

# EV - Market Segmentation

## Topic- 2-Wheeler EV Trend & Growth Prospects

Submitted by:

Hemant Kshirsagar- Team Leader

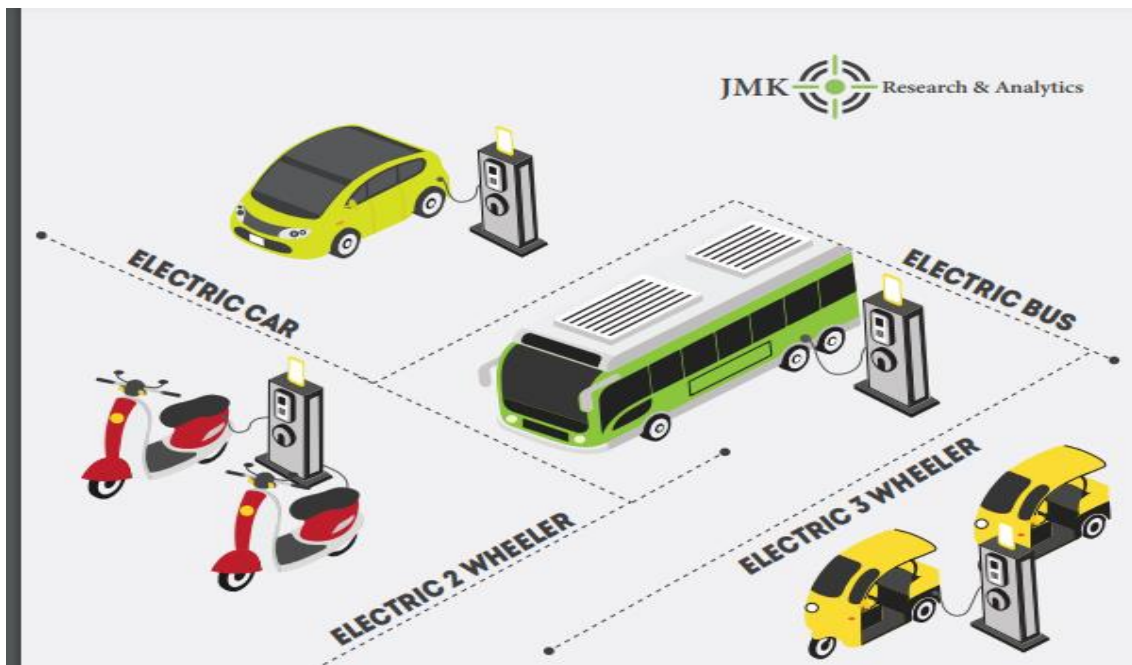
Simran Kaur

Apeksha Nawkar

Aditi Verma

Sana Modak

Deivaprakash k



<https://github.com/mhantkshir/EV-Market-Segmentation>

## ABSTRACT

This paper focuses on the sales of electric vehicles in India and the three main platforms that are affected by it which include the fuel prices (petrol and diesel), battery costs (battery pack and cell prices) and CO2 emission in the country.

While India transitions into the era of an electric vehicle driven economy, there are some limitations and merits that are considered in the following study.

We have used EXCEL to obtain a regression model to predict the futuristic aspects of electric vehicles and how it will change the dimensions of automobile industry in India.

Lastly, we have also mentioned various schemes proposed by the government to accelerate the sales of EVs.

## INTRODUCTION

### India to become No. 1 EV manufacturer with lithium reserves?

After the first lithium reserve - of an estimated 5.9 million tonne - was discovered in Jammu & Kashmir's Reasi district, union minister Nitin Gadkari said that India can become world's number one automobile manufacturer in EV segment if it uses the same reserve.

Transport infrastructure plays a catalytic and major role in the economic growth and development of any region. There has been a linear growth in the number of vehicles and this leads to large amounts of fuel consumption and thus GHG emissions.

Air pollution in India is one of the serious health issues and is one of the greatest threats in the global context. India, being a country comprising of world second largest population of almost a 130 million (equivalent to 17.7% of world's population), is facing serious air pollution issues since a decade which is increasing at an alarming rate.

India is ranked 3<sup>rd</sup> for the most air polluted countries. The main reasons for this exponential increase in the pollution levels is poor fuel quality, usage old vehicles, inadequate maintenance, congested traffic etc. Reason behind large share of vehicular pollution is India's gigantic automotive industry. The major pollutants emitted from the automobiles are hydrocarbons, nitrogen dioxide, lead, carbon monoxide, sulfur dioxide, and particulate matter.

This air pollution cost adds on to the welfare costs. Air pollution costs Indian businesses about **USD 95 billion (7 lakh crores)** every fiscal year which is around **3% of India's total GDP**. The government's aim has been to mitigate the rising concern of increasing emissions of GHG which results in poor air quality and the remedial measures taken to reduce emissions is by introducing EV's and HEV's (hybrid EVs). The population of electric vehicles in India is increasing at the rate of 37.5%.

## ADVANTAGES OF EVs

In order to reduce air pollution and make the world sustainable for the future generations, we need to switch over to an alternate source of transportation from ICE convention vehicles to EVs as they are:

- Environment Friendly:

Compared to ICE vehicles EVs do not produce smoke which does not cause air pollution. EVs don't even have an exhaust system, which means they have zero emissions. Since they are gas-powered vehicles, they are large contributors to greenhouse-gas making. The switch to EVs can help in making the planet healthy.

- Cheaper than gasoline:

Per kilometre cost of EVs is cheaper compared to ICE vehicles. The fact cannot be denied that many EVs run at one-third of the cost, given electricity is significantly less expensive than gasoline. And since consumer charge there EVs in garage most of the time, installing solar panels at home can save even more money.

- Low Maintenance:

Due to the absence of internal combustion engine in EVs its maintenance isn't a burden.

## ELECTRIC MOBILITY IN INDIA:

A total of **5,30,560 EVs** (including electric two-wheelers [e-2W], electric three-wheelers [e-3W], electric rickshaws [e-rickshaws], electric cars [e-cars], and electric buses [e-buses]) were sold in India (CEEW - Centre for Energy Finance 2020). This is lower from the **National Electric Mobility Mission Plan (NEMMP)** 2020 target of 6-7 million EV and hybrid sales by 2020. However, there is a steady uptick in the sales of EVs since 2017.

A number of high-voltage electric cars were launched towards the end of 2019 and many more models showcased at the Auto-Expo 2020 were being prepared to be launched, including Tata Altroz EV, Mahindra eKUV100, and MG Marvel X.

The COVID-19 pandemic has disrupted the global supply chains for EV components, mainly power electronics, battery, and the minerals that are used in these components. The supply chain disruption has cast its shadow over the entire auto-industry, not just the EV sector. Although the EV industry in India stands uncertain, experts are divided on how the EV sector will eventually emerge out of the present situation: some have forecast stagnation while others see a possibility of the Indian EV sector becoming a strong contender in the global electric mobility manufacturing space.

## **INDIA'S POLICY ON ELECTRIC VEHICLES:**

The Government of India has given a call for '**Only Electric Vehicles**' on Road by 2030. India's primary focus is to contain the increasing pollution and reduce carbon footprint.

In 2012, National Electric Mobility Mission Plan (NEMMP) 2020 was established, under which an incentive scheme, Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME), was launched in 2015 to reduce the cost of hybrid and electric vehicles and to encourage their penetration in the market.

According to the **International Energy Agency (IEA)** only 30% of the new vehicle sales in India will be electric by 2030 which is significantly different from the Government of India's target of only selling electric vehicles by 2030. The report notes that the EV penetration in India will mainly be led by electric two-wheelers and three-wheelers, which will reach a cumulative sales share of almost 50%. It also highlighted that the rate of electrification of buses and light-duty vehicles will be lower, expected to be below 15% of the total sale share by 2030.

The Indian govt (on Sep 15 2021) approved Rs 25,938 crore PLI scheme for the automobile and auto ancillary sectors to promote domestic manufacturing of green vehicles and enable India to become a part of the global supply chain.

