



Thematic Research: The EV Revolution
Understanding The Electric Vehicle Ecosystem

Shridhar Kallani
Automobile Analyst

Global EV Market Scenario- Preface



In 2023, the global electric vehicle market was valued at US\$ 255 Bn. It is forecasted to reach approximately US\$ 2,108 Bn by 2033, growing at a significant CAGR of 23% from 2024 to 2033.



Over the next decade in India, significant adoption is expected across the 3W, 2W, e-bus, and Passenger Vehicle segments with an expected **~10 Mn annual volumes** (FY24 cumulative domestic volumes were ~1.7Mn). This growth will be driven by favorable government policies, new product launches, declining bill of materials (BoM) costs, and technological advancements, positioning India as a key player in the global EV space.



This presentation provides an *in-depth analysis of the evolving global Electric Vehicle (EV) ecosystem*, with a special emphasis on India's emerging role. We are pleased to present an overview of the global EV landscape, with a particular focus on key policy interventions in major economies and India.



The presentation delves into strategic initiatives by leading OEMs and Auto Component Manufacturers that are driving a more sustainable EV ecosystem while showcasing the immense growth opportunities in this rapidly transforming industry.

1. Global EV Landscape (Post Covid Scenario)

2. China: Favorable EV Policies led to Rapid Market Growth

3. India: Evolution of The India EV Story to Date

: Policies Adopted by the Government

: Volume Growth

: Segment-wise EV Penetration in India (in %)

: PM E-drive Scheme: Rs 10,900 Cr Subsidy Scheme

4. Long Term Road Map of Indian OEMs

5. Deep Dive into the Indian EV Ecosystem

Overview of Different Types of EVs

Key Components of Electric Vehicles (EVs)

A.Battery Packs: The Powerhouse of Evs.

B.Electric Traction Motor: Converting Energy into Motion.

C.Chargers and Charging Infrastructure Electric Motor and Propulsion System; BMS.

D.Thermal Management Systems: Regulating Temperature.

E.Power Electronics Controller and BMS: Managing Electrical Flow.

F.Regenerative Braking Systems.

G.Cables and Connectors.

6. Factors for Sustainable Growth in EV Space in India-The PBIT Approach

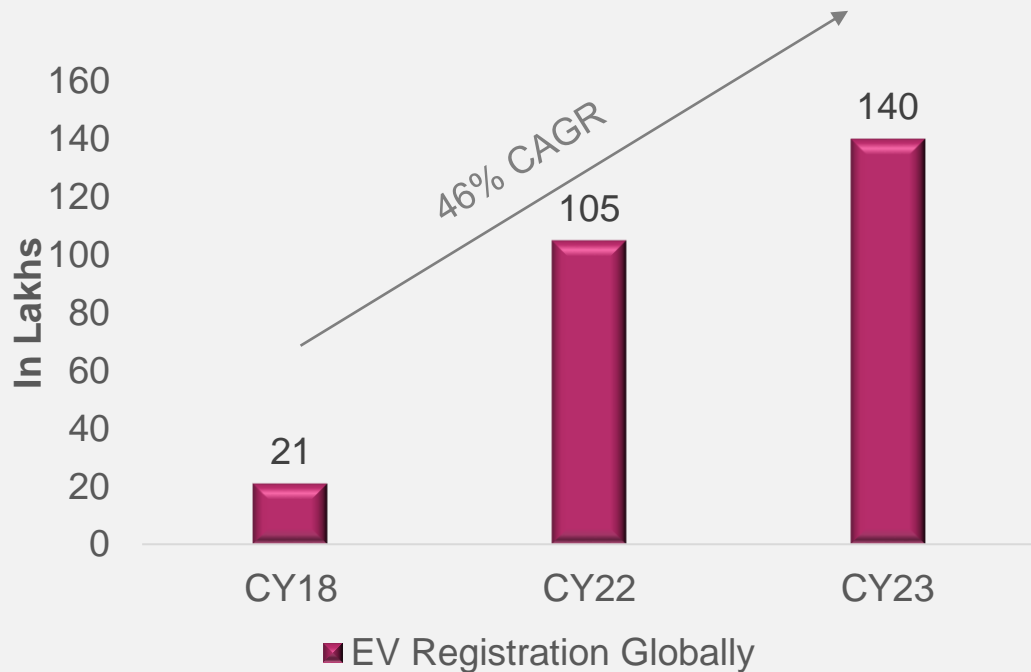
7. The India EV Story Ahead....FY30

8. Conclusion

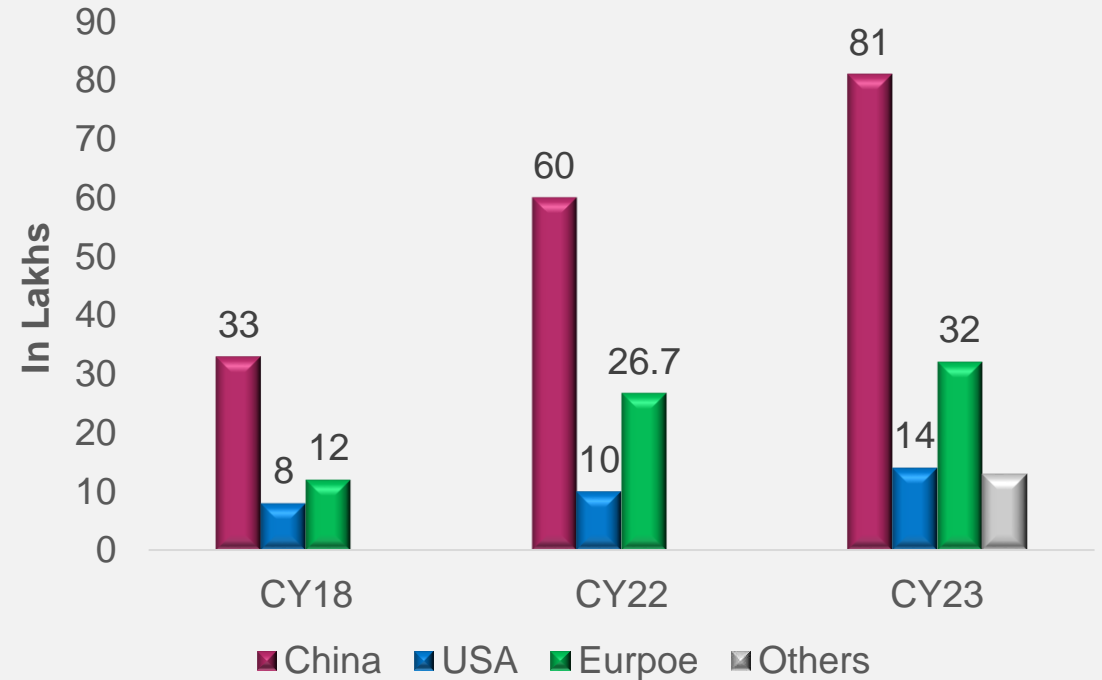
Global EV Landscape (Post Covid Scenario)

The Global EV sales registration has seen a strong **CAGR of 46% in volumes over CY18-23** with major growth coming from economies like China, followed by EU and US respectively.

