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Movement towards clean energy in the Indian mobility sector

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Abstract
India has one of the largest automobile markets in the world. However, the relative share of Electric Vehicles (EV) in the automobile market is very low. EV adoption in India is at a nascent stage. Numerous government policies have been formulated and implemented to support this sector. Prior to COVID-19 the EV sector, dominated by two wheelers and three wheelers, was steadily growing. Despite the economic slowdown due to the pandemic, the growth trajectory of EV sector remained upward. Certain social and behavioral changes have taken place in response to the pandemic. These changes will have a long-term impact on the EV sector. To have a sustainable long-term growth, there is a compelling need to adopt clean energy in the mobility sector. There are a myriad of challenges and obstacles in adoption of electric vehicles. Creating a domestic supply chain, developing a robust charging infrastructure, tackling a huge unorganized sector in some vehicle segments, lack of R&D for cost reduction, are some of the constraints which the EV industry is facing. Accelerated transition towards E-mobility will substantially cut the India's oil import bill and reduce the carbon emissions. A boost to the EV sector will help India move towards a green recovery.

Keywords: e-mobility, GHG emissions, e-rickshaws, FAME I, FAME II, clean energy

Introduction

The unprecedented COVID 19 pandemic and subsequent lockdowns brought clean air, blue skies, and recapitulating nature. Large scale disruptions are being witnessed in almost all spheres of life, they are of a scale never experienced or witnessed before. There was a transitionary reprieve from pollution. Particulate pollution in big cities declined considerably. As life and livelihoods move back to normal, it is being realized that there is a need to sustain these environmental gains. Things are fast moving towards the previously existing toxic gridlock. To avoid this, there is a need to cut down on pollution and congestion. The collective experience of this 'new normal' and cleaner environment is a motivation to make a big shift towards a better world.

However, there are many challenges to reinvent and adopt greener solutions in the mobility sector. Not only in India but globally cities are trying to find solutions to survive the crisis and set standards for sustained changes. Social distancing and fear of infection has led to restricted mobility and near collapse of public transportation system. The mobility sector in India is witnessing a preferential shift towards cars and two wheelers, which would create more pollution and carbon emissions.

Many solutions are being worked out for immediate crisis management, but there is indication of movement towards a direction of change for combating pollution and environmental degradation and improve livability. Despite the pandemic this opportunity must be leveraged.

The virtual workplaces and digital platforms have curtailed the need for unnecessary travel. The public transport systems are operating at very low occupancy and earnings. The government is trying to make public transport and ride sharing systems safe and hygienic. In many countries fiscal and bailout packages are being extended to the auto sector, these should be linked to green recovery. A fiscal flip to the EV sector in India will boost the idea of clean, renewable energy-based mobility in the future. In the post COVID scenario transition to EV has an immense potential for growth and market expansion. The target of 30 percent EV transition by 2030 has wide ranging implications on the economy in the context of oil import, employment, value addition, public finances, and environmental gains from reduced emissions. So far there has been no clear mandate for EV penetration. Energy security, curbing local pollution and cutting GHG emissions from transportation sector are the three guiding imperatives for India's electric mobility transition.

Pre pandemic Electric Mobility sector in India

The initiation to clean energy in India started in 2013 with the National Electric Mobility Mission Plan (NEEMP) 2020. Since then, there has been a considerable progress in EV adoption. This plan targeted 6-7 million electric vehicles on Indian roads by 2020. Under NEEMP, in 2015, FAME I scheme was introduced to accelerate adoption of EV's. an allocation of Rs 895 Cr was made for direct purchase incentives, support for R&D and support for infrastructure for EV ecosystem. In 2018 the government announced plans to extend financial support worth $1.3 Bn (8730 Cr) under FAME II.

Under FAME I the government had allowed incentives for mild hybrid diesel cars, which appropriated nearly 60% of the total allocations. This had a negative impact on adoption of fully battery-operated vehicles. FAME I largely focused on passenger vehicles; two wheelers and four wheelers largely benefited from this scheme. Total sale of electric vehicles till 2018- 19 was 7.59 lakhs, out of these 1.26 lakh (16.59%) vehicles were two wheelers, 6.3 lakhs (82.94%) were three wheelers and 3600 (0.47%) were passenger four wheelers.

