SUMMARY REPORT-EV MARKET SEGMENTATION IN INDIA

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1. Introduction

The electric vehicle industry in India is still in its nascent stage, but it has potential to grow more than 10% every year. According to a report by Fortune business Insights, the Indian electric vehicle market size was USD 1.45 billion in 2021 and is projected to grow to USD 114 billion in 2029 growing at a CAGR of 66.5% during the 2022-2029 forecast period.

2. Challenges

There are several challenges that the EV industry faces. Some of the major challenges for the electric vehicles industry India are

1. **Initial cost of owning**: The initial cost of purchasing an electric vehicle is higher than that of a conventional vehicle.
2. **Lack of choice of EVs**: There are limited options for electric vehicles in India.
3. **Infrastructure**: The availability and accessibility of charging stations, battery swapping facilities, and grid connectivity are crucial for the adoption and operation of EVs. The government and private sector are investing in developing the EV infrastructure, but more efforts are needed to meet the growing demand and ensure quality and reliability
4. **Innovation**: The EV market in India offers a lot of opportunities for innovation and entrepreneurship, especially in the areas of battery technology, vehicle design, charging solutions, and mobility services. The innovation ecosystem in India is vibrant and dynamic, with many startups, research institutions, and corporates working on developing and deploying new and improved EV products and solutions. The government and the industry are also collaborating to foster innovation and create a conducive environment for the EV market.
5. **Lack of awareness**: There is a lack of awareness among consumers about electric vehicles and their benefits.
6. **Uneven electricity distribution**: The uneven distribution of electricity across India makes it difficult to provide uninterrupted power supply for charging electric vehicles.
7. **Charging time**: The charging time for electric vehicles is longer than that of conventional vehicles.
8. **Lack of EV charging infrastructure**: There is a lack of EV charging infrastructure in India.
9. **Service center and repair options**: There are limited service centers and repair options for electric vehicles in India.
10. **Range anxiety in consumers**: Consumers are concerned about the range of electric vehicles and the availability of charging stations.

Formalizing the legal framework, increasing public awareness, and addressing logistical issues can help advance electric mobility in India

3. Initiatives taken by Govt of India to promote EV industry in India

- Reducing the GST on electric vehicles from 12% to 5%, while conventional vehicles are taxed at 28% or higher.

- Exempting the registration fees for electric vehicles.

- Launching the FAME India scheme, which provides subsidies and incentives for electric vehicles and charging infrastructure.

- Setting up the National Electric Mobility Mission Plan, which aims to achieve 30% electric mobility by 2030.

- Developing the Bharat Standard for charging stations, which ensures compatibility and interoperability of different types of chargers.

- Supporting the research and development of electric vehicles and batteries through various schemes and programs.

4. Which Indian States have implemented EV policies to promote EV vehicles?

Electric vehicles (EVs) are gaining popularity in India as a cleaner and more sustainable mode of transportation. The Indian government and various state governments have introduced policies and subsidies to encourage the adoption of EVs and the development of the EV industry.

According to a recent article, about 50% of Indian states have EV policies that include monetary incentives, tax exemptions, and infrastructure support for EV buyers and manufacturers. Some of the states that have EV policies are:

- **Maharashtra:** The state has the most recent and user-friendly EV policy, which aims to make Maharashtra the top producer and consumer of EVs in India. The policy offers subsidies of up to Rs 1.5 lakh for electric cars, Rs 30,000 for electric two-wheelers, and Rs 50,000 for electric three-wheelers. It also provides a waiver of road tax and registration fees, and a 15% capital subsidy for EV charging stations.
- **Gujarat:** The state has the highest subsidy for electric two-wheelers, offering Rs 20,000 per kWh of battery capacity, up to Rs 1.5 lakh. It also provides subsidies of Rs 10,000 per kWh for electric cars, up to Rs 1.5 lakh, and Rs 5,000 per kWh for electric three-wheelers, up to Rs 20,000. The policy also exempts EVs from road tax and registration fees, and aims to set up 250 charging stations across the state.
- Delhi: The state has the most ambitious EV policy, which targets to have 25% of all new vehicle registrations to be EVs by 2024. The policy offers subsidies of up to Rs 3 lakh for electric cars, Rs 30,000 for electric two-wheelers, and Rs 30,000 for electric three-wheelers. It also provides a 100% waiver of road tax and registration fees, and a low-interest loan scheme for EV buyers. The policy also plans to set up 200 public charging stations and 100 battery swapping stations in the city.

Other states that have EV policies are Rajasthan, Karnataka, Telangana, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Bihar, Punjab, Haryana, Chandigarh, West Bengal, Odisha, Meghalaya, Assam, and Goa. These states have varying degrees of incentives and support for EVs, depending on their local needs and resources.

5. ML model (algorithm) used in current project

EV segmentation is the process of identifying and grouping potential buyers of EVs based on various factors such as their preferences, attitudes, behaviors, and socio-economic characteristics. EV segmentation can help companies to target the most suitable customers and design effective marketing strategies.

There are different machine learning models that can help in EV segmentation, depending on the type and amount of data available, the complexity of the problem, and the desired outcome. Some machine learning models for EV segmentation used are:

- **Clustering**: Clustering is an unsupervised learning technique that groups data points based on their similarity or distance. Clustering can be used to discover the natural structure of the data and find the optimal number of segments. Some of the popular clustering algorithms are K-means, hierarchical clustering, and DBSCAN.
- **Classification**: Classification is a supervised learning technique that assigns data points to predefined categories or labels. Classification can be used to predict the segment of a new customer based on their features. Some of the popular classification algorithms are logistic regression, decision tree, random forest, and support vector machine.
- **Reinforcement learning**: Reinforcement learning is a learning technique that learns from its own actions and rewards. Reinforcement learning can be used to optimize the routing of EVs with intermediary charging stations, taking into account the energy consumption, travel time, and customer satisfaction.

