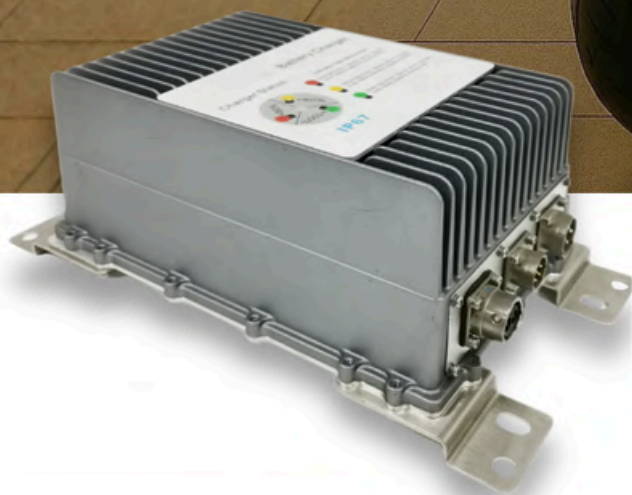




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E-MOBILITY**

**Introducing On Board Charger for
3-Wheelers and Superbikes**



Nominal Power: 3.3kW
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Output Voltage Range: 0-95VDC
Communication: CAN
Multiple Electrical Safety Protections





BILLIONE MOBILITY AND HINDALCO LAUNCHED GUJARAT'S FIRST ELECTRIC FREIGHT CORRIDOR

BillionE Mobility, in partnership with Hindalco Industries' Birla Copper Division, has launched Gujarat's first heavy-duty electric freight corridor. Covering a 160-kilometre route between Dahej and Asoj, this corridor will be powered by a fleet of 15 Ashok Leyland electric trucks, each with 55-ton capacity, deployed in phases.

Supported by ChargeZone's reliable charging network at key points such as Karjan and Bharuch, the corridor is a proof of concept for sustainable, high-performance freight movement in India. It marks a significant step toward decarbonising industrial transport while maintaining efficiency and reliability.

BillionE Mobility is redefining the future of logistics by combining technology, infrastructure, and sustainability. With intelligent fleet management and a scalable EV ecosystem, the company is enabling businesses to move responsibly and operate efficiently.

**Moving goods, reducing emissions, and
driving change for a cleaner tomorrow.**



A company that understands the changes in the world and challenges the future through technological innovation.

Special Vehicles

Motor / Inverter



Higen's versatile EV solutions deliver proven performance across industrial and commercial vehicles, from light to heavy-duty applications, serving diverse customer needs worldwide

**BE THE BEST,
BE THE FIRST!**

Output(kW)

**Railway
repair vehicle**
150~300 [kW]

**Large Bus
Large Truck**
150~250 [kW]

**HEV,
Micro mobility**
7~25 [kW]

**2Wheeler
Golf carts**
0.5~4.5 [kW]

**Mini Bus
Mini Truck**
40~150 [kW]

60 ⁺
Years
HIGENRNM
ROBOT N MOBILITY

48Vdc

144Vdc

350Vdc

650Vdc

+ 650Vdc

Voltage

What's INSIDE



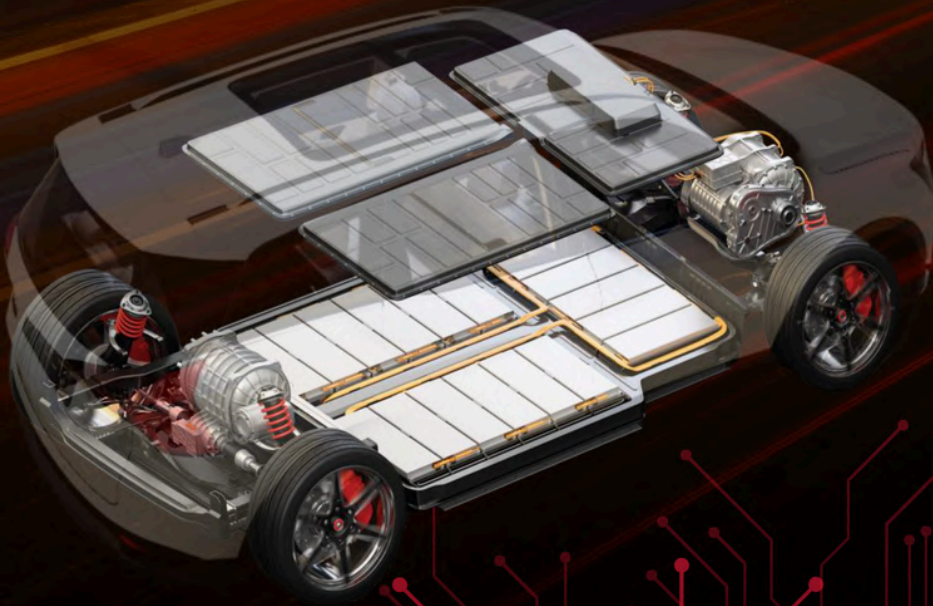
- 06 India EV Sales and Top OEMs for Oct 2025
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Disclaimer

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Motor Cores

that Save Energy



A major player in India's electrical stamping industry, **focused on manufacturing of motor cores for EV (2W, 3W, 4W & CV) and consumer durables.** Our state-of-the-art facility has capability to handle multirow carbide dies; with rotation of each stamping & hydraulic backup pressure; to manufacture EV motor cores up to 0.2mm thickness.



**Electric Vehicle
- 2W/3W/4W
Motor Core**



Alternator



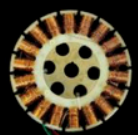
**BLDC Fan
motor core**



**SRM Stator
Rotor**



**Hermetic Compressor
Motor - Stator, Rotor
& die cast rotor**



**BLDC Fan
Winding**



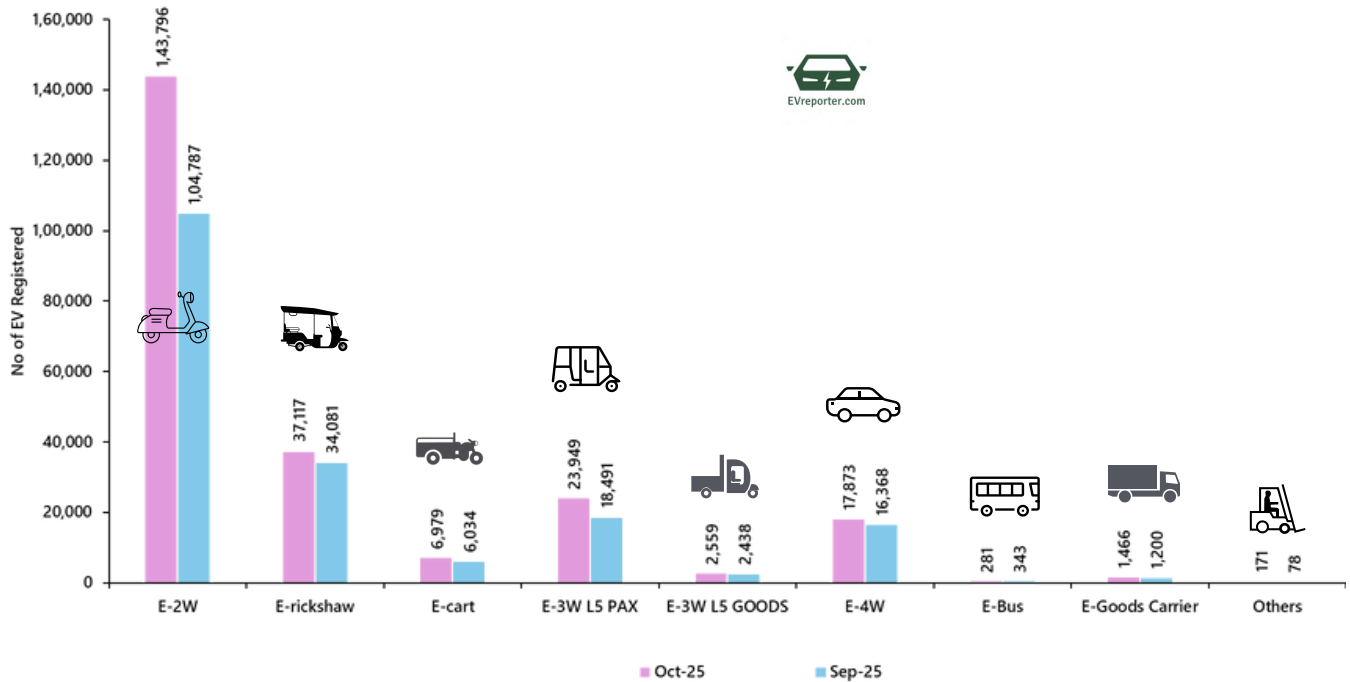
Email:
contact.accelo@mahindra.com



Website:
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Category-wise Electric Vehicle sales, Oct 2025 | India

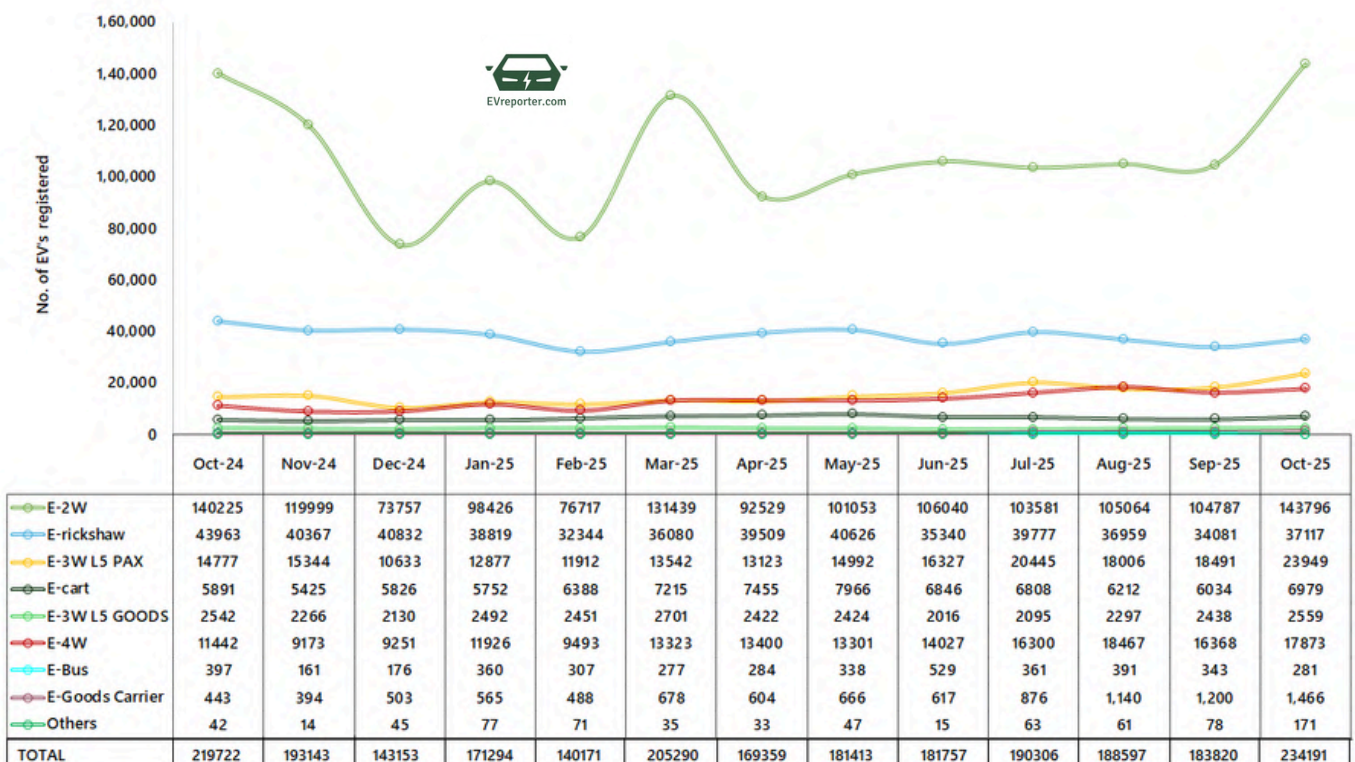
Total Registered Electric Vehicle Sales - **Oct'25 - 2,34,191** | Sep'25 - 1,83,820



'Goods Carrier' refers to 4W cargo vehicles, including LCVs and HGVs, as categorised in Vahan dashboard. 'E-rickshaw' refers to low-speed electric 3Ws (up to 25 kmph) used for passenger transportation. 'E-cart' designates low-speed electric 3Ws (up to 25 kmph) used for goods transportation. 'L5M' stands for passenger 3W L5 vehicles, 'L5N' stands for Cargo 3W L5 vehicles.

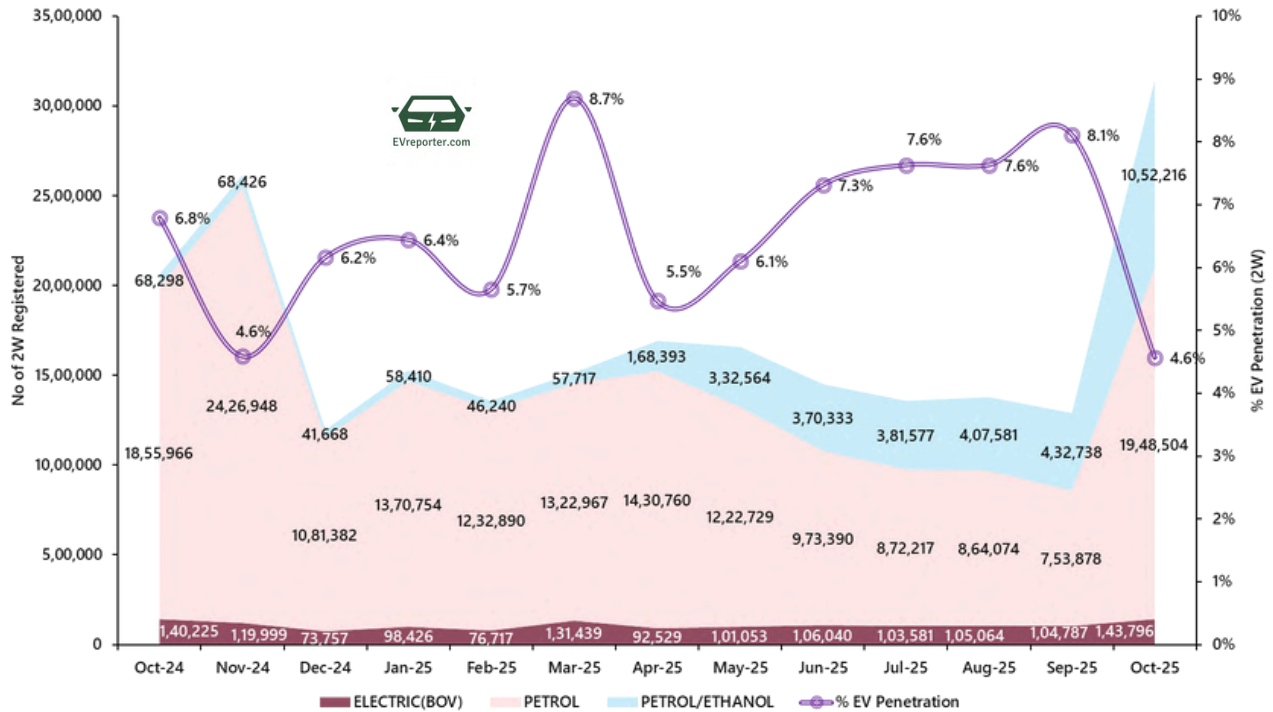
Category wise-Sales Trend from Oct 2024 to Oct 2025