FAME II started in March 2019 with tenure until 2022. The focus of this policy is on two wheelers, three wheelers (including e-rickshaws) and buses. The incentives provided by this scheme are applicable to mainly vehicles used for public transport and commercial vehicles, for two wheelers segment incentives are available for private vehicles also. Around 41% of total purchase incentive (3,545 crore) has been allocated for buses. Department of heavy industries (DHI) sanctioned 5,595 buses to 22 states (64) cities. 100 electric buses were sanctioned to Delhi Metro rail corporation for last mile connectivity. FAME II also envisages establishing a network of charging stations in the country. Before the pandemic struck FAME II had made substantial progress. Intrusion of the pandemic has raised questions about its final stages and subsequent strategies.

Table 1: FAME II Incentives- Investment rollout plan.

FAME II Incentives – Investment rollout plan (FY20 to FY22)[11]

	2 Wheelers	E - rickshaws	Electric 4W	Strong hybrid 4W	E-buses	Charging Infrastructure
Number of Vehicles	10,00,000	5,00,000	35,000	20,000	7,090	2,700 charging stations
Incentive per vehicle (INR)	20,000	50,000	1,50,000	13,000	50,00,000	-
Total Incentives (INR Cr)	**2,000**	**2,500**	**525**	**26**	**3,545**	**1,000**
Demand Incentives	10,000 per KWh Maximum cap on incentives of 20% of total cost of vehicles				20,000 per KWh Maximum cap on incentives of 40% of total cost of vehicles	

Source: Department of Heavy Industries

Despite tremendous challenges and obstacles, the Indian EV industry, in the pre pandemic time was steadily gaining traction. The government efforts led to entry of international players like Honda, Suzuki, Ford, Toyota, Volvo, and Hyundai. Many startups like Ether Energy, ION Energy, Ultraviolette Automative started operations. Tata Motors and Mahindra and Mahindra are the two domestic automative giants leading the EV revolution in the country.

Recovery from the Pandemic, Entailing adoption of Green Energy.

Globally, because of the pandemic the automobiles and EV sales witnessed a sharp negative growth. The pandemic hit at a time when climate and energy issues and policy making was gaining momentum around the world. Electric vehicle adoption policies were being aggressively implemented. Due to the pandemic global supply chains were disrupted; R&D inventories, component supply market was hit. The EV industry faced supply shocks.

The pandemic also impacted consumer demand as there were delays in purchase decisions. In the first quarter of 2020 the EV sales dipped globally. In China, US, and top five markets of Europe, the EV sales were reduced by 23%. A rebound in sales occurred after April. EU which is the market leader in EVs since the beginning, due to strong fiscal and non- fiscal initiatives, had robust sales of EVs in the last quarter of 2020. US which has much smaller EV market than Europe and China, witnessed 15% increase in EV sales despite the pandemic and downturn. China extended its New Energy Vehicle Program for another two years till 2022. Globally there was continued support to EV adoption despite downturn and disruptions.

Despite a challenging fiscal year 2020 the Indian EV industry witnessed a 20% rise in domestic sales. According to data released by Society of Manufacturers of Electric Vehicles (SMEV), in India EV sales were 1,56,000 units in FY20 as against 1,30,000 units sold in FY19. This figure does not include E-rickshaws which are largely with the unorganized sector. Sale of around 90,000 units of E-rickshaws were reported.

Table 2: EV Sales in India 2019-20

EV sales in FY20 and YoY change:

Segment	FY20	FY19	%Change
Cars	3400	3600	-5.5
Two-Wheelers	1,52,000	1,26,000	20.63
Buses	600	400	50
Total	1,56,000	1,30,000	20

Source: SMEV

In the FY20, out of the 1,56,000 electric vehicles sold, 1,52,000 were two wheelers, 3400 cars and 600 buses, the corresponding figure for FY19 was 126,000 two wheelers, 3600 cars and around 400 buses making a total of 1,30,000electric vehicles.