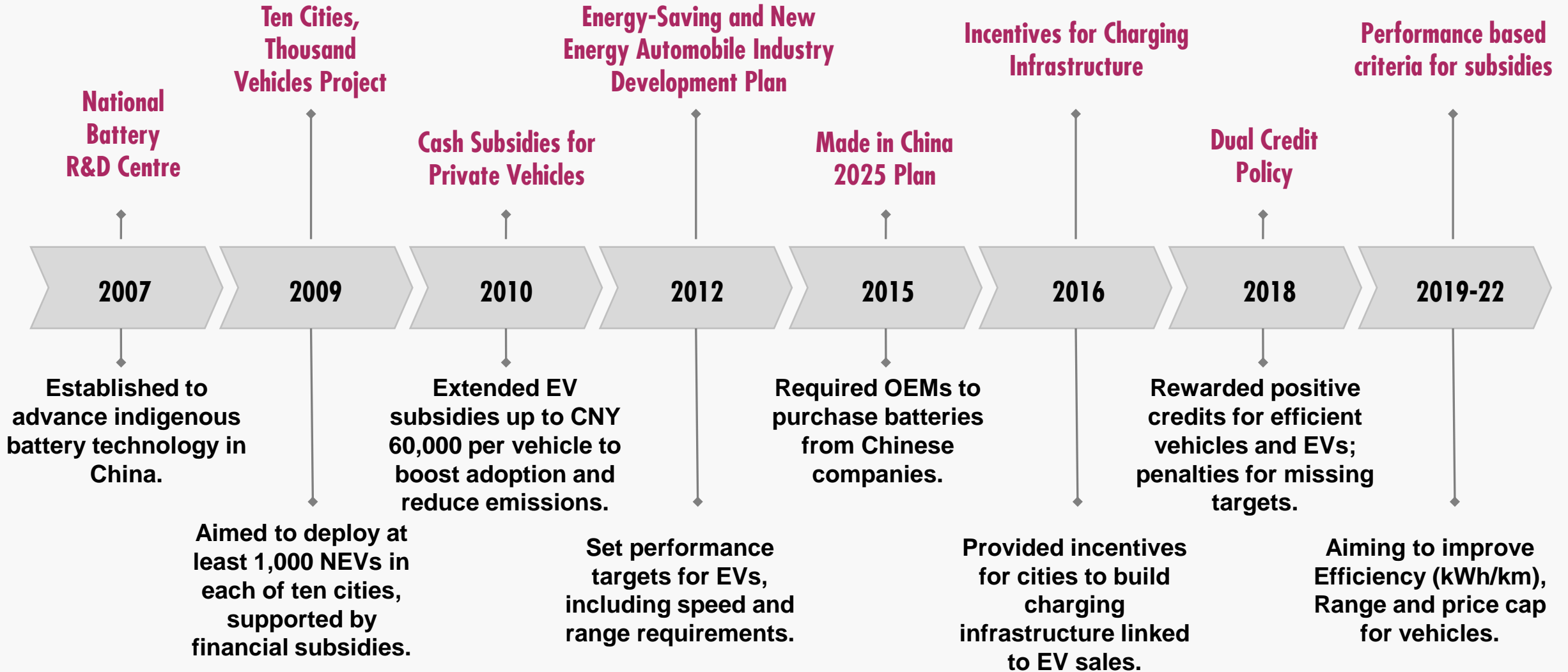
Global EV Registration 2018-2023



Geography wise registration



CHINA: Favorable EV Policies led to Rapid Market Growth

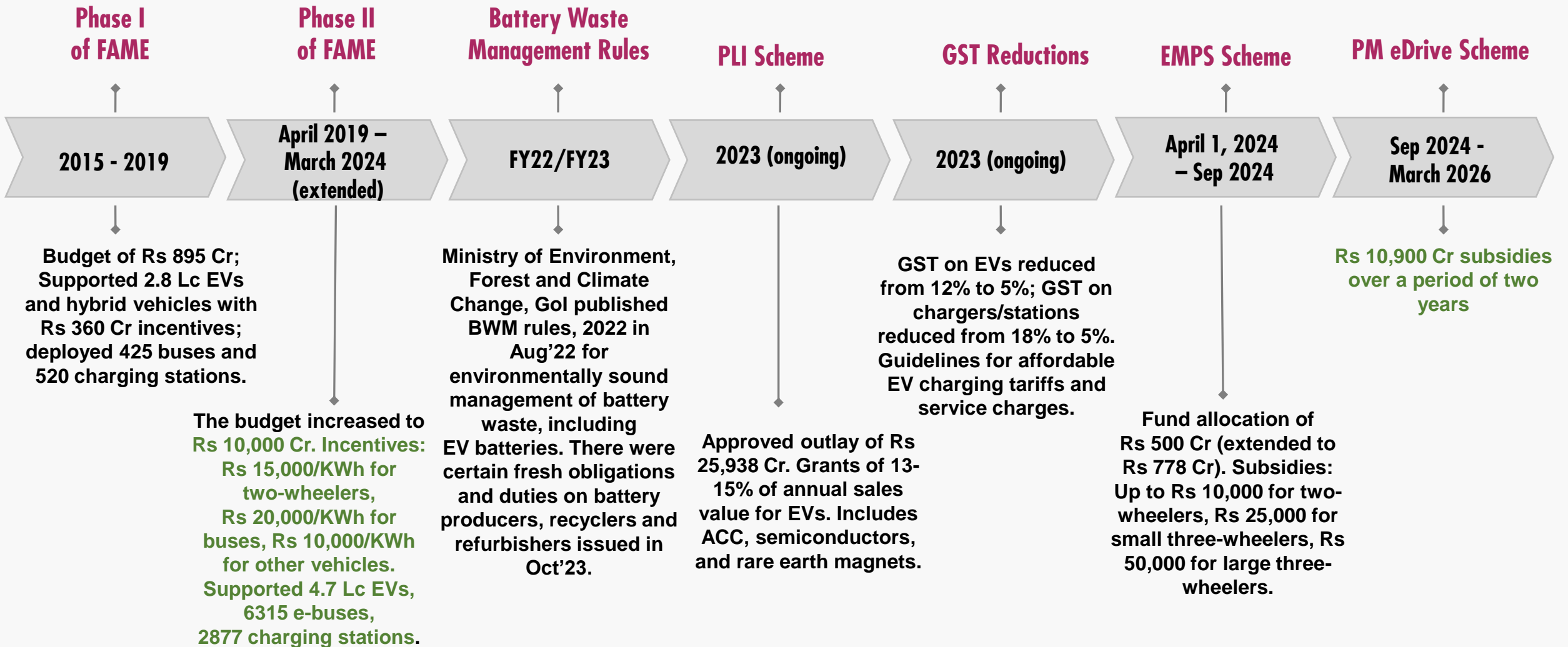


“

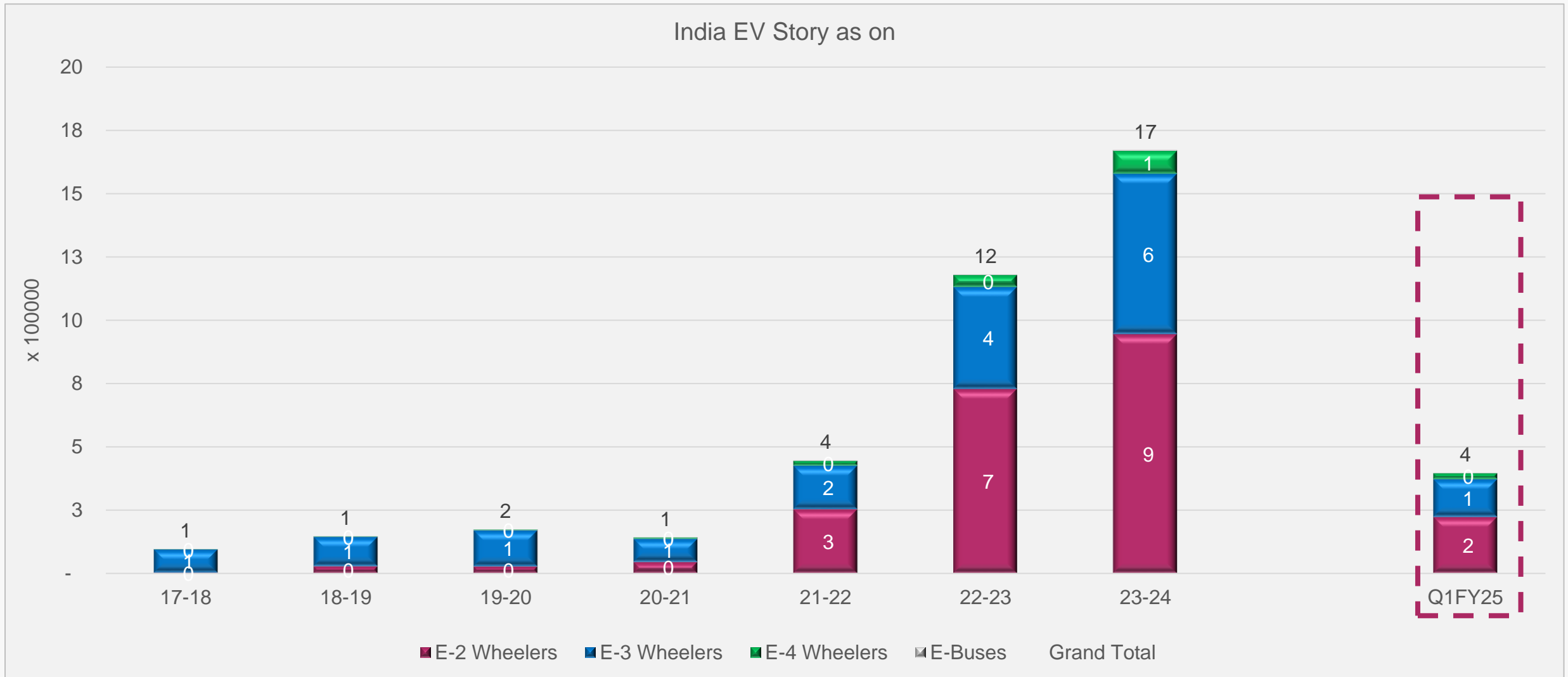
India: Evolution of The Indian EV Story till Date....

”

EV Policies Adopted by the Indian Government

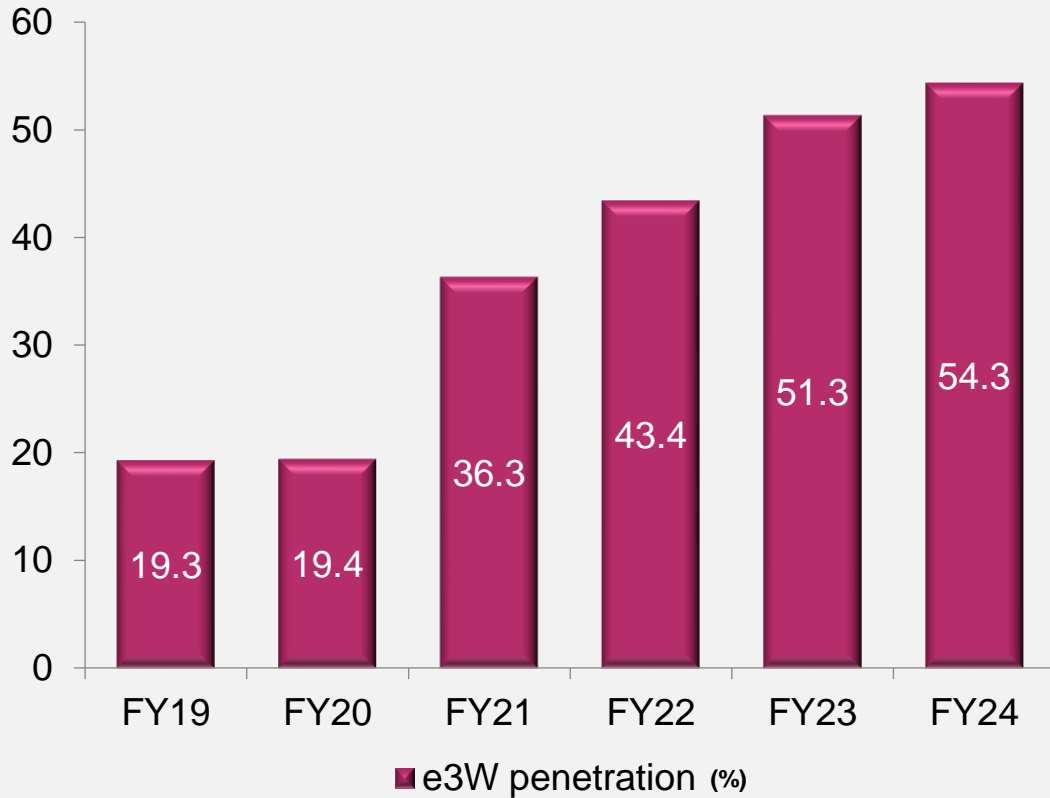


India: Volume Growth Trajectory

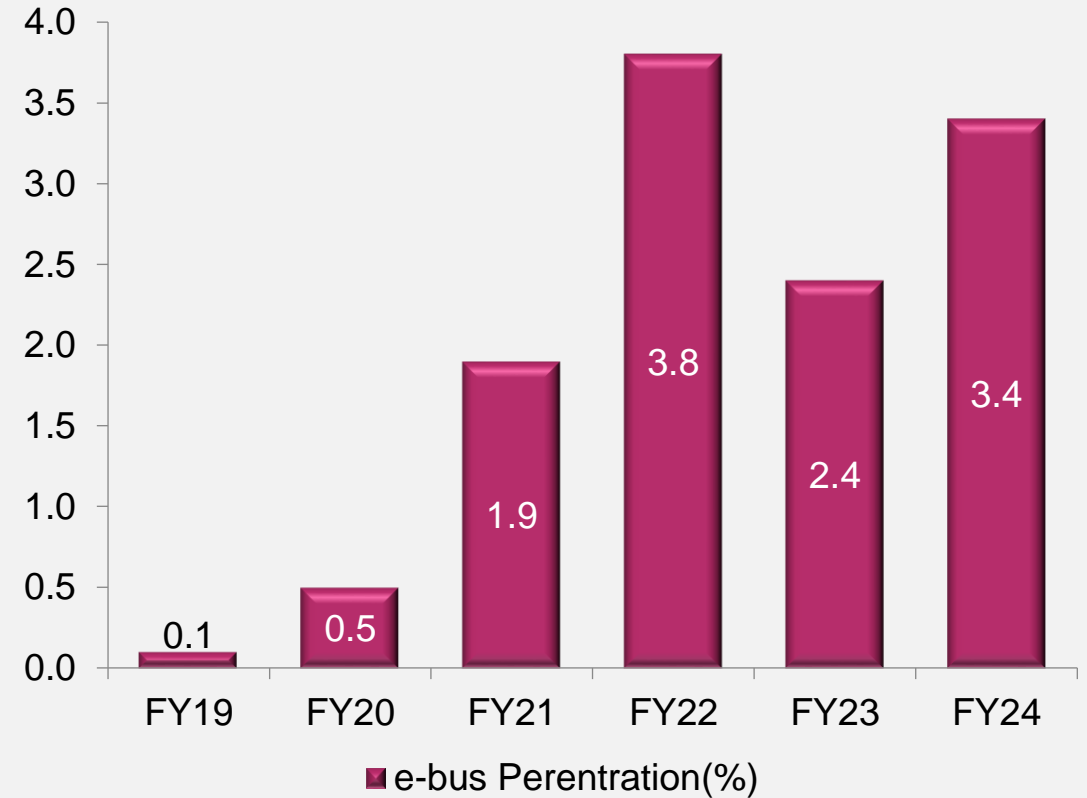


Segment-wise EV Penetration in India (in %)