21,82,494 EVs sold in last 12 months from Nov 2024 to Oct 2025



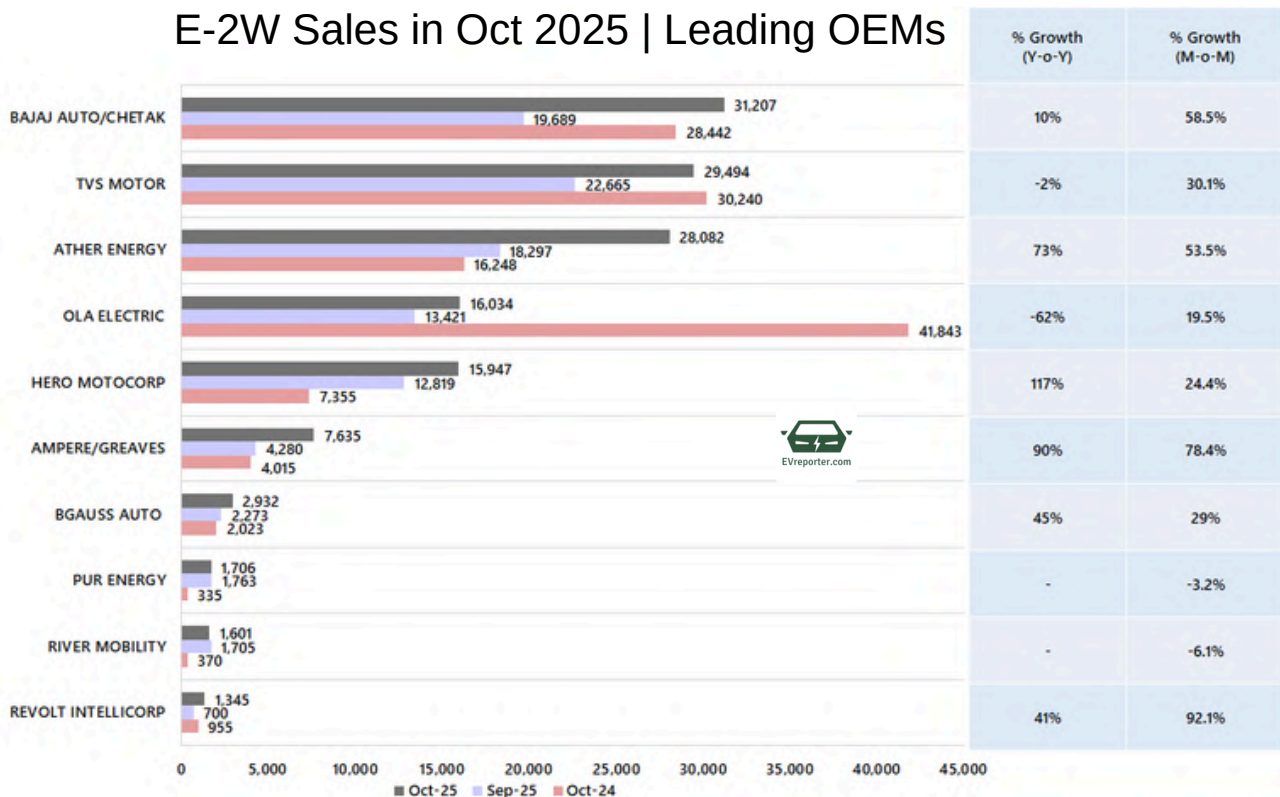
Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included. Low speed e-2W sales data not included.

Fuel wise 2-Wheeler Sales Trend, Oct 2024 - Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included. Low speed e-2W sales data not included.

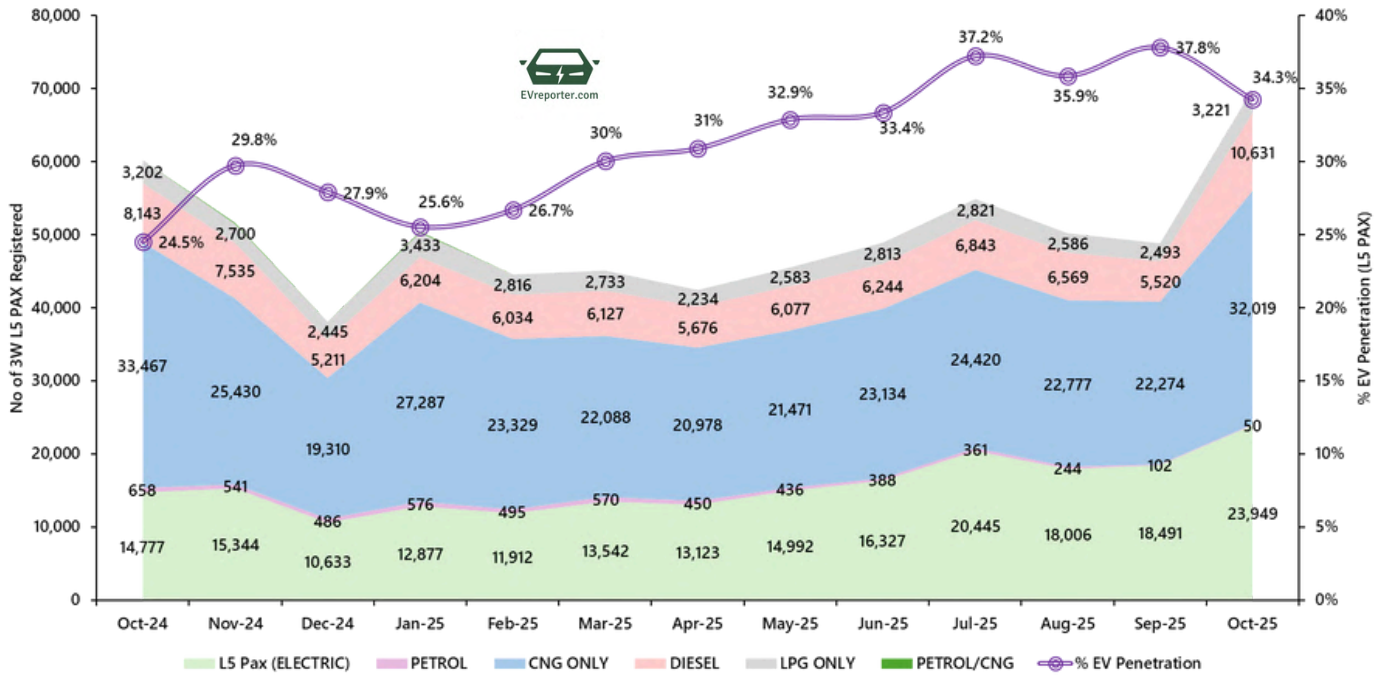
E-2W Sales in Oct 2025 | Leading OEMs



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included. Low speed e-2W sales data not included.

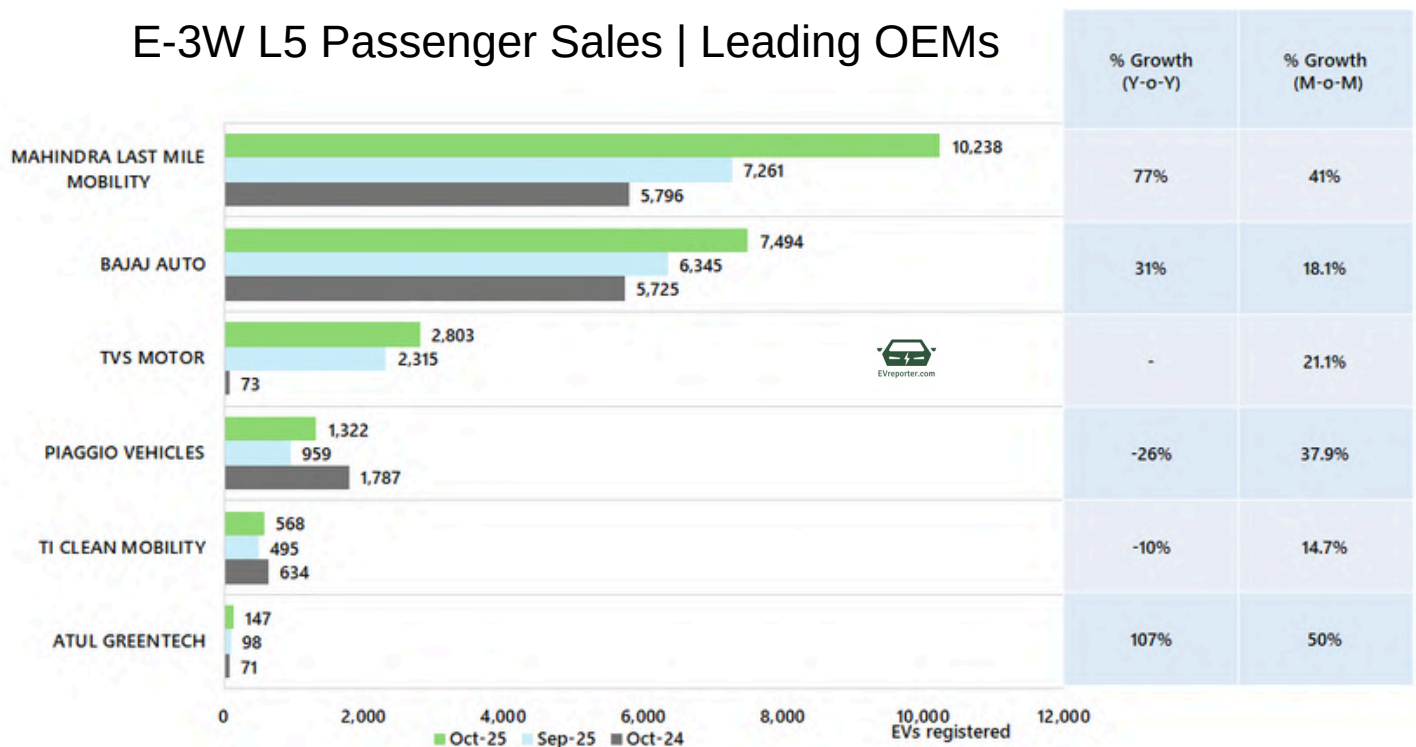
For EV sales, including Telangana data, state-wise, city-wise (70 cities), Top performing RTO data and OEM-wise performance, check out the [EVreporter Data Portal here](#).

Fuel-wise 3W L5 Passenger Sales Trend | Oct 2024 - Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

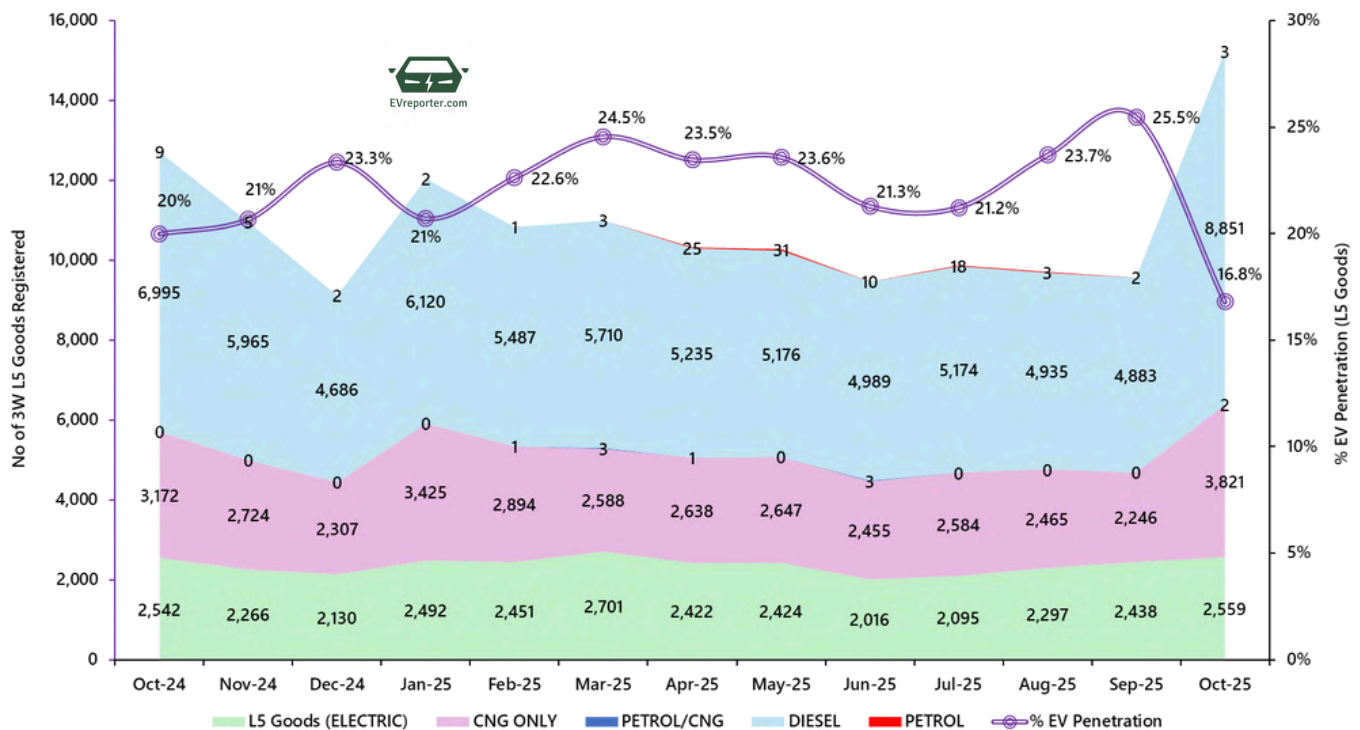
E-3W L5 Passenger Sales | Leading OEMs



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

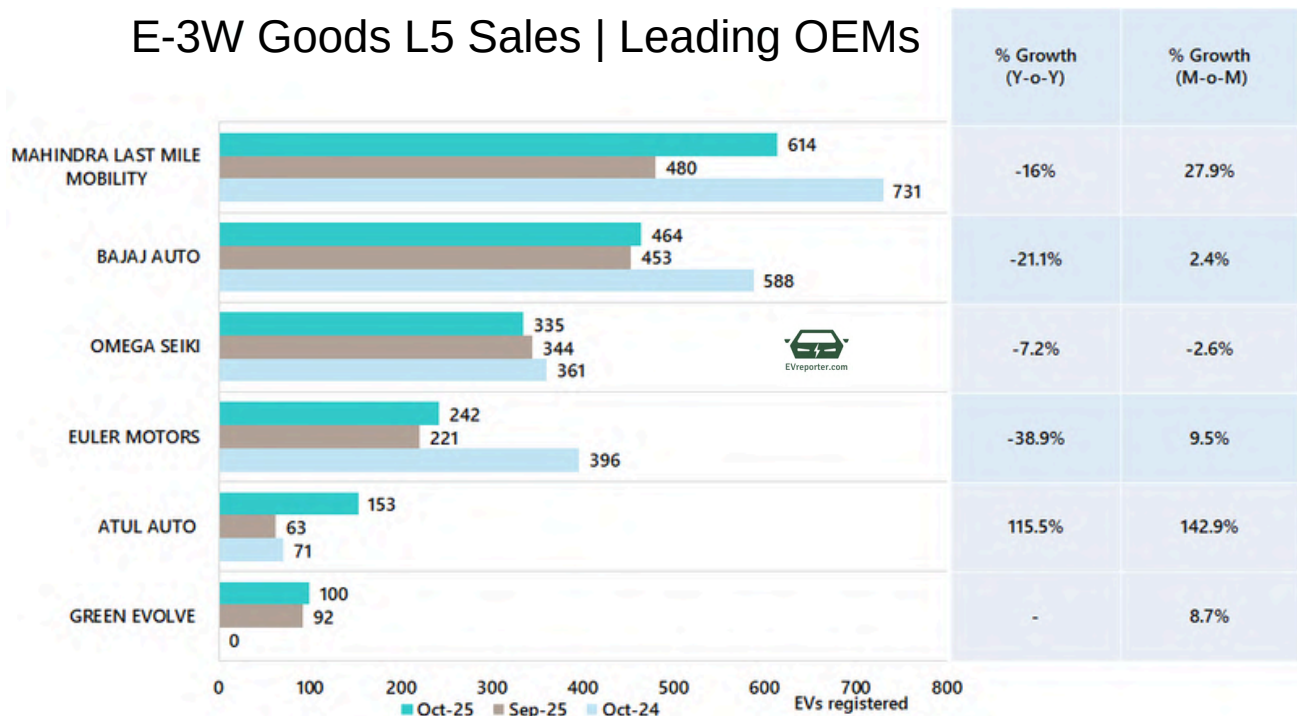
For EV sales, including Telangana data, state-wise, city-wise (70 cities), Top performing RTO data and OEM-wise performance, check out the [EVreporter Data Portal here](#).

Fuel wise 3W L5 Goods Sales Trend | Oct 2024 - Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

E-3W Goods L5 Sales | Leading OEMs



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

For EV sales, including Telangana data, state-wise, city-wise (70 cities), Top performing RTO data and OEM-wise performance, check out the [EVreporter Data Portal here](#).

