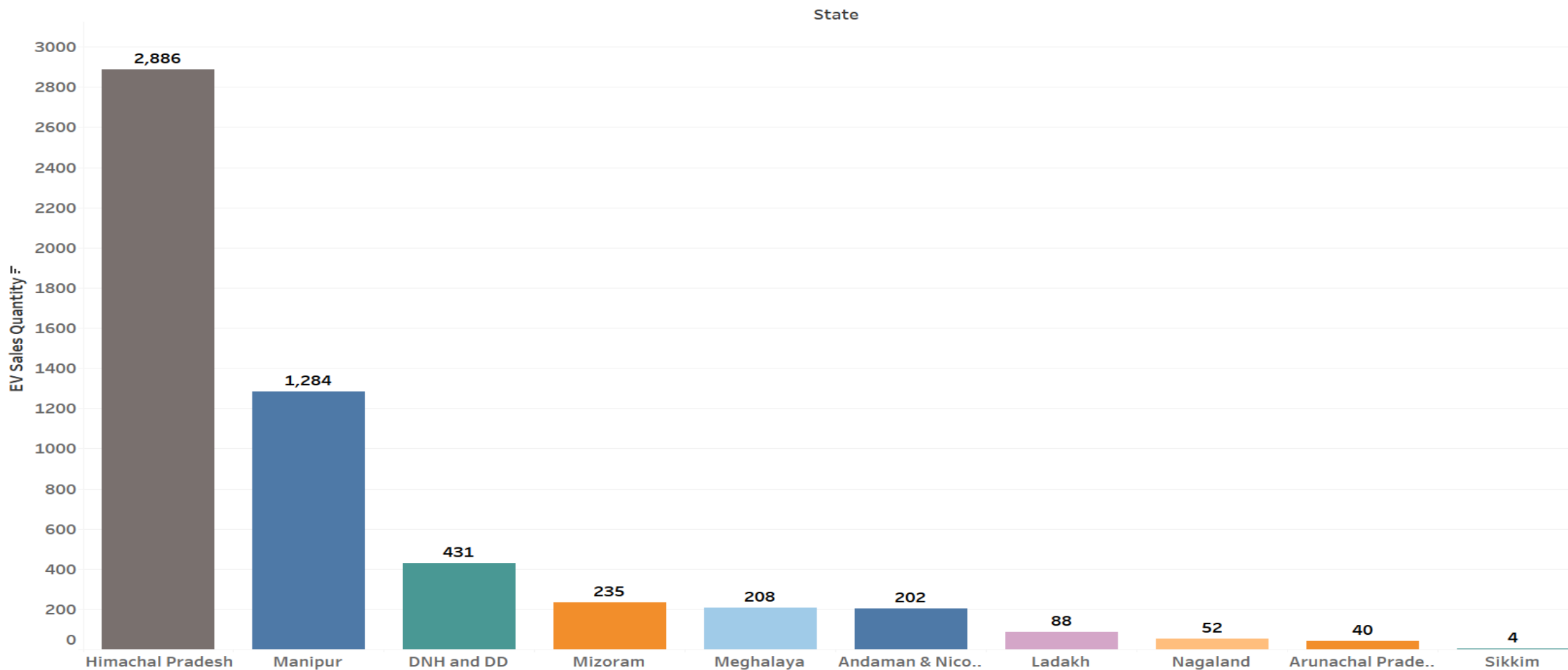


Top 10 States by EV Sale



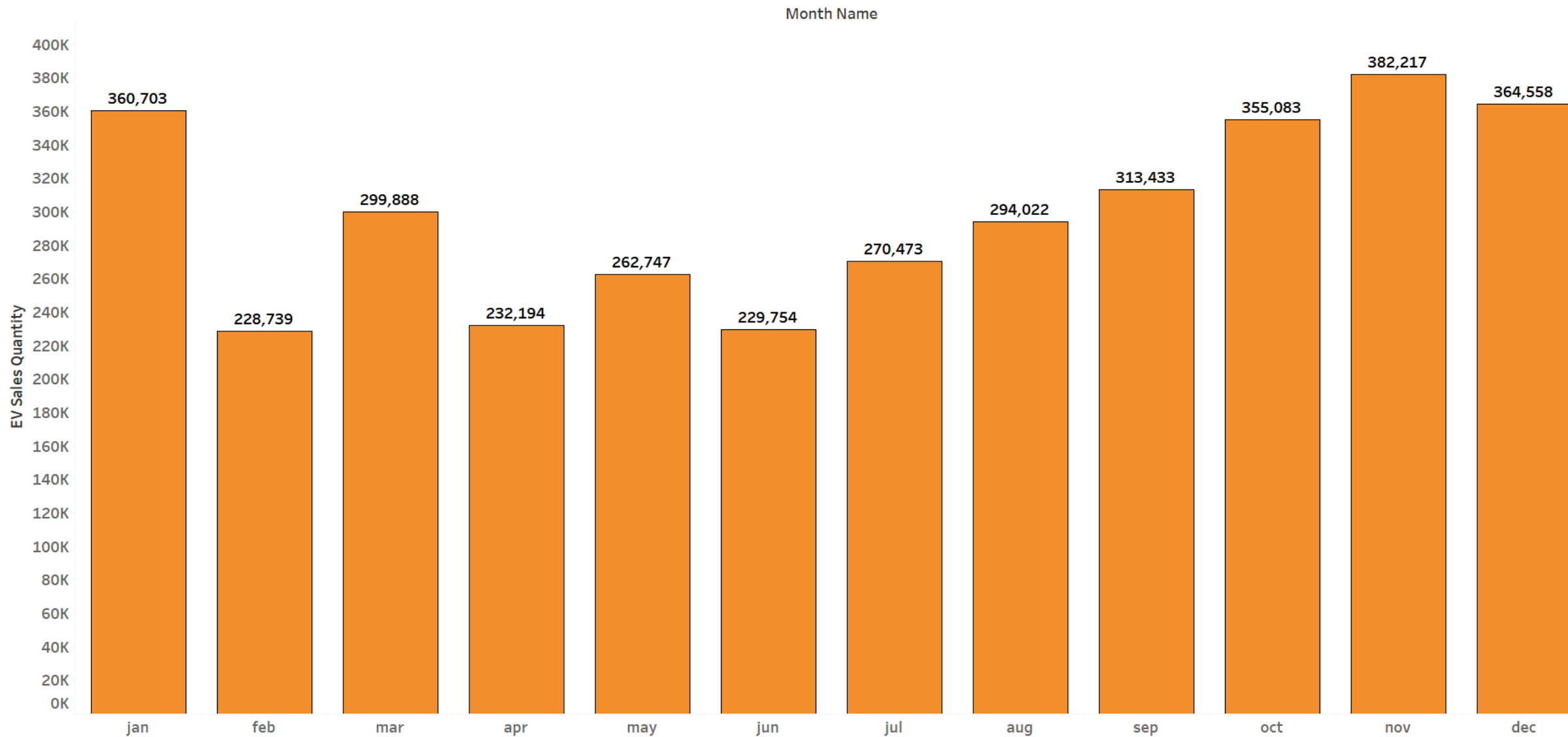
Bottom 10 State By EV Sale

