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ELECTRIC VEHICLE

CUSTOMER SEGMENTATION

USING MACHINE LEARNING

Overview

More than 90% of vehicles all over the world run on oil, there is a noticeable trend of desire to power vehicles with alternative energy sources. As a result, the subject of electric vehicles (EVs) is gaining popularity. An electric vehicle is one that operates on an electric motor instead of an internal combustion engine, which generates power by burning a mix of fuel and gases. Therefore, an electric vehicle is seen as a possible replacement for the current-generation automobile in the near future. As the problem of rising levels of global air pollution is serious, the use of electric cars can be a response to the achievement of sustainable development goals. With a pressing need for smarter infrastructure and friendlier government policy, electric vehicles have an important role to play in India's energy and mobility markets. In India the current market share of EV/HEV/PHEV is around 0.1%. At present almost all vehicles rely on fossil fuel-based transportation. This pollutes the atmosphere by the emission of greenhouse gases & causes global warming. The Indian transportation sector is growing very fast. The gap between domestic crude oil production and consumption is widening. India is a country which imports around 70% of oil required per year. Hence, there is an urgent need to investigate factors and challenges for the development of sustainable and clean alternatives for transportation systems. Electrified vehicles are one of the promising, clean and sustainable forms of transportation.

Unlike other countries the vehicle to people ratio is very high, however, the population is more and emission is high. India stands third with the CO₂ emission of 1.726 billion Metric ton. Hence, there is an urgent need to focus towards EV technology which has the capability towards zero emission for sustainable transportation.

In addition, due to urbanization and decentralization of city areas, a rapid increase in personal vehicles has been observed.

EV (Electric Vehicle) /HEV (Hybrid Electric Vehicle) /PHEV (Plug-in Hybrid Electric Vehicle) can be more beneficial for Indian roads due to the following reasons:

1. Hybrid or electric powertrains operate at much higher efficiency at low Indian driving speeds than an Internal Combustion Engine.

2. A higher share of energy per Indian trip is lost in braking, which is almost recovered in a hybrid-electric vehicle (HEV) and EV (Regenerative braking).
3. HEVs and EVs use no fuel during idling and the share of idling time in traffic is much higher in India (than the U.S. & Europe).
4. The average range travelled in India is much smaller than in the U.S. & Europe, making EVs much more feasible and with no range problem with a single charge.
5. Vehicle use and vehicle distance – Urban driving cycle patterns have a frequent start and stop, high traffic benefits to provide high efficiency electric vehicles.

MARKET OVERVIEW

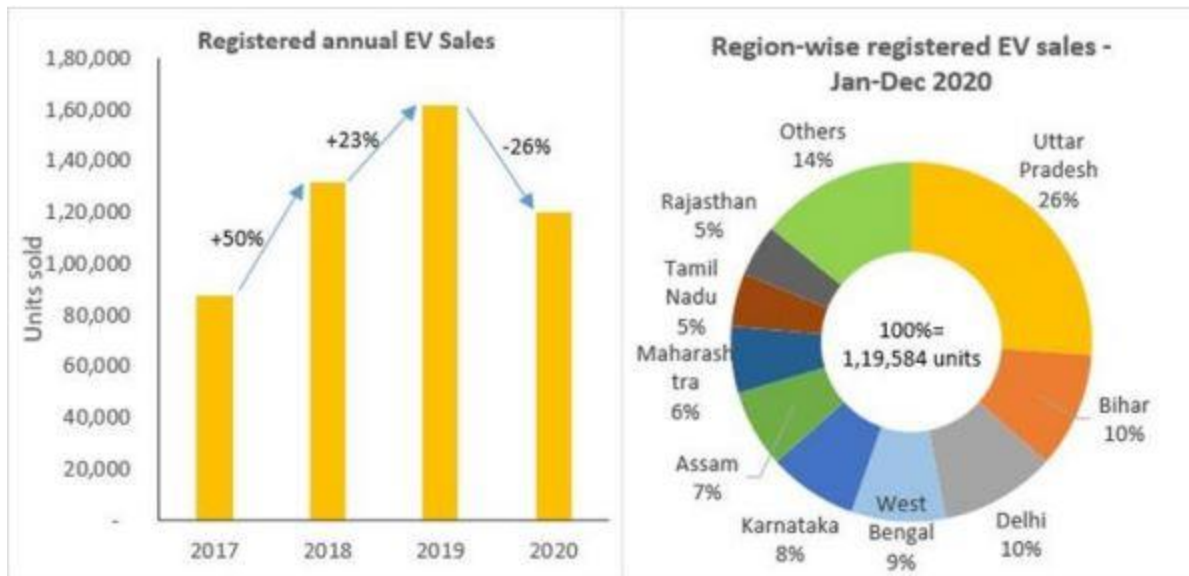
The Indian Electric Vehicle Market is segmented by Vehicle Type and Power Source.