Engineering plastics solutions for E-mobility applications

XYRON™ modified polyphenylene ether [mPPE]



Solution for AIS156 Thermal Propagation & Fire Test

Excellent flammability class

Grade/UL94	V-0 (mmt)	5VA (mmt)
XYRON™ 340Z	0.75	2.5
XYRON™ 540Z	0.75	2.5
XYRON™ 443Z	0.75	2.5
XYRON™ G601Z	1.50	2.0

Burn Test for Li-B applications⁴

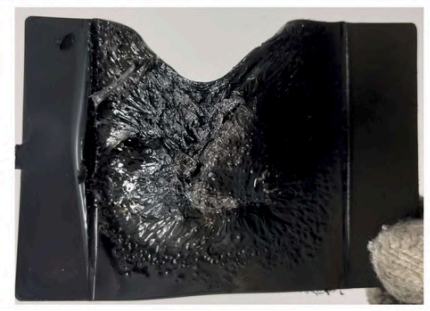
FR PC/ABS



XYRON™ 540Z



XYRON™ 443Z



Burn temp: 850°C
Burn time: 0 min 58 secs
Burn through: Yes
Drip: No

Burn temp: 850°C
Burn time: 2 min 19 secs
Burn through: Yes
Drip: No

Burn temp: 850°C
Burn time: 2 min 58 secs
Burn through: Yes
Drip: No

Burn test method:
 Angle of flame: 20°, Thickness: 3 mm
 Flame: Blue tip at the center of the plate
 Time start: When the fire is turn on
 Time stop: When burn through happen

⁵Advantages of XYRON™

Value proposition		Property	XYRON™	PC	PC/ABS
Energy efficiency due to low weight		Low specific gravity	●	●	●
Structural integrity for large and complex designs		Dimension stable	●	●	●
Battery Safety AIS-156	Fire resistance test with thin plate	Thickness ⁴	●	●	●
	1m drop test	Impact strength ¹	●	●	●
	Direct/indirect contact of water	Impact strength (after aging) ²	●	●	●
	Thermal shock test	Impact strength (after aging) ³	●	●	●

Note:
 1 – Notched Charpy Impact ISO179
 2 – Notched Charpy Impact ISO179 after conditioned using Internal Method: -20°C to 85°C/85%RH for 10 cycles.
 3 – Notched Charpy Impact ISO179 after conditioned using AIS-156 – Thermal shock: -40°C to 80°C for 10 cycles.
 4 – Asahi Kasei Method
 5 – Result shown are estimates comparison conducted by Asahi Kasei

● Excellent
 ● Good



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Sensor Bearing



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Insuohm Bearing



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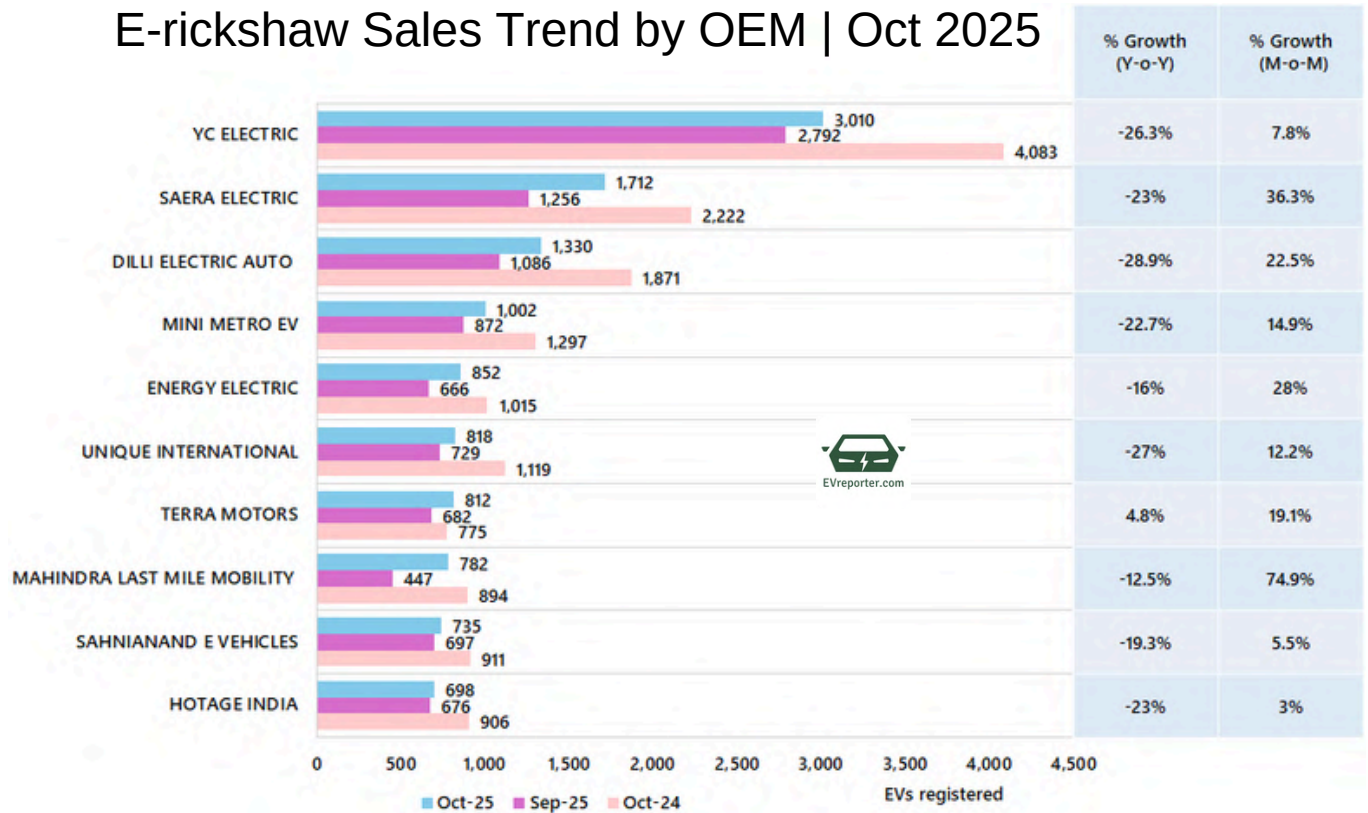
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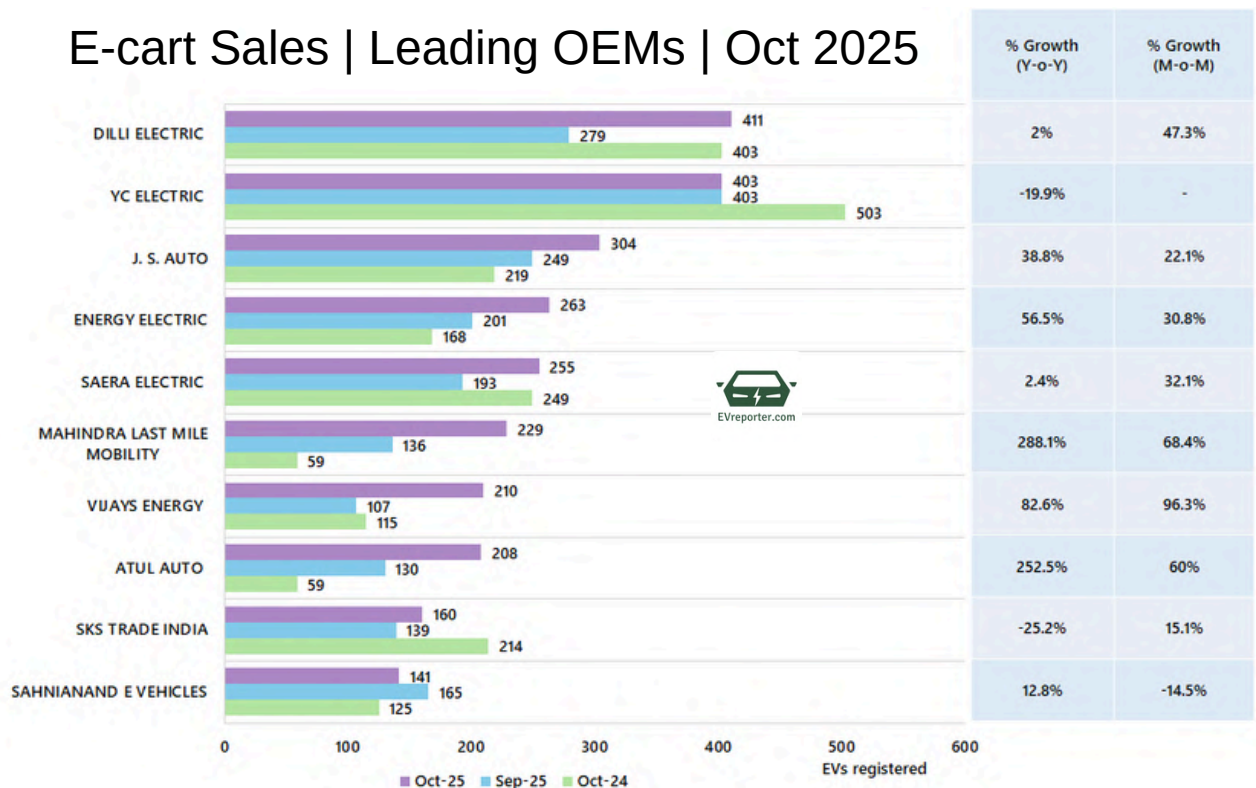


E-rickshaw Sales Trend by OEM | Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

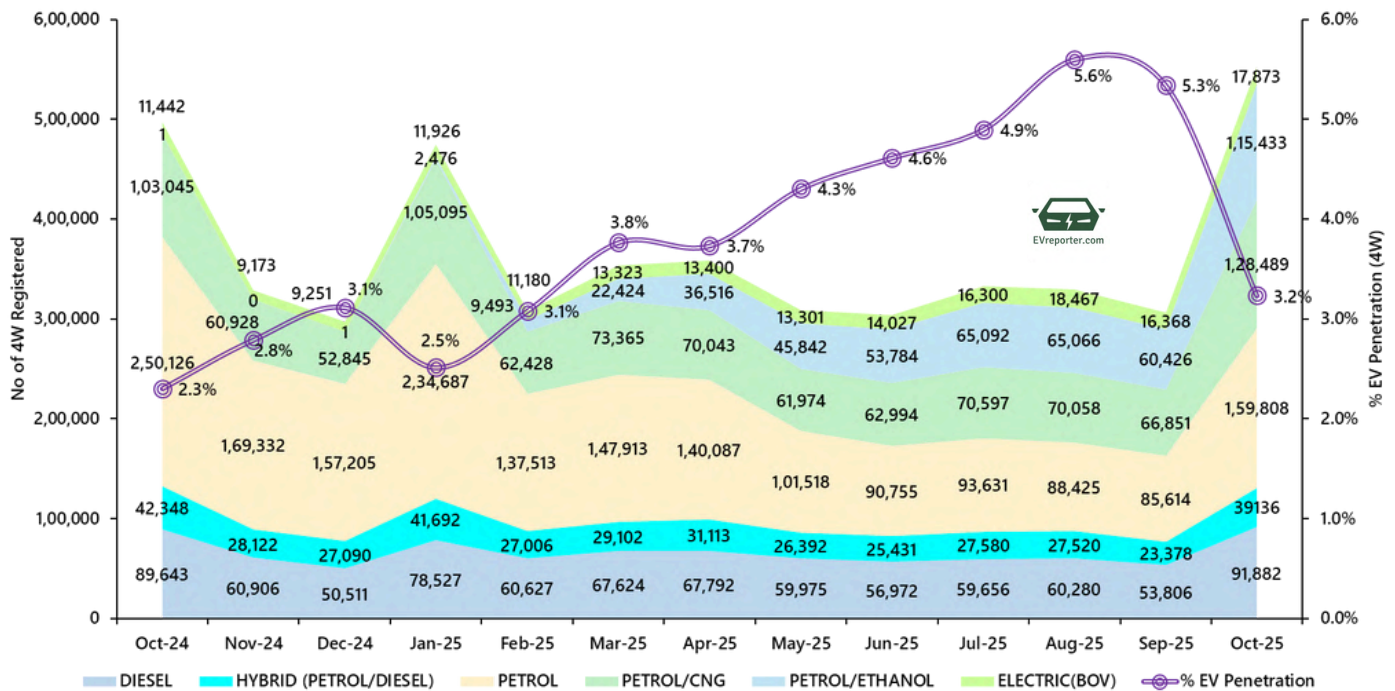
E-cart Sales | Leading OEMs | Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

For EV sales, including Telangana data, state-wise, city-wise (70 cities), Top performing RTO data and OEM-wise performance, check out the [EVreporter Data Portal here](#).

Fuel wise Car Sales Trend | Oct 2024 - Oct 2025



Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

Electric Car Sales Trend by OEM

S No.	Makers	Oct-25	Sep-25	Difference	% Change	Market Share Oct-25
1	TATA MOTORS	7,157	6,641	516	7.8%	40%
2	JSW MG MOTOR INDIA	4,525	4,165	360	8.6%	25.3%
3	MAHINDRA & MAHINDRA	3,877	3,491	386	11.1%	21.7%
4	KIA INDIA	655	528	127	24.1%	3.7%
5	BYD INDIA	565	595	-30	-5%	3.2%
6	HYUNDAI MOTOR	437	364	73	20.1%	2.4%
7	BMW INDIA	309	333	-24	-7.2%	1.7%
8	VINFAST AUTO INDIA	131	6	125	-	0.7%
9	MERCEDES -BENZ AG	90	108	-18	-16.7%	0.5%
10	STELLANTIS AUTOMOBILES	52	37	15	40.5%	0.3%
11	TESLA INDIA MOTORS	40	69	-29	-42%	0.2%
12	VOLVO AUTO INDIA	20	24	-4	-16.7%	0.1%
13	PORSCHE AG GERMANY	13	6	7	116.7%	0.1%
14	OTHERS	2	1	1	100%	-
TOTAL		17,873	16,368	1,505	9.2%	100%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

OEM wise Electric Bus Sales | Oct 2025

S No.	Makers		Oct-25	Sep-25	Difference	% Change	Market Share Oct-25
1	PMI ELECTRO MOBILITY		107	85	22	25.9%	38.1%
2	OLECTRA GREENTECH		106	143	-37	-25.9%	37.7%
3	JBM AUTO		34	21	13	61.9%	12.1%
4	SWITCH MOBILITY		29	70	-41	-58.6%	10.3%
5	PINNACLE MOBILITY		5	5	0	-	1.8%
6	AZAD INDIA		0	2	-2	-	-
7	TATA MOTORS		0	11	-11	-	-
8	VE COMMERCIAL		0	6	-6	-	-
TOTAL			281	343	-62	-18%	100%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

OEM wise E-Goods Carrier Sales | Oct 2025

S No.	Makers		Oct-25	Sep-25	Difference	% Change	Market Share Oct-25
1	TATA MOTORS		597	594	3	0.5%	40.7%
2	MAHINDRA LAST MILE MOBILITY		306	276	30	10.9%	21%
3	EULER MOTORS		151	55	96	174.5%	10.3%
4	SWITCH MOBILITY AUTOMOTIVE		123	90	33	36.7%	8.4%
5	ENERGY IN MOTION		61	13	48	369.2%	4.2%
6	VE COMMERCIAL VEHICLES		61	68	-7	-10.3%	4.2%
7	TIVOLT ELECTRIC VEHICLES		46	33	13	39.4%	2.7%
8	JAIDKA POWER SYSTEMS*		39	0	39	-	3.1%
9	JUPITER ELECTRIC MOBILITY		24	0	24	-	1.6%
10	IPL TECH ELECTRIC		17	6	11	183.3%	1.2%
11	OTHERS		41	65	-24	-36.9%	2.8%
TOTAL			1,466	1,200	266	22.2%	100%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

'Goods Carrier' refers to 4W+ cargo vehicles, including LCVs and HGVs, as categorised in Vahan dashboard.

*We could not find e-4W cargo vehicles listed on Jaidka Power Systems' website.

For EV sales, including e-goods carriers, Telangana data, state-wise, city-wise (70 cities), top-performing RTO data, and OEM-wise performance, check out [EVreporter Data Portal here](#).

EV Penetration for Different Vehicle Category Sales in India

Category	Oct-25	Sep-25	Oct-24
2W 	4.6%	8.1%	6.8%
3W L5M	34.3%	37.8%	24.5%
3W L5N	16.8%	25.5%	20%
4W	3.2%	5.3%	2.3%
Goods Carrier	1.5%	2%	0.7%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

'Goods Carrier' refers to 4W+ cargo vehicles, including LCVs and HGVs, as categorised in Vahan dashboard. 'L5M' stands for passenger 3W L5 vehicles, 'L5N' stands for Cargo 3W L5 vehicles.

