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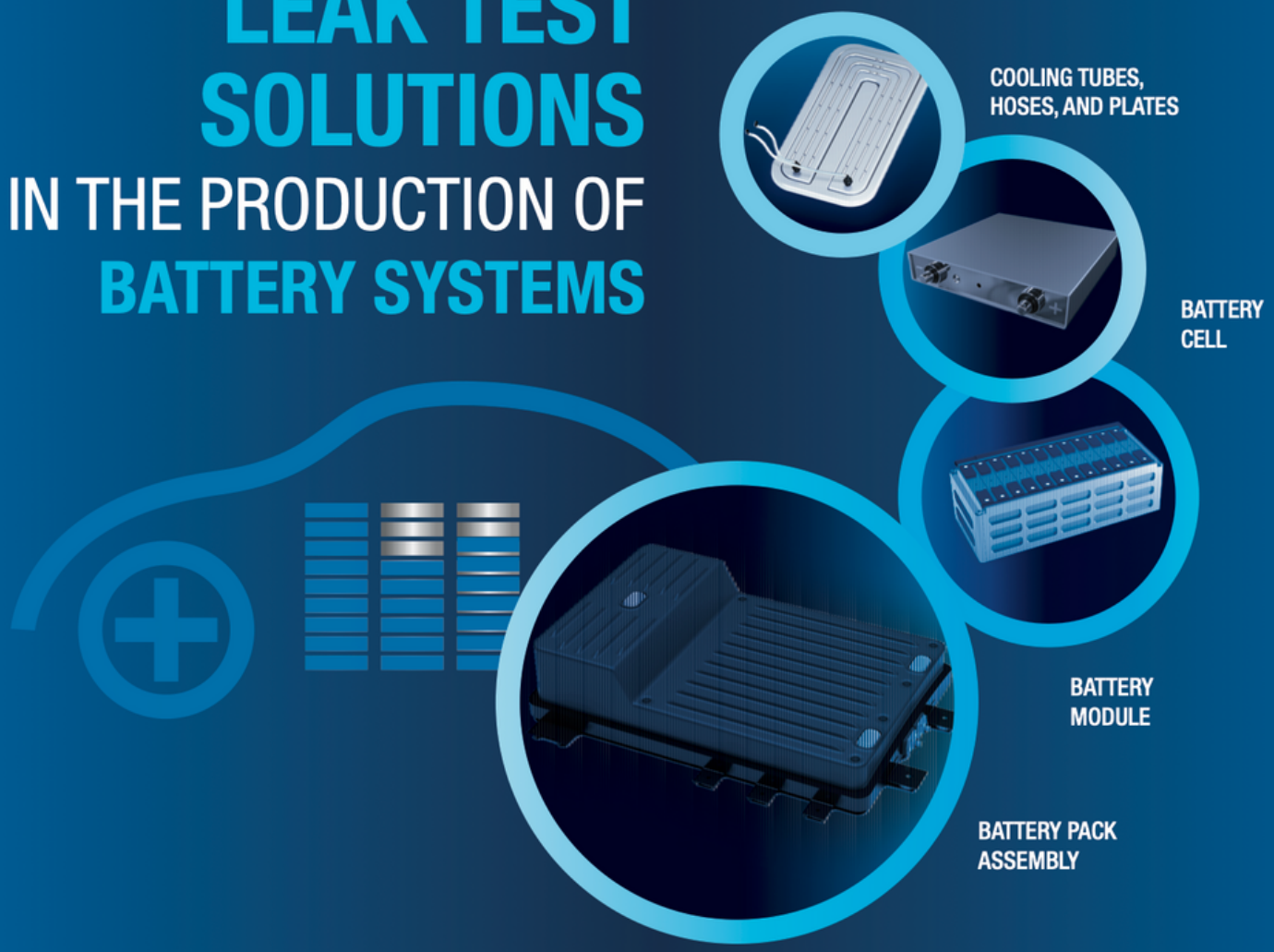
JULY 2022 | MAGAZINE

WHAT'S INSIDE

MARPOSS

LEAK TEST SOLUTIONS IN THE PRODUCTION OF BATTERY SYSTEMS



THE TRACTION BATTERY
THE CORE ELEMENT OF AN ELECTRIC VEHICLE...AND MUCH MORE

INDIA eMobility SHOW
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Booth G4 - Hall 1

Marposs, with a wide range of available options, offers tailor-made solutions for leakage control. With manual or automatic machine systems any type of battery cells, modules, packs, cooling circuits can be inspected, to fit all requirements of different industry sectors like automotive, consumer electronics, stationary storage.

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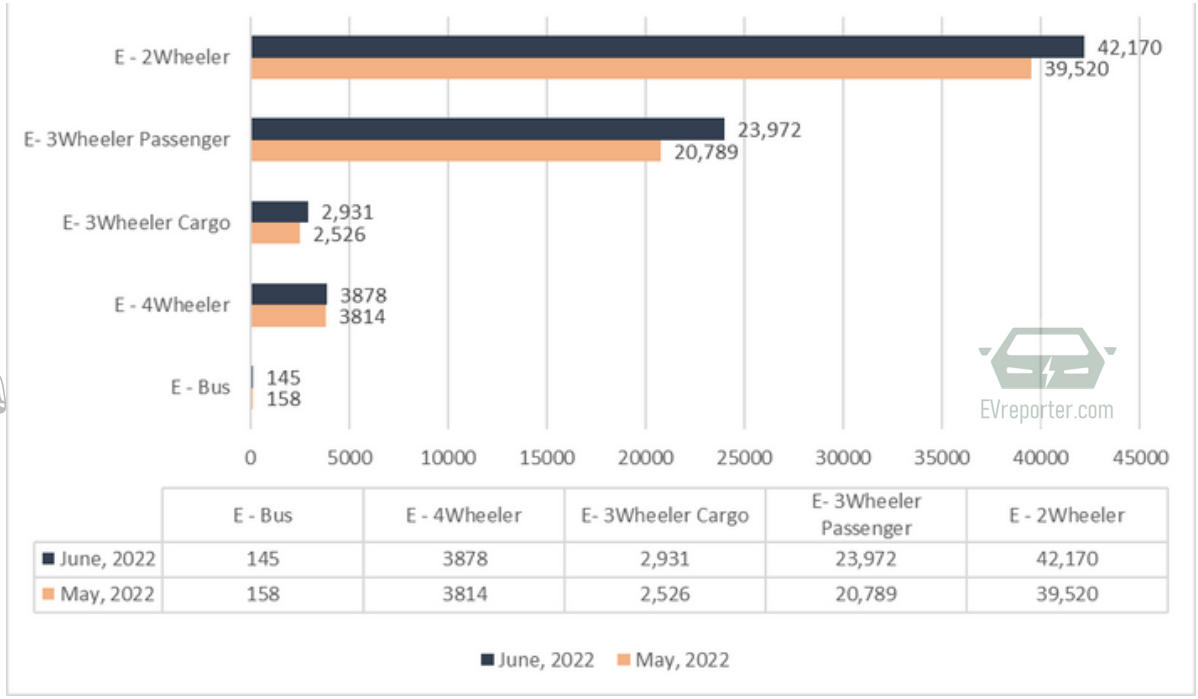
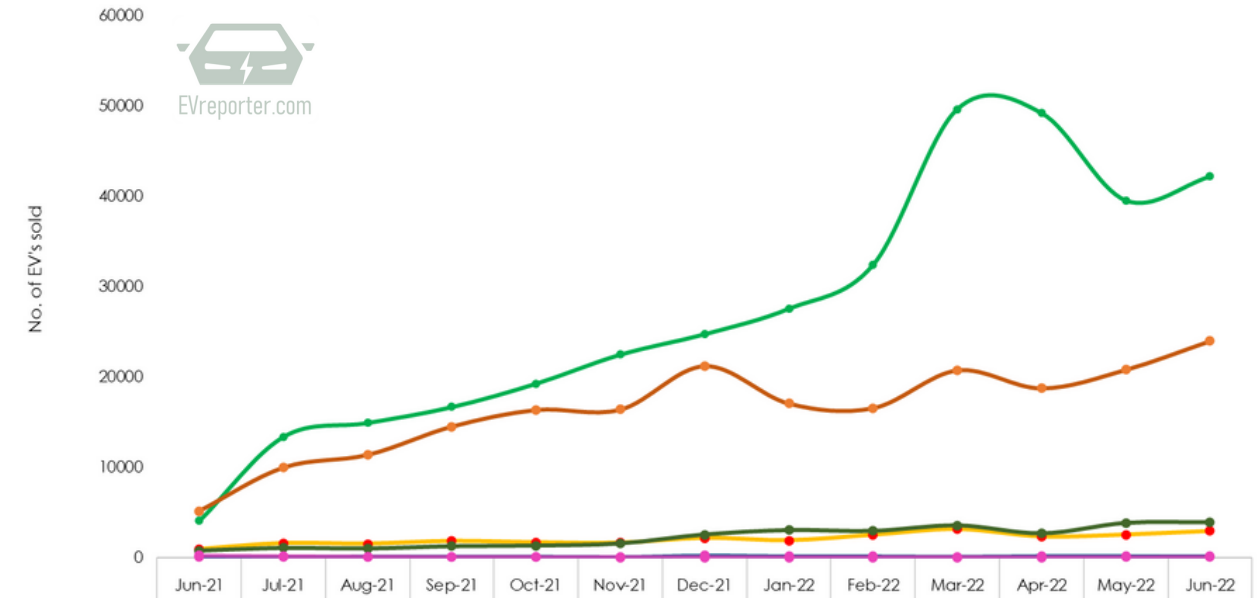
Category-wise Electric Vehicle sales, Jun 2022

Total Registered Electric Vehicle Sales - **June 22 - 73,158** | May 22 - 66,839



	E - Bus	E - 4Wheeler	E- 3Wheeler Cargo	E- 3Wheeler Passenger	E - 2Wheeler
June, 2022	145	3878	2,931	23,972	42,170
May, 2022	158	3814	2,526	20,789	39,520

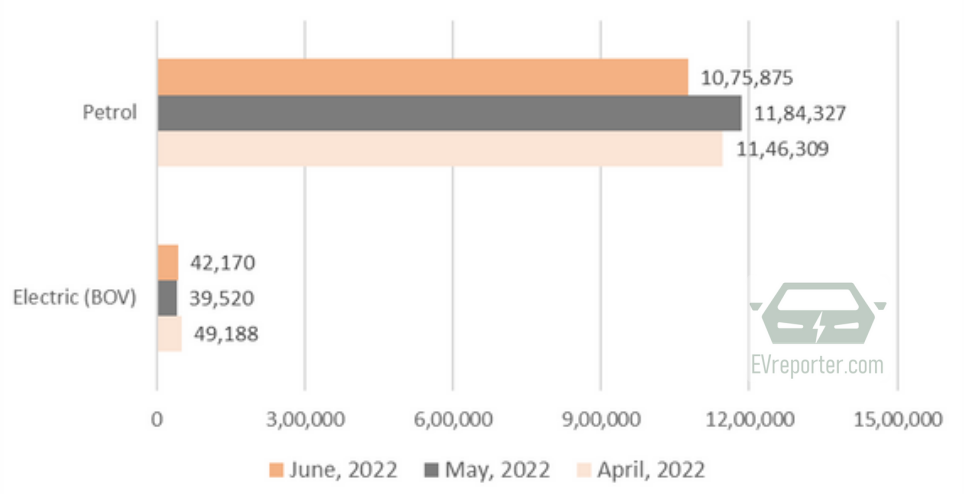
Category wise-Sales Trend from June 2021 to June 2022



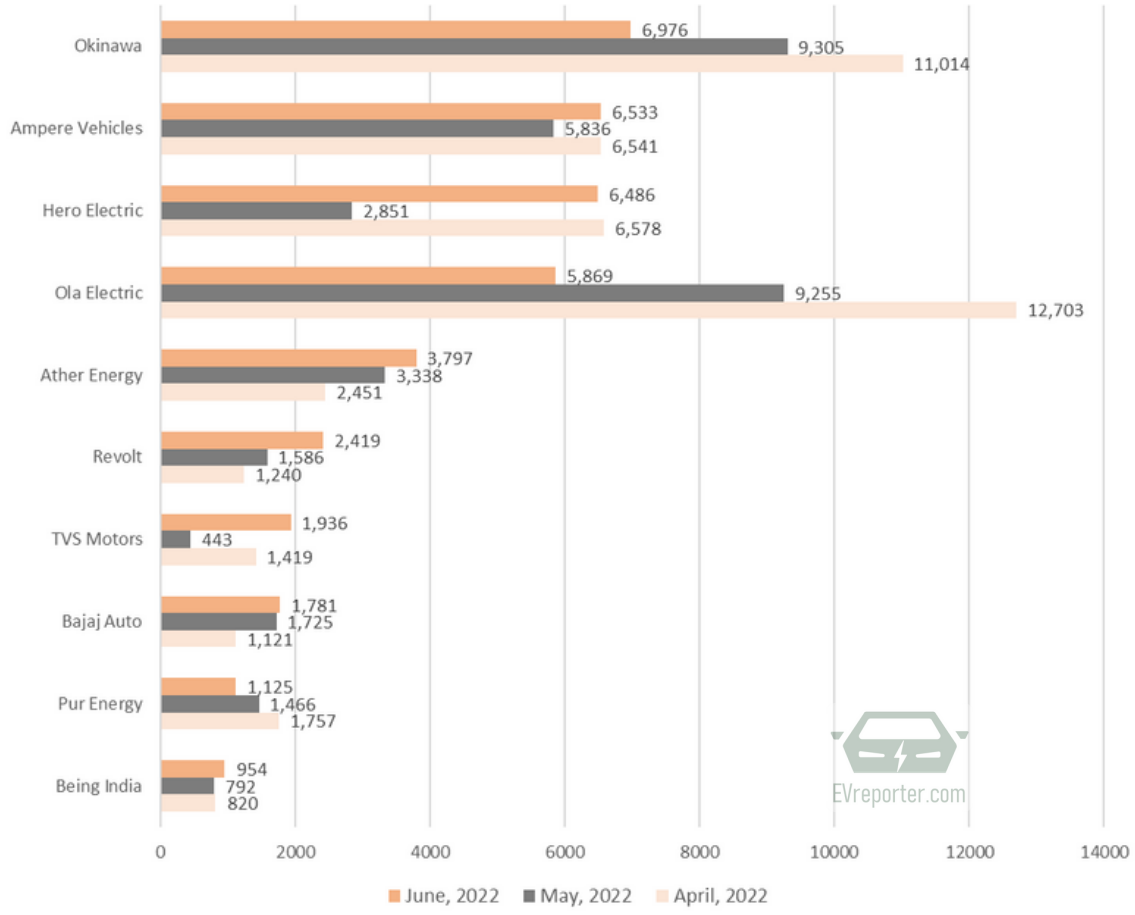
	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
2W	4073	13389	14911	16672	19264	22474	24732	27555	32416	49642	49182	39,520	42,170
3W Passenger	5147	9962	11366	14505	16340	16383	21208	17039	16540	20731	18735	20,789	23,972
3W Cargo	923	1582	1519	1825	1671	1632	2162	1893	2509	3146	2318	2,526	2,931
4W	766	1063	999	1250	1320	1559	2548	3,020	2933	3,545	2668	3,814	3,878
e-Bus	70	44	80	79	84	34	221	126	133	76	164	158	145
Others	219	142	86	47	43	18	25	27	21	29	26	32	62
TOTAL	**11198**	**26181**	**28961**	**34379**	**38722**	**42108**	**50899**	**49660**	**54552**	**77169**	**73093**	**66839**	**73,158**

Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs. Low speed e-2Ws not included.