- By Vehicle Type, the market is segmented into Passenger Cars, Commercial Vehicles, and Two- and Three-wheelers.
- By Power Source Type, the market is segmented into Battery Electric Vehicle, Plug-in Electric Vehicle, and Hybrid Electric Vehicle.

Our report mainly focuses on the Indian Electric Vehicle Market segmented by Vehicle Type. However, accessibility to Power Sources for Electric Vehicles affects the market and would be slightly discussed in the report.

The Indian Electric Vehicle Market was valued at USD 5 billion in 2020, and it is expected to reach USD 47 billion by 2026, registering a compound annual growth rate (CAGR) of above 44% during the forecast period (2021-2026).

The Indian Electric Vehicle Market has been impacted by the outbreak of the COVID-19 pandemic due to supply chain disruptions and halt of manufacturing units due to continuous lockdowns and travel restrictions across the country. However, the electric vehicle (EV) market is still in its nascent stage in India. It is expected to grow at a much faster rate during the forecast period due to various government initiatives and policies.



E-commerce companies (Amazon, for example) are launching initiatives to use e-Mobility for last-mile deliveries to reduce carbon footprint. India is experimenting with e-Mobility for public transport, and the country has deployed electric intercity buses across some major cities. In addition, state governments are also playing an active role in the deployment of policies encouraging the usage of EVs. For instance,

- Kerala aims to put one million EV units on the road by 2022 and 6,000 ebuses in public transport by 2025.
- Telangana aims to have EV sales targets for 2025 to achieve 80% 2- and 3-wheelers (motorcycles, scooters, auto-rickshaws), 70% commercial cars (ride-hailing companies, such as Ola and Uber), 40% buses, 30% private cars, and 15% electrification of all vehicles.

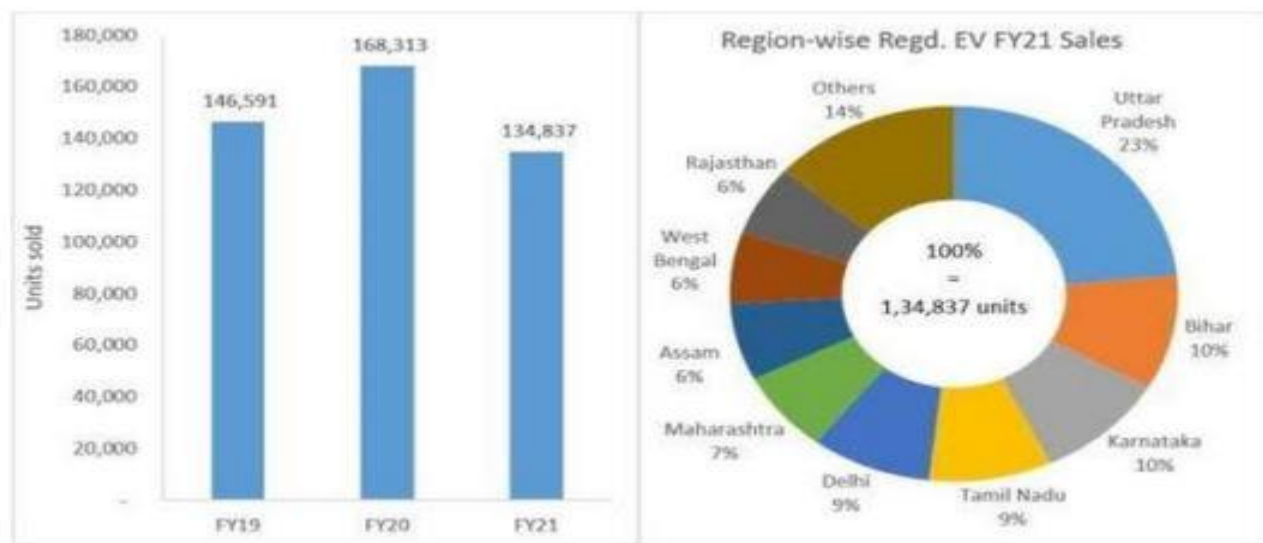
The EV market in India has gained significant momentum after the implementation of the (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles in India) FAME India scheme with its aim of shifting toward e-mobility in the wake of growing international policy commitments and environmental challenges. Moreover, India offers the world's largest untapped market, especially in the electric two-wheeler segment. As 100% foreign direct investment is allowed in this sector, the automatic route market is expected to gain momentum during the forecast period.