Petrol and diesel vehicles haven't been included in this scheme. This is because the focus is to promote the transition to clean automotive technologies which are expected to gain volumes in the coming years.

Scheme is expected to generate

- investments of over Rs. 42500 crores in 5 years
- incremental production of over Rs. 2.3lakh crores
- additional employment for over 750,000 people

## **ADOPTION OF EV'S IN INDIA:**

### **End of India's dependence on Chinese lithium?**

So far, India has been dependent on China and expensive foreign supplies for lithium. In the year 2020-21, India had imported lithium worth more than ₹6,000 crore and of this, more than ₹3,500 crore-worth of lithium was bought from China, according to IANS. However, with the second reserve found in Rajasthan, it is believed that China's monopoly in the global market will change.

Every year, we import 1,200 tonnes of lithium. Now, in Jammu and Kashmir, we got lithium. (If) we can use this lithium ion, we will be the number one automobile manufacturing country in the world.

India's plan to increase EV penetration by 30 per cent by 2030 relies heavily on lithium - as of now, only a little more than 1 per cent of all vehicle sales in the country are electric vehicles.

Still, there are many challenges for the EVs market. The major role to run the Electric Vehicle in India is power generation. Without electricity, we cannot imagine Electric Vehicles running on road. Therefore, responsibility of distribution network increases to supply the proper electric power without failure.

- High Cost:

Cost of buying EV is quite high when compared to that of an ICE vehicle i.e., the average cost of electric cars in India is around 13 Lakh (INR), which is much higher than the average INR 5 Lakh for economical cars run on traditional fuel. These are mainly due to the lithium import for battery making and since batteries make up to about 50% cost of the vehicle therefore EVs are costlier. Lithium is a rare metal which has its high reserves in countries like Chile, Australia, and Argentina.

- Lack of charging infrastructure:

The main hindrance behind commercial viability of EVs in India is inadequate charging infrastructure. India only had 650 charging stations in 2018, whereas China had over 456K charging points in the same year. Other reason creating anxiety is charging time. Battery charger efficiency according to the present available technologies all over the world varies in percentage from low 70s to high 90s.

- Range anxiety:

Range anxiety is one of the most significant roadblocks to EV adoption. EVs generally have shorter range which causes charging fear in consumers mind. At present longest range EV available is Tesla's model S which has a range of 370 miles per charge. But since Tesla is not entered the Indian market so Indians do not have reach to this high range vehicle. EVs available in India do not have range more than 500 km per charge. This is deeply associated to the lack of charging infrastructure in the country, and while conventional vehicles can be re-fueled at petrol stations, such is not the case when it comes to EVs.

- Purchasing price:

One obstacle for the adoption of EV's could be the initial purchasing price/cost and its battery replacement cost. In spite of government tax-breaks and incentives, EV's initial purchase price is about 30% higher than the conventional vehicles. However during the vehicle's life cycle, the difference in purchase price is often offset by savings on fuel and maintenance.

- Low operating range-

The average range for the electric 2 wheelers currently available in the market is around 84km per charge and for electric cars is 150-200 km per charge.

## **IMPACT OF TRANSITIONING TO EV'S ON ECONOMY:**

Among the many measures taken to revive the economy in the aftermath of COVID-19, electric mobility should be prioritized as a key sector for India's economic recovery and sustainable growth. In an EV30 scenario, the domestic value-add generated in manufacturing, reduction in oil import bill, and environmental and health benefits far outweigh the loss in value addition from the petroleum and automotive sectors.

When comparing direct jobs, there are more jobs lost than created in the transition. However, assessment of job creation only considers direct manufacturing jobs associated with EV powertrain, batteries, and charging infrastructure and jobs in the electricity sector.

Direct jobs from activities such as installation and operations, charging infrastructure, battery recycling, telematics, and other service-related jobs and indirect jobs have not been taken into account. But the EV roadmap for India should identify activities beyond manufacturing within the EV value chain for job creation.

If EVs garner 30 per cent of vehicle sales by 2030, the central and state governments are set to lose revenue from petrol and diesel taxes by 15%. When pushing for EV transition, the government's plans should also include diversification of revenue sources.

### **1. Impacts arising from the change in oil consumption:**

In FY19, the oil consumption from road transport stood at 91 Mtoe. Petroleum imports constituted nearly one-third of India's total imports in value terms and the country imported 87 per cent of its domestic consumption of crude oil according to provisional estimates (MoPNG 2020). So the government has set a target of reducing oil import by 10% by 2022. Electric mobility and limiting private vehicle ownership hold key to achieving this target.

### **2. Reduction the petroleum tax revenue of central and state governments:**

While the intent is to bring down the consumption of petrol and diesel through changes in mode-share and fuel mix, it is to be noted that the petroleum sector is a significant contributor to revenues for the centre and states in the form of taxes and dividend income. The total revenue realized from taxes on petrol and diesel was INR 5,76,000 crore in FY19, with 60 per cent of these revenues going to the centre and the remaining to the states.

Tax on fuel constitutes 15–20 per cent of tax revenue for the majority of the states (RBI 2019). The central government would lose 15–31 per cent of potential petroleum tax revenues in 2030. On the other hand, in a high private vehicle scenario, the central and state governments, respectively, gain a revenue of 4 and 8 per cent in the form of fuel taxes.

### 3. Impact on employment:

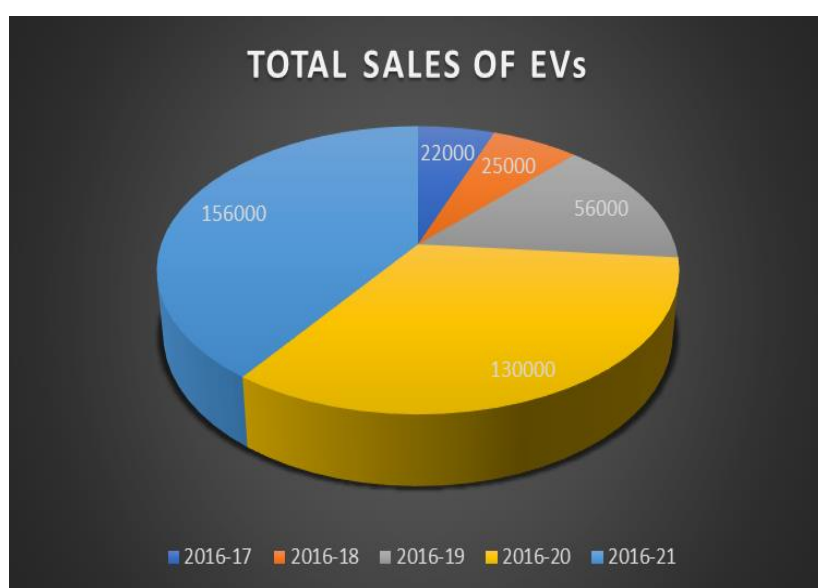
In the course of transition to electric mobility, new high-skilled jobs in the manufacturing of batteries, EV powertrain, and charging infrastructure are likely to be created. Additional consumption of electricity will drive job creation in the power sector. Simultaneously, reduced consumption of oil would lead to a reduction in jobs created in the petroleum sector and in internal combustion engine (ICE) vehicle manufacturing.

The petroleum value chain (refining, processing, wholesale, and retail) creates the least number of jobs per INR 1 crore of output value-added. If the EV transition at EV30 is reached, it is likely to result in a reduction of 19 per cent of jobs in the petroleum and automotive (ICE vehicle) sectors.

For EV industry to thrive it is essential to train existing workforce for new jobs. As the EV sector scales up, the new jobs created in the EV value chain would require imparting training and skilling to create a workforce that can cater to the needs of EV manufacturing as a prerequisite to meet any anticipated demand for EVs.

## TOTAL SALES OF ELECTRIC VEHICLES FROM THE YEAR 2016-2020

FINANCIAL YEAR	TOTAL SALES
2016-17	22000
2016-18	25000
2016-19	56000
2016-20	130000
2016-21	156000



## 2-Wheeler Sales Trends

Torch bearer of EV revolution in India, the Electric 2-wheeler industry accounted for 55% of the total EV sales in FY2022 alone.

- The overall E2W sales in India during the first half (H1) of FY2023 was about 4.56 lakh units which is more than twice the sales in H1 of FY2022. During the same period, the sales of high-speed (HS) E2W was more than 65% of the overall E2W sales<sup>1</sup>.
- During H1 FY2023, Maharashtra recorded the highest HS-E2W sales at 53,043 units followed by Karnataka (42,371 units) and Gujarat (32,414 units).
- Considering the H1 FY2023 sales in E2W-HS segment, Okinawa emerged as the leader with sales of 53,550 units followed by Hero Electric (49,484 units) and Ola Electric (48,015 units). The combined HS sales of the top 10 OEMs in H1 FY2023 have already surpassed their sales in FY2022.
- During the 18-month period between April 2021 and September 2022, as per JMK Research estimates, more than 4.6 lakh units of low speed (LS) E2W were sold pan-India.<sup>2</sup>
- As per JMK Research estimates, the next half of FY2023 i.e., H2 FY2023, will witness overall E2W sales of ~7.3 lakh units.
- Furthermore, we expect the overall E2W market to reach 67.14 lakh vehicles by FY2027.
- An analysis of new products launched indicates that 54 new lithium-ion battery-based E2W models were launched in India from January to October 2022. Of this, 44 were HS models.
- 12 E-bikes were launched between January 2022 and October 2022. Their top speeds range from 65-180 kmph whereas the maximum battery range of these E-bikes vary between 100 km and 200 km.
- 5 new-entrant brands/OEMs launched 10 new models in 2022 year-to-date (YTD).
- E2Ws account for about 90% i.e. ~4.2 lakh units of the FAME3-2 subsidized EVs sold until 11th July 2022, signifying a gap of 58% from the FAME 2 sales target (10 lakh units).
- 20 OEMs/brands have E2W models with active FAME 2 certification. The L1 category (i.e., 2Ws with top speed not exceeding 45 kmph) includes 29 models across 12 OEMs.
- The L2 category (i.e. 2Ws with top speed over 45 kmph) includes 15 models across 8 OEMs.
- Also, over the course of last one year, the government undertook new initiatives bearing an impact on the E2W market as well. These include the Production-linked Incentive (PLI) Scheme for automotive sector (INR25,938 crore) and the PLI scheme for Advanced Chemistry Cell (ACC) (INR18,100 crore). Furthermore, the central government issued critical notifications vis-à-vis new guidelines for battery swapping and battery safety norms.
- So far, 25 states or union territories (UTs) have either issued draft or implemented their own EV policy.



- The total volume of investments made in the Indian E2W market so far have been ~INR14,000 Crore. In H1 FY2023 (April to September 2022) alone, investments to the tune of ~INR3,844 Crore were injected into the E2W market.
- The Indian E2W market, though anticipated to ride high over the long-term, still needs to overcome several challenges in terms of the inadequacies and/or inefficiencies of different support systems required in the EV ecosystem viz. retail financing, supply chain, and timely disbursement of government subsidy

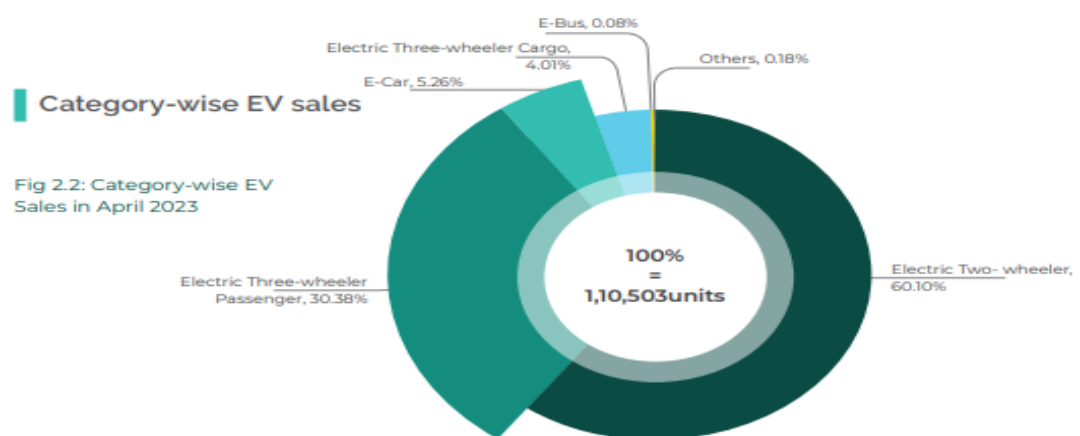
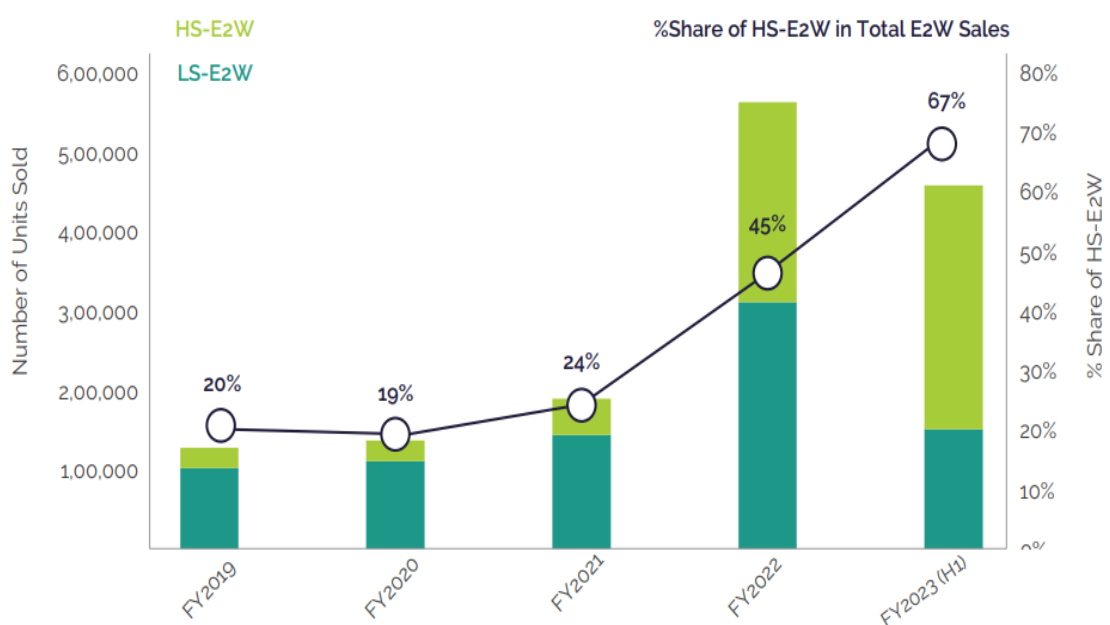
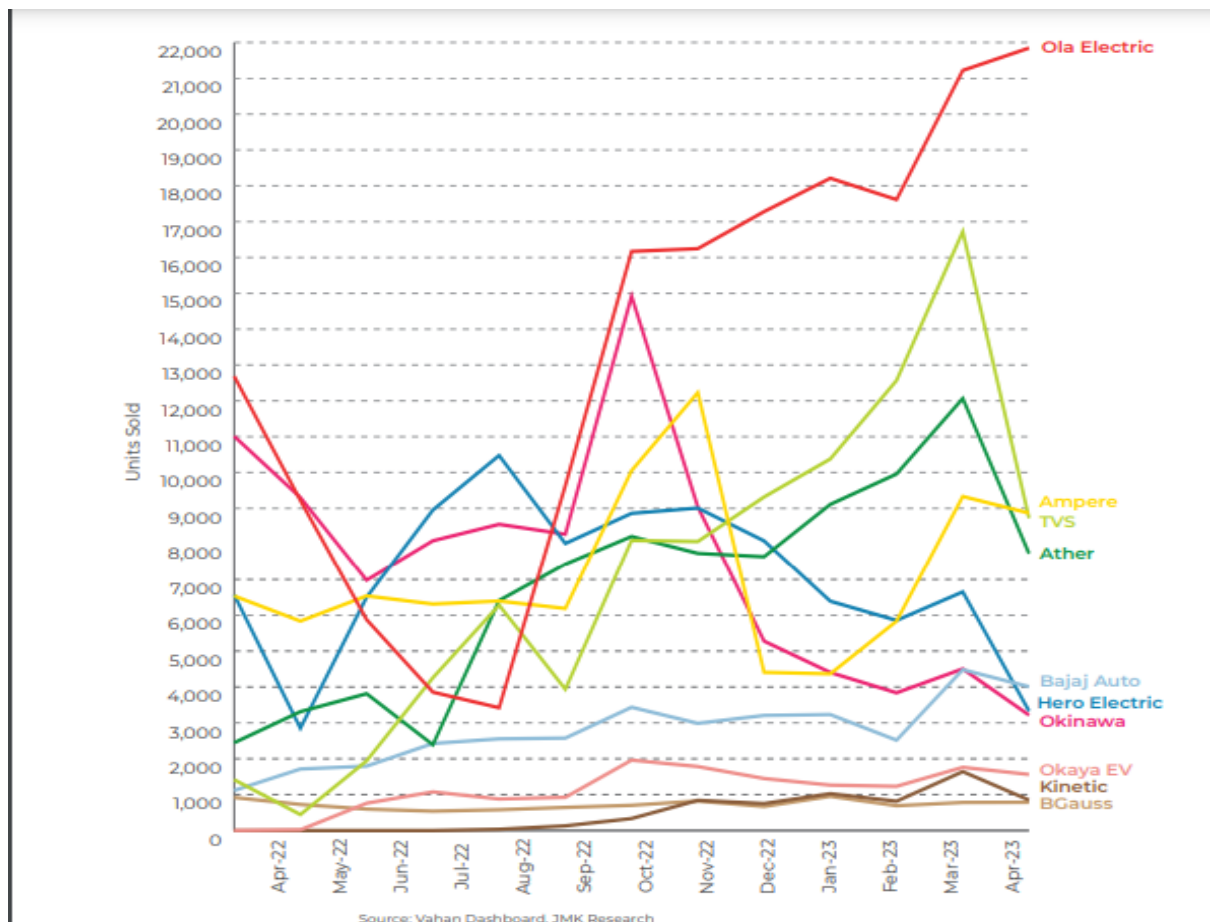


Figure 1: Breakup of HS- and LS-E2Ws



From above figure we can see that undoubtedly 2-Wheeler leading the sales trends.

## Major 2-Wheeler Player wise Sales Analysis



Ola Electric recorded the highest ever sales in this month with 21,845 units sold. Ampere moved into second place, replacing TVS Motors. TVS Motors and Ather secured third and fourth positions respectively. BGauss again made an entry to the top 10 squad this month.

## Key Manufacturing Updates

Mahindra Last Mile Mobility breaks ground on new EV plant in Zaheerabad Mahindra Last Mile Mobility (LMM), a part of Mahindra & Mahindra (M&M), opened a new manufacturing unit in Zaheerabad, Telangana. The ground-breaking follows the announcement of M&M's INR1,000 crore investment in Telangana that M&M had announced on February 10, 2023. With this new facility, the company aims to build a state-of-the-art battery assembly line, producing power packs and manufacture electronic as well as drivetrain components for electric three- and four-wheelers.

Log9 Materials commissions commercial Li-ion cell manufacturing line The Bengaluru-headquartered Log9 Materials, an advanced battery technology and deep-technology startup, inaugurated India's first commercial Li-ion cell manufacturing unit at its campus in Jakkur, Bengaluru, and its indigenously developed Battery Management System (BMS)—Charvik. The new battery plant will have an annual capacity to produce 50-megawatt hours of batteries, which can power about 8000 units of three-wheeler electric vehicles per year. This facility will cater to LTO and LFP cell manufacturing. The manufacturing line will support the production of large form factor cylindrical cells ranging from 22 Series to 66 Series.

Virtus Motors announces new facility to increase production capacity and expand R&D efforts Virtus Motors, a leading electric vehicle firm, has announced its plan of action to utilize their new 12,000 sq. ft. facility in Faridabad, Haryana to increase their assembly capacity to 24,000 electric cycles per year. The facility will also serve as an R & D center for research on manufacturing technologies, new motor tech, advanced batteries, and EV electronics. The company plans to expand their retail presence to 20 metro cities and 50 mini-metros and create a countrywide service network.

Omega Seiki Mobility to set up US\$200 Mn EV factories. Omega Seiki Mobility is in negotiations with three States, including Tamil Nadu, about setting up two electric car plants in South India for an investment of US\$100 million each. The business already runs EV plants in Pune's Chakan and Faridabad. The potential for expansion in the southern market as well as the possibility of reducing logistics costs is driving the idea to build additional factories in the region.

Sona Comstar inaugurates second largest manufacturing plant in Chakan. Auto component manufacturer Sona BLW Precision Forgings (Sona Comstar) has inaugurated its second-largest manufacturing plant in Chakan, Pune. With a production capacity of roughly 11.8 million gears, and an estimated investment of INR231 crores, the new plant will manufacture driveline products for EV and non-EV applications.

Royal Enfield plots new factory in Tamil Nadu, revs up for global ride and EV foray Chennai-based midsize motorcycle major Royal Enfield plans to set up a new factory in Tamil Nadu to cater to its growing global ambition and diversification into electric vehicles. The company has already acquired a 60-acre land parcel in Cheyyar, on the outskirts of Chennai, which is likely to be the key production base for its two wheeled EVs in the future. Royal Enfield is likely to invest between INR1,000 to INR1,500 crore in the next 12-24 months towards expanding both its product portfolio and manufacturing capacity

## Deals & Investments

Company name	Company type	Deal type	Investor(s)	Deal value (INR Crore)	Details
BluSmart (Subsidiary of Gensol Engineering)	EV Ride-hailing platform	Debt	Power Finance Corporation Ltd (PFC)	633	PFC to provide INR633 crores to BluSmart Mobility
Mobec Innovations	Mobile charging as a service company	Equity	Singapore-based Purple Stone Consulting	8.174	Mobile EV charging firm Mobec Innovations raises US\$1 million
Nysa Mobility	EV manufacturer	Equity + Debt	Touchstone Ventures, Panthera Peak Capital, and select family offices and angel investors.	28.54	Nysa Mobility Tech raises US\$3.5 million in seed funding
Magenta Mobility	EV Charge Point Operator	Equity	BP and Morgan Stanley	180.29 (A1 funding)	Magenta Mobility raises USD 22 Mn from bp, Morgan Stanley India Infra
Blue Energy Motors	Electric Truck technology start-up	Equity	FPT Industrial	undisclosed	FPT Industrial invests in Blue Energy Motors to jointly develop BEV truck platform
Metastable Materials	Li-ion battery recycling start-up	Equity	Surge, Sequoia Capital India, and Southeast Asia's rapid scale-up program, which included participation from deep-tech VC Speciale Invest, Theia Ventures, and other angels	undisclosed	Metastable Materials raises seed funding by Surge, Sequoia Capital India, and others