Despite the pandemic the EV sales remained positive. Experience of clean air in polluted cities left a marked impression on the minds of the people. Government policy impetus and consumer willingness will be the key drivers of the E-mobility sector in the coming years.

EV sales in India are driven by the two wheelers segment, the share of four wheelers is still very small. Due to government initiatives and support under FAME II, the two wheelers industry started in a power mode in 2020. In the two wheelers segment 97% share is of electric scooters and a very small share of 3% is of motorcycles. Low speed scooters that go to a maximum speed of 25km/hr. and do not require registration constitute 90% of the total three wheelers sold in India.

Two wheelers are the prime drivers of the Indian EV market and have the maximum growth potential. India is a populous middle-income country; the demand patterns will remain skewed towards two wheelers in future also. A new experiment is being made in this segment, two wheelers are being sold without batteries and customers are paying for batteries like fuel. This will enhance affordability.

E-rickshaws are a special challenge in the Indian EV market. The e-rickshaw network in India is pertinent for providing the first and last mile connectivity. A huge unorganized market of e-rickshaws exists. Due to the nature of operations in the unorganized sector the acquisition costs and the operations costs are very low (vehicles are without licenses, irregular fares etc.) Only 0.66% of three wheelers utilized the incentives under FAME I. The unorganized sector also imports complete knock down (CKD) kits for e-rickshaws from China, so majority of manufacturers do not meet the FAME scheme eligibility criteria due to the low-quality parts manufactured locally or imported. The e-rickshaw market was heavily impacted during the severe lockdowns when mobility was restricted. As the economy is recovering from the COVID shock, the e-rickshaw segment presents a great opportunity in the EV sector.

For minimizing the impact of economic shock of COVID on the e-mobility sector the two wheelers and three wheelers' segments must be focused on. A market forecast by Frost and Sullivan suggests that electric two wheelers' numbers will reach 30 lakh units in sale volume and e-rickshaw numbers will reach 10 lakh units in 2025. These two segments will be the escalators and will lead the e-mobility goals for India in the short and the medium term. These are the segments which need to be targeted in the shorter time horizon.

Leveraging Pandemic Recovery to Push Electric Vehicles

Recovering from the pandemic and the resulting economic slowdown can catalyze change towards new business models and strategies. New technologies can be adopted for clean air and climate. Green investments for recovery can help achieve both growth and a cleaner environment. India needs to link the post pandemic recovery with a firm roadmap for the EV sector. There is a need to ensure that the current policy framework remains on track and there is a green recovery funding attached to FAME II. There should be firm steps and a strong mandate towards transition to zero emissions.

The pandemic is still not over, the EV industry can benefit from the behavioral changes in the population. The fiscal policies and other incentives can leverage themselves to benefit the growth of EV industry.