3W Seeing Encouraging EV Transition

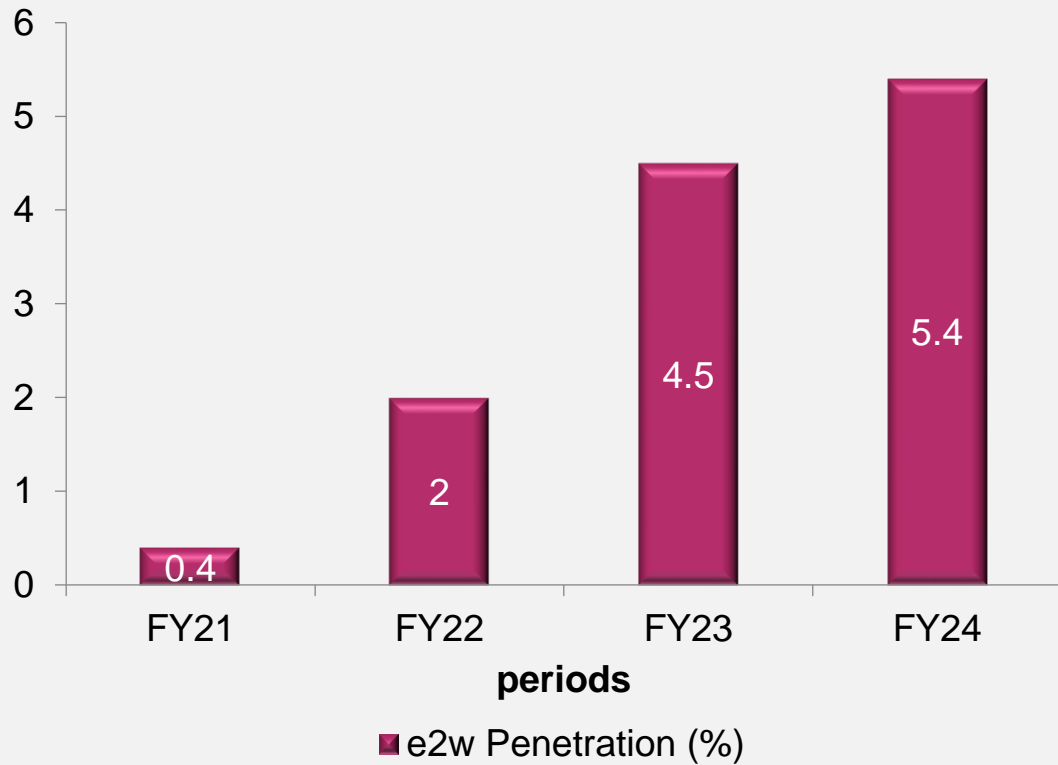


Momentum in e-bus Penetration to Pick-up going ahead

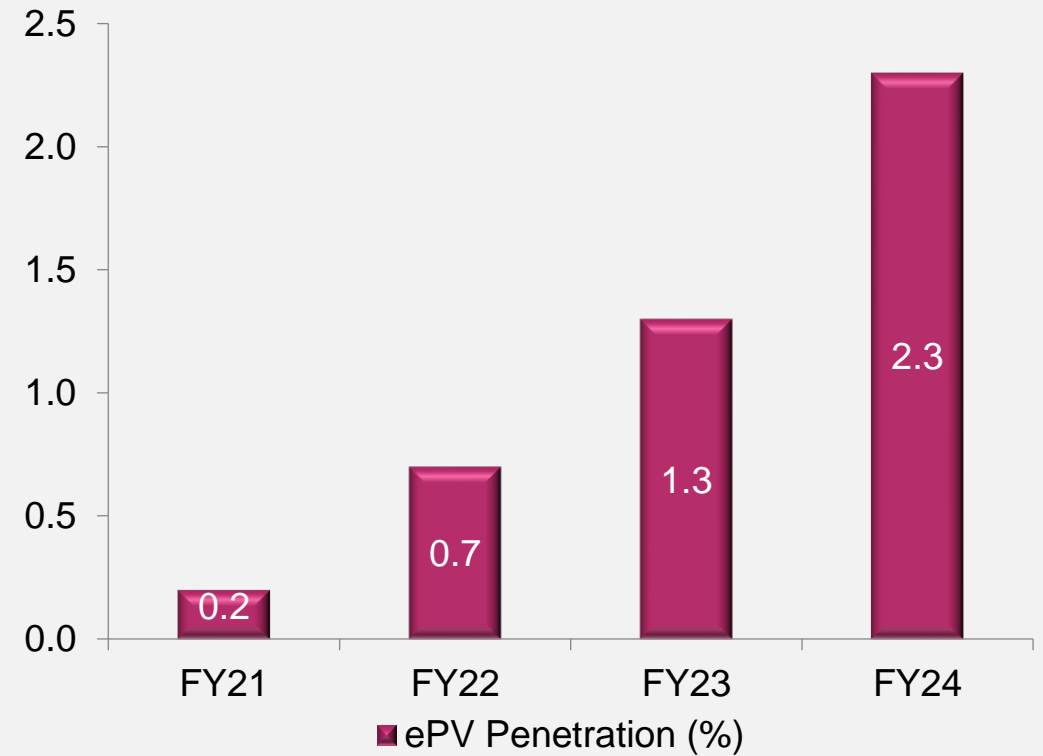


Segment-wise EV Penetration in India (in %)

e2W Rapid penetration continues

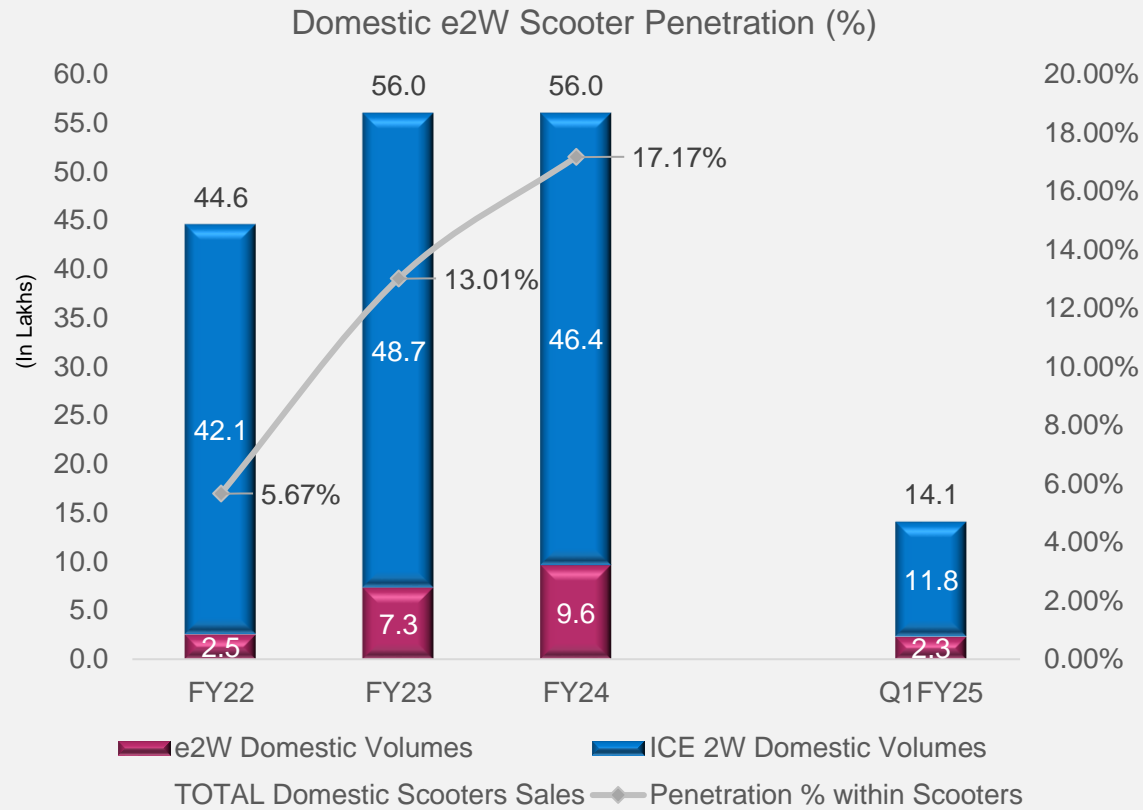


Gradual EV penetration in PVs

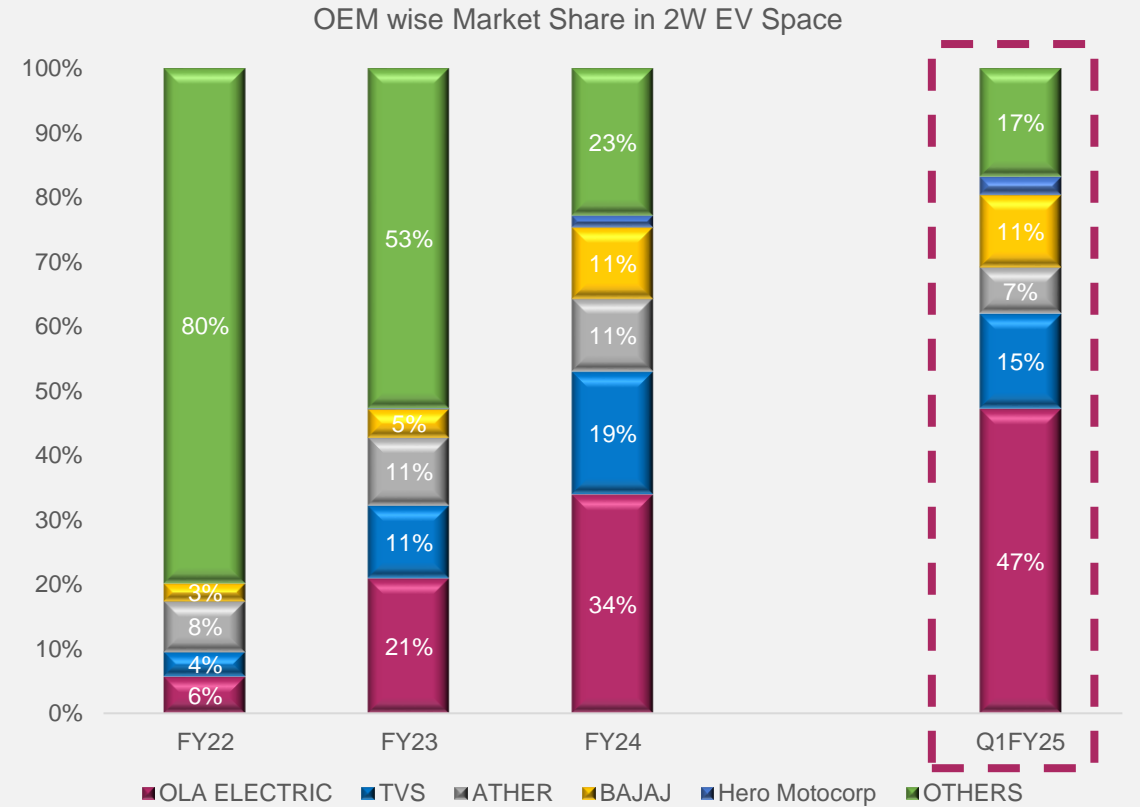


India 2W Scooters EV Story....

