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INDIAN VENTURE AND ALTERNATE CAPITAL ASSOCIATION
PROMOTING PRIVATE CAPITAL ECOSYSTEM

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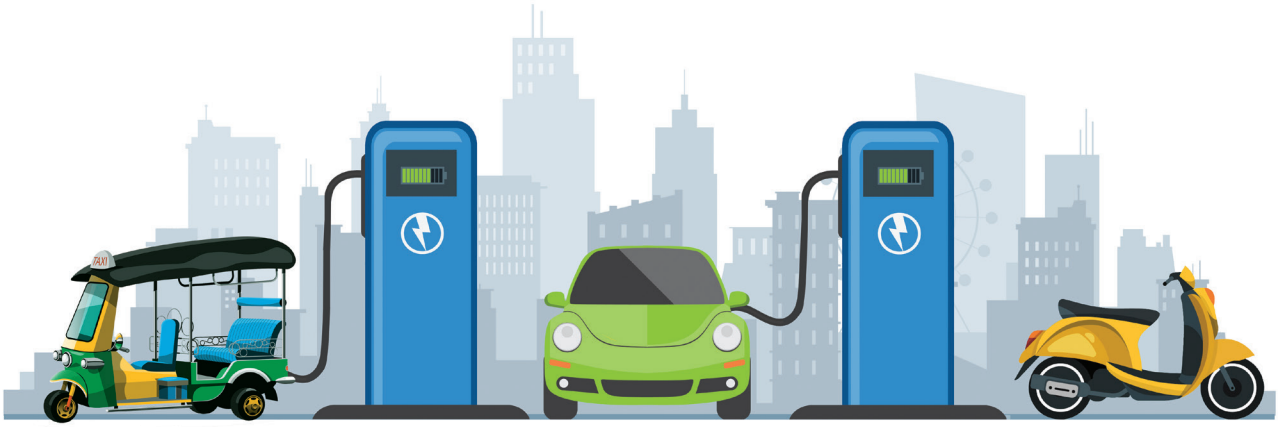
THOUGHT LEADERSHIP ... APPLIED

ELECTRIFYING INDIAN MOBILITY

CONTENTS



FOREWORD

Rajat Tandon

President, IVCA

2022 is proving to be a record year for EV sales giving a much-needed validation and confidence for consumers weighing their options between ICE vs EV.

Indian Startups are keeping up with the times to have the technological edge and the traditional companies too have quickly adapted to the change in consumer preferences. The government has been very proactive and supportive with EV policies and incentives. At the same time, it's great to see many states coming up with state level policies to support the EV industry.

The total cost of ownership is likely to reduce going forward with the growing demand and strong government resolve to bring parity between ICE and EVs. Hon'ble Road Transport and Highways Minister Nitin Gadkari, recently said 'The prices of all electric vehicles (EVs) will be equal to the cost of petrol vehicles in the country within one year'.

Overall EV financing remains a concern for the industry, and there is a need for government and the larger investor community to come together and come up with solutions.

PE/VC investors poured in around $1.7 billion in EV industry in 2021 while the number has touched approx. $666 million in 2022. With the growth in ESG and Climate specific funds, the investment momentum is expected to continue. As the startups and companies grow, we are seeing many new and 1st time investors join the bandwagon.

Fast adoption of EV across all the segments is truly the path to the green frontier.

I thank all of you for your support and look forward to your continued participation in IVCA initiatives which is working tirelessly to strengthen the Indian private equity and venture capital ecosystem.

I thank the EY and IndusLaw teams for putting together this report and for their detailed work.

EXECUTIVE SUMMARY

The Indian Electric Vehicle ecosystem is currently in the initial stages of development but has been gaining traction. In 2021, EV registrations amounted to ~330k units, a jump of 168% from 2020. The sales were led by 2- and 3-wheelers – ~48% and ~47%, respectively – followed by passenger vehicles at ~4%. E-rickshaw/e-kart category (top speed less than 25km/hr) takes the major share among three wheelers with ~45%. E-buses are included in others with a share of 0.36%.

The spike can be attributed to the need for personal mobility, increased awareness of the environment and rise in prices of gasoline (which have increased by INR 43 in the three years from 2019 to 2022). The second phase of Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME II) incentives have also helped in the increased adoption of e2W. Q1 2022 has already seen sales of almost 110k units.

Uttar Pradesh tops EV registrations in the country with ~20%, followed by Karnataka and Tamil Nadu. Of the overall 2-wheeler registrations, ~67% are from Karnataka, Tamil Nadu, Maharashtra, Telangana, and Rajasthan. Majority of the 3-wheeler registrations are in Uttar Pradesh, Bihar, Assam, and Delhi, which collectively account for ~75% of total sales. Maharashtra, however, boasts of the highest sales of passenger vehicles with ~3,700 units.

As of CY21, electric vehicles accounted for 1.1% of total vehicle sales and is expected to account for 39% of total automotive sales by CY27 growing at a ~68% CAGR over the next 5 years. The majority growth in EVs is expected to come from the travel segment, especially E3Ws and E2Ws due to fixed duty cycle and companies (E-commerce, groceries, shops) committing to going completely electric in their last mile deliveries.

Lack of charging infrastructure is one of the biggest challenges for the EV sector. Currently, there are only 1,742 charging stations in the country. This number is expected to increase to 100,000 units by 2027 to accommodate the increasing demand by ~1.4 million EVs expected to be on the roads by then.

Currently, India adds about 2.5 billion metric tons of carbon, or ~7% of the global emission. The ICE vehicular pollution contributes to ~40% of the total pollution in India. With this, it is imperative to usher in a strong push towards EV adoption to curtail the increasing pollution. EVs will help reduce exposure to VOCs (which are carcinogenic) and help improve life expectancy.

Climate change has led to a shift in global climate policy which requires the world to adopt a low carbon economy, thereby saving the planet from the adverse impact of climate change. Around 20 states in India have already come up with either a draft or final state level EV policy, these state policies overall aim to promote India's transition from ICE to EVs.

Improving the air quality issues, mitigating climate change, reducing dependence on oil imports and developing the EV industry are some common objectives of the policies published by the states. India has taken a leap towards a clean energy-based future as it is evident from the changes in the policies of the governments with respect to environmental protection.

In terms of investments, EV industry has attracted ~USD 6 billion in 2021 and is expected to gain USD 20 billion by 2030. EV market has observed strong attention from PE/VC investors in India with investments increasing from US$ 181 million to US$ 1,718 million (recording an annual growth rate of 849%). Ministry of Skill Development and Entrepreneurship has estimated that EV industry can create 1 crore direct jobs and 5 crore indirect jobs by 2030.

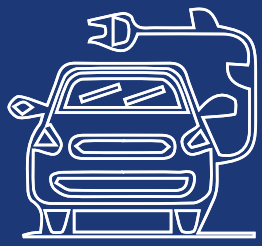
01 INTRODUCTION

There has been a global paradigm shift in how the future of vehicles will evolve. While flying cars may not be seen as a feasible option in 2022, we have come a long way from the traditional fuel-guzzling vehicles to alternatives such as EVs, both in two-wheeler and four-wheeler segments. While Indian sentiments are clearly more oriented towards two-wheelers which occupy almost 70% of road presence, this does not seem to be limiting the development of four-wheeler EVs. India is actively investing in and promoting a market which is predicted to hit over a 9 million units mark per annum by the year 2027[1]. The need to shift to an alternative fuel can be attributed to rising fuel costs and adopting cleaner energy sources. Climate change is an increasingly relevant concern, with every major nation actively acknowledging the problem and looking at real time solutions, which provides a further impetus to the shift to EVs.

The Indian automobile industry places heavy reliance on the use of traditional fossil fuels and non-renewable forms of energy which has raised concerns regarding its impact on the environment, climate change and the depletion of the non-renewable resources. To adopt a cleaner and more eco-friendly energy alternative, India has formulated policies to shift from traditional ICE vehicles to vehicles using alternate forms of energy, specifically EVs. Further, dependance on fuel imports and the consistently rising prices of conventional fuels have also prompted consumers to seek more cost-efficient sources of transportation. These initiatives for adoption of clean engines for both commercial and private vehicles has led to an increase in the number of manufacturers of EVs in the short and long distance transportation and last mile connectivity arenas[2] . Mahindra & Mahindra, an Indian manufacturer of automobiles, plans to aggressively expand its range of EVs being offered in the Indian market and has planned for an investment of approximately USD 400 million whilst also looking at foreign investors[3]. TVS Motors, a two-wheeler manufacturer, is also in discussion with global private equity investors looking at investment of approximately USD 296 million to USD 493 million for business expansion into EVs through the launch of a new line of electric two-wheelers[4].

1 Secondary Research, Secondary Reports, EY-P analysis
2 https://medium.com/batterybits/electric-vehicle-policy-framework-in-india-6bdc3ed64ed7
3 https://www.autocarindia.com/car-news/mahindra-electric-sub-brand-likely-plans-for-8-ev-launches-by-2027-422580
4 https://economictimes.indiatimes.com/industry/renewables/tvs-in-talks-to-raise-up-to-500-million-for-ev-subsidiary/articleshow/87595707.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

02 THE NEED FOR ELECTRIC MOBILITY



2.1 Global Framework For Climate Change (GFCS)

GFCS is a framework that enables decision making on better climate management, based on a scientific approach that can predict climate information which can be utilized for planning, policy formation and practice. The GFCS framework also aims that every country and climate-sensitive sector of the society is well equipped to access and apply the relevant climate information.

The origin of GFCS can be traced back to 2009 when different heads of states, ministers and delegations met at WCC-3 which was held from 31 August 2009 to 04 September 2009 in Geneva. It was decided to establish GFCS to provide climate monitoring and prediction services through scientific climate studies and resources. A global partnership like GFCS can enable both state and private organizations to come forward and collectively find solutions for issues related to climate, especially in developing countries. GFCS also seeks to build upon continued improvements in climate forecasts and climate change scenarios to expand access to the best available climate data and information. The collective efforts by the stakeholders under GFCS can be utilised to achieve the desired results of better management of risks of climate variability. An effective global partnership can enable climatic predications based on the scientific findings and informed decision making.

Climate, though a global phenomenon, has local consequences. In the Indian context, the issue of climate change is more complex due to various factors. India has adopted two major climate change policies. One such policy is NAPCC which was adopted on 30 June 2008. The other policy is called INDC, submitted to the UNFCC on 02 October 2015. While NAPCC has its focus domestically, INDC is more of a statement of intent on climate change in relation to the 'Paris Climate Change' summit which is held every year.

The NAPCC captures India's intent of ecologically sustainable developments and steps that may be needed to implement such developments. It focuses on energy, industry, agriculture, water, forest and urban spaces. The NAPCC can be considered as India's response to climatic change and promotes collective effort for other States to contribute to this global phenomenon. India is realising that its reliance on fossil fuels must reduce, and that it should shift more towards renewable sources of energies while preserving its economic growth. Usage of cleaner sources of energy such as solar and nuclear energy can enhance the global position of its commitment to deal with climate change. While any such change requires multilateral support, all eyes are set on India to become a global leader of sustainable development.
The INDC has set a target of 175 GW of renewable energy by the year 2030 basis India's 'National Solar Mission'. With India actively working on reducing usage of coal based thermal power generation, it may be possible to achieve this target way before the scheduled date of 2030.

EVs could be one of the major consumers of renewable energy. In a country like India where cost is one of the important factors, majority of vehicle owners also looks forward to costs accrued in a longer run in using such vehicle. While the dependence on consumption of fossil fuel is high, the world is now looking for an alternative and sustainable option. Interestingly, in India, both central and state governments are actively taking up the cause of pushing EVs. The governments are proactive and have adopted several policies which not only incentivise the buyers and consumers but also strengthen their role as value chain participants. While offering subsidy is one of the major features, it is equally important to allow investment by the corporates in the segment of EVs.

The issue of pollution in India has been highlighted on a global level. Some of the most polluted cities in the world are located in India. The year-on-year statistical data on pollution of some of the major states in India has seen a continuous growth and air pollution has become one of the major reasons of low life expectancy in India. Indian automotive industry has faced some resistance in implementing and enforcing emission norms. One direct example of this can be seen where the central government in January 2016, decided to skip BS-V norms and jump to BS-VI norms by April 2020. Any transition from one set of BS norms to a higher level of BS norms require drastic improvements or changes in the engine and technology. For an automobile manufacturer, this would entail some extra costs and such improvements need to be carried out with the subsequent BS norms which will be implemented. EVs on the other hand do not contribute to any form of pollution which can be cost effective for automobile manufacturers in the longer run.

Some of the major states in India have adopted policies related to EVs which clearly define the objectives, as more elaborately described in Chapter 10.2.1.

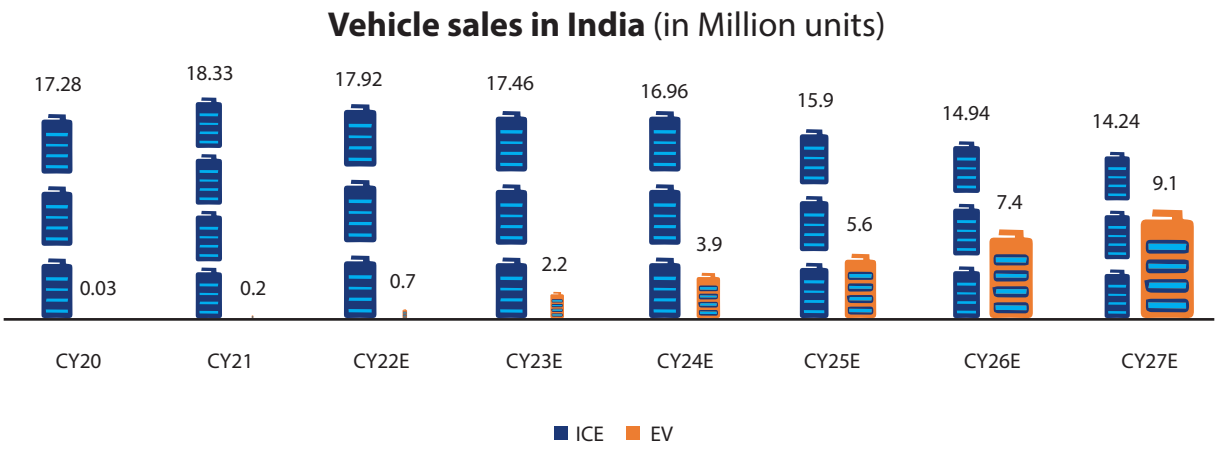
2.2 Current Vehicular Pollution Levels And Subsequent Transition to EVs

Currently, India adds about 2.5 billion metric tons of carbon or ~7% of the global emission. The ICE vehicular pollution contributes PM2.5 (having a width of less than two and a half microns), which amounts to ~40% of the total pollution in India.

It is imperative to usher in a strong push toward EV adoption to curtail the increasing pollution. EVs will help reduce exposure to VOCs, which are carcinogenic, and help improve life expectancy.

As per the government targets, assuming 30% of vehicle PARC are EVs by 2030, a 17% decrease in particulate matter and NOx emissions, 18% reduction in CO2 emissions, and 4% reduction in GHG emissions can be achieved.

Current ICE vehicle usage and projections (commercial/travel demand) and the impact of incremental demand being met by EVs



Source: Secondary research, secondary reports, EY-P analysis

As of CY21, EVs accounted for 1% of total vehicle sales and are expected to account for 39% of total automotive sales by CY27. The majority of this growth is likely to come from the travel segment, especially E3Ws and E2Ws (occupying 34% and 64% of total vehicle registrations as of June 2022). Though the adoption rate of e-buses is lower (0.5% of total vehicle registrations) than E2Ws and E3Ws (The numbers include e-rickshaws and e-carts, which are estimated to reach ~850,000 units in 2027), it is expected to gain traction with state governments inviting tenders to procure e-buses on a large scale. E4Ws are expected to take additional time for large-scale adoption due to issues related to range anxiety, varying duty cycles, and sparse charging networks.

High EV adoption by CY27 can decrease particulate matter by ~39%*.

2.3 Impact of EVs on Economic Growth and Employment

New entrants manufacture most EVs in the two-wheeler, three-wheeler, and bus segments. Several manufacturers have technology tie-ups with international players (Olectra Greentech has collaborated with BYD to roll out a 12-meter K9-electric bus), bringing investments and the latest technology into the country. These collaborations are aimed at setting up new factories, generating employment opportunities, and competing in existing markets with established OEMs. In terms of investments, the EV industry has attracted ~US$6 billion in 2021 and is expected to gain US$20 billion by 2030. Furthermore, it is estimated that if India reaches the government's target, it can become a manufacturing hub for EVs, subsequently driving the exports.

On the employment front, the Ministry of Skill Development and Entrepreneurship has estimated that the EV industry can create one crore direct jobs and five crore indirect jobs by 2030. There is a significant scope for employment in the technological domains, such as artificial intelligence, analytics, and application development. The industry is likely to observe high recruitments in development and manufacturing, wherein it can also bring subject-matter expertise involving supplychain, operations, and consumer behavior. Strong demand is expected for professionals skilled in electrical concepts. Furthermore, the government has also offered support through the National Skill Qualification Framework (NSQF), enabling channels to energize skilling and generate a resource pool for the EV industry.

FUEL IMPORT

India is ~85% reliant on imports to meet its crude-oil requirements. Being a large oil-importing economy, its oil imports amounted to US$119.2 billion in FY22, up from US$62.2 billion in FY21. This resulted in the current account deficit hitting a 3-year high of 1.8% (US$43.81 billion) in FY22.

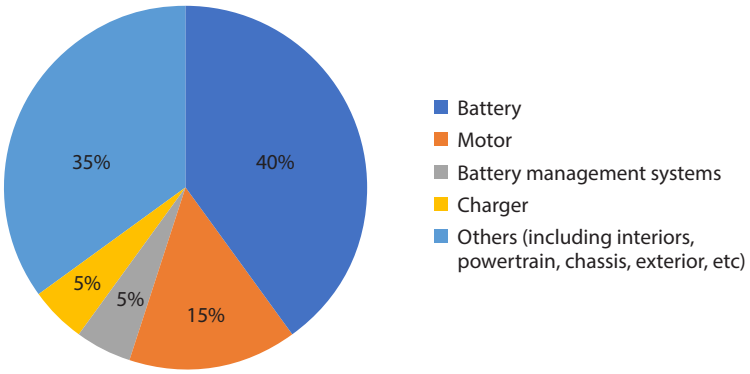
In the coming fiscals, crude oil demand is expected to grow 3%-4% annually, leading to a strong imperative shift from fuel-powered vehicles. This can present a strong opportunity for EVs to fill the void. They will also reduce India's oil dependency, decarbonize the mobility industry, and help it transition toward zero-emission models.

According to the research study by Council on Energy, Environment and Water (CEEW), if the share of EVs increases to 30% by 2030, India could save up to US$14 billion on its oil import bill.

5 *EY analysis: ICE vehicles can generate particulate matter of PM 2.5 by CY21. This figure could have reached PM 4.9 by CY27 without the adoption of EVs. However, particulate matter content to reach PM 4.07 by CY27, with EV sales amounting to 1.4 million units.

EV Technology

Component-wise cost breakdown for EVs



Source: Secondary research, secondary reports, EY-P analysis

VEHICLE COMPONENTS AND TECHNICAL DIFFERENCE IN ICE VS. EV:
The fundamental component in an EV is a high voltage battery (occupying 40% of the cost of production). The battery is responsible for providing sufficient energy to the electric motor and is placed on the floor or in the boot.

The electric motor is another essential component of EVs, responsible for converting electrical energy into mechanical energy and propelling the vehicle to move. Almost all EVs are equipped with automatic transmission (direct drive), reducing the need for transmission fluid and lower power loss to the wheels.

The power train is the differentiating system between ICE and EV. Power trains for ICEs are complex compared to EVs, with hundreds of parts, including differentials, axles, emission controls, exhausts, and engine cooling systems. EV powertrains have a relatively simpler structure compared to ICE power trains and only include battery packs, charging ports and drive train units.

TOTAL COST OF OWNERSHIP (TCO) AND ITS EVOLUTION:
Currently, there is a strong imparity in Capex for EV and ICE variants, with an electric car costing ~2x of an ICE variant. Similarly, the cost of e-buses is ~1.5-2x higher than the diesel counterparts, subject to specifications. Strong government support (from central and state governments) in the form of subsidies has helped E2W and E3W achieve price parity with their ICE counterparts. However, OEMs are struggling to achieve price parity for E4W and buses, owing to the inflationary impact driving the input prices. Additionally, the EV industry is heavily import-driven pertaining to Li-ion battery cells, and the high inflation rate in India has deteriorated the USD/INR, making it difficult for importers to procure cells at a lower cost.

With this, India must develop indigenous battery supply chains to achieve price parity for E4W and e-buses. Furthermore, the EV industry needs economies of scale to be resilient to the frequent input price shocks.

High demand subsidies under the Faster Adoption and Manufacturing of Hybrid and EV (FAME II) scheme coupled with the emergence of the battery-as-a-service (BaaS) model are likely to reduce the total cost of operation (TCO) of EVs in coming years.

04 EV DEMAND

4.1 Total EV Sales

India's electric vehicle (EV) market is fast becoming a complex sector defined by different requirements by enterprises, governments, and consumers. While decarbonization of logistics and mobility is a prime concern for all stakeholders, high costs, small scale, lack of domestic technology, and demand limited to pockets are among the many challenges.

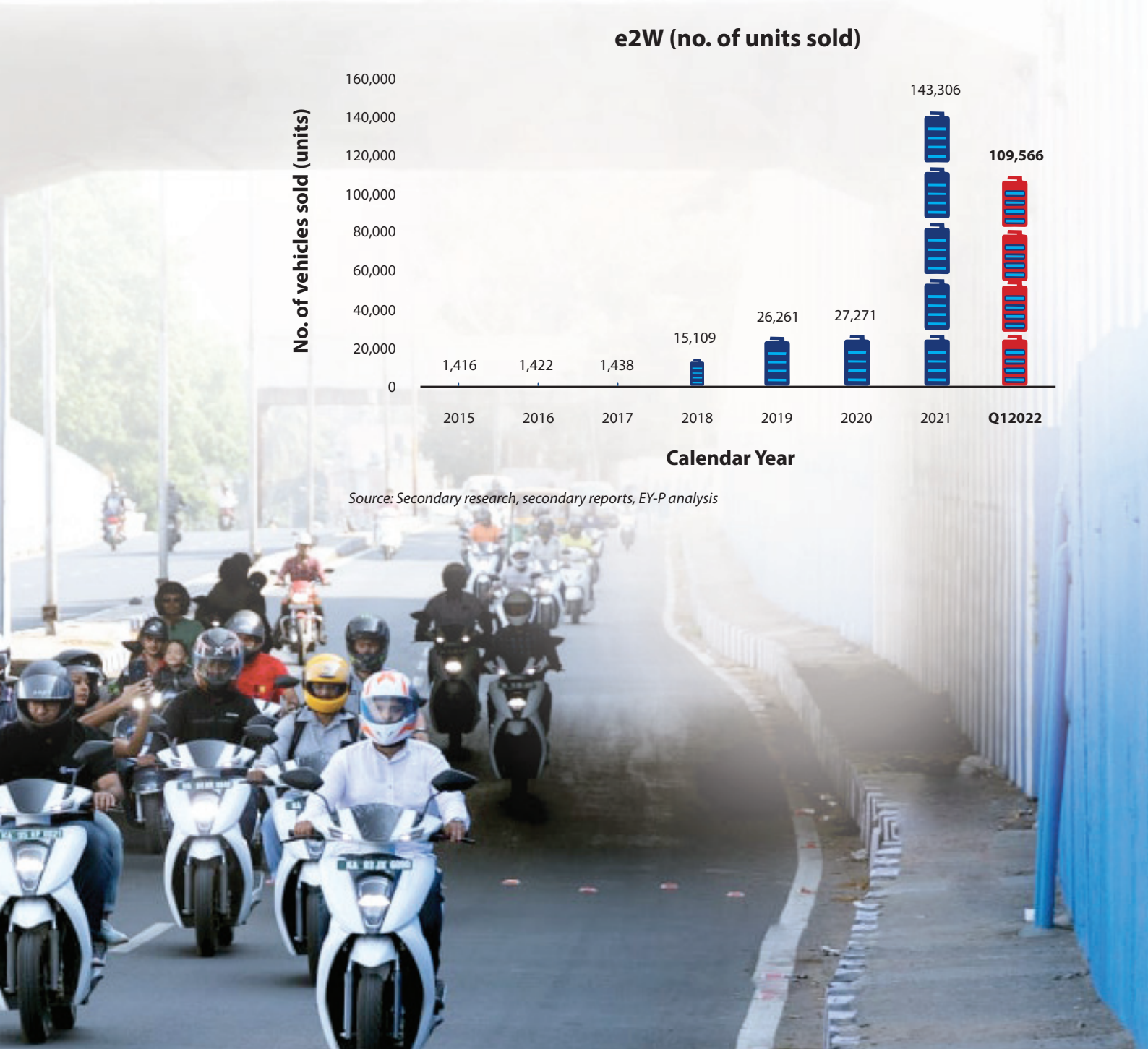
The Indian EV ecosystem is currently in the initial stages of development but has been gaining traction. In 2021, EV registrations amounted to ~330k units (a jump of 168% from 2020. The sales were led by 2- and three-wheelers — ~48% and ~47%, respectively — followed by passenger vehicles at ~4%. The e-rickshaw/e-kart category (top speed less than 25km/hr) has a significant share of ~45% among three-wheelers. E-buses, with a share of 0.36%, are included in others.

EV registrations have increased by ~168%, from 120,000 in 2020 to ~330,000 in 2021 (these numbers include e-rickshaws). The main EV segments are electric two, three and four-wheelers and buses. Among these, electric two-wheelers (e2W) account for ~48% of the total number of vehicles sold in the market. Registrations in 2022 are set to increase and have already crossed ~120,000 in the first quarter of 2022. Electric three-wheelers (e3W), cars and buses accounted for only ~47% of the total sales in 2021. Range anxiety (due to the non-availability of chargers) and limited models from established OEMs are the two biggest roadblocks to having increased EV penetration in India.

4.2 Segment-wise EV Registrations

Electric 2-wheelers (e2W)

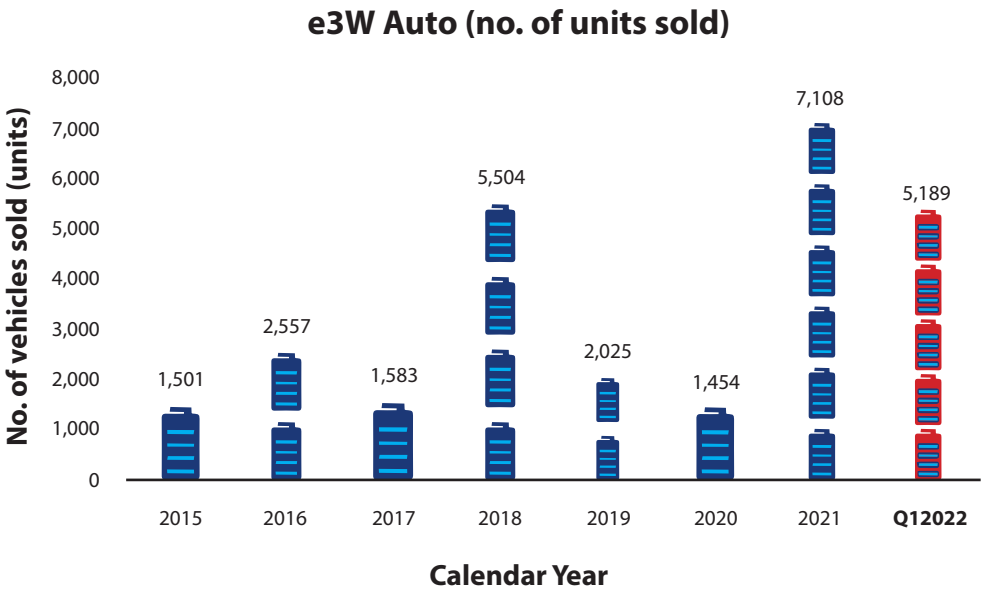
Sales of e2Ws have gained traction in the last two years, going from ~27,000 to over 143,000, a growth of ~425% over 2020. The spike can be attributed to the need for personal mobility, increased environmental awareness and a rise in gasoline prices (increased by INR43(~46%) from 2019 to 2022). The second phase of Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME II) incentives have also helped in the increased adoption of e2W. The first quarter of 2022 has already seen sales of almost 110,000 units.



Source: Secondary research, secondary reports, EY-P analysis

Electric 3-wheelers (e3W Auto)

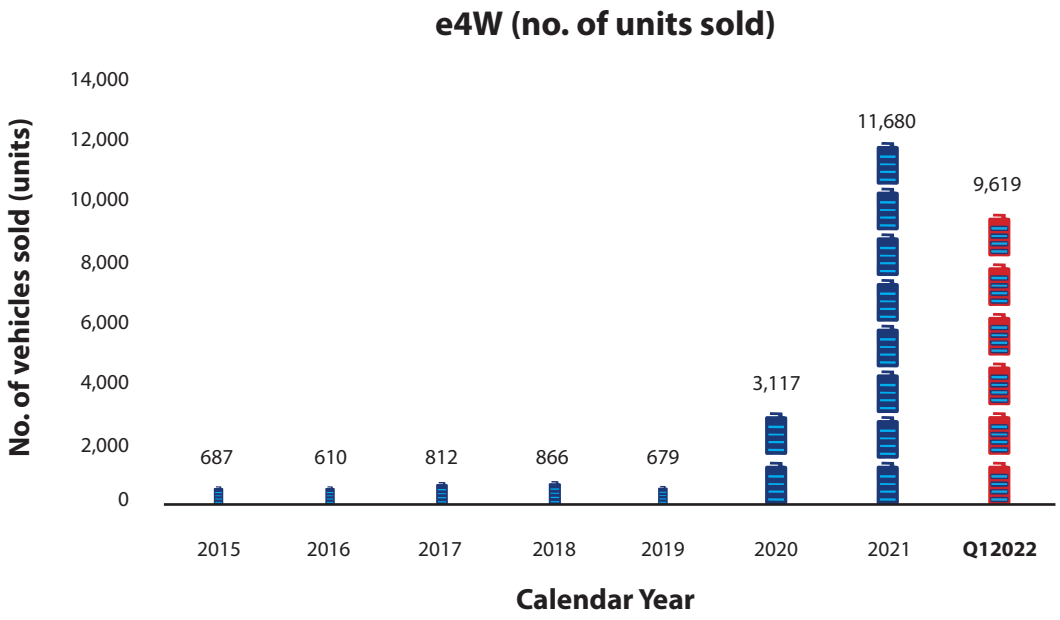
Electric 3-wheelers: Apart from e2W, the electric 3-wheeler (e3W) auto market (which includes the cargo and passenger segments but excludes e-rickshaws) has seen a significant increase in patronage. Most of the sales are coming from the goods segment, as companies use e-autos for last-mile delivery. Their total cost of operation per km is lower than the conventional IC engine autos' by ~55%. In addition to that, increase in e-commerce sales and easy switch ability from ICE due to fixed load cycles (groceries) are helping drive sales. Passenger autos are still ICE based, as their load cycles are not regular, and range anxiety remains a hurdle. The projected numbers do not include E-rickshaws and e-carts, which are estimated to reach ~850,000 units by the year 2027.



Source: Secondary research, secondary reports, EY-P analysis

Electric 4-wheelers (e4W)

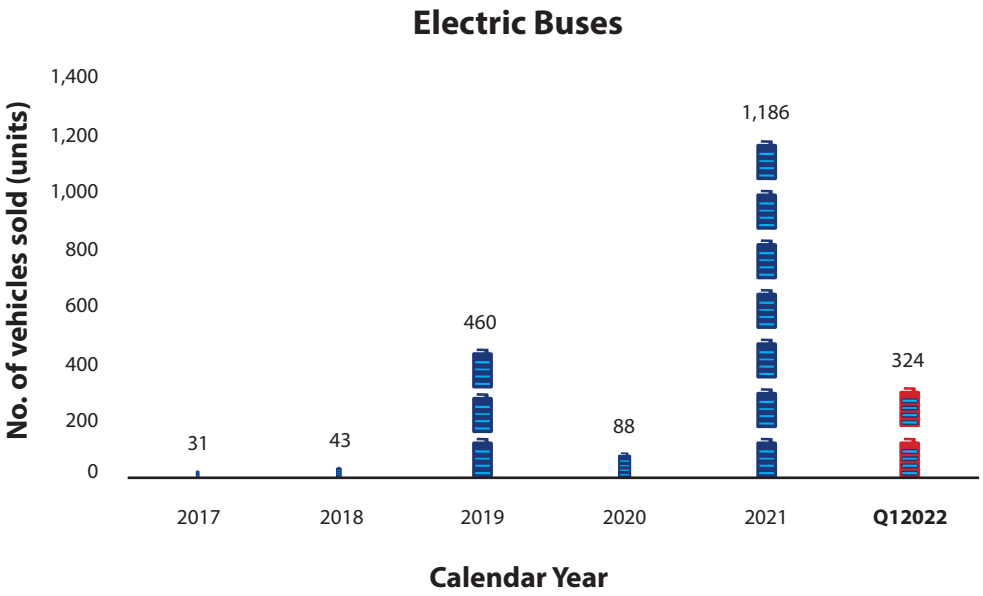
Electric four-wheelers (e4W) sales gained momentum in 2021 (after the pandemic) due to higher gasoline prices and the growing need for personal mobility. However, it is still in the early stages, and ICE cars are dominating the market. Several factors are contributing to this scenario. Most households have only one car. Moreover, e4W doesn't have the range needed for inter-city commute (not fixed load cycles), and the price difference between ICE and EVs is significant. However, we expect a ~200% increase in sales in 2022 compared to 2021.



Source: Secondary research, secondary reports, EY-P analysis

Electric buses

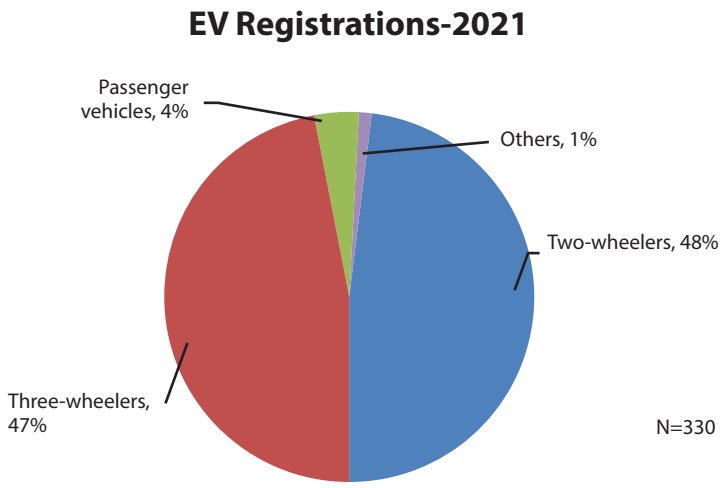
Fleet electrification is a fledgling segment. There are fewer e-buses than ICE ones, and the penetration is also low. Limited models from OEMs, range anxiety, varying duty cycles, and high initial procurement costs prevent the segment from growing. However, e-buses with improved efficiency are a high priority for several state governments aiming to decarbonize public transport and retire over-aged buses. More traction in this segment is expected over the next five years.



