EVreporter.com

December 2023

Issue No. 35

EVreporter

What's INSIDE

EVreporter.com

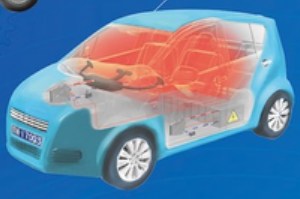
Accelerated by

ISB | aic Indian School of Business

Global Supplier of EV PTC Heater | NF GROUP

HEBEI NANFENG AUTOMOBILE EQUIPMENT (GROUP) CO., LTD
BEIJING GOLDEN NANFENG INTERNATIONAL TRADING CO.,LTD

APPLICATION



PTC COOLANT HEATER
Customized power 1.2~30KW Voltage 48V-1000V

WPTC07 | CH06 | W09 | SH05 | Q Series

PTC AIR HEATER Customized power 1-6KW Voltage 150-650V
ELECTRONIC WATER PUMP Customized power 30-2500W Head 3-24M

PTC air heater | PTC air heater | Water pump 522 | Water pump 201A | Water pump 151A

NF PTC coolant heater customized power from 1.2-30KW and the voltage range is 48-1000V.

NF PTC air heater customized power from 1-6KW and the voltage range is DC150-650V.

NF group can provide electronic water pump solutions. Customized power range 30-2500W, pump head 3-24M, pump capacity up to 900-23100 (L/H).Mainly used for cooling and heat dissipation of motors, controllers, batteries and other electrical appliances in new energy vehicles.

Hebei Nanfeng Automobile Equipment Group Co., Ltd was established in 1993, which is a group company with 6 factories and a trade company (Beijing Golden Nanfeng International Trade Co., Ltd., located in Beijing). We are the biggest vehicle heating & cooling system manufacturer in China.
The main products are: PTC Coolant Heater, PTC Air Heater, Electronic Water Pump, etc.

NF group has passed IATF 16949:2016, ISO 14001 :2015,CE, E-mark certificate and other certifications.
The products meet the European safety and environmental protection standards and have formed large-scale and serialized production. NF group holds a domestic market share of 40% and exports them around the globe particularly in Asia, Europe and Americas.

Daisy Qu

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EXPERIENCE THE NEXT GENERATION OF E-MOBILITY!

At OKLA, we are more than just an electric vehicle manufacturer; we are the driving force behind a greener, smarter, and more sustainable tomorrow. As the world embraces the era of big data, we are actively shaping the future of green travel and integration services.

- TECHNOLOGY SUPPORT
- MANUFACTURING
- SUPPLY CHAIN MANAGEMENT
- RESEARCH AND DEVELOPMENT
- EV PARTS SOLUTION

Our mission is clear: to contribute to a sustainable planet for our global customers.

Our unwavering commitment to eco-friendly practices, efficient production management, intelligent security, and data analysis sets us apart as industry leaders. We prioritize consumer interactions, delivering fast, reliable services and support. Our ultimate goal? To set the industry standard for environmental protection and forge a greener future for humanity.

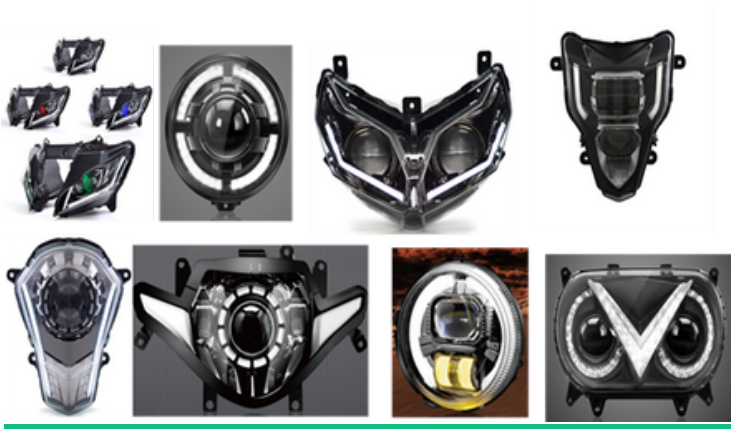
WHO WE ARE

OKLA is an electric vehicle manufacturer based in Taizhou, China. Our history with vehicles dates back to 2006 under the brand of gasoline motorcycle “CHINV”. In 2015, we set up a new electric vehicle brand “OKLA”. Our diverse range of electric vehicles, including e-motorcycles-scooters-delivery vehicles, and e-bicycles, cater to the evolving needs of urban commuters and eco-conscious individuals. We take pride in our commitment to technological innovation, design excellence, and environmentally friendly practices.

OKLA Global has a global presence and a commitment to sustainability. Headquartered in Taizhou, China, with two R&D centres, Taizhou and Shangai, the company's core values revolve around innovation, environmental responsibility, and customer satisfaction.

WHAT WE DO

The journey from design to reality is where OKLA Global's **mold manufacturing** comes into play. We specialize in the **production of electric motorcycles, scooters, delivery vehicles, and bicycles.** Each manufactured mold undergoes rigorous scrutiny to ensure it adheres meticulously to the original design. Surface finishes are perfected, dimensions are scrutinized, and the molds are subjected to an array of tests that affirm their precision and functionality. Our products are designed to provide an unparallel riding experience, delivering power, performance, and sustainability in every journey.



OKLA Global LIGHTS

OKLA Global CONTROLLER

OKLA Global MOTOR

TECHNICAL PARAMETERS

	Model No.	ES01	ES02	ES02-PLUS	ES04	ES05	ES06	ES07	ES09	ED01	ED02
	Model Name	OVEGA (EEC)	MX	MX-PLUS	DREAM	MOJITO	HERBEN	LG-PLUS	ROMESUNNY	MX-MINI	SHENMA
PHOTOS											
Basic Info.	Dimension mm	2090X795X1100MM	2120*710*1150	2120*710*1180	2220*710*1150	1950*670*1180	1725*760*1120	1920*700*1170	1930*720*1190	1960×730×1130	1780*750*1080
	Wheel Base mm	1475	1430	1470	1540	1350	1335	1335	1400	1350	1300
	Ground clearance mm	140	170	190	180	220	180	220	210	180	120
	Seat height mm	880	770	780	810	800	770	800	830	770	730
	Weight without battery kg	119	92	111.2	107	85	61	85	67.1	78.2	65
	MAX Load kg	180	180	210	150	180	150	180	150	150	150
	Tire Size: F/R	F:130/60-13 R:140/70-13	FR: 100/80-16 RR: 110/80-14	FR: 100/80-16 RR: 110/80-14	F:100-80-16 R:120-80-16	120-70-12	100-80-12	120-70-12 tubeless	3.0-10	100/80-12	3.0-10-12
	Wheel material	Alluminium/Iron	Alloy wheels	Alloy wheels	Alluminium/Iron	Alloy wheels	Alluminium/Iron	Alluminium/Iron	Alluminium/Iron		Alluminium/Iron
	Brake: F/R	F/R: Disc Brake (ABS)	DISC Brake	DISC WITH CBS	DISC WITH CBS	DISC WITH CBS	DISC WITH CBS	DISC WITH CBS	DISC Brake	DISC WITH CBS	DISC Brake
	Light	LED	LED	LED	LED	LED	LED	LED	Halogen bulb	LED	LED
	Light Front Suspension	Aluminum hydraulic suspension	Telescop alluminium hydraulic suspension	Telescop alluminium hydraulic suspension	Aluminum hydraulic suspension	Telescopic: Aluminium hydraulic suspension	Halogen bulb	Hydraulic spring shock absorber	Alluminium hydraulic suspension	Telescop alluminium hydraulic suspension	Alluminium hydraulic suspension
	Light Rear Suspension	Hydraulic adjustable suspension	Hydraulic adjustable suspension	Hydraulic adjustable suspension	Hydraulic adjustable suspension	Hydraulic spring shock absorber	Hydraulic spring shock absorber	Hydraulic spring shock absorber	Hydraulic adjustable suspension	Hydraulic adjustable suspension	Hydraulic adjustable suspension
Motor	Motor Type	Central Motor	Hub Motor	Side Motor	Central Motor	Hub Motor	Hub Motor	Hub Motor	Hub Motor	Hub Motor	Hub Motor
	Motor Power(Rated)	7000W	2000W	4000W	3000W	2000W	2000W	2000W	1000W	2000W	1500W
	Motor Power(Peak)	16000W	6000W	8500W	6000W	7000W	5400W	7000W	2600W	5400W	3000W
	Motor On-wheelTorque(Rated)	80NM	27NM	41NM	60NM	35NM	24NM	35NM	18NM	24NM	22NM
	Motor On-wheelTorque(Peak)	360NM	130NM	180NM	145NM	160NM	135NM	160NM	110NM	132NM	120NM
Performance	Speed km/h	120	45	90	80	65	65	65	45	65	60
	Gradeability	26°	17°	20°	17°	17°	17°	17°	13°	17	16°
	Range km (45km/h)	215	75/150 (2psc Battery)	75/150 (2psc Battery)	85	75	75/150 (2psc Battery)	75	75	75/150 (2psc Battery)	75
Charger	Output Voltage/Current	72V25A	72V15A/72V8A	72V15A/72V8A	72V10A	72V15A/72V8A	72V15A/72V8A	72V15A/72V8A	72V8A	72V15A/72V8A	60V15A
	Charging Time	4.5H	4H	3H	3H	3H	3H	3H	4H	3H	3H
Speedometer	Display Type/Size	TFT Color	LED	TFT Color	LCD	TFTColor	LED	TFT Color	LED	LED	LCD
	Display Connectivity	CAN	CAN	CAN	485	CAN	CAN	CAN	1-WIRE	CAN	1-WIRE
	Iot Enable	Yes	Yes	Yes	No		Yes	No	No	Yes	No

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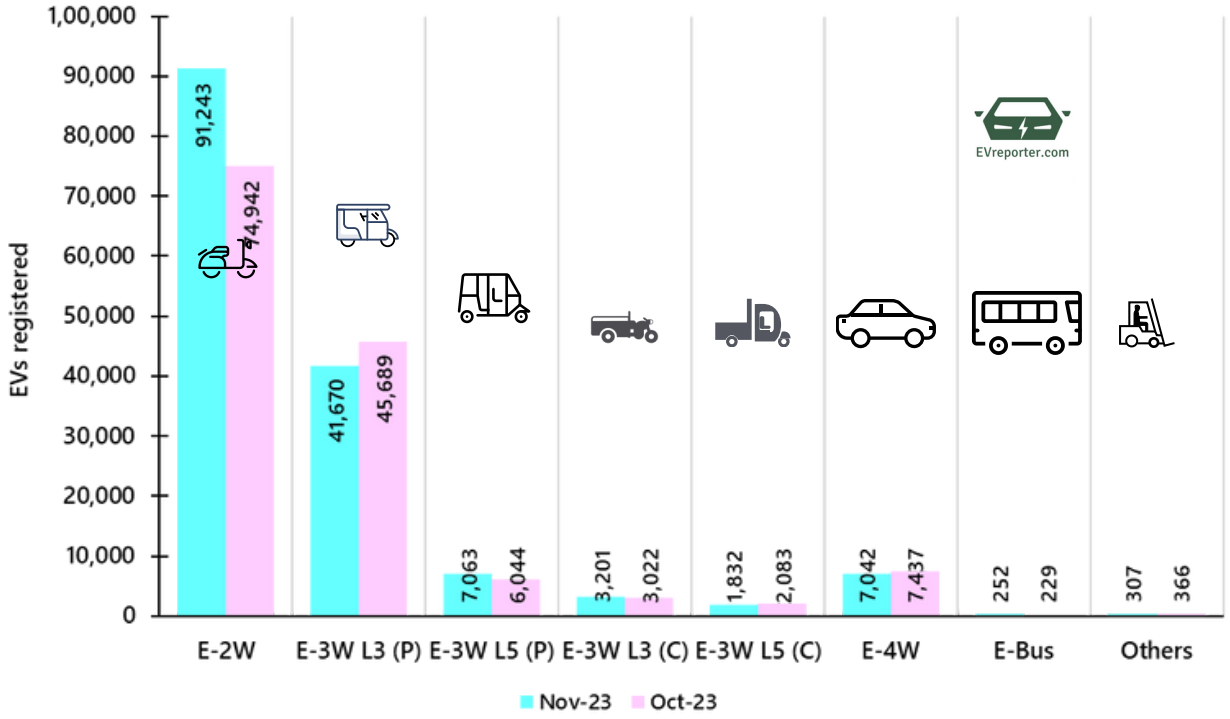
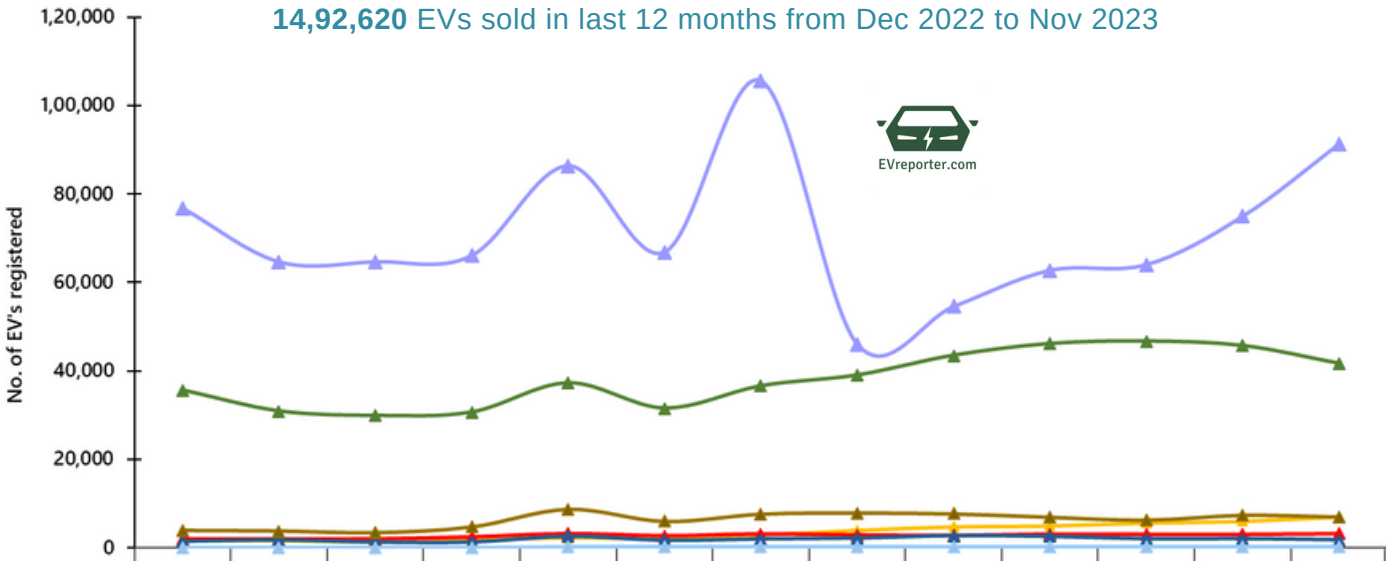
Category wise Electric Vehicle sales, Nov 2023 | India

Total Registered Electric Vehicle Sales - Nov'23 - 1,52,610 I Oct'23 - 1,39,812



Category wise-Sales Trend from Nov 2022 to Nov 2023

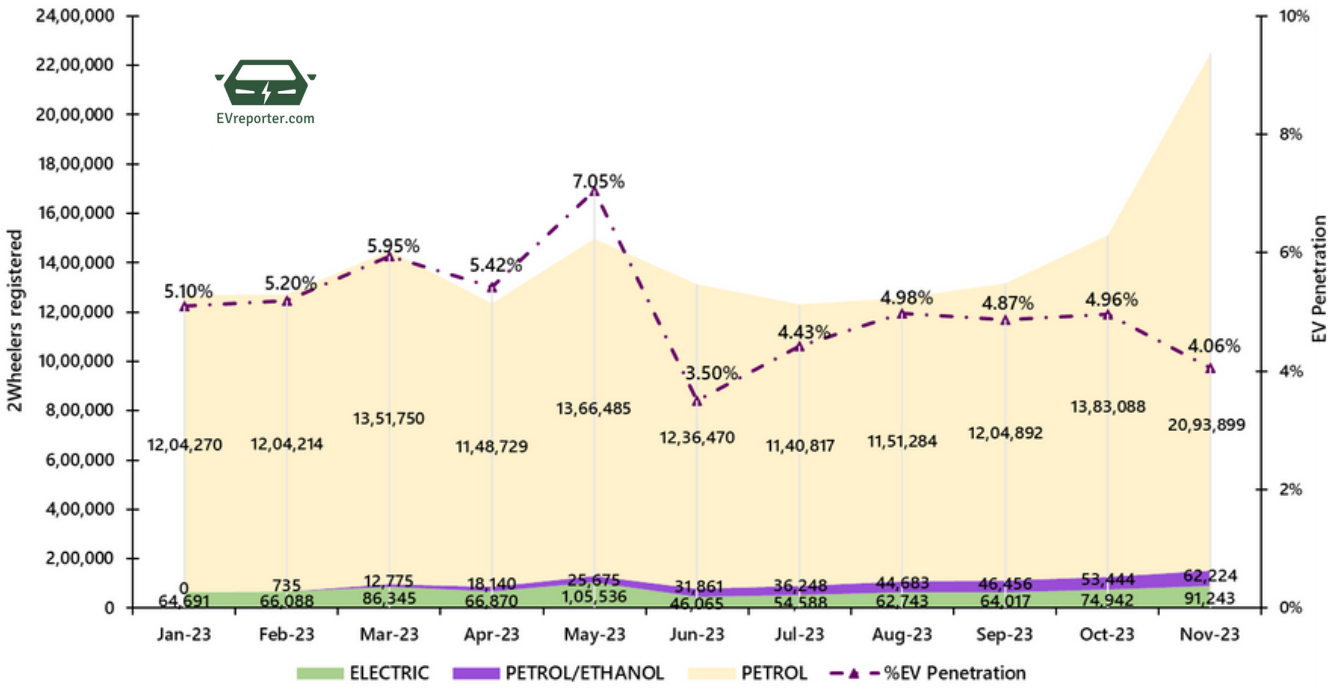
14,92,620 EVs sold in last 12 months from Dec 2022 to Nov 2023



