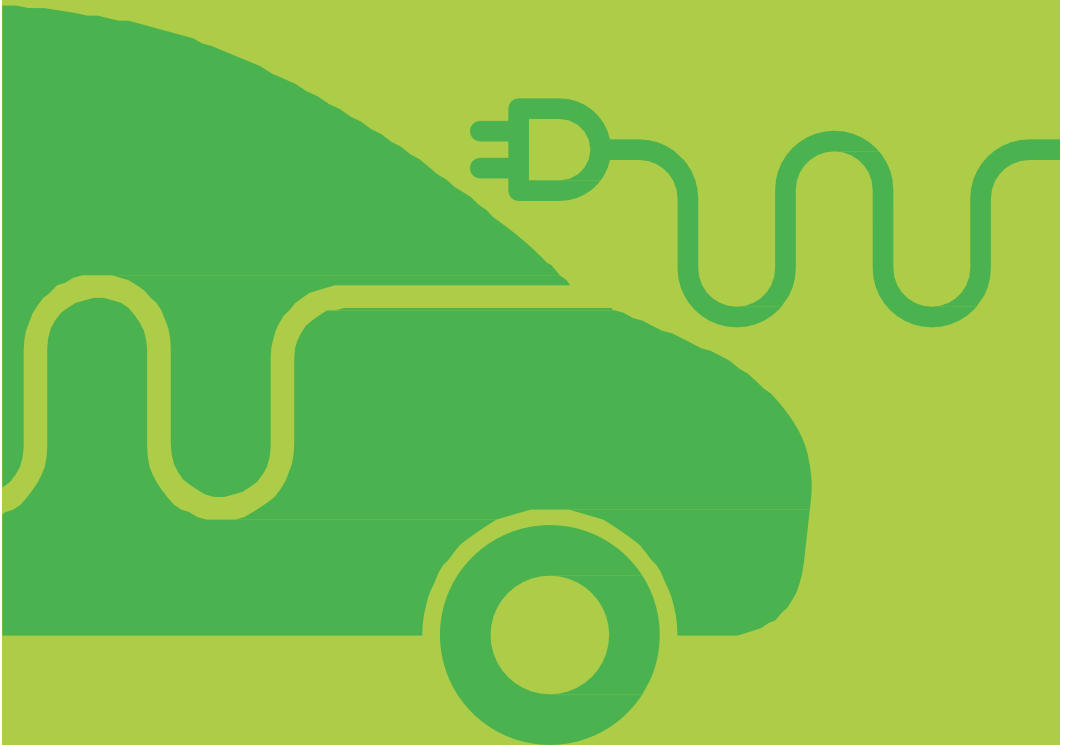




Innovation  
Norway

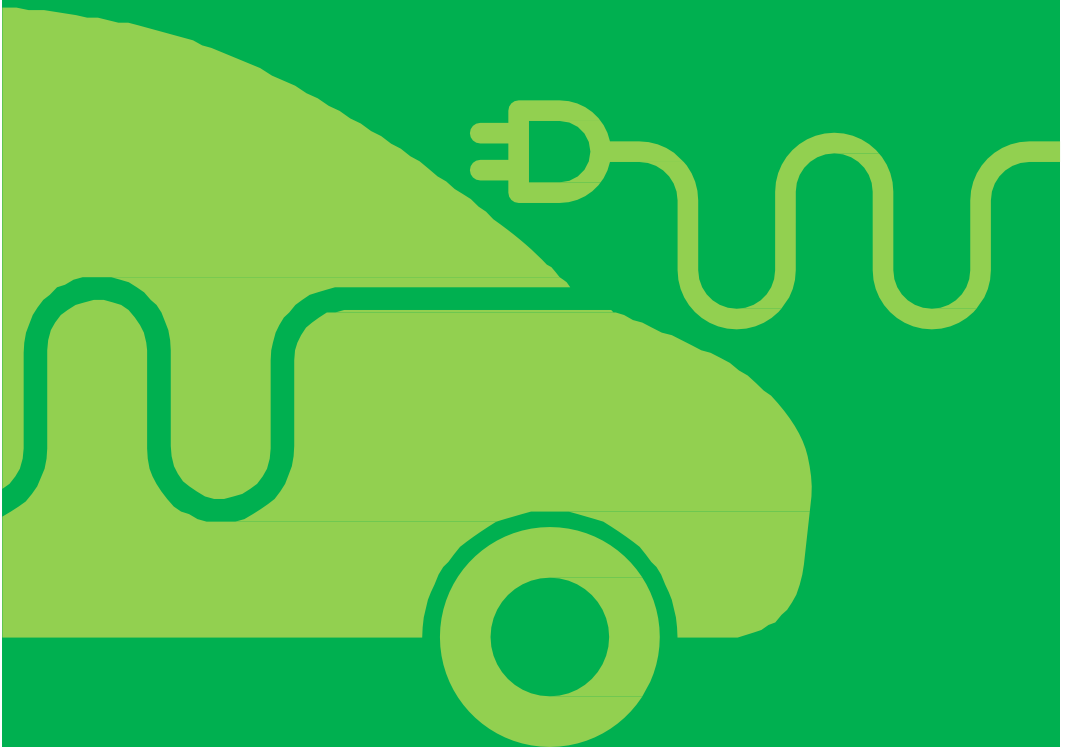
# India EV Story

## Emerging Opportunities



# Indian Automobile Industry

## An Overview



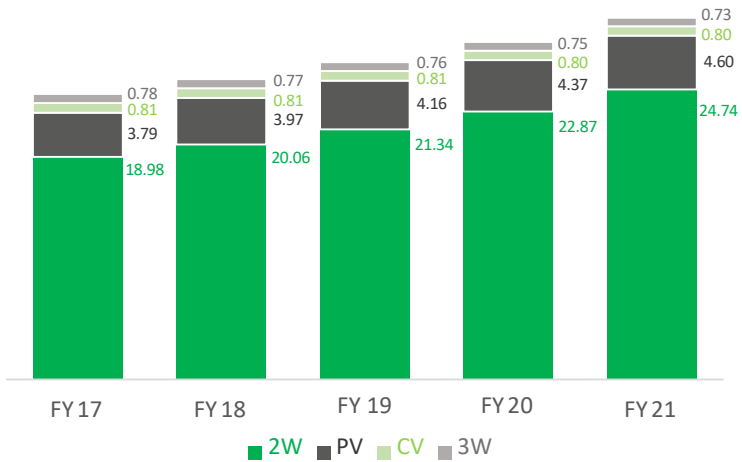
## Current status of the Indian Auto Industry

