

EV Market Segmentation Analysis

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Git link: https://github.com/patilanirudh/Market_Segmentation

Problem Statement:

As the technology is evolving on daily basis, people are moving from fuelled vehicles to electric vehicles, which in turn is cost cutting and is helping in cutting down the pollution rate.

This report is a walkthrough of market segmentation analysis of electric vehicle and the task is to gather data, analyse geographic, demographic, psychographic, behavioural factors, and other segments, which can be targeted for EV sales growth.

WHY EV?

Low Running cost

- The running cost of an electric vehicle is much lower than an equivalent petrol or diesel vehicle.
- Electric vehicles use electricity to charge their batteries instead of using fossil fuels like petrol or diesel.
- Electric vehicles are more efficient, and that combined with the electricity cost means that charging an electric vehicle is cheaper than filling petrol or diesel for your travel requirements.
- Using renewable energy sources can make the use of electric vehicles more eco-friendly. The electricity cost can be reduced further if charging is done with the help of renewable energy sources installed at home, such as solar panels.

Low maintenance cost

Electric vehicles have very low maintenance costs because they don't have as many moving parts as an internal combustion vehicle. The servicing requirements for electric vehicles are lesser than the conventional petrol or diesel vehicles. Therefore, the yearly cost of running an electric vehicle is significantly low.

Zero Tailpipe Emissions

Driving an electric vehicle can help you reduce your carbon footprint because there will be zero tailpipe emissions. You can reduce the environmental impact of charging your vehicle further by choosing renewable energy options for home electricity.

Tax and financial benefits

Registration fees and road tax on purchasing electric vehicles are lesser than petrol or diesel vehicles. There are multiple policies and incentives offered by the government depending on which state you are in.

Creates very little noise

The electric vehicles run at almost no noise hence decreasing the sound pollution and environmentally friendly.

No exhaust, spark plugs

No exhaust, hence no air, sound pollution; as it runs on electrical energy, there is no need of any spark plug.

Data Sources

Kaggle and other search engine platforms were used to gather data and it was loaded as csv file to do the analysis.

Data Pre-processing:

There are some basic libraries needed for analysis like:

- Numpy
- Pandas
- Matplotlib
- Seaborn

Segment Extraction:

- Basic concepts of are used like EDA and other visualization techniques using libraries like seaborn and matplotlib.
- Different approaches can be used to determine the model efficiency like regression/classification, KNN/ K-means clustering etc
- Model can be optimized using hypertuning, grid search and random search. Tuned model gives better performance compared to untuned.
- Standardization and normalization can be used depending upon the problem statement.

Profiling segments:

Exploratory data analysis was performed to get the sementation analysis as follows

Data loading

```
In [2]: df=pd.read_csv("data.csv")
```

Data sample

df											
	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack Kwh	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	460	70.0	161	940	Yes	AWD	Type 2 CCS
1	Volkswagen	ID.3 Pure	10.0	160	270	45.0	167	250	Yes	RWD	Type 2 CCS
2	Polestar	2	4.7	210	400	75.0	181	620	Yes	AWD	Type 2 CCS
3	BMW	IX3	6.8	180	360	74.0	206	560	Yes	RWD	Type 2 CCS
4	Honda	e	9.5	145	170	28.5	168	190	Yes	RWD	Type 2 CCS
...
97	Nissan	Ariya 63kWh	7.5	160	330	63.0	191	440	Yes	FWD	Type 2 CCS
98	Audi	e-tron S Sportback 55 quattro	4.5	210	335	86.5	258	540	Yes	AWD	Type 2 CCS