India 2W Scooters Volume



India 2W Scooters Market Share (%)



PM E-drive Scheme: Rs 10,900 Cr Subsidy Scheme

Major Notifications:

- ➔ Total outlays of Rs 10,900 Cr subsidies over a period of two years. The scheme to support 24.79 Lc e-2Ws, 3.16 Lc e-3Ws, and 14,028 e-buses.
- ➔ Rs 3,679 Cr Subsidies/Demand incentives to incentivize e-2Ws, e-3Ws, e-ambulances, e-trucks and other emerging EVs (but not e-cars).
- ➔ Until March 2025, each e-2W will receive a subsidy of Rs 10,000 and an e-3W will get a subsidy of Rs 50,000.
- ➔ The scheme allocates Rs 500 Cr for the deployment of e-ambulances (including hybrids).
- ➔ Rs 4,391 Cr for the procurement of 14,028 e-buses by STUs/public transport agencies.
- ➔ Rs 500 Cr has been allocated for incentivising e-trucks. Incentives will be given to those who have a scrapping certificate from MoRTH-approved vehicle scrapping centres (RVSF).
- ➔ Installation of 22,100 fast chargers for e-4 Ws, 1800 for e-buses and 48,400 for e-2W/3Ws. The outlay for Electric Vehicle Public Charing Stations will be Rs 2,000 Cr.

(The government continues to tax electric cars at 5% vs 28% on hybrids and 49% on ICE vehicles)

Future Norms:

April 2027 - March 2032

CAFE 3 Norms





New emission standards with targets of 91.7 gCO₂/km for passenger vehicles, stricter than CAFE 2. Penalties for non-compliance.













We have analyzed the long term roadmap of Indian OEMs on following parameters:

- *Multiple New Products to be Launched by FY30.*
- *Capital Allocation Strategy*
- *Global Partnerships*
- *Strategies aligned with Govt's Policy of Make in India, Make for the World*



Company	Key Actionables
 <p>TATA MOTORS LTD MCAP: 3,54,837 Cr</p>	<ul style="list-style-type: none"> ◆ TTMT plans to invest Rs 16k-18k Cr in Capex for its EV segment over the next few years, focusing on platform and technology development. The company intends to launch 10 EV models by the end of FY26, aiming for a 30% EV portfolio mix by 2030. TTMT is also set to introduce its first electric Range Rover by the end of CY24. ◆ Tata Sons' subsidiary, Agratas, will establish a 20GW battery manufacturing plant (LFP cells) in Gujarat with an estimated investment of Rs 13k Cr, targeting production by FY26. Furthermore, a 40GW battery plant (NMC cells) for Jaguar is planned for the UK. Additionally, the company has signed an MoU with BPCL to jointly establish 7,000 public charging stations across India.
 <p>M&M MCAP: 3,84,500 Cr</p>	<ul style="list-style-type: none"> ◆ M&M plans to launch 7 BEVs by FY30 and targets having 30% of its SUV portfolio as electric by 2027, leveraging its new Inglo Platform. The company is set to invest Rs 10,000 Cr in its EV business by FY27. In the current fiscal year, M&M aims to boost its monthly production capacity by 15k units, of which 10k will be EVs, thereby increasing its total monthly capacity to 64k units. ◆ In January 2024, Mahindra & Mahindra Ltd. and the India-Japan Fund ("IJF"), managed by the National Investment and Infrastructure Fund Limited ("NIIF"), entered into a binding agreement, with IJF committing to invest US\$ 48.1 million (Rs. 400 crore) in Mahindra Last Mile Mobility Limited (MLMML)
 <p>Maruti Suzuki MCAP: 4,01,641</p>	<ul style="list-style-type: none"> ◆ Maruti Suzuki plans to launch 6 BEV models by 2030, with an expected EV sales contribution of 15-20% by FY30. The company also intends to export its EVs to Japan and European countries, expanding its global footprint in the EV segment. ◆ Parent company Suzuki Motors, in a JV with Toshiba and Denso, is setting up an EV battery manufacturing plant in Hansalpur, Gujarat, with an investment of approximately ₹7,300 Cr. This facility will support Maruti Suzuki's EV ambitions by ensuring a steady supply of batteries for its electric vehicle lineup.
 <p>HYUNDAI (IPO AWITED)</p>	<ul style="list-style-type: none"> ◆ Hyundai plans to have 6 BEV models by 2028, with a total capital investment outlay of Rs 20k Cr from 2023-33. This includes a recent investment of ₹6,180 Cr in Tamil Nadu, aimed at boosting EV production and infrastructure. ◆ The company is expected to launch the Creta EV in Q4FY25E, adding to its current EV lineup - the Ioniq5, a premium electric vehicle.

Company	Key Actionables
 <p>TVS Motors MCAP: 1,36,402 Cr</p>	<ul style="list-style-type: none"> ◆ TVS Motor plans to invest approximately Rs 1,000 Cr in FY25 to introduce a new lineup of two and three-wheelers, covering both electric and internal combustion engine (ICE) models. As part of its strategy to expand in international markets, TVS is targeting Europe by launching premium EVs and ICE two-wheelers in France and Italy. This move is aligned with the company's efforts to strengthen its global footprint and capitalize on the growing demand for electric mobility solutions.
 <p>Bajaj Auto MCAP: 3,47,789 Cr</p>	<ul style="list-style-type: none"> ◆ Bajaj Auto is adding more variations to the Chetak (currently four), its first model in the electric two-wheeler market. The company aims to expand its e3W network to 70-80 cities and increase Chetak EV sales to 40,000 units per month. Additionally, Bajaj will commission a new facility for e3W with a Rs 400 Cr investment.
 <p>Ola Electric Mobility MCAP: 45,933 Cr</p>	<ul style="list-style-type: none"> ◆ Ola is currently the market leader in e2W in India, with six models in its portfolio. The company is expected to launch three e-motorcycles and e3W by FY26. Ola is also setting up a cell manufacturing unit with a current capacity of 1.4GWh, expected to expand to 5GWh by Feb 2025 and 6.4GWh by April 2025. The total capacity of this factory is envisioned to reach 20GWh by Jun'26. Additionally, Ola Electric is developing a new 4680 form of battery cell, which is more advanced and energy-dense than the 2170 cells it currently uses.
 <p>Hero Motocorp Ltd MCAP: 1,22,617 Cr</p>	<ul style="list-style-type: none"> ◆ Hero MotoCorp is planning to have a portfolio of four models by FY25 end, which is likely to include two new electric scooters at lower price points, one business-to-business product for last-mile connectivity, and a refreshed model of the V1. The company also intends to introduce six electric motorcycles under the Vida range and another four motorcycles under its alliance with Zero Motors starting from FY26. Additionally, Hero MotoCorp is working with Ather Energy, in which it holds a 44% stake, to improve the electric vehicle ecosystem in India. Together, they have set up nearly 2,000 fast-charging points across 200 cities in the country.
 <p>Ather Energy (IPO AWITED)</p>	<ul style="list-style-type: none"> ◆ Ather is a pure-play EV company in India with two product lines-the Ather450 and the Ather Ritza comprising a total of seven variants. ◆ Ather Energy became a unicorn after receiving a \$71 million funding round from the National Investment and Infrastructure Fund (NIIF). This funding round increased the company's valuation to \$1.3 Bn (Rs 11k Cr approximately), making it the fourth unicorn in India this year and the second in the mobility space.

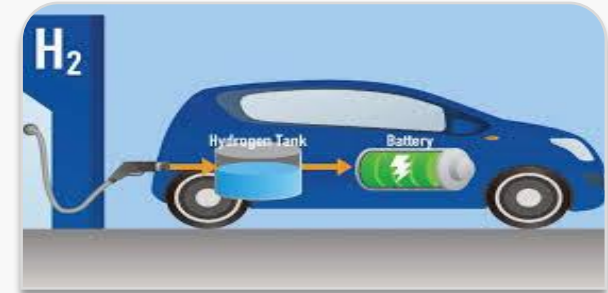
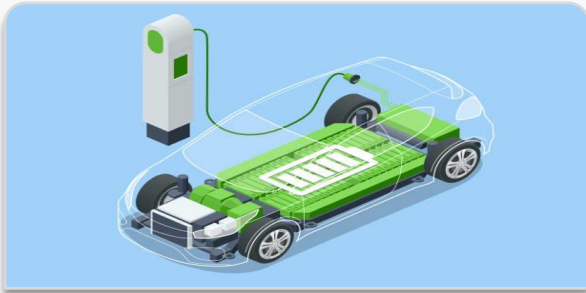
Company	Key Actionables
 Ashok Leyland Ashok Leyland MCAP: 69,739 Cr	<ul style="list-style-type: none"> ◆ Investing in Switch (Electric Buses & LCVs) & Ohm (e-MaaS) ◆ Showcased readiness in Alternate power trains: CNG, LNG, H2 ICE, H2 FC, BEV Trucks ◆ 71 Million Green KMs Globally 28 Million Green KMs in India by FY23. ◆ Drive System Design (DSD), a subsidiary of Hinduja Tech, focuses on innovations in electrified propulsion systems and advanced technologies.
 TATA MOTORS TATA Motors Ltd MCAP: 3,54,837 Cr	<ul style="list-style-type: none"> ◆ TTML is working on multi-fuel capability – Gasoline, Diesel, CNG, Ethanol Blend, Bio-diesel, Bio-CNG, LNG, and Hydrogen. ◆ Aims 30%+ penetration of Evs in the portfolio by FY30. EBITDA is neutral before product development expenses. ◆ TTML has Completed a milestone of 150k in EV sales.
 VE COMMERCIAL VEHICLES <small>A VOLVO GROUP AND EICHER MOTORS JOINT VENTURE</small> VE Commercial Vehicles (Eicher Motors) MCAP: 1,38,524 Cr	<ul style="list-style-type: none"> ◆ Eicher Trucks and Buses is committed to advancing alternative fuel technologies like CNG, LNG, and HCNG alongside its EV initiatives. ◆ Eicher and Amazon are collaborating to introduce up to 1,000 electric trucks for Amazon's delivery operations in India.
 Olectra Olectra Greentech MCAP: 13,944 Cr	<ul style="list-style-type: none"> ◆ Olectra Greentech has secured orders from multiple state transport undertakings, including MSRTC and BEST. Olectra Greentech acquired a 26% stake in Evey Trans (Mah) Private Limited to help fulfill a contract for 2,400 electric buses with BEST. ◆ Olectra Greentech renewed its collaboration with BYD until 2030. ◆ Olectra Greentech is building a new 150-acre plant in Telangana that will initially produce 5,000 buses per year and eventually scale up to 10,000 by FY26.
 JBM Group JBM Auto MCAP: 21,980 Cr	<ul style="list-style-type: none"> ◆ JBM Auto develops advanced battery systems for electric vehicles. ◆ JBM Auto has set a goal of introducing 3,000 e-buses in FY25, and forecasts 150,000 electric buses for STUs by 2030. ◆ JBM Auto is setting up EV charging stations in major cities across India, including DC fast chargers and AC slow chargers. ◆ In the last five years, JBM Auto claims to have clocked 150+ Mn e-kms and expects to clock over 1 Bn e-kms in the next 3-4 years.