Bottom 10 State By EV Sales



Monthly Trends in EV Sales

Monthly Trends in EV Sales

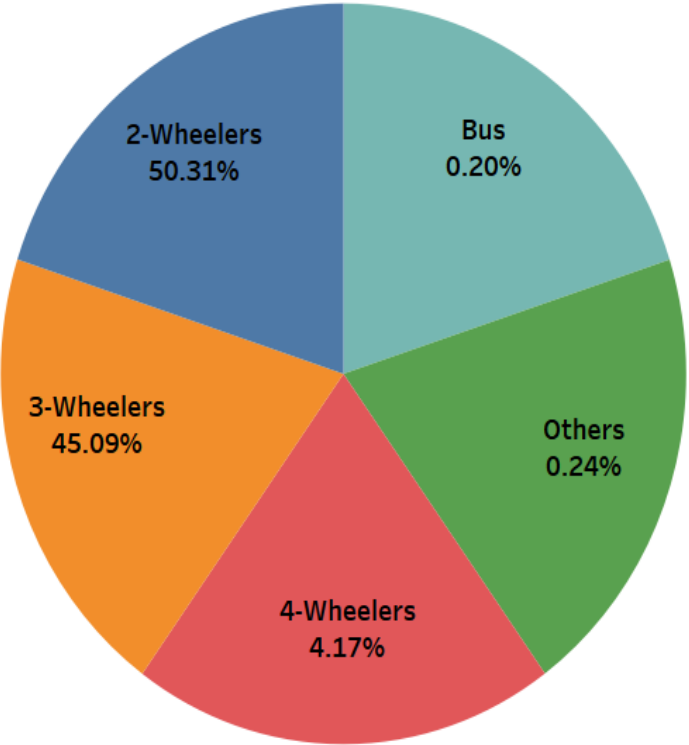


EV Sales According to Vehicle