6. Estimated EV market size in India

The estimated market size of electric vehicles (EVs) in India varies depending on the source and the methodology used. However, most sources agree that the EV market in India is growing rapidly and has a huge potential for further expansion. Here are some of the estimates from different sources:

Vehicle Type	Sales (in thousands)	Market Share (%)
Electric Two-Wheeler	583.4	55.3
Electric Three-Wheeler (Passenger)	368.9	35.0
Electric Three-Wheeler (Cargo)	42.7	4.1
Electric Car	38.6	3.7
Electric Bus	14.3	1.4
Electric Truck	7.0	0.7

- According to IBEF, the EV market in India was valued at USD 5.3 billion in 2020 and is expected to reach USD 15.6 billion by 2026, growing at a compound annual growth rate (CAGR) of 20.6%.
- According to Mordor Intelligence, the EV market in India was estimated at USD 5.61 billion in 2023 and is projected to reach USD 37.70 billion by 2028, growing at a CAGR of 46.38%.
- According to Fortune Business Insights, the EV market in India was valued at USD 1.45 billion in 2021 and is forecasted to grow from USD 3.21 billion in 2022 to USD 113.99 billion in 2029, growing at a CAGR of 66.52%.
- According to IMARC Group, the EV market in India reached USD 772 million in 2022 and is anticipated to reach USD 19,980 million by 2028, growing at a CAGR of 69%.

As you can see, there is a wide range of estimates for the EV market size in India, but they all indicate a strong growth trend and a promising future for the EV industry in India

7. Top 4 variables/features

The top 4 variables/features that can be used to create most optimal market segments for our EV domain are

Market segmentation is the process of dividing a market into distinct groups of customers who have similar needs, preferences, or characteristics. Market segmentation can help businesses to design products and services that better meet the needs of different customer segments, as well as to develop more effective marketing and pricing strategies.

There is no definitive answer to what are the best variables or features for market segmentation, as different businesses may have different objectives and criteria for segmenting their markets. However, some possible variables or features that could be used to create optimal market segments for the electric vehicle (EV) domain are:

- **Driving behavior**: This variable captures how customers use their vehicles, such as the driving distance, speed, frequency, and purpose of their trips. Driving behavior can affect the energy consumption and storage requirements of EVs, as well as the customers' preferences for performance, range, and charging options. For example, a study by McKinsey suggested that one way to segment the EV market is to focus on tailoring battery-powered vehicles to the actual driving missions of specific consumers, such as around-town, commuting, or long-distance [1].

- **Environmental attitude**: This variable measures how customers perceive and value the environmental benefits of EVs, such as reduced emissions, noise, and pollution. Environmental attitude can influence the customers' willingness to pay, brand loyalty, and word-of-mouth for EVs. For example, a study by Deloitte found that environmental attitude was one of the key factors that differentiated EV buyers from non-buyers in the United Kingdom [2].
- **Demographics**: This variable includes the basic characteristics of customers, such as age, gender, income, education, and household size. Demographics can affect the customers' affordability, accessibility, and suitability of EVs, as well as their awareness and perception of EVs. For example, a study by Electric Vehicles found that demographics were one of the main reasons for the growth of the two-wheeler EV market in Asia, as most of the customers were young, urban, and middle-class [3].
- **Technology adoption**: This variable reflects how customers adopt and use new technologies, such as their level of innovativeness, risk aversion, and information seeking. Technology adoption can influence the customers' adoption and diffusion of EVs, as well as their expectations and satisfaction with EVs. For example, a study by Deloitte identified four segments of EV buyers based on their technology adoption: enthusiasts, pragmatists, conservatives, and skeptics

8. Final conclusion and insights gained from research/analysis work
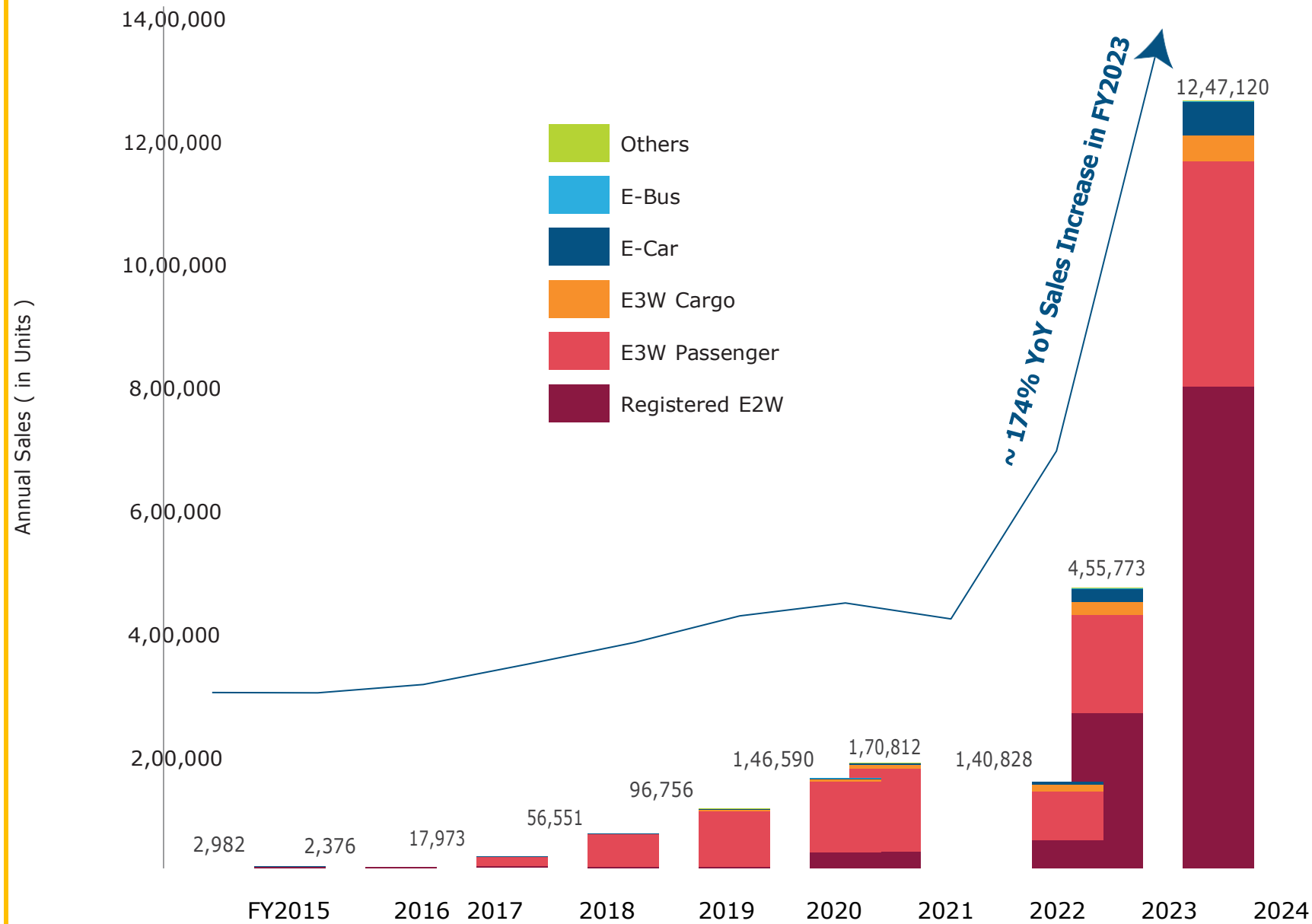
The research and analysis on the EV market segmentation in India reveal some key insights and conclusions, such as:

- The EV market in India is expected to witness a rapid growth in the coming years, reaching USD 113.99 billion by 2029, from USD 1.45 billion in 2021 .
- The government plays a crucial role in promoting the adoption of EVs in India, by implementing favorable policies and programs, such as FAME II, National Electric Mobility Mission Plan, and state-level EV policies.
- The EV market in India is dominated by the three-wheeler segment, which accounted for 83.5% of the total EV sales in 2021, followed by the two-wheeler segment with 14.9%, and the four-wheeler segment with 1.6% .
- The EV market in India faces some challenges, such as the high upfront cost of EVs, the lack of adequate charging infrastructure, the low consumer awareness and preference, and the dependency on imports for critical components, such as batteries and semiconductors
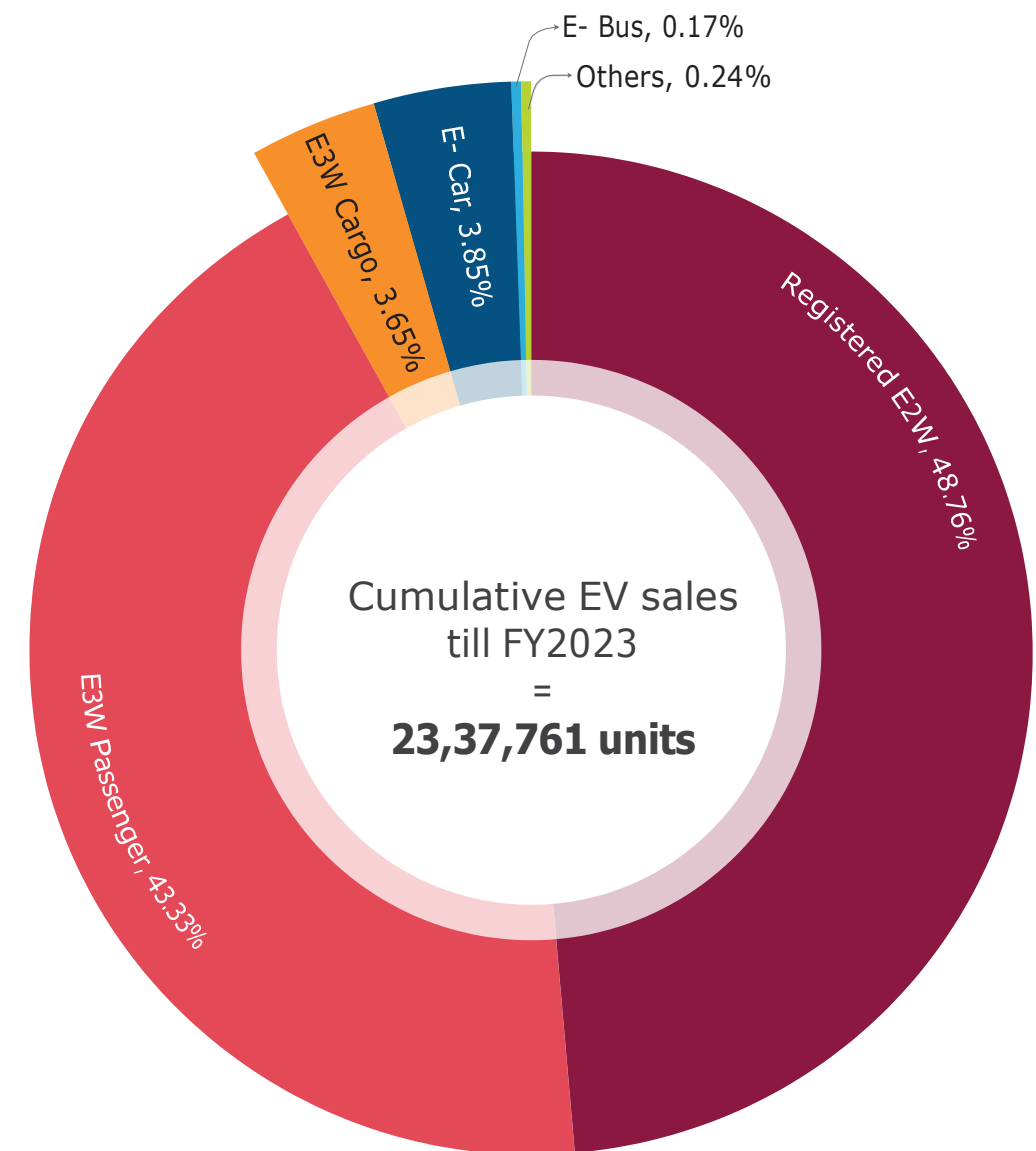
The EV market in India offers some opportunities, such as the potential for battery manufacturing and recycling, the development of smart and shared mobility solutions, the integration of renewable energy sources, and the creation of employment and economic benefits.

EV SALES TREND IN INDIA

EV Annual Sales Trend in India (FY2014 - FY2023) FY2023)

Annual Sales (in Units)

Legend:
- Others
- E-Bus
- E-Car
- E3W Cargo
- E3W Passenger
- Registered E2W

~ 174% YoY Sales Increase in FY2023

Y-axis values: 14,00,000 / 12,00,000 / 10,00,000 / 8,00,000 / 6,00,000 / 4,00,000 / 2,00,000

Bar values:
- 2,982
- 2,376
- 17,973
- 56,551
- 96,756
- 1,46,590
- 1,70,812
- 1,40,828
- 4,55,773
- 12,47,120

X-axis: FY2015 2016 2017 2018 2019 2020 2021 2022 2023 2024

Vehicle Category-wise Market Share (Cumulative till FY2023)

- E- Bus, 0.17%
- Others, 0.24%
- E- Car, 3.85%
- E3W Cargo, 3.65%
- Registered E2W, 48.76%
- E3W Passenger, 43.33%

Cumulative EV sales till FY2023
=
23,37,761 units

STATE-WISE SALES

State-wise Registered EV Cumulative Sales (Till FY2023)

