



# EV Charging Stations in Maharashtra

1. Prof. M. R. Jadhav    2. N. R. Bodake

3. A. S. Yadav            4. M. M. Mankar

Lecturer LoGMIEER (Diploma) Nashik

## 1. Abstract

This case study explores the potential demand for EV charging station (CS) infrastructure as well as its difficulties in the context of India. With a surge in privatization, liberalization, and the expansion of distributed and renewable energy sources. Finding charging stations for electric vehicles is a significant problem for drivers that calls for the development of a network of smart charging infrastructure. To ensure EV adoption and to address some of the inherent risks, such as battery cost and degradation, economic risks, lack of charging infrastructure, risky maintenance of EVs, problems with its integration in the smart grid, range anxiety, auxiliary loads, and motorist attitude, it is crucial to choose the location for installing charging stations.

## Objectives

- Provide the statics and relevant data for following topics (the latest data till July 2023)
- Charging levels (L1, L2 & L3) wise segregation of charging stations
- Number of charging station are installed in a state
- Number of public private partnership (PPP)
- Type of charging available
- Number of battery swapping station
- Applications available to locate the charging station
- Major leader/companies for installing charging station or charging systems

- Are charging stations for 2W or 4W? Comment on this

## Introduction

### Introduction to EV

The Electric Vehicle Is the Part Of Automobile Means the The Mobility of object by Automatically. In IC engine Vehicle Power of Propulsion comes from the Engine.

The Automatic Mobility of Vehicle Comes with Propulsion of the Electric Motor and Energy to run the electric motor comes from rechargeable battery Called as Electric Vehicle (EV).

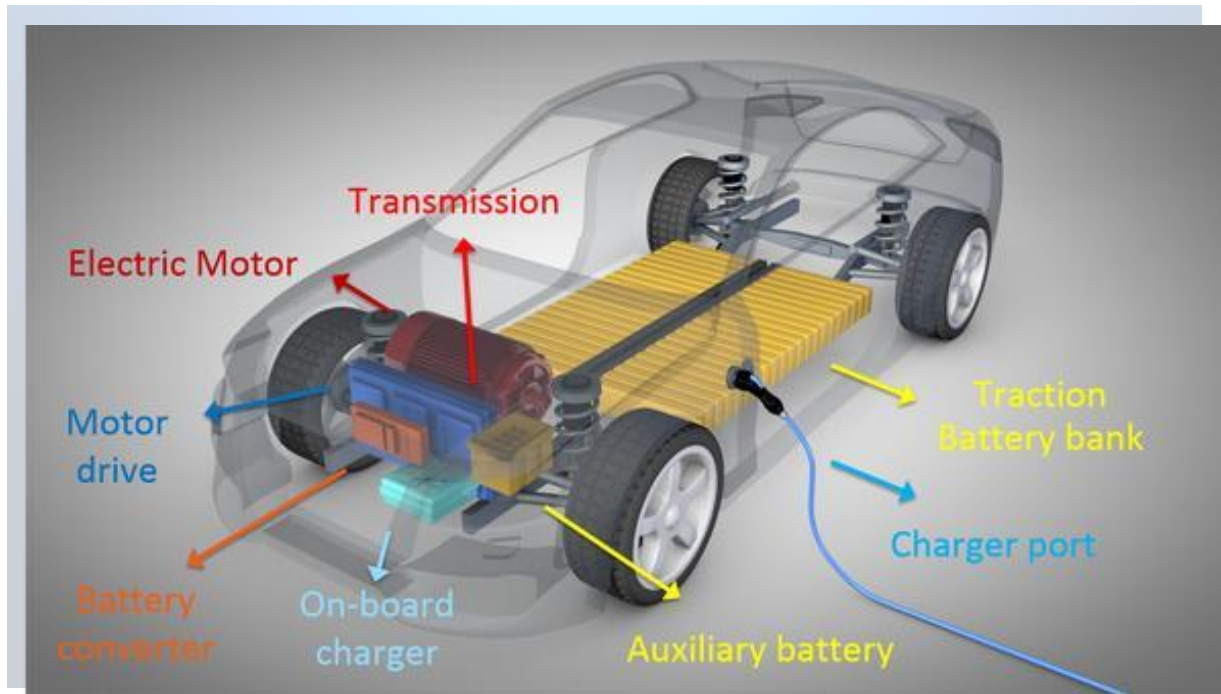


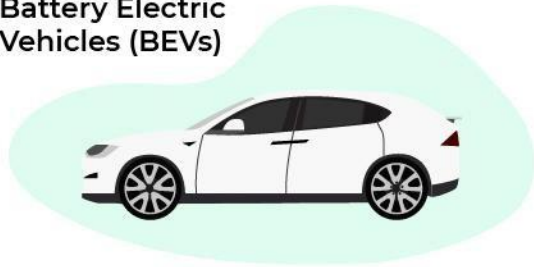
Fig.2.1 Electric Vehicle

### Types of Electric Vehicle

There are various types of Electric vehicle

According to level of electrification vehicle these are divided in several types.

