EVreporter.com

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Issue no. 31

EVreporter

What's INSIDE

Global Supplier of EV PTC Heater | NF GROUP

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BEIJING GOLDEN NANFENG INTERNATIONAL TRADING CO.,LTD

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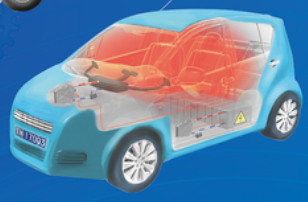
WPTC07 | CH06 | W13 | SH07 | Q Series

APPLICATION



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.

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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.
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India EV Sales Data

- Month wise , OEM wise, State wise (including Telengana)
- City wise sales data (Coming Soon)
- Cargo, Passengers, L3, L5 breakup for 3W sales
- e2W, e3W, e4W, eBuses
- Interactive Tables & Charts

Bonus Content :
Databases and Reports

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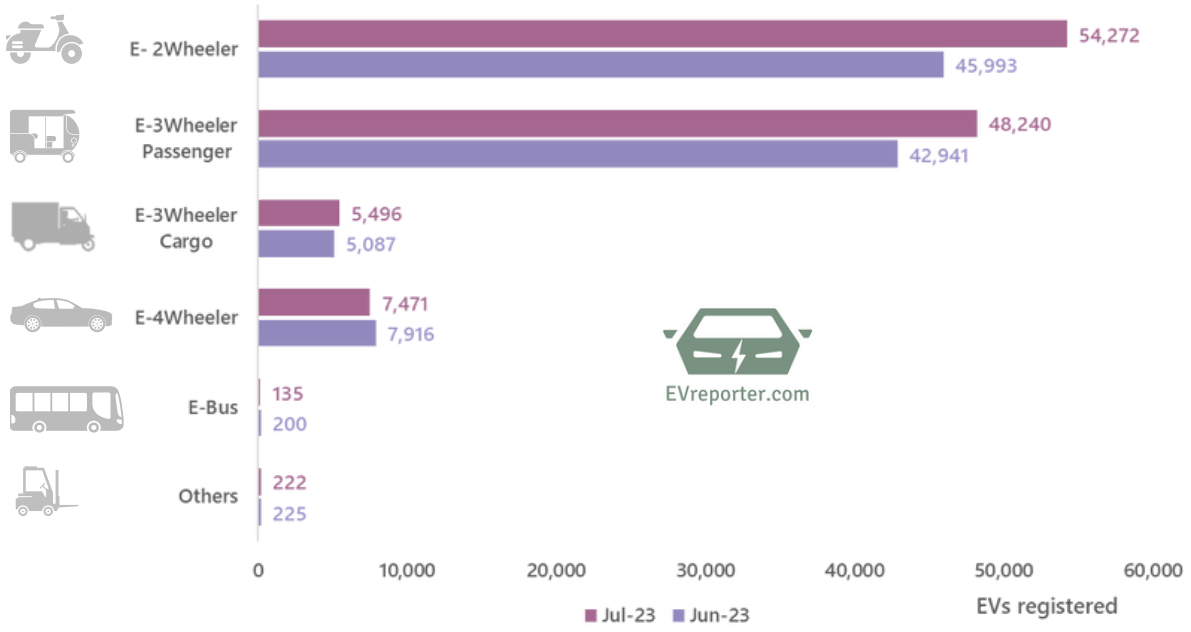
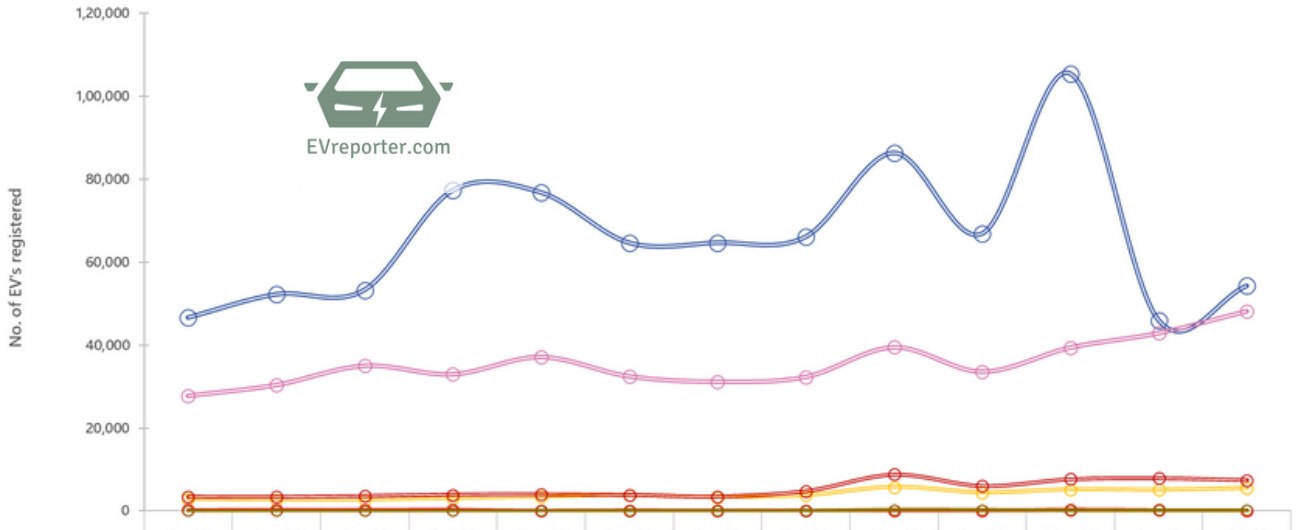
Category wise Electric Vehicle sales, Jul 2023

Total Registered EV Sales - **Jul 2023 - 1,15,836** I Jun 2023 - 1,02,362



Category wise-Sales Trend from Jul 2022 to Jul 2023

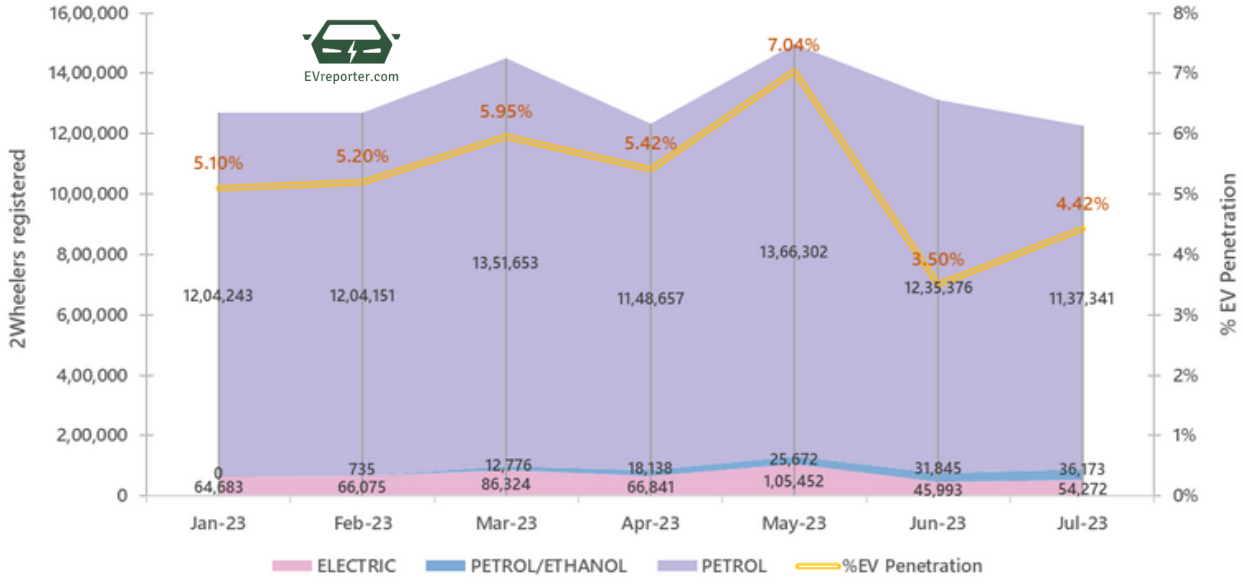
13,66,780 EVs sold in last 12 months from Aug 2022 to Jul 2023



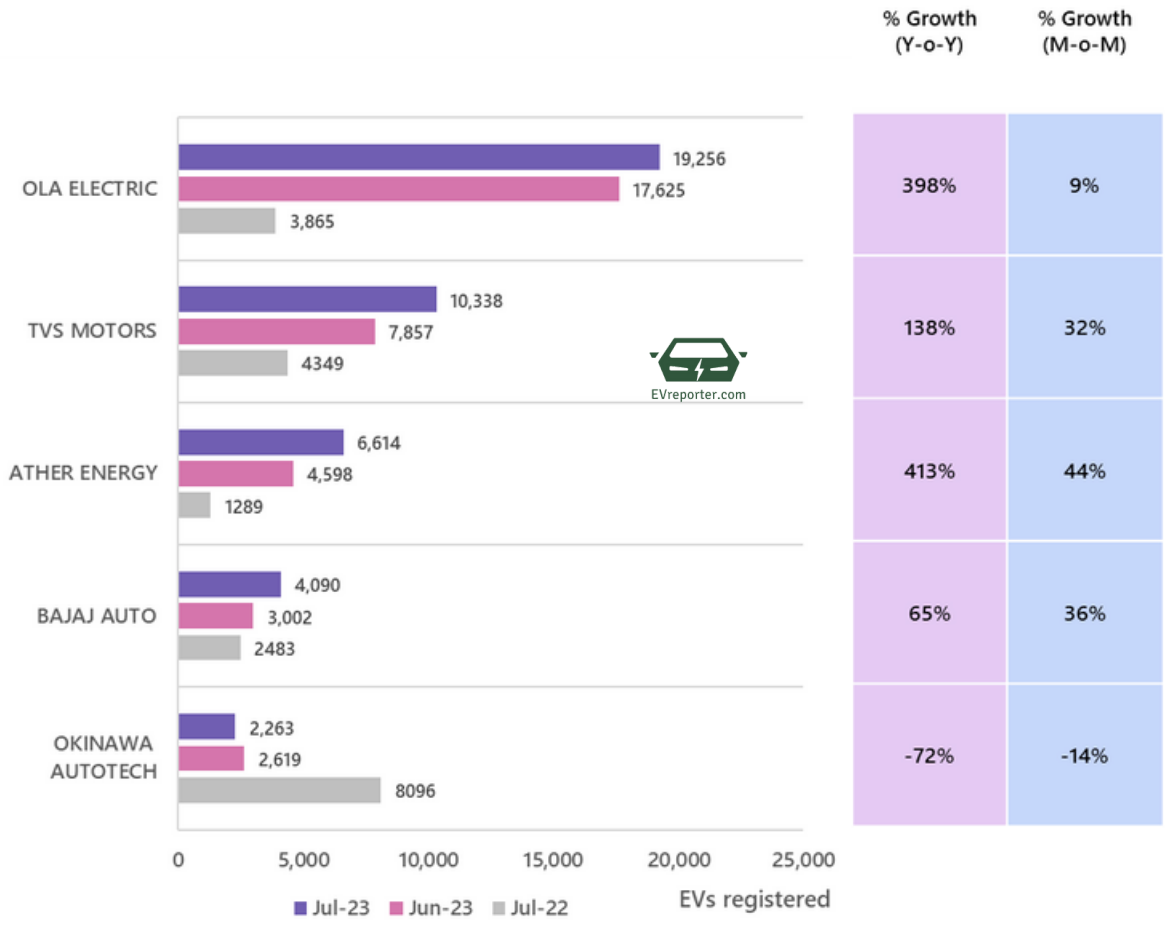
	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23
E- 2Wheeler	46607	52226	53282	77267	76791	64657	64683	66075	86324	66,841	1,05,452	45,993	54,272
E-3Wheeler Passenger	27763	30371	35049	32979	37171	32471	31183	32329	39512	33,617	39,468	42,941	48,240
E-3Wheeler Cargo	2842	2760	2754	3041	3453	3763	3318	3781	5780	4,434	5,169	5,087	5,496
E-4Wheeler	3406	3358	3546	3914	3979	3,840	3441	4,758	8822	6,020	7,681	7916	7,471
E-Bus	207	227	216	245	117	161	138	122	98	88	280	200	135
Others	52	65	54	54	91	112	98	144	350	312	250	225	222
TOTAL	**80877**	**89007**	**94901**	**117500**	**121602**	**105004**	**102861**	**107209**	**140886**	**111312**	**158300**	**102362**	**115836**

Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs
Low speed 2Ws not included.