100% = 23,37,761 units

State	Percentage
Uttar Pradesh	20.64%
Maharashtra	10.15%
Delhi	8.85%
Karnataka	8.54%
Rajasthan	6.40%
Bihar	5.74%
Tamil Nadu	5.59%
Telangana	4.57%
Gujarat	4.45%
Assam	4.26%
Others	20.80%
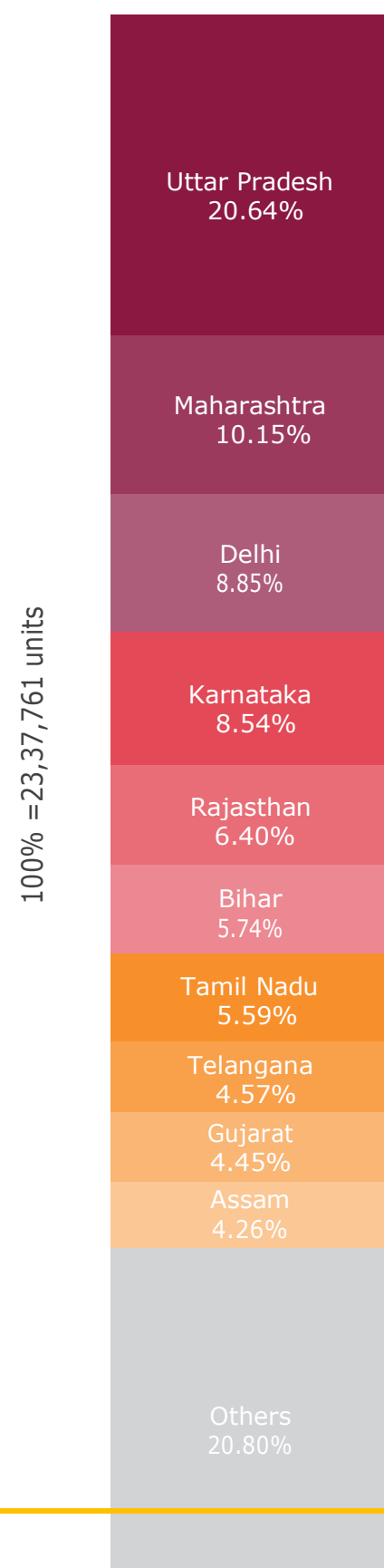
State-wise Registered EV Annual Sales (FY2023)

Others, 4.34%
Jharkhand, 1.29%
Uttarakhand, 1.34%
Chhattisgarh, 2.22%
Haryana, 2.30%
Andhra Pradesh, 2.46%
Odisha, 2.59%
Madhya Pradesh, 3.62%
Assam 3.67%
Gujarat 4.19%
Bihar 5.02%
Telangana 5.25%
Bihar 5.38%
Tamil Nadu 5.76%
Delhi 6.50%
Rajasthan 7.08%
Karnataka 9.14%
Maharashtra 12.72%
Uttar Pradesh 15.15%

100% = 12,47,120 UNITS

Legend:
- Registered E2W
- E3W Passenger
- E3W Cargo
- E-Car
- E-Bus
- Others
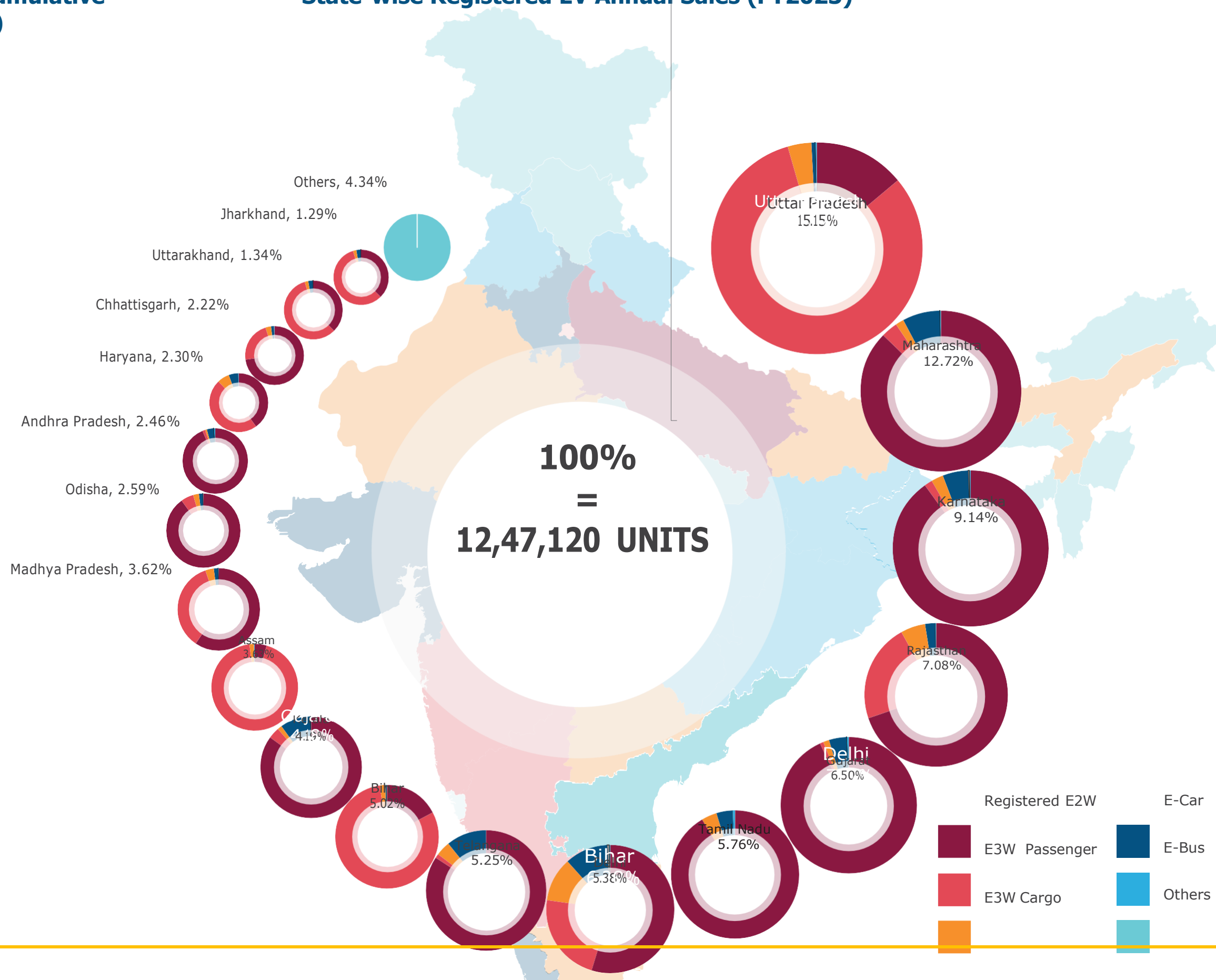
ELECTRIC 2-WHEELERS