India Electric Vehicle (EV) Market - Revenue Share (%), By Vehicle Type, 2020



MARKET DYNAMICS

In the financial year 2020-21, the leading type of electric vehicles sold in India was two-wheelers, reaching around 144 thousand units. This was a five percent decrease from the previous year's 152 thousand units. The only section that saw growth was four-wheelers



The Indian EV market is consolidated with the presence of major players in the market, owing to cheap and readily available manpower. However, established players in the market are introducing new models to gain a competitive edge over other player. The start-ups are expanding their presence by raising funds from

investors and tapping into new and unexplored cities. Companies are investing a tremendous amount in R&D and launching new models to mark their presence in the market.

Data Structure

The data was extracted from various different websites and the reviews were collected based on the experiences of the customers on the available EV in the market.

The following Dataset consists of various data of various EV available in the market, with there different brands and there features.

	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyle	Segment
0	Tesla	Model 3 Long Range Dual Motor	4.6	233	450	161	940	Yes	AWD	Type 2 CCS	Sedan	D
1	Volkswagen	ID.3 Pure	10.0	160	270	167	250	Yes	RWD	Type 2 CCS	Hatchback	C
2	Polestar	2	4.7	210	400	181	620	Yes	AWD	Type 2 CCS	Liftback	D
3	BMW	iX3	6.8	180	360	206	560	Yes	RWD	Type 2 CCS	SUV	D
4	Honda	e	9.5	145	170	168	190	Yes	RWD	Type 2 CCS	Hatchback	B