ICE vs EV Sales & Penetration Trend

- India's EV Sales Trend for Oct 2025 shows the highest EV sales in the last 12 months, including 12-month highs in registrations for electric two-wheelers, L5 passenger autos, L5 Goods, passenger vehicles, and Goods Carriers.
- However, compared to the major uptick in overall automotive sales during the festive season, EV numbers looked weak with penetration nosediving to the lowest in the year for two-wheelers and L5 goods 3W categories. A significant drop in 2W EV penetration was also observed last year in November 2024 during the festive season.
- EV penetration for 2Ws dropped to 4.6% from a high of 8.1% last month, while for the L5N category, it declined to 16.8% from 25.5% the month before.
- L5 pax autos and passenger vehicles also suffered declines compared to the last few months.
- The least affected category (in terms of EV penetration) during the festive season was L5 pax autos.

WHAT'S NEW?

EVREPORTER DATA PORTAL

For paid subscribers only



- ✓ India Q2 FY25-26 EV sales report (New!)
- ✓ India Q1 FY25-26 EV sales report
- ✓ CY 2024 India EV sales report
- ✓ CY 2024 India Electric Car sales report

- ✓ FY24-25 EV Sales & Investment Report
- ✓ Electric goods carrier 4W sales data
- ✓ EV companies Investment Tracker
- ✓ Telangana Data included
- ✓ Break-up of L3M, L3N, L5M, L5N for e-3Ws



This section aims to showcase the part of EV sales for top-selling OEMs in the two-wheeler, three-wheeler and four-wheeler categories.

India's Top 2W OEMs | ICE vs EV Sales for Oct 2025

S No.	Maker		Total Sales Oct-25	ICE	EV	% EV
1	HERO MOTOCORP		9,94,613	9,78,666	15,947	1.6%
2	HONDA MOTORCYCLE		8,21,666	8,21,265	401	0.05%
3	TVS MOTOR		5,57,858	5,28,364	29,494	5.3%
4	BAJAJ AUTO		3,23,585	2,92,378	31,207	9.6%
5	ROYAL-ENFIELD		1,44,279	1,44,279	0	-
6	SUZUKI MOTORCYCLE		1,35,594	1,35,594	0	-
7	INDIA YAMAHA MOTOR		92,306	92,306	0	-
8	ATHER ENERGY		28,082	0	28,082	100%
9	OLA ELECTRIC		16,034	0	16,034	100%
10	AMPERE/GREAVES		7,635	0	7,635	100%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

India's Top 3W Pax Auto OEMs | ICE vs EV Sales for Oct 2025

S No.	Maker		Total Sales Oct-25	ICE	EV	% EV
1	BAJAJ AUTO		43,798	36,304	7,494	17.1%
2	MAHINDRA LAST MILE MOBILITY		10,661	423	10,238	96%
3	PIAGGIO VEHICLES		6,424	5,102	1,322	20.6%
4	TVS MOTOR		5,484	2,681	2,803	51.1%
5	ATUL AUTO		1159	1087	72	6.2%
6	TI CLEAN MOBILITY		568	0	568	100%
7	MLR AUTO		529	461	68	12.9%
8	BAXY		203	132	71	35%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

For EV sales, including e-goods carriers, Telangana data, state-wise, city-wise (70 cities), top-performing RTO data, and OEM-wise performance, check out [EVreporter Data Portal here](#).

India's Top 3W Goods Auto OEMs | ICE vs EV Sales for Oct 2025

S No.	Maker	Total Sales Oct-25	ICE	EV	% EV
1	BAJAJ AUTO	7,110	6,646	464	6.5%
2	PIAGGIO VEHICLES	3,353	3,273	80	2.4%
3	ATUL AUTO	1,964	1,811	153	7.8%
4	MAHINDRA LAST MILE MOBILITY	1,111	497	614	55.3%
5	OMEGA SEIKI	335	0	335	100%
6	MLR AUTO	257	252	5	1.9%
7	EULER MOTORS	242	0	242	100%
8	BAXY	158	152	6	3.8%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

India's Top 4W OEMs | ICE vs EV Sales for Oct 2025

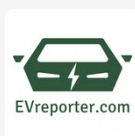
S No.	Maker	Total Sales Oct-25	ICE	EV	% EV
1	MARUTI SUZUKI INDIA	2,38,875	2,38,875	0	-
2	TATA MOTORS	74,855	67,698	7,157	9.6%
3	MAHINDRA & MAHINDRA	67,109	63,232	3,877	5.8%
4	HYUNDAI MOTOR	65,192	64,755	437	0.7%
5	TOYOTA KIRLOSKAR MOTOR	34,349	34,349	0	-
6	KIA INDIA	32,796	32,141	655	2%
7	SKODA AUTO AS	12,086	12,086	0	-
8	HONDA CARS INDIA	7,193	7,193	0	-
9	JSW MG MOTOR	5,785	1,260	4,525	78.2%
10	RENAULT INDIA	5,046	5,046	0	-
11	NISSAN MOTOR INDIA	2,553	2,553	0	-
12	MERCEDES BENZ	1,821	1,731	90	4.9%

Source: Vahan Dashboard as of Nov 2, 2025. Telangana Data not included.

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- ✓ EV companies Investment Tracker
- ✓ Telangana Data included
- ✓ Break-up of L3M, L3N, L5M, L5N for e-3Ws



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Image source: Argonne National Laboratory

Government Tightens Lithium-ion Battery Black Mass Export Curbs | *Stakeholders Share Perspective*

Black mass—the powdery residue left after the end of life lithium-ion batteries are shredded—contains recoverable cobalt, nickel, lithium, graphite and other materials. It is classified as hazardous waste (HS Code 8549), and exporting it requires explicit permission from the Ministry of Environment, Forest & Climate Change (MoEF&CC) and a licence from the Directorate General of Foreign Trade (DGFT). Yet, multiple shredding facilities have been exporting the material as non-hazardous products.

The Central Board of Excise and Customs is aware of this practice and has put in place checks and curbs to prevent the shipment of forbidden materials through misrepresentation. The primary concern is to stop the drain of critical materials.

Setting the context

The price of blackmass is largely determined by its Cobalt content, and at present, most end-of-life lithium-ion battery feedstock still comes from mobile phone and electronic LCO batteries. It is also true that domestic facilities capable of absorbing the black mass may not offer the same prices as exports. The Indian lithium-ion battery recycling is currently divided into two segments:

- **R2 recyclers** - Players who engage in only Battery Dismantling and Physical separation (i.e., processing until black mass generation).
- **R4 recyclers** - Companies involved in Battery Dismantling, Physical Separation and Refining (i.e. Black Mass Processing).

Chinese and Korean refiners have achieved massive economies of scale, allowing them to offer higher payables for black mass while maintaining low refining costs. This has created a distorted market where Indian recyclers are lured by high export prices.

We spoke with multiple practitioners and leaders in India's lithium-ion battery ecosystem regarding black mass exports/curbs. This write-up is a compilation of their comments and aims to provide a comprehensive perspective, presenting different points of view and recommendations on the matter.

Rahul Singh - Business Head, Exigo Recycling, noted the claims of some R2 recyclers that Indian refineries **pay ~2% less on black mass**, making exporting the material more profitable. However, as a strong advocate of domestic refining, he believes that the imposition of export curbs are a welcome signal to build our refining ecosystem and strengthen our recycling infrastructure.



NITIN GUPTA | CO-FOUNDER & CEO - ATTERO

*"Attero has built a capacity to refine up to 15,000 MT of battery blackmass a year, backed by proprietary technology. There is sufficient demand within India to take in all the blackmass being produced in the country. The government needs to put a stop to the export as soon as possible to **avoid surrendering valuable feedstock to overseas** hydrometallurgy plants in South Korea and China."*



BHUWAN PUROHIT | EXECUTIVE DIRECTOR - RUBAMIN

*"The MoEF&CC should not issue any licenses to export black mass to shredding units (R2) or fully integrated recyclers (R4 recyclers), as data indicates that there are sufficient refining units in the country to convert all the black mass generated into critical metal compounds. The **refining capacities created with government support are already short of feedstock.**"*

Rubamin has a blackmass refining capacity of 10,000 MTA at its Gujarat plant.



RAMAN SHARMA | MD - EXIGO RECYCLING

*"The Critical Mineral Mission is not just a policy — it is a declaration of economic nationalism. Those opposing the export ban are, in effect, defending the **old economic position, where India supplies raw materials cheaply, only to buy back finished products at premium prices.**"*

At Exigo, we are breaking that cycle. Our Karnal facility houses a 7,600 MTA black mass refining capacity for lithium-ion, zinc-carbon, and alkaline batteries, the first in India with direct cathode-to-cathode recycling for LFP. We are building value in India, for India."

However, some voices in the industry argue that **export restrictions on black mass should be introduced in a phased manner**, given that multiple R2 recyclers currently rely on exports. One recycling business owner also noted that **there is no restriction on the export of materials recovered post-refining**. *"Black mass refining does add a significant step towards domestic value addition, but to achieve the aim of keeping valuable materials within the country, similar export curbs should also apply to refined metals and salts", they added.*

Some concerns were also expressed about the categorisation of black mass as a hazardous waste. A few people highlighted the lack of local capabilities to absorb the refined materials and produce battery-grade powders needed to reintroduce them into the lithium-ion cell value chain.

AKSHAY JAIN | FOUNDER - NAMO E-WASTE MANAGEMENT

*"We support the Government's objective to restrict the outflow of critical minerals in the interest of national supply security. However, the recent Customs notification appears to have been issued without adequate stakeholder consultation and seemingly influenced by a limited set of players. **Classifying black mass as hazardous waste is also inconsistent with its true nature** as an intermediate product from R2 level recycling, serving as essential feedstock for downstream R3 & R4 Refining."*



*"**The current restrictions overlook the challenges faced by R2 recyclers**, who form over 80% of India's Li-ion battery recycling industry and currently receive better payables from overseas refiners than domestic ones. This may create a price monopoly for a few players, particularly in an unregulated and largely unorganised battery scrap market. Established international refiners offer much higher recovery rates, which at the moment help R2 recyclers sustain margins and reinvest in R4 level refining capabilities to support India's critical minerals mission."*

*"Further, if the aim is to prevent critical mineral outflow, similar export curbs should also apply to refined metals and salts of Lithium, Nickel, Cobalt, and Manganese to ensure consistency across the value chain. We therefore urge that any **export restrictions on black mass be introduced in a phased and consultative manner** to ensure fairness, market stability, and balanced industry growth."*



GAURAV DOLWANI | CEO - LICO MATERIALS

*"Firstly, India needs to **define the standards and formalise on what's black mass**, and the country's overall critical mineral roadmap should be owned and managed at inter ministry level. China and Europe have defined the parameters, standardised black mass categorisation, and based import/export policies on that categorisation."*

*The current **payable difference between the export rates and domestic procurement** is not at par, which makes it unviable for R2 recyclers to sell their product locally. Moreover, blanket export curbs on any materials containing Nickel or Cobalt pose an existential threat to a large number of small/medium players who collectively employ thousands of people directly or by extension.*

If domestic R4 refiners pay a fair price within the market-determined range, there will be no incentive for R2 players to export and subject themselves to the complexity of managing export logistics.

The government has introduced an incentive policy to support critical mineral refining, which is a welcome step, as it gives R2 recyclers an opportunity to avail of the incentive and build R4 capabilities. We feel that the current export curbs stem from the commercial interests of some companies, and the authorities need to be mindful of not making decisions that crush the existing businesses with the potential to turn R4 tomorrow."

Battery expert Dr SRS Prabaharan added that the **CAM (cathode active material) manufacturing capabilities of Indian firms are practically non-existent at this point**, which means that most of the recovered materials would again be exported out of the country, raising questions on the impact of black mass refining to help curb the outflow of critical materials.



DR PRABAHARAN S.R.S

FOUNDER & CEO - INVENTUS BATTERY ENERGY TECHNOLOGIES

"We also need to consider who is positioned to utilise the recovered Cobalt from blackmass refining operations, given that there are no legitimate producers of battery-grade NMC powder—either pre-CAM or CAM—within India as of today. Unless India steps up to build a domestic CAM production ecosystem, black mass producers can only sustain operations through exports."

*Without a clear roadmap, export curbs could inadvertently consolidate monopolistic control over black mass flows. That's not just a supply chain issue—it's a strategic vulnerability. India must move fast. **Build CAM capacity first.** Enable feedstock collection. And ensure that policy doesn't outpace infrastructure.*

However, **R4 recyclers argue that they do not have to depend solely on CAM manufacturers to absorb the materials.** Recovered materials find myriad applications in other domestic industries that primarily procure them directly or indirectly through an import route, an industry practitioner noted. To name some:

- Cobalt Sulphate finds mass application in the paint drier and animal feed industries.
- Nickel Sulphate is used for electroplating.
- Lithium Carbonate is procured by the pharma industry.
- Manganese Sulphate is used by the fertiliser industry.

Beyond the debate over export policy, there are also **calls for forging a united industry front and formalising India's fragmented lithium-ion recycling industry**, which currently comprises of a large number of small unorganised players as well. Frameworks for black mass pricing are also required to ensure stakeholder alignment.



RAHUL JHA | ADV METAL COMBINE

*"With the launch of the National Critical Mineral Mission, there's finally a policy window to change the current trajectory - but it will take coordination and discipline among recyclers. **Indian black mass processors must formalise collection and build integrated refining capacity.** As long as export authorisations remain possible, the race to the bottom will continue. Unless the sector works as one front, this will only enrich scrap aggregators while **genuine refiners and national interest lose out.**"*

ADV produces battery-grade raw materials at its R4 recycling facility. The company is licensed to handle 2500 MT/Annum of Li-ion Battery waste.

Black Mass export ban is a strategic push towards domestic value recovery and security. However, **turning the ban into an advantage would take more than the refining capabilities**, believes ALN Rao, Head - Sustainability Solutions, at Recykal.

ALN RAO | HEAD - SUSTAINABILITY SOLUTIONS, RECYKAL

"We need a transparent market with a fair pricing index, enforceable rewards/penalties, and end-to-end tracking to ensure provenance and accountability. An efficient market design would also entail enabling forwards/futures and indexed contracts to reduce price risk for the stakeholders."



Recommendations:

- **Map national black mass volumes** and set interim technical standards.
- Launch 3–5 accredited assay labs and a pilot **digital chain-of-custody** (unique IDs, tamper sensors, machine-readable assays, permissioned ledger) in a high-volume region.
- Seed one public–private "anchor" refinery and announce a provisional **"India Black Mass Index"**.
- Accountability: Clear stakeholder obligations, performance-linked premiums, and penalties and **mandatory third-party audits**.

In Conclusion

Building, fully utilising domestic refining capacities, and ensuring national resource security are non-negotiable. The path lies in immediate action on three fronts: formalising the fragmented recycling sector through technical standards and digital traceability, establishing a transparent black mass pricing index in India to ensure fair value distribution, and promoting upstream investment in CAM manufacturing to prevent refined battery-grade materials from taking a different route abroad. Success will depend on creating a self-sustaining domestic market where **industry discipline and policy** together secure India's critical mineral future.