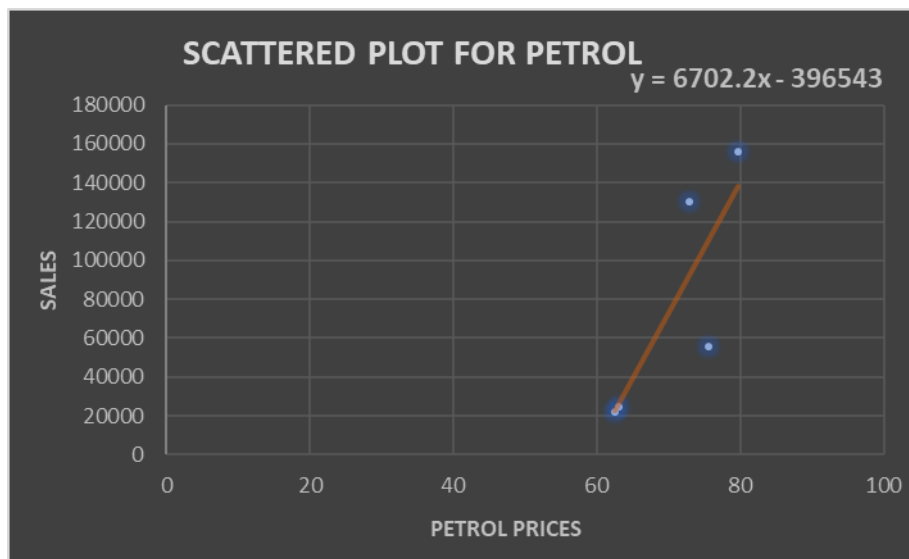
# METHODOLOGY

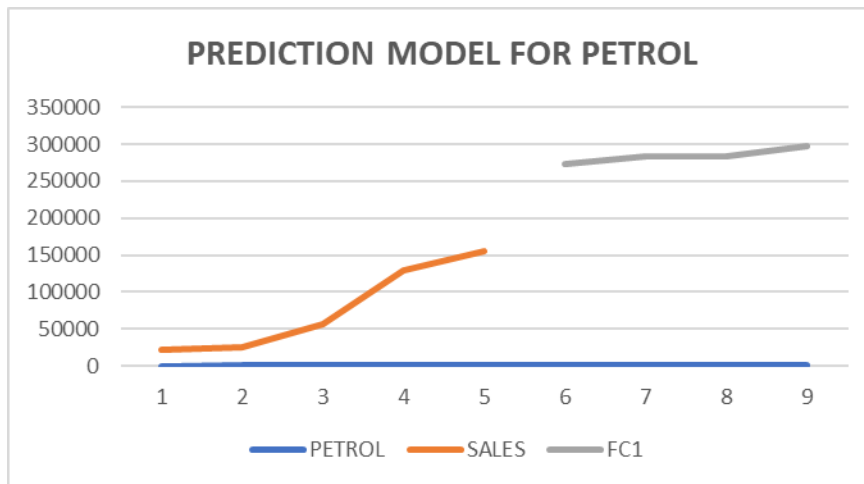
Regression model for sales (dependent variable) and fuel (diesel and petrol separately) prices (independent variable)

Petrol and diesel prices in litres (rupees)

Sales on per year basis, considering only 2 and 4-wheeler evs

YEAR	PETROL	SALES	FC1
2016	62.51	22000	
2017	63.09	25000	
2018	75.55	56000	
2019	72.96	130000	
2020	79.76	156000	
2021JULY	99.86		272738.7
2021AUG	101.49		283663.3
2021SEP	101.39		282993.1
2021OCT	103.54		297402.8





FC= regression model used by the regression equation

$Y=a+bx$  where

SLOPE

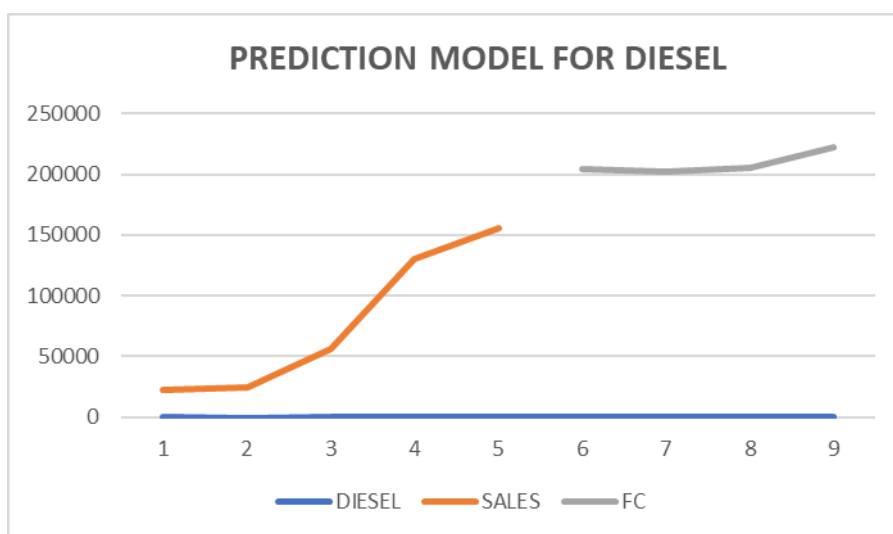
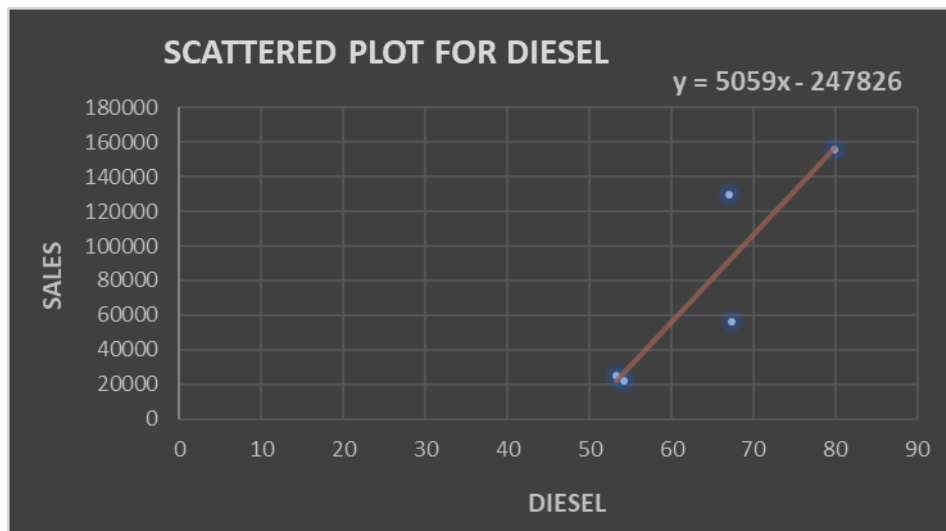
(b) 6702.226

INTERCEPT

(a) 396543

Analysis- From the above model we can analysis that the slope gives us a positive relation between the electronic vehicle sales and petrol prices. We can also observe that the prediction done for the months of July to October 2021 show a further increase in the sales of EVs with the continuous increasing petrol prices.

YEAR	DIESEL	SALES	FC
2016	54.28	22000	
2017	53.33	25000	
2018	67.38	56000	
2019	66.96	130000	
2020	79.88	156000	
2021JULY	89.36		204246.2
2021AUG	88.92		202020.3
2021SEP	89.57		205308.6
2021OCT	92.82		221750.4



where, to predict the values

FC= FORECAST METHOD USING THE REGRESSION EQUATION

FC formula =  $a + bx$ , where  $a$ = intercept;  $b$ =slope

SLOPE(b)	5058.969		INTERCEPT(a)	-
				247826

Analysis- The above data shows the positive relationship between the diesel prices and sales of EVs with a prediction model for the year 2021. Sales will shoot up further in EVs with the increasing diesel prices however, the sales will be still lower in comparison to the case of petrol prices and sales of EVs.