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

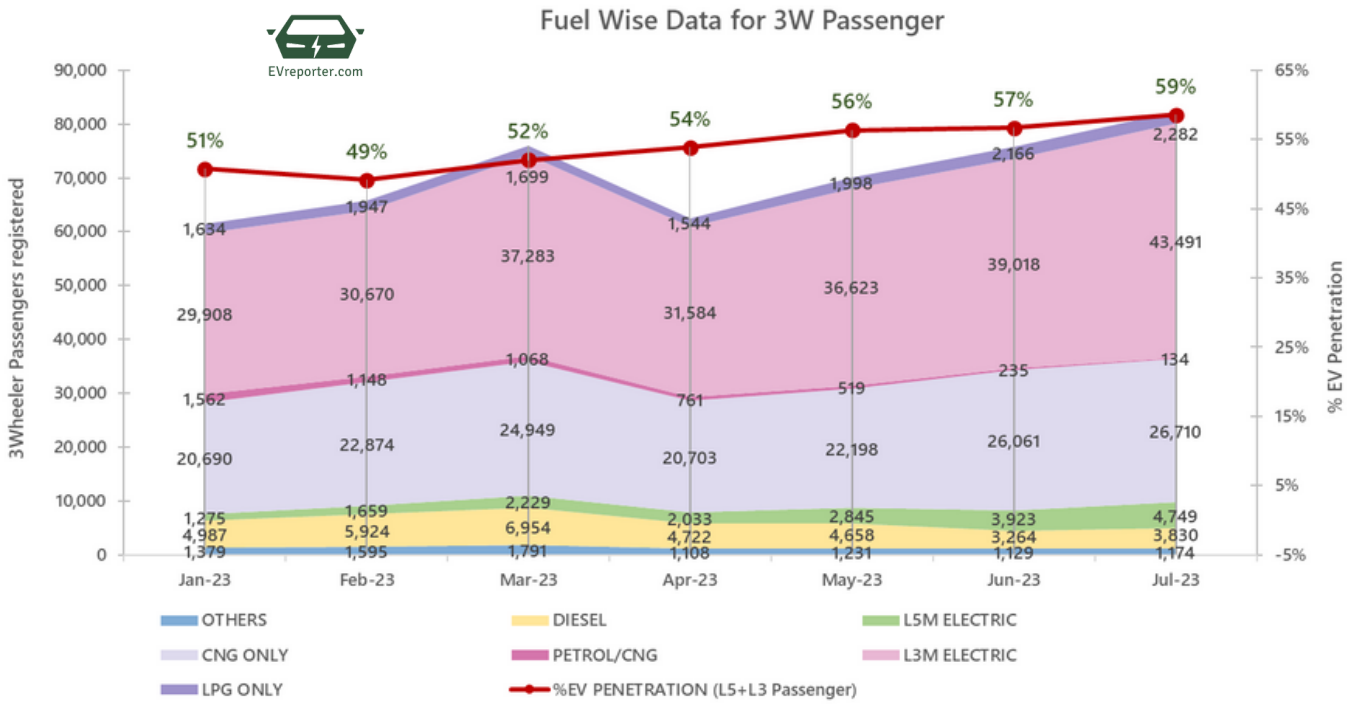


High Speed E-2W Sales Trend by OEM

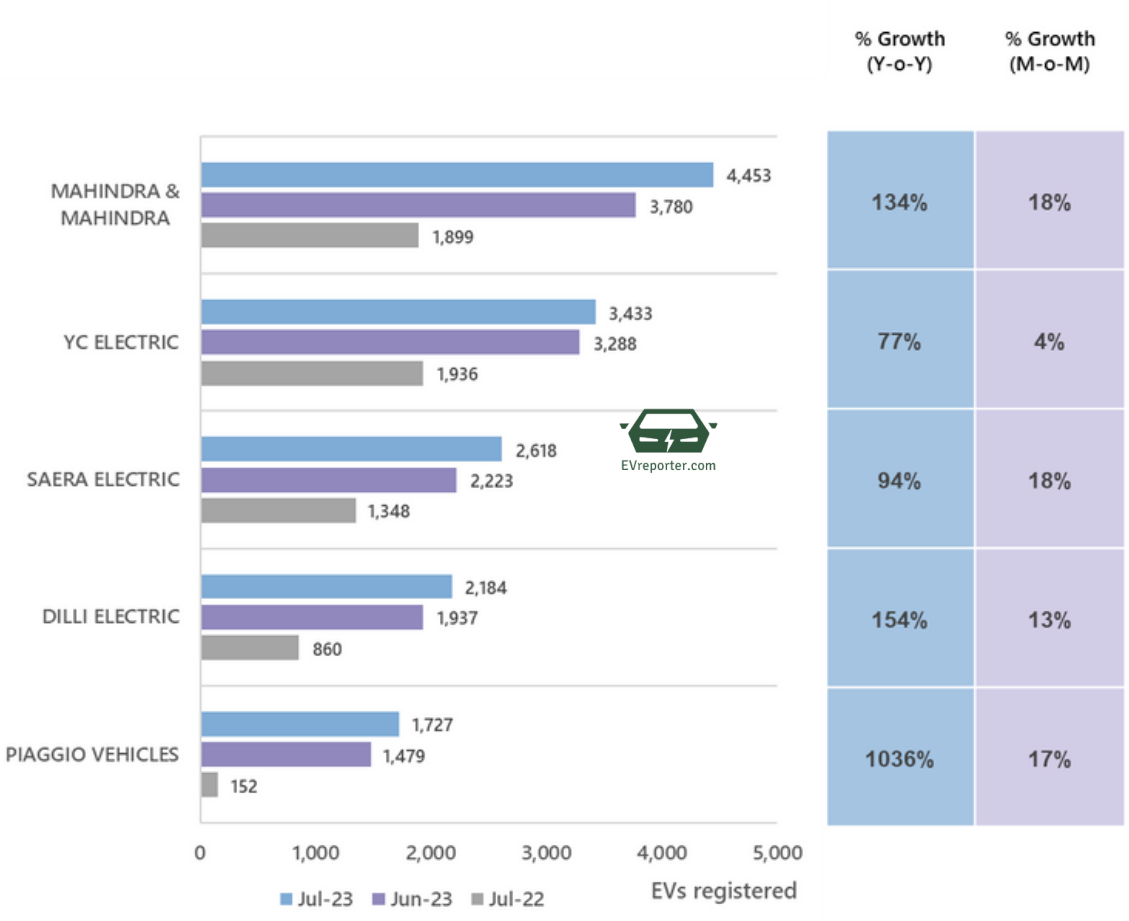


Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs
Low speed 2Ws not included.

3W Passenger Sales Trend by Fuel Type, Jan 2023 - Jul 2023

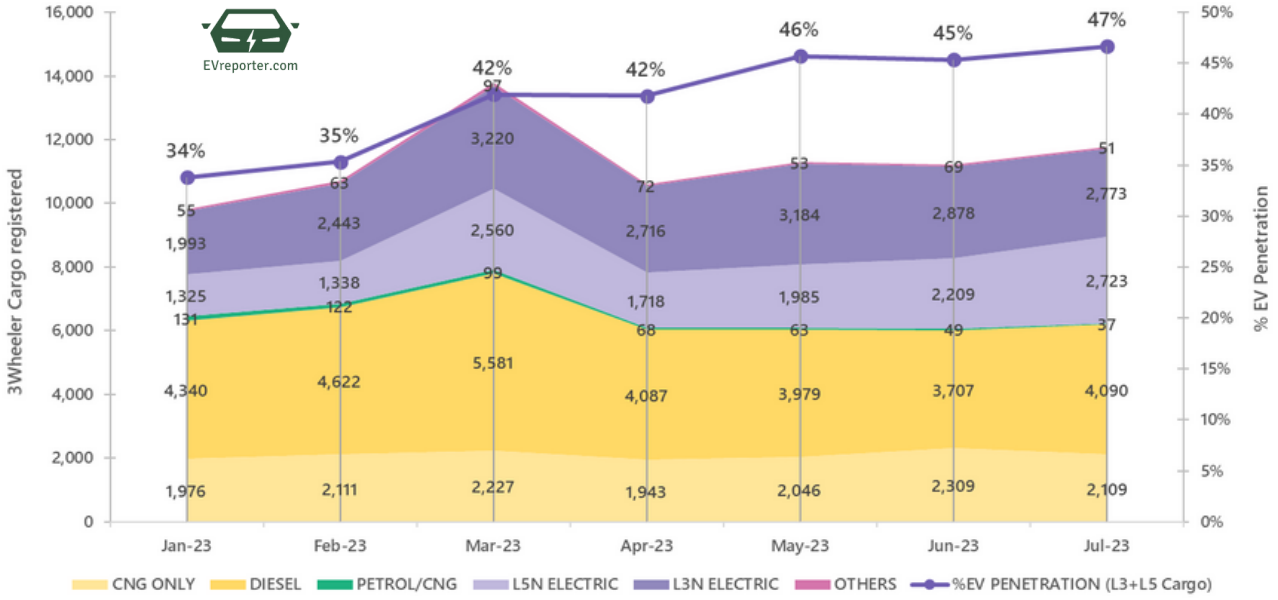


E-3W Passenger Sales Trend by OEM

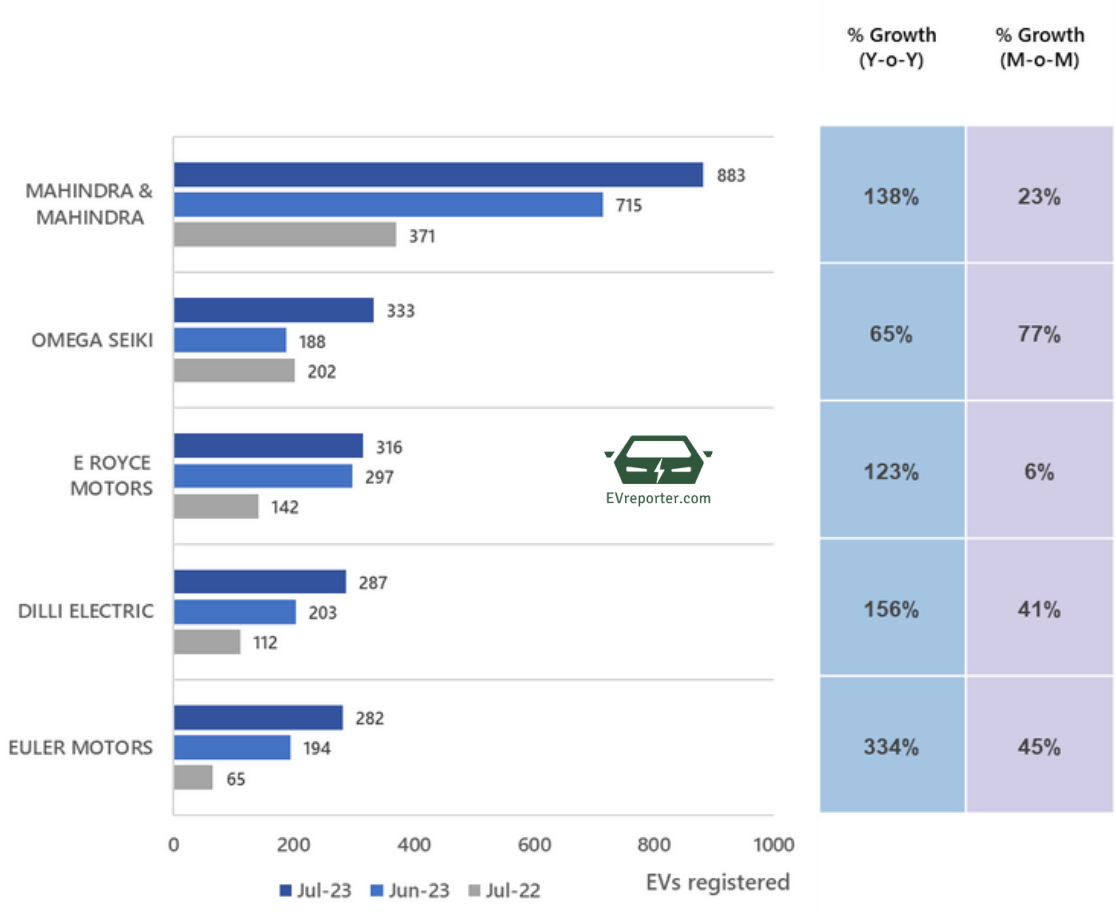


Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs.

3W Cargo Sales Trend by Fuel Type, Jan 2023 - Jul 2023



E-3W Cargo Sales Trend by OEM



Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs.

OEM wise E- 4Wheeler Sales, Jul 2023

S.No	4W OEM	Jul-23	Jun-23	Difference	% Change	Market Share July 23
1	TATA MOTORS	5,326	5,473	-147	-3%	71.3%
2	MG MOTOR	1189	1153	36	3%	15.9%
3	MAHINDRA & MAHINDRA	362	408	-46	-11%	4.8%
4	PCA AUTOMOBILES	215	334	-119	-36%	2.9%
5	BYD INDIA	111	182	-71	-39%	1.5%
6	HYUNDAI MOTOR	111	160	-49	-31%	1.5%
7	BMW INDIA	92	97	-5	-5%	1.2%
8	VOLVO AUTO	30	44	-14	-32%	0.4%
9	OTHERS	35	65	-30	-46%	0.5%
	TOTAL	7,471	7,916	-445	-6%	100%

Others include JLR, Porsche, Audi etc.

Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs.

OEM wise Electric Bus Sales, Jul 2023

S.No	e-Bus OEM	Jul-23	Jun-23	Difference	% Change	Market Share July 23
1	TATA MOTORS	64	153	-89	-58%	47%
2	OLECTRA GREENTECH	26	13	13	100%	19%
3	PMI ELECTRO MOBILITY	20	19	1	5%	15%
4	MYTRAH MOBILITY	11	10	1	10%	8%
5	SWITCH MOBILITY	9	5	4	80%	7%
6	JBM AUTO	5	0	5	-	4%
	TOTAL	135	200	-65	-33%	100%

Source: Vahan Dashboard. Data as per 1352 out of 1438 RTOs across 34 out of 36 state/UTs.

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

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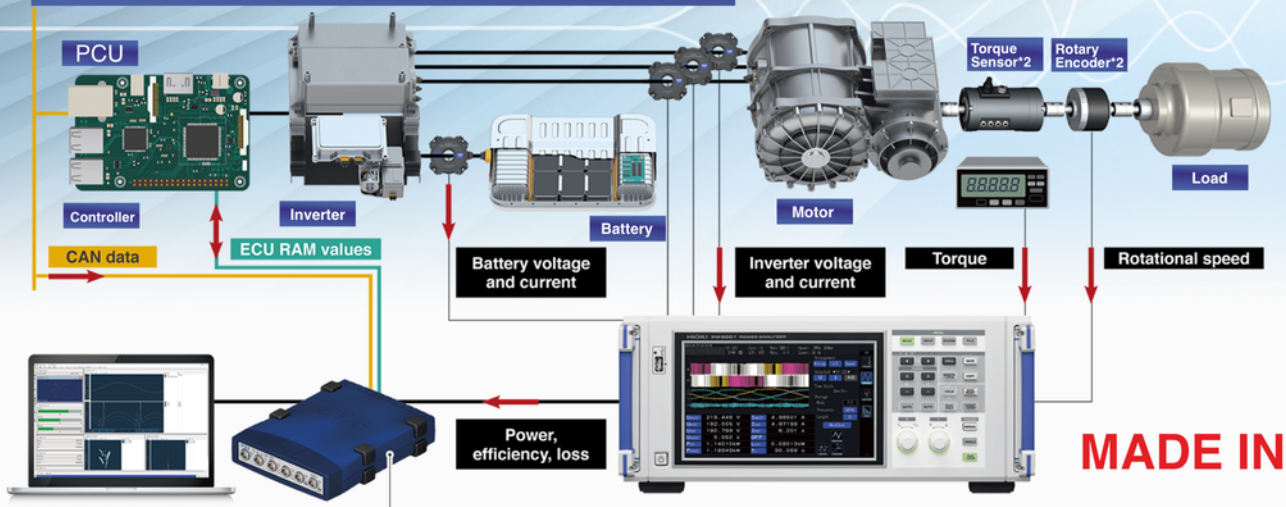

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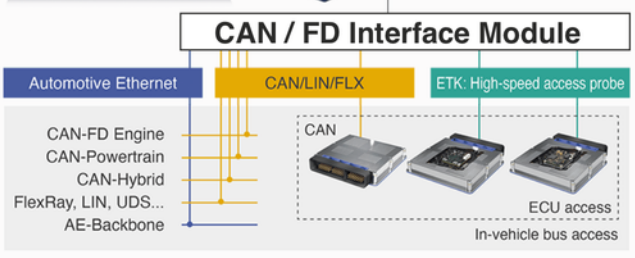

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SMART BMS FOR A POST-SUBSIDY WORLD | FLEXIBILITY IS KEY

The sudden tapering of the FAME-II subsidy in June 2023 has disrupted the nascent e2W industry in India. While there are differing views on whether tapering was the right decision at the right time, the industry has been unanimous in increasing prices. This has consequently had a moderating effect on sales that is expected to persist in the near term.

Demand for e2Ws in commercial applications such as last-mile delivery and shared mobility is expected to be strong, with battery swapping picking up pace, due to favorable economics. Consumer demand for personal ownership will eventually bounce back as well on the strength of new launches and growing awareness of the lower total cost of ownership.

This article by Narsimh Kamath looks at some opportunities in the BMS for Tier1s and OEMs to mitigate the impact of subsidy taper.

Future-proofing BMS to multiple chemistries & pack mechanical designs

In a post-subsidy world, OEMs are racing to launch new lower-cost models. A BMS platform that can provide flexibility to support different pack mechanical designs and battery chemistries would help accelerate the time to market on new launches. Here, it is crucial to consider the following:

- For OEMs who are clear in their choice of NMC chemistry, a 14S BMS may be the most cost-optimized design.
- For OEMs who have either decided to use only LFP or want the flexibility to support LFP in the future, the obvious choice at first glance might be a 16S BMS. However, it is important to consider potential mechanical constraints in the vehicle and pack design that may introduce a split battery pack in some models and, associated with it, one or two busbars. Here, an 18S BMS that supports busbar measurement may provide greater flexibility in supporting a wider range of battery pack mechanical designs in addition to supporting both NMC & LFP chemistries.

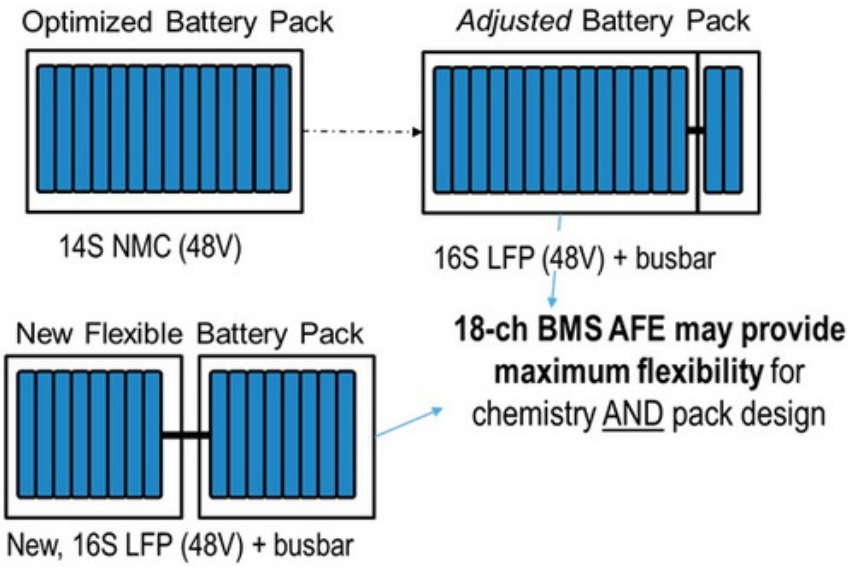

Figure 1: An ideal BMS is flexible to support different pack mechanical designs in addition to supporting multiple cell chemistries

Image credit: Narsimh Kamath

Optimizing battery size for lower cost

In a post-subsidy world, OEMs are actively re-evaluating the battery capacity and, in most cases, are planning to downsize the battery. Rightly, since the FAME subsidy was tied to the battery capacity and with subsidy tapering, so does the motivation to offer large batteries. Here, it is vital to consider the problem of oversizing battery packs to ensure the consumer can achieve the promised range. Typically, the battery cells are kept between 10% and 90% of their full capacity, meaning only 80% of the battery capacity is usable for a normal driving range. Now, if there is a cell voltage measurement error of 5%, the cells must be kept between 15% and 85%, which means that to achieve the same range, the battery must be oversized by close to 18%.

Additionally, suppose the cell voltage measurement error is not specified in terms of a maximum error; then, a further margin must be added to ensure that cells are not over-charged or over-discharged. This means the battery must be further oversized to provide the promised range for the consumer. This oversizing of the battery can add significant costs. It is crucial for the Tier1s and OEMs to evaluate whether the BMS AFE specifies a maximum measurement error applicable across the entire operating temperature range and the whole cell voltage range that is relevant to their battery chemistry. Tier1s may sometimes to tempted to use low-cost BMS AFEs to reduce their BOM. However, a BMS AFE that provides accurate cell voltage measurements within an error that is specified across both the operating temperature range as well as the entire cell voltage range (different range, depending on LFP or NMC chemistry) can save significant costs at the vehicle level for the OEM in terms of optimized battery capacity.

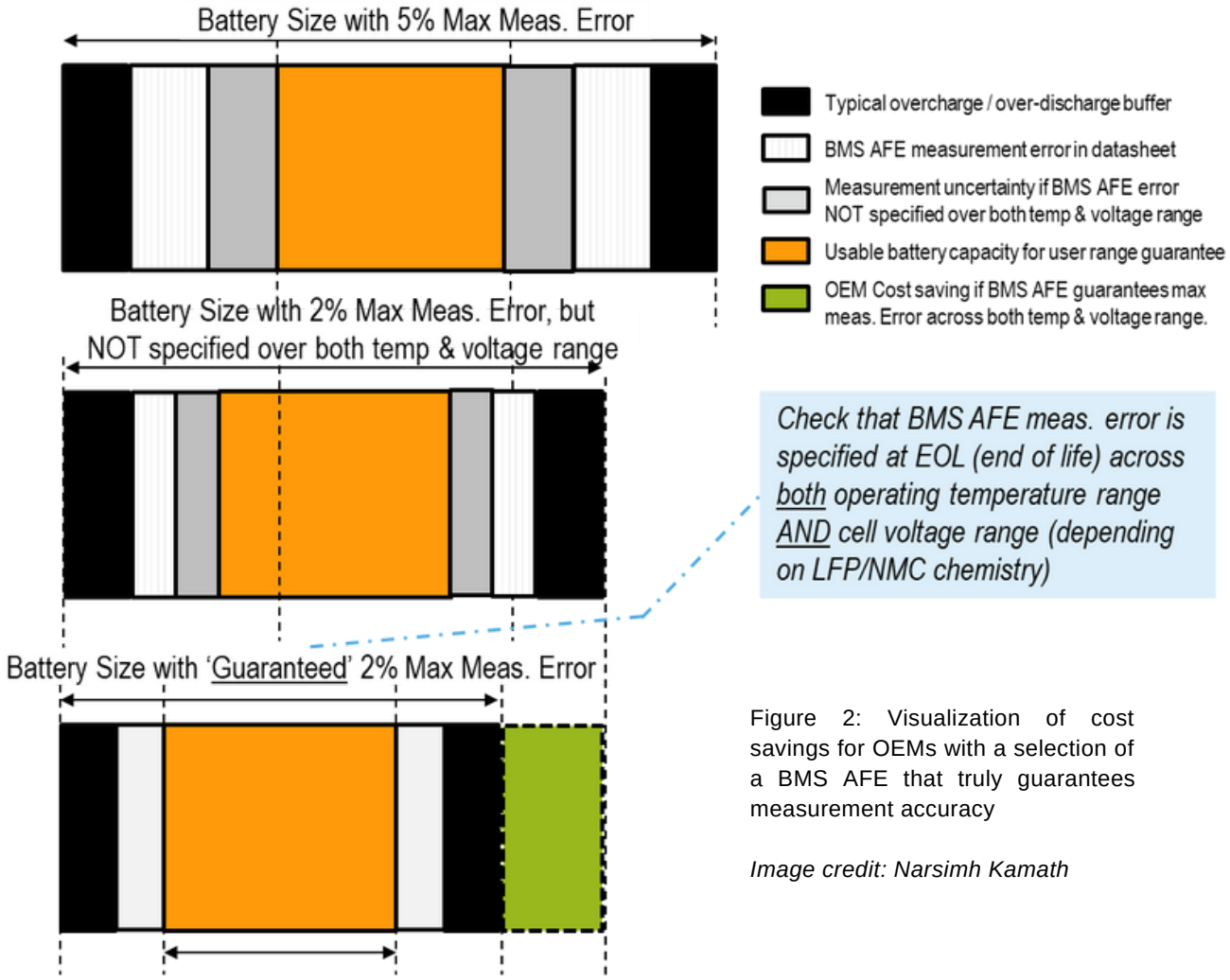

Figure 2: Visualization of cost savings for OEMs with a selection of a BMS AFE that truly guarantees measurement accuracy

Image credit: Narsimh Kamath

Leveraging smart BMS to offer value-added services

In a post-subsidy world, OEMs can benefit from adopting a 'Smart BMS' platform that allows them the ability to leverage digital & AI technologies to offer value-added services to end consumers. Here are a few examples of value-added services that are personalized for each vehicle and user:

- Battery extended warranty
- User-specific insurance
- Optimized charging profiles
- Drive mode recommendations
- Charger recommendations

Smart BMS

A smart BMS is a BMS that employs intelligence at the edge & works in conjunction with a digital twin in the cloud to maximize battery life, ensure battery safety, improve range, and reduce charging time. A smart BMS interprets the raw sensor data (measurements of cell voltages, temperatures, and of the current) and exchanges information with other systems in the vehicle (e.g., charger and VCU) to generate timely insights that help in autonomously protecting the battery, accurately estimating its state of charge and state of health and in constantly optimizing battery operation through drive and charging cycles.