“

Deep Dive Into The **Electric Vehicle Ecosystem**

”

Overview of Different Types of EVs



BEVs (Battery Electric Vehicles)

Operate solely on electric power stored in batteries and emit no pollutants.

Scope of Battery: 2W,3W,4W,CV



HEVs (Hybrid Electric Vehicles)

Combine a petrol/ diesel engine with an electric motor for better fuel efficiency.

Scope of Battery: 4W,CV



PHEVs (Plug-in Hybrid Electric Vehicles)

Runs on gasoline and electricity, with the ability to recharge the battery from an external power source.

Scope of Battery: 4W,CV



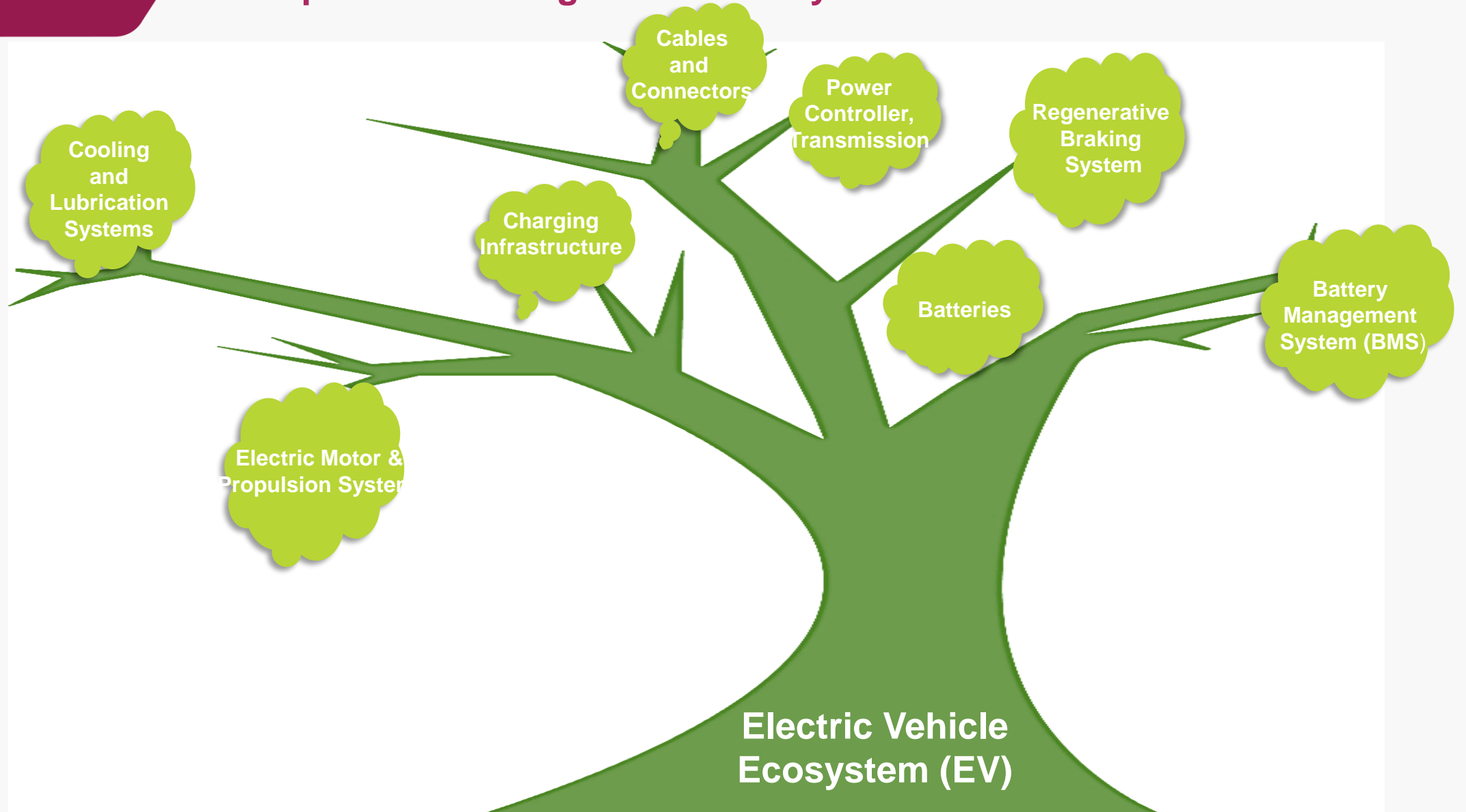
FCEVs (Fuel Cell Electric Vehicles)

Use hydrogen fuel cells to generate electricity, emitting only water vapour as a by product.

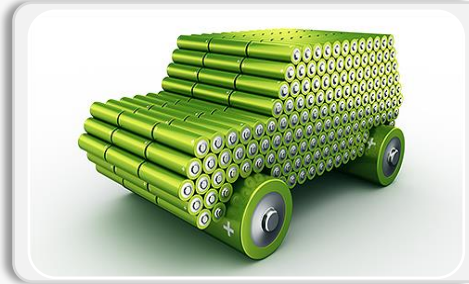
Scope of Battery: 4W,CV



Components Driving The EV Ecosystem





Key Components of Electric Vehicles (EVs)





Batteries: The Powerhouse of EVs

- ◆ a rechargeable energy storage system
- ◆ Lithium-Ion batteries: high energy density, thermal stability and long lifespan.
- ◆ Directly influences driving range and efficiency.

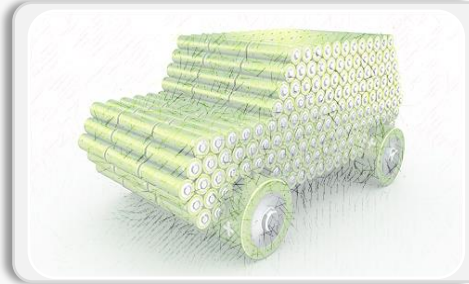
A. Batteries: Advanced Chemistry Cell

Company	Description
 <p>Exide Industries MCAP: 40,553 Cr</p>	<ul style="list-style-type: none"> ◆ Exide Industries, through its wholly owned subsidiary, Exide Energy Solutions Limited (EESL), is setting up a gigafactory for lithium-ion cells in Bengaluru with a capacity of 12 GWh. The first phase of the project, with a capacity of 6 GWh, is expected to be completed in 2025. As of March 2024, the company has invested Rs 2,302 Cr in EESL. Exide has partnered with China-based SVOLT Energy Technology, which develops and manufactures lithium-ion batteries and storage solutions for multiple applications. Additionally, Hyundai Motors and Kia have signed a memorandum of understanding (MoU) with Exide Energy Solutions to localize EV battery production in India.
 <p>OLA Electric MCAP: 45,933 Cr</p>	<ul style="list-style-type: none"> ◆ Ola is setting up a cell manufacturing unit named the Ola Gigafactory in the vicinity of its Ola Future factory. This factory, as of now, has the capacity of 1.4GWh and is expected to expand to 5GWh by Feb'25 and 6.4GWh by Apr'25. The total capacity of this factory is envisioned to be 20GWh by Jun'26. Ola has developed in-house its 4680-form factor battery cell which it is manufacturing in this factory and will use in its products.

A. Batteries: Advanced Chemistry Cell (contd.)

Company	Description
 <p>Reliance Industries Limited</p> <p>Reliance Industries MCAP: 20.21 Lk Cr</p>	<p>◆ Reliance Industries is set to start operations at its battery gigafactory by H2FY26, with an annual capacity of 30 GW. The facility, spread across 5,000 acres in Jamnagar, Gujarat, will initially focus on assembling battery systems and packs, before expanding into cell manufacturing and chemical production. The company has already established a pilot line with a capacity of 50 MWh per year for manufacturing lithium-ion battery cells. Additionally, it is working on the commercialization of its sodium-ion battery technology, with plans to industrialize sodium-ion cell production at a megawatt level by FY26.</p>
 <p>AMARA RAJA Gotta be a better way</p> <p>Amara Raja: MCAP: 24,986 Cr</p>	<p>◆ Amara Raja is setting up a Rs 9,500 Cr gigafactory for lithium-ion cells and battery packs in Telangana. The company is targeting a capacity of 16 GWh for cells and 5 GWh for battery packs over the next decade as per its initial plan. The first phase of the factory, with a capacity of 2 GWh, is expected to be operational by FY26. Recently, Amara Raja announced a technology partnership with Gotion High-Tech's subsidiary, Gotion-InoBat-Batteries (GIB) EnergyX Slovakia, to license Gotion's technology for manufacturing lithium-ion cells in both cylindrical and prismatic form factors.</p>

Key Components of Electric Vehicles (EVs)



Battery Packs: The Powerhouse of EVs




- ◆ a rechargeable energy storage system
- ◆ Lithium-Ion batteries: high energy density, thermal stability and long lifespan.
- ◆ Directly influences driving range and efficiency.