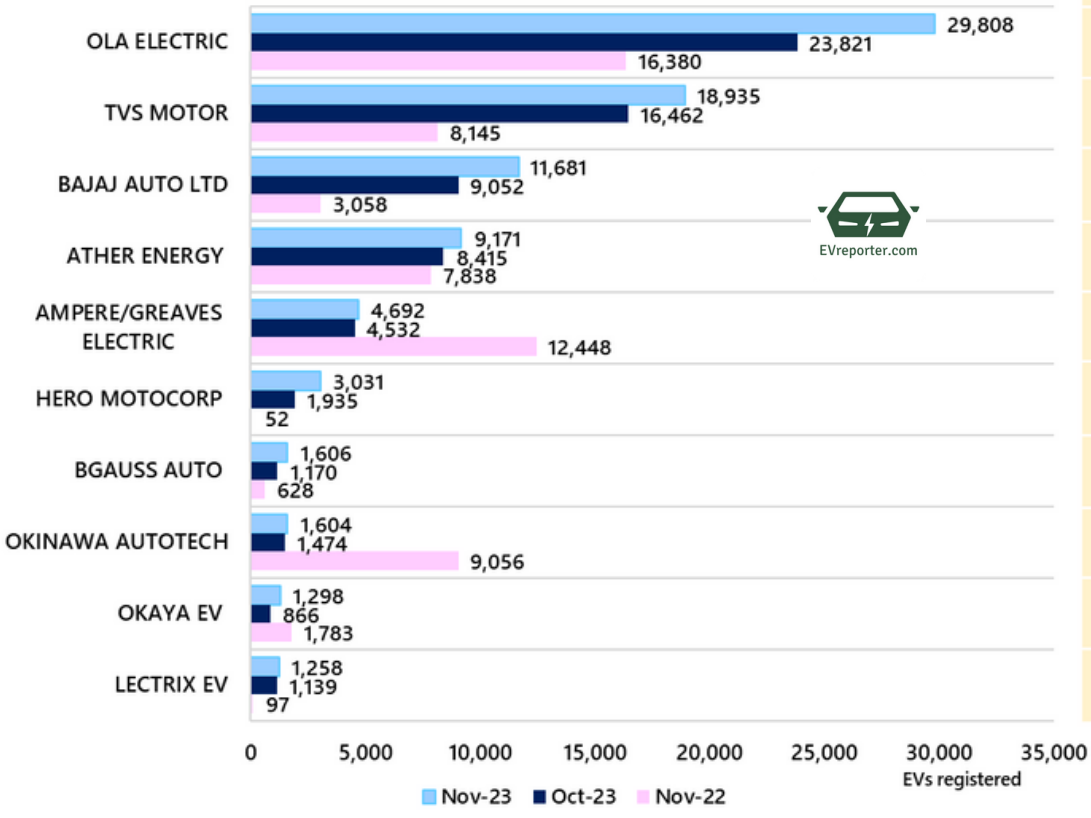
	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23
E-2W	76,791	64,660	64,691	66,088	86,345	66,870	1,05,536	46,065	54,588	62,743	64,017	74,942	91,243
E-3W L3 (P)	35,636	30,912	29,908	30,666	37,263	31,565	36,590	39,026	43,498	46,133	46,692	45,689	41,670
E-3W L5 (P)	1,530	1,557	1,276	1,661	2,248	2,053	2,879	3,939	4,752	4,975	5,652	6,044	7,063
E-3W L3 (C)	1,948	1,964	1,985	2,440	3,214	2,703	3,154	2,887	2,775	3,094	3,037	3,022	3,201
E-3W L5 (C)	1,505	1,799	1,333	1,341	2,568	1,730	2,012	2,208	2,724	2,557	2,071	2,083	1,832
E-4W	3,980	3,840	3,443	4,757	8,826	6,029	7,708	7,963	7,761	6,989	6,315	7,437	7,042
E-Bus	117	161	138	122	98	88	280	204	144	250	254	229	252
Others	91	112	98	144	350	313	261	241	239	315	311	366	307
TOTAL	1,21,598	1,05,005	1,02,872	1,07,219	1,40,912	1,11,351	1,58,420	1,02,533	1,16,481	1,27,056	1,28,349	1,39,812	1,52,610

P - Passenger, C - Cargo | Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs

Fuel wise 2W Sales Trend, Jan 2023 - Nov 2023



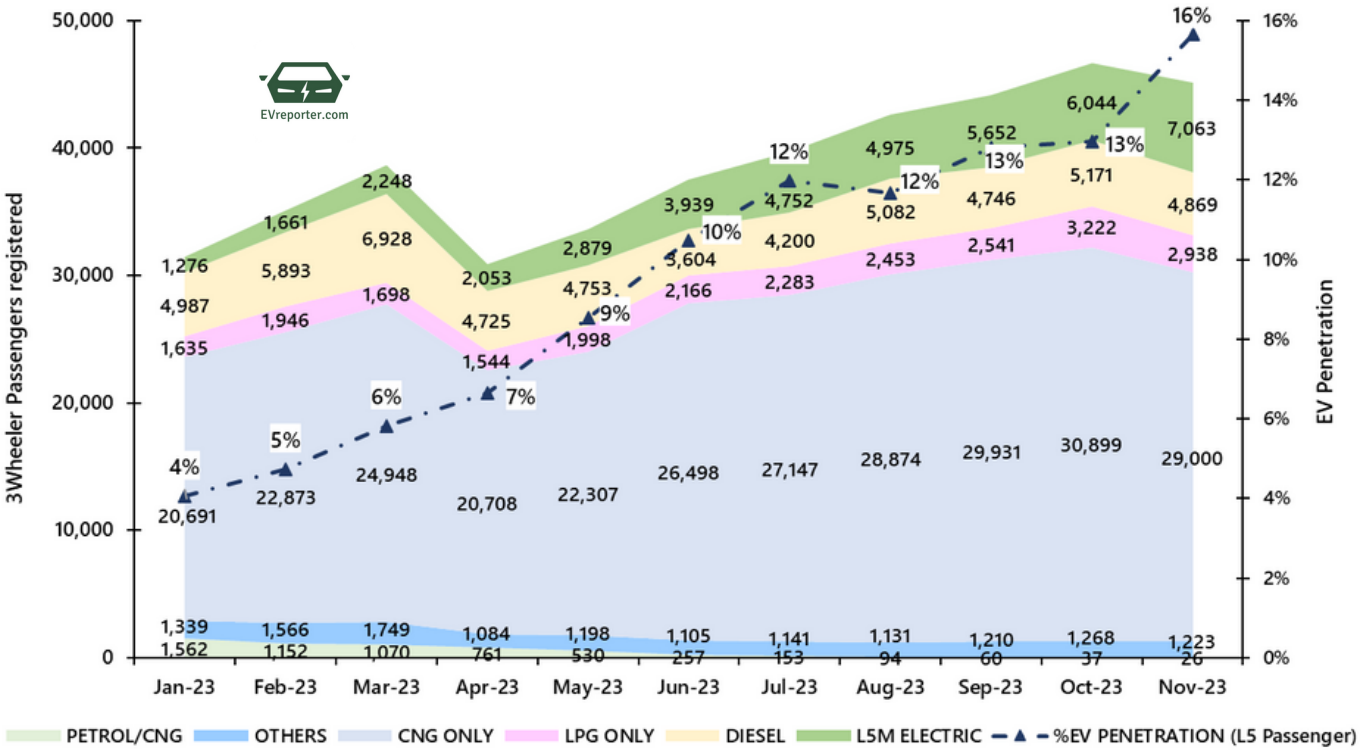
High Speed E-2W Sales Trend by OEM



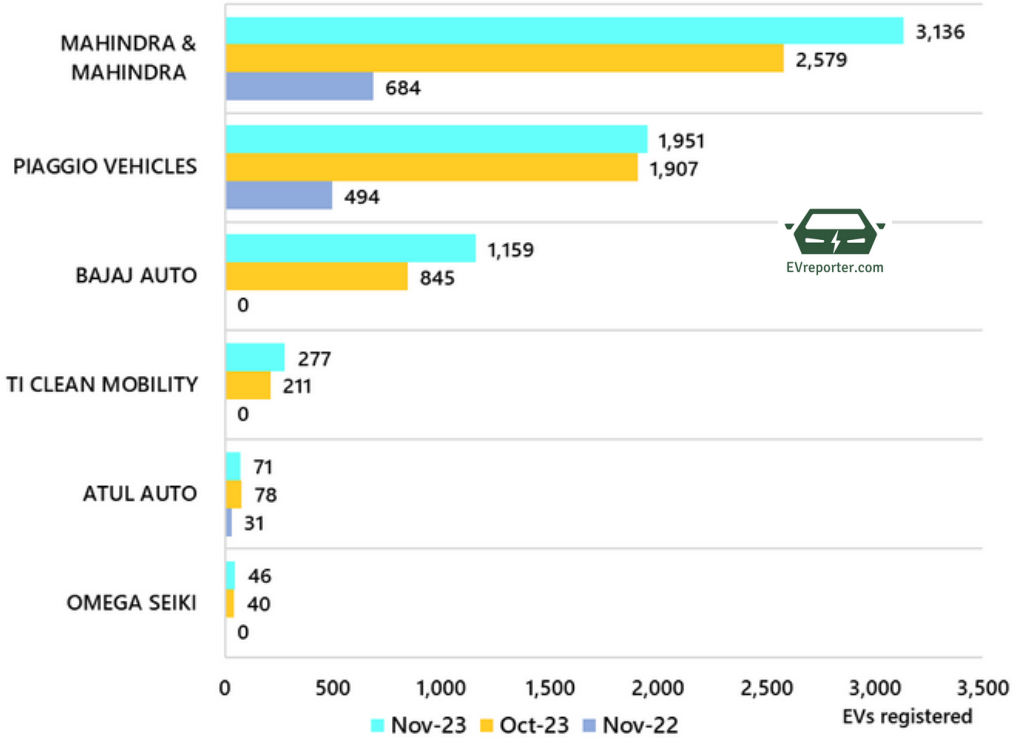
	% Growth (Y-o-Y)	% Growth (M-o-M)
OLA ELECTRIC	82%	25.13%
TVS MOTOR	132%	15.02%
BAJAJ AUTO LTD	282%	29.04%
ATHER ENERGY	17%	8.98%
AMPERE/GREAVES ELECTRIC	-62%	3.53%
HERO MOTOCORP	5729%	56.64%
BGAUSS AUTO	156%	37.26%
OKINAWA AUTOTECH	-82%	8.82%
OKAYA EV	-27%	49.88%
LECTRIX EV	1197%	10.45%

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs
Note: Low speed Electric 2 Wheelers data is not included

Fuel-wise 3W **Passenger L5** Sales Trend



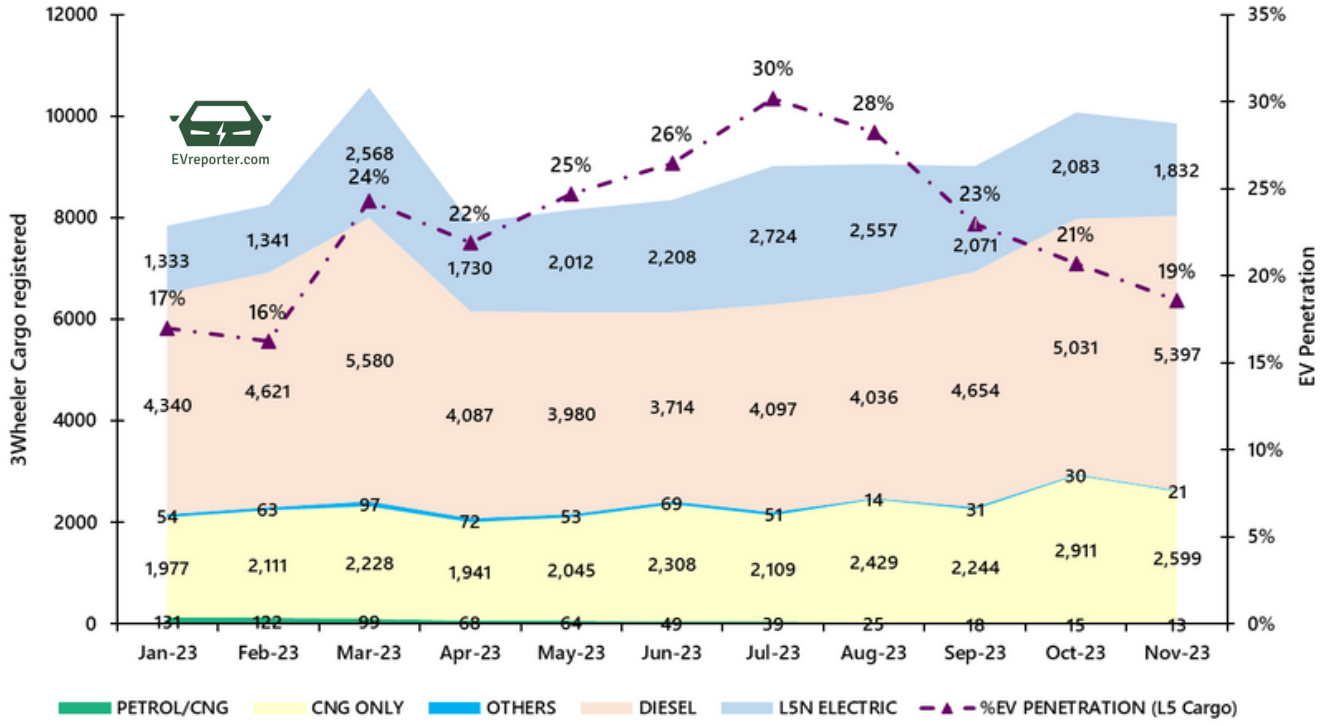
E-3W Passenger L5 Sales Trend by OEM



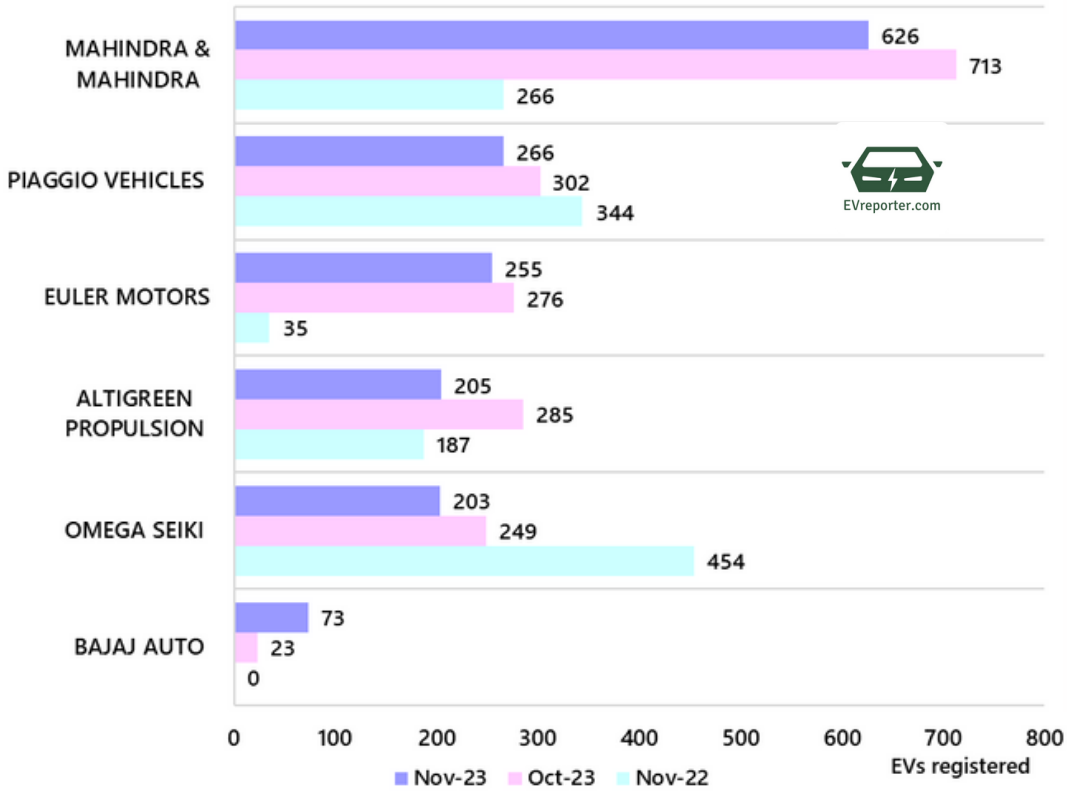
	% Growth (Y-o-Y)	% Growth (M-o-M)
MAHINDRA & MAHINDRA	358%	22%
PIAGGIO VEHICLES	295%	2%
BAJAJ AUTO	-	37%
TI CLEAN MOBILITY	-	31%
ATUL AUTO	129%	-9%
OMEGA SEIKI	-	15%

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs.

Fuel wise 3W **Cargo L5** Sales Trend



E-3W Cargo L5 Sales Trend by OEM



	% Growth (Y-o-Y)	% Growth (M-o-M)
MAHINDRA & MAHINDRA	135%	-12%
PIAGGIO VEHICLES	-23%	-12%
EULER MOTORS	629%	-8%
ALTIGREEN PROPULSION	10%	-28%
OMEGA SEIKI	-55%	-18%
BAJAJ AUTO	-	217%

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs.

Ampace
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Power Up Your E-Motorcycle with Kun Era Battery

Support Multiple Packs in Parallel with Leading Dynamic Connection
Experience Enhanced Endurance and Superior Power

Achieve *Greater Speeds*
Enjoy *Extended Journeys*

About Ampace

As a world-renowned lithium battery supplier, AMPACE, which is jointly invested by ATL and CATL, inherits the leading technology and experience of lithium batteries for more than 20 years, empowering various industries including energy storage, drone, vacuum cleaners, power tools and electric vehicles.

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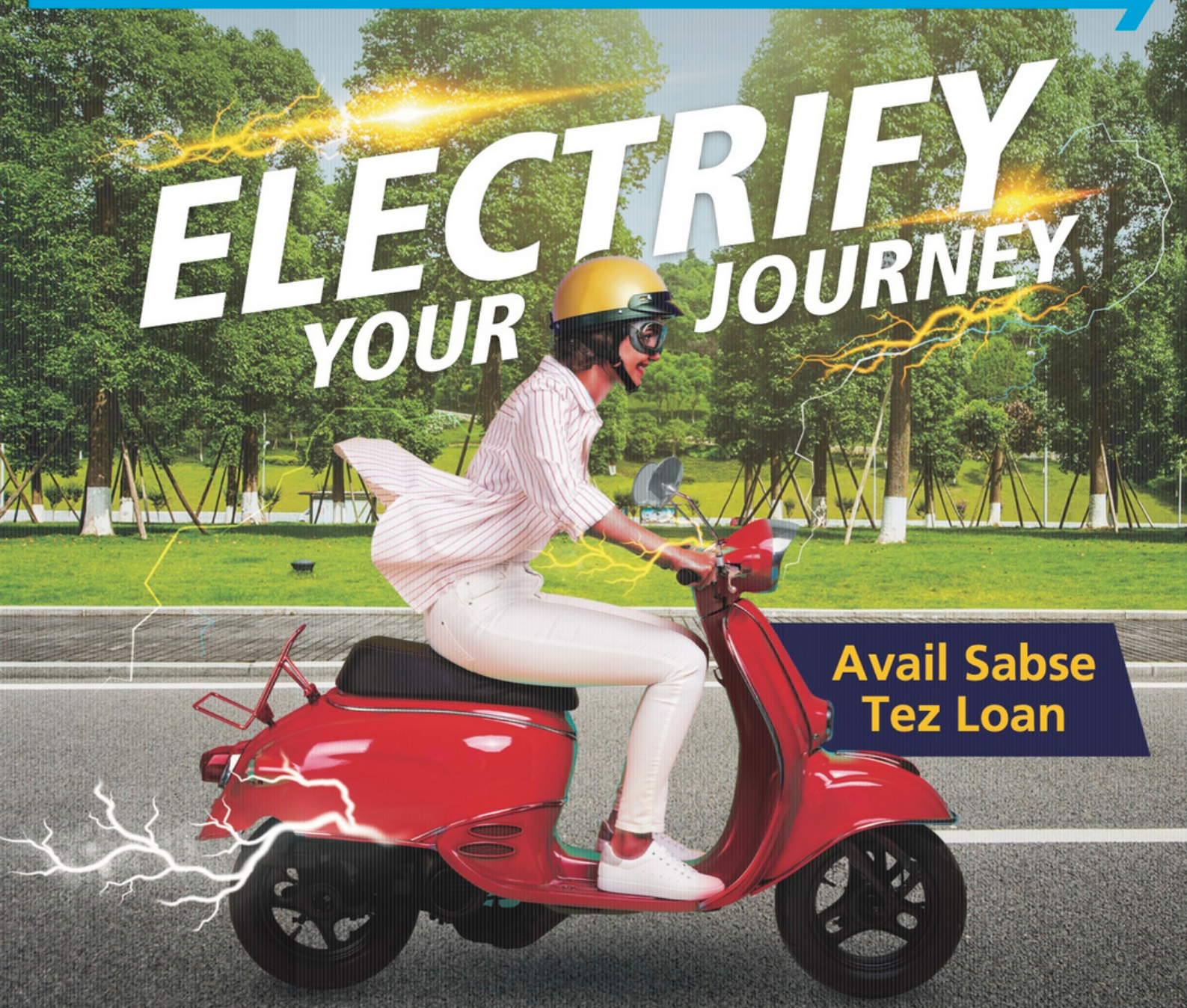

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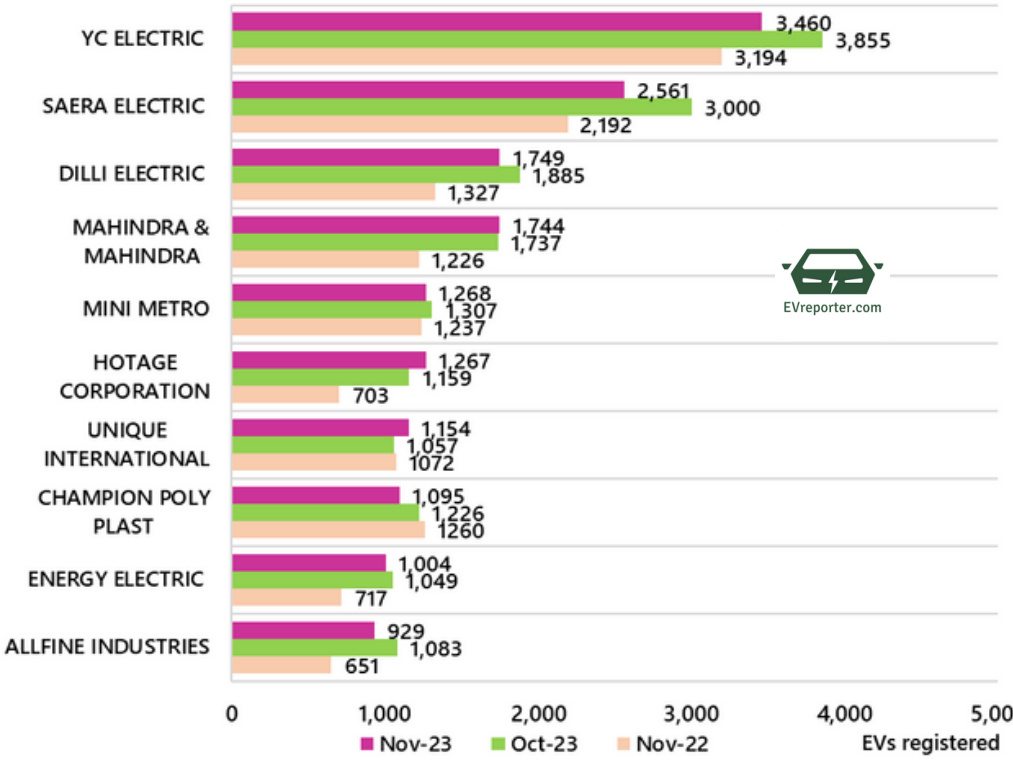
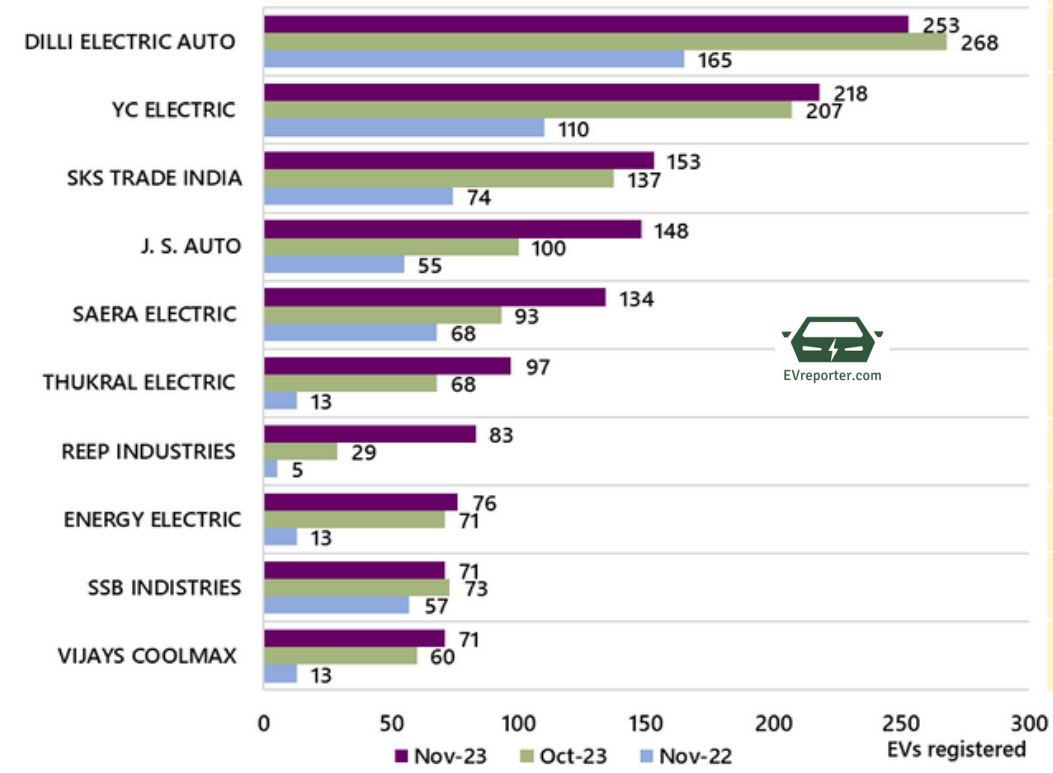
E-3W Passenger L3 (Low-speed) Sales by OEM



	% Growth (Y-o-Y)	% Growth (M-o-M)
YC ELECTRIC	8%	-10.25%
SAERA ELECTRIC	17%	-14.63%
DILLI ELECTRIC	32%	-7.21%
MAHINDRA & MAHINDRA	42%	0.40%
MINI METRO	3%	-2.98%
HOTAGE CORPORATION	80%	9.32%
UNIQUE INTERNATIONAL	8%	9.18%
CHAMPION POLY PLAST	-13%	-10.69%
ENERGY ELECTRIC	40%	-4.29%
ALLFINE INDUSTRIES	43%	-14.22%

E-3W Cargo L3 (Low-speed) Sales by OEM



	% Growth (Y-o-Y)	% Growth (M-o-M)
DILLI ELECTRIC AUTO	53%	-6%
YC ELECTRIC	98%	5%
SKS TRADE INDIA	107%	12%
J. S. AUTO	169%	48%
SAERA ELECTRIC	97%	44%
THUKRAL ELECTRIC	646%	43%
REEP INDUSTRIES	1560%	186%
ENERGY ELECTRIC	485%	7%
SSB INDISTRIES	25%	-3%
VIJAYS COOLMAX	446%	18%

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs.

OEM wise E-4W sales, Nov 2023

S. No.	Maker	Nov-23	Oct-23	Difference	% Change	Market Share Nov 23
1	TATA MOTORS	4,828	5,481	-653	-12%	68.56%
2	MG MOTOR	891	922	-31	-3%	12.65%
3	MAHINDRA & MAHINDRA	493	270	223	83%	7.00%
4	HYUNDAI MOTOR	160	194	-34	-18%	2.27%
5	PCA AUTOMOBILES	121	172	-51	-30%	1.72%
6	BYD INDIA	122	137	-15	-11%	1.73%
7	BMW INDIA	262	93	169	182%	3.72%
8	VOLVO AUTO	66	51	15	29%	0.94%
9	KIA MOTORS	29	49	-20	-41%	0.4%
10	MERCEDES -BENZ AG	53	34	19	56%	0.75%
11	Others	17	34	-17	-50%	0.24%
	TOTAL	7,042	7,437	-395	5%	100%

Others include Audi, Porsche etc.

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs.

OEM wise Electric Bus Sales, Nov 2023

S.No.	Maker	Nov-23	Oct-23	Difference	% Change	Market Share Nov 23
1	TATA MOTORS	160	170	-10	-6%	63.5%
2	OLECTRA GREENTECH	63	36	27	75%	25.0%
3	JBM AUTO	23	2	21	1050%	9.1%
4	MYTRAH MOBILITY	4	4	0	0%	1.6%
5	PINNACLE MOBILITY	1	5	-4	-80%	0.4%
6	VEERA VAHANA UDYOG	1	0	1	-	0.4%
7	SWITCH MOBILITY	0	9	-9	-100%	0.0%
8	VE COMMERCIAL	0	3	-3	-100%	0.0%
	Total	252	229	23	10%	100%

Source: Vahan Dashboard. Data as per 1355 out of 1442 RTOs across 34 out of 36 state/UTs.

For deeper insights into India EV sales trends - city-wise, state-wise, segment-wise and OEM wise, check out the EVreporter Data Portal here.

Be Limitless | Change the way you charge your EV with CHOGORI's Cutting-edge Charging Gun

RELIABLE GREEN CONNECTIONS

CHOGORI®
Reliable Green Connections

Chogori: Pioneering EV Connector Solutions Since 2014

Chogori has been at the forefront of Electric Two-Wheeler and Three-Wheeler connectors since 2014. Chogori offers a comprehensive range of connector solutions, catering to applications spanning low to high currents in battery and motor charging and discharging. Chogori has always believed in continuous innovation to bring out the best and latest interconnect solutions to cater to the needs of the booming electric vehicle market by leveraging the wealth of experience it has gained over the years.

A **charging gun and inlet** are the most essential components in an electric vehicle charging system, often termed "EVSE" (electric vehicle supply equipment). These components **facilitate the safe transfer of electricity from the main supply to the vehicle**. The EVSE must be designed carefully considering various factors such as form factor, electrical isolation, government regulations and protocols.

Introducing ES-CT6: Electrifying your journeys with the state of the art interconnect solutions from the house of CHOGORI.

Chogori has strived to incorporate several regulations over the last few months whilst ensuring the charging gun is interoperable with the EVSE (Charging gun and Inlets) available in the market.

Upgrade to ES-CT6 and elevate your EV Charging experience!

Enquiries

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Karthik Arsikere – karthik.arsikere@chogoriasia.com.sg

Visit us - http://www.chogori-tech.com/

Salient Features of ES-CT6

- Compliant with IEC 62196 – 6
- In line with IS 17017 (Part-2, Sec: 6)
- Complete knocked down (CKD) design for localized cable assembly
- Compact design, which can be easily accommodated in the under-seat storage
- Advanced product quality to ensure reliability

Specifications of ES-CT6

- Rated Voltage: 120 V DC
- Rated Current: 25 Amperes
- Ingress Protection: IP 55
- Mating Cycles: ≥ 10 K
- Cable Cross Section: 12 AWG ~ 14 AWG (Power)

Applications

ES-CT6 has been developed to meet the electric vehicle market's diverse needs and serve the following customer segments.

- Electric two-wheelers
- Electric three-wheelers
- Charging Infrastructure companies

ES-CT6 charging guns are interoperable and allow the OEMs to share their charging network irrespective of the brands, which will further fuel EV adoption.

Chogori is geared towards providing efficient and user-friendly charging solutions to support our customers transitioning towards sustainable and clean energy solutions. At Chogori, we believe in delivering reliable solutions and acting as catalysts in our customers' success.

Written by - Karthik Arsikere

Enquiries

CHOGORI®
Reliable Green Connections

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LITHIUM-ION BATTERY ECONOMY IN ELECTRIC VEHICLE ECOSYSTEM IN INDIA

With the increasing demand for sustainable mobility, the adoption of electric vehicles (EVs) in India will grow significantly. By 2030, the union government aims to achieve EV sales penetration of 30% for private automobiles, 70% for commercial vehicles, and 30% for two-wheelers and three-wheelers. To support this rapid growth of sustainable transition, our country requires an efficient electric vehicle ecosystem and a robust battery supply chain.

Electric vehicle battery supply chain

Bottleneck: Challenges in the raw materials supply chain

India's roadmap for domestically manufacturing lithium-ion cells is still unclear. There is a scarcity of primary raw materials, viz. lithium, cobalt, and nickel, required for lithium-ion cell manufacturing in India. Figures 1,2 and 3 depict the global production and reserves of lithium, cobalt, and nickel, respectively. Scaling up battery production and sourcing the raw materials for battery manufacturing are critical bottlenecks in India's electric vehicle industry. This ambitious shift to sustainable transportation could be slowed if we fail to acquire ample raw materials to manufacture Li-ion cells.

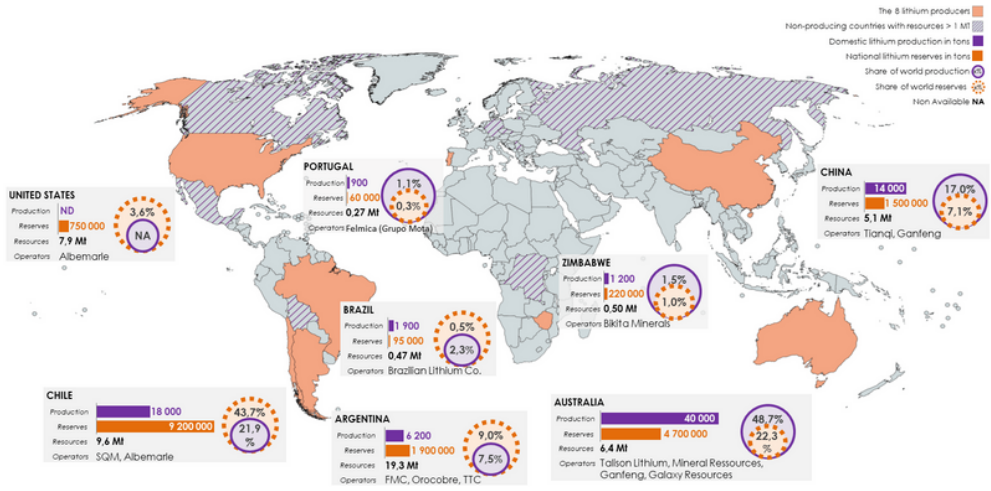

Figure 1: ***Global lithium production and reserves in 2020****.*

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2021

Map created by IFP Energies Nouvelles with Mapchart.net

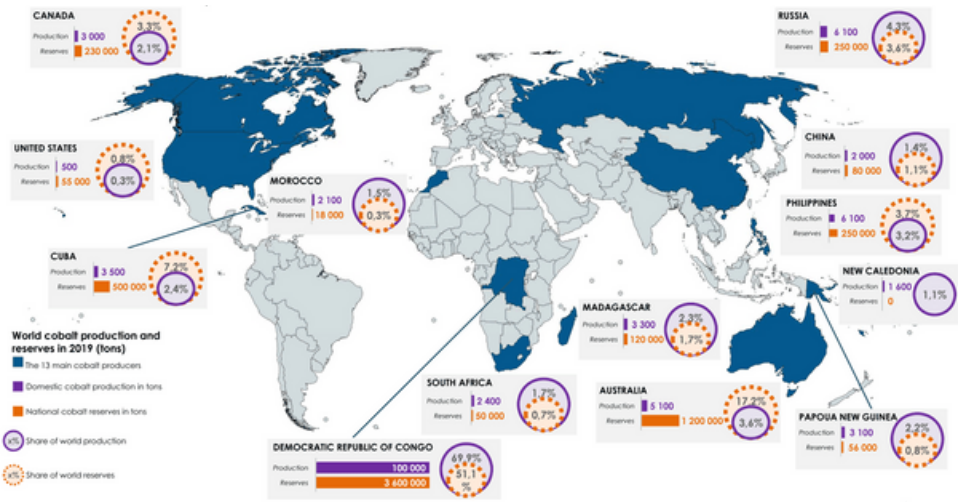

Figure 2: ***Global cobalt production and reserves in 2019.***

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2020

Map created by IFP Energies Nouvelles with Mapchart.net

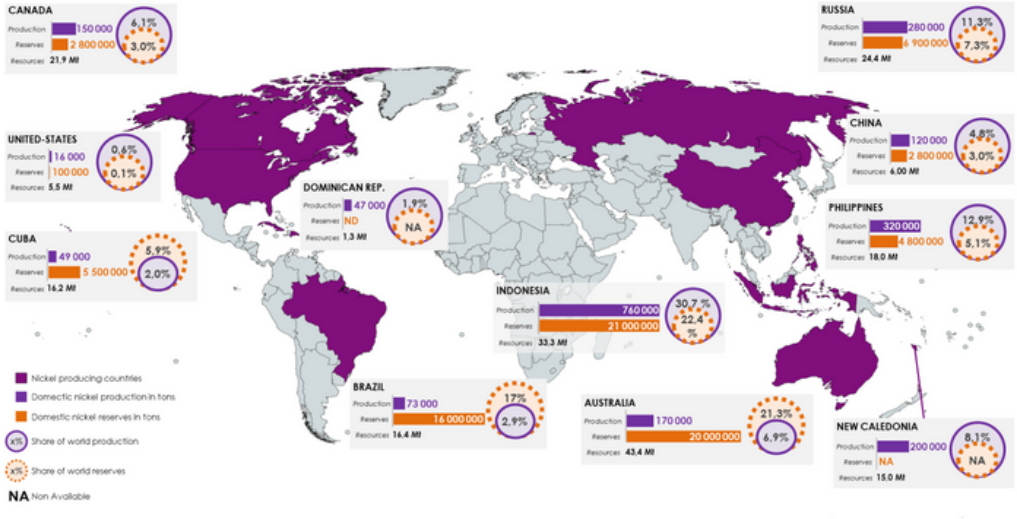

Figure 3: Global nickel production and reserves in 2020.

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2021

Map created by IFP Energies Nouvelles with Mapchart.net

A significant investment from European and North American regions is required to diversify the global metal supply chain for lithium-ion batteries. The BloombergNEF 1H 2021 Battery Metals Outlook reports that the **annual lithium-ion battery demand will pass 2.7 TWh by 2030**. Figure 4 shows the growth in the demand for metals from lithium-ion batteries from 2020 to 2030.

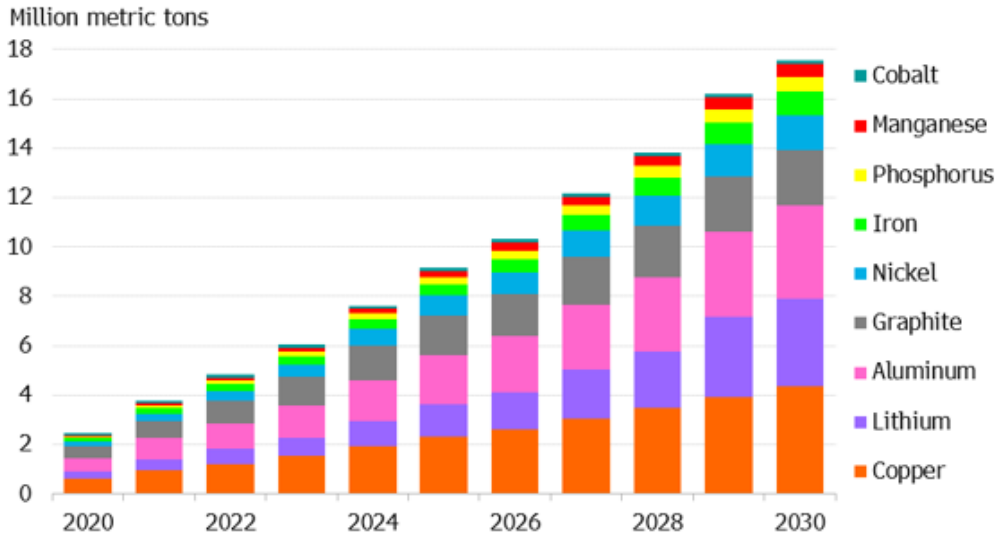

Figure 4: Metals demand growth from lithium-ion batteries.

Source: BloombergNEF

Note: All metals expressed in metric tons of contained metal, except lithium, which is in lithium carbonate equivalent (LCE))

Between 2021 and 2030, a sevenfold surge in the total demand for metals is expected, racing to over 17.5 million metric tons by 2030. As the demand for key battery materials such as lithium, nickel, manganese, graphite and cobalt continuously grows, battery manufacturers and producers worldwide are competing to get their hands on these critical raw materials despite higher prices and inhibited supply. China currently has the biggest market share over the aforementioned raw materials and controls the battery manufacturing industry.

Although India continues to be **self-sufficient in primary metals like aluminium and zinc**, we depend on imports for battery-critical metals, viz. lithium, nickel, manganese, and cobalt.

As per reports from the Ministry of Mines, India, with a supply of 3696 kT and a demand of 3676 kT, is 100% self-sufficient in aluminium reserves. With a supply of 696 kT and a demand of 778 kT, India is 89% self-sufficient in Zinc reserves. However, **our country's supply and demand gap in Copper (refined) and Lead (primary) metals is considerable.**

Supply and Demand gap in Principal Metals in India, 2019-2020 (P)

Commodity (Metal)	Demand/Domestic Consumption (kilo tonnes)	Supply/ Domestic supply (kilo tonnes)	Order of self sufficiency (%)
Aluminium (primary)	3676	3696	100
Zinc	778	696	89
Lead (primary)	381	198	52
Copper (refined)	1159	454	39

(Source: Annual report 2021-2022, Ministry of Mines, GOI)

Potential solutions - partnerships and collaborations

The mining process of lithium, cobalt, and nickel, involved in the initial stage of battery production, is expensive and environmentally disparaging. Moreover, to keep up with the demand, the markets for these raw materials need to be scaled up tremendously. A considerable investment is required to develop innovative technologies for raw material extraction. **This time-consuming process would eventually cause serious bottleneck issues in five to ten years.**

Furthermore, the mined metals must be chemically processed and refined before being used in the batteries. Currently, China has most of the raw material processing facilities, putting other countries worldwide at risk of disrupting the supply chain. Hence, to meet the government's ambitious targets in the transportation sector's electrification, India must invest in sourcing the batteries and other stages of the EV battery supply chain, mining, processing, and refining.

A potential solution for India to secure the battery supply chain would be collaborating with other countries, e.g., Australia, which has exceptional reach in critical mineral reserves in its western part, including lithium. Collaborating with resource rich countries will help India strengthen its battery supply chain and develop advanced battery manufacturing.

Alternative solutions - battery recycling

Furthermore, recycling the batteries is an alternative solution to this bottleneck of production of raw materials for battery manufacturing and the element of setting up upstream. The upstream sectors seldom receive investors' interest in setting up manufacturing plants as this is time-consuming. On average, **it takes more than five years for a mine to become operational once the deposits are discovered**. **Besides, another couple of years will be needed to convert this formed ore into battery-grade compounds such as hydroxides and carbonates.** This considerable lead time in this upstream sector can be alternatively attended by opting for the recycling of batteries.

The escalation in the cost of raw materials can be managed alternatively in a sustainable way by using recycled products in the production stage of batteries.

Figure 5 shows one of the recycling processes implemented for lithium-ion batteries. In this **direct recycling process**, mechanical separation separates anode and cathode materials, followed by reconditioning. After this, the conditioned materials are reused directly for LIB manufacturing.

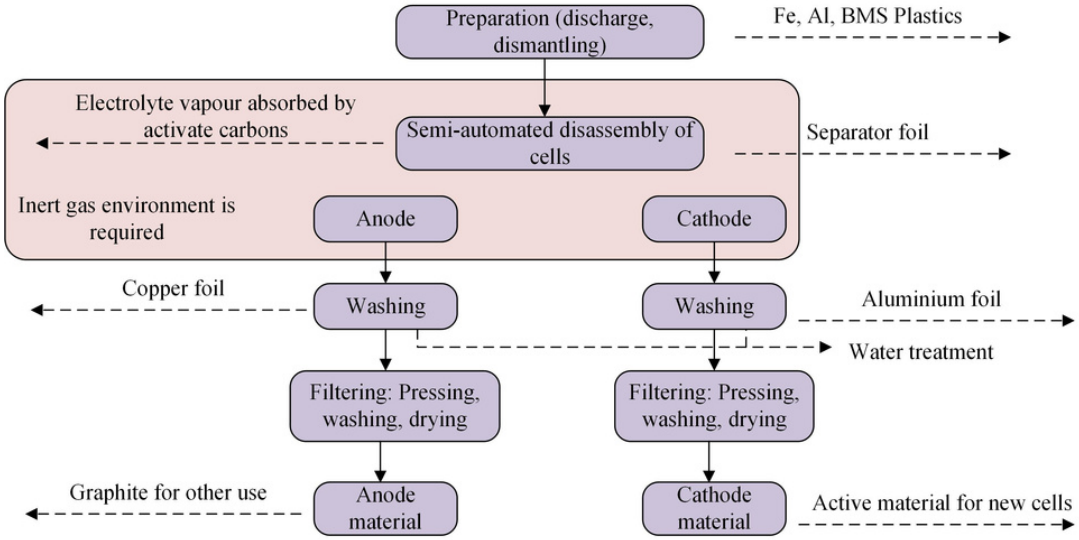

Figure 5: Direct recycling process.

Source: Mohr, M., Weil, M., Peters, J. and Wang, Z. (2020) Recycling of Lithium-Ion Batteries. In A.J. Bard (ed.) Encyclopedia of Electrochemistry)

The performance demonstrated by the cells made from recycled products is on par with those made from fresh raw materials during the electrochemical testing. North America and Europe are already exploring recycling opportunities to reduce their dependency on Chinese battery-grade suppliers. NITI Ayog estimates that, by 2030, cumulative battery storage potential in India will be around 600 GWh, considering various segments in the storage sector, as shown in Figure 6. **Out of this, about 128 GWh of lithium-ion batteries will be available for recycling.**

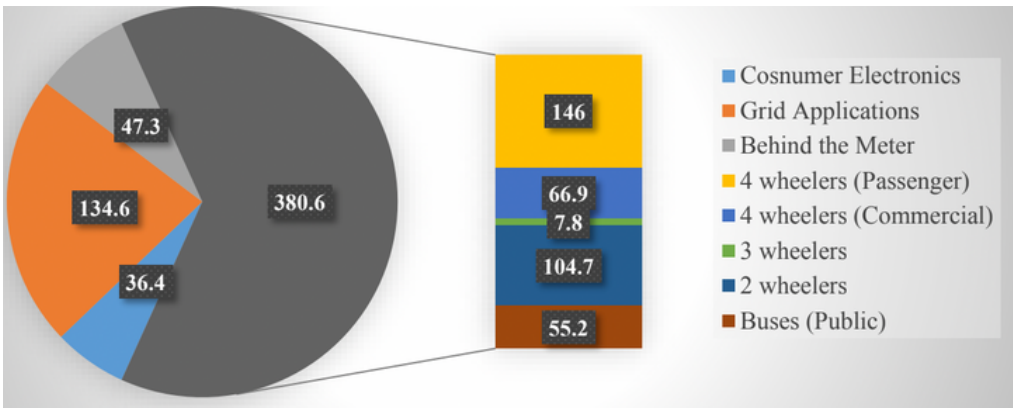

Figure 6: Cumulative potential of battery storage (in GWh) in India by 2030.

Source: NITI Aayog: Advanced Chemistry Cell Battery Reuse and Recycling Market in India)

Currently, the large-scale commercial battery recycling ecosystem in India is still in the initial stages of shaping up. Improper treatment of end-of-life batteries, such as disposing of the used batteries in a scrapyard, may lead to explosions. However, mandatory recycling practices are called for by recent E-Waste (Management) Amendment Rules, which guarantee the safe disposal and recycling of EV batteries. Going forward, emerging battery technologies such as Sodium-ion present a better scope of localisation and self-sufficiency (in terms of resource availability) in India.

Authored by

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XYRON™ 540Z	0.75	2.5
XYRON™ 443Z	0.75	2.5
XYRON™ G601Z	1.50	2.0

Burn Test for Li-B applications[4]

FR PC/ABS

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

XYRON™ 540Z

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

XYRON™ 443Z

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

[5]Advantages 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

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● Good

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NEED TO BUILD LOCAL REFINING CAPABILITIES TO CURB BLACK MASS EXPORT

*From smartphones to electric vehicles, batteries power our lives. However, there is a pressing concern—what happens to these batteries at the end of their lifecycle? The battery recycling sector in India stands at a crossroads, facing challenges and untapped opportunities. In this opinion piece, battery recycling practitioner **Rahul Jha** shares his take on the current scenario and the need to build material recovery capabilities within the country.*

India, like many other nations, faces the mounting issue of battery disposal. The current landscape reveals a burgeoning sector with a mix of formal and informal players striving to manage the increasing volume of discarded batteries. Currently, China is at the helm of the global recycling ecosystem and the global strategic metals, rare earth metals, and precious metals stockpile. China controls the global pricing of all commodities today due to the sheer volume and scale at which they are working.

Challenges for India's LIB recycling space

- **Informal recycling practices** - The informal sector, operating without regulations, poses environmental and health risks. Unregulated disposal methods lead to soil and water pollution, while workers in these facilities face hazardous conditions.

- **Lack of awareness** - A lack of awareness among consumers about proper battery disposal exacerbates the problem. Many are unaware of the environmental impact and potential harm caused by improper disposal methods.

- **Lack of offtake for recycled materials** - Despite recycling efforts, a significant hurdle lies in the struggle to find markets and buyers for recycled materials in India —concerns about material quality and reliability drive industry hesitation in adopting recycled components.

- **Discouraging partial recycling and export of unrefined material -** India should demotivate partial recyclers and put an immediate halt to the export of unrefined materials because if we encourage them, we are at an absolute loss as we would be losing in on our critical metals (Cobalt, Lithium, Nickel, Manganese, and Copper) stockpile. By focusing on refining processes domestically, India can build its strategic material stockpile, ensuring a more sustainable and self-reliant approach.

Black Mass/Unwrought Cobalt Powder/mixed metal powder is the product that all recyclers have managed to produce. Most recyclers ship the same to countries such as South Korea, the Philippines, China and Indonesia. Some conglomerates that have set up their entities in India have been shipping the black mass to the countries mentioned above and are currently stockpiling the same (Hedging).

The above practices have led to increased prices of **spent Lithium-ion batteries** for actual refiners who are on the verge of pausing all refining activities due to such increased pricing of the un-refined product.

To explain this, I can say that **the price of Black Mass is much higher than the price of Cobalt Sulphate** (a finished good obtained from refining Black Mass, which is in the majority content and a part of precursor material to be used in the manufacturing of Lithium-ion Batteries). Some global players do this to discourage final refining/recycling in India and keep a hold on all metals by spiking the price of unfinished goods.

Opprotunities

- **Government initiatives** - The Indian government can potentially play a pivotal role in steering the battery recycling sector towards sustainability. Policies and incentives could be devised to promote responsible disposal and recycling practices. The government can also step in and create a national reserve for critical metals, which would ensure the offtake of all recycled materials, as China has done.