Indian Automobile industry is currently the 5th largest in the world and is set to take over as the 3rd largest automobile industry by 2030. There are a range of players operating in India as shown below:

Passenger Vehicles	2 Wheelers	3 wheelers	Commercial Vehicles	Tractors
Number of OEMs				
15	13	7	12	17
No. of Manufacturing units				
29	22	7	34	20

# Indian Automobile Industry

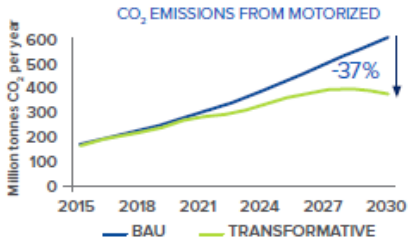
## Vehicle Production Trend (Volume in Mn)



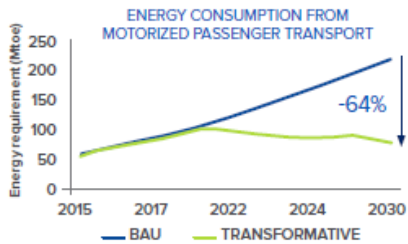
Source: SIAM data and Feedback Analysis

## 3 key Strategic Imperatives to look at EVs

### Higher Carbon Emissions



### Fuel Security Risks

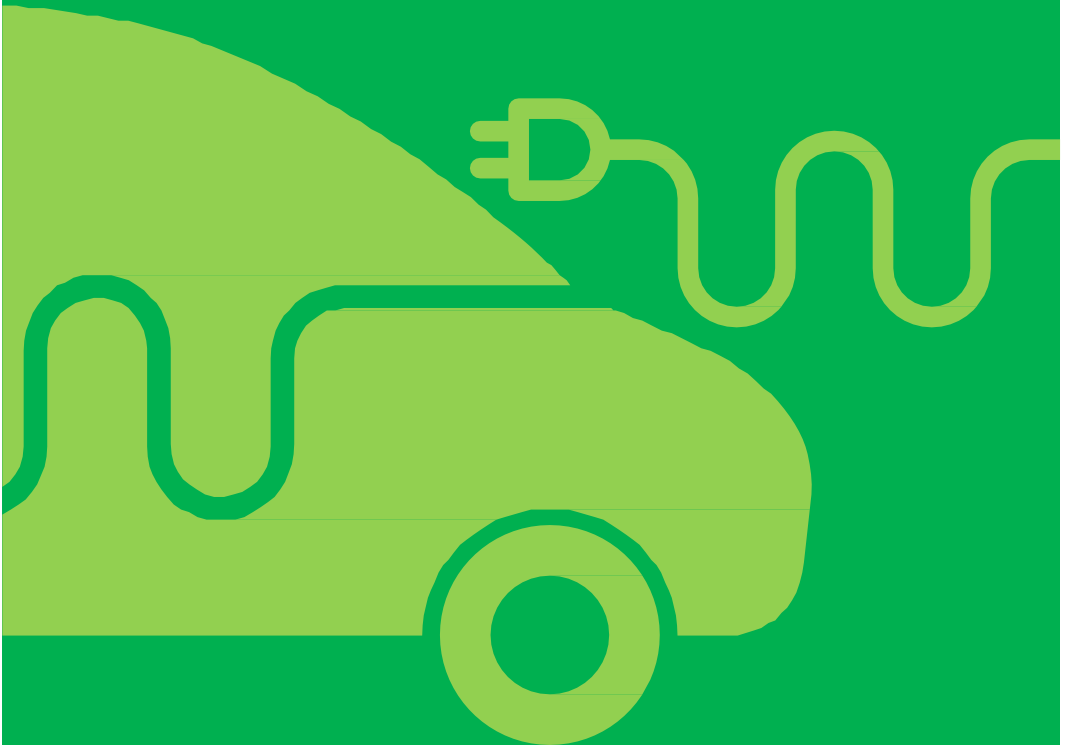


### Lower Power Demand

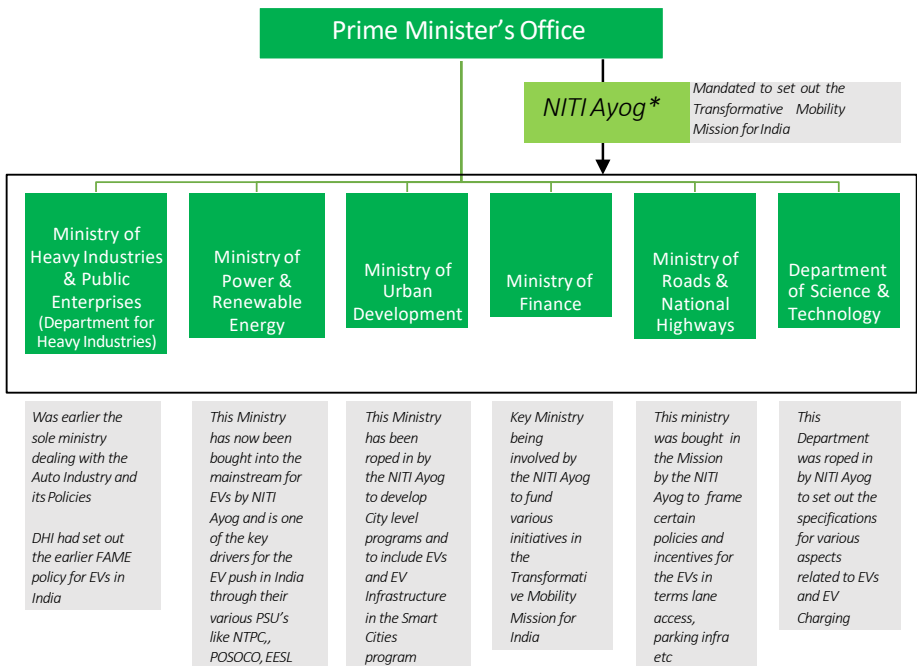
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# Electric Vehicles

## Policy Structure

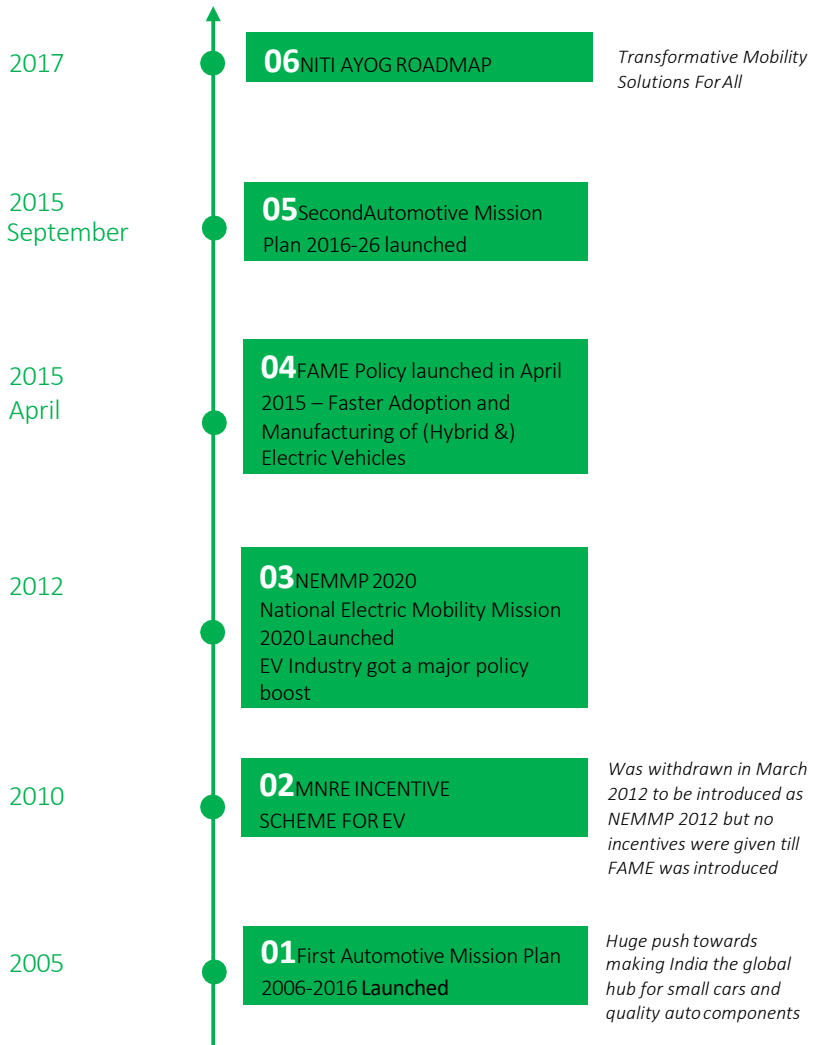


# Overview of Political structure involved in EV Policy planning



\*NITI Ayog – National Institution for Transformative Initiatives

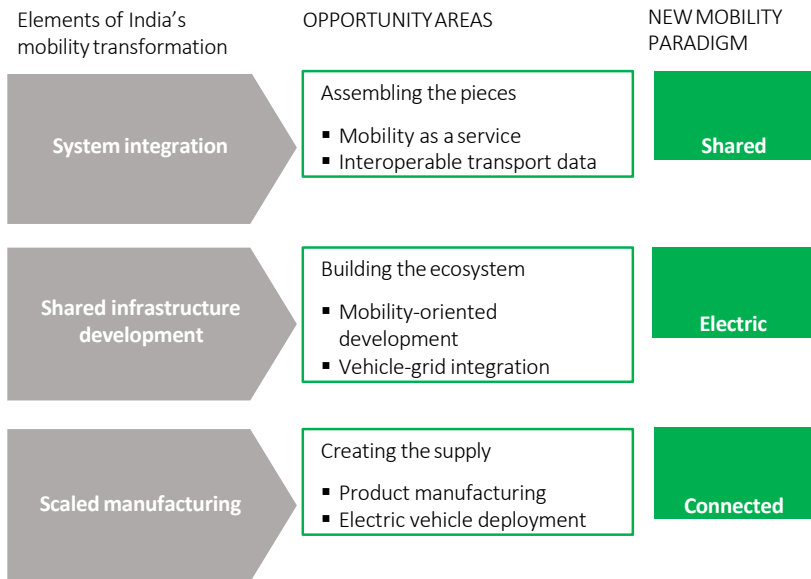
## Key milestones in the EV Policies in India