Power Controller, Transmission and Motors: Converting Energy into Motion

- ◆ Transforming electrical energy into mechanical energy.
- ◆ Includes permanent magnet, AC and DC motors; usage based on performance needs

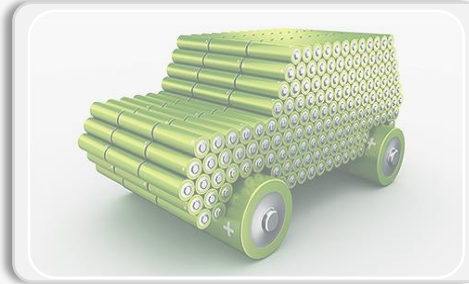
B. Power Controller, Transmission and Motors

Company	Description
 <p>Divgi Torque Transfer Systems MCAP: 1,784 Cr</p>	<ul style="list-style-type: none"> ◆ DTTS is a system-level provider offering a range of transmission solutions. The company has been one of the pioneers in EV transmission products (including the planetary sun gear, final drive gear, counter shaft assembly, and input shaft) in India. DTTS has localized the technology to reduce its customers' dependence on imports (orders received from Tata Motors and M&M). It currently has a capacity of 120k units per annum, expandable to 3 shifts to meet growing demand. Currently, the company has a range of three transmissions catering the motor power ratings of 55 Kilowatts, 60 Kilowatts and 95 Kilowatts.
 <p>Varroc Engineering Ltd: MCAP: 8,998 Cr</p>	<ul style="list-style-type: none"> ◆ The company is engaged in the production of customizable traction motors and controllers, as well as DC-DC converters, with Bajaj Auto as its anchor customer (the sole supplier for 3Ws and holding a 50% market share for 2Ws). According to management, EV components contributed 4-5% of Q1FY25 revenue. Recently, Varroc has received orders from international brands such as River Indie and Stark Motors, and expects commercial production to commence by the end of FY25E. Ongoing R&D in the fields of BMS and off-board battery chargers for 2W EVs will play a crucial role in their sustainable product portfolio.
 <p>UNO MINDA LTD MCAP: 66,409 Cr</p>	<ul style="list-style-type: none"> ◆ Uno Minda EV Systems Private Limited is a joint venture between Uno Minda Ltd and FRIWO AG Germany, a leading international manufacturer of innovative power supply units and e-drive solutions. Uno Minda Ltd holds a majority stake of 50.1% in the joint venture entity. Uno Minda Buehler Motor Private Limited (UMBM), incorporated on December 12, 2022, is another joint venture between Uno Minda Ltd and Buehler Motor GmbH (“Buehler”). This JV focuses on developing, manufacturing, and marketing traction motors in India and other SAARC nations. UMBM will offer traction motors for battery-driven electrified 2-wheelers and 3-wheelers. Uno Minda will hold a 50.1% stake in the joint venture, while the remaining stake will be held by Buehler. The company announced a technical license agreement (TLA) with Suzhou Inovance Automotive Co. of China : charging control units (CCUs), EV inverters, EV motors, and next-generation 3-in-1 electric drive systems (e-Axle).

B. Power Controller, Transmission and Motors (contd.)

Company	Description
 <p>Sona BLW Precision Forgings Ltd MCAP: 45,756 Cr</p>	<ul style="list-style-type: none"> ◆ Also known as Sona Comstar, the company is an automotive technology firm that manufactures and supplies components for electric vehicles (EVs), including starter motors for conventional, micro-hybrid, and electric vehicles; EV traction motors; and motor control units. Sona BLW recently signed a technology licensing agreement with Equipmake, enabling them to manufacture and sell EV powertrains, sub-systems, and components. This agreement includes patented spoke motor and inverter technology, with a power range of 100 kW to 440 kW. Sona BLW will be able to sell these components in India, Thailand, and select South Asian countries. Additionally, Sona BLW operates a manufacturing plant in Silao, Mexico, which produces critical driveline components for BEVs. This plant is designed to serve the EV market in North America and to streamline the company's supply chain.
 <p>STERLING TOOLS LIMITED MCAP: 2,180 Cr</p>	<ul style="list-style-type: none"> ◆ The Motor Controller Unit (MCU), Battery Management System (BMS), and Vehicle Controller (VCU) are three of the most crucial core technologies for EVs, significantly impacting their performance, reliability, safety, and economy. SGEM, a joint venture between Sterling Tools Ltd and Jiangsu Gtack Electric Co. Ltd., is at the forefront of the EV value chain by offering localized MCUs for Battery & Hybrid Electric Vehicles in India. SGEM has a strong presence in the 2W, 3W, and LCV segments, having witnessed an 86% YoY segmental revenue growth in FY24. SGEM operates a manufacturing plant in Faridabad and has two tech centres in Faridabad and Bangalore. The company plans to expand its production capacity from the existing 4 Lc units to 6 Lc units annually, with an investment of Rs 55 Cr. Ola Electric Mobility is the anchor customer for the company.

Key Components of Electric Vehicles (EVs)



Battery Packs: The Powerhouse of EVs

- ◆ a rechargeable energy storage system
- ◆ Lithium-Ion batteries: high energy density, thermal stability and long lifespan.
- ◆ Directly influences driving range and efficiency.



Electric Traction Motor: Converting Energy into Motion

- ◆ Transforming electrical energy into mechanical energy.
- ◆ Includes permanent magnet, AC and DC motors; usage based on performance needs



Chargers and Charging Infrastructure

- ◆ Onboard/Offboard Charger and Charging Infra: Enabling Recharging
- ◆ Converts AC electricity from the grid into DC power for charging the battery.
- ◆ Allows for the replenishment of the battery pack's energy.

C. Charging Infrastructure

Company
Description

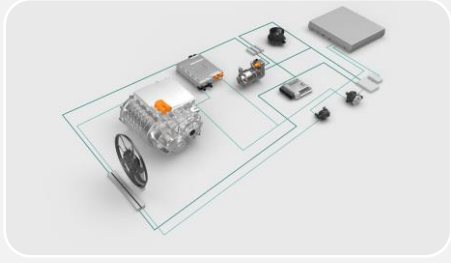

Servotech Power System
MCAP: 4,283 Cr

- ◆ Servotech Power System Ltd., an NSE-listed company, is a leading manufacturer of power electronics products, specializing in innovative and high-quality solar products and **EV chargers**. As of March 2024, the company has **deployed over 5,800 charging stations** nationwide, primarily through various Oil Marketing Companies (**OMCs**). Servotech has a robust **order book of Rs 450-500 Cr**, predominantly from OMCs such as **BPCL, IOCL, HPCL, and Nayara Energy**. The company has also secured contracts with various Municipal Corporations for supplying DC chargers and with **Adani Total Energies E-mobility Ltd** to supply AC EV chargers at airports across India.
- ◆ Servotech's consolidated revenue has grown at a **57% CAGR over FY22-24**, reaching Rs 355 Cr, with management confident in sustaining this growth trend in the coming years. The company's Haryana manufacturing facility has a production capacity of 30,000 AC EV chargers and 12,000 DC EV chargers annually. Servotech is also constructing a new facility dedicated to **producing power modules, control circuits, and PLCs**. The new plant will initially produce **24,000 power modules** annually, with plans to increase **production capacity to 2.4 Lc power modules** per year over the next few years.

Key Components of Electric Vehicles (EVs)

Thermal Management Systems: Regulating Temperature

- ◆ Air Cooling is suitable for smaller, less powerful EVs or applications where cost, simplicity, and weight are more critical than maximum performance
- ◆ Liquid Cooling is ideal for high-performance EVs, longer-range vehicles, or applications where efficient heat management is crucial for maintaining battery life, safety, and rapid charging capabilities



D. Thermal Management System: Cooling And Lubrication

Company
Description


Castrol India
MCAP: 24,744 Cr

- ◆ Castrol India has developed a range of high-quality **EV Transmission fluids, EV Thermal Fluids, and EV Greases**. Castrol ON EV Thermal Fluids are designed to help avoid the risk of thermal propagation by directly cooling the individual cells, where high temperatures can cause irreversible failure as a result of overcharging or short-circuiting. **Its innovation in immersion cooling** directly addresses the challenges associated with battery overheating and thermal propagation, making EVs safer and more reliable for everyday use.

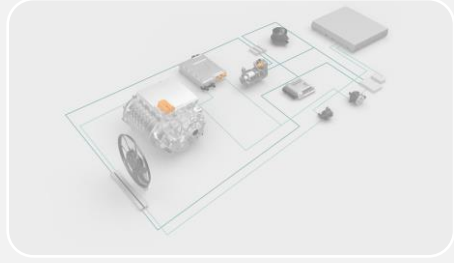


Gulf Oil Lubricants India Limited

Gulf Oil India
(GULF International)
MCAP: 6,996 Cr

- ◆ Gulf Oil has developed a specialized range of EV fluids (**Gulf eLEC Coolant, Gulf eLEC Driveline Fluid, and Gulf eLEC Brake Fluid**) for electric and hybrid vehicles. To prepare for the future in the sustainable mobility sector in India, Gulf Oil has also **partnered with ElectreeFi**, an EV SaaS provider, and Indra Technologies, a charger/mobility company based in the UK.

Key Components of Electric Vehicles (EVs)



Thermal Management Systems: Regulating Temperature

- ◆ Air Cooling is suitable for smaller, less powerful EVs or applications where cost, simplicity, and weight are more critical than maximum performance
- ◆ Liquid Cooling is ideal for high-performance EVs, longer-range vehicles, or applications where efficient heat management is crucial for maintaining battery life, safety, and rapid charging capabilities



Power Electronics Controller and BMS: Managing Electrical Flow

- ◆ controlling and regulating the flow of electrical energy between the battery pack and the electric motor.
- ◆ The BMS monitors the battery's state, including its voltage, temperature, charge level, and health. It also monitors the flow of coolant and current into and out of the battery.

E. Electric Motor and Propulsion System

Company
Description


Siemens
MCAP: 2,55,694 Cr

- ◆ **Electric Motors:** Siemens is developing high-efficiency electric motors specifically designed for EVs, including compact and lightweight designs that enhance vehicle performance and range. Their motors are known for high power density and energy efficiency, which are critical for maximizing battery life.
- ◆ **Propulsion Systems:** Siemens provides integrated electric propulsion systems that combine motors, inverters, and control units into a single, optimized package. These systems are designed to be highly scalable, making them suitable for a wide range of EVs, from passenger cars to heavy-duty commercial vehicles.
- ◆ **Software and Digitalization:** Siemens leverages its expertise in digitalization and automation to enhance the design, manufacturing, and operation of electric motors. The company uses advanced simulation tools to optimize motor performance and energy use.



ABB
MCAP: 1,73,235 Cr

- ◆ **Electric Motors:** ABB is a leader in developing electric motors for various applications, including EVs. Their motors are designed for high efficiency, reliability, and low maintenance, helping to extend the range and performance of electric vehicles.
- ◆ **Power Electronics and Propulsion:** ABB focuses on power electronics, which are essential for converting and controlling electrical power in EVs. The company provides advanced inverters and converters that ensure efficient energy use and seamless power delivery to the motor.
- ◆ **Charging Infrastructure:** Beyond propulsion systems, ABB is a major player in EV charging infrastructure, developing fast-charging solutions that are crucial for the widespread adoption of electric vehicles.