Source: Secondary research, secondary reports, EY-P analysis

4.3 State-Wise EV Registrations

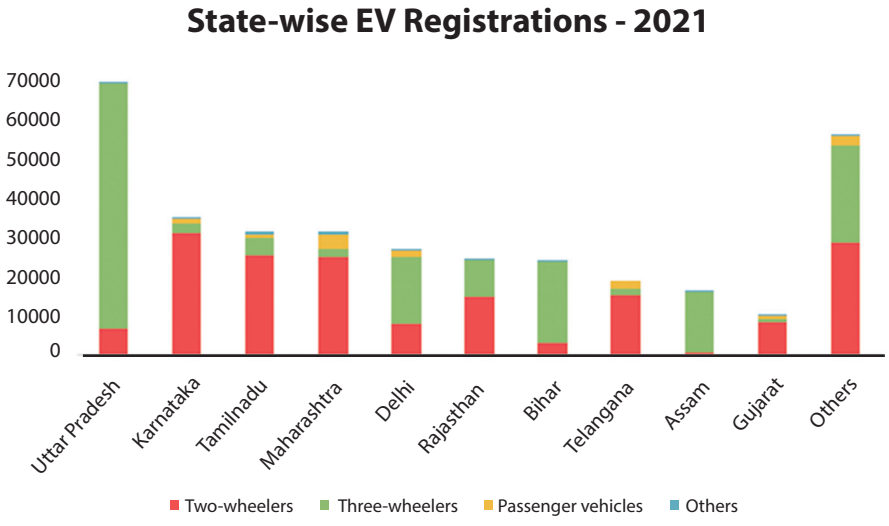
In 2021, EV registrations amounted to ~330k units, a jump of 168% from 2020. The sales were led by two and three-wheelers with ~48% and ~47% respectively and followed by passenger vehicles with ~4%. E-rickshaw/e-kart category (top speed less than 25km/hr) takes the major share among three wheelers with ~45%. E-buses are included in others with a share of 0.36%.



Source: Secondary research, secondary reports, EY-P analysis

With ~20% share, Uttar Pradesh tops EV registrations in the country, followed by Karnataka and Tamil Nadu. Of the overall e2Ws registrations, ~67% are from Karnataka, Tamil Nadu, Maharashtra, Telangana, and Rajasthan. The majority of e3Ws are in Uttar Pradesh, Bihar, Assam, and Delhi, collectively accounting for ~75% of total sales. Maharashtra, however, boasts of the highest sales of passenger vehicles with ~3,700 units.

Apart from the overarching role played by the central and state governments as policymakers, the EV ecosystem in India is broadly divided into three sets of players: EV suppliers, component and infrastructure suppliers, and consumers. Each set has its own structure, complexity, and challenges.



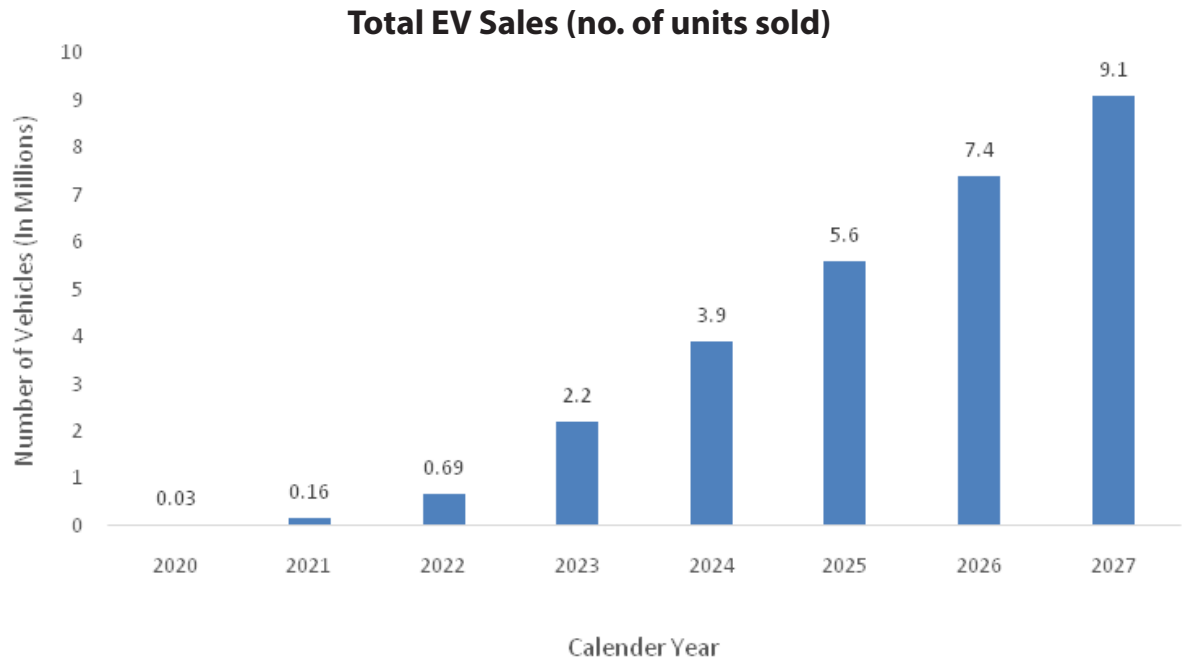
Source: Secondary research, secondary reports, EY-P analysis

6 Secondary reports referring to Vahan website and Telangana Regional Transport
7 Does not include low speed vehicles as they do not require registration

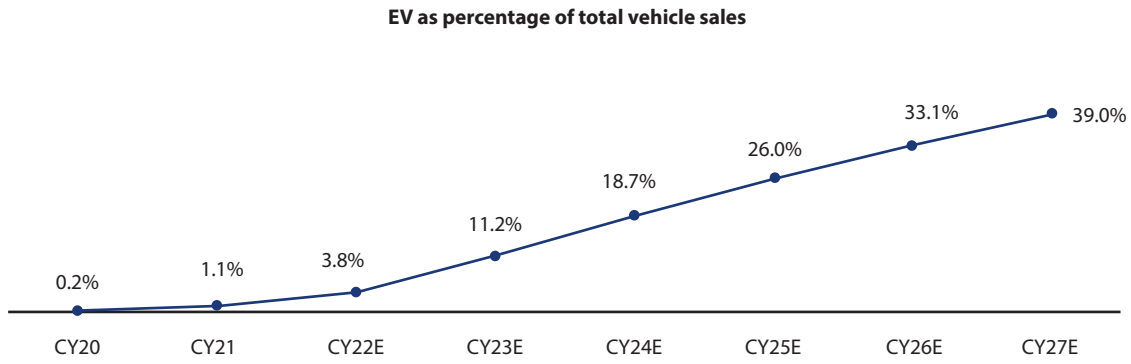
4.4 Projected EV Sales

Total EV sales are expected to grow at a CAGR of ~68% till 2027. The increased sale will be driven by the e2Ws and electric auto segments (including e-rickshaws).

Sales of e2Ws and e3Ws are set to increase by 2030 due to a fixed duty cycle (this will lower range anxiety) and the initiatives by small businesses such as local groceries shops to adopt electric vehicles for last-mile deliveries. Amazon and Flipkart, for instance, are aiming for a 100% electric fleet by 2030. Electric buses will gain traction due to a need for more fuel-efficient buses. E-buses will replace the over-aged buses at most State Road Transport Undertakings (STUs) due to a better operating model with OEMs.



EV as total % of Automobiles – Current and Projections

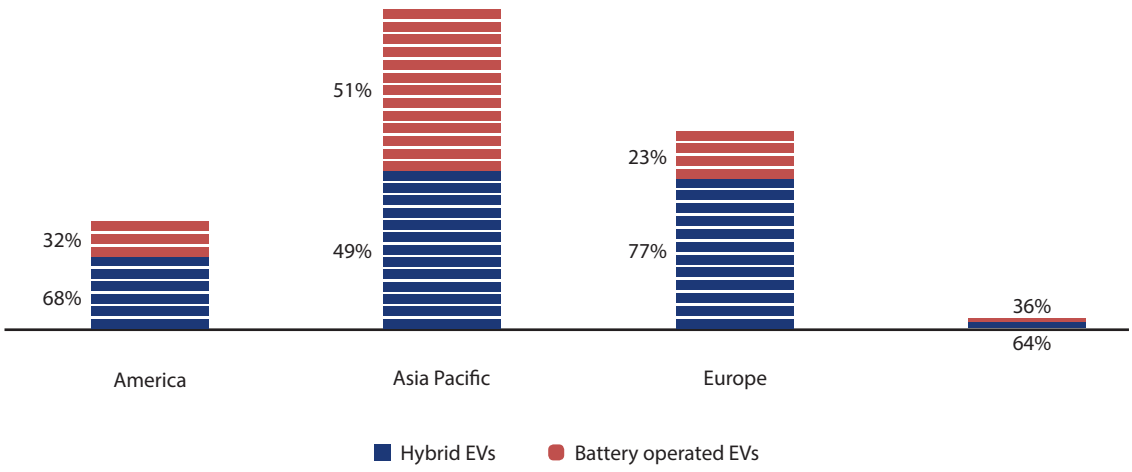


Source: Secondary research, secondary reports, EY-P analysis

4.5 Global Comparison

Asia-Pacific is leading the race in terms of EV adoption with 5.5 million units of EV sales in CY2021, led by China. The Chinese market has robust raw material processing capabilities and a strong density of local EV manufacturers, leading to a secure supply chain and significant product rollouts. On the other hand, India is heavily reliant on foreign markets to procure raw materials for batteries, which leads to a high total cost of ownership (TCO) for EVs, resulting in a relatively lower adoption than global peers.

Global EV sales in million units - CY21 (segmented by regions)



Source: Secondary research, secondary reports, EY-P analysis

We believe that decarbonization is of national importance to India from the point of view of securing our energy needs while creating a sustainable future. At NIIF we are upbeat about the prospects of decarbonization and are evaluating investment opportunities across technologies and their respective value chains – one of which is the transition to electric vehicles.

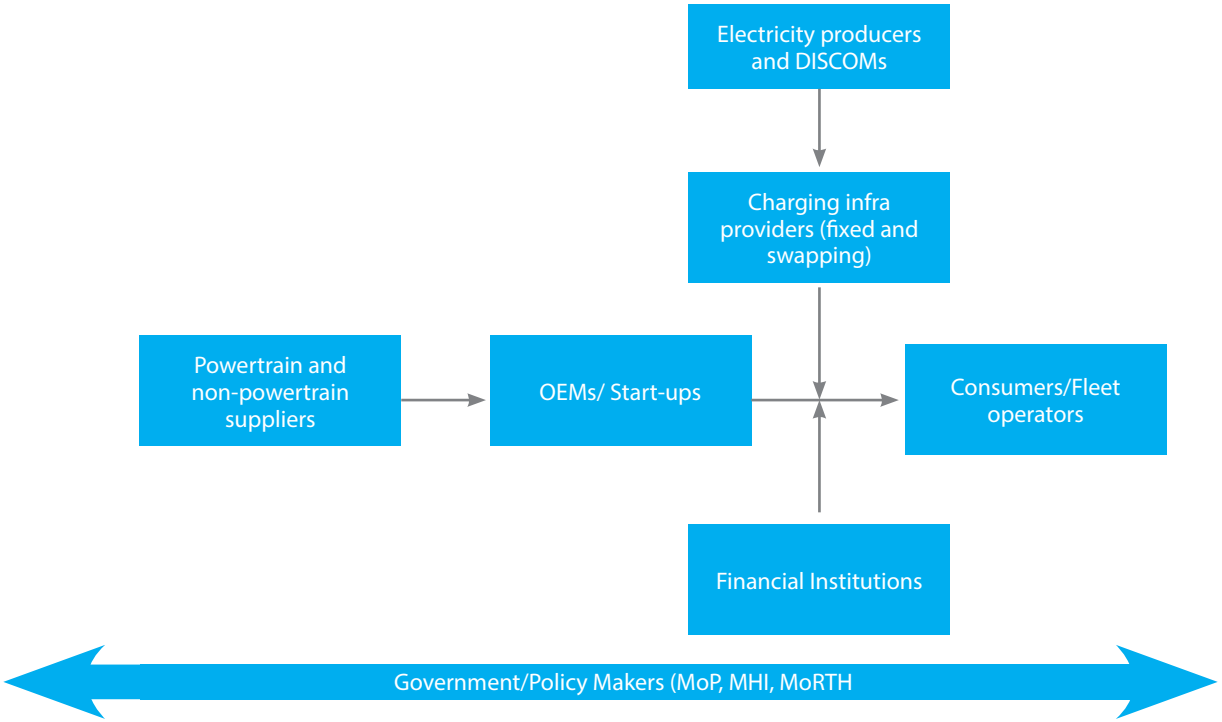
We recently invested in Ather Energy which is a leading indigenously designed electric two-wheeler manufacturer. The electric scooter industry is expected to grow significantly in the coming years driven by customer acceptance and consumer aspiration for future-ready products.

India is at an inflection point as far as electric penetration is concerned for scooters. Apart from electric vehicles, we believe that there will be significant opportunities to invest across the value chain including component manufacturers, battery and battery management systems, and mobility services.

- **Padmanabh Sinha**, ED & CIO, Growth Equity, National Investment and Infrastructure Fund (NIIF)

05 PLAYERS AND STAKEHOLDERS IN THE INDIAN EV ECOSYSTEM

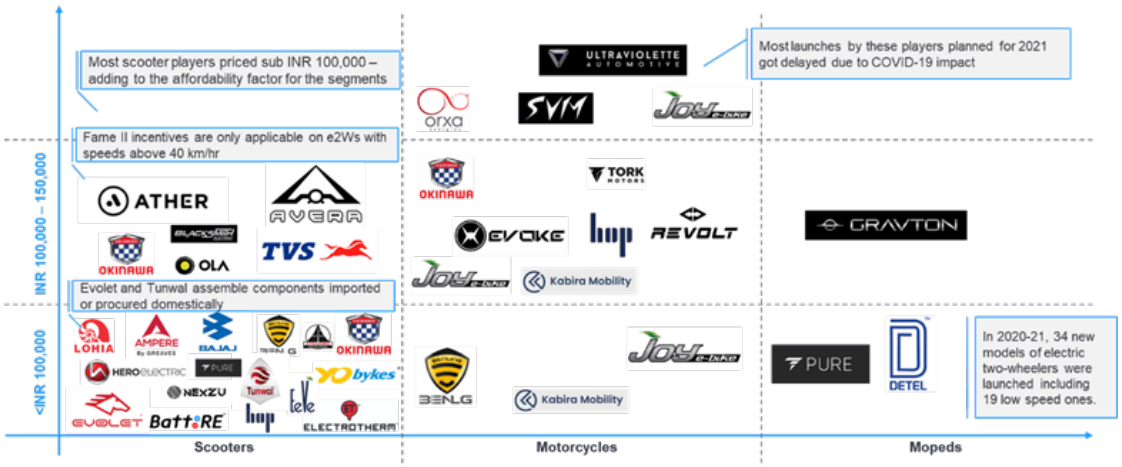
The following map shows different key stakeholders in the EV ecosystem



5.1 OEMS/ Start-ups

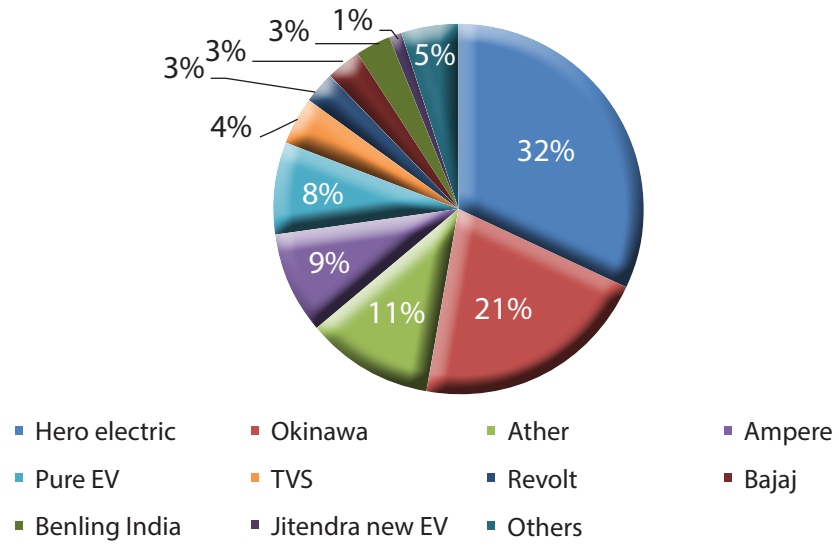
Two Wheelers (e2W)

The e2W segment is largely divided into high-speed and low-speed vehicles. Low-speed vehicles have a top speed of 25km/hr and do not require registration or a driver's license. High-speed vehicles, with a top speed greater than 25km/hr need to be registered. The low-speed section was dominating sales until Q2-21. However, with the increase in FAME II incentives from mid-last year, entry-level high-speed vehicles have become cheaper than low-speed ones, resulting in de-growth in the low-speed segment in the last two quarters of 2021. The following graphic provides the landscape of players in the e2Ws segment:



Led by Hero Electric and Okinawa with 32% and 21% market share respectively, the top 10 players accounted for majority of the sales in high-speed e2Ws. Revolt is the only e-motorcycle producer currently present among the top 10 while others are e-scooter manufacturers.

OEM Market share in high speed segment (Total sales, 2021: ~158k



The e2W segment has been gaining pace, and some significant players have launched products or announced their entry in 2021. Hero MotoCorp, the world's largest motorcycle manufacturer, is expected to launch its electric scooter in March 2022. Products from Ola and Bounce are also likely to take a fair share of the sales from 2022. Bounce is the first e2W manufacturer to announce battery swapping with its Infinity E1 model.

	Hero Electric	Okinawa	Bajaj	TVS	Ather	Ola	Bounce	Revolt
	Photon HX	I-Praise+	Chetak	iQube	450X	S1	Infinity E1	RV 400
Battery (kWh)	1.8	3.3	3	2.25	2.61	2.98	2	3.24
Battery type	Removable	Removable	Fixed	Fixed	Fixed	Fixed	Remov-able/ swappable	Removable/ swappable
Top Speed (kmph)	45	58	60	78	80	90	65	45-85
Peak Motor power (kW)	1.8	2.5	4.08	4.4	6	8.5	2.2	5
Range (km)	108	139	95	75	Eco-85 Ride-70 Sport-60	121	85	80-150
Charge Time (Hrs)	5	4-5	5	5	0-80% in 3.5 hrs (home)	4 hrs 48 mins	4-5	4.5 hours
Payload (kg)	-	150	-	-	-	-	-	150
Kerb Wt. (kg)	87	150	100	118	108	121	94	108
Ex-showroom Price (INR)	**74,240**	**105,990**	**1,42,830**	**93088-1,28,113**	**1,32,426-1,47,087**	**79,999-99,999**	**45,000-68,999**	**106,999**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Three Wheeler (e3W)

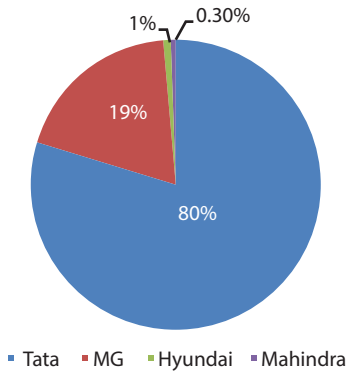
The sales of e3Ws are dominated by low-speed vehicles (top speed of 25km/hr), categorized as e-rickshaws/ e-karts. A significant part of the sales (~90%) is for passenger movers, while cargo movers are limited to ~10%. The top players include YC Electric, Mahindra, Saera, and Champion, among others.

Parameter	YC Electric	Mahindra	Kinetic	Piaggio	Omega Seiki	Euler	Altigreen
	Yatri Deluxe	Treo Yaari	Safar smart	Ape city (fixed)	Rage +	HiLoad DV	neEV
Category	e-rickshaw	e-rickshaw	e-rickshaw	L5	L5 cargo	L5 cargo	L5 cargo
Battery (kWh)	- (Lead Acid)	3.69	4	7.5	10.8	12.4	11
Top Speed (kmph)	25	25	25	45	45	42	53
Peak Motor power (kW)	1.4	1.95	1.2	5.44	9.55	10.96	8.25
Range (km)	75-90	125	100	110	120	151	150-180
Charge Time (Hrs)	5-7	2.5	2	3hr 45min	5	3.5-4 (slow)	3.5 (0-80%)
Payload (kg)	380	-	-	413	500	655	550
Kerb Wt. (kg)	326	276	-	300	460	690	-
Ex-show-room Price (INR)	**1,50,000**	**1,77,000**	**1,53,000**	**2,83,000**	**3,59,000**	**3,49,999**	-

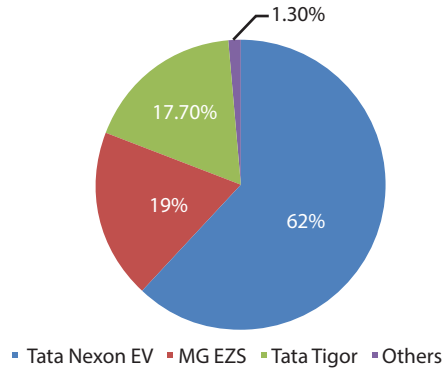
Passenger vehicles

In 2021, EVs registered in the passenger vehicle segment were 14,218, a jump of ~200% from 4,642 in 2020. However, their penetration is 0.48%, up from 0.2% in 2020.

OEM Market share, 2021



Model-wise Market share, 2021



	Tata Motors		MG	Hyundai	Mahindra
	Nexon	Tigor	EZS	Kona	Verito
Battery (kWh)	30.2	26	44.5	39.2	21.2
Top Speed (kmph)	120	80	140	165	86
Peak Motor power (kW)	96	55	105	100	31
Range (km)	300	306	419	452	181
Charge Time (Hrs)	0-80% in 1 (fast); 0-80% in 8.5 (slow)	0-80% in 1hr (fast); 8.75 (slow)	6-8 (AC) 50min (DC fast)	6 (AC); 1 (DC fast)	11.5 (slow); 1.5 (fast)
Kerb Wt. (kg)	1400	1235	-	1535	1265
Ex-showroom Price (INR)	**14,29,000-16,90,000**	**11,99,000-13,14,000**	**21,49,000-25,18,000**	**23,79,000-23,97,800**	**10,15,000-10,49,000**

Electric Buses

Electric buses have found limited acceptance, and most of them are purchased by state governments or State Road Transportation Corporations (SRTCs). Nearly 1,200 e-buses were sold in 2021. The market is dominated by Tata Motors with ~32% market share, followed by JBM and Foton PMI with ~28% and ~21% share, respectively.

	Tata Motors	PMI Mobility (Foton)	Ashok Leyland	Olectra
	Star bus EV	Urban	12m bus	K7
Battery (kWh)	250	152	250	-
Top Speed (kmph)	70-75	-	-	70
Motor power (kW)	245 (Peak)	145 (Rated)	150 (Continuous)	180 (Peak)
Range (km)	>200	144 (nominal)	200-300	200
Charge Time (Hrs)	2-3 (fast)	0.5-1 (fast)	2-3	2-3
GVW (T)	19.5	18	-	13.5T

5.2 Component Suppliers

The key difference between ICE and EVs is the power train. The conventional engine in ICE is replaced by an e-motor, a battery pack, and power electronics.

Battery
Battery manufacturing consists of two major steps: cell manufacturing and pack manufacturing. Currently, battery cells are imported from countries like China and South Korea, and packs are assembled locally. However, some players have announced plans to start cell manufacturing in India.

Battery Manufacturers	Commentary
TDSG	● Joint venture between Suzuki, Toshiba and Denso ● Will manufacture & supply Li-ion batteries to Maruti Suzuki & Suzuki Motor Gujarat plant
nexcharge Exide Leclanche Energy Private Limited	● Joint venture between Exide and Leclanche; Exide to have 80% ● Will initially import cells from Leclanche's plant in Germany
TATA TATA CHEMICALS LIMITED	● Plans to invest INR 4,000 Cr on a plant in Dholera, Gujarat ● Can manufacture up to 10GW per annum in its 127-acre plant, along with recycling operations
AIL	● Japanese multinational owned by TDK ● Has spent INR 550 crores to acquire 180-acres land in Haryana for the plant site
Li ENERGY	● India-based energy storage & renewable energy start-up ● Has purchased 125-acres land and has a MoU with Guidance Tamil Nadu (Govt nodal agency)

Other battery technology manufacturers in India include:

ACE Green Recycling	Ace Green Recycling	GODI	Godi	MICROWATT	Microwatt
AMARA RAJA	Amar Raja Batteries	GRINNTECH	Grinntech Motors	Livguard	Livguard
Offgrid	Offgrid	INVERTED	Inverted	LOG9	Log9 Materials
cygni	Cygni Energy	IONENERGY	Ion Energy	LOHUM	Lohum
EPSILON	Epsilon	RELICELL	Relicell	Gegadyne Energy	Gegadyne Energy
EXIDE	Exide Batteries	EXPONENT	Exponent Energy		

Electric Motor

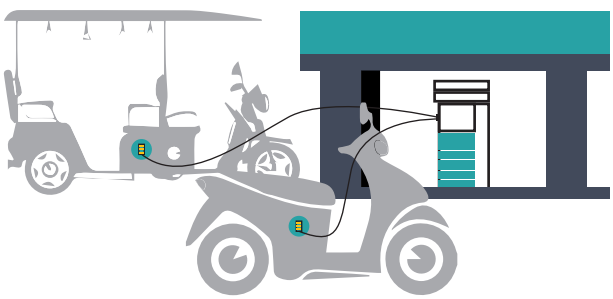
As the need to localize components grows, several global and Indian companies have increased their focus on developing and manufacturing Brushless DC motors (BLDC) and Permanent Magnet Synchronous Motors (PMSM).

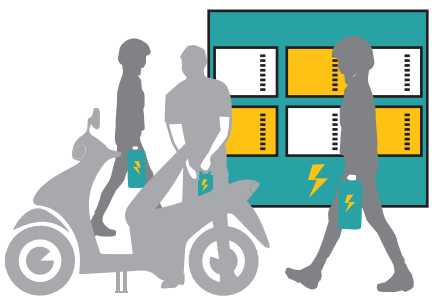
Motor Manufacturers	Commentary
SONA COMSTAR	● Head quartered in Gurgaon, Sona Comstar is a manufacturer of integrated powertrain solutions for EVs including differential assembly for e-passenger vehicles, hub motor for 2Ws, drive motors for 2/3Ws and motor controllers
TATA AUTOCOMP SYSTEMS Enabling Mobility Solutions	● One of the leading suppliers of EV components in India ● Manufactures motors, controllers, and integrated drivetrains
MAHLE	● MAHLE GmbH is a German automotive supplier with global presence ● The company manufactures electric motors for 2/3Ws for Indian market
varroc	● Global tier-1 automotive supplier, Varroc has developed a 48V PMSM motor and is supplying to one of the leading 2W players
Lucas TVS DRIVEN	● Lucas TVS is a part of TVS group, which entered EV segment with BLDC and PMSM motors for bicycles and 2/3Ws; products for passenger vehicles and tractors in the pipeline
Valeo SMART TECHNOLOGY FOR SMARTER MOBILITY	● One of the leading auto components suppliers, Valeo has launched an e-powertrain system (reducer, integrated motor & inverter) for 2/3Ws; currently powering Omega Seiki's vehicles

5.3 Charging Infrastructure Providers

Fixed charging and battery swapping are the two types of public charging options currently available. OEMs like Tata Motors, Ather and Ola are establishing exclusive charging infrastructure. Some of the prominent third-party players providing charging solutions include:

Charging infra provider	Vehicle segments	Fixed charging	Battery swapping
EXICOM POWER SOLUTIONS	2Ws/3Ws/passenger Vehicles	✓	✓
CHARGE+ZONE	2Ws/3Ws/ passenger vehicles/ e-buses	✓	✓
DELTA	2Ws/3Ws/passenger Vehicles	✓	✗
fortum	Passenger vehicles	✓	✗
magenta	2Ws/3Ws/passenger Vehicles	✓	✗
EVtron	2Ws/3Ws/passenger Vehicles	✓	✗
SUN MOBILITY	2Ws/3Ws	✗	✓
BatterySmart	2Ws/3Ws	✗	✓



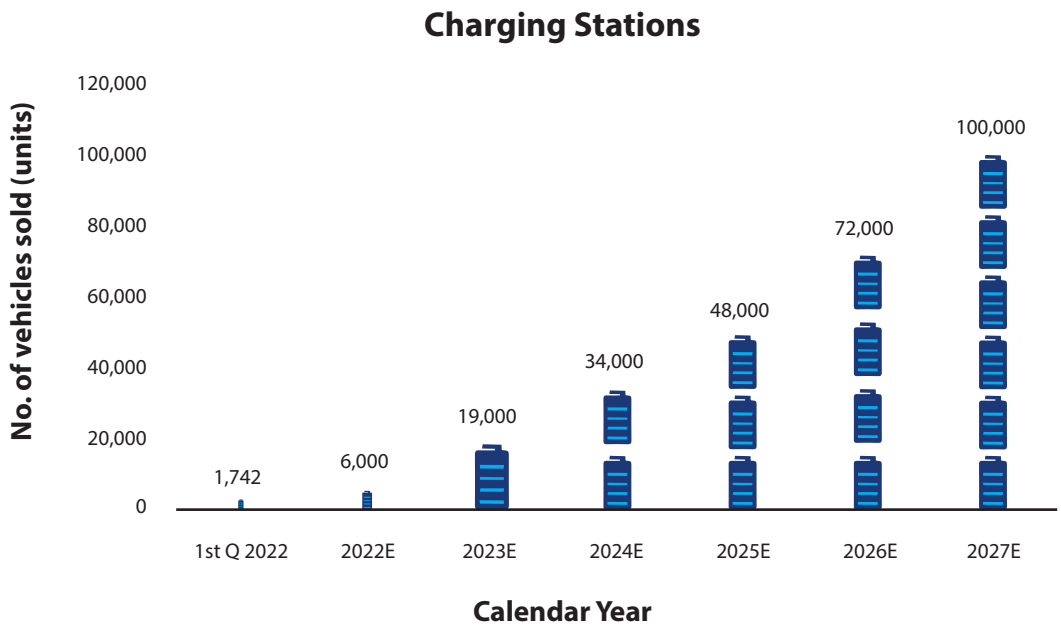


Other players in charging infrastructure space include:

ABB	Evre	Massive Mobility
Ather Energy	EVTech	Numocity
BOLT	Statiq	Tata Power
EESL	goEgoNetwork	Voltic
ElectricPe	Kazam	RACEnergy
EVI Technologies	Mass Tech Control	Charge-Up

Charging Infrastructure:

The lack of charging infrastructure is one of the biggest challenges for the EV sector. Currently, there are only 1,742 charging stations in the country. This number is expected to increase to 100,000 units by 2027 to accommodate the increasing demand by ~1.4 million EVs expected to be on the roads by then. An adequate presence of charging points, especially for fast charging, can tip the scales in favor of EVs, especially as cars and two to four- wheelers are expected to be used for long-distance transport. Currently, the limited presence of charging points means customers cannot opt for quick top-ups or charging their vehicles in emergencies.



5.4 Fleet Operators

Fleet Operator	2Ws	3Ws	PVs	Remarks
Bounce	✓			● Started as a bike-sharing company with ICE vehicles, Bounce has transformed itself into an e2W manufacturer ● Has a fleet size of 4,000 vehicles and plans to expand it to 100,000 by 2026; could include its product, Infinity E1, in the fleet
yulu	✓			● A fleet operator in bike sharing model; has deployed 10k low-speed e2Ws; plans to expand to 900,000 by 2026 ● Investor and a strategic partner, Bajaj, is likely to support Yulu's future product development
ZYPP ELECTRIC	✓			● Exclusive e2W fleet operator catering to businesses ● Plans to expand fleet from 2,000 in 2021 to 100,000 by 2026
SMARTE		✓		● e3W operator with a fleet size of 1000 vehicles in Delhi NCR ● Recently closed a funding round of INR100 crore for fleet expansion to 10,000 vehicles across six cities in the next 18 months
Lets transport		✓		● Founded in 2015, LetsTransport is an aggregator of e3Ws and light commercial vehicles for last-mile logistics ● The company is planning to add 1000 e3Ws to its fleet by June 2022
BLU SMART MOBILITY			✓	● Operates electric passenger vehicles and has a fleet size of 400 vehicles in Delhi NCR ● Partnered with Tata Motors for the expansion of its fleet; Tata Motors to supply 3500 XPRES –T EVs
Lithium			✓	● Based out of Bengaluru, Lithium Urban technologies holds a fleet of 400 electric passenger vehicles

Other fleet operators in India are:

alt. mobility — Alt Mobility

MOEVING — MoEVing

PRAKRITI E-MOBILITY PRIVATE LIMITED — Prakriti E-mobility

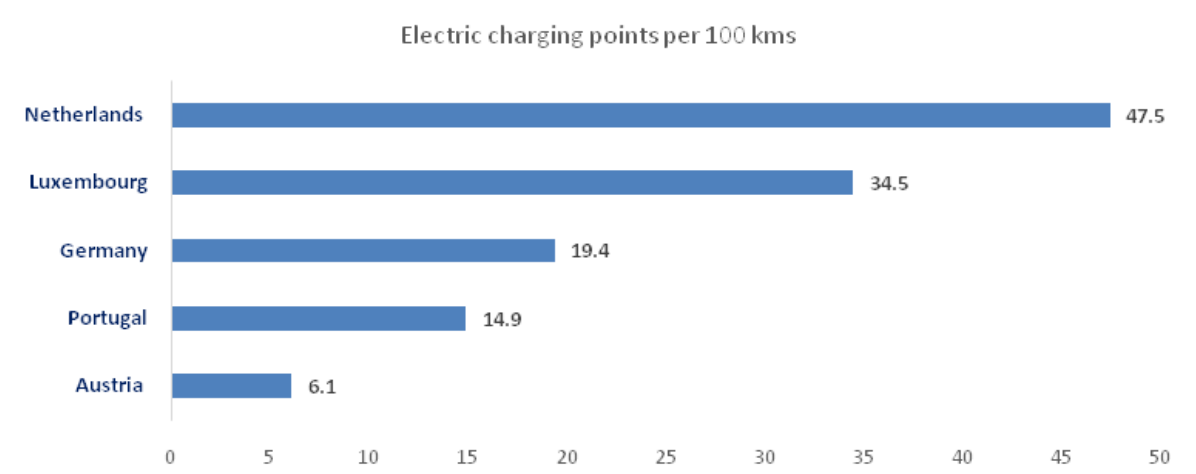
Infaprime Logistics Technologies

OYE! RICKSHAW — Oye Rickshaw

VOGO — VOGO

5.5 Case Study: Charging Infrastructure - Europe

Evolution of charging infrastructure in Netherlands



The European Union has 0.3 million public charging points situated across its countries. The highest density for EV chargers is in the Netherlands, with 47.5 stations per 1,000 km, followed by Luxembourg (34.5), Germany (19.4), Portugal (14.9) and Austria (6.1).

The growth in EV charging infrastructure across Europe is due to the increased adoption of EVs. According to the European Automobile Manufacturers Association, one in 11 new cars sold in 2021 was fully electric (a 63% increase from 2020). EV growth is largely driven by the strong need to comply with European Union CO2 norms for cars and vans.

The growth in the expansion of charging infrastructure is also fueled by the adoption of digital applications, like ChargeMap and PlugShare, which enable the detection of surrounding chargers.

Furthermore, the EU plans to expand its network of charging stations to 2.9 million by 2030, with an earmarked budgetary outlay of EUR1.8 billion (3% of the EU's annual budget for roads and infrastructure).

Netherlands has observed strong density in EV charging stations, beating its European counterparts. The expansion of the EV charging ecosystem in the Netherlands started in 2010 with 400 charging stations, despite EV adoption being in its early stages. The charging stations grew exponentially in subsequent years to reach 75,000 in 2021 (one-third of the total charging market in Europe).

The growth in charging networks is attributed to a slew of supply-side initiatives by the Dutch government, including:
1.Cost reductions of up to 36% for purchasing and installing charging stations
2.Tax return up to 75% of costs associated with purchasing and installing charging stations.

Furthermore, municipalities, provinces, and regions are encouraged to develop their mobility programs individually through subsidies and other incentives. Municipalities associate themselves with external partners to ensure charging network expansion and operation.

The Dutch government expects the initiatives to lead to increased EV adoption as it has forecasted 400,000 EV PARC by 2030. The government's commitment to zero-emission mobility and corresponding growth in EV charging space has led to strong EV optimism.

We are bullish on overall rising EV penetration globally and have been investing behind this theme since 2017. The combination of declining costs and improving energy density for lithium-ion batteries, supportive policies across geographies and increased consumer interest as more electric options become available have greatly accelerated adoption. As more governments and companies commit to net zero targets, electric vehicles are among the consensus technologies expected to be adopted ever more quickly.

We have investments across the value chain including lithium extraction, mining exploration using AI for nickel/lithium/cobalt/copper, OEMs, battery manufacturing and materials, recycling and EV charging. The batteries needed to make this transition away to electrification requires significant capital to expand availability of raw materials, scale up new technologies and ramp up manufacturing. We believe this will drive growth for existing companies and allow new, large companies to emerge, particularly those with defensible moats.

- **Caitlin Walsh**, Managing Director, Growth Equity, CPP Investments

We strongly believe that climate concerns have become an integral component in business decision making and consumer preferences. The Indian government is aligned and is taking resolute steps to decarbonize the economy with a push towards electrification of mobility. As investors, we believe the EV space in India is nascent but evolving rapidly. This offers investors an opportunity to not only make significant financial returns but also drive outsized environmental and social impact. This dual outcome is something that we are very excited about.

- **Nikhil Khattau**, Managing Partner, Mayfield India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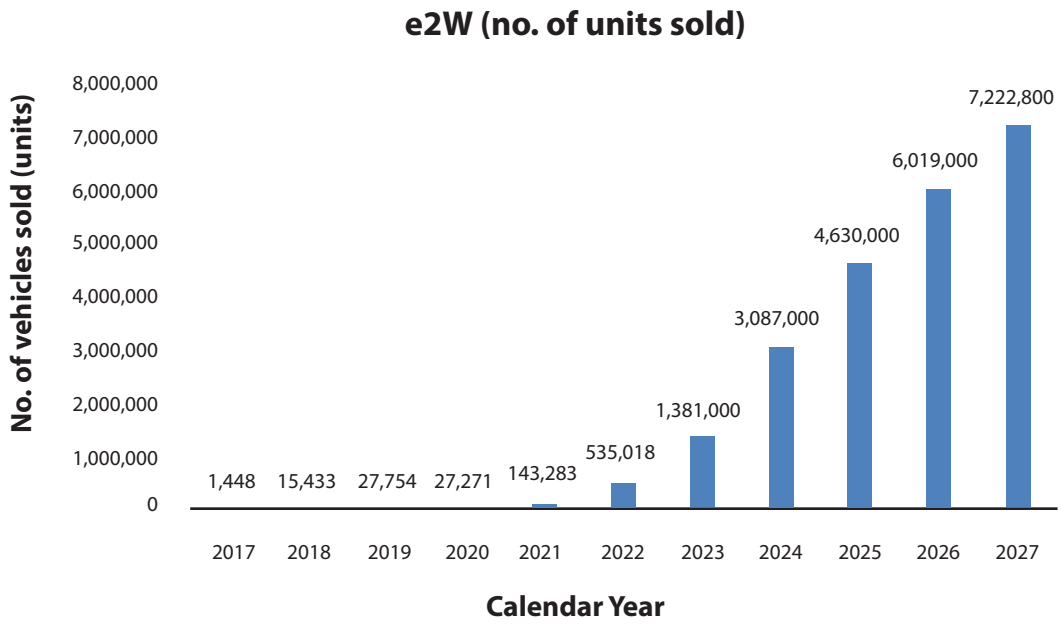
06 EV ADOPTION IN INDIA AND CHALLENGES

6.1 EV Penetration by Segment

Two Wheelers (e2W)

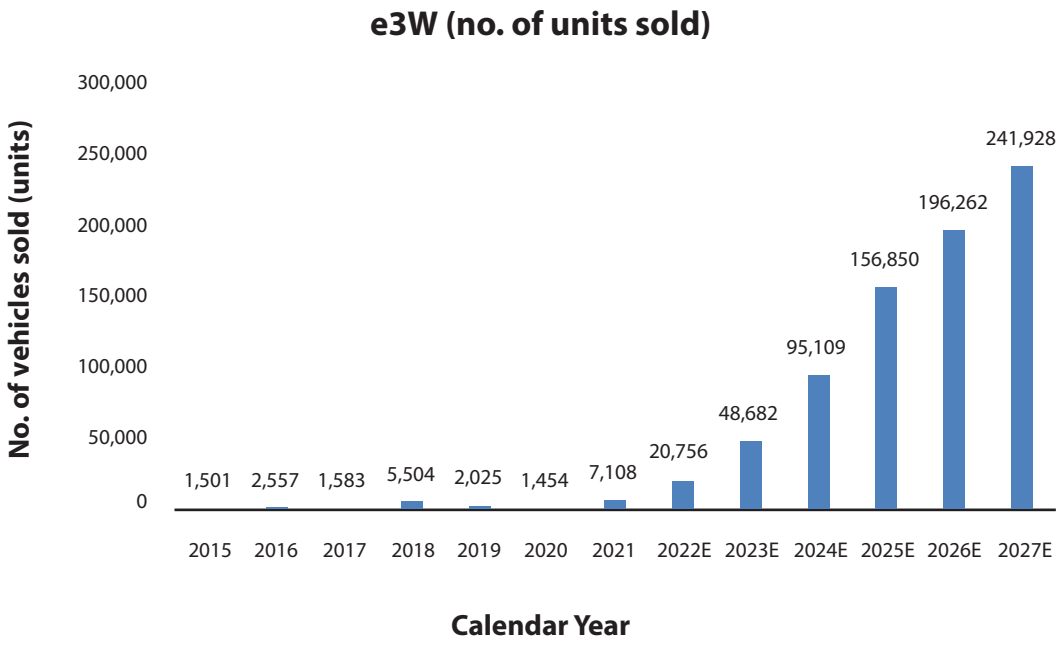
Electric 2-wheelers are showing a significant increase in sales, with numbers touching ~110k in the first quarter of 2022, and on to a projected ~535k for the year. The numbers are estimated to reach ~7.2 million vehicles with a CAGR of ~68% over the next 5 years till 2027, with a penetration of ~38%. The government has set a target of 80% penetration by 20230, which we feel is aggressive; a realistic target of 45-50% seems achievable by 2030, especially considering the recent incidents of battery fires.



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
% Penetration	0%	0%	0%	0%	1%	4%	9%	18%	26%	33%	38%

Three Wheeler (e3W)

There is a substantial increase in the penetration of e3W vehicles, with ~5% penetration in Q1-22. The passenger segment currently has lower penetration because only a few models are available. Cargo models are expected to see more traction primarily due to two factors: an increase in e-commerce sales and last-mile deliveries; and a commitment from Amazon and Flipkart to go 100% electric by 2030. The Delhi government has asked for an aggressive push in using e3Ws for its delivery aggregators; a draft policy is being prepared.



	2015	2016	2017	2018	2019	2020	2021	2022E	2023	2024	2025
Penetration	0.30%	0.50%	0.30%	0.80%	0.30%	0.60%	2.70%	6.67%	13.44%	22.22%	31.60%

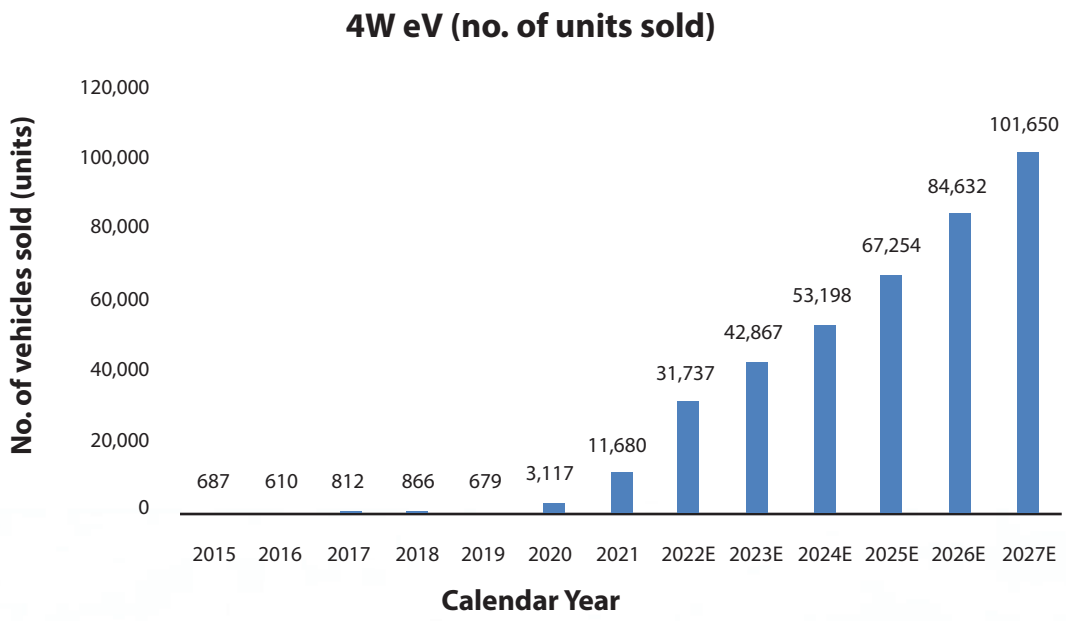
2026	2027
33.90%	40%

Four Wheelers (e4W)

Increasing fuel prices and the need for personal mobility will fuel an increase in this segment. Currently, at ~1%, we expect to see ~4% penetration by 2027. There is a push for hybrid, E5 and E10-based fuels, which will allow IC engines to be used soon.

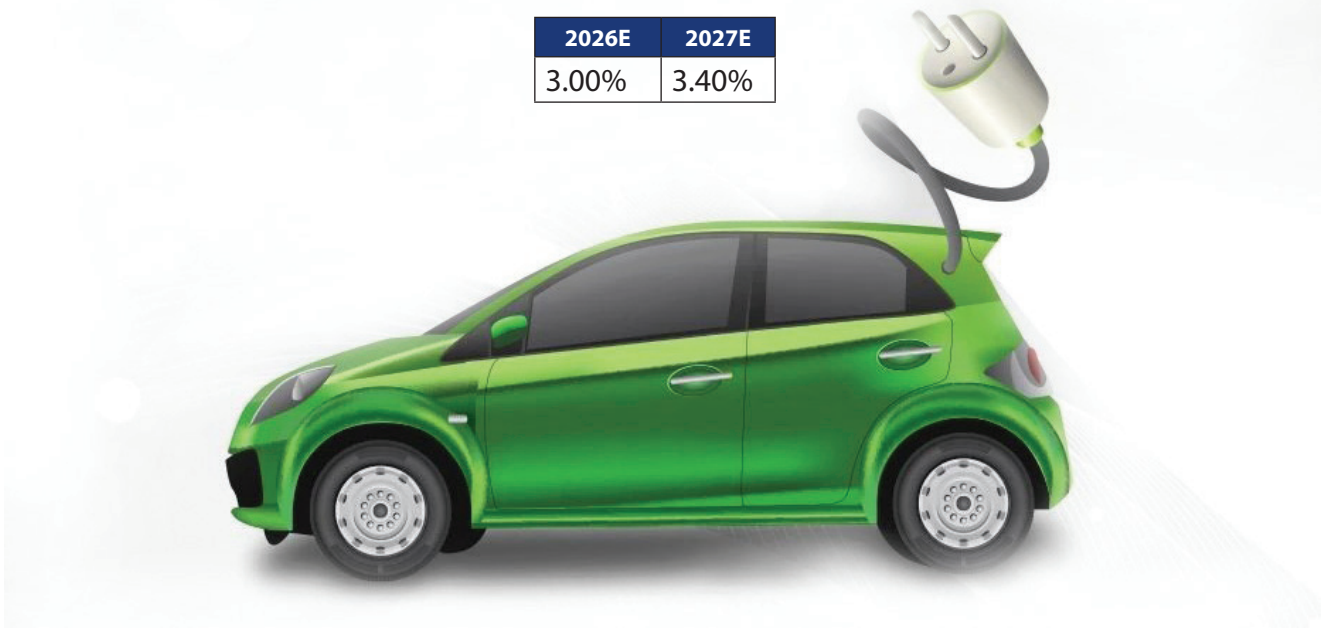
The present low penetration of e4Ws is due to various factors.

- There are only a few models available in the market. In addition, these models have range issues and are slow charging. Newer and better models are expected in the coming years.
- Most families have only one car, which is used for local and out-station commutes. This translates to non-fixed duty cycles.
- The current limitations in the charging infrastructure are expected to remain deterrents in the near future. There will be more traction after 2025-26, and electric cars may achieve ~12% realistic penetration in the segment.



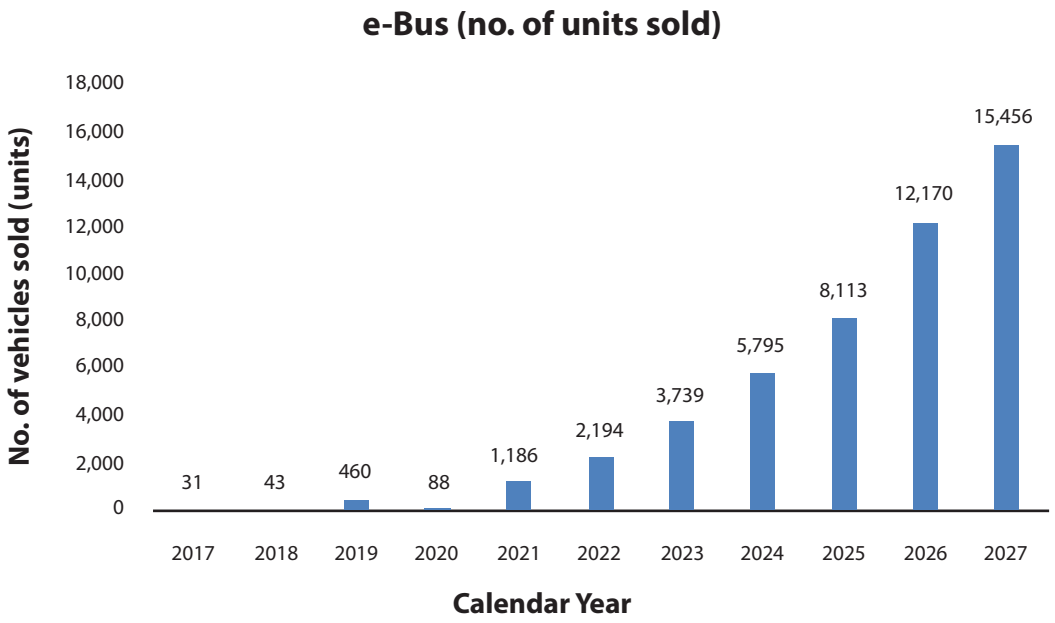
	2015	2016	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E
% Penetration	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.00%	2.00%	2.00%	2.00%

2026E	2027E
3.00%	3.40%



Electric Buses

Demand for electric buses has been very low. However, the segment is expected to gain traction over the coming years to reach ~16% penetration by 2027. Maximum demand is from the over-aged and beyond replacement cycle (>11 years) of STU buses from six states. The supply of 5,450 buses from Tata Motors to these state STUs will help increase the penetration over the next 4 to5 years. There is traction in the intra-city transportation segment due to fixed duty cycles and the availability of chargers (once the buses are operational) at the bus depots to allow for quick top-ups between duty cycles.



	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E
% Penetration	0.1%	0.1%	0.5%	0.3%	4.1%	5.1%	6.8%	9.0%	10.9%	14.8%	16.3%

> In India EV penetration is led by two – wheelers, unlike developed markets where it is driven by luxury passenger cars. While incumbent companies have been slow off the blocks, it would be wrong to write them off, there are a lot of opportunities currently available in the private space and soon they will be available for the public market investors as well.
>
> - **Anshu Kapoor**, President & Head, Investment Management, Edelweiss Wealth Management

> The EV industry has been booming in recent times with 3L+ EVs sold in the first 5 months of 2022. The industry is expected to grow at a CAGR of ~47% by 2030 and is well-positioned to significantly contribute to the Indian automotive industry. The macroeconomic environment also looks promising with the government pushing for greater adoption of electric mobility transport with schemes like FAME I & II and the Union Budget 2022 providing a greater impetus towards more sustainable and renewable energy source alternatives. These reasons make EV an exciting space for investors.
>
> Within the start-up ecosystem, we have seen a significant rise in the number of companies in the EV space in the past couple of years. EV has almost become synonymous to start-ups with majority of the companies in the space being recently established. Several early-stage startups have also progressively started to develop predictable cash flow models, making them ideal for debt financing. While investment in the space has increased, it continues to be a largely untapped market, presenting a significant opportunity for investors to bridge the funding gap through structures like Vehicle financing, Capex financing, etc. This presents a huge opportunity for EVs to be driven commercially through electric bikes, rickshaws, buses, cabs, etc.
>
> - **Ishpreet Gandhi**, Founder & Managing Partner, Stride Ventures

6.2 Barriers to EV Adoption in India

While it cannot be denied that EVs provide huge benefits over traditional vehicles that use fossil fuels, there are several challenges that need to be addressed to realise the full potential of EVs in India. The major issues present in the EV space are summarised below:

6.2.1 Charging Infrastructure

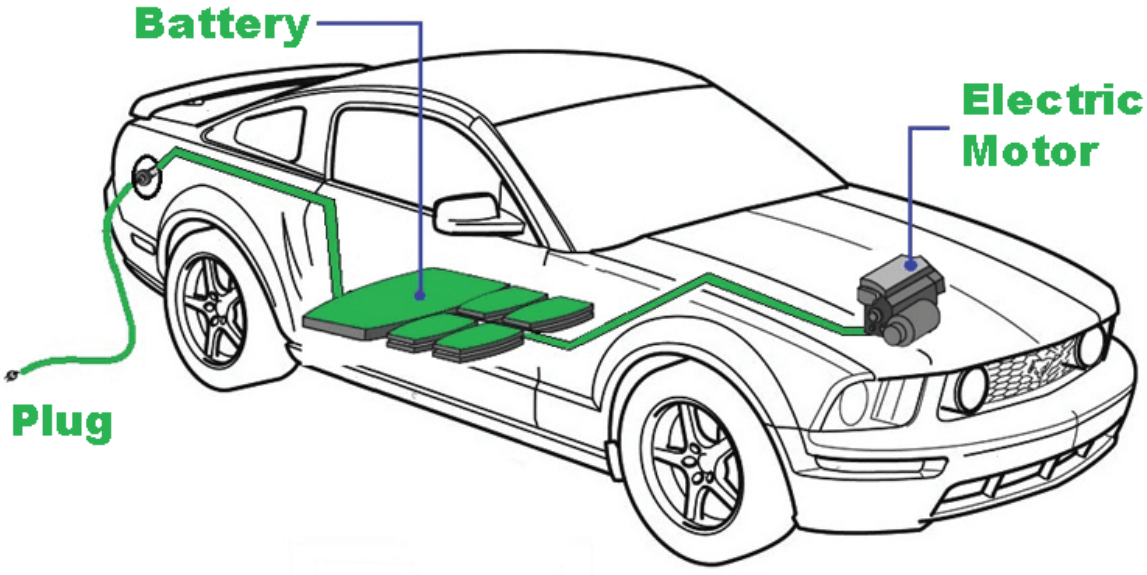
One of the major hurdles in adoption of EVs in India is the unavailability and slow development of charging infrastructure. Charging infrastructure is the foundation on which the EV market is built and India has not achieved an expeditious pace of establishment and use of charging infrastructure which creates a barrier in both production and sale of EVs in India. Factors like unsurety in utilization rates of charging stations, huge operating costs, load on electricity DISCOMs, etc., create a negative environment for operators to establish charging stations and discourage investment when there are not sufficient number of EVs in Indian roads for operators to realise the returns on their investments.

However, as discussed above, Indian policymakers are taking steps to address the lack of charging infrastructure and providing legal regulatory support for setting up of charging infrastructure for EVs. A smart, low cost, AC charge point has been developed by the DST and the office of the PSA to the Government of India with NITI Aayog for light EVs (e-scooter and e-autorickshaws) which may be installed in metros, railways, parking spaces, shopping malls, offices, residential areas which will give a much needed push for EVs. Since this low cost AC charge point requires lower investment the dependance on subsidiaries and concessions from the government can also be reduced.

6.2.2 Batteries used in EVS

EVs use lithium-ion batteries that require the use of metals like lithium, magnesium, cobalt, nickel, etc. This means that to successfully incorporate EVs as mainstream vehicles adequate resources of these metals are required to manufacture the batteries used in EVs. For countries deficient in these resources, manufacture of EVs become dependent on availability of the same mainly through imports which increases the cost of procurement of raw materials and manufacturing of EVs. In the financial year 2019-2020, India imported approximately 450 million units of lithium-ion batteries at a cost of approx. USD 865 million. Lithiumion batteries also have a huge environmental impact. Lithium extraction requires a huge amount of water, harms the soil, and contaminates the air. In addition, recycling of lithium-ion batteries is also not efficient since they degrade over time and cannot be used as new batteries.

However, alternatives to lithium-ion batteries are being developed by major manufacturers in the automobile industry. A prime contender of replacement of lithium-ion batteries is a dual carbon battery which is both less toxic and cheaper than lithium- ion batteries. Research is well underway to intensify the energy density of such batteries. Another way forward is the use of aluminum-air batteries to shift reliance to bauxite and aluminum from lithium which is of limited availability in the country.



7 https://pib.gov.in/PressReleasePage.aspx?PRID=1717977

6.2.3 Research and development

India still falls behind on strong R&D capability and consequently, manufacturers rely mostly on technological know-how borrowed from their foreign counterparts for EV components. Main research areas related to EV components are the constituents of the cells of lithium-ion batteries since these constitute the most expensive components requiring significant research in these areas. Research is required to be undertaken on high priority on EV components to make way for affordable and efficient adoption of EVs. However, this scenario is also changing, and the ARAI has been leading research on EVs and fast charging technologies as per the requirements of the Indian market.

6.2.4 Pollution

Compared to traditional vehicles that burn fossil fuel for energy, EVs are a cleaner, greener and better alternative in curbing depletion of natural resources and greenhouse gas emissions from the automobile industry. However, it cannot be denied that manufacture and use of EVs also contribute to environmental degradation. A major reason for pollution attributable to EVs is the use of traditional fossil fuels like coal to generate electricity for charging infrastructure. Establishment and operations of charging stations depend largely on the thermal power plants that further contribute to pollution. Therefore, it is important that the source of power generation for charging infrastructure be cleaner alternatives like solar or wind or hybrid power plants since using traditional power generating methods may defeat the main purpose of adoption of EVs.

As discussed above, extraction of metals for manufacture of lithium-ion batteries also causes contamination of soil and air and require huge amount of water. Disposal of batteries of EVs also is an arena of concern. Only a small number of batteries are recycled and most batteries end up in garbage dumps or are used for extraction of metals through other unclean technologies.

From a legal perspective, the Batteries (Management and Handling) Rules, 2001 does provide for a mechanism for handling and disposal of lead-acid batteries, however these rules do not cover lithium ion batteries used in EVs. The Ministry of Environment, Forest and Climate Change have published the draft Battery Waste Management Rules, 2020 for suggestions from the public which defines 'battery' to include lead acid/lithium ion/lithium metal/nickel cadmium batteries. The draft Battery Waste Management Rules, 2020 lays down detailed provisions on the responsibilities of the manufacturers, producers, dealers, recyclers, consumers, state pollution control board/pollution control committee and other stakeholders for collection, labelling, disposal and handling of batteries, including establishment of collection centers, which will provide a much needed ecosystem to curb pollution attributable to lithium ion batteries used in EVs.

8 http://164.100.24.220/loksabhaquestions/annex/173/AU1018.pdf
9 https://www.instituteforenergyresearch.org/renewable/the-environmental-impact-of-lithium-batteries/
10 https://www.instituteforenergyresearch.org/renewable/the-environmental-impact-of-lithium-batteries/
11 https://economictimes.indiatimes.com/articleshow/69766788.cms?from=mdr&utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
12 https://www.thehindu.com/news/cities/Hyderabad/iit-hyderabad-research-team-develops-an-alternative-to-lithium-ion-batteries/article34248169.ece

6.2.5 Consumer attitude

Cost effectiveness is one of the major factors an Indian customer considers before making their choice and if the EV market cannot showcase cost benefit and optimum utilization, it might fail to attract the attention of Indian customers. Various levels of the Indian government have attempted to provide cost incentives to EV consumers that addresses the issue in a limited manner. However, barriers like absence of sufficient charging infrastructure, cost for repetitive battery replacement, etc., do not make EVs a popular option for the Indian consumers. Further, in the absence of widespread marketing strategies concerning the impact and importance of EVs, Indian consumers have limited awareness of EVs as alternative to traditional fossil fuel engine-based vehicles.

Despite the above, there has been an influence of global trends on Indian consumers resulting in an upward shift in consumer preference toward EVs. Global brand like Tesla, an American manufacturer of EVs, has earned world recognition in making cost effective and energy efficient EVs which have become world renowned. The worldwide adoption and use of EVs along with awareness of the importance of climate change has slowly instilled the consumer's confidence in EVs in the Indian market. Another factor that has influenced the attitude of the Indian consumer towards EVs is the introduction of e-rickshaws which has replaced traditional rickshaws in the public transportation sector due to their cost, energy efficiency and cheaper maintenance. This has also contributed to the Indian market feeling familiarised with EVs and willing to adopt EVs over traditional engine-based vehicles. Therefore, evolving consumer trends can contribute to make the EV market in India grow exponentially. Incentives and subsidies offered by the government also go a long way to facilitate widespread adoption of EVs by Indian consumers.

The resolution of the aforementioned barriers may be undertaken through serious intervention by the government at various levels, ownership of EV infrastructure at high levels, fast decision making, collaboration and coordination with different stakeholders in the EV space and serious commitment to short and long term goals is required to ensure faster adoption of EVs in India.

> "The switch to electric mobility presents itself as one of the biggest changes of our lifetimes. The impact on India - although under-appreciated widely - will be all pervasive, perhaps as big as the advent of Internet itself. There are opportunities to build scalable and lasting companies across the value chain - OEMs and Components, Charging and Swapping operators, EV Financing and Mobility. Given this is a technology intensive landscape, it give startups a unique opportunity to play in a very large market albeit one where they are at a level field with age-old incumbents.
>
> As compared to most of the technology-enabled sectors, predicting the future of these businesses is, unfortunately, fraught with risk as it is a dynamic and inter-connected ecosystem where everything is likely to impact everything else. As a consequence, while entrepreneurs are happy building for the customer love, investors find it hard to wrap their minds around this. This work by EY and IVCA will surely help unravel some of this mystery and provide frameworks that can lead to super'charging' the EV ecosystem in our country."
>
> - **Arpit Agarwal**, Director, Blume Ventures

> "The car is becoming a smartphone on wheels, resulting in a digital transformation within the automotive sector that is creating opportunities for expanded revenue through additional services. Qualcomm Technologies, Inc. provides advanced solutions that support the entire transportation ecosystem and the ongoing transformation of the automotive industry. Electrification, autonomous driving, shared mobility – are all future possibilities that the automotive sector should be prepared for. Qualcomm Ventures looks forward to supporting innovative startups in this space and the digital transformation of the India mobility sector."
>
> - **Varsha Tagare**, Managing Director, Qualcomm Ventures

13 https://thewire.in/environment/electric-vehicles-lithium-ion-batteries-coal-power
14 Ministry of Environment, Forests and Climate Change Notification No. S.O.770(E) dated 20 February 2022 available at https://moef.gov.in/wp-content/uploads/2020/02/BATTERY-RULE.pdf
15 https://scroll.in/article/992703/india-faces-two-major-challenges-in-its-transition-to-electric-vehicles

6.3 Removal of Barriers of EV Adoption

The Indian government, both at centre and the state, have taken several steps to address the barriers to faster EV adoption in India. Actions that have been adopted to facilitate wider acceptance and infiltration of EVs are discussed in brief below.

6.3.1 Adoption of EV infrastructure

There have been several methods adopted for developing an ecosystem viable to the establishment of EV charging infrastructure. As has been discussed in the previous chapters, governmental authorities are providing incentives to increase the number of EV charging stations in India at both the central and state levels. In addition, the MoP has also delicensed the activity of charging of batteries of EVs by clarifying that charging stations do not undertake any activity of, transmission, distribution or trading of electricity as envisaged under the Electricity Act, 2003. In addition, the guidelines on charging infrastructure issued by the MoP have also made it easy to set up charging stations in offices, residential areas, parking spaces and any other public spaces by any individual or corporate firm without the requirement of any licenses subject to the guidelines issued by the MoP and the CEA. Incentives and subsidies are also being provided to attract investment in charging infrastructure. Under the FAME II, the MHI has sanctioned the establishment of 2877 EV charging stations in 68 cities across 25 states/UTs and 1576 EV charging stations across 9 expressways and 16 highways . Therefore, it can be said that development of sufficient charging infrastructure in India is well underway to ensure seamless adoption of EVs as mainstream vehicles.

6.3.2 Provision of incentives and subsidies

As has been discussed in the previous chapters, it is evident that the government has introduced both demand and supply side incentives which are both financial and operational. This is important to enhance both manufacture and sale of EVs in the Indian automobile industry. Cost of manufacturing of EVs is still high resulting in high cost of EVs and incentives are required to be introduced to give EVs a competitive edge over traditional petrol/diesel vehicle. Subsidies may be provided to manufacturers of EVs and EV components especially during the nascent stages of development of the EV sector in India. A unique method being contemplated by the Indian authorities is to require taxi aggregators like Ola and Uber to convert their fleet to 40% EVs by 2026 . Previously, Ola attempted to operate EVs but was restrained due to unavailability of related infrastructure and high costs. However, with governmental intervention it can be expected to that aggregators will have regulatory support in converting their fleets. Such plan may be extended to food delivery operators like Swiggy and Zomato, and e-commerce firms like Amazon, Flipkart, etc., that rely exclusively on delivery vehicles.

16 Press Information Bureau report dated 07 December 2021 available at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1778958
17 https://www.businesstoday.in/latest/economy-politics/story/govt-plans-to-order-uber-ola-to-convert-40-of-their-cars-to-electric-by-april-2026-report-203053-2019-06-07

As discussed in the previous chapters, several Indian states have also adopted EV policies that provide incentives and subsidies that create an investor and consumer friendly ecosystem that gives the EV industry a much needed push over traditional petrol/diesel engine vehicles. These incentives and subsidies have been summarised in Annexure I to this report.

6.3.3 Division of activities

Several agencies have been appointed and empowered for the expeditious implementation of policies and regulations issued by the state and central governments. These agencies constitute of concerned ministries, industry experts, R&D institutes, academicians, and other stakeholders that interact and coordinate to find solutions to the issues hindering the adoption of EVs in the Indian market. An example of the same is the constitution of the NCEM and NBEM with the NAB constituting of experts to assist the NCEM and NBEM. Task forces, subgroups, working groups, etc., also assist in rolling out all facets of the policies and initiatives which streamlines the implementation process and effectively resolves of issues at various levels of implementation.

6.3.4 Increase in consumer awareness

It cannot be denied that consumers have adopted an attitude of transition and acceptance of EVs keeping in mind the need of the hour to adopt energy efficient and clean modes of vehicles. This is generating significant demand for establishment of proper EV infrastructure and EV manufacturing hubs. A major trend has been seen in the adoption of EVs by e-commerce platforms and delivery companies which has boosted EV sale and manufacture. Considering that the growing e-commerce and delivery industry are one of the major contributors of greenhouse gas emissions, this transition from ICE vehicles to EVs in these industries is expected to go a long way in curbing the effect of these businesses on the environment. It is also likely that the operational cost of these companies may reduce leading to an increase in their profit margins. Further, adoption of EVs is also a good marketing strategy for companies that have traditionally been polluting sectors and are now adopting more sustainable and environmentally friendly approaches.

6.4 EV Financing

EV financing in India is still in its infancy, as a strong transition to electric mobility is yet to be observed. However, many fintech companies, including Rev Fin, Oto Capital, and Three Wheels United, have taken the lead in EV financing and are reporting high volume growth of 5x-8x since the easing of COVID-19 restrictions in CY2021.

Fintech companies have collaborated with banks to offer innovative lending schemes, including 12 to24 months of purchase, lower EMIs and attractive interest rates. The Union Ministry also has extended support to make EVs a priority lending sector. (RBI requires 40% of net banking credit to be deployed toward key priority sectors)

Some of the robust ecosystem enablers driving EV financing include:
1)Digital sourcing, underwriting, and sanctioning can help streamline lending toward EVs.
2)The commercialization of new business models can help build consumer trust for EVs.

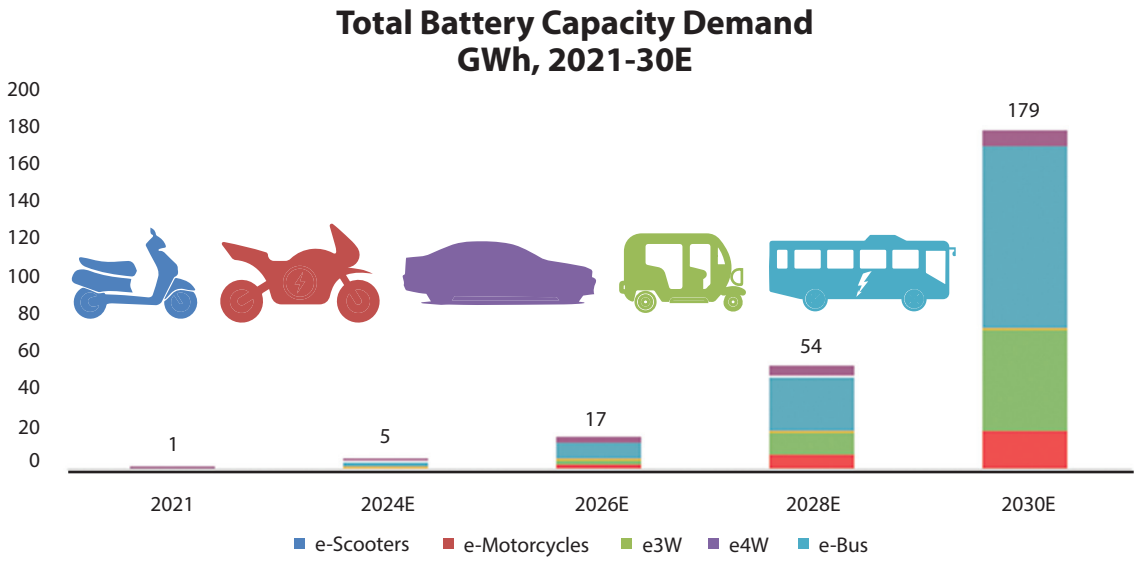
> Geopolitical events in 2022 have reinforced India's need to accelerate its shift, as a large oil-importer, towards electric mobility. The Government too is thinking about the EV industry as strategic, one in which enabling local champions to scale is key.
>
> With this backdrop, Indian companies are now beginning to integrate into the global EV supply chain and are discovering how broken it is. Shortages that range from semiconductor and chips to electric metals to batteries are hitting companies everywhere, leading to more technology and sourcing partnerships becoming the norm. As shortages persist, technology-forward OEMs will bridge the gap vs. today's market-leaders and new technologies and vertical integration will become the new way to differentiate.
>
> Matrix India is excited to be part of shaping this industry and it is our privilege to already be in business with the best founders in this sector in India. But it is still early-days, there will be multiple multi-billion dollar companies in the EV sector and we hope to be partners to all of them over the next decade. If anyone can think of a bigger capex cycle and technology revolution than this upgrade to a cleaner, more energy secure future, then you know where to find us.
>
> - **Rajinder Balaraman**, Managing Director, Matrix India

> There is a near-global consensus to achieve net-zero CO2 by 2050 and urgency to rapidly decarbonize all sectors continues to rise. India is committed to reducing its carbon footprint and has made national policy announcements and investments to secure its energy future. Transport is a major source of energy demand & it is vital to reimagine this value chain. As a multi-sector fund, we have backed early-stage teams that are striving for category leadership across last-mile mobility and charging infrastructure. We will continue to invest in and support many more teams creating IP and business models to support rapid transformation.
>
> As India's first VC PRI signatory, 3one4 continues to grow its commitment to ESG-aligned tech businesses. Electric mobility has become an important area of investment focus, and we are grateful to be able to play a role in the growth of tomorrow's change makers.
>
> - **Sonal Saldanha**, VP, 3one4 Capital

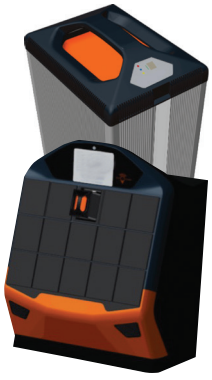
07 ALL ABOUT THE POWER OF EVs

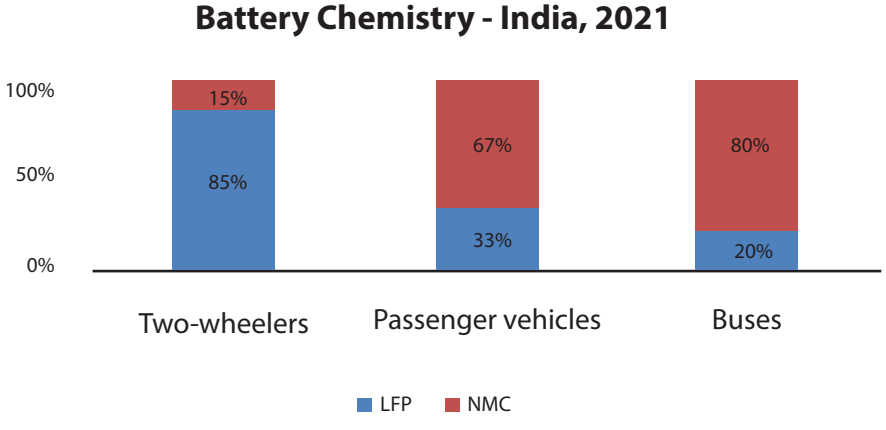
7.1 Powering the EVs – Batteries

Lithium-ion is the primary battery technology being deployed. Given the fast uptake of EVs in many countries, global demand for lithium-ion batteries is increasing rapidly. As of 2021, the established battery capacity is estimated to be 736GWh and is expected to reach ~1TWh in 2023. The demand for battery capacity in India, however, is still low. As of 2021, it was estimated at ~1GWh.



Until 2025, a large part of the Indian market will comprise sub-10kWh batteries that go into the e2Ws and e3Ws. Large-scale growth in the passenger vehicle segment is a critical factor in the rising battery capacity. Given India's low reserves of lithium/ cobalt and reliance on imports to meet the rising demand, along with the absence of its cell technology, it is anticipated that the domestic capacity will stay low — most of the demand estimated will be met through imported cells. Until 2025, a large part of the Indian market will comprise sub-10kWh batteries that go into the e2Ws and e3Ws. Large-scale growth in the passenger vehicle segment is a critical factor in the rising battery capacity. Given India's low reserves of lithium/ cobalt and reliance on imports to meet the rising demand, along with the absence of its cell technology, it is anticipated that the domestic capacity will stay low — most of the demand estimated will be met through imported cells.





In terms of choice based on chemical composition, Nickel Manganese Cobalt (NMC) batteries have a higher energy density than Lithium Iron Phosphate (LFP) batteries. Thus, LFP batteries are used mostly for stationery purposes.

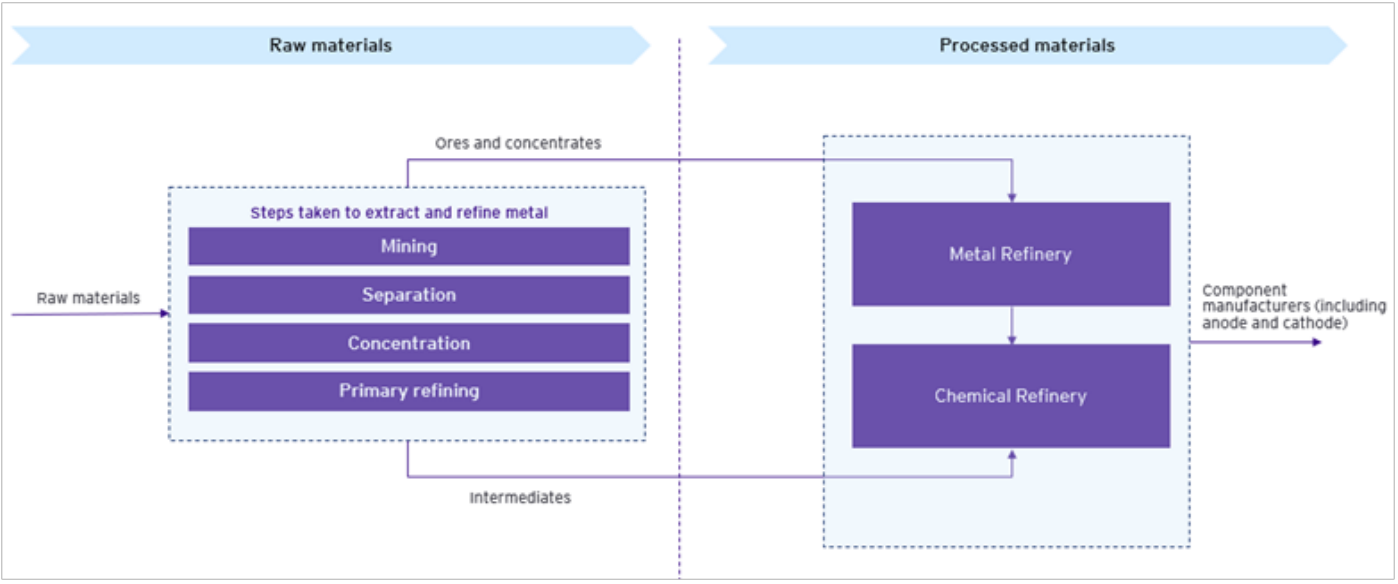
Companies foraying into battery manufacturing:

- New York-based CV4 has signed a Memorandum of Understanding with Omega Seiki. It aims to become India's first lithium-ion cell maker with solid-state technology under the government's ambitious INR18,000 crore PLI scheme.
- Eventually, C4V plans to produce solid-state batteries with 400Wh/kg energy density in India to cater to the EV and renewable market.
- Tata Motors plans a 15% improvement in energy density of battery tech by 2024-25 and another 20% improvement beyond 2025.
- Tata Motors also plans a 10% improvement in packaging efficiency of battery technology and a 5% to6% jump in efficiency levels of EV motors by 2025.

Key deterrents for localization of batteries in India are:

1. High entry barriers in terms of technology and capital due to lack of India-made technology and highly consolidated market with five dominant global players.
2. Import dependency for key raw materials like lithium and cobalt as the global supply chains are volatile and not well established.
3. Lack of scale as the market is primarily focused on the price-sensitive two- and three-wheeler industry that comprises numerous small battery packs.

SUPPLY-CHAIN OF RAW MATERIAL FOR BATTERIES



Source: Secondary research, secondary reports, EY-P analysis

The key elements sourced for manufacturing lithium-ion batteries include lithium, cobalt, manganese, graphite, etc. The raw material processing involves a series of steps including mining, separation, concentration, and primary refining. The ores are further sent to metal and chemical refineries for further processing and then finally sent to component manufacturers.

India has low mine density for procuring key raw materials on timely basis, leading to high dependency on international markets. This has posed high geopolitical perils for India's ability to ensure timely procurement of raw materials.

Lithium: As India has fewer avenues to procure lithium locally, the majority of procurement is done from China. This could eventually slow India's ability to be self-reliant, given the expected increase in demand for EVs.

Cobalt: Cobalt, a core ingredient in EV battery, is sourced from Democratic Republic of Congo. The conflicted region has observed several local skirmishes, leading to many companies losing their strategic grasp over the mines. With this, the cobalt supply will probably reach a standstill in subsequent years.

Graphite: China, a central hub for graphite mining, reported a decline in graphite production in 2021 due to depletion of its ore reserves. Benchmark Mineral Intelligence, a consultancy firm, expects 80,000 tonnes of graphite deficit in 2022 (~20,000 tonnes graphite can provide for roughly 2,50,000 EVs).

India must seek alternate avenues to set up recycling stations and diversify supply chains to localize the procurement of battery raw materials.

7.2 Range Anxiety and Charging Infrastructure

Range anxiety is medium as majority of the usage is intracity and average duty cycles are 30-40kms per day; charging options like removable batteries further reduces the range anxiety

Range anxiety is high as three wheelers are used for commercial purposes and any downtime affects the revenue of the operator; >80% of the vehicles are purchased on credit and owners are typically the drivers

Range anxiety is high as passenger vehicles are also used for inter-city travel and extensive charging network is necessary; extreme situations like travelling in remote areas affect the purchasing decisions

Range anxiety is high as buses are used for commercial purposes and higher downtime is not appreciated; the concern aggravates for inter-city buses than intracity buses

Vehicle Segment	Fixed charging	Battery swapping	Removable battery
Two wheelers	ATHER OLA	BOUNCE infinity	HERO ELECTRIC The smart move OKINAWA
Three wheelers	Mahindra electric KINETIC GREEN		-
Passenger vehicles	TATA MOTORS Connecting Aspirations MG	-	-
E-buses	ASHOK LEYLAND	-	-

Three types of charging are available in the market:

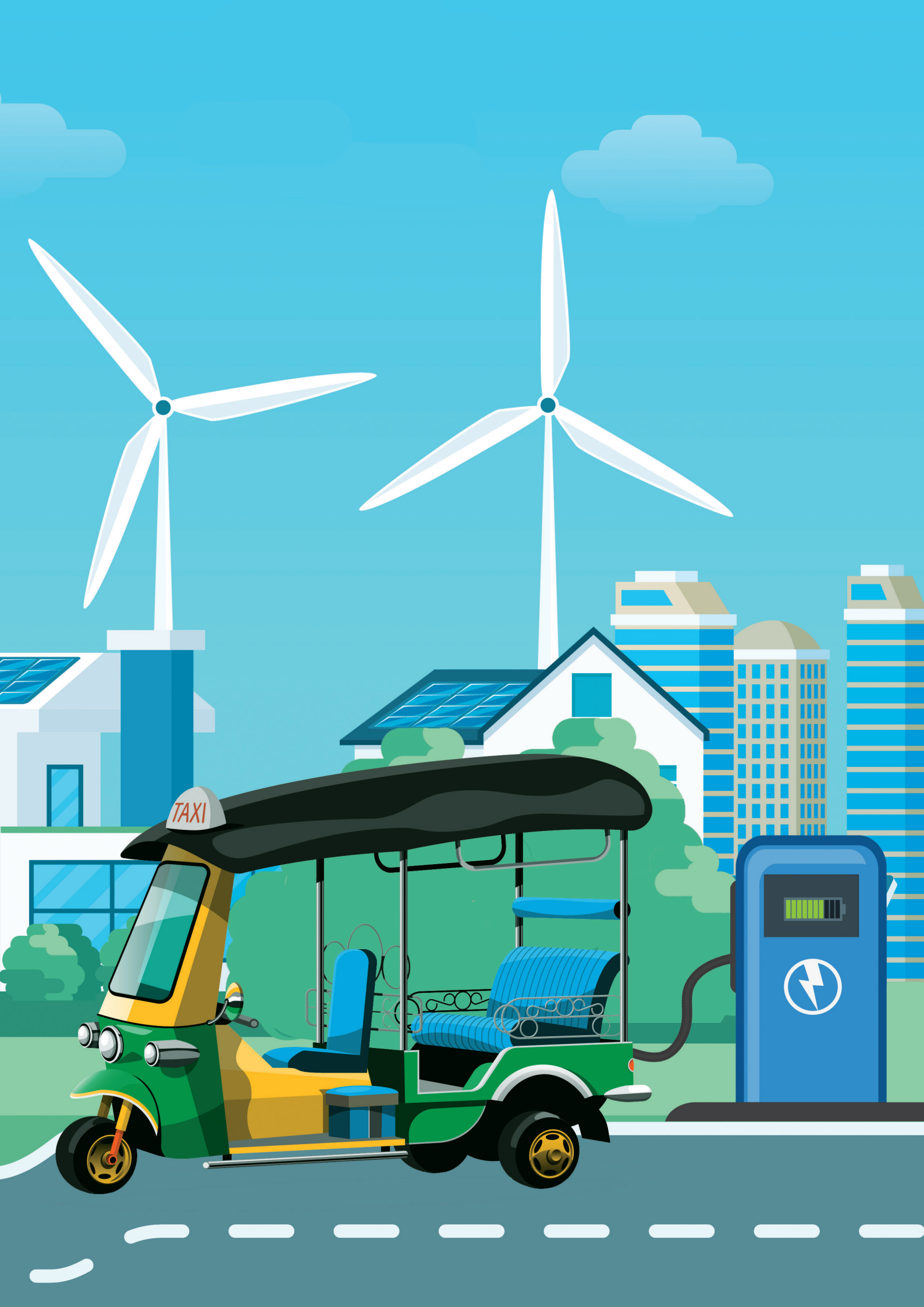
1) **Fixed charging**
Battery cannot be detached from the vehicle, and charging is done through the outlet in the vehicle. Charging time becomes a deterrent in this type of charging; hence, DC fast charging has been introduced. R&D is being carried out to reduce the charging time, which will probably result in ultra-fast charging. However, ultra-fast charging comes with challenges like:

a. A vehicle needs additional cooling arrangements as more heat is generated with ultra-fast charging, which could pose safety issues in tropical countries like India.
b. Need for Grade A battery cells to enable fast charging. Currently, low-cost Grade B cells are popular among Indian manufacturers.
c. Infrastructural necessities like larger parking spaces as fast charging require parking the vehicles for at least 30 minutes, while battery swapping takes less than five minutes.

Fixed charging is the potential path for larger vehicles with larger batteries, like passenger vehicles and buses. However, some two- and three-wheeler companies are also focusing on it. Both home (slow AC charging) and public (fast DC charging) charging options are being made available to customers depending on the need.

2) **Battery swapping**
The discharged battery is exchanged with a charged one at a swap station. While the technology is available for all types of vehicles, battery swapping is more appropriate for lower-capacity batteries for two and three-wheelers. Battery swapping for passenger vehicles and buses does exist, but it demands heavy investment into machinery, as the batteries cannot be handled manually. China's Nio and South Korea's Edison Motors are working on battery swapping for passenger vehicles and buses.

3) **Removable battery**
Battery is detached from the vehicle and charged separately at home or office. Like battery swapping, removable batteries are suitable for two and three-wheelers because of their smaller battery sizes. Players like Hero Electric and Okinawa are focused on removable batteries. Battery fires could be a potential concern in this type of charging, and recent events of battery fires have intensified the fears.


TAXI

Two wheelers (2W) have been a great personal mobility solution to India's limited penetration of affordable public transport and ever-increasing cost of cars (4Ws). However, with rising fuel prices and increasing cost of ICE scooters, ownership of personal 2Ws is becoming financially challenging. Owing to this, customers are now looking for reliable and affordable personal mobility solutions. This new customer demand, along with increasing environmental concerns and favourable government regulations, has created an urgency for electric mobility and set the stage for the rapid adoption of EVs.

While EVs present a strong case for adoption, lack of adequate charging infrastructure, long charging times, and high upfront costs make the adoption of electric mobility challenging at present. The two viable solutions for India today are removable batteries for self-charging and Battery-as-a-Service (BaaS). BaaS is the 21st-century electric mobility parallel to buying fuel from a fuel station. BaaS offers higher convenience and lower cost and it is expected to be the dominant solution over removal batteries for self-charging.

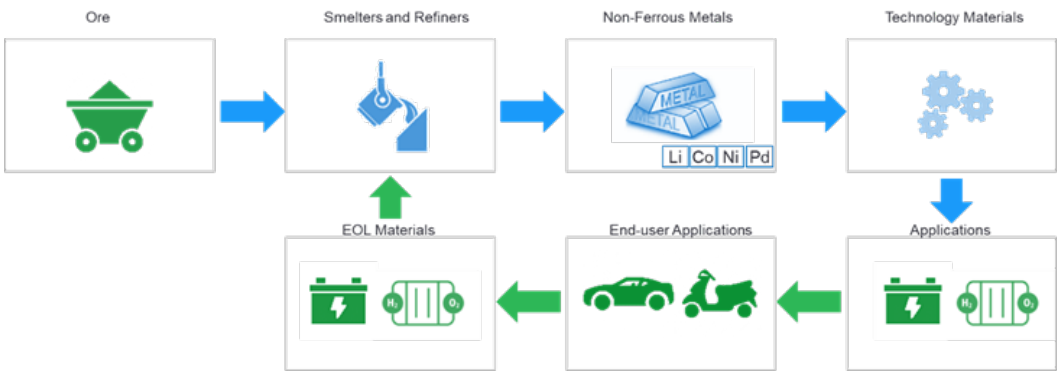
We strongly feel that the mobility sector is ripe for disruption and that the adoption of electric vehicles, driven by electric 2Ws, is inevitable. We expect EV penetration to go up from current 1.5% to atleast 10-20% in the 2W segment by 2030.

- **Anand Daniel**, Partner, Accel

7.3 Planned Obsolescence/ Recycling

With the growth of EVs, high consumption of batteries is inevitable. Given that the agenda of using EVs is decarbonization, entirely relying on natural resources harms the environment and increases the cost of batteries due to limited resources. Therefore, developing a circular economy through recycling is a potential solution to the problem.

Post usage in EVs, the end-of-life batteries can be used for a second life as power storage units. After complete depletion of capacity, recycling needs to be done to extract the necessary metals like lithium, cobalt, etc.



As EV adoption grows in India, the industry is looking toward recycling as a potential opportunity to counter dependency on imports for battery raw materials. Some enablers for the growth of battery recycling include:

Battery recycling policy: Government support is needed to encourage e-waste recyclers to focus on battery recycling. As per recent reports, the government is working on framing the policy.

Extended Producer Responsibility: Regulations have been framed that mandate the producer of batteries or OEMs to take responsibility for the recycling of batteries. The regulation needs stringent implementation to ensure the timely recycling of end-of-life batteries.

Suitable battery design: Suitable battery design: Battery design must include aspects that make battery recycling easy. Employing features like electrolyte flush and using nuts and bolts for interconnection of cells instead of welding help in recycling.

ATTERO	●Claims to be the largest e-waste recycling company in the country ●To invest INR 300 Cr in Li-ion battery recycling; built partnerships with MG, Tata Motors, Hyundai etc.
GRAVITA INDIA LIMITED	●Gravita is India's largest battery recycling company with facilities to recycle Lead Acid batteries and is entering Li-ion battery space ●Have tie-ups with Amara Raja Batteries and HBL Power
LOHUM	●Li-ion battery production and recycling start-up, Lohum cleantech is operating a plant with capacity to recycle 100,000 packs per annum ●15-20% of the company's revenue is from recycling

"We are at a historic point in time when EV 2-wheelers can be cheaper than the petrol 2-wheelers. This is likely to lead to mass adoption of EV 2-wheelers which are expected to cross 80% of new 2-wheeler shipments by 2027 much ahead of the Govt's target of 2030. Similarly, intra-city and inter-city freight market is expected to adopt EVs both due to economics and Govt regulations. This opens up great opportunities for entrepreneurship across the EV value chain covering battery management, swapping infrastructure, lending for purchase of EVs immediately and re-sale of EVs a few years down the line."

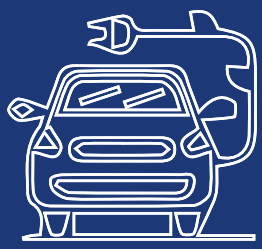
- **TC Meenakshisundaram (TCM)**, Founder and Vice Chairman, Chiratae Ventures

"We at Ideaspring Capital have been bullish on the EV story in India. With rising fuel prices supplementing the demand side and better battery technology along with improved charging infrastructure fuelling the supply side, it was only a matter of time before EVs became mainstream in India. The mass adoption of EVs will usher in a spurt in India's economic growth previously seen with the advent of 4G technology in the telecom sector.

In 2019, we invested in a company called Numocity that offered a cloud-based digital platform- a middleware- that allows consumers and fleet operators to use a network of fixed chargers or battery swapping solutions on a "pay as you go" basis. The solution also included Grid Management. In May this year, Numocity became the first acquisition in the Indian EV space by a global company viz., ABB. With the platform provided by ABB, it will only be a matter of time before their solution becomes mainstream across all global charging stations. This deal also validated our belief that with a sound business model and a scalable business, global product start-ups can be established in India. We will continue to invest in innovative enterprise products in the Indian EV industry."

- **Naganand Doraswamy**, Founder & Managing Partner at Ideaspring Capital

08 INVESTMENTS IN EVs (PE/VC FUNDING)



EV manufacturers like OLA Electric, EULER, and Ather Energy have attracted massive investments (~US$550 million) in the last two years to develop better and safer EVs.

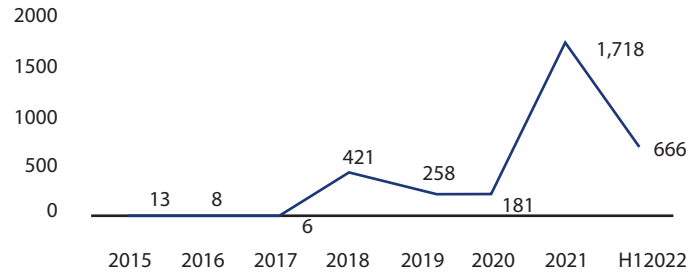
The technology is still in a nascent stage, and a lot of development is needed in terms of range, faster vehicles, quick charging, and batteries maintaining composure under temperature. Euler is working on e3W with higher payload, range and gradeability. Ather Energy is also funded by Hero Motor Corp to develop e2W technology and vehicles.

Announced Date	Company	Segment	Funding round	Funding amount (US$mn)	Total funding till date (US$mn)	Valuation (US$mn)	Latest funding round investors
Nov-2021	Simple Energy	EV 2W OEM	Pre-Series	21.0	~21.8	NA	Sattva Group, Athivas Group, UiPath India
Sep-2021	Blu Smart Mobility	EV ride hailing platform	Series A	25.0	40.6	NA	BP ventures, Mayfield, Survam Partners, 9Unicorns
Sep-2021	Ola Electric	EV 2W OEM	Series B	200.0	525.9	2,636.1	Falcon Edge Capital, Alpha Wave Investors, SoftBank
Aug-2021	Simple Energy	EV 2W OEM	Seed	7.7	8.8	NA	1Digi Investment Management, Ativas Electric, Vasavi Green Tech, Ativas Craft, Quespreon, Benling, etc
Jul-2021	Switch	EV 2W OEM	Series A	18.0	18.0	NA	Dana
Jul-2021	Hero Electric	EV 2W OEM	Series B	29.5	71.7	NA	Gulf Islamic Investments, OAKS
Apr-2021	Revolt	EV 2W OEM	Series B	20.0	20.0	39.4	Rattan India Group
Mar-2021	Bajaj	EV 2W OEM	Series C	50.0	50.0	NA	Global Emerging Markets
Mar-2021	Euler	EV 3W OEM	Series A	6.7	11.9	29.9	Jetty Ventures, Inventus Capital India, Sujeet Kumar, Srinivas Anumolu, K Ganesh, Blume Ventures, Asian Development Bank
Nov-2020	Ather	EV 2W OEM	Series D	35.1	157.7	199.5	Hero MotoCorp
Sep-2020	Blu Smart Mobility	EV 4W rental platform	Seed	7.0	40.6	NA	IPV, JITO, LetsVenture, Venture Catalysts, Mumbai Angels, Kalpavriksh Fund, Survam Partners, Faad Network, etc.
Jul-2020	Ather	EV 2W OEM	Series C	11.3	157.7	NA	Hero MotoCorp
Jul-2020	Blu Smart Mobility	EV 4W rental platform	Seed	5.0	40.6	NA	Mumbai Angels, IPV, LetsVenture
Jan-2020	Yulu	EV 3W rental platform	Series A	10.4	17.1	NA	Chiratae Ventures, Xiaomi, Matrix Partners India

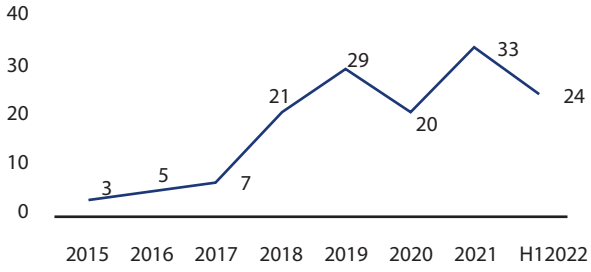
The EV market has observed strong attention from PE/VC investors in India, with investments increasing from US$181 million (2020) to US$1,718 million (2021) (recording an annual growth rate of 849%). Substantial investments in the EV segment can help boost operations in last-mile delivery, which, if implemented across scale, can generate operational savings for the fleet operators.

PE/VC investments in EV industry in India

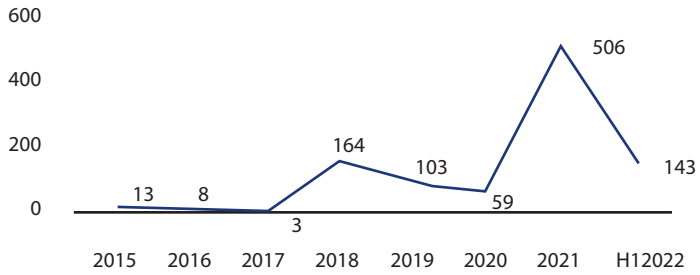
Total investment in EV industry (US$ million)



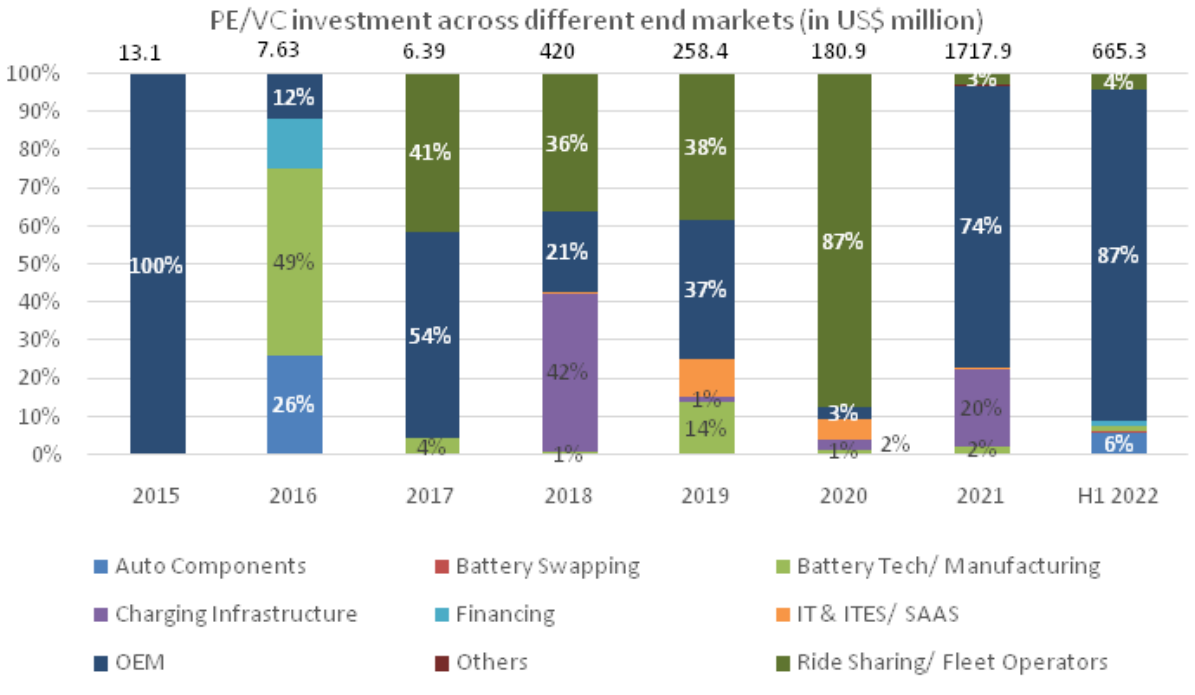
Total deals in EV industry



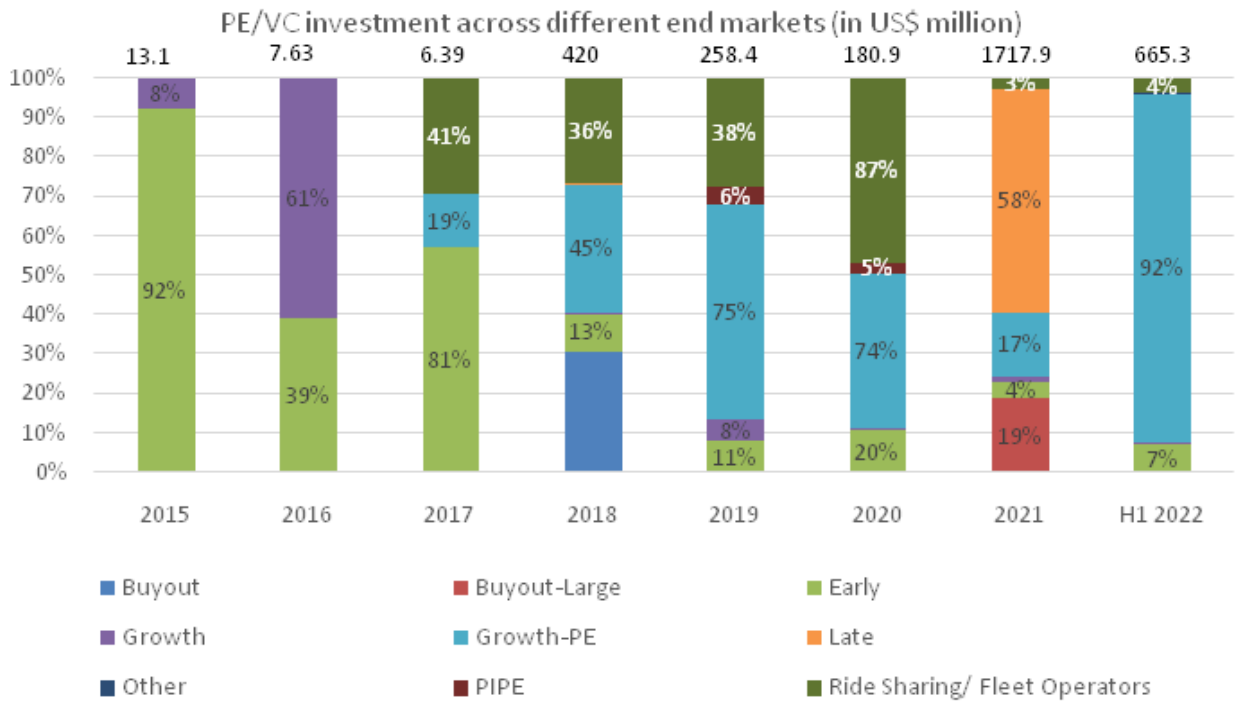
Average investment in EV industry (US$ million)



Total PE/VC investment in EV industry (by end-markets)



Total PE/VC investment in EV industry (by stages)



I expect temporary headwinds in mobility electrification such as short term increase in prices or eventual withdrawal of subsidies. However, in the long term, EV adoption will accelerate aided by non fiscal government policy support and favorable unit economics. Commercial fleets will lead the transformation followed by private passenger vehicles.

- **Akshay Gupta**, Executive Director, Kotak Infrastructure Funds

Electrification of Vehicles is inevitable and over the next 10 years we will see 30-40% vehicles electric. The infrastructure needed for electric vehicles will lag the deployment of vehicles by a few years. Hence, we at Athera believe that the adoption will happen in phase. The commercial and cargo segments will be the first to get electrified as they are most price sensitive and do not need extensive charging infrastructure. This will be followed by passenger 2 wheelers and ultimately passenger vehicles. We have already invested in Euler motors and are keenly following this space and will continue to invest more.

- **Rutvik Doshi**, Managing Director, Athera Venture Partners

09 CASE STUDIES: SUCCESS STORIES

Ather Energy

Segment: 2W Manufacturing
Year Established: 2013
Founders: Tarun Mehta and Swapnil Jain
Total Amount Raised: USD 346.24 mn
HQ: Bangalore

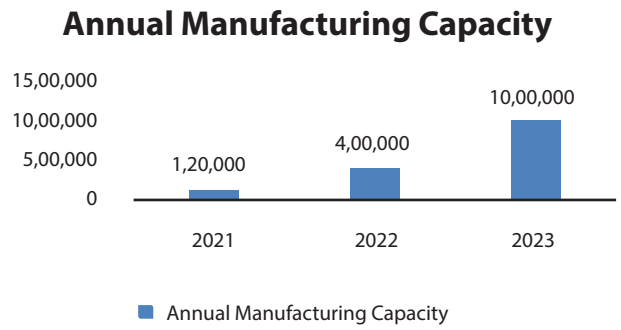
Product
Ather Energy started with two variants 340 and 450 but later discontinued 340 due to poor demand. Later, the company launched 450x, which replaced 450. The product competes with 125cc ICE equivalent scooter. 450x comes with:

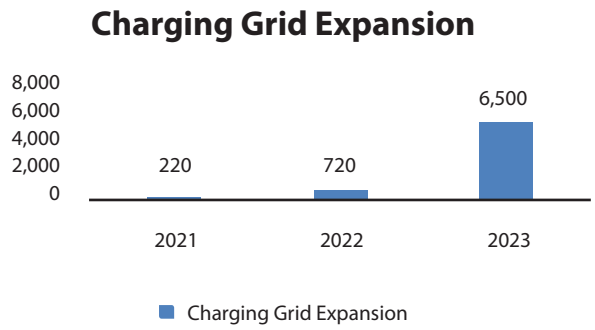
- Upgraded battery back (21700 type cells vs 18650 in 450)
- New PMSM motor with peak power of 6kW & torque of 26 Nm
- New light weight chassis (vehicle is lighter by 3 kgs) on account of weight reduction
- New Android based opensource touchscreen with Bluetooth, music streaming, improved touch sensitivity etc.

450x is available in two software restricted modes
- Plus mode – Performance and range are similar to Ather 450 (Range of 70km, 1km/min charging time & three years battery warranty)
- Pro mode – Upgraded range of 85 km, WARP mode (0-40 kmph in 3.3 sec compared to 3.9 sec in plus mode); 1.5 km/ min charging time & 3 years battery warranty

Ather provides IoT features like on-board diagnostics, OTA updates, ride statistics etc. on 450x, which are on-par with the successful global electric two-wheeler models like Gogoro, Piaggio, Kymco etc.

Expansion plan:





Product Development Philosophy:

- Ather scooters have been designed grounds-up keeping the Indian consumer in mind; the body panels feature part-steel and part aluminium design, which not only keeps weight low but also provides strength & rigidity
- Several elements have been thought of differently from the conventional scooters for ex. the pillion footrest, side-stand, rear view mirrors, seat storage etc.

- Ather developed their own battery pack with focus on power output, range, fast charging and water resistant capabilities etc. and cells are manufactured by LG Chem, and battery is assembled in-house.
- The PMSM motor, controller & transmission used in 450 is designed and developed in close association with manufacturing partners/ suppliers.

- Sourcing of the components was initially a mixture of domestically manufactured products and imported but with growth in local EV supply chain, proportion of domestically manufactured component is expected to increase.
- Ather has partnered with Sanmina, a California based integrated manufacturing solutions company for production of BMS, charging system and dashboard.

- Ather's philosophy is to provide a range which could be achieved in varying riding conditions; provides 3 different driving modes by varying speed and available torque.
- Dashboard comes with a 7-inch IP65 rated capacitive touchscreen with on-board navigation, provides feedback on vehicle health, charging status, ride patterns etc.

- Ather's strategy is to be one-stop solution to the vehicle ownership and provides
  - Charging option (Ather Dot), public charging (Ather Grid) and vehicle servicing through different subscription plans for the users to select themselves.
  - OTA (over the air updates) for software, performance, firmware etc.

Sona Comstar

Segment: Auto Components
Year Established: 1997
HQ: Gurugram

Company
A premier manufacturer of transmission systems such as driveline gears, differential assembly and e-drives for e2Ws, e3Ws, e4Ws and electric LCVs.

- Currently runs 30 EV programs across North America, Europe, Asia and India
- Has five programs scheduled for India for their yet-to-launch "Enedym" series of motors for use in electric bikes, autos and LCVs
- Revenue share from BEVs has grown by 19x over the last three years,
- The global share of starter motors for the company increased from 2.5% (2019) to 4.6% (2021)
- ICE dependence continues to drop from 24.8% (FY21) to 17.6% (FY22)
- Company revenue has grown at 34% CAGR from 2020 to date
- Six manufacturing plants, three R&D offices across the country, and one tool and die shop for molds
- To concentrate on the PHEV, MHEV, and BEV segments in India (range of products to include motors and drive trains)

YULU (Fleet Operator)

Segment: Bike Sharing
Year Established: 2017
Founder: Amit Gupta
Total Amount Raised: USD 40.96 mn
HQ: Bangalore

Company
Yulu currently provides first mile, last mile connectivity and short trips from the public transport stations.

- Clusters (Collection) of bikes are kept at points near bus stops and railway stations to help customers reach their destination. Easy charging points and battery swap help quick turnaround time for vehicles to be ready for use.
- Bikes are relocated to high-demand zones; repair and maintenance are done at regular intervals to ensure bikes are in top condition; the company has dedicated staff to recover lost or stolen vehicles.
- Operations are fully automated and help the company cater to the demand.
- Yulu also helps in employing people who don't have a job by providing training at the Yulu Academy.
- Mobility as a Service (MaaS)- Yulu Dex was launched especially for delivery executives in the B2B2C model. Amazon, Flipkart, India Post, Swiggy and Zomato are some of the major consumers of this service.
- Yulu will also venture into the battery-as-a-service (battery swap, charging stations) via a JV with Magna. Yulu provides the demand, operational expertise, software, branding, and government relationships, whereas Magna will provide 100% funding and may design and manufacture 48V batteries and charging/swap stations.

Charge+Zone (Charging Station Infra)

Segment: Bike Sharing (Fleet Operator)
Year Established: 2018
Founder: Kartikey Hariyani
Total Amount Raised: USD 14.43 mn
HQ: Vadodara

Company

- Chargezone plans to set up 1 million unmanned EV stations by 2030.
- Key differentiator is the technology platform, "over the air" flow of data, IoT backed applications - which will help in the remote control of "unmanned charging stations."
- The energy distribution system helps to run the DC Charging stations, which are monitored by the local controller; the charge for top-up is calculated via the Charge+zone mobile app.
- Chargezone also plans to enter the Battery Swapping space. It has an advanced battery tracking system, geo-fencing, and remote kill to ensure the batteries are not stolen or misplaced. Currently available only in Delhi NCR for e3Ws.
- Caters to the B2B sector- fleet operators, corporates, ride handling and last-mile delivery companies.
- Chargezone currently manufactures two types of chargers: an AC type 2 max Charger and a mini charger for places where space is a constraint.
- Currently serving 2000 EVs daily, with about 1000+ chargers across 15 cities in the country.
- The company is currently planning the electrification of 10000km of national highways/state highways.
- Currently provides charging support to a network of 125 electric buses of Ashok Leyland across three cities (Ahmedabad, Patna and Chandigarh).

"There are great benefits EVs offer - especially for the commercial / B2B segment. The RoI is much quicker. EVs have taken off in local delivery, city buses, and commercial goods carrier segments and my guess is short to medium distance Cabs are the next.

For personal vehicles, affordable 2W and 4W have taken off and my guess is well rounded, premium EVs will increase the overall appeal and help make EVs mainstream. Range anxiety is still real though and it will take time before we can get there. There needs to be an infra (be it charging stations or on demand charge delivery) to give the early adopters that peace of mind and spur word of mouth.

ICEs have been around and people learnt to live around them over time. EVs are a new technological beast for us, also because of a lot of 'jugaad' EVs in the market - people just don't know how to manage them safely and effectively. There is a huge need for customer awareness - both B2B and B2C. Like the 'investor education' program the MF industry ran for retail investors, funded EV companies should come together and at least correct the narrative and improve understanding of EVs. They can start with DOs and DONTs (around charging batteries in typically Indian conditions, optimum charging methods to maximise life of the expensive battery, risks of charging at low-rated sockets or unstable power supply, right way to store EVs to prevent battery degradation); opening up charging infra; industry level initiatives to run EV/battery health check camps; push for some standards and protocols etc.

One aspect no one is talking about is battery replacement costs that an EV will have to endure every 5-7 years, depending on capacity degradation. These could be >50% of residual vehicle value, even after assuming steady battery price drops."

- **Ashish Taneja**, Partner, growX ventures

All the major OEMs across the globe have announced plans to build EVs and gradually reduce its ICE counterparts. However, there are various considerations that are likely to impact EV adoption. Constraints pertaining to charging infra, tech scalability, battery range, software etc. continue to plague the industry. Also, the availability of the battery's core component – lithium, capability of manufacturing larger battery packs as well as chip manufacturing is concentrated within a few countries with a major share currently being held by China. Recycling of these batteries and proper disposal is yet another area which needs to be refined to make EVs truly sustainable. Further, EV buyers also face a range of financing challenges, such as high interest and insurance rates, low LTV ratios, and limited specialized financing options. Moreover, mushrooming growth of EV startups fuelled by Govt. incentives and seemingly diluted norms for EVs has also led to multiple players enter the industry with no existing domain knowledge, thus increasing the occurrence of fire incidents manifold. Thus, to scale EV adoption in India, we need to mitigate customer pain points, set up in-house capabilities and ensure adequate reserves are at our disposal for creating a comprehensive EV ecosystem.

With EV transformation, this ecosystem is going to see considerable change and a major section of this ecosystem needs to be rebuilt, re-skilled and enhanced to tackle future requirements of EVs. Since EV is still at a nascent stage and an evolving industry in India, we at BlackSoil have taken a conservative approach & invested in just one EV deal – a 100% EV ride-hailing platform operating in Delhi NCR. Having said that, we are cautiously optimistic on this sector & undertaking further evaluation of only those companies which we believe are serious contenders.

Since we are bullish on this sector, we have continued to increase our awareness & knowledge base, as we have looked at 30+ EV deals seeking various forms of funding such as venture debt, dealer / customer financing, seed funding etc.

- **Ankur Bansal**, Director & Co-Founder, BlackSoil

10 POLICY AND REGULATIONS

10.1 Current Indian Policy Environment for EVs

Climate change has led to a shift in global climate policy which requires the world to adopt a low carbon economy, thereby saving the planet from the adverse impact of climate change.

The Constitution of India under various Articles provides for the state to direct its policies towards securing the ownership and control of the material resources of the community to conserve natural resources, protect the natural environment and subserve the common good. Around 20 states in India have already come up with either a draft or final state level EV policy, these state policies overall aim to promote India's transition from ICE to EVs. Improving the air quality issues, mitigating climate change, reducing dependence on oil imports and developing the EV industry are some common objectives of the policies published by the states. Almost all the state policies prioritised two-wheeler and three-wheeler vehicles.

Regulators / Agencies:
48% of Indian cities in 2021 exceeded 10 times the permissible limits mentioned in the WHO air quality guideline, as per the World Air Quality Report released by IQAir. . Even with national and state declared lockdown during the Covid-19 pandemic crisis in 2020, 36 cities out of 50 cities which had unhealthy levels of air quality were from India.

India has taken a leap towards a clean energy-based future as it is evident from the changes in the policies of the governments with respect to environmental protection.

(a) **Ministry of Heavy Industries and Public Enterprises**
Under the MoHI&PE, the policy and implementation measures for adoption of EVs in India are led by the DHI. In order to achieve the objectives of reduced emission and energy security under the NMEM, DHI had notified the FAME scheme in March 2015, with the following four major focus areas: technology development, demand incentives, charging infrastructure, and pilot projects.

In March 2019, MoHI&PE notified the FAME–II scheme, where the primary role of the ministry is to develop a framework for implementation of the FAME scheme.

The NAB is an operating agency for the implementation of FAME schemes. It monitors state-wise progress and maintains the web portal for publicising data related to the schemes. Further, PISC is an inter-ministerial panel, setup by the DHI for monitoring, sanctioning and implementation of projects under the FAME-II programme in March 2019. The PISC is chaired by Secretary of MHI with members comprising of the CEO NITI Aayog and secretaries, financial advisors and directors of various ministries and association. The PISC plays an important role in carrying out the following functions:

- Sanctioning projects under the FAME II scheme;
- Modifying coverage of various components and sub-components of the scheme;
- Modifying limits of the fund allocation under the scheme;
- Review of demand incentive under the scheme, annually;
- Review of vehicle-wise capping of incentive, annually; and
- Deciding other scheme parameters for smooth implementation.

(b) **Ministry of Road Transport and Highways**
The MoRTH is responsible for formulating policies and regulations pertaining to road transport. It helps in formulating non-financial incentives for promoting EVs by provisioning for parking infrastructure, priority lane access, etc.

In February 2021, the MoRTH launched the 'Go Electric' campaign of the BEE to promote and spread awareness on electric mobility and EV charging infrastructure with a motive to lead India towards a clean ecosystem and to combat adverse climate changes.

Under the MoRTH, the ARAI carries out research and engineering services on its behalf. One of the functions of the ARAI is to develop standards for vehicles and its components. These standards are marked as AIS-XXX standards. Till date about 220 standards are published by the ARAI. AIS 138-Part 1 and Part 2 notified by the ARAI specify the charging requirements (AC and DC) for all EVs (two-wheelers, three-wheelers and four-wheelers) with the exception of trolley buses, rail vehicles and off-road industrial vehicles.

(c) **Ministry of Power**
The MoP formulates policies, plans and processes projects for investment decision, monitors the implementation of power projects, trains and develops manpower and the administration and enacts legislation regarding the development of the power sector. The MoP has issued guidelines for implementation of charging infrastructure under which the BEE has been entrusted with the role of the CAN. The CEA under the MoP is responsible for preparation of standards related to safety of EVSE.

(d) **Ministry of Housing and Urban Affairs**
The MoHUA has played a key role in amending building bye-laws in order to fast tract the development of charging facilities in commercial and residential building complexes. The MoHUA notified that the residential and commercial complexes will have to allot 20% of their parking space for EV charging facilities. It has also amended the 'Urban and Regional Development Plans Formulation and Implementation Guidelines– 2014' to include the formulations of norms and standards for charging infrastructure in city infrastructure planning.

18 https://www.iqair.com/world-air-quality-report
19 https://www.iqair.com/in-en/world-most-polluted-cities

(e) **Ministry of Finance**

To support the 'Make in India' initiative of the GoI, the Ministry of Finance in 2019 rationalised the customs duty for all categories of vehicles, battery packs and cells.. It also reduced the GST rates on the purchase EVs from 12% to 5% and announced income tax rebate of approx. USD 1965 on purchase of EVs. More recently in 2022, the Ministry of Finance has tripled the allocation under the FAME scheme and for the Financial Year 2023, the allocation is expected to be around USD 381 million. Due to considerable interest in the field of EVs, the union government's total expenditure under the FAME scheme is to be around USD 612 million between Financial Year 2019 and Financial Year 2023. The demand for EVs is already soaring with government registering close to 311,000 EVs in 2021 in comparison to 119,000 EV registrations in the previous year. Further, it has been recommended that EV loans should be included in the priority lending sector to make borrowing for the purchase of EVs easier. There has also been a recommendation to reduce GST from the present slab of 18% to 5%.

(f) **Ministry of Environment, Forest and Climate Change**

The Ministry of Environment, Forest and Climate Change is the primary union ministry connected with the 'National Electric Mobility Mission Plan 2020' initiative. The ministry also published the Draft Battery Waste Management Rules, 2020 ("Draft Rules") to strengthen the ecosystem for handling and disposal of batteries across India. The Draft Rules aim at creating an effective mechanism for the disposal of batteries and ensuring public safety. The Draft Rules also aim to hold accountable every player in the value chain including central and state authorities. However, the Draft Rules have not been notified yet.

(g) **Ministry of Science and Technology**

A 'Technology Platform for Electric Mobility (TPEM)' has been formed by MoST which is primarily funded by the MoHI&PE. The MoST is playing a key role in forming an electric mobility standardization roadmap for India. The objectives under this scheme include developing technologies and products that specifically address the needs of the Indian market and to develop a competitive edge in some of the technologies of electric mobility. TPEM is also aimed at creating centers of excellence and testing facilities; formation of industry technology consortia to be led by automotive and component companies; and to encourage innovation program to support scientific research by academia and laboratories and support new product development by private entities.

10.2 Legal Issues, Policy and Regulation In India

10.2.1 Legal landscape & foreign investment

India has always upheld its commitment towards the protection and sustainability of environment which inter alia includes reduction of emission of greenhouse gases through a relook at its automobile industry. India is a signatory to the 'Paris Agreement' which has been signed by the members of UNFCCC to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future at COP 21 in Paris on 12 December 2015. Under the Paris Agreement, India has committed to reduce its greenhouse gas emissions by 2030 which was a significant step in combating global warming by a coalition of developed and developing nations.

The UNFCCC executed the Paris Agreement to address concerns on greenhouse gasses, their emissions and mitigation. The Paris Agreement aims to stop increase in global average temperature and reduce the risk of climate change. As per the terms of the Paris Agreement, a signatory has to determine and plan measures to mitigate climate change and global warming and share reports regularly on the same. To perform its obligations under the Paris Agreement, India has undertaken several measures which, among other things, include the vision to completely shift from fossil fuel based traditional vehicles to EVs. The Prime Minister of India, Narendra Modi, has reiterated that India was well placed to achieve its targets under the Paris Agreement before 2030. The Prime Minister has also committed to (i) achieve net zero carbon emissions by 2070, (ii) increase the non-fossil fuel energy capacity to 500 GW by 2030, and (iii) ensure India fulfils 50% of energy requirements through renewable energy by the year 2030.

At COP 21, India committed to reduce its carbon footprint by 33-35% by 2030 from 2005 levels and to increase the share of non-fossil fuels-based electricity to 40% by 2030. To fulfil its commitment under the COP 21 and other international conventions, India has been proactively establishing a legal framework for efficient and faster adoption of EVs. It is important to note that compared to the world industry, India is a relatively new market and the extant laws applicable to EVs are still in the process of developing through coordination and cooperation between various stakeholders.

We have discussed the various policies in place in India that contribute to a cohesive legal framework for faster adoption of EVs hereunder.

(a) **Automotive Mission Plan 2006-16 (AMP I)**

AMP I was launched in January 2007 with the vision to make India the destination of choice in the world for design and manufacture of automobiles and auto components with output reaching a level of approx USD 145 billion accounting for more than 10% of the GDP and providing additional employment to 25 million people by 2016. AMP I provided incentives for development of infrastructure, including that of EVs like incentives related to investments, exemption from payment of duties, etc.

(b)**Automotive Mission Plan 2016-26 (AMP II)**

AMP II provides for a plan to provide adequate incentives to ensure expeditious development of indigenous EV component designs and development of manufacturing industry for hybrid vehicles and EVs in India. The main objective of AMP II was to establish the automotive sector as the largest creator of employment opportunities and as a major contributor of the 'Skills India' programme.

(c) **National Mission for Electric Mobility (2011)**

In light of fast dwindling petroleum resources and their impact on the environment, the Government of India has recognised the need to gradually shift to more efficient and cleaner technologies in the automobile industry. In March 2011, the NCEM and the NBEM were set-up by the DHI to promote electric mobility and manufacturing of EVs in India on a mission mode approach as 'National Mission for Electric Mobility'. The NCEM functions as the apex body in the Government of India for making recommendations for such matters with the NBEM assisting the NCEM at a secretary level. The NAB was also formulated as the technical advisor and secretariat for both the NCEM and the NBEM. The NCEM comprised of ministers from the key central ministries

20 Status quo analysis of various segments of electric mobility and low carbon passenger road transport in India available at https://www.niti.gov.in/sites/default/files/2021-04/FullReport_Status_quo_analysis_of_various_segments_of_electric_mobility-compressed.pdf

21 https://heavyindustries.gov.in/writereaddata/Content/Automotive%20Mission%20Plan%20(2006-2016).pdf

and departments, eminent representatives from the industry and academia and chaired by the MoHI&PE. The NBEM is constituted of the secretaries of the stakeholder central departments and ministries along with representatives from the academia and industry.

(d) **National Electricity Mobility Mission Plan (2020)**
The NEMMP envisions the roadmap for faster adoption of all kinds of hybrid vehicles and EVs (xEVs) and their manufacturing to achieve increased sales of xEVs across India. This is expected to result in a proportional increase in fuel savings. The NEMMP 2020 aims to provide affordable and environmentally sustainable transportation, to increase the national fuel security, and to achieve global leadership in manufacturing in the automotive industry. The NEMMP 2020 provides strategies for expeditious adoption of EVs that include measures like demand generation, supply related interventions encouraging domestic manufacturing, R&D, infrastructure support, fuel efficient, and creation of awareness. The NEMMP 2020 had set an ambitious target to achieve 6-7 million sales of hybrid and EVs by the year 2020. However, it is realised that to achieve the same there needs to be a radical modification of the existent charging infrastructure to support the acceptance of EVs in the Indian market through governmental support and coordination of various stakeholders.

(e) **FAME I (2015-2019)**
Under the NEMMP 2020, the DHI notified the Faster Adoption and Manufacturing of (Hybrid &) EVs in India ("FAME") scheme in the year 2015 to promote manufacturing of electric and hybrid vehicle technology and to ensure sustainable growth of the same.

The Phase-I of FAME ("**FAME I**") was initially launched for a period of 2 years, commencing from 01 April 2015, which was subsequently extended from time to time with 31 March 2019 being the last extended date. FAME I was implemented through four focus areas namely, (i) Demand creation - through upfront reduction of cost of EVs and hybrid vehicles; (ii) Technology platform - by sanctioning grants for R&D related to EVs and EV components; (iii) Pilot project - through grants to build awareness and increase utilisation of eco-friendly vehicles; and (iv) Charging infrastructure - including grants for public charging infrastructure components, revision of existing legal framework to enable roll out of infrastructure, and evaluation of designs for optimal charging infrastructure.

All vehicle segments including two-wheelers, three-wheelers auto, passenger four-wheeler vehicles, light commercial vehicles and buses were incentivised to create a market for EVs in India. Demand incentives were provided to buyers of EVs by way of upfront reduced purchase price, sanction of grants for specific pilot projects. R&D of technologies and public charging infrastructures, etc. During FAME I, about 2,78,000 xEVs were supported with a total demand incentive of approximately USD 45 million. Under this scheme, various cities and states have also been sanctioned with 465 buses. Under FAME I, the demand incentive amount was determined for each category of EVs (i.e., vehicle, technology, battery types) taking into account the principles of total cost of ownership, cost of maintenance, pay-back period on account of fuel savings, etc.
However, an evaluation of the FAME I phase by an independent consultant was presented in writing in the Lok Sabha by the erstwhile minister of MoHI&PE, Arvind Ganpat Sawant, in March 2019 which concluded the following as the main findings of the scheme:

(i) Notable achievement of FAME I was the creation of awareness regarding clean mobility in all discussions between stakeholders;

(ii) The key parameters of fuel savings and carbon dioxide reduction was below the targets proposed under FAME I. Structure of subsidies was required to be revised based on powertrain technology with a focus to incentivise cleaner technologies and to establish parity across technologies. While the implementation plan was off-taken, the progress of the implementation of FAME I was slow and limited.

(iii) It was also realised that unaccounted segments of EVs like e-three wheelers, e-rickshaws, etc., in relation to which no support was planned could have the potential to drive the aims of the scheme further.

(f) **FAME II (2019-present)**
Based on the main findings of the FAME I scheme along with comments from various stakeholders, the DHI notified Phase-II of FAME ("FAME II") on 08 March 2019, with the approval of the Government of India with an outlay of approx. USD 1,311 million to incentivize demand for EVs by providing upfront subsidies and creating EV charging infrastructure. FAME-II commenced with effect from 01 April 2019 and was rolled out for over a period of 3 years which was further extended till 2024 . After rollout of FAME I, it was realised that to achieve the objectives of FAME, sufficient charging infrastructure was required to be established to allow for faster adoption of EVs.

Under FAME II, 1 million electric two-wheelers, 5,00,000 electric three-wheelers, 55,000 electric cars and 7,090 electric buses are to be supported through subsidies. Allocation of approx USD 131 million has also been made under FAME II for provision of EV charging stations. This policy also supports establishment of charging stations in the larger cities, other cities with over a million in population, smart cities, and cities in hilly states across the country for ease of access. Implementation of the FAME-II scheme was undertaken through – (i) providing incentives on demand for EVs, (ii) establishment of a network of charging stations, and (iii) publicity, administration of information, education on EVs, communication with stakeholders and similar awareness campaigns.

FAME II was amended in June 2021 in accordance with the feedback from the industry and users and based on the lessons learnt during the onslaught of the novel coronavirus in India especially with respect to the automobile industry. To prioritize faster adoption of EVs by lowering costs, FAME II scheme was amended to increase demand incentive for two-wheelers from approx. USD 131/kWh to approx. USD 196/kWh with maximum cap increased from 20% to 40% of the cost of vehicles. For three-wheelers also, methods will be adopted to bring the upfront cost at an affordable level. Cities with more than 4 million population, i.e., Ahmedabad, Bangalore, Chennai, Delhi, Hyderabad, Kolkata, Mumbai, Pune, and Surat, will be focused on for electric buses. It is expected that such incentives will notably reduce the purchase price of EVs leading to an upliftment in buyer sentiment and creating a spur in market demand. After amendment of FAME II in June 2021 sale of electric two wheelers have increased to over 5000 per week from 700 per week before such amendment.

(g) **Charging Infrastructure**
The MoP issued the guidelines and standards on 'Charging Infrastructure for Electronic Vehicles' on 14 December 2018 which were recently amended on 14 January 2022. Under the said amendment, the MoP notified a major overhaul of the existing guidelines in suppression of all previous ones. The revised guidelines aim to enable faster adoption of EVs, provide affordable tariffs for charging station operators and EV owners and support the establishment of charging infrastructure for EVs. The new guidelines provide for charging of EVs at residences and offices through existing electricity connections. Any entity is free to establish PCS provided it fulfils the standard and protocols laid down by

22 Press release by the Press Information Bureau, Government of India on Setting up of National Mission for Electric Mobility by the Ministry of Heavy Industries and Public Enterprises dated 31 March 2011 available at https://pib.gov.in/newsite/PrintRelease.aspx?relid=71403
23 NEMMP 2020 available at https://heavyindustries.gov.in/writereaddata/Content/NEMMP2020.pdf
24 Press Information Bureau report on FAME India Scheme dated 09 July 2019 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1577880

the MoP, the BEE, and the CEA. On application for electricity connection by a PCS, the distribution licensee shall release connection for such PCS as per the timelines under the Electricity (Right of Consumers) Rules, 2020. Additionally, any PCS can procure electricity from any generating company through open access. The revised guidelines also state the requirements for PCI including requirements for PCI for long range and/or heavy duty EVs. The guidelines also require the setting up of at least one charging station in a grid of 3x3 km and one charging station every 25 km on both sides of the highways. In addition, for long range and/or heavy duty EVs, at least one fast-charging station with charging infrastructure at every 100 km one on each side of the highways is required to be established. The tariff for electricity supply to PCS will be a single part tariff and will not exceed the average cost of supply until 31 March 2025 and this tariff shall also be applicable for the battery charging stations. The state governments have been empowered to fix the ceiling of service charges to be levied by the charging stations. The revised guidelines also provide for land available with the government or public entities to be made available to a government or public entity to install PCS on a revenue-sharing basis at the fixed rate of approximately USD 0.013 (i.e., INR 1)/kWh payable to the land-owning agency by the PCS entity on a quarterly basis.

The PCS will be rolled out in two phases: (a) Phase I for 1 to 3 years in all megacities with population more than 4 million and (b) Phase II between 3 to 5 years in big cities, state capitals, and headquarters of UTs. The BEE is appointed as the CAN for PCI rollout and every state may nominate its own nodal agency for the same.
It is interesting to note herein that the DST, the Office of the PSA to the Government of India, along with NITI Aayog is developing the Indian standard for EV charging infrastructure which shall be formally issued by the BIS.

(h) **EV Policies adopted by Indian States**
Indian states have either adopted or are in the process of adoption of EV policies based on the policies notified by the central agencies. We have inserted hereunder a comparison of the aims and objectives of the policies drafted by a few states.

STATE EV POLICIES

Sl. No.	State	Status	Features
1.	Andhra Pradesh	Electric Mobility Policy 2018-2023 adopted on 08 June 2018	The Government of Andhra Pradesh has identified electric mobility as a sector that will drive growth in the state in the years to come. It aims to be a leader in building a sustainable infrastructure for transports by promoting a friendly ecosystem for electric mobility in the state. Under the policy , subsidies are planned to be provided for manufacturers of EV like subsidies on capital, supply of water, reimbursement duties on purchase or lease of land for industrial use and for lease of lands/shed/building, mortgages and hypothecations, reimbursement of cost of power and other duties on electricity, other tax incentives, marketing incentives, etc., to create demand in the state for EVs, private charging stations are also allowed financial incentives. Andhra Pradesh aims to: (a) Convert 100% of the state bus fleet comprising over 11,000 buses into electric buses by 2029, with the first phase being conversion of 100% of the bus fleet in top 4 cities in the state by 2024; (b) Phase out all fossil fuel based commercial and logistics vehicles in top 4 cities by 2024 and in all cities by 2030; (c) Convert all forms of vehicles utilised by the government to EVs by 2024.
2.	Delhi	Delhi Electric Vehicles Policy, 2020 notified on 07 August 2020	The primary objective of the policy is to make Delhi the EV capital of India and increase the pace of EV adoption across all types of vehicles, especially in the category of goods carriers, public/shared transport vehicles and two wheelers. The policy aims to increase adoption of Battery EVs (BEVs) so that they contribute to 25% of all new vehicles registered in the state by 2024. This is being undertaken to improve Delhi's environment by bringing down emissions from the transport sector. This will also put in place measures to support the creation of jobs in the NCT of Delhi. The policy provides for (a) financial incentives, for example, incentives related to purchase , incentives, loans availed for EVs, (b) waiver of road tax and registration fees, (c) establishment of a wide network of charging stations and swappable battery stations, and development of publicly owned database of the same, (d) constitution of state electric vehicle board and a dedicated EV cell, and development of an intensive public outreach programme for creating awareness about EVs and key elements of the policy, (e) setting up of skill centres that will provide training related to jobs in the EV sector, (f) setting up of facilities for recycling of batteries of the EVs, (g) creation of 'State EV Fund', funded through levy of additional taxes, cess, fee etc., on inefficient or polluting vehicles.

25 Press Information Bureau report on FAME India Scheme dated 09 July 2019 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1577880
26 Press Information Bureau report on FAME India Scheme dated 09 July 2019 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1577880
27 Press Information Bureau report on FAME India Scheme dated 09 July 2019 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1577880
28 A powertrain is an assembly of every component that pushes a vehicle forward.
29 Notification No. S. O. 2526(E) dated 25 June 2021 by the Ministry Of Heavy Industries And Public Enterprises (Department Of Heavy Industry).

3.	Gujarat	Gujarat State Electric Vehicle Policy 2019	The policy aims to position Gujarat as a leader in the adoption of EVs and to establish an environment to encourage development of the EV market. The policy provides for the installation of charging stations at designated parking spaces, reserved parking/charging facility for EVs, charging points in office parking areas for government employees and visitors, facilitation of private charging infrastructure facilitated through DISCOMS.
4.	Karnataka	Electric vehicle and Energy Storage policy 2017	The policy aims to make Karnataka the preferred destination for development of electric mobility, to promote conducive manufacturing ecosystem and to develop human capital to meet the needs of the industry. The objectives are (a) investment of USD 4064 million and creation of employment opportunities for 55,000 persons, (b) development of R&D in electric mobility, (c) transition to EVs from ICE. The policy adopts special initiatives for EV manufacturing, support for charging infrastructure, support for R&D and skill development along with other incentives and concession.
5.	Kerala	Electric Vehicle Policy approved on 10 March 2019	The policy aims to achieve the following targets (a) 1 million EVs on road by 2022 and (b) pilot fleet of 200,000 two-wheelers, 50,000 three-wheelers, 1000 goods carriers, 3000 buses and 100 ferry boats by 2020. It also aims to attract investment opportunities in manufacturing of EV components, long term EV manufacturing and centres of excellence in the EV value chains. The policy provides for managing electrical grid, upgrading bus transport fleets, and other strategy initiatives like addressing the gap in visibility of EVs, creating charging infrastructure and EV manufacturing in the state, creating awareness through promotion of EVs, etc.
6.	Madhya Pradesh	Madhya Pradesh Electric Vehicle Policy 2019 dated 01 November 2019	The primary objective of the policy is to promote sustainable electric mobility and improve the air quality of the state by bringing down emissions from transport sector. The plan is to undertake the above through rapid adoption of EVs in a manner so that 25% of all new public transport vehicles registrations by 2026 may be of EVs. The policy proposes to achieve its objectives by emphasising on: (a) driving EV Adoption; (b) EV type incentive structure; (c) manufacturing of EV and its components; (d) charging infrastructure; (e) recycling ecosystem – battery and EVs; (f) demand creation for EVs; and (g) R&D. The policy also provides for incentives for two-wheelers, shared e-rickshaws, electric autorickshaws, electric good carriers (three-wheelers), electric cars and buses, and other vehicles.
7.	Maharashtra	Electric Vehicle Policy 2018	The policy targets to: (a) Increase number of EV registered in Maharashtra to 5,00,000; (b) Generate an investment of approx. USD 3277 mission (INR 25,000 crores) in EV and in manufacturing of EVs, its component, batteries (including assembly enterprises) and charging infrastructure equipment in the state; and (c) Create jobs for 1,00,000 persons. The above targets are implemented through promotion of EV technology, fiscal and non-fiscal incentives, creation of dedicated charging infrastructure through subsidization of investment, and promotion of R&D and establishment of R&D centres across the state.
8.	Tamil Nadu	Tamil Nadu Electric Vehicle Policy 2019	The policy envisions (a) the attraction of Rs 50,000 crore investment in EV manufacturing, (b) creation of a comprehensive EV ecosystem in the state and (c) creation of 1,50,000 new jobs through such investment. The conversion from traditional vehicles to EVs is being encouraged through fiscal concessions and creation of charging network. The policy proposes conversion of (a) all auto-rickshaws in 6 major cities of the state to EVs within a span of 10 years, (b) conversion of all taxis and app-based transport operators and aggregators in the 6 major cities to EVs within a span of 10 years, (c) replacement of around 5% of the state buses to electric buses every year and introducing around 1000 EV buses every year. The policy also provides for demand side incentives for two-wheelers, three-seater autorickshaws, transport vehicles, light goods carriers and private cars, incentive and support for charging infrastructure, supply side incentives for promotion of EV manufacturing among other provisions.