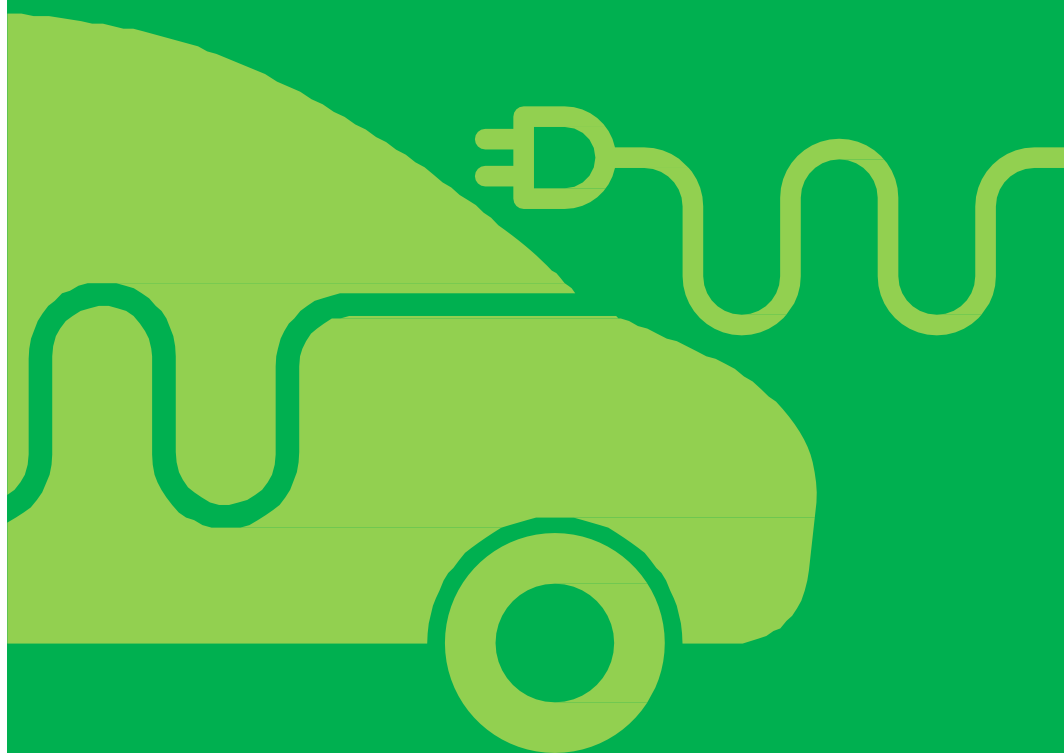


# NitiAyog Plan

## Planned approach to mobility transformation



# Towards EV Mission 2030

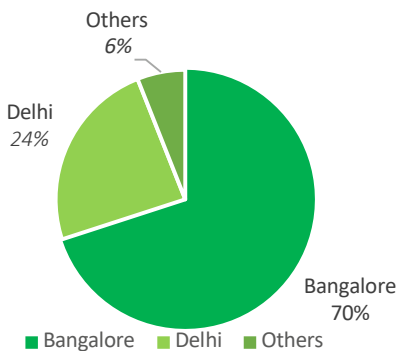
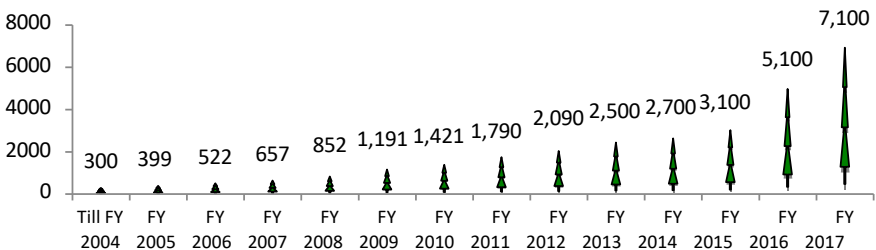


## Currently electric car market is at a very nascent stage with only 1 serious player

- About 7100 cars on road since introduction of the first Electric Car in 2001 by REVA (Mahindra)
- Limited support from the government in the car market

- Currently the market largely limited to 2 cities in India
- Mahindra's manufacturing plant is located in Bangalore & a new one is being planned at Nashik

## Installed base of Electric Cars in India

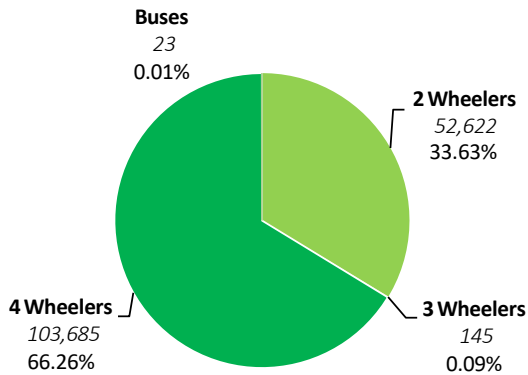


Source: Feedback Analysis

## Current Market

### No. of EVs & Hybrids sold under FAME

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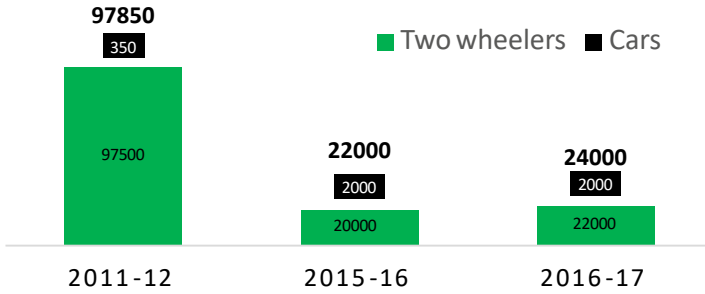
Source: FeedbackAnalysis

***Under the 4 Wheelers segment – nearly ~99,000 are Hybrid SUV's and only about 4000 are EV Passenger cars***

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## Electric Vehicle Annual Sales Volume By Type In India

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# Approach to Future EV Market Estimation

## Likely future market for EVs in India

2016-17 revised classification as per NitiAyog classification	SIAMData	Feedback estimate	Feedback projection based on the explanation earlier	
	2016-17 domestic sales (all Types)	2016-17 domestic sales (only EVs)	2026 Business As usual (BAU)	2026 Transformative
Passenger Vehicles - Personal	2,132,709	2,000	31,350	1,254,000
Passenger Vehicles - Commercial / fleet	914,018		102,600	3,078,000
Commercial Vehicles - Goods	616,106	-	-	-
Commercial Vehicles - Passenger	98,126	20	2,213	265,500
Three Wheelers	511,658	50	27,000	675,000
Two Wheelers	17,589,511	22,000	1,062,000	10,620,000
<b>Overall vehicles</b>	<b>21,862,128</b>	<b>24,070</b>	<b>1,225,163</b>	<b>15,892,500</b>

***Around 10-12 Million EVs by 2026 would be a safer projection to consider***



**e2oPlus**

The 4 door all-electric city car from Mahindra Electric.