Checking null values

```
df.isnull().sum()
```

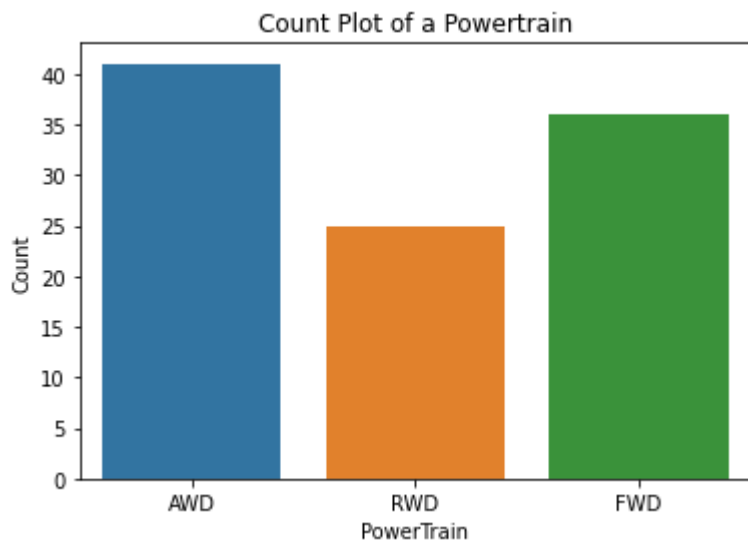
```
Brand          0
Model          0
AccelSec       0
TopSpeed_KmH   0
Range_Km       0
Battery_Pack_Kwh 0
Efficiency_WhKm 0
FastCharge_KmH 0
RapidCharge    0
PowerTrain     0
PlugType       0
BodyStyle      0
Segment        0
Seats          0
PriceEuro      0
INR            0
dtype: int64
```

Data Description

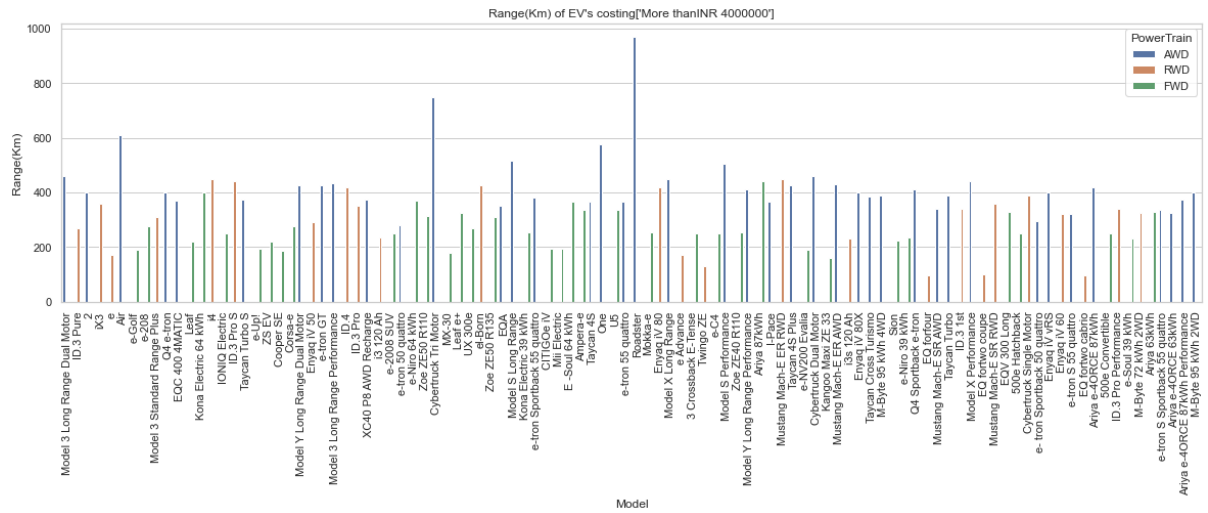
```
df.describe()
```

	AccelSec	TopSpeed_KmH	Range_Km	Battery_Pack_Kwh	Efficiency_WhKm	FastCharge_KmH	Seats	PriceEuro	INR
count	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	102.000000	1.020000e+02
mean	7.391176	179.313725	338.627451	65.415686	189.303922	435.686275	4.882353	55997.588235	4.583352e+06
std	3.031913	43.771228	126.700623	29.955782	29.679072	220.447384	0.799680	34250.724403	2.803391e+06
min	2.100000	123.000000	95.000000	16.700000	104.000000	0.000000	2.000000	20129.000000	1.647541e+06
25%	5.100000	150.000000	250.000000	43.125000	168.000000	260.000000	5.000000	34414.750000	2.816816e+06
50%	7.300000	160.000000	340.000000	64.350000	180.500000	440.000000	5.000000	45000.000000	3.683210e+06
75%	9.000000	200.000000	400.000000	83.700000	204.500000	557.500000	5.000000	65000.000000	5.320192e+06
max	22.400000	410.000000	970.000000	200.000000	273.000000	940.000000	7.000000	215000.000000	1.759756e+07