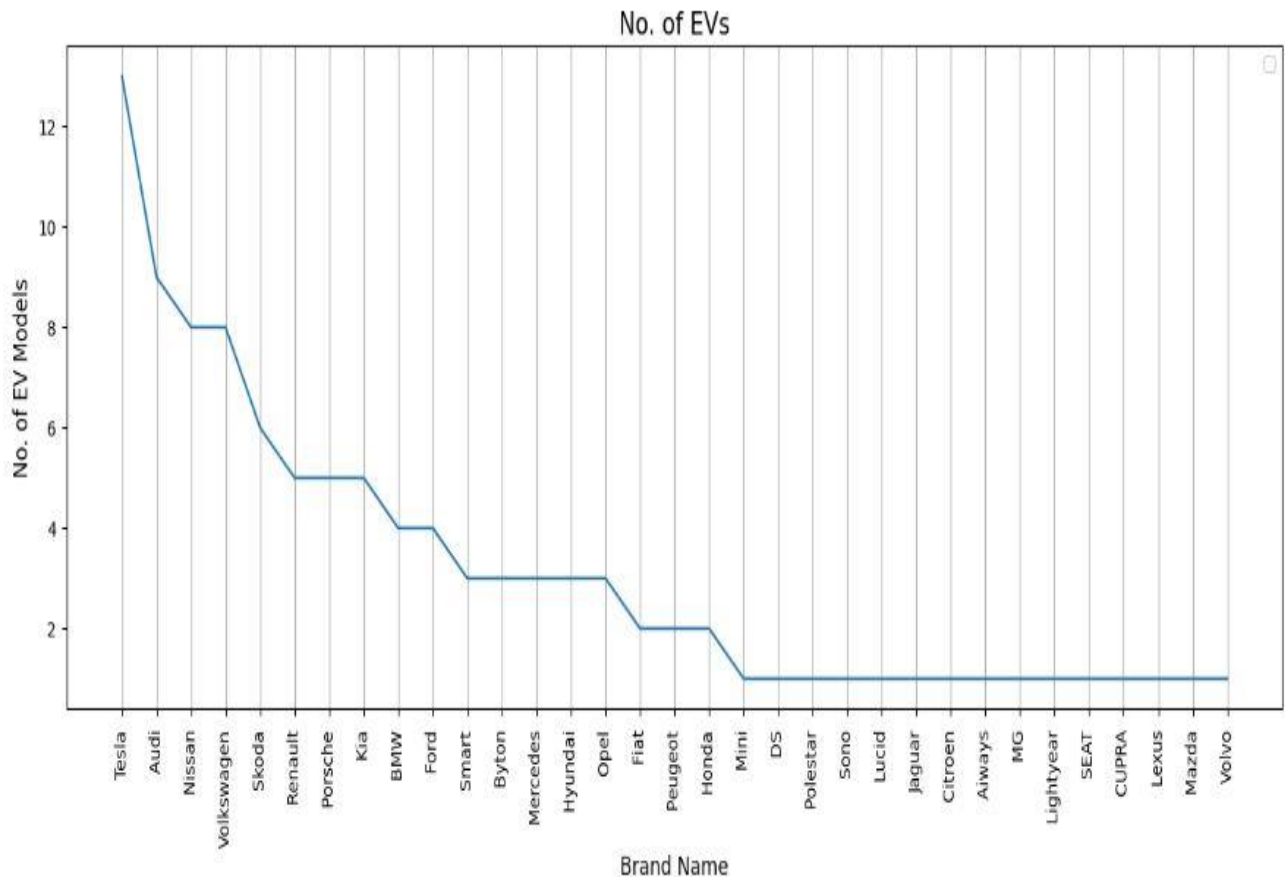
Description of the Dataset

The following is the description of the dataset provided which provides us with the descriptive stats of the data. It provides us all kind of description like the minimum value and the maximum value. The measures of central tendencies etc.

	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	Seats	PriceEuro
count	103.000000	103.000000	103.000000	103.000000	103.000000	103.000000
mean	7.396117	179.194175	338.786408	189.165049	4.883495	55811.563107
std	3.017430	43.573030	126.014444	29.566839	0.795834	34134.665280
min	2.100000	123.000000	95.000000	104.000000	2.000000	20129.000000
25%	5.100000	150.000000	250.000000	168.000000	5.000000	34429.500000
50%	7.300000	160.000000	340.000000	180.000000	5.000000	45000.000000
75%	9.000000	200.000000	400.000000	203.000000	5.000000	65000.000000
max	22.400000	410.000000	970.000000	273.000000	7.000000	215000.000000

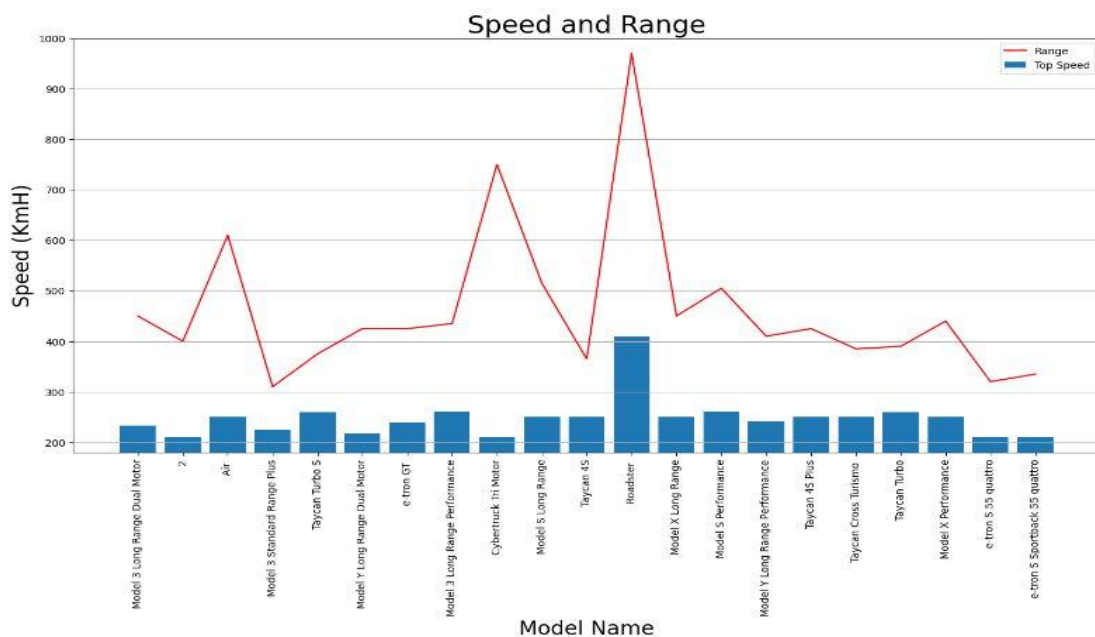
Finding out Number of EV models for different companies