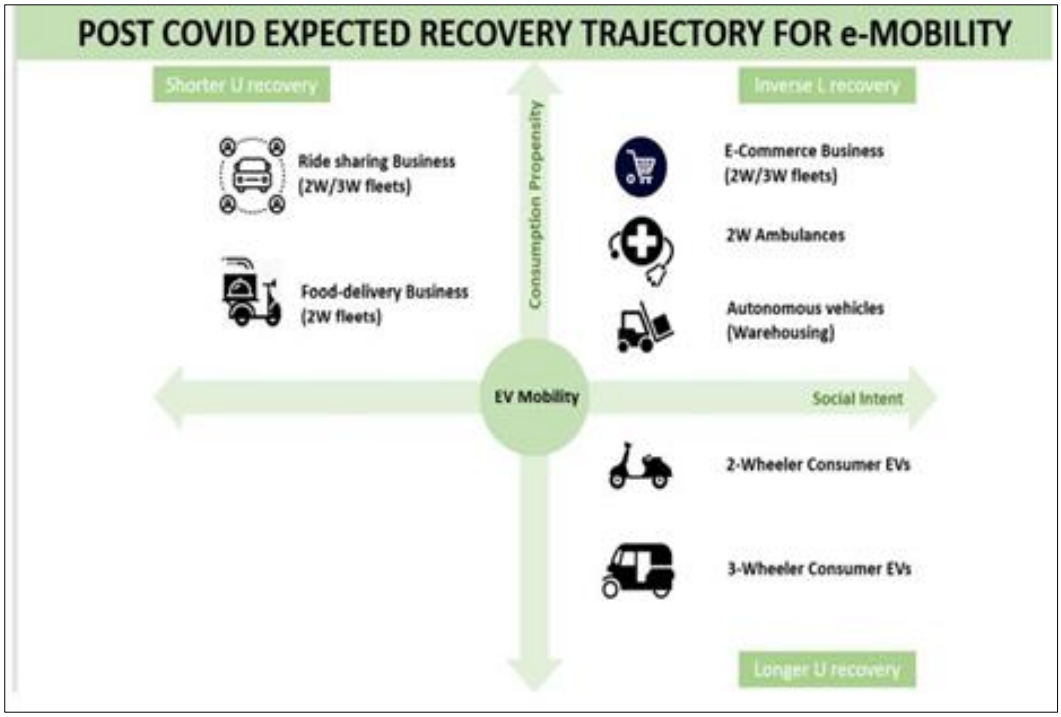

Fig 1: Four Quadrant Diagram Showing Post-Covid Trajectory of Evs

Certain pandemic related behavioral changes can be analyzed in terms of consumption propensity and social intent to predict the trajectory for e-mobility. E-commerce business has picked up during the pandemic and e-commerce companies are realizing the economic benefits of EVs and are converting their fleets to electric vehicles. E-carts are becoming a convenient and cost-effective means of short distance logistics. Motor bike ambulances in India, which provide accessibility to health services, have witnessed a high consumption propensity and social intent during the pandemic. The new demand for e-commerce also led to a surge in demand for autonomous vehicles for warehousing services. An inverse L shaped trajectory is predicted for e-commerce business fleets, two wheelers' ambulances and warehousing electric vehicles.

Two wheelers and three wheelers in the passenger segment have dominated the EV space in India. Social intent is large for these two, but due to fall in income levels the consumption propensity will remain low till economic growth reaches the pre pandemic level. Although sales have not fallen considerably in these segments, the inflection point will be delayed by the pandemic. A longer U-shaped recovery is expected in these two segments.

Due to social distancing and fear of infection the ride sharing business and food delivery business have been affected to a great extent. The two wheelers and three wheelers' fleets in these two segments will recover once the vaccination drive picks up and the impact of pandemic tapers off. A shorter U-shaped recovery is expected in these segments.

The analysis of consideration point and inflection point will help understand the EV penetration across segments in the coming decade. Consideration point occurs when the consumers start considering purchase of EVs while making vehicle purchase decision. At this point market penetration is very low, new models are being launched and performance and cost parities are being worked out.

The inflection point occurs when the various aspects related to EV performance, cost, technology, and the enabling ecosystem get established. Inflection point onwards the market gathers momentum and moves towards faster growth rates.

Table 3: Consideration and Inflection Points for EVs

User Segment	Vehicle Segment	Consideration Point	Inflection Point
Public Transportation	3W-L3, 4W	2018	2023
E-Commerce / Delivery	3W-L3,3W-L5,2W	2019	2022
Personally Owned	2W	2021	2024
Personally Owned	4W	2022	2026

As India aims to become a major electric vehicle market in next ten years, the inflection points for various segments of EVs can be delayed due to the pandemic. Demand for electric vehicles in the e-commerce sector will sees a boost, with inflection point as

early as 2022. There will be delays in demand surge in the passenger two wheelers and four wheelers due to impact of the pandemic on income levels. Public transportation related EV demand will also witness a further pushing of inflection point as people will prefer self-owned vehicles for commuting.

Case for a Green Recovery

In the post pandemic scenario, the government policy package should aim at delivering positive social, economic and climate outcomes. The governments aspirational growth targets will unfold tremendous development of infrastructure in the coming decade. Growth entailing a green recovery can address the problems of job creation as well as environmental degradation and climate change. India will also witness exponential urbanization in the coming decade with nearly 40% of its population is expected to live in urban areas by 2030.