When accompanied by a battery digital twin in the cloud, the smart BMS offers digital services that provide powerful efficiency gains for OEMs and the ability to offer differentiated features and SW updates for enhanced value to consumers.

At the heart of the smart BMS is a powerful and scalable safety microcontroller. The microcontroller must be powerful to execute various software modules for algorithms, control loops, safety monitoring, and safety decisions. It must be scalable to support software updates that allow fast adaptation to changing regulations, bug fixes, and new features such as machine learning at the edge. And finally, it must be a safety microcontroller so that random hardware faults do not cause unintended malfunction.

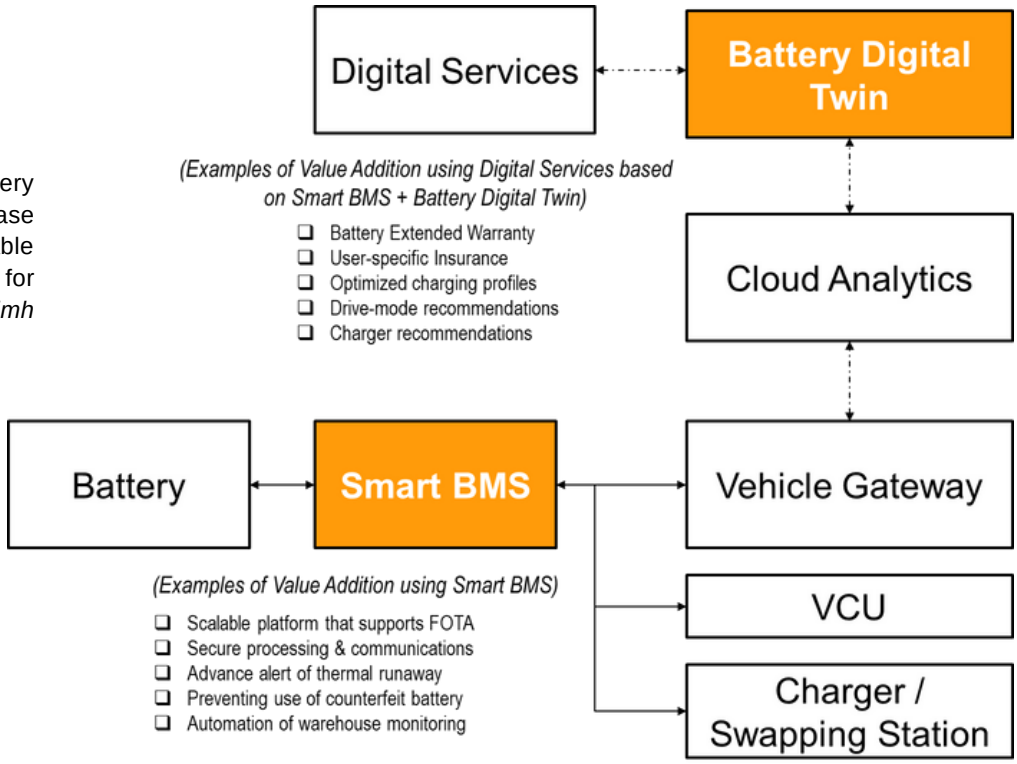

Figure 3: A smart BMS + battery digital twin can increase efficiencies for the OEM & enable value-added services for consumers. *Image credit: Narsimh Kamath*

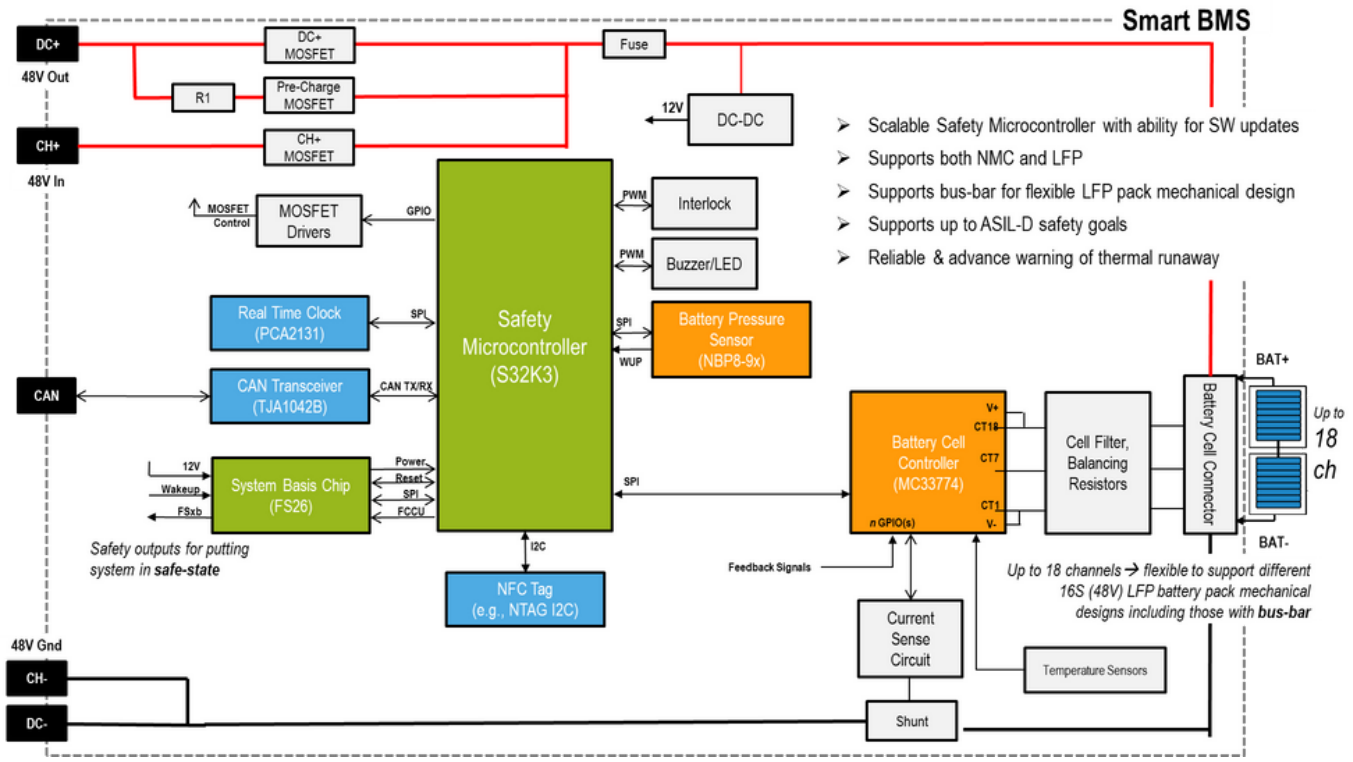

Figure 4: An example of a Smart BMS that is safe, scalable, secure, and flexible. Image credit: Narsimh Kamath

Don't forget safety!

In a post-subsidy world, it will be necessary not to drop the ball when it comes to increasing the safety levels of the pack. Two examples of where there is an opportunity to improve safety levels:

Active paralleling of swappable batteries

Tapering of FAME-II subsidy creates a more level playing field for fixed and swappable batteries. Indeed, swappable batteries offer the benefit of a lower upfront cost of acquiring an EV alongside the convenience of near-zero downtime due to charging. As such, swappable batteries will likely gain traction in a post-subsidy world. For certain use cases, OEMs prefer to use two battery packs that are connected in parallel. The total capacity of the battery pack is then the sum of the capacities in the individual packs. Using this scheme is attractive, for e.g., in models with removable battery packs for swapping or convenience of charging. Using two smaller battery packs means the user can load and unload the individual packs more easily during battery charging or swapping. This configuration can also be visualized as a single battery pack comprising two parallel strings (of battery cells). It introduces unique challenges, such as the possibility of large inrush currents and eddy (circulating) currents when the two individual strings have differing capacities. If left unaddressed, these challenges could pose a risk to battery safety.

Indeed, item 6 in Annexure 8K of AIS-156 Amendment 3 states, ‘REESS shall have Active paralleling circuits for the parallel connection of strings to eliminate circulating currents...’.
Here, an option is to consider using two separate diode-protected DC buses, one for charging; the other for discharge, with software-controlled MOSFETs (part of the SmartBMS) that allow only one path at a time. This configuration eliminates circulating (eddy) currents.

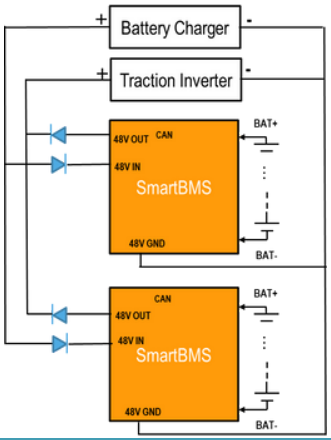

Figure 5: A concept for active paralleling of multiple removable (swappable) batteries in an electric two-wheeler. Image credit: Narsimh Kamath

Early detection of thermal runaway

A key consideration is the prevention and detection of thermal runaway. Indeed, criteria (b) in clause 6.11.4.1 of AIS156 Amendment 3 states that 'REESS shall have an audio-visual warning for early detection of thermal event/gases in case of thermal runaway of cells. This warning shall be activated at least 5 minutes prior to thermal propagation such as fire and explosion occurs.'

Here, it is important to understand early indicators of a thermal runway to determine ways to provide early warning efficiently. The figure below compares various indicators during the thermal runaway process. While gas sensors respond quickly, different cell chemistries may require different gas detection. Gas sensors may also be prone to providing false alarms in case of pollution near the battery pack. On the other hand, pressure sensors offer a fast and reliable reaction to thermal runaway independent of their position in the battery pack. The smartBMS block diagram in an earlier section shows the use of a pressure sensor interfaced with the safety MCU to respond to the AIS156 requirement in an efficient and scalable manner across different battery pack designs.

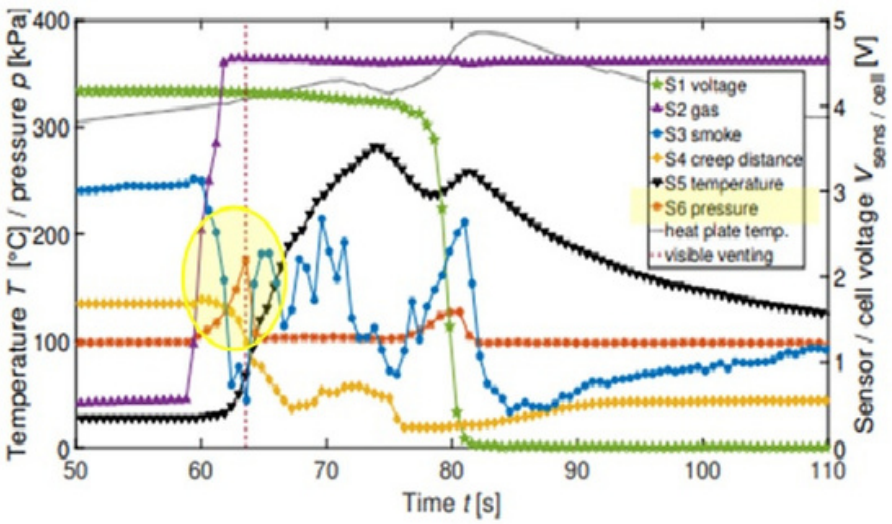

Figure 6: Comparison of different types of sensors in detecting thermal runaways. A small, low-power battery pressure sensor can offer fast and reliable detection independent of its location in the battery pack. Image Credit: 'Fast Thermal Runaway Detection for Lithium-Ion Cells in Large Scale Traction Batteries', Koch et al., Batteries (ISSN 2313-0105).

Conclusion

A post-subsidy world calls for a smart BMS that is flexible and capable of supporting multiple chemistries and battery pack mechanical designs. The BMS should be a conduit for providing digital value-added services to increase revenue generation opportunities for the OEM. Swappable batteries will likely gain traction, so BMS developers should pay attention to additional considerations, such as active paralleling. And finally, the industry should not let down its guard when it comes to safety. Additional safety measures, such as battery pressure sensors, can help with the early detection of thermal runaways.