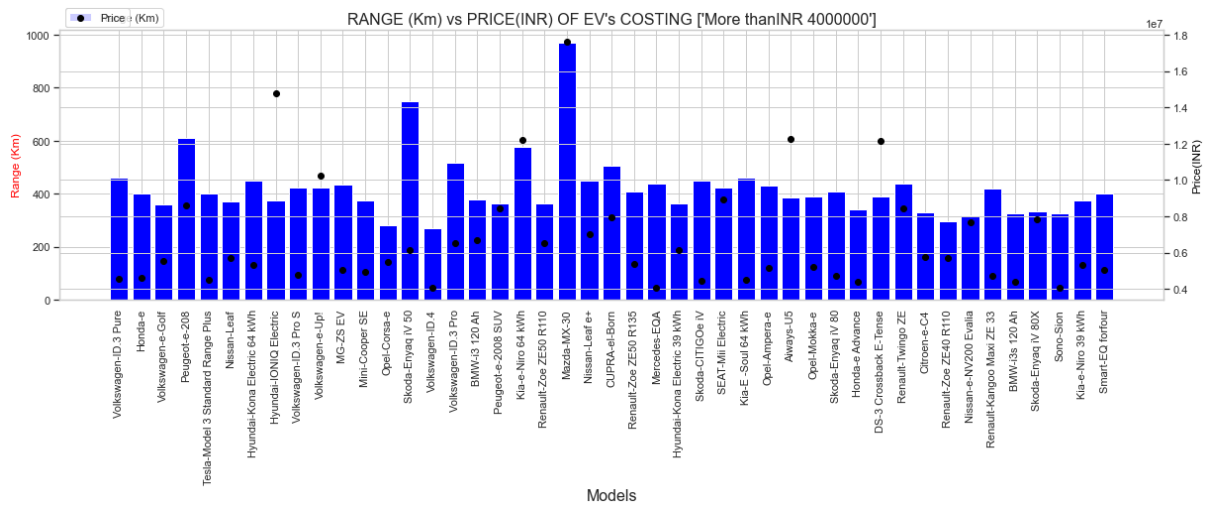
Visualizations