The urbanization process must integrate growth with low carbon solutions. Presently there is a public appetite as well as political opportunities to shift towards low carbon solutions. one of the dimension of this shift towards low carbon solutions is shift of mobility towards electrification. Climate Smart Cities Assessment Framework (CSCAF) is a step by the government towards holistic, climate responsive urban development. Under this framework mobility and air quality linkages have been identified and promotion of electric shared mobility has emerged as one of the solutions to achieve ambient air quality.

Urbanization propelled EV demand will accelerate mobility transition in India. the pace of EV adoption has picked up in the past decade but is expected to grow further in the coming decade. Electric Vehicle sales in India have grown at least 9 times in the past four years, with two wheelers scooters driving the growth. With new innovations and extensive R&D in the electric vehicles ecosystem, things will change in the coming decades. India must leverage its economic recovery towards a green recovery. If the need for green recovery is ignored, then it can be economically disruptive for the industry in the long run.

In the past a flawed fuel pricing policy skewed the market towards diesel cars. Automobile industry expanded towards diesel vehicles in disregard to environmental and health concerns. Subsequently when the fuel price differential narrowed down; environmental action against diesel cars ramped up in Delhi and NCR and there was a movement towards Bharat Stage VI standards 2020, the diesel vehicle production rationalized. This posed considerable business risks.

The government's fiscal based support and policy initiatives must have a green roadmap. Concerns about environment and health impacts cannot be ignored. This pandemic induced crisis will lead to finding sustainable solutions for growth.

According to Frost and Sullivan, 2022-2023 will be the golden period for the Electric Vehicle sector. There will be new launches, battery and components prices will come down and infrastructure will be created. India being a middle-income country the growth in the EV market will be skewed towards two wheelers and e-rickshaws and e-autos. The focus should now be on increasing investment on localized manufacturing across the value chain, skill development and creating fast charging networks. Localization of the supply chains is taking place under FAME II framework. This will lead to manufacturing cost reduction and bringing about a parity of prices of electrical vehicles and the fossil fuel vehicles. All this should be supported by more short-term incentives by the government.

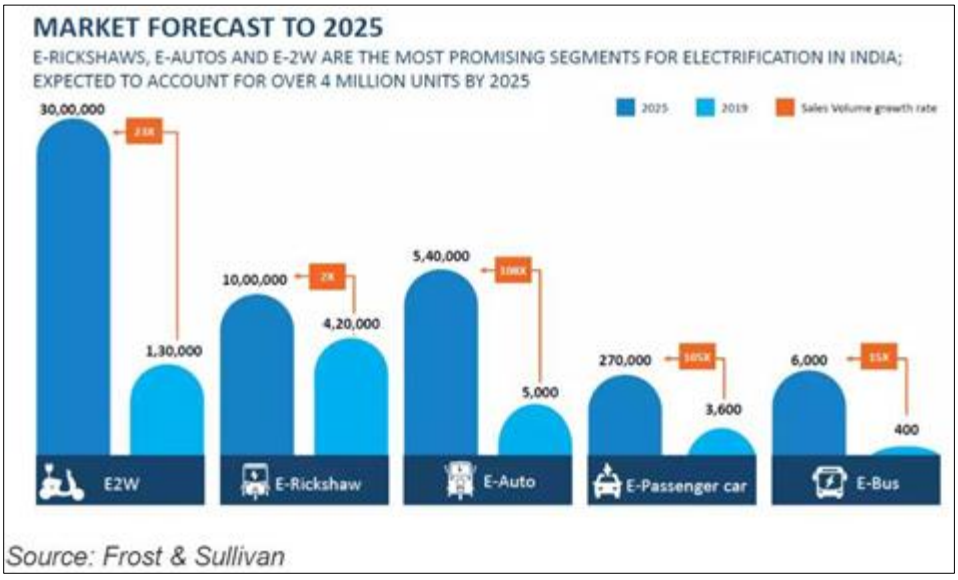

Fig 2: EV Adoption Forecast 2025

With strong support from central government policies many state governments are also formulating and adopting EV policies. Karnataka was the was the first Indian state to roll out its Electric Vehicle and Energy Storage Policy 2017. Recently the Delhi government notified its Electric Vehicle Policy 2020. The Delhi EV policy comes in the backdrop of Delhi being declared as the most polluted capital city of the world. It is an ambitious policy targeting registration of 5 lakh electric vehicles by 2024. Other states like Kerala, Maharashtra, Andhra Pradesh, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand, and Bihar, have formulated EV policies. Active role of state governments will provide an impetus for fast growth in the EV sector.