BEFORE WE GO

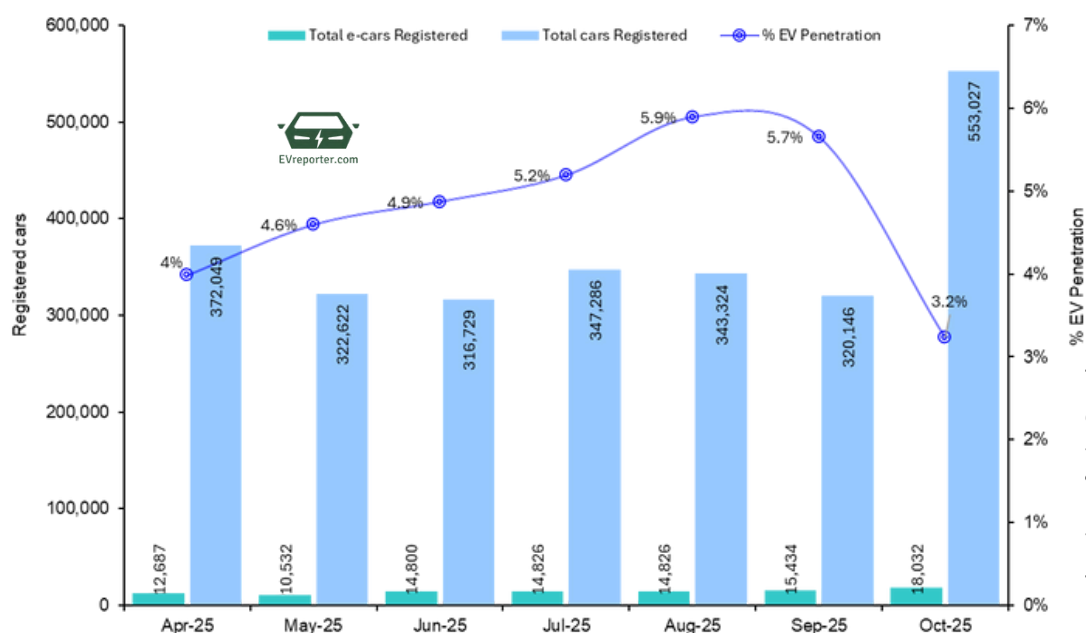


During our research and industry consultations for this article, we came across a worrying trend: **the wrongful exploitation of Battery Waste EPR (Extended Producer Responsibility) credits** by some players. India's EPR credits are marred by inefficiencies and illicit claims. Some industry insiders even said that fixing the Battery Waste EPR Credit Mechanism and ensuring its proper implementation is a much more urgent issue for India's recycling infrastructure than the subject of this current article.

At EVreporter, we are looking to pursue the EPR story. Do write to us at info@EVreporter.com to share your take. Your inputs can be included with credit or anonymously, as per your preference.

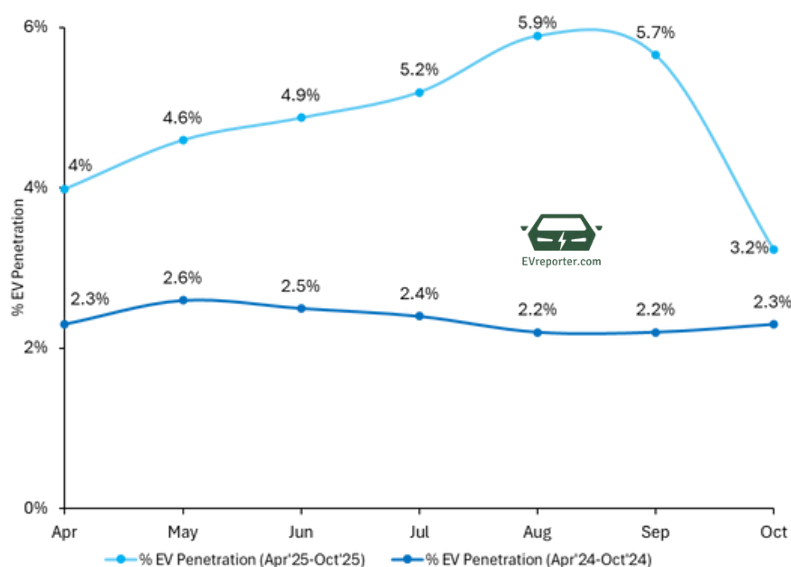
India's Electric Car Sales Zoom Past the 1,00,000 Mark in the Current FY 2025-26

- A total of 119,332 electric cars were registered in India in this FY 2025-26 from Apr-Oct 2025, surpassing the previous FY's total sales of 117,072 units. In comparison, 58,104 electric cars were registered between Apr-Oct 2024. **During the first 7 months of the FY, India's registrations of electric four-wheelers more than doubled, growing 105.37% YoY.**



Graph: EVreporter Intelligence | Source: Vahan Dashboard (Data as of 2nd Nov 2025) and Telangana Portal (Data as of Sept 2025).

EV penetration trend in car sales for current FY and last FY

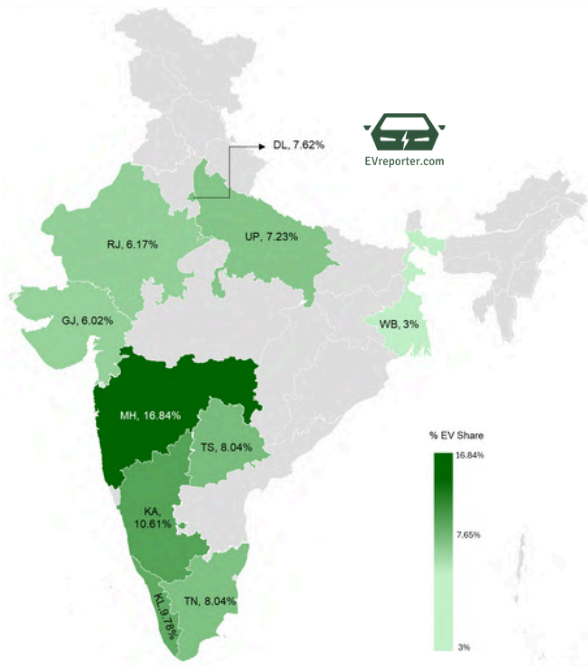


- e-4W penetration in FY25-26 shows a steady upward trend, peaking around Aug 2025 before a slight drop in Sep, and a major decline in Oct 2025 during the festive season.
- %EV penetration in the passenger vehicle market was 4.6% in FY 2025-26 (till Oct-25), compared to 2.1% in FY 2024-25 (till Oct-24).

Graph: EVreporter Intelligence | Source: Vahan Dashboard (Data as of 2nd Nov 2025) and Telangana Portal (Data as of Sept 2025).

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Top States for Electric Car sales | Apr'25-Oct'25



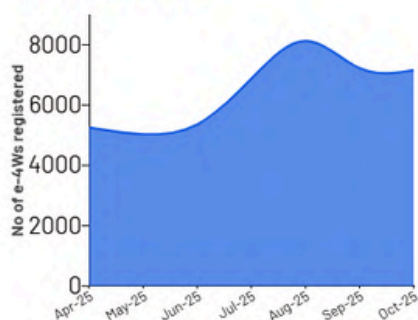
STATES	TOTAL E-4W SOLD	% SHARE	EV PENETRATION
MAHARASHTRA	20,098	16.84%	6.17%
KARNATAKA	12,660	10.61%	6.64%
KERALA	11,672	9.78%	8.2%
TELANGANA	9,596	8.04%	12.69%
TAMIL NADU	9,092	7.62%	5.26%
UTTAR PRADESH	9,078	7.61%	3.2%
DELHI	8,626	7.23%	8.03%
GUJARAT	7,367	6.17%	3.35%
RAJASTHAN	7,181	6.02%	4.73%
WEST BENGAL	3,577	3%	5.28%

Graph: EVreporter Intelligence | Source: Vahan Dashboard (Data till Oct 2025) and Telangana Data till Sept 2025

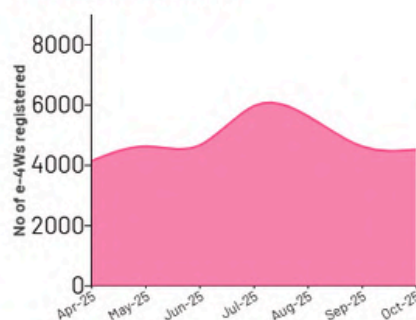
- The top 10 states account for nearly 83% of all electric 4W sold in India during this period.
- Maharashtra** (20,098 units) recorded the **highest e-4W sales** in FY 2025-26 (Till Oct'25), followed by Karnataka (12,660 units) and Kerala (11,672 units).
- Maharashtra accounted for 16.84% of total e-4W sales in India in FY 2025-26 (Till Oct'25), while Karnataka and Kerala accounted for 10.61% and 9.78%, respectively.
- Telangana, Kerala and Delhi** lead with the **highest EV penetration** in the 4W category among the 10 top-selling states.

Leading OEMs for Electric Car Sales | Apr'25-Oct'25

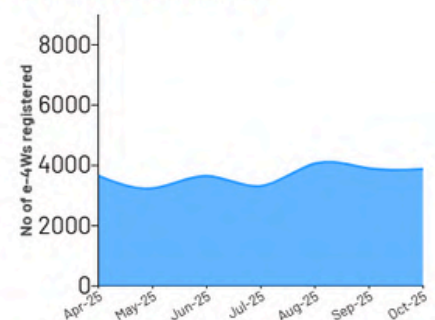
TATA MOTORS LTD



JSW MG MOTOR INDIA



MAHINDRA & MAHINDRA



Graph: EVreporter Intelligence | Source: Vahan Dashboard (Data till Oct 2025) and Telangana Data till Sept 2025

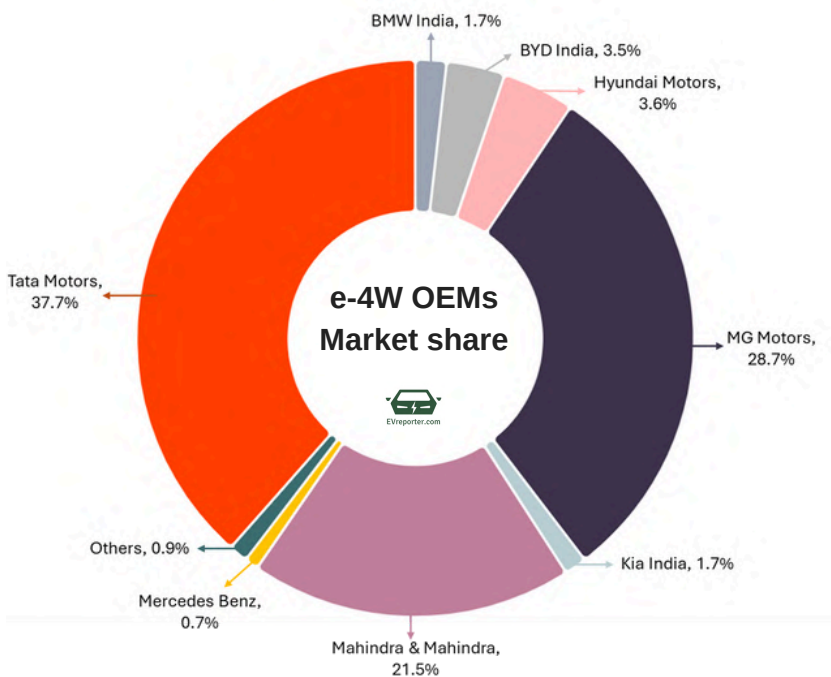
Tata Motors, MG, and Mahindra remain the top three e-car OEMs. Recently, companies like Tesla and VinFast have entered the Indian market and are expanding their presence.

Top States for Electric Car sales | Apr'25-Oct'25

S No	OEMs	Apr-25	May-25	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	TOTAL
1	TATA MOTORS	5,257	5,031	5,354	6,872	8,129	7,225	7,157	45,025
2	JSW MG MOTOR	4,155	4,634	4,670	5,975	5,630	4,626	4,525	34,215
3	MAHINDRA & MAHINDRA	3654	3240	3650	3314	4063	3902	3877	25700
4	HYUNDAI MOTOR	817	717	592	696	670	400	437	4329
5	BYD INDIA	497	651	597	579	565	712	565	4166
6	BMW INDIA	158	216	251	285	443	357	309	2019
7	KIA INDIA	41	39	54	76	548	592	655	2005
8	MERCEDES - BENZ AG	103	121	119	115	110	133	90	791
9	STELLANTIS AUTOMOBILES INDIA	84	130	105	63	44	37	52	515
10	VOLVO AUTO INDIA	48	38	29	45	21	26	20	227
11	VINFAST AUTO INDIA	0	0	0	0	0	21	131	152
12	TESLA INDIA	0	0	0	0	0	69	40	109
13	OTHERS	12	9	13	12	11	7	15	79
TOTAL		14,826	14,826	15,434	18,032	20,234	18,107	17,873	119,332

Graph: EVreporter Intelligence | Source: Vahan Dashboard (Data till Oct 2025) and Telangana Data till Sept 2025

Market Share for Leading Electric Car OEMs | Apr'25-Oct'25



- **Tata Motors** held the dominant position, selling 45,025 e-4Ws during Apr'25 - Oct'25, capturing approximately 37.7% market share and recording a 23.8% YoY growth in EV sales numbers.
- **JSW MG Motor** sold 34,215 units, marking a 189% YoY increase over FY24-25 (Till Oct'24) and securing a 28.7% market share in FY25-26 (till Oct 2025).
- **Mahindra** secured the third position with a 21.5% market share, recording an impressive **512.3% YoY growth** during the period.

- The top three brands mentioned above command ~88% of India's electric car sales.
- Luxury brands BMW and Mercedes have also shown market presence, collectively registering around 2,810 units during the period April to October 2025.
- Tesla and VinFast have recently entered the Indian market and are expanding their presence.

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Mahindra Last Mile Mobility - Focused On Maintaining Leadership and Momentum

Suman Mishra, MD & CEO – Mahindra Last Mile Mobility shares her take on the increasing penetration of EVs in the L5 3W segment, intensifying competition in the electric commercial vehicle space, evolving customer profiles and outlook towards the emerging secondary EV market.

Today, all 3W manufacturers — including new entrants and legacy players — are offering electric models. Mahindra Last Mile Mobility (MLMM) continues to lead the market in both the L5 passenger and cargo segments. Could you share what strategies have helped you maintain this leadership as competition intensifies?

Electrification in the L5 category today is around 32% year-to-date, which is a great number for the segment — but that still means about 68% is left to be electrified. In my view, the entry of more players, especially strong OEMs, helps the category. They bring credibility, offer more product choices, and, in turn, accelerate electrification. About three or four years ago, we had around 60–70% market share, but the market wasn't really growing. Today, being number one truly means more. **The presence of multiple OEMs shows that this has become a bona fide category.**

Coming to strategy - this category sells based on the overall offering. Customers want products that meet their needs at an affordable price. They also want peace of mind with service or maintenance. Financing plays an even bigger role than pricing. Even for the down payment, customers need access to multiple financiers. Then comes service — both reach and quality. Much of our technology is localised and developed in-house, enabling us to resolve service issues quickly.

These three factors — product, financing, and service — are what define leadership. Wherever we can deliver across these parameters, we lead in those micro-markets. And where others do better, they lead there. We aim to keep innovating and bringing better products to customers. We aim to keep moving forward on all fronts.

What kind of aftermarket support does MLMM provide for its electric CV customers, particularly in Tier 2 and Tier 3 markets?

Today, we have around **800 touchpoints**, covering both sales and service.

Our reach in Tier 2 and Tier 3 markets is particularly strong. Historically, when Mahindra sold Alfa diesel vehicles, these weren't allowed in cities, and sales were mostly outside urban areas. That gave us an existing channel, which we've strengthened significantly to build a robust network across all 3W markets.

We're also trying out several innovative schemes. For example, we offer **roadside assistance** and have **local technicians** called Mahindra Mitra Technicians. These aren't full 3S outlets, but they are **Mahindra-trained** and run smaller setups where they can sell spares and quickly service vehicles. Additionally, we have **mobile service initiatives**, such as Mahindra Mobile Seva (MMS) vans and Mahindra Service on Wheels (MSoW) on a 2W, which allow us to reach customers directly. For fleet customers, we often provide **dedicated technicians on-site**.



For the different vehicle segments — L5 three-wheelers as well as SCVs — who are your current priority customers? Are you focusing more on individual delivery and cargo operators (DCOs), or is the demand mainly coming from fleet operators?

In the L5N or cargo segments, we saw a significant rise in demand **last year from e-commerce delivery fleet partners**. However, that momentum seems to have **slowed down** recently. The industry has naturally consolidated, with only a few major players remaining active in the e-commerce delivery space. Now the growth is coming from smaller, captive fleets — businesses that own a few vehicles for their own use.

Government fleets, such as those used for **waste collection** and other **municipal operations**, are also becoming an important part of the cargo segment. Of course, traditional users such as FMCG companies and distributors remain key customers, and fleet service providers also play a role.

But overall, the **major growth right now is happening in the captive fleet segment**, i.e. vehicles used for one's own business needs, not for third-party transport or fleet services. Earlier, large fleets — especially in e-commerce — dominated usage, and while several good delivery companies still exist, the focus has now shifted more toward individual or self-use customers.

While you're constantly expanding your reach, how do you ensure that the quality of service and customer support keep pace with this expansion?

Our focus is on two things: ensuring high-quality service and having the right reach. Wherever a customer goes, they should be able to access spare parts quickly. We've also launched an **accidental insurance scheme** called Uday NXT, offering a ₹20 lakh cover that provides customers with added protection beyond transactional aspects.