Fuel wise 2-Wheeler Sales Trend, Apr - June 2022

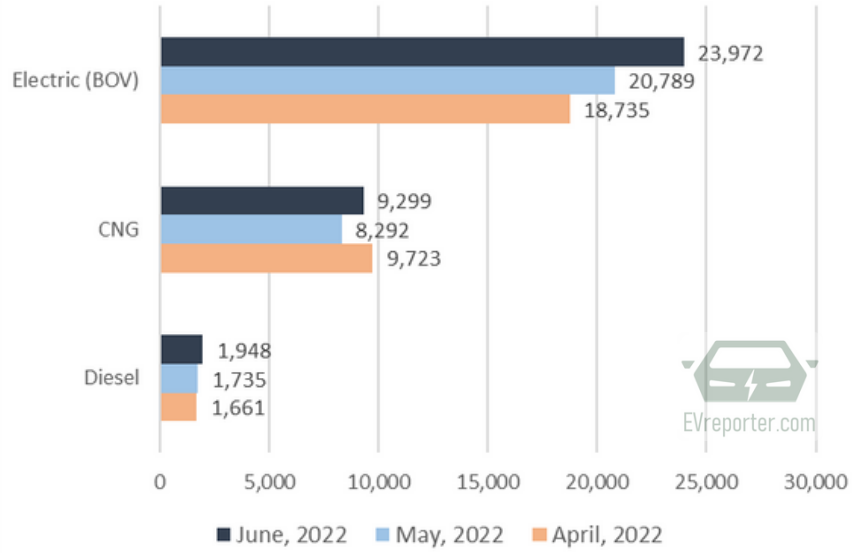


High Speed E - 2W Sales Trend by OEM, Apr - June 2022

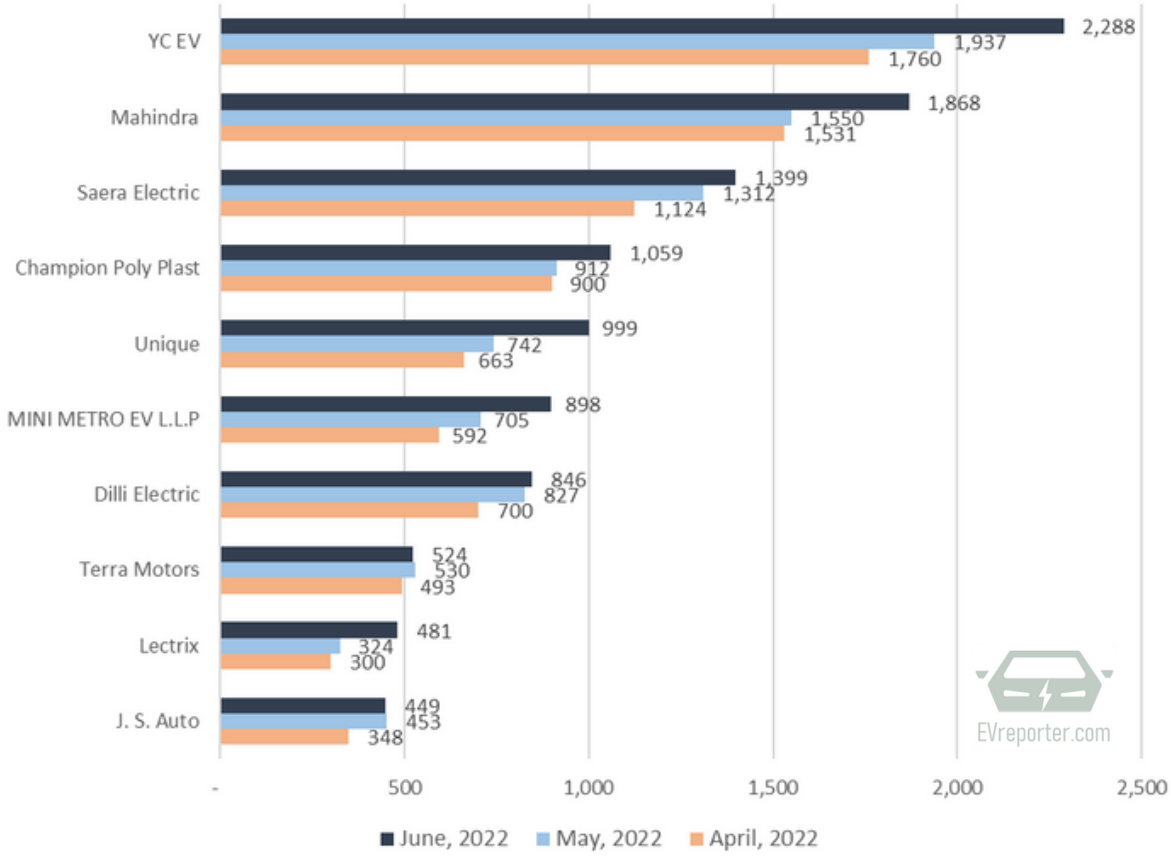


Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs
Note: Low speed Electric 2 Wheelers data is not included

3W Passenger Sales Trend by Fuel Type, Apr - June 2022



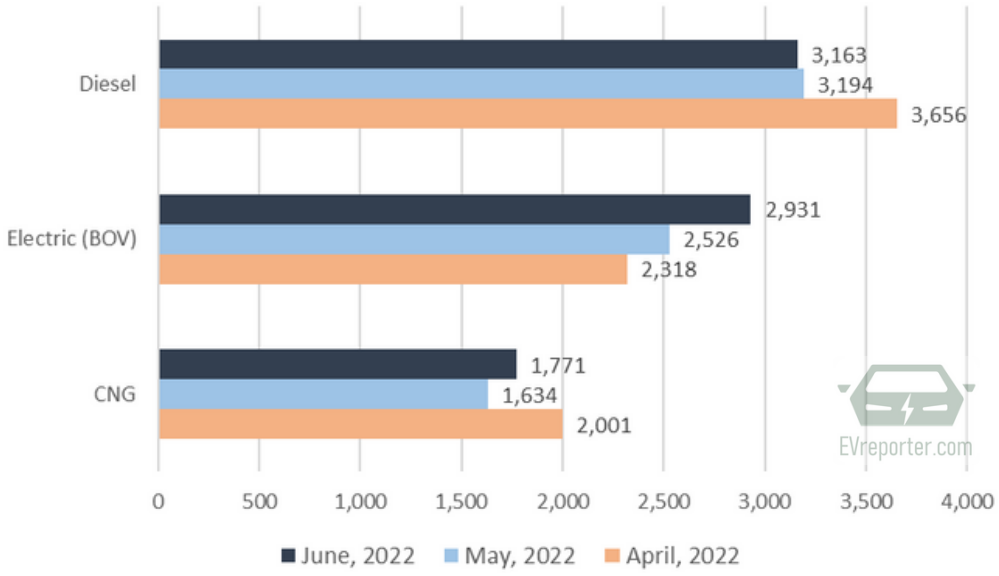
E-3W Passenger Sales Trend by OEM, Apr - June 2022



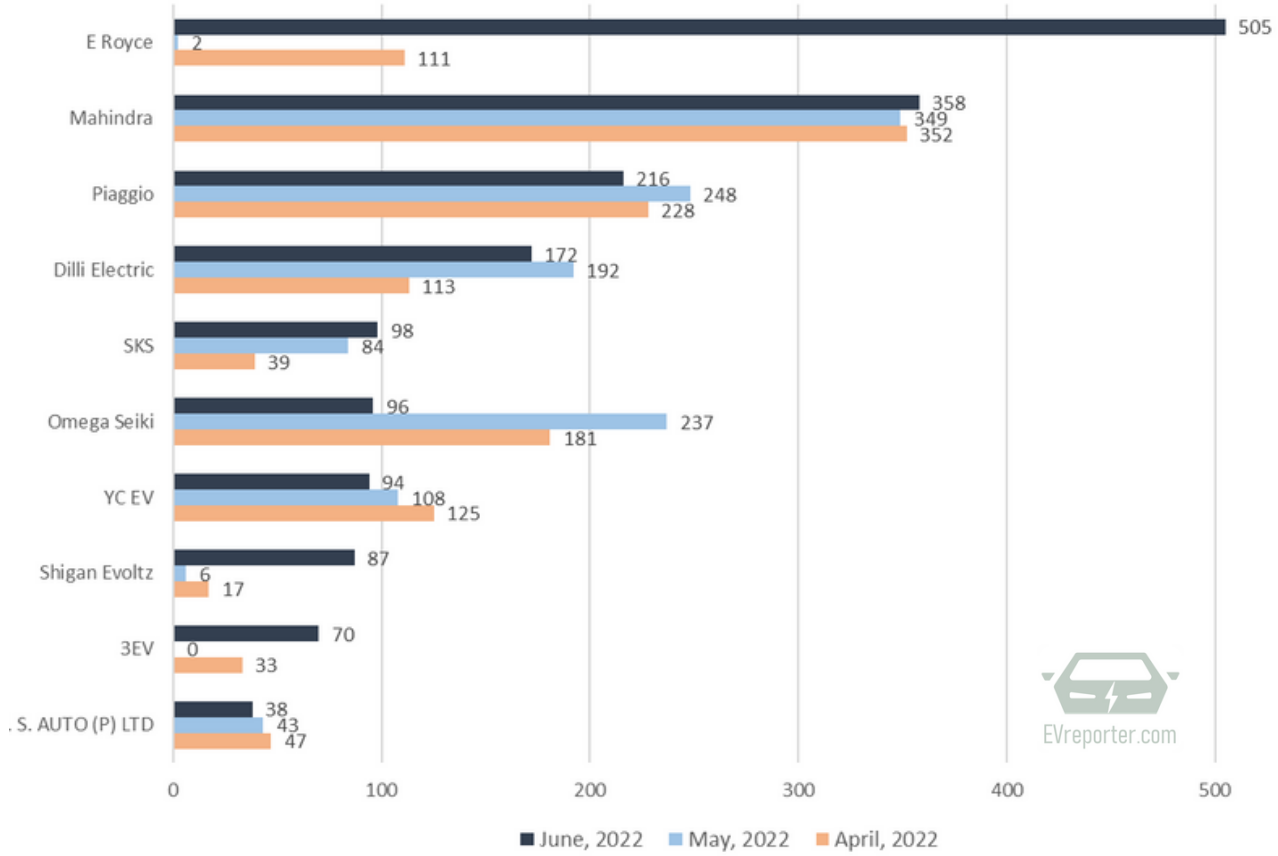
For E-3W Passenger vehicles, the top 10 OEMs contributed only 45% of the total sales in June 2022. Both L3 and L5 Electric 3Wheelers are included in the analysis.

Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs. The aim of these graphs is to represent an overall trend of the new EV registrations in India.

3W Cargo Sales Trend by Fuel Type, Apr - June 2022



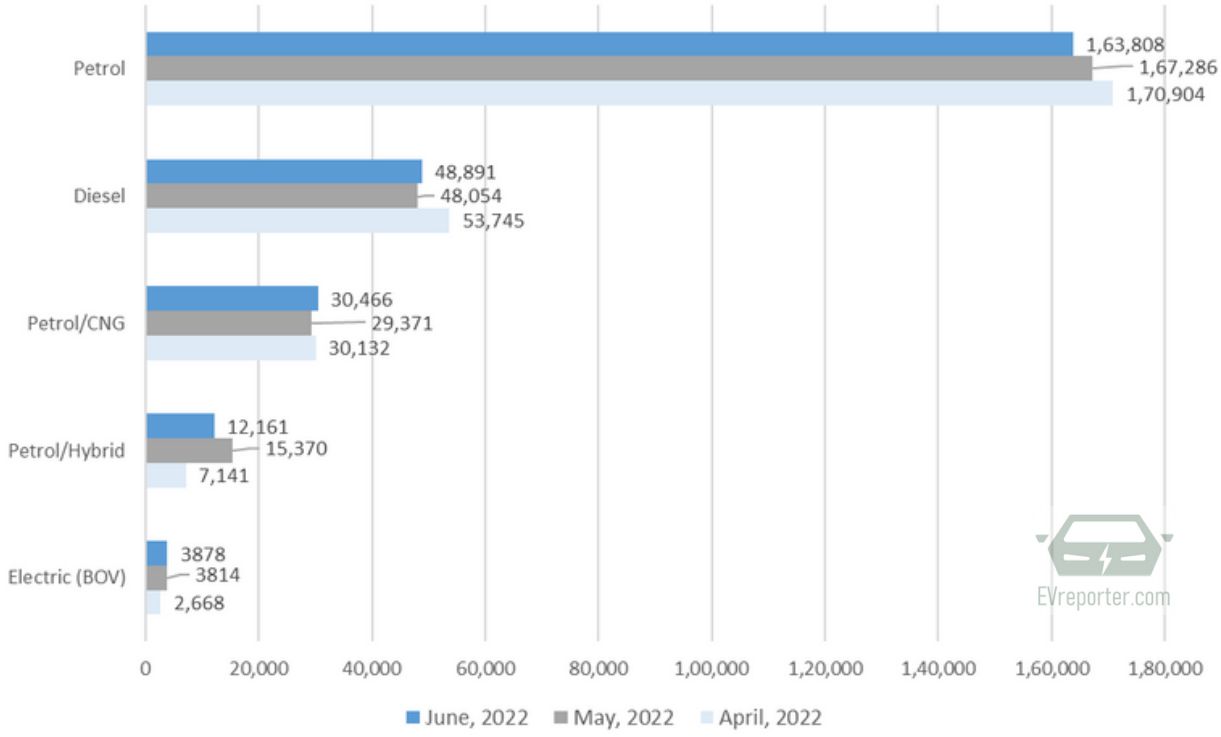
E-3W Cargo Sales Trend by OEM, Apr - June 2022



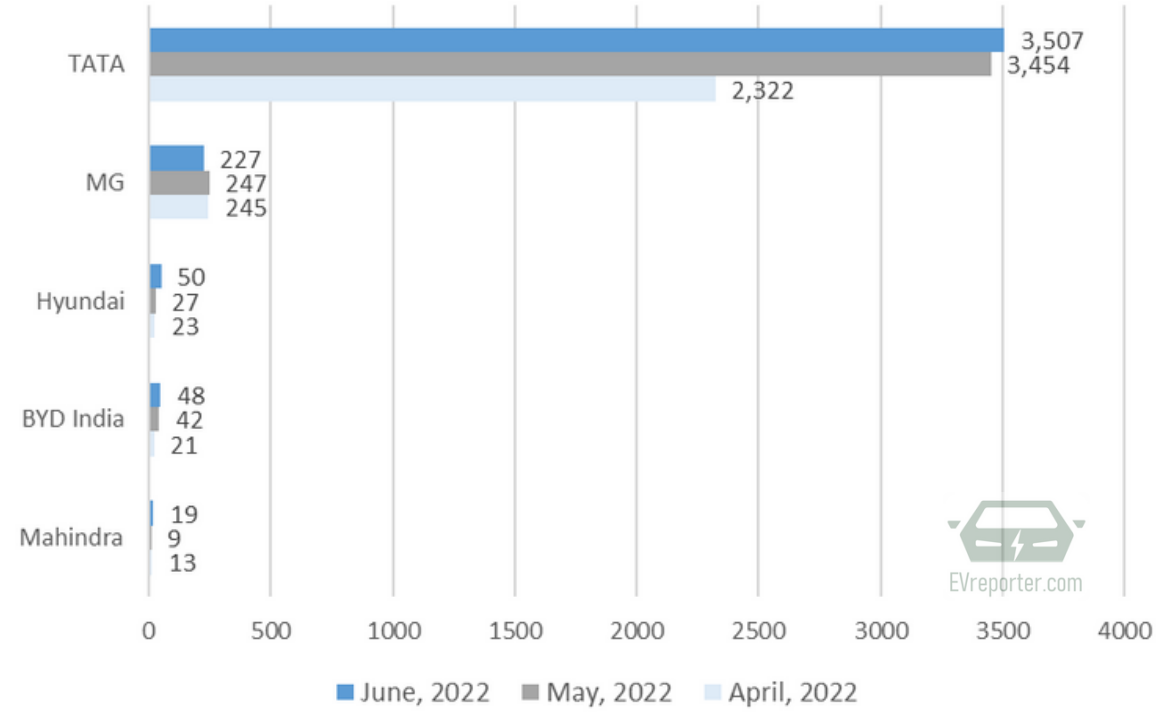
For E-3W Cargo vehicles, the top 10 OEMs contributed only 59% of the total sales in June 2022. Both L3 and L5 Electric 3Wheelers are included in the analysis.

Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs. The aim of these graphs is to represent an overall trend of the new EV registrations in India.

4W Sales Trend by Fuel Type, Apr - June 2022

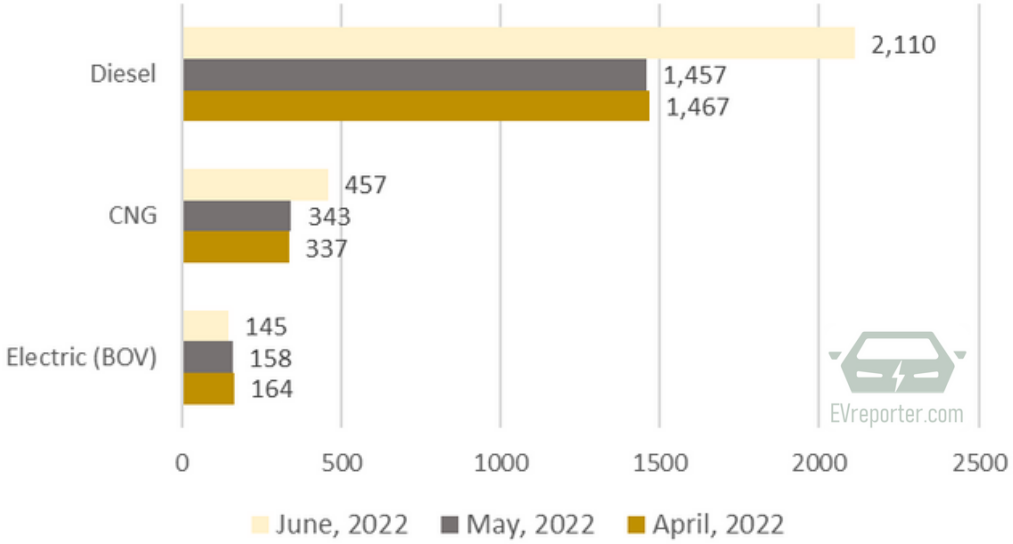


E-4W Sales Trend by OEM, Apr - June 2022

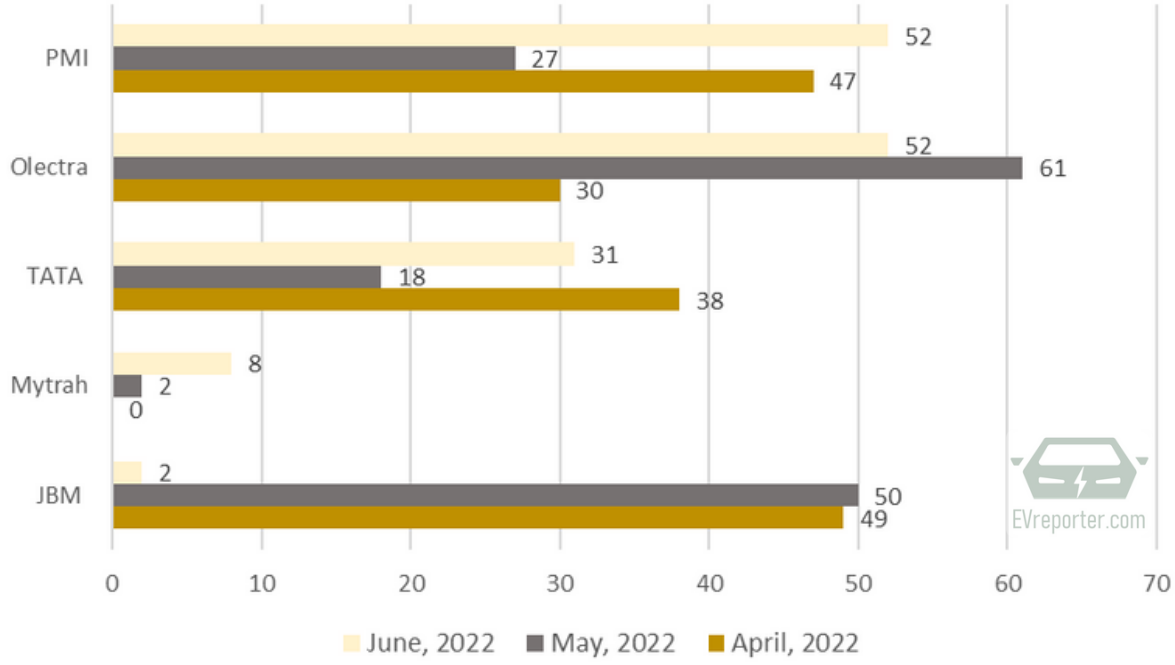


Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs. The aim of these graphs is to represent an overall trend of the new EV registrations in India.

Bus Sales Trend by Fuel Type, Apr - June 2022



Electric Bus Sales Trend by OEM, Apr - June 2022



Source: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs. The aim of these graphs is to represent an overall trend of the new EV registrations in India.

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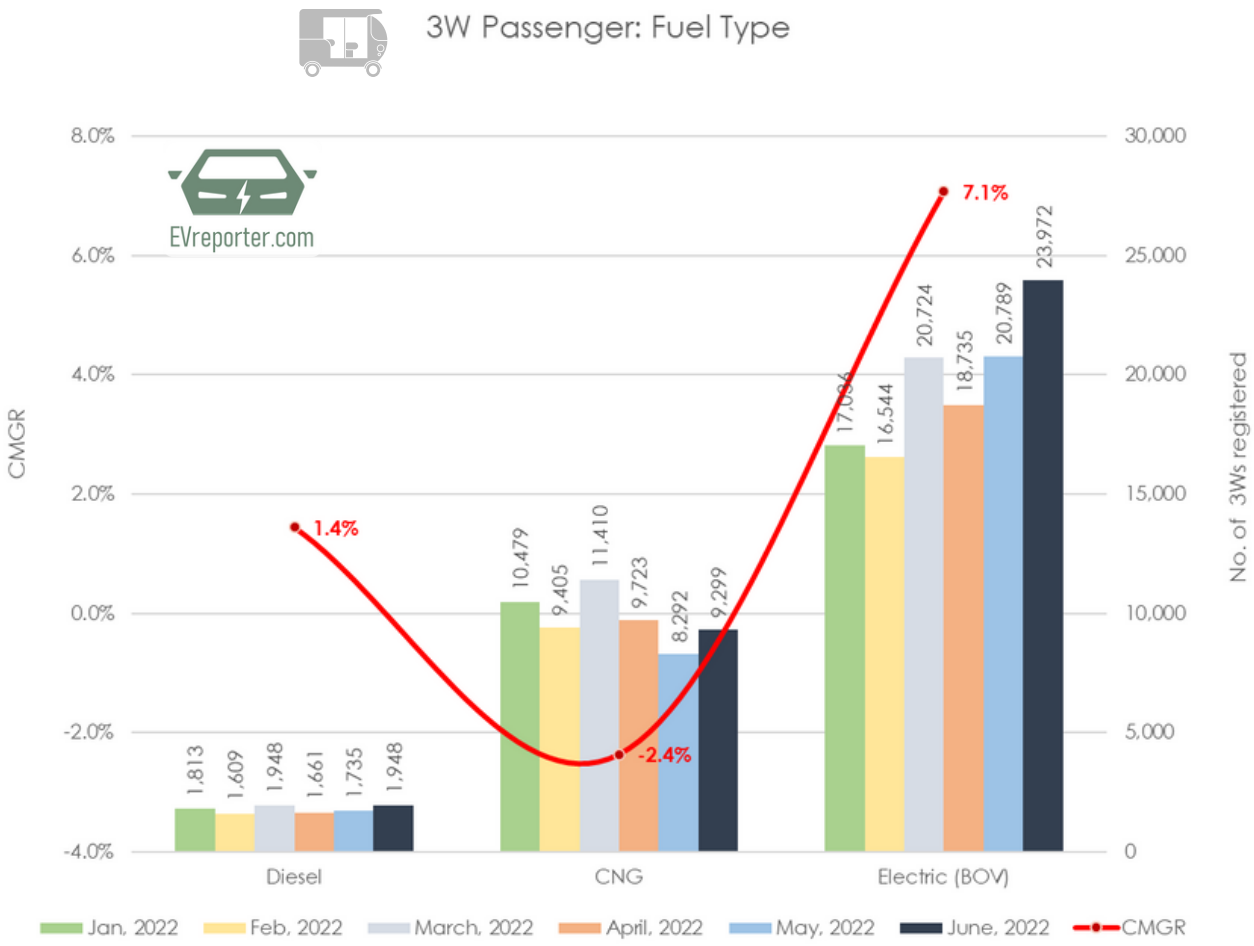
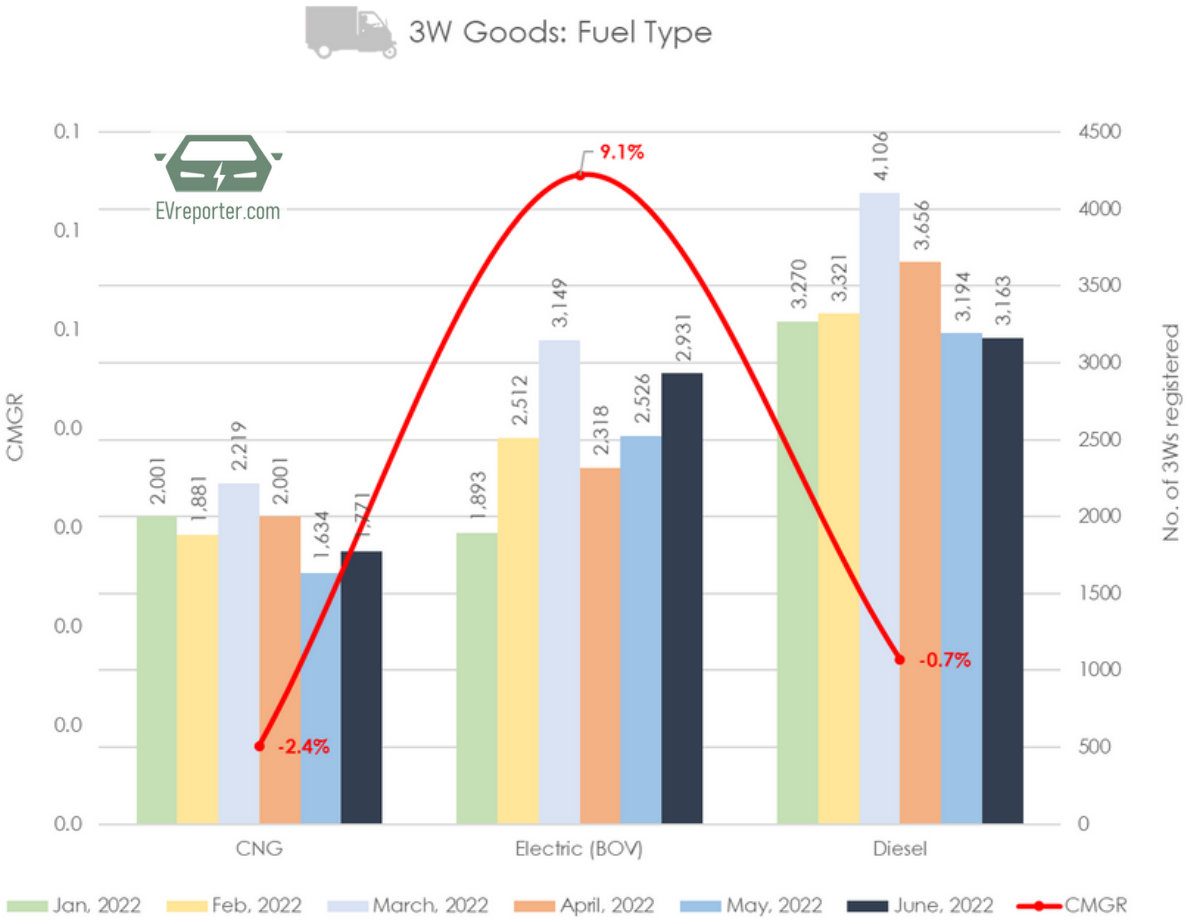
TRENDS IN INDIA'S THREE-WHEELER MARKET
JAN TO JUNE 2022

During the first half of the calendar year 2022 (H1 2022), a total of 2,57,658 units of 3-Wheelers were sold in India including both cargo and passenger models.



Observations for passenger three wheeler category - Jan 22 to Jun 22

- For Passenger category 3 Wheelers, the **Electric powertrain dominated the sales with 56%** (1,17,809 units) up from 51% volume share in H2 2021 (July to Dec 2021) and achieved a positive CMGR (compounded monthly growth rate) of 7.1%.
- Within electric powertrain (56%) for the Passenger category, the Low-spec L3 category, i.e. e-3W, made up the majority of sales with 1,14,046 units sold (54%) while the L5 category sold 3,763 (2%).
- **CNG Powertrain comes next with a 28%** sales volume share for H1 2022 (identical to H2 2021 volume share) and CMGR of -2.4% showing a negative trend over the period.
- **Diesel powertrain obtained a sales volume share of 5.1%** for H1 2022, down from 7.3% in H2 2021, as the demand for Diesel 3Ws shows a decreasing trend.



Observations for Cargo three wheeler category - Jan 22 to Jun 22

- A total of **48,810 units of 3 Wheelers** were sold for the cargo category during the first six months of 2022.
- For cargo category 3 Wheelers, **Diesel powertrain registered the highest sales** (42%) in H1 2022 with 20,711 units and a negative CMGR of -0.7% over the period. This marks a considerable decline in the popularity of diesel vehicles in the category, as the volume share of Diesel-run cargo 3Ws was 51% in H2 2021.
- During H1 2022, **Electric Powertrain** for L3 and L5 category cargo vehicles combined sold a total of 15,329 units, i.e. **31%** of all vehicles sold in the category, registering a compounded monthly growth rate of 9.1% over the period. **In H2 2021, the electric powertrain share was 23.1%.**
- Within the electric powertrain for cargo vehicles, L3 category vehicles sold 10,085 units (20%), while the high-speed L5 category cargo 3 Wheeler sold 5,244 units (11%) during the period.
- CNG-powered cargo 3 Wheelers registered a negative CMGR of -2.4% over the first six months of the calendar year 2022.

S No	3W Passenger OEM	H1 2022 sales	3W Cargo OEM	H1 2022 sales
1	YC Electric	11,545	Mahindra Electric	2,002
2	Mahindra Electric	8,832	Piaggio	1,429
3	Saera Electric	6,784	Omega Seiki	1,091
4	Champion Poly Plast	5,172	Dilli Electric	915
5	Unique International	4,276	E Royce	864
6	Mini Metro	3,712	SKS	346

3 Wheeler sales for Electric Vehicle OEMs - Jan 22 to July 22

- **For the Passenger category, YC Electric** which manufactures the Low-speed L3 electric 3 Wheelers, **recorded the maximum sales with 11,545 units and held a 10% market share**. **Mahindra Electric comes second** with 8,832 units sold or 8% market share. Mahindra Electric manufactures both L3 and L5 category electric 3 Wheelers.

- **For the Cargo Category, Mahindra Electric** dominates with 2,002 units sold or 13% market share, **followed by Piaggio** with 1,429 EVs sold or 9% market share.

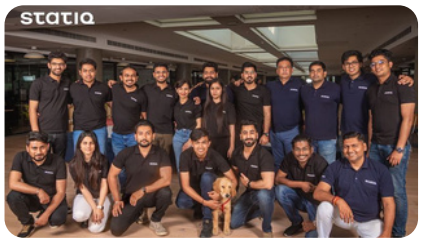
- India's electric 3 Wheeler market is highly fragmented and has around **350 manufacturers for the Passenger category vehicles** and more than **200 OEMs for the Cargo category vehicles.**

- The top 6 OEMs in the Passenger category contribute only 34% of the total sales, whereas the top 6 OEMs in the cargo category contribute 46% of the sales.

- **A total of 1,33,124 electric 3-wheelers were sold in India during the first six months of the calendar year 2022.**

- Most of these EV sales were for the L3 passenger category with 86% share, followed by the L3 cargo category with 8% share. For the High-spec L5 category, the passenger and cargo models sold approximately 4% and 3%, respectively.

Source of data: Vahan Dashboard. Data as per 1283 out of 1409 RTOs across 33 out of 37 state/UTs.



Gurugram-based EV Charging solutions start-up **Statiq has raised USD 25.7 million in series A round led by Shell Ventures**. The company will use the Series A funding to primarily invest in product engineering and network infrastructure. The start-up, led by Raghav Arora and Akshit Bansal, had also raised USD 2.45 million in seed rounds in 2020.

Gurgaon headquartered Electric vehicle battery swapping startup **Battery Smart has raised USD 25 million** in a round led by Tiger Global Management, with participation from Blume Ventures and Orios Venture Partners. In November 2021, it had raised $7 million from Blume Ventures, Orios Ventures and others. Founded in 2019, the company will use the fresh funds to expand to new cities, strengthen its battery assignment technology, and build its team.

Ahmedabad-based electric mobility and energy storage start-up **Matter has raised an initial USD 10 million** from Capital 2B, Climate Angels Fund, HNIs and other marquee investors. Founded in 2019, the start-up is expected to launch its first electric two-wheeler later this year.

MATTER

Bengaluru-based **Turno**, a start-up operating in the commercial EV space since April 2022, has **raised USD 3.1 million** in new equity financing. Stellaris Venture Partners and Avaana Capital led the investment. Turno provides retail users a solution for commercial EV adoption, including the guidance to select the right EV for the use case, financing options and vehicle resale guarantees.

Gurgaon-based **Lithium-ion battery recycling startup BatX Energies has raised USD 1.6 million** in a seed funding round led by Jito Angel Network, Mankind Pharma and others. Founded in 2020, the firm intends to use the funds towards improved R&D to develop battery-grade materials, scale their capacity, and build micro facilities.

EVIFY, a Surat-based logistics startup founded in July 2021, has **raised 80 lakhs in a seed round** from angel investors including We Founder Circle. Eveeto is the logistics wing of Evify which operates only Electric Vehicles for deliveries. The capital raised will go towards technology development, team building and scaling up the company's operations.

Bengaluru-based urban mining start-up **Metastable Materials** raised an undisclosed amount in a **pre-seed funding round led by Akshay Singhal and Kartik Hajela, Co-Founders of Log9 Materials.** The start-up claims to have an indigenous, chemical-free technology showcasing a recovery rate of over 90% for the constituent materials from end-of-life Lithium-ion batteries.

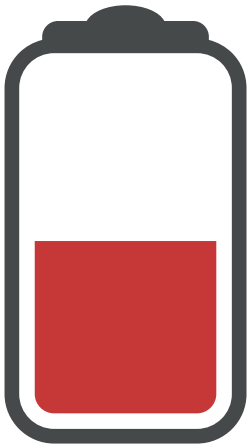
UNDERSTANDING SELF-DISCHARGE OF A LITHIUM-ION BATTERY

What is self-discharge?

Battery self-discharge is caused by the internal reactions in a battery that reduce the energy stored without any connection with an external circuit. In other words, the battery loses the energy stored in it by itself due to its internal behaviour even when the connected application is not demanding any energy. Since the state-of-charge (SoC) is directly linked to the battery's open-circuit voltage (OCV), self-discharge leads to a reduction of the SoC, which leads to the reduction of the OCV of the battery.

Self-discharge is undeniable, and it happens in every type of system (battery) that stores energy. However, the speed at which the self-discharge happens is of concern.

This is one of the reasons why supercapacitors are not preferred in electric vehicle applications. Supercapacitors have a high self-discharge of up to 50% per month. Whereas **Lithium-ion batteries have a self-discharge of up to 5% per month. But these values can change depending on the grade of cells.**



What is the significance of self-discharge?

Grading

Self-discharge is an important parameter when the Lithium-ion cells undergo grading during cell manufacturing. However, many practitioners are unaware of the self-discharge parameter and only tend to check the capacity, OCV and IR values to understand the quality of the cell during the battery pack assembly process. Let us discuss the self-discharge characteristics of a popular type of cell used by many Indian battery pack assembly companies.

For this exercise, let's take the self-discharge grading parameters of an LFP cylindrical cell. The cell is to be charged to its nominal voltage of 3.2V and then kept at 45°C temperature for ten days. At this stage, the voltage drop to about 3.17V. The self-discharge test is performed hereafter by keeping the cell for 30 days in standard conditions. The following observations can be made based on their grades.

- A grade cell would see a voltage drop of less than 30mV.
- A minus grade cell would see a voltage drop between 30mV and 90mV.
- B grade cell would see a voltage drop of more than 90mV.

The above values are for reference only and based on a technical exercise the author conducted with a particular cell manufacturer. These values are subject to change depending on the cell manufacturer and storage conditions for self-discharge. The above values will also vary for each type of cell chemistry.

Rating cell quality would mean the following:

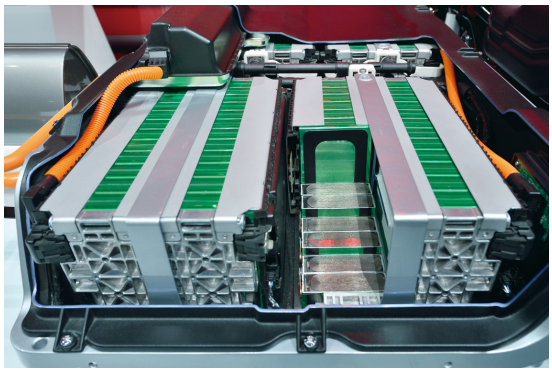
A grade > A minus grade > B grade

The self-discharge parameter of the cell is often overlooked but is a critical factor when it comes to grading the cells. **Many companies straightaway go for capacity grading and then for OCV and IR grading, but a little-known fact is that A and A-minus grades can have very similar values of capacity, OCV and IR and the distinguishing factor between them is self-discharge**.

This means that a company might think **they are purchasing A grade cells, but in reality, they are receiving A-minus cells as self-discharge was not considered.**

Balancing

A grade cell usage is essential for serious applications such as electric vehicles and long-duration energy storage systems. A grade cells have the least variation among themselves, and they **can be used in battery packs with a high number of parallel connections**. Such packs still manage not to have many balancing issues with ageing. This is why Tesla cars almost never face balancing issues.



A-minus grade cells can be used in slow charge and low power discharge scenarios such as smaller solar applications since slow charging gives more time for the BMS to balance the cells. They need time for balancing because the variation among A-minus cells is higher than A grade cells. It is advisable to **use A-minus grade cells in a battery pack with a low number of parallel connections**. If A-minus cells are used in battery packs with a high number of parallel connections, the battery pack tends to experience balancing issues after a few hundred cycles.

B grade cells are not suitable to be used in battery packs with any number of parallel connections. This is because the variation among B grade cells can be very high and cause many balancing issues in a battery pack. The balancing issues in a battery pack lead to the inability of a battery pack to charge fully and discharge fully. This will mean that the vehicle range (in the case of an electric vehicle) or backup time (in the case of an energy storage system) will drastically be lower than the original value.

Choosing the right quality of cells along with a BMS with reliable components and the right parameters is the key to making a successful battery pack. Add thermal management to that, and you have a battery that can last a long time, avoiding on-field issues to a large extent.

Article contributed by Rahul Bollini. More details about the author on the next page.

UNDERSTANDING MEMORY EFFECT IN LITHIUM-ION BATTERIES

Memory effect is a term commonly used in the battery industry, and it dates back to battery technologies such as Nickel-cadmium and Nickel-metal hydride. The ***memory effect is the ability of the battery to remember its regular usage pattern****. It is a common scenario when the battery frequently operates at partial state-of-charge (PSoC). The memory effect would mean that the* ***battery tends to remember this regular usage pattern of low depth-of-discharge (DoD) and gradually loses its ability to deliver energy equal to its usable capacity due to a lower window of working voltage.***

How does memory effect affect the end consumers?

The memory effect leads to a reduction in the usable capacity of the battery in the overall window of the working voltage. This results in lower capacity being discharged and a wrong estimation of State of Charge (SoC). Applications using such batteries would show a different estimation of energy left in the battery compared to the real energy it can deliver.

Do Lithium-ion batteries have memory effect?

The answer is no and yes. **Most Lithium-ion cells, such as NMC, NCA and LCO do not have memory effect, except for LFP chemistry cells.** The effect is more evident in lower-grade LFP cells or LFP cells stored in harsh conditions for a long time.

SoC measurement is done by measuring the voltage, a popular method adopted by the industry. It is called the direct measurement method for SoC estimation. LFP chemistry cells exhibit the memory effect. And as LFP chemistry cells have a flatter voltage curve, a slight change in voltage results in a large change in SoC measuring algorithm.

LFP working voltage is vast compared to older technologies such as Ni-Cd and NIMH. However, the memory effect shifts the working voltage. The memory effect does not have much impact on the capacity delivered by the individual LFP cell over its complete lifetime. But in the battery pack, their **voltage shift due to the memory effect can create balancing issues and make the battery pack cut off earlier than required.**

Since the BMS of the battery pack is supposed to cut off the battery pack even if one cell reaches overvoltage (during charging) or undervoltage (during discharging), the memory effect can create situations leading to an earlier cut-off during overvoltage and undervoltage situations. This translates to lower energy stored and lower energy delivered by the pack.

About the author

Rahul Bollini is a Lithium-ion cell and battery pack R&D expert with an industrial experience of over 7 years. He can be reached at +91-7204957389 and bollinienergy@gmail.com.

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Application possibilities with XYRON™

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Application Areas

- Automotive industry
  (relay block, structural parts of lithium-ion batteries)
- Energy industry
  (photovoltaic junction box, connectors)
- Other industries (water-related applications)

Properties	Unit	Method	PP/PPE	PS/PPE			
			TF701	340Z	540Z	443Z	G601Z
Specific Gravity	g/cm³	ISO 1183	1.08	1.08	1.08	1.10	1.17
Tensile Strength	MPa	ISO 527	48	55	69	62	84
Tensile Elongation	%	ISO 527	12	14	12	14	4
Flexural Strength	MPa	ISO 178	70	90	107	96	136
Flexural Modulus	MPa	ISO 178	2300	2400	2500	2200	3700
Charpy Impact Strength (Notched)	kJ/m²	ISO 179	5	15	19	42	10
Deflection temperature under load (DTUL)	°C	ISO 75 (1.8 MPa)	108	96	112	108	118
Flammability	-	UL 94	V0	V0	V0	V0	V0
CTI	-	UL 746A	-	PLC 3	PLC 0	PLC 0	-
RTI	°C	UL 746B	65/65/65	105/105/105	110/105/110	105/105/105	50/50/50

Properties of various XYRON™ grades

XYRON™ (modified polyphenylene ether or mPPE) is an engineering plastic with unique properties due to various possible alloy combinations of PPE with polystyrene (PS), polyamide (PA), polypropylene (PP), polyphenylene sulfide (PPS) or other polymeric materials.

XYRON™ PS/PPE features excellent dimensional stability, electrical properties and is suitable for PV junction boxes and connectors, contributing to downsizing.

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- Low water absorption
- High resistance to acids and alkalis
- Excellent electrical properties

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https://www.asahi-kasei.com.sg/

Electric bus and light commercial vehicle company **Switch Mobility** has launched its **electric bus platform 'SWITCH EiV 12'** for the Indian market. The EV architecture of EiV platform is common with the recently launched European Switch e1 bus. Available in two variants - EiV 12 low floor and EiV 12 standard. The company currently has an order book of over 600 buses.

Minister KT Rama Rao from the Government of Telangana launched **Telangana's first plug-and-play EV Park.** EV Park also has an incubation centre for EV startups. **Two models of new e-2Ws by Padmaja Greentech (Vayu Motors) and two models of e-3Ws by ZERO21 were also unveiled during the event.**

The first product from **ZERO21** '**Teer**' is a high-speed passenger three-wheeler that offers rated power of 5kW and Peak Power of Upto 8.5kW.

The 48 V electric three-wheeler generates peak torque of 72Nm and gives a range of up to 110 km on a single charge with a top speed of 55 km/ hr.

The second product **Smart Mule-X** is a high-speed goods carrier that has a rated power of 8kW and a Peak Power of up to 10.9kW. The 72V EV generates peak torque of 97Nm, gives a range of up to 125 km on a single charge with a top speed of 55 km/ hr, and has a payload capacity of 750 kg.

Voltrider Private Limited, a New Delhi-based e-mobility startup, recently launched **'Volton Booty' series of electric bicycles.** "Booty" is a portmanteau word derived from Bicycle and Scooty. BOOTY is designed to carry two people and has a maximum load-bearing capacity of 140 Kg and a range of 120 km on a single charge. It supports throttle mode and has a range of 140-150 km with pedal assist. Comes at a price tag of INR 41,000 (inclusive of GST).

Volvo Car India will offer its first pure electric offering, XC40 Recharge, in the locally assembled form to customers in India. **The XC40 Recharge will be assembled at their Bangalore Plant.** Their current range of internal combustion engine cars is already being rolled out from their Bangalore plant.

Haryana Government has approved the State Electric Vehicle EV Policy 2022.

Policy Incentives for the EV buyers -

- Early-bird direct benefit transfer up to INR 10 lakh on EV purchase.
- Relaxation in the registration fee and discount on Motor Vehicle Tax.
- 100% rebate in motor vehicle tax on the purchase of e-2Ws and e-3Ws.

Policy Incentives for Manufacturers of EV and EV Components -

- 100% reimbursement of Stamp duty and exemption in Electricity Duty for a period of 20 years.
- The SGST reimbursement shall be 50% of the applicable Net SGST for a period of 10 years.
- Companies manufacturing EVs, EV components, EV batteries and charging equipment shall be incentivized with capital subsidy.
- Companies setting up battery disposal units to get 15% of Fixed Capital Investment up to INR 1 crore.
- One-time support to facilitate the conversion of existing manufacturer units completely into EV manufacturing of 25% of book value up to INR 2 Crores for Micro, Small, Medium and Large units.

Policy Incentives for R&D Centres -

- The policy will grant 50% of the project cost up to INR 1 crore for developing new electric charging technology and up to INR 5 crore for developing new EV technology.
- INR 5 crore grant provision for Institutes conducting dedicated research on non-fossil-fuel-based mobility solutions.
- One-time subsidy of INR 25 Lakh shall be extended to the first 20 colleges/ ITIs / Polytechnics for setting up infrastructure related to R&D of EV.

Other Incentives -

- Govt. organizations/ PSU/ Private companies shall be encouraged to set up Centre of Excellence (CoE) that shall be incentivized with a 50% grant of the project cost up to INR 5 crores.
- The policy provides an Employment generation subsidy of INR 48,000 per employee per annum for 10 Years in lieu of Haryana domiciled manpower employed with EV companies.

Delhi Government released the operational guidelines for the delivery of demand incentives for e-cycles.

- The incentive on electric cycles is valid for the first 10,000 electric cycles (passenger and cargo).
- E-cycles are eligible for a purchase incentive of 25% of the e-cycle price (not exceeding INR 5,500 per vehicle). An additional INR 2,000 incentive is marked for the first 1,000 individual owners of e-cycles.
- E-cargo cycles are eligible for a purchase incentive of 33% of the e-cycle price (not exceeding INR 15,000 per vehicle). E-cargo cycles will also be eligible for a scrapping incentive of up to INR 3000 under the Delhi EV Policy, against the scrapping of old ICE vehicles.

The 47th GST Council Meeting, which took place on 29th June 2022, has clarified that **electric vehicles, whether or not fitted with a battery pack, are eligible for the concessional GST rate of 5%**.

CONSUMER AWARENESS NEEDED TO ENSURE THAT E-VEHICLES EMERGE AS A TRULY 'SUSTAINABLE' ALTERNATIVE

Transportation is the third-largest emitter of greenhouse gases (GHG). When we think about the GHG from transportation, we mostly picture the tailpipe emissions. **However, much of the emission happens during the manufacturing and end-of-life phase**.

*This article by **Dr.ing. Praveen Kumar** discusses a few aspects of consumer awareness necessary to ensure that the consumers make an informed choice when making an EV purchase decision. The article also intends to ascertain that EVs can emerge as a sustainable and environmentally friendly alternative to ICE vehicles if we consumers become aware and make judicious choices.*

From a long-term sustainability point of view, we need to ensure that EVs and their subsystems are manufactured in a manner that does not cause avoidable environmental harm. As evolved consumers, we need to **ask questions beyond the price tag, range and top speed to apprise ourselves of the supply chain** that puts these vehicles on the road. It is imperative that consumers are aware of the industry practices and the source of the constituent parts. This will go a long way in ensuring that the companies do not overlook the difficult but sustainable options in the interest of easy and opportunistic sourcing decisions.

Let's take a look at different EV subsystems and raw materials in the EV supply chain, which would play a huge role in determining the 'sustainability' quotient of EVs.

Rare earth elements (REE) - Rare earth elements are frequently used in cells and permanent magnets for electric motors. Kleinman Center for Energy Policy at the University of Pennsylvania estimates [1] that processing each ton of REE produces 1 ton of radioactive material. The production of REE has a social impact which we as consumers overlook. A report by German broadcaster DW cites [2] multiple examples of ecological and social damage resulting from irresponsible rare earth mining practices. For instance, many companies in China, the world's larger producer of rare earth elements (REE), have sprayed acid over the mining areas to separate the REEs from other ores. These mined areas are often abandoned after excavation and remain no longer viable for agricultural use.

There are **many organisations working towards developing and commercialising magnet-free motor technologies for EVs**. However, large-scale commercialisation of the technology is still considered a few years away.

Lithium - EV batteries use Lithium. The lithium extraction process uses a lot of water—approximately 20,00,000 litres per metric ton of Lithium [3]. Suppose batteries are recycled to extract the constituent Lithium. In that case, the water consumption for the same amount can be reduced by at least 50%.

However, **for recycling to be effective, high-quality Li cells must be used** (grade A). These cells are expensive, but as responsible customers, we must pay for them and demand the EV manufacturers use them. Please note that **grade B and lower quality cells are not recyclable.** Unfortunately, most companies in India are currently using B-grade cells in their EV batteries to reduce the cost. This practice was also corroborated by a report by the agencies involved in investigating recent fire incidents with electric 2Ws.

Cobalt - More than half of the world's cobalt, a critical component in high energy density lithium-ion batteries (e.g. NCA and NMC), comes from the Democratic Republic of Congo (DRC), and 20% of it is mined by hand. Amnesty International documented that children and adults mining cobalt in narrow tunnels are at risk of fatal accidents and severe lung disease [4]. No revolution is worth it at the expense of exploiting fellow humans at some other geographical location.

End-of-life batteries - Irresponsibly disposed battery packs may lead to environmental damage by seeping harmful substances into groundwater and entering the food chain. **OEMs should formulate and communicate a clear plan for end-of-life management of the battery packs**.

Product quality and lifetime - The current push towards electrification has also led to mushrooming of many companies operating EV assembly and sales on a trading model. Many of the EV start-ups have taken an opportunistic route to enter the automotive industry and go on assembling the imported CKDs without any in-house R&D and technology.

If we buy an electric vehicle that is not properly engineered and we are forced to discard it within 2-3 years, then we are adding to the environmental pollution.

As responsible consumers, we must be ready to **shell out money for a sustainable product rather than fancy features that do not add much intrinsic value.** A case in point is that we pay for features like playing music from the two-wheeler's dashboard or navigation - features we already have on our phones. We must understand that these features add to the overall cost of making a vehicle. The same money can be diverted towards ensuring battery safety (better cells, proper BMS and thermal management) and sustainable sourcing to get a no-frills, solid engineered product.

What can one do as a customer to keep the OEMs and their business practices in check?

As customers, the onus of quality and sustainability also lies on us. It is our foremost duty to ask the OEMs the following:

- **What is the total carbon footprint of producing the vehicle?**
- **What recycling plans are in place once the vehicle and the battery reach end of life?**
- **How much of the material used in the vehicle has come from recycled processes?**

We must take pride in using an environmentally healthy product rather than a glitzy product. Near to mid-term existential threat to human civilization could occur in the next 30 to 50 years if the environmental issues are not addressed. Most of the readers of this article will experience it in their lifetime, and their children will certainly experience it.

Hence, as consumers, we must demand 'end-to-end' sustainable products and ensure that the next generation has a chance at a good life. If we do not **demand more transparency into the overall lifecycle of the products we use**, we will end up creating a huge pile of electronic garbage and all the green revolution will go down the drain.

References:

[1]https://kleinmanenergy.upenn.edu/research/publications/rare-earth-elements-a-resource-constraint-of-the-energy-transition/

[2]https://www.dw.com/en/toxic-and-radioactive-the-damage-from-mining-rare-elements/a-57148185

[3]https://www.instituteforenergyresearch.org/renewable/the-environmental-impact-of-lithium-batteries/)

[4]https://www.amnesty.org/en/latest/news/2017/11/industry-giants-fail-to-tackle-child-labour-allegations-in-cobalt-battery-supply-chains/)

About the author

Dr.ing. Praveen Kumar *is a Professor in the Department of EEE - IIT Guwahati and also leads the E-mobility Research Lab at the institute.*

The German–Indian start-up **Nunam is working on a project with the Audi environment foundation** to explore how modules made with high-voltage batterie can be reused after their car life cycle and become a viable second-life use case. Three electric rickshaws will be deployed early next year, powered by AUDI AG's etron battery modules from its test fleet. The team plans to combine these second-life batteries with a solar-powered charging station that runs on 2nd life batteries, both from Audi e-tron preproduction vehicles.

UAE-based group META4 will make an investment of INR 250 crore to set up an e-2W manufacturing plant in Telangana. The Telangana government will provide 15 acres of subsidised land in the national investment and manufacturing zone at Zaheerabad. The unit is expected to be ready by the end of FY 2022-23.

According to a Press Statement by Tata Motors, a detailed investigation is currently being conducted to ascertain the facts of the **recent fire incident with Nexon EV.** A detailed response will be shared after the investigation. The company noted that it was the first incident after more than 30,000 EVs have cumulatively covered over 100 million km across the country in nearly 4 years.

Okaya EV said it has sold 1.70 lakh EVs since it ventured into the domestic electric vehicle space nine months ago. During this period, the company has created a network of more than **400 showrooms,** covering all the states across the country.

JLNPhenix Energy announced the launch of its new facility in Hyderabad. The 10,000 Sqft plant facilitates the manufacturing of powertrain components such as Hub Motor, Mid-drive motor, Motor Controller, DC-DC Converter, Wiring Harness, Visual Display Units etc., for EVs.

Mesha Energy Solutions (a wholly-owned subsidiary of the US-based Mesha Inc.) announced that it has acquired the grant of a patent by the government of India for its battery performance technology. The company has patented technology to improve the energy and power density of the batteries. The technology is battery agnostic and applicable for Lead Acid, Lithium-ion, Sodium-ion Batteries etc. The company has also entered a **strategic partnership with Greaves Electric Mobility.**

Okinawa Autotech announced the launch of its mega factory near Karoli in Rajasthan. The project is expected to be rolled out in October 2023 and will see an investment of around Rs 500 crore.

Tork Motors started the deliveries of its electric motorcycle KRATOS to customers in Pune.

Kerala State Electricity Board Limited (KSEBL) and Elocity inaugurated a network of EV charging stations in Palakkad District. Elocity is KSEBL's technology provider for the innovative EV charging project. The public can charge their EVs at the KSEBL's EV charging infrastructure network using Elocity's "HIEV India" mobile app.

ABOUT CHARGE+ZONE

CHARGE+ZONE is building Electric Vehicle Charging Service Infrastructure globally integrated with its indigenously developed IoT based Charging Station Management System (CSMS) & Mobile Application. The company was incorporated in July 2018 and has made strides by installing more than 750+ charging points across India as of March 2021.

Video Wall, 7.7kW AC Type 2 Dual Gun Charger

SPECIFICATION

- **Input:** 415V AC 3 Phase, 32A Max., 50 Hz
- **Number Outputs / Guns:** 2 Each Output connector rating : 240V AC, 32A Mx, 50 Hz
- **Output Power:** 7.7 KW x 2
- **Output connector type:** IEC62196 - 2 Type 2 Plug , 5m cable
- **Protection:** Over Voltage , UnderVoltage , Over Current , Residual Current , Short Circuit , Over Temperature , Ground Fault , Surge Protection
- **Push Buttons:** Emergency Stop
- **Ambient Temp.:** - 25° C to + 45°C
- **Humidity:** < 95%, Non condensing
- **Altitude:** Up to 2,000m
- **User Interface:** Vertical 55" HD Display , status indicators ,
- **User authentication:** QR code / RFID / OTP
- **Communication:** OCPP 1.6J Forced Cooling , Floor Mounting
- **Complies to:** IEC 61851-1, IEC 61851-21-2
- **Installation:** Semi Outdoor
- **Communication Interface:** Ethernet / Wi-Fi / GSM
- **Mechanical:** 850x2250x300MM (Appx)
- **Ingress protection:** IP54

8" Screen, 7.7kW AC Type 2 Dual Gun Charger

SPECIFICATION

- **Input:** 415V AC 3 Phase, 32A Max., Number of Outputs :2
- **Each Output connector rating:** 240V AC, 32A Max,50 Hz
- **Output Power:** 7.2 KW x 2
- **Output connector type:** IEC 62196-2 Type 2 Plug, 5m cable
- **Protection:** Over Voltage, Under Voltage, Over Current Residual Current, Short Circuit, Over Temperature, Ground
- **Fault Push Buttons**: Emergency Stop
- **Ambient Temp.:** -25°C to +55°C
- **Humidity :** <95%, Non-condensing
- **Altitude :** Upto 2,000 m
- **User Interface:** 8" LCD screen, status indicators, user authentication by QR code/ RFID/ OTP
- **Communication:** OCPP 1.6J Natural Cooling, Floor Mounting
- **Complies to:** IEC61851-1, IEC61851-21-2
- **Communication Interface:** Ethernet/WiFi/ GSM
- **Mechanical:**350W x 300D x 1525H (**all Dimensions are in MM)
- **Ingress protection:** IP54 50 Hz

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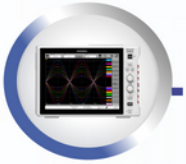
Motor Solutions



MEMORY HiCORDER

LCR METER

Battery Solutions

BATTERY IMPEDANCE METER

BATTERY HiTESTER

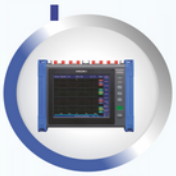
BATTERY CELL VOLTAGE GENERATOR

AUTOMATIC INSULATION/ WITHSTANDING HiTESTER

Inverter / Controller Solutions

NEW

POWER ANALYZER

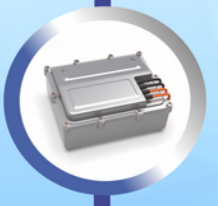


MEMORY HiCORDER

Solutions

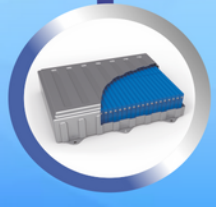
Motor

- Evaluating Motor Efficiency and Loss.
- Measuring Motor Torque Vibrations and Measuring Resolver Rotation Angles
- Performing Layer Short Testing of Motor Windings.
- Measuring Winding Resistance, Measuring Motor Coil Inductance and Measuring Motor Weld Resistance.



Inverter/ Controller

- Inverter Motor ECU Measurement and Calibration
- Calculate Inverter Output Power,
- Evaluating Inverter Efficiency and Loss.



Battery

- Solutions for Lithium-ion Battery Production Processes
- Evaluate and test BMS
- Measuring internal resistance and no-load voltage
- One of the fastest technology to Test and Evaluate Li-ion cell and battery pack.

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Atumobile, a Hyderabad-based electric vehicle manufacturing start-up, announced that its electric bike, **the Atum Vader**, has **passed the ARAI certification**. The EV comes with a 2.4 kWh battery pack, a top speed of 65 km/h speed, and a 100 km/charge range. The bikes are manufactured at the company's facility in Patancheru, Telangana. Atumobile launched its first electric 2W, the Atum 1.0, in October 2020. It was a low-speed electric bike which has sold over 1000 units.

Bengaluru-based electric scooters startup **kWh Bikes has registered 78,000 pre-orders in the form of signed Letters of Intent for its upcoming e-scooter,** which is expected to be launched in early 2023. The company recently raised USD 2 million in a seed round led by LetsVenture, with Better Capital, Cloud Capital, Founder Backer Capital, and Faad Network, among others

Hero Electric has rolled out the first batch of its electric scooters from Mahindra Group's Pithampur plant in Madhya Pradesh. As part of a strategic alliance between the two companies, Hero Electric's Optima & NYX scooters are being manufactured at Pithampur.

Ather Energy has partnered with the State Bank of India (SBI) for vehicle financing. Ather aims to use SBI's massive reach in the country to provide wider financing options to its customers.

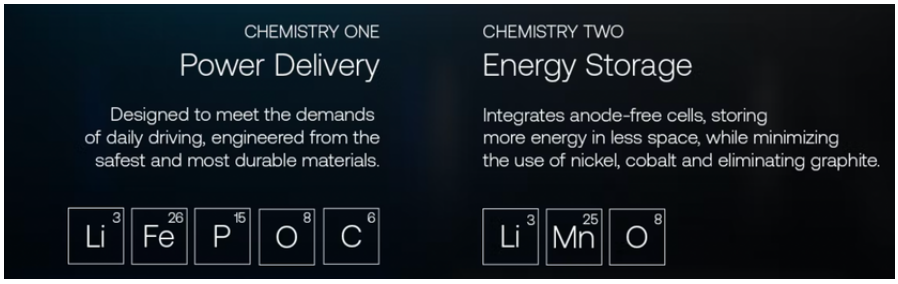
Multi-brand EV solution provider **BLive** has partnered with EV charging solution provider **BOLT** to set up EV charging points in 100+ locations. The first set of installations will be targeted at strategic locations in Goa, Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, and Telangana.

SONY

HONDA

Sony and Honda enter a JV to establish 'Sony Honda Mobility Inc' that will engage in the sale of EVs and provide mobility services. The new company will be established within 2022 (subject to regulatory approvals), and it will begin the sale of EVs in 2025. With its location in Tokyo and a capital of 10 billion yen, the investment ratio of Sony Group Corporation and Honda Motor Co. Ltd. will be 50% each.

US-based Battey technology company **Our Next Energy (ONE)** and **BMW** have signed a development agreement to demonstrate the former's GEMINI **dual-chemistry battery** technology in BMW's iX platform at the end of this year.



Chinese automobile manufacturer **Great Wall Motor (GWM) has decided to abandon its India plans**. According to media reports, all India employees have been issued pink slips. Times of India said that GWM has now set its eyes on Brazil, where they recently bought a manufacturing plant and pledged to invest INR 15,790 crores.

Bajaj Auto's wholly-owned subsidiary, **Chetak Technology Ltd,** inaugurated its dedicated and integrated electric vehicle manufacturing facility at Akurdi, Pune. Chetak Technology and its vendor partners will be **investing nearly Rs. 750 crores in this new EV plant.**

Spread over 6.5-acre of land, the 5-lakh annual capacity two-wheeler production plant aims to cater to both domestic and export markets.

Chennai-based **Sundram Fasteners Limited has planned an investment of Rs 350 Crores over a period of five years for manufacturing Advanced Automotive Technology components** like powertrain sub-assemblies for Electric Vehicles and select ICE vehicles under the PLI Scheme. According to a statement, the company has been awarded contracts worth Rs 150 crores for EV products, and its Sricity Unit has commenced the supply of products for Hybrid / EV applications. It also expects to sign contracts worth over Rs 200 crores for new EV products.

Amara Raja Group says it **plans to invest $1 billion in the manufacturing of lithium-ion batteries over 5-10 years.** The group has invested in new energy start-ups intending to incubate technologies that they can scale up and commercialise via partnerships.

The group had announced plans to invest in **InoBat**, a European EV battery technology company that specialises in custom-designed batteries and is developing an R&D centre and production line in Voderady, Slovakia. Amara Raja had also invested $5 million in Bengaluru-based **Log9 Materials** in August 2021.

Bharat Forge consolidates its electromobility business unit. To improve its strategic alignment, Bharat Forge Ltd. is transferring its shares in REFU Drive GmbH to Kalyani Powertrain Ltd, a wholly-owned subsidiary of the company. **Two trucks electrified by REFU Drive GmbH and Kalyani Powertrain with the former's RPCS 730 series are currently driving on test routes through India.**

SUN Mobility announced the expansion of its battery-swapping network to Maharashtra as part of its partnership with Amazon India. SUN Mobility plans to deploy over 2,000 Swap Points across Maharashtra by 2025, with an investment of over INR 2,200 crores. This will support over 2 lakh e-2Ws and e-3Ws and over 2,00,000 self-employed/fleet-employed EV users. This financial year, SUN Mobility plans to deploy over 100 swap stations in Mumbai, followed by Pune.

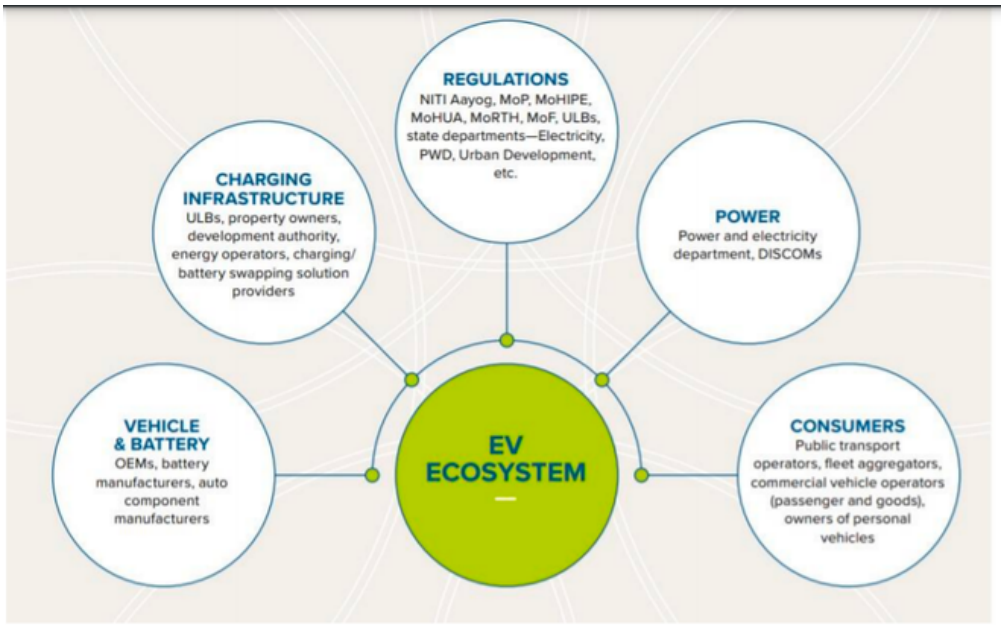
In Delhi, Cabinet gave a nod for the induction of 1500 electric buses by DTC under the grand challenge floated by Convergence Energy Services Limited. Tata Motors won the bid.

REIMAGINING THE AUTOMOTIVE ECOSYSTEM WITH ELECTRIC VEHICLES - CHAPTER 4

The previous chapters in this series discussed the different EV sub-systems and how the transition to e-mobility is impacting the automotive ecosystem. This fourth article of the series by **Dr Maruti Khaire (Head EV and Special Projects at SKF India)** reimagines the automotive ecosystem with vehicle electrification.

Automotive Ecosystem with Electrical Vehicles

The internal combustion engine is at the core of the present automotive ecosystem right from the vehicle concept to the end of life of the vehicle (Cradle to the grave). The vehicle is designed and the sub-systems are fine-tuned for optimum engine performance. The focus on the engine is not limited to vehicles but also extends to regulations, laws, and associated ecosystems like insurance, re-fueling economy, maintenance, spare parts.



Source: Electric Mobility Policy Framework, Ministry of Housing and Urban Affairs

Figure 1: **Automotive EV Ecosystem** [Source: www.alpha-affairs.com]

Fig 1 summarizes the new EV Ecosystem and its components at a macro level, which will be centred around electricity [recharging], eMotor, and battery [storage of energy]. Other configurations will be adopted from ICE vehicles for the performance optimization of EVs.

Performance battery manufacturing will be key to the success of vehicle electrification and needs optimization of battery chemistry, power density, battery size standardization, manufacturing process, and cost. OEMs and battery manufacturers need synergies for achieving optimum battery performance.

Charging infrastructure will be another important constituent of the new automotive ecosystem, which will extend beyond traditional fuel distributor & retailer models to personal home charging systems via the grid. The energy distribution companies will replace or partner with fuel stations for providing retail charging services to vehicles.

Regulations for electric vehicles need changes to the current set of rules and even the formation of new ones. Government agencies are working and will need to extend cooperation to ensure a flawless transition.

Consumer behavior will change with the new mobility ecosystem. Public transportation will be emphasized to adopt electrification. Fleet operators, as well as personal operators, will expect more ecosystem changes in line with electrification including service networks, charging networks, etc.

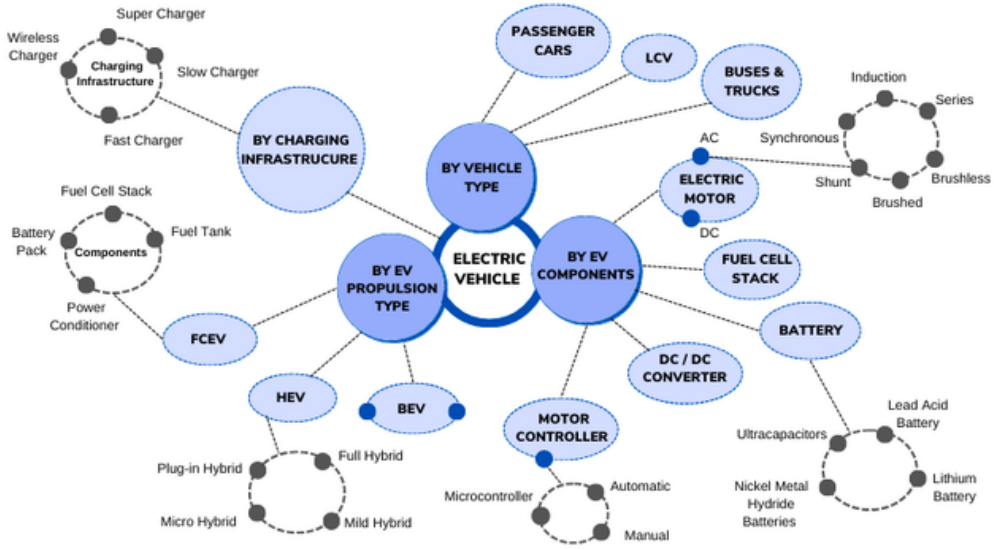


Figure 2 depicts the reimagined automotive ecosystem with vehicle electrification. It can be observed that the automotive ecosystem will evolve around the new sub-systems and new ways of energy storage as well as distribution.

Figure 2: **Automotive EV Ecosystem Reimagined** | [Source - Recreated from Capgemini Report: The Automotive Industry in the Era of Sustainability]

However, vehicle types and their classification will be as present, but they will be more designated based on motor power/battery capacity dimension. Motors, motor controllers, converters, battery are going to replace the ICE and its systems. Transmission and other torque transfer systems will get simplified compared to the present ICE vehicle system.

Deep Dive into "New Mobility" Ecosystem Constituents

This section discusses in detail each constituent of the new ecosystem.

a. **EV – Type of Vehicles**

As mentioned, in the previous section, the classification of vehicles will be followed like the present automotive system. However, the configuration and designation of vehicles will be different in the electrified vehicle world.

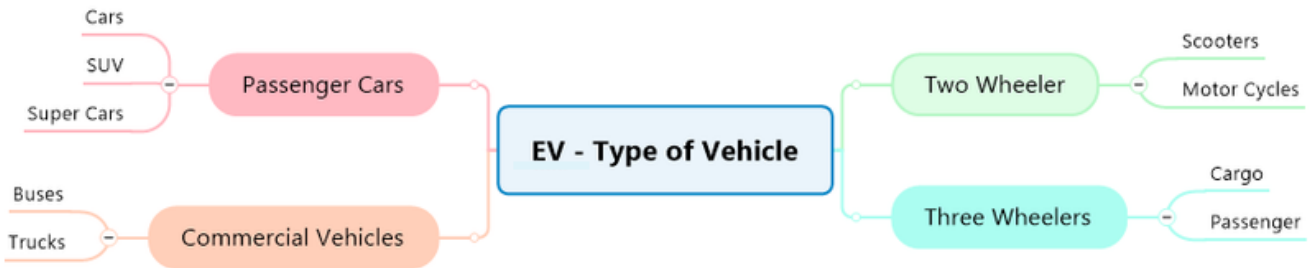


Figure 3: EV Ecosystem by Vehicle Types

The adoption of vehicle electrification and the evolution of the EV ecosystem will vary from region to region. In India, EV adoption started with mass individual transport vehicles like two-wheeler and three-wheelers, however, in the western world the passenger car, and public transport vehicles are driving the electrification journey. Intra-city last-mile connectivity or short-distance personal commuting needs, congested city roads, and vehicle movement within narrow roads make two-wheeler scooters a popular segment for electrification. In the Asian continent, two-wheelers have a high rate of electrification and hence encouraging personal charging as well as providing power to housings for the vehicle charging is prioritized. Regulation and EV policies of different state governments in India are encouraging charging within the housing societies, parking places, malls, etc. In European as well as USA markets, public charging and charging station availability on highways is prioritized to encourage EV penetration.

b. EV – by Major Components

New systems and subsystems are being introduced for electric vehicles. Vehicle electrification replaces ICE with the new prime mover i.e., eMotor. EVs have multiple options including types of operation like A/C or DC as well as types of motors. The motor controller is also an important part of the prime mover system. Based on the type of motor controller, its service and maintenance may play a role in the new ecosystem.

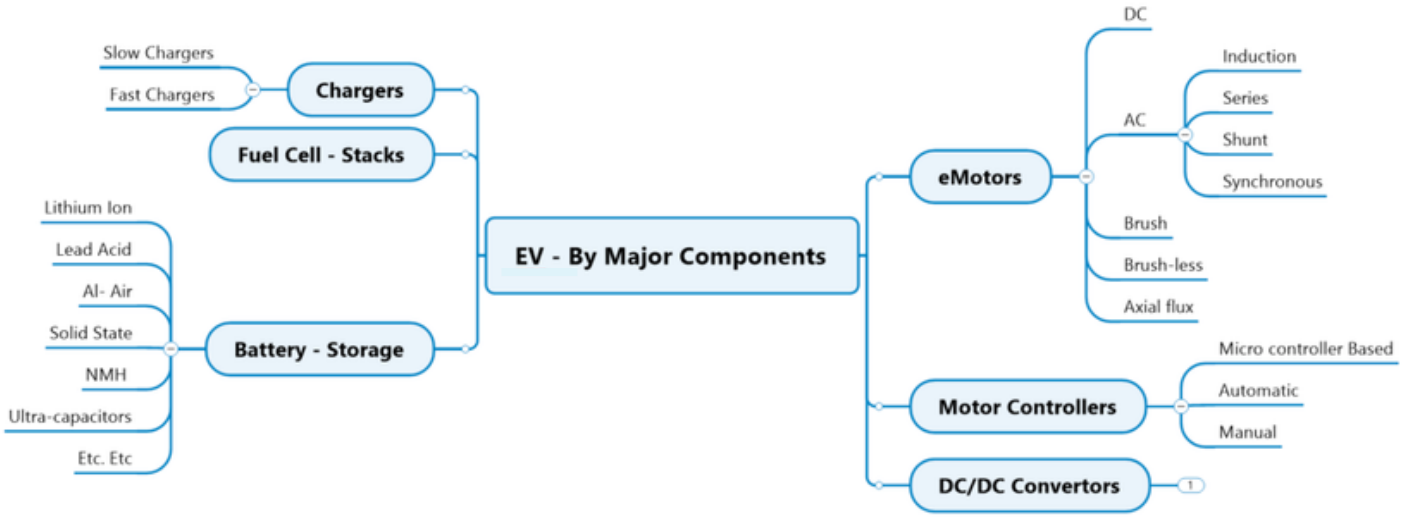


Figure 4: EV Ecosystem by Major Components / Sub-Systems

Battery, battery management system [BMS], and Battery charging systems are important parts of EVs. Electric vehicle needs high voltage current and depending on the type of motor it also needs a convertor of supplied current suitable for the motor operation.

Another significant system of vehicle electrification in the future will be the fuel cell and its system. Currently, the fuel cell system is evolving. However, considering its advantages soon it is expected to become a part of new mobility systems. Traditional ICE systems like the fuel systems, cooling systems, FEAD systems etc will be eliminated or will be present in a different form in new mobility vehicles.

c. EV – by Propulsion Type

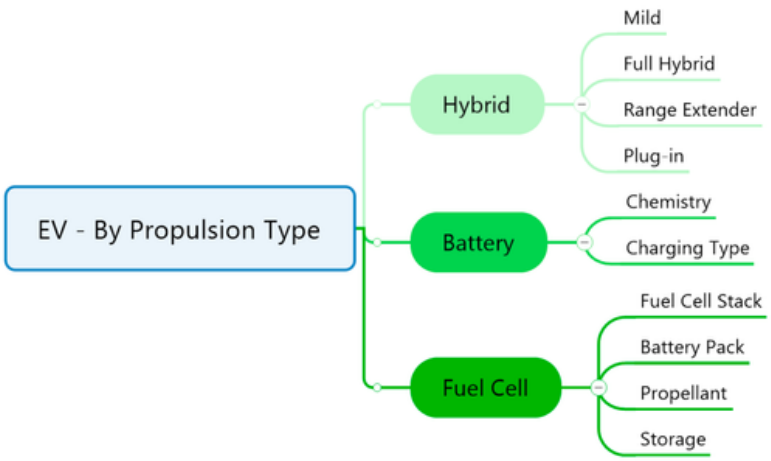


Figure 5: EV Ecosystem by Propulsion Types

Referring to Figure 5, the Hybrid propulsion system is popular even today as it is based on ICE and BEV technology. It is more of an extension as well as strategic positioning to optimize the emission level of a vehicle. The hybrid systems are a good compromise but they are expensive compared to a stand-alone ICE or BEV solution. Some advanced economies have adopted hybrid as a way forward for their automotive plan.

However, Battery electric vehicles are becoming more popular in Europe, USA, and China. There are many reasons for its popularity which include the availability of clean electricity from renewable sources as well as the favourable total cost of ownership. Infrastructure is also getting developed for Battery electric vehicles including battery manufacturing, charging stations and inclusive regulation, financial services, etc.

Fuel cell propulsion is based on hydrogen fuel, and it is evolving for commercial usage. As a new automotive eco-system evolves around a new propulsion system, it will impact significantly the current automotive ecosystem of OEM, suppliers, and other players.

d. EV – by Recharging [Refueling] of Vehicle

As electric vehicles become popular, recharging infrastructure will take the centre place in the automotive ecosystem.

Recharging time, energy storage options, charging technology as well as infrastructure ownership are some of the aspects of new electric mobility. Vehicle electrification growth will be positively impacted by charging speed. Slow charging, faster-charging options and reasonable availability are an important part of the ecosystem.

Energy storage options like battery swapping may emerge as a viable option in many economies.

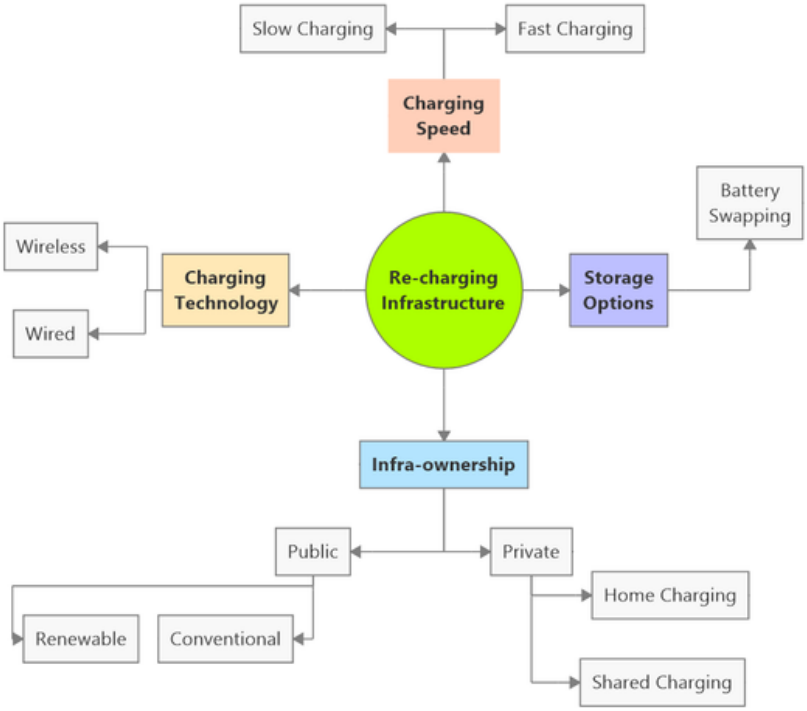


Figure 6: EV Ecosystem by Recharging Infrastructure

Charging technology is another important constituent that emerges in the new automotive ecosystem. Many countries are exploring advanced options such as wireless charging on the go and it may become a popular option in the future. However, if vehicle electrification moves to fuel cell vehicles, then ICE infrastructure of refueling can be adopted. The fueling infrastructure is well established between the oil refineries, distributors, and retailers. However, with electrification, even the individual vehicle owner has the opportunity to own the battery charging station. Ownership of charging infrastructure is still evolving.

d. EV – by Service Network

The present automotive ecosystem has well-established organized as well as unorganized service networks.

An organized service network is established by OEMs who exercise considerable control over the networks' operations in terms of quality and customer experience. However, an unorganized service network is established over time by aspiring entrepreneurs in the field. Generally, this sector operates based on expertise developed on the job and over time. Limited or no formal training is given to the people working in the unorganized sector. However, knowledge is built over time and experience by handling issues in the field. Reimagination of the automotive ecosystem in the vehicle electrification era also needs consideration for this service network. **The face of the service network will change with vehicle electrification. The EVs will need different skills as well as service competence.**

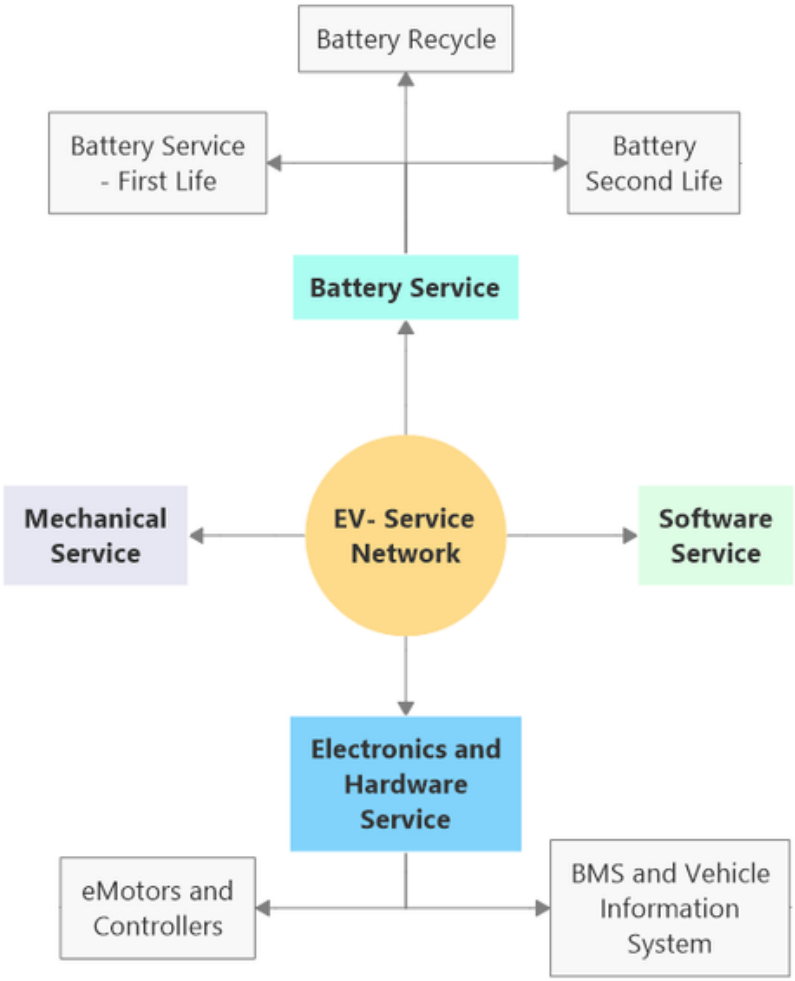


Figure 7: EV Ecosystem by Vehicle Service Network

The mechanical servicing part of the vehicle may be addressed with current know-how as well as some adoption of new vehicle design. However, the major parts of electric vehicle services are the battery, software, and electronic hardware that call for core skills. The organized service sector will see a faster pick-up compared to the unorganized sector network. Battery servicing requires good knowledge of batteries, inspections, and rectification. However, a big concern is the recycling of batteries post end of life. Experience from Lead-acid batteries suggests that a major portion of batteries are recycled today. However, complex chemistry Lithium-Ion batteries demand capital intensive recycling infrastructure.

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BATTERY MANAGEMENT SYSTEMS FOR SAFER AND COMFORTABLE E-VEHICLES

Vijayalayan R from **MathWorks India** discusses the significance of an efficient Battery Management System (BMS) for electric vehicles and how emerging technologies such as Artificial Intelligence can be leveraged in the design and development of sustainable BMS.

Significance of efficient BMS in EV ecosystem

Battery Safety

We are seeing several tailwinds that are helping the Electric Vehicle (EV) industry grow in India. We are also seeing some teething troubles. There have been concerns over the safety of electric vehicles, especially two-wheelers in our country. Vehicles catching fire and a few manufacturers recalling some batches of their EVs have been reported. The battery manufacturers are looking at various ways to enhance the safety of the cell.

Some of these include technology to turn off parts during an adverse event, and finding a non-inflammable electrolyte for the battery. This is where a properly designed battery management system (BMS) plays a vital role.

Battery Swapping Policy

As we are investing efforts to boost EV charging infrastructure in the country, battery swapping is an attractive alternative that involves exchanging discharged batteries for charged ones and provides flexibility to charge them separately. NITI Aayog under Govt of India has been working with a wide spectrum of stakeholders -- battery swapping operators, battery manufacturers, vehicle OEMs, financial institutions, CSOs, think tanks, and other experts -- to draft a policy that will introduce a battery swapping policy and interoperability standards to improve efficiency in the EV ecosystem.

A few key aspects mentioned in the draft policy are:

- Batteries must be BMS-enabled – to enable monitoring, data analysis and safety
- The battery's BMS must be self-certified and open for testing to check its compatibility with various systems, and capability to meet safety requirements
- Batteries must be IoT-enabled to allow for safety and security monitoring

Having understood the significance of an efficient BMS, let us look at some of the technologies that are driving advancements in the technology.

Battery Modeling and Digital Twins

Battery models have become an indispensable tool for the design of battery-powered systems. Their uses include -

- battery characterization
- state-of-charge (SOC) and state-of-health (SOH) estimation
- algorithm development
- system-level optimization
- real-time simulation for battery management system design.

Battery models based on equivalent circuits are preferred for system-level development and control applications due to their relative simplicity.

A digital twin of a battery, which is an up-to-date representation of the actual battery, provides access to verified simulation models across cloud platforms, hence supporting collaboration and rapid innovation across multiple engineering teams. Researchers, engineers, and other stakeholders use digital twin models to accelerate development time and reduce batteries' development costs. These battery models can also help in developing a BMS that accounts for degradation.

