Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

In Cooperation with

सत्यमेव जयते

NITI Aayog

Status quo analysis of various segments of electric mobility and low carbon passenger road transport in India

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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Foreword by NITI Aayog

In 2015, India signed the historic Paris climate agreement along with more than 170 nations, marking a significant step that brought together developing and developed nations in combating global warming by cutting down on greenhouse gas emissions.

At COP21, India had pledged to reduce its carbon footprint by 33-35% by 2030 below 2005 levels. It has also pledged to increase the share of non-fossil fuels-based electricity to 40 per cent by 2030. Considering the same, it is high time to switch to alternative fuel options to minimize air pollution and rising crude oil import bill of the country so that we can meet our commitments at the global level.

The transport sector in India is the largest user of oil and second largest source of CO2 emissions world-wide. India has seen a rapid increase in adoption of automobiles since the last ten years. Currently, Indian transportation sector accounts for one-third of the total crude oil consumed in the country, where 80% is being consumed by road transportation alone. It also accounts for around 11% of total CO2 emissions from fuel combustion.

Government of India had notified the National Electric Mobility Mission Plan 2020 which seeks to enhance national energy security, mitigate adverse environmental impacts from road transport vehicles and boost domestic manufacturing capabilities for Electric Vehicles. In addition to this, the Government has notified Phase-II of Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme to stimulate the market of EVs in the country, de-licensed the charging infrastructure business and specified guidelines & standards for charging infrastructure for electric vehicle thereby opening up the market of public charging infrastructure & ensuring a roadmap for development of charging infrastructure, and introduced various financial incentives to reduce upfront cost of EVs and charging infrastructure.

While, Government of India has taken crucial steps towards faster adoption of EVs, there are several challenges and gaps existing in the EV ecosystem that must be addressed. In this context, the report on "Status quo analysis of various segments of E-mobility and low carbon passenger road transport in India" is a welcome initiative. It is believed that that the report will stimulate concerted and coordinated efforts by Policy makers, Regulators, Utilities, OEMs and other value chain players to understand the existing gaps in current landscape of EV industry India and the key action items required for enabling accelerated adoption of EVs to support India's vision of transitioning to sustainable and green mobility.

The team acknowledges and appreciates the contributions of all the stakeholders, who provided critical inputs in shaping up the report.

About the study

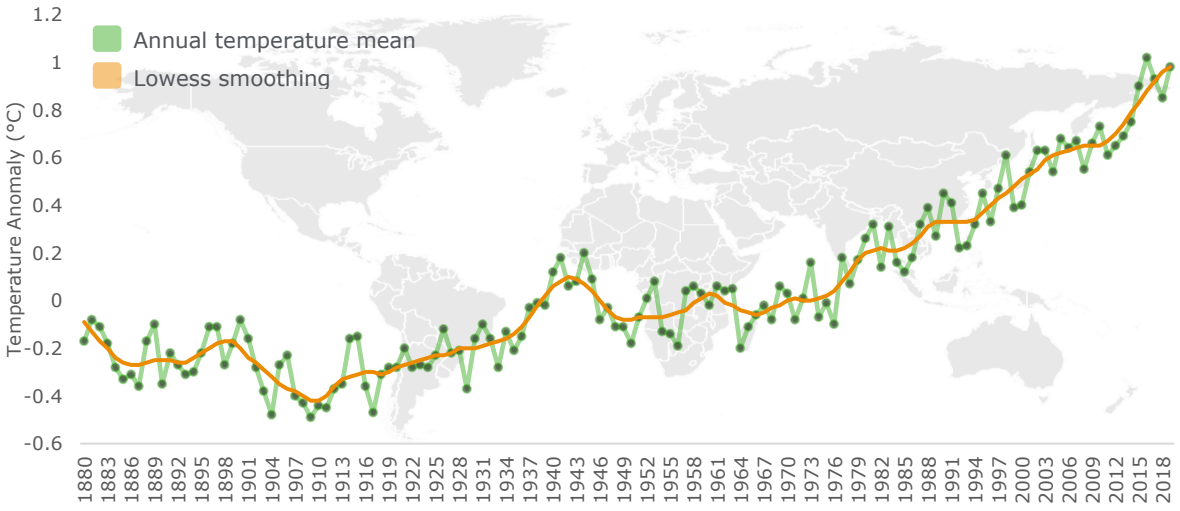
On behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Nationally Determined Contribution-Transport Initiative for Asia (NDC-TIA) is a joint project of seven organisations and with the engagement of China, India, and Vietnam. It aims at promoting a comprehensive approach on decarbonizing transport i.e. a coherent strategy of effective policies that are coordinated among various sector ministries, civil society, and the private sector. The overall aim of the project, which is being implemented by the consortium of seven organisations together to support countries in facilitating and informing these stakeholder processes and in developing selected climate actions. This enables partners to make a sectoral contribution towards achieving their NDCs and increase ambition in transport sections of long-term strategies and 2025 NDCs.

In this context, under the regional technical assistance programme NDC-TIA; one of the activities was to "Perform a status quo analysis/investigation on different segments in India" (e.g. 2W, cars, trucks, buses, freights) under its International Climate Initiative (IKI). This analysis provided us the existing status, opportunities, challenges, gaps, and way forward for low carbon road transport in India. Different types and technologies, services, business models, standards, protocols, contribution in India's long-term NDCs and other climate action and clean energy targets were assessed for various segments of low carbon road transport including electric mobility.

The main objective or goal of this study is to examine the Low-Carbon Road Transport (LCRT)/E-mobility development, accomplishments so far, supported by the policy, schemes, and regulatory interventions in India.

The global average temperature is on a continuous rise and has been a cause of worry for leaders across the world. As per NASA, 19 out of the 20 warmest years have occurred in the 21st century. The rise in change in global temperature was an alarming bell and therefore needed immediate global attention. The 21st yearly session of the Conference of the Parties (COP21) took place in Paris on 30 November 2015. It laid the foundation for global climate change agreement that came into being on 04 November 2016. The central aim of the Paris Agreement was to strengthen the global response to the threat of climate change by limiting the global temperature rise to 1.5 - 2 degree Celsius above pre-industrial levels for the 21st century, along with increasing the ability of countries to deal with the impact of climate change. Worldwide, Energy Sector had contributed 73% of GHG emission[1] in 2016. Within the energy sector, transportation accounted for 7.9 GtCO2e in 2016, or 15% of total emissions.

Figure 1 Change in global surface temperature relative to 1951-1980 average temperatures



Source: 1 NASA's Goddard Institute for Space Studies (GISS)

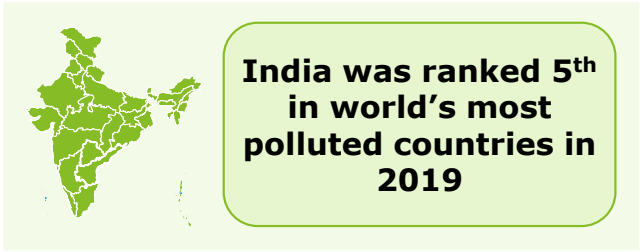
[1] Greenhouse Gas Emissions by Countries and Sectors (access here)

Transport industry of India and emission challenges

With one of the lowest motorization rates in the world (22 cars per 1,000 people[2]), India is among the fastest growing countries in transportation sector. From 2011 to 2020, India's domestic vehicle sale (2W, 3W, Passenger Vehicle, Commercial Vehicle) has grown at ~4% CAGR. With rising income and rapid urbanization, the Indian mobility market is expected to expand rapidly.

Transportation, however, has contributed significantly in India's overall GHG emission. During year 2016, transport sector contributed to 270.6 MT CO_2e of GHG emission[3], third highest, only after power industry and industrial combustion. Within transportation, road transport has been the highest contributor to the GHG emission[4]. With the rising transport industry, India is also facing intense emission challenges.

Figure 2 Pollution level in India in the past has been alarming



Source: 2 IQAir

India therefore has a great opportunity to leapfrog towards decarbonizing the transport system to meet its NDC commitments and to overcome environmental issues which would likely to become more severe, if remain unaddressed, as India has huge prospects for growth.

LCPRT and e-mobility: India's solution for sustainable growth of transportation sector

As India is experiencing acute challenges in controlling its carbon emissions, the country expects the emission level to grow even further as its transport industry is expanding. To tackle the emission from the transport industry, India is moving towards "zero or low carbon emission" transportation model by promoting the use of alternative fuel vehicles and Electric Vehicles (EVs).

In 2009, through its National Biofuels policy, India sets an "aspirational" target to blend 20% biofuels into the diesel and petrol mix by 2017. However, it has fallen well short of these targets. So far, it has attained only around 2% bioethanol and 0.1% biodiesel blend in 2018. Further, India came up with its first passenger vehicle fuel efficiency standards in 2014 that came into being in 2017. However, they are still less stringent than the EU norms.

In addition, India has also set the national target of achieving 30% EV sales penetration by 2030 and launched National Mission on Transformative Mobility and Battery Storage to promote localization of EV component manufacturing. Alongside the various central level interventions, several states have also notified their respective policies for promoting Electric Vehicles which cover subsidy and tax exemptions, among other incentives, for consumers/ buyers.

However, with all these efforts in place, the market for EVs in India hasn't picked-up as expected.

Low growth in this domain instigates to do a deeper analysis to identify the barriers, challenges and gaps existing in the EV ecosystem that needs to be addressed to unveil the growth of e-mobility and other LCPRT systems in India.

[2] India motorization rate (access here)
[3] The Carbon Brief Profile: India (access here)
[4] Distribution of greenhouse gas emissions from the transport sector in India in 2014 by type (access here)

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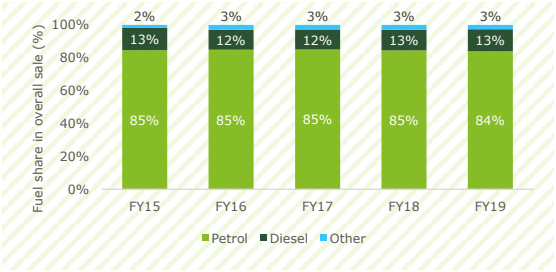
Executive summary

India is the fifth largest automobiles market in the world, with 3.82 million units sold in 2019. It is expected that factors such as growth in urbanization, increase in per capita income and improvement in economic indicators would increase the demand for vehicles going forward. Historically, conventional technologies such as petrol and diesel have dominated the fuel type in the total vehicle population (*conventional vehicles accounted for 97% of total vehicle sales in FY19*). However, it is imperative that a growing share of conventional vehicles in the overall passenger automobile mix, would lead to rising imports of oil thereby aggravating the energy security concerns, increasing the risk of exposure to oil price fluctuations in future and leading to a consequential growth in GHG emissions.

Figure 3 Fuel-wise share in overall vehicle sale

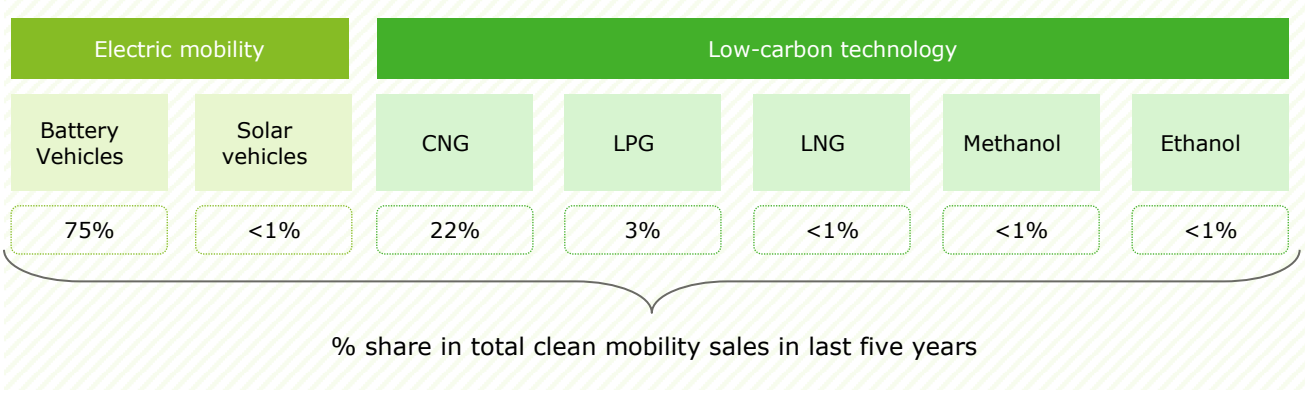


Source: 3 Vahan portal

The use of Electrical Vehicles (EVs) – which have an air pollutant emission level of zero, has emerged as the most promising alternative transportation method. The transition towards Electric Vehicles (EVs) is one of the most promising pathways to increase energy security, reduce oil imports, lower carbon emissions, and improve air quality in Indian cities. The Government of India has identified electric mobility as one of the key focus areas for development.

Currently, the overall share of electric vehicles and low-carbon road transport technology in total vehicle sales in the country is less than 1%. Although, several policy measures have been taken to increase adoption of clean mobility in India, however, the country is still awaiting to witness a large scale adoption of EVs.

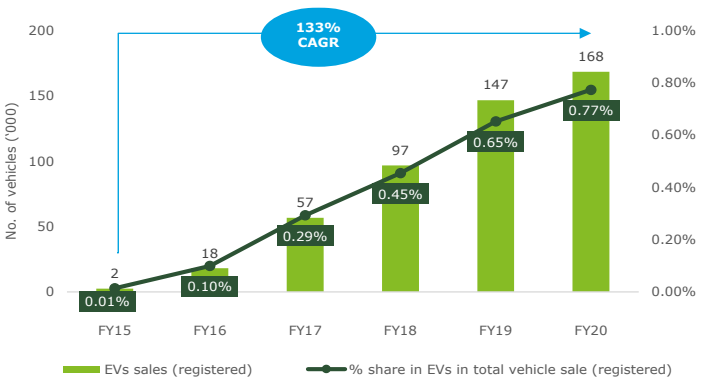
Figure 4 Clean and low carbon technologies on road in India with share in sales



Source 4: Vahan dashboard; % are rounded

Central and State Governments in the country have either taken or are in the process of adopting several interventions for promoting growth of EVs and charging infrastructure growth. Govt. of India in the last 10 years has notified numerous measures including fiscal incentives for electric vehicle buyers, incentives for manufacturing of EV and charging equipment, financial support for public EV charging infrastructure development etc. to support uptake of electric vehicles in the country. The timeline of various policy / regulatory initiatives is provided Figure 6. On the back of such measures, it has been witnessed that the adoption of electric vehicles has significantly

Figure 5: Year-wise EV sales trend from FY15 to FY20 in India



Source 3: VAHAN dashboard

increased in last five years (industry grew at CAGR of 133%)

Figure 6 Key national level initiatives to promote adoption of electric vehicles - Timeline

Source 4: Government notifications

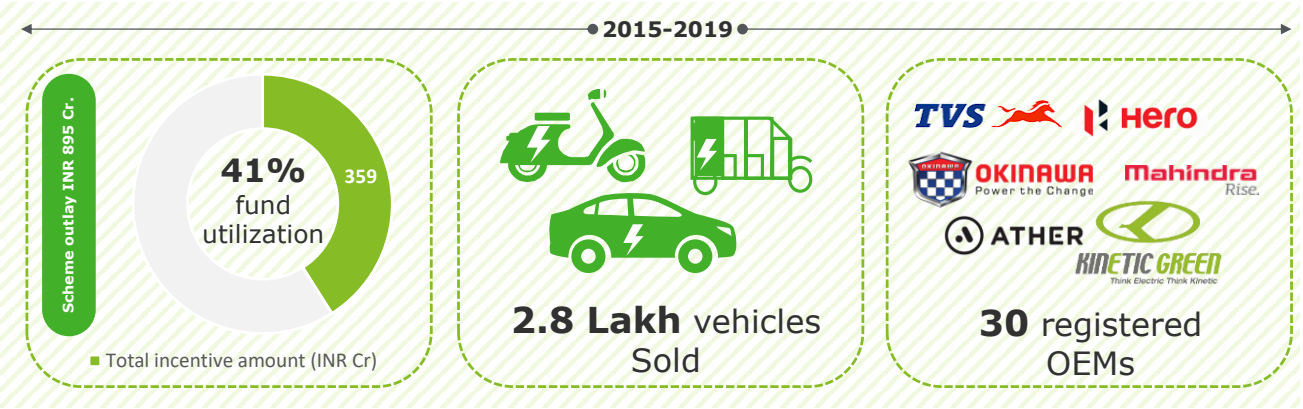
The NEMMP (National Electric Mobility Mission Plan) 2020 lays the vision and provides the roadmap for achieving significant penetration of efficient and environmentally friendly electric vehicles. As a flagship scheme under the NEMMP 2020 mission, FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) was launched in by government in 2015.

FAME Phase I

Phase 1 of the scheme was initially launched for over a two-year period starting from FY 2015-16 to FY 2016-17 with an overall outlay of INR 795 Cr. The scheme was later extended four times for six months each with additional outlay of INR 100 Cr.

The funds were used to provide direct subsidy to the EV buyers. Along with direct subsidy, grants for specific projects under pilot projects were sanctioned along-with financial support for R&D/technology development and public charging infrastructure. Under the FAME-I scheme, 465 buses were sanctioned to various cities/states.

Figure 7 Snapshot of FAME I scheme

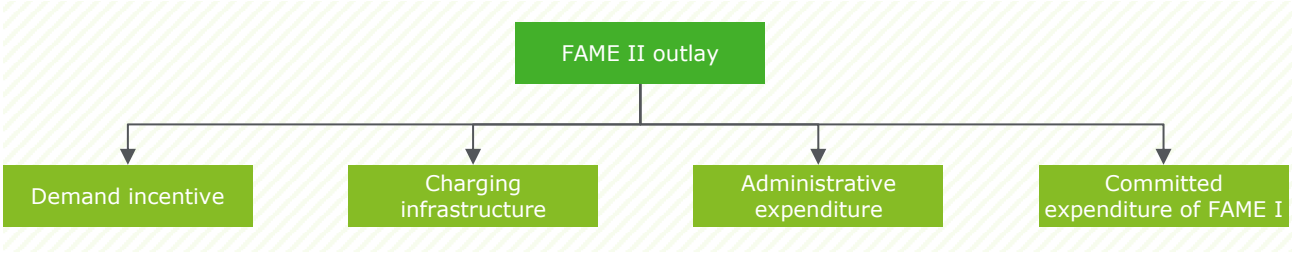


Although the FAME I scheme failed to utilize the overall amount of sanctioned funds, it has provided the necessary impetus for future uptake of electric mobility in Indian market.

FAME Phase II

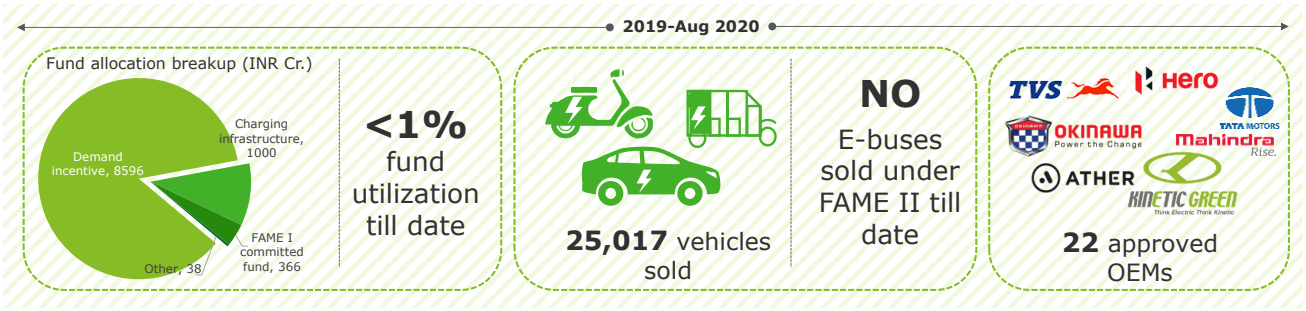
In March 2019, the MoHI&PE notified FAME –II scheme with an increased outlay of Rs 10,000/- crores, which includes a spill over of Rs 366 Cr from FAME-I. FAME-II scheme has been made applicable from FY 2019-20 till FY 2021-22 and aims to leverage the buzz created by FAME I to boost the uptake of EVs in the country. The scheme is majorly focused on providing suitable incentives to buyers since 86% of the scheme outlay is reserved for demand incentive for purchase of EVs. The scheme aims to support sale of ~ 1.56 Mn vehicles across all categories. The overall outlay is segregated into four categories:

Figure 8 Outlay break-up under FAME II



The current utilization of funds under FAME-II is at an abysmally low level (less than 1%). There are issues and concerns around FAME-II which needs to be addressed by policymakers to achieve results envisaged under the scheme. Key policy gaps are summarized in the section below:

Figure 9 Snapshot of FAME II and progress till date



Key policy gaps in FAME II scheme

Gap 1	**No incentive for vehicle scrappage/ Retro fitment allowance**	The incentives under the policy are for purchase of new EV only, however it does not provide for any scrappage incentive, to encourage ICE vehicle owners to scrap their vehicle for EVs. Further, it does not talk about any retro-fitment allowance for converting existing ICE vehicle to EV.
Gap 2	**No mandate for EV adoption**	Unlike China and California, there is no EV mandate provided under the scheme that led to following issues: 1. **Insufficient development of charging infrastructure**: In China, State Owned Grid Utilities are investing hugely in development of charging infrastructure; EV mandate in the country provides assurance to investors in terms of business continuity, higher utilization of assets and early payback. 2. **Investment dilemma among automobile manufacturer**: Currently, automobile

		manufacturers have hugely invested in ICE technology. India is transitioning towards BS IV to BS VI standard and EV at the same time. In the absence of clarity on certain uptake of EV (through mandate) it will be very difficult for the automobile industry to do parallel investment in two technologies simultaneously as limited resources are available with industry.
Gap 3	**No provision for fee-bate concept**	ICE vehicles have been in use since decades and therefore users are comfortable in using it. A huge inertia has been developed among consumers that restricts them to switch to EVs. Presently, there is no concept of fee-bate being used in the policy that allows to put huge fees/ penalty /cess/surcharge in using ICE vehicle that may reduce the inertia carried by ICE technology. (Sweden has increased taxes on cars that create pollution, thereby dissuading consumers from buying vehicles with internal combustion engines as they contribute significantly to noise and air pollution)
Gap 4	**Additional riders for availing subsidy**	Under FAME I, two-wheelers with top speed of up to 25km/hr were qualified for incentives of up to INR 17,000 and INR 22,000 for high speed ones. However, riders put under FAME II mandated to have a minimum range of 80 km per charge and minimum top speed of 40 kmph to qualify an electric two-wheeler for an incentive of INR 20,000. The higher performance parameters comes at a higher cost that have excluded the large section of society that are price-sensitive from EV purchase. Ather's 450X model (Top speed: 80 km/hr), Revolt's RE400 (Top speed: 80 km/hr), Bajaj's Chetal (Top speed: 80 km/hr) all priced at more than Rs. 1.15 Lakh. Avon E Star (range 65km/charge, top speed less than 50kmph comes at Rs. 60,000)
Gap 5	**No subsidy for private 4W**	With growing per capita income of the country, it was expected that there would be an increase in purchase of private 4Ws. However, the FAME II is providing subsidy only for public 4Ws.
Gap 6	**Requirement of re-certification**	To be eligible for demand incentive OEMs are mandated to undergo re-certification process for conformity check to obtain certificate of 'FAME II India Phase II eligibility fulfilment' from approved testing agencies in India. Further, the OEMs need to get the certificate in each year to claim the subsidy. This creates and unnecessary administrative bottleneck for OEMs
Gap 7	**Requirement of indigenous component**	FAME –II guideline requires OEMs to use certain percentage of indigenous components to be eligible for availing subsidy. However, the Auto ancillary industry for EVs is at a nascent stage. To have a large number of EVs on road, there is a need for well-developed

		supply chain of auto components. In absence of the same, the requirement of indigenous components acts as a barrier in realizing the incentives. . Further, limited number of indigenous manufacturers of EV components leads to import of such components thereby driving up the prices of EVs.
Gap 8	**No institution is assigned with responsibility of developing charging Infrastructure**	Uptake of EV and setting-up of charging infrastructure is a chicken and egg problem. FAME-II allocated Rs. 1000 crore as incentive for developing charging infrastructure. However, presently there is no centralised institution which is assigned the responsibility of development of country wide charging infrastructure. In China, the guidance for developing electric vehicle charging infrastructure for 2015–2020 was developed as focused policy document to develop charging infrastructure across country. It has established clear goals for national and regional electric charging infrastructure layout and identified strategic regions for development of charging infrastructure. State Grid Corporation of China, a State-owned electric utility is investing hugely in development of charging infrastructure across country.

Further, under the FAME scheme, GOI has earmarked ~40% of the demand incentive for purchase of e-buses. In line with the same, NITI Aayog issued a Model Concession Agreement (MCA)[5] in January 2019 to support electric bus procurement under the scheme. The document provides a framework for city authorities to procure e-buses under the Gross Cost Contract (GCC) mode of procurement.

Through such an intervention, the GoI intends to provide a push for purchase of e-buses by earmarking highest share of demand incentive to e-bus vehicle category. However, till date, no e-bus has been operated under FAME-II scheme. There are multiple issues being cited by industry players in the existing MCA which have been highlighted below:

Gaps in Model Concession Agreement (MCA)

Gap 1	**Contract tenure is more than asset useful life**	The Model Concession Agreement recommends a contract duration of 16 years which is longer than the life of a typical e-bus. This poses risk to both Operator and Authority (STUs) alike. (i) Risk to Operator – Since the contract period is more than useful life of the asset, the Operator may either needs to replace the asset or have to invest huge amount in maintenance, after using the e-bus for its maximum useful life, in order to oblige the SLAs specified in MCA This would also lead to higher quotation in response to the bid. (ii) Risk to STUs –The e-bus technology is at evolving stage and such a long commitment to the current technology may restrict STUs from taking advantage of upcoming/better technologies.

[5] Model Concession Agreement for Operation and Maintenance of Electric Buses in Cities (OPEX Model) (access here)

Gap 2	**Transfer of asset(e-buses) is not specified**	MCA clearly specifies that the maintenance Depot along with its entire infrastructure needs to be transferred to STUs by Operator upon termination of the Contract. However, it doesn't provide clarity on transfer of e-buses to STU upon termination of the Contract.
Gap 3	**Technical Specifications suitable for ICE buses are specified**	As per MCA, the e-buses would need to conform to the Urban Bus Specification (UBS)-II issued by the Ministry of Housing and Urban Affairs (MoHUA) in April 2013. While UBS II covers many relevant aspects, it was developed for Internal Combustion Engine (ICE) based buses and does not capture many of the e-bus related specifications like batteries and charging infrastructure. MCA could have specified the common bus specification for procurement. This would be helpful for OEMs to standardize their assembly lines. City wise variants would cause issues in standardization of assembly line, obtaining approvals etc. leading to lost opportunity of cost saving in manufacturing.
Gap 4	**Charging technology**	Operator can choose any charging technology as per the requirement. However, MCA does not put any obligation on STU to facilitate the Operator in case he wish to put Pantograph Charging or wireless charging methods. MCA confined the premises of assistance up to Depot charging. This has limited the convenience of Operator to trade-off with respect to battery size, capacity and cost that becomes available with different charging methodologies for e-bus.
Gap 5	**Development of Charging Infrastructure at each Maintenance Depot**	Development of Charging Infrastructure is a capital intensive exercise. MCA makes its mandatory for Operator to develop Charging Infrastructure at each Maintenance Depot, irrespective of number of buses plying from the Depot (i.e., even for Depot that would have low capacity utilization of charging infrastructure, Operator are still mandated to develop charging station). Instead MCA could have provided the flexibility to Operator to develop optimal Charging Infrastructure at suitable Depots to optimize the overall CAPEX requirement.
Gap 6	**Inappropriate division of responsibility among Operator and STU**	MCA requires the Operator to complete construction of Maintenance Depot within 180 days from Appointment Date. However, it provisioned 1 year for Authority from Appointment Date for completion of road up to the Maintenance Depot. Availability of road up to Depot is an enabler for timely completion of the construction work at Depot. Therefore, instead of Appointment Date, MCA should have to link the due date of completion of construction work at Maintenance Depot with date of availability of road connectivity up to Depot.
Gap 7	**Inefficient way of provisioning for Performance Security**	MCA requires Operator to provide Performance Security (based on value of Contract) for the entire duration of the Contract. However, to reduce the cost of financing of Operator, provision for yearly reducing Performance Security could be made, whereby the amount of Performance Security decreases (in same ratio of amount for which services were successfully rendered) with each completed

		year of satisfactory performance of Contract Obligation by the Operator.
Gap 8	**Damage liability for delay in meeting Conditions Precedent to Agreement, among Operator and STU is unjustified**	Upon not meeting the Conditions Precedent to Agreement, the STU is liable to pay an amount calculated at the rate of 0.1% of the Performance Security for each day's delay, whereas it is calculated at the rate of 0.25% of the Performance Security for each day's delay for Operator
Gap 9	**Escrow Mechanism could be a financial burden for some STUs**	MCA provides for maintaining ESCROW account wherein the Authority shall always, throughout the Contract Period, maintain a balance of at least an amount equivalent to 2 months' estimated fee payable to the Operator. Given the financial condition of STU, this provision could offer significant financial burden on STUs that have poor financial health. Instead of it, two-month revolving letter of credit from state Government could be provisioned.
Gap 10	**No provision to have system generated SLAs**	Manual calculation of SLAs are susceptible to human error and misrepresentation at times. Therefore, an IT enabled system could be warranted in the MCA to create system generated SLAs. Further, MCA has not specified any process for verification of SLAs calculated and provided by the Operator.
Gap 11	**Ambiguity in penalty and incentive provisions w.r.t. SLAs**	MCA specified Six SLAs, however, it is not clear in the document whether incentive/penalty is to be provided separately for each SLA or on achievement/non-achievement of any of single SLA. Further, maximum ceiling of incentive and penalty is not provided in MCA
Gap 12	**Bankability of Project is not considered**	The operation of fleet depends on the availability of adequate charging infrastructure. However, the risk of arranging for upstream power network up to Maintenance Depot is provided with Operator and role of STU is kept limited to providing assistance to Operator in arranging for such connectivity. Inappropriate risk sharing that has an impact on entire business model and revenue stream of the Operator may lead to reduced bankability of the Project. Further, to fund the project, operator would borrow form commercial banks that may offer loan at high interest rate owing to factors discussed above. Such high cost of financing will be passed on to city authorities. Alternative approach of profitable transport utilities (e.g. PMPML[6]) raising money, possibly at lower interest rate, has not been explored.
Gap 13	**Termination payment is not covering the entire debt due, which is further reducing the bankability of the Project**	MCA provides termination of Contract under Force Majeure which encompasses non-Political events, Indirect Political events and Political event. In case of non-Political event, the payment upon termination covers only 90% of the Debt-due less insurance cover.
Gap 14	**Restricting innovation in e-bus procurement**	FAME –II guidelines provides for transfer of demand incentive to OEM/ Operator. Further, MCA specifies the modus operandi for e-bus procurement using Opex based GCC model. Defining of boundary conditions have put restrictions on cities to innovate any

[6] PMPML – P&L Statement (access here)

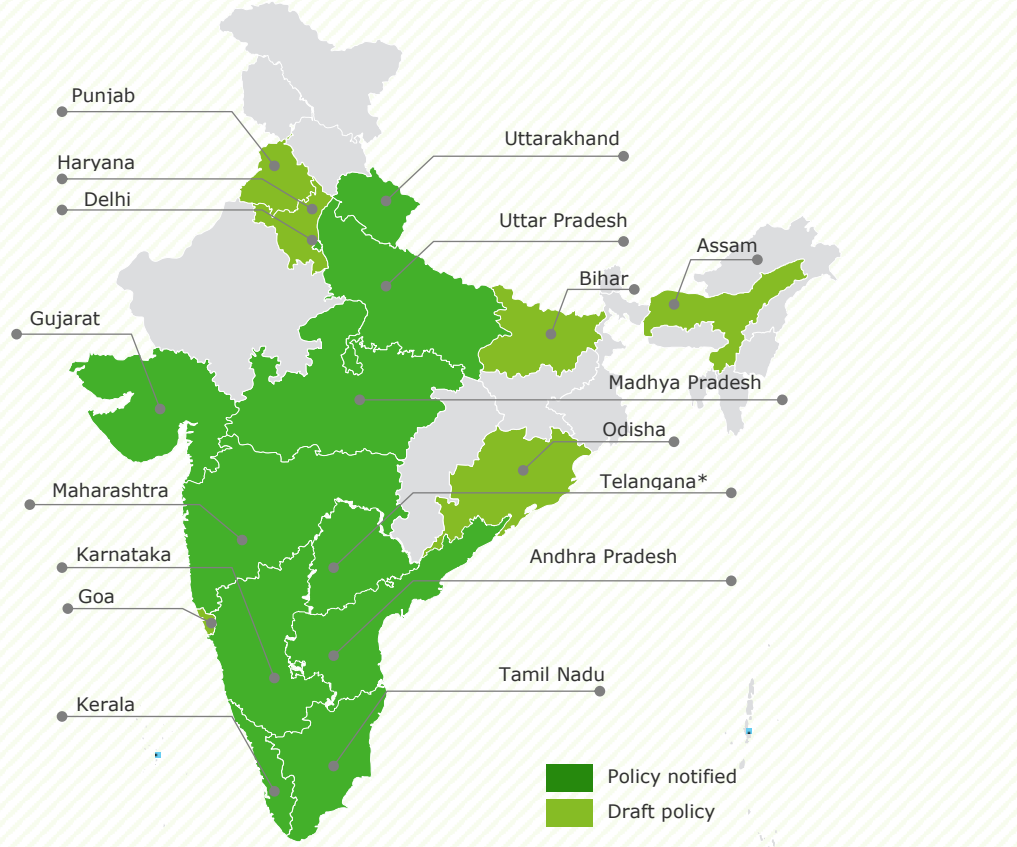
		new procurement/operation methodology that could be better than GCC model or any other model prevalent today.
Gap 15	**Other issues**	i. MCA provide that an open bidding process with RfQ followed by RfP. However, it doesn't provide any guidance on • Minimum technical and financial qualification criteria for bidders • Clarity on allowing International Competitive Bidding ii. Doesn't provide guidance on minimum technical specification requirement for e-buses iii. Guidance on timeline for completion of bidding process iv. MCA does not provide the guidance on the clauses that cannot be changed by States. This leads to inconsistent modification of MCA across States (Review of RFP covering wide variation of MCA clauses is provide *v.* STU to pay Termination payment to operator even if termination is on account of Operator's default

State Government Initiatives

Several states have also notified their EV policies aimed at promoting manufacturing and increasing demand of electric vehicles in their respective states. Karnataka was the first state to release its EV policy. Till date, a total of eleven states have notified their EV policies viz. Delhi, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Gujarat.

The summary of comparison of State EV policy is provided Table 1.

Figure 10 States with notified and draft EV policy



** State Government of Telangana & Gujarat have approved their EV policies, however the final policy is not available in public domain*

Draft EV Policy: Punjab, Bihar, Goa, Odisha, Assam, and Haryana have either published their Draft policies or are in process of drafting

Table 1: Comparision of State EV Policies

Parameter	DL	AP	UP	MH	UK	KA	MP	KL	TN	BR*	PB*	TS*
Institutional Mechanism and Target												
EV target	✓	✓	✓	✓		✓	✓	✓	✓		✓	
Institutional setup	✓	✓		✓		✓	✓	✓	✓		✓	✓
Model EM cities		✓	✓									
Policy Mandates												
EV adoption mandate to institutions		✓										✓
Plan for induction of EVs in government department	✓	✓					✓				✓	✓
Mandate for Discoms	✓	✓	✓	✓		✓	✓	✓	✓		✓	
Mandate for Transport Department		✓				✓						✓
Demand Incentives												
Fiscal Incentives -2 W	✓		✓	✓			✓		✓	✓	✓	✓
Fiscal Incentives -3 W (e-auto, e-rickshaw and e-cart)	✓		✓	✓			✓	✓	✓	✓	✓	
Fiscal Incentives -4 W	✓		✓	✓			✓		✓	✓	✓	✓
Fiscal Incentives -2W fleet/ 4 W (Fleets)		✓					✓		✓		✓	
Fiscal Incentives - Bus				✓			✓		✓	✓	✓	
Fiscal Incentives - Goods carrier	✓				✓		✓		✓		✓	
EV Charging infrastructure												
Incentive for public charging deployment	✓		✓	✓			✓		✓		✓	✓
Incentive for Energy Operator/Battery Swapping station	✓		✓			✓	✓			✓	✓	✓
Incentive for Home/Workplace charging	✓		✓					✓				✓
Manufacturing												
Incentive to manufacturer		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Parameter	DL	AP	UP	MH	UK	KA	MP	KL	TN	BR*	PB*	TS*
Focus on promotion of auto-ancillary manufacturer		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Provision for Industrial Parks and Clusters for EV/Ancillary manufacturing		✓	✓			✓		✓	✓	✓	✓	✓
Battery OEM			✓	✓	✓	✓	✓	✓	✓	✓	✓	
Scrapping and recycling												
Vehicle scrappage incentive	✓						✓				✓	
Battery recycling related provision	✓	✓	✓		✓	✓	✓		✓		✓	
Miscellaneous												
Payment system and information exchange	✓	✓					✓	✓				
Identification of source of funding for various incentives declared in policy	✓						✓					
Skill Development/Job creation	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
R&D	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Public awareness	✓						✓				✓	
Changes in building bye-laws	✓	✓	✓			✓	✓					✓

Note: *Draft**;** DL: Delhi; AP: Andhra Pradesh; UP: Uttar Pradesh; MH: Maharashtra; UK: Uttarakhand; KA: Karnataka; MP: Madhya Pradesh; KL: Kerala; TN: Tamil Nadu; BR: Bihar; PB: Punjab; TS: Telangana

The initiatives taken under State EV policies are commendable, however proper implementation and operationalization of the policy measure would govern the success of EV uptake in the state.

Summary of electric mobility landscape analysis

01

Commitment towards GHG reduction, huge dependency on imported crude oil, high urbanization, and growing population are the key drivers that could propel the transition from conventional mobility to electric mobility. Policy makers and regulators have taken collective effort to promote electric mobility in India. DHI introduced FAME schemes (I & II) to spur the EV demand whereas MoP notified guidelines on installation of charging infrastructure. Electricity regulatory commissions have also brought out special tariffs for EV charging, and ARAI has introduced standards for AC & DC charging. MoHUA has amended Building Bye-laws and Urban and Regional Development Plans Formulation and Implementation Guidelines to make charging infrastructure development as an integral part of urban planning, development and construction.

Along with the policy efforts by the Govt. of India, states have also come out with their independent EV policies to help uptake of electric mobility.

02

Although central government and state government are putting substantial efforts to drive the EV adoption in India, traction can only be seen in 3W and 2W segments. The 3W segment, particularly e-rickshaws, is driving the high adoption rate of EVs. For 2W the major drivers are lower operational cost, ease of charging at home with available infrastructure. However, EVs still need to achieve cost parity with ICE vehicle for large offtake by consumers, especially in the2W segment. High cost of EVs is identified as the biggest bottleneck in adoption of electric vehicles in the country.

Exclusion of 4W private vehicle from FAME – II eligibility for demand incentive along with multiple issues related to high cost, unavailability of adequate charging infrastructure, range anxiety etc. is causing this segment to witness lesser adoption of EVs.

E-buses have not witnessed the required level of traction as envisaged under various policies. Even after allocating more than 40% of total incentive pie for e-buses under FAME – II, no significant traction has been observed. Mandatory requirement of procuring e-buses on GCC model needs to be re-looked with consideration for relaxing requirement of huge bank guarantees as security to increase uptake of e-buses.

03

From supply-side point of view, there are several constraints. For battery manufacturing, India lacks in access to raw materials (mineral resources). EV auto ancillary in India is also at nascent stage with limited manufacturing capabilities. Huge dependency on imported auto component (mainly electronic and electrical) acts as a barrier in attaining price parity with ICE vehicle. Phased Manufacturing Program, Aatma Nirbhar Bharat, and incentives announced by several states in their EV policy is expected to strengthen the supply-side scenario in medium to long run.

04

FAME II scheme allotted 10% of its overall outlay for EV charging however, there has been no significant growth in development of EV charging infrastructure. Administrative procedures of land acquisition and electricity connection, lower utilization of charging infrastructure, absence of provisions for recovery of expenditure through tariffs, absence of regulatory provision for participating in ancillary market etc. are some of the challenges industry is currently facing.

Discoms have not been mandated to actively participate in the development of charging infrastructure. Further, as highlighted above, There exists no regulatory clarity on allowing capex for charging-infra development as pass-through in tariffs.

05

With their inherited capability of existing infrastructure, existing consumer base and superior technical skills, the role of distribution utilities will be crucial for uptake of EV charging.

Discoms need to actively participate in planning for EV charging infrastructure. Random charging of EVs may put strain in the grid. Harmonics from EV charging stations will also impact the power quality of the system. There is need to carry out analysis and determine the need for strengthening the distribution network in order to integrate EV charging stations.

06

Battery constitutes approximately 25 - 40% of the vehicle cost. Battery swapping model allows to take out of the cost of battery from the upfront cost of EVs. The cost can be reduced, and a better value proposition could be offered to consumer for adoption of EVs with prices at par or lower than the ICE vehicle. However, lack of policy guidance on standardization of battery for EVs, and huge upfront capital requirement is posing challenge in massive uptake of battery swapping business model.

07

To incentivize charging infrastructure development, regulatory commission needs to play an active role. This can include the following:-

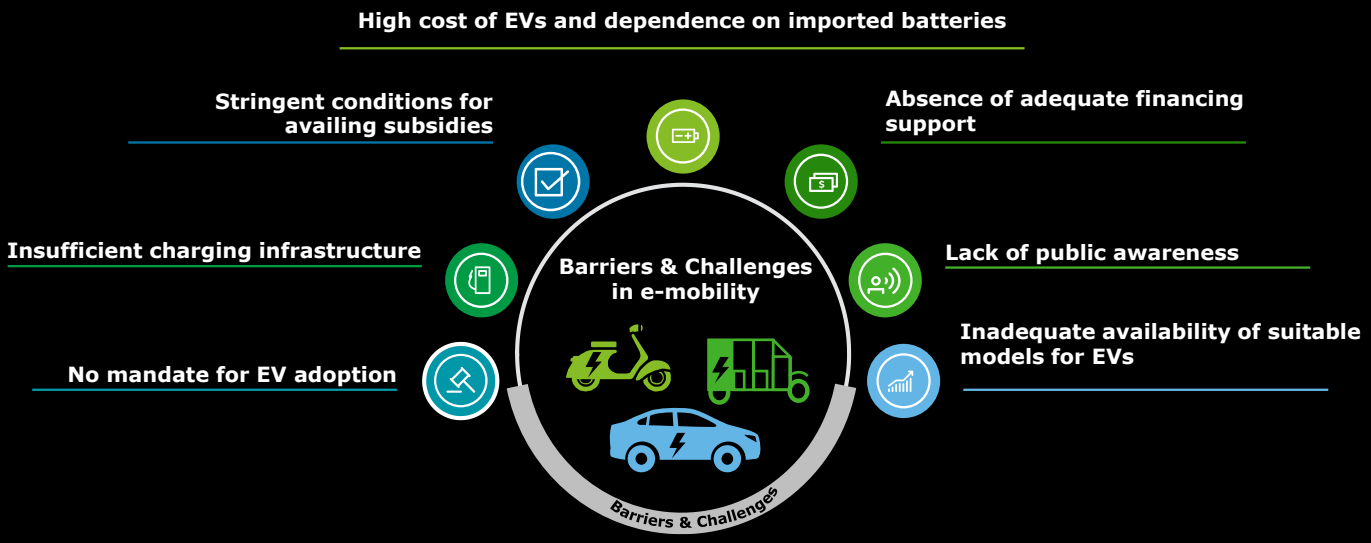
- Devising mechanism for recovery of investment made by discoms as part of tariff.
- Incentivizing charging infrastructure developers by allowing them to participate in real-time and ancillary power market
- Developing framework to promote managed charging

08

Although there are still challenges across EV landscape, private players are betting heavily on success story of EVs in India. Many start-ups have entered into manufacturing of EVs in past 5-7 years and conventional vehicle manufacturers, both domestic and global, are also launching EVs in Indian marketplace.

Similarly, several players have ventured into development of charging stations and have substantial plans for developing charging stations as well as battery swapping station across India in the future.

Key challenges and barriers in adoption of EV



01 No mandate for EV adoption

ICE vehicle have served all the stakeholders for many decades and therefore there is an inherent inertia in favour of such vehicles. Without a clear mandate, it would be very difficult to provide thrust for EV adoption as nearly all stakeholders are comfortable with the current state of using ICE vehicles and do not see a need for change to meet their travel needs. As for end user's perspective, any change in behaviour means a learning curve and changing the current ways of transportation, refuelling, servicing and maintenance. Manufacturers have heavily invested in the conventional set of manufacturing facilities for ICE vehicles and any change in technology will need significant additional investments. Oil companies are also invested up to neck in upstream and downstream oil infrastructure. Retail outlet/fuelling stations will also have to lose their investments or will have to invest in charging/swapping facilities as a new line of business. There is a large auto ancillary / repair industry that stands to lose business as electric vehicles pave their way in. As a result, there is a strong resistance by various stakeholders.

Globally, EV mandate and heavy taxes on ICE vehicles have played an important role in rapid EV adoption

02 Insufficient charging infrastructure

EV adoption and development of sufficient charging infrastructure is a classic example of chicken-egg problem. However, the existing policies have not adequately addressed this issue.

The range anxie ty and limited availability of on-route charging infrastructure are the main concern of people shying away from

Wider availability of adequate charging infrastructure is vital for EV uptake in India

purchasing EVs. Further, policies have not provided sufficient focus on promotion of development of home charging/ workplace charging infrastructure that could potentially offer a convenient alternative to on-route charging infrastructure for vehicle owner. Further, concept such as e-roaming are still not evolved in India that could provide flexibility and interoperability in charging across multiple location.

03 Stringent conditions for availing subsidies

The subsidies on EV purchase were announced to bridge the gap between the prices of EV and ICE vehicles. However, various riders placed around eligibility conditions for availing subsidies have largely defeated the purpose of extending subsidy support. For end-users riders were put on minimum range per charge and minimum top speed. Similarly, OEM are mandated to undergo re-certification process for conformity check to obtain certificate of 'FAME II India Phase II eligibility fulfilment' from approved testing agencies in India.

Such riders are posing significant barriers in utilization of subsidy utilization and EV adoption.

Purpose of the subsidies should be to have more and more EVs on road. Riders and other conditions may be postponed till EV ecosystem become sustainable in medium to long term horizon

04 High cost of EVs and dependence on imported batteries

One of the major barriers for switching to EVs is its cost. Although, there have been significant reduction in battery prices over last few years; still EVs are not able to achieve cost parity with their ICE vehicle equivalent.

Further, due to unavailability of raw material in India for battery manufacturing, there is continuous overarching risk of price change and availability of batteries owing to geo-political conditions. This is also imposing sense of uncertainty in assessing long-term operating cost of EVs that is the main proponent for its adoption.

Boosting of local manufacturing capabilities for battery and EV auto-component would help EVs in achieving cost parity with their ICE equivalents

05 Absence of adequate financing support

Particularly for e-bus there is no suitable financing support exist, except FAME –II subsidy that too available for limited no. of e-buses. Facility such as concessional loan, government guarantee backed loan, funding through green bonds, municipality bonds etc. are not available for procurement of e-buses leading to inadequate uptake of the same in shared-mobility space.

Innovative financing mechanism should be explored to arrange finance for e-bus procurement

06 Lack of public awareness

Electric vehicles technology is still evolving and details about its performance, ease of use and maintenance are relatively unknown to the public at large. People do not know what its benefits and challenges are. They are not aware of why it is important to make

Many State EV policies have provisioned to have campaign and drive to raise awareness on EV among public. EV adoption largely depends

the transition. There are myths and concern about availability of spare parts and ease of availability of mechanics for repair works. Further, the vehicle owner does not know the concept of Total Cost of Ownership (TCO), therefore, purchase decisions are largely governed by upfront purchase cost only. Further, availability of subsidy scheme on purchase of EV is known to limited segment of society.

on meticulous implementation of such policy measures

07

Inadequate availability of suitable models for EVs

OEMs of ICE vehicles have invested hugely over the years in R&D and developed variety of models with varying performance parameters to cater almost all consumer segment in a society. However, this is not true with EVs. There are limited models available for consumer to choose from, that restrict their ability to select suitable model of their choice. This issue is particularly more prominent among 2W and 4W consumer segment.

Unless there exist mandate for EV adoption, OEMs would not significantly invest in EVs development. With limited choices, EVs are less likely to be adopted.

Key barriers in EV charging infrastructure

- Uncertainty around EV penetration in India
- No mechanism for socializing the cost of power infrastructure development
- Lower capacity utilization
- Lack of Managed Charging Framework and functions
- High cost of finance
- No regulatory framework for charging service provider to participate in power market for demand response
- No mandate for Discom to develop charging infrastructure
- Land identification and allocation
- Fixed demand charges in EV tariff
- Issues related to administrative clearances

01 Uncertainty around EV penetration in India

Central and State Governments are equally promoting EVs. However, none of the governments have provided mandate for EV adoption. The capacity utilization and hence revenue assessment is largely dependent on number of EVs being served by the charging infrastructure. In case of uncertainty around rate of EV penetration in India, the business risk overshoots manifolds, causing developer to shy away from putting resources in development of charging infrastructure.

To bolster the confidence of charging infra developer to be able recover cost of finance, government must portray certainty around EV adoption

02 Lower capacity utilization

For early payback of capital invested in the business, it is required to have high utilization of assets. However, in India, since EV on road are not significant, the asset utilization remains critically low leading to multiple issues such as delay in payback, non-recovery of operating expenses, default in bank loan etc. Thus, under-utilization of the charging assets does not substantiate the business case for development of charging infrastructure and acting as a major barrier

Only higher rate of EV adoption can offer a plausible business case for charging infra development. It will remain as a chicken-egg problem, unless government mandate Discoms to take responsibility of development of charging infrastructure

03 High cost of finance

This issue is interrelated with issues presented in above points. The cost of finance has direct relationship with the perceived business risk by the financial institution. EV is an evolving technology and charging business model is not matured enough in India therefore, financial institutions are shying away from providing loans to the developer or even if it has been provided the cost of finance is high considering the risk factors involved. This is leading to insufficient scaling-up of EV charging business in India.

Policy measures to make available concessional loan or government guarantee backed loan should be taken to ensure viability of business and sufficient scaling-up of charging infrastructure in India

04 No mandate for Discom to develop charging infrastructure

Globally Discoms are playing key role in development of charging infrastructure. In China, State Owned Grid Utilities are investing hugely in development of charging infrastructure. Similarly, in USA electric utilities have to mandatorily file transportation electrification proposal. However, in India, Discoms are not obligated with the responsibility of development of charging infrastructure.

EV adoption and development of sufficient charging infrastructure is a classic example of chicken-egg problem. However, the existing policies have not adequately addressed this issue. In absence of any established business model, lower charging infrastructure utilization, and uncertainty around EV adoption (due to no EV adoption mandate), the private players perceiving huge risk in entering into charging business. Therefore, particularly in Indian context, it becomes important to delegate responsibility of developing charging infrastructure to Discoms.

Discoms to be mandated to develop charging infrastructure, at least in initial years, to provide sufficient confidence in EV adopters related to refuelling

05 Fixed demand charges in EV tariff

15 states and UTs (out of 22) such as Gujarat, Haryana, Karnataka, Maharashtra etc. have announced demand charges for EV charging stations. Electricity demand charges are fixed charges levied on charging station operator based on connected load irrespective of usage of the charging station facility.

In case of low asset utilization, levy of the electricity demand charges makes it difficult for charging station operator to achieve break-even.

There is need to design a suitable tariff that increases feasibility of operation of charging infrastructure facilities at even low asset utilization level

06 No mechanism for socializing the cost of power infrastructure development

Regulators in US allow utilities to undertake investment in "make-ready" infrastructure for EVSE integration as well as EVSE infrastructure and recover the cost through rate-basing. Rate basing is a mechanism to allow recovery of expenses incurred by utilities in developing of grid network suitable to provide make-ready

Regulators should encourage utilities to carry out such investments and provide pathway to cost recovery through rate basing. Forum for Regulators

infrastructure for EV charging stations, through regulatory means of tariff determination. This allows utilities to undertake costly investment and socialize the cost of setting up "make-ready" infrastructure for EVs. Such a proactive approach creates an eco-system for setting up EV charging infrastructure.

While several states in India have introduced EV policies, state utilities and regulators are yet to facilitate large-scale investments in "make-ready" infrastructure for EVs. In the absence of regulatory clarity on allowing expenses incurred in development of upstream network in tariff, utilities are demanding cost of development of requisite grid infrastructure from the charging infrastructure developer. Such a huge investment impacting the overall business proposition.

may draft a mechanism for rate basing in India

07 Lack of Managed Charging Framework and functions

Utilities in western countries with significant levels of EVSE penetration have focused on developing a managed charging framework so as to efficiently manage the additional stress on distribution system network on account of EV charging. This entails setting up various communication and hardware protocols to implement a managed charging framework as well as creating various incentives for consumers to participate in managed charging initiatives.

In the Indian context, absence of standardized protocols for EV managed charging limits the discoms ability to control the charging of EVs. Therefore, in such a scenario, utilities have to upgrade and design the network for peak system demand, which is a capital-intensive affair and is posing as a major barrier in rapid scaling up of EV charging infrastructure

While EV growth is still at a nascent stage in India, utilities and regulators will need to plan for implementing a managed charging framework with a long-term perspective.

08 No regulatory framework for charging service provider to participate in power market for demand response

To take advantage of flexibility from managed operation of EV charging, ancillary markets in developed countries have provisions for demand response providers to participate in the ancillary market. This provides additional revenue stream to demand response sources and allows utilities to better manage its demand-supply position.

This is particularly important in the scenario where capacity utilization of existing charging infrastructure is critically low, additional revenue stream by participating in power market would increase feasibility of the business.

Regulator should establish a mechanism for demand response products in the ancillary market wherein charging service provider could participate

However, in India there is no mechanism exist that allow charging service provider to participate in power market for demand response.

09

Land identification and allocation

Identification and allocation of the suitable land is critical in the entire value proposition of EV charging business. Some State EV policies have recognized this issue and offered various facilitation mechanisms for identification and allocation of land. Stakeholder interactions however suggest that there are administrative challenges involved in land acquisition and in case of lease, uncertainty involves around the lease rental on long-term basis.

In a survey conducted by Deloitte as a part of this study, it was revealed that identification of suitable location for setting-up of charging station and allotment of land are among key barriers in the development of charging infrastructure.

Government should develop an online portal to provide transparent information on availability of suitable land for development of charging infrastructure

Further, government should mandate Oil Marketing Company to offer land available at their retail outlets for development of charging infrastructure as most of the retail outlets are suitably placed within the city provided approval is granted by Petroleum and Explosives Safety Organization (PESO) for change in layout plan for setting up PCI

10

Issues related to administrative clearances

In a survey conducted by Deloitte as a part of this study reveals that there is requirement for establishment of Single Window Clearance System for providing time-bound technical and administrative approval, for matters related to land allocation, electricity connection and other issues.

Availing administrative clearances are posing significant delays in development of charging infrastructure.

Government should develop a District Level Implementation Committee chaired by District Collector to review the status of time-bound clearance provided to charging infrastructure developer under single window system

Recommendations

Key recommendations for state policies

Best policy practices for promotion of electric mobility value-chain:

	Key policy recommendations
 Institutional setup	✓ Formulate a cross-department apex committee constituting members from at least the Transport Department, Energy Department, Industrial Development, and Housing and Urban Development for better co-ordination, policy implementation and effective monitoring. ✓ Set-up a District Level Implementation Committee headed by District Collector for field level monitoring and implementation of EV policy; and to smooth out administrative approval processes
   OEMs	✓ Online portal and single window clearance system for availing clearances and subsidies/rebate in transparent manner ✓ Provision for interest subvention on loan ✓ Provision for State Guarantee on loan for Micro and Small Industries ✓ State support in knowledge and technology transfer (Technology transfer fund could be created as proposed in Kerala policy) ✓ Longer policy tenure to develop confidence among industrialist in sustainability of rebates and subsidies for longer horizon ✓ Employment generation subsidy to be included as part of state policy (Punjab is providing employment generation subsidy to industrialist in EV domain, Rs. 36,000 per male employee and Rs. 48,000/ per employee per year in case of females and SC/ST/OBC employee) ✓ Reimbursement of employer's contribution to the EPF for all new jobs created in EV industry (Tamil Nadu have similar policy provision) ✓ Stipend to individual taking in-plant training in manufacturing units
 Network operators	✓ Discoms to mandatorily file transportation electrification proposal (plan to set-up charging stations) ✓ Targets to discoms on installation of EV charging infrastructure ✓ Policy should encourage conducting network flow study to assess the need of power system upgradation and augmentation due to EV charging and provide capital subsidy for development of infrastructure ✓ Allow recovery of network investment cost through regulatory provisions of ARR and Tariff Determination
 EVSE and battery swapping	✓ Online portal and single window clearance system for availing clearances and subsidies/rebate in transparent manner ✓ Allow Charging Infra Developer to use certain percentage of allotted land to open public amenities such as cafeteria/food zone etc. to have additional revenue stream to ensure sustainability of business (Madhya Pradesh EV policy has made similar provision) ✓ Provide opportunity to Battery Swapping Stations to participate in real time market and ancillary service market ✓ Discoms to be mandated to provide connectivity within a limited time frame under State Guaranteed Delivery of Service Act

	Key policy recommendations
	✓ Electrical Inspectorate Department/ Discoms to be mandated to set-up express helpdesk for expediting inspection and clearance in respect of CEA Regulations for electrical safety and grid interconnection
 Consumers	✓ EV Purchase subsidy over and above FAME II subsidy ✓ Interest subvention on loan amount taken for EV purchase ✓ Creation of non-financial incentives such as priority lanes, reserved parking for EV only vehicle in commercial/shopping complexes etc. ✓ Incentives for vehicle scrapping
 Financing	✓ Include EVs and associated business in priority lending sector ✓ State backed loan guarantees for EV and associated component manufacturers ✓ Electric Mobility Bonds (Madhya Pradesh have similar provision) ✓ Use of fee-bate concept for funding of policy provisions (Delhi policy have similar provision), whereby additional taxes to be levied on conventional fuel vehicle
 Miscellaneous	✓ Green Zone to be demarcated within cities that permit only EVs and charge heavy taxes on conventional fuel vehicle ✓ Green Corridors to be earmarked on which only e-buses are provided permit to operate ✓ Provision for providing training in electric mobility, upskilling of existing ICE mechanics needs to be focused in State policies ✓ Disseminate public awareness through launching test drives, competitions, celebrating Electric mobility day etc.

Recommendations for uptake of electric mobility in India

01 National / State level policy should be formulated for incentivizing Distribution Utilities on investing in development of EV charging infrastructure

02 In line of international case-studies, a Charge-ready infrastructure programme to be launched mandating Discoms to spearhead the development of charging infrastructure by leveraging their technical capabilities, international case studies shall be capitalized to align Discom role in charging infrastructure ecosystem

03 Electricity Regulator to be mandated to provide mechanism for approval for Rate-basing of utility investments in building EV charging infrastructure

04 Electricity Regulator should design and implement TOU tariffs for EV charging

05 Technical standards for charging equipment in the case of Managed charging should be designed and approved

06 Designing electricity market structures for participation of EVs. Electricity regulators shall be mandated to devise mechanism for allowing charging infra developer in demand response market.

07 Policy consideration to be deliberated for workers in ICE Auto Ancillary industry (primary mechanical) to skill them suitably for working in EV auto ancillary industry (primary electrical and electronics)

08 Standardization of battery should be done to enable battery swapping a plausible business model catering primarily to commercial vehicle

09 Financial Institutions should be encouraged to extend their lending facility to electric mobility sector.

10 Existing scheme/policies designed for promoting electric mobility needs to be fine-tuned, based on the scheme/policy performance and market expectations. For examples, riders are availing subsides could be re-examined.

11 Many of the new technology related to managed charging of EV has been introduced first using a pilot platform. The results for these pilots are then used to carry out large scale deployment of technology. While standards and guidelines introduced in India do provide provisions for communication protocol between EVSE and other stakeholders, there has been no pilot initiative on large-scale managed charging pilots. Utilities and regulators across India need to take initiative on introducing pilot projects which can demonstrate the benefits of managed charging of EVs.

12 It has been observed that having dedicated tariffs and incentives for EV encourages adoption. While few states in India have taken EV policy initiatives, a large number of states are yet to introduce EV specific tariffs for public and home charging as well as incentives under state policies for purchasing EVs and setting up home and public charging stations.

13 National level policy for Urban Local bodies / municipalities, etc. to issue Charger Deployment plans and undertake investments in PCS through loans from Central government. The same could be converted to grants on timely achievement of milestones subject to the local authorities tying up with designated government agencies for implementing the roll out plan.

14 Adopt a framework for state level / city level authorities to undertake competitive bidding for allotment of zones for PCS installations.

Develop frameworks for public private partnerships / franchisee agreements for developing EVCS.

Explore innovative business models for development of charging stations.

15 For EV users, interoperability, or “e-roaming,” means that users can charge at any station with a single identification or payment method, and that all charging stations can communicate equally with vehicles. For this to work seamlessly, common standards for charging network operators must also be established

16 A key enabler for smart charging and other vehicle-grid integration aspects is collaboration among various stakeholders. There is a need to create a common platform which can bring together expertise of all stakeholders.

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