Being a new category, we're constantly innovating to find the sweet spot: how to deliver quality service, where to deliver it, and at what cost. Across these three metrics, we're always experimenting to find the best solution.

You offer both three- and four-wheeler commercial vehicles. Over the next two to three years, which segment do you expect to drive growth more significantly?

All segments have potential. Right now, electrification in four-wheelers is at a very early stage. The **SCV segment has seen a bit of a slowdown; in fact, the overall four-wheeler ICE category** contracted last year. But I believe it's a cyclical industry, and the trend should reverse — once that happens, the category will grow again. In the L5 category, I expect electrification to continue increasing — both in passenger and cargo segments.

So, there are positive tailwinds in multiple areas. Overall, across both L5 and 4W SCVs, I'm optimistic about seeing steady growth.

Beyond the vehicle itself, what other solutions or value-added offerings are you providing for fleet operators?

Quite a few, actually.

- We've been offering a **battery-as-a-service model** for over three years now through one of our financing partners. In this model, if a customer prefers to buy only the vehicle and not the battery, the battery is owned by the financier, and the customer pays for the vehicle.
- We also offer value-added products and customization for specialized applications on our vehicles. For instance, we help fabricate mobile coffee shops, drone-controlled pesticide spraying application and so on. These tailored solutions add value for customers who need vehicles for their business needs.

As for battery swapping, to be candid, we haven't focused on that. It has relevance in some niche applications, but we don't currently see it as a major growth driver.

On the other hand, **we're actively working on charging infrastructure.**

For fleet operators, we **collaborate with our charging partners to install chargers at their fleet hubs.** In markets with a high concentration of our vehicles, we also work with charging operators to set up chargers in common or high-traffic areas. Enabling convenient charging solutions is definitely a key focus area for us.

What are your thoughts on the emerging ultra-fast charging technologies that some startups are developing for small vehicles, including 3Ws?

We are in discussions with several such companies to explore potential fitments. However, as I discussed earlier, this is a commercial vehicle category — so adoption will only make sense if it's economically viable for the customer and if the technology is widely available. For a commercial vehicle user, reliability is key. If they're not sure they can get a charger along their route, it's very difficult for them to switch. Fast charging is certainly an exciting technology, but its cost is currently higher, which can impact the overall economics for the customer.

How do you view the emerging EV resale market? Are there any initiatives from Mahindra to facilitate the secondary market?

Resale is very important for any commercial vehicle because it enables a second round of electrification — the same customer can sell their old vehicle and buy a new one. In EVs, the main factor affecting resale value is the battery — its remaining capacity and the value it holds. The rest of the vehicle, like the motor and other components, are well-understood and established technologies, so that part is relatively straightforward.

For batteries, we've conducted several pilots to estimate their value. While we haven't seen a huge influx yet, **we aim to establish a clear exchange value when vehicles are returned**. Batteries can also be repurposed for secondary applications or, at the end of life, recycled to extract value. We anticipate that **cargo vehicles may return faster** because they're used more intensively, whereas passenger vehicles, often owned by individual drivers, may last longer. Overall, we're well-prepared. We've conducted multiple pilots to understand how the resale market will evolve. In areas with high vehicle density, a resale ecosystem is already starting to emerge, and the market can innovate in ways that often surprise you.

A few startups are also working to facilitate the resale of vehicles, which I've seen firsthand. We're already collaborating with a few of them on different initiatives. When you see this influx of interest, it's clear that the challenges in this space will be addressed.

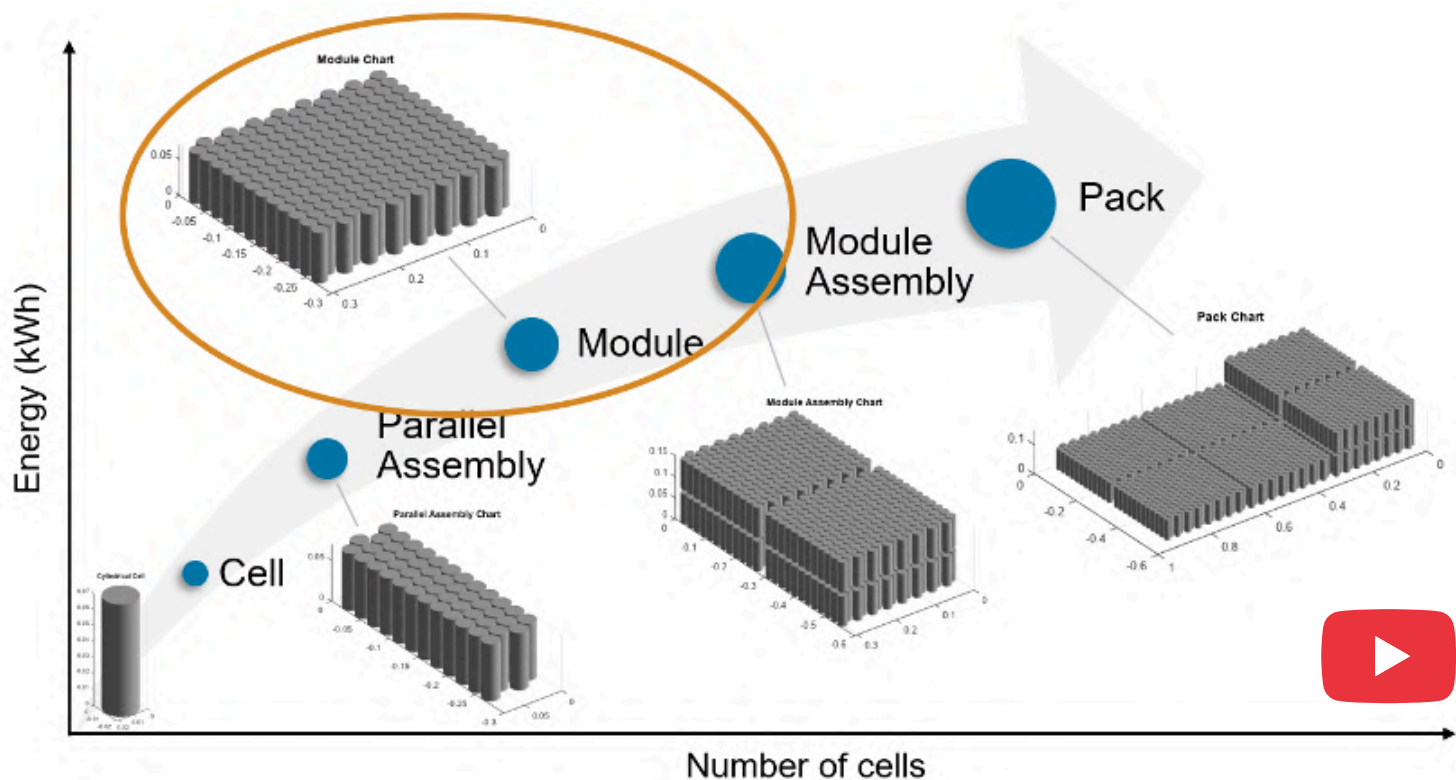
Some startups are trying to build frameworks to determine and standardize the value of a vehicle in the secondary market.

Yes, exactly. **These startups want access to battery charge data so they can help establish a vehicle's resale value**. That's precisely what we're also working on. By the time the first batch of batteries returns — likely by mid to late next year — we'll be ready. In the meantime, we're addressing the challenge through more focused pilot programs.

Mahindra has now surpassed 2.8 lakh electric commercial vehicle sales. What are your specific sales and market share targets going forward?

By the end of this year, we expect to definitely surpass 3 lakh. Currently, according to Vahan, we hold around 37% of the L5 market. We hope to retain or slightly grow this share, but we don't have formal targets. As the overall market and electrification grow, it's a win-win for everyone. Our primary focus remains on maintaining our leadership and not losing momentum.

Disclaimer: This interview was taken in October 2025



Prassana Deshpande



Danielle Chu

Exploring Battery Modelling and Simulation Using Data and AI

As demand rises for safer, more efficient, and scalable battery solutions, simulation has emerged as a strategic enabler. In electric vehicle (EV) battery development, virtual modeling helps engineers design and test battery behavior faster, safer, and more cost-effectively. We interviewed experts from **MathWorks** to discuss how data and AI-powered simulation tools are helping engineers model and optimize battery systems with greater precision and speed.

Danielle Chu is a Product Manager at MathWorks, specialising in power electronics and battery systems, while **Prasanna Deshpande** is an Application Engineering Manager at MathWorks India and works closely with automotive OEMs, suppliers, and startups adopting model-based design.

What makes simulation such a critical enabler for engineers working on battery packs and battery management systems (BMS)?

MathWorks provides a block-diagram environment that enables engineers to perform system-level, multi-domain modeling — covering electrical, mechanical, and digital control systems. This includes full powertrain simulations as well as component-level modeling, such as for the battery pack. It also supports algorithm development for functions like state of charge (SOC) estimation within the battery management system (BMS). Running system-level simulations helps engineers understand the interactions among subsystems.

Using Simulink, engineers can model an EV's powertrain, while the Optimization Toolbox helps determine the ideal battery pack size to meet range and cost targets. Once the pack size is identified, Simscape can be used to model the battery pack and BMS algorithms — including SOC estimation, state of health (SOH) estimation, and cell balancing.

To achieve accurate results, engineers model the right level of physics, including thermal behavior, and design control algorithms within the same environment. These same models in Simulink can then be used to automatically generate C code or Hardware Description Language (HDL) code for hardware-in-the-loop (HIL) testing, enabling real-time validation of BMS algorithms.

In a real-time simulation, the models run at the same rate as the actual system — for example, if a battery takes 30 minutes to charge from 60% to 80%, it takes the same time in simulation. This virtual environment allows engineers to validate BMS functionality before creating a hardware prototype.

The process is iterative — engineers can refine algorithms, regenerate the code, and re-test it in the hardware-in-the-loop setup. By the time physical testing begins, the algorithms are already well validated, reducing the need for extensive hardware trials. While more time is spent upfront on simulations, this results in faster, more successful hardware testing and a shorter overall development cycle.

Importance of cell characterisation in battery modeling - How do engineers ensure that the model accurately aligns with experimental data?

When engineers model batteries, a key question is: how accurately does the model represent real battery behavior? Cell characterization addresses this by fitting a battery model to experimental data. It's crucial because BMS algorithms rely on accurate models to set control parameters — such as Kalman filter tuning for SOC estimation or power limits based on SOC and temperature — helping prevent overvoltage or undervoltage conditions.

Accurate characterization improves simulation precision, leading to better BMS design. To achieve this, engineers follow a structured process involving data collection, model selection, parameter fitting, and validation, ensuring the model reflects experimental data effectively.

1. Data Collection: Engineers first determine what tests to run in a battery lab, gathering voltage, current, temperature, and charge data during charge and discharge cycles. Current profiles must sufficiently excite the battery to capture its behavior — for instance, through Hybrid Pulse Power Characterization (HPPC) or other pulsed current profiles.

2. Model Selection: Choosing the right battery model is critical. Options include equivalent circuit models, electrochemical models, and data-driven (AI-based) models. The equivalent circuit model is most commonly used for BMS design because it offers a good balance between simplicity, fidelity, and computational efficiency.

3. Parameter Fitting: Once a model is chosen, engineers adjust its parameters to match experimental data using curve fitting, optimization algorithms, or machine learning techniques. This minimizes the difference between model predictions and real measurements, ensuring accuracy across different conditions.

4. Validation: Engineers then validate the model by comparing its predictions against a different set of experimental data — for example, a drive cycle profile not used during fitting. Based on validation results, the model may be refined iteratively by adjusting parameters or adding new data.

In short, **cell characterization is a foundational process that aligns the battery model closely with experimental behavior.** By systematically following these steps — data collection, model selection, parameter fitting, and validation — engineers can develop accurate models that significantly enhance BMS design.

An accurate representation of the battery pack is essential for a complete end-to-end BMS development workflow. What specific features within MathWorks tools make this process easier for battery engineers?

- One key tool is the **Battery Pack Model Builder** app, which automates the creation of battery pack architectures — from cell to module and pack levels. It allows engineers to include elements like cooling or thermal plates and enables interactive 3D visualization to inspect geometry, layout, and thermal interfaces. This significantly speeds up and simplifies the process of building battery packs once the cell characterization is complete.
- Next, the **Simscape Battery tool** provides flexible model fidelity options. Engineers can choose low-fidelity models for early design stages that simulate faster, or high-fidelity models for detailed analysis.
- **Thermal coupling** is another important feature. Engineers can easily integrate cooling systems and simulate cell-to-cell temperature variations — a critical factor under high-temperature conditions, such as those in India.

The toolset also includes **BMS block libraries within Simulink** for key algorithms like SOC and SOH estimation, fault detection, and cell balancing. These ready-to-use blocks act as starting points for engineers to build and parameterize their own BMS control architectures.

Once the BMS algorithms are developed, engineers can use verification and validation tools for both functional testing and design error detection. This includes identifying issues such as dead code, unused logic, or divide-by-zero errors — all of which are critical for ensuring safety and reliability in battery management systems.

Together, these tools enable engineers to **rapidly iterate, test control strategies, and perform hardware-in-the-loop (HIL) validation within a unified environment** — streamlining the overall BMS and battery development process.

What kind of support does MathWorks offer to address the specific design challenges of battery packs used in two- and three-wheelers?

Challenges in the two- and three-wheeler EV segments include tight packaging constraints, highly cost-sensitive markets, and diverse usage conditions. Manufacturers must design vehicles that perform reliably across all these scenarios.

Simulation plays a key role here by enabling virtual prototyping and optimization before any physical testing begins.

Extending the end-to-end BMS workflow to an end-to-end EV development workflow, engineers can simulate drive cycles for both urban and rural conditions, optimize component sizing (battery, motor, and controller), and balance trade-offs between performance and cost. They can also design and test control algorithms for critical vehicle functions like regenerative braking, ABS, and thermal management — the latter being especially important in Indian operating conditions.

User Story | Ather Energy



Ather used simulation extensively to evaluate design concepts across various riding and usage scenarios and to make informed trade-offs. For instance, increasing battery capacity improves range but adds cost, size, and affects the EV's centre of gravity. To find the optimal balance, Ather built a **system-level vehicle model** incorporating the main components and vehicle dynamics.

Using a first-principles approach, they developed empirical models of battery cells and then designed control algorithms for battery charging, power management, and temperature management in Simulink. They ran closed-loop simulations to validate their control design and used Embedded Coder to generate deployable code for the ARM Cortex processor and D PIC2000 controller.

As a result, **Ather reduced its design cycle time from months to weeks and cut testing time by nearly 50%.** Field issues were also resolved much faster.

It's worth mentioning that **Ather benefited from the MathWorks Startup Program**, which provides qualifying startups access to MATLAB and related tools — sometimes complimentary through partner incubation centers. This includes technical support and collaboration with our application engineering team, helping startups scale efficiently.

How does AI help enhance the performance and capabilities of MathWorks solutions?

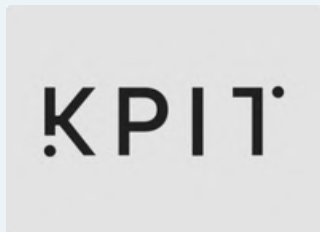
With the availability of large datasets today, MathWorks provides AI-based workflows for both battery modeling and BMS design. **Engineers can use AI techniques to create reduced-order models of batteries using the Reduced-Order Modeler App.** This app helps generate simplified yet accurate battery models when engineers have large amounts of data—either from high-fidelity simulations or experimental testing.

These AI-based models can then be integrated into **Simulink** for system-level simulations, C-code generation, and hardware-in-the-loop (HIL) testing.

For battery state estimation, engineers can leverage the **Deep Learning Toolbox** to estimate the state of charge or even develop virtual sensors that estimate parameters like internal battery temperature. Similarly, using the **Predictive Maintenance Toolbox**, engineers can estimate the remaining useful life of the battery—information that's crucial for both developers and end users to understand battery health and longevity.

These AI-driven models can also be deployed to **real-time target machines** for virtual and real-time testing, helping engineers validate and optimize battery performance more efficiently.

User Story | KPIT



KPIT is a leading software integrator in the automotive domain. They used deep learning tools—specifically **a deep neural network approach—for SoC and SoH estimation in BMS development**. Many engineers find traditional methods, such as Coulomb counting and Kalman filtering, quite complex to implement. By using deep learning-based techniques, KPIT achieved high accuracy in SoC and SoH estimation, comparable to, and in some cases better than, traditional approaches. Moreover, they were able to deploy their AI algorithms on an embedded platform.