30 Press Release by Press Information Bureau dated 22 December 2021 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1784161
31 Press Release by Press Information Bureau dated 22 December 2021 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1784161
32 Press Release by Press Information Bureau dated 22 December 2021 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1784161
33 Notification No. 12/2/2018-EV (Comp. no. 244347) dated 14 January 2022 by the Ministry of Power.
34 The Electricity Act, 2003 defines a distribution licensee in Section 2 (17) to mean a licensee authorised to operate and maintain a distribution system for supplying electricity to the consumers in his area of supply.

9.	Telangana	Telangana Electric Vehicle and Energy Storage Policy 2020-2030	The objectives of the policy, among others, is (a) to increase the adoption of EVs in public transportation, two-wheeler and three-wheelers, four-wheelers, light commercial vehicles and shared transportation to reduce total cost of mobility, (b) to attract investments worth USD 4.0 billion and create employment for 120,000 persons by year 2030 through EVs in shared mobility, charging infrastructure development, and EV and energy storage manufacturing activities, (c) generate demand for battery storage solutions through EV adoption and supply side incentives for battery manufacturing, and (d) generate demand for battery storage solutions by EV adoption incentives and supply side incentives for battery manufacturing.
10.	Uttar Pradesh	Uttar Pradesh Electric Vehicles Manufacturing and Mobility Policy 2018	The policy provides for fiscal and non-fiscal incentives to attract investments to promote electric mobility in the state. The policy also promotes early adoption of EVs in the state as well as create demand in the sector . The policy encourages the use of hybrid EVs and plug-in EVs during the transition phase. It targets 2,00,000 charging (fast, slow and swapping) stations by 2024, 1 million EVs on the road in all categories and 70% EVs in public transport by 2030. The state offers incentives such as capital interest subsidy, infrastructure interest subsidy, industrial quality subsidy, exemption from stamp duty and electricity duty, SGST reimbursement, etc., for EV manufacturing units - large, medium, small and micro alike. It also has a single window system in place for all approvals for EV and battery manufacturing units.
DRAFT STATE EV POLICIES			
11.	Bihar	Draft Bihar Electric Vehicle Policy 2019	The policy provides for incentives to industries in the state of Bihar. The policy however, deems EV manufacturing and allied activities in the EV sector as non-priority sector and thus, an amendment has been proposed to include EVs as a priority sector under the policy. The mission of the state policy, inter alia, is to supplement the Government of India in its mission to bring 100% e-mobility by 2030, upgrade rickshaws to 100% electric ones by 2022, create fast charging stations at every 50 km on state highways/national highways, attract on-ground investments of approx. USD 327 million and create direct empowerment opportunities for 10,000 persons in the state. The policy also proposes incentives for EV manufacturing, EV charging and EV buyers.
12.	Chandigarh	Draft EV Policy 2019 and new EV policy to be notified in April 2022	As per the draft EV Policy 2019, the UT of Chandigarh aims to (a) register only EVs in the city after 2030; (b) have an all-EV fleet of public buses by 2027, (c) all EVs of government fleet by 2025, (d) all electric autorickshaws, corporate fleets, cabs and school busses by 2030; and (e) 1000 public chargers by 2030 through monetary incentives for buyers, free parking slots in government parking. This will also include charging infrastructure for EV owners in commercial, residential and educational institutions, incentives and assistance for EV charging, battery recycling incentives, etc. Subsidy can also be availed for battery operated vehicles for limited number of buyers on first-come-first-serve basis subject to availability of funds.
13.	Punjab	Punjab Electric Vehicle Policy 2019	Punjab has decided to develop a dedicated policy that promotes EVs, EV component manufacturing, and EV adoption in the state along with a prime focus on promoting cleaner mobility and creating jobs . Development of a robust EV ecosystem, provision for incentives, procedures for adoption of EVs, developing networks of charging infrastructure, R&D and innovation, recycling and reuse of EV batteries are a few provisions covered under the policy.

35 The Electricity Act, 2003 defines a generating company in Section 2 (28) to mean any company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person, which owns or operates or maintains a generating station (viz., any station for generating electricity, including any building and plant with step-up transformer, switch-gear, switch yard, cables or other appurtenant equipment, if any, used for that purpose and the site thereof; a site intended to be used for a generating station, and any building used for housing the operating staff of a generating station, and where electricity is generated by water-power, includes penstocks, head and tail works, main and regulating reservoirs, dams and other hydraulic works, but does not in any case include any sub-station (ref. Section 2(30) of the Electricity Act, 2003)).
36 Available at https://dst.gov.in/innovative-low-cost-charging-infrastructure-accelerate-adoption-evs-indian-standards-low-cost-ac
37 https://powermin.gov.in/sites/default/files/uploads/EV/Andhra_Pradesh.pdf
38 https://powermin.gov.in/sites/default/files/uploads/EV/Delhi.pdf
39 https://powermin.gov.in/sites/default/files/uploads/EV/Delhi.pdf
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42 https://powermin.gov.in/sites/default/files/uploads/EV/Karnataka.pdf
43 https://powermin.gov.in/sites/default/files/uploads/EV/Kerala.pdf
44 http://mpurban.gov.in/Uploaded%20Document/guidelines/1-MPEVP2019.pdf
45 https://powermin.gov.in/sites/default/files/uploads/EV/Maharashtra.pdf
46 https://powermin.gov.in/sites/default/files/uploads/EV/Tamilnadu.pdf
47 https://powermin.gov.in/sites/default/files/uploads/EV/Uttar_Pradesh.pdf
48 https://powermin.gov.in/sites/default/files/uploads/EV/Uttar_Pradesh.pdf
49 Available at https://powermin.gov.in/sites/default/files/uploads/EV/Bihar.pdf

The various demand and supply side incentives offered by the EV policies of different states have also been tabulated in Annexure I enclosed with this report.

(i) **Land**
In establishing EV manufacturing unit, land acquisition becomes a crucial aspect of operations and usually the basic activity to be undertaken by the manufacturer. The basic checklist of any land acquisition would include title investigation and all approvals required to setup an EV manufacturing unit that must be obtained from the relevant authorities. It is always advisable to undertake a comprehensive land title diligence and verify the ownership of the land and ensure that such land is free from any encumbrance, charges and security and other legal disputes. In the event the desirable land is an agricultural land, such land must be first converted into industrial use if the same is being considered for a manufacturing plant. Acquiring a private land would include compliance with certain land ceiling laws. Industrial parks on the other hand can be considered to be a viable option as it has all the basic amenities like power, water, roads and other necessary factors that maybe required by an EV manufacturer. The companies may explore such options in the event acquiring land becomes capital intensive activity.

Land acquisition alone is not the only factor to be considered by the EV manufacturer but host of other factors must be considered. Some of the other important factors would include availability of raw materials for the production of EVs, rail and road connectivity to the manufacturing unit, availability of labour to manufacture the EVs, implications of manufacturing policy of that particular State along with the production incentives provided by the government to push more EV manufacturers to show interest in setting up their manufacturing unit in a particular State.

It is to be noted that EV policies formulated by States like Punjab, Andhra Pradesh, Karnataka and Tamil Nadu offer supply-side and manufacturer-driven incentives and accordingly, the EV manufacturer may want to establish his manufacturing plant in and around such States and accordingly expand to other EV manufacturing friendly States.

(j) **Foreign Investment**
In case of foreign investment, 100% foreign direct investment is allowed in the EV sector under the automatic route. Taking advantage of the same and the incentives provided under the legal framework of the central and state government of India, several major investments have been made by foreign companies in India.

Foreign companies can establish their presence in India through subsidiaries, joint ventures and limited liability partnerships. Cross border loans are permitted under exchange control rules for capex or working capital purposes subject to minimum maturity and interest rate caps. Payment of considerations for technical services, royalty or repatriation of profits via dividends or through buyback is also permitted under exchange control rules. Functioning of a corporate entity is regulated by the (Indian) Companies Act, 2013 and all foreign companies are also required to comply with the extant foreign exchange control rules and regulations. India allows a rebate on customs duty on imports from preferred trade nations. Customs duties may also be avoided if imports are made into SEZ – of which there are more than 250 in India. These zones are typically used as low-cost manufacturing zones for goods intended for export from India but may also be used to access the domestic market, though upon entry to the domestic tariff areas, additional duties may be payable. There are also export trade incentives for manufacturing/services exports from India, under which the government provides incentives to exporters. Since there has been a push for investments in the EV sector, foreign investment is an attractive option for governmental and non-governmental stakeholders who aim at developing a strong EV market in India.

10.2.2 Laws Relating To Manufacturing

(a) **Product Linked Incentive Scheme**
The PLI Scheme was launched under the Make in India programme to enhance investments in the manufacturing industry of India and to establish an ecosystem of large-scale manufacturing in India. Either cash incentives or incentives through adjustment mechanisms are being provided to certain investors based on their eligibility criteria. The PLI schemes provide support to domestic manufacturers and such PLIs are based on increasing revenue by providing supply side incentives. Furthermore, even foreign companies are invited to set up their manufacturing units in India and local manufacturers are being urged to set-up new units and expand the existing ones. The PLI Schemes relevant for manufacture of EVs in India are:

(i) **PLI Scheme for Advanced Chemistry Cell (ACC) Battery Storage:**
The PLI scheme for ACC battery manufacturing was approved in November 2020 as battery is one of the most important and critical aspect of any EV. Battery carries approximately 50% of the total cost in an EV and accordingly, improved battery chemistry can reduce the overall cost of an EV. Hence, the PLI scheme is now being targeted at battery manufacturing and development as well.

The PLI scheme for national programme on ACC Battery Storage incentivizes potential investors, both domestic and overseas, to set- up giga-scale ACC manufacturing facilities in India. The scheme emphasises on maximum value addition, quality output and achieving pre committed capacity level within a pre-defined time-period. The scheme has an outlay of approx. USD 2373 million for the entire tenure. As per a Press Information Bureau report, "ACCs are the new generation advance energy storage technologies that can store electric energy either as electrochemical or as chemical energy and convert it back to electric energy as and when required". The tenure of this scheme was from the financial year 2024-2025 until financial year 2028-2029 along with a period of 2 years to establish facilities for manufacturing of ACCs. The scheme targets the establishment of an ACC manufacturing plant of 50 GWh and a 5 GWh plant for niche ACC technologies.

The MHI released a request for proposal in October 2021 inviting bidders for a total manufacturing capacity of battery storage of 50 GWh with an outlay of approx. USD 2,37,2 million (INR 18,100 crore) and the bidding was conducted online through a transparent two-stage bid process as per the cost and quality base selection process. The bidding for this PLI scheme was held in January 2022 and around 115 companies submitted bids to receive incentives under the scheme. The selected bidders are Hyundai Global Motor Company Limited (with allotted capacity of 20 GWh), Ola Electric Mobility Private Limited (with allotted capacity of 20 GWh), Reliance New Energy Solar Limited (with allotted capacity of 5 GWh) and Rajesh Exports Limited (with allotted capacity of 5 GWh). The selected companies will have 2 years to set up manufacturing units after which the incentives under the scheme shall be distributed over a period of 5 years.

50 Based on the information published in the following websites: (a) https://evreporter.com/chandigarh-ev-policy-2019/ (rerouted through MoP) and (b) https://chandigarh.gov.in/subsidy-on-battery-operated-vehicles.
51 https://evreporter.com/chandigarh-ev-policy-2019/
52 https://chandigarh.gov.in/subsidy-on-battery-operated-vehicles
53 https://powermin.gov.in/sites/default/files/uploads/EV/Punjab.pdf
54 https://powermin.gov.in/sites/default/files/uploads/EV/Punjab.pdf

(ii) **PLI Scheme for Automobile Industry:**
The MHI notified the PLI Scheme for advanced automotive products that is expected to enhance India's manufacturing capabilities and attract investments in manufacture of advanced automotive products and technology like collision warning systems, tire pressure monitoring systems, automatic braking, adaptive front lighting, etc., with a budgetary outlay of approx. USD 3400 million. The PLI Scheme starts from the financial year 2022-2023, with disbursal of the pertinent incentives in the financial year 2023-2024 and so on, for a period of 5 consecutive financial years ending in the financial year 2027-2028. The scheme has two components that incentivize the sales of automobile and auto components related to advanced automotive technology:

A. **Champion OEM Incentive Scheme:**

This scheme provides incentives range between 13% to 16% of the determined sales value to OEMs of automotive and first time investors in automobile or auto components, who manufacture advanced automotive technology vehicles including BEVs, hydrogen fuel cell vehicles etc.; and

B. **Component Champion Incentive Scheme:**
This scheme includes incentive in the range of 8% to 11% of the determined sales value for manufacturers of auto components including OEMs and first time investors, who manufacture advanced automotive technology components notified by the MoHI&PE.

Companies are only eligible to apply for this scheme if they meet following thresholds:

Eligibility Criteria	Automotive OEM	Automotive Components
Global revenue (including revenue of group companies)	Approx. USD 1.35 billion	Approx. USD 67.40 million
Investment in fixed assets (including investment of group companies)	Approx. USD 405 million	Approx. USD 20 million

Additionally, only first-time investors with global net worth of approx. USD 131 million as on 31 March 2021 and a minimum cumulative new domestic investment of approx. USD 262 million (in case of OEM) or of approx. USD 65 million (for components manufacturing) can apply under this scheme. Companies availing benefits under this scheme have to obtain determined sales value of approx. USD 16 million under the champion OEM incentive scheme and of approx. USD 3 million under the component champion incentive scheme for the first year. A growth of 10% in determined sales value on year-to-year basis for the next 5 years also has to be shown by the companies to claim the incentives.

The MHI had received around 115 applications for the PLI schemes for the automobile and auto components sector. The scheme received proposed investment of approx. USD 5901 million from the selected applicants under the Champion OEM Incentive Scheme and of approx. USD 3911 million under the Component Champion Incentive Scheme. Under the Champion OEM Incentive Scheme, almost 20 participants have been approved including Tata Motors Limited, Mahindra & Mahindra, Ford India, Suzuki Motor Gujarat, Hyundai Motor India, Pinnacle Mobility Solutions, Kia India, Eicher Motors, Ashok Leyland and PCA Automobiles India. With respect to the incentives available for manufacturers of two-wheeler and three-wheelers, the selected companies include TVS Motor, Hero MotoCorp, Bajaj Auto and Piaggio Vehicles. Foreign companies from countries such as USA, UK, Netherlands, Italy, France, Japan and the Republic of Korea have also been selected to receive incentives under the scheme.

The PLI Scheme for automotive sector along with the PLI scheme for ACC discussed above and FAME scheme aim to facilitate transition of India's reliance for power from traditional fossil fuel-based vehicles to environmentally cleaner, sustainable, advanced and more efficient EVs. It is estimated that over a period of 5 years, the PLI Scheme for automobile and auto components industry will lead to fresh investment of over approx. USD 5571 million, production of over approx. USD 30153 million and will create over 7,50,000 jobs. Further this will increase India's share in global automotive trade.

(b) **Phased Manufacturing Programme**

The PMP was notified vide Notification No. F. No. 12 (31)/2017 – AEI dated 06 March 2019 by the DHI with the objective of development of domestic manufacturing of EVs, its assemblies/sub-assemblies and parts/sub-parts, thereby increasing the domestic value addition and creating employment opportunities. The PMP enables manufacturers in the sector to plan their investments for the establishment of a robust indigenous EV and related sub-assembly/components manufacturing base in India through a revision of the erstwhile custom duties. The PMP proposed to increase the base customs duty on vehicles from April 2020 and for lithium ion cells, battery packs and certain parts for use in manufacture of EVs from April 2021 onwards.

(c) **Operational Guidelines for Delivery of Demand Incentives under FAME II**

The Operational Guidelines for Demand Incentives ("OGDI") have been notified by the DHI for promotion of indigenous manufacturing of EVs vide Notification No. S.O. 1300 (E) on 08 March 2019 . The rationale of notifying the OGDI is to implement FAME II through demand incentives, establishment of network of charging stations and administration of FAME II including publicity, information, education and communication activities. It provides for demand incentives that are important components of FAME II which directly help in demand generation of the EVs. The OGDI further provides for the registration of OEM (who may be proprietor, private or public companies or partnership firms), manufacturing any vehicle covered under the FAME scheme and seek to avail the benefits under the FAME scheme. The OGDI lays down the guidelines to be followed to by the OEMs at the time of sale of the vehicle, including, mandatory certifications, disclosures, procedure for reimbursements, billing mechanism for sale of EV, and resolution of disputes between stakeholders. For availing such benefits, the OEM shall apply to the DHI (NAB) in the prescribed format as per Annexure-A of the OGDI. There are guidelines for OEMs, testing agencies, dealers of the EVs to

55 http://sezindia.nic.in/cms/operational-sezs-in-india
56 Department of Heavy Industry Notification No. S.O. 2208(E) dated 09 June 2021 available at https://heavyindustries.gov.in/writereaddata/UploadFile/ACC%20Scheme%20
57 Notification%209June21.pdf
Available at https://pib.gov.in/PressReleasePage.aspx?PRID=1717938

be followed at the time of sale of EVs that is detailed in the OGDI. The purpose of the OGDI is to help implement FAME II and also to push the Make in India initiative of the Government of India.

10.2.3 Laws Relating to Sale and Distribution

The sale and distribution of EV's in India are governed by policies such as FAME I and FAME II along with PLI schemes and some of the states in India have their own policies for promoting the usage of the EVs. Some of the concessions to the consumers include subsidy of the purchase of the EVs, exemption from road tax, registration charges and competitive interest rates on financing of such EVs. While it is a fact that India is one the world's largest importers of fossil fuels, it is equally a contributor to primary source of pollution. Over more than 10 states in India have published their final EV policies that support national electric mobility policies. Nearly all state EVs policies prioritize two and three-wheelers and public transportation. The policies, however, may differ in terms of target, supply side incentives which is manufacturing, and demand side incentives which are consumer centric and involve charging infrastructure investments.

Another possible alternative to the advanced chemistry battery cell which is more environmentally friendly is hydrogen fuel cell that can be a more sustainable form of mobility and may even work in terms of economic viability of an EV. Hydrogen fuel cell can provide much more energy than the traditional lithium-ion batteries, without adding on to the existing weight of the EV. In a hydrogen fuel cell, hydrogen is stored on board just like any traditional fuel and the fuel cell passes the electricity through chemical reaction to the electric motor in the EV.

The current battery system of the EV as it stands today makes up for 50% of the total cost of the vehicle. Hydrogen fuel cell not only hold more charge, but it also consumes about half the time to charge in comparison to the traditional lithium-ion battery. As the world will accept the EVs as more traditional form of vehicles, refueling time will also need to be reduced, especially in commercial EVs such as trucks. Presently, one of the limitations to the usage of hydrogen is the insufficient production of it that too in a competitive pricing by using green electricity. The availability of hydrogen as fuel in every country also seems to be impractical at this juncture but it cannot be ruled out as a much cleaner, efficient, and effective fuel in comparison to the existing lithium-ion battery system. Another environmental pro of using hydrogen fuel cell is that it need not be disposed of like a lithium-ion battery needs to be disposed of and it can have serious environmental impact if not undertaken correctly.

According to the CEEW, India has seen a growth of more than 5% in the registered electric two-wheeler sales at 22,450 units in November 2021 as compared to about 4,000 units in November 2020. With the growing awareness and inclination of the customers for green mobility, there has been a monthly growth of approximately 17% in the sale of electric two-wheelers.

Among other initiatives, the registration charges for all kinds of EVs across the country have been waived.

Currently, India imposes 100% import duty on fully imported cars with cost, insurance and freight, and it doesn't treat EVs separately from ICE vehicles. Therefore, the government needs to subsidise EVs in order to promote green mobility.

Certain standards and certification requirements have been put in place by the governmental authorities for EV components/systems. Most of these standards are aligned with the international standards with the exception of some reflecting local use and environment; for example, tests to demonstrate protection from flood and rain damage.

Alongside the various initiatives by the central government, in order to promote the sale of the EVs, several state policies also cover subsidy and tax exemptions, among other incentives, for buyers.

Government of Delhi has become the first government to exempt road tax and registration fees for new EVs which has encouraged the buyers to purchase EVs. The government has also allowed the retro fitment of diesel vehicles with EV kits which will allow the old diesel vehicle owners to convert their vehicles into electric ones and get limited by the ban on 10-year-old diesel models ordered by the NGT.

Road tax for EVs is completely waived in most states where the policy has been implemented, except for in Gujarat and Kerala, where buyers have to pay 50% of the total road tax amount.

(a) **State-wise incentives for electric two-wheelers:**

State	Per kWh of battery capacity	Max subsidy	Road tax exemption
Delhi	Rs 5,000	Rs 30,000	100%
Maharashtra (including early bird incentive)	Rs 5,000	Rs 25,000	100%
Meghalaya	Rs 10,000	Rs 20,000	100%
Gujarat	Rs 10,000	Rs 20,000	50%
Assam	Rs 10,000	Rs 20,000	100%
West Bengal	Rs 10,000	Rs 20,000	100%
Rajasthan	Rs 2,500	Rs 10,000	NA
Odisha	NA	Rs 5,000	100%
Uttar Pradesh	No	No	100%
Kerala	No	No	50%
Karnataka	No	No	100%

58 https://www.thehindubusinessline.com/news/ministry-of-heavy-industries-holds-pre-bid-meeting-for-battery-storage-pli-scheme/article37505454.ece
59 https://www.carandbike.com/news/hyundai-motors-ola-electric-receive-incentive-under-pli-scheme-for-advanced-chemistry-cell-battery-storage-2840683?publisher=newsstand&utm_source=googlenews
60 Sales value means total sales for eligible vehicles/ components minus total sales for eligible/ components in the base year i.e., financial year 2019-2020
61 Press Information Bureau report dated 15 September 2021 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1755062

Tamil Nadu	No	No	100%
Telangana	No	No	100%
Madhya Pradesh	No	No	99%
Andhra Pradesh	No	No	100%

(b) **State EV subsidies on electric cars and SUVs:**

State	Per kWh of battery capacity	Max subsidy	Road tax exemption
Maharashtra (including early bird incentive)	Rs 5,000	Rs 2,50,000	100%
Delhi (only for first 1000 buyers)	Rs 10,000	Rs 1,50,000	100%
Gujarat	Rs 10,000	Rs 1,50,000	50%
Assam	Rs 10,000	Rs 1,50,000	100%
West Bengal	Rs 10,000	Rs 1,50,000	100%
Odisha	NA	Rs 1,00,000	100%
Meghalaya	Rs 4,000	Rs 60,000	100%
Rajasthan	No	No	NA
Uttar Pradesh	No	No	75%
Kerala	No	No	50%
Karnataka	No	No	100%
Tamil Nadu	No	No	100%
Telangana	No	No	100%
Madhya Pradesh	No	No	99%
Andhra Pradesh	No	No	100%

(c) **Standards and specifications for EV, its Battery and Charging Infrastructure:**

The CMVR committee established by the MoRTH is responsible for regulations and standards for EVs and ancillary components. The CMVR approves AIS prepared by the AISC in India. In addition to the AIS 138 Parts 1 and 2 discussed in chapter 3.1 (b) above, manufacture of EVs and its batteries are required to follow the standard and specifications mentioned in IS 17017 Part 1, Part 2, Part 21, Part 22, Part 23, Part 24, and Part 25 along with IS-15118 notified by the BIS. The MoP has also notified certain specifications to be adhered for selection of equipment for setting up of charging infrastructure of EVs vide its notification no. 12/2/2018-EV dated 01 October 2019. As discussed under chapter 6.5 (a), the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 were also amended in 2019 to accommodate for safety provision in relation to EV charging stations. Rule 11A of the Central Electricity Authority (Technical Standards for Connectivity of the Distributed Generation Resources) Regulations, 2013 also provides for standards for charging station, prosumer or a person seeking connectivity or connected to the electricity system.

The EV auto-component industry is at a very early stage as compared to the conventional vehicles. Currently, there is a limited EV auto-ancillary manufacturing space in the country. As the automobile market shifts its trends toward EVs, existing manufacturers of automobiles and auto components are also expected to realign the portfolio of their products to match the demands of the upcoming market for EVs. At this stage, the industry and the local manufacturers require government support for the development of localized market for EV component manufacturing and facilitating skill development for the workers.

10.2.4 Laws Relating to Licensing and Intellectual Property

Licensing and patenting are essentials for sharing and advancing technology and in the development of competition, technology and R&D of the EVs. The patenting procedure in India involves filing of an application, followed by publication of the same for public knowledge, 18 months after the filing date and examination to grant. The applicant is required to file a request for examination after the publication of the application. Further, post examination, a patent is finally granted at least 30 months from the filing date.

The Office of the Controller General of Patents, Designs and Trade Marks (Indian Patent Office) grants a patent that fulfils all requirements after the examination. Once granted, a patent remains in force for a period of 20 years from the date of filing, subject to an annual renewal fee. Any improvement or modification of an already existing patent of an invention can be protected by a 'patent of addition' in India. It is granted for protecting the novel, industrial applicability,

62 Determined sales value is defined as the incremental eligible sales of a particular year over the base year
63 Press Information Bureau report dated 24 September 2021 available at https://pib.gov.in/PressReleasePage.aspx?PRID=1757651
64 https://economictimes.indiatimes.com/industry/auto/auto-news/115-companies-file-applications-under-pli-scheme-for-auto-sector/articleshow/88814866.cms
65 https://fa.news/articles/maruti_suzuki_tvs_among_95_firms_approved_for_pli_scheme-140495/
66 https://eng.bharattimes.co.in/tata-suzuki-mahindra-along-with-20-other-companies-win-the-auto-pli-bid/
67 https://fa.news/articles/maruti_suzuki_tvs_among_95_firms_approved_for_pli_scheme-140495/
68 https://fa.news/articles/maruti_suzuki_tvs_among_95_firms_approved_for_pli_scheme-140495/
69 Press Information Bureau report dated 15 September 2021available at https://pib.gov.in/PressReleasePage.aspx?PRID=1755062

and non-inventive improvements or modifications in an already filed or granted patent application.

The Designs Act 2000 and the Designs Rules 2001 provide protection to designs . Designs are valid for a maximum of 10 years, renewable for a further 5 years.

With the increase in market demand of the EVs, the patent application filing trends have also increased worldwide. Toyota Motor Corp., Nissan Motor Co. Ltd, KIA Motors Corporation, Boyd Company Limited, Mitsubishi Motors Corp., Ford Global Technologies LLC, Honda Motor Co. Ltd, Hyundai Motor Corporation and Beijing Electric Vehicle Co. Ltd have the highest number of patent applications. Companies have also applied for a number of EV related design patents in India. These range from design patents for battery packs and chargers, to motors and cooling systems, and even entire EVs. In India, Honda seems to have dominated the EV powertrain patents in the market with about 400 patents related to batteries which is 75% of patent applications. Companies like Toyota, NTN, Suzuki, Bosh and Mitsubishi have also joined the race. TVS and Hero MotoCorp remain as the two biggest two-wheeler manufacturers filing of the patent applications.

A major challenge with EVs remain the setting up of new manufacturing facilities. Thus, most innovations come from changing the existing systems to produce EVs on the same assembly lines as the conventional vehicles.

10.2.5 Laws Relating to Energy Supply and Sale

Indian authorities are trying to develop a seamless and stakeholder friendly model to prioritise the adoption of EVs in India and therefore, there has been an attempt to deregulate the sale and supply of electricity to charging stations while accommodating the mandatory requirements to be followed for procurement of electricity for charging stations. As discussed previously, the guidelines for charging infrastructure were revised to provide for a robust regime for establishment of charging stations in India.

In addition to the above, as per the MoP, the charging of EV batteries involve use of electrical energy for its conversion to chemical energy which gets stored in the battery which involves a service requiring consumption of electricity by the charging station and earning revenue for the same from the owner of the EV. As the electricity is consumed within the premises owned by the charging station, which may be connected to a distribution system otherwise for receiving electricity, such charging activity does not constitute sale of electricity to any person neither does such activity involve further distribution or transmission of electricity. Basis the same, the MoP has clarified that the charging station does not perform any activities which require license under the provisions of the Electricity Act, 2003, namely, transmission, distribution or trading of electricity and therefore the charging of batteries of EVs through charging stations do not require any license under the Electricity Act, 2003.

Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 (CEA Supply Regulations):

The CEA Supply Regulations and the CEA Supply (Amendment) Regulations, 2019 have also been issued by the CEA under the powers conferred under Section 177 of the Electricity Act, 2003. These guidelines have been amended to facilitate the establishment of charging infrastructure for EVs. The CEA Supply (Amendment) Regulations, 2019 makes amendment to the CEA Supply Regulations to make way for establishment of a proper legal regime regulating the supply of electricity to and safety of charging stations. The CEA Supply (Amendment) Regulations, 2019provide for general safety requirement for EV charging stations by requiring all EV charging stations to be designed, installed, tested, certified, inspected and connected in accordance with the provisions contained therein. It also incorporates the requirements for earth protection system for charging stations, requirement to prevent fire for EV charging stations and testing of charging stations.

To ensure that these regulations are complied with, the CEA Supply (Amendment) Regulations, 2019 also lay down the procedure for inspection and periodic assessment of charging stations. The owner or the electrical inspector or the chartered electrical safety engineer is mandated to test every charging station before energisation of charging stations and the owner of the charging station has to ensure that test and inspection of charging station is carried out every year in the initial period of first 3 years after the energisation of charging station and in every four years thereafter. The owner is also responsible to establish and implement a safety assessment programme for regular periodic assessment of the electrical safety of the charging station. The CEA Supply (Amendment) Regulations, 2019 also detail the international standards for charging stations.

10.2.6 Laws Relating to Use (Payment, Insurance and Consumer Protection)

(a) The central government through FAME scheme provides subsidies for EV's under two and three-wheeler category and also for light commercial vehicles and buses at a national level. Many states provide further subsidy which brings down the total cost of EVs. Dealer and manufacturer discounts are also some of the benefits which are passed on to the consumer of the EVs. In addition to this, there are certain tax exemptions which are made available to the end consumer. Tax exemptions are largely limited to individuals. Section 80EEB of the Income Tax Act, 1961 provides deduction of interest payments upto approx. USD 1966 which can be used by the individual to claim interest paid on the purchase of an EV. With FAME I and later FAME II along with host of other schemes, it is proposed to be implemented through creating demand of the EVs, establishing enough charging stations and educating the masses through information, education and communication activities. Further, in order to bring down the cost of the EV's, MoRTH has permitted the sale and registration of two and three-wheeler vehicles without preinstalled batteries. This way, the upfront cost of the EVs can be reduced and batteries may be sold by the manufacturers separately and the total cost may be split.

(b) **Insurance**
Recently, there has been a rise in the incidents of electric scooters catching fire, across the country. This has led to companies such as Okinawa Autotech, Pure EV and Ola Electric to recall certain electric scooters and fix any manufacturing defects, in particular, and undertake a detailed check of the diagnostics across all battery systems, thermal systems as well as safety systems. In light of the increase in such instances, the Minister of Road Transport and Highways, Nitin Gadkari has constituted an expert committee to investigate these incidents that have occurred in the past couple of months. Based on the committee's report if any EV company is identified to be negligent with their processes, a heavy penalty will be imposed on such a company and a recall of all defective vehicles will be ordered.

A pivotal question that arises, following such incidents of electric scooters catching fire across the country, is whether the damages suffered due to such incidents get covered under an insurance policy and whether the treatment is different from other ICE vehicles when it comes to claiming insurance for such defects. The MV Act mandates every vehicle that operates in a public space to obtain at least a third-party liability motor vehicle insurance cover. Currently, EVs are (d)

70 Department of Heavy Industry, Notification No. S. O. 1300 (E) dated 08 March 2019 https://heavyindustries.gov.in/writereaddata/fame/famedepository/1-pmp.pdf.
71 https://heavyindustries.gov.in/writereaddata/fame/famedepository/3-operational%20guidelines.pdf

insured just like other vehicles and there is no specialized insurance policy for EVs. In India, the IRDAI has, in an attempt to incentivize EV owners and to promote the use of EVs, provided a 15% discount on premiums for third party liability insurance for private electric cars compared to the rates for general private cars of similar category, with effect from June 2019.

A third-party liability insurance policy typically provides a two-fold coverage against: (i) any third-party injury or death or damage to any property of a third-party caused by the insured's vehicle (as required under the MV Act); and (ii) any injury caused to the insured due to an accident (provided that the insured has a personal accident cover as part of the third-party insurance plan). However, other damages such as those caused by fire (self-ignition or lightning) are covered only under a comprehensive insurance plan and do not get covered under a standalone third-party insurance policy. Such a comprehensive policy also covers instances of theft, own damage, personal accident and natural disasters like earthquakes, cyclones, landslides, amongst others. In this regard, it is pertinent to note that such comprehensive policies also have certain exclusions such as with respect to mechanical and electrical defects, damages caused on account of any modifications made to the vehicle, over-heating and oil leakage, amongst others.

Therefore, it is crucial to determine the cause of fire before claims may be submitted to insurance companies. If the cause of fire is specifically mentioned as an exclusion under the insurance policy or if the limitations of use as mentioned in the insurance policies are violated, the insurance provider may reject the claim. It is important to note that the CFEES has discovered serious battery defects and defects in designs of the battery packs and modules in its report on the incidences of electric scooters catching fire.

Globally, most countries seem to provide specialized insurance products/coverages to EVs. The Insurance Association of China recently launched a commercial insurance dedicated to new energy vehicles (NEVs), resulting in significant increase in premium of many NEV models. Compared to the traditional vehicle insurances, the NEV-dedicated insurances take into account the risks of batteries, energy storage systems, electric motors and electric control systems and NEV buyers will be compensated for accidents (including spontaneous combustion) to vehicles that are running, parked or charged. Countries such as United Kingdom , offer specialist policies for EVs that cover risk of batteries being accidentally damaged, damaged by fire or stolen. In Singapore, battery default and other defects by default do not form part of the general electric car insurance policy and are required to be added to the maintenance package .

Considering that the current fires may not be covered under the comprehensive insurance policies, if such fires are proved to be caused due to a manufacturing defect, insurers in India should consider introducing new products offering for specialized EV insurance covering specific EV exposures. Further, as per publicly available information, we understand that the insurance companies are currently monitoring claims of EVs, including instances of fire and may consider incorporating such risks while pricing premiums. The regulatory agencies may also need to review and update, if required, the testing requirements and safety standards applicable for EVs in India to provide a globally compliant EV ecosystem.

(c) In India, there is no specific law to deal with product liability in case of any automobile. In case a consumer suffers any loss as a result of any defect in the automobile, such customer may approach the relevant authority under the CPA which protects the rights of the consumers. Claims under CPA are made at district, state and national levels. Even for EVs, the consumers have protection under CPA in the event a consumer suffers any loss accruing from the usage of EVs. It is also within the power of consumer forums to award damages in cases of death, permanent injury or related losses arising from usage of a product.