**eVerito**

The electric sedan from Mahindra Electric.



**eSupro**

India's 1st all-electric cargo and passenger van by Mahindra Electric.



**eAlfa**

Mahindra's zero emission and all-new, electric rickshaw.

**Mahindra**  
**ELECTRIC**

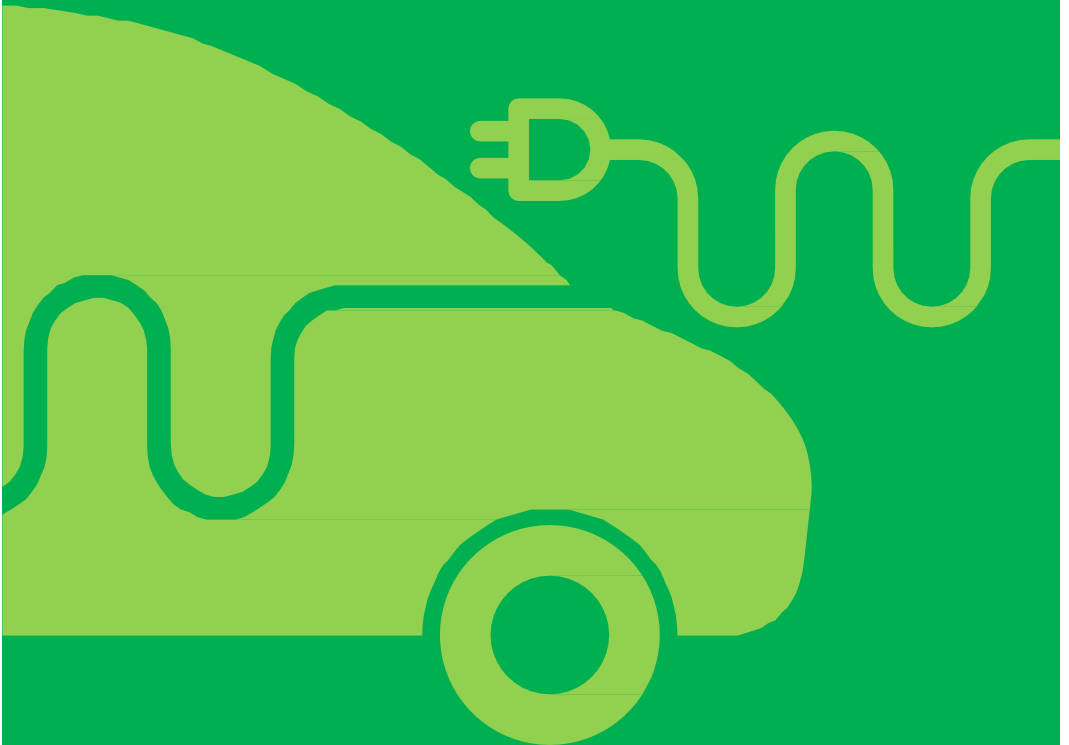
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Tata Motors has recently entered the EV market in passenger vehicles and Electric buses





# EV Chargers in India



## EV Chargers

# Industry Structure in India

### Existing suppliers

- ~15 firms currently supplying EV Chargers in India
- Only 3 firms in 4W, AC Chargers so far in India
- 4 Wheelers – AC Chargers - RRT Electro Power, Chennai; Mass Tech Controls, Mumbai; Exicom, New Delhi
- These are mostly Power Electronics & Battery Charger manufacturers who have diversified into EV Chargers
- 10-12 firms in small 2W AC Chargers who supply along with their vehicles and a few OEMs for EV Chargers

### Global EV Charger firms

- 5-6 key global firms eyeing the EV Chargers market closely
- Firms like ABB India, Delta India, Schneider India, Siemens India etc are looking at the Indian market closely
- These firms have their global designs and products and are studying the technical / specifications, business models and potential for their products
- All these firms are only looking at the 4 Wheelers' (Cars) EV Chargers

### Likely Indian firms in EV chargers

- Huge interest in the Indian market for manufacturing EV Chargers
  - Most Large & MSME firms in power electronics & battery rectifiers are looking at this market very closely
  - Some names we could confirm, who have evinced interest in EV Chargers manufacturing are Raychem RPG India, Analogic India, Deltron, EOS Power, AdorPowertron, Kraft Power Con, Elind etc
  - Most of these firms are currently getting their designs and products in place
-

## EV Chargers

## Overview of Key Players

Type of Vehicle	4 Wheelers (Ecars)	4 Wheelers (Ecars)	2 Wheelers
Type of Firms	Existing Indian suppliers	Existing Indian suppliers	Existing Indian Suppliers
Name	RRT Electro Power, Chennai	Mass-Tech Controls, Mumbai	<b>Most bike manufacturers have their own in-house chargers manufacturing and few OEM's like Axiom</b>
Background	Power Electronic & Battery Chargers	Power Electronic & Battery Chargers	eBike manufacturing and Power Electronic firms
Their presence in EV Charging	They have been supplying to Mahindra for sometime now	They have been an OEM for various Power Electronics for Tata Power, they are now supplying EV Chargers for Tata Power Pilot projects in Mumbai	Most firms are into supplying Chargers for bikes for nearly a decade now.

## EV Chargers

# Market Characteristics and Business Models

### **Nascent Market**

- EV Chargers market is at a very nascent stage
- Few players are present in the market barring the small 2W Chargers.