As electric vehicles become more complex, especially with shared thermal systems, what are some of the key challenges in thermal system development, and how does simulation help address them?

Thermal management in EVs isn't just about cooling batteries anymore. Modern electric vehicles have interconnected thermal loops for batteries, motors, power electronics, and even cabin HVAC systems. That adds complexity — engineers need to balance heat loads and maintain energy efficiency under varying environmental conditions.

For example, if you're driving in hot weather with a low state of charge, the vehicle control unit has to decide whether to prioritize cabin cooling or range — these trade-offs are part of the system logic. Thermal management is also safety-critical, especially during fast charging or under extreme temperature conditions.

Simulation allows engineers to model and test multi-domain systems — electrical, thermal, and control — together. They can simulate scenarios like high-speed driving or cabin cooling, and evaluate optimization strategies to minimize energy consumption and maximize range.

User Story | Mahindra & Mahindra



Mahindra used MathWorks tools to build a flexible real-time simulation setup. This enabled their engineers to **develop and validate EV thermal system controls even before the Electronic Control Unit (ECU) hardware was available** — significantly speeding up development and reducing costs. By leveraging **rapid control prototyping** using MATLAB and Speedgoat, they could test control strategies and logic in real time.

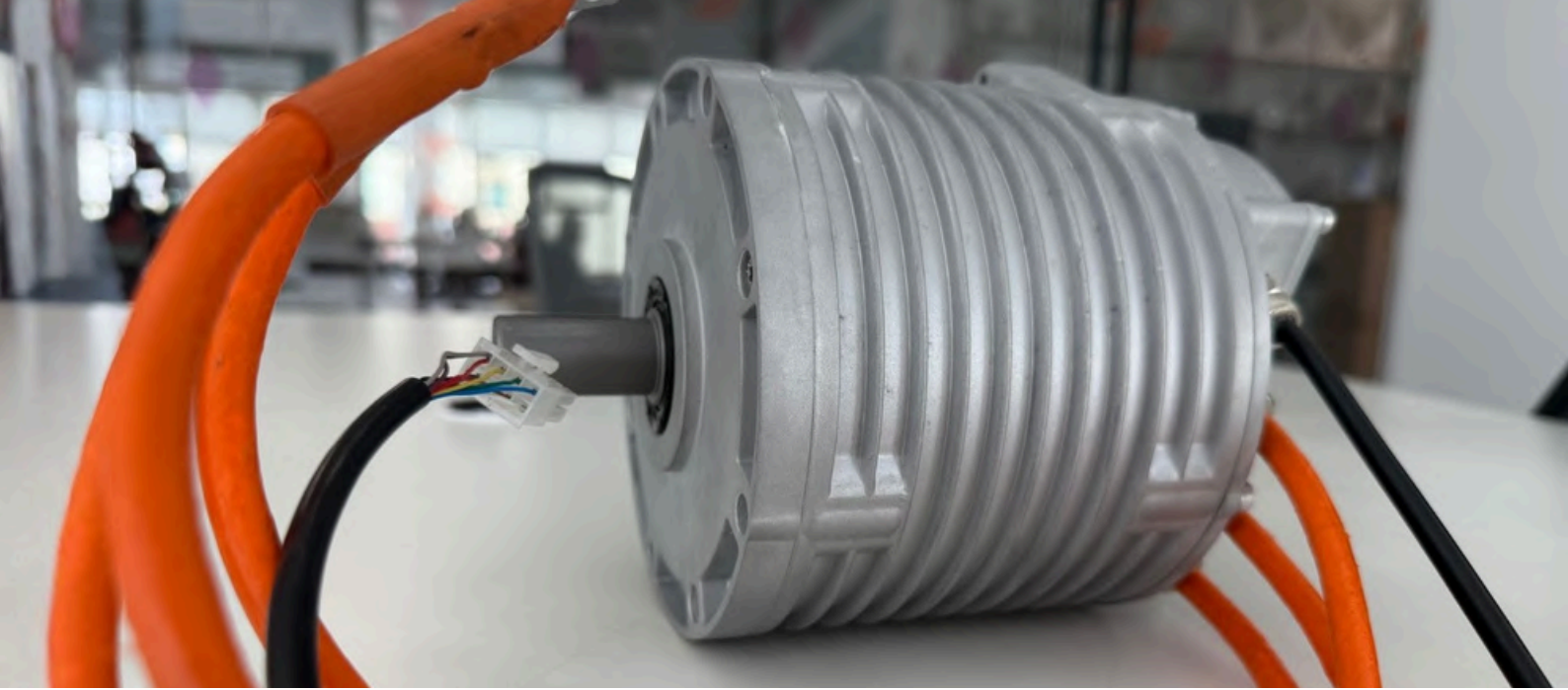
[Visit MathWorks Website](#) to learn more about simulation solutions for battery systems and BMS.



Follow the EVreporter WhatsApp channel to stay updated on India's clean mobility ecosystem.

[Click to join.](#)





Motor Efficiency is the New Fuel | Rethinking Motors for a Sustainable Future



Naxatra Labs has built a base platform of motors for different applications, including EVs, Agricultural Machinery, Power Tools and Drones. The motors are designed to be efficient and perfectly matched to their intended environment.

Piyush Verma, Co-Founder at Naxatra Labs, writes about the relevance of and the science behind application-specific motor design.

Motors have become ubiquitous in our modern life, silently powering almost everything that makes motion possible. Motors also **consume over 50% of the world's electricity**. While motors enable our lives and industries, most of them still rely on decades-old designs that are inefficient by today's standards. As the world commits to reducing carbon emissions and embracing sustainable energy, there's one truth we cannot ignore: **motor efficiency is energy efficiency**. Every % improvement in motor efficiency translates directly into massive electricity savings and reduced emissions.

Therefore, a significant part of efforts towards carbon neutrality should also focus on making motors increasingly efficient. **We believe the future of clean energy demands not just more motors, but better, application-specific motors.**

Historically, motors were built on a generic design philosophy, a single motor type repurposed across applications. While convenient for mass production, this approach led to two inefficiencies:

- Over-engineering: Motors that are heavier, bulkier, and consume more energy than required.
- Under-performance: Motors that fail prematurely due to overheating, poor load matching, external factors or unsuitable duty cycles.

For example, if an induction motor designed for industrial pumps is repurposed in an EV, it would struggle with torque density, heat management, and regenerative braking integration. Each application brings unique technical demands. Designing motors for these specific needs unlocks higher efficiency, reliability, and sustainability.

Different Applications have Different Motor Requirements

Electric Two-Wheelers: High torque density for stop-go traffic, high efficiency over drive cycle, thermal stability in hot climates, and regenerative braking compatibility.

Drones/UAVs: Ultra-lightweight construction, high RPM (10,000+), weatherproof, rapid dynamic response, and low inertia.

Agricultural Machinery: Ruggedness, high starting torque, and ingress protection (IP67+). Must withstand dust, water, and mud.

Power Tools: Compactness, shock resistance, and intermittent high-load duty.

Industrial Machines: Long continuous operation, reliability, compliant to IE4/IE5 efficiency classes.

Robotics: High Precision position control, high torque, zero backlash.

Motor Efficiency is the New Fuel

When the world discusses clean energy, we imagine solar panels, wind farms, and EV batteries. But there's a quieter, hidden revolution: motor efficiency.

- **IE Standards:** Motors are classified under IEC efficiency classes — IE3 (Premium), IE4 (Super Premium), IE5 (Ultra Premium). Moving industries from IE2 to IE4/IE5 can save hundreds of terawatt-hours annually.
- **Induction vs PMSM:** Induction Motors: ~85–88% efficiency | PMSM: ~94–96% efficiency with better torque control.
- **Impact Example:** A 2 kW EV motor, improved from 88% to 94% efficiency, saves ~100 kWh annually per vehicle. Multiply this by 1 million EV 2W sold annually - the savings equal several gigawatt-hours of power plant output.

In short, every percentage point in efficiency is equivalent to new power generation capacity.

The Science Behind Application-Specific Motor Design

A motor is an energy converter. Its performance depends on how efficiently it moves energy:

- **Electrical → Magnetic:** minimising copper loss through slot fill optimisation and low-loss laminations.
- **Magnetic → Mechanical:** shaping the torque curve so that the motor delivers peak efficiency at the exact speed band of the application.
- **Mechanical → Thermal:** channelling heat away through materials, coatings, and housings effectively.

For example, in an electric scooter motor, we optimise the efficiency band around 35–50 km/h, because that's where the vehicle spends most of its life in the city. In agricultural motors, we flatten the torque curve at lower RPMs to handle pump loads without overheating.

1. Electromagnetic Architecture

At the heart of every motor lies its electromagnetic design, the geometry of stator slots, winding patterns, and magnet configuration. Instead of using fixed templates, we tune the architecture to the load profile of the application:

- Concentrated windings for applications where torque transients dominate.
- Distributed windings for applications where smooth torque and NVH are critical.
- Halbach magnet arrays in drone motors for higher air-gap flux without adding mass.

Detailed simulation of flux density maps, cogging torque profiles, and harmonic distortion allows to ensure the chosen design aligns with the intended duty cycle.

2. Thermal Management

Heat is the number one motor killer. The motor design has to be optimized considering the external conditions the motor is to be deployed in. e.g. an EV in India during summers can see an ambient temperature of upwards of 50°C, for which the motors need to sustain and function effectively,

- Optimized slot fill factors to minimize copper loss.
- Advanced epoxy/varnish methods to improve insulation and thermal conductivity.
- Optimizing outer casing design for higher thermal loads.

This leads to a longer lifespan and stable performance in the required conditions.

3. Electronics and Control

A modern motor doesn't end at copper and steel; its brain is equally important. The co-design of motor and controller is where much of the efficiency gain comes from. **A generic controller running a high-efficiency motor can still waste 10–15% of energy.** An integrated design approach trims those losses and ensures smooth operation in the field.

4. System Level Optimization

A motor is never used in isolation. It always sits within a larger powertrain ecosystem, where its efficiency, reliability, and performance are directly influenced by the components it interacts with.

- In EVs, it is about how the motor, controller, battery, and transmission work as a single unit.
- In Drones, its Motor + Propeller Aerodynamics, the thrust, vibration, and endurance depend on how well the motor's torque-speed curve matches the propeller load curve.

Similarly, all other applications have their own system designs. To provide the best solution, we optimise the system, not just the motor, ensuring real-world efficiency, durability, and performance.

As the world pushes towards net-zero goals, every kilowatt saved matters. Smarter, efficient application-specific motors hold the key to unlocking these savings.



BESS Plant Setup – Part 6

Warranty, LTSA and Maintenance for BESS

Rahul Bollini, Bollini Energy

Rahul is an R&D expert in Lithium-ion cells with 10 years of experience. He founded Bollini Energy to assist in deep understanding of the characteristics of Lithium-ion cells to EV, BESS, BMS and battery data analytics companies across the globe. Contact | +91-7204957389; bollinienergy@gmail.com.

This article is the sixth and final part of the BESS Plant Setup Series published from June to November 2025 on EVreporter by Rahul Bollini. While Part 5 focused on understanding the parameters of the FAT (factory acceptance test), Part 6 focuses on the important warranty terms, LTSA, and maintenance for BESS. The details mentioned in the warranty terms and the **LTSA (long-term service agreement)** are crucial to the decision-making process when a customer has finalised the product and is on the verge of placing an order.

Important factors to be noted during warranty period:

- The customer must define the project duration and the number of cycles intended to be used per day and per year. Accordingly, the initial battery sizing and augmentation are planned and agreed upon by both parties. A SoH-based performance warranty can be agreed upon, so the project can proceed smoothly.
- A contract must be signed for the battery operation and maintenance method. A system manual must be provided with detailed instructions.
- The customer must take as much support and guidance from the battery manufacturer as possible during installation of the battery system.
- The battery manufacturer must assign a team to every project, consisting of a team administrator to manage the service team and several engineers for service and technical support. This team is expected to be reachable by phone, email or video conference on short notice. This team is also responsible for planning spares and scheduling preventive checkups and maintenance. It is explained in detail in an LTSA document.
- The battery manufacturer must ensure that only professionally trained personnel perform maintenance of the battery system. All precautions must be taken during maintenance to avoid injuries. No jewellery must be worn during maintenance.
- Many battery manufacturers do not allow full-power operation of the battery system above 45°C and mandate derating the system, which must be considered for projects operating in hot geographies. Similarly, higher-altitude projects require system derating, and if the derated power is insufficient, the battery must be oversized to achieve the required power.
- If the battery system will be idle for a long period, the DC circuit breaker must be turned off to prevent other devices from drawing energy. Also, the battery system must be turned on at least once to check the battery status.
- On-site storage time is defined as the period from the time container is shipped from the factory until it is connected to the grid. Maximum time allowed is documented in the contract.

- A detailed technical agreement is signed between the manufacturer and the customer that outlines the scope of supply, the project's functioning, a SoH-based performance warranty, and product maintenance technical requirements.
- For battery projects that experience power outages, it is important to have a UPS to power the BMS and fire suppression system (FSS) for a while. This is required when the battery is at a very low state-of-charge (SoC) and there is a power outage situation.

Situations when battery manufacturer does not provide warranty:

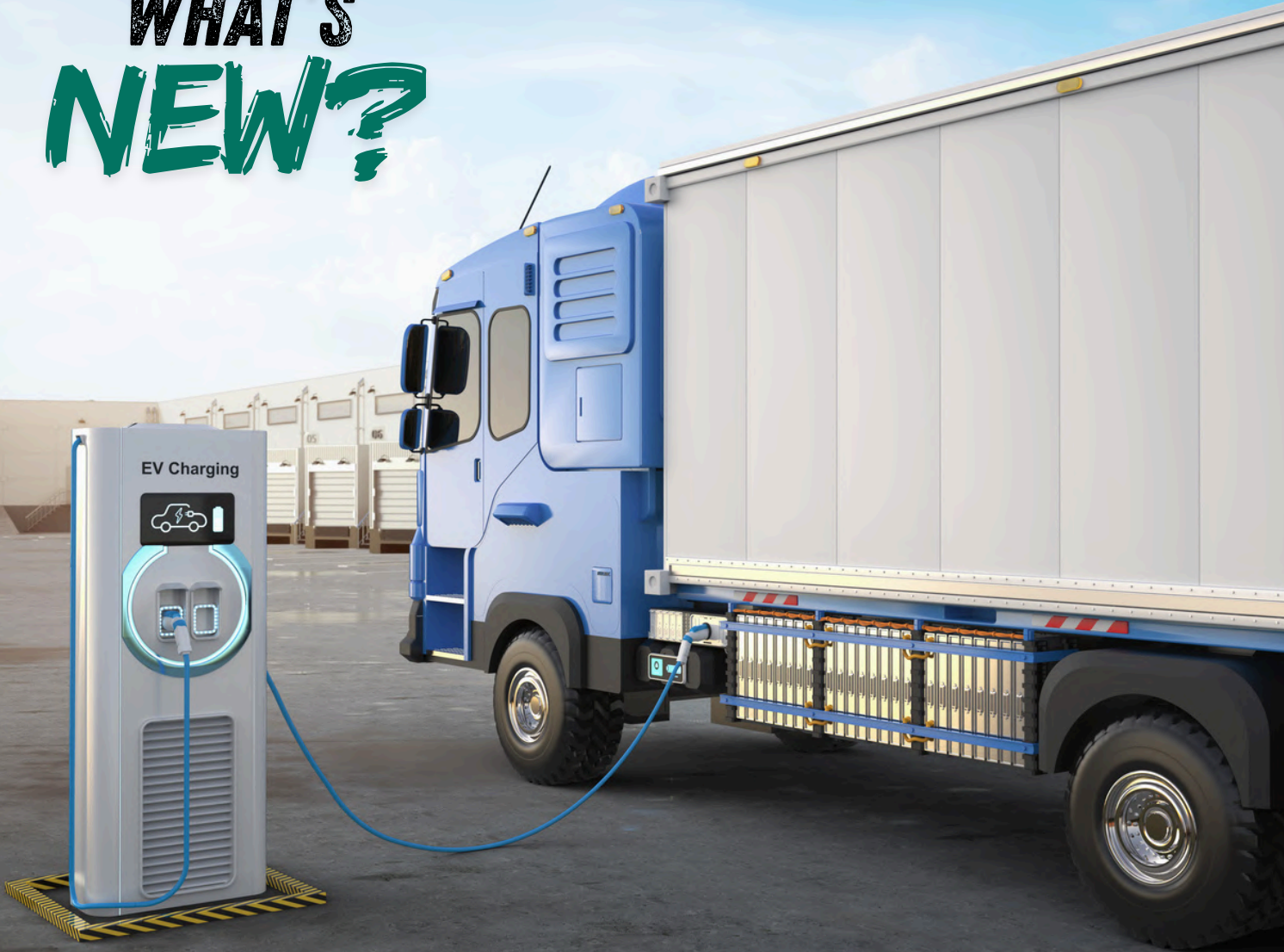
- If the system has been stored at the site for more than the agreed-upon time and loses more SoH than anticipated, the project's SoH-based performance warranty from the manufacturer needs to be renegotiated. In some cases, battery augmentation may be required if too much SoH is lost due to prolonged delays. It is common for projects to be delayed due to permits. Most manufacturers suggest connecting the battery to the grid within 6 months of FAT. Similarly, the SoH-based performance warranty would be renegotiated if DoD use of the project exceeds the agreed amount, or if the buyer fails to maintain the system or operates it differently than agreed in the contract.
- If an individual cell or battery system is allowed to go below undervoltage level beyond a specific time during maintenance, warranty can be voided.