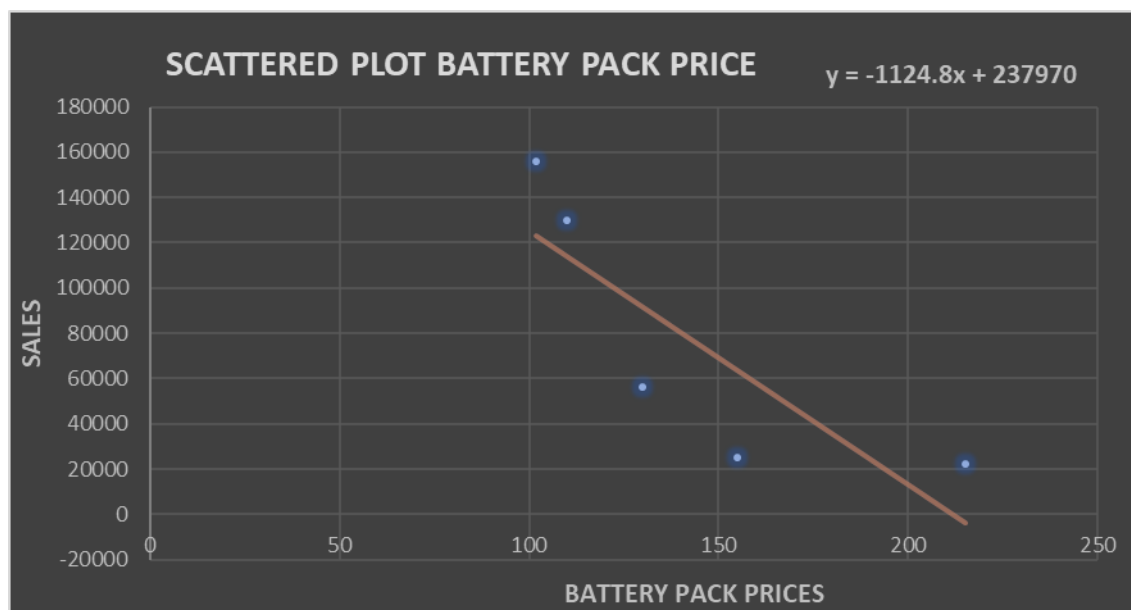
Thus, we can observe that more people using petrol driven cars will soon be switching to EVs since it is more economically beneficial and eco-friendly.

## BATTERY PACK PRICE AND CELL PRICE ARE INDEPENDENT VARIABLES IN 100/KILOWATT HOUR IN DOLLARS

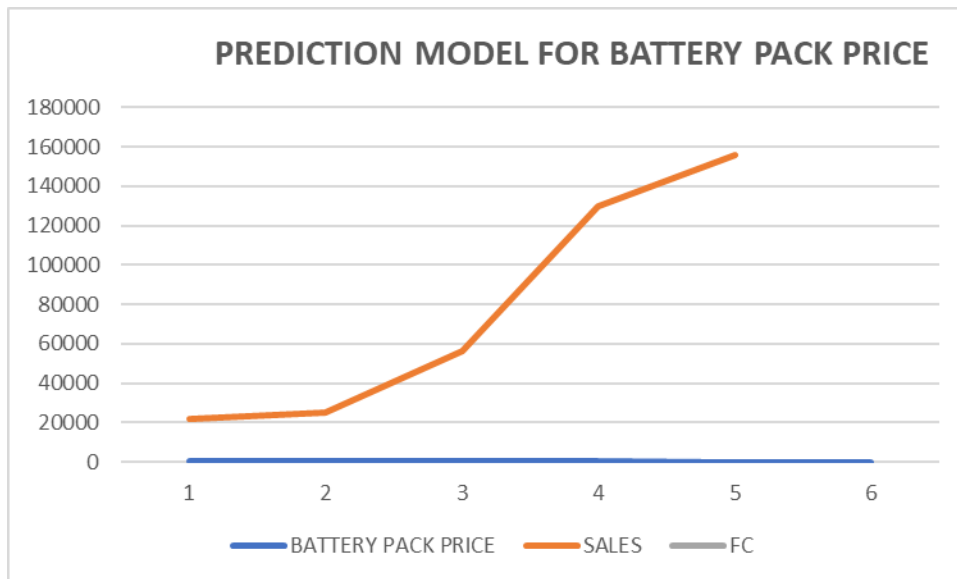
What are battery pack?

A battery pack is a set of any number of (preferably) identical batteries or individual battery cells. The battery pack high voltage system is designed to control power flow to and from the cells and to maintain the power level within the design envelope.

YEAR	BATTERY PACK PRICE	SALES	FC
2016	215	22000	
2017	155	25000	
2018	130	56000	
2019	110	130000	
2020	102	156000	
2021	102		123241.4







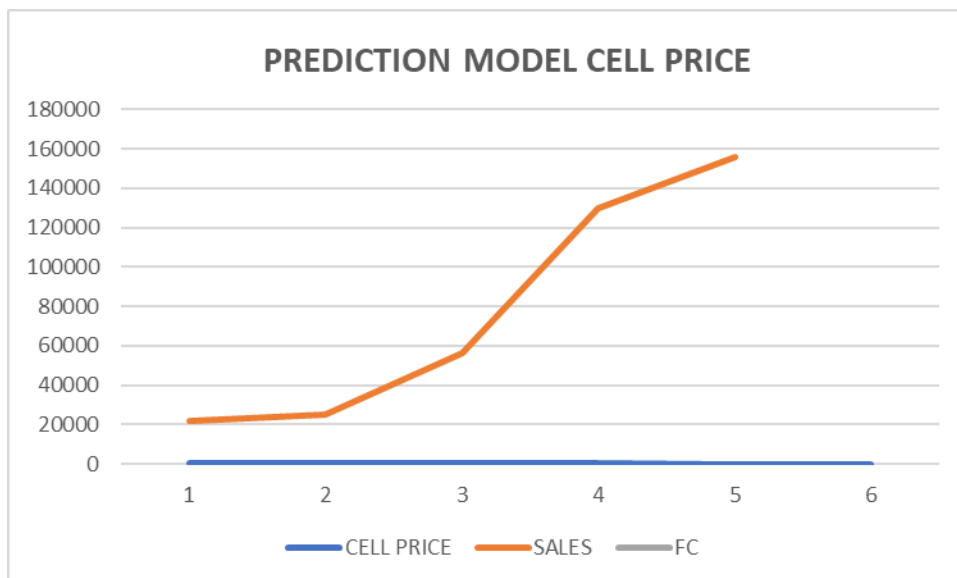
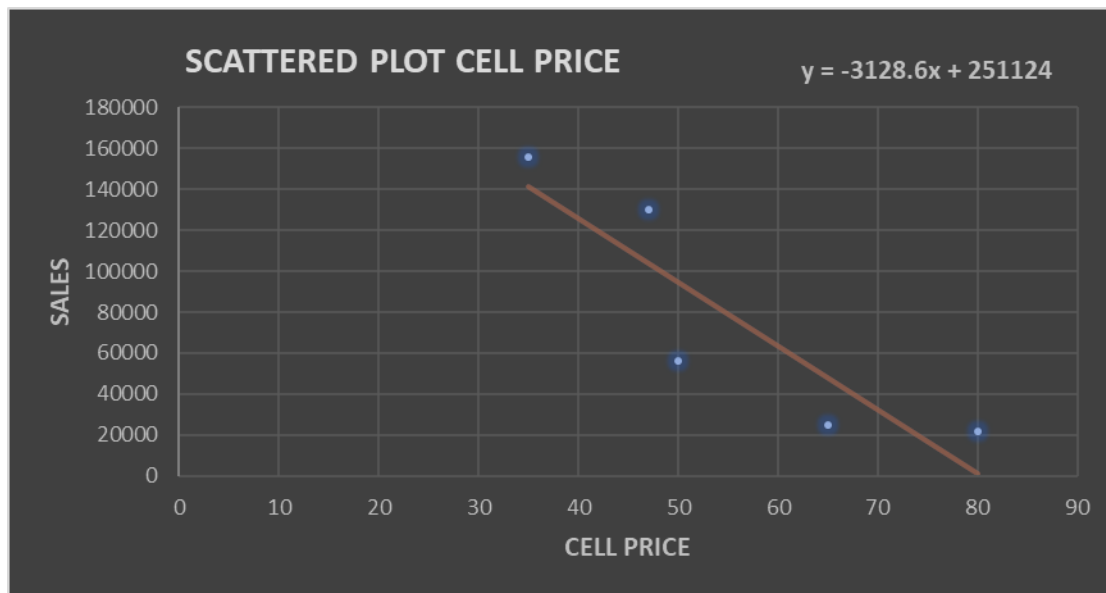
SLOPE (b)	- 1124.79		INTERCEPT (a)	237969.8495
--------------	--------------	--	------------------	-------------

Analysis- From the above data we can analyse that there is a negative or an inverse relation between the battery pack prices and sales of EVs. This is so because, these batteries are a raw material for the electric vehicles on which they run. If the battery prices rise, it will lead to increase in cost of production and hence, increase in EV prices which will then result in less demand. Thus, we can observe that in our prediction model which is only done for 2021, the battery prices are same which leads to a slight decrease in the sales of EVs. Thus, only a further decline in the prices will get the sales to rise up.