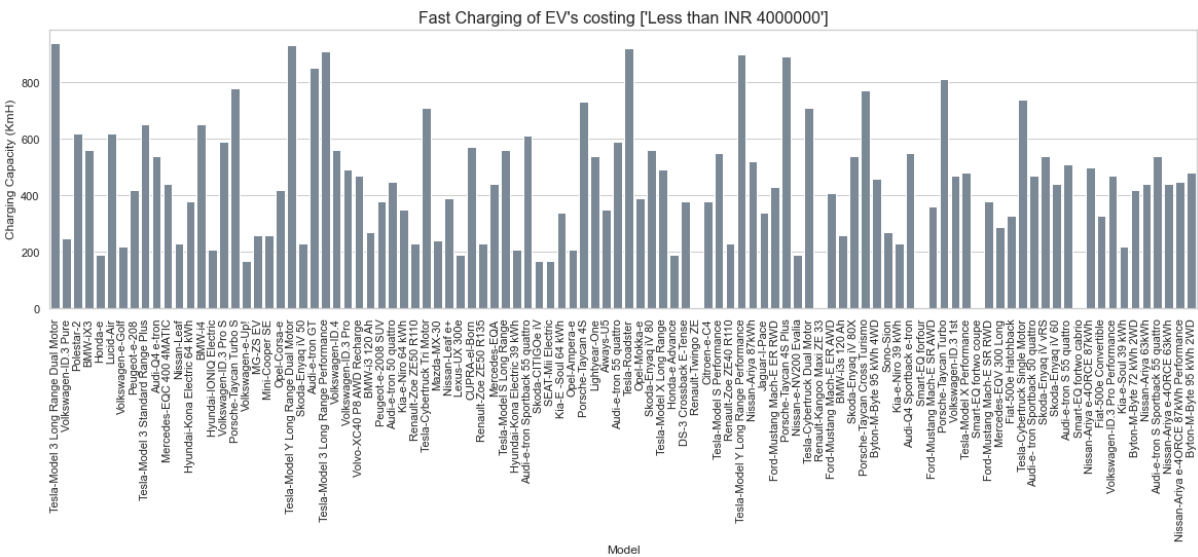
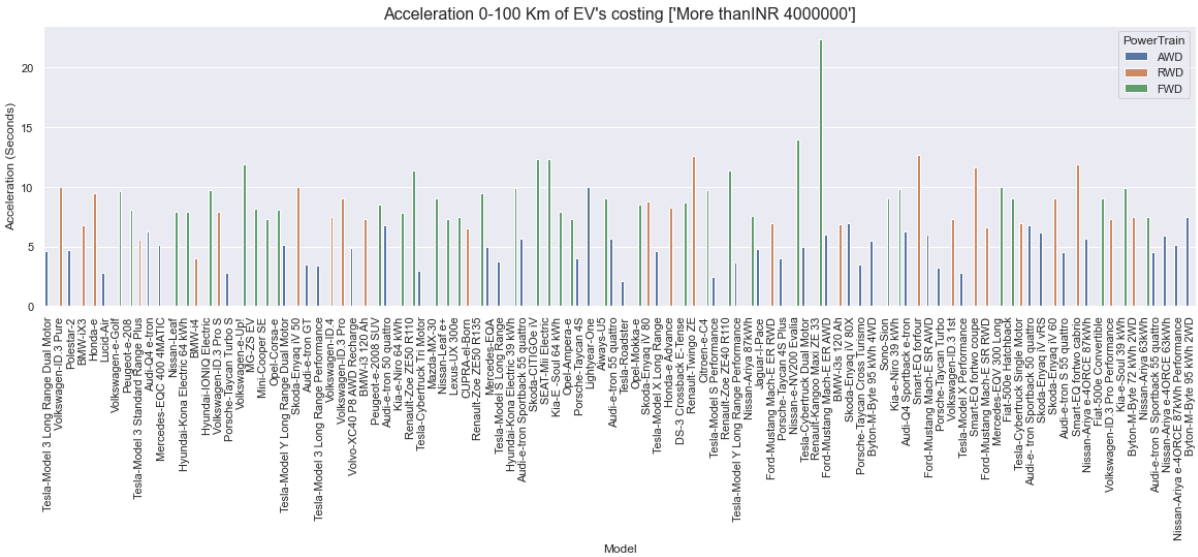
Heatmap