Class, Vehicle Category and Vehicle Type

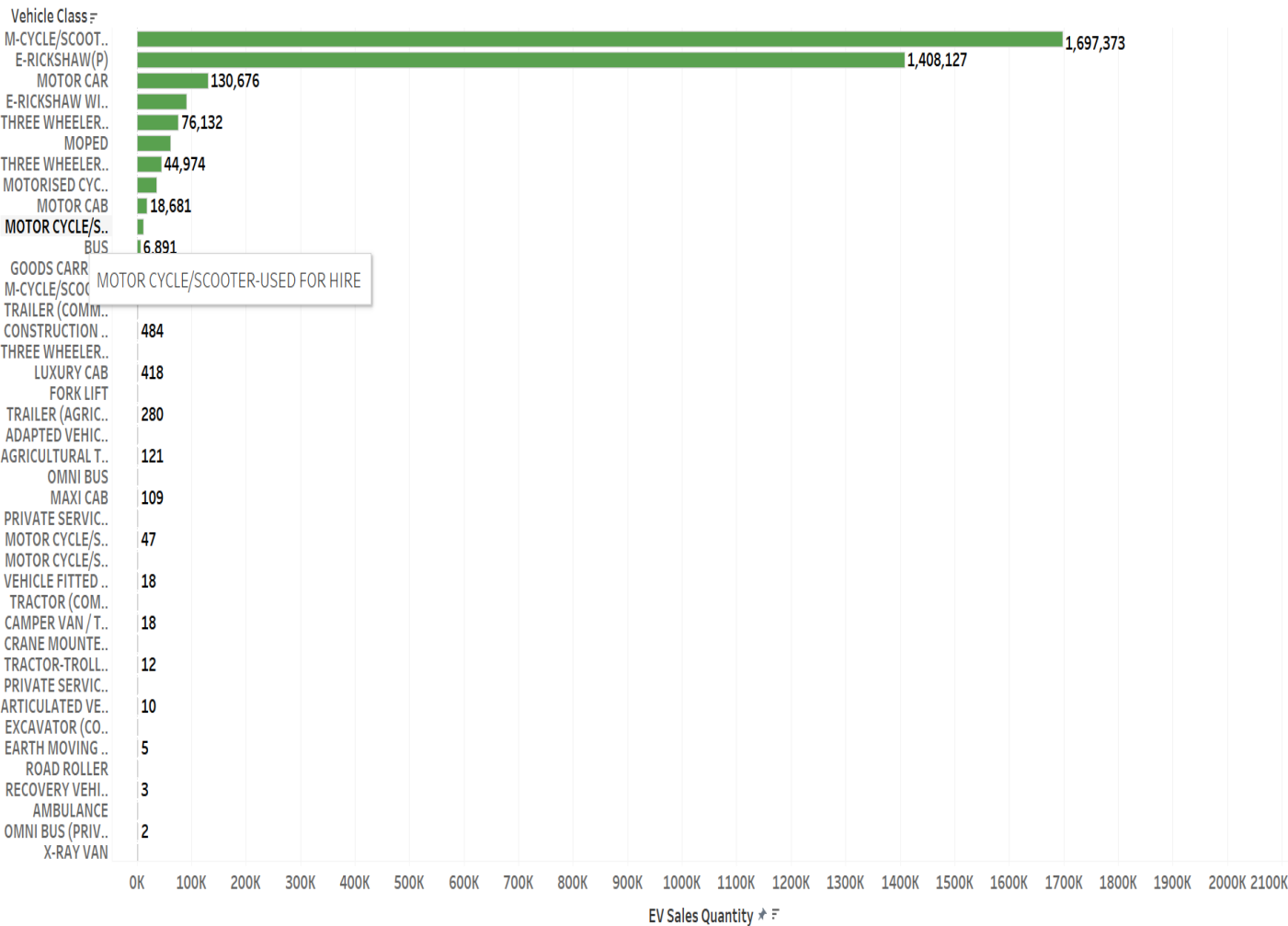
Percentile Distribution of EV Sales Across Categories

Vehicle Catego..