(d) **Battery Swapping**

The union budget for 2022-23 indicates strengthening the ecosystem of EVs in India. One of the major steps in the direction seems to be the introduction of a battery swapping policy and interoperability standards which will ensure that use cases for EVs are increased. Under battery swapping, EV owners can exchange a depleted battery for a fully charged one, without waiting for the depleted battery to be fully charged which can be a game-changer. The policy is aimed at making EVs a more lucrative industry to bet on and also develop sustainable and innovative business models for battery and energy as a service along with the EV charging ecosystem. Further, this also indicates that the central government may bring a special policy for battery swapping and uniform standard for EV batteries. Urban planning has to be made more inclusive to set up more PCS but given the space constraints, the battery swapping policy can help achieve the goal of smooth operation and running of the EVs. This policy will also ensure that EV manufacturers will manufacture standard removable batteries and also reduce the cost of EV ownership. The reduction in ownership costs of EVs will act as one of the major lucrative options for the consumers of traditional fuel-operated vehicles. The policy, however, needs to be prepared in such a way that even commercial EV makers can benefit from battery swapping.

Presently, not many EV manufacturers provide battery swapping through their vehicle design and enabling it for the whole industry may seem to be a bit of a challenge here. If nothing, the policy is indicative of increased interest in clean energy and the environment through supporting the EV charging segment. Some Indian manufacturers of swappable EV batteries are Sun Mobility, Ola Electric, Lithion Power, Voltup, Race energy, Esmito, Numocity, BatterySmart, ChargeUp and the Okaya Power group. Battery swapping stations have been established in various places like Azadpur, Delhi (Tata Power-DDI-Sun Mobility), Vaishali Colony Station (Battery Smart) and Huda parking area in Gurugram (Zypp).

Battery swapping is an ideal mechanism for e-commerce and delivery companies for whom speed is an essential element of the business model. For EVs used by these companies, battery swapping is a convenient alternative to charging stations. Many last mile delivery companies have set up swapping stations where delivery vehicles may exchange depleted batteries with fully charged ones.

(e) **Motor Vehicle Requirements**

The MV Act provides for laws on licensing, registration, insurance requirements, and permits in relation to motor vehicles in India. Under the MV Act, the definition of motor vehicles covers under it EVs and therefore, the MV Act and the rules notified thereunder are applicable to the use of EVs. The MoRTH has issued a draft notification

72 https://emobility.araiindia.com/standards/

73 Bureau of Indian Standards Corrigendum dated 18 August 2021 available at https://legalitysimplified.com/wp-content/uploads/2021/09/BIS1.pdf

74 Available at https://powermin.gov.in/sites/default/files/uploads/Revised_MoP_Guidelines_01_10_2019.pdf

75 See Chapter XI Safety Provisions for Electric Vehicle Charging Stations of the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010 available at https://powermin.gov.in/sites/default/files/webform/notices/OM_merged.pdf

76 As per the Designs Act, 200, "design" is defined to mean only the features of shape, configuration, pattern, ornament or composition of lines or colours applied to any article whether in two dimensional or three dimensional or in both forms, by any industrial process or means, whether manual, mechanical or chemical, separate or combined, which in the finished article appeal to and are judged solely by the eye; but does not include any mode or principle of construction or anything which is in substance a mere mechanical device, and does not include any trade mark as defined in clause (v) of sub-section (1) of section 2 of the Trade and Merchandise Marks Act, 1958 (43 of 1958) or property mark as defined in section 479 of the Indian Penal Code (45 of 1860) or any artistic work as defined in clause (c) of section 2 of the Copyright Act, 1957 (14 of 1957).

under the MV Act to exempt all battery-operated vehicles from the payment of fees for the purpose of issue or renewal of registration certificate or for assignment of registration marks . However, it is important to note that there are no specific laws in India that regulate the EV space exclusively.

10.2.7 Laws Relating to Environment (Production, Use, Disposal Of Batteries Etc.)

(a) **Environment Protection Act, 1986**

In India, the EPA provides for the protection of the environment. The EPA being wide in scope, provides for an overall framework for studying the impact of the long term environment safety and implementing the solutions that may be needed to deal with the consequences of such long term impacts. Under the EPA, the word environment comprises of water, air and land along with plants, micro-organisms etc. The EPA empowers the central government to formulate measures to protect and improve environmental conditions and also manage the waste disposal system. In an EV, although there is no pollution in terms of usage of the EV, the biggest concern is usually of the disposal of batteries. Every battery has a limited life cycle post which it becomes obsolete and may need to be changed. In such a case, battery disposal becomes one of the major cause of worry, especially when there is a strong backing by the government to make EVs a mainstream. In the process, it must be ensured that we do not end up creating pollution on land while saving ourselves from the ever-increasing air pollution. Further, the consent to establish (CTE) and consent to operate (CTO)are integrated permit systems under the Water (Prevention & Control of Pollution) Act, 1974 and the Air (Prevention & Control of Pollution) Act, 1981 which can be obtained through a combined consent application which needs to be submitted to the state pollution control board of such particular state. Any renewals for CTE and CTO are also undertaken through a similar mechanism. Multiple permits may be required by a company depending upon the type of activities undertaken by it.

Any non-compliance under EPA invites strict penalties along with the imprisonment up to 5 years and monetary fine of approx USD 1,311 or both. In the event any violation continues for a period beyond one year, there is a provision under the EPA which shall punish the offender with an imprisonment of 7 years.

For disposal of the batteries, the same shall come under hazardous waste management regulations. Due to the chemical nature of the batteries, it is likely to cause severe environmental damage. While there are relevant legislations such as the Factories Act, 1948 along with the rules framed thereunder.

For battery disposal, there are specific rules dealing with the hazardous waste which are:

(i) E-Waste (Management and Handling) Rules, 2011 which are primarily to reduce the usage of hazardous substance in electrical equipment by specifying a threshold for use of such material and to also channelise the e-waste for recycling. The wide applicability of the rules ensures that right from the manufacturer to the user, each stakeholder is responsible to adhere to such rules.

(ii) Batteries (Management and Handling) Rules, 2001 that deal with proper and effective handling of lead acid battery waste and ensures that every stakeholder such as manufacturer, importers, assemblers, auctioneers, consumers, stakeholders involved in manufacture, processing, sale, purchase and use of battery and battery components to comply with the provisions of these rules.

(b) **Vehicle Scrappage Policy**

The Vehicle Scrappage Policy, introduced in 2021, makes the concept of a waste to wealth economy into reality. The policy requires mandatory scrappage of all commercial vehicles that are older than 15 years and passenger vehicles older than 20 years in the event they fail to adhere to fitness and emission tests. The age, quality of the brakes, engine performance, etc., are a few factors taken into account while deciding whether a vehicle shall be scrapped or not. This policy has been launched, among other initiatives, as a stimulus for OEMs to create demand for newer vehicles. This policy also supplements the 'Green India' mission by removing old and polluting vehicles and replacing them with newer and cleaner vehicles on Indian roads. The policy considers all stakeholders like importers, exporters, MSMEs, OEMs, and consumers. The policy imbibes the principle of reuse, recycle and recover into the Indian auto sector.

77 https://evreporter.com/patents-and-technology-trends-in-ev-powertrain/#:~:text=It%20has%20about%20400%20patents,averaged%2020%20in%20the%20segment.

78 https://www.businessworld.in/article/Nitin-Gadkari-Forms-Committee-To-Investigate-EV-Fire-Incidents/22-04-2022-426271/

79 The Centre for Fire Explosive and Environment Safety (CFEES) comes under the System Analysis and Modelling cluster of DRDO labs. It is the regulatory authority for fire, explosive and environment safety in Ministry of Defence establishments and is the nodal agency for implementation of Safety Healthy Environment (SHE) & Disaster Management for DRDO. It is also involved in R&D in fire, explosive and environment safety.

80 https://government.economictimes.indiatimes.com/news/digital-india/ev-fire-drdo-investigation-finds-serious-battery-defects-in-evs-that-caught-fire/91758399

The main aim of this policy is to deploy fuel efficient vehicles by phasing out old vehicles on Indian roads which will lead to a reduction in environmental pollution, improvement in road and vehicular safety, enhancement of production of low cost and recycled scrap materials and increase in demand in the economy. The policy also encourages infrastructural development for testing of cars, establishment of scrappage centers and use of recycled materials. Taking advantage of this policy, Tata Motors has planned to set up scrappage centers at Greater Mumbai, Hyderabad, Karnal and Howrah.

In addition to the laws discussed above, there are several legislations that become applicable on EVs like the EPA, such as the E-Waste (Management) Rules, 2016, the Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016 and the Dangerous Goods (Classification, Packaging, Labelling) Rules, 2013, etc.

10.2.8 Labour Laws

In addition to the Factories Act, 1948, mentioned above, that deals with compliances on safety, working hours, benefits, overtime and leave, all manufacturers and companies in India are required to adhere to the compliances and obtain ancillary permissions under following major labour legislations in India:

(a) Building and Other Construction Workers Act, 1996,
(b) Contract Labour Act, 1970,
(c) Minimum Wages Act, 1948,
(d) Payment of Wages Act, 1936,
(e) Payment of Bonus Act, 1965,
(f) Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979
(g) Maternity Benefit Act, 1961
(h) Equal Remuneration Act, 1976
(i) Employees State Insurance Act, 1948
(j) Employees Provident Fund and Miscellaneous Provision Act, 1952
(k) Payment of Gratuity Act, 1972.

It is relevant here to mention that the Indian labour laws are undergoing a major overhaul and the aforementioned legislations may soon be replaced with newer laws. However, till such new laws are notified by the Government of India and other state governments, all companies are required to adhere strictly to the terms and conditions of the labour laws mentioned above.

10.2.9 Environmental, Social and Governance

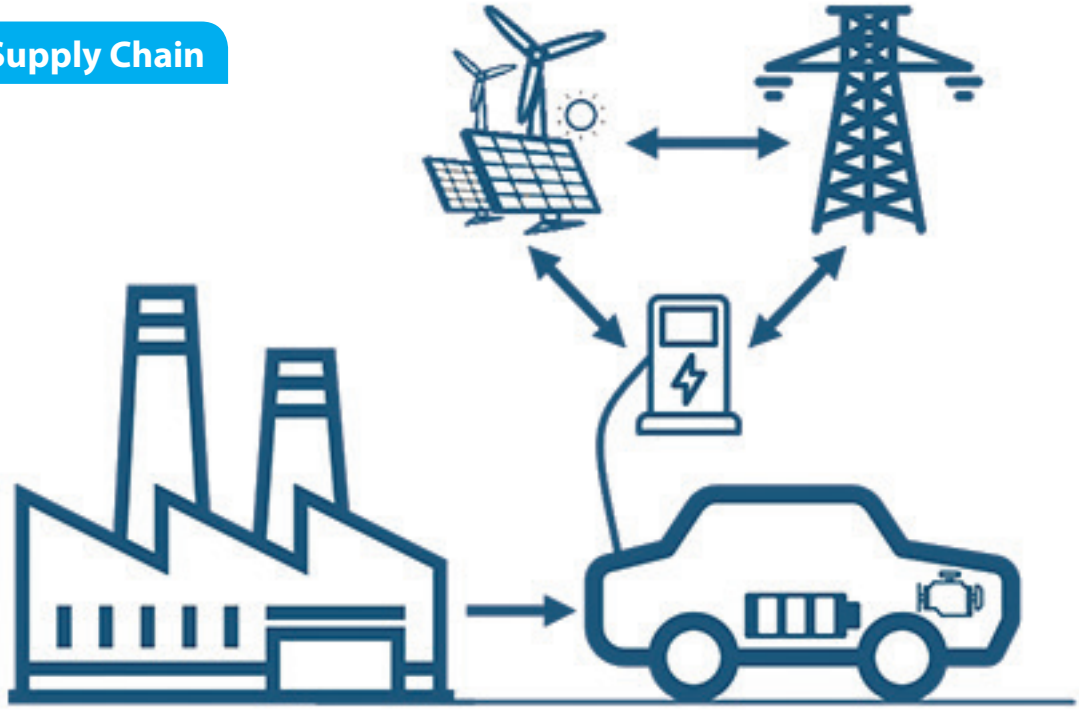
With a global shift towards EVs and clean technology, investors and companies are paving the way for further adoption of non-financial factors like environmental, social and governance policies ("ESG") to analyse the opportunities for growth and identification of material risks. EV manufacturers have to ensure that their supply chains remain committed to the goals envisaged under the policies issued by the Government of India and the various states in India. A paradigm shift is required in the basic aim of companies from traditional models of profit making to establishment of policies that further the goal of a clean and emission free environment. The underlying intent for adoption of EVs is rooted in clean environment practices and companies all around the world are adopting string ESG policies to ensure that the EV adoption process is aligned with the goal of an emission free environment. It is important to ensure that the EV manufacturing and supply chain are fiscally responsible and managed well by competent and trained personnel. It is also important to ensure that adequate investment and importance is placed on R&D so that innovative methods of EV manufacture, battery disposal, battery use are established to minimize any footprint left by EV adoption on the environment. EV adoption will also increase the requirement of sophisticated technology and complex data processing capabilities which will provide a push to EV manufacturers to adopt better branding and change customer relationships.

In the Indian scenario, it is important that manufacturers and suppliers establish strong ESG policies. A major policy may be the utilisation of renewable energy sources of power in charging infrastructure over conventional sources which will further assist in making a cleaner environment. Innovation and research is also required to understand how battery disposal may work without leaving any effect on the environment or the society at large. Further research may also be adopted in the arenas of extraction of minerals required for EV batteries to reduce the adverse polluting effect of these activities.

81 https://www.swissre.com/en/china/news-insights/articles/a-comprehensive-analysis-of-new-energy-vehicle-risk-characteristics.html
82 https://www.which.co.uk/money/insurance/car-insurance/electric-car-insurance-adjz63f08vcn
83 https://www.directasia.com/blog/5-things-you-should-know-about-electric-car-insurance-in-singapore/
84 https://e-vehicleinfo.com/battery-swapping-stations-cost-and-companies/#Battery_Swapping_Companies_in_India
85 https://e-vehicleinfo.com/battery-swapping-stations-cost-and-companies/#Battery_Swapping_Companies_in_India
86 Section 2 (28) of the Motor Vehicles Act, 1988 defines 'motor vehicles' as any mechanically propelled vehicle adapted for use upon roads whether the power of propulsion is transmitted thereto from an external or internal source and includes a chassis to which a body has not been attached and a trailer; but does not include a vehicle running upon fixed rails or a vehicle of a special type adapted for use only in a factory or in any other enclosed premises or a vehicle having less than four wheels fitted with engine capacity of not exceeding twenty-five cubic centimeters.
87 Available at https://morth.nic.in/sites/default/files/notifications_document/draft%20GSR%20352%28E%29%20dated%2027th%20May%202021%20registration%20fees%20exemption%20to%20battery%20operated%20vehicle.pdf
88 https://medium.com/batterybits/electric-vehicle-policy-framework-in-india-6bdc3ed64ed7

11 POTENTIAL OPPORTUNITIES IN THE ELECTRIC VEHICLE SEGMENT

EV Supply Chain



The Introduction of phased manufacturing program has forced vehicle manufacturers to identify reliable local suppliers to qualify for FAME II subsidies. All the components, including motor and power electronics, need to be localized except for the battery pack. As of 2020, India was the world's fifth largest automotive market, and with the growing penetration of EVs, local suppliers will have a more significant role to play. Besides Indian companies, the opportunity is being utilized by several global players. Some of the players are:

Brose: Germany's EV component supplier has entered the Indian market and is set to manufacture motor, vehicle control units and power electronics in its Pune plant

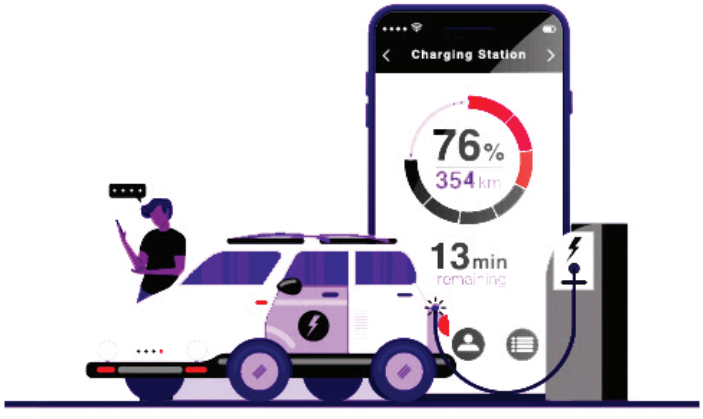
Valeo: One of the top automotive suppliers, it has tied up with Omega Seiki to supply its integrated power train

Saietta group: The UK-based company specializes in Axial Flux Technology (AFT) electric motors and has partnered with Padmini VNA for opportunities in the Indian market

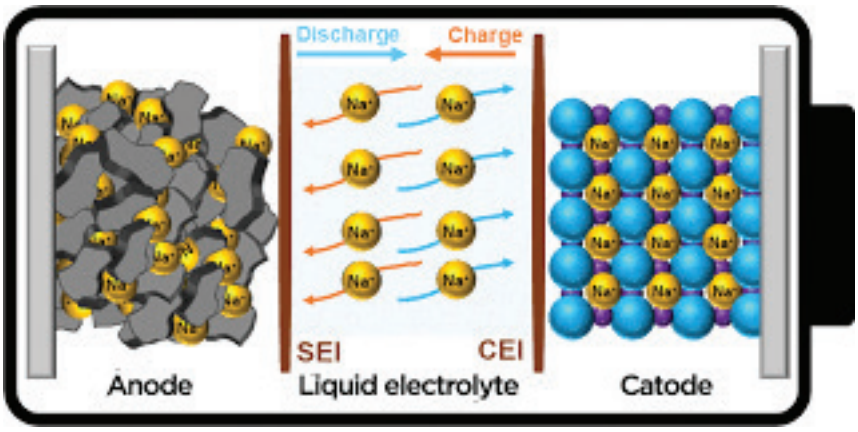
IRP Nexus Group: The Israeli company has partnered with Sona Comstar to develop power train for two and three-wheeler applications.

Software

Unlike ICE vehicles that run on mechanical systems like engines, EVs rely on embedded software. Batteries and motors are the most critical components of an EV and are primarily managed by a battery management unit and motor controller that runs on software. For example, BMS performs cell balancing to ensure maximum battery life by minimizing cell degradation. Besides, aspects like charging, navigation, and diagnostics require software-enabled connectivity.



Other Battery Technologies (Sodium-Ion)



Given the growing concerns around the scarcity of metals like Lithium and Cobalt for Lithium-ion batteries, other technologies, including Sodium-ion, are being looked like alternatives. Reliance Industries has first cemented this interest in India through its recent acquisition of Faradion, a UK-based Sodium-ion battery manufacturer. However, the technology is still in its early stages and needs significant R&D before competing with Li-ion.

Safety: Sodium-ion batteries are safer than Lithium-ion given lower thermal runaway, which implies a lower likelihood of catching fire. Further, the technology also works better in cold temperatures (at -20°C, the sodium-ion has a capacity retention rate of greater than 90%)

Energy Density: Sodium-ion typically has lower energy densities of 150-160Wh/kg but is expected to go up to 200Wh/kg. At the same time, Lithium-ion offers 250Wh/kg, and good quality cells can give up to 300Wh/kg.

Cost: Sodium-ion batteries, even without scale, can compete with LFP batteries in terms of cost. LFP is the most cost-effective chemistry that reached the price level of US$100/kWh in 2020.

Battery Recycling

As stated earlier, the employment of a circular economy is key to long-term sustainability due to the limited resources of battery raw materials. The moment has already arrived where the raw material suppliers are not able to service the sudden spike in demand for EVs, which is set to result in a battery price rise in 2022. In China, the price of Lithium Carbonate has reached US$41k/ton, which is five times higher than the prices in Jan 2021. Similarly, the price of cobalt has doubled since January 2021M and Nickel jumped by 15%.

Recycling is a potential opportunity for India, generating ~50k tonnes of battery waste (including consumer electronics) per annum to reduce the import dependency. Besides the domestic market, Indian companies can also serve global EV players. As demand for EVs is starting to increase, this is the time to perfect the technology and begin servicing the sector.

12 GLOBAL BEST PRACTICES FOR EVs

Global best practices for EVs across key geographies
Governments worldwide have rolled out incentive programs and outlined roadmaps to ensure an efficient global transition toward electric mobility. The government initiatives aim to curtail the price parity between EVs and conventional vehicles.

Some of global practices followed within key geographies include:

Europe: Europe is leading the way in drafting necessary policy changes for accelerating EV adoption. The European Commission has set up robust CO2 targets for the transport sector. The EU's 'Fit for 55 Package' is a strategic roadmap to reduce emissions by at least 55% by 2030 and be the first climate-neutral continent by 2050. Under this roadmap, all the sectors are expected to contribute to reaching the targets. The EU Commission has also revised the CO2 standards and has directed all ICE vehicles to be phased out by 2035.

United States: The US government is expanding its fleet depots to reduce range anxiety issues for EV owners. Majority of the consumers in the US charge EV batteries at their respective residences. However, the government is taking initiatives to increase consumer footfall at the charging stations. Attracting higher footfall is imperative for the charging to be cost-effective. The US government is taking steps to reduce costs by providing subsidies for installing and operating chargers in low-demand centers.

China: China is diverting from the subsidy route to electrify its EV PARC. In 2020, China phased out its subsidy plan and replaced it with mandates for vehicle OEMs. According to the mandate, a certain percentage of vehicles manufactured every year should be battery-powered. Chinese manufacturers earn a stipulated number of points for each EV manufactured, which they use to avoid financial penalties.

13 CONCLUSION

There has been a lot of buzz and hype around the EV industry in India and the Indian government also has placed EVs as the primary alternative to traditional combustion engine vehicles. However, before placing reliance on EVs, a holistic analysis is required to be undertaken involving the polluting effects of EVs, EV components and EV infrastructure along with other alternative technologies like hydrogen powered vehicles, etc. Still, the impact of EVs in a market with huge greenhouse gas emissions cannot be downplayed.

Mr. Nitin Gadkari, the minister of MoRTH, Government of India has been quoted to mention that the government intends to have EV sales penetration of 30% for private cars, 70% for commercial vehicles, 40% for buses, 80% for two and three-wheelers by 2030 and that the government is supporting localisation of all EV components and Rs 57,000 crore have been allotted for the same through the PLI schemes. He also said that the government has also allocated Rs 18,100 crore for the manufacturing of advanced battery cells.

While these investments are welcome, the government has been primarily focused on reducing India's reliance on fossil fuels and other traditional non-renewable forms of energy. However, India is still at a nascent stage of EV adoption and needs to further strengthen its laws and regulations to realise its objectives of EV saturation in Indian market. There are still some limitations to manufacture and use of EVs as compared to combustion engine vehicles which has inhibited the demand side from accepting EVs with open arms. Formalisation of the legal regime, initiatives for public awareness, redressal of logistical issues in the EV market are still required for seamless and fast adoption of EVs.

To increase EV adoption in India, Indian regulators must:

1. Push more for demand-side incentives to reduce parity between the prices for EV and ICE variants.
2. Focus on extending the mechanism for safety ratings (particularly used for ICE variants) toward EVs. This will help instill confidence in the consumer before making the purchase.
3. Focus on providing incentives to companies for rapid product development of their truck portfolio and setting up CV-specific charging stations.

89 https://www.financialexpress.com/auto/electric-vehicles/express-mobility-2021-ev-conference-in-depth-analysis-of-the-indian-ev-ecosystem/2378276/

ANNEXURE

Annexure : Incentives Offered Under Different State EV Policies

ANDHRA PRADESH

[A] TERM: 2018-2023

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- **Micro industries:** 25% of (FCI) – up to approx. USD 19,665
- **Small industries:** 20% of FCI– up to approx. USD 52,440
- **Medium industries:** 20% of FCI– up to approx. USD 65,550
- **Large industries (as defined in the policy):** 10% of FCI – up to approx. USD 1 million for first two units, in each segment of EVs (i.e., two, three and four-wheelers, buses), battery and charging equipment, hydrogen storage and fueling equipment manufacturing
- **Mega industries (as defined in the policy):** 10% of FCI – up to approx. USD 2 million for first two units, in each segment of EVs, battery and charging equipment, hydrogen storage and fueling equipment manufacturing
- **Clean production measures:** (a) MSME - 35% subsidy on cost of plant and machinery – up to approx. USD 45,886 (b) Large - 10% subsidy on cost of plant and machinery – up to approx. USD 45,886
- **Sustainable green measures:** 25% subsidy of FCI of the Project – up to approx. USD 6 million for MSME and Large projects
- Developers of Auto Clusters and Automotive Suppliers Manufacturing Centers (ASMC) specific to EVs shall be provided financial assistance of 50% of FCIs in building and common infrastructure, up to a maximum of approx. USD 2 million

(II) ELECTRICITY DUTY

- Fixed power cost reimbursement: approx.. USD 0.013 (INR 1)/ unit – for 5 years from the date of commencement of commercial production
- Electricity duty reimbursement for 5 years
- A dedicated line along with special discount for nighttime/non-peak time usage will be offered for testing of BEV batteries based on requirements

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- Mega integrated projects (as defined in the policy): Government to offer land to dependent ancillary units at same rate as OEMs up to a maximum of 50% of the government land allocated to OEM (if allocated)

(IV) SGST REIMBURSEMENT

- 100% net SGST reimbursement (limited to 100% of capex or for the period stated, whichever earlier) for - (a) Micro: 5 years (b) Medium: 7 years (c) Large: 10 years
- 100% reimbursement of stamp duty and transfer duty paid on purchase or lease of land

(V) STAMP DUTY EXEMPTION

- 100% reimbursement of stamp duty for lease of land/shed/building, mortgages and hypothecations

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- State DISCOMs to establish slow and fast charging stations for both government and private vehicles and charging infrastructure to be installed at least every 50 km on highways, other major roads, etc.
- Land to be allocated to private developers for setting up charging or battery swapping stations
- Allocation of 500 to 1,000 acres of land for developing EV Parks

(II) CAPITAL SUBSIDY

- DC chargers (>=100V): 25% capital subsidy of the charging station equipment/machinery for first 100 stations up to approx. USD 13,110
- DC chargers (<100V): 25% capital subsidy of the value of charging station equipment/machinery for first 300 charging stations up to approx. USD 393
- 25% capital subsidy of the FCI (for eligible assets excluding cost of battery inventory) up to approx. USD 13,110 for the first 50 swapping stations
- 25% capital subsidy of the FCI for hydrogen generation and fueling plants, with a maximum subsidy of approx. USD 1 million/unit for the first 10 units
- 100% net SGST to be reimbursed for purchase of fast chargers (DC chargers of capacity 100V and above)

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- 100% net SGST reimbursement for purchase of advanced batteries for battery swapping
- Reimbursement of net SGST for services rendered by firms involved in services such as leasing of fleet of EVs, owning or operating EV fleets and providing charging/battery swapping/Hydrogen Stations for recharging/refueling EVs, until 2024.

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% Registration of EVs will be done online immediately

(V) ROAD TAX EXEMPTION

- 100% reimbursement of road tax and registration charges on sale of EVs till 2024

(VI) ENERGY SALE

- Separate EV tariff to be created
- APERC to issue regulations, defining tariff and related terms & conditions, for vehicle to grid (V2G) sale of power and process and charges of procurement of power through open access
- Third party EV charging infrastructure providers can procure power from DISCOM at regulator determined tariff and provide the charging service to EVs or through open access sources to open access. (vi) Cloud charging features are encouraged

[E] ADDITIONAL REMARKS

- All external infrastructure such as power supply, water supply, roads to be provided at the doorstep of the industrial unit, charging & battery swapping stations at 50% of the cost of the infrastructure with an overall limit of approx. USD 262,204 per project.
- Stipend of approx. USD 131 per employee per year to a maximum of first 50 employees for a single company for Micro, Small, Medium and Large firms
- **Marketing:** 50% cost of participation -up to approx. USD 6,555 reimbursed to 10 MSME units per year for participating in International Trade Fairs
- **Research grant:** approx. USD 65 million
- **Water supply:** 50% of price of existing industrial supply tariff for initial 3 years from date of commercial production; reimbursement of 25% of the cost of water treatment plant up to approx. USD 262,204
- Supply tariff - for 3 years from date of commercial production
- Battery recycling plants will be incentivized to mine for compounds from used batteries.

ASSAM

[A] TERM: 2021-2026

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- Units manufacturing EV or its component are eligible for the following capital subsidy incentives on the cost of plant and machinery: Micro units - 20%– up to approx. USD 19,665; Small units - 20% – up to approx. USD 65,551; Medium units - 20% – up to approx. USD 131,102; Large units - 10% – up to approx. USD 1 million
- 30% capital subsidy is also available under the North-East Industrial Development Scheme, 2017 (NEIDS)
- Interest subsidy at 2% on working capital loan in addition to the 3% interest subsidy available under the NEIDS

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- Exemption of 90% electricity duty of EV charging stations while 10% electricity duty at the account of the entrepreneurs during the term of the policy
- The tariff for new third-party owned EV charging infrastructure shall be as per the AERC tariff order for utilities

(II) CAPITAL SUBSIDY

- 25% capital subsidy of the commercial public EV charging station equipment/machinery up to approx. USD 13,110 for first 500 stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- Two Wheelers (2 kWh): approx. USD 131/kWh up to total state subsidy of approx. USD 262 and maximum ex-factory price to avail incentive at approx. USD 1,967
- Three Wheelers (5 kWh): approx. USD 131/kWh up to total state subsidy of approx. USD 656 and maximum ex-factory price to avail incentive at approx. USD 6,555
- Four Wheelers (15 kWh): approx. USD 131/kWh up to total state subsidy of approx. USD 1,967 and maximum ex-factory price to avail incentive at approx. USD 19,665
- Beneficiary will be allowed to avail similar subsidy from only one scheme and maximum subsidy amount is limited to a maximum of 40% of ex-factory price of the EV
- Retro-fitment incentive @ 15% up to approx USD 197 for 3-Seater auto rickshaws

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% for 5 years including 100% waiver of parking charges for 5 years

(V) ROAD TAX EXEMPTION

- 100% for 5 years

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- Financial support will be offered to start-ups for research and innovation in EV & battery technologies

DELHI

[A] TERM: 2020-2023

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- Grant of 100% for the purchase of charging equipment up to approx. USD 79/- per charging point for the first 30,000 charging points

(II) CAPITAL SUBSIDY

- Capital subsidy for the cost of chargers installation expenses to the selected Energy Operators (as appointed under the policy)

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- The following incentives are subject to the eligibility criteria and other terms and conditions mentioned under the EV policy of Delhi.

- **Two-wheelers** – (i) Purchase Incentive of approx. USD 66kWh of battery capacity per vehicle up to approx. USD 393; (ii) reimbursement up to approx. USD 66 to registered EV owner for scrapping and de-registering old ICE two-wheelers

- **E-autos** - (i) purchase incentive of approx. USD 393 per vehicle; (ii) Interest subvention of 5% on loans and/or hire purchase scheme; (iii) reimbursement up to approx. USD 98 for scrapping and de-registering old ICE autos

- **E-rickshaws** – (i) Purchase Incentive of approx. USD 393/- per vehicle for the purchase of one E-rickshaw or one E-cart per individual; (ii) for models certified by ARAI as an E-rickshaw or E-cart and having an advanced battery, interest subvention of 5% on loans and/or hire purchase schemes

- **Goods carrier** – (i) Purchase Incentive of approx. USD 393/- to the first 10,000 e-Carriers registered in Delhi after the issuance of this policy; (ii) interest subvention of 5% on loans and/or hire purchase scheme for purchase of e-carriers and (iii) for purchase of e-carriers, reimbursement up to approx. USD 98 for scrapping and de-registering old ICE goods carriers

- **Four Wheelers:** Purchase Incentive of approx. USD 131/kWh of battery capacity up to approx. USD 1,967 for the first 1000 e-cars registered in Delhi after the issuance of the EV policy

(II) SGST REIMBURSEMENT

- 100% of the net SGST to be reimbursed to the Energy Operators for purchase of advanced batteries to be used at swapping stations.

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% during the term of the policy

(V) ROAD TAX EXEMPTION

- 100% during the term of the policy

(VI) ENERGY SALE

- Electricity tariff applicable for all Public and Captive charging stations for commercial use (i.e., charging facilities used by fleet owners) shall be as notified in the DERC Tariff Schedule for 2019-20 as being applicable for "Charging Stations for e-rickshaw/e-vehicle on single point delivery" as per applicable DERC Tariff Order

[E] ADDITIONAL REMARKS

- n/a

GUJARAT

[A] TERM: 2021-2025

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- State DISCOMs to allow charging of EVs from the existing connection of a consumer at existing tariff except from agriculture connection
- The tariff for new third-party owned EV charging infrastructure shall be as per the GERC tariff order for utilities dated 31 March 2018 and any amendments thereafter.

(II) CAPITAL SUBSIDY

- 25% capital subsidy on the charging station equipment/machinery up to USD 13,110 for the first 250 commercial public EV charging stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- **Two Wheelers (battery capacity 2 kWh):** approx. USD 131/kWh subject to maximum ex-factory price of approx. USD 1,967

- **Three Wheelers (battery capacity 5 kWh):** approx. USD 131/kWh subject to maximum ex-factory price of approx. USD 6,555

- **Four Wheelers (battery capacity 15 kWh):** approx. USD 19,665/kWh subject to maximum ex-factory price of approx. USD 19,665

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- n/a

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- All housing and commercial establishments to give NOC to its members who wish to install charging stations with designated parking spaces

KARNATAKA

[A] TERM: 2017-2022

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- Investment promotion subsidy: (a) Micro - 25% value of fixed assets (VFA) – up to approx. USD 19,665 (b) Small - 20% VFA – up to USD 52,441 (c) Medium – up to USD 65,551
- Capital subsidy for setting up effluent treatment plant for all EV and component manufacturing enterprises: one-time capital subsidy up to 50% of cost of the effluent treatment plant up to USD 65,551.
- Capital subsidy for setting up effluent treatment plant for all EV for EV cell manufacturing, EV battery pack/module manufacturing and assembly enterprises: (a) MSME - 50% - up to USD 65,551 (b) Large/ Mega/Super mega - 50% - up to USD 262,205
- Investment promotion subsidy for EV battery manufacturing/ assembly enterprises: (a) Micro - 25% VFA – up to USD 19,665 (b) Small - 20% VFA – up to USD 52,441 (c) Medium – up to USD 65,551;
- Large/Mega/Ultra/Super Mega EV cell/ battery/ module manufacturing: 15 per cent subsidy to be offered on capital expenditure on land value (fixed value assets) up to a maximum of 50 acres
- Production linked subsidy of 1% will be given on the company's turnover for a period of five years beginning from the first year of commercial operations, subject to a maximum cap of 50 per cent of VFA

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- 100% reimbursement of land conversion fee

(IV) SGST REIMBURSEMENT

- 100% exemption from payment of all taxes on electric non-transport and transport vehicles

(V) STAMP DUTY EXEMPTION

- 100% exemption of stamp duty payable for loan agreements, credit deeds, mortgage and hypothecation deeds executed for availing loans from state government and/or state financial corporation, national level financial institutions, commercial banks, RRBs, Co-operative Banks, KVIB/KVIC, Karnataka State SC/ST Development Corporation, Karnataka State Minority Development Corporation and their institutions which may be notified by the Government from time to time and for lease deeds, lease-cum-sale, sub-lease and absolute sale deeds executed in respect of industrial plots, sheds, industrial tenements by KIADB, KSSIDC, KEONICS, Industrial Co-operatives and approved private industrial estates/parks
- For the aforementioned loan documents, lease deed and sale deeds, registration charges shall be at concessional rate of USD 0.013 per USD 13 (i.e., INR 1 per INR 1,000).