About the author

Narsimh Kamath *graduated with a B. Tech in Electronics & Communication Engineering from the National Institute of Technology Karnataka and has 15 years of experience spanning multiple roles across design and applications in the semiconductor industry. He is currently the business development manager - electrification for India, Southeast Asia, and ANZ regions at NXP, a global leader in automotive and industrial semiconductors. He has previously served as lead systems architect on a battery management system solution and holds multiple US patents.* ***Reach him at narsimh.kamath@nxp.com.***

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SECURING THE INTERNET OF THINGS IN ELECTRIC VEHICLES

Electric vehicles are well known for running on battery power instead of internal combustion. However, their batteries are not their only essential parts. Electric vehicles (EVs) normally contain dozens of connected sensors and devices that help them function.

These devices—which are part of the Internet of Things (IoT)—rely on wireless networks to exchange data. And where there's a network, there's a pressing need to protect it from security threats. In this article, **Ruchin Kumar, Vice President - South Asia, Futurex, explains how EV manufacturers deploy cryptography to secure the IoT devices in their vehicles.**

Electric vehicles and IoT devices

Essentially, an EV's motor converts electrical energy stored in the batteries into mechanical energy to move the wheels. However, modern automobiles need more than the bare essentials. EVs are often equipped with IoT devices to enhance safety, performance, and convenience for the driver.

Here are a few examples of IoT devices common to electric vehicles:

- **Telematics devices**: These include connected sensors that monitor and report on important metrics like battery performance, speed, internal diagnostics, and geographic location.
- **Vehicle-to-grid (V2G) technology**: V2G technology allows the EV to exchange data with the power grid to return energy to the grid when it's not in use.
- **Charging station management**: EVs can be equipped with IoT devices that allow them to communicate with charging stations and manage the charging process.
- **Remote control**: EVs might have IoT devices that allow drivers to remotely lock and unlock doors, turn on the AC, and start or stop the motor.
- **Safety sensors**: These can monitor an EV's surroundings and inform the driver of things like incoming obstacles and sudden changes in the speed of adjacent vehicles.

Securing IoT devices

Internet of Things devices can be secured by giving them **unique identities**. Assigning a unique identity to a device allows users to monitor it and manage its access to data. To provide an IoT device with an identity, it is necessary to create and issue a **digital certificate to the device.**

Digital certificates are electronic files that bind identifiable information—like device ID numbers or IP addresses—with an asymmetric key pair. Each asymmetric key pair consists of a public key, which encrypts data, and a private key which decrypts it. The certificate will often contain the public key, which is authenticated by its assigned private key to prove the identity of the IoT device.

This process of validating device identity through asymmetric encryption is part of **public key infrastructure (or PKI)**. PKI is a common way to create trust between devices on a network using strong encryption. Similar to how a person might present their driver's license to identify themselves, a device can identify itself to other devices with a digital certificate. When PKI is deployed to secure IoT devices, it mitigates the risk of their data being stolen or sent to unauthorized devices.

So, **PKI, digital certificates, and strong encryption are the strategy for protecting IoT devices**. The question then becomes, how do you deploy that in electric vehicles?

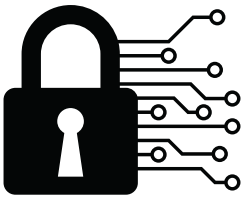
Deploying cryptography for electric vehicles

Manufacturers of electric vehicles have to secure countless IoT devices around the world. This involves the issuing of a huge number of digital certificates. The most efficient way of doing this is to deploy a cryptographic strategy comprising both hardware-based encryption and cryptographic management solutions.

Encryption keys are used in encryption algorithms to encrypt data. They are also used to validate each other, such as when the private key authenticates the public key in an asymmetric pair. A **certificate authority** (CA) is needed to generate and issue certificates. A PKI must be established to manage CAs and the certificate process. And all the encryption keys used throughout the process must be managed: administrators have to define the policies by which keys are created, distributed, rotated, and retired after a set time or condition.

In fewer words, a combination of hardware security modules (HSMs) and key management solutions can be used to accomplish the following use cases to secure IoT devices:

- Generate, sign, and manage encryption keys
- Establish and manage a public key infrastructure (PKI)
- Use enterprise certificate authority (CA) to digitally sign objects



Choosing a solution

The solution for IoT security may sound complex, but implementing the solution can be fairly straightforward. Instead of looking for multiple solutions through different vendors and finding a way to coordinate such a system, **organizations are well advised to find a cryptographic platform that allows them to deploy encryption, PKI, CA, and key management all from one place.**

A **centralized approach to cryptography** is essential to prevent IT sprawl, increase efficiency, reduce costs, and—most importantly—preserve trust across an organization's connected devices and among its customers.

Ruchin Kumar is Vice President of South Asia at Futurex, where he is working with BFSI, Government & Enterprises dealing with critical data and where security & compliance is a concern. He is responsible for developing partner and channel networks, developing strong relationships with key customers, robust business growth and monitoring business operations in the South Asia region.

HOW ELECTRIC CYCLES CAN REVOLUTIONISE LAST-MILE DELIVERY ECONOMICS

Last Mile Delivery unit economics is all about the Total Cost of Ownership (TCO), which includes the vehicle cost and the opex (maintenance and spares cost). The operational costs of e-bikes, including electricity charges and battery maintenance, are considerably lower than those associated with ICE vehicles. By optimizing routes and reducing delivery time, businesses can increase their productivity and serve a larger customer base within a given timeframe.

Raghuveer Chadalavada, CEO and Co-founder of Aurita Bikes shares his perspective on the operational efficiencies and cost savings enabled by using electric bicycles for last-mile deliveries.

Last mile delivery ecosystem

To understand the whole last-mile delivery ecosystem, here are key role players involved:

- **Demand Creators** (e.g. Swiggy, Zomato, Amazon, Flipkart) provide value-added services to end customers and create a demand for doorstep delivery.
- **Third-Party Logistics Players** (e.g. Mahindra Logistics, Lighting Logistics) act as a backbone for demand creators, delivering goods to end customers and managing the delivery partners/riders and vehicle fleet.
- **Rental Companies** (e.g. Yulu, Eveez) provide an alternative to third-party logistics, renting out vehicles to delivery partners/riders.
- **OEMs** deliver purpose-built vehicles to rental companies or third-party logistics players for last-mile delivery operations.
- **Delivery Partners/Riders**, who are gig workers, play a crucial role in the value chain and are responsible for delivering the end packet to customers.

The advantages of eBikes

Comparing different 2W form factors (eMotorbike, e-scooter, ecycle), eCycles always have the lowest TCO. **Typically, e-cycles have a TCO 70-80% less than a petrol 2W, while low-speed e-scooters have a TCO 40-50% less**. This difference of ~25% gives an advantage in the overall transaction. However, e-cycles have their own set of limitations concerning maximum speed, payload carrying capacity, ability to travel longer distances, rider comfort, and overall vehicle life.

Since e-cycles are generally non-CMVR vehicles and do not require special licenses, it becomes crucial to get the right set of design, engineering, and commercial feasibility for e-cycles. **Some applications of e-cycles in last mile include quick commerce, food delivery, and e-commerce last mile in denser regions.**

These applications generally involve **packet sizes below 25-30 kg, average speeds below 25 km/h, and delivery radii ranging from 3-5 km.** The volume of deliveries in these subsegments is significant and growing rapidly.

Insights from Aurita bikes

At Aurita Bikes, successful collaborations with Mahindra Logistics for Amazon Last Mile deliveries have demonstrated tangible benefits. **For every packet delivered, a 15% cost reduction** has been achieved, resulting in a **total cost reduction of around ₹1.88 lakhs over a vehicle life of 3 years**. Furthermore, around 2.8 tons of CO2 emissions have been saved over the same vehicle lifespan. This was attained without compromising the delivery time, user experience, riding comfort, or packet safety.

TCO comparison

In comparing the Total Cost of Ownership between a low speed E-Scooter and Utility E-Cycle, as well as the Utility E-Cycle and Petrol 2W, we can gain valuable insights into the financial aspects of these vehicle choices over a three-year holding period.

Travel Data			
Vehicle Holding Period (Years)	3	Years	
Daily Distance Travelled (km)	60	Km	
No of Days per month	26	Days	
No of Months per Year	12	Months	
Annual Distance Travelled (km)	18720	Km	
Overhead	**Petrol Vehicle**	**E-Scooter**	**Utility E-Cycle**
	WRI Source	Low Speed EV	
Capital Costs			
Vehicle Purchase Cost	₹ 66,271.00	₹ 60,000.00	₹ 32,500.00
Tax	₹ 4,638.00	₹ 0.00	₹ 0.00
Insurance @ Vehicle Holding Period	₹ 4,418.00	₹ 0.00	₹ 0.00
Financial Incentive (Subsidy)	₹ 0.00	₹ 0.00	₹ 0.00
Operational Costs			
Fuel Cost (₹/L or ₹/kWh)	₹ 105.45	₹ 7.00	₹ 7.00
Capacity of Battery (kWh)	₹ 0.00	₹ 1.54	₹ 0.63
Mileage (km/L or Km/Kwh)	38	₹ 85.00	₹ 75.00
Annual Maintainance cost	₹ 7,200.00	₹ 4,800.00	₹ 2,400.00

Summary	Petrol Vehicle	E-Scooter	Utility E-Cycle
	WRI Source	Low Speed EV	
Capital Cost			
Total Vehicle Cost	₹ 75,327.00	₹ 60,000.00	₹ 32,500.00
Misc Cost	0	0	0
Financial Incentive	₹ 0.00	₹ 0.00	₹ 0.00
Sub Total	**₹ 75,327.00**	**₹ 60,000.00**	**₹ 32,500.00**
Annual Operational Cost			
Maintainance Cost	₹ 7,200.00	₹ 4,800.00	₹ 2,400.00
Average Fuel Cost	₹ 51,948.00	₹ 2,367.97	₹ 1,092.52
Misc Cost	0	0	0
Sub Total	**₹ 59,148.00**	**₹ 7,167.97**	**₹ 3,492.52**
Total Operating Cost over 3 years	**₹ 1,77,444.00**	**₹ 21,503.91**	**₹ 10,477.57**
Total Cost of Ownership	**₹ 2,52,771.00**	**₹ 81,503.91**	**₹ 42,977.57**

Calculations by author

For the low-speed **E-Scooter**, the annual operating cost over 3 years amounts to approximately **₹21,504**, considering an annual operational cost of ₹7,168. In contrast, the **Utility E-Cycle** presents a more economical option with an operating cost of around **₹10,478** over 3 years. This represents a significant cost-saving advantage of more than 51% when opting for the **Utility E-Cycle (TCO ₹42,978) over the low-cost E-Scooter (TCO ₹81,504).**

When comparing the Utility E-Cycle with the Petrol 2W, the cost difference becomes even more pronounced. The **Petrol 2W's TCO stands at ₹252,771**, significantly higher than the Utility E-Cycle's TCO of ₹42,978.

Conclusion

The statistics highlighting a **50% jump in cargo bike sales in Europe last year** indicate the growing acceptance of electric bicycles for last-mile delivery purposes. The Indian market has the potential to replicate this trend by offering suitable, cost-effective products. With the government's supportive stance and the potential for cost savings and operational efficiency, the economics of using electric bicycles for last-mile deliveries are highly favourable. The time is ripe for businesses to tap into the economic and environmental advantages of electric bicycles in last-mile deliveries.

Enhancing Electric Vehicle Performance with Advanced Connectors

Connectors serve as crucial coupling devices that enable electrical terminations to form seamless circuits. They facilitate the connection of wires, cables, printed circuit boards, and electronic components. In the realm of electric vehicles (EVs), connectors play a pivotal role, directly impacting various features and functionalities. The design, reliability, and performance of connectors greatly influence the overall performance of EV components.

CHOGORI®
Focused on Your Connections

Chogori: Pioneering EV Connector Solutions Since 2014

Chogori has been at the forefront of E2W (Electric Two-Wheeler) and E3W (Electric Three-Wheeler) connectors since 2014. With an unwavering commitment to innovation, Chogori offers a comprehensive range of connector solutions, catering to applications spanning from low to high current in battery and motor charging and discharging. Continuously striving to meet market demands and leveraging their wealth of experience, Chogori has consistently improved and developed new products.

Introducing the Bourbon Series: Unleashing Advanced Connector Capabilities

One exemplary addition to Chogori's impressive portfolio is the Bourbon series, which epitomizes cutting-edge connector technology. Let's explore the key specifications and features that make it a game-changer.

Basic Specifications: Versatility Meets Power

The Bourbon series boasts three distinct configurations:

2 power pins + 1 charging pin + 7 signal pins
2 power pins + 8 signal pins
3 power pins + 6 signal pins

These configurations provide a wide range of options to suit various EV requirements. The power pins offer a robust rated current range, from 70A to 80A, while the charging pin accommodates up to 25A. With an impressive ingress protection level of IP67, the Bourbon series ensures optimal performance even in challenging environments.

