PLANNING STRATEGIES FOR ELECTRIC VEHICLE CHARGING INFRASTRUCTURE: A CASE STUDY OF LUCKNOW

Thesis Submitted in Partial Fulfilment of the requirements
for the award of the degree of

MASTERS OF PLANNING

(URBAN PLANNING)

by
SABAHAT KHAN
(1220152007)

Under the guidance of
Prof. Varsha Verma

SCHOOL OF ARCHITECTURE & PLANNING,
BABU BANARASI DAS UNIVERSITY
FAIZABAD ROAD, LUCKNOW, U.P-226028
2023-2024

BABU BANARASI DAS UNIVERSITY, LUCKNOW

Report of M.Tech./M Pharma/M.Plan. Thesis/Dissertation Evaluation

Name of Student:_____ Roll No._____

Department:_____

Thesis Title:_____

(in capital)_____

Thesis Supervisor(s):_____

Remarks: Satisfactory/Not Satisfactory (in case of not satisfactory give comments)

_____

_____

_____

_____ _____

Sign of Thesis Supervisor Sign of External Examiner

_____ _____

Sign of Head of Department Sign of Dean of School

_____

Convener

BABU BANARASI DAS UNIVERSITY, LUCKNOW

CERTIFICATE OF THESIS SUBMISSION FOR EVALUATION

(Submit in Duplicate)

1. Name :**Sabahat khan**

2. Enrollment No. : **11201520053**

3. Thesis title: **PLANNING STRATEGIES FOR ELECTRIC VEHICLE CHARGING INFRASTRUCTURE**

3. Degree for which the thesis is submitted: **Masters of Planning (urban planning)**

4. Faculty of the University to which the thesis is submitted
   School of Architecture and Planning

6. Thesis Preparation Guide was referred to for preparing the thesis. ☐ YES ☐ NO
7. Specifications regarding thesis format have been closely followed. ☐ YES ☐ NO
8. The contents of the thesis have been organized based on the guidelines. ☐ YES ☐ NO
9. The thesis has been prepared without resorting to plagiarism. ☐ YES ☐ NO
10. All sources used have been cited appropriately. ☐ YES ☐ NO
11. The thesis has not been submitted elsewhere for a degree. ☐ YES ☐ NO
12. Submitted 2 spiral bound copies plus one CD. ☐ YES ☐ NO

(Signature of the Candidate)
Name: Sabahat khan
Roll No. 1220152007

BABU BANARASI DAS UNIVERSITY, LUCKNOW

CERTIFICATE OF FINALTHESIS SUBMISSION

(To be submitted in duplicate)

1. Name : **Sabahat khan**

2. Enrollment No. : **11201520053**

3. Thesis title: **PLANNING STRATEGIES FOR ELECTRIC VEHICLE CHARGING INFRASTRUCTURE**

3. Degree for which the thesis is submitted: **Masters of planning (urban planning)**

4. School (of the University to which the thesis is submitted)
   School of Architecture and Planning

6. Thesis Preparation Guide was referred to for preparing the thesis. ☐ YES ☐ NO

7. Specifications regarding thesis format have been closely followed. ☐ YES ☐ NO

8. The contents of the thesis have been organized based on the guidelines. ☐ YES ☐ NO

9. The thesis has been prepared without resorting to plagiarism. ☐ YES ☐ NO

10. All sources used have been cited appropriately. ☐ YES ☐ NO

11. The thesis has not been submitted elsewhere for a degree. ☐ YES ☐ NO

12. All the corrections have been incorporated. ☐ YES ☐ NO

13. Submitted 4 hard bound copies plus one CD.

(Signature(s) of the Supervisor(s))
Name(s):……...…….

(Signature of the Candidate)
Name:……...…….
Roll No …….
Enrollment No.:……

UNDERTAKING

I, Ms. Sabahat khan , the author of the thesis titled "PLANNING STRATEGIES FOR ELECTRIC VEHICLE CHARGING INFRASTRUCTURE", hereby declare that this is an independent work of mine, carried out towards fulfilment of the requirements for the award of the Masters in Planning (Urban planning) at the Department of Architecture and Planning, BBDU, Lucknow. The work has not been submitted to any other organization / institution for the award of any Degree/Diploma.

…….

Sabahat khan

Enroll. No. **11201520053**,

M.PLAN (Urban Planning)

(2023-2024)

Department of Architecture and Planning

Date: June,2024

ACKNOWLEDGEMENT

I sincerely thank school of Architecture & Planning, Lucknow for believing in me and giving me the chance to pursue a Masters of planning (urban planning) degree.

First and foremost, I want to express my deepest gratitude to my guide – Prof. Varsha Verma, who served as my mentor and adviser, for her excellent guidance, insightful suggestions, encouragement, motivation, and support throughout the entire process of this endeavor. I wouldn't have been able to finish my task on time without her guidance. she never stopped praising me and inspired me to put in continual effort.

I would also like to express my gratitude to Dean (SAP) – Dr. Mohit Kumar Agarwal, His invaluable guidance, expertise, and unwavering support throughout this research Endeavour have been instrumental in shaping the direction and quality of my work. His continuous encouragement, insightful feedback, and patience have truly been a source of inspiration for me.

I would also like to extend my heartfelt appreciation to my parents, Mr. Galib khan and Mrs. Subuhi khan. Their constant belief in my abilities, unwavering encouragement, and emotional support have been instrumental in this thesis's successful completion. Their profound wisdom and guidance have continuously motivated me to strive for excellence.

My friends have shown a great deal of interest in my research topic, and I am very appreciative of all the materials, links, and advice they have given me.

The project's success is credited to the support and direction of numerous individuals. I would want to take this opportunity to thank everyone who has contributed in any way to the successful completion of this project.

EXECUTIVE SUMMARY

The worldwide transportation industry is currently making the switch from conventional fossil fuel-powered automobiles to zero or extremely low exhaust emission vehicles. To effect this transformation, the right infrastructure for charging stations (CS), information systems, intelligent distributed power generating units, and helpful governmental policies are required. The purpose of this study is to discuss the important considerations that must be made using the guidelines and handbook prepared by the Government of India while designing the infrastructure for electric vehicle charging stations. The report also discusses important research and locational aspect of the study area and its current infrastructure capabilities so as to improve the modify the Electric vehicle charging infrastructure and effective administration of charging station infrastructure. The state of developments and major market participants for electric car charging stations in India are covered in the paper. The paper specifically offers a critical review of the opinions of the study area's residents regarding the adoption of electric vehicles, the issues related to it, and their willingness to purchase EVs in the near future if the required infrastructure is put in place after speaking with stakeholders.

Additionally, based on forecasts, proposals are created at the infrastructure and policy levels to support and promote emerging EVs. According to guidelines provided by the Ministries of Power, Urban Affairs and Housing, infrastructure is further classified into public, semi-public, and private sectors. In addition, policy proposals have been made to ensure EV adoption and to encourage stakeholders and major market players to engage actively in the process.

LIST OF TABLES

LIST FIGURES

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION

1.1 Introduction

As of 2020, Lucknow is the ninth most polluted city in the world. Lucknow has been seeing a spike in temperature as a result of increasing global temperatures. According to the Intergovernmental Panel on Climate Change (IPCC), increasing hazards to "health, livelihoods, food security, human security, water supply, and economic growth" will result from global warming of 1.5 °C. Reductions in crop yields and nutritional quality are examples of impact vectors. The availability of water resources, the spread of disease, and changes in feed quality all have an impact on livestock. Additionally, the risks associated with some vector-borne diseases, such as malaria and dengue fever, are anticipated to rise. Many places and seasons warm more than the average yearly temperature for the entire world, for example, "2-3 times higher in the Arctic."

Hence, to de-carbonize it's important to de-carbonize one of the most important sectors of development i.e. Transportation. Transportation is heavily dependent on fossil fuels and is one the leading contributors of climate change. And with the rise of Electric Vehicle and with recent advancements it can be a major factor in saving our planet.

1.2 Background

With batteries that have ever-increasing range, class-leading performance metrics, and cutting-edge technologies, the electric vehicle (EV) revolution that started to smoulder in the early 2000s has recently expanded into a fast-paced roll-out of dozens of new EV models that promise a future of fully autonomous vehicles and emissions-free transportation. The fact that EVs have zero tailpipe emissions is one of the most compelling arguments in favour of seeking progressive EV adoption. About 23% of the global greenhouse gas emissions are caused by

transportation [1]. Considering that most people consider EVs as an alternative to conventional ICE vehicles, the 2 are frequently contrasted to see how much of an influence they have on pollution emissions [2]. Conclusion of dissertation done in previous semester led to the following points:

1. Cost of EVs will be subsequently less in the Operation Phase further particle emissions will be very less too.
2. Fast paced 2-W and 3-Ware gaining momentum in UP.
3. Lack of Charging infrastructure and policies regarding them are creating hindrance to EV adoption.
4. Only if energy comes from renewable sources, then only adequate impact of EVs can control the Carbon Emissions as per CoP26 goals.
5. Lucknow comes up in the 2nd phase (i.e., 2025 onwards) of EV infrastructure development as per Ministry of Power.

Hence, this formed a basis for this study and our topic, **"PLANNING STRATEGIES & POLICIES FOR PROVISION OF ELECTRIC VEHICLE CHARGING INFRASTRUCTURE".**

1.3 EV Charging Requirements

Not just a single unit plays part in the charging infrastructure, it's a combination of various equipment as per standards laid to increase the EV adoption rate. The major equipment are discussed below.

1.3.1 Electric Vehicle Supply Equipment

The fundamental component of an EV charging infrastructure is electric vehicle supply equipment (EVSE). The EVSE uses a connected connection and a control system to safely charge EVs by drawing power from the local power grid. A user authentication system, charging authorization, information recording and exchange for network management, privacy and security, and other functions can all be carried out by an EVSE control system. It is advisable to use EVSEs with at least basic control and management options for all charging needs. Conductive charging, commonly referred to as plug-in (wired) charging, is the most widely used charging technology.. The amount of EVSE needed for conductive charging depends on various elements, including the type of vehicle, the battery capacity, the charging techniques, and the power ratings [3].

1.3.2 Types of Charging Methods and Chargers

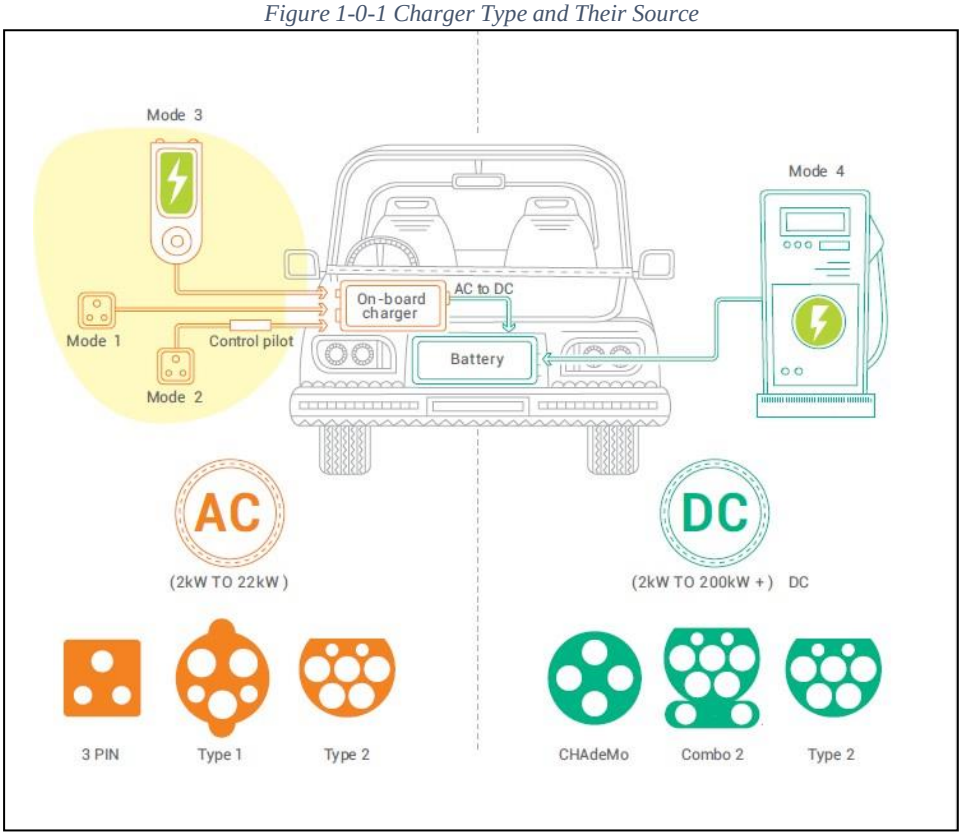
Direct current (DC) must be supplied to the battery pack in order for an EV to charge. A converter is needed to give DC power to the battery since alternating current (AC) power is supplied by energy distribution systems. AC or DC conductive charging is both possible. In the case of an AC EVSE, the onboard charger of the EV receives the AC power and converts it to DC. Bypassing the onboard charger, a DC EVSE externally transforms the power and delivers DC power straight to the battery. There are four additional charging modes that separate AC and DC charging, with Modes 1-3 pertaining to AC charging and Mode 4 pertaining to DC charging. [4].

Table 1-1 EVSE POWER RATING

	Power Level	Current Type	Compatible EV Segments
Normal Power Charging	P<7kW	AC & DC	E-2Ws, e-3Ws, e-cars, other LCVs (up to 1 ton)
	7kW < P < 22kW	AC & DC	
High Power Charging	22kW < P < 50 kW	DC	E-cars, LCVs and MCVs (1-6 tons)
	50 kW < P < 200kW	DC	

Source: Handbook for EV Charging Infrastructure

Figure 1-0-1 Charger Type and Their Source

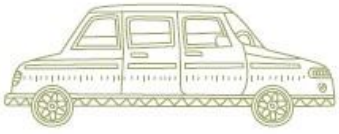


Source: Handbook of EV Charging Infrastructure

1.3.3 Battery Specifications for Different Segments

In India, light electric vehicles (LEVs), which include three wheelers and two-wheelers (bikes and scooters), are anticipated to be the primary force behind transport electrification during the next ten years (passenger and cargo). Other important vehicle sectors being electrified include autos and light commercial vehicles (LCVs), in addition to these. Low-voltage batteries power E-3Ws and E-2Ws. Low voltage batteries are also used to power the first generation of e-cars. Nevertheless, even if they continue in particular use cases like taxis, these will probably be phased away in the future. High-voltage batteries power the upcoming e-car models of the second generation of e-cars. Electric LCVs will be made up of both high-voltage and low-voltage vehicles, depending on their ability to carry loads. [3].

Table 1-2 Typical Battery Specification for different segment

VEHICLE SEGMENT	BATTERY CAPACITY	BATTERY VOLTAGE
 E-2W	1.2-3.3 kWh	48-72V
 E-3W (passenger/ goods)	3.6-8 kWh	48-60V
 E-cars (1st generation)	21 kWh	72V
 E-cars (2nd generation)	30-80 kWh	350-500V

Source: Compiled from market data of available EV models (as of July 2021)

1.3.4 EV Standards for Interoperability

Standards guarantee the compatibility and interoperability of every EVSE with every EV. India's national standards organisation, the Bureau of Indian Standards (BIS), is in charge of creating the nation's EV charging regulations. A global organisation called the International Electrotechnical Commission (IEC) is developing reference standards to ensure

interoperability and lower trade barriers for electric vehicles and their parts, is a member of the BIS. While Indian EV charging requirements are consistent with international norms, local climate factors and the variety of car types available in the nation require adaptations that are unique to India.

Standards for AC Charging in India : primary EV charging standard in India is IS 17017, All EV charging systems have the fundamental features listed in IS-17017-Part-1.

Technically speaking, AC and DC EVSE must both meet IS-17017-Parts 21 and 22. Additional Indian specifications for AC EVSEs have been certified for usage in parking lots by light EVs and e-cars (in the form of inexpensive charging stations).

Indian Standards for DC Charging: The specifications for DC charging stations with power outputs ranging from 50 kW to 200 kW are laid out in IS-17017-Part-23. In addition, in order to accommodate buses and other big vehicles, high power charging standards are needed. The IS-17017-Part-25, which is designed for providing low DC power of less than 7kW for light EVs, was just finalised by the BIS. IS-17017-Part 24 specifies data communication standards since digital communications between the EV and the DC EVSE are necessary. Communications will follow the IS-15118 series after the Combined Charging System (CCS) standard, which may offer both AC and DC charging, is implemented.

1.3.5 Access to Electric Vehicle Charging Infrastructure

It is desirable to have a large number of low-power charging stations in an EV charging network as opposed to a few high-power ones. For EVs, any parking space where the car is parked still and where there is a charging station for EVs presents a chance to recharge the battery. This is also known as destination charging, in contrast to "on-the-go charging," in which vehicles quickly top off their battery charge to carry on driving to their destinations. Therefore, EV charging infrastructure should be provided at locations where cars are frequently parked rather than in new locations for EV charging hubs. This approach to building out the infrastructure for charging encourages a dispersed network of EV charging stations that users can access at various locations, such as offices, residences, apartment buildings, retail malls, metro stations, and trains, bus depots, etc. For consumers and operators, a distributed network architecture like this has several benefits, from accessibility to economic feasibility.

Use of Normal Charging Points: The requirement for ultra-high power and high power charging points, which are more expensive and can be harmful to the health of EV batteries if overused, is reduced by a compact network of normal-power EV charging stations.

Cost Efficiency: In addition to being less expensive, normal power charging stations also take up less room and use less electricity, which further lowers capital expenditures. Low-voltage single- and three phase distribution networks, which are prevalent in buildings and public areas, can be used to connect them.

Financial Viability: Government subsidies can be cut back by lowering the upfront costs of installing charging infrastructure, which also increases the profitability of private sector involvement in charging operations.

Increasing the availability of charging stations is more important than anything else for an effective rollout of EV infrastructure in a developing EV market. It is possible to guarantee that EV charging needs are effectively addressed by distributing the availability of numerous conventional power charging points along with a small number of high-power charging stations.

1.3.6 India’s RoadMap for Electric Vehicles

India's plan to sell exclusively electric vehicles by 2030 focuses on integrating mobility with electricity, creating a shared ecosystem platform, and scaling up manufacturing. There are three stages to the implementation. [5]

1. Phase 1's objective is to seize currently available economic possibilities while laying the groundwork for future strategic options. This entails setting up the necessary transportation infrastructure. This infrastructure consists of the actual on-demand transportation vehicles as well as the software platform. [5]
2. The second phase entails enhancing and expanding upon the recommendations made in the previous phase while enticing private players to participate. In this stage, a system-wide mobility solution will be installed. [5]
3. The third phase allows electric vehicles to discharge electricity to the grid and combines electricity with the transportation system. At this point, all government incentives will also gradually disappear. [5]

1.3.7 Need of Study

1. Government's projections and estimation for EV fleet leads to requirement of adequate amount of Electric Vehicle Charging Infrastructure.
2. Un-availability of charging infrastructure has been a major cause of concern for people buying EV.
3. EV adoption because of EV infrastructure will lead to de-carbonization in the atmosphere.
4. Further, release of PPM will also decrease, leading to decrease in rate of respiratory disease.

1.4 Aim

Provision of Area based EV charging infrastructure and suggest policies & regulations for faster EV adoption.

1.5 Objectives

a. To study the infrastructure and working environment related to
b. EV through various foreign & national literature & case studies.
c. To familiarize Electric Vehicles with current scenario.
d. To analyze the existing issues related to charging infrastructure for EV.
e. To propose EV infrastructure as per norms and regulations.
f. To suggest policies and regulations to increase public and private EV charging infrastructure.

1.6 Scope

1. Types of EV charging infrastructure for public and private infrastructure.
2. Incentives to be provided by public and private agencies to promote EV.
3. Possible location of public charging station within present infrastructure
4. Public awareness through various means like campaign & events.
5. Green energy to be used for EV charging infrastructure.

1.7 Limitations

1. Long range and heavy-duty vehicles are not considered.
2. Un-availability of renewable energy is not considered.
3. EV penetration rate assumed by government will only be taken into account.

1.8 Methodology

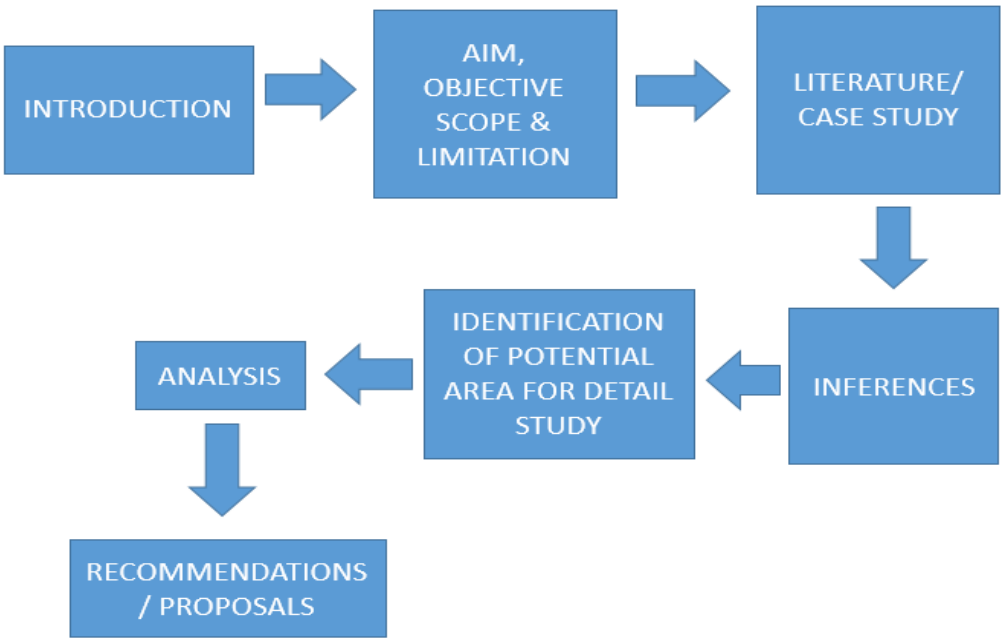


fig 1-8 workflow of methodology
Source: Author

To achieve the identified objectives above mentioned methodology is formulated as per the location of the study area and need of the topic. The research requires a lot of literature study and research related to the topic before conducting any kind of physical survey to correlate with the inferences developed from the literature review.

CHAPTER 2: LITERATURE STUDY

2.1 Guidelines and Standards for Electric Vehicle Ministry of Power (January, 2022)

❖ **PUBLIC CHARGING STATIONS –**

- owners may charge their EVs at their residences and offices using their existing electricity connections.
- An entity will be free to set up public charging stations provided such stations meet the technical, safety, and performance standards and protocols laid down by the Ministry of Power, Bureau of Energy Efficiency, and Central Electricity Authority.
- The public charging station may apply for electricity connection to the distributive company licensee.
- public charging stations will be provided with connectivity within seven days in metro cities,15 days in other municipal areas, and 30 days in rural areas.
- The EV Supply Equipment (EVSE) should have been tested by an agency or lab accredited by (NABL).

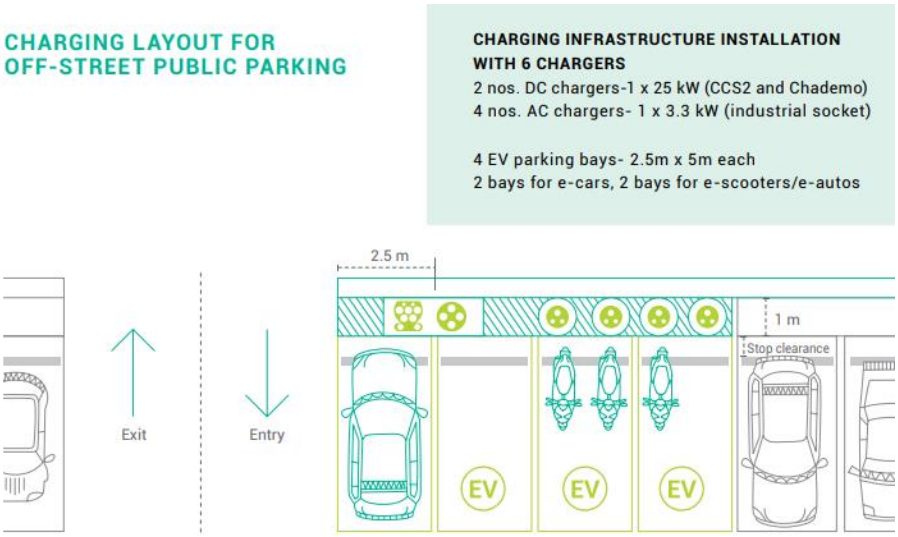


fig 2-1-1 charging layout for off- street parking
Source: Niti Aayog

- 20% of the parking spaces should be reserved for EV.
- The building premises will need an additional energy load of 1.25 i.e. equal to the electricity needed for all PCS.
- **LOCATION OF PUBLIC CHARGING STATIONS –**
- At least one charging station will be available in a grid of 3X3km. On both sides of the highways one charging station will be set up at every 25 km.
- for long-range and heavy-duty EVs, There will be at least one fast-charging station with charging infrastructure at every 100 km, one on each side of the highways.

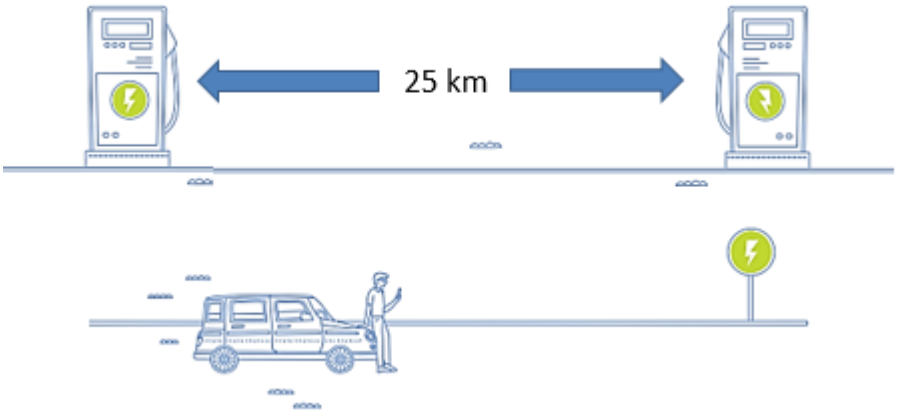


fig 2-1-2. location of public charging stations
Source: Niti Aayog

- the central and state governments must prioritize existing retail outlets of oil marketing companies to install public charging stations in order to meet the listed requirements.
- **TARIFF FOR THE SUPPLY OF ELECTRICITY TO EV PUBLIC CHARGING STATIONS –**
- The tariff for electricity supply to public charging stations will be a single part tariff and will not exceed the average cost of supply until March 31, 2025.
- Also, the tariff applicable for domestic consumption will be applicable for domestic charging. separate metering arrangement for public charging stations will be there, so that the consumption can be recorded and billed as per the tariffs for public EV charging stations.
- **STATE GOVERNMENTS TO FIX THE CEILING OF SERVICE CHARGES –**
- the state government will fix the ceiling of service charges to be levied by such charging stations. As electricity is being provided at concessional rates and the central or state governments are giving subsidies for setting up public charging stations.

fig 2-1-3. Fame india scheme
Source: google images

- **PRIORITY FOR THE ROLLOUT OF EV CHARGING STATIONS –**
- The public charging stations will be rolled out in the following phased manner:
- **Phase I (1 to 3 years):** In all megacities with a population of more than four million, all existing expressways connected to these megacities and important highways connected with

each of these megacities will be taken up for coverage.

- **Phase-II (3-5 years):** Big cities, state capitals, and headquarters of union territories will be covered for distributed and demonstrative effect. Highways connected with these cities will be taken up for coverage**.**
- **PROVISION OF LAND FOR PUBLIC CHARGING STATIONS–**
- land available with the government or public entities will be provided to install public charging stations to a government or public entity on a revenue-sharing basis at the fixed rate of ₹1 (~$0.0135)/kWh.

❖ **URDPFI GUIDELINES FOR EV CHARGING STATIONS –**

Sr. No.	Category	Population served per unit	Land Area requirement Type of Facility	 Area required	Other controls
1.	Petrol/Diesel filling/EV charging* and service centre				
	Along National and State Highways Villages identified as growth centres Freight Complex Proposed major roads Police/security forces services (for captive use only) (MPD, pg 125)		v. Public Charging Station (PCS) (minimum requirement as per MoP guidelines) vi. FCB CS 1 CCS 1 CHAdeMO vii. Battery Swapping Station (optional)	Min. 13.5m x 5.5m Min. 15m x 7m Earmarking area for "battery fitting"	fire department. Charging station and all equipment layout with respect to nearest dispensing unit (DU)/fuel tank to be as per PESO rules. Equipped with CCE and LCC, as required in addition to requirements of PCS. Optional addition to PCS by the SP
			Type of Facility	Area required	
3.	Standalone Public Charging Stations (PCS)				
A	Public Charging Stations	Every 25 Kms, both sides along the highways/roads	PCS with charger ratio (minimum requirements of PCS, as per MoP) - 1 FC for every 10 EVs 1 SC for every 3 EVs	Additional area as per total parking capacity at the Restaurants /Eateries.	Equipped with CCE and LCC, as may be required for fast charging.
B	Fast Charging facility / FCB CS (*for Long Distance & Heavy Duty EVs*)	Every 100 Kms, both sides along the highways/roads	At least 2 chargers 1 CCC type 1 CHAdeMO type (min 100KW each)	Min. 15m x 7m	May be coupled with the PCS at item A above, with CCE and LCC.
C	Battery Swapping Station	Optional provisions as per MoP Guidelines.	Standalone Provided along with FBC charging Stations	Min 5.5m x 2.75m	May be coupled with PCS at item A or FCB CS at item B above.

fig 2-1-4. URDPFI guidelines
Source: MOP

2.2 Electric vehicle charging network in Europe: An accessibility and deployment trends analysis: Giacomo Falchetta, Michel Noussan (April 2021)

❖ **INTRODUCTION :**

A detailed spatial analysis of the availability of EV charging stations with a focus on European countries and in comparison with the population and vehicles distribution in different regions.

❖ **OBJECTIVE :**

To study the Infrastructure and working environment related to EVs in various European countries and study schemes promoting it.

❖ **EVOLUTION OF EV CHARGING STATIONS :**

- The historical trends over the last six years of the cumulative number of charging points and nominal charging capacity are reported in below chart show a continuous evolution over the years, leading to a three-fold increase in the number of points and a four fold increase of the total charging power.
- The countries with the highest installed capacity are Germany, Norway, the UK, Italy, Sweden, France and the Netherlands. Germany is the country with the highest installed capacity, with the combined capacity of Norway and the UK. considering the population of these countries, the position of Norway appears the highest.

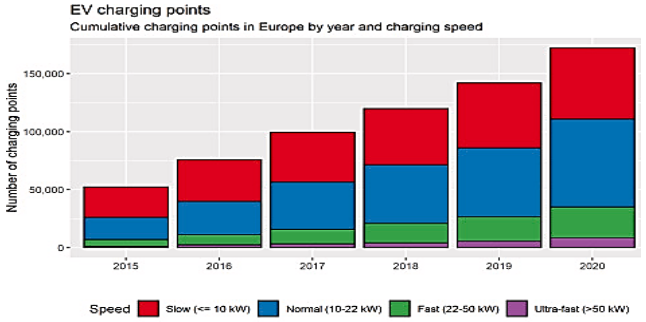


fig 2-2-1. EV charging points

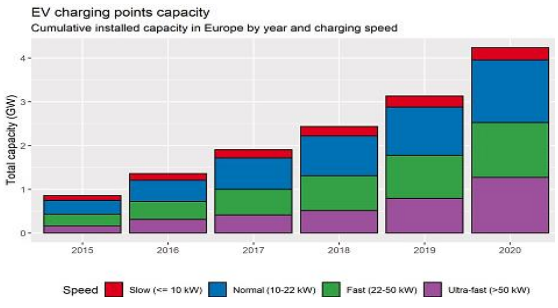


fig 2-2-2. EV charging points capacity

- For the first five countries by number of charging points in the report (Germany, UK, France, Spain and Italy), the number of existing public charging points (according to the Open Charge Map database) is in the 3%–15% range compared to estimated numbers for 2025. in the future, to meet future targets significant increases are likely required.

❖ **DISTRIBUTION OF EV CHARGING POINTS :**

Additional details on the distribution of EV charging points in European regions are reported in below figures represent the ratio between charging points and vehicle ownership, population, and the working population, respectively.

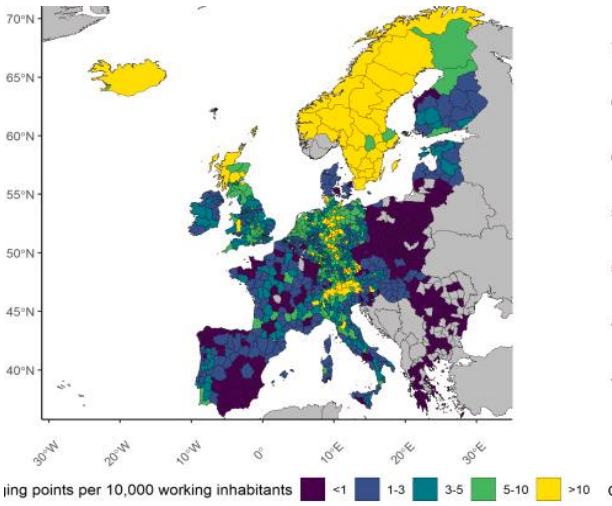


fig 2-2-3. charging points per working inhabitants

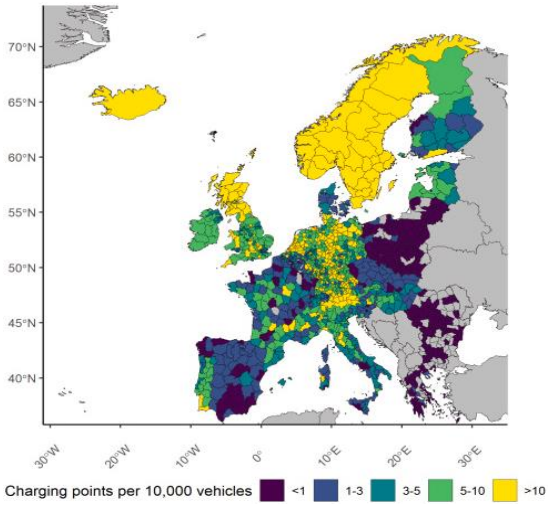


fig 2-2-4. charging points per vehicles

- Comparing the three maps is insightful because it helps appreciating differences across urban and rural areas, and chiefly the role of different motorization rates, which tend to be significantly higher in rural areas.
- regions in Central and Northern Europe tend to show on average a larger number of charging points per capita, while in Eastern and Southern Europe (with the exception of Northern Italy and some areas of Portugal) people have a lower number of public accessible charging points for their EVs.
- The most prominent differences between the charging points-to-vehicle and charging points-to-population ratios can be observed in France, Portugal, England, Ireland, the Baltic countries and Hungary. Conversely, in EU countries with high motorization rates such as Italy, Poland and Spain, the discrepancy is significantly smaller.

These differences among countries are to be considered by acknowledging the significant variability of dedicated policies from one country to another, given the fact that EV market is often in a preliminary stage, thus needing a public support to shift towards a growth stage.

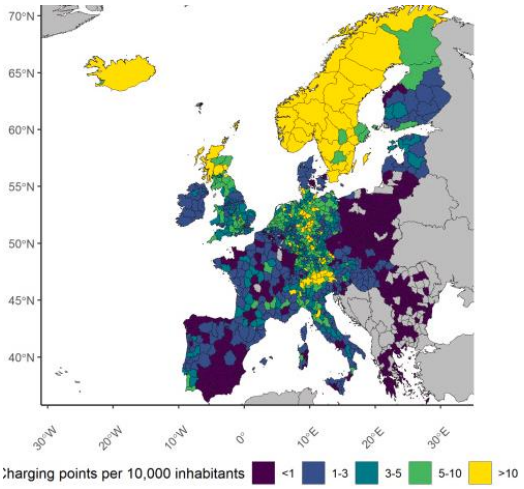


fig 2-2-5. charging points per inhabitants

❖ ACCESSIBILTY TO EV CHARGING STATIONS :

- A stark inequality characterizes both across and within country accessibility to EV

charging stations. The United Kingdom, the Netherlands, Belgium, large parts of Germany, France, and northern Italy appear as the areas in the considered countries in Europe with the quickest accessibility potential.

- Other scattered areas, in particular in the surroundings of large metropolitan areas in Spain, Portugal, southern Italy, Scandinavia and Poland are characterized by EV charging infrastructure availability in the proximity of population place of residence.
- Conversely, other areas such as a major portion of the Iberian Peninsula, Scandinavia, Greece, and Eastern show major accessibility deficit which would disincentive drivers purchasing EV vehicles or would discourage EV owners to travel towards these locations.
- a significant role is likely played by the different degrees of market maturity as well as the public policy support to the installation of EV infrastructure.

❖ **COMPETITION IN LOCAL EV CHARGING MARKETS :**

- The map evidences the number of unique operators active with at least one charging station in each unit.

The map is particularly interesting when compared

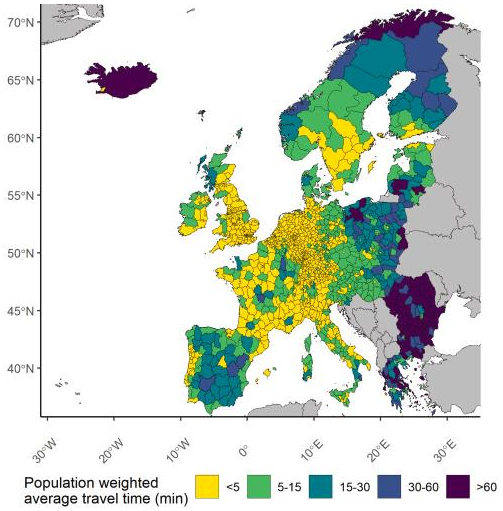


fig 2-2-6. Accessibility

- with the results of the charging station accessibility analysis, because it shows that while competition is positively correlated with accessibility, i.e. negatively correlated with travel time, the correlation is not constant across regions.
- certain regions of northern and eastern Spain, central Italy, Poland and Scandinavia show fairly competitive markets (5–10 operators) and yet are still affected by charging station accessibility issues, likely because operations of several operators in these provinces is still at an early stage. Conversely, other areas show a oligopolistic tendency irrespective of generally good accessibility to charging stations. These areas include parts of Germany, France, the Netherlands and Belgium.

❖ **SCHEMES PROMOTING EV :**

•free charging, sometimes with additional constraints, including maximum duration, with fixed parking fees, required membership. In some cases the free option is limited to the first months/years of operation.

•annual or monthly pass, for a fixed cost.

•charging price based on energy, expressed in euro/kWh (or other currencies), with variable values related to the charging power that is available. The most popular schemes are in the range 0.25–0.50 euro/kWh (or equivalent).

•more complex pricing schemes, including combinations of energy consumption, duration and fixed price per charging. In some cases the cost is flat, with a maximum duration of the charging process.

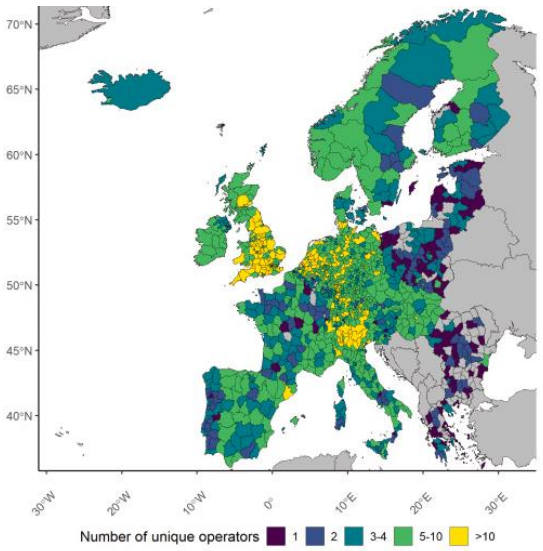


fig 2-2-7. No. of operators

❖ **ISSUES :**

- although recent years have witnessed a notable expansion of the ev charging network, stark inequalities persist across and within countries, both in terms of accessibility and of the charging points available to users.
- notwithstanding the continuous increase in the last years, as of 2020 most European regions have less than 0.5 ev charging points per 1,000 inhabitants, and this increasing pace of new installations needs to continue in the future to support an increase in ev fleets.
- increasing the urban–rural divide is also a major issue which should be addressed.
- The electricity supply to EVs need to be optimized.

❖ **INFERENCES :**

- The results highlight the differences between European countries, which reflect the various levels of maturity of the EV markets. In this early stage, such levels are strongly related to the level of support from National policies, not only considering incentives for the deployment of electric cars, but especially for the support to a widespread network of public accessible charging points.
- The policy support for public charging may vary across countries, since strategies are based on the specific conditions of building types, population density, drivers' habits.
- These very same differences appear when focusing on the largest European cities, with a significant variability in both the average distance from a charging point and the number of installed charging points compared to the population. Additionally, differences emerge between urban and rural areas.

- the increase of charging points preceding the increase of EV sales is noticeable in most

countries. Additionally, the more intense the competition between different operators in a specific region, the lower the average distance to a charging points for its citizens.

- Further, important aspects include the significance of the charging station access mode: operators should aim at partnering into a shared membership platform, possibly EU-wide, so that EV drivers can travel without 'range anxiety' in different regions as they would do with an ICE vehicle.
- This approach is gaining momentum in Europe, as several providers are currently offering to their customers the possibility of using the charging infrastructure of partner companies abroad.
- In the next decades, an increased deployment of EVs in middle- and lower-income households without home-charging options, especially in urban environments, will likely require a significant public charging infrastructure. Estimations of the share of public EV charging in EU countries will increase from 5%–28% in 2020 to 47%–59% in 2030
- These figures may vary from a country to another, depending on the share of urban and rural population, as well as on the prevalent building type: in countries with a very high share of detached and semi-detached housing, there may be less need for public charging infrastructure.
- Fast and ultra-fast charging points are mostly installed along highways, since they are aiming at users that travel for long distances and need a quick source of energy supply. These stations thus show a low degree of flexibility in the demand and they are also charging higher prices to the customers per unit of energy supplied.
- Conversely, slow- and normal-speed charging points are generally used for occasional charging or a substitute for household or workplace charging for users that do not have access to those options.

Chapter 3 CASE STUDY

3.1 The Spatial Planning Of Public Electric Vehicle Charging Infrastructure In A High-density City Using A Contextualized Location-allocation Model- Hong Kong (April,2022)

❖ **INTRODUCTION :**

This study considers Hong Kong, a high-density city with a population of 7.5 million people. The urban centres of the city are located along the Hong Kong Island and Kowloon. Outside the urban areas, new towns and new development areas constitute the suburban areas of the city, which has lower job accessibility and longer commutes because of the strong agglomeration economy in the urban core.

❖ **OBJECTIVE :**

To study the allocation pattern of EV charging stations in a high Density city through location location -allocation model.

❖ **METHODOLOGY :**

From the supply side, we studied the latest planning guidelines and conducted a spatial analysis of potential charging sites. From the demand side, we conducted a questionnaire survey with local residents, estimated their EV purchase intention, and then projected the usage demand for public chargers. These supply-and-demand constraints were subsequently incorporated into a location-allocation model to minimise both charging demand shortfall and travel time to charging facilities.

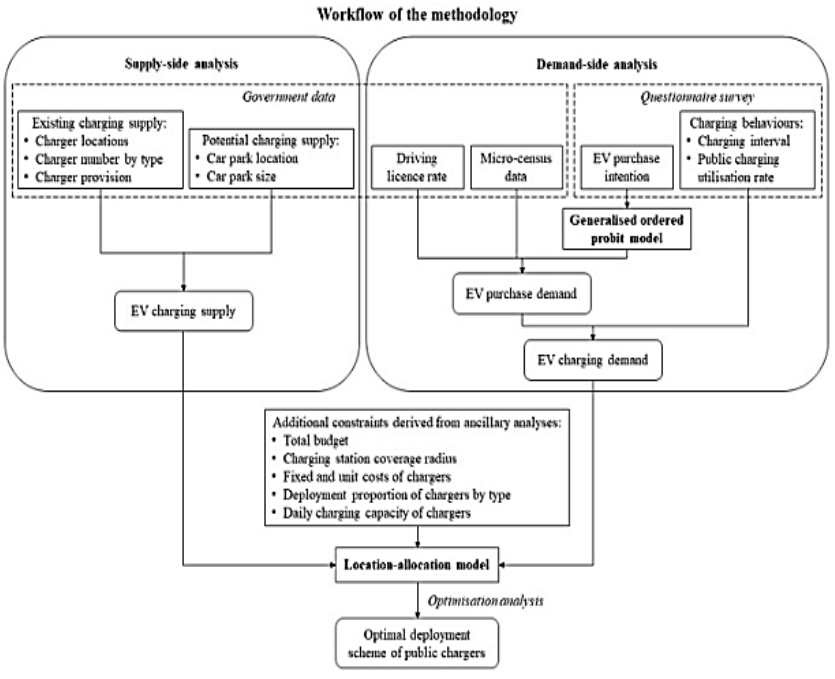


fig 3-1-1. Workflow of the methodology

❖ **SUPPLY-SIDE ANALYSIS: EXISTING AND POTENTIAL ELECTRIC VEHICLE CHARGING STATIONS**

we have identified public car parks as potential sites for charging facility deployment because the whole of Hong Kong's existing public charging network corresponds to parking lots.

Although car park locations generally overlapped with Hong Kong's urban areas,

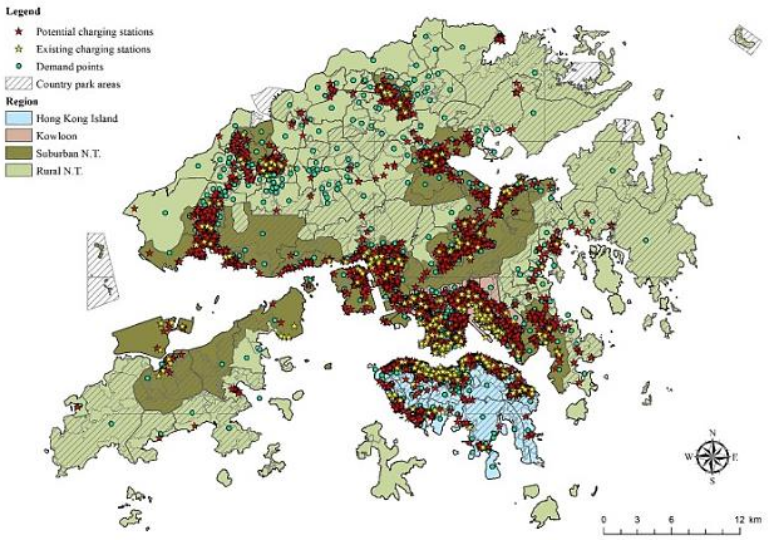


fig 3-1-2. Existing and potential charging stations

EV charging stations were concentrated along the harbourfronts of Hong Kong Island and Kowloon Peninsula. In contrast, charger supply in the New Territories was scattered across satellite communities in suburban areas, with few existing or potential charging spots located in the relatively vast rural region.

❖ **DEMAND-SIDE ANALYSIS:**

The demand-side analysis included two steps. First, we predicted EV purchase demand for each neighborhood in the study area based on the number of EVs. Second, we estimated each neighborhood's charging needs based on the prospective EV fleet. From the demand side, we conducted a questionnaire survey with local residents, estimated their EV purchase intention, and then projected the usage demand for public chargers.

▪ **DATA COLLECTION: QUESTIONNAIRE SURVEY**

For EV purchase demand, we measured a person's intention to buy an EV in the next 5 years using a 7-point Likert scale where 1 corresponded to 'definitely not' and 7 corresponded to 'definitely'.

The questionnaire inquired about their regular charging interval and their primary charging location. Based on the survey results, EV drivers on average charge their EVs at a 4-day interval, and about 52.5% of them utilized the public charging network as primary charging solution.

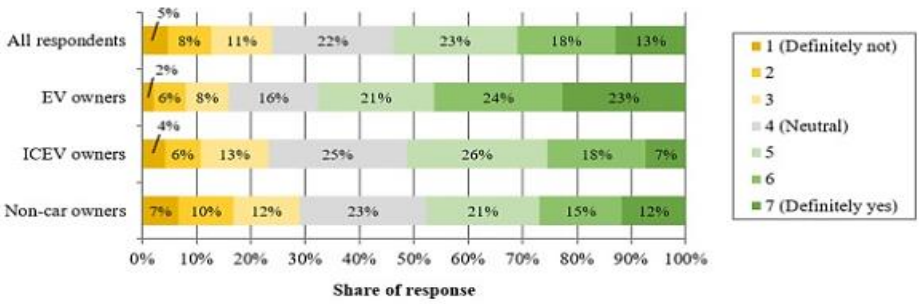


fig 3-1-3. share of response

- **ELECTRIC VEHICLE CHARGING DEMAND :**

Despite being the wealthiest region, most parts of Hong Kong Island (excluding the Eastern District) indicated only moderate EV charging demand. This can be attributed to public transport providing relatively easy access to workplaces and car parking being expensive; these factors reduce both the need and desire to buy a car in general. In Kowloon, there is substantial

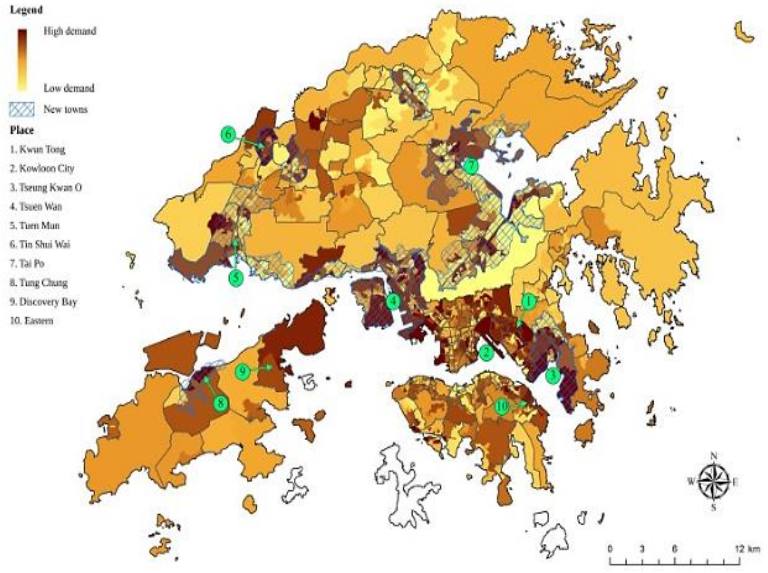


fig 3-1-4. charging demand

charging demand for the East Kowloon area, including Kwun Tong District and parts of Kowloon City District. In the New Territories, new towns represent major sources of charging demand, especially Tseung Kwan O, Tsuen Wan, Tuen Mun, Tin Shui Wai, Tai Po and Tung Chung. A small number of individual residential zones outside the urban areas and new towns (e.g. Discovery Bay) also represent substantial charging demand.

- **RESULTS OF LOCATION - ALLOCATION MODEL**

- According to the optimal solution, in addition to the 332 existing charging stations, 113 new stations would be required to satisfy demand. Of the existing charging stations, 244 would require expansion, indicating accessible locations not reaching supply potential.

- Most new charging stations recommended by our model would be allocated to the suburban areas to expand charging accessibility in new towns.

Clusters of new charging stations would also be located in selected communities across the Kowloon and Hong Kong Island urban areas, namely, the north-eastern skirt of

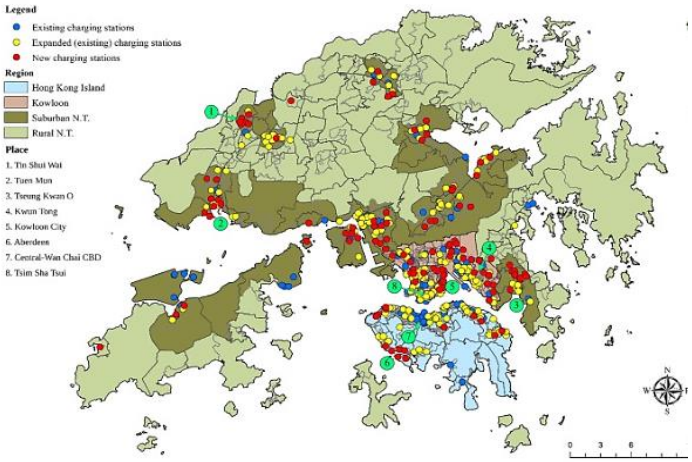


fig 3-1-5. Results

- Kwun Tong District, Kowloon City District (Kowloon) and Aberdeen (Hong Kong Island).

The concentration of new charging stations in these districts suggests that a shortage of convenient charging spots demands new charging locations to promote access to the charging network.

- On Hong Kong Island, the Central-Wan Chai CBD (Central & Western District and Wan Chai District) would primarily receive charging station expansions making it more economical to expand capacity at these stations because it would reduce the fixed costs associated with establishing new charging stations.
- There could be two possible reasons for the clustering of charging stations expansions: first, these districts enjoy a high concentration of major shopping malls and commercial. second, given our model estimated charging demand based on a district's population demographics, business districts, such as the CBD, contain relatively few residential units and its residents do not generate a particularly substantial charging demand.

❖ **ISSUES :**

- Providing public charging infrastructure is especially crucial for high-density cities, where home charging is often unfeasible due to the scarcity of single-family housing units and the lack of individual parking space.
- charger supply in the New Territories was scattered across satellite communities in suburban areas, with few existing or potential charging spots located in the relatively vast rural region.
- 75% EV owners living in private residential units.
- the current supply of public charging facilities is insufficient, making it imperative to establish new charging infrastructure – including facilities at both existing and new locations – to satisfy Hong Kong's future EV charging demand.
- fulfilling the demand shortfall in new towns should be prioritized.

❖ **PROPOSALS & RECOMMENDATIONS :**

- To counter limited home-charger penetration, it is necessary to balance the proximity of public charging facilities to residential areas.
- assigning public EV chargers at community hubs such as shopping malls or community centres could plausibly serve nearby residents and provide add-on services such as quick daytime charging.
- To ascertain supply capacity, authorities could assign a minimum percentage of charging-enabled parking spaces to certain communal buildings. For example, Hong Kong's latest planning guideline advise that 30% of private car parking spaces in newly constructed residential, industrial and business developments should be equipped with standard charging facilities.
- Additionally, our LA model demonstrated that scaling up existing charging stations by

incorporating more chargers appears to be more efficient than constructing new charging stations.

- First, the main urban areas of Kowloon and the northern shore of Hong Kong Island are highly accessible by public transport. Therefore, we recommend the co-location of public EV chargers and park-and-ride infrastructure to encourage better integration of EV with the urban core's existing public transport network to enable a more sustainable and integrated transport network; this could relieve traffic congestion in the central urban areas.
- Second, fulfilling the demand shortfall in new towns should be prioritized because (i) new towns are projected to represent the major demand hotspots in the next 5 years, which could soon overwhelm existing charging facilities, and (ii) long-distance trips across Hong Kong, especially featuring trips ending in suburban or rural areas, will call for more public charging infrastructure in new towns and new development areas to ease the range anxiety experienced by EV users.
- By embracing this planning approach, the fixed costs associated with new charging locations could be avoided, and the budget could be focused on installing more chargers at the same locations. Although this approach might deplete the electricity capacity of buildings, demanding that the government and electricity suppliers work to ensure ample power reserves in preparation for charger installations.
- the Hong Kong government has granted 100% gross floor area concessions to new developments equipped with EV charging enabling in underground car parks.

3.2 A review of electric vehicle charging infrastructure in Delhi

❖ **INTRODUCTION :-**

- The World Health Organization (WHO) has listed New Delhi amongst top 10 world cities with the worst PM_{10} pollution in its 2014 assessment.
- Because of the increasing global warming and climate change in New Delhi area, the city's mobility is expected to grow from ICE (internal combustion engines) to electric vehicles in the near future in order to reduce pollution.
- The Government of Delhi recently announced its intention to sell only electric vehicles by 2030.

❖ **OBJECTIVES :-**

- To study the infrastructure and working environment
- Provision of Area based EV charging infrastructure.
- suggest policies & regulations for faster EV adoption.

❖ **DEMOGRAPHY :-**

- As per details from Census 2011, Delhi has population of 1.68 Crores, an increase from figure of 1.39 Crore in 2001 census. Total population of Delhi as per latest census data is 16,787,941 of which male and female are 8,987,326 and 7,800,615 respectively. In 2001, total population was 13,850,507 in which males were 7,607,234 while females were 6,243,273.
- The total population growth in this decade was 21.21 percent while in previous decade it was 46.31 percent.
- The population of Delhi forms 1.39 percent of India in 2011. In 2001, the figure was 1.35 percent.
- **LITERACY RATE –**
- in Delhi has seen upward trend and is 86.21 percent as per latest population census. Of that, male literacy stands at 90.94 percent while female literacy is at 80.76 percent.
- **POPULATION PROJECTION-**
- Delhi's projected population to rise to 2.65cr by 2036.
- **POPULATION DENSITY-** the population density of Delhi was 9,340/ sq. km in 2001, and 11,320/ sq. km in 2011**.**

Year	Projected Population	
2011	1.68 Crores	16,787,941
2021	1.99 Crores	19,920,000
2022	2.03 Crores	20,250,000
2023	2.05 Crores	20,530,000

fig 3-2-1. projected population

❖ **CURRENT EV SCENARIO IN DELHI :**

At present Delhi has :

- Two wheelers – 26,787
  Three wheelers – 31,506
  Four wheelers – 5,266
  Buses – 323
- charging stations – 1919
  charging points – 2452
  battery swapping stations – 232
- Vehicle- charging ratio is 72:1

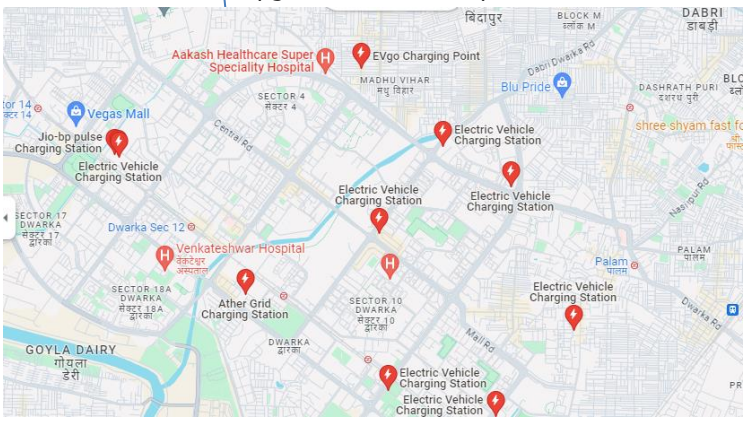
❖ **FUTURE EV SCENARIO IN DELHI :**

- Delhi EV policy targets 25 %
  of all new vehicle registrations
  by 2024 to be EVs.
  vehicle- charging ratio to be 15:1

fig 3-2-2. locations of stations

- 18000 more charging stations
  would be required.
- EV charging stations to be
  accessible Within 3km travel
  from anywhere in the city.

❖ **LOCATIONS OF EV CHARGING STATIONS IN DELHI :-**



❖ **PROJECTED EV SALES :-**

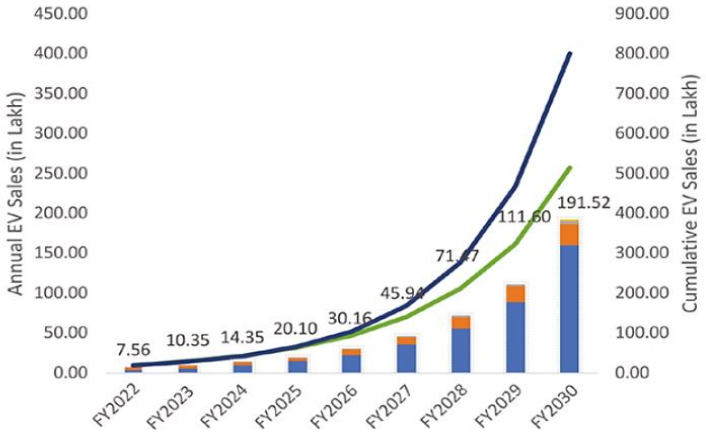
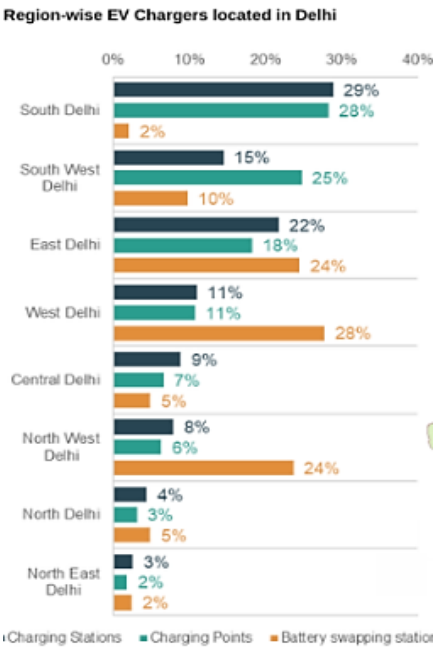


fig 3-2-3. projected EV sales



❖ **ISSUES :-**

- Insufficient charging stations in study Area.
- Study area is concentrated with large no. of apartments and residential complexes which will require public charging facility in the future.
- EV charging stations in malls parkings are not available 24 hrs.
  3x3km grid requirement of EV stations according to MOP guidelines is missing.

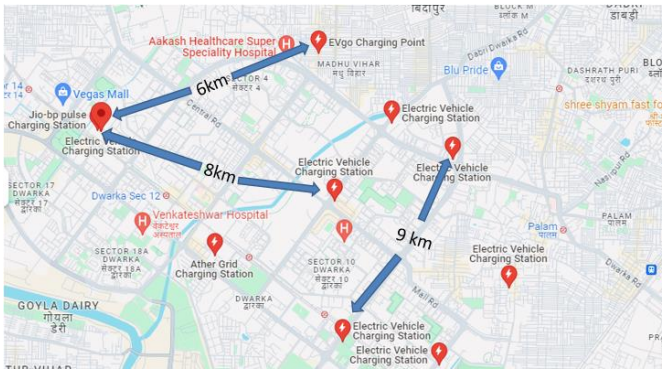


fig 3-2-4. distance between stations

- no fuel stations in study area are having EV charging infrastructure.
- No apartment buildings or hotels are having EV charging infrastructure.
- No metro stations (sector11, 12, 13,14) has provision of EV charging infrastructure.
- No public parking facility is having provision of EV charging infrastructure.
- Schools, colleges have no EV charging infrastructure.
- VEGAS mall is also not having EV charging facility.
- Few residences were only equipped with EV charging facilities.

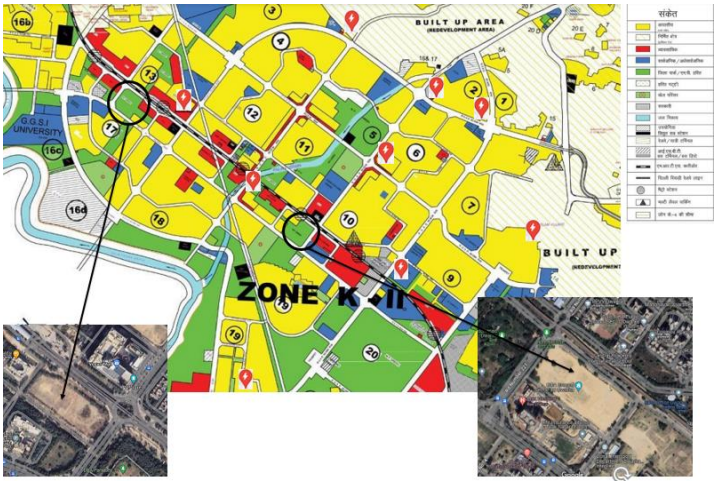


fig 3-2-5. Land use analysis

- **LAND- USE ANALYSIS & PROPOSALS FOR PUBLIC CHARGING INFRASTRUCTURE :-**
- Government or public Vacant land should be utilized by providing adequate EV charging infrastructure as per MOP, Niti Aayog guidelines.
  PROPOSALS :-

❖ **PUBLIC & SEMI – PUBLIC INFRASTRUCTURE :-**

- within a 3km by 3km region, at least one charging station must be established to meet minimum standards.
- 20% parking spaces should be dedicated to EV charging infrastructure at metro

stations, malls in study area.

- 20% parking spaces of Colleges public/private, Schools must be dedicated to EV
- charging infrastructure.

▲ Proposed charging stations at public parkings.

◯ Proposed charging stations at metro stations.

▯ Proposed charging stations at Vegas mall.

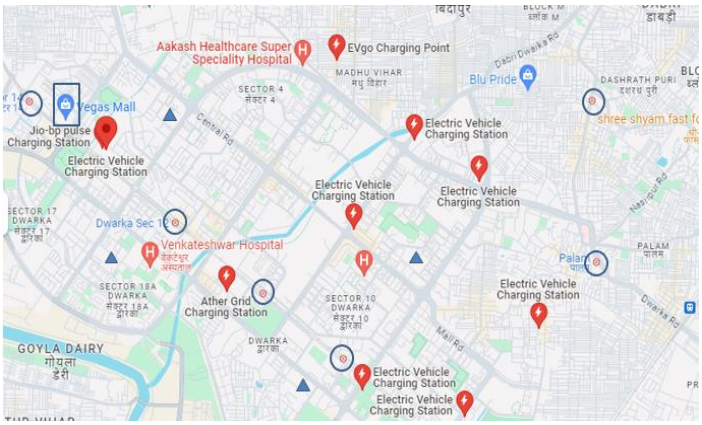


fig 3-2-6 . proposed infrastructure

Proposed EV charging stations at

existing fuel stations According to

URDPFI guidelines

Areas Along National and State Highways Villages identified as growth centres Freight Complex Proposed major roads Police/security forces services (for captive use only) (MPD, pg 125)		v. Public Charging Station (PCS) (minimum requirement as per MoP guidelines) vi. FCB CS 1 CCS 1 CHAdeMO vii. Battery Swapping Station (optional)	Min. 13.5m x 5.5m Min. 15m x 7m Earmarking area for "battery fitting"	by the explosive/ fire department. Charging station and all equipment layout with respect to nearest dispensing unit (DU)/fuel tank to be as per PESO rules. Equipped with CCE and LCC, as required in addition to requirements of PCS. Optional addition to PCS by the SP

fig 3-2-7. URDPFI guidelines

fig 3-2-8. proposed infrastructure

❖ PRIVATE INFRASTRUCTURE :-

20% Parking area of apartments should have EV charging infrastructure. It must be mandatory for all apartment buildings to have EV charging infrastructure with installation of solar panels.

Residences in the study area should also provide EV charging infrastructure with solar panels.

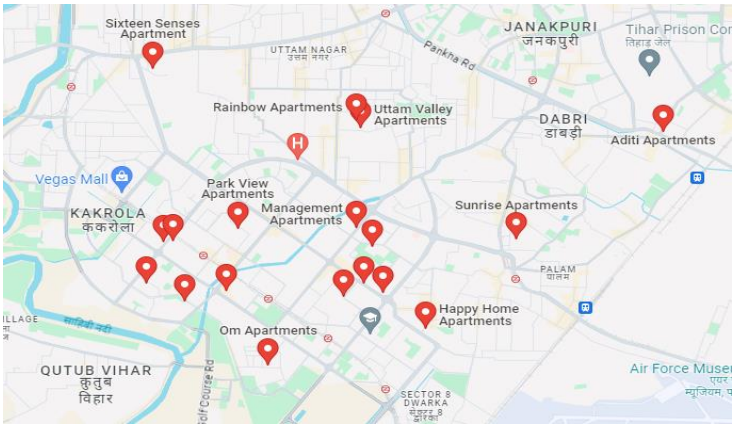


fig 3-2-9. proposed infrastructure

❖ DELHI EV POLICY :

- The Delhi Electric Vehicle Policy, introduced in August 2020, aims at increasing the EV share in total vehicle sales to 25 per cent by 2024. According to official data, over 1.12 lakh electric vehicles have been sold under the policy.
- The Delhi government is set to unveil its EV Policy 2.0, which will promote the adoption of electric vehicles (EVs) through retro-fitment. Retro-fitment involves

converting traditional petrol or diesel vehicles into electric ones, enabling them to run on clean energy sources. The government plans to address the high costs of retro-fitment by introducing subsidies or incentives.

- Delhi Transco Limited (DTL), which is the state nodal agency for charging infrastructure.
- The Delhi government launched a unique single-window process for installing and maintaining 30,000 charging points at private and semi-public sites , with the provision of availing INR 6,000/charging point. The single-window process ensures a one-stop solution to select EV chargers/vendors, obtaining new electrical connection, installing charging points, and availing subsidy for chargers.
- For setting up PCS/BSF, Delhi Government will provide
- the following support:
- Land at highly concessional rates,
- Electrical infrastructure of up to 100kW on each site,
- Subsidy of INR 6000/charging point for slow chargers.
- The current Delhi EV Policy offers a battery-capacity-linked subsidy of Rs 5,000/kWh or up to Rs 30,000 for electric two-wheeler purchases.
- For electric four-wheelers, a purchase incentive of Rs 10,000/kWh of battery capacity was provided with a maximum limit of Rs 1.5 lakh per e-car.
- EV tariff rates rs 4.5 – 5 per unit.
- **PUBLIC AWARENESS AND STAKEHOLDER ENGAGEMENT :-**
- These measures include targeted and continuous awareness drives and stakeholder engagement programmes, chatbots to answer queries pertaining to EVs in Delhi, campaigns to encourage use of e-buses, and forums to resolve the challenges faced by the EV industry and potential consumers.

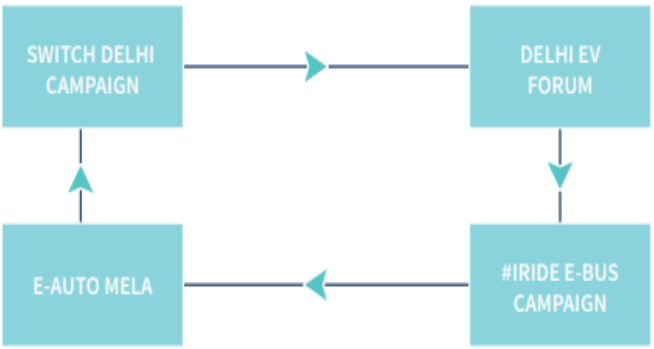


fig 3-2-10. campaigns

- **POLICY RECOMMENDATIONS FOR FASTER EV ADOPTION:**
- Create warehouses outside cities and allow only EV-
- transported goods vehicles to enter the city.
- Continue subsidizing renewable energy generation projects.
- Ban battery manufacturing near New Delhi area.
- Fund innovation in battery technology.
- EV must be exempted from all kinds of taxes for a limited period of time to have greater attraction of buyers.
- Taxes to be increased if apartments don't use solar energy and doesn't provide and maintain EV charging infrastructure.

- Tariff in EV bills generated in charging.
- Reduced GST on chargers from 18 % to 5%.
- Exemption of stamp duty
- 100% Road Tax exemption
- All electric vehicles, including e-rickshaws and e-carts, should be exempted from payment of taxes.
- E-commerce and delivery companies in Delhi will be encouraged to replace their fleet of two wheelers/three wheelers to EVs in a phased manner with an intention to achieve 100% electric mobility by 2030.

❖ **INFERENCES**

- Insufficient charging stations in the study area are causing lower adoption of EV by the people.
- Strong policies should be recommended along with sufficient EV charging infrastructure so that people have no obligations in buying EV.
- Without proper adoption of EVs there is no need of providing EV charging infrastructure.
- Government initiatives and policies play a vital role in EV adoption.
- People should be made aware about the benefits of adopting EVs as these are very needed for sustainable transportation because of increasing climate change.

CHAPTER 4 : SITE ANALYSIS

4.1 CITY PROFILE

lucknow is the state capital of uttar pradesh. Additionally, it serves as the administrative centre for the division and district of lucknow. In addition to being a significant hub for governance, administration, education, business, aerospace, finance, design, tourism, culture, music and poetry in the past and present, it has long been a multicultural and artistic centre. According to the 2011 census, lucknow city's population was 2,817,105 and its area was 350 sq. km.

The city is located at confluence of national and state highways, Barabanki lies on east side of lucknow (27.2 km), on the west by unnao (65.7 km), on the south by Rae Bareli (79.4 km) and in the north by sitapur (88.2 km) and Hardoi (110.4 km). Having a total area of 631 sq.km. (2024) and is situated 123 metres above sea level. Lucknow city is divided into 8 zones and 110 wards.

❖ INTRODUCTION TO STUDY AREA

- Ward-94 (Vivekanand puri Ward), Ward-98 (begum hazrat mahal Ward) & Ward – 109(Aliganj Ward) of Zone 3 lucknow are quite developed in terms of infrastructure and Economic status.
- The wards are situated in the City of Lucknow, which is also the capital city of Uttar Pradesh state in India.
- Study Area - 9.048 sq.km.

fig 4-1-1. Location map

❖ GEOGRAPHICAL LOCATION OF STUDY AREA :-

- The wards are situated 123 meters above sea level and is located on 26°30' and 27°10' North latitude 80° 30'and 81°13' East longitude.
- On its eastern side ward is bounded by Mahanagar, in western side by Nirala Nagar, on the southern side Nishat Ganj and on the northern side the Vikas Nagar.

4.2 GEO-SPATIAL PLANNING FOR ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

- Spatial planning for public charging infrastructure is based mainly on considerations of accessibility and potential EV charging demand.
- Geospatial analysis is undertaken using Geographic Information System (GIS) software to estimate relative levels of public EV charging demand by mapping and assessing the impact of various spatial parameters.
- This is then used to distribute public charging infrastructure in different areas, in proportion to the charging demand.

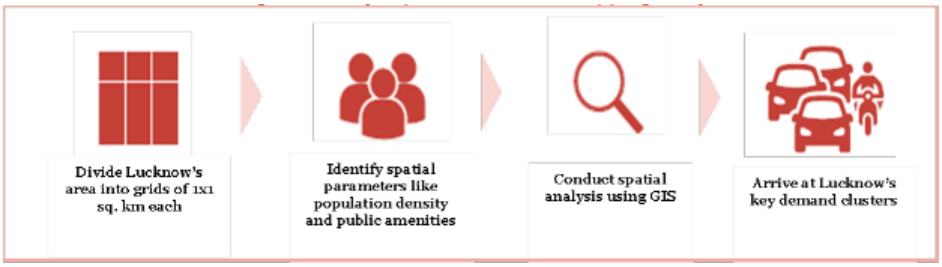


fig 4-2-1 . Key aspects of demand mapping analysis

source : CEMP lucknow

- Spatialized parameters are mapped to these grids, including **population density, density of commercial establishments, locations of trip generators** such as educational institutes, shopping malls, parks and hospitals.
- Existing transport infrastructure such as road networks, fuel stations and transit stations are also mapped and the parameters that indicate potential charging demand are identified and collated spatially.

❖ In one square kilometer, the charging requirement in Lucknow varies from 6 to 111 charging points, with a maximum of 55-111 chargers per grid. When calculated as a 3*3km grid (9 sq.km.), in line with the MOP guidelines, the charging requirement varies from 1 to 433 chargers, with a maximum of 250- 433 chargers per grid.

❖ **METHODOLOGY FOR ESTIMATING NUMBER OF CHARGERS -**

❖ *ASSUMPTIONS CONSIDERED –*

- *For base year, number of ICE vehicles registered in 2021 were considered for electric vehicle projections.*
- *Based on ICCT's projections for 2030, a net battery capacity of 6 kWh was considered for e2W segment, 9 kWh for e-3W segment and 62 kWh for e-4W segment.*
- *Based on ICCT's research, a y-o-y decrease in energy consumption of 0.65% for e-2Ws, e3Ws and e-4Ws was considered.*
- *With cities expanding and with availability of better EV models, the daily distance*

travelled is assumed to increase across all vehicle segments.

- *The share of public charging considered for all vehicle segments is*
  - *as follows:*
  - *e-2W: 10% e-3W: 50% e-rickshaw- 50% e-4W (private): 20% e-4W*
  - *(commercial): 50%*
- *For charger utilization rates, a 5% y-oy increase was considered*
  - *where the average utilization by 2030 will be around 50 - 60%.*
- *For e-2Ws, e-3Ws, e-rickshaws and e-4Ws, a c-rate of battery*
  - *(charging rate) of 0.5 to 0.7 was considered until 2030.*
- *On the charger type, 3.3kW chargers for e-2Ws, e-rickshaws and e-*
  - *3Ws, ,15kW chargers for e-4W (commercial) and 50kW chargers*
  - *for e-4W (private) were considered.*

STEP 1: Considering EV penetration rates for the city for different vehicle segments and target penetrations, number of EVs on road by 2030 is estimated.

STEP 2: The daily kilometers driven by EVs for both private and commercial , the current and future battery capacities for e-2W, e-3W and e-4Ws are considered.

Vehicle Segment	2030
2w	2,58,366
3w	5,422
e-rickshaw	84,284
4w private	38,540
4w commercial	25506
Total EVs on road	412118

Penetration rates considered	2030
E-2W	50%
E-3W	100%
E-Rickshaw	100%
E-4W (personal)	15%
E-4W (commercial)	30%

fig 4-2-2 . vehicle segments projections

source : CEMP lucknow

STEP 3: The energy consumption per km is calculated and a y-o-y decrease in energy consumption levels is considered.

STEP 4: The daily energy needs for charging EVs is calculated and the share of charging to be fulfilled through public charging infrastructure is assigned.

STEP 5: Considering a y-o-y charger utilization rate and maximum power drawn by an EV (based on battery capacity and C-rate) , the power delivered by chargers per day is estimated.

STEP 6: The cumulative number of chargers needed to support charging needs of EVs in the city is calculated

$$\text{Number of public Chargers} = \frac{\text{Energy need from public charging per day (kWh)}}{\text{Power delivered per charger (kWh/ day)}}$$

Total no. of chargers needed by 2030 in lucknow are – 7000 of which **433** will be needed in our study area.

And acc. to target set by gov. a ratio of **1 :10** is to be accomplished by the end of 2030.

Which means there should be at least one charging point for every 10 EVs.

Hence, Our study area needs **433** charging points to satisfy charging demand of approx. **4330 EVs** by 2030.

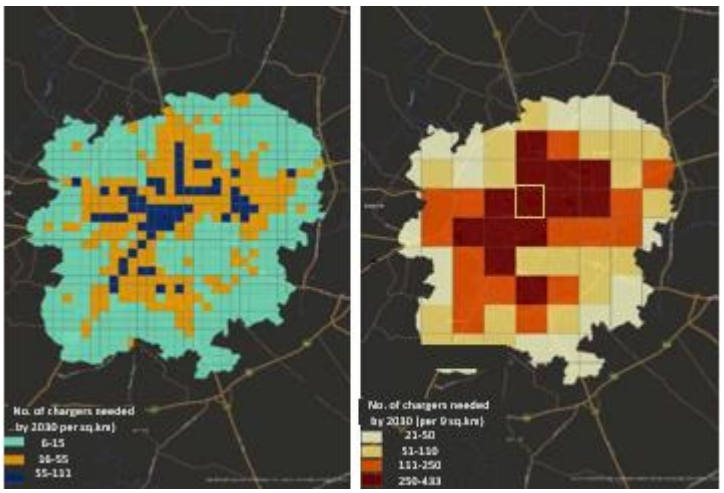


fig 4-2-3 . Geo – spatial distribution

4.3 REGIONAL CONNECTIVITY :-

Wards are connected to major landmarks in the city. Airports and bus-stations via highways and metro network.

- **Road connectivity :-**

- Ward 94, 98 & 109 are well connected by one National Highways & one MDR (major district road)
- NH-27 : Faizabad road (Acharya Narendra dev Marg)
- Aliganj Main road
- MDR 77C : kursi road (Aliganj Mahabirji mandir Marg)
- Nearest metro stations are IT college metro station & bad shah nagar metro station. It also consists of Aliganj Bus Stand & Badshahnagar bus stand.
- **Railway connectivity :-**
- daliganj junction railway station - 3.6 km.
- Badshah nagar railway station- 1.5 km

Airways connectivity :-

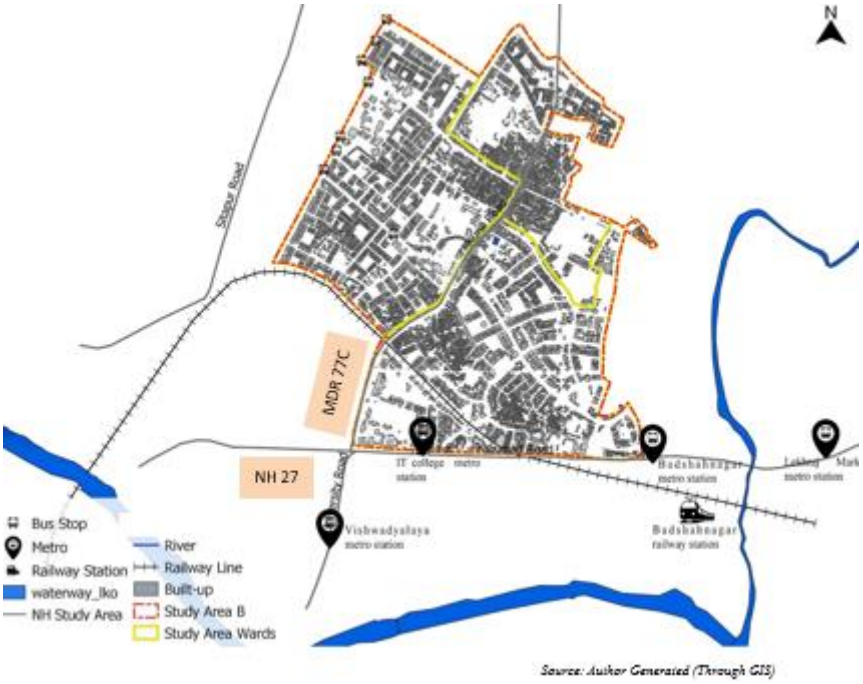


fig 4-3-1 . Regional connectivity

- Chaudhary charan Singh international airport – 11km

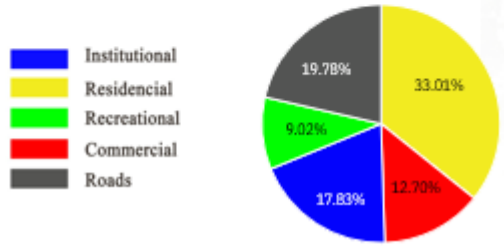
4.4 LAND-USE ANALYSIS :-

All wards are characterized by its various forms of Land-use pattern, clusters of residential colonies, commercial and mixed used settlements.

Major form of land- use pattern in these wards is Residential And institutional land – use is the second most form of land – use in the study Area.

LAND – USE CATEGORY	AREA (KM)	AREA (%)
RESIDENTIAL	2.98	33.01
COMMERCIAL	1.14	12.70
INSTITUTIONAL	1.61	17.83
RECREATIONAL	0.82	9.02
ROAD	1.78	19.78
TOTAL	9.048	100%

Source: lucknow master plan 2031



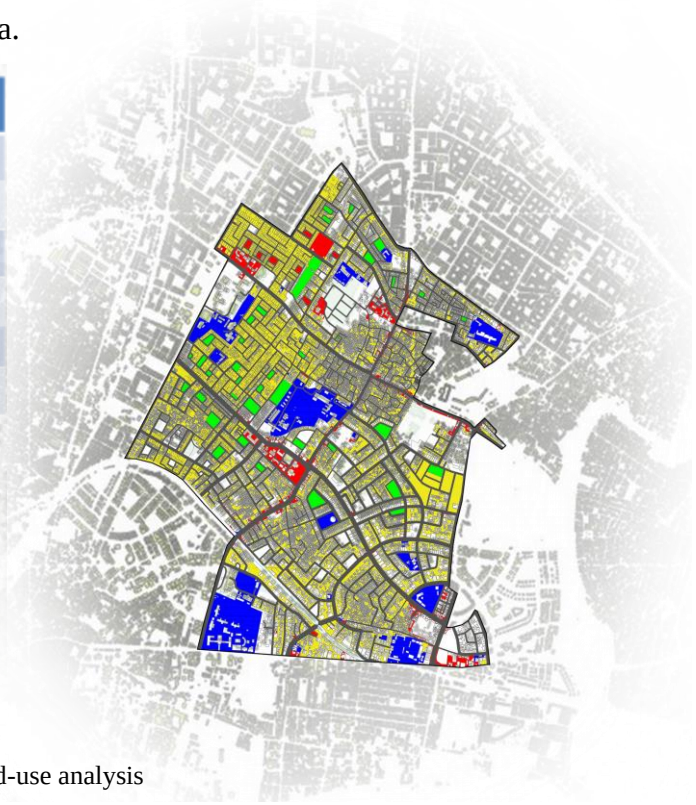


fig 4-4-1. land-use analysis

4.5 DEMOGRAPHY :-

According to census 2001 & census 2011 data there is

decrease in population of ward 94 and increase in

population of ward 98 &109. According to census 2011, Total population of Lucknow city is 28.15 lakh.

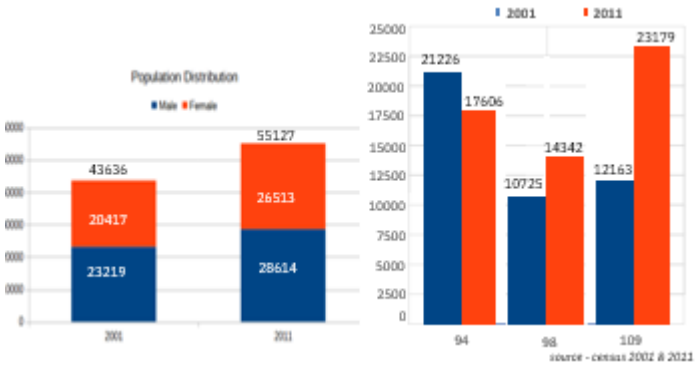


fig 4-5-1. Population distribution

❖ Population projections :-

S.No.	Methods	2025 Projection	2030 Projection
1	Arithmetic	82702	96485
2	Geometric	73568	81839
3	Incremental	97199	92638
4	Average	**79489**	**90329**

Therefore,

Total population of these wards is 55,127 which is 11.5% of the total population of lucknow.

fig 4-5-2. Population projections

❖ **Population density :-**

According to census 2001, the average density of our study area is 93 pph, ward no. 109 has the lowest density while ward no. 98 has highest density. According to census 2011, the average density of our study area is 120 pph, ward no. 94 has the lowest density and ward no. 98 has the highest.

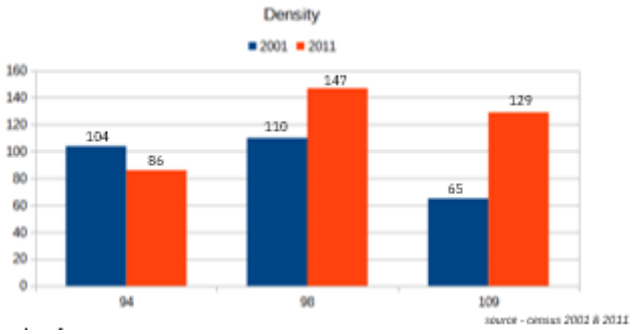


fig 4-5-3.Population density

❖ **Literacy Rate :-**

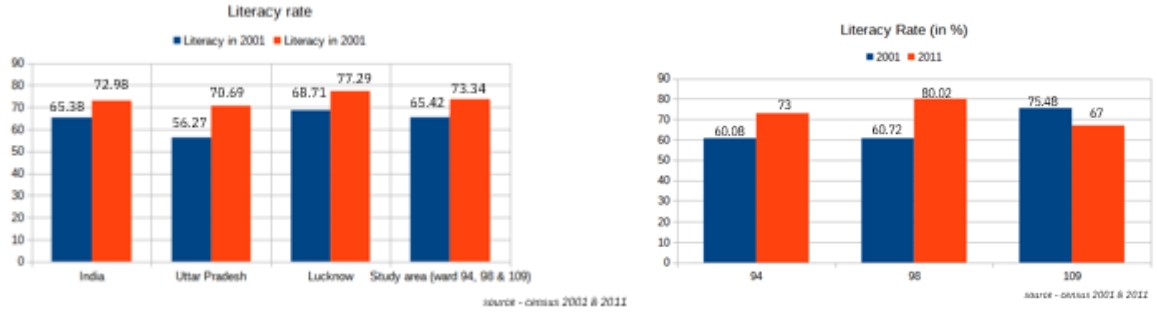


fig 4-5-4. Literacy rate

- Number of literate persons aged 7 or above = 29050
- Number of population aged 7 and above = 39500
- Effective literacy rate = (number of literate persons aged 7 or above/ population aged 7 and above) * 100

= (29050/ 39500) * 100 = 73.34 %

The literacy rate of the study area is highly exceptional which makes it really potential for jobs and business opportunities. That is why this is a primarily developed area with medium and high – income groups that have more purchasing power of EVs that are expensive from conventional vehicles at present.

Induction of charging infrastructure will certainly help in positive decision making for the potential buyers and create an ecosystem for future of EVs and their charging infrastructure.

❖ **Working population :-**

The growth of working population in the area justifies the selection of study area. Literate and working people have a better understanding towards Environment and are very likely to own an EV.

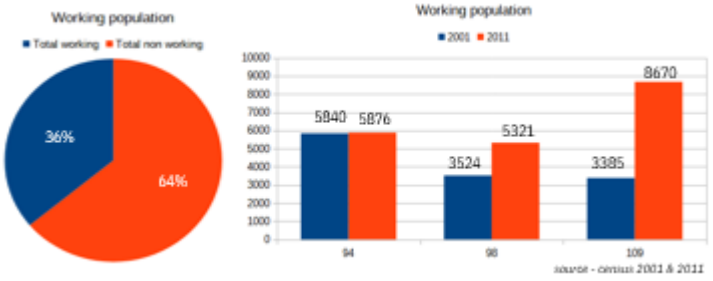
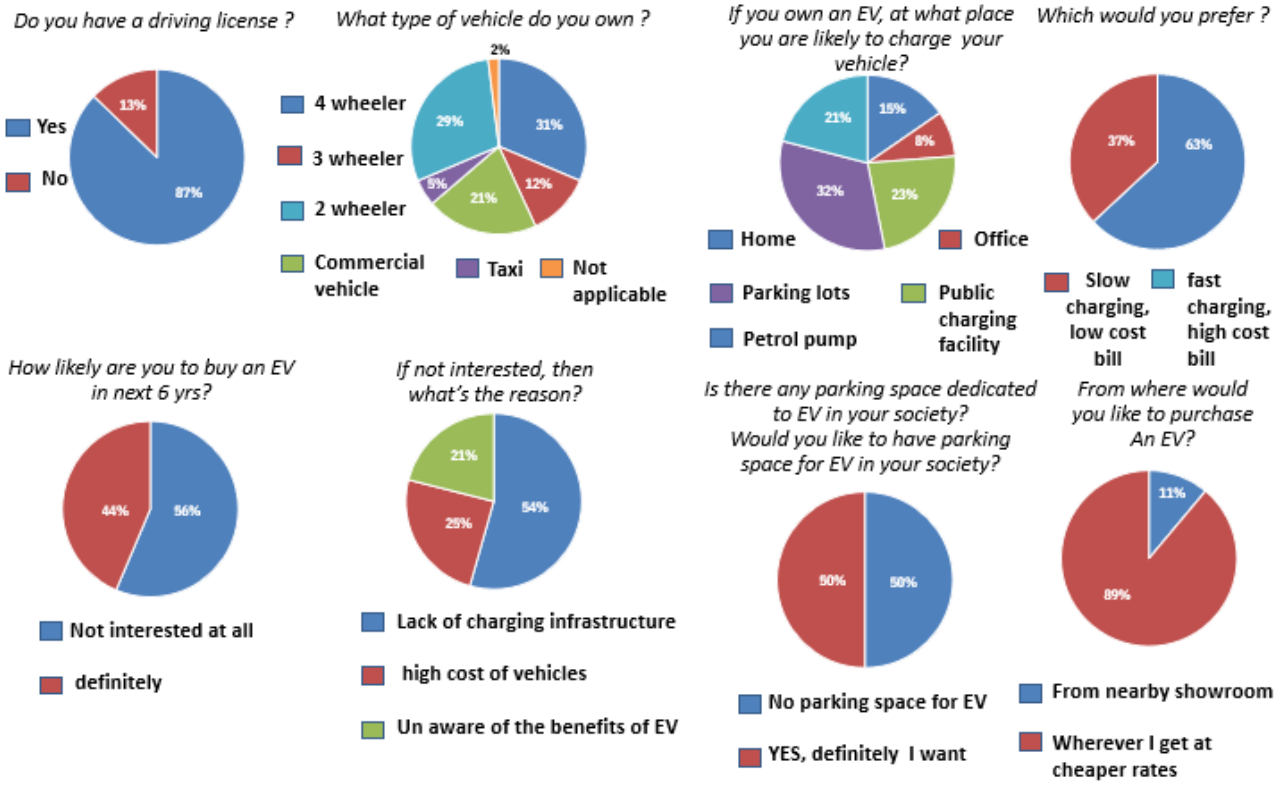


fig 4-5-5. Working population

- The vast difference in working and non- working population is due to large amount of migration due to higher education and job opportunities for people and marginal workers.
- Therefore, these permanent residents and daily workers are the potential EV consumers and acquire EV charging infrastructure for the same.

CHAPTER 5 : QUESTIONNAIRE SURVEY

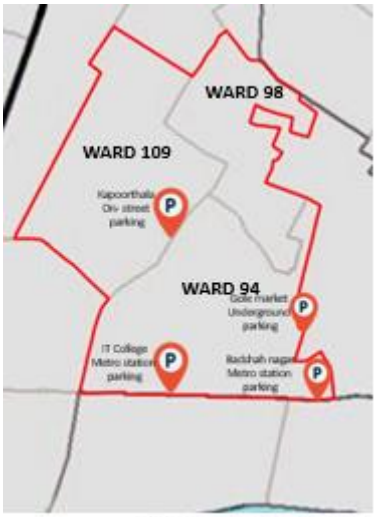


As per the Questionnaire analysis,

- The survey finds that due to the high cost and absence of a charging infrastructure, residents of residential areas are not interested in acquiring EVs. On the other hand, if they were to buy an EV in the future, they would prefer to charge it at home using a low-speed charger to save money on electricity.
- People who travel from metro prefer charging their automobiles at metro parking or oil filling stations as long as they are fast charging stations.
- People who come from local area prefer charging their vehicles at their workplace or nearby.
- Due to lack of charging infrastructure people in the study area prefer charge their vehicles at home or in parking at night with slow chargers.

CHAPTER 6 : PROPOSALS

6.1. PUBLIC INFRASTRUCTURE



Source: Author Generated (Through GIS)

fig 6-1-1. Public Infrastructure

- At every 3km there should be at least one public EV charging station.
- Within a 3 km by 3 km region, at least three public charging station must be established to meet minimum standards. However, both wards together cover 9 sq.km.
- Public charging Infrastructure consists of EV charging stations in petrol pumps, public parking lots , metro stations parkings etc.
- Metro stations, and public parking spaces must have at least 20 % parking space dedicated for EV charging Infrastructure.
- Public parking lots should also have basic amenities like – free WIFI , washrooms , mini café , library , etc.

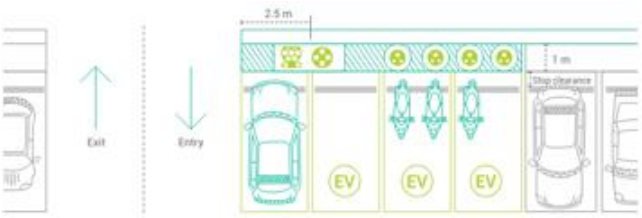


fig . EV charging station layout (OFF- street parking)
source : Niti Aayog

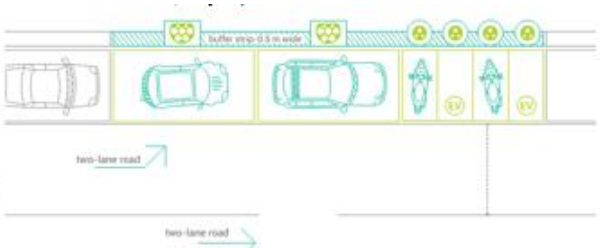


fig . EV charging station layout (ON- street parking)
source : Niti Aayog

Total public EV charging points – 24

Study area consists of four oil filling stations .

Public parking Lots	Existing parking	EV charging points (20%)
IT college metro station parking	25	5
Badshah nagar metro station parking	**25**	**5**
Gole market underground parking	150	30
Kapoorthala on-street parking	**150**	**30**

- Two in Vivekanand puri ward – Indian oil Samthar petrol pump & Vinayak service station.
- one in begum hazrat mahal ward – Dandaiya petrol pump
- another one in Aliganj ward – Indian oil coco petrol pump.
- Vinayak service station has less area so there is no space for providing EV charging points there.
- Petrol pumps have a higher footfall, hence the stations which have appropriate area will be

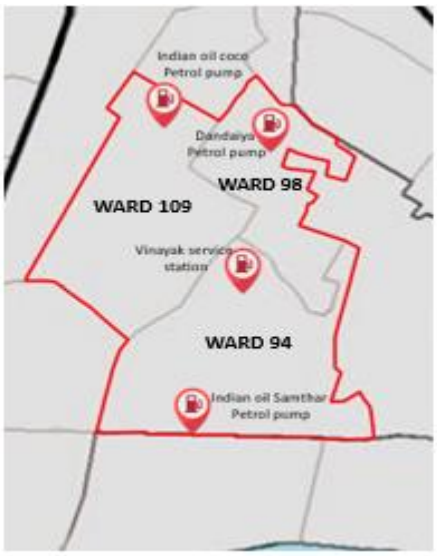


fig 6-1-2. Public Infrastructure

selected based on below mentioned criteria.

Sr. No.	Category	Population served per unit	Land Area requirement		Other controls
			Type of Facility	Area required	
1.	Petrol/Diesel filling/EV charging* and service centre				
	Areas Along National and State Highways Villages identified as growth centres Freight Complex Proposed major roads Police/security forces services (for captive use only) (MPD, pg 125)		v. Public Charging Station (PCS) (minimum requirement as per MoP guidelines) vi. FCB CS 1 CCS 1 CHAdeMO vii. Battery Swapping Station (optional)	Min. 13.5m x 5.5m Min. 15m x 7m Earmarking area for "battery fitting"	by the explosive/ fire department. Charging station and all equipment layout with respect to nearest dispensing unit (DU)/fuel tank to be as per PESO rules. Equipped with CCE and LCC, as required in addition to requirements of PCS. Optional addition to PCS by the SP

- Total public EV charging points -2

Petrol Pumps	Area	EV charging points
Indian oil Samthar petrol pump	1260	2
Vinayak service station	500	-
Dandaiya petrol pump	**1340**	**2**
Indian oil coco petrol pump	1056	2

Petrol pumps should also have basic amenities like – free WIFI , washrooms , mini café , library , etc.

6.2 SEMI – PUBLIC INFRASTRUCTURE

- Colleges public/private in the study area are very potential for use of EV as youth is quite aware about EV and students try to cut short their monthly budget using EV. That is why they must be equipped with EV charging stations at 20% ratio of parking space.
- Schools also require charging points for EV in the same manner. Therefore, it must be mandatory for the schools to provide EV charging point according to requirement.
- Government buildings must have EV charging station because this is the best way to promote the development of EV infrastructure.
- Institutions / government buildings having more than 100 vehicles parking space must have 5 % space dedicated for EV charging stations.
- Apartments in the study area are lacking EV charging infrastructure , hence 20 % parking space must be equipped with EV charging infrastructure .
- Hospitals are also lacking EV charging infrastructure , so 20 % of their parking spaces must be utilized for EV charging.

6.2.1 WARD - 109 (ALIGANJ WARD)

fig 6-2-1. Semi-Public Infrastructure (ward 109)

Apartments name	Existing parking	EV charging points (20%)
Diamond hills	16	4
Kashi Vishwanath	8	2
Drosia	50	10
Nalini heights	8	2
Anandi	16	4
Vijay Aditya	8	2
Total		**24**

Hotels Name	Existing parking	EV charging points (20%)
Sandstone Inn	4	1
Kapoor's inn	4	1
Royal Residency	16	4
Trishakti hotel	4	1
Jaiswal star stay	4	1
flagship star stay	8	2
Total		**10**

Hospitals Name	Existing parking	EV charging points (20%)
Vaga	35	7
Aliganj vet	4	1
SCT trust hospital	5	1
Konark	8	2
Eye Q	4	1
Total		**12**

Schools/Institutes/ Government buildings	Existing parking	EV charging points (20%)
CMS Aliganj II	2	1
Modern school	20	4
Government ITI	25	5
Regional science city	100	20
Total		**30**

Schools/Institutes/ Government buildings	Existing parking	EV charging points (20%)
Panchayati Raj training Institute	150	30
Kendriya Bhawan	150	30
Geological Survey of India	200	40
Total		**100**

Total no. of charging points – **176.**

6.2.2 WARD -94 (VIVEKANAND PURI WARD)

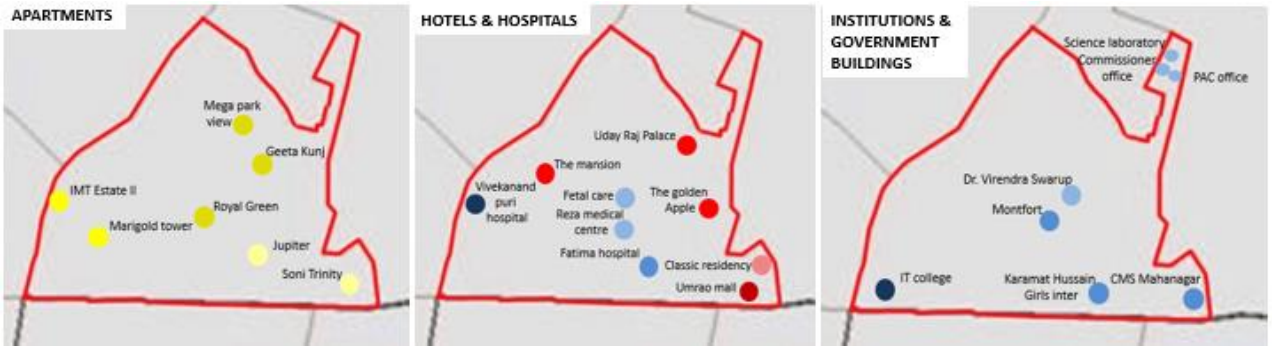


fig 6-2-2. Semi-Public Infrastructure (ward 94)

Apartments name	Existing parking	EV charging points (20%)
Soni trinity	8	2
Mega park view	16	4
Geeta Kunj	16	4
Royal green	16	4
Marigold tower	40	8
Jupiter	8	2
IMT Estate II	32	8
Total		**36**

mall name	Existing parking	EV charging points (20%)
Umrao mall	150	30
Total		**30**

Hotels name	Existing parking	EV charging points (20%)
The golden apple	10	2
Uday raj palace	10	2
The Mansion	8	2
Classic residency	4	1
Total		**7**

Hospitals Name	Existing parking	EV charging points (20%)
Fatima hospital	20	4
Vivekanand Puri	50	10
Fetal care	8	2
Reza Medical	8	2
Total		**18**

Schools/Institutions/ Government	Existing parking	EV charging points (20%)
IT college	50	10
Karamat Hussain inter college	20	4
CMS Mahanagar	20	4
Montfort	20	4
Dr. Virendra Swarup	10	2
Police Commissionerate office	10	2
State forensic science laboratory	10	2
Total		**28**

Total no. of charging points – **119.**

6.2.3 WARD 98 (BEGUM HAZRAT MAHAL WARD)

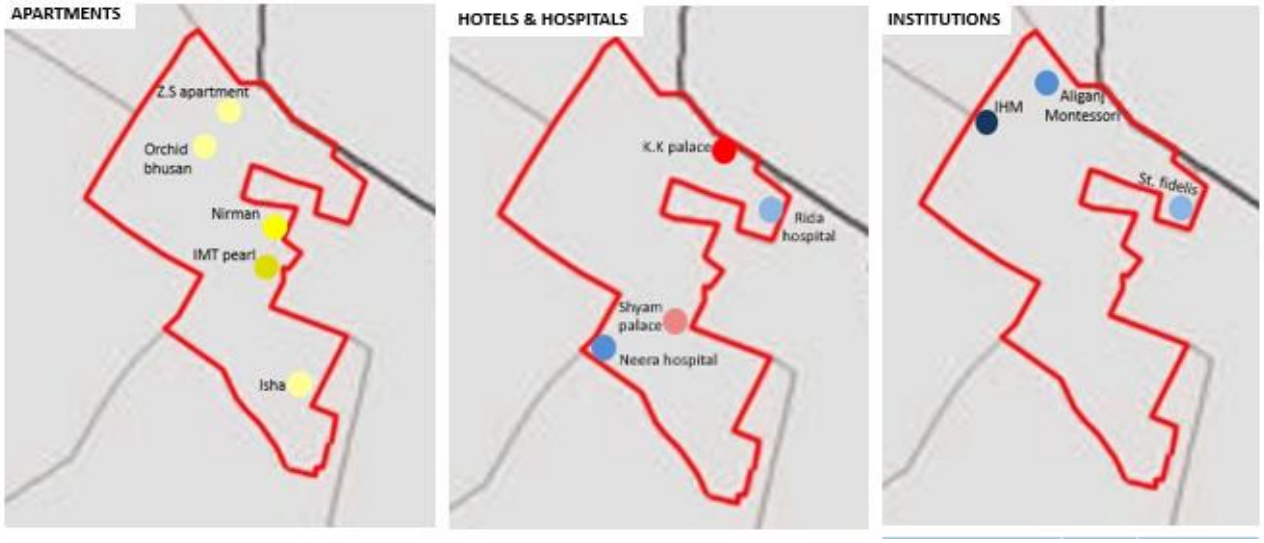


fig 6-2-3. Semi-Public Infrastructure (ward 98)

Apartments name	Existing parking	EV charging points (20%)
Shalimar gallant	300	60
Z.S apartment	8	2
Khiri Nirman apartment	50	10
IMT Pearl	20	4
Orchid Bhushan	12	2
Isha	12	2
Total		**80**

Hotels/ Hospitals	Existing parking	EV charging points (20%)
K.K Palace	6	1
Shyam Palace	4	1
Rida hospital	6	1
Neera hospital	9	2
Total		**5**

Schools/ Institutions	Existing parking	EV charging points (20%)
IHM lucknow	45	9
Aliganj Montessori	10	2
St. fidelis	16	4
Total		**15**

Total no. of charging points – **100**.

6.3 PROPOSED PUBLIC & SEMI – PUBLIC INFRASTRUCTURE

- Three public EV charging stations are located at –

1. Dandaiya petrol pump
2. Badshah nagar metro station parking
3. Kapoorthala on-street parking.

These are located according to the MOP guidelines.

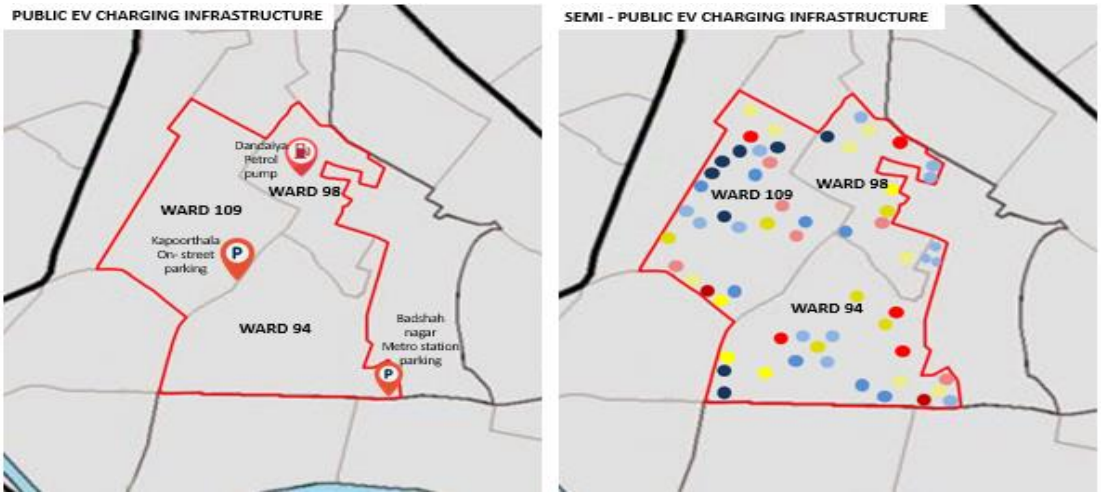


fig 6-3. Semi-Public & public Infrastructure

Public parking Lots	Existing parking	EV charging points (20%)
Badshah nagar metro station parking	25	5
Kapoorthala on- street parking	150	30
Total		**35**

Petrol Pumps	Area	EV charging points
Dandaiya petrol pump	**1340**	**3**

WARDS	Total no. of EV charging points
Ward 94	119
Ward 98	100
Ward 109	176
Total	**395**

Total no. of charging points = public charging points + semi – public charging points
= 35 +3 +395
= **433**

6.4 PRIVATE INFRASTRUCTURE

1. According to the MoHUA's proposed changes to the construction byelaws, 20 % of parking spaces in al new buildings must have charging infrastructure. The only jurisdiction with the authority to do so through municipal corporations or urban development authorities is a state.

2. Since buildings normally last for 50 years or longer, it is advised that states enact the EV infrastructure adjustments as soon as possible to guarantee that all new constructions are EV-ready.

3. It must be mandatory for all Residences to have EV charging infrastructure with installation of Solar girds, subsidies to be provided and tax to be remitted on new connections and solar grids.

6.5 SAFETY REQUIREMENTS

1. The building premises must have an additional power load with a safety factor of 1.25 that is equal to the power needed for all charging points to run simultaneously.
2. Comply with all safety regulations outlined in the CEA (Measures pertaining to Safety and Electric Supply) (Amendment) Regulations, 2019, for EV charging plans.
3. The requirement to follow safety rules outlined by international standards, including testing of charging stations, inspection and routine evaluation, record-keeping, and safety requirements.
4. It is necessary to make signs and indicators for EVs mandatory in order to ensure quick and secure access.

6.6 POLICIES AND TAXES

1. EVs should be exempted from parking fees for fixed period of time.
2. Promote **retrofitted** vehicles- set up dedicated windows at RTO's.
3. EV must be exempted from all kinds of taxes for a limited period of time to have greater attraction of buyers.
4. 30% government vehicles having 10% residual life must be exchanged by EVs.
5. E-commerce and delivery companies be encouraged to replace their fleet of two wheelers/three wheelers to EVs.
6. **Tariff** in EV bills generated in charging.
7. **Reduced GST** on chargers from 18% to 5%.
8. Continue subsidizing renewable energy generation projects.

6.7 ADDITIONAL ASPECTS

1. Promotional campaigns and events launched by market players to be organized by incorporating public participation strategies to increase people's interest for the same.

2. Applications must be developed having updated information of the vacant or engaged charging stations slots for the convenience of the people.

3. A system must be developed for money deduction according to which money deducts from the account of the person owning the vehicle irrespective of the slot or machine at which he charges the vehicle.
4. Locking system at charging stations to avoid mess amongst customers.
5. Applications to alert customers once their vehicle is charged

Points to be discussed with

stakeholders on account of installing a commercial charging station for EV:

- Profit due to demand and supply is very high in this field for local investors and businessmen.
- This is the right time to invest as EV is the future due to EV penetration for 2030 enforced by the government.
- Norms and criteria for EV charging infrastructure are not very complicated. Policies are made for fast approval.

References

I. EV Adoption Influence on Air Quality and Associated-Infrastructure Costs Carsten Christensen and John Salmon

II. Samaras, C.; Meisterling, K. Life cycle assessment of greenhouse gas emissions from plug-in hybrid vehicles: Implications for policy. Environ. Sci. Technol. 2008, 42, 3170–3176.

III. Handbook for Electric Vehicle Charging Infrastructure Implementation Government of Inda, Ministry of Power

IV. A Comprehensive Review on Developments in Electric Vehicle Charging Station Infrastructure and Present Scenario of India; Shubham Mishra, Shrey Verma, Gaurav Dwivedi, Puneet Verma, 2021.

V. NITI Aayog and Rocky Mountain Institute. India Leaps Ahead: Transformative Mobility Solutions for All. 2017

VI. European EV Charging Infrastructure Masterplan March 2022

VII. The spatial planning of public electric vehicle charging infrastructure in a high-density city using a contextualised location-allocation model Sylvia Y. He [a,*], Yong-Hong Kuo [b], Ka Kit Sun [a]

VIII. Charging the Future: Challenges and Opportunities for Electric Vehicle Adoption Faculty Research Working Paper Series

IX. *Census of India, Uttar Pradesh 2011*. (2011).

X. Charging Infrastructure for Electric Vehicles (EV) - the revised consolidated Guidelines Letter No.12/2/2018 (Comp No.244) Government of India, Ministry ofPower.

Plagiarism Detector .net

Dec 31, 2023

Plagiarism Scan Report

Characters:6165	Words:953
Sentences:44	Speak Time: 8 Min

Excluded URL: None

Content Checked for Plagiarism

The worldwide transportation industry is currently making the switch from conventional fossil fuel-powered automobiles to zero or extremely low exhaust emission vehicles. To effect this transformation, the right infrastructure for charging stations (CS), information systems, intelligent distributed power generating units, and helpful governmental policies are required. The purpose of this study is to discuss the important considerations that must be made using the guidelines and handbook prepared by the Government of India while designing the infrastructure for electric vehicle charging stations. The report also discusses important research and locational aspect of the study area and its current infrastructure capabilities so as to improve the modify the Electric vehicle charging infrastructure and effective administration of charging station infrastructure. The state of developments and major market participants for electric car charging stations in India are covered in the paper. The paper specifically offers a critical review of the opinions of the study area's residents regarding the adoption of electric vehicles, the issues related to it, and their willingness to purchase EVs in the near future if the required infrastructure is put in place after speaking with stakeholders. Additionally, based on forecasts, proposals are created at the infrastructure and policy levels to support and promote emerging EVs. According to guidelines provided by the Ministries of Power, Urban Affairs and Housing, infrastructure is further classified into public, semi- public, and private sectors. In addition, policy proposals have been made to ensure EV adoption and to encourage stakeholders and major market players to engage actively in the process. As of 2020, Lucknow is the ninth most polluted city in the world. Lucknow has been seeing a spike in temperature as a result of increasing global temperatures. According to the Intergovernmental Panel on Climate Change (IPCC), increasing hazards to "health, livelihoods, food security, human security, water supply, and economic growth" will result from global warming of 1.5 °C. Reductions in crop yields and nutritional quality are examples of impact vectors. The availability of water resources, the spread of disease, and changes in feed quality all have an impact on livestock. Additionally, the risks associated with some vector-borne diseases, such as malaria and dengue fever, are anticipated to rise. Many places and seasons warm more than the average yearly temperature for the entire world, for example, "2-3 times higher in the Arctic." Hence, to de-carbonize it's important to de-carbonize one of the most

important sectors of development i.e. Transportation. Transportation is heavily dependent on fossil fuels and is one the leading contributors of climate change. And with the rise of Electric Vehicle and with recent advancements it can be a major factor in saving our planet. With batteries that have ever-increasing range, class-leading performance metrics, and cutting- edge technologies, the electric vehicle (EV) revolution that started to smoulder in the early 2000s has recently expanded into a fast-paced roll-out of dozens of new EV models that promise a future of fully autonomous vehicles and emissions-free transportation. The fact that EVs have zero tailpipe emissions is one of the most compelling arguments in favour of seeking progressive EV adoption. About 23% of the global greenhouse gas emissions are caused by transportation [1]. Considering that most people consider EVs as an alternative to conventional ICE vehicles, the 2 are frequently contrasted to see how much of an influence they have on pollution emissions [2]. Conclusion of dissertation done in previous semester led to the following points: 1. Cost of EVs will be subsequently less in the Operation Phase further particle emissions will be very less too. 2. Fast paced 2-W and 3-Ware gaining momentum in UP. 3. Lack of Charging infrastructure and policies regarding them are creating hindrance to EV adoption. 4. Only if energy comes from renewable sources, then only adequate impact of EVs can control the Carbon Emissions as per CoP26 goals. 5. Lucknow comes up in the 2nd phase (i.e., 2025 onwards) of EV infrastructure development as per Ministry of Power. Hence, this formed a basis for this study and our topic, "PLANNING STRATEGIES & POLICIES FOR PROVISION OF ELECTRIC VEHICLE CHARGING INFRASTRUCTURE". Not just a single unit plays part in the charging infrastructure, it's a combination of various equipment as per standards laid to increase the EV adoption rate. The major equipment are discussed below. The fundamental component of an EV charging infrastructure is electric vehicle supply equipment (EVSE). The EVSE uses a connected connection and a control system to safely charge EVs by drawing power from the local power grid. A user authentication system, charging authorization, information recording and exchange for network management, privacy and security, and other functions can all be carried out by an EVSE control system. It is advisable to use EVSEs with at least basic control and management options for all charging needs. Conductive charging, commonly referred to as plug-in (wired) charging, is the most widely used charging technology.. The amount of EVSE needed for conductive charging depends on various elements, including the type of vehicle, the battery capacity, the charging techniques, and the power ratings [3]. Direct current (DC) must be supplied to the battery pack in order for an EV to charge. A converter is needed to give DC power to the battery since alternating current (AC) power is supplied by energy distribution systems. AC or DC conductive charging is both possible. In the case of an AC EVSE, the onboard charger of the EV receives the AC power and converts it to DC. Bypassing the onboard charger, a DC EVSE externally transforms the power and delivers DC power straight to the battery. There are four additional charging modes that separate AC and DC charging, with

Plagiarism Detector .net

Dec 31, 2023

Plagiarism Scan Report

Characters:6215	Words:926
Sentences:43	Speak Time: 8 Min

Excluded URL: None

Content Checked for Plagiarism

In India, light electric vehicles (LEVs), which include three wheelers and two-wheelers (bikes and scooters), are anticipated to be the primary force behind transport electrification during the next ten years (passenger and cargo). Other important vehicle sectors being electrified include autos and light commercial vehicles (LCVs), in addition to these. Low-voltage batteries power E-3Ws and E-2Ws. Low voltage batteries are also used to power the first generation of e-cars. Nevertheless, even if they continue in particular use cases like taxis, these will probably be phased away in the future. High-voltage batteries power the upcoming e-car models of the second generation of e-cars. Electric LCVs will be made up of both high-voltage and low- voltage vehicles, depending on their ability to carry loads. [3]. Standards guarantee the compatibility and interoperability of every EVSE with every EV. India's national standards organisation, the Bureau of Indian Standards (BIS), is in charge of creating the nation's EV charging regulations. A global organisation called the International Electrotechnical Commission (IEC) is developing reference standards to ensure BIS. While Indian EV charging requirements are consistent with international norms, local climate factors and the variety of car types available in the nation require adaptations that are unique to India. Indian Standards for AC Charging: Standards for AC Charging in India : primary EV charging standard in India is IS 17017,All EV charging systems have the fundamental features listed in IS-17017-Part-I.Technically speaking, AC and DC EVSE must both meet IS-17017-Parts 21 and 22. Additional Indian specifications for AC EVSEs have been certified for usage in parking lots by light EVs and e-cars (in the form of inexpensive charging stations).Indian Standards for DC Charging: The specifications for DC charging stations with power outputs ranging from 50 kW to 200 kW are laid out in IS-17017-Part-23. In addition, in order to accommodate buses and other big vehicles, high power charging standards are needed. The IS-17017-Part-25, which is designed for providing low DC power of less than 7kW for light EVs, was just finalised by the BIS. IS-17017-Part 24 specifies data communication standards since digital communications between the EV and the DC EVSE are necessary. Communications will follow the IS-15118 series after the Combined Charging System (CCS) standard, which may offer both AC and DC charging, is implemented. 1.3.5 Access to Electric Vehicle Charging Infrastructure It is desirable to have a large number of low-power charging stations in an EV charging network as opposed to a few high-power ones. For EVs, any parking

space where the car is parked still and where there is a charging station for EVs presents a chance to recharge the battery. This is also known as destination charging, in contrast to "on-the-go charging," in which vehicles quickly top off their battery charge to carry on driving to their destinations. Therefore, