

E-TWO WHEELER

INDIA MARKET OUTLOOK

May, 2020

Including
'E2W CXO Survey'

JMK Research & Analytics is a boutique consultancy for all kinds of research and advisory services for Indian and international clients focusing on Renewables, Electric mobility and Storage markets. We employ our interdisciplinary team, strong industry network, existing databases along with vast project experience in the Indian power sector to create substantive business value for our clients. Our subscribers include, equipment suppliers, investment agencies, multi-lateral and bilateral agencies, project developers, government authorities.

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Abbreviations

2W	Two-wheeler	km	Kilometre
4W	Four-wheeler	kmph	kilometre per hour
Ah	Ampere hour	kWh	kilowatt-hour
AI	Artificial Intelligence	LA	Lead Acid
BNEF	Bloomberg New Energy Finance	Li	Lithium
BSS	Battery Swapping Station	MAAS	Motorcycle-As-A-Service
CAGR	Compound Annual Growth Rate	MCD	Municipal Corporation of Delhi
CO ₂	Carbon dioxide	MRP	My Revolt Plan
CRISIL	Credit Rating Information Services of India Limited	NEMMP	National Electric Mobility Mission Plan
DC	Direct Current	NITI	National Institution for Transforming India
DHI	Department of Heavy Industries	OEM	Original Equipment Manufacturer
E2W	Electric Two-wheeler	PCS	Public Charging Station
ET	Electrotherm	PM	Particulate Matter
EV	Electric Vehicle	R&D	Research and Development
FAME	Faster Adoption and Manufacturing of Electric (& Hybrid) Vehicles	RTO	Regional Transport Office/ Road Transport Office
FY	Fiscal Year	SC	Scheduled Castes
GHG	Greenhouse Gas	SMEV	Society of Manufacturers of Electric Vehicles
GST	Goods and Services Tax	ST	Scheduled Tribes
GW	Gigawatt	STU	State Transport Undertaking
ICE	Internal Combustion Engine	USD	United States Dollar
INR	Indian Rupee	WHO	World Health Organization
IOT	Internet of things	YOY	Year-Over-Year

1. Introduction

India is a massive market for two-wheelers which accounts for 70% of the 200 million total vehicles running across the length and breadth of this huge nation. This common man's commute is also responsible for over 20% of the total CO₂ emissions, and about 30% of the particulate emissions in urban areas (PM_{2.5}). Since this segment is bound to grow further, there is an urgent need to switch to cleaner mode, mainly in the urban areas, as 7 of the 10 most polluted cities across the world are in India.

The growth engine of the electric two wheeler (E2W) market would be fuelled by various drivers, of which strong governmental push and affordability would play key roles. NITI Aayog is targeting 30% EV penetration in India by 2030.

To make EV adoption easier for manufacturers and consumers, the Government of India has taken some key steps in the last few years. Various incentives and subsidies are provided under FAME 1 and FAME 2 schemes by the government. Under the FAME-II scheme, the subsidy outlay is increased to nearly ten times that of FAME-I allocations.

India has shown considerable progress in the E2W space with serious players entering the EV market. With the entry of significant two-wheeler brands such as TVS, Bajaj, and Hero in this segment compounded with the Government's EV push, the investors are much more confident and have shown an active

interest in the EV ecosystem.

In the last two years, more than \$600 million of investments have been raised by E2W companies in India.

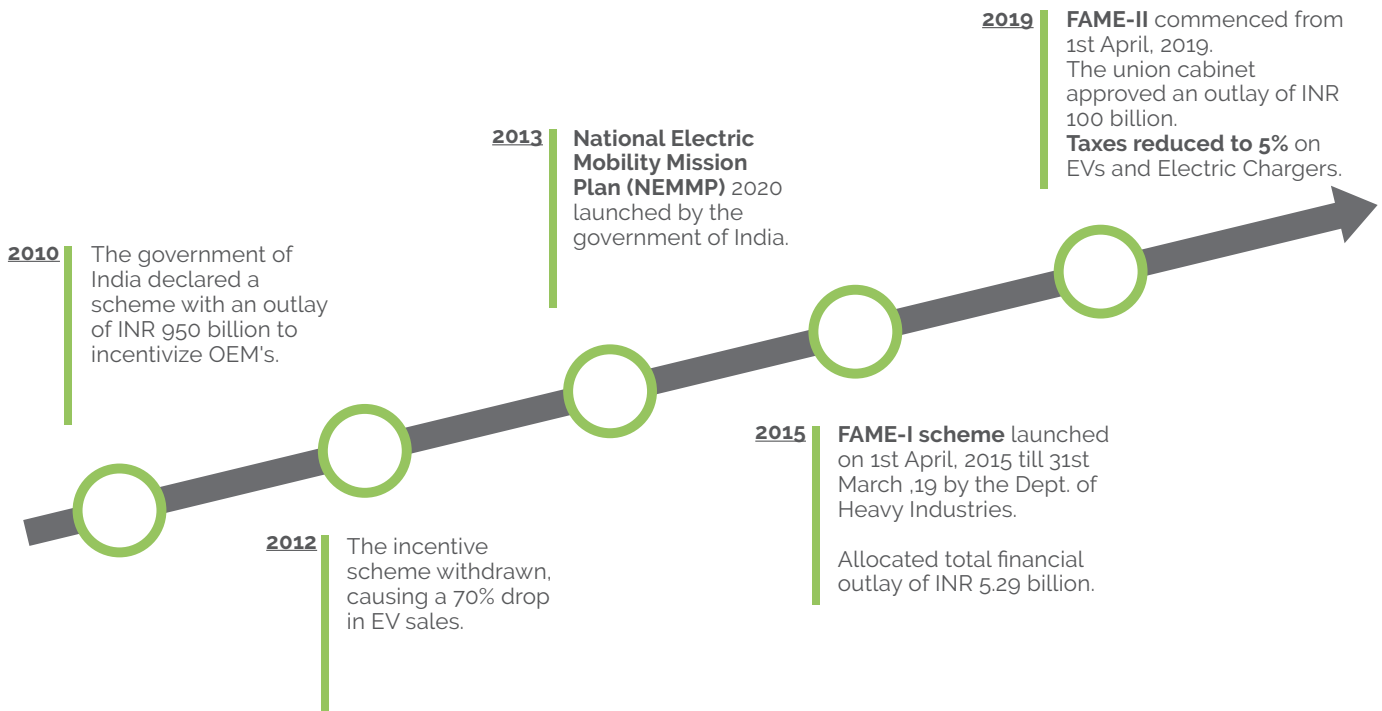
The electric two-wheeler (E2W) market in India has grown by a CAGR of 62% from FY2016 till FY2020. The FY2020 sales of electric two-wheelers stood at 152,000 units, which is a marginal increase of 20% over that in the previous year. E2W space is anticipated to witness significant disruption after 2024 when the battery prices fall below \$100/ kWh. This price is seen as the point around which EVs would reach at price parity with the Internal Combustion Engine (ICE) vehicles.

As per JMK Research estimates, this market is likely to grow from 1,52,000 units in FY2020 to about 34,50,000 units by FY2025 (CAGR of 87%).

However, there are concerns that need to be addressed for faster growth of this segment. As per JMK Research "E2W CXO Survey" where about 12 key players participated, high upfront costs of E2W and Government incentives linked to local manufacturing are the imperative roadblocks.

2. Policy Scenario

Policy Road Map for EVs in India



Source: JMK Research

Central Policies

NEMMP 2020 In 2013, the Government of India launched NEMMP 2020, intending to reduce dependence on crude oil for transportation by promoting electric vehicles in India. Department of Heavy Industries (DHI) had estimated Government support in the range of INR 135 - 153 billion for R&D and building EV infrastructure .

By providing fiscal incentives in the nascent stage of development, the Government aimed a humongous target to attain 6-7 million electric vehicle sales year on year from 2020 onwards. It was expected that a cumulative sale of 15-16 million EVs by 2020 would

save 9500 million litres of crude oil, which is equivalent to INR 620 billion of savings.

FAME – I Under the national mission, DHI formulated the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme with an approved financial outlay of INR 7.95 billion for a period of two years. The focussed areas of development in this scheme were R&D of pilot projects, charging infrastructure, and demand creation. The demand incentive provided under the scheme could directly be availed by the buyers upfront at the point of purchase. The two years scheme was later extended for

another two years up to 31st March 2019. FAME – I had a planned budget allocation of 7.95 billion as demand incentives, but only 5.29 billion was allocated in over four years. The subsidies were applicable for two-wheelers, three-wheelers, passenger cars, light commercial vehicles, and buses.

In December 2017, Minister of Heavy Industries announced subsidy for 390 buses, 370 taxis, and 720 three-wheelers across 11 cities in India under FAME scheme. To attain this, the government proposed total fund support of INR 4.4 billion, which included INR 0.4 billion as incentive for the installation of charging infrastructure.

FAME – II In March 2019, DHI notified phase II of the FAME scheme with a total budget outlay of INR 100 billion until March 2022. FAME – II proposes INR 86 billion as demand incentives to be provided upfront during the purchase of EVs. To encourage public transport, the buses would receive a subsidy of 40% of the cost of vehicles, and a 20% subsidy would be given to other commercial

vehicles. The scheme would cover incentives for 1.56 million vehicles until 2022. To provide a further push to clean public mobility, the DHI approved a sanction of 5595 electric buses to 64 cities, state government entities, State Transport Undertakings (STUs) for intra-city and intercity operation under the scheme.

Fund allocation under the FAME-II scheme is focussed more towards demand incentives and setting up charging infrastructure.

Under FAME 2, stringent eligibility conditions are imposed to promote local manufacturing.

- Localization of up to 40% for buses, 50% for other vehicle categories of ex-factory price
- Subsidy linked to battery size with no reference to range/ performance: INR 20,000 per kWh for buses; INR 10,000 per kWh for other vehicles
- Maximum subsidy cap across categories

As of May 2020, about 14,451 E2Ws have been sold under FAME II scheme. 70% of these sales are from the three states of Karnataka,

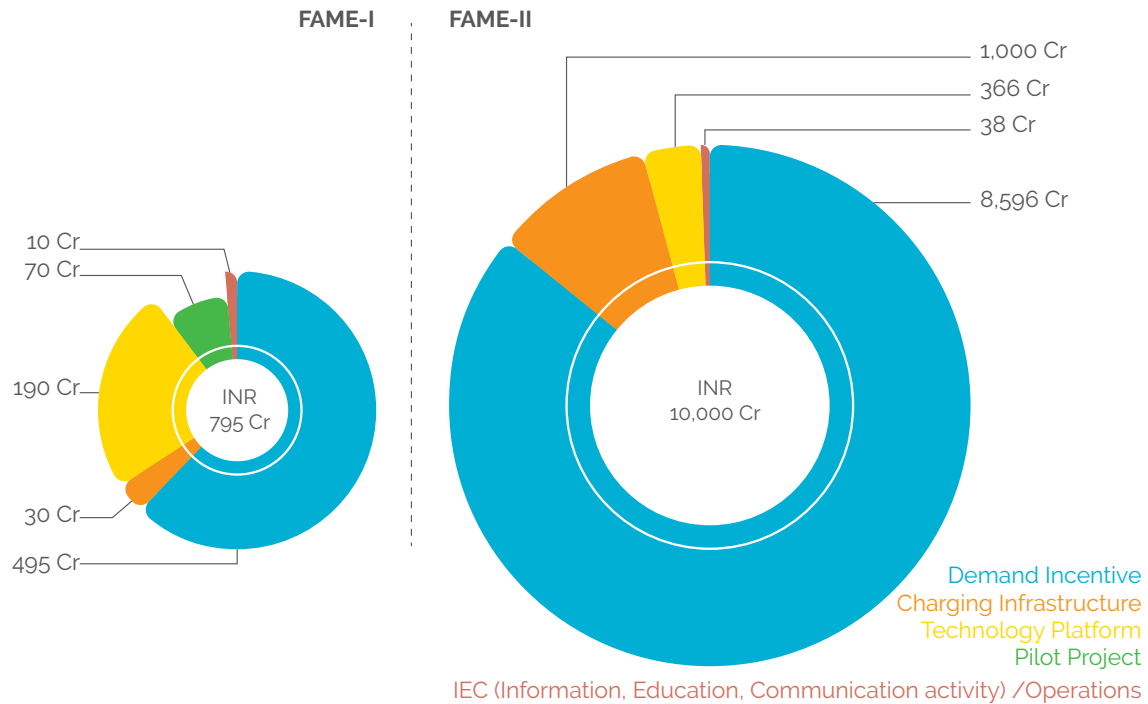
Table 2.1: Segment-wise distribution of subsidy allocation under the scheme

S.No	Electric Vehicle segment	Number of vehicles to be supported	Size of battery in kW	Total subsidy per vehicle, INR	Ceiling price to avail incentive, INR	Total fund support from DHI, INR million
1	Two Wheeler	1,000,000	2	20,000	150,000	20,000
2	Three-wheelers	500,000	5	50,000	500,000	25,000
3	Four-wheelers	35,000	15	150,000	1,500,000	5,250
4	4W hybrid vehicles	20,000	13	13,000	1,500,000	260
5	Buses	7,090	250	5,000,000	20,000,000	35,450
Total		1,562,090				85,960

Source: Ministry of Heavy Industries & Public Enterprises, Government of India

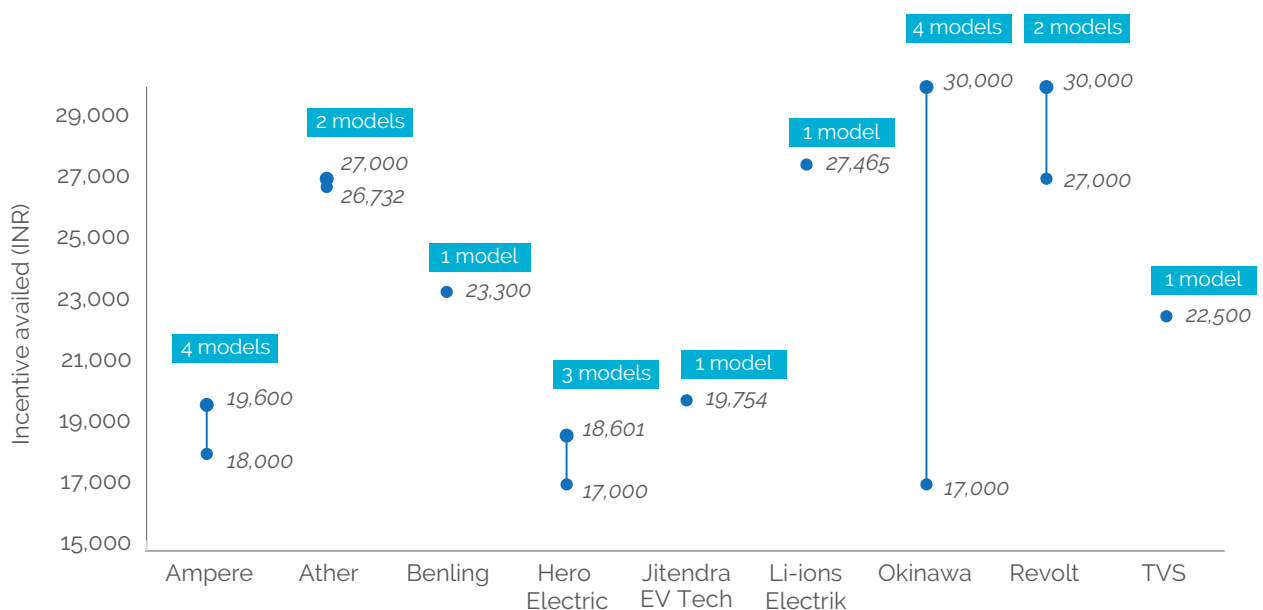
Tamil Nadu and Maharashtra. This is evident from the fact that most of the E2W players are concentrated in these states only.

Figure 2.1: Fund allocation under phase I and phase II of the scheme, INR Crore



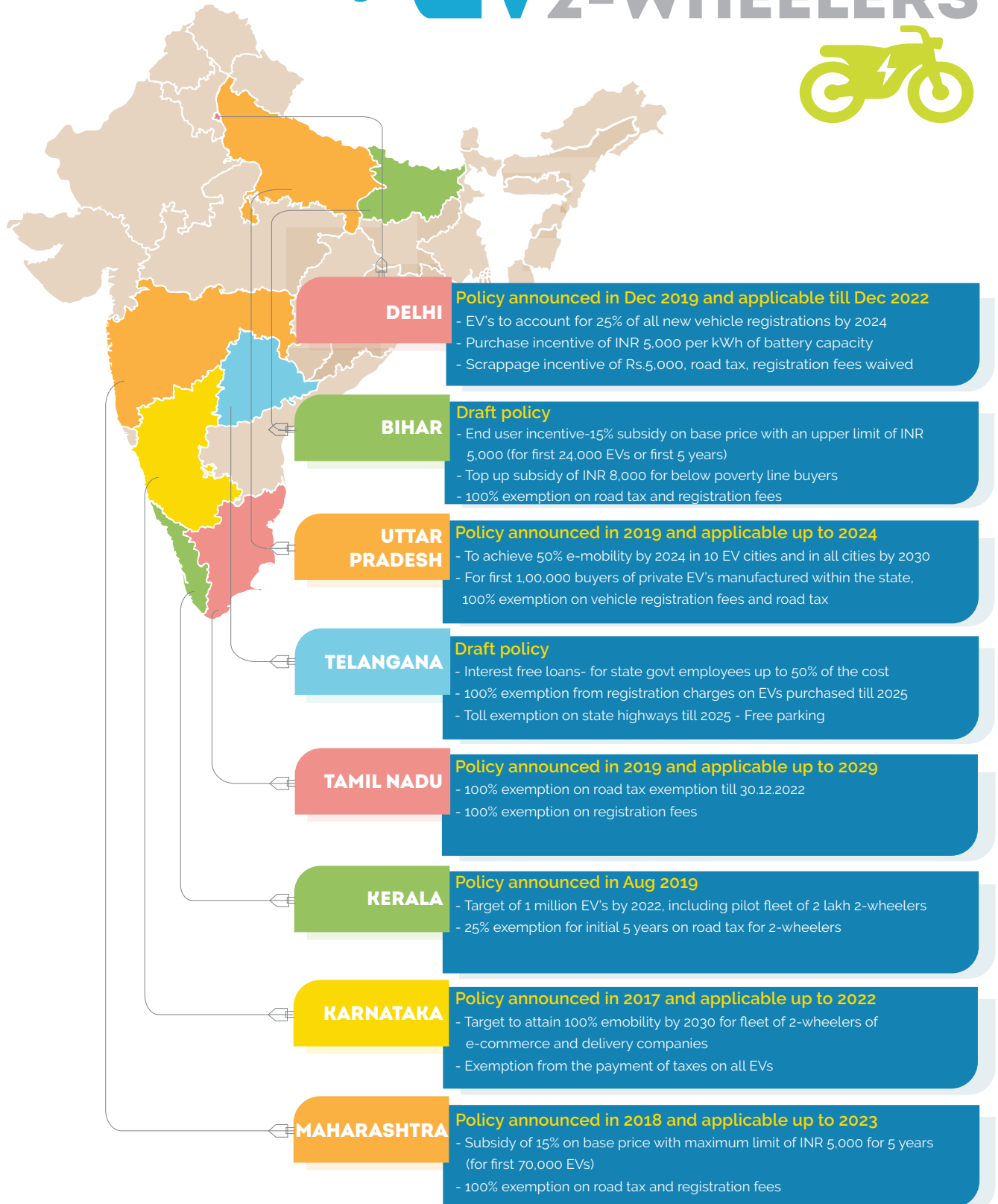
Source: Ministry of Heavy Industries & Public Enterprises, Government of India

Figure 2.2: Approved Models and incentives availed under FAME 2



Source: Ministry of Heavy Industries & Public Enterprises, Government of India

EV 2-WHEELERS STATE POLICIES



Source: JMK Research

3. Key Market Drivers

India has shown considerable progress in the E2W space with serious players entering the EV market. Some of the key drivers that are driving the growth in this segment are:

Strong Government push

To make EV adoption easier for manufacturers and consumers, the Government of India has taken some key steps in the last few years.

- NITI Aayog is targeting 30% EV penetration in India by 2030. Various incentives and subsidies are provided under the FAME schemes by the Government. Under FAME-II scheme, the subsidy outlay is increased by nearly ten times as compared to FAME-I allocations.

- GST rates on EVs are lowered from 12% to 5%, which is much lower than the 28% GST on ICE vehicles, making EVs much more attractive to the buyers.

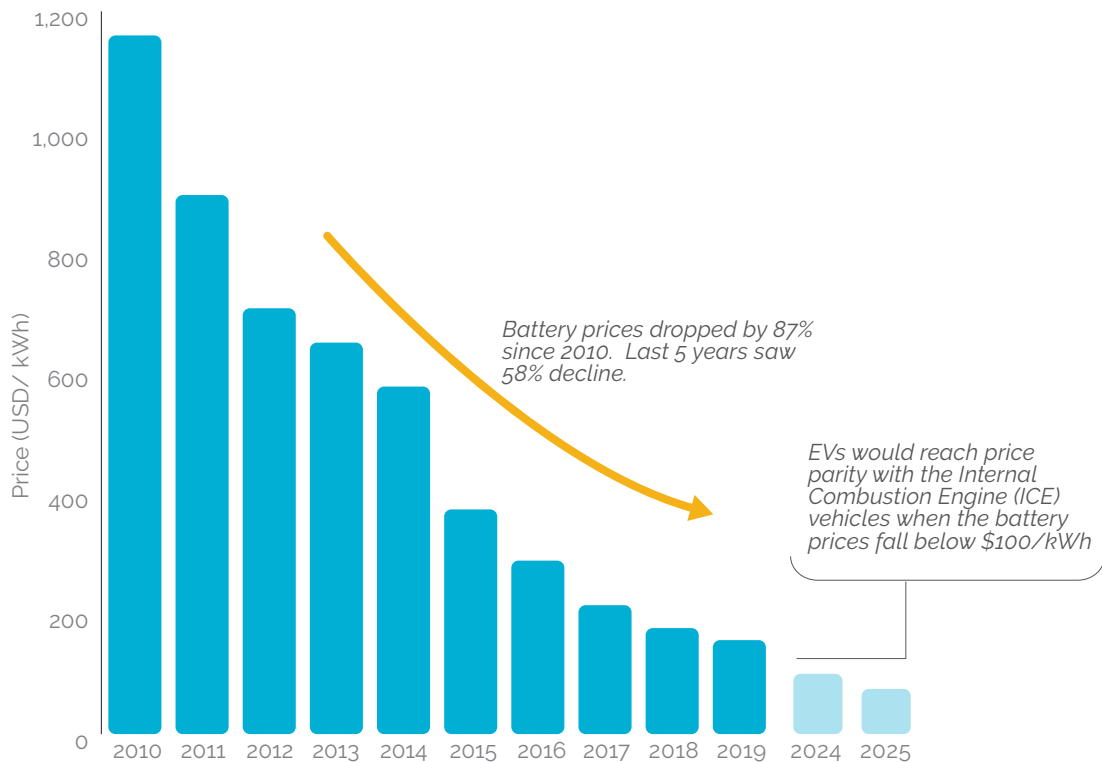
- Registration fees of EV's are waived off across most states.

- The Government provides various state-level incentives (refer Policies section)

Falling battery prices

Battery constitutes to about 40-50% of the total EV cost. From 2010 to 2019, the battery prices saw a massive drop from USD 1,160/ kWh to USD 156/ kWh. The increasing scale economics are expected to push the prices

Fig 3.1 : Average volume-weighted li-ion battery pack price



Source: Bloomberg New Energy Finance

further down to US\$75 over the next 4-5 years.

In addition to reduction in prices, the advancements in battery design have improved their performance in terms of lower charging time and power to density ratio (trimmed size and weight of batteries), etc.

Air pollution and GHG emissions

EVs emit 50% less greenhouse gas (GHG) than petrol or diesel vehicles. The top economies of the world have been taking measures towards reducing vehicular pollution and GHG emissions by supporting EVs and providing infrastructure wherever necessary. Extremely low emissions by electric vehicles are the best bet to tackle the hazardous air pollution levels in choked cities in India. As per the WHO report, 14 out of 20 most polluted cities in the world are in India. Many of these cities exceed the WHO outdoor pollution limits by 5–15 times. Vehicular emissions from passenger and goods road transportation contribute a majority share of this. EVs can improve this scenario by reducing local concentrations of pollutants in cities.

New battery manufacturing units to be set up in India

As India is getting ready with its roadmap for transition to electric mobility, leading global manufacturers of lithium-ion batteries have started exploring the opportunities to initially build battery pack assembly units, and eventually transition to large scale lithium-ion cell manufacturing in the country. Raasi Solar is the first company to start domestic production of lithium batteries in India in 2019 in Tamil Nadu. Exicom, Amaron, Greenfuel Energy Solutions, Trontek, Coslight India, Napino Auto & Electronics, Trinity Energy Systems, and Versatile Auto Components are

some of the players that have announced their plans to manufacture lithium-ion batteries locally. Other key announcements include:

- Panasonic Corporation is looking forward to setting up a facility for assembling lithium-ion (li-ion) battery modules in India.
- Suzuki Motor Corporation has tied up with Toshiba and Denso to set up the country's biggest lithium-ion battery manufacturing facility in Gujarat with an investment of INR 11.5 billion.
- Exide Industries Ltd and Amara Raja Batteries Ltd have formed joint ventures with foreign companies to start assembling batteries.
- South Korea's LG Chem Ltd and Japan's Toshiba have formed collaborations for assembling battery packs with Mahindra and Mahindra (M&M) Ltd.
- Indian Oil Corporation Ltd announced its plans to partner with a foreign startup to set up a 1 GW battery manufacturing plant in India.

Looking at the scale of investments planned to set up battery manufacturing in India, it is assured that batteries would become more affordable, and so would be the products running on these batteries.

4. Electric Two Wheelers market size: India

Since FY2016, the Indian electric two-wheeler market has grown at a CAGR of 62%. The FY2020 sales of electric two-wheelers stood at 152,000 units, which is a marginal increase of 20% over the previous year. This YOY growth for FY2020 is quite low when compared to the last two years annual growth rates, which were more than 100%. Such sudden de-growth of a sector that carries huge expectations is attributed to a policy update by the Government under FAME II, which caught the EV sector off-guard. Under this update, only the high range battery models with 50% localization are eligible for the subsidy, making ineligible almost 90% of the existing operators for the incentives/ subsidies offered under FAME II even though the budget outlay was way higher than the FAME I scheme. The policy shift was introduced to promote 'Make in India' initiative and eventually make the Indian economy self-sufficient.

The high range models with speed >25 kmph took around 18% of the total E2W market share whereas the economical and affordable low-speed models with top speed lesser than 25kmph comprised 80% of total E2W sales in FY2020. These models are exempted from RTO registration, and their riders don't require driving license or helmets. These factors, along with affordability, makes low-speed E2Ws highly attractive to buyers.

As per JMK Research estimates, the next year's sales growth figures of E2W are expected to be same as those of FY2020 i.e., about 25% only. Global pandemic situation due to COVID-19, which lead to lock down first in China and then in India (Jan 2020- May 2020), would be the crucial factor behind low sales. This has led to complete supply chain

disruption and brought an extended halt to the manufacturing in India for three months. The industry would take a few months to be back on track after the start of full-scale operations, with sales getting back to normal, not before late 2020.

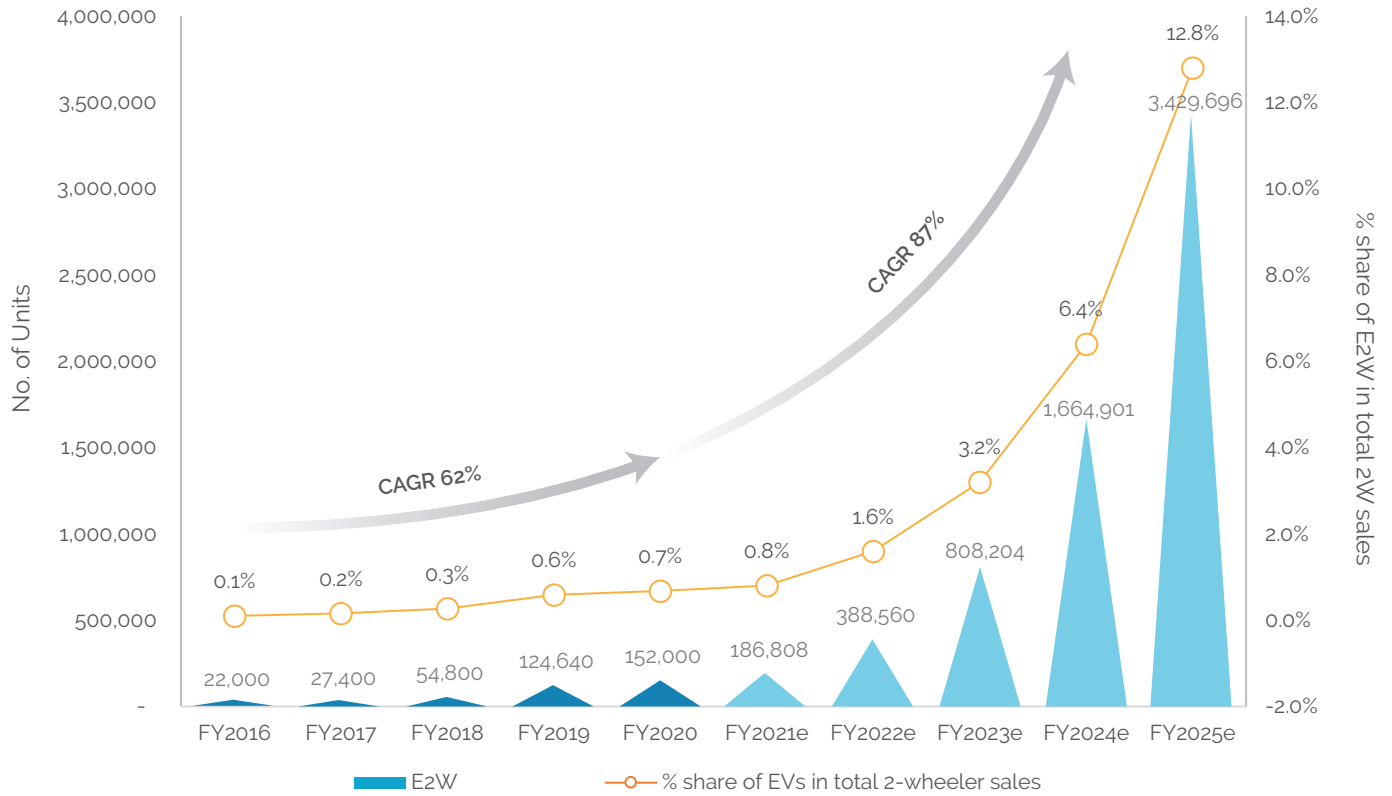
Assuming there is no change in the current policy scenario, the future adoption of Electric two-wheelers will mainly be driven by battery prices, which constitute over 50% of total E2W cost.

After 2024, significant disruption in E2W space is anticipated, with the fall of battery prices below \$100/ kWh. This price is seen as the point around which EVs will start to reach price parity with the Internal Combustion Engine (ICE) vehicles.

As per JMK Research estimates, from FY2022 onwards, with every 7-8% fall in YOY battery prices, the share of E2W's in total two-wheeler sales is projected to double. The percentage of E2W in overall two-wheeler sales in India is predicted to increase from 0.6% (FY2020) to about 13% (FY2025) in the next five years. Thus, clocking about 34 lakh units of E2W annual sales in FY2025. As per these estimations, the CAGR of E2W sales from FY2020 to FY2025 is expected to be about 87%.

As per our 'E2W CXO Survey' (refer section Chapter 10) about 42% of the survey respondents anticipate the E2W sales to be in the range of 20-25 lakh units by FY2025 while 41% of the respondents foresee the E2W sales to zoom past 30 lakh units by FY2025.

Fig 4.1 : E2W market size in India



Source: FY2016- FY2020 data taken from SMEV, projection analysis by JMK Research

Note: Total 2 wheeler sales in India from FY2021 to FY2025 are assumed to grow at a CAGR of 4%.

5. Key investments in the E2W space

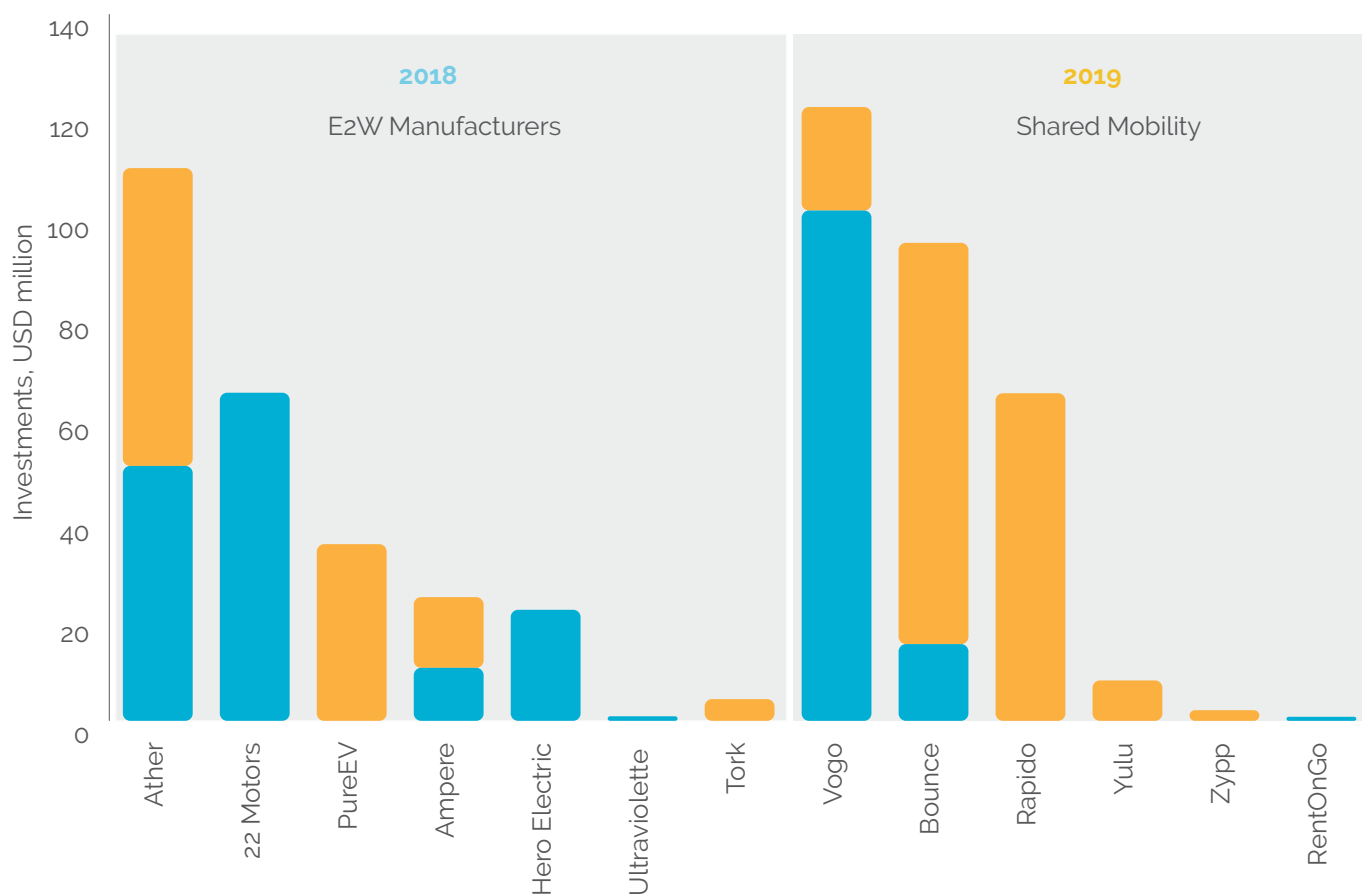
Initially, for the lack of consumer awareness, policy clarity, and market visibility, a lot of product-led E2W startups faced difficulty in getting investors on-board. However, with the entry of significant two-wheeler brands such as TVS, Bajaj, and Hero in this segment compounded with the Government's EV push, the investors are much more confident and have shown an active interest in the EV ecosystem.

In the last two years, more than \$600 million of investments have been raised by E2W companies in India. These investments helped manufacturers not only with high

upfront capital required in the initial stages of assembly and supply chain setup but also in keeping the cost of E2W low while boosting the quality of the products.

Comparing the investments, it can be inferred that the investments are more towards shared services than private vehicles, as cost economics are working well in the shared mobility segment. Amongst the E2W manufacturers, Among the manufacturers, Ather has raised the maximum funding of more than \$110 million, while in the shared mobility space, Vogo and Bounce led from front.

Fig 5.1 : Key investments in E2W space in India in last two years



Source: Industry news articles, JMK Research

Table 5.1 : Key Investment deals in E2W space in India

Date	Company name	Company type	Deal type	Investor(s)	Deal value (\$ Mn)
Mar-20	Bounce	Bike & scooter rental	Equity	InnoVen Capital	7
Nov-19	Ampere Vehicles	Manufacturer	Equity	Greaves Cotton	8.4
Nov-19	Vogo	Bike rental	Equity	Matrix Partners, Stellaris Venture Partners, Kalaari Capital.	4.0
Nov-19	Yulu	Bicycle & e-scooter rental	Equity	Bajaj Auto	8.0
Nov-19	Zypp	E-scooter sharing	Equity	Indian Angel Network	2.1
Oct-19	Tork Motors	Manufacturer	Equity	Ratan Tata	
Aug-19	Rapido	Bike taxi aggregator	Equity	Westbridge Capital, B Ace Fund, Astrend India Investment and Nexus Venture Partners	54.9
Jul-19	Ampere Vehicles	Manufacturer	Equity	Greaves Cotton	5.6
Jul-19	Pure EV	Manufacturer	Equity	V.C. Nannapaneni, Chairman and Managing Director, Natco Pharma	35
Jul-19	BattRE	Manufacturer	Equity	Gajendra Chandel, Former President, Tata Motors Ltd.	Undisclosed
Jul-19	Bounce	Bike & scooter rental	Debt	BACQ Acquisitions Pvt Ltd.	1.5
Jun-19	Bounce	Bike & scooter rental	Equity	B Capital, Falcon Edge, Accel Growth Fund, Maverick, Qualcomm	72.0
Jun-19	Tork Motors	Manufacturer	Equity	Bharat Forge	4.3
Jun-19	Vogo	Bike rental	Debt	Alteria Capital	3.6
Jun-19	Vogo	Bike rental	Equity	Ananth Narayanan, K Ganesh, Srinu Anumolu, Manish Vij	1.1
May-19	Ather Energy	Manufacturer	Equity	Sachin Bansal	32.0
May-19	Ather Energy	Manufacturer	Debt	InnoVen Capital	8.0
Apr-19	Bounce	Bike & scooter rental	Debt	InnoVen Capital	3.0
Mar-19	Bounce	Bike & scooter rental	Debt	Sachin Bansal	3.0
Mar-19	Vogo	Bike rental	Debt	Sachin Bansal	3.0
Jan-19	Rapido	Bike taxi aggregator	Equity	Integrated Capital, Skycatchr, AdvantEdge and Astrac Ventures	10.0

Date	Company name	Company type	Deal type	Investor(s)	Deal value (\$ Mn)
Jan-19	Vogo	Bike rental	Equity	Matrix Partners India, Stellaris Venture Partners, Kalaari Capital, Pawan Munjal's family office	8.8
Dec-18	Hero Electric	Manufacturer	Equity	Alpha Capital Advisors	22
Dec-18	Vogo	Bike rental	Equity	Ola	100.0
Dec-18	Vogo	Bike rental	Debt	Alteria Capital	1.1
Oct-18	22 Motors	Manufacturer	Equity	Kymco	65.0
Oct-18	Ampere Vehicles	Manufacturer	Equity	Greaves Cotton	10.5
Sep-18	Bounce	Bike & scooter rental	Debt	InnoVen Capital	3.0
Aug-18	Bounce	Bike & scooter rental	Equity	Sequoia Capital India and Accel Partners	12.2
Aug-18	Ultraviolette Automotive	Manufacturer	Equity	TVS Motors	0.9
Jul-18	Ather Energy	Manufacturer	Equity	Hero MotoCorp	19
Jan-18	RentOnGo	Online vehicle rental marketplace	Equity	TVS Motor	0.8
Dec-17	Ultraviolette Automotive	Manufacturer	Equity	TVS Motors	0.8
2016	Ather Energy	Manufacturer	Equity	Hero MotoCorp	31
2015	Ather Energy	Manufacturer	Equity	Tiger Global	12
2014	Ather Energy	Manufacturer	Equity	Sachin Bansal, Binny Bansal, Raju Venkataraman	1.0

Source: Industry news articles, JMK Research

6. New Product Launches

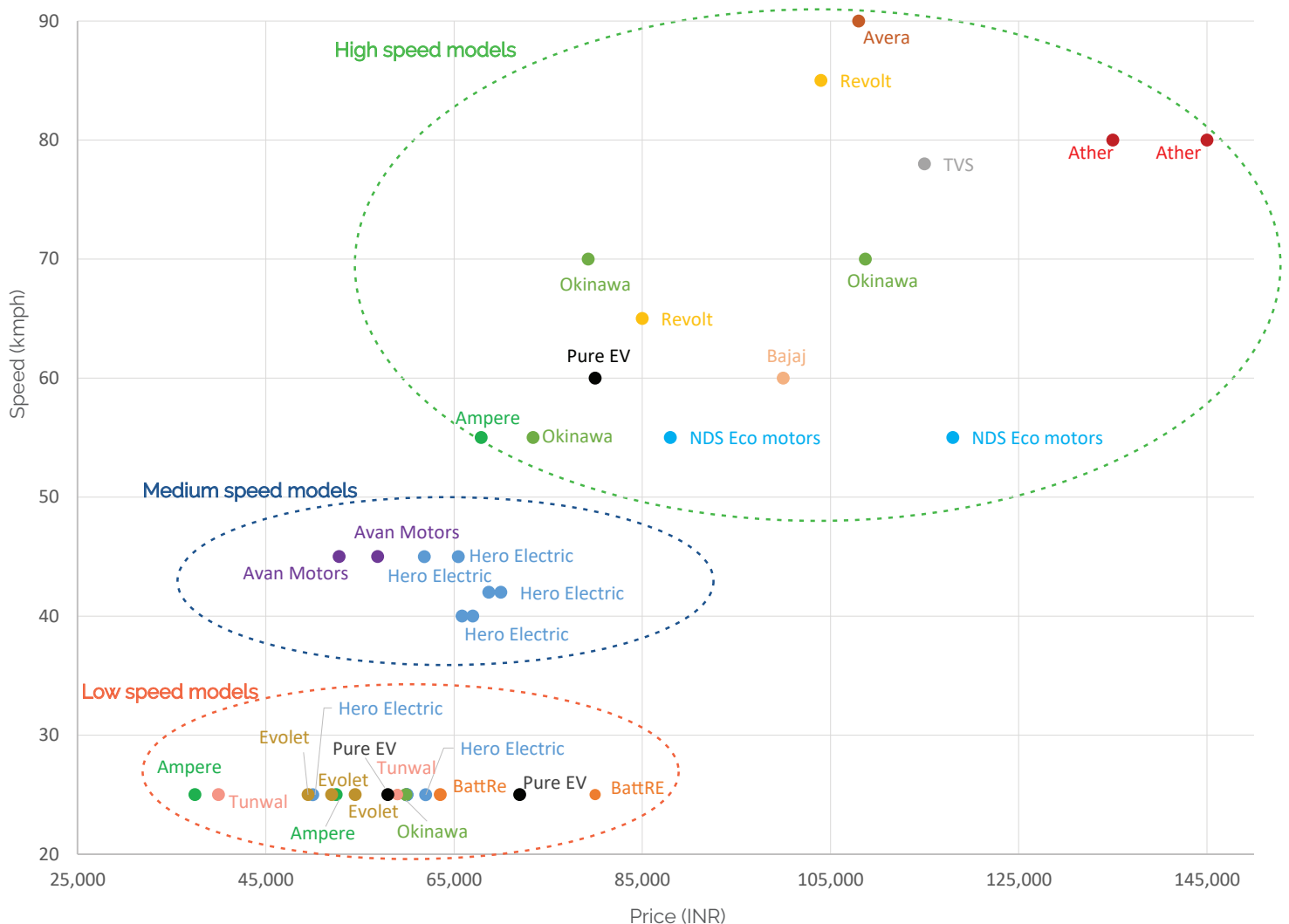
In the last two years, about 14 new models with speed under 25 kmph and 20 models with top speed in range of 40- 147 kmph were launched. However, the market didn't see any new entry with speed limits of 25-40 kmph.

As per FAME 2 guidelines, only the E2Ws with speed higher than 40 kmph are eligible for incentives. This could be the reason why majority of players are focussed on E2Ws with speed higher than 40kmph.

While Ather, Bajaj, TVS, Revolt, NDS Eco Motors, Ultraviolette are betting on high speed vehicles. BattRE, Electrotherm, and Tunwal are operating in low speed segment. Ampere, Hero Electric, Okinawa, Evolet, PureEV have products in both the segments.

Additionally, launch of 5 new models with speed over 100 kmph, by Hero Electric, Tork, Emflux, and Evolet is contemplated in next 6 months.

Fig 6.1 : Key E2W models available in India



Source: Company websites, JMK Research

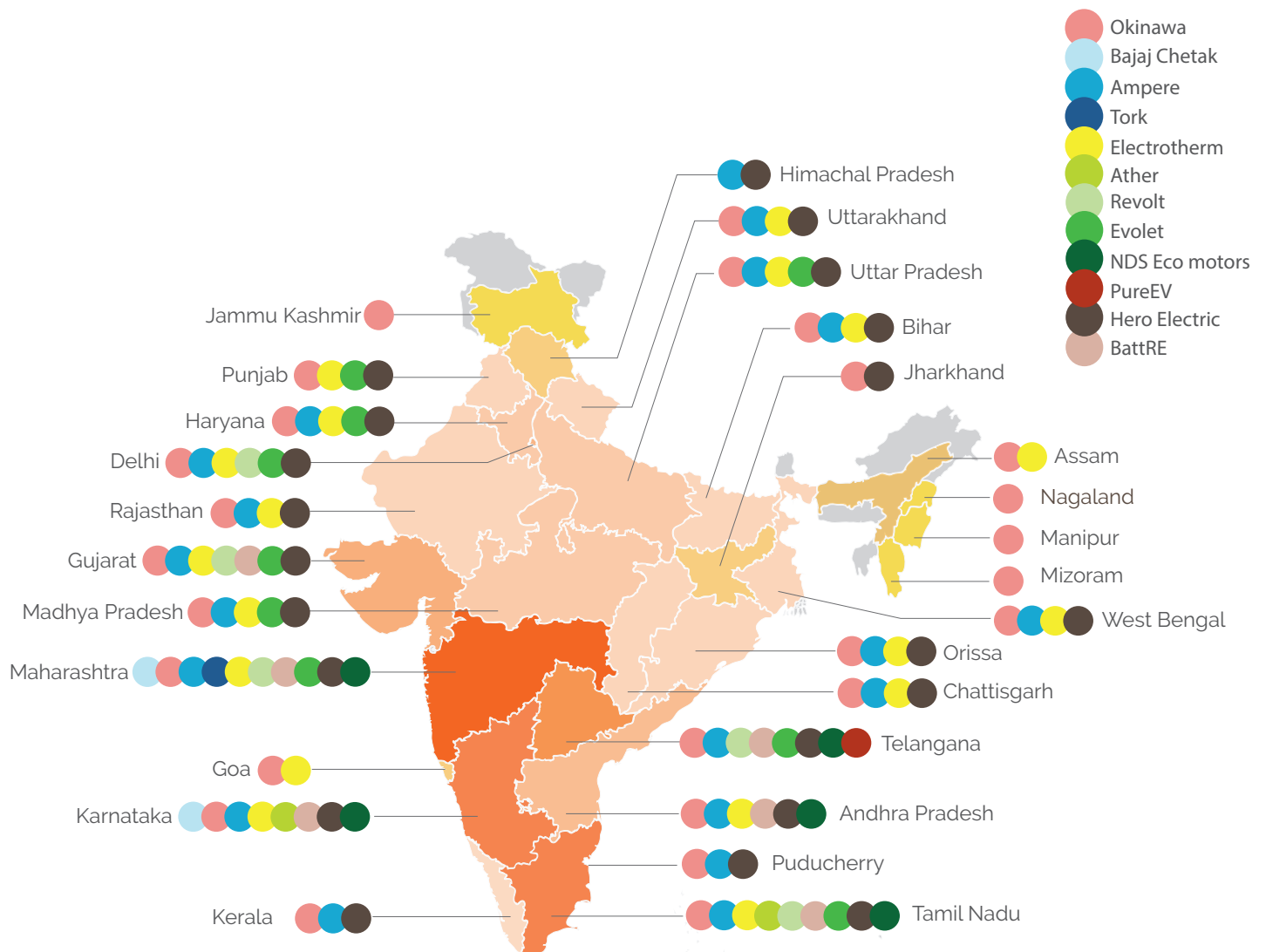
7. Pan India Network of Leading Players

The heat map clearly shows the concentration of E2W players in different states of India. Maharashtra and Tamil Nadu has the largest spectrum of brands followed by Karnataka, and Telangana. Most of these dealerships are concentrated in Tier 1 cities and metros across India.

Okinawa, Electrotherm and Hero Electric are some players with Pan India presence.

Okinawa is the sole company having dealerships in far east in Mizoram, Manipur and Nagaland along with Jammu and Kashmir.

Fig 7.1 : Pan India network of leading players as of March 31, 2020



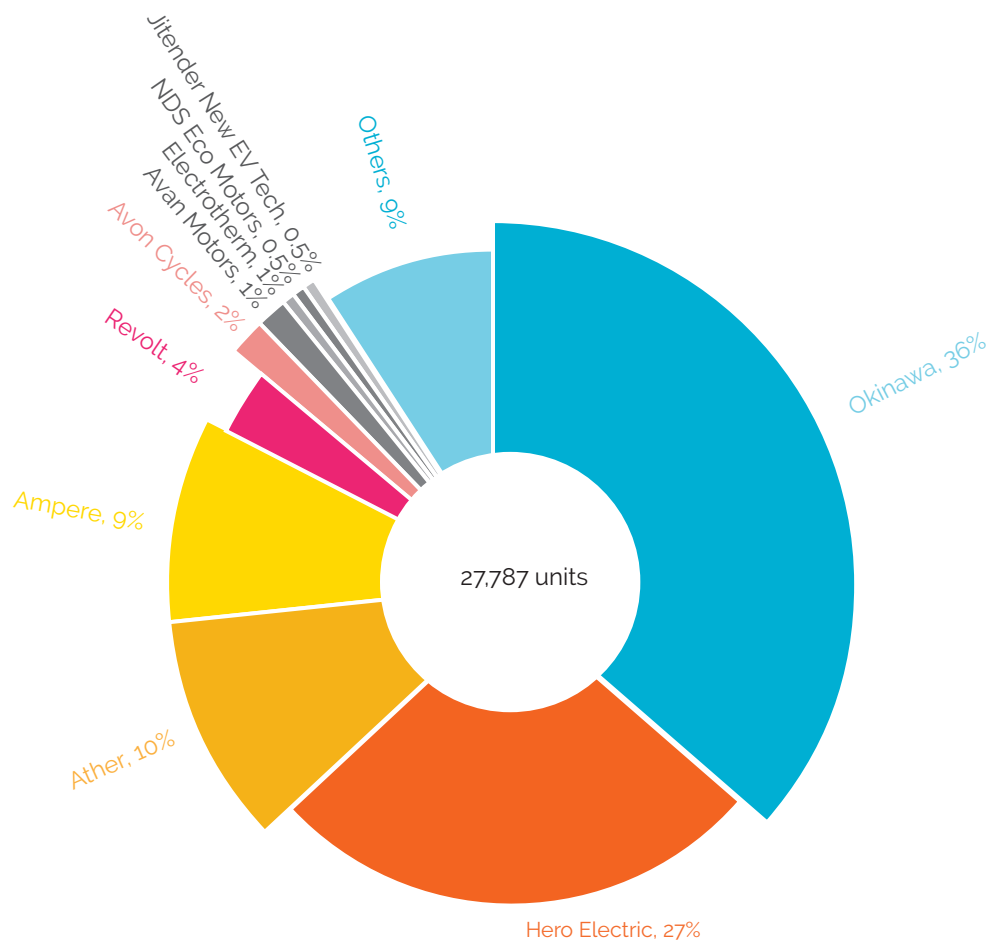
Source: Company websites, JMK Research

8. Market share of High speed E2Ws in India

In FY2020, in high speed (>25 kmph speed) E2W market, Okinawa is the biggest player selling more than 10,000 units with 36% market share, followed by Hero Electric with about 27% share (7,400 units sold) and Ather with 10% share (>2,900 units sold). Together these three players contributed more than

70% sales of high speed E2W market. Ampere which is the oldest player in this segment has sold about 2,500 units of high range E2W in FY2020. While a completely new entrant Revolt is able to clock sales of more than 1,000 units in just six months of its product launch. Other players which are active in this

Fig 8.1: Market Share of E2W players in India in high speed segment (>25 kmph) in FY2020



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research

Note: Sales figure are for only high speed E2W models with >25kmph speed. As per SMEV, high speed vehicles market in FY2020 is only 15,200 units as SMEV has considered high speed vehicles of >40 kmph speed instead of 25 kmph speed. This is in accordance with the FAME 2 guidelines.

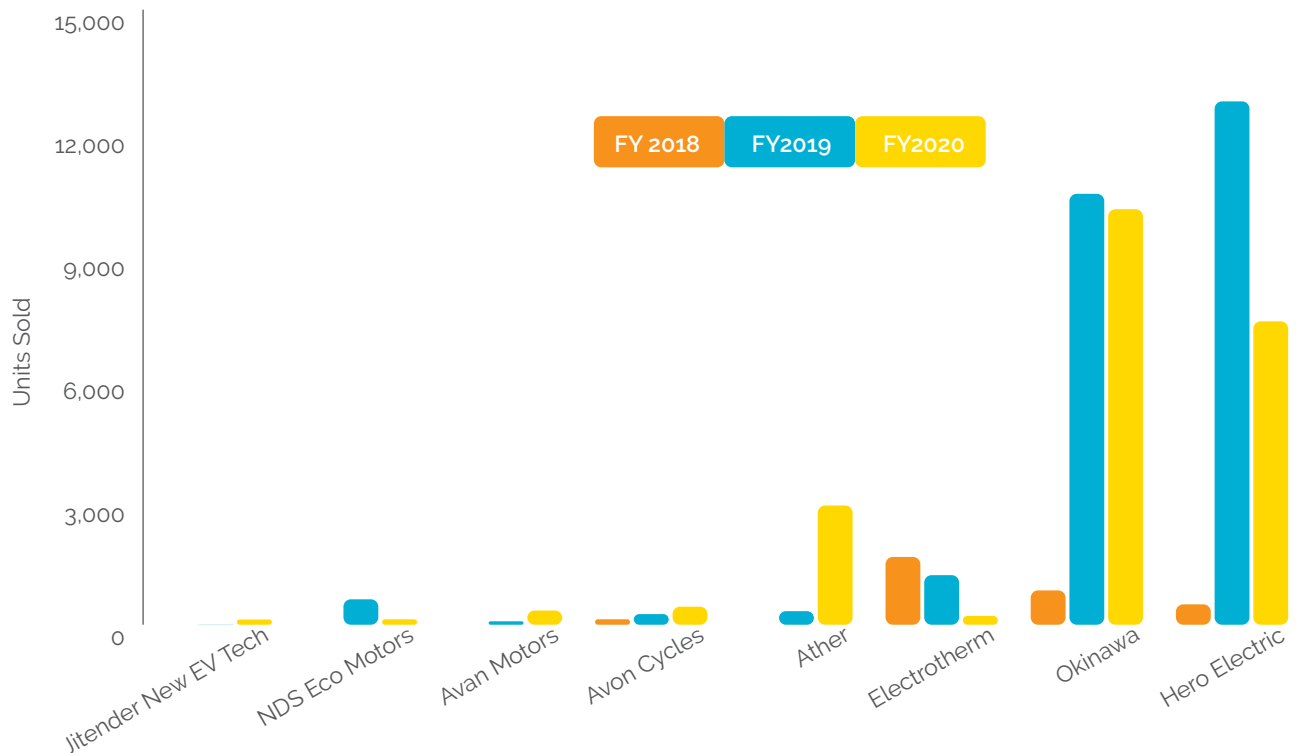
**We have assumed that 'Others' is just 10% of the total high speed E2W sales, top 10 players contribute 90% of the market

space are Avon Cycles, NDS Eco Motors, Avan Motors and Electrotherm (Yobikes).

On comparing last three years sales trend in the high speed (>25 kmph) E2W space, it is seen that in FY2020, sales have dropped significantly for all players except Ather. Hero Electric has seen a fall of about 42%, while

Okinawa sales have observed a 4% YOY drop. This is mainly the impact of FAME II scheme under which 50% localization criteria needs to be met to avail subsidy benefit. Okinawa and Ather are the amongst the first two companies to meet this criterion and were able to claim subsidy benefit for their E2W.

Fig 8.2 : Year wise sales trend of high speed (>25 kmph) E2W



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research

9. Challenges

The challenges faced by the nascent EV market can broadly be categorized into three groups of consumer perceptions, policy concerns, and supply chain network.

Challenges faced by end consumer

High upfront cost:

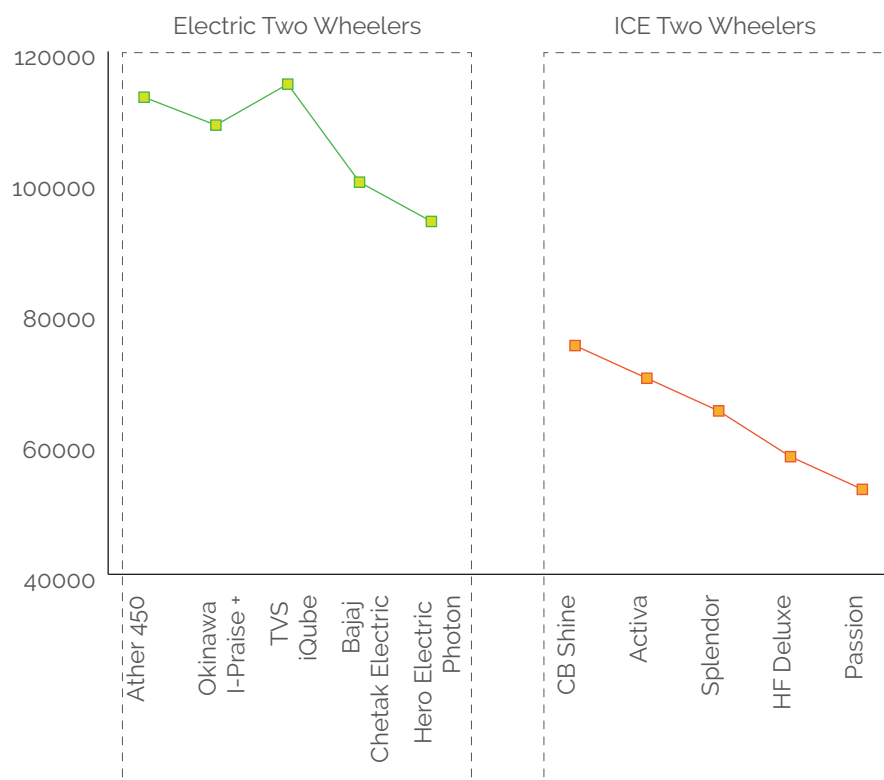
Indian customers, being very price-sensitive, are, generally, reluctant to buy an expensive electric 2-wheeler. For personal use, high upfront cost and battery replacement cost make

the electric two-wheelers financially unattractive. As can be seen from the chart below, the price of some popular electric two-wheelers available in the Indian market is about 60% higher than that of ICE 2-wheelers with similar features.

High battery replacement cost:

High battery replacement cost is another factor behind the subdued interest of a buyer towards EV 2 wheelers. The battery replacement cost associated with, specifically, high range E2W models after four years of use is expected to be INR

Fig 9.1 : E2W prices Vs. ICE 2 wheeler prices



Source: Company websites, JMK research

* Prices are Ex-showroom prices

** EV prices are excluding subsidy (of up to INR 22,000) for high range models with a top speed of 70-80 Kmph

40,000 – 45,000. This is beyond the other wear and tear costs of EVs.

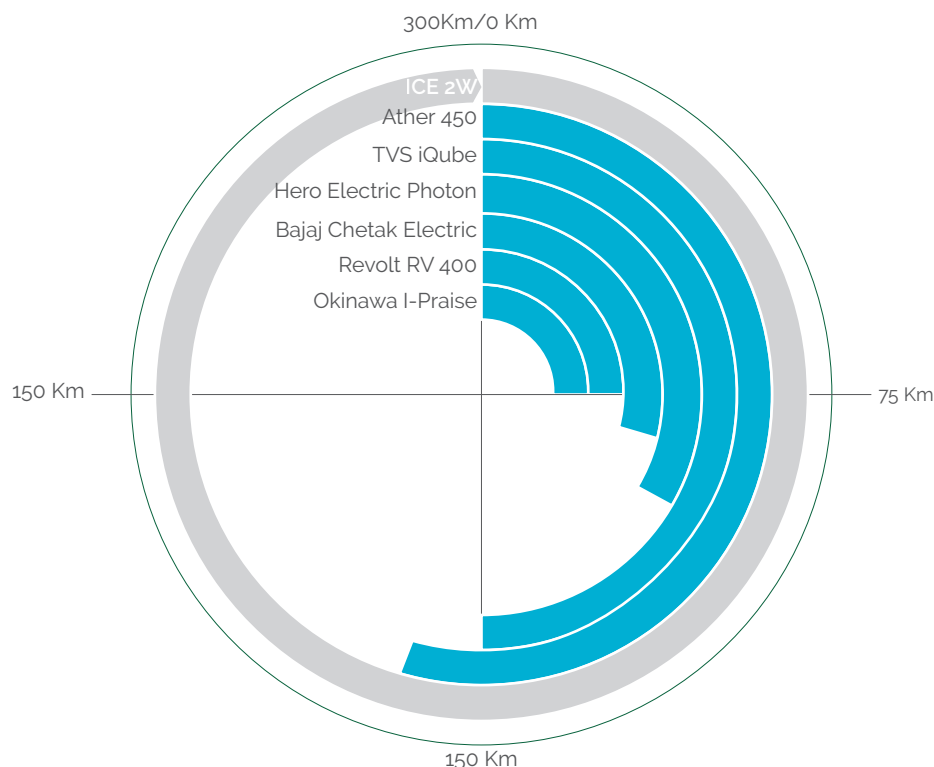
Range anxiety:

EVs can only be driven for a limited distance on a single charge as compared to the distance a petrol/diesel vehicle covers with a single filling. The average riding range of EVs with a single charge is about 50-80 km, whereas that of petrol-powered scooters is about 300 km (assuming the fuel tank capacity is 5 liters and the mileage of 60 km/ltr).

Inadequate public charging infrastructure:

- As of 31st December 2019, only 1,332 public charging stations were installed across India. If we have to match the sales of ICE 2 wheelers, the charging stations have to grow at an exponential rate, covering both urban and rural India.
- There are land lease and acquisition challenges pertaining to public charging stations (PCS). The most significant factor is the land costs associated with PCS. The likelihood of a PCS business being feasible is very low in urban areas when the land

Fig 9.2: Electric 2-wheeler ride range



Source: Company websites, JMK research

* Prices are Ex-showroom prices

** EV prices are excluding subsidy for high range models with a top speed of 70-80 Km/h

lease and purchase rates are taken into consideration

- In the tier -1 cities such as Delhi, Mumbai, Chennai, Bangalore, etc. most of the population reside in Multi-Unit Residential Blocks of high rises. The existing infrastructure lacks space even for parking facilities within the buildings. Arranging charging stations or charging points in such complexes is a huge challenge. New complexes can be designed favourably, but altering the existing ones would require a lot of investment and building plan alterations.

Issues with battery swapping stations:

- At present, BSS (Battery Swapping Stations) are considerably costlier than home charging and Public Charging Stations (PCS) in India. The high cost of battery swapping can be attributed to the huge cost associated with maintaining a sizeable number of long-life & reliable batteries (includes battery replacement cost), and the lack of battery pack design standardization across different OEMs and vehicle types.

Others:

- Poor service network for E2W also poses an impediment towards the rise in demand for these vehicles. The sizeable informal service sector would have no knowledge about the new technologies that have been venturing into the two-wheeler market. Therefore, there is a need for the current supply chain to evolve and constitute support after-sales service through an authorized dealership in the near future.
- Low resale value is another perception that makes Indian customers reluctant to buy an expensive 2 Wheeler. As long as

the sales of E2Ws are low, people would remain unreceptive towards the resale of an E2W.

- Low pickup and top speed are also deterrents for two-wheeler enthusiasts.

Policy-related speed bumps on the road to the E2W revolution

- The latest version of FAME, also called FAME-II, had the most unfavourable impact on E2W, leading to a huge decline of 34% in YOY sales of electric scooters in 2019 to 32,400 units. As per FAME II, only the E2Ws with a minimum top speed of 40 kmph and a range of 80 km per charge would qualify for subsidy incentives. When this criterion came into effect in April 2019, it rendered 90% of the E2W being produced then, ineligible for subsidy.
- The FAME II scheme requires the EV manufacturers to have a minimum of 50% localization in their products in order to be eligible for incentives. Most local suppliers are not willing to sell their products, at competitive prices supported by economies of scale, until the annual volumes in domestic E2W market reach 1 million units. This hinders the localization of the supply chain, which in many cases, is below 50%.
- The current incentives in FAME II are based on their battery size, which has actually made low-powered electric two wheelers costlier by a range of INR 10,000 to INR 12,000.
- Batteries sold as an integral part of EV attract 5% GST whereas those sold separately attract 18%. This is a critical

barrier for those customers who wish to buy battery back-up or those who look for battery change in the future. Simultaneously, the businesses which desire to provide battery swapping facility to its customers would be levied an 18% GST on battery procurement.

Barriers in road to E2W industry success

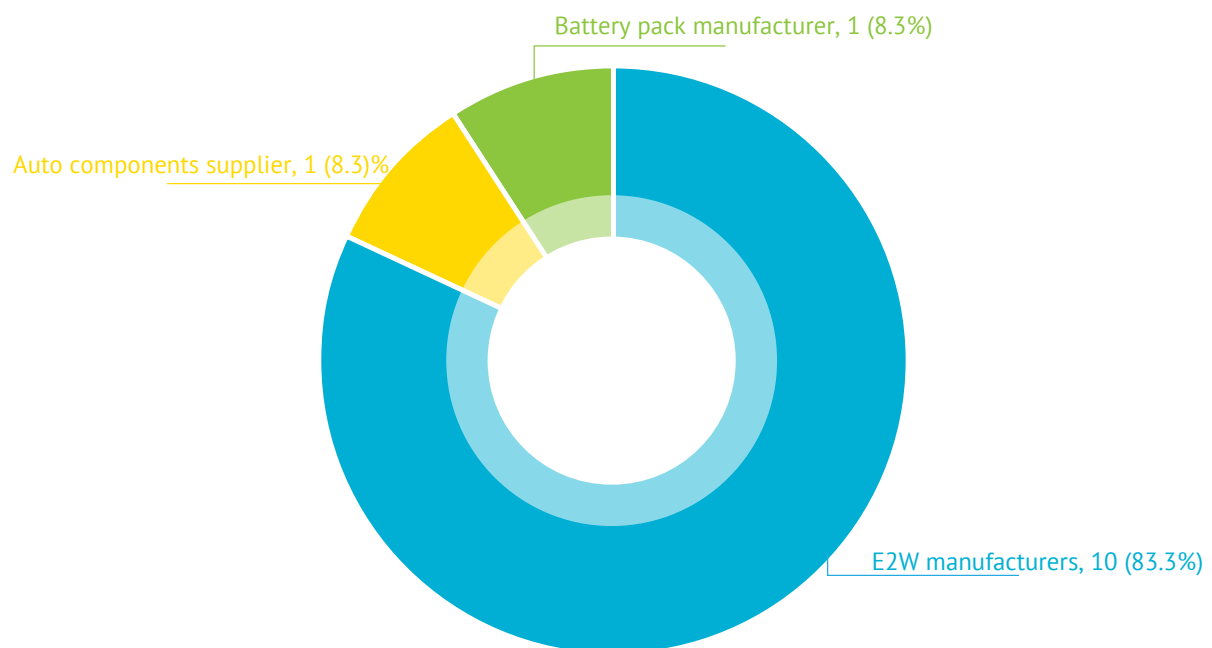
- **High dependence on Imports:** The key components of E2W such as the battery, motor, controllers, etc. along with battery components such as Lithium, permanent magnets, cobalt are being imported to India. The industry fears that there will be a huge disruption in the whole automotive supply chain. Hence there is a concern relating to the import dependence for batteries and the possibility that battery imports may just replace oil imports.
- **Fear of undercutting current ICE 2-wheeler sales:** Many leading players in the ICE two-wheeler manufacturing business are hesitant to foray in the E2W market primarily because of the fear of undercutting their current sales of ICE 2-wheelers; even though these players are heavily invested in R&D of new and innovative technologies which includes E2W, awaiting the opportune moment to launch them commercially.
- **Lack of standards available for charging hardware:** At present, there aren't any industry or Government decided standards for charging hardware of electric two-wheelers. This could be a deterrent for private investments in setting up charging stations.

10. E2W CXO Survey

JMK Research & Analytics conducted a survey with key players active in E2W space in India. The purpose of this survey is to highlight the key issues grappling the sector, understand

the impact of government policies and gauge future expectations of the Indian E2W industry.

Respondents profiles

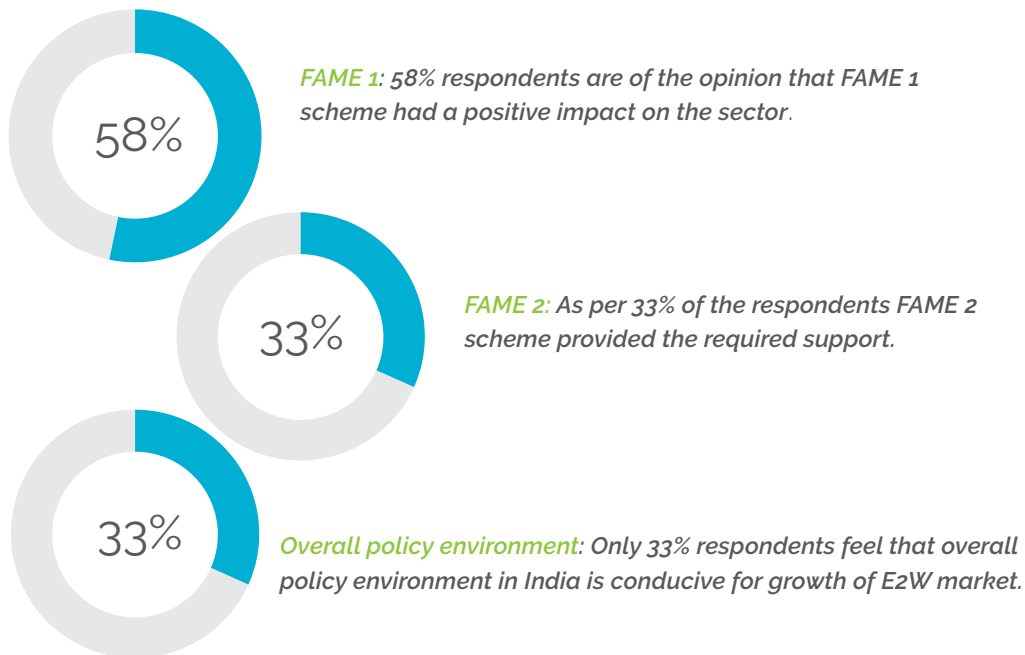


We got responses from 12 leading players in E2W space in India:

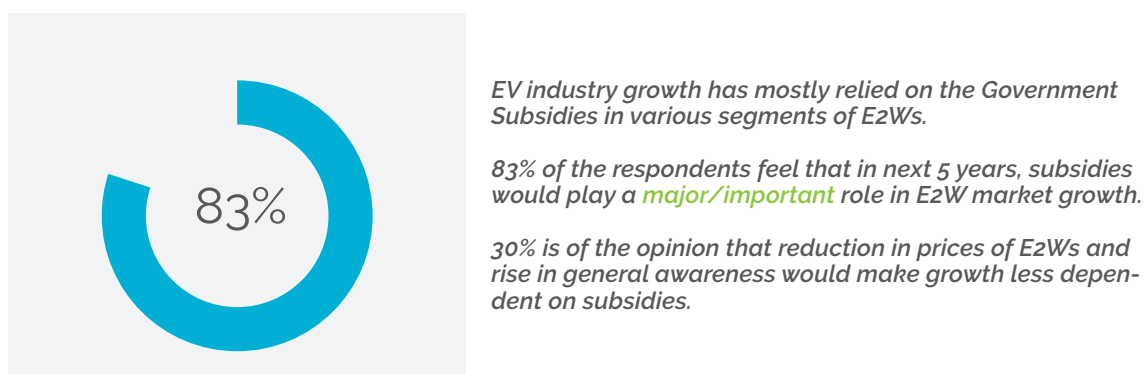
- | | |
|------------------|----------------------|
| 1. Ather Energy | 7. Nibe Motors |
| 2. Hero Electric | 8. Virtus Motors |
| 3. Revolt Motors | 9. Tunwal E-Vehicles |
| 4. Lucas TVS | 10. Phyllion Battery |
| 5. Evolet | 11. Benling India |
| 6. Battre | 12. Okinawa |

Survey Findings

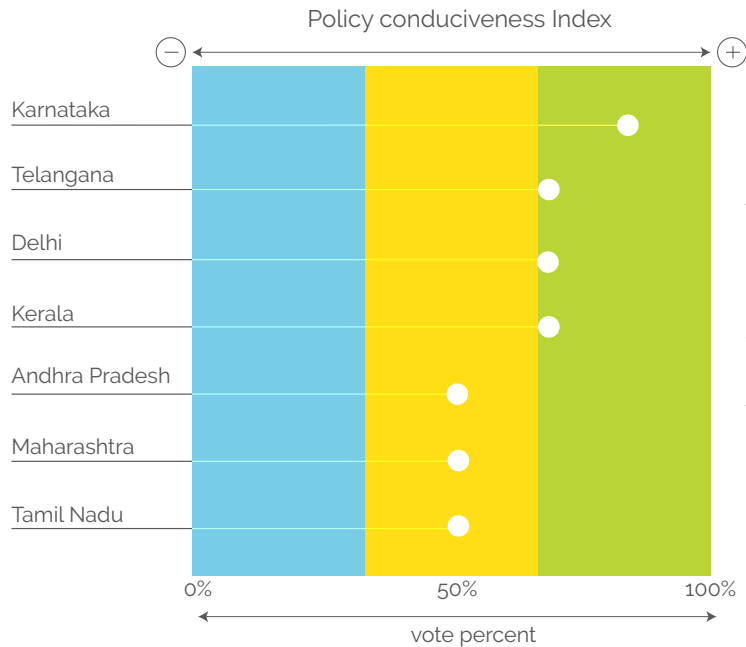
Impact assessment of policies



Importance of Government subsidies for next five years for E2W market



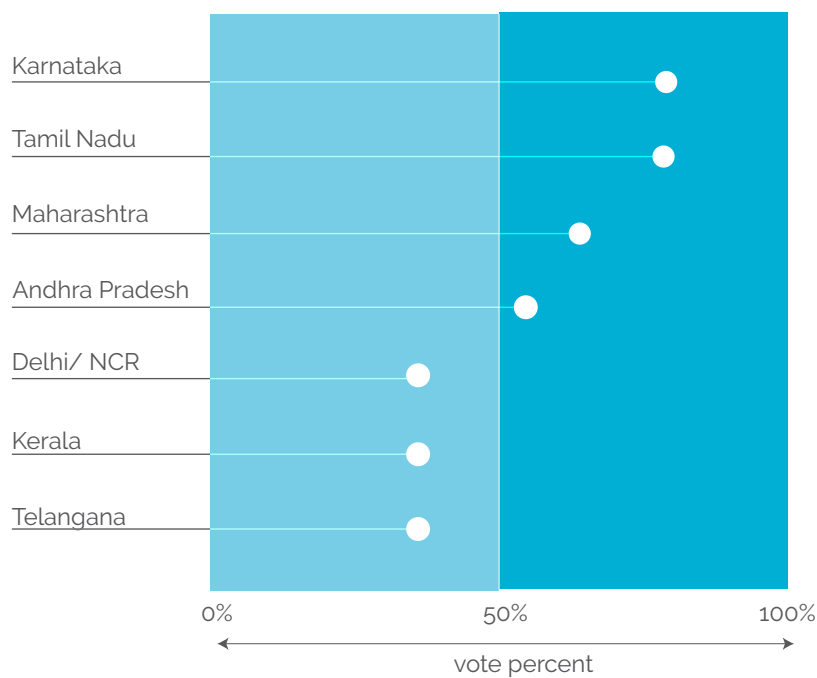
State wise impact of policies



Amongst all the states that have introduced E2W policies in India, 70% respondents consider **Karnataka** has a highly conducive policy environment for E2W segment growth.

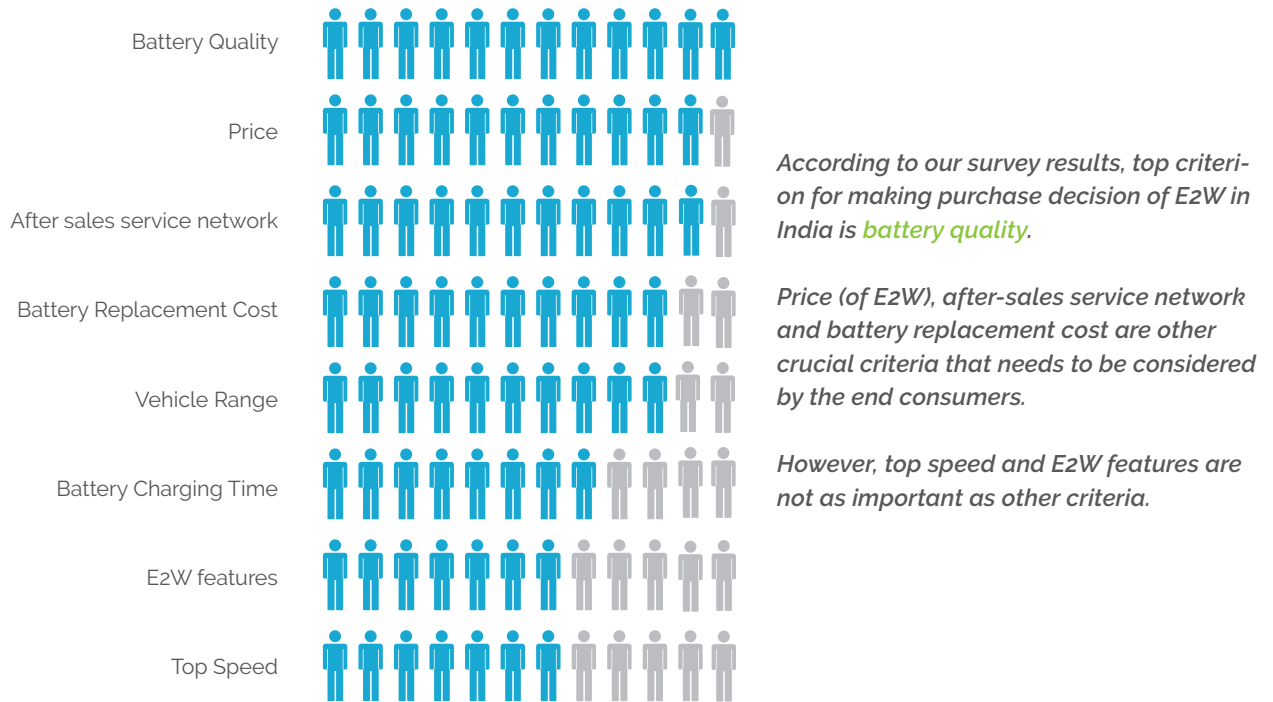
After Karnataka, **Telangana, Delhi and Kerala** are other favourable states for 60% of the survey respondents.

State wise E2W sales in India

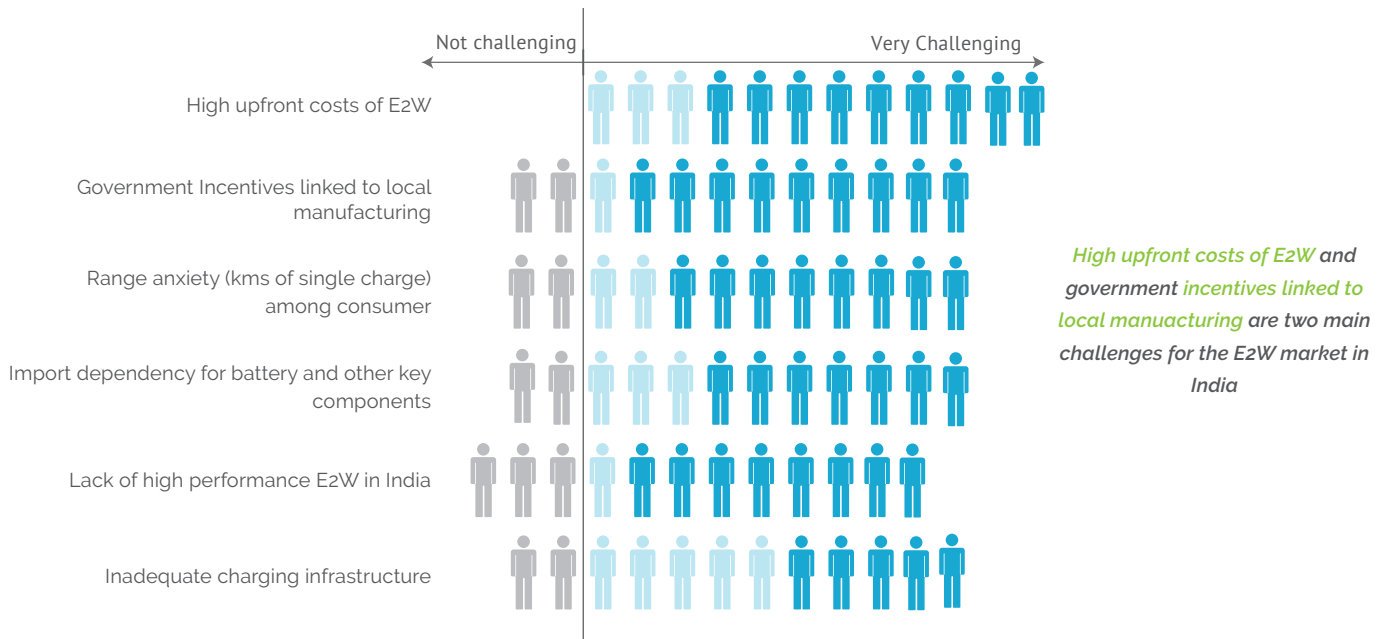


More than 70% of the survey respondents say that **Karnataka** and **Tamil Nadu** are the two key states where maximum E2W's were sold in the last 3 years in India.

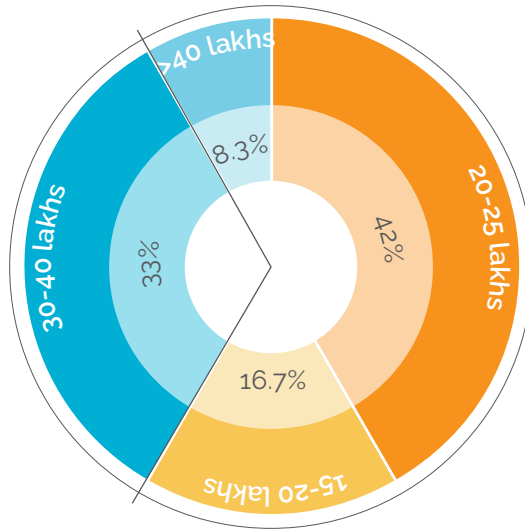
Importance of E2W buying criteria for end consumers



Key Challenges for E2W market in India



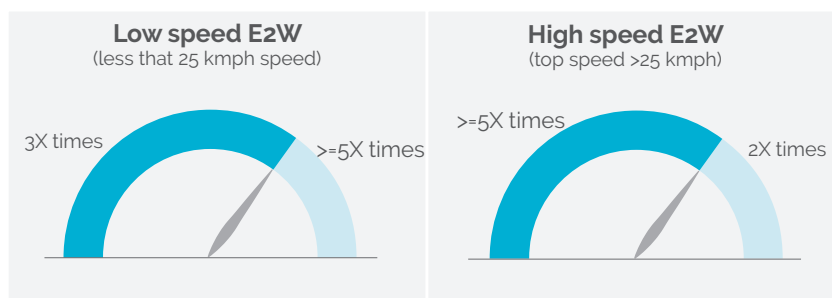
E2W market size in next five years



42% of the survey respondents anticipate the E2W sales to be in the range of 20-25 lakh units by FY2025.

About 41% of the respondents foresee the E2W sales zoom past 30 lakh units in FY2025.

Expected growth of high range and low range E2W segments in next five years

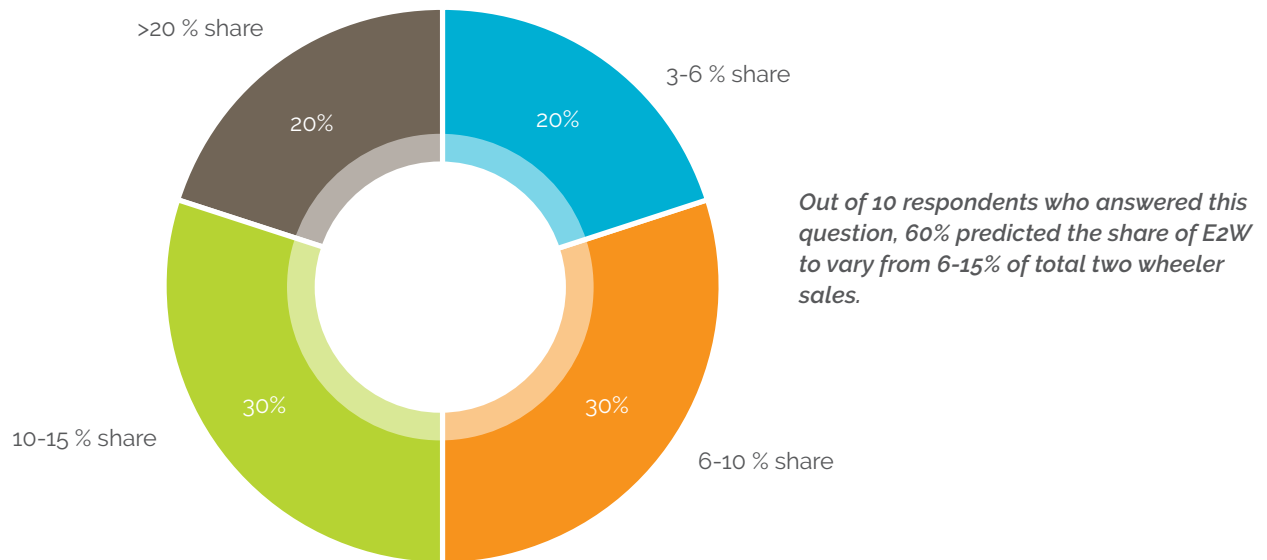


High speed E2Ws are expected to grow at faster rate compared to low speed E2W's.

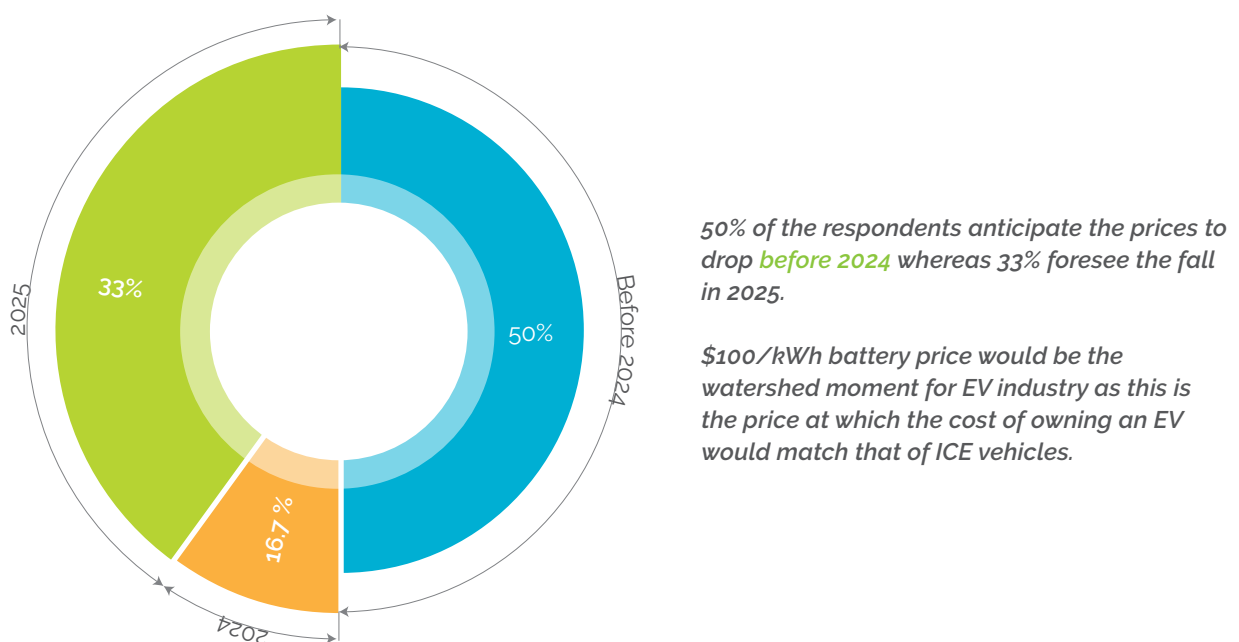
For **low speed E2Ws**, nearly 60% of the survey respondents projected 3 times market growth in next 5 years.

For **high speed E2Ws**, 60% of the survey respondents expect the market to grow 5-fold or more in the next 5 years.

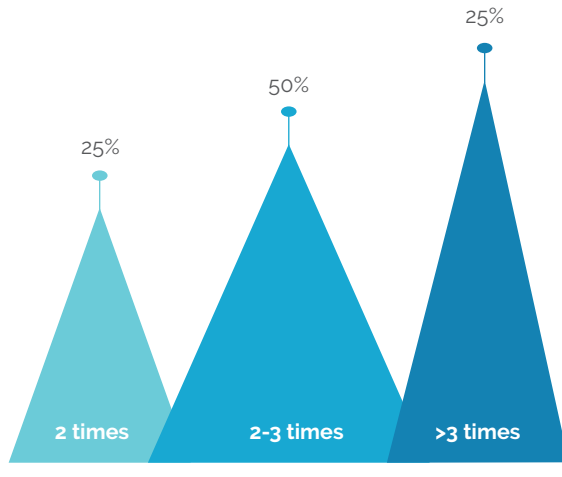
Expected share of E2W in total two-wheeler sales in India in the next 5 years



When are the battery prices expected to fall below \$100/kWh?



Next year business growth expected of survey respondents



There is strong growth sentiment in E2W market. Half of the respondents foresee 2-3 times growth in their business while around 25% expect over 3 times growth.

Wishlist for Government from E2W industry players

- Quality**

Stringent guidelines for OEMs, component manufacturers, battery manufacturers to maintain quality level of products at par with the international standards.
- Awareness**

Government should promote consumer awareness programs regarding E2W, its subsidies and other benefits.
- Incentives**

State governments need to implement policies that will incentivize private ownership of EVs. Including low range E2Ws.
Promote subsidies to support local manufacturing of E2W components.
- Infra**

Local municipal and government bodies need to simplify and ease the process to install private and public charging
- Battery**

Strict government guidelines for Battery manufacturers. Most lack certifications such as UN 38.3 required to transport dangerous goods for Li-ion Battery packs, manufacture and store batteries.



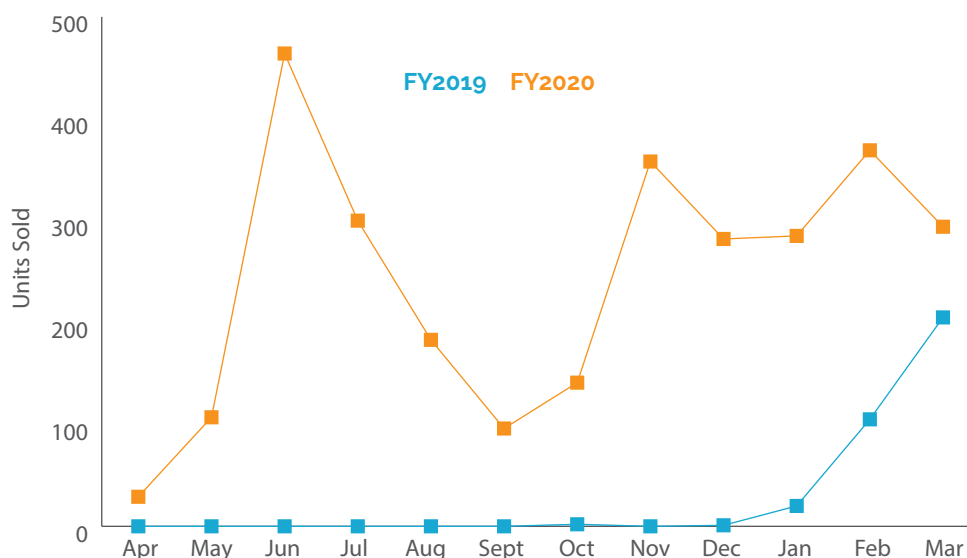
11. Key Players Profiles



Ather Energy was started in 2013 by two IIT Madras alumni Tarun Mehta and Swapnil Jain. It is backed by Hero MotoCorp, which is Ather's largest investor, along with Tiger Global, the founders of Flipkart, etc. The startup launched its first smart electric scooter in February 2016 and is focusing on designing and selling only premium electric scooters.

In FY2020, Ather was able to sell more than 2900 E2W, while in the previous year, only 330 units were sold by them. Clearly, the market is picking up for Ather. In last year maximum sales happened in June 2019 just after Ather has raised about \$40 million funding from Flipkart Founder Sachin Bansal and InnoVen Capital.

Fig 11.1: Ather: Annual sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research
Note: Sales figure are for only high speed E2W models with >25kmph speed.

Funds raised by Ather

Ather received its investments via multiple rounds of funding, which is spread over the past 6-7 years. Since the \$1 million seed funding in 2014, which gave the company its kick-start, Ather has come a long way, attracting marquee investors to support

its growth and expansion plans. So far, the company has raised capital of about \$100 million through equity.

Table 11.1: Ather - Investments

Date	Investor(s)	Deal type	Deal value (in \$ Mn)	Stake acquired
2014	Sachin & Binny Bansal, Raju Venkataraman	Equity	1	
2015	Tiger Global	Equity	12	
2016	Hero MotoCorp	Equity	31	
July-18	Hero MotoCorp	Equity	19	35.1%
May-19	Sachin Bansal	Equity	32	26-30%
May-19	InnoVen Capital	Debt	8.0	
May-19	InnoVen Capital	Debt	8.0	

Product Portfolio

In its product portfolio, Ather has only two models. Both are high-end models above INR 1 lac price. The home charger is provided to customers in this price along with a three-year warranty on battery and vehicle.

Apart from these E2W models, Ather is also

building its network of charging stations under its program "Ather Grid". Charging stations are already placed in over 30 locations in Bengaluru and 10 in Chennai. These charging stations provide fast DC charging upto 80% at 1.5 km/ min.

Table 11.2: Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Ather 450	2.4 kWh	75	4-5	80	INR 1,13,715
Ather 450X	2.9 kWh	85	4-5	85	INR 1,59,000

Source: Company Website

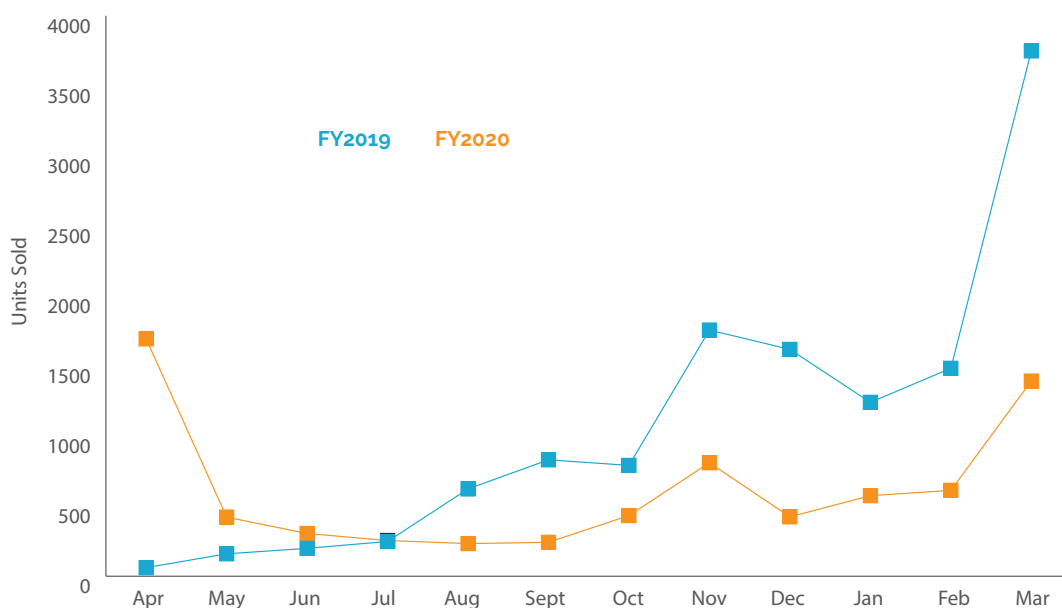


HEROelectric

Hero Electric started its own manufacturing of Electric Bikes in the year 2007 at its manufacturing facility near Ludhiana, Punjab, India. The built up area is 58,000 sq. ft. with 60,000 sq. ft. of open area. The first lithium-ion battery scooter was launched in 2017. At present, the Company has 600+ dealership networks across the country with a presence in more than 325 cities.

Hero Electric is the most prominent player in the E2W market in India and claims to capture more than 60% of the market share of E2W space in India. In FY2020, the Company sold about 7,399 units, while in FY2019, it sold more than 12,700 units of high range E2W. The high range models sales are just a small percentage of total E2W sales by the company.

Fig11.2: Hero Electric: Annual sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research
Note: Sales figure are for only high speed E2W models with >25kmph speed.

Key financing deals

A majority of the funds raised for the company have been done internally; the first and only external fundraising to date was done by Alpha Capital Advisors in December 2018 of USD22 million. This investment was brought in

to provide an additional impetus to facilitate diversification of the company's product portfolio, advancement in technology and also, to enhance R&D capabilities.

Product Portfolio

The Company offers about 12 different E2W models with a pricing range of INR 37,000 to INR 70,000. 50% of the available models

are low-speed models with a top speed of 25kmph only. Other models are in the range of 40-45 kmph top speed.

Table 11.3: Hero electric - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Dash	48V / 28Ah	60	4-5	25	Rs. 62,000
Flash LA	48V / 20Ah	50	8-10	25	Rs. 37,000
Flash e2 Li	48V / 28Ah	65	4-5	25	Rs. 50,000
Nyx e2	48V / 28Ah	65	4-5	25	Rs. 60,000
Nyx e5	48V / 28Ah	50	4-5	40	Rs. 69,754
Nyx ER	48V / 28Ah	100	4-5	42	Rs. 70,000
Optima e5	48V / 28Ah	55	4-5	40	Rs. 67,000
Optima e2 LA	48V / 28Ah	50	8	25	Rs. 42,000
Optima e2 Li	48V / 28Ah	65	4-5	25	Rs. 58,000
Optima ER	48V / 28Ah	110	4-5	42	Rs. 69,000
Photon 48V	48V / 28Ah	110	4-5	45	Rs. 66,000
Photon 72V	48V / 28Ah	45	4-5	45	Rs. 62,000

Source: Company Website



Okinawa was founded in 2015 by Jeetender Sharma and Rupali Sharma. Okinawa has its manufacturing facility in Bhiwadi, Rajasthan with production capacity of more than 1.8 lakh units per year. It has about 550 dealers (350 Primary dealership + 200 Secondary dealership) in its network.

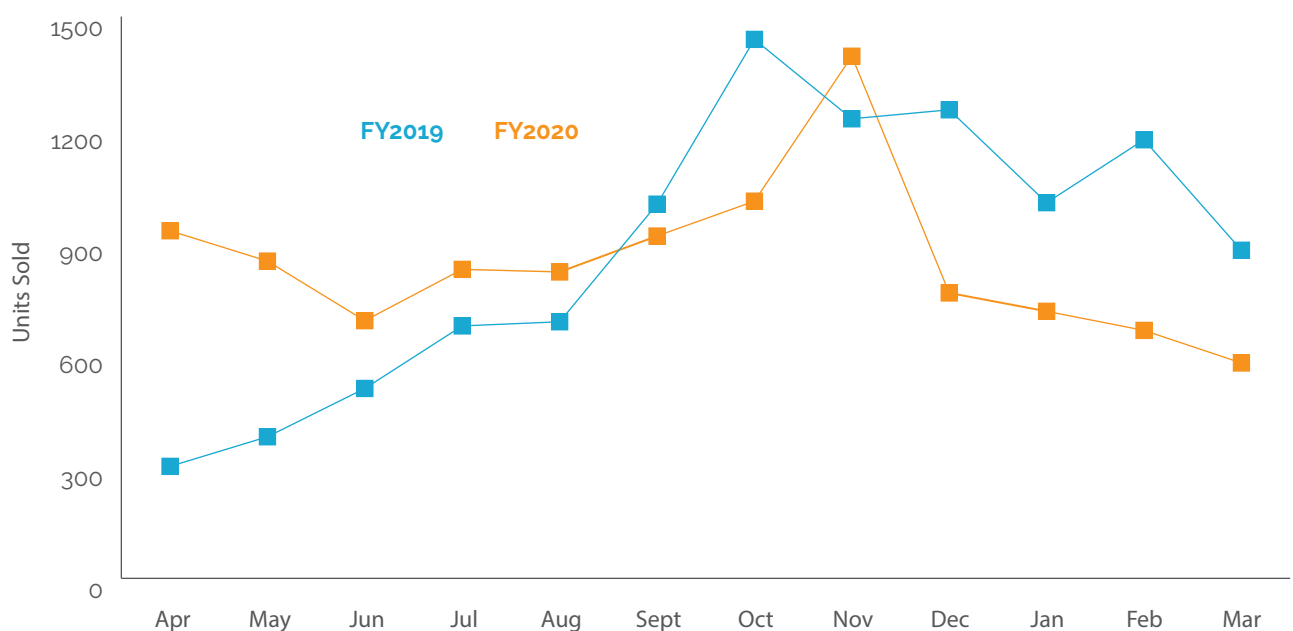
The company has partnered with several e-scooter taxi fleets and last-mile connectivity providers like Vogo, Fae Bikes, Bixie, and KDM Group, which is the primary driver for growth in its sales also. The localization level of the company's products is claimed to be over 90%. From the last two years, the

company is able to achieve sales >10,000 units/ year for high range models, which is substantially higher than the sales of other leading players in the sector.

The Company is planning to open a new manufacturing facility by end of 2020 in Rajasthan with about Rs. 200 crore investments.

The Company is expected to launch its new model Oki 100 in next 6 months. It is expected to be a 100% Make in India product with speed 100kmph and ride range of 150Kms/Charge.

Fig 11.3: Okinawa: Annual sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research
Note: Sales figure are for only high speed E2W models with >25kmph speed.

Table 11.4: Okinawa - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Raise	48V / 24Ah	65	4-6	25	Rs. 39,990
Ridge 30	60V / 24Ah	100	4-6	25	Rs. 44,790
Ridge	60V / 24Ah	90	4-6	55	Rs. 53,390
Ridge+	1.75kWh	100	2-3	55	Rs. 73,417
Lite	1.25 kWh	60	4-5	25	Rs. 59,990
Praise	72V / 42Ah	200	6-8	70	Rs. 74,880
Praise Pro	2 kWh	110	2-3	70	Rs. 79,277
I-Praise+	3.3 kWh	160	3-4	70	Rs. 1,08,728

Source: Company Website

AMPERE

By GREAVES

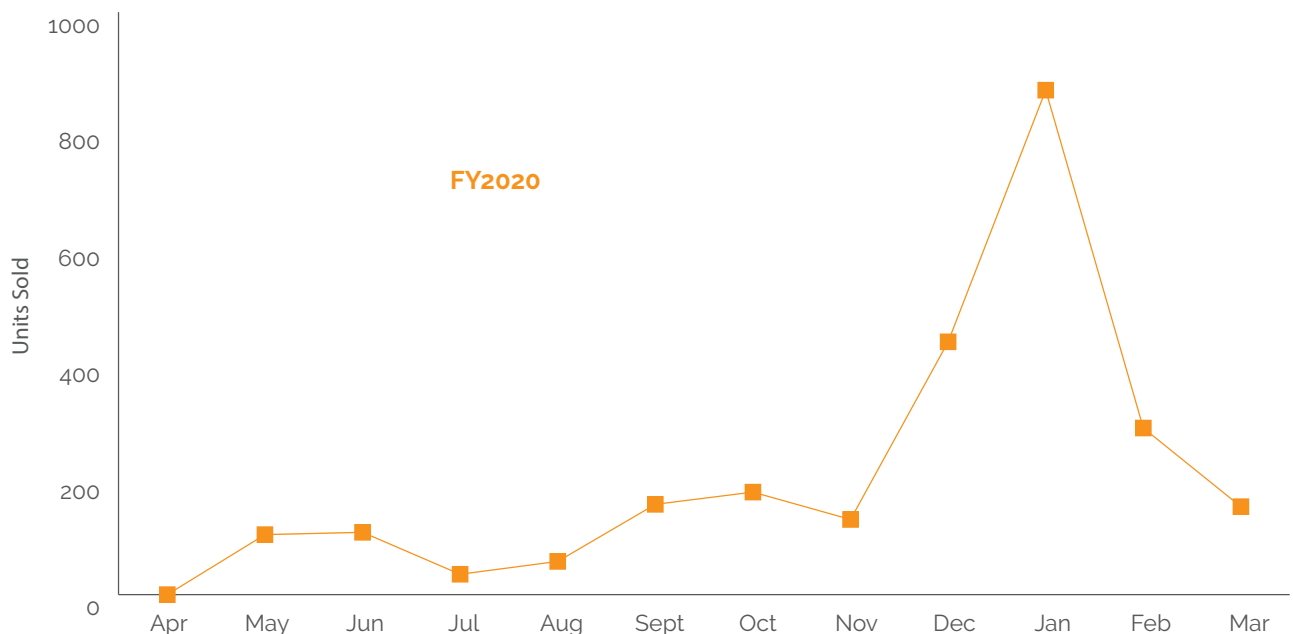
Ampere has more than a decade of experience in building and manufacturing electric vehicles. With a strong base of 60,000+ customers, Ampere is one of the first companies in India to indigenously manufacture key components of an Electric Vehicle. The Company manufactures both lead acid as well as lithium ion battery based EV's from its two manufacturing sites producing 60,000 units per day.

Ampere Vehicles is a wholly-owned subsidiary of Greaves cotton, an engineering

company with a diverse portfolio. With 200+ dealerships across India & Ampere is one of the fastest growing E2W brands in the country with YoY growth rate of 30%.

In FY2020, the Company has registered sales of 2499 units for its high range models, which is a fraction of total E2W sold by Ampere vehicles. Most of its sales are contributed by low range vehicles with a top speed of less than 25 kmph.

Fig 11.4: Ampere: Annual sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research
 Note: Sales figure are for only high speed E2W models with >25kmph speed.
 *Sales figure for FY19 not available

Amongst its E2W models, the company product portfolio has seven models of low range vehicles (top speed 25 kmph) and only 1 model of high range category (top speed of 55 kmph).

Table 11.5: Ampere - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Zeal (Li)	60V / 30Ah	65-70	5-6	55	Rs. 67,899
Magnus (LA)	60V / 20Ah	65-70	8-10	25	Rs. 45,099
V48 (LA)	48V / 20Ah	45-50	8-10	25	Rs. 34,299
Reo (LA)	48V / 20Ah	45-50	8-10	25	Rs. 39,899
Reo (Li)	48V / 24Ah	55-60	5-6	25	Rs. 52,899
Reo Elite (LA)	48V / 24Ah	55-60	8-10	25	Rs. 42,999
Reo Elite (Li)	48V / 20Ah	55-60	5-6	25	Rs. 59,990

Source: Company Website



Based out of Pune, Tork Motorcycles was founded by Kapil Shelke in 2010. The startup designs and manufactures electric performance motorcycle. Tork is the only full-fledged electric motorcycle manufacturer in the country, while most other E2W players are focused on the scooter segment. Its flagship product is Tork T6X, which was launched in December 2019. The Company claims that T6X has 90% local components. The company has a factory in Chakan, Pune, with a manufacturing capacity of about 20,000 motorcycles in a year.

Key financing deals

Tork Motors has raised funds from prominent investors such as Ratan Tata, Bhavish Aggarwal (Founder of Ola cabs), and Bharat Forge. All the investors associated with Tork have affiliations of various kinds to the automobile industry. In the midst of the transition to electric mobility, these stakeholders are experimenting with the new EV sphere through start ups such as Tork, which have good manufacturability and promising strategies. In May 2018, Tork raised around INR 45 lakh from Ola co-founders Bhavish Aggarwal and Ankit Bhati. Bharat Forge has also invested INR 30 crore in the Company, which was completed in 3 tranches over the course of nearly two years, taking its stake in Tork to 49%.

Table 11.6: Tork - Investments

Date	Investor(s)	Deal type	Deal value (in \$ Mn)	Stake acquired
Jun-19	Bharat Forge	Equity	4.3	49%
Oct-19	Ratan Tata	Equity	Not Disclosed	–
May 2018	Ola co-founders Bhavish Aggarwal, Ankit Bhati	Equity	0.07	–

Table 11.7: Tork - Product portfolio

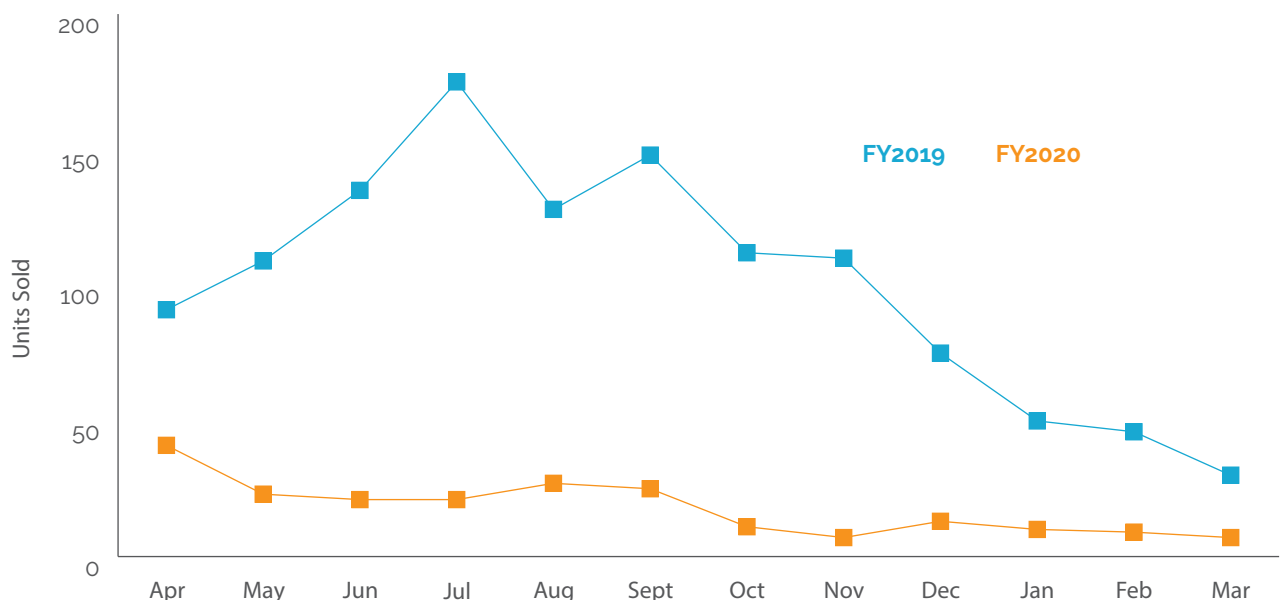
Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
T6X	72Ah	100	2	100	Rs. 1,25,000

Source: Company Website



Founded in 1983, Electrotherm is a leading conglomerate from Gujarat, having a primary interest in electrical and electronics engineering. In 2006, Electrotherm introduced its first E2W under the brand name YObykes. The Company claims to have sold more than one lakh units of Yobikes in India till date. Sales of Yobikes have fallen significantly in FY2020 compared to the previous year.

Fig11.5: YoBikes: Annual Sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research

Note: Sales figure are for only high speed E2W models with >25kmph speed.

Table 11.8: Electrotherm YObykes - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Drift	24 Ah x 5	70	8-12	25	Rs. 51,501
Edge	24 Ah x 5	70	8-12	25	Rs. 43,090
Electron	48V / 24Ah	70	6-8	25	Rs. 36,937
Xplor	48V / 24Ah	70	6-8	25	Rs. 38,978

Source: Company Website



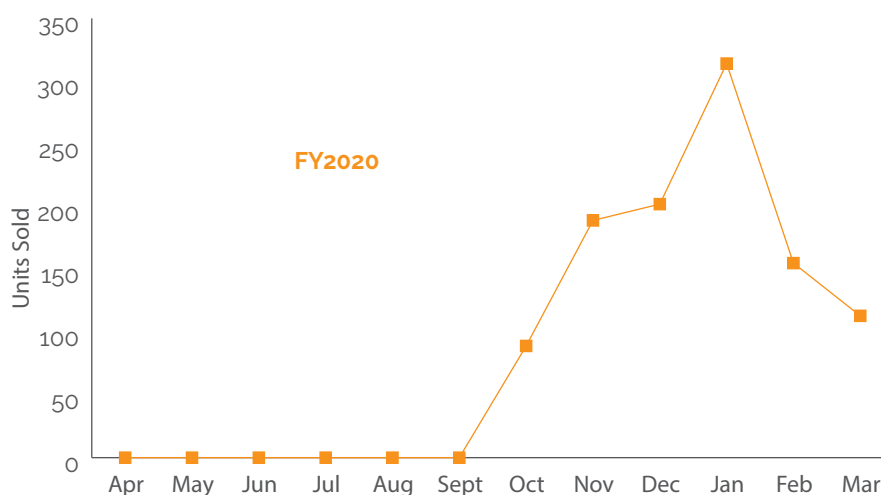
India's first AI-driven electric bike manufacturing company, Revolt Motors, was founded by Rahul Sharma in 2019. It has its headquarters in Gurugram, Haryana. The company is funded, so far, through Rahul Sharma's personal investment (around Rs. 500 crores). The commercial launch of Revolt's first two bikes, RV 300 and RV 400 were in August 2019. Both the models are high end products with top speed varying from 65-85 kmph and priced between INR 1,11,000- 1,29,000.

Revolt follows an innovative business model called MAAS – Motorcycle-As-A-Service, which is a first of its kind in India. Under

the MAAS scheme, customers need to pay specific monthly charges, which is Rs. 2,999 for RV300 and Rs. 3,499 or Rs. 3,999 for RV400 (as it offers two monthly plans). There are no extra charges applicable. Customers are only required to pay their monthly rates as per the subscribed plan, also called MRP –My Revolt Plan, for the duration of 3 years. Post this term, the customer will have complete ownership over their vehicle.

Two months after its launch, Revolt started receiving subscriptions for its two models, and within the last half of FY20, the start up has registered a total of 1062 new subscriptions.

Fig 11.6: Revolt: Annual sales of high speed E2W (>25 kmph speed)



Source: Ministry of Road Transport & Highways (MoRTH), JMK Research
Note: Sales figure are for only high speed E2W models with >25kmph speed.

Table 11.9: Revolt - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
RV 300	24 Ah x 5	180	4.2	65	Rs. 1,11,000
RV 400	24 Ah x 5	150	4.5	85	Rs. 1,29,000

Source: Company Website



It is the EV division of PuREnergy, a startup incubated and nurtured in IIT Hyderabad. It was founded by IITH faculty, Dr. Nishanth Dongari, in 2015.

PuREnergy specializes in the manufacturing and testing of lithium-ion batteries. The company has pioneered Li-ion based battery backup solutions for residential applications. Eyeing the abundant opportunities in the Indian EV market, it entered the E2W space in 2016.

It has set up a large scale EV manufacturing facility in Hyderabad with 40,000 sq. ft. area

and is also supported by the R&D facilities of IITH.

The startup made its first commercial launch of EVs in April 2019 with four electric two-wheeler models. These models make up their low-speed E2Ws range. It introduced its first high-speed E2W, EPluto 7G, in February 2020.

Key financing deal

In July 2019, Pure EV had raised VC funding of \$35 million from V.C. Nannapaneni, Chairman and Managing Director, Natco Pharma, a Hyderabad-based company.

Table 11.10: Pure EV - Investments

Date	Investor(s)	Deal type	Deal value (in \$ Mn)	Stake Acquired
2019	V.C. Nannapaneni, Chairman and MD, Natco Pharma	Equity	35	-

Product Portfolio

Pure EV offers five products, of which 2 are e-cycles, Egnite, and Etron. The three e-scooters launched by the start up are EPluto, EPluto 7G, and ETrance.

Table 11.11: Revolt - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
EPluto	1.8 kWh	80	4	25	Rs. 71,999
EPluto 7G	2.5 kWh	120	unknown	60	Rs. 80,000
ETrance	1.0 kWh	70	4	25	Rs. 51,999

Source: Company Website



This e-mobility startup, based out of Jaipur, was founded in 2017 by a former Airtel executive, Nishchal Chaudhary. The company manufactures e-scooters and e-cycles. It receives its funding support from Sangam Ventures, an investor company that regularly invests in clean technology projects.

One, in June 2019. Later, it introduced two other models, IOT and LoEV, in January 2020. All the three models are entry-level low-speed E2Ws. So far, the company has expanded its distribution network to more than 50 dealers across Maharashtra, Tamil Nadu, Telangana, Andhra Pradesh, Karnataka, and Gujarat.

BattRE launched its first e-scooter, BattRE

Table 11.12: BattRE - Investments

Date	Investor(s)	Deal type	Deal value (in \$ Mn)	Stake acquired
2019	Gajendra Chandel, Former President, Tata Motors Ltd.	Equity	undisclosed	-

Table 11.13: BattRE - Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (km/hr)	Price (ex-show-room)
IOT	1.4 kWh	85	2.5	25	Rs. 79,999
LoEV	1.2 kWh	65	2.5	25	Rs. 59,900
One	1.4 kWh	85	2.5	25	Rs. 63,555

Source: Company Website



The brand 'Evolet' came into being on 4th September 2019 and unveiling with it is a broad range of EVs comprising electric scooters, motorcycles, quad bikes, ambulances, and buses. It was established by veteran defence officers, Col. Ajay Ahlawat, Sqn Ldr Prerana Chaturvedi, and Kamaljeet Kataria, a full-time businessman.

A subsidiary of Gurugram-based Rissala Electric Motors Pvt. Ltd. (REM), Evolet has its manufacturing facilities in Haryana, Hyderabad, and Chennai. The startup opened its dealership network in Punjab in March 2020.

It claims that it's a debt free company and has no external investors. The company has devised a plan for phase-wise investment, which amounts to a total of INR 150 crores for its operations and production needs.

Product Portfolio

Evolet boasts 13 products in its offering across multiple segments. Among the 13, 6 of them are E2W models. Out of these 6, the three models, Derby, Polo, and Pony are the E2Ws which have been launched by the company so far; each of these models has two, lithium-ion and lead acid battery, variants.

Table 11.14:Evolet- Product portfolio

Models	Battery Capacity	Vehicle range Km	Charging time (Hours)	Top speed (Km/hr)	Price (ex-show-room)
Derby EZ	1.8 kWh	100	9	25	Rs. 46,499
Derby Classic	1.8 kWh	90	4	25	Rs. 59,999
Polo EZ	1.2 kWh	100	9	25	Rs. 44,499
Polo Classic	1.2 kWh	100	4	25	Rs. 54,499
Pony EZ	1.2 kWh	100	9	25	Rs. 39,499
Pony Classic	1.2 kWh	100	4	25	Rs. 49,499

Source: Company Website



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