Government Scrappage Policy should be also linked to the EV adoption. Removal of polluting vehicles from roads to reduce

carbon emissions will stimulate the EV market. There should be conditional link between EV and Scrappage policy. Re registration fee should be increased, and direct financial incentives should be increased. The Voluntary Vehicle Scrappage Policy announced in the budget of 2021 will provide a big boost to consumption in the automobile sector. This vehicle scrappage policy will pave way for higher adoption of EVs in the future. The policy will be implemented in India starting April 2022.

Tightening of fuel efficiency norms for passenger cars, two wheelers and commercial vehicles will also accelerate EV adoption in India. Corporate average fuel consumption standards for passenger cars will be introduced in 2022. Currently these norms are very weak and do not induce inclusion of EVs in corporate fleets.

State level policies to create a bottom-up pressure, scrappage linked to EV adoption and a stringent fuel efficiency norms will enable an EV adoption agenda, in the economic recovery process. For attaining sustained growth after COVID-19 dies down, electrification of the mobility sector will play a tremendous role. It would lead to cutting emissions of GHG and job creation through localizing the supply chains. The market for batteries, components and charging infrastructure can generate a significant stimulus for new investments in a favorable policy scenario. The government target of 30% EV sales by 2030 holds a good promise for environment as well as the economy.

Concluding Observations

It is a well-recognized fact now that the future fuel of transportation industry is electricity and to have sustainable growth India requires large scale EV adoption. During the peak time of the first wave of COVID-19 in India there were large scale supply disruptions in the EV manufacturing which is highly dependent on imports from China, South Korea, Japan, Taiwan, and some European countries. The COVID-19 pandemic is far from over yet, however the economic recovery process after the initial shock of lockdowns, has taken off.

The intensity of impact of the pandemic on the EV industry will depend on factors like fall in purchasing power of the people, speed of economic recovery which will be largely dependent on fiscal stimuli, and the intent and mandate of the various government EV policies. The economy is resilient and responding to various fiscal initiatives of the government. FAME II and various state government policies are giving demand side incentives and are creating a framework for localized supply chains in the EV ecosystem. However, the government is dealing with massive health and economic costs of the pandemic and there is little room for more generous fiscal packages for EV adoption, which must be accelerated without relying on the exchequer money.

Social and behavioral changes induced by the pandemic will also have an impact on EV market. The consumers are eager to see blue skies, breathe clean air and build a resilient world for the future generations. All this will lead to a positive consumer response towards EV adoption. There is increase in e-delivery system and subsequent electrification e-delivery fleets will boost movement towards clean energy. E-three wheelers will take a hit due to social distancing norms, affordable electric two wheelers market will see a considerable surge in demand.

Despite fall in global crude oil prices, oil prices in India did not fall due to government taxes on various petroleum products. Therefore, the economic viability of EVs remains intact from the consumer perspective.

Cost of electric vehicles, components and setting up of charging infrastructure are few deterrents for EV adoption in a cost-conscious market like India. Bring down costs, creating consumer awareness, easy access to charging stations are pertinent variables to be developed for increasing EV penetration.

For EV adoption the focus should also be on increasing clean kilometers along with increase in EV units sales. Electrification of high-utilization vehicles such as public transport, ride hailing, employee transport, and urban freight and deliveries can provide demand and growth for the EV market.

Transformation and decarbonization of the mobility sector will create sustainability in the growth and development process and solve the environmental problems. Development of new technologies will bring down the green premiums in the coming years and there will be faster adoption of electric vehicles in India.

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