Locking Mechanism: Stability and User-Friendliness Combined

Chogori has implemented an innovative four-locking dot push lock nut for the Bourbon series. This mechanism guarantees a secure and stable connection with enhanced resistance to vibrations. Its rotating pull-out design allows for effortless unlocking, enabling users to disengage the connector single-handedly, even in confined spaces.

Empowering EVs with Bourbon Connectors

The versatility of the Bourbon series renders it indispensable for various EV applications:

Bourbon 2(power) + 8(signal): Designed for battery discharging in electric 2Ws or 3Ws, this configuration excels in delivering reliable power transmission for optimal performance.

Bourbon 3(power) + 6(signal): This configuration is tailored for motors in electric 2Ws, 3Ws and lawnmowers. Its exceptional anti-vibration features ensure reliable and stable connectivity. The panel's high working temperature tolerance of up to 125 °C makes it ideal for demanding motor environments.

Chogori's unwavering dedication to providing state-of-the-art connector solutions has revolutionized the electric vehicle industry. The Bourbon series, with its versatile configurations, advanced locking mechanism, and application-specific features, exemplifies Chogori's commitment to driving innovation in the EV space. By leveraging Chogori's cutting-edge connectors, manufacturers can enhance the performance, reliability, and functionality of their electric vehicles, paving the way for a sustainable and electrified future.

Written by: Lily Ma, Product Manager at Chogori

Enquiries

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BATTERY LEASING MODELS ARE GRADUALLY BECOMING THE BACKBONE FOR THE USED ELECTRIC 2W & 3W MARKET

Today no one wants to buy a used EV because of battery performance uncertainty and the cost of procuring a new battery exceeding twice the market price of the old vehicle. **Jeenit Mehta**, Co-founder of **RedE EV Mobility Pvt Ltd.** shares his take on this price disparity and how battery leasing models can help support the secondary market of electric 2Ws and 3Ws.

As the dialogue from Govind Namdev (Veeran) in the Hindi movie Sarfarosh goes, “Goli ke bina yeh laakhon-karodo ki bandook patthar hai patthar” (“*Without the bullets, these guns are just stone*”).

The same way, **the value of electric vehicles without the costly batteries is nothing.**

Image Source: Meme from Twitter

- The cost of a lithium battery pack currently forms 40-50% of the new electric 2W or 3W.
- Whereas the price of a new battery pack is at least 200% of the market price of the old vehicle in which it is to be fitted.

Primary reasons for this price disparity are:

- **FAME subsidy is for the entire vehicle**: A new EV gets the FAME subsidy, whereas a new component for an old EV has no subsidy.
- **Lack of residual value for old lithium-ion batteries**: In India, most recycling companies do not retrieve valuable materials like Li, Ni, and Co from spent Lithium-ion batteries. They instead extract the black mass using mechanical separation and export it. The price of this black mass for export mainly relies on its Cobalt content. According to an industry practitioner, these end-of-life lithium-ion batteries are at times acquired at rates as low as INR 150 per kg.
- **Battery health is difficult to ascertain**: Since battery warranty is a function of charge-discharge cycles, and the range of the battery is more or less kept grey. Even if a battery is under warranty, it is difficult to ascertain the future utility of a used battery and generally valued at scrap.
- Until now, the electric vehicle market for 2Ws and 3Ws has been dominated by small-scale OEMs that rely heavily on imported components. The availability of these components can be problematic. Additionally, as there are many different models with varying component specifications, people are **hesitant to purchase** these vehicles second-hand.

The scrap value of electric 2-wheelers with an end-of-life lithium-ion battery is typically between Rs 3,000 to Rs 5,000. This is equivalent to around Rs 30 to Rs 50 per kg for the vehicle, which is roughly 4% to 6% of the ex-showroom price of a new vehicle.

How battery leasing is turning the tide for used electric 3W market

For the low-speed 3W, we are seeing a different story. Unlike most electric 2Ws, electric three-wheelers are commercial vehicles. Companies like **Battery Smart** and **Sun Mobility** are providing batteries on lease for three-wheelers. **For an investment of Rs 8,000 to Rs 10,000, lithium-ion batteries with a capacity of more than 80Ah can be leased for life time.**

As a result the electric 3W body (without the battery) still commands a good resale value.

- A used e-rickshaw, which is a low-speed L3 vehicle, generally costs around Rs 30,000 in its mid-life without a battery. Instead of investing in a new lead-acid battery of Rs 35,000 or a new lithium-ion battery with a charger worth Rs 80,000, an investment of Rs 8,000 to Rs 10,000 for a lease makes more sense. This investment is hardly one-third the total price of the old vehicle.
- Battery theft, which is not covered by vehicle insurers, gets covered by battery lease service providers.
- With multiple battery leasing players now in the Indian market, the vehicle owner is not dependent on a single provider anymore and thus has a say.
- Swappable Lithium-ion batteries not only reduce the net weight of the vehicle but also prevent corrosion of the chassis due to acid (which happens in the case of lead-acid batteries), thus prolonging the vehicle's life.

Outlook for used electric 2W

With most battery leasing done at 48V, many used electric 2Ws that work on 32V get excluded from availing of the battery leasing service.

With more OEMs getting into the 48V system and the booming number of riders for the gig economy, **a rise in the leasing of batteries for the used as well as new electric 2Ws is expected.**

Conclusion

Till the time lithium-ion battery costs get reduced drastically, the battery leasing model will continue to create value in used electric 2W space and has already demonstrated it for the low-speed three-wheelers. With more new 2-wheelers and high-speed 3-wheelers penetrating the market, we expect to see similar value creation for used vehicles through the battery leasing model.

UNDERSTANDING AI-BASED ROAD SAFETY SOLUTIONS FOR COMMERCIAL FLEETS

Established in 2015 in India, fleet safety and management solutions company Netradyne was recently conferred with the **FICCI Road Safety Award**. The company has its R&D and manufacturing centre in India. Netradyne says that by adopting its vision-based technology, organizations have achieved a **50% reduction in road accidents** and over 90% decrease in distracted driving incidents.

Netradyne has **raised $197.5 million** globally through key investors such as **Reliance, Softbank, Point 72, Microsoft Corp, and Hyundai.** The company stands at an Annual Recurring Revenue of INR 600 cr. and is on track to cross INR 1000 cr, according to a company statement.

*In this interaction with **Durgadutt Nedungadi, Senior Vice President - India and International Business at Netradyne**, we explore how vision-based systems and Artificial Intelligence are being used to increase road safety in commercial fleet operations.*

What specific road safety challenges are faced by fleet vehicles that differ from those faced by personal vehicles?

There are two primary differences between personal vehicles and fleet vehicles. Firstly, ownership; a personal vehicle is typically owned by an individual, and thus the responsibility for its safety, optimization, and upkeep falls squarely on one person. This is not the case with a fleet, where responsibility is shared among multiple parties.

The second difference lies in driving conditions. A personally owned vehicle is typically limited to a specific geographic area, with occasional long-distance trips. However, this is not the case with commercial fleets. Additionally, commercial drivers often spend much longer periods behind the wheel, with drives lasting between 6-12 hours. This extended driving time creates unique significant challenges for fleet drivers and the vehicles they operate.

How are Netradyne's solutions different from other AI-based dashcams? Are there any India-specific features incorporated for deployment with the Indian fleets?

There are several ways in which we differ.

- One significant distinction is that we were among the **first to introduce a dual-camera system**. The external camera focuses on the relative behaviour of your vehicle vis-a-vis other objects on the road, and the internal camera focuses on the driver.

In the West, where there's a lot more consistency in road construction, we recognize speed signs, stop signs, traffic lights, and U-turns. If there is an infraction, for example, crossing a stop sign, an alert is raised. In India, because we don't have that consistency yet, we've limited ourselves to following distance and collision warning from an external camera perspective. The inward camera checks if the driver is wearing a seatbelt, talking on the phone, or distracted. It also monitors if the driver is drowsy or yawning, among other things.

- The second difference is **precision**. We possess a valuable asset in the form of over 10 billion miles of recorded drive time footage, which we use to train our devices. We are able to deliver alerts to our customers with **90% accuracy or higher**. Detecting a drowsy driver and confirming drowsiness with 90-95% accuracy is what we strive to meet. Other devices may claim to offer similar features, but if they have a lower accuracy rate of 60-70%, false alerts will bombard the user, causing a loss of trust in the device.

We launched simultaneously in the US and India, recognizing the vast difference in driving conditions between the two regions. In the US, the acceptable following distance would probably be 10 to 15 feet, which is not the case in India. Here, we have a reduced following distance threshold. In India, we recognize two-wheelers, auto-rickshaws, and we are in the process of becoming able to recognize cows as these are all very important aspects of Indian road conditions.

- Plus, we use **cameras of the highest resolution**, which give clear videos even at nighttime.
- We now have the capability to **detect environmental conditions** like heavy fog during winter and heavy rain in coastal areas. An alert is raised to the fleet manager, who can identify the vehicles operating in that area and make decisions on whether to change the vehicle speed or stop it in severe conditions.
- Another example is **compound alerts**, where a single violation like following distance may not be severe, but when combined with other alerts like looking at the phone, it becomes a high-severity alert. These are some of the ways we differentiate ourselves.

Can you provide a few of examples where Netradyne solutions have been deployed?

Our solution has been selected by **Amazon for their last-mile delivery vehicles** worldwide. This choice was made because these vehicles operate in challenging conditions.

Drivers often work long hours to ensure timely deliveries. Amazon also closely monitors driver behaviour, including seatbelt usage and phone usage. We are currently exploring ways to detect smoking in the cabin as well. Additionally, **Writer Safeguard**, one of India's foremost cash management companies, has decided to equip their vans with our device due to their need to transport critical cargo.

Are there any risks attached with increased dependence on Artifical Intelligence in ensuring safe driver behaviour?

Here, I would like to to explain the difference between active ADAS and passive ADAS. **Currently, we are focusing on passive ADAS**, which uses the same algorithms as a normal ADAS vehicle. However, instead of giving the vehicle direct control, the **driver makes the decisions**. For example, with auto braking, it's important to test accuracy levels under specific driving conditions. On a US highway, it's acceptable for the auto brake to stop the vehicle immediately from 50 miles an hour, but in India, the auto braking would need to go down gradually from 80 kilometers an hour to 60 kilometers an hour to slow the vehicle without causing a collision.

These methods help reduce risks but require extensive testing and precision to be effective. This is why autonomous vehicles are taking longer to become a reality. At the end of the day, if you can reduce accident levels to anywhere between, say, 20 to 50% using passive ADAS, then that's a risk-free way to go.

There are numerous last-mile delivery and hyperlocal fleets running on electric 3Ws and 2Ws in India. Can your solutions be applied in these cases?

We are strongly looking into how we can have some kind of technology for the two-wheeler market; We don't have one yet. But for the three-wheeler kind of minivans and above, the technology is absolutely valid and viable.

Do insurance companies factor in the integration of tech-based accident prevention systems while charging the insurance premiums for fleets?

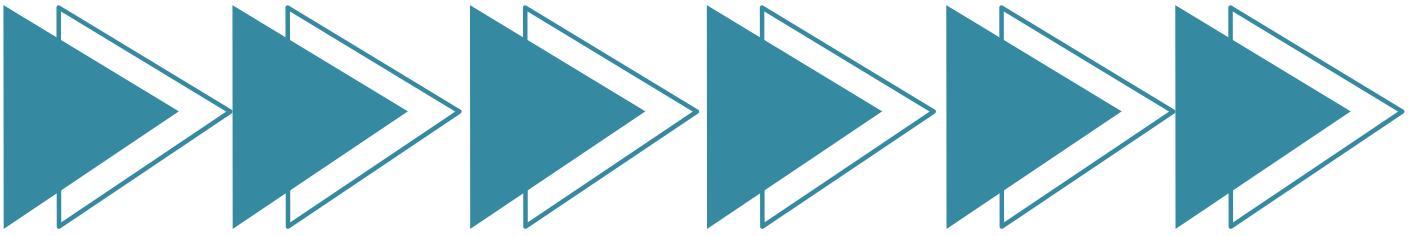
In countries like the US, liabilities are very high, leading to increased interest in solutions like ours. Indian insurance companies are also looking into whether our device can reduce driving risks significantly. This could result in rewarding the customer with lower premiums or certifying the driver for a lower premium. There are various ways of structuring this, and insurance companies in India are currently exploring these possibilities.

Are there any other road safety solutions in the pipeline that Netradyne intends to roll out in future.

Our main focus is **road safety through the use of vision-based technology**. We aim to provide a comprehensive solution that includes not only safety but also basic fleet management, fuel management, and vehicle maintenance. This way, our customers won't have to purchase separate solutions for these needs. We may partner with other companies to achieve this goal, but our focus remains on safety.

As of today, yours is an aftermarket solution. Are you also talking to OEMs to bring it as a standard fitment in some vehicles?