Key Players' Registered E2W Sales (FY2023)-
(100% = 7,82,389 Units)

Odysse, 0.19%
KLB Komaki, 0.50%
Goreen e-Mobility, 0.72%
Twenty Two Motors, 0.85%
Jitendra New EV Tech, 1.10%
Bgauss, 0.88%
Benling, 1.44%
Revolt, 1.79%
Kinetic Green Energy, 1.81%
Bajaj Auto, 4.47%
Others, 4.38%

Ather Energy, 10.77%

a Electric, 12.37%

Hero Electric, 12.50%

TVS Motors, 11.48%

Okinawa, 12.38%

Annual E2W Sales Trend

Legend:
- Low Speed (LS)
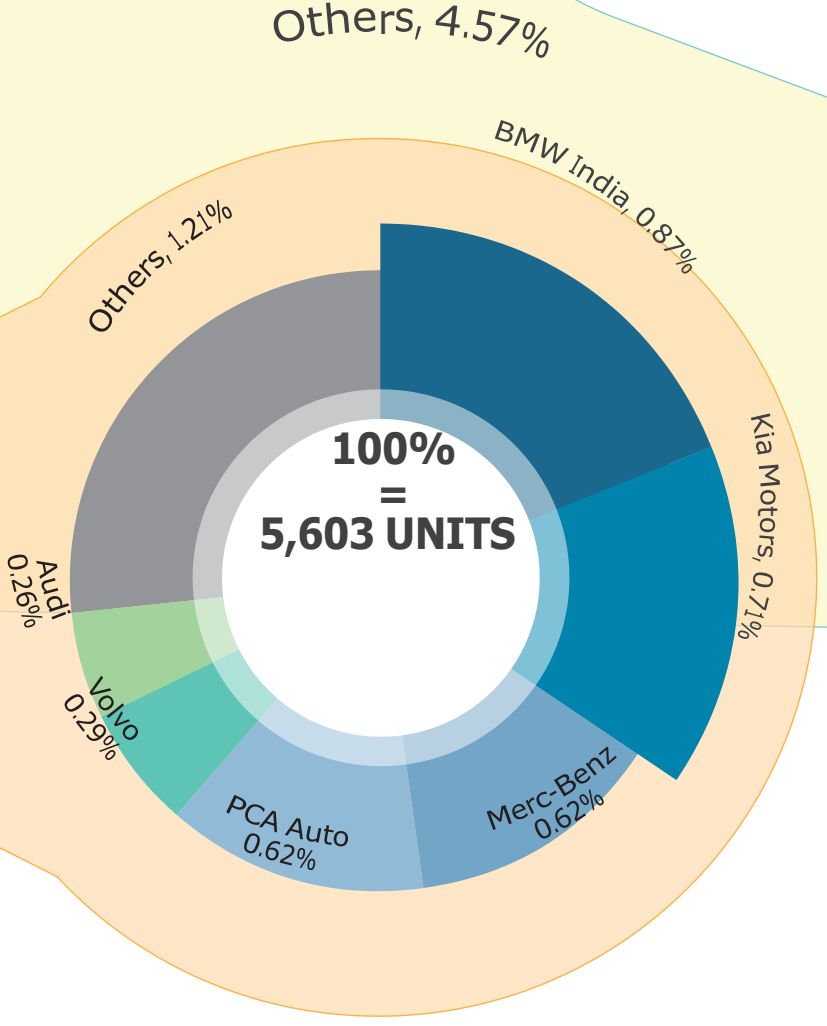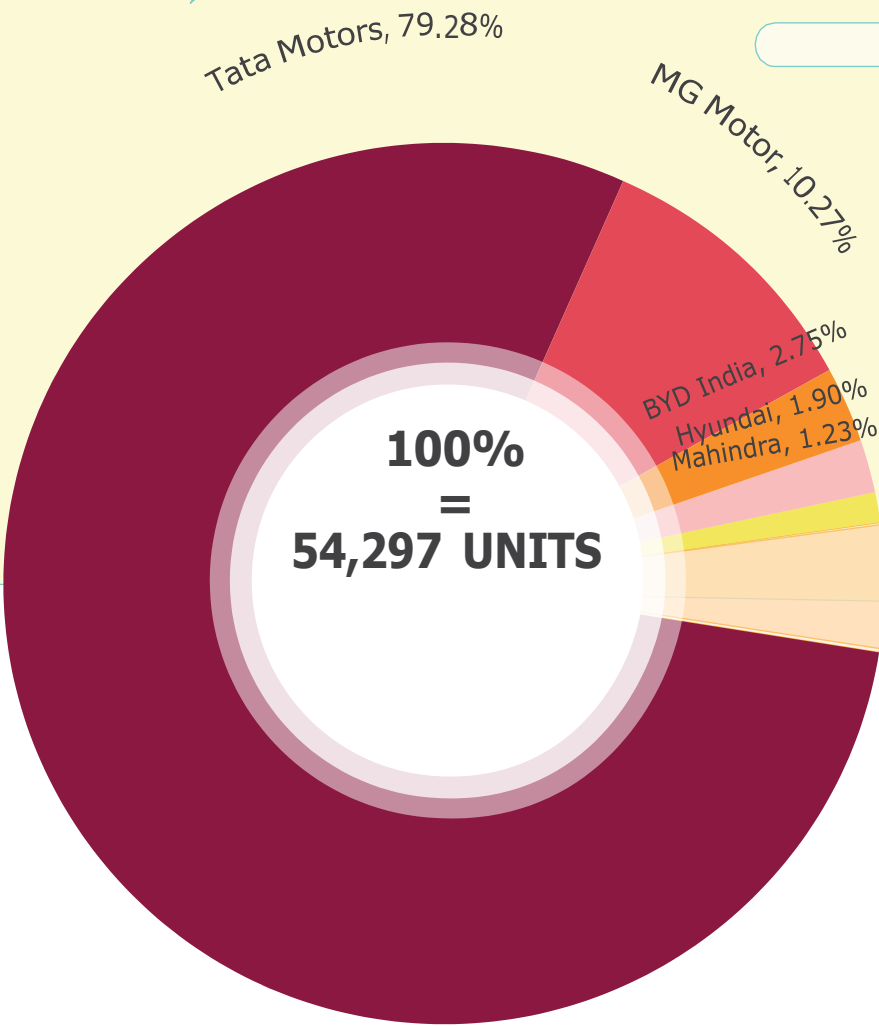- High Speed (HS)
- % Share of HS E2W of Total E2W Sales
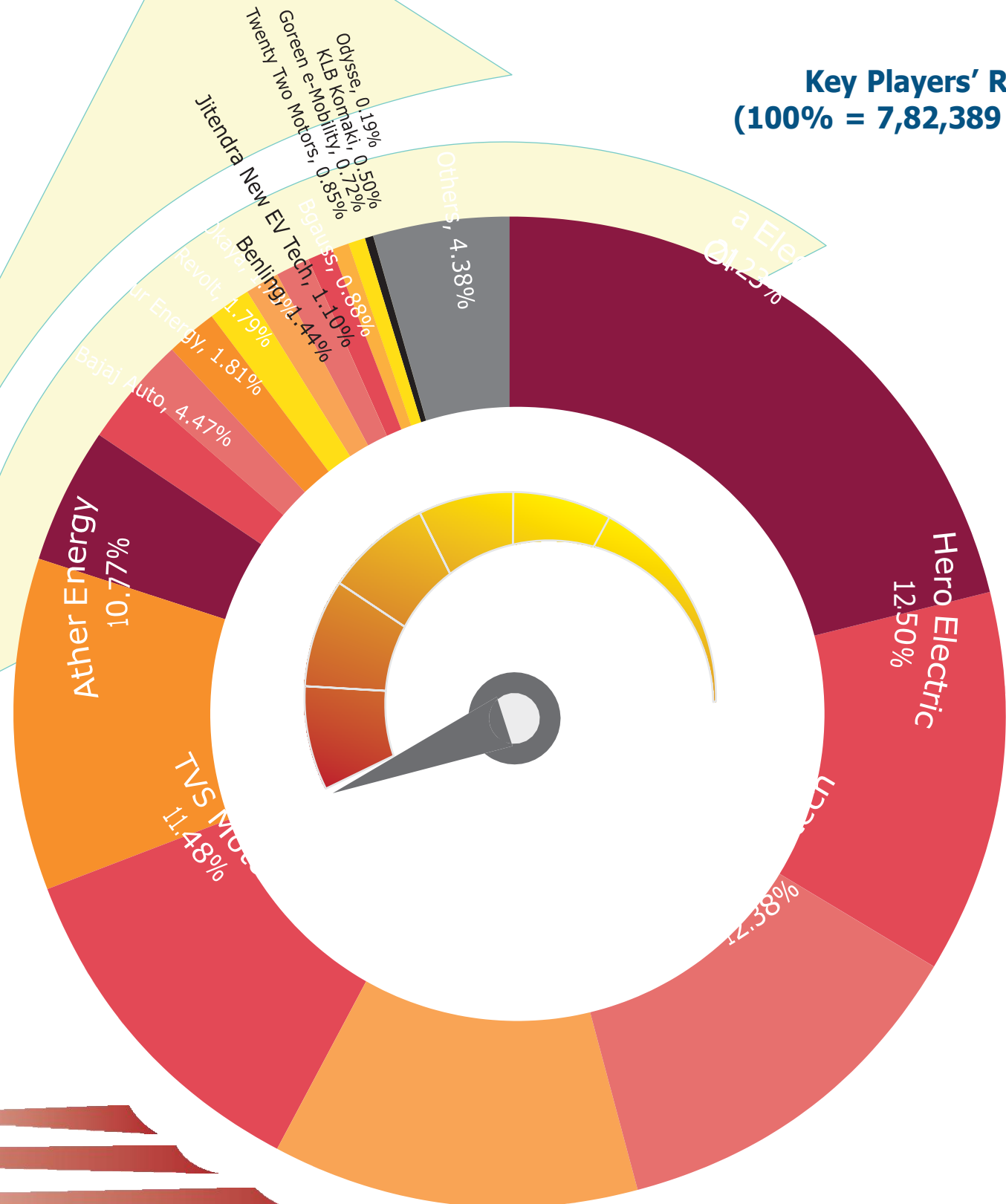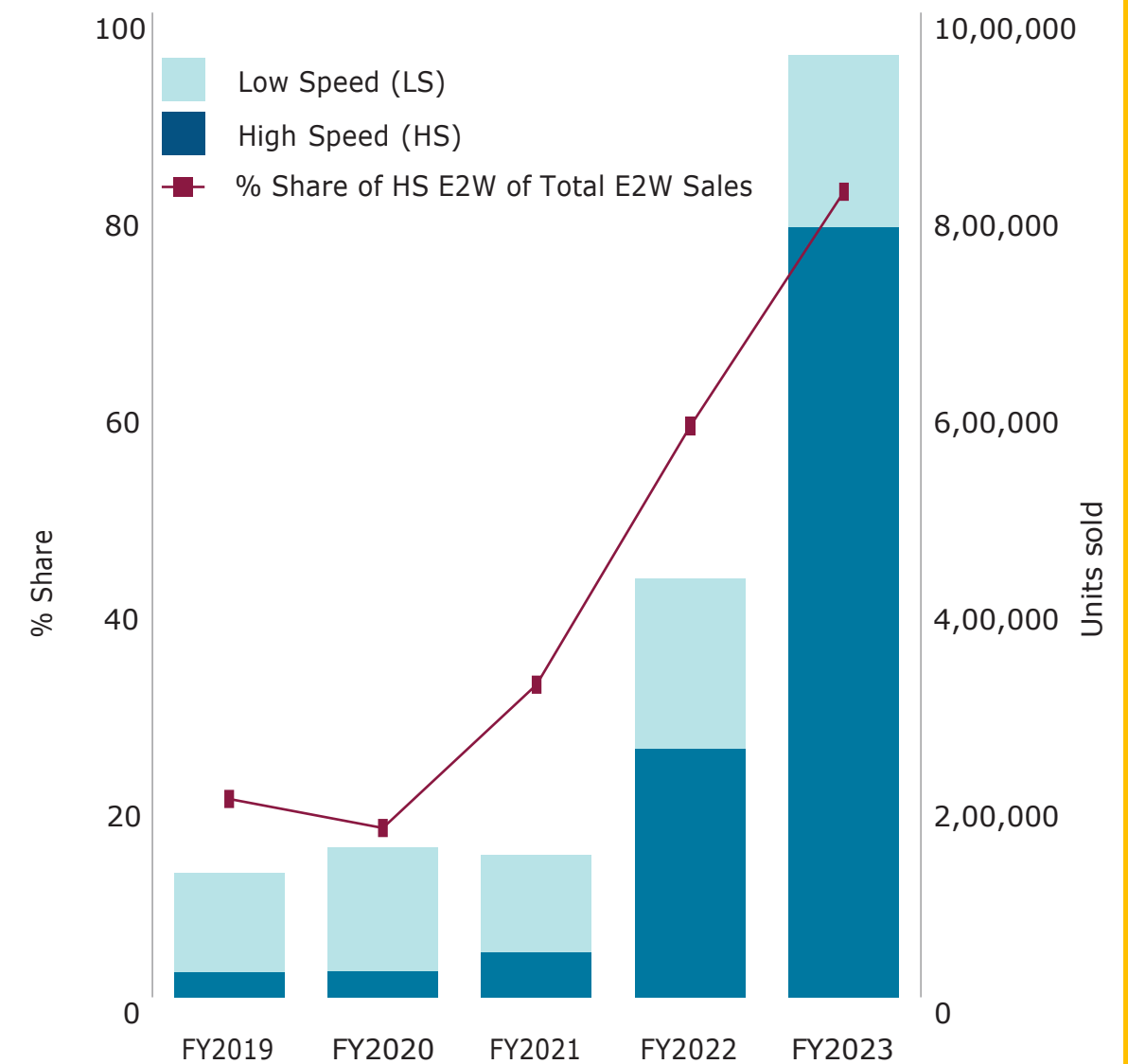
Source: JMK Research Estimates, Vahan Dashboard, Company Press Release, Telangana RTO