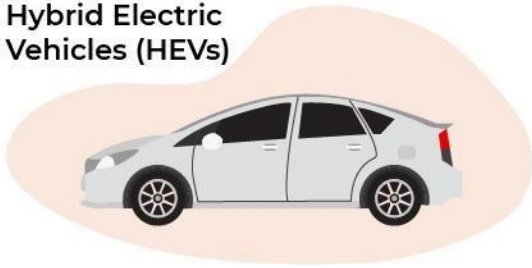
Battery Electric Vehicles (BEVs)



Plug-in Hybrid Electric Vehicles (PHEVs)



Hybrid Electric Vehicles (HEVs)



Fuel-cell Electric Vehicles (FCEVs)

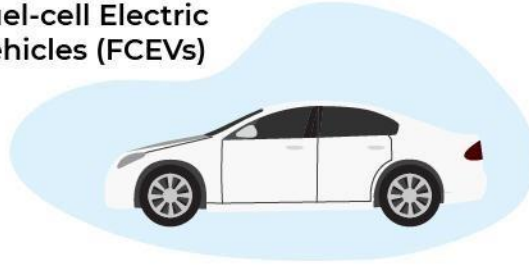


Fig. Types of Electric Vehicle

## 2. Electric Vehicle Adoption

Solution to reduce greenhouse gas emissions and combat climate change. As the popularity of EVs increases, the need for a robust and reliable EV charging infrastructure becomes critical. This case study examines the implementation of an EV charging infrastructure in Cities in Maharashtra, showcasing the challenges faced, strategies employed, and the resulting impact on the city's sustainability goals.

### 2.1 Challenges EV adoption

Like ICE vehicle Electric Vehicle also required to Refuel after certain distance called as range of vehicle. The range of vehicle is depends upon vehicle manufacturing company or on the dependent on type of battery used in it. But in any condition it is required to refilled (recharge) and this part of the place at which battery of vehicle is recharged called as EV Charging Station.

As the production of EV's important for developing E-mobility and also called as Zero Emission mobility in India same as it totally dependent on the development of EV Charging Stations all over the India. Some of the charging stations are equipped with advanced features like as

- Smart metering,
- cellular capability
- network connectivity.

while other stations are with basics of charging only. These EV Charging stations are also called electricvehicle supply equipment (EVSE) and are provided in parking municipal co .by electric service companies or at retail centers by privatised companies. These stations provide special connectors that conform to the variety of electric charging connector as well as safety standards.

**Charging Levels**

Parameter	Level 1	Level 2	Level 3
Voltage	120	240	480
Current	AC	AC	DC
Circuit	Dedicated	Home / Public	Special charging port
Range / time	5 miles / hr ofcharging	10-20 miles / hr of charging	40 miles / every 10 min of charging
Speed	Normal	Normal	Fast chargers