- **Technological advancements** - Embracing innovative recycling technologies, such as hydrometallurgical processes and advanced sorting systems, can enhance efficiency and reduce the environmental footprint of recycling facilities.

- **Promoting circular economy practices** - Encouraging industries to incorporate recycled materials into their manufacturing processes is vital. Establishing a circular economy approach can not only benefit the environment but also create a market for recycled materials. The government, in its recent push to promote a circular economy, launched the **EPR mechanism**, which mainly focuses on producers of electronic manufacturing companies being given targets for the collection, disposal, and recycling of end-of-life products through a credit mechanism which is to be generated by the recyclers. **The government could have inserted the clause of using the same recycled products in manufacturing, further boosting this entire mechanism.**

Unfortunately, in the current scenario, it is easy for recyclers to get away by generating invoices of semi-finished goods or, in fact, they can generate invoices of finished goods to dummy entities to generate EPR Credits, which will later on be bought by producers on the government-launched EPR Portal.

Conclusion

As electric vehicles and renewable energy storage become increasingly prevalent, the demand for efficient battery recycling is poised to surge. Addressing the lack of offtake for recycled materials becomes crucial in ensuring the sector's growth and sustainability.

Black mass export data (see table on next page) obtained through third-party sources show that we are losing a significant amount of critical metals on a year-on-year basis. Let's take the average metal content value described by our national pollution monitoring agency, i.e., CPCB, on their newly launched portal, as shown in Figure 1 on the next page.

We can deduce that we have lost **350 Tonnes of Cobalt Metal, 71.7 Tonnes of Lithium Metal, and 215 Tonnes of Nickel metal this year alone**. The volume may be much more as the data is partial, and some recyclers have not been covered.

Date	Product Description	Shipper Name	Consignee Name	Standard Qty(Kgs)	Estimated F.O.B Value $
04-10-2022	Black Mass [Cobalt metal and other intermediate A		SAMSUNG C T CORPORATION	186.38	151,080.05
28-10-2022	Black Mass [Cobalt metal and other intermediate A		SAMSUNG C T CORPORATION	17,964.00	169,793.19
08-11-2022	METAL CONCENTRATES BLACK MASS-COBALT		ROCKLINK ASIA LIMITED	18,105.00	203,744.96
18-11-2022	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	3,010.00	23,522.87
18-11-2022	METAL CONCENTRATE BLACK MASS NMC		PETROMINE M SDN BHD BRANCH OFFICE	17,420.00	40,000.00
21-12-2022	METAL CONCENTRATES BLACK MASS COBALT		ROCKLINK ASIA LIMITED	56,187.00	635,643.75
07-01-2023	METAL CONCENTRATES BLACK MASS COBALT		SE-CURE WASTE MANAGEMENT PTE LTD	36,323.00	411,937.86
19-01-2023	METAL POWDER CONCENTRATE BLACK MASS FOR		DONGGUAN HUAMOTONG TRADING CO LTD	23,000.00	252,713.33
02-02-2023	METAL POWDER CONCENTRATE BLACK MASS FOR		DONGGUAN HUAMOTONG TRADING CO LTD	23,000.00	271,367.20
04-02-2023	METAL POWDER CONCENTRATE BLACK MASS FOR		DONGGUAN HUAMOTONG TRADING CO LTD	23,000.00	271,358.43
04-02-2023	BLACK MASS RAW MATERIAL FOR THE LITHIUM-IC		JAEYOUNGTECH JYT CO LTD	1.00	0.00
26-02-2023	BLACK MASS LCO DETAILS AS PER DOCUMENT A		Z To Order and NA	10,000.00	57,199.17
03-03-2023	METAL CONCENTRATES BLACK MASS		ROCKLINK ASIA LIMITED	36,232.00	430,699.32
14-03-2023	METAL CONCENTRATES BLACK MASS		ROCKLINK ASIA LIMITED	80,489.00	946,101.87
16-05-2023	LCO Black Mass		WISTRON GREENTECH TEXAS	500.00	7,307.56
17-05-2023	LCO Black Mass		SAMUEL SHAPIRO	500.00	5,085.67
17-05-2023	LCO Black Mass		DONGGUAN HUAMOTONG TRADING CO LTD	13,811.00	45,750.32
17-05-2023	LCO Black Mass		SAMUEL SHAPIRO	500.00	7,307.56
17-06-2023	BLACK MASS COBALT MATTE		HARTREE PARTNERS LP	30,000.00	90,415.00
20-06-2023	Black Mass NMC DETAILS AS PER DOCUMENT AN		PETROMINE M SDN BHD BRANCH OFFICE	16,600.00	66,504.70
27-06-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	13,869.00	8,722.53
27-06-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	19,346.00	12,157.57
27-06-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	5,945.00	21,898.34
02-07-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	20,000.00	95,812.91
02-07-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	19,785.00	94,782.40
11-07-2023	BLACK MASS LCO		Z To Order and NA	20,000.00	81,626.73
13-07-2023	BLACK MASS LITHIUM IRON PHOSPHATE		GLENCORE LIMITED	30.00	108.15
13-07-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	6,713.00	7,232.60
13-07-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	12,814.00	45,267.96
24-07-2023	METAL CONCENTRATE BLACK MASS		PETROMINE M SDN BHD BRANCH OFFICE	20,000.00	122,007.61
01-08-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	18,538.00	18,816.97
01-08-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	1,151.00	6,710.69
16-08-2023	BLACK MASS COBALT MATTE		ECONILI BATTERY PTE LTD	44,000.00	169,367.83
27-08-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	12,844.50	11,339.80
27-08-2023	METAL CONCENTRATE BLACK MASS NMC		PETROMINE M SDN BHD BRANCH OFFICE	4,610.50	13,160.98
27-08-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	4,585.50	27,693.89
01-09-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	9,550.00	8,037.42
01-09-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	10,844.00	67,006.84
02-09-2023	METAL CONCENTRATE BLACK MASS LFP		PETROMINE M SDN BHD BRANCH OFFICE	9,550.00	8,037.42
02-09-2023	METAL CONCENTRATE BLACK MASS LCO		PETROMINE M SDN BHD BRANCH OFFICE	10,844.00	67,006.84
19-09-2023	BLACK MASS COBALT POWDER		XXNGEXX HDXXCH XX XXD	81,000.00	950,261.04
19-09-2023	BLACK MASS LCO METAL CONCENTRATE		PETROMINE M SDN BHD BRANCH OFFICE	21,155.00	135,544.67
27-09-2023	BLACK MASS LCO EA METAL CONCENTRATE		PETROMINE M SDN BHD BRANCH OFFICE	21.16	130.99
				792475.655	6,060,264.98

Date	Product Description	Standard Qty(Kgs)	Estimated F.O.B Value $
22-10-2022	UNWROUGHT COBALT POWDER	21400	82,862.45
24-11-2022	UNWROUGHT COBALT POWDER	40,000.00	267,194.07
24-11-2022	UNWROUGHT COBALT POWDER	18,000.00	197,045.74
10-01-2023	UNWROUGHT COBALT POWDER	39,500.00	219,468.00
31-01-2023	UNWROUGHT COBALT POWDER	21,100.00	80,831.18
09-02-2023	UNWROUGHT COBALT POWDER	19,600.00	178,853.79
21-02-2023	UNWROUGHT COBALT POWDER	21,000.00	169,831.72
07-03-2023	UNWROUGHT COBALT POWDER	31,000.00	250,689.91
07-03-2023	UNWROUGHT COBALT POWDER	35,000.00	351,562.70
10-04-2023	UNWROUGHT COBALT POWDER	41,000.00	282,767.11
24-04-2023	UNWROUGHT COBALT POWDER.	20,000.00	140,168.52
29-04-2023	UNWROUGHT COBALT POWDER	38,000.00	262,011.47
08-05-2023	UNWROUGHT COBALT POWDER	19,961.40	140,046.20
15-05-2023	UNWROUGHT COBALT POWDER	18,000.00	124,081.55
22-05-2023	UNWROUGHT COBALT POWDER	20,000.00	135,717.79
30-05-2023	UNWROUGHT COBALT POWDER	20,000.00	135,717.79
08-06-2023	UNWROUGHT COBALT POWDER	20,000.00	135,725.60
01-07-2023	UNWROUGHT COBALT POWDER	40,000.00	271,439.25
24-07-2023	UNWROUGHT COBALT POWDER	2,000.00	13,482.83
24-07-2023	UNWROUGHT COBALT POWDER	38,000.00	229,165.98
21-08-2023	UNWROUGHT COBALT POWDER	40,000.00	241,156.14
01-09-2023	UNWROUGHT COBALT POWDER	19,000.00	114,478.32
27-09-2023	UNWROUGHT COBALT POWDER	30,000.00	206,884.49
27-09-2023	UNWROUGHT COBALT POWDER	30,000.00	155,521.75
		642561.4	4,386,704.35

India black mass export data obtained from third-party sources

Kind of Battery	Maximum Composition of key Battery Metal (in %)									
	Lead (Pb)	Lithium (Li)	Mangnese (Mn)	Zinc (Zn)	Nickel (Ni)	Cobalt (Co)	Cadmium (Cd)	Aluminium (Al)	Iron (Fe)	Copper (Cu)
Lead Acid	80%	*	*	*	*	*	*	*	*	*
Lithium Ion	*	5	15	*	15	20	*	25	46	18
Zinc Based	*	*	30	40	*	*	*	*	40	*
Nickel - Cadmium	*	*	*	*	30	20	*	*	35	*
Others – Nickel Metal Hydride (NiMH)	*	*	*	*	30	*	*	*	35	*

Fig 1 - CPCB Data for recoveries from Spent LIB (Black Mass)

These figures should serve as a wake-up call for the Indian government. India has yet to capitalize on its recently discovered lithium mines, a resource that is notably absent in terms of cobalt and nickel. This highlights an opportunity for the government to **strategically focus on developing its refining/recycling sector,** which is already established and has the potential to reshape India's global standing. India's battery recycling sector stands on the cusp of transformation.

By learning from China's success, addressing challenges, capitalizing on opportunities, discouraging partial recyclers, and fostering demand for recycled materials, we can pave the way for a more sustainable and circular approach, unlocking the true potential of this critical industry.

About the author

Rahul Jha *works with* ***ADV Metal Combine Pvt. Ltd****. ADV Metal Combine was incorporated in 1997 and has since then engaged in the waste recycling business. Their LIB and E-waste recycling division in Bhilai, Chhatisgarh, became functional in 2008 by jointly developing technologies with CSIR-NML Jamshedpur and, later on, BARC. ADV has a fully functional LIB recycling facility in which they produce battery-grade raw materials such as Cobalt Sulphate, Lithium Carbonate, Nickel Sulphate, Copper Sulphate and Manganese Sulphate, which all are essentially required for LIB manufacturing. Currently, the company is operating with a capacity of refining 2MT/Day (Black Mass) and has planned to scale it up to 8MT/day by August 2024.*

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EMPOWERING LOCAL MANUFACTURING

AMPACE CONTINUES TO THRIVE IN THE INDIAN MARKET, ENABLING HIGH-QUALITY LOW-CARBON TRAVEL FOR LOCAL USERS

Focused on high-end lithium battery research and innovation, **Xiamen Ampace Technology Limited (hereinafter referred to as "Ampace")**, through establishing high-end lithium battery intelligent manufacturing bases in India, leverages its globally leading lithium battery R&D and manufacturing solutions to accelerate the transition from fuel to electricity.

Behind the robust growth of India's E-motorcycle industry, Ampace has entered the scene with advanced energy technology. **Since 2018, Ampace has been continuously deepening its involvement in the Indian market**, comprehensively deploying local intelligent manufacturing, collaborating deeply with several emerging Indian automotive companies, and in **2023, signing contracts with top-tier local motorcycle companie**s, injecting core energy into the accelerated growth of India's electric transportation industry with its partners.

Ampace's significant achievements in the Indian market over the years are evident, with its localized manufacturing enabling high-quality low-carbon travel.

Through years of smooth operation, this base has perfectly integrated into the local electric transportation industry chain in India, continuously providing partners with highly compatible, efficient, and compact battery product technology and service support.

Leveraging the support of two global giants, CATL and ATL, Ampace accelerates its capture of the global "fuel to electricity" market

Ampace, a joint venture between two leading global lithium battery giants, **Contemporary Amperex Technology Limited (CATL) and Amperex Technology Limited (ATL)**, brings forth a wealth of cutting-edge **lithium battery technology** expertise garnered over more than two decades from its parent companies. Ampace boasts well-established research and development capabilities along with robust manufacturing prowess.

In the fiercely competitive micro electric vehicle (MEV) market, Ampace distinguishes itself in lithium battery applications, providing whole-chain products and services spanning from **battery cells to battery packs and BMS management**, tailored to meet the diverse needs of various usage scenarios.

In the electric transportation forefront markets of Southeast Asia, Europe, the Americas, and Africa, Ampace has completed market layouts and reached deep cooperation with top-tier brands, jointly capturing the vast space in the global "fuel to electricity" market.

The newly self-developed BP system material system leads the upgrade in transportation, empowering partners with advanced energy technology solutions

Based on the recognition of pain points in electric transportation, such as power, endurance, and safety, Ampace globally unveiled its groundbreaking **BP system and the "Kun-Era" series lithium batteries for E-motorcycles** in third quarter of this year.

Named **Boost Power**, the BP system makes breakthroughs in material design, process formulation, electrode engineering, and system optimization, acting as the core driving force for the continuous improvement of the "Kun-Era" battery performance, **specially designed for E-motorcycles.**

As the next generation of battery technology, the **BP system materials balance high energy density, high stability, and high kinetic materials, effectively expanding the endurance range.** It excites the ultimate power of racing while ensuring the battery and vehicle's lightweight design, creating high-performance vehicle-grade lithium batteries.

Simultaneously, **Ampace's full lifecycle management system** encompasses four critical technical aspects: "**achieving ultimate power, ensuring ultimate safety, enabling super-fast charging, and implementing multi-pack parallel connection**", which is poised to address the technological challenges encountered by E-motorcycle companies comprehensively.

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LARGE SCALE HYDROMETALLURGY OPERATIONS TO EXTRACT BATTERY MATERIALS

Rubamin Pvt Ltd has been transforming hazardous industrial waste into useful chemicals for over three decades. They are now aggressively working on a large-scale circular economy project to **extract critical battery materials from used lithium-ion battery (LIB) packs**. This interview with Mr **Bhuwan Purohit - Executive Director**, discusses their business outlook and recycling plans.

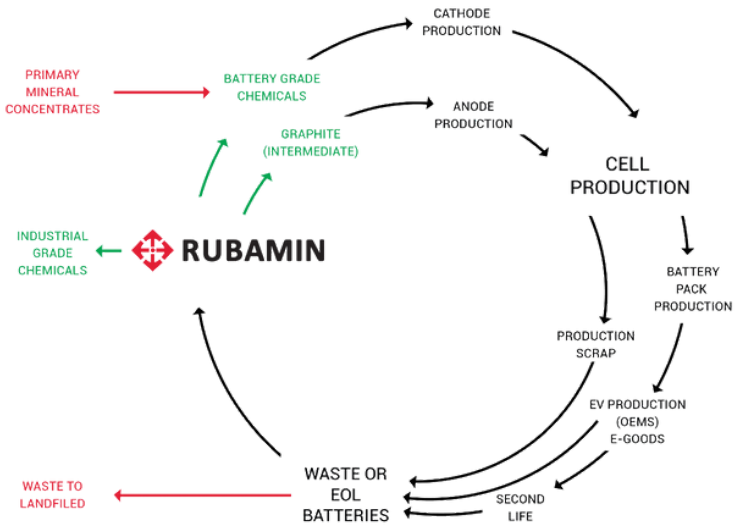
Can you please tell us about Rubamin's industrial waste recycling business and plans for LIB recycling?

As a company, Rubamin started 40 years ago with recycling, and it adopted the extraction process about 30 years back. We have been treating hazardous waste coming out of multiple Industrial processes. The key metals we work on include zinc, molybdenum, tungsten, vanadium, cobalt, nickel, and copper. However, copper is not from the industrial source as of now.

Now, we are moving into lithium-ion recycling by using waste batteries or battery black mass as input to our extraction process.

For this, we have an INR 525 crores of investment planned, to start refining 5,000 TPA of battery black mass come July 2024.

There are plans beyond that, but they haven't been crystallized yet. We are awaiting the results from the first plant with respect to the products, yields and costs at which we can do this.



What prompted you to enter LIB recycling? What kind of synergies do you derive from your existing operations?

We have been doing nickel, cobalt, and manganese for decades. **Our search for Cobalt-rich secondary material led us to LIB black mass, which further led us to the lithium-ion battery.** There is a lot of synergy with our existing operations. We are adopting solvent extraction as the key method to extract all the metals in the battery black mass. We have been in R&D for almost 25 years and have a large team of scientists working on the hydrometallurgy process.

There are the people, the process, and the infrastructure we have built over so many years. We also have the approvals, the customer base and the history of being a responsible recycler. I think all these aspects give us an edge as we enter this new business of battery recycling.

Can you tell us about Kilo Lab - your demo plat for LIB recycling?

Interestingly, the KiloLab was sanctioned after our board had already approved the LIB recycling project. **Not many international and Indian players were willing to believe that an Indian company could extract metals with high purity without waste.** So, we decided to have a small plant in action, and it's already running.

We are submitting our material samples from this plant to large battery and electronics companies to hasten the customer qualification processes. By the time the full-scale plant is up in July next year, we expect to be in a good state to go ahead and let the business roll.