E. Battery Management Systems

Company
Description


Endurance Technologies
MCAP: 34,227 Cr

- ◆ In July 2022, ETL executed an agreement to acquire a 100% stake in **Maxwell Energy Systems Pvt Ltd** in a phased manner. Maxwell specializes in embedded electronics, particularly **Battery Management Systems (BMS)** for automobile EVs and battery packs. The company supplies to over 70 automotive OEMs and battery pack makers across 15 countries, including India, France, Spain, and the US. ETL currently holds a 61.54% stake in Maxwell. Orders booked in the last 3 years have resulted in peak annual sales of Rs 420 Cr. Maxwell has also expanded into non-automotive applications, securing two Letters of Intent (LOIs) for boats and ATVs, with peak annual business of approximately Rs 110 Cr. Additionally, it has received an **LOI from Govvecs**, a major European E-2W OEM, for Rs 13 Cr in annual revenue at peak business, starting from Q3FY25. A BMS is a crucial component of an EV's safety system, managing the battery's electronics and ensuring safe operation. It monitors the battery's temperature and controls valves to maintain a safe temperature range.

Key Components of Electric Vehicles (EVs)

Thermal Management Systems: Regulating Temperature

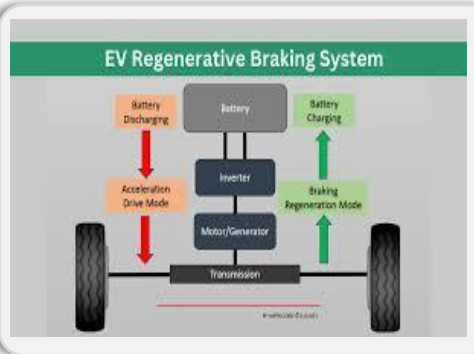
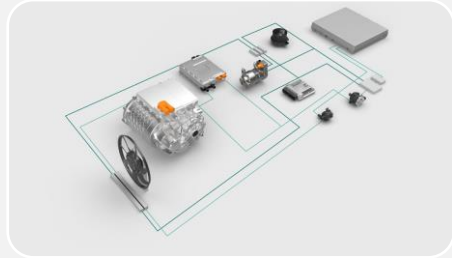
- ◆ Air Cooling is suitable for smaller, less powerful EVs or applications where cost, simplicity, and weight are more critical than maximum performance
- ◆ Liquid Cooling is ideal for high-performance EVs, longer-range vehicles, or applications where efficient heat management is crucial for maintaining battery life, safety, and rapid charging capabilities

Power Electronics Controller and BMS: Managing Electrical Flow



- ◆ controlling and regulating the flow of electrical energy between the battery pack and the electric motor.
- ◆ The BMS monitors the battery's state, including its voltage, temperature, charge level, and health. It also monitors the flow of coolant and current into and out of the battery.

Regenerative Braking Systems

- ◆ During braking, the electric motor of the hybrid or electric vehicle switches to generator mode. The wheels transfer the kinetic energy via the powertrain to the generator.



F. Regenerative Braking

Company	Description
 <p>Bosch MCAP: 1,08,834 Cr</p>	<ul style="list-style-type: none"> ◆ Market leaders like Bosch are expanding their offerings beyond traditional hydraulic regenerative braking systems. They are introducing electronically controlled systems that enhance energy recovery efficiency and integrating these systems with advanced driver-assistance features, such as adaptive cruise control, to maximize energy conservation. Regenerative braking energy has the potential to wirelessly charge electric vehicles while in motion. Coordinating regenerative braking with other vehicle systems, such as electric motors and batteries, is crucial for optimal performance. These regenerative braking systems recover energy, which is then stored in a high-voltage battery.
 <p>ZF International (ZF Commercial Vehicle Control System India Ltd): MCAP: 30,310 Cr</p>	<ul style="list-style-type: none"> ◆ ZF offers a range of park brake solutions, including integrated park brakes and full Electronic Park Brake (EPB) systems. Their offerings include standard EPB, EPBi—which eliminates the need for a separate Electronic Control Unit (ECU) by integrating it within the electronic stability control system—and EPB for front axles, which is more suitable for smaller vehicle segments. ◆ The Integrated Brake Control (IBC) is a vacuum-independent, integrated electro-hydraulic brake actuation control system that can replace the electronic stability control, vacuum brake booster, and, if necessary, the vacuum pump along with the associated cables, sensors, switches, and control units. With this single, integrated unit, ZF enables full regenerative braking and eliminates the need for additional vacuum pumps. The company has also announced a partnership with REE Automotive to develop integrated e-drive and braking systems for electric and hybrid vehicles.

Key Components of Electric Vehicles (EVs)



Cables and Connectors

- ◆ includes Wiring Harnesses, Battery Cables, Wiring Sets, Connectors & Terminals.
- ◆ for power supply and data transfer across various vehicle segments and other industrial applications

Company
Description


Spark Minda
MCAP: 14,031 Cr

◆ Spark Minda is a leading manufacturer of a wide range of components, including **Wiring Harnesses, Battery Cables, Wiring Sets, Connectors & Terminals**, and Low Voltage Wiring Harnesses for EV commercial vehicles. Through its wholly owned subsidiary, Spark Minda Green Mobility Systems (SMGM), the company focuses on products tailored for the EV segment, such as **Battery Chargers, DC-DC Converters, Battery Management Systems (BMS), Motor Controllers, and Vehicle Controllers (VCUs)**.

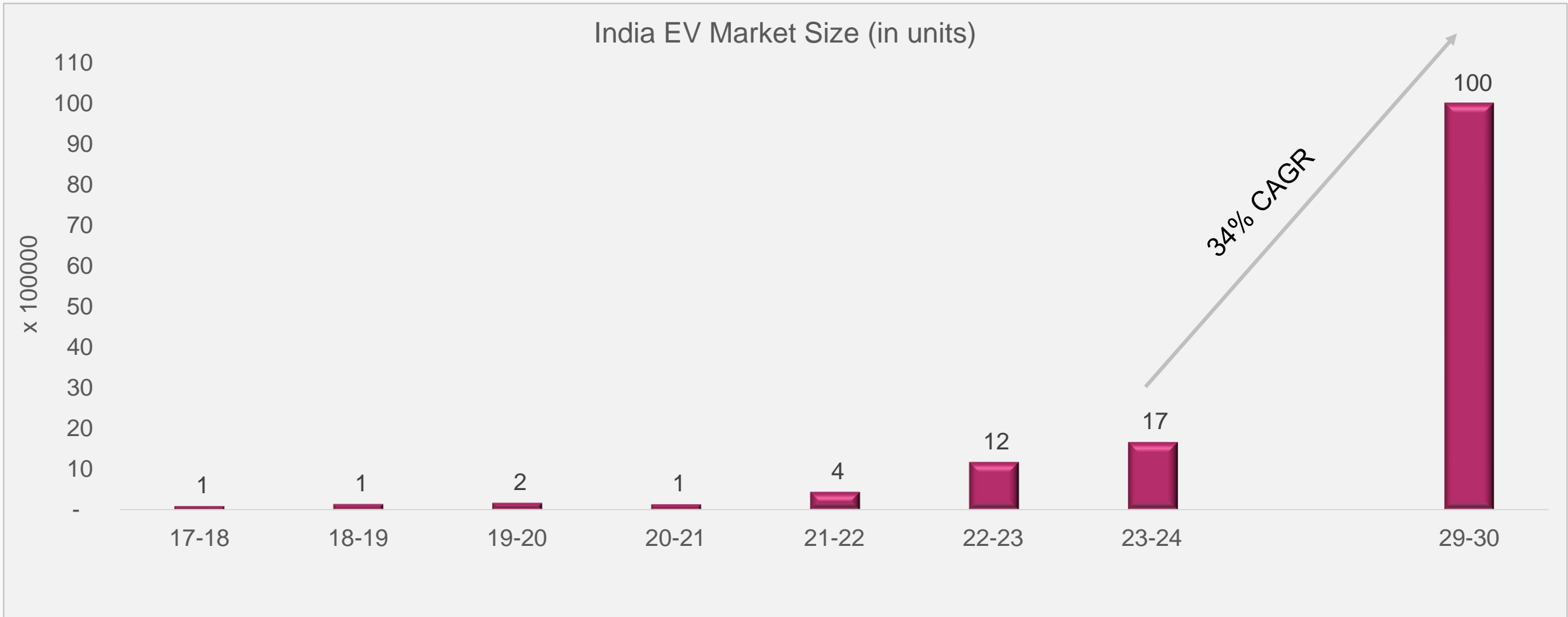
◆ In partnership with **EVQPOINT Solutions**, Spark Minda has entered into an exclusive technology and manufacturing agreement for **battery chargers and EV supply equipment**. Additionally, Minda Corp has signed a Technology Licensing Agreement (**TLA**) with **Sanco** to locally develop EV connecting systems, charging gun assemblies with sockets and accessories, bus bars, cell contact systems, Power Distribution Units (PDU), and Battery Distribution Units (BDU).



Samvardhana Motherson
International Ltd
MCAP: 1,45,189 Cr

◆ Sampardhana Motherson specializes in designing, manufacturing, and integrating **advanced Electrical & Electronic Distribution Systems** (Wiring Harness Systems) for power supply and data transfer across various vehicle segments and other industrial applications. Its wiring harness division, Motherson Sumi Wiring India Limited (MSWIL), is a joint venture between SAMIL and Sumitomo Wiring Systems, Ltd. (SWS). MSWIL is a **market leader** in the Indian wiring harness industry, supplying components to two of the top three electric vehicle passenger vehicle OEMs and two of the top five electric vehicle 2W OEMs in India.

The India EV Story Ahead....FY30



***As per the Economic Survey of India India's domestic electric vehicle market is estimated at 10 million annually by 2030.**

India's Key EV Growth Drivers – The PBIT Approach



PRICING (SUBSIDIES, LITHIUM AVAILABILITY, REGULATIONS/GRANTS): EVs have higher upfront costs than ICE vehicles but are becoming more affordable with subsidies and falling battery prices. Lower running costs over time make EVs more economical in the long run.



BATTERY RANGE (R&D SPENDS): While ICE vehicles offer longer range and quick refueling, EVs are improving with better battery technology, reducing the gap.



INFRASTRUCTURE (CHARGING STATIONS): ICE vehicles benefit from a mature fuel network. EV charging stations are expanding rapidly in India, with growing government and private sector support.



TERMINAL VALUE (RESALE): ICE vehicles have a stable resale market. EVs are catching up as battery technology improves, stabilizing their long-term value.

To Conclude...



The Economic Survey of India 2023 had forecast a robust Indian domestic EV market with an estimated **10 Mn annual sales by 2030.**

Indian Governments focus on both the demand-side and supply-side incentives in its EV policy aims to ensure long-term sustainability and foster self-reliance in the electric vehicle sector. The PM E-Drive scheme, which targets public transport, commercial EVs, and charging infrastructure, is complemented by the Production Linked Incentive (PLI) programs aimed at bolstering domestic manufacturing and reducing reliance on imports. By positioning itself as a manufacturing hub, India seeks to solidify its competitiveness in the global EV landscape, reinforcing its ambition to be a key player in the emerging green economy.