Note: Sales figures from Vahan Dashboard represent EVs registered across 1,404 RTOs and Unit Offices in 35 states/ UTs.
Sales of Bajaj Auto includes sales of Bajaj and Chetak technology; sales of Bgauss includes sales of both Bgauss and Mew Electricals
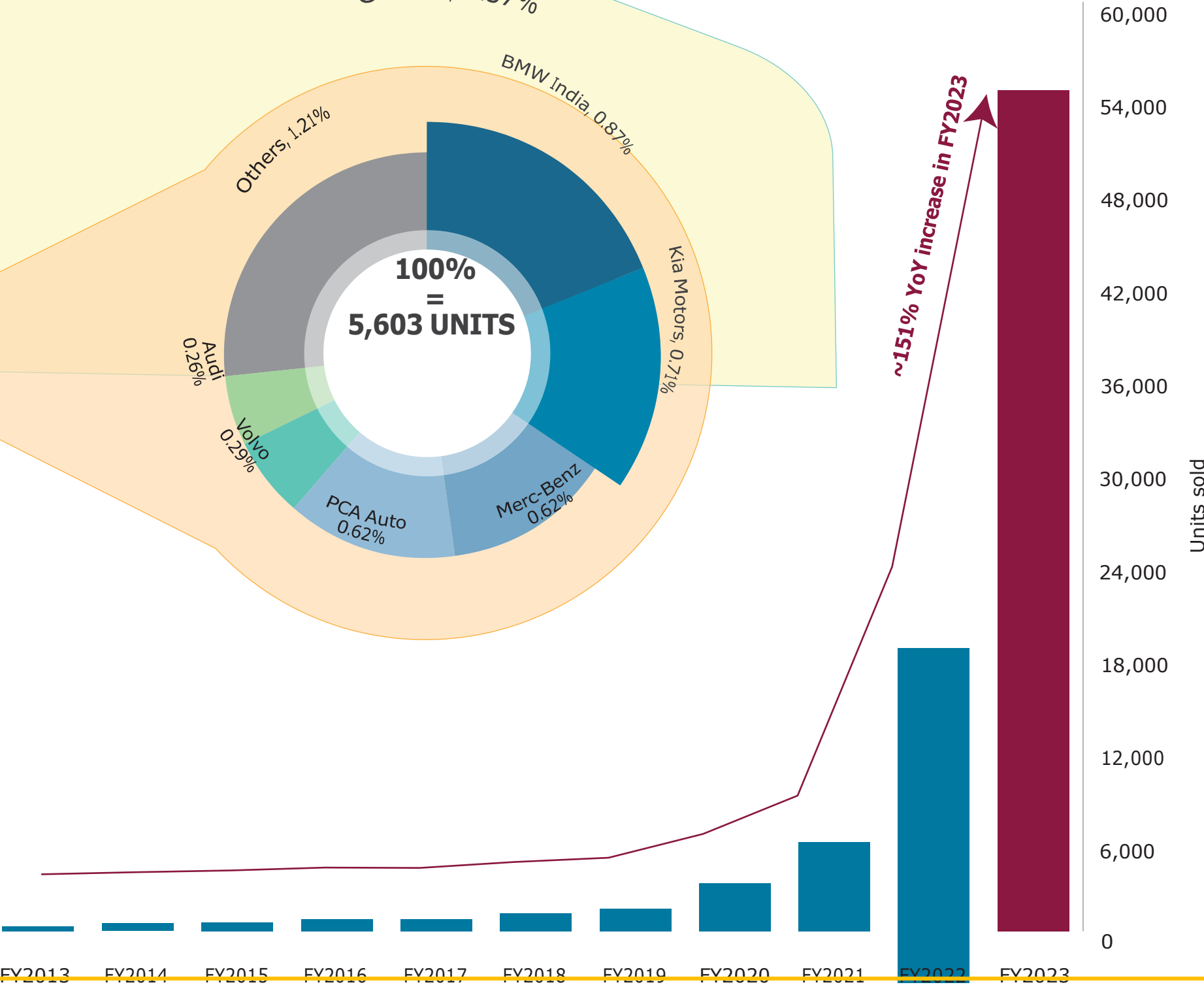
ELECTRIC CARS

Player-wise E-Car Sales' Share (FY2023)