### **Unorganised / small players dominating now**

- Currently limited to small electronic firms making products like power panels, battery chargers, rectifiers etc
- The high technology, Indian and foreign players are in the process of getting their products and designs ready for India

### **Low on technology**

- Most of these chargers are AC chargers with about 90 minutes charging time and are claimed as Fast Chargers

### **Business model dependent on Auto OEM's and their plans for now**

- Due to its nascent status, business models are yet to be established and most players are in this business either with an alliance with 1-2 auto firms or a charging service provider

### **Charging Services firms emerging now**

- No existing charging services firms yet
  - Huge interest seen in this business post the push from NITI Ayog plan
-

# NTPC will be a key player in setting up EV chargers infra in India



## Present Status of EV Charging Stations

- National Thermal Power Corporation (NTPC) ventured into EV-Charging business and has installed first charging stations at its offices in Delhi and Noida
- At present, they are looking for a country-wide licensing. If that happens then they will be able to set up the charging stations very quickly
- The main objective in setting up EV charging points is to be part of promoting clean energy transportation
- In NTPC, the charging station installed as of now is specific to Mahindra vehicles.
- NTPC has applied for National Distribution License to roll out this at a national level



# Bharat Heavy Electricals Ltd (BHEL)



- MOU has been signed between BHEL and ISRO for making Electric Vehicles battery. ISRO is providing R&D technology to BHEL for making efficient and low cost lithium - ion battery
  - For batteries, BHEL is in conversation with ISRO. A foreign agency is also involved with the company for technology tie-up
  - BHEL has started manufacturing electric motors for Ashok Leyland and Tata Motors for their electric vehicles
  - BHEL has formed an internal committee to understand the market and demand for batteries
  - According to BHEL there should be a generic standard for batteries in India
  - Presently, Mahindra Reva is using Chinese battery for its EVs
-

## The Ministry of Power to source 4000 chargers

Phase	Location of delivery	Cars to be procured	Number of EVs
Phase 1	India (Delhi NCR)	AC-001 Charger	250
	India (Delhi NCR)	DC-001 Charger	50
Phase 2	As per requirement, anywhere in India	AC-001 Charger	2,750
	As per requirement, anywhere in India	DC-001 Charger	950
<b>TOTAL</b>			<b>4,000</b>

### Some key points on the EV Chargers

- The charging equipment must be CE Certified
- The charging equipment must come with a comprehensive extended on-site warranty and AMC package for 5 years from the date of commissioning and must have a design life of 10 years
- The charging equipment before delivery, should be type tested as per AIS 138 at ARAI (Automotive Research Association of India) and IIT Madras



## Tata Power

### **Tata Power is a private power distribution company that plans to invest in EV charging infrastructure**

- Tata Power recently has installed its first electric vehicle charging facility at Vikhroli in Mumbai. It has set up 2 more stations in North & Central Mumbai.
- Tata Power plans to roll out nearly 50 EV charging stations in Mumbai and New Delhi
- The chargers can also monitor the car battery charging status and units consumed while charging a car.



Ola



## Ola has gone one step ahead in implementing Charging stations

### Electric Vehicles

- Launched 200+ Ola cars that are charged by the company as of now in Nagpur pilot project
- Has 50+ charging stations at 4 strategic locations in Nagpur
- Ola electric vehicles are from Mahindra Electric (E20 model)
- The payment system is provided to third party vendor and can be paid via electronic or cash mode
- These cabs run around 200Kms per day

### Limitations/ hurdles

- Setting up charging stations in Tier I city is operationally not feasible
- Drivers come back to charging station to charge, covering 7-8 trips
- Navigation and other apps are draining the battery, and in some instances, they have covered only 75-80 km over an anticipated mileage of 100km

### Charging Stations

- DC fast charging that takes around 75 min to charge
- The ACME group has supplied the charging station
- Company has invested INR 50 Cr in the entire EV project
- The Ola cars are charged by the company under a subsidy

### Future Plans

- Planning to launch the same in 2 Tier-I and 3 Tier-III cities in coming years
  - Looking at Hyderabad, Lucknow and Kochi in the pilot phase
  - Plans to invest \$2 billion in Evs in all cities of India and run one million electricity-powered vehicles on the Ola platform by 2020
  - Looking to tie up with OEM's like TATA and Bajaj in future
  - Ola is in talks with Government for PPP for pilot projects on EV segment
-

## Current installed base of EV Chargers in India is about 270 units

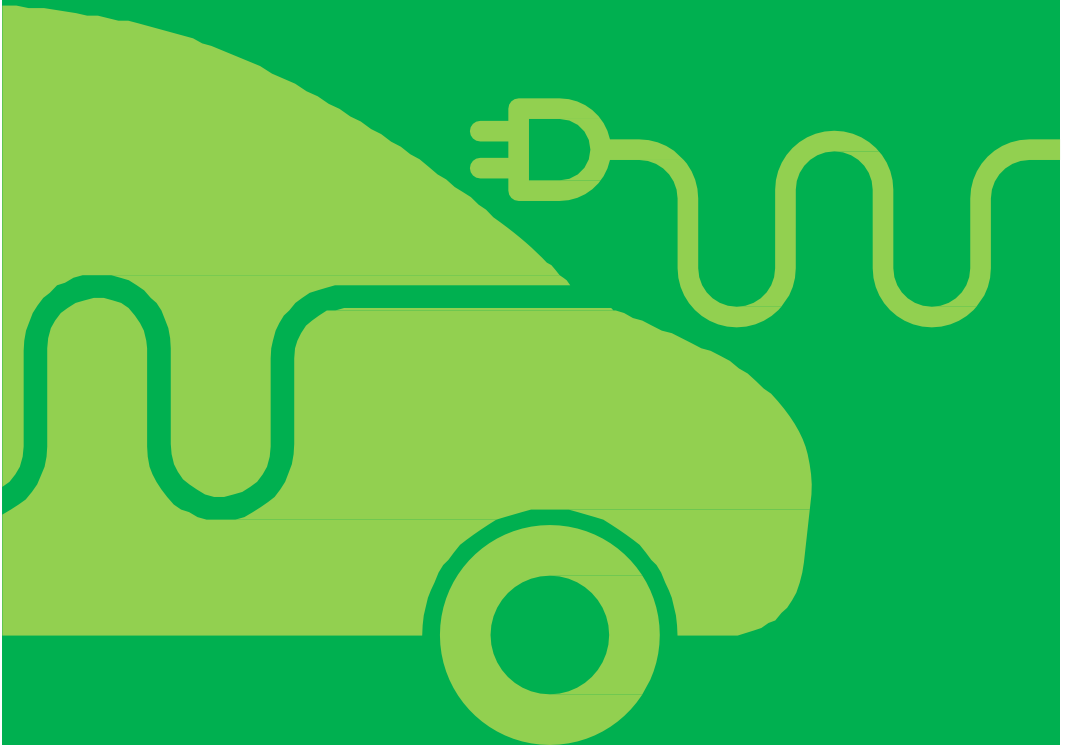
- The EV chargers business in India is in nascent stages with only one major car manufacturer
- Home chargers are not included in these estimations; only public EV charging stations are considered
- Post FAME and the NitiAyog Plan announcement, we have seen an increased thrust on setting up EV chargers in the last 3-4 months in India