How does Rubamin's proprietary hydrometallurgy process minimize waste and make the operations environmentally sustainable?

Hydrometallurgy is a complex, resource-intensive process, but over time, with research, practice and experience, we have been able to minimize or, to a great extent, eradicate the impact on the waste side. **Rubamin has a 65-acre green recycling complex in Halol, Gujarat; we have zero waste from that plant**. Nothing is going to landfill, and there is zero liquid discharge. The existing operations where we treat other industrial waste are already more than 30 per cent circular.

We have a World Business Council of Sustainable Development's **circular transitory indicator score of 30%**. In terms of the quantum of material that comes into a plant, 30 per cent goes back to the same supply chain, making the operation circular.

Rubamin aims to become completely independent of river water or groundwater. The dream is to eradicate 100,000 tons of hazardous toxic waste from the country with zero waste, zero water and renewable power in a finite time frame.

Most Indian companies involved in end-of-life LIB management of spent batteries export the black mass. What are the factors that prohibit companies from entering the next stage which is metal extraction?

- Black mass refining is very **capital-intensive.** A typical battery shredding unit for 10,000 tons of battery would cost you anywhere from a couple of crores to 15 crores INR. However, setting up a hydrometallurgy unit to extract metals from that 10,000 tons of battery will cost you between 400 and 600 crores INR. So, we are talking about a **hefty investment and a huge land footprint.**

- Another critical part is the **technology** because only extracting those metals is not enough. You must convert them into **usable products, such as chemicals or high-purity metals.** Meeting the qualification criteria of a cell manufacturer or a sensitive industrial customer is challenging. So, technology is one of the big deterrents.

- Another factor is the environmental challenge this process brings. Unless you are adept at the technology, **hazardous waste** will always come out of the units, which must be dealt with. So, these are the key challenges that stop people from investing in refining capabilities.

Are you also going to do the shredding part as well?

Our initial thought was to start with the black mass. After studying the industry closely, we have come to realize that our customers want to have a one-stop shop, a clear view of their material, and to have it responsibly treated.

We have decided that as we advance, we will do the mechanical separation or disassembly as well. **These operations for 10,000 tons of lithium-ion battery shredding will be built parallely.**

For the extracted metals, your end product, what kind of customer base do you expect to find in India?

We would want to serve the Indian market completely. The government in India has made some very positive investments towards incentivizing the demand side. EV sales are picking up. Units are coming alive for advanced chemistry cell production in the country. We expect to have a lot more investment going into the battery segment. **With the Government's focus on ensuring domestic value addition, I expect to have all our customers from India.** We will be able to service their demand for critical metal-based compounds.

How would the extracted metals compare with virgin materials?

Rubamin currently **recycles over 20,000 tons of spent oil catalysts from refineries.** We extract molybdenum, tungsten, vanadium, cobalt and nickel and send them back to catalyst producers, who are (if not more) equally sensitive to purity profiles and physical parameters, whether it is the morphology, the surface areas or the bulk density of the product. **For years, we have been selling the extracted material against virgin competition.**

Responsible companies need recycled products as a part of their supply chain, and they are also willing to pay a premium. Rubamin gets premium for its products because they are not only green, but they're equally good in quality compared to any primary product.

The same logic extends to the battery materials. Our kilo lab is already submitting extracted metal samples to companies, and they are finding the product to be of high quality. **If the product is not as good as the primary, you can't sell it**. You will need to provide top-class products, and our process is capable of doing that.

What kind of policy support do you think will help the companies set up large-scale operations for LIB recycling?

- **Responsible recycling** - You cannot have unscrupulous players enter the segment. We must curb them immediately if we want to see serious players, quality material, circularity and zero waste. The CPCB and MoEF have declared the waste from the used batteries hazardous and it must be treated accordingly. We only expect the law to be implemented in all its true meaning and spirit.

- **Supply-side challenge** - In a new industry, there is always a timeline mismatch between when the supply side becomes strong and when the market demand becomes strong. This gap needs to be patched up so that businesses feel secure and they can invest the right amount of money. While the waste batteries and the waste coming out of the shredding have been regarded as hazardous, **the import of black mass and used batteries must be permitted to authorized recyclers to prevent this gap in the supply chain.** The black mass and used batteries are the new urban mining resources. The government has already recognized the critical metals in its policy, and I recommend that imports be allowed to the authorised, zero waste, and circular units.

FAME II PERFORMANCE REPORT

AS OF DEC 1, 2023

ABOUT FAME II

- The Ministry of Heavy Industries (MHI) formulated the Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME India Phase II) Scheme for five years commencing from 1st April 2019, with a total budgetary support of **INR 10,000 crore**.
- This phase mainly focuses on supporting the electrification of public and shared transportation and aims to support **7090 e-Buses, 5 lakh electric 3Ws**, **55,000 e-4W Passenger Cars** and **10 lakh electric 2Ws** through demand incentives.
- The creation of charging infrastructure is also supported under the Scheme.

DEMAND INCENTIVES

It must be noted that no incentive is given to EV manufacturers under the scheme.

The incentive is provided to consumers (buyers/end users) through an upfront reduced purchase price of approved hybrid and electric vehicles, for which the government of India will reimburse the OEM (EV manufacturers).

Under phase II of the FAME, subsidy amount of **INR 5,228 crores** has been given to electric vehicle manufacturers on the sale of **11,53,079 electric vehicles**.

The details of sold electric vehicles category wise are in the adjacent table.

Wheeler Type	Total No. of Vehicle
2 wheeler	10,16,887
3 wheeler	1,21,374
4 wheeler	14,818
	11,53,079

Source: PIB

- **62 OEMs** have been registered as of 29.11.2023 to avail of demand incentives.
- According to the official FAME 2 dashboard, **154 vehicle models** across vehicle categories are eligible for the incentive.
- Total claims submitted till 15.11.2023 amount to INR 5,094 crore, of which INR 3,815 crore have been disbursed.

ELECTRIC BUSES AND CHARGING INFRASTRUCTURE

- MHI sanctioned 6,862 electric buses to various cities/STUs/State Govt. entities for intracity operations.
- Of 6,862 e-buses, **3,487 e-buses have been supplied to STUs** as of 29th November, 2023.
- MHI has also sanctioned **INR 800 Crores as a capital subsidy to the three oil marketing companies** of the Ministry of Petroleum and Natural Gas (MoPNG) for the establishment of **7,432 public electric vehicle charging stations.**

This information was given by the Minister of State for Heavy Industries, Shri Krishan Pal Gurjar, in a written reply in Lok Sabha.

COMBINING EDGE ML ON BMS MICROCONTROLLER WITH HIGH-FIDELITY TRAINING DATA FOR EV BATTERIES

How oorja Heat App + NXP eIQ Auto can enable efficient thermal management and better battery insights

Introduction

The temperature of a Li-Ion battery cell plays a crucial role in its performance and degradation profile. Cell temperature is a key parameter in determining metrics such as SoH (state of health), internal impedance, and RUL (remaining useful life). At the same time, limitations with traditional BMS (battery management system) hardware mean OEMs are constrained to the use of a handful of physical temperature sensors.

An actual 48V Li-Ion battery pack for use in electric 2W or 3W may have as many as 100 to 200 cells connected in series and parallel with a small number of physical temperature sensors (e.g., 4-6). This means that the OEM has potentially low-confidence cell temperature data for most of the cells in the battery pack. The consequences are significant:

- OEMs often oversize their thermal management system to ensure battery safety.
- OEMs cannot extract the actual state of health, limiting the value of a second life.

Based on the current state-of-the-art scenario, it is shown conceptually in Fig. 1.

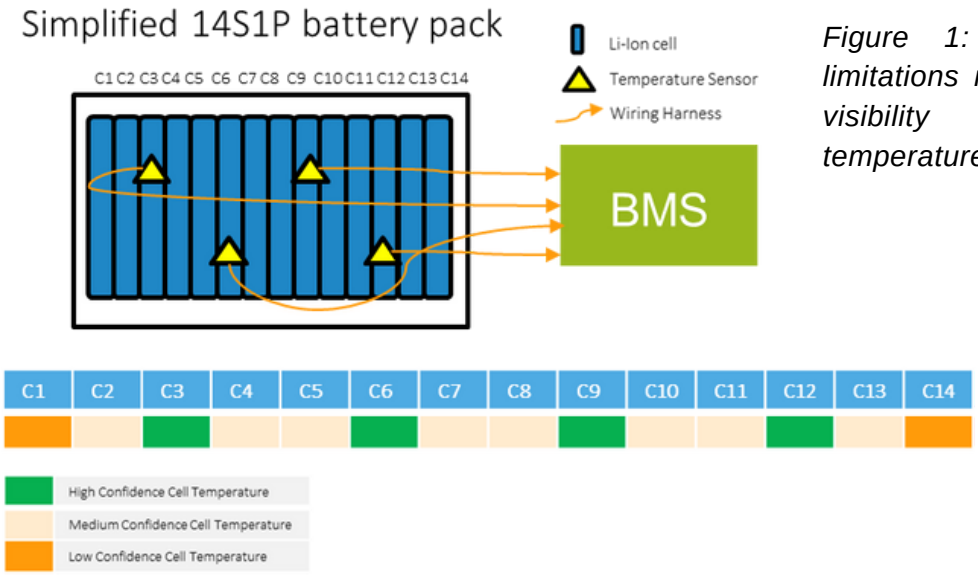


Figure 1: Traditional BMS HW limitations mean OEMs have limited visibility into individual cell temperatures.

Machine learning offers a software-based approach for predicting individual cell temperatures based on existing HW temperature sensors and pack characteristics such as filler material, cell chemistry, and pack current profiles. However, the BMS that would incorporate machine learning for predicting cell temperatures is a critical system that needs to operate reliably and safely in the vehicle. As such, there are two crucial challenges with deploying ML in the real world for BMS:

- Running edge ML with automotive quality software for inference and in real-time.
- Generating accurate real-life training data covering the range of operating conditions and ensuring region-specific training data generation.

In this paper, NXP and oorja present a collaborative approach to solving the problem.

- NXP eIQ Auto brings an automotive quality inference engine that can run in real-time on S32K3, automotive microcontroller platform. This enables running edge ML for electric 2W & 3W powertrain applications such as BMS & traction motor control.
- oorja HEAT enables the quick generation of high-fidelity battery response data at the battery pack design stage using a hybrid (physics model + ML-based) approach for quickly generating large amounts of high-fidelity training data for a given battery pack design.

This new approach can be visualized conceptually with the help of Fig.2.

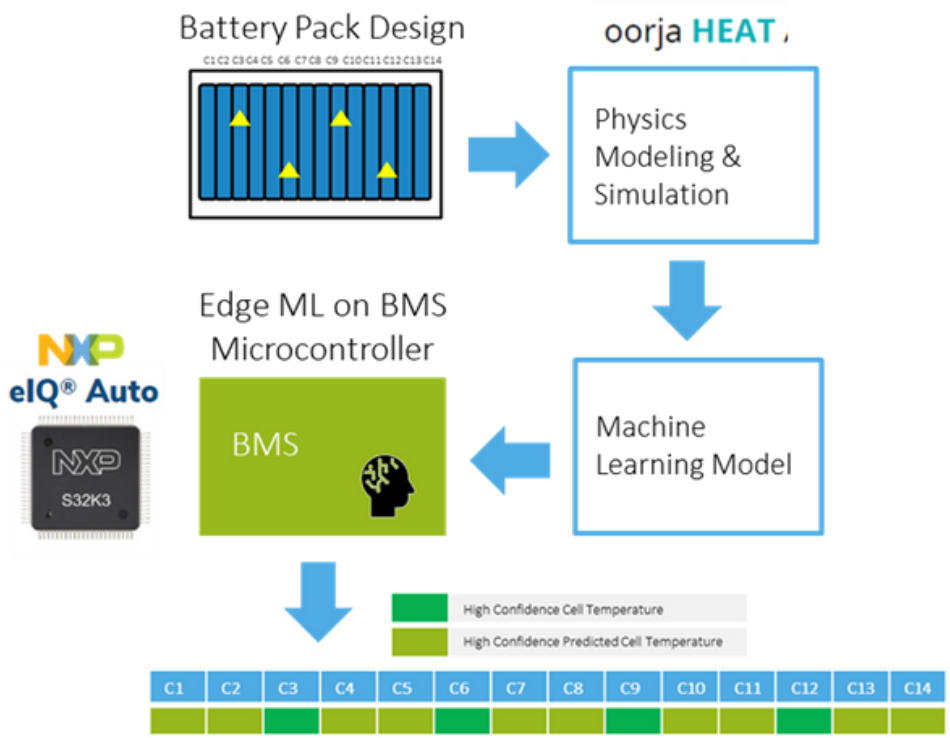
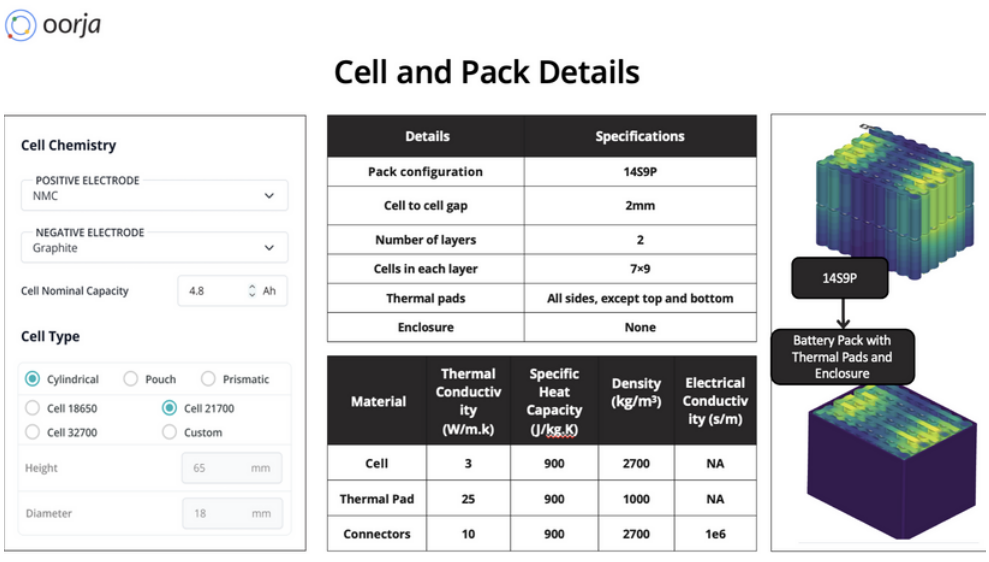


Figure 2: Conceptual framework showing the coming together of oorja HEAT + eIQ Auto for edge ML on the S32K3 platform.

Workflow

The workflow starts with a battery pack design in the oorja Design App.

The oorja app uses a combination of high-fidelity physics-based models: electrochemical, thermal, and flow. It then uses information from cell-level HPPC data to combine the two to create a predictive model for the entire pack's thermal behavior and performance.



In this case, we have chosen a typical 14S9P battery pack using NMC cells, with a nominal capacity of 4.8Ah and a power of 2.23kW. The pack design, shown in Fig. 3, is representative of an e-scooter battery pack.

Figure 3: Details of the battery pack modeled using oorja app.

Next, the pack designer selects the location of physical temperature sensors, e.g., based on thermal hotspot simulations. Once the pack design and temperature sensor locations are finalized, the next step is to run simulations with the oorja Heat App over multiple operating conditions in order to predict individual cell temperatures. The output of the simulations, comprising individual cell temperatures, pack voltage, and pack current, is then used as training and test data for the edge ML. The training data can be visualized using Fig. 4.

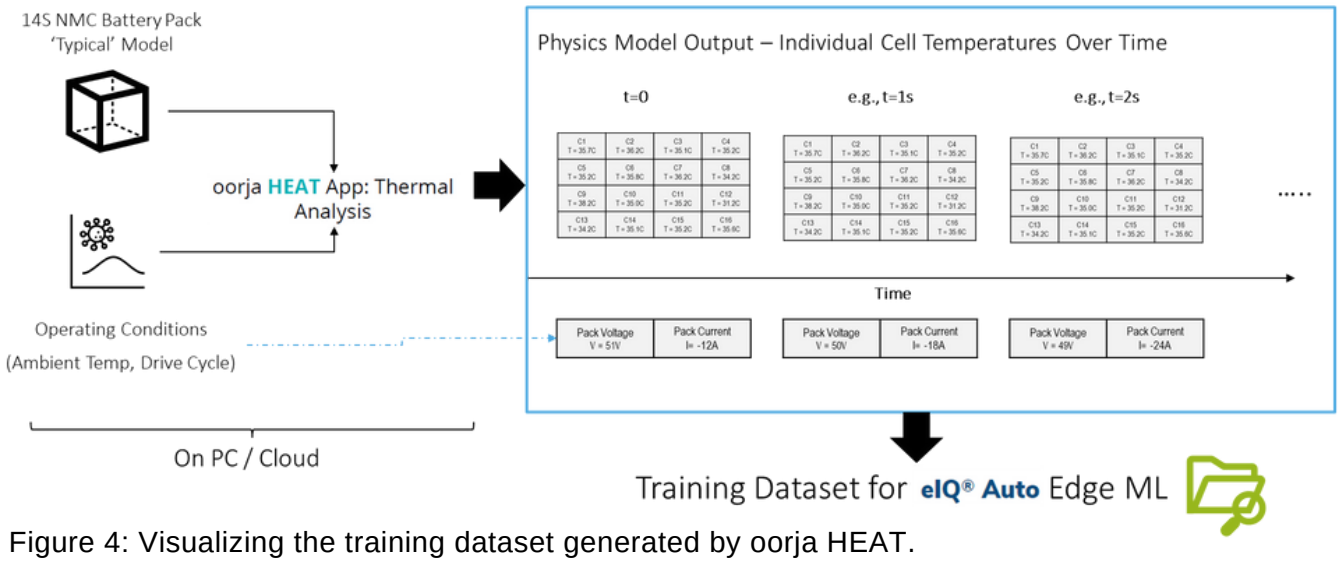


Figure 4: Visualizing the training dataset generated by oorja HEAT.