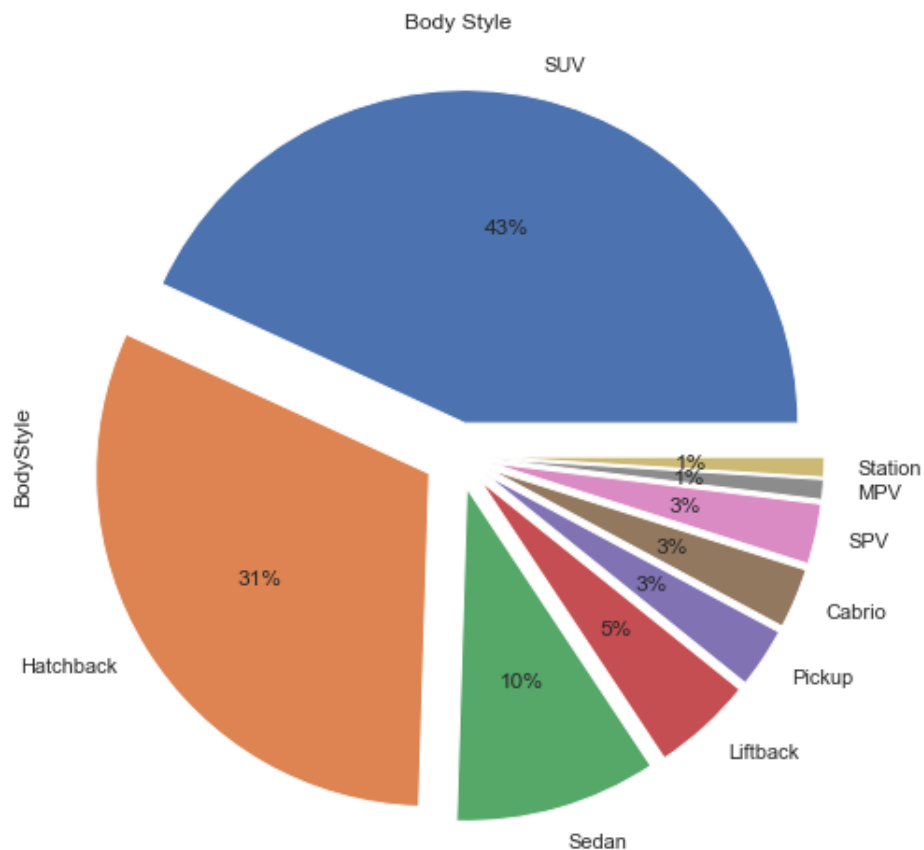
Range vs Price analysis



Charging and Acceleration Analysis



Body Style Segmentation



Factors Affecting an EV start up in India for an EV start up there are some other factors which may affect its business. To analyse these factors we have divided our segments state wise. Some of the factors considered in our report are:

1. Percentage of Tax Exemption given by the respective State/UT
2. Subsidy Amount(in INR) given by the respective State/UT
3. Fuel(Petrol and diesel) prices in the respective State/UT
4. Pollution/Air Quality of the respective State/UT

An EV company can put up their showroom in the region where the state is giving maximum Tax Exemption and Subsidy as this would be helpful in business point of view. It can also put up their showroom where the fuel prices are high as people in those states/UT's would be

looking for another alternative than paying huge prices for the fuel. In environment point of view an EV company start their business in the region whose air quality is not good or poor, people over there would be also willing to decrease the pollution rate by switching their means of transport from fuel to electric, This would be helpful for both company and the environment.

Market Definition

Body Type - It includes buses, light commercial vehicles, medium& heavy-duty vehicles, medium and heavy-duty buses, trucks, M&HDT.

Engine Type - Hybrid and electric vehicles are vehicles that run on batteries and use one or more electric motors for propulsion. .

Fuel Type - Hybrid and electric vehicles include HEV, PHEV, BEV, and FCEV.

Sub Body Type - Under this category, buses, heavy-duty commercial trucks, light commercial pickup trucks, light commercial vans, and medium-duty commercial trucks have been included.