Currently, the majority of our business is aftermarket. However, we are engaged in promising discussions with various Indian original equipment manufacturers (OEMs). It has become clear to OEMs that ADAS, whether in the form of purely passive or a combination of passive and active systems, will soon be essential in vehicles. As a result, we are in advanced talks with multiple Indian OEMs, although we have not signed anyone yet.



XYRON™ E-mobility

AsahiKASEI
Creating for Tomorrow

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 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

● Excellent
● Good

AsahiKASEI
XYRON™ LEONA™ TENAC™ TENAC™-C
PRODUCTS

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1 HabourFront Place, #16-03, Singapore 098633
+65 6324 3001
www.asahi-kasei-plastics.com/en/

contact us

CHALLENGES DURING LITHIUM-ION CELL MANUFACTURING PLANT SETUP - PART 6

EXPANSION AND DIVERSIFICATION OF PORTFOLIO

Rahul Bollini is writing a series of articles explaining the challenges faced during Lithium-ion cell manufacturing plant setup, which should be relevant to any company entering this field. This article (part 6 of the series) explains the challenges faced by the Lithium-ion cell manufacturing company while planning for expansion and diversification.

Expansion for the same type of cell manufacturing is generally done in a modular way, meaning multiple lines of the same type of equipment are added if the plant is already fully automated. In case of the plant not being fully automated, automation is deployed to increase the output of the existing equipment.

Less automation allows for more flexibility in the desired output but with some limitations. For example, 15Ah (higher cycle life model) and 16Ah capacity of LFP in 33140 cylindrical form factors can be produced with the same equipment. Cells with a lower height and similar diameter, such as 6Ah of LFP in 32700 cylindrical form factor, can also be produced from the same equipment (some minor changes and tuning required). Additionally, higher and lower gravimetric energy density (Wh) cells can be produced by modifying the inner cell design. LFP cells can reach very close to 200Wh/Kg by simply using thinner current collectors and utilising more active material in the cathode and anode slurry composition. But this affects the cycle life, internal resistance, charging speed and will lead to higher temperature rise during operations.

An already well-automated plant running at full capacity utilisation does not have much scope to increase the production capacity. Hence similar size lines are added in more numbers to increase the production capacity. One might ask, what's the difference in the equipment in the semi-automatic and fully automatic plants? To start with, the mixer capacity would be smaller, and their quantities would be higher in a semi-automatic plant to allow for various formulations and various mixing speeds to produce various types of cells. On the other hand, a fully automatic plant would use a larger capacity to ensure higher homogeneity in the production, and it would focus towards making fewer models of cells.

If the system integrator for the plant expansion is different from the previous one, especially during increasing automation levels, it can pose a challenge in bringing the plant to work as per desired output. There could be certain delays and higher wastage of raw material & production output. With changing styles of automation, there are changes in the production styles, and the workforce needs additional training to handle these changes.

For a cell manufacturing company, producing a diverse range of cells is crucial in order to meet the needs of a wider range of applications. Due to their higher energy density (gravimetric and volumetric), voltage, power and cycle life, Lithium-ion batteries are becoming increasingly popular. As a result, many applications are now transitioning to these batteries. But these applications demand different types of Lithium-ion cells.

Consider a Lithium-ion cell used in a cell phone versus the one used in an electric bus. These two applications require different form factors, capacities, and chemistries. It can be challenging for a cell manufacturer to produce for both, but selecting applications that use similar parameters for Lithium-ion cells is a simpler task.

Types of diversification in cells

Same form factor, different capacities/power ratings - Ever heard of EV cell and ESS cell? Let's take an example of a LFP prismatic cell. A manufacturer can produce EV cells that can deliver higher power (C rate) and have higher energy density (gravimetric and volumetric) but lower cycle life. Compare it with ESS cells of the same LFP prismatic type, which would have lower power and lower energy density but provide a higher cycle life. The changes happen in the cell design and in the type of materials (similar but different specifications) used.

This parameter is looked upon as a development plan. Companies plan to enhance the discharge capacity of their products with the same form factor and dimension in order to provide greater gravimetric and volumetric energy density in the future.

Same form factor and different chemistries - This can be explained very well by taking the example of 5Ah capacity cells in 21700 cylindrical form factors. The same cell can be manufactured with NMC 811 + Silicon Graphite and NCA + Silicon Graphite combinations. The choice of cathode materials offers different advantages and disadvantages related to maximum continuous current (charge and discharge), peak discharge current, cycle life and safety.

Same capacity and different form factors - Let's take the example of 5Ah capacity cells. This capacity can be manufactured in 21700 cylindrical form factor and 26650 cylindrical form factor. 21700 uses NMC 811 or NCA cathode + Silicon Graphite while 26650 uses NMC 532/622 + Graphite. The advantages of a 21700 cell, in this case, include higher energy gravimetric and volumetric energy density. The advantages of a 26650 cell, in this case, include higher safety and cycle life and lower cost.

All the diversification plans require the R&D team of a company to make tried and tested products and study them for a good period of time before bringing the product into mass production. There are many tests related to ageing that tell how good the newly developed product will be. These tests can be cycle life at various charge and discharge C rate combinations at various temperatures, end-of-life study, calendar ageing, rise in IR with ageing, thermal profiling with ageing, Wh and Ah efficiency of cell with ageing, etc.

Upcoming parts of this series:

Part – 7 (Evolving to Newer Technologies)
Part – 8 (Backward Integration)

Rahul Bollini *is an R&D expert in Lithium-ion cells with 8 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. Rahul can be reached at +91-7204957389 and bollinienergy@gmail.com.*

INSIGHTS INTO ELECTRIC VEHICLE FLEET ADOPTION AND STAKEHOLDER CONCERNS

ALT Mobility is a leasing and lifecycle management company with a fleet of 5,000 EVs across 7 cities in India, primarily two-wheelers and three-wheelers. They are working with 11 OEMs, and their fleet partners include the likes of LetsTransport, Lithium Urban, Entoo, EVeeZ, and CABT.

In this chat with **Dev Arora (CEO & Co-founder)**, we discuss their business model, stakeholder concerns, challenges with financing electric vehicles, residual value of EVs and effective asset management for an extended vehicle lifetime.

What is the business model of Alt Mobility? Which stakeholders do you interact with?

ALT collaborates with fleet operators, offering comprehensive full-stack leasing and lifecycle management solutions for their fleets. **With no upfront costs, fleet operators can scale up their fleets and pay a monthly lease** rental that covers the vehicle cost, service, insurance, fleet monitoring, and telematics. We establish co-leasing partnerships with banks, non-banking financial companies (NBFCs), and leasing companies to address their concerns regarding residual value risk and reduce operating costs.

In close partnership with OEMs, we strive to provide the most **competitive leasing rates and tenures** in the market. We also collaborate with insurance providers, charge point operators, service garages, and roadside assistance teams across the cities where we operate, streamlining the entire user experience.

Our integrated ecosystem is designed to simplify fleet electrification at scale, ensuring maximum uptime and extending the overall lifespan of the vehicles. We reduce the total cost of ownership to unparalleled levels. Our seamless, cost-effective solution empowers fleet operators to embrace electrification and reap the benefits of sustainable mobility.

How are different stakeholders responding to the growing demand for EVs, and what are their apprehensions?

EVs offer the advantage of up to **20% lower monthly operating costs** and overall total cost of ownership compared to traditional combustion engine vehicles. **Among the adopters of EVs, B2B fleet operators and aggregators remain the largest segment**, with new-age EV logistic companies leading the way, followed closely by established players. According to data shared by our original equipment manufacturer (OEM) and fleet partners, **fleets account for 70-80% of the overall EV penetration, with over 90% of them opting for leasing instead of financing.**

Fleet operators are looking for several key benefits, including an asset-light balance sheet, low monthly cash outflows, no upfront capital expenditure costs, the lowest total cost of ownership, flexible ownership options, and a fully managed experience to transition to electric vehicles. **However, the adoption of EVs among drivers remains relatively low** due to factors such as high financing costs, range anxiety, lack of understanding regarding vehicle repairs, and limited availability of charging and service infrastructure.

How are banks and financing institutions looking at this space?

Throughout this year, there has been a remarkable level of interest from financial institutions (FIs) to actively participate in the electric vehicle financing space. FIs acknowledge the enormous potential within this sector, but they are proceeding with cautious investments. **The high premium associated with financing commercial EVs primarily stems from the lack of a secondary market and insufficient data on the residual value of these assets. Conventional players in the market lack the expertise to evaluate EVs accurately,** and the limited availability of market sentiment data hinders the pricing of vehicles solely based on market conditions.

To address this challenge, a data-enabled approach becomes **essential to comprehend the usable life of the battery pack**, which constitutes 40% of the vehicle cost. By gaining insights into battery life, users and lenders can develop confidence in the redeployment and resale capabilities of EVs, thus mitigating risks associated with financing.

What is required to unlock access to finance and reduce the cost of financing for commercial electric fleets?

The risk **premium associated with financing EV fleets is over 5% higher** than combustion engine vehicles. CV finance has already been associated with the high cost of financing given the credit profile of borrowers, bankability of underlying income streams, high collection costs, and overall risk premium associated with the segment. With EVs, there's an added layer of risk surrounding asset bankability. EVs, however, present the opportunity for **data-driven underwriting** – lenders which are able to leverage the ability to understand and underwrite the underlying asset and use those capabilities to reduce the operating cost and the risk premiums would be able to drive down their internal costs and provide more value to customers.

What can stakeholders do to increase the bankability of EV financing?

We are currently working with the first generation of electric vehicles in India, and we actively provide feedback to most OEMs regarding the need for product improvements. Our suggestions encompass areas such as addressing product flaws, enhancing the longevity of the vehicles, expanding the service network, and ensuring the availability of spare parts. We anticipate that **many of these changes will be implemented in the upcoming second-generation vehicles**, scheduled to be launched in the coming months and years. It is crucial for vehicles to be built specifically for India, taking into account the unique road conditions and temperature variations.

In addition to product enhancements, we emphasize **the importance of OEMs having greater control over the battery packs. We prefer working with OEMs that manufacture their own packs and are transparent in sharing data with us.** An electric vehicle that lacks sufficient data hampers our ability to effectively support our fleets on the ground and fully leverage our capabilities to collaborate with our OEM partners in improving fleet uptime.

Furthermore, **effective asset management** is of utmost importance. Vehicles should not be designed or used with a limited lifespan of just three years. We firmly believe that with the expertise of a dedicated team that understands the underlying technology, the lifespan and performance of the vehicles can be significantly extended. This approach reduces the likelihood of default, as improved earnings for drivers and fleets contribute to enhanced asset bankability. Moreover, the vehicle's resale value becomes sufficient to recover the outstanding amount owed to the financier.

What happens to the vehicle after the warranty period, and how does Alt Moblity manage the residual value risk?

We have developed products that extend the warranty of the vehicle in collaboration with OEMs and insurance partners. **During the second life of the vehicle, we work closely with our OEM partners to refurbish both the vehicle and the battery pack, preparing them for redeployment with a new driver or fleet operator.** Our in-depth understanding of the underlying technology, combined with ongoing asset monitoring and maintenance, ensures that our fleets are in optimal condition and can be continuously redeployed.

When the battery pack reaches the end of its life, we replace it and continue leasing the vehicle, keeping it operational for as long as possible. Our primary objective is not to sell the vehicle but to operate it with a focus on continuous optimization of vehicle performance. Through alerts, recommendations, and promoting driving behavioural changes, we aim to reduce the overall monthly outflow and total cost of ownership for the fleet. By maximizing the lifespan and performance of the vehicles in our fleet, we deliver value to our customers while contributing to the sustainability and longevity of the EV ecosystem.

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RELIABLE AND COST-EFFECTIVE ELECTRIC MOTORS

EMF Innovations Pvt Ltd (EMFi) is a technology provider specialising in the design and manufacture of electric motors & controllers for green mobility and other applications based on customers' technical specifications. EMFi is headquartered in Singapore with substantial R&D and manufacturing operations in India.

Our Products

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We design and produce BLDC Hub and Inner Rotor Motors, Switched Reluctance Motors (SRMs) and Permanent Magnet Synchronous Motors (PMSMs) for 2-wheelers, 3-wheelers, and various other applications.

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Battery swapping start-up for electric 2W and 3Ws, **Battery Smart** has successfully **raised $33 million** in Pre-Series B round. The round saw participation from both existing and new investors, including Tiger Global Management, Blume Ventures, Ecosystem Integrity Fund, and British International Investment. Battery Smart had previously raised $25 million in a Series A funding round led by Tiger Global in June 2022.

Mumbai-based **Neuron Energy has raised INR 20 crores during Pre-Series A Round.** The company said is heading towards crossing the INR 100 Crores net sales revenue mark. Neuron Energy provides li-ion batteries for electric 2Ws, 3Ws, golf carts and forklifts. According to the company website, it sells more than 5,000 batteries per month to many large OEMs.