	Installed base 2016-17	Additions in the last 4 months	Total installed base as of August 2017
EV Charging stations	100	30	<b>130</b>
Average Norms of EV Chargers	1.5	4	
Total EV Chargers installed	150	120	<b>270</b>
% of AC Slow chargers	100%	80%	
% of DC Fast Chargers	0%	20%	
No of AC Slow chargers installed	150	96	<b>246</b>
No of DC Fast Chargers installed	0	24	<b>24</b>

## Likely future market for EV Chargers in India

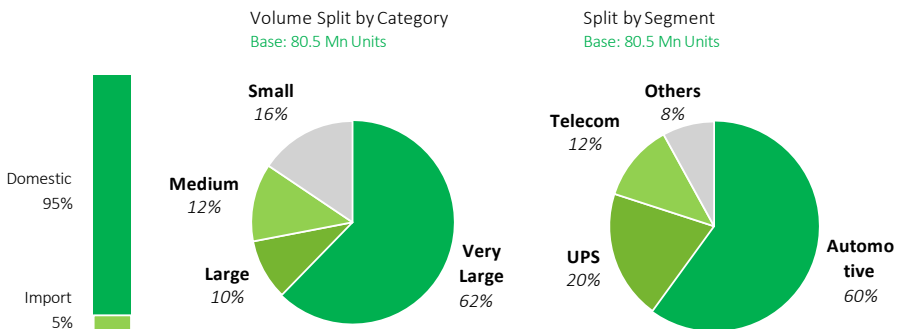
	2017-18	2018-19	2019-21	2021-25	Cumulative potential upto 2026
No. of EV Charging stations likely to be set up	1,000	5,000	50,000	350,000	<b>406,000</b>
No. of EV charging units / station	4	4	6	6	
Total EV Chargers likely to be installed	4,000	20,000	300,000	2,100,000	<b>2,424,000</b>
% of AC Slow chargers likely	90%	80%	80%	70%	
% of DC Fast Chargers likely	10%	20%	20%	30%	
No of AC Slow chargers likely to be installed	3,600	16,000	240,000	1,470,000	1,729,600
No of DC Fast Chargers likely to be installed	400	4,000	60,000	630,000	694,400

# Overview on EV Battery Segment



## Battery Market in India- An Introduction

**Automotive sector accounts for 60% of the 80.5 mn battery unit market**

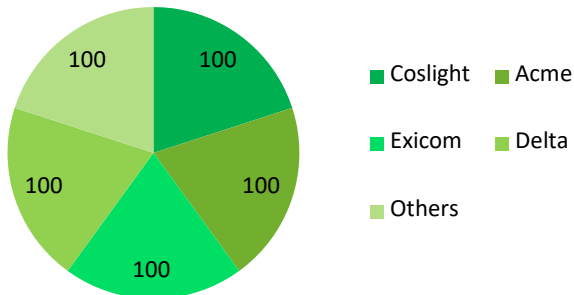


Source: Feedback Analysis

Lithium Ion battery packaging started gaining momentum in India in the last 1 year

**Current Lithium Ion battery packaging capacity in India ~500MWh**

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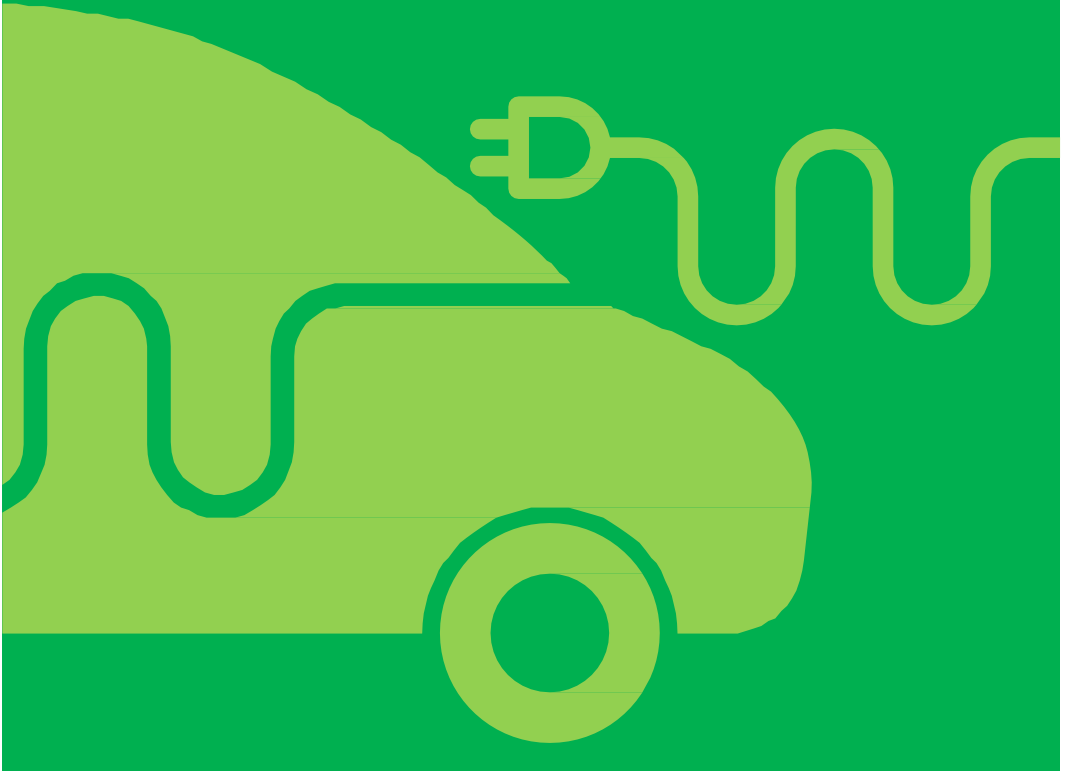
Source: Feedback Analysis