What are cells in EV?

The conventional battery pack uses cells to build a module and then assembles modules into a pack. A blade battery pack builds on wide and short cells and assembles them directly into a pack, thereby having much higher mass and volume integration efficiencies than the conventional pack.

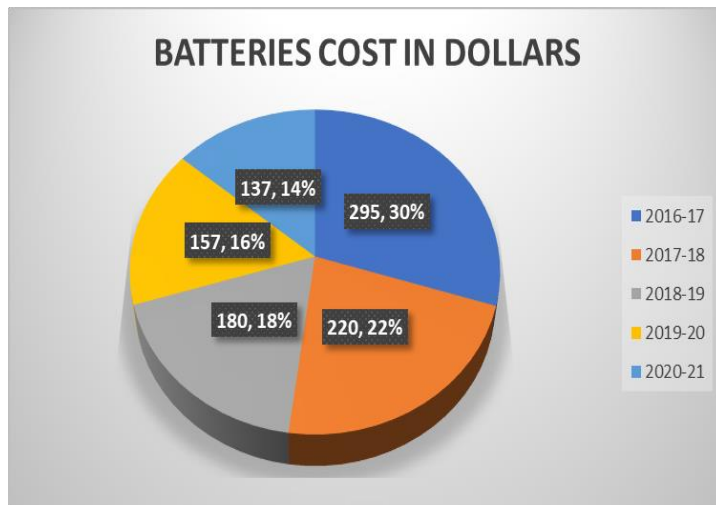
YEAR	CELL PRICE	SALES	FC
2016	80	22000	
2017	65	25000	
2018	50	56000	
2019	47	130000	
2020	35	156000	
2021	35		141623



SLOPE	-		INTERCEPT	251123.6
(a)	3128.59		(b)	

Analysis- To draw a conclusion, we can observe that there is a negative relationship between the cell prices and the sales of EVs. With any reduction in these cell prices will lead to increase in the sales of EVs. Hence, from the prediction model we can see that, with similar pricing in 2021, there is a slight drop in sales. However, the sales drop due to cell prices is much lower than in battery pack prices. This is because, micro-fuel cells, once commercialized, hold the promise for providing more back up 'green power' at lower cost than its competing battery technologies.

## THE TOTAL BATTERY COST FROM THE YEAR 2016 TO 2020 AND THE CORRESPONDING SALES OF ELECTRIC VEHICLES.



YEAR	BATTERIES COST	SALES
2016-17	295	22000
2017-18	220	25000
2018-19	180	56000
2019-20	157	130000
2020-21	137	156000

YEAR	CO2	SALES	FC
2016	1.81	22000	
2017	1.84	25000	
2018	1.92	56000	
2019	1.91	130000	
2020	2.47	156000	
2021	2.407		152103.7

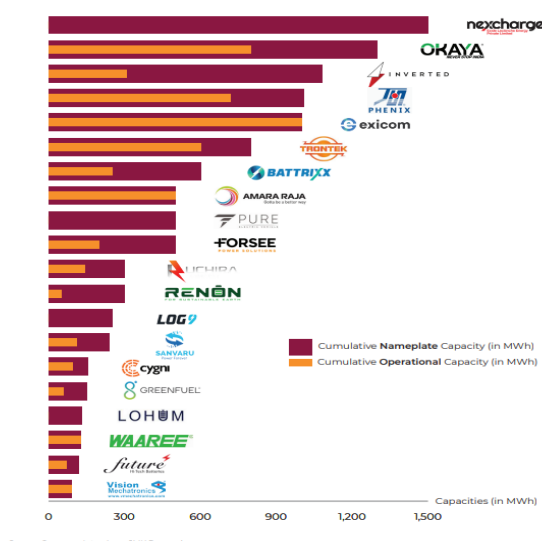
Carbon dioxide (CO<sub>2</sub>) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included

CO<sub>2</sub> EMISSIONS PER CAPITA IN BILLION TONS

HERE, CO<sub>2</sub>- INDEPENDENT VARIABLE  
SALES- DEPENDENT VARIABLE

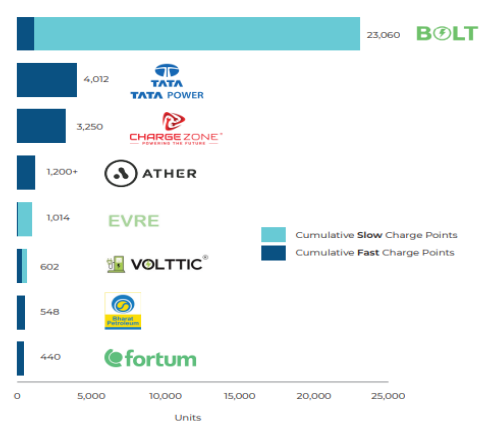
## BATTERY PACKS

Nameplate & Operational Battery Pack Capacities (till FY2023)



## CHARGE POINTS

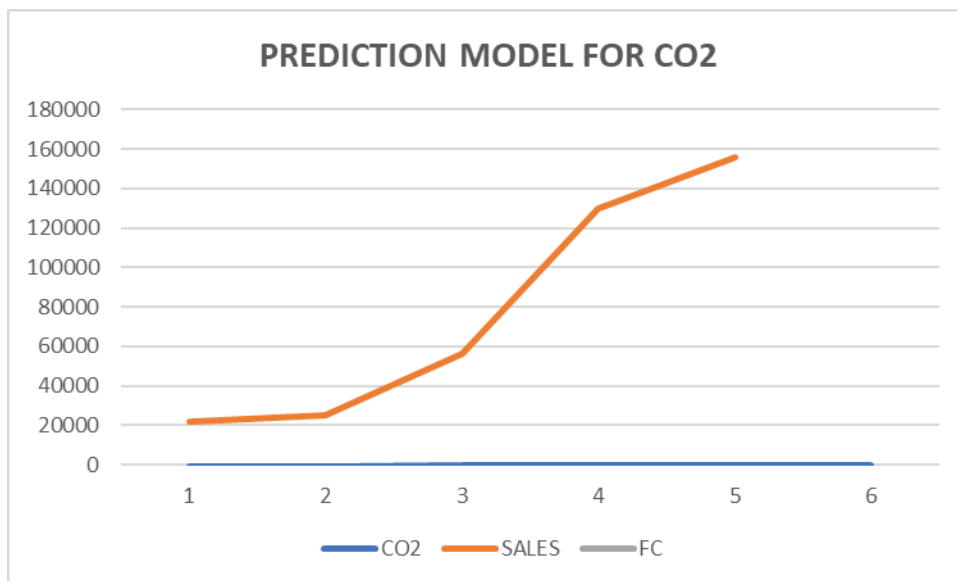
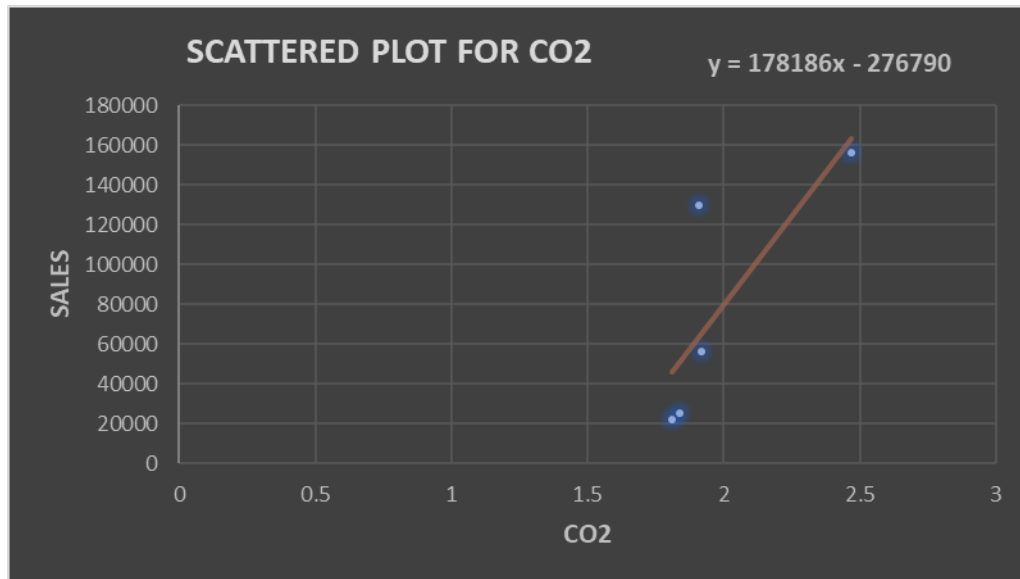
Installed Fast and Slow Charge Points (till FY2023)



Source: Company Interviews, JMK Research

Note:

1. Slow charge points include AC001 charge points; Fast charge points include DC001 (30/60 kW)/ AC Level 1/CCS (50/60kW), and combo charge points.
2. Tata Power has not shared breakup of charge point numbers into slow and fast ones. Tata Power has an installed network of 4,012 Public, Captive, and Bus Charge points. Excludes 35,000+ Home chargers (for private use).
3. BOLT's charge point count includes public charge points only and excludes private (home) charge points.
4. Rest of the CPs have not shared their numbers, hence not included.



SLOPE(b)	178186.1		INTERCEPT(a)	-276790
----------	----------	--	--------------	---------

Analysis- We can see from the above model that there is an positive relationship between the CO2 emission per capita and the sales of EVs. With the decreased numbers of the CO2 emission, the sales also drop. This is due to the facts that,

- The raw materials for building up EVs, like cobalt, lithium, ion is very difficult and rare to find. Any increase in sales of electric vehicles will lead to less sustainability. Additionally, lithium, cobalt and other such raw materials may cause more harm to the environment, like

increase global warming and make the already scarce resources more limited.

- Lastly, there are very few EVs in proportion to the ICE vehicles (Internal Combustion Engine) so, any change in CO2 emission will not really be affected by the change in EV sales.

#### TOTAL SALES OF ELECTRIC VEHICLES FROM THE YEAR 2016-2020

FINANCIAL YEAR	TOTAL SALES
2016-17	22000
2016-18	25000
2016-19	56000
2016-20	130000
2016-21	156000

#### STACKED CHART FOR FOUR AND TWO-WHEELER ELECTRIC VEHICLES

FINANCIAL YEAR	FOUR WHEELER	TWO WHEELER
2016-17	2000	20000
2016-18	2000	23000
2016-19	1200	54800
2016-20	4000	126000
2016-21	4000	152000

## CONCLUSION

EVs are found to be energy efficient along with low-cost maintenance than fuel vehicles. During the purchase of a vehicle consumers usually focus on their initial investment and do not really appreciate the future gains. By capitalizing on this aspect certain measures can be taken which may result in the increased penetration of EV's in the Indian market.

High cost is one of the reasons which divert the customers from purchasing EVs. To work upon this government has pushed for a wider EV adoption by offering subsidies to commercial vehicles. But electric cars still remain costlier by at least 30%, mainly due to imported batteries. The Centre's Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme of 2015 rolled out subsidies for electric commercial vehicles.

Experts say the main challenges facing the EV industry are inadequate charging infrastructure and reliance on imported components and batteries. By 2023 all of this could change. Cost of battery imports are expected to come down. Over the last quarter, manufacturers have announced several new EV models that promise a higher range.

The CO<sub>2</sub> emissions will only drop down if sustainability goal is kept in mind and the government schemes are properly directed and abided by. Our analysis shows that CO<sub>2</sub> emissions and sales of EVs are positively related due to the fact that there are not enough sales and ICE car models are still outstripping the comparability with respect to the former. Thus, with gradual increase in sales, the CO<sub>2</sub> may be expected to come down and hence, our prediction is based on low level sales of EVs only.

Lastly, we can observe that if there is a continuous rise in the fuel prices, it will only increase the demand for EVs due to the following reasons;

- the market will prefer a more economical method of investment thereby, leading them to switch to electric vehicles
- Electric vehicle is a step into the modern world and with less interest of consumers in ICE vehicles due to surge in fuel prices, it will only be a beneficial move to step into a safer and cheaper era of automobiles

All in all, although there are many shortcomings and challenges in EV sector for the Indian Economy, there is a lot of scope for advancement in this industry which can prove to be a big transitioning phase for India and its automobile industry.

## REFERENCES

[https://www.researchgate.net/publication/353260957\\_Electric\\_Vehicles\\_in\\_India\\_A\\_Literature\\_Review](https://www.researchgate.net/publication/353260957_Electric_Vehicles_in_India_A_Literature_Review)

<https://www.teriin.org/article/air-pollution-india-major-issues-and-challenges>

<https://journals.sagepub.com/doi/full/10.1177/0972262919875548>

<https://inc42.com/infocus/electric-vehicles-this-week/electric-vehicles-this-week-assessing-indias-2030-electric-mobility-goals-more/>

<https://www.ceew.in/sites/default/files/CEEW-India's-EV-Transition-Post-COVID-19-22Dec20.pdf>

<https://jmkresearch.com/electric-vehicles-published-reports/monthly-electric-vehicles-update/monthly-ev-update-july-2021/>

<https://www.iisd.org/articles/india-electric-vehicle-revolution>

NMEM (2018) National Automotive Board, FAME-India, [www.fame-india.gov.in/](http://www.fame-india.gov.in/)

ModelUnderFame.aspx (Last accessed 14 March, 2018).

PTI (2017) Delhi's Diesel Consumption Reduced in 2016-17, Consumption of Petrol up Marginally, <https://www.moneycontrol.com/news/business/wire-news/delhis-dieselconsumption-reduced-in-2016-17-consumption-of-petrol-up-marginally-2472185.html> (Last accessed 20 February, 2018).

Sood, R. (2017) Delhi Government Declares Subsidies for Electric Vehicles, <http://www.ecardlr.com/car-news/delhi-government-declares-subsidies-for-electric-vehicles.aspx>

For electric vehicles being sold in India from 2015-2020

<https://dazeinfo.com/2020/05/28/total-electric-vehicle-sales-in-india-by-year-graphfarm/>

Petrol and diesel prices

[https://www.mycarhelpline.com/index.php?option=com\\_easyblog&view=entry&id=808&Itemid=91](https://www.mycarhelpline.com/index.php?option=com_easyblog&view=entry&id=808&Itemid=91)

<https://www.firstpost.com/india/petrol-diesel-auto-fuel-price-in-your-city-today-delhi-mumbai-kolkata-chennai-bengaluru-hyderabad-august-21-2021-9901881.html>

<https://www.firstpost.com>

<https://www.industryweek.com/technology-and-iiot/energy/article/22017905/electric-cars-soon-will-cost-less-than-gasoline-autos-research-shows>

Prices of Batteries for EVs

<https://auto.economictimes.indiatimes.com/news/auto-components/evs-to-close-in-on-ice-vehicles-in-few-years-as-battery-costs-expected-to-plummet-to-100/kwh-by-2023/79764942>

<https://www.renewableenergyworld.com/storage/annual-survey-finds-battery-prices-dropped-13-in-2020/#gref>

CO2 Emissions

<https://www.carbonbrief.org/analysis-indias-co2-emissions-fall-for-first-time-in-four-decades-amid-coronavirus>

<https://ourworldindata.org/co2/country/india>

<https://jmkresearch.com/electric-vehicles-published-reports/monthly-electric-vehicles-update/monthly-ev-update-july-2021/>

Regression Model theory

[https://youtu.be/8iqzFQ\\_nZI8](https://youtu.be/8iqzFQ_nZI8)