Mufin Green Finance has secured **USD 1 million** in funding from UK registered **Shell Foundation** to create a USD 2 million joint de-risking pool in the form of First Loan Default Guarantee. The funding is aimed at catalyzing commercial debt by enabling Mufin to leverage approx US$ 40-60 million debt over five years in two to three cycles for additional lending through recycling of de-risking pool. This would allow Mufin to fund ~42,000 EVs for low-income clients.

GreenCell Mobility and REC Limited have forged a **INR 3,000 Crores partnership** through an MoU. This collaboration aims to accelerate the acquisition of more than 3,000 e-buses and support alternative fuel technology bus projects, battery energy storage initiatives, and establishing a robust charging infrastructure network.

PMI Electro Mobility has signed an MoU with REC Limited. PMI Electroc will have the ability to receive INR 480 crores of financial assistance from REC Limited in the form of debt over 5 years.

LOHUM will serve as **Altigreen Propulsion Labs's Extended Producer Responsibility (EPR) partner** for end-of-life battery management. Lohum will recycle the spent batteries from Altigreen's electric vehicles using its NEETM™ technology which allows for the recovery of 95% of battery raw materials. Over the next three years, **LOHUM aims to recycle 1 GWh of Altigreen EV cargo vehicle batteries.**

Transport Department, Government of Uttar Pradesh, has launched the EV Subsidy portal for the state. The subsidy will be provided on the early bird method. The subsidy scheme for EV buyers in Uttar Pradesh provides the following incentives:

- **2-Wheeler EV:** 15% of ex-factory cost up to Rs 5000 per vehicle subject to the maximum budget outlay of Rs 100 Cr to a maximum of 2 Lac EVs.
- **4-Wheeler EV:** 15% of ex-factory cost up to Rs 1 lakh per vehicle subject to a maximum budget outlay of Rs 250 Cr to a maximum of 25000 EVs.
- **E-Buses (Non-Govt. i.e. School buses, ambulances, etc.):** 15% of ex-factory cost up to Rs 20 lakh per vehicle subject to the maximum budget outlay of Rs 80 Cr to a maximum of 400 E-Buses.
- **E-Goods Carriers:** 10% of ex-factory cost up to Rs 1,00.000 per vehicle subject to the maximum budget outlay of Rs 10 Cr to a maximum of 1000 E-Goods Carriers.

भारी उद्योग मंत्रालय
MINISTRY OF
HEAVY INDUSTRIES
सत्यमेव जयते

The Ministry of Heavy Industries (MHI) will conduct re-bidding for 20 GWh remaining capacity for ACC manufacturing under PLI scheme. Notably, the first round of the ACC PLI bidding was concluded in March 2022.

Ola Electric qualified for the PLI ACC scheme final selection (20 GWh) alongside Hyundai Global Motors (20 GWh), **Reliance Industries** (5 GWh) and **Rajesh Exports** (5 GWh). Later, Hyundai Global Motors was disqualified as the Hyundai group issued a statement that the former was NOT an official entity of the group. The remaining three signed the PLI Scheme on July 29, 2022.

Log9 Materials, a battery tech start-up based in Bengaluru, announced a partnership with **Hala Mobility India**, a multimodal EV logistics services platform headquartered in Hyderabad. Hala Mobility will gain access to **1500 electric two-wheelers** called BzinessLite InstaCharged by Log9. Log9 will provide Hala Mobility with access to its rapid-charging stations, ensuring convenient charging options for their end customers.

Log9, together with its **OEM partner Quantum Energy**, previously announced a mission to deploy 10,000 2W InstaCharged EVs across India by March 2024.

Battery solutions company **C4V** and **Trot Solutions, a UAE-based company** that offers infrastructure solutions for ports, are joining hands to **develop self-sustainable ports in India.** The focus is on creating **renewable energy solutions integrated with energy storage** to meet the power demands of ports, especially during peak hours and on reinforcing eco-friendly power sources to power port equipment, including e-mobility solutions like port container cranes, trailers, forklifts, and port trucks.

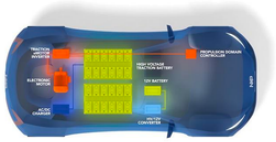
Automotive component manufacturer **Spark Minda Group** has secured a significant contract from a leading OEM to produce **electric vehicle chargers**. The lifetime value of the order is **INR 750 crores**. The chargers will be manufactured in **Pune**.

Valeo expands its **Ultrasonic sensor manufacturing capacity to 7 million** units at the Sanand plant in Gujarat. The first production line at Sanand was started in November 2021. With this additional line, the total production capacity will increase from 3 million to 7 million units annually.

Singapore-headquartered global investment firm **Temasek will invest INR 1,200 crore into MEAL (Mahindra Electric Automobile Limited), the four-wheeler passenger electric vehicle company, resulting in Temasek's ownership of a 1.49% to 2.97% stake.**

Temasek will join British International Investments as an investor in MEAL. With this investment, **Mahindra's EV subsidiary's valuation** goes up by 15% from up to INR 70,070 crore to up to **INR 80,580 crore**.

Mahindra is setting up an **EV battery testing facility at Mahindra Research Valley (MRV), Chengalpattu, Tamil Nadu, with an Investment of INR 210 Crores**. An MoU between M&M and Guidance, Government of Tamilnadu, was established in July 2022 for the former to make an additional investment of INR 500 crores in the state. Along with the battery testing facility, the company has also come forward with an investment proposal worth INR 290 Crore for a crash testing lab in Mahindra SUV Proving Track, SIPCOT Cheyyar Industrial Park and INR 12 Crore worth of investment in their Information Technology Facility located in Coimbatore.



Mahindra & Mahindra has entered into an MoU with **NXP Semiconductors,** a leading player in secure connectivity solutions, to collaborate on e-mobility solutions for a wide range of vehicles, such as utility vehicles, light commercial vehicles, farm equipment, and tractors.

Mahindra will leverage NXP's automotive system solutions and expertise in areas like **zonal and domain controllers, electrification, advanced vehicle networking, and secure car access technologies** for their upcoming platforms.

Servotech Power Systems has established a wholly owned subsidiary, **Techbec Green Energy, to manufacture key components for EV chargers** like Power modules, CCS 2 guns, Type 2 guns, Connectors, Control Cards, PLC Modules & Lithium-ion Batteries. The new subsidiary will operate from a manufacturing facility in Sonipat, Haryana.

To kickstart, Servotech and Techbec Green Energy are investing **₹30 Crores.** The companies are planning to further invest ₹300 Crores by March 2025.

BGAUSS unveiled its new electric scooter, BG C12, with an ARAI-certified range of 143 km and a 3.2 kWh-CAN-enabled Li-ion battery.

The electric scooter comes with a waterproof IP 67-rated electric motor and battery pack.

DelEVery, Coimbatore-based **Future Motors Corporation's** Brand for commercial fleet, **has launched an electric 2W XL 200 starting at ₹ 1,14,900.** The e-2W has a range of 120 km, a top speed of 45 kmph and a load-carrying capacity of up to 250 kg. The vehicle is based on Australia's Benzina Zero duo.

Madhya Pradesh-based **Enigma Automobiles** has launched **Ambier N8 electric scooter with a range of 200 kilometres** on a single charge and a 50 kmph top speed at a starting ex-showroom tag of **INR 1,05,000**.

Ambier N8 is powered by a 1500-watt BLDC motor, offering a top speed of 45 kmph – 50 kmph. It has a load capacity of 200 kg, including the driver. The scooter also features a 26-litre boot capacity.

Oben Electric has delivered the first 25 units of its electric motorcycles at an event held at their manufacturing facility in Jigani, Bangalore. The company said it has 21,000 pre-orders for its product and is actively expanding its manufacturing capacity. Oben has raised INR 88 crores since its inception and is looking to launch a second product in 2024.

Hyderabad-based Quantum Energy has tied up with **ScooEV,** an EV 2W rental company in Bangalore, to deploy over 1000 units of Quantum Energy's Bziness Pro e-scooters for last-mile deliveries.

The **Bziness Pro e-scooter** is equipped with a 1200W motor, allowing it to reach a top speed of 55 kmph. Its LFP battery offers a range of up to 135 km on a single charge with a 200 kg load capacity. The scooter comes with a 3-year or 90,000 km warranty.

FinTech platform **Rupyy** has announced its foray into the **electric vehicle financing**. Rupyy has partnered with OEMs and multi-brand outlets (MBOs) such as Pure EV, Trinity, Blive - MBO, Tork, Jitendra EV, Hero Electric, Electric One - MBO, Hop Electric, Ampere, Hero MotoCorp in the EV industry to offer accessible loans to customers.

BattRE Electric Mobility announced that its in-house R&D unit has been accorded **government recognition** under the certification TU/IV-RD/4916/2023 by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (Government of India). The centre, which started in 2020 has received 20 patents, which includes 12 patents for its Electric scooters and 8 patents for its upcoming Motorcycles.

Greaves Electric Mobility, the E-mobility division of Greaves Cotton Limited, has achieved more than **200,000 secondary sales of its Ampere brand electric 2W** as of the first quarter of fiscal year 2024. In April, the Company announced surpassing the 100,000 sales milestone of its Ampere brand electric 2-wheelers in the fiscal year 2023. The numbers include low-speed E2W sales.

Fortum Charge & Drive India, one of the leading charge point operators, has **rebranded to Glida India**, a new brand identity that represents seamless and reliable electric mobility experiences. Established in 2017, GLIDA is present across 15 states and 6 highways with over 450 public EV charging points offering charging options of CCS, DC001 and Type 2.

CHARGE ZONE launched ChargeCloud, a SaaS solution that the CPOs manage EV charging stations and offers software services that connect chargers to CHARGE+ZONE's CMS. Charging station operators can subscribe to ChargeCloud for a fee of **INR 499 per charger per month.** The EV drivers get access to the network through a mobile app.

Euler Motors, an electric L5 company, announced its expansion in South India with the launch of **four new retail outlets across Karnataka and Telangana.** This expansion intends to cater to the retail, logistics and e-commerce demand for sustainable mobility solutions in the Southern region. With this, the company now has four showrooms covering Bangalore (Peenya and Mysore Road) and Hyderabad (Malakpet and Balanagar).

Nissan will adopt the **North American Charging Standard (NACS)** beginning in 2025. From 2024, Nissan will make available a NACS charging adapter for Ariya models, which are currently equipped with CCS1 for DC fast charging. Starting in 2025, Nissan will begin offering EVs for the US and Canadian markets with a NACS port.

Mercedes-Benz electric vehicles in North America will also adopt the Tesla-developed charging technology starting in 2025. Earlier, **Rivian**, **Ford**, **GM**, and **Polestar** also announced adopt Tesla's NACS. **ABB E-mobility** also announced the addition of NACS as an option for their chargers, along with other global and regional standards (CCS, MCS, CHAdeMO, GB/T).

Seven major global automakers – **BMW Group, General Motors, Honda, Hyundai Motor Company, Kia, Mercedes-Benz Group, and Stellantis NV –** are joining forces to establish a JV to accelerate EV transition in North America. The JV plans to install at least 30,000 charging points across urban and highway locations. These charging stations will support both the CCS and NACS connectors.

The JV intends to power the charging network solely by renewable energy. The first stations are expected to open in the summer of 2024 in the United States and later in Canada. As of July 2023, there are currently 32,000 publicly available DC fast chargers in the United States, serving 2.3 million electric vehicles. This results in a ratio of 72 vehicles per charger. National Renewable Energy Laboratory estimates that 182,000 DC fast chargers will be required to meet the needs of an expected 30-42 million plug-in vehicles on the road by 2030

Tata Sons will build a 40 GW battery cell gigafactory in the UK. The investment, of over £4 billion, will deliver electric mobility and renewable energy storage solutions for customers in UK and Europe. **JLR and Tata Motors will be anchor customers, with supplies commencing in 2026.** The gigafactory will produce battery cells and packs for a variety of applications within the mobility and energy sectors.

Electromin, a smart-mobility solutions provider under Petromin Corporation, **is set to launch the first electric vehicle ultra-fast DC charging network in the Kingdom of Saudi Arabia (KSA).** These DC chargers will complement Electromin's existing network of over 100 AC chargers that were installed in 2022.

Volkswagen Group aims to strengthen its 'in China for China' strategy and bring more electric models to the country. **Volkswagen will acquire 4.99% of the stake in Chinese EV OEM XPENG for approximately US$700 million.** The two companies will also jointly develop two B-class BEVs (mid-size segment) under the Volkswagen brand for sale in the Chinese market leveraging XPENG's G9 platform, Connectivity and ADAS software. The models are expected to start production in 2026.

AUDI AG and SAIC Motor will jointly develop connected electric models in a new premium segment, in which Audi is not yet represented in China.

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