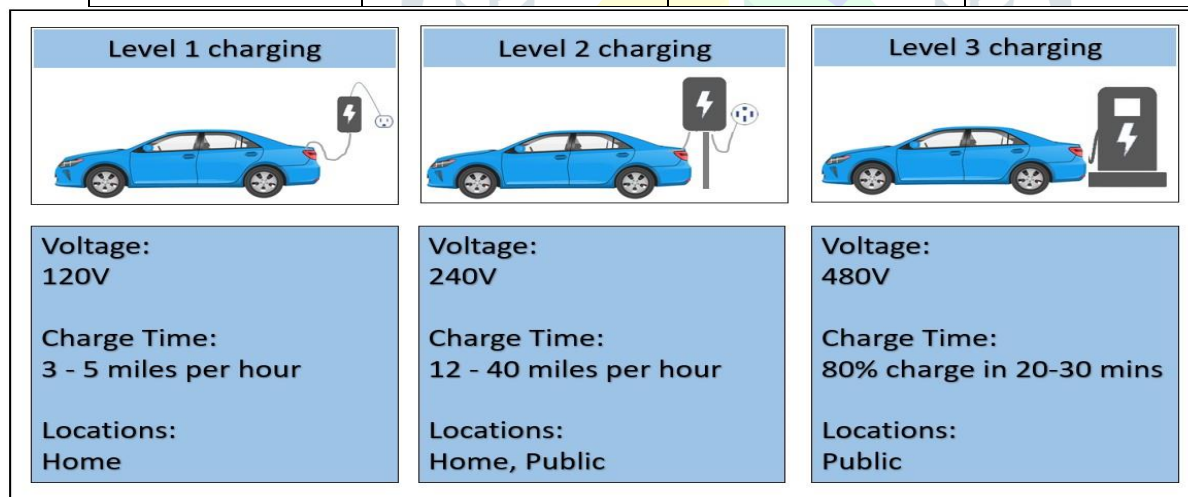


Fig. 2.3 Charging levels

### 3. EV Charging Stations

Ev Charging Stations are the place at EV get recharged with electricity with the help of various types of charger like CHAdeMO And CCS.

As to adopt EV's to have zero pollution and save non renewable energy we have to adopt Electric mobility as fast as possible. Excluding coast Charging Infrastructure is more important and main affecting part of EV adoption.

The main issue is with the range of vehicle which is given in charge. As we know minimum 25km/hr speed EV's are available and in case of passenger cars we have cars with 80- 100 km/hr range. In case of Tesla they have highest range of 420- 820. So this problem of range can be rectify by introducing EV charging station in every radius of 3km.

#### Primary Requirements for EVCS.

4. Transformer equipped with all required substation including safety cares.
5. Current conductors should be as per standards including termination and metering. With 33/11 KV.
6. Standard Civil Works with required approval as per area.
7. Area should be enough for entry, exit and turning.

As various type of charger used by manufacturer hence following types of charging slots should be there in charging stations

8. Current 9. Type	10. Charger 11. Currents	12. Rated 13. Voltage	14. No. of 15. Points
16. 17. Fast	18. CCS (min 50KW)	19. 200-1000	20. 1/1 CG
	21. CHAdeMO ((min 50K	22. 200-1000	23. 1/1 CG
	24. Type -2 A (min 22 K	25. 380 - 480	26. 1/1 CG
27. Slow / 28. Moderate	29. Bharat DC -001(15 K	30. 72 - 200	31. 1/1 CG

33. The kiosk/board may have optional for installation or excess chargers if required.
34. The Public Charging Station Providers are free
35. to create Charging Hubs and to install additional number of Kiosk/Chargers in addition to the minimum number of chargers prescribed above.
36. Tie up with at least one online Network Service Providers (NSPs) to enable advance remote/online booking of charging slots by EV owners. Such online information to EV owners should also include information regarding location, types and numbers of chargers installed/available etc.
37. Appropriate Public amenities.
38. Where, in addition to the above, fast charging
39. facility is also planned to be provided at the PCS by the PCI provider, the following additional infrastructure must be provided:
40. Appropriate Liquid Cooled cables if High
41. Speed Charging Facility for onboard charge
42. ing of Fluid Cooled Batteries (FCBs) is also planned.
43. Appropriate Climate Control Equipment for Fast Charging of Batteries to be used for swapping (i.e. not onboard).

### Layout EV charging Station

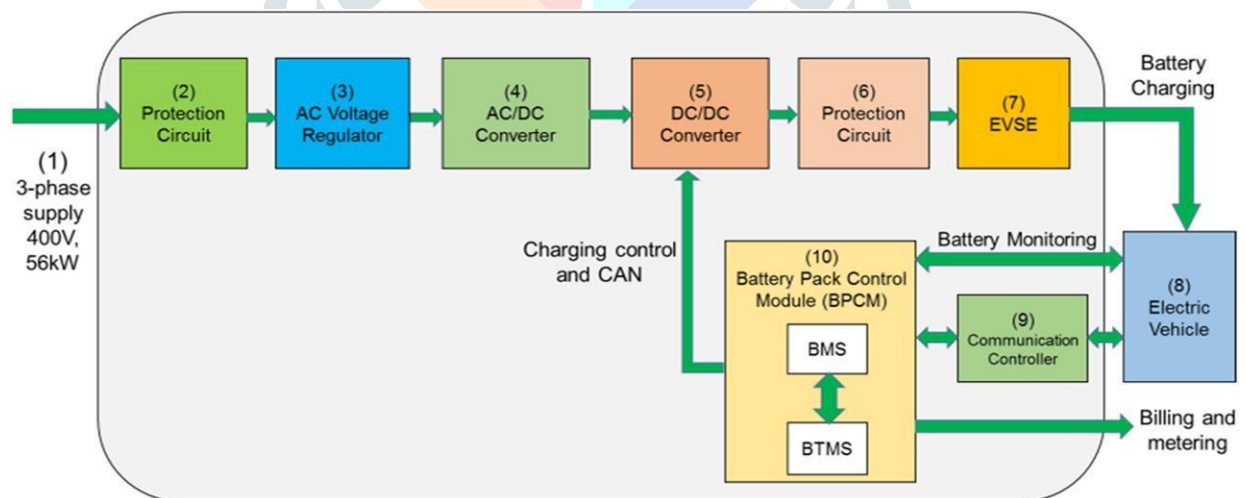


Fig.3.1 Layout EV charging Station



## Key Players in Charging Infrastructure Planning In India

Despite the many visible benefits of EVs, their peer acceptance is a question mark. Since the launch of National Electric Mobility Mission Plan 2020) launched in 2013, the electric vehicle industry in India has significant political momentum. Still, the concept electric mobility is in the developing stage in India. Stakeholders and policy makers therefore need to identify the factors that prevent this adoption of e-mobility in India to create a comprehensive strategy. Few researches have been done until now made regarding consumer intention to use e-mobility in India. Charges apply to various ministries and organizations infrastructure planning in India . Despite the fact that various ministries and organizations are actively seeking expansion .When it comes to charging infrastructure, the evolution from ICE-powered vehicles to EVs is slow due to a lack of coordination between organizations.

## Companies Providing EV charging station in Maharashtra

As of last update in 2023, several companies in India were providing EV charging stations using both private and Public-Private Partnership (PPP) formats. However, it's important to note that the EV charging infrastructure landscape is continuously evolving, and new companies may have entered the market since then. Here are some prominent companies that were involved in offering EV charging solutions in India

1. **Tata Power:** Tata Power is one of India's leading power companies and has a significant presence in the EV charging infrastructure sector. They offer charging stations for electric vehicles across various locations and have been actively involved in PPP projects with government bodies.
2. **ChargePoint India:** ChargePoint is a global EV charging network company that expanded its operations to India. They provide charging solutions for both private and commercial customers and have collaborated with multiple stakeholders to deploy EV charging stations.
3. **ABB India:** ABB is a multinational corporation specializing in electrification, automation, and digitalization solutions. They have a presence in India's EV charging infrastructure market, offering a range of charging solutions for different applications.
4. **Fortum India:** Fortum is a Finnish energy company that has ventured into the Indian EV charging market. They have been involved in PPP projects with government bodies and offer charging solutions for homes, workplaces, and public spaces.
5. **EVI Technologies:** EVI Technologies is an Indian company that focuses on developing EV charging

infrastructure in the country. They provide charging solutions for various types of electric vehicles, including two-wheelers, three-wheelers, and cars.

6. Delta Electronics India: Delta Electronics is a global company with expertise in power and thermal management solutions. They have expanded their operations to provide EV charging solutions in India and have participated in PPP projects.

7. Magenta Power: Magenta Power is an Indian company that offers EV charging infrastructure solutions for commercial and residential applications. They have been actively working to expand their charging network in the country.

8. Exicom Power Solutions: Exicom is an Indian company specializing in power and energy solutions. They have been involved in deploying EV charging stations in partnership with various organizations and government agencies.

### **Incentives provided by Maharashtra Government.**

#### **1. Capital Subsidy:**

The Maharashtra government offered capital subsidies to private entities, individuals, and businesses for setting up EV charging stations. The subsidy amount varied depending on the type and capacity of the charging station.

#### **2. Electricity Tariff Incentives:**

Electricity tariffs for EV charging stations were set at lower rates to make the operation of charging stations more cost-effective for operators. These reduced tariffs aimed to attract more investment in the EV charging infrastructure sector.

#### **3. Land Allocation:**



In some cases, the Maharashtra government allocated land at subsidized rates for the installation of public EV charging stations. This measure was aimed at making it easier for private companies and entrepreneurs to find suitable locations for charging infrastructure.

#### **4.Support for PPP Projects:**

The government supported Public-Private Partnership (PPP) projects for the deployment of EV charging stations in the state. These partnerships helped leverage private sector expertise and resources while aligning with the government's vision of promoting sustainable mobility.

#### **5.Green Building Incentives:**

For commercial and residential complexes that incorporated EV charging infrastructure as part of their green building initiatives, the government provided additional incentive and benefits.

#### **6.Waiver of Permit Fees:**

The Maharashtra government waived or reduced permit fees for the installation of EV charging stations to simplify the process for private entities and reduce upfront costs.

#### **7.Fast-Track Approvals:**

To streamline the approval process, the government established a fast-track mechanism for granting licenses and permits for EV charging station installations.

#### **8.Public-Private Collaboration for Infrastructure Development:**

The Maharashtra government actively collaborated with private companies and electric utilities to develop a robust and widespread EV charging network across the state.

#### **EV charging stations in Maharashtra**

As the Electric Mobility increases in India efforts also increases to develop the charging infrastructures, specially charging stations for infrastructures. It very useful for the owners of EV and also increases flexibility of owners without any limitations.

According to data provided by BEE (Beuro of Energy Efficiency) The leading state which is having highest no of EV Charging stations out of total charging stations in India is The Maharashtra State and this value meet to **2,354** nos. from all charging stations in India is is **8754**. These all EVCS are operated by total 84 different companies. From all these **27** are under Public Sector Undertakings (PSU's) and remaining **57** are from private companies.

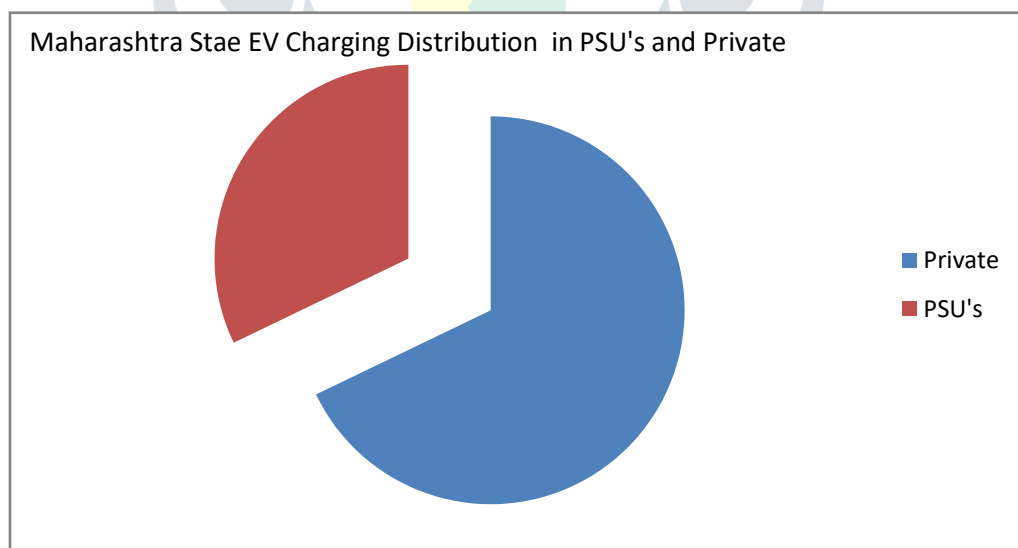
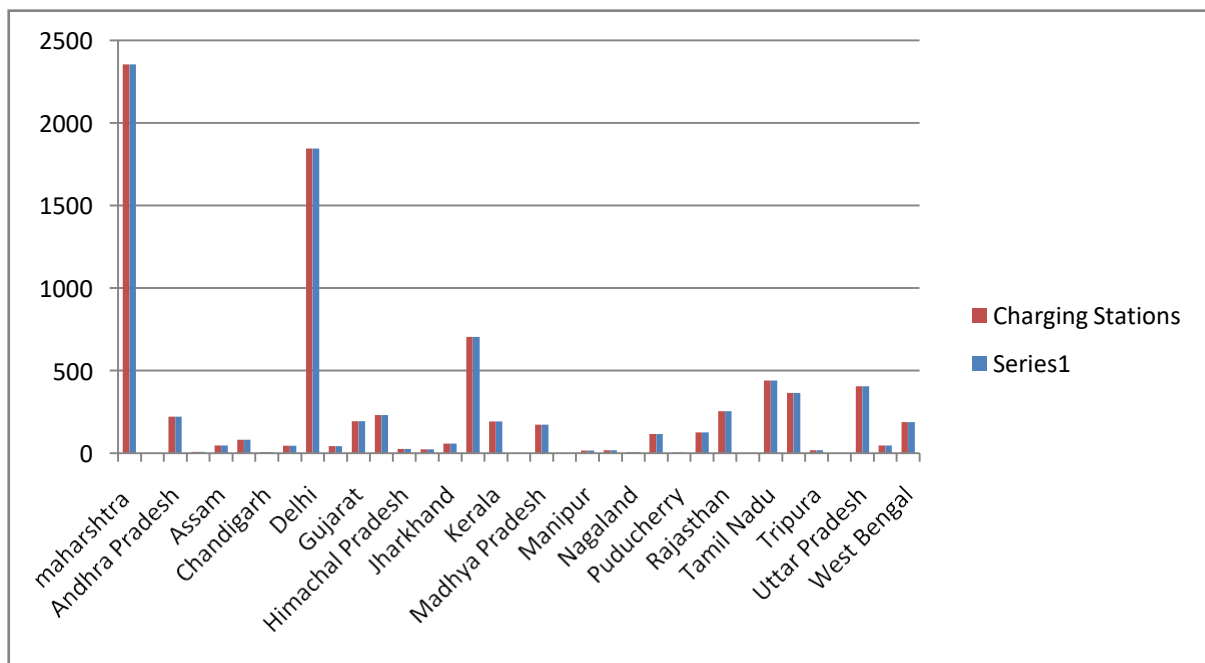


Fig.3.2. EV charging stations in maharashtra

### 3.7 District wise Number of Charging Stations

Table. No. 3.1 No. of charging stations in Maharashtra

Name of company	Nos.
Tata Power: Tata Power was actively involved in setting up EV charging infrastructure in various cities of Maharashtra.	450
Mahindra Electric: Mahindra Electric was promoting EVs and also had plans to develop charging infrastructure in the state.	67
Ather Energy: Ather Energy, an electric scooter manufacturer, was expanding its charging network in cities like Mumbai and Pune.	150
Magenta Power: Magenta Power was working on establishing EV charging stations in several locations across Maharashtra.	370
EVRE: EVRE (Electric Vehicle Recharge Equipment) was another company involved in providing EV charging solutions.	.....
ChargeGrid: ChargeGrid by Exicom Tele-Systems was also working on setting up EV charging stations in Maharashtra.	.....
Fortum India: Fortum India had plans to deploy EV charging infrastructure in various cities, including Pune and Mumbai	
MSEDCL	2375

Table No. 3.2 companies having charging stations in Maharashtra

#### Largest company for EV Charging Station in Maharashtra

Everyone should admit that when it comes to EV charging no other brand is well-known as Tata Power India. They are the country's largest CPO of EV charging infrastructure. They use all types of chargers, including DC 001, AC, Type 2, and Fast DC chargers with capacities of up to 50kwh for cars and up to 240kwh for buses. With a comprehensive network of over 24,000 public and semi-public chargers scattered over 300 cities, towns, and national roads, they ease the country's biggest charging issue among EV owners.

#### PPP Type

PPP stands for Public-Private Partnership. In the context of EV (Electric Vehicle) charging stations, a PPP-type EV charging station refers to a charging station that is set up and operated through a collaboration between the government (public sector) and private companies (private

sector). This partnership aims to combine the resources and expertise of both sectors to establish and maintain EV charging infrastructure in a more efficient and effective manner.

The government's involvement in the PPP model can include providing land or financial incentives, facilitating permits and regulations, and supporting the development of charging infrastructure. Private companies, on the other hand, invest in the construction, installation, and operation of the charging stations, offering their expertise in managing the charging network and ensuring its smooth functioning.

### **Battery Swapping and Charging Stations.**

In the most significant development yet on swappable battery infrastructure in India, electric vehicle (EV) firm Gogoro has pledged an investment of \$1.5 billion (approx. Rs 12,300 crore) in Maharashtra. Gogoro has announced it will open battery swapping stations in the state starting late-2023. The investment, which will be spread out over eight years, will be directed towards setting up a manufacturing facility for EVs, battery packs and battery swap stations. Gogoro has entered into an „Ultra Mega Project“ agreement with the Maharashtra government. Company founder and CEO Horace Luke received an offer letter at a state press conference from Maharashtra Chief Minister Eknath Shinde. Being classified as an „Ultra Mega Project“, Gogoro’s operations will make it eligible for a variety of state incentives.

Speaking at the announcement, CM Shinde said, “As the leading state in India for electric vehicles, Maharashtra is demonstrating our strong commitment towards sustainable transportation for all. As part of the project, Gogoro will establish its India vehicle, smart battery and battery swapping station manufacturing in Maharashtra and deploy their industry leading smart battery infrastructure in the state, generating approximately 10,000 direct and indirect jobs”.

## 4. Results

### District wise Number of Charging Stations

District	Nos.	District	Nos.	District	Nos.
Sangli	20	Jalna	5	Ahmednagar	20
Satara	8	Dharashiv	16	Dhule	6
Solapur	60	Nanded	3	Jalgaon	8
Kolhapur	95	Latur	4	Nandurbar	2
Pune	103	Parbhani	2	Nashik	26
Akola	3	Hingoli	1	Mumbai City district	210
Amravati	27	Bhandara	20	Mumbai Sub. district	881
Buldhana	3	Chandrapur	4	Thane	19
Yavatmal	3	Gadchiroli	4	Palghar	12
Washim	447	Gondia	5	Raigad	20
Sambhaji nagar	21	Nagpur	19	Ratnagiri	21
Beed	2	Wardha	2	Sindhudurg	14

Table No. 4.1 District wise Charging Stations

### Companies Providing Charging stations

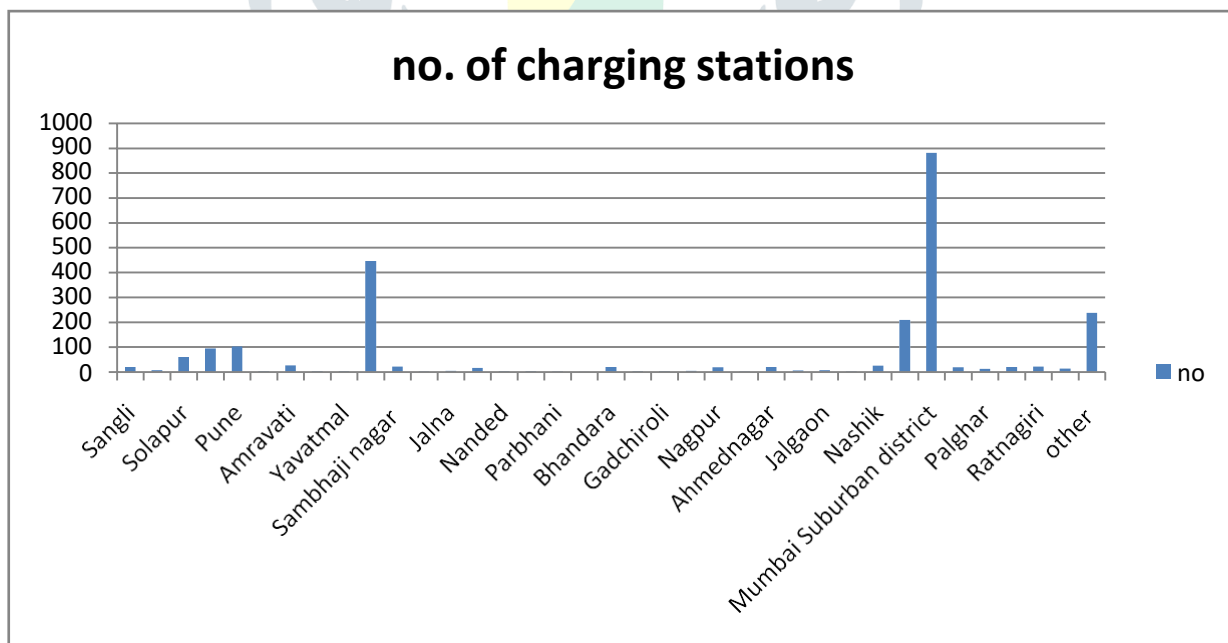
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Tata Power:	450
Mahindra Electric	67
Ather Energy	150
Magenta Power	370
EVRE	.....
ChargeGrid	.....
Fortum India	
MSEDCL	2375

Table No. 4.2 Companies Providing Charging stations

### 5. Observation and Conclusion

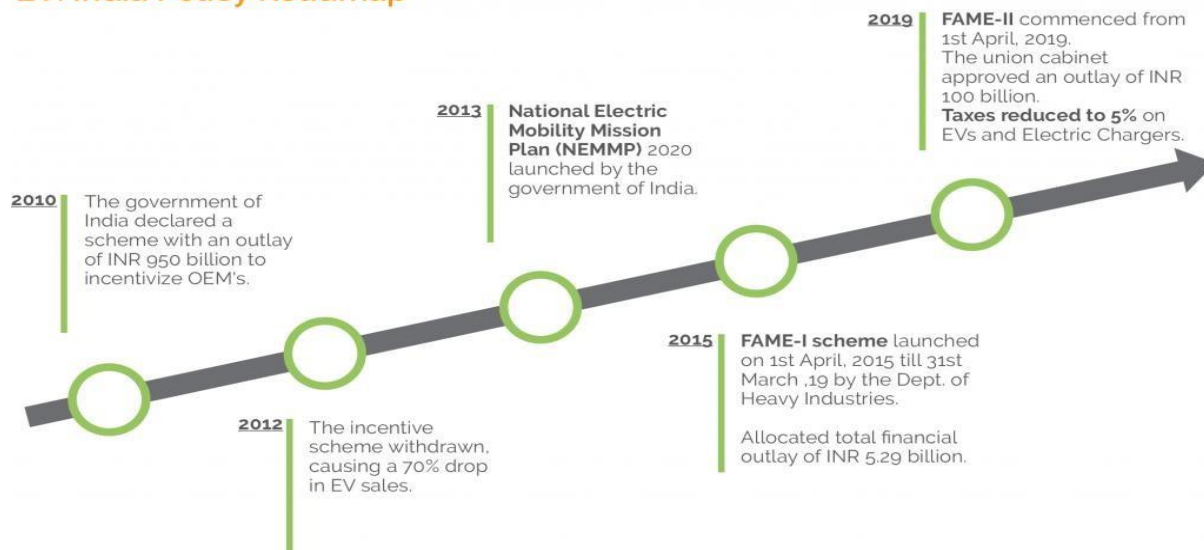
Total No of Charging Stations	2354
Top Charging Station Provider	Tata Power
Is Government Providing Incentive for Charging infrastructure	Yes
Is Government Providing Incentive for EV Purchase	Yes
Are Swappable Battery Stations available	Yes
Which Company Providing Swappable Battery Stations	Taiwan
Target 2030 For EV Charging Stations	Approx. 20000
Target 2030 For EV	80 to 100 %
Available applications for Charging Infrastructure	Hotels, National and state highways (both sides) Super market and mall

#### Available Charging Stations





## EV: India Policy Roadmap



## Conclusion

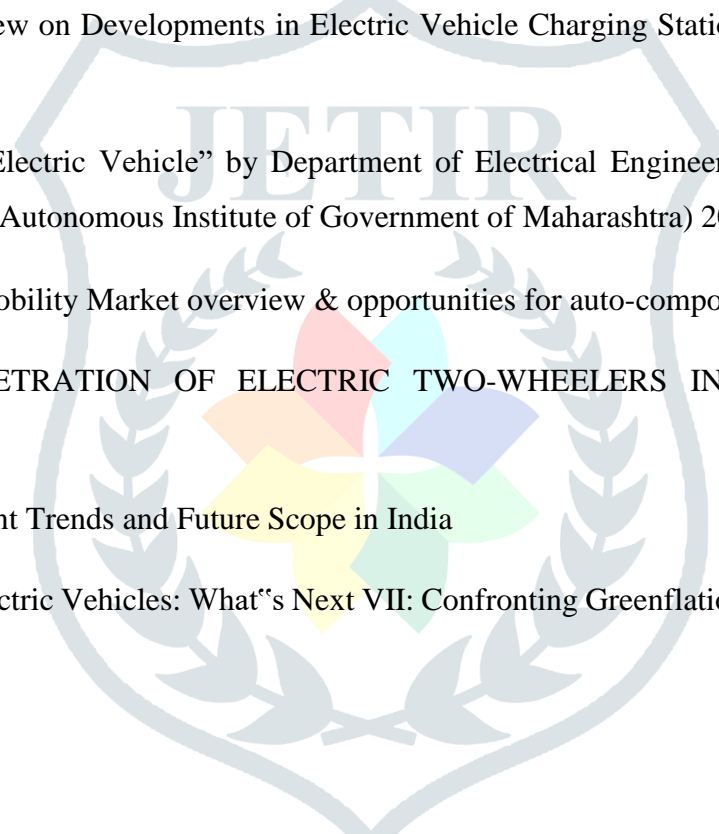
1. After the overall study of EV and the charging infrastructure we observed that Growing Network: Maharashtra has been witnessing a steady increase in the number of EV charging stations across the state. Major cities like Mumbai, Pune, Nagpur, and Aurangabad have seen substantial growth in charging infrastructure.
2. Public and Private Charging Points: Both public and private entities have been actively installing EV charging stations. Public charging points are usually located in prominent places like shopping malls, parking lots, and fuel stations, while private charging points are often found in residential and commercial complexes.
3. Charging Speeds: Different types of charging stations are available, offering varying charging speeds. Slow chargers (AC) are more commonly found in residential areas, while fast chargers (DC) are installed at public locations for quicker charging.
4. Government Initiatives: The Maharashtra state government has been implementing various initiatives to promote electric vehicles and support the establishment of charging infrastructure. Incentives and subsidies are often provided to encourage the adoption of

electric vehicles and the expansion of charging networks.

5.Charging Station Maps: Several online platforms and mobile applications offer maps and real-time information about EV charging stations across Maharashtra. These maps help users find nearby charging points and check their availability.

6.Charging Station Operators: Multiple companies and organizations have entered the charging infrastructure space, leading to diverse operators managing various charging stations.

## 9. References

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- The logo for JETIR (Journal of Emerging Technologies and Innovative Research) is a watermark in the background. It features a shield-like shape with a laurel wreath border. Inside the shield, the word 'JETIR' is written in large, bold, blue letters. Below the text is a colorful emblem consisting of several overlapping, semi-transparent shapes in shades of red, orange, yellow, green, and blue, arranged in a circular pattern.
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