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- Investment promotion subsidy: (a) Micro: 25% of VFA up to USD 19,665; (b) Small: 20% VFA up to approx. USD 52,441; (c) Medium: approx. USD 65,551; (d) large/mega/ultra/super mega EV charging infrastructure equipment or component manufacturing, EV battery swapping infrastructure equipment or component manufacturing enterprises: 20% VFA up to USD 655,512 per project for first 5 units in the state
- Fast charging stations: capital subsidy of 25% on the equipment/ machinery up to USD 13,110 per station for first 100 stations
- EV battery switching/swapping stations for electric two and three-wheelers: capital subsidy of 25% on the charging equipment/ machinery up to USD 3,933 per station for first 100 stations
- EV battery switching/swapping stations for electric cars: capital subsidy of 25% on the charging equipment/machinery up to USD 6,555 per station for first 50 stations
- EV battery switching/swapping stations for electric buses: capital subsidy of 25% on the charging equipment/machinery up to USD 13,110 per station for first 50 stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- 100% exemption from payment of all taxes on electric non-transport and transport vehicles

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- 100%

(VI) ENERGY SALE

- 100% exemption of duty/tax on electricity tariff for initial period of 5 years

[E] ADDITIONAL REMARKS

- All large, mega, ultra-mega and super-mega enterprises manufacturing EV, its components, EV cell manufacturing, EV battery pack/module manufacturing and assembly enterprises, all mega EV charging infrastructure equipment or component manufacturing, EV battery swapping infrastructure equipment or component manufacturing enterprises will be eligible for interest free loan on net SGST subject to the terms and conditions mentioned in the policy

KERALA

[A] TERM: 2019

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- **DC chargers (>=100V):** capital subsidy of 25% of the charging station equipment/machinery up to USD 13,110 for the first 100 stations
- **DC chargers (< 100V):** capital subsidy of 25% of the charging station equipment/machinery up to USD 393 for the first 300 stations
- Other: 25% capital subsidy of FCI for up to USD 13,110 for the first 50 BS stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- Promotional Schemes: (a) Three wheelers: incentives of approx. USD 393 or 25% of the EV, whichever lower procured from empaneled vendors; (b) state tax breaks, road tax exemptions and free permit to fleet drivers; (c) exemption from toll charges, free parking, etc.

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- 100% exempted for the initial 3 years

(VI) ENERGY SALE

- Energy to public or bulk charging stations to be offered at a rate less than the average during initial 3 years

[E] ADDITIONAL REMARKS

- Concessions to be provided in electricity tariff, property taxes and tax breaks as per the IT and ESDM policy.

MADHYA PRADESH

[A] TERM: 2019-2029

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- Small charging stations (as defined under the policy): 25% capital subsidy of the value of charging equipment/machinery up to USD 1,967 for the first 300 stations
- Medium charging stations (as defined under the policy): 25% capital subsidy of the value of charging equipment/machinery up to USD 2,622 for the first 100 stations
- Large charging stations (as defined under the policy): 25% capital subsidy of the value of charging equipment/machinery up to USD 13,110 for the first 100 stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- First 15,000 electric two-wheelers it total electric two-wheelers in 5 years, whichever less, to be charges 1% motor vehicle tax
- First 5,000 shared E-Rickshaws or total shared E-Rickshaws in 5 years, whichever less, charged motor vehicle tax at 1%
- The first 5,000 electric auto-Rickshaws or total electric auto-Rickshaws in 5 years, whichever less, charged motor vehicle tax at 1%
- The first 2,000 electric three-wheeler goods carrier or total electric three-wheeler goods carrier in 5 years, whichever less, charged motor vehicle tax at 1%
- First 6,000 electric cars or total electric cars in 5 years, whichever less, charged motor vehicle tax at 1%
- First 1,500 electric buses or total electric buses in 5 years, whichever less, charged motor vehicle tax at 1%

(IV) REGISTRATION FEE EXEMPTION

- 100% exemption for the first 22,500 electric two-wheelers or total electric two-wheelers in 5 years, whichever lesser
- 100% exemption for the first 7,500 shared E-Rickshaws or total shared E-Rickshaws in 5 years, whichever lesser
- 100% exemption for the first 7,500 electric auto-Rickshaws or total electric auto-Rickshaws in 5 years, whichever lesser
- 100% exemption for the first 3,000 electric three-wheeler goods carrier or total electric three-wheeler goods carrier in 5 years, whichever lesser
- 100% exemption for the first 9,000 electric cars or total electric cars in 5 years, whichever lesser
- 100% for the first 2,250 electric buses or total electric buses in 5 years, whichever lesser

(V) ROAD TAX EXEMPTION

- n/a

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- All electric two-wheelers, shared e-rickshaws, Electric Auto Rickshaws, electric three-wheeler goods carriers, electric cars, have 100% waiver on parking charges at any urban local body run parking facility for 5 years
- Express route permissions given to shared e-rickshaws
- Exemption of requirement of operations permit for first 2,000 electric three-wheeler goods carriers or total electric three-wheeler goods carrier in 5 years, whichever less
- Motor Vehicle tax, registration fees and ULB parking fee will be waived for all other EVs that are eligible for FAME India demand incentives for the term of the policy
- The state government is to provide marginally increased incentives including land concessions and FAR relaxation with respect to the incentives that are already been sanctioned under Industrial Promotion Policy 2010 as applicable with amendments to EV manufacturing units, as the case may be. The EV manufacturing units shall be eligible for R&D grants including subsidy on stipend for research scholars who do quality research in electric mobility and its components, patent registration and quality certification as per Madhya Pradesh Industrial Promotion Policy 2010 as applicable with amendments

MAHARASHTRA

[A] TERM: 2021-2025

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- OEMs can avail the following incentives: (a) assured buyback – 6% of total vehicle cost capped at approx. USD 131 and (b) battery warranty of at least 5 years – 4% of total vehicle cost capped at approx. USD 79 An OEM can avail both the incentives simultaneously, however the total incentive amount will be limited to approx. USD 157.

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- 60% for the first 15,000 slow public and semi-public charging stations up to USD 131
- 50% for the first 500 moderate and fast public and semi-public charging stations up to USD 6,555

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- **Demand Incentives:** (a) 1,00,000 e two-wheelers (L1&L2) to be incentivised at approx. USD 66/kWh up to USD 131 per vehicle; (b) 15000 e- wheelers autos (L5M) to be incentivised at approx. USD 66/kWh up to USD 393 per vehicle; (c) 10,000 e-three-wheeler goods carrier (L5N) to be incentivised at approx. USD 66/kWh up to USD 393 per vehicle; (d) 10,000 e-four- wheeler cars (M1) to be incentivised at approx. USD 66/kWh up to USD 1,967 per vehicle; (e) 10,000 e-four-wheeler goods carrier (N1) to be incentivised at approx. USD 66/kWh up to USD 1,311 per vehicle; (f) 1,000 e-buses to be incentivised at 10% of vehicle cost up to USD 26,220
- **Scrappage Incentives:** (a) two-wheelers (L1 & L2) – up to USD 92; (b) three-wheelers (L5M & L5N) – up to USD 197; (c) four-wheelers (M1 & N1) – up to USD 328

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- 100% during the term of the policy

(IV) REGISTRATION FEE EXEMPTION

- 100%

(V) ROAD TAX EXEMPTION

- n/a

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- n/a

TAMIL NADU

[A] TERM: 2020-2030

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- 15% capital subsidy on eligible investments over 10 years, in the case of intermediate products used in the manufacture of EV and charging infrastructure, till 31 December 2025. The cost of land shall not exceed 20% of the total eligible investments reckoned for the purpose of capital subsidy
- Special Package for EV Battery Manufacturing: 20% capital subsidy on eligible investments over 20 years (50% subsidy in case of southern districts). This special package is available for investments till 31 December 2025
- Additional capital subsidy of 20% will be offered over existing capital subsidy to MSME units

(II) ELECTRICITY DUTY

- 100% till 31 December 2025

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- Land subsidy till 31 December 2022:cLand obtained from SIPCOT, SIDCO or other Governmental agencies obtained land: 15% on cost of land; Southern districts: 50% on cost of land

(IV) SGST REIMBURSEMENT

- 100% SGST paid on the sale of EVs manufactured, sold and registered for use in the state will be

reimbursed to the manufacturing companies till 31 December 2030

(V) STAMP DUTY EXEMPTION

- EV related and charging infrastructure manufacturing industries in the state that obtain land by sale or lease shall be entitled to 100% exemption on stamp duty for transactions till 31 December 2025

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- Employment incentive in the form of the reimbursement of employer's contribution to the EPF for all new jobs created till 31 December 2025 for a period of one year and shall not exceed USD 629.22 (INR 48,000) per employee
- Interest subvention (EV component, charging manufacturing): 6% (Medium industries with loans under TN Industrial Investment Corporation) till 21 December 2025
- Tariff for the supply of electricity to PCS will be determined by TNERC and it will endeavour to fix the tariff as not more than the 15% above the average cost of supply

(II) CAPITAL SUBSIDY

- n/a

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- Waiver on Registration charges/fees will be done as per GoI notification

(V) ROAD TAX EXEMPTION

- 100% till 30 December 2022

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- Permit fees for Auto Rickshaw, electric transport vehicles will be waived for e-autos till 30 December 2022; waiver of requirement of permit for the three-wheeler goods, e-carriers as well as electric Light Goods carrier

TELANGANA

[A] TERM: 2020-2030

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- Capital investment subsidy: 20% of investment up to USD 3 million for Mega enterprises Interest subvention: 5.25% over 5 years up to USD 655,512

(II) ELECTRICITY DUTY

- Power Tariff Discount: 25% for 5 years capped at approx. USD 655,512 for Mega Enterprises
- Electricity Duty Exemption: 100% for 5 years capped at 0.5 Cr

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- 100% capped at approx. USD 655,512 per year with cumulative cap of approx. USD 3 million crores over 7 years for mega enterprises

(V) STAMP DUTY EXEMPTION

- 100%

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- Registration fees exemption: 100%

(II) CAPITAL SUBSIDY

- n/a

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- Retro-fitment incentive at 15% of the retro-fitment cost capped at approx. USD 197 per vehicle for first 5,000 retrofit 3-seater auto rickshaws in Telangana

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% for the first 2,00,000 electric two-wheelers purchased & registered within Telangana
- 100% for the first 20,000 electric three-wheelers purchased & registered within Telangana
- 100% for the first 5,000 electric four-wheelers commercial passenger vehicles purchased & registered within Telangana
- 100% for the first 10,000 electric goods carriers purchased & registered within Telangana
- 100% for the first 5,000 electric four-wheelers private vehicles purchased & registered within Telangana
- 100% for the first 500 electric buses purchased & registered within Telangana
- 100% for the electric tractors purchased & registered within Telangana

(V) ROAD TAX EXEMPTION

- 100% for the first 2,00,000 electric two-wheelers purchased & registered within Telangana
- 100% for the first 20,000 electric three-wheelers purchased & registered within Telangana
- 100% for the first 5,000 electric four-wheelers commercial passenger vehicles purchased & registered within Telangana
- 100% for the first 10,000 electric goods carriers purchased & registered within Telangana
- 100% for the first 5,000 electric four-wheelers private vehicles purchased & registered within Telangana
- 100% for the first 500 electric buses purchased & registered within Telangana
- 100% for the electric tractors purchased & registered within Telangana

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- **Subsidy:** 60% with 10% reduction Year on Year - for 5 years; capped at approx. USD 655,512
- **Stamp Duty/ Transfer Duty/ Registration Fees Reimbursements:** 100% on first, 50% on second transaction
- Lease Rental Assistance, Assistance in Patent Filing, Reimbursement of Quality Certification costs, Cleaner Production cost reimbursement, Exhibition Cost Reimbursements, Skill Development Assistance.

UTTAR PRADESH

[A] TERM: 2019-2024

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- The Large, Anchor EVMUs/EBUs and MSME units plant (as defined in the policy) will be provided incentives at par to those provided to industrial units under UP Industrial Investment and Employment Promotion Policy, 2017. These incentives include capital interest subsidy, infrastructure interest subsidy, industrial quality subsidy, Stamp duty and electricity duty exemption, SGST reimbursement, etc.
- Service units (as defined under the policy) shall be provided with the following incentives – (a) Capital Subsidy at 25% on FCI (excluding land cost) to first 100 charging stations subject to maximum Rs 6 lakh per charging station; (b) To set up Hydrogen enabled refuelling Infrastructure – 50% Capital interest subsidy on FCI (excluding land cost) will be provided for setting up hydrogen generation and fuelling plants in the form of reimbursement to first 10 units in UP, subject to maximum USD 65,551 per unit over the term of the policy

(II) ELECTRICITY DUTY

- 100%

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- For mega anchor and ultra-mega battery plant (as defined in the policy): 25% cost of land at prevalent circle rate or purchase price, whichever is less, only on land purchased in the notified areas in Uttar Pradesh

(IV) SGST REIMBURSEMENT

- 100%

(V) STAMP DUTY EXEMPTION

- 100%

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- n/a

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- First 1,00,000 buyers of private EVs manufactured within the state of Uttar Pradesh over the term of the policy will be provided 100% exemption form vehicle registration fees

(V) ROAD TAX EXEMPTION

- First 1,00,000 buyers of private EVs manufactured within the state of Uttar Pradesh over the term of the policy will be provided
- 100%exemption from road tax for electric two-wheelers
- 75% exemption from road tax for other EVs

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- **Technology transfer for alternate clean fuel mobility:** Anchor EBUs: 100% cost - 5 vendor units & 75% cost - next 5 vendor units -up to USD 65,551 •Ultra mega battery plant: 50% cost -up to USD 13,110
- For sustainable and green production measures, Large, Anchor EVMUs/EBUs and Service units (as defined in the policy) will be provided with (a) for setting up Waste Treatment plant – subsidy of 50% on annual interest on loan taken in form of reimbursement to set up Waste Treatment Plant for 5 years upto maximum USD 131,102 per unit; (b) For Battery Recycling – Capital Interest Subsidy at 50% per annum for 5years in the form of reimbursement on loan taken for procuring equipment/machinery for battery recycling subject to maximum ceiling of USD 131,102 per annum.

UTTARAKHAND

[A] TERM: 2019-2024

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- **Interest Subsidy:** Applicable for 5 years from the date of commercial production, on the term loans availed from scheduled Bank/ financial Institution. Rate of subsidy to be administered as below: For MSMEs – 5-10% For Heavy Industries – 5% For Large – 7% (Max. USD 32,776), Mega – 7% (Max. USD 45,886) Ultra Mega – 7% (Max. USD 65,551) EPF reimbursement: 50% reimbursement for 10 years with ceiling of approx. USD 262,205 for units employing 100 or more Skilled/ Semi skilled labour on full time basis
- **Environmental protection Incentive:** For Large Projects: 30% (Up to USD 26,220) For Large, Mega and Ultra Mega Projects: 30% (Up to USD 65,551)

(II) ELECTRICITY DUTY

- 100% for 5 years from the date of commencement of commercial production

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- **For Large Industrial investment** – 5% (in case of 100% payment at the time of allotment) For large – 15%, Mega – 25%, Ultra mega – 30%

(IV) SGST REIMBURSEMENT

- For MSME & Large (investment upto USD 6 million) - 30% for 5 years after adjustment of input tax credit (for B2C sale)
- For investment above approx USD 6 million - 50% for 5 years

(V) STAMP DUTY EXEMPTION

- **For MSMEs** – 50-100% depending on the category
- For Heavy Industrial investment: 50%
- For Large, Mega & Ultra mega investment: 50%

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- 100% exemption of stage carriage permit for Commercial vehicles for 5 years from the date of Registration
- 100% exemption from paying Motor Van Tax for 5 years from the date of registration

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- n/a

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- For skill development training in EV/HEV component manufacturing will be entitled for training reimbursement USD 13 per month for 50 trainees

BIHAR

[A] TERM: 5 years from date of notification

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- All incentives as mentioned in Chapter 6 of Bihar Industrial Investment Promotion Policy, 2016

(II) ELECTRICITY DUTY

- Across the state, the rate of Electrical power required for EV charging shall be industrial rate of electricity.

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- All incentives as mentioned in Chapter 6 of Bihar Industrial Investment Promotion Policy, 2016
- Commercial public EV charging stations will be eligible for 25% capital subsidy on equipment/machinery (limited up to USD 13,110 per station) for first 250 commercial public EV charging stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- All incentives as mentioned in Chapter 6 of Bihar Industrial Investment Promotion Policy, 2016
- In addition to the above: End user subsidy at 15% of base price of the EV to be provided on first 1,00,000 EVs manufactured (segregated into two wheeler-24,000; three-wheeler-70,000; four-wheeler-4,000; Four-wheeler hybrid- 1,000 and private/public passenger bus -1,000), up to USD 26,220 per bus, approx. USD 1,311 for four-wheeler (including hybrid ones), Approx. USD 157 for three-wheeler and approx. USD 65 for two-wheeler
- Special incentives of approx. USD 131/- shall Be given on Electric Rickshaw using Lithium ion battery instead of conventional lead acid battery.
- Top up subsidy of approx. USD 104/- if the end user is below poverty line or belong to S.C./S.T. category

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100%

(V) ROAD TAX EXEMPTION

- 100%

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- Additional incentive of approx. USD 92/- per kWh shall be given on electric rickshaw and e-two wheelers using Lithium ion battery instead of conventional lead acid battery.
- Interest subvention of 10% to buyer of light electric freight vehicle or e-bus
- Special grant of approx. USD 131 per kWh to manual pedal rickshaw puller for conversion/upgradation to 100% electric mobility. For pedal rickshaw fleet owner interest subvention of 10% on loan taken for conversion/upgradation to 100% electric mobility.
- Top up subsidy of approx. USD 105/- on ex-showroom price if the end user is below poverty line or belong to MBC or S.C./S.T.

CHANDIGARH

[A] TERM: 5 years from date of notification

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- 30% subsidy on installation of home chargers
- 15% subsidy (on total investment) for charging infrastructure companies to set up PCS
- Incentives provided to batter recycling of Rs 2,000 per passenger vehicle and Rs 20,000 per electric bus to battery recycling facility operators located in the city

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- Direct subsidy of approx. USD 262 for first 3,000 buyers of Electric two-wheelers & three-wheelers
- Free one-year insurance for first 1,000 EV buyers, Group Purchase Incentive of Rs 30,000 per vehicle to all legal entities that will make a one-time purchase of more than a certain number of EVs on top of other incentives/subsidies.

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% exemption till 2024

(V) ROAD TAX EXEMPTION

- 100% exemption till 2024

(VI) ENERGY SALE

- Joint Electricity Regulatory Commission has fixed Rs 4 per unit and Rs 100 as a fixed monthly charge on electricity bill for the PCS

[E] ADDITIONAL REMARKS

- Additional road tax and pollution cess on all ICE vehicles after 2025

GOA

[A] TERM: 5 years from date of notification

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- Upto 20% of FCI for Pioneer, Mega and Large Units (as defined in the policy). 30% of the cost of capital in case of Micro, Small & Medium Units
- Price preference at the rate of 15% on the purchase made by the Government Departments is available to the registered Small- Scale Units
- Support to utilities in construction of effluent treatment plant (ETP) with 50% capital subsidy

(II) ELECTRICITY DUTY

- 100% reimbursement for 5 years for utilities

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- 100% for 5 years

(V) STAMP DUTY EXEMPTION

- 100%

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- State government to incur all electricity infrastructure cost, up to USD 10,488 associated with installation of EVSEs and charging stations.
- For solar-powered charging stations, the state shall provide a 20% capital subsidy for installation

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- **Two & Three Wheelers:** Purchase incentive of approx. USD 131 per kWh of battery capacity till approx. USD 393
- **Four Wheelers:** Purchase incentive of approx. USD 131 per kWh of battery capacity till approx. USD 66
- **Scrapping Incentive of for scrapping and de-registering old ICE vehicles registered in Goa:** two wheelers reimbursement up to USD 66; e-autos up to USD 131; e-carriers up to USD 131.
- Interest subvention of 5% on loans and/or hire purchase scheme for purchase of e-autos, E- rickshaws, E-carts and Goods carriers shall be provided by Convergence Energy Services Limited.

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% during term of the policy

(V) ROAD TAX EXEMPTION

- 100% during term of the policy

(VI) ENERGY SALE

- Electricity will be provided at a lowered power tariff, currently of USD 0.055 (INR 4.2)/unit, as determined by the Joint Electricity Regulatory Commission on an annual basis

[E] ADDITIONAL REMARKS

- n/a

HARYANA

[A] TERM: 2018-2023

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- 25% of FCI up to a maximum of approx. USD 19,665 for micro industries.

- 20% of FCI up to a maximum of approx. USD 52,441 for small and approx USD 65,551 for medium industries.
- 10% of FCI up to a maximum of approx USD 1 million for first two units, under large industries, in each segment of EVs (two, three and four-wheelers buses), battery and charging equipment, hydrogen storage & fueling equipment manufacturing.
- 10% of FCI up to a maximum of approx. USD 2 million for first two units, under mega category, in each segment of EVs (two, three and four-wheelers, buses), battery and charging equipment, hydrogen storage & fueling equipment manufacturing
- 25% subsidy, for micro, small, medium enterprise and large projects, for sustainable green measures on total fixed capital investment of the project (excluding cost of land, land development, preliminary and pre-operative expenses and consultancy fees) with a ceiling of USD 6 million.

(II) ELECTRICITY DUTY

- 100% for 10 years

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- The Government of Haryana will allocate 100 to 200 acres of land for developing EV Parks

(IV) SGST REIMBURSEMENT

- 100% net SGST to be reimbursed for a period of 5 years for micro & small, 7 years for medium, 10 years for large industries. This reimbursement will be limited to 100% of capex or for the period stated, whichever is earlier.

(V) STAMP DUTY EXEMPTION

- 100% of stamp duty and transfer duty paid by the industry on purchase or lease of land meant for industrial use will be reimbursed.
- 100% of stamp duty for lease of land/shed/buildings, mortgages and hypothecations will be reimbursed.
- Stamp duty will be reimbursed only one time on the land. Stamp duty will not be waived on subsequent transactions on the same land.

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- 100% net SGST reimbursement for purchase of fast chargers (Direct Current (DC) chargers of capacity 100 Volt and above)
- 100% net SGST reimbursement for purchase of advanced batteries for BEV swapping stations/ battery banks.

(II) CAPITAL SUBSIDY

- DC Chargers (100 Volt and above): Capital Subsidy of 25% upto a maximum subsidy of approx. USD 13,110 of the value of the charging station equipment/ machinery
- DC Chargers (Below 100 Volt): Capital Subsidy of 25% upto a maximum subsidy of approx USD 393 of the value of the charging station equipment/machinery for first 300 charging stations/battery banks.
- Capital subsidy of 25% of FCI (for eligible assets excluding cost of battery inventory) up to a maximum subsidy of approx. USD 13,110 for swapping stations/ battery banks for the first 50 stations will be provided.

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- 30% subsidy on road price of EV in form of reimbursement
- 30% subsidy on road price of EV in form of reimbursement directly to the buyer in the state on purchase of EV and to the financer, if the EV is hypothecated, applicable over the Term of the policy
- Extra Incentives for buyers who intends to purchase the following categories of EV within a period of six months from the date of issuance of the policy: (a) coupon of Rs 25,000 for purchase E-Rickshaw/Carts; (b) coupon of Rs 50,000 on Electric based light motor vehicles; (c) coupon of Rs 75,000 on purchase of Electric cars (below Approx. USD 13,110); (d) coupon of Rs 100,000 on purchase of Electric cars (above USD 13,110)

(II) SGST REIMBURSEMENT

- Reimbursement of the SGST for services rendered, accrued to the state, for firms involved in services such as leasing of fleet of EVs, owning or operating EV fleets and providing charging/ battery swapping/ Hydrogen stations for recharging/ refueling EVs, until 2024

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- 100% exemption of road tax on transportation EVs purchased within Haryana state and manufactured within the State, applicable over the term of the policy.

(VI) ENERGY SALE

- Government will provide fixed power cost reimbursement @ Rs 3.00 per unit for a period of 5 years from the date of commencement of commercial production.

[E] ADDITIONAL REMARKS

- Water Supply will be made at 50% of the price of existing industrial supply tariff for the initial 3 years from the date of commencement of commercial production. The state government will reimburse 25% of the cost of water treatment plant wherever necessary, with a limit of approx USD 262,205 on this subsidy
- 100% interest free loans to the state government employees for purchase of EVs in the State.
- All the registered EVs will be exempted from paying of state toll tax.
- The dealers of EVs (Non-Transport) will be exempted from submitting of Bank Guarantee of approx USD 1,311 for Online Dealer Point Registration in the State.
- EVs will be registered on priority basis with a minimum Token fee of USD 1.31 (INR 100)
- Stipend of approx USD 131 per employee per year to a maximum of first 50 employees for a single company for micro, small, medium and large firms

MEGHALAYA

[A] TERM: 5 years from the date of its notification

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- n/a

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- n/a

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- **Two Wheelers:** Rs 10,000/- per kWh for the first 3500 electric two wheelers purchased
- **Three wheelers:** Rs 4,000/- per kWh for the first 200 electric three wheelers purchased
- **Four Wheelers:** Rs 4,000/- per kWh for the first 2500 four-wheeler EVs purchased purchase subsidy @ Rs 4,000/- per kWh for the first 30 strong hybrid four-wheeler EVs purchased purchase subsidy @ Rs 4,000/- per kWh for the first 30 EV Buses

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- 100% during the term of the policy

(V) ROAD TAX EXEMPTION

- 100% during the term of the policy

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- n/a

ODISHA

[A] TERM: 2021-2026

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- Micro and small enterprise: 25% of the capital investment made in plant and machinery up to USD 131,102
- Micro and small enterprise (owned by SC/ST/differently abled/ women): 30% of the capital investment made in plant and machinery up to USD 163,878
- Micro and small enterprise (set up in industrially backward districts): Additional 5% capital investment subsidy

(II) ELECTRICITY DUTY

- n/a

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- n/a

(IV) SGST REIMBURSEMENT

- 100%

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- n/a

(II) CAPITAL SUBSIDY

- Grant of approx USD 66 for purchase of charging equipment for the first 20,000 private charging points
- 25% capital subsidy to the selected energy operators for the first 500 charging stations

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- **Two Wheelers:** 15% up to USD 66 •Three Wheelers: 15% up to USD 157 • Four Wheelers: 15% up to USD 1,311
- **Others:** •e-buses: 10% up to USD 26,220 •Goods carriers: Purchase incentive of approx USD 393 for the first 5,000 electric goods carriers
- **For pure electric buses:** (a) subsidy of 10% (maximum limit of approx USD 26,220 per vehicle) shall be extended to the buyers for passenger buses registered in the State; (b) 100% SGST on the sale of electric buses sold and registered in the state will be reimbursed during policy period; (c) 100% exemption on road tax & registration fees for the first four years will be made available; (d) Interest subvention of 5% on loans for purchase of Electric Buses would be made available
- **For goods carriers:** (a) Individual and fleet Owners shall be given purchase incentive of approx USD 393 to the first 5,000 electric goods carriers to be registered in the State; (b) Interest subvention of 5% on loans for purchase of electric goods carriers in the policy period; (c) 100% SGST on the sale of electric goods carriages sold and registered in the state will be reimbursed for the policy period; (d) 100% exemption on road tax & registration fees for the policy period will be made available; (e) exempted from prohibition on plying and idle parking on identified roads of the state during specified timings as notified by the local authorities from time to time; (f) scrapping incentive shall also be extended for old ICE goods carriages registered in the state as per the scrapping Policy announced by GoI.

(II) SGST REIMBURSEMENT

- 100% SGST reimbursement to the Energy Operators for purchase of batteries to be used in swapping stations.

(III) MOTOR VEHICLE TAX EXEMPTION

- n/a

(IV) REGISTRATION FEE EXEMPTION

- n/a

(V) ROAD TAX EXEMPTION

- n/a

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- There shall be open permit for autos (three wheelers)
- 100% interest free loans would be made available to State Government employees for purchase EVs
- Interest subvention to public for purchasing personal EVs.

PUNJAB

[A] TERM: 5

[B] MANUFACTURING

(I) CAPITAL SUBSIDY:

- n/a

(II) ELECTRICITY DUTY

- 100% exemption from electricity duty for 15 years

(III) LAND CONVERSION FEE AND LAND SUBSIDY

- 100% exemption from Change of Land Use / External Development charges for anchor units

(IV) SGST REIMBURSEMENT

- For Anchor Units, 100% reimbursement of net SGST for a period of 15 years subject to maximum 200% of FCI

(V) STAMP DUTY EXEMPTION

- n/a

[C] CHARGING INFRASTRUCTURE AND BATTERY

(I) OTHERS

- Punjab State Electricity Regulatory Commission though its order dated 27 May 2019 has defined EV Charging Stations as a separate category under Single Part Tariff rate of approx. USD 0.079 (INR 6.00) per kWh under the Schedule of Tariff applicable for Non-Residential Supply (NRS) category. This is also applicable for fleet charging/ swapping stations
- 100% electricity duty exemption for the policy period) for EV Charging points

(II) CAPITAL SUBSIDY

- First 1,000 charging points shall be eligible for 25% capital subsidy on equipment/machinery (limited up to a total of approx. USD 655.43 (Rs. 50,000) per charging point). In case the charging equipment is manufactured in Punjab, the maximum capital subsidy shall be 50% (limited up to a total of approx. USD 1,310.86 i.e., INR 1 Lakh per charging point)

[D] CONSUMERS

(I) CAPITAL SUBSIDY

- n/a

(II) SGST REIMBURSEMENT

- n/a

(III) MOTOR VEHICLE TAX EXEMPTION

- 100% during policy period. Additionally for vehicles manufactured in Punjab, this waiver shall be applicable for a period of 10 years.

(IV) REGISTRATION FEE EXEMPTION

- 100% for e-rickshaws

(V) ROAD TAX EXEMPTION

- 100%

(VI) ENERGY SALE

- n/a

[E] ADDITIONAL REMARKS

- 100% waiver on Permit Fee during policy period. Additionally, for vehicles manufactured in Punjab this waiver shall be applicable for a period of 10 years.
- Employment generation subsidy of approx. USD 472 per male employee per year for a period of 5 years and approx. USD 629 per employee per year for a maximum period of 5 years in case of females and SC/ST/OBC employee (as certified by a government agency). This will be applicable without any domicile restriction

ABBREVIATION

ACC - Advanced Chemistry Cell
AMP - Automotive Mission Plan
ARAI - Automotive Research Association of India
AIS - Automotive Industry Standards
AISC - Automotive Industry Standard Committee
AC - Alternate Current
BS - Bharat Stage
BIS - Bureau of Indian Standards
BEVs - Battery Electric Vehicles
BEE - Bureau of Energy Efficiency
CAN - Central Nodal Agency
CEA - Central Electricity Authority
CFEES - Centre for Fire Explosive and Environment Safety
CEO - Chief Executive Officer
COP 21 - 21st Conference of Parties
CPA - Consumer Protection Act, 1986
CEEW - Council on Energy, Environment and Water
CMVR - Central Motor Vehicles Rules
DHI - Department of Heavy Industries
DC - Direct Current
DST - Department of Science and Technology
DISCOMS - Distribution Companies
EVSE - Electric Vehicle Supply Equipment
EV/EVs - Electric Vehicle/ Electric Vehicles
EPA - Environment Protection Act, 1986
Etc - Etcetera
FAME - Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FCI - Fixed Capital Investment
GWh - Giga Watt per hour
GFCS - Global Framework for Climate Services
GST - Goods and Services Tax
GW - Giga Watt
GDP - Gross domestic product
ICE - Internal Combustion Engine
INDC - Intended Nationally Determined Commitments
INR - Indian National Rupees
IRDAI - Insurance Regulatory and Development Authority
i.e. - that is
kWh - Kilo Watt per hour
Km - Kilometer
MoST - Ministry of Science and Technology
MoP - Ministry of Power
MoHI&PE/MHI - Ministry of Heavy Industries and Public Enterprises
MoRTH - Ministry of Road Transport and Highways
MoHUA - Ministry of Housing and Urban Affairs
MV Act - Motor Vehicle Act, 1988
MSME - Micro, Small & Medium Enterprises
NMEM - National Mission on Electric Mobility
NCT- National Capital Territory
NITI - National Institution for Transforming India NAPCC
NEMMP - National Electricity Mobility Mission Plan
NBEM - National Board for Electric Mobility
NCEM - National Council for Electric Mobility
NAB - National Automotive Board
NAPCC - National Action Plan for Climate Change
NGT - National Green Tribunal
OEM - Original Equipment Manufacturers
PLI - Production Linked Incentive
PCS - Public Charging Station
PISC - Project Implementation and Sanctioning Committee
PSA - Principal Scientific Advisor
PMP - Phased Manufacturing Programme
R&D - Research and Development
Rs./Rs - Indian Rupee
SEZ - Special Economic Zone
TPEM - Technology Platform for Electric Mobility
UNFCCC - United Nations Framework Convention on Climate Change
USD - United States Dollars
UT - Union Territory(s)
WHO - World Health Organisation
WCC 3 - World Climate Conference 3

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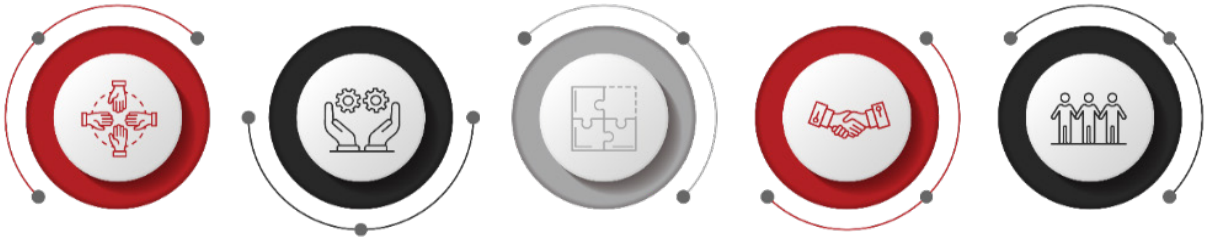

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Committed to excellence

Synergy

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With a prime motive to support the ecosystem, it facilitates contact with policy makers, research institutions, universities, trade associations and other relevant organizations. Thus, support entrepreneurial activity, innovation and job creation.

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