The next step is to train the ML model – e.g., a neural network to predict the temperatures of cells that are not monitored by a physical temperature sensor. This training is performed offline. Once the ML model is trained, the next step is to deploy the model on the S32K3 target platform. The eIQ Auto ML training and deployment process can be visualized in Fig. 5.

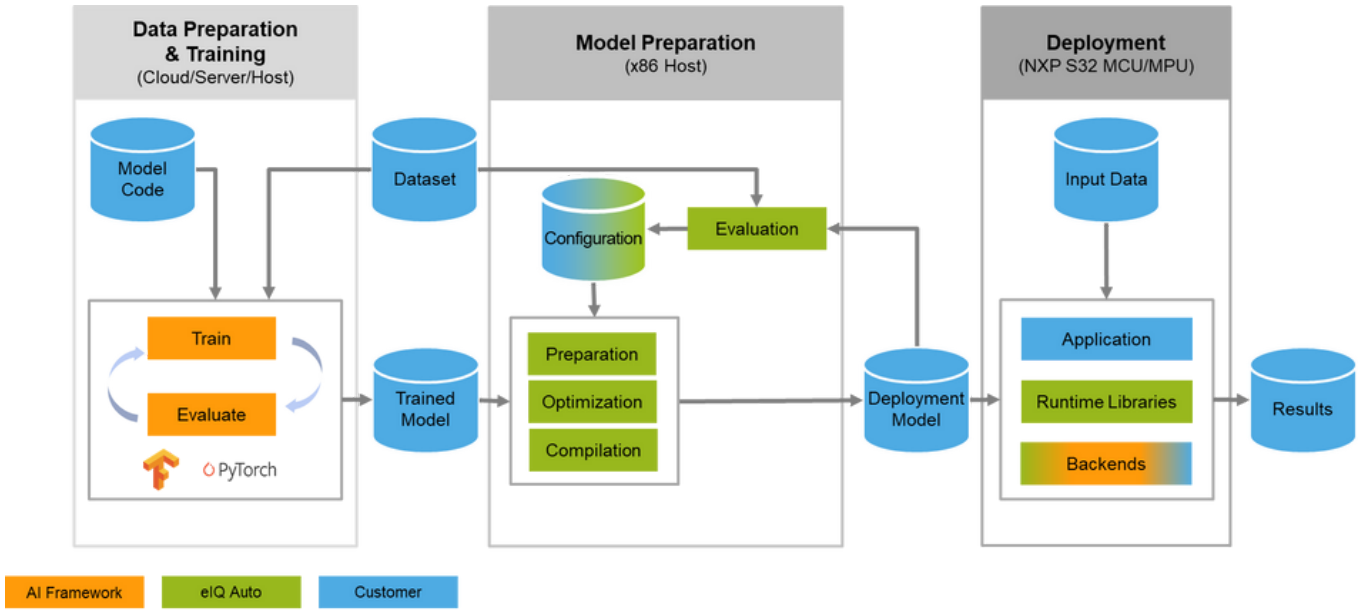


Figure 5: NXP eIQ Auto workflow that enables seamless progress from training to deployment.

Finally, the baseline results comprising predicted individual cell temperatures from the oorja Heat App are compared with those from the edge ML inference engine for evaluating the accuracy of cell temperature prediction. This combined workflow is shown in Fig. 6.

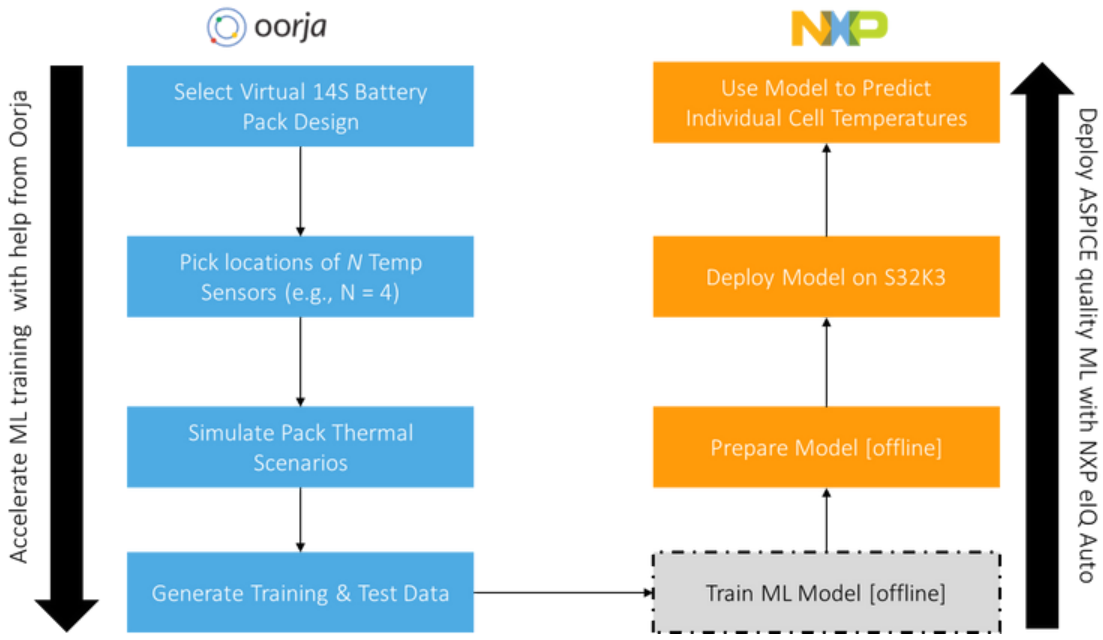


Figure 6: Combined workflow across oorja HEAT & NXP eIQ Auto

Multiple real-world driving profiles can be loaded into oorja HEAT to generate data for training the ML model. The scenarios used for training and testing are summarized in Fig. 7 below. An LSTM neural network was trained on six features summarized in Fig. 8 below.

eIQ Auto Training Dataset from Oorja

#	Scenario	Ambient
1	US06 drive cycle	30 °C
2	MIDC drive cycle	25 °C
3	50A continuous discharge	30 °C
4	US06	15 °C
5	US06; charging 0.5C	30 °C
6	US06; 10 kg payload; 0.5C charging	30 °C
7	MIDC; 0.3C charging	20 °C
8	MIDC slope; 0.3C charging	20 °C
9	MIDC; 0.5C charging	25 °C
10	US06; 0.75C charging	25 °C

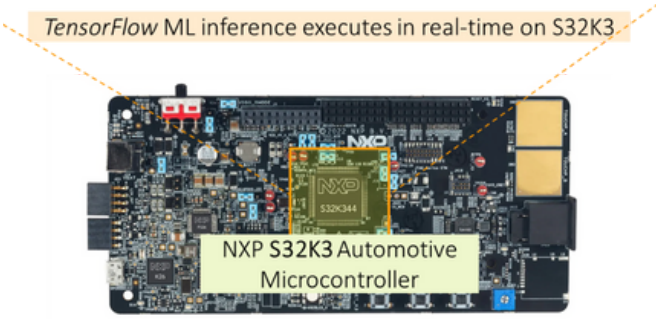
Test Scenarios

#	Scenario	Ambient
1	US06; 20kg payload	25 °C
2	MIDC drive cycle; 10kg payload	25 °C

Figure 7: Multiple MIDC and US06 driving profiles were used for training the edge ML model.

#	Feature
1	C1T (cell temperature for cell #1)
2	C35T (cell temperature for cell #35)
3	C91T (cell temperature for cell #91)
4	C125T (cell temperature for cell #125)
5	V, where V is pack voltage
6	Integral of I^2 (where I is pack current)

Figure 8: Summary of features – four temperature sensors were selected as features in addition to pack voltage & current.



The neural network itself was modeled as a convLSTM neural network. The inference engine executes on S32K3 automotive uC.

Results

Table 1 below summarizes prediction accuracy results, averaged over all predicted cell temperatures. The MAE (Mean Absolute Error) is less than one deg C, while the R^2 coefficient is > 0.9, indicating a good fit with patterns seen in cell temperatures. All of this is with an edge ML model that can execute inference in real time on the S32K3 microcontroller. Overall, the results appear promising. Further optimizations can improve accuracy or reduce model footprint depending on the priority. Furthermore, the same model could be extended for applications such as predicting battery degradation and the state of charge/health parameters, maximizing the benefit of edge ML using eIQ Auto.

		Prediction Accuracy		
#	Scenario	MAE	RMSE	R^2
1	MIDC drive cycle; 10kg payload	0.61 °C	0.71 °C	0.96
2	US06; 20kg payload	0.60 °C	0.65 °C	0.94

Table 1: Results for prediction accuracy and edge ML performance

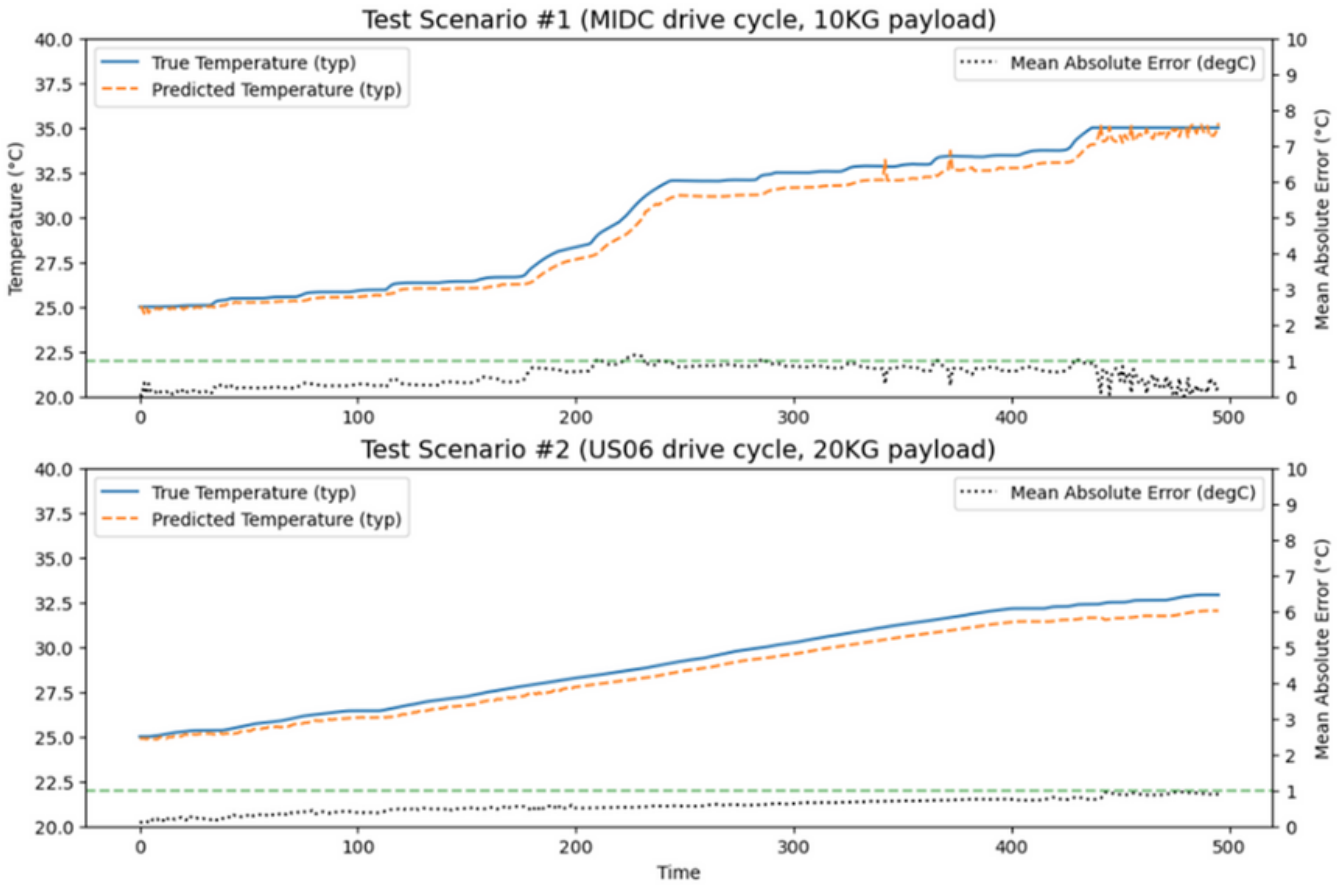


Figure 9: Edge ML predicted vs True temperature for a typical cell.

Indicative results for proof-of-concept.
Results may improve further with further ML training & model optimization.

Conclusion

Combining the ability to deploy an automotive quality ML inference engine in real-time on the edge with the capability to generate high-fidelity training data using simulation software such as oorja Heat App can unlock new opportunities for OEMs – e.g., to generate better battery insights for enhancing battery residual value & optimize the battery thermal management systems to save overall system-level costs. The eIQ Auto framework would also help you easily port the algorithm to other current and future NXP S32 microcontroller devices.

While the current proof-of-concept demonstrates the use case of predicting individual cell temperatures, the beauty of the edge ML model is that the same model can potentially be extended to generate various other vital insights – as shown in Fig. 10. In conclusion, the ability to deploy automotive quality edge ML seamlessly can be a game-changer for unlocking the full potential of different business models associated with Li-Ion batteries.

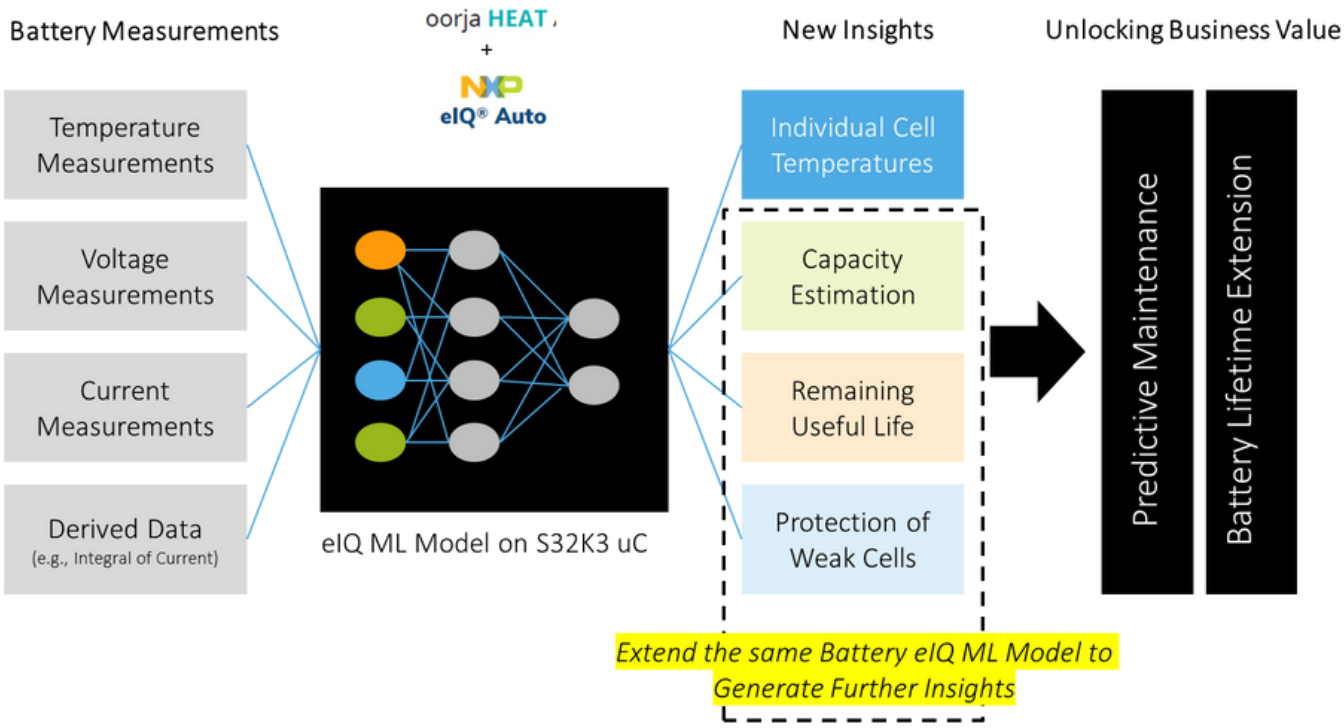


Figure 10: Possibilities with extending the edge ML model for other use-cases.

About the authors

This article is an edited reproduction of a concept paper co-authored by:

- ***Vineet Dravid (Founder and CEO - oorja.energy)***
- ***Narsimh Kamath (Business Development Manager - Electrification at NXP Semiconductors)***.

The complete paper has been published here and can be accessed on EVreporter website.

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EVOLVING INPUT TRENDS FOR END-OF-LIFE (EOL) LITHIUM-ION CELLS



The trend of Lithium-ion cell stock coming for recycling is an important consideration every recycling company needs to account for. ***This aspect directly links to the economics of battery recycling operations as different types of cells (in terms of form factor and cathode material used) have different unit economics linked to them.***

This article by Rahul Bollini discusses the changing trends of lithium-ion cell chemistries.

The need to understand incoming cell stock trends

Different raw materials are used for the casing of different form factor cells.