- Lithium Ion battery for the telecom segment was the first major segment to be consumed in India
  - For long we relied on importing these batteries from China and other countries
  - Coslight & Exicom were the 2 serious players catering to this segment
  - Many more battery packaging plants are likely to come up in this year
  - The capacity is likely to reach 1GWH by 2018 end
  - We foresee this to reach 5-6 GWH over the next 2-3 years depending on how the EVs take off in India
  - Lithium Ion Cell manufacturing is still not on the radar even though the Government is seriously contemplating this and attracting investors
-

## Major announcements being done in the last 6 months in India in Lithium Ion Battery manufacturing

Firm name	Key announcement detail
Reliance Industries Ltd	India's large corporate body has announced plans to enter the Lithium Ion battery production business – media reports note that it was looking at a large factory that would produce Lithium-Ion (Li-Ion) batteries of 25 gigawatt-hours (GWh) capacity
Suzuki / Toshiba / Denso	Suzuki announced that it will invest Rs 1,150 crore (US \$ 185 million) together with Japanese partners Toshiba and Denso Corp. to set up a Li-Ion battery facility in Gujarat. Suzuki will own 50%, Toshiba 40%, and Denso 10% of the joint venture that will make batteries and battery packs for Indian car maker Maruti Suzuki and export to Suzuki.
Indian Oil Corporation Ltd	The nation's biggest fuel supplier, is developing batteries and other technology for energy storage applications. According to Economic Times, while IOC is mainly focusing on lead-acid, it is also working on lithium-ion battery chemistries.
Exicom Industries Ltd	Exicom, a telecom infrastructure provider that is part of the HFCL group, which has been in the Li-Ion battery business since 2013, is planning to increase its manufacturing capacity to 1 GWh.
Other firms	Other major firms such as JSW Group, Adani, Mahindra, Hero Electric, Panasonic, Exide Batteries, Amara Raja and many others have evinced interest in getting into Lithium Ion Batteries

# EV Opportunities for Norway in India

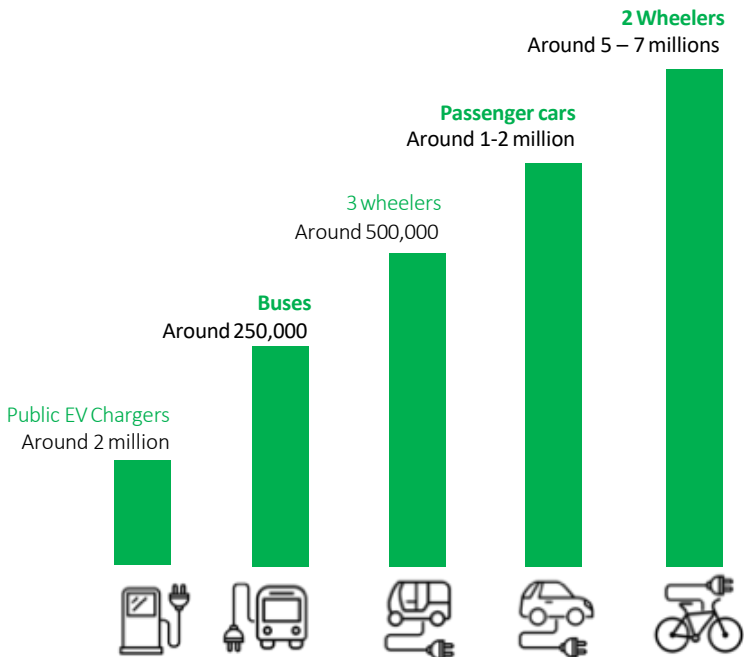




# Opportunity landscape in EV business in India by 2026

***Unlike other countries, Indian EV opportunity lies in a variety of automobiles and not just passenger cars business....***

***...many other opportunities like Ebike, Ecycles etc could emerge as we move ahead towards an electric future***



# Key opportunities for Norwegian firms lie in relatively unexplored businesses in India

## EV Charging spaces

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- EV Chargers / Smart Chargers (equipment / technology)
- Charging Infrastructure Services
- Smart Charging networks
- Cloud based solutions for Charging

*Apart from a few local firms in power electronics, EV Charging sector remains an uncharted territory for India. This offers excellent opportunities for Norwegian technology to be introduced*

## EV Mobility Services

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- Cloud based mobility / fleet services
- Technology for such services
- Smart Networks

*Ola and Uber are 2 national fleet operators, there is scope to introduce new solutions and enter this space of shared mobility in India*

## Vehicle to Grid / Storage / Battery

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- Vehicle to Grid solutions
- RE integration with EV charging and Storage
- Lithium Battery Solutions and BMS

*Currently, there is little awareness of the scope and extent of impact on the grid. Norwegian firms could bring in global experiences to India*

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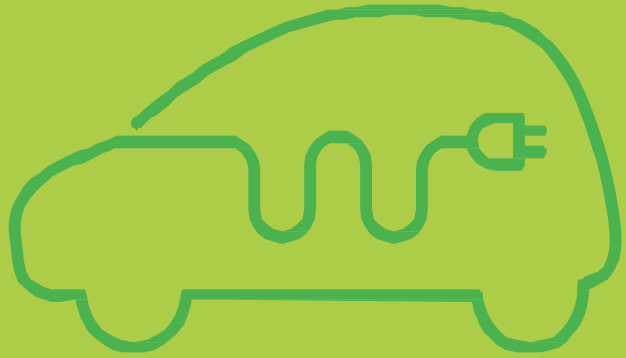
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Emerging Opportunities  
India EV Story