Axis Securities Limited is a subsidiary company of Axis Bank Ltd. Axis Bank Ltd. is a listed public company and one of India's largest private sector banks and has its various subsidiaries engaged in businesses of Asset management, NBFC, Merchant Banking, Trusteeship, Venture Capital, Stock Broking, the details in respect of which are available on www.axisbank.com.

Axis Securities Limited, is registered as a Stock Broker, Depository Participant, Portfolio Manager, Investment Adviser and Research Analyst with Securities and Exchange Board of India
Corporate Agent with Insurance Regulatory and Development Authority of India
Point of Presence with Pension Fund Regulatory and Development Authority
Distributor for Mutual Funds with AMFI

Registration Details:

SEBI Single Reg. No.- NSE, BSE, MSEI, MCX & NCDEX – INZ000161633 | SEBI Depository Participant Reg. No. IN-DP-403-2019 | Portfolio Manager Reg. No.- INP000000654 | Investment Advisor Reg No. INA000000615 | SEBI-Research Analyst Reg. No. INH000000297 | IRDA Corporate Agent (Composite) Reg. No. CA0073| PFRDA – POP Reg. No. POP387122023 | Mutual Fund Distributor ARN- 64610.

Compliance Officer Details: Name – Mr. Jatin Sanghani, Tel No. – 022-68555574, Email id – compliance.officer@axisdirect.in;

Registered Office Address – Axis Securities Limited, Unit No.002, Building- A, Agastya Corporate Park, Piramal Realty, Kamani Junction, Kurla (W), Mumbai – 400070.

Administrative office address: Arium Q Parç, Q2 Building, Unit No. 1001, 10th Floor, Level – 6, Plot No. 4/1 TTC, Thane – Belapur Road, Ghansoli, Navi Mumbai, Pin Code – 400710.

In case of any grievances please call us at 022-40508080 or write to us helpdesk@axisdirect.in.

We hereby declare that our activities were neither suspended nor we have defaulted with any stock exchange authority with whom we are registered in last five years. However, SEBI, Exchanges, Clearing Corporations and Depositories etc. have conducted the routine inspection and based on their observations have issued advise/warning/show cause notices/deficiency letters/ or levied penalty or imposed charges for certain deviations observed in inspections or in normal course of business, as a Stock Broker / Depository Participant/Portfolio Manager. We have not been debarred from doing business by any Stock Exchange / SEBI or any other authorities; nor has our certificate of registration been cancelled by SEBI at any point of time.

Investments in securities market are subject to market risks. Read all the related documents carefully before investing.
By referring to any particular sector, Axis Securities does not provide any promise or assurance of favourable view for a particular industry or sector or business group in any manner.

Registration granted by SEBI, membership of BASL (in case of IAs) and certification from NISM in no way guarantee performance of the intermediary or provide any assurance of returns to investors. None of the research recommendations promise or guarantee any assured, minimum or risk-free return to the investors. Our research should not be considered as an advertisement or advice, professional or otherwise. This research report and its respective content by Axis Securities made available on this page or otherwise do not constitute an offer to sell or purchase or subscribe for any securities or solicitation of any investments or investment services for the residents of Canada and / or USA or any jurisdiction where such an offer or solicitation would be illegal.

Subject company(ies) may have been client during twelve months preceding the date of distribution of the research report. Derivatives are a sophisticated investment device. The investor is requested to take into consideration all the risk factors before actually trading in derivative contracts.

Past performance should not be taken as an indication or guarantee of future performance, and no representation or warranty, express or implied, is made regarding future performance. Information, opinions and estimates contained in this report reflect a judgment of its original date of publication by ASL and are subject to change without notice. The price, value of and income from any of the securities or financial instruments mentioned in this report can fall as well as rise. The value of securities and financial instruments is subject to exchange rate fluctuation that may have a positive or adverse effect on the price or income of such securities or financial instruments.

The information and opinions in this report have been prepared by Axis Securities and are subject to change without any notice. The report and information contained herein is strictly confidential and meant solely for the selected recipient and may not be altered in any way, transmitted to, copied or distributed, in part or in whole, to any other person or to the media or reproduced in any form, without prior written consent of Axis Securities. The report must not be used as a singular basis of any investment decision. The views herein are of a general nature and do not consider the risk appetite, investment objective or the particular circumstances of an individual investor. The investor is requested to take into consideration all the risk factors including their financial condition, suitability to risk return profile and the like and take professional advice before investing.

While we would endeavour to update the information herein on a reasonable basis, Axis Securities is under no obligation to update or keep the information current. Also, there may be regulatory, compliance or other reasons that may prevent Axis Securities from doing so. Non-rated securities indicate that rating on a particular security has been suspended temporarily and such suspension is in compliance with applicable regulations and/or Axis Securities policies, in circumstances where Axis Securities might be acting in an advisory capacity to this company, or in certain other circumstances.

This report is based on information obtained in good faith from public sources and sources believed to be reliable, but no independent verification has been made nor is its accuracy or completeness guaranteed. This report and information herein is solely for informational purpose and shall not be used or considered as an offer document or solicitation of offer to buy or sell or subscribe for securities or other financial instruments. Though disseminated to all the customers simultaneously, not all customers may receive this report at the same time. Axis Securities will not treat recipients as customers by virtue of their receiving this report. Nothing in this report constitutes investment, legal, accounting and tax advice or a representation that any investment or strategy is suitable or appropriate to your specific circumstances. The securities discussed and opinions expressed in this report may not be suitable for all investors, who must make their own investment decisions, based on their own investment objectives, financial positions and needs of specific recipient. This may not be taken in substitution for the exercise of independent judgment by any recipient. The recipient should independently evaluate the investment risks. The value and return on investment may vary because of changes in interest rates, foreign exchange rates or any other reason. Axis Securities accepts no liabilities whatsoever for any loss or damage of any kind arising out of the use of this report. Past performance is not necessarily a guide to future performance. Investors are advised to see Risk Disclosure Document to understand the risks associated before investing in the securities markets. Actual results may differ materially from those set forth in projections. Forward-looking statements are not predictions and may be subject to change without notice. Axis Securities or its associates might have managed or co-managed public offering of securities for the subject company or might have been mandated by the subject company for any other assignment in the past twelve months. Axis Securities or its associates might have received any compensation from the companies mentioned in the report during the period preceding twelve months from the date of this report for services in respect of managing or co-managing public offerings, corporate finance, investment banking or merchant banking, brokerage services or other advisory service in a merger or specific transaction. Axis Securities or its associates might have received any compensation for products or services other than investment banking or merchant banking or brokerage services from the companies mentioned in the report in the past twelve months. Axis Securities encourages independence in research report preparation and strives to minimize conflict in preparation of research report. Axis Securities or its associates or its analysts did not receive any compensation or other benefits from the companies mentioned in the report or third party in connection with preparation of the research report. Accordingly, neither Axis Securities nor Research Analysts and / or their relatives have any material conflict of interest at the time of publication of this report. Please note that Axis Securities has a proprietary trading desk. This desk maintains an arm's length distance with the Research team and all its activities are segregated from Research activities. The proprietary desk operates independently, potentially leading to investment decisions that may deviate from research views.

Compensation of our Research Analysts is not based on any specific merchant banking, investment banking or brokerage service transactions.

Research Analyst may have served as an officer, director or employee of subject company(ies). Axis Securities or Research Analysts or their relatives do not own 1% or more of the equity securities of the Company mentioned in the report as of the last day of the month preceding the publication of the research report. Since associates of Axis Securities and Axis Securities as an entity are engaged in various financial service businesses, they might have financial interests or actual/beneficial ownership of one percent or more or other material conflict of interest in various companies including the subject company/companies mentioned in this report. Axis Securities may have issued other reports that are inconsistent with and reach different conclusion from the information presented in this report. Certain transactions -including those involving futures, options and other derivatives as well as non-investment grade securities - involve substantial risk and are not suitable for all investors. Reports based on technical analysis centres on studying charts of a stock's price movement and trading volume, as opposed to focusing on a company's fundamentals and as such, may not match with a report on a company's fundamentals.

We and our affiliates/associates, officers, directors, and employees, Research Analyst(including relatives) worldwide may: (a) from time to time, have long or short positions in, and buy or sell the securities thereof, of company (ies) mentioned herein or (b) be engaged in any other transaction involving such securities and earn brokerage or other compensation or act as a market maker in the financial instruments of the subject company/company (ies) discussed herein or act as advisor or lender / borrower to such company (ies) or have other potential/material conflict of interest with respect to any recommendation and related information and opinions at the time of publication of Research Report or at the time of public appearance. Axis Securities may have proprietary long/short position in the above mentioned scrip(s) and therefore may be considered as interested. This should not be construed as invitation or solicitation to do business with Axis Securities. Axis Securities is also a Portfolio Manager. Portfolio Management Team (PMS) takes its investment decisions independent of the PCG research and accordingly PMS may have positions contrary to the PCG research recommendation.

Sr. No	Name	Designation	Sector	E-mail
1	Neeraj Chadawar	Head of Research	All Sectors	neeraj.chadawar@axissecurities.in
2	Preeyam Tolia	Research Analyst	FMCG and Retail, Real Estate	preeyam.tolia@axissecurities.in
3	Omkar Tanksale	Research Analyst	IT, Telecom, Internet	omkar.tanksale@axissecurities.in
4	Uttamkumar Srimal	Research Analyst	Cement, Infra, Railway	uttamkumar.srimal@axissecurities.in
5	Ankush Mahajan	Research Analyst	Pharmaceutical, Hospital, Hotel	ankush.mahajan@axissecurities.in
6	Dnyanada Vaidya	Research Analyst	BFSI	dnyanada.vaidya@axissecurities.in
7	Aditya Welekar	Research Analyst	Metal and Mining, Power Utilities	aditya.welekar@axissecurities.in
8	Sani Vishe	Research Analyst	Chemicals Capital Goods, Mid-cap	sani.vishe@axissecurities.in
9	Eesha Shah	Research Analyst	Real Estate, Special Situation	eesha.shah@axissecurities.in
10	Shridhar Kallani	Research Associate	Auto and Auto ancillaries	shridhar.kallani@axissecurities.in
11	Shikha Doshi	Research Associate	Cement, Infra, Railway	shikha.doshi@axissecurities.in
12	Suhanee Shome	Research Associate	FMCG and Retail	suhanee.shome@axissecurities.in
13	Shivani More	Research Associate	Chemicals Capital Goods, Mid-cap	shivani.more@axissecurities.in
14	Pranav Nawale	Research Associate	BFSI	pranav.nawale@axissecurities.in
15	Darsh Solanki	Research Associate	Metal and Mining, Power Utilities	darsh.Solanki@axissecurities.in
16	Aman Goyal	Research Associate	Pharmaceutical, Hospital, Hotel	aman.goyal@axissecurities.in
17	Arundhati Bagchi	Research Associate	Database Analyst, Economy	arundhati.bagchi@axissecurities.in