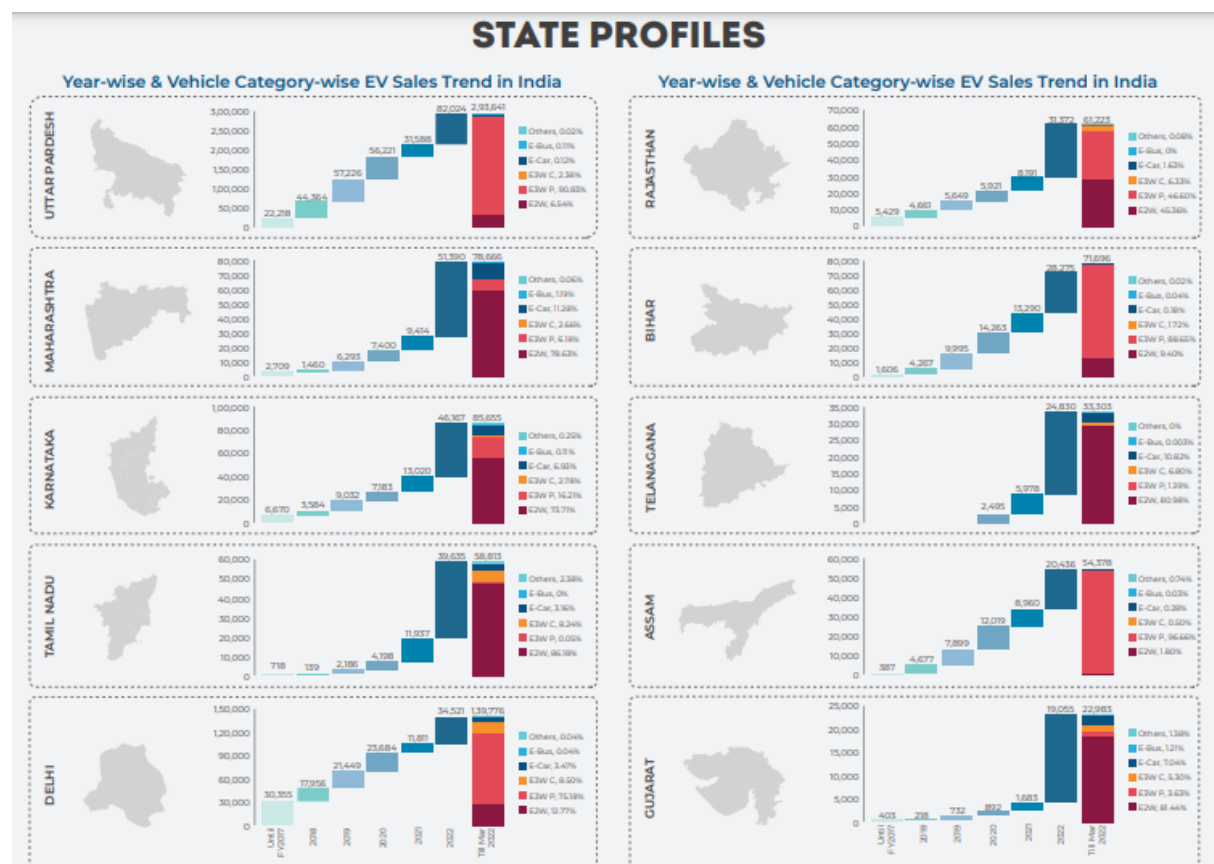
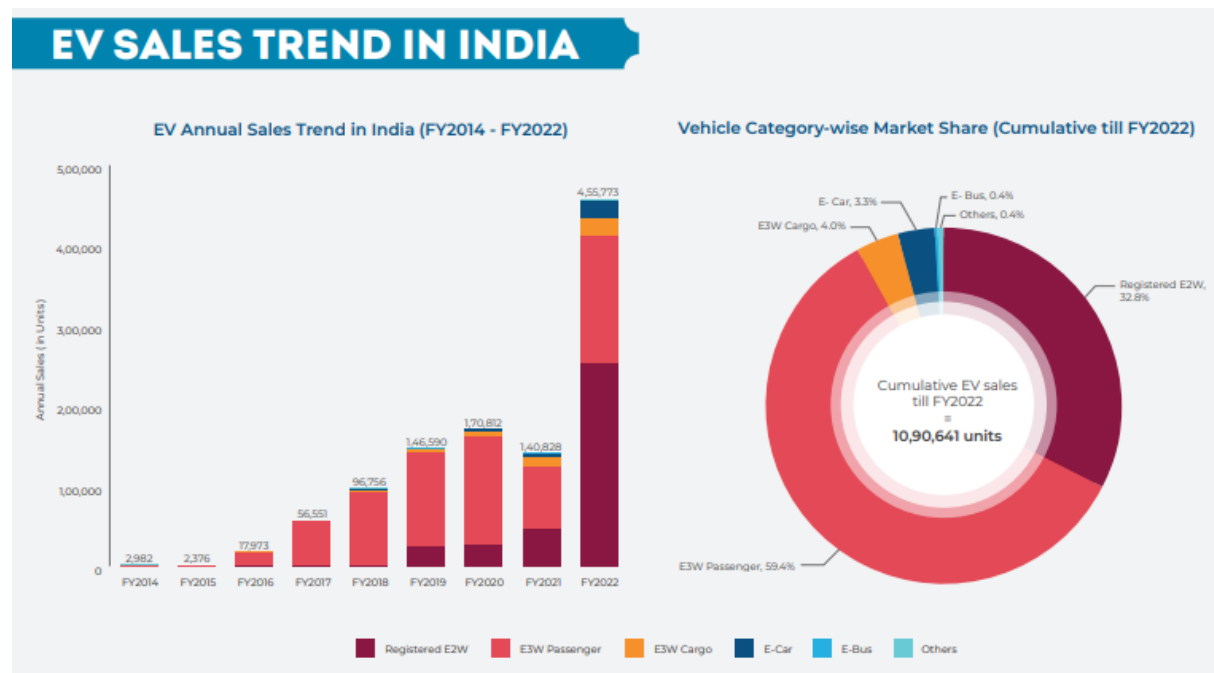
Vehicle Type - It includes passenger vehicles, commercial vehicles, and two wheelers.