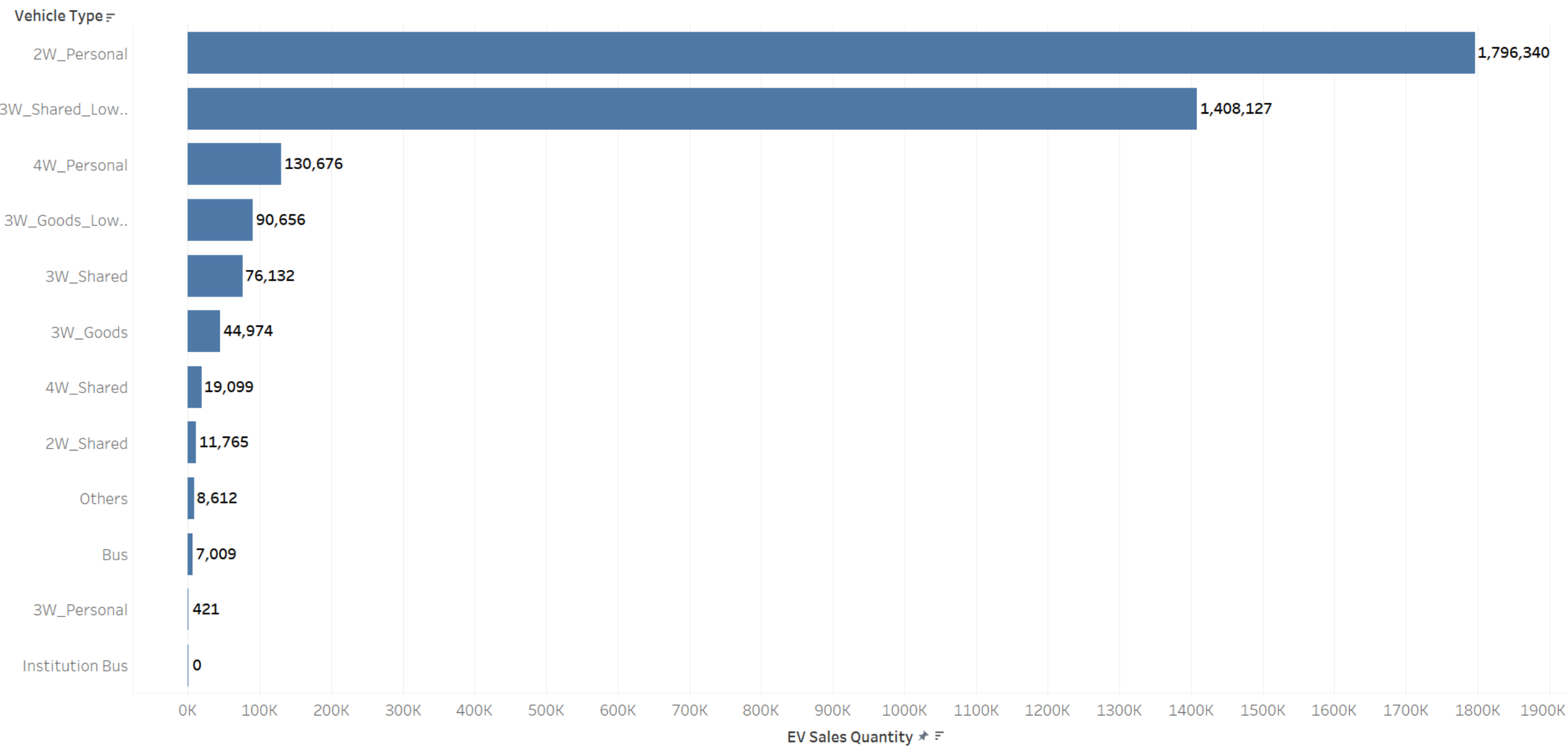
- Bus
- Others
- 4-Wheelers
- 3-Wheelers
- 2-Wheelers



EV Sales Trends by Vehicle Class



"EV Sales Quantity by Vehicle Type"



KEY INSIGHTS

- EV sales in India have grown from 2,392 units in 2014 to over 1.5 million in 2023, showing a significant shift toward electric mobility. This trend highlights the increasing consumer preference for EVs and the expanding market.
- While sales were relatively low until 2020, they saw an exponential rise after 2021, surpassing 1 million in 2022. This indicates a strong shift toward EV adoption, likely driven by increasing availability and demand.
- A decline in EV sales was observed in 2020 before a strong rebound in 2021. This could be due to factors such as supply chain disruptions, reduced consumer spending, or shifts in industry dynamics.
- Sales figures for 2024 appear lower but may be incomplete. Given past trends, EV adoption is expected to continue rising with advancements in battery technology and increased awareness.

- Some states, such as Uttar Pradesh, Maharashtra, and Karnataka, have significantly higher EV sales compared to others. This could be due to factors such as population density, urbanization, or state-level EV policies, though further investigation is required.
- Certain states have lower EV sales, which may be influenced by factors like infrastructure, consumer demand, or economic conditions. However, without additional data, the exact reasons cannot be determined.
- The **two-wheeler** and **three-wheeler** segments dominate EV sales, making up the majority of the market. Passenger and commercial EVs are also growing but at a slower pace compared to smaller vehicles.
- Monthly EV sales patterns indicate that **sales often peak in the last quarter of the year**. This could be due to festive season purchases, year-end government incentives, or corporate fleet expansions.
- In **2020, EV sales declined compared to 2019**, likely due to the economic slowdown and supply chain disruptions caused by COVID-19. However, post-pandemic, there was a strong rebound in 2021, showing resilience in the EV sector.

EV
ELECTRIC
VEHICLE

THANK YOU!

EV



THANK
YOU