Tata Motors, 79.28%

MG Motor, 10.27%

BYD India, 2.75%

Hyundai, 1.90%

Mahindra, 1.23%

Others, 4.57%

**100%
=
54,297 UNITS**

Others, 1.21%

BMW India, 0.87%

Kia Motors, 0.71%

Audi 0.26%

Volvo 0.29%

PCA Auto 0.62%

Merc-Benz 0.62%

**100%
=
5,603 UNITS**

YoY E-Car sales in India

~151% YoY increase in FY2023

60,000

54,000

48,000

42,000

36,000

30,000

24,000

18,000

12,000

6,000

0

Units sold

FY2013 FY2014 FY2015 FY2016 FY2017 FY2018 FY2019 FY2020 FY2021 FY2022 FY2023

BATTERY PACKS   CHARGE POINTS

Nameplate & Operational Battery Pack Capacities (till FY2023)

Legend:
- Cumulative **Nameplate** Capacity (in MWh)
- Cumulative **Operational** Capacity (in MWh)

Companies (top to bottom):
- nexcharge — Exide Leclanche Energy Private Limited
- OKAYA — NEVER STOP INDIA
- INVERTED
- PHENIX
- exicom
- TRONTEK
- BATTRIXX
- AMARA RAJA — Gotta be a better way
- PURE — ELECTRIC VEHICLE
- FORSEE — POWER SOLUTIONS
- UCHIRA
- RENON — FOR SUSTAINABLE EARTH
- LOG9
- SANVARU — Power Forever
- cygni
- GREENFUEL
- LOHUM
- WAAREE
- future — Hi-Tech Batteries
- Vision Mechatronics — www.vmechatronics.com

Capacities (in MWh)

X-axis: 0, 300, 600, 900, 1,200, 1,500

Installed Fast and Slow Charge Points (till FY2023)

- BOLT — 23,060
- TATA POWER — 4,012
- CHARGE ZONE — POWERING THE FUTURE — 3,250
- ATHER — 1,200+
- EVRE — 1,014
- VOLTTIC — 602
- Bharat Petroleum — 548
- fortum — 440

Legend:
- Cumulative **Slow** Charge Points
- Cumulative **Fast** Charge Points

X-axis: 0, 5,000, 10,000, 15,000, 20,000, 25,000

Units
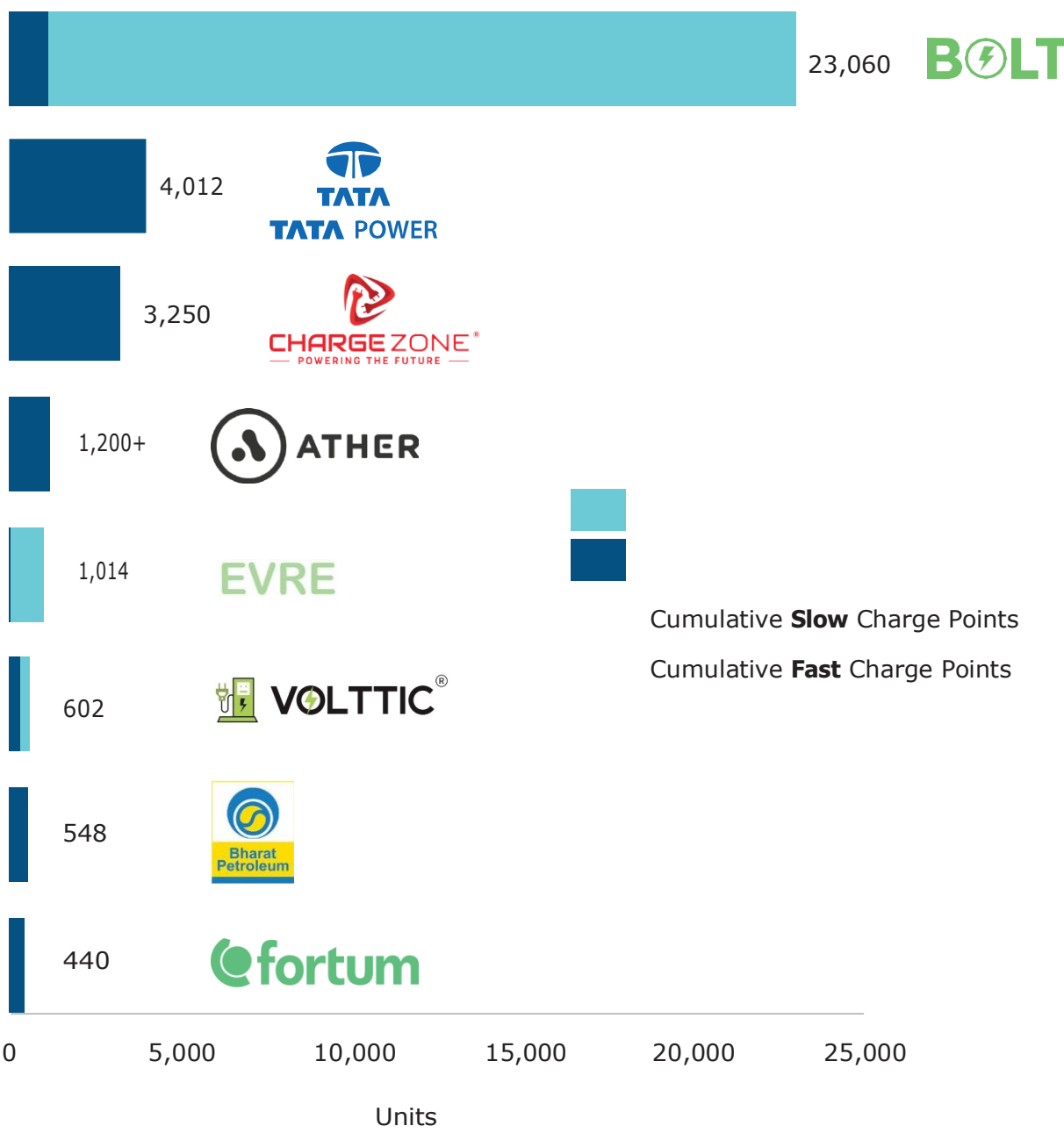
Source: Company Interviews, JMK Research

Note:
1. Slow charge points include AC001 charge points; Fast charge points include DC001 (30/60 kW)/ AC Level II/CCS (50/60kW), and combo charge points.
2. Tata Power has not shared breakup of charge point numbers into slow and fast ones. Tata Power has an installed network of 4,012 Public, Captive, and Bus Charge points. Excludes 39,000+ Home chargers (for private use).
3. BOLT's charge point count includes public charge points only and excludes private (home) charge points.
4. Rest of the CPOs have not shared their numbers, hence not included