Selection of target segment

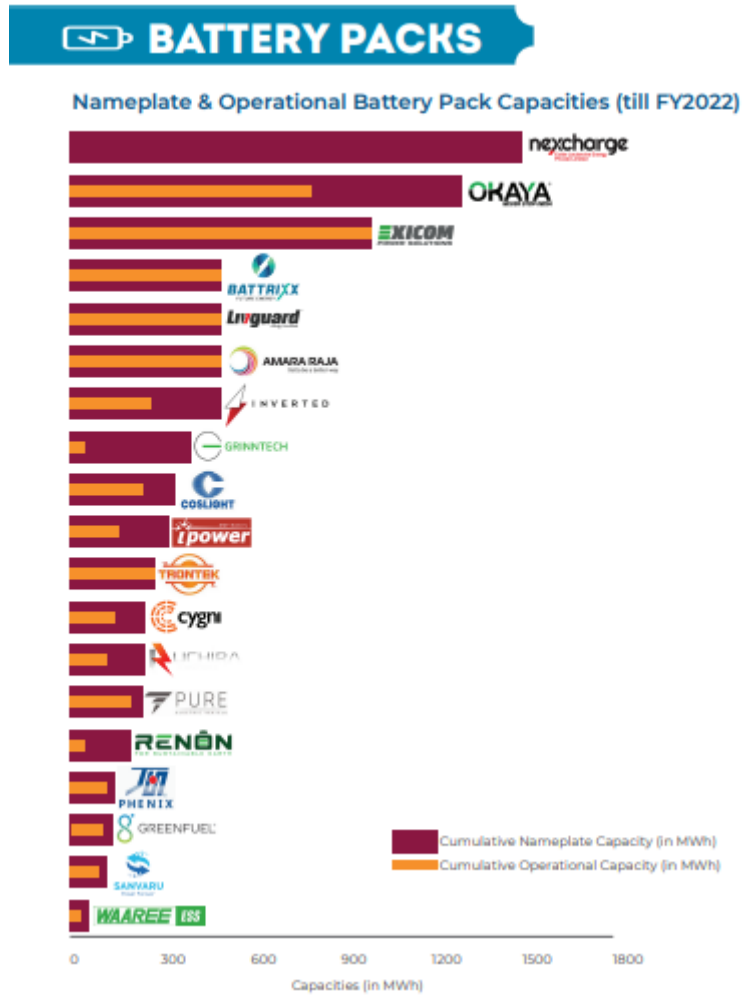
A target market is the specific group of people you want to reach with your marketing message. They are the people who are most likely to buy your products or services, and they are united by some common characteristics, like demographics and behaviors.

The more clearly you define your target market, the better you can understand how and where to reach your ideal potential customers. You can start with broad categories like millennials or single dads, but you need to get much more detailed than that to achieve the best possible conversion rates.