- **Cylindrical** can is made up of steel coated with nickel.
- **Pouch** case is made up of aluminium, polyamide and polypropylene layers.
- **Prismatic** can is made up of aluminium.

The **electrolyte content is also different for each form factor**, which means different Lithium content. This factor is closely related to operation planning, as most companies in their initial stages have a single processing line requiring continuous operation with a consistent Lithium-ion cell input. This is necessary to ensure that a uniform composition of black mass is generated during the mechanical separation, which is the first process in recycling.

A test certificate is issued to assure black mass buyers that they receive what they pay for. Blackmass pricing is based on its material composition. The companies need to plan the batches with decent input volumes of Lithium-ion cells with the same characteristics to get a predictable blackmass output in terms of material constituents. Hence, it becomes important for them to understand the trends of incoming types of Lithium-ion cells.

Let us explore the type of Lithium-ion cells that have come and gone, the type of Lithium-ion cells in circulation, and the type we can expect coming in the future.

LCO (Lithium Cobalt Oxide)

- Due to its high voltage and stability, given its high cobalt content, LCO is used in portable devices such as mobile phones and laptops.
- It is the most expensive battery type and uses graphite anode.
- The black mass value of the LCO cell is highest due to its high cobalt content.

LMO (Lithium Manganese Oxide)

- LMO offers high power delivery but failed to impress the market due to higher degradation at high operating temperatures. The cells become less uniform after about two years, drastically dropping the EV range. It was featured in the first-generation Nissan Leaf.
- Its price is very low due to the use of low-cost Manganese and the lack of Nickel or Cobalt.
- It delivers a nominal voltage of more than 3.7V.
- It has now been relaunched in combination with NMC and is doing well in the fast-charging market segment. **Many electric buses in India use this mix of LMO + NMC**.

NMC (Lithium Nickel Manganese Cobalt Oxide)

- Very popular in the electric 2-wheeler segment. NMC was also widely used in the electric car segment until recently when LFP started replacing NMC.
- Initially launched as NMC 111 - ratio of one part nickel, one part manganese, one part cobalt.
- Then came newer variants such as NMC 442 (short-lived).
- NMC 532 (very popular today in the Indian market in 2600mAh 18650).
- NMC 631 (higher voltage cell, 3.75V nominal voltage).
- NMC 622 (used in pouch and prismatic cells).
- NMC 712 (popularised by LG).
- NMC 811 (popular with Graphite and Silicon Graphite).

NCA (Lithium Nickel Cobalt Aluminium Oxide)

- Tesla popularised NCA until they recently adopted LFP for low-range cars.
- It is used in high-range vehicles and is more expensive than NMC. Its thermal runaway is more challenging than NMC, so it needs a good thermal management system.
- Most premium electric 2W companies use NCA cells. These variants contain Silicon in their anode to enable higher energy density.
- Due to its ability to deliver high power when put in a high-power cell design, NCA is used in drone batteries.

LFP (Lithium Iron Phosphate)

- LFP is considered favourable because of its low cost, safety, and longevity. However, its gravimetric and volumetric energy density are not the best in the market.
- I believe LFP is not good news for recycling companies because of its lack of Cobalt or Nickel. It also has lower Lithium content per Kg of cells than other cells.
- LFP is highly preferred in Indian electric cars and 3-wheelers.
- 2W companies are slowly planning to shift to LFP after the FAME subsidy was reduced.
- Most upcoming Indian cell manufacturing companies consider LFP as their first choice because of its growing demand and also because its constituents are easier to source.

Various cell models are available in the market, and understanding their chemistry is key for recycling companies. Let us try to understand the cell type by model name. For example, any cell model that begins with IF is a LFP cell.

The LFP cylindrical cell model name will begin with IFR, and the pouch and prismatic cell model name will begin with IFP. R in IFR indicates that it is a round cell, and P in IFP indicates that it is a pouch or prismatic cell.

New Lithium-ion cell chemistries to watch out for

- **LCO + Silicon Graphite**: It has already begun production for mobile phones to enable higher capacity for the same space availability.
- **NCMA (Lithium Nickel Cobalt Manganese Aluminium Oxide):** Known for being stable despite using high Nickel content (around 90%) because it contains both Manganese and Aluminium. Popularised by LG, it has already entered the market for electric cars.
- **NMC 9.5.5 (Lithium Nickel Manganese Cobalt Oxide):** Trials are going on for use in portable applications, given its high energy density. Gravimetric energy density is close to 300Wh/Kg.
- **LMFP (Lithium Manganese Iron Phosphate)**: On trial in the market to compete with NMC, given the ability of LMFP cells to have similar voltage and pass the nail penetration test. Some companies are mixing NMC and LMFP in various ratios, and they still call it an LMFP cell.

A test certificate is issued to the black mass buyer for assurance, as even though the cell model and cell form factor look similar, the composition of the raw materials can differ. For example, the amount of conductive carbon additive can be different in the electrode composition (cathode and/or anode), thereby affecting the content of other materials present in a given quantity of black mass.

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भारी उद्योग मंत्रालय
MINISTRY OF
HEAVY INDUSTRIES
सत्यमेव जयते

Indian Government, in an official Gazette notification, has declared that the "**Supervision of the production, sale, and promotion of electric vehicles**" will be managed by the "**Ministry of Heavy Industries**".

Ministry of Heavy Industries issued **revised Phased Manufacturing Program Timelines for EV Chargers under FAME-II.** The target to achieve minimum 50% Domestic Value Addition has been pushed back by ~3 years to 1st December 2024 to allow OEMs more time for localization of key components like charging guns, charger controllers, power modules, HMI and switchgear etc.

PM-eBus Sewa has requested a proposal to select bus operators to procure, supply, operate and maintain **3,600 electric buses** and develop allied electric and civil infrastructure on Gross Cost Contracting. The tender bid document has been prepared by **CESL** under the overall guidance of the Ministry of Housing and Urban Affairs, Government of India.

Transport Department
Government of NCT of Delhi
सत्यमेव जयते

Delhi Transport Department notified the **Premium Bus Aggregator Scheme 2023** to enhance the quality of premium bus services in Delhi. The aggregators will be eligible for a five-year license. The scheme makes some specific considerations for electric buses.

- The license fee is exempted for electric buses.
- Starting Jan 1, 2025, induction of only electric buses will be allowed under the scheme.

Delhi Government Transport Dept has notified the **Delhi Motor Vehicle Aggregator and Delivery Service Provider Scheme, 2023,** to license and regulate aggregators providing passenger transport services and delivery service providers.

- **Applicability**: This scheme will apply to players with at least 25 motor vehicles (2Ws, 3Ws and 4W passenger vehicles) in their fleet.
- **Phased passenger fleet conversion to EVs**: 100% EVs in the new fleet for 2Ws (bike taxis) - within 6 months, 3Ws - within 4 years, 4Ws - within 5 years of notification of the scheme.
- **Phased goods fleet conversion to EVs:** 100% EVs in the new fleet for 2Ws and 3Ws - within 4 years, 4Ws - within 5 years of notification of the scheme.
- Aggregators and delivery service providers must switch to an all-electric fleet by April 1, 2030.

Euler Motors raised INR 120 Crore in its series-C extension round. Last year, the company raised USD 60 million in its series C round, led by GIC Singapore. The latest round saw participation from British International Investment and Green Frontier Capital. Existing backers, including Athera Venture Partners (formerly Inventus India), ADB Ventures, Blume Ventures, Alteria Capital, GIC Singapore, and QRG Holdings, also participated. This extension round brings the total investment in Euler Motors to around INR 690 crores.

Ashok Leyland approved an investment of **INR 1200 crore in Switch Mobility** as equity through its holding company Optare PLC UK. The funds will be utilized for capital expenditure, R&D and operational requirements in the UK and India. Currently, 800+ buses from Switch are operational in India and the UK, with an order book exceeding 1200 buses. In September 2023, Switch India introduced e-LCVs and signed MoUs for over 13,000 vehicles, with deliveries commencing from the fourth quarter of the current fiscal year.

Pune-based electric bicycle maker **EMotorad has raised $20M in a Series B round led by Panthera Growth Partners.** xto10x and Green Frontier Capital (GFC) also participated in the round. The company had earlier raised INR 24 crore, led by GFC and IVY Growth Associates.

Delhi NCR-based mobility platform for gig workers **Baaz Bikes raised $8M in a** Series A round led by Singapore-based **BIG Capital** to expand and strengthen its ebike offerings for last-mile delivery. The funding round also saw participation from Japan-based Rakuten Group's venture capital arm, Rakuten Capital, and existing investors like Kalaari Capital, 9Unicorns, and Sumant Sinha.

Faridabad-based **BBROS Mobility** has secured an **additional USD 120,000 in seed funding.** The funding comes as a part of the start-up's ongoing effort to raise USD 1 million, aiming to conclude the round within the next few months. Earlier, the start-up had secured its initial seed investment of USD 185,000 from angel investors based in Canada. **Bbros plans to introduce two electric scooter models by the third quarter of 2024.**

Bangalore-based **Orxa Energies** launched an electric motorcycle - **The Mantis**, with a 1.3 kW charger. The EV is priced at INR 3.6 Lakhs ex-showroom.

- Top speed - 135 km/h | 0 to 100 km/h in 8.9 seconds.
- 8.9 kWh battery pack | Estimated range of 221 km

PURE EV announced the launch of a new electric motorcycle – **ecoDryft 350, with a range of 171 km.**

- 3.5 kWh Lithium-ion battery | Motor - 3 kW
- Torque - 40 Nm | Top speed - 75 kmph

e-Sprinto launched **low-speed** electric scooters **Rapo and Roamy,** at a starting price of INR 54,999 and INR 62,999, respectively. Rapo and Roamy are equipped with 250 W BLDC Hub Motor and offer a range of 100 km on a full charge.

Tarun Mehta, Co-founder and CEO at **Ather Energy,** announced that the company will launch a **premium family scooter in 2024.**

Electric motorcycle manufacturer **Revolt Motors** has bagged an order from **Adani Green Energy Ltd (AGEL)** for its RV400 e-motocycles for use in its corporate fleet.

Ultraviolette Automotive launched the international-spec F77 motorcycle in Europe. Deliveries are to start in Q2 2024. The F77 Production Electric Motorcycle boasts 100 Nm of peak torque and 30 kW (40 bhp) of peak power with a 10.3 kWh battery pack. European riders can ride the F77 with either A1 or A2 driving licenses. The F77 is set to be priced between **9,000 to 11,000 euros in Europe**, subject to federal / state government incentives and taxes.

TVS Motor Company signed an agreement with Zurich-based **Emil Frey** for import and distribution of its two-wheelers in key European markets. Emil Frey will distribute TVS Motor's scooters, **including ICE and its electric two-wheelers — iQube S and TVS X.**

ISB accelerated **Perpetuity Capital, a digital platform specializing in EV finance,** announced getting into a debt funding agreement with **Mufin Green Finance.** Perpetuity Capital and Mufin Green Finance aim to finance over 1,000 electric vehicles this financial year.

Gogoro signed an MoU to set up thousands of battery-swapping stations across **HPCL's retail outlets t**hroughout the country in the coming years. Hindustan Petroleum Corporation Limited has more than 21,000 retail outlets across India.

Gogoro also became the first foreign **OEM empanelled by the Small Industries Development Bank of India (SIDBI)** for the latter's EV financing programs.

Hindustan Zinc, a Vedanta Group company in Zinc, Lead & Silver business, has partnered with **Inland EV Green Services Pvt Ltd to deploy 10 electric trucks,** each having a capacity of 55 metric tons. The trucks will be dedicated to the inter-operations transport of concentrates.

The EV trucks will be supplied by **IPLTech Electric Pvt Ltd., a Murugappa group EV venture**. These trucks can charge from 20% to 100% in 90 minutes. The Inland Group, led by the Somani family, operates under the brand 'Enviiiro Wheels.

Fleet operator **MoEVing** has deployed **100 units of Tata Ace EV** for last-mile logistics that will operate across Delhi NCR, Kolkata, Mumbai, Pune, etc. **StrideOne** and **Gensol eV** are MoEVing's leasing partners for this deployment. The company has an MoU with Tata Motors to deploy 5000 Tata Ace EVs by 2025.

Hyderabad-based **Blackbuck EV** unveiled the photos of their upcoming vehicle **ELON 3X - a 3 Axle electric Bus currently in pre-production.** The company plans to commence production in Hyderabad by the end of 2024. Founder and CEO Ramakrishnam Raju Chintalapati said that the **13.5-meter intercity** ELON 3X model has been designed for domestic and international markets.

ZEVO unveiled an **Electric Refrigerated Vehicle** in collaboration with Machphy Solutions. The vehicle aims to serve the last-mile delivery segment for sectors like Pharmaceutical, QSR, Seafood, Dairy, and FMCG, where **temperature control** is important. ZEVOs system, operating with an overnight plug-in electric charge, enables **intracity operations for up to 16 hours at -20°C and a range of 120 km** using PCM-based technology, with the use of composite materials and aluminium in REV L5 construction.

Tata Motors has been granted the inaugural **Auto Production Linked Incentive PLI certificate in the N1 category by ARAI** for the **Ace EV.**

Valeo will provide the **electric powertrain** for a certain range of **Mahindra's "Born Electric"** passenger vehicle platform and onboard charger combo for **electric utility vehicles.** The total order is close to **1 billion dollars**. Valeo will invest close to the Mahindra plant in **Pune** to localize the electric powertrain production, which includes the electric motor, its inverter, and the gearbox, as well as the integrated 3-in-1 bi-directional Combo power electronics that integrates the Onboard Charger, the DC-DC converter and the Power Distribution Unit.

Raymond Group announced its foray into the aerospace, defence, and **electric vehicle components business** by acquiring a **59.25 per cent stake worth INR 682 crore** in **Maini Precision Products.**

Tata Passenger Electric Mobility will license **JLR's Electrified Modular Architecture platform for a royalty fee for developing its premium EV series 'Avinya'.** This includes electrical architecture, electric drive units, battery packs, and manufacturing know-how for product development. The concept 'Avinya' was introduced in 2022, and is expected to be introduced to the market by 2025. Both companies are 100% subsidiaries of TATA Motors.

Tractors and Farm Equipment Limited, in order to expand its presence in the European market, unveiled its **electric tractor** and displayed a **concept Hydrogen tractor** at Agritechnica 2023 in Hanover, Germany. TAFE's e-tractor is equipped with 20 kW power, efficient transmission, low noise powertrain and an electric motor with efficiency >90%. It has a fast charge feature and is compatible with CCS2.

Shoffr expands its e-taxi fleet to 40 BYD e6 electric vehicles in Bengaluru, collaborating with **RevFin.** The companies intend to broaden their operations beyond Bengaluru.

Varroc Engineering secured a new lifetime order worth Rs 3602 crore during H1 FY24 while **onboarding three new EV customers in the second quarter of fiscal year 2024.** This order win comes in addition to securing business from two customers for supplying components related to EV powertrain.

Connected vehicle technology company **Sibros** has partnered with India's telematics solutions giant **Accolade Electronics Private Limited.** Accolade has deployed its solutions on over 800,000 connected devices running on various vehicle models. The collaboration empowers Sibros to deliver its connected vehicle solutions through integration with Accolade's embedded hardware systems via FreeRTOS.

Altmin, a Hyderabad-based Battery active materials manufacturing company, signed a strategic agreement with a Bolivian Government-owned entity for Lithium Deposits, **YLB.** The collaboration aims to **fulfil Lithium Carbonate requirements for Altmin's operations in India.** It entails technology sharing for manufacturing battery active materials through the establishment of a 3 GWh pilot plant in La Palca, Potosi, using Altmin's "C-LFP" technology.

StoreDot is collaborating with **Polestar** to explore and demonstrate technically how **XFC battery cell technology** can be applied to an existing platform. The companies are exploring how StoreDot's '100-in-5' technology can be brought into automotive production. The announcement was made in Los Angeles, California, where '100-in-5' XFC cell charging was demonstrated alongside a prototype of a Polestar battery module. A prototype vehicle fitted with XFC batteries is to be demonstrated next year.

Stellantis N.V. and CATL signed an MoU for the **local supply of LFP battery cells and modules to power Stellantis' electric vehicle production in Europe** and support its Dare Forward 2030 electrification targets.

EV charger manufacturer **Servotech Power Systems Ltd** has established a wholly owned subsidiary, **Servotech EV Infra Pvt. Ltd., to foray into the EV Charge Point Operator business.**

The company also said it has bagged an order for 2649 AC EV chargers from Bharat Petroleum Corporation Limited under the BPCL E-drive Project. Earlier, Servotech supplied and installed 800 units of 30 KW DC fast EV Chargers at different locations for this project.

Okaya EV Charging Solutions said it will install **2,550 charging points** for **Indian Oil Corporation,** with an investment of **INR 125 Crores.** This includes a combination of 3.3 KW Charger, 7.4 KW Charger, 30 KW Wall Mounted CCS2 DC Charger, and 60 KW CCS2 DC Charging points.

Terra Motors India is expanding its **EV charging infrastructure venture, Terra Charge,** with new offices in Hyderabad, Bangalore, Pune, Gurgaon, Kolkata, and Chennai. This expansion comes after Terra Motors (Japan) raised **$28 million in a recent Series C** funding round.

evnnovator (eMSP) and **CHARGE ZONE (CPO)** have collaborated with **Mercedes-Benz India** to deliver a vertically integrated charging solution. Mercedes-Benz's existing charging network is now integrated with over 150 DC Fast Charging stations and 100+ Type 2 Chargers operating on Evnnovator's eMSP platform. This integration results in a network of approximately 500 charging points through a mobile app.

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