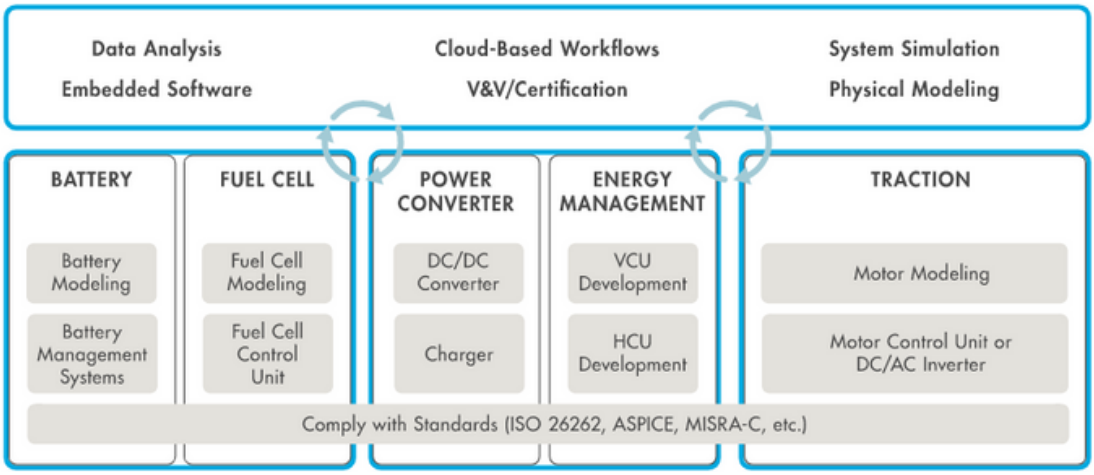
Artificial Intelligence, IoT and Data Science

Battery state of charge (SOC) is a critical signal for a BMS. Yet, it cannot be directly measured. **Virtual sensor modeling can help in situations where the signal of interest cannot be measured or when a physical sensor adds too much cost and complexity to the design**. Deep learning and machine learning techniques can be used as alternatives or supplements to Kalman filters and other well-known virtual sensing techniques. These AI-based virtual sensor models must integrate with other parts of the embedded system.

With the need for remote monitoring of the performance of a battery, as suggested by the draft of NITI Ayog's Battery Swapping policy, we will likely see IoT leveraged more broadly to support the initiative.

Automate Model Verification and Code to Safety Standards

With the increase in software content in today's electric vehicles, companies need to focus on migrating their existing embedded software development process to be compliant with objectives of functional safety standards such as ISO 26262. **Model-Based design with production code generation has been extensively utilized throughout the automotive software engineering community because of its ability to address complexity, productivity, and quality challenges.** It can also help in automating model and code verification, thereby enabling engineers to streamline verification and deployment efforts when adhering to the ISO 26262 functional safety standard.



Conclusion

Technologies that enable data analytics, artificial intelligence (AI), modeling and simulation, embedded software development, and verification have become relevant for building a sustainable and stronger EV ecosystem. The regulatory framework currently being developed by the government will help accelerate the adoption of these technologies and ensure compliance of various OEMs and other value chain players. All these will make consumers the ultimate beneficiary. When they start purchasing and using more EVs, the ecosystem will develop further in aspects of technology, operations, and regulation.

About the author

R Vijayalayan manages the automotive industry and control design vertical application engineering teams at MathWorks India. He specializes in the field of Industrial Automation, Robotics and Model-Based Design. He can be reached at vijayr@mathworks.com

INDUSTRY SPEAK

*The 47th GST Council Meeting, which took place on 29.06.22, clarified that **EVs, whether or not fitted with a battery pack, are eligible for the concessional GST rate of 5%**.*

> The government's initiative to offer a favourable GST slab for EVs sold without batteries is a **welcome move**, as it makes new **BAAS (Battery as a service) models** such as Battery on Lease, Battery Swapping, etc. more viable, hence making **EVs more affordable** for customers.

Dr Akshay Singhal, CEO & Co-founder, Log9 Materials

> Reducing the GST rate on EVs sold without battery pack to 5% **doesn't really help most EV OEMs due to the existing inverted duty structure**, **wherein input GST on batteries is being retained at 18%**. What will truly help EV OEMs is the reduction of GST rate on key input components of EVs such as batteries, powertrain, etc to 5%. This can help OEMs reduce working capital outlay and expenses as they would not have to wait for GST refunds.

Mr. Kalyan C Korimerla, MD & Co-Promoter, Etrio Automobiles

Yamaha Motors enters 2-wheeler EV leasing in India starting from New Delhi. Its first investment is with Zypp Electric with the launch of 250 Hero Electric 2-wheelers. **Yamaha Motor group's company - MBSI (Moto Business Service India),** will facilitate **Zypp Electric** to deploy the scooters for their last-mile delivery requirements with IoT Tech support.

Omaxe, one of India's leading real estate developers, announced its **partnership with Jio-bp.** Jio-bp will set up EV charging and swapping infrastructure at Omaxe properties across Delhi, Noida, Greater Noida, Faridabad, Ghaziabad, New Chandigarh, Ludhiana, Patiala, Amritsar, Jaipur, Sonipat and Bahadurgarh in a phased manner.

Jio-bp and Zomato announced that they have entered an agreement to support Zomato's commitment towards 'The Climate Group's EV100 initiative of 100% EV fleet by 2030'. Jio-bp will provide EV mobility services to Zomato along with access to 'Jio-bp pulse' branded battery swapping stations for last-mile delivery.

Automotive component maker **Valeo**, e-3W maker **Atul Greentech** and swappable battery service provider **Honda Powerpack Energy** have signed an MoU, through which Valeo will provide its 48V integrated electric powertrain system along with the Powertrain Control Unit for Atul's upcoming cargo and passenger three-wheelers. Valeo will provide the technology integration support to help Atul go to market with Honda's swappable battery.

Euler Motors has partnered with urban logistics aggregator **LetsTransport to deploy 1,000 HiLoad EVs.** The companies will collaborate to deploy these EVs in Bangalore, Hyderabad, and Delhi-NCR and cover other cities across India over the next 12 months. Euler Motors has already commenced deliveries for LetsTransport, where the first batch of vehicles is operational in NCR.

Logistics start-up **Howdyy** announced its partnership with **Bounce Share**, the EV rental arm of Bounce to deploy more than **10,000 electric scooters in the next two years**. The electric scooters will be deployed across Bangalore, Mumbai, Pune, Chennai, and Hyderabad, and all scooters come powered with **battery swapping** technology.

EV charging infrastructure startup **EVI Technologies (EVIT) has partnered with Hindustan Petroleum Corporation Limited (HPCL)** to set up EV chargers at the OMC's fuel pumps. The startup will install stations at HPCL pumps located in major cities and highways in UP, Bihar, and Uttarakhand.

IMPLEMENTING A FACTORY-FITTED TELEMATICS SOLUTION | WHAT ARE THE OEM REQUIREMENTS?

Traditionally, telematics solutions are implemented as aftermarket solutions. Driven by the need for more advanced data collection, connected vehicles and shared mobility business models, automakers are increasingly exploring production line fitment of telematics solutions. **Venkat Nathan, Founder and CEO at Nesh LIVE** explains who are key stakeholders and how they collaborate to enable production line fitment of telematics solutions.

Introduction - Telematics Solutions

A telematics solution comprises a telematics device and a cloud-hosted secure & scalable server. The device, when fitted in a vehicle, collects and sends data to the cloud server for intelligent analytics-based reports about the vehicle and engine health, processing reports, driver behaviour, alerts and other location-based services.

Aftermarket telematics solutions

The telematics solution device is being predominantly offered as a retrofit today. It is either offered by the dealer or by any Telematics Service Provider (TSP). The solutions offered by the TSPs are focused on traditional fleet management features such as trip analysis, location-based services, route optimization and other driver and vehicle owner-focused features, location history, travel summary and fuel reports. Many companies are catering effectively to the basic fleet owner requirements with features for trip analysis, and location-based services. However, these solutions are limited in their ability to meet the requirements of a vehicle manufacturer (OEM) both in terms of features for vehicle health and engine analytics as well as production line fitment capabilities to meet end-of-line tests and customer onboarding processes.

In recent years, the OEMs are keen to collect & analyze such vehicle data in the cloud in real-time for service alerts and engineering advancements to enhance vehicle safety and efficiency. Also, some countries have started to impose regulatory requirements that need telematics devices for certain categories of vehicles to meet the safety and efficiency guidelines. **This has prompted vehicle OEMs to offer the solution as a factory fitment**. They are also keen to collect the vehicle data under different terrain, weather and driver behaviour conditions for their ongoing product enhancements and diagnostics.

OEMs are exploring factory fitment of the telematics solution at the production line like any other accessory such as the reverse camera or an infotainment system. The trend of factory-fitted telematics solutions is expected to increase, given the demand for connected vehicles and shared mobility use cases. To handle this scale and complexity, the OEM telematics solution needs to offer extra operational features focused on fleet owners to seamlessly launch the telematics solution.

Key stakeholders and distributed collaboration in the OEM environment

The OEM scale of the process to ensure smooth activation and provisioning of the service involves multiple stakeholders. In the case of OEM line fitment, the **various key stakeholders in a telematics ecosystem are listed here.**

In some cases, **one of the stakeholders may double up as another.** e.g. the OEM may also be a TSP or the device manufacturer may also provide a telematics server etc. Even if the stakeholders overlap the respective functions of SIM and device management, the end-of-line testing activities might still be distributed and require strong collaboration for seamless rollout and the best customer experience at the time of provisioning the telematics services.

- Telematics device manufacturer
- SIM provider
- Telematics server
- Telematics service provider (TSP)
- OEM
- Dealer
- Authorized service centers (ASCs)

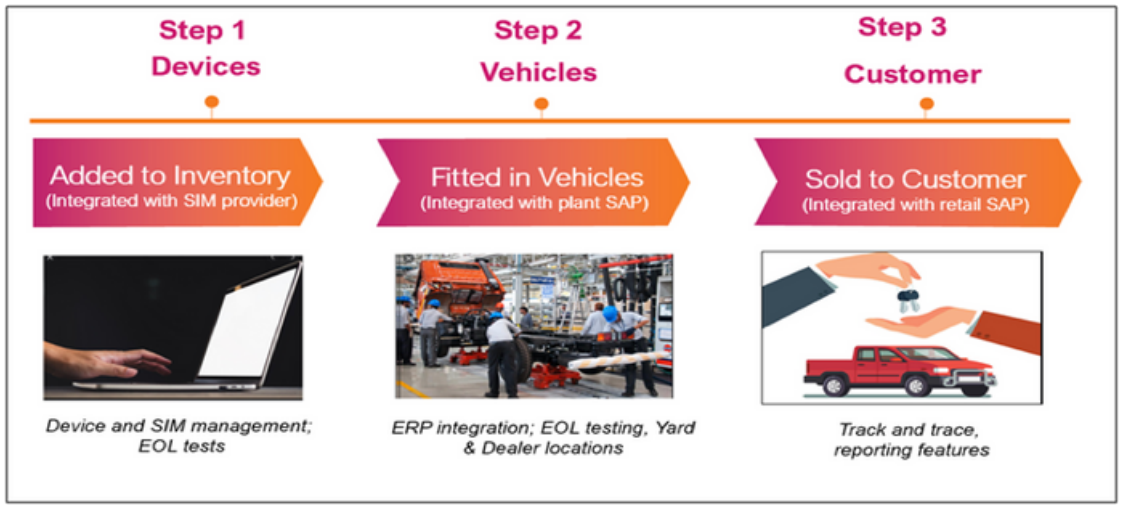


Figure 1: Key steps in line fitment of a telematics device by OEMs

Telematics platform for production line fitment

There are various platforms that enable stakeholders to collaborate in real-time with the telematics system.

- The SIM provider with selective access can upload, activate or pause SIMs using an internet service provider.
- The device manufacturers then upload their respective device information with the necessary SIMs used in them.
- The line testing at the device and system level is captured to make sure that the key parameters are relayed to the telematics server before it is prepared for line fitment.

- In the OEM line, once the device is fitted in the vehicle, the VIN number is sent to the telematics server to create or update the vehicle information.
- When the dealer makes a sale, an account is created for the customer and the vehicle is moved to their account with the chosen telematics plan.
- While the customer can view only their vehicles, the dealers or any service agency can view the select vehicles in their region or area of responsibility.
- The OEM retains the entire view of vehicles across all dealers and customers.

Support for efficient SIM Management

The figure below shows the SIM management phases starting from the line fitment process to onboarding a new customer with connectivity services. The SIM either embedded or physical will need to be proactively managed to ensure the data costs are minimal and do not add up over time.

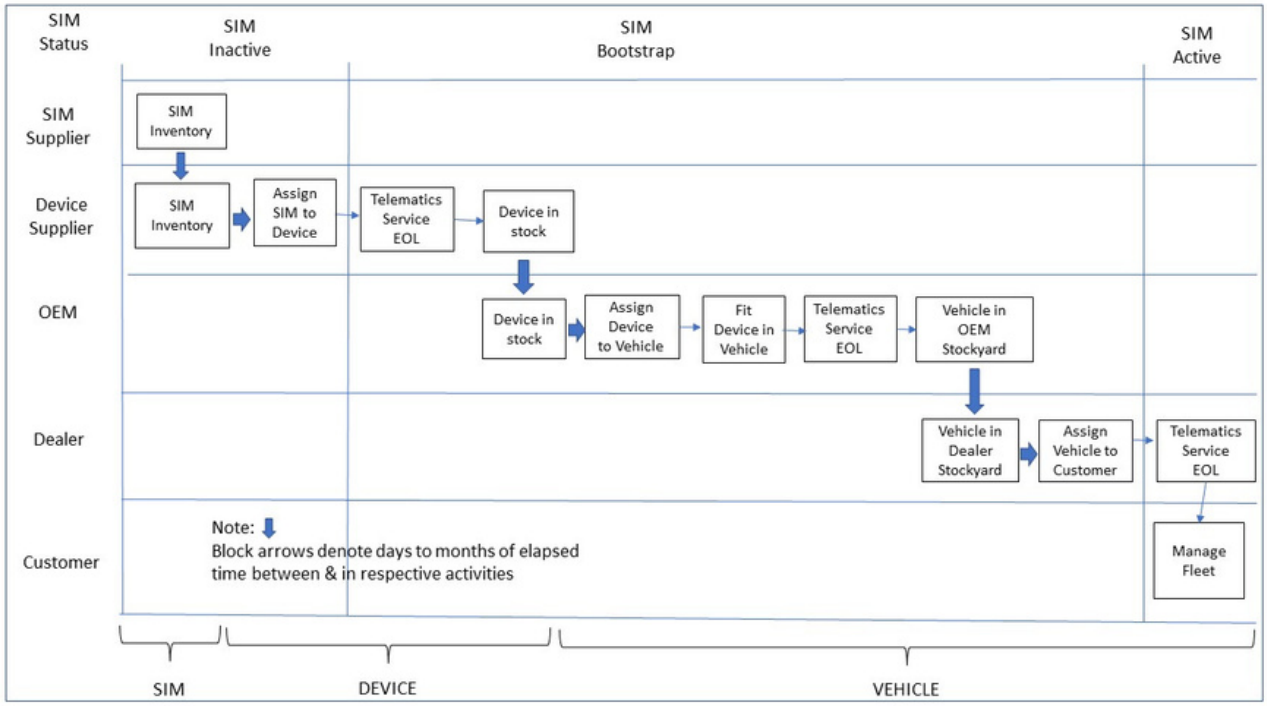


Figure 2: Management of SIM in a Line-Fitted Telematics Device

In summary, OEM line fitment of telematics devices requires a team with deep expertise in the production line process and skills to build highly scalable software. This software is fitted with multiple integration points to ensure the entire process is fully automated and seamless. This also helps to onboard a few hundred vehicles and new customers every minute.

Therefore, the OEMs are best advised to evaluate the option of using readily available, proven and robust solutions in a secure SaaS or dedicated hosting model. It will help address their line fitment while meeting their connectivity requirements from an end-user point of view.

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