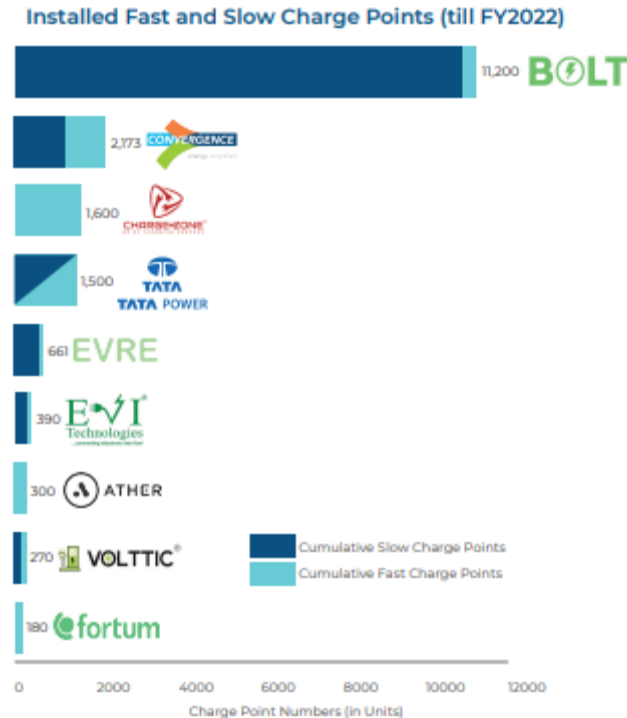
In this Image EV sales analysis is done on yearly basis and in other image the categorical vehicle market share analysis is done.



Battery Capacity analysis



No. of charging Points Available



Sales Trends:

Vehicle Category-wise EV Sales: The cumulative EV sales in India reached 10,90,641 units by the end of FY2022. While the annual EV sales crossed 4 lakh vehicles in FY2022 with more than 55% of share accounted for by registered electric two-wheelers (E2W) followed by passenger electric three-wheeler (E3W P) with ~35% market share.

State-wise EV Sales: Uttar Pradesh, Maharashtra, Karnataka, Bihar, and Delhi were the top EV selling states between FY2014 and FY2022, accounting for more than 60% of the market share. In terms of FY2022 sales' share, Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, and Delhi were the top EV selling states.

Customizing the Marketing Mix:

Four P's of marketing mix are:

- Product
- Price
- Promotion
- Place

Other important factors:

- Cost base pricing
- Value base pricing
- Market skimming price
- Goods value price
- Competition based price
- Design and management
- Advertising, sales, promotion
- Public relations and Marketing ways
- Mission and Message of product

Potential customer Base:

- EV adoption is increasing, with early adopters having already bought EVs. Most of the growth still lies ahead of us. In order to market to this group, an emphasis on technology would work best as this group is most interested.
- Younger people are more likely to buy EVs. This is a great target market for any company, as younger people have the money and the desire to be environmentally conscious.
- There are many different types of EVs, and the competition is increasing. This shows that there is a market for these cars and that they are selling well.
- EV sales occur in major cities in India, which is not surprising because India has been supportive of EVs. The distribution is still concentrated in the major cities of India, but it is slowly spreading to other parts of the country.
- Charging occurs at home, which is also not surprising. However, the workplace charging is becoming more popular and public charging facilities needed to be developed more in future.

Most Optimal Market Segments:

- Age group between 25-30
- Cities with good roads and charging facilities
- Safety psychometric is important for people
- Family with more working people and who travel on daily basis
- Behavioural aspects include likeliness to the looks of EV's

Conclusion

The Indian EV Industry is slowly gathering momentum, supported by government initiatives and rise in crude oil prices, as people look for alternative sources to reduce their monthly bills. However, a mass shift from internal combustion engine (ICE) vehicles to EVs requires expansion of infrastructure facilities, including charging stations, and vehicles that could provide a higher range (KM range with a single charge). Several initiatives taken by the government to support the manufacturing and adoption of electric vehicles in the country should help in achieving the target of a 100% EV adoption by 2030.