The following image shows the availability of different brand of EV in the market



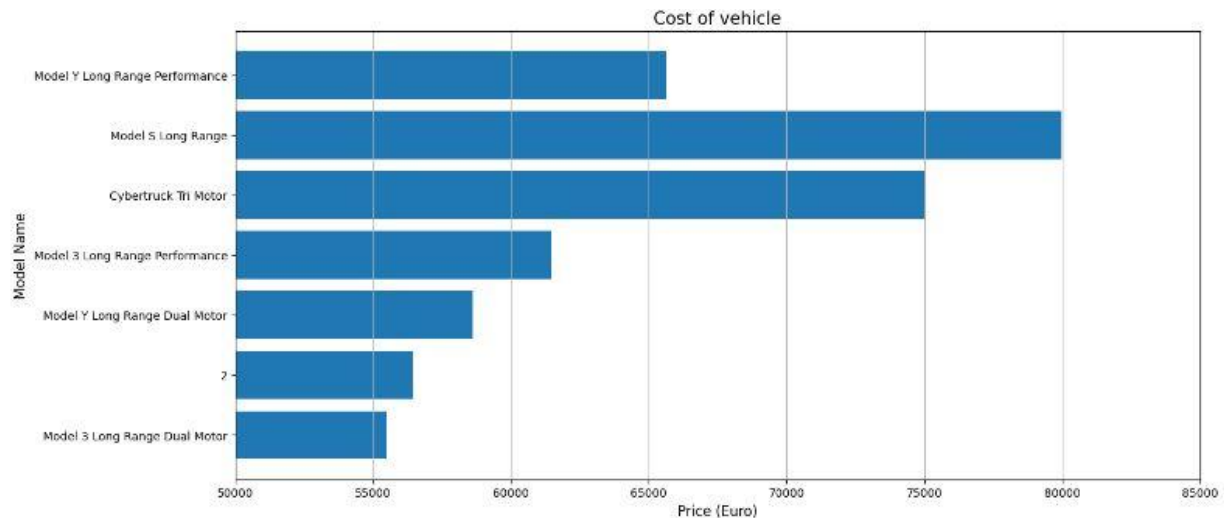
Top Speed and Range filtration

The following image shows the speed and range of different EV brand



Price Range

The following image the different price ranges of EV



This shows the top speed of around more than 400Kmh is the Roadster which is from tesla and other models that are quiet good in top speed

Conclulsion

Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyle	Segment	!
Tesla	Model 3 Long Range Dual Motor	4.600000	233	450	161	940	Yes	AWD	Type 2 CCS	Sedan	D	
Polestar	2	4.700000	210	400	181	620	Yes	AWD	Type 2 CCS	Liftback	D	
Tesla	Model Y Long Range Dual Motor	5.100000	217	425	171	930	Yes	AWD	Type 2 CCS	SUV	D	
Tesla	Model 3 Long Range Performance	3.400000	261	435	167	910	Yes	AWD	Type 2 CCS	Sedan	D	
Tesla	Cybertruck Tri Motor	3.000000	210	750	267	710	Yes	AWD	Type 2 CCS	Pickup	N	
Tesla	Model S Long Range	3.800000	250	515	184	560	Yes	AWD	Type 2	Liftback	F	
Tesla	Model Y Long Range Performance	3.700000	241	410	177	900	Yes	AWD	Type 2 CCS	SUV	D	

From the entire calculation it is clear that Tesla is the most loved EV in the market