General Maintenance to be Performed for the Project:

- Check for power cable and communication cables for any damage or cuts.
- Check the inlet and outlet of the liquid-cooling unit and ensure there is no blockage. Also, check the exhaust system for any blockage and clean or replace the filter if required.
- Check the fire suppression system functionality for any abnormalities.
- Check that the indicators are in good condition and are functioning as usual.
- Check the status of each plug, fuse and switch for any abnormalities.
- Check whether any components' temperatures are higher than usual using a thermal imager.
- If SoC errors are noticed during operation, the SoC must be recalibrated.
- Check the humidity and dust levels in the system.
- Perform a thorough test to determine if the system function is normal. Parameters such as power accuracy and power response time must be tested.
- Check for any corrosion of any metal elements.
- Check for any terminal surface that has rusted.
- Check if the emergency stop button is working.
- Perform a shutdown and check if the shutdown signal is normal.
- Check if the warning signs are intact and replace them if they are worn out.
- Check for any loose screws and tighten them.

Part 6 marks the end of BESS Plant Setup series. I will write more about BESS in future editions.

**WHAT'S
NEW?**



COMMERCIAL E-VEHICLES

An Exclusive and Comprehensive Newsletter Covering Periodical Updates from the Evolving Commercial Electric Vehicle Ecosystem in India.

COMMERCIAL VEHICLES GO ELECTRIC

Electric Light Commercial Vehicles and Heavy Duty Trucks find their way to India's roads like never before.

Rhino 5538 EV 4x2 TT



Montra Electric's new electric truck

- ₹1.15 crore for fixed-battery
- ₹1.18 crore (ex-factory) for **swapping**
- 282 kWh LFP battery
- 380 HP and 2000 Nm torque
- 198 km claimed range
- GCW - 55 tons
- Manufacturing - Manesar

BEM 5548e



Blue Energy Motors' heavy-duty e-truck

- Battery-**swapping** enabled
- LFP 282 kWh battery
- PMSM, 480HP @ 1990rpm
- GCW - 55T with 3 axle trailer
- Kerb weight - 8.8T without trailer
- Claimed range - 200 km
- Manufacturing - Chakan

Turbo EV 1000



Euler Motors' new e-LCV

- City, Fast Charge, Maxx models
- ₹5,99,999 | ₹8,19,999 | ₹ 7,19,999
- GVW - 1900 Kg | Payload - 1 ton
- 15.36 kWh battery
- Range - 140-170 km
- Motor - LV AC PMSM
- Peak power - 15 kW
- CCS2 fast charging

Electric Commercial Vehicle Brief | e-Goods Carrier Deployments & Commitments

Deployment - 50 electric trucks with swappable batteries at JNPA (Jawaharlal Nehru Port Authority)

Vehicle OEM - Energy In Motion (EIM) - a subsidiary of Ravindra Energy Ltd. Technology partnership with Beiqi Foton Motor.

Note - This fleet is expected to expand to 80 e-trucks by the end of 2025. JNPA targets 90% conversion of its 600-truck fleet to EVs by 2026. A heavy-duty battery swapping station has also been commissioned.



September 2025

Deployment - 13-ton **retrofitted** e-trucks for **Dalmia Cement** by **FLYTТА** on the Yadwad-Goa Corridor

Vehicle OEM - Custom developed by Kalyani Powertrain

Note - Flytta plans to deploy nearly 200 such retrofitted e-trucks in the coming months. Their electric trucking platform offers payload capacities from 13 tons to 40 tons across trucks, dumpers, and trailers.



Deployment - 10 electric trucks (55-ton) for **Hindalco Industries'** Birla Copper Division by **BillionE** Mobility on the 160 km Dahej - Asoj route in Gujarat.

Vehicle OEM - Ashok Leyland

Note: 5 more trucks to be inducted over the next 3 months.



Deployment - Electric trucks for **JK Lakshmi Cement** by **BillionE** Mobility for clinker dispatches from Sirohi (Rajasthan) to Surat (Gujarat) - 1,000 km round trip.

Vehicle OEM - Ashok Leyland



Electric Commercial Vehicle Brief | e-Goods Carrier Deployments & Commitments

Deployment - 4 units of AVTR 55T electric trucks handed over to **ASAT Logistics** towards deployment for **Shree Cement**.

Vehicle OEM - Ashok Leyland

Note - 20 more trucks to be supplied. AVTR features a 300 kWh battery, a 220 kW motor, a top speed of 80 kmph and a range of nearly 180 km.



Deployment - 100 e-LCVs (3.5T) deployed as Reefer Trucks for cold chain logistics by **Celcius Green** (Vertical of Celcius Logistics)

Vehicle OEM - Switch Mobility

250 more vehicles to be rolled out by the end of FY26.



Deployment - Tata Prima E.55S electric prime movers to be deployed by **Enviro Wheels Mobility** in Chittorgarh, Rajasthan, for transporting minerals and ores. Vehicle deliveries have commenced.

Vehicle OEM - Tata Motors Commercial Vehicles

Note - Tata Prima E.55S offers a range of 350 km.



Deployment - Electric Bulker deployment at Durg plant of **JK Lakshmi Cement** by **SwitchLabs** for flyash transportation

Vehicle OEM - Tata Motors Commercial Vehicles



Note - SwitchLabs plans to add 52 new 55-ton Tata Prima Electric Trucks to its fleet across four locations during October and November 2025. Of these, 25 are to be deployed to JK Lakshmi Cement at 2 locations.

Electric Commercial Vehicle Brief | e-Goods Carrier Deployments & Commitments

Deployment - Delivery of 20 heavy-duty electric trucks (SANY 5550 E) to **SG Green Logistics Pvt. Ltd.**

Vehicle OEM - SANY INDIA. 376 kWh battery, 55T GCW, 360 kW PMSM motor

This is the first electric truck delivery from SANY India, a company known for its construction equipment.



Deployment - MoEving will deploy 500 e-LCVs from Switch Mobility and 700 e-LCVs from Tata Motors.

Vehicle OEM - Switch Mobility and Tata Motors Commercial Vehicles

Note - MoEving has partnered with Tata Motors Commercial Vehicles' leading dealers—Pascos, Johar Automobiles, and Bhadari Automotive — to procure these vehicles.



Deployment - Fitsol will deploy 100 from Storm e-LCVs over the next few months to serve its clients.

Vehicle OEM - Euler Motors

Note - Fitsol is a Decarbonisation as a service provider.



Electric Commercial Vehicle Brief | e-Bus Deployments

PMI Electro Mobility

- 120 electric buses
- For the Brihanmumbai Electric Supply and Transport Undertaking (BEST), Mumbai

PMI Electro Mobility said it will set up an **electric bus plant in Ghiloth**, Rajasthan, with an investment of ₹1,200 crores. Rajasthan State Industrial Development and Investment Corporation (RIICO) allotted 65.56 acres of land worth ₹208 crores on October 14, 2025.



JBM Electric Vehicles

- 25 electric buses
- At the Statue of Unity in Kevadia, Ekta Nagar, Gujarat



Olectra Greentech Limited

- 25 electric buses | 15 non-AC, 10 AC
- For the Puducherry Road Transport Corporation (PRTC) under Puducherry's Smart City initiative.



EKA Mobility, subsidiary of Pinnacle Industries Limited



Investment commitment received - INR 500 crore

From - India Japan Fund, a fund managed by National Investment and Infrastructure Fund (NIIF)

Eka's Portfolio - E-buses (7m, 9m, and 12m variants), intercity coaches, 3Ws, heavy-duty trucks (55T and 7T) and SCVs in the 1.5T, 2.5T, and 3.5T categories. Order book of 3,300 electric buses.

Existing shareholders - VDL Groep (Netherlands), Mitsui & Co (Japan), Enam Holdings (India)

Note - In Jan 2024, NIIF's India-Japan Fund announced an INR 400 crore investment in Mahindra Last Mile Mobility. NIIF's SOF (Strategic Opportunities Fund) invested in Ather Energy in 2022.



Rare-earth-free motor maker **Chara Technologies** has raised **INR 52 crore (USD 6 million)** in Series A round led by Arkam Ventures, with participation from Exfinity Venture Partners, Kalaari Capital, and IIMA Ventures. Chara aims to increase its production capacity from 20,000 to 1,00,000 units annually. Earlier, the company had raised **\$4.75M in January 2023** in a pre-Series A round.

Delhi-based electric powertrain company **Tsuyo Manufacturing** raises **INR 40 crores in a Pre-Series A round led by Avaana Capital**. The investment will fund a second R&D centre and a third manufacturing facility. Tsuyo is currently focused on high-wattage motor production (15kW–250kW) with an annual capacity of 20,000 units, and launching retrofit solutions for commercial vehicles (1.5T–90T).



Gulf Oil India to acquire an additional 14.18% stake in Gujarat-based Tirex Chargers for INR 38.09 crores, increasing Gulf's total stake to 65.18%. Tirex delivered 75% revenue growth in H1, closing the first half of the current FY with a topline of INR 42 crores. In Aug 2023, Gulf Oil had acquired a 51% stake in Tirex for ₹103 crores.

TrusTerra, a marketplace for used EVs, **announced raising ₹9 Crore in a Pre-Seed funding** round led by Finvolve and India Accelerator, with co-investment from GrowthCap Ventures and angel participation. TrusTerra has evaluated 2,000+ used EVs for resale. Over the next 18 months, the company aims to certify 20,000 used EVs across 20+ cities.



EV Fleet Startup **Battwheelz Mobility Solutions** secures **₹2 Crores** in seed funding round, at a valuation of ₹60 Crores. The round was led by Finvolve, with participation from other angel investors. Founded in 2022, Battwheelz has launched operations in Pune, Chennai, and Bengaluru, with an electric fleet of 450+ vehicles deployed for 3PL logistics.



The **Advanced Carbons Company (TACC Limited)** has secured **INR 1,230 Crore Credit Facility** from State Bank of India for its Lithium-ion Battery Grade **Graphite Anode Facility** in Dewas, Madhya Pradesh. The facility is planned to be scaled to an annual capacity of 20,000 MTPA of graphite anode material. TACC is a part of the LNJ Bhilwara Group.

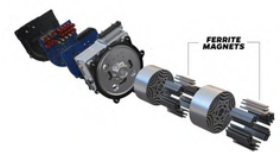


Enigma Automobiles has received a **₹6.5 crore credit facility** from **SBI** to support its production and expansion plans. The funding, structured as a term loan and LC line of credit, will help the company scale up manufacturing and expand into Tier-1 cities such as Bengaluru, Delhi, and Hyderabad over the next two years.



SPIRO, an African 2W transportation and battery-swapping company, has raised **\$100 million in a round led by Fund for Export Development in Africa (FEDA)**, with FEDA contributing \$75 million. The funding will support the expansion of its battery-swapping network and technology platform, with plans to deploy over 100,000 vehicles by 2025.

Ola Electric received certification for its **rare-earth-free ferrite motor** from the Global Automotive Research Centre, Tamil Nadu. Ola says the performance matches that of rare-earth permanent magnet motors in the 7kW and 11kW variants, and that it will start using ferrite motors in its vehicles.



Ola Electric's **4680 Bharat Cell battery packs** (battery packs containing in-house manufactured lithium-ion cells) have been **certified by ARAI**. The company will start deploying these battery packs in its S1 Pro+ model.



Ola also launched **Ola Shakti** to enter India's residential **BESS** market, powered by indigenous **4680 Bharat Cells**. Deliveries will begin on Makar Sankranti 2026, i.e., mid-January 2026. Launched in 1.5 kWh, 3 kWh, 5.2 kWh, and 9.1 kWh battery configurations at introductory pricing of ₹29,999, ₹55,999, ₹ 1,19,999 and ₹1,59,999, respectively, for the first 10,000 units.



Vrinda Nano Technologies has launched a 1 MW Electric Vehicle Charger, intended for heavy-duty fleets, commercial vehicles, and long-haul transport.



Pune-based **Ador Powertron Limited launches a 30kW EV-charger power module.** This indigenous AC-DC converter will power DC fast chargers for electric vehicles. The product substitutes a sub-assembly that has historically been import-dependent for many Indian charger OEMs.

EVamp Technologies launches fast DC chargers for e-2Ws and e-3Ws. Their LECCS (Light Electric Combined Charging System) charger product lineup includes 3.2 kW, 6.4 kW, and 10 kW chargers. The chargers have been developed by partnering with **Ather Energy**.

Also **commonly known as the Type 7 connector** [IS-17017 Part 2 / Sec 7], LECCS is an AC and DC combined port solution adopted by Ather and Hero MotoCorp's Vida series.



Dürr and GROB presented a new concept factory for lithium-ion cell production, claiming 70% less energy and 50% less space requirement at the Battery Show India. Key technologies include dry-coating of the electrodes, eliminating the drying process, and Z-fold technology for cell assembly with integrated notching.

Charging network provider **Statiq** and **BMW Group** partner to establish an EV charging corridor covering over 4,000 km from Jammu to Madurai, and to ensure **at least a 120 kW fast-charging station every 300-350 km to support inter-city travel for all EV users.** BMW customers can access these chargers through the myBMW app.



EV energy solutions provider **Kazam** partners with **Hindustan Petroleum Corporation** to **integrate 5,350 HPCL EV chargers, including 3,043 DC fast chargers, into the Kazam app.** HPCL, which runs a network of more than 24,000 fuel retail locations, is growing its EV charging infrastructure.

Plush Miles has partnered with **Alt Mobility** to **expand its EV fleet across Delhi-NCR.** Alt Mobility will lease new BYD vehicles to Plush Miles, with IREDA Ltd. providing financing support. The partnership aims to enhance fleet availability for airport transfers and day rentals.



Montra Electric launches electric passenger 3W **All-New Super Auto at ₹3,79,500 (Ex-showroom, post subsidy).** The company already has 13,000 Super Auto EVs on the road. The new model offers:

- On-road range of 160 km per charge
- Equipped with “One Montra Electric” software platform
- Colour options of White, Blue, Green, and Black



3ev Industries, an EV OEM headquartered in Bangalore, has signed a technical collaboration agreement with **Gentari India** to work together on EV service and maintenance, vehicle retrofitting and refurbishment, battery reuse, Battery-as-a-Service solutions, and charging infrastructure development.



Battery swapping network **Battery Smart** partners with **Lilypad**, a digital marketplace for e-2Ws. Lilypad will include battery-less electric 2Ws on its website, which can be integrated into Battery Smart's swapping network across Delhi NCR. The initiative is set to launch across Noida and Greater Noida from October to December 2025.

Indofast Energy has partnered with **e-Sprinto** to deploy 20,000 e-2Ws across India by 2026, integrated with Indofast Energy's battery-swapping network.



Greaves Electric Mobility Limited (GEML) has announced a partnership with **Shriram Green Finance**. The partnership will provide retail financing for GEML's electric three-wheelers under the Greaves 3W brand and electric LCVs (ELE).



Batt:RE has partnered with **Battery Smart** to introduce **Battery-as-a-Service (BaaS)** solutions for e-2Ws in **Jaipur**. Fleet operator **Beez Electric** has deployed over 1,000 BattRE e-scooters powered by Battery Smart's swapping technology. Riders can access 100+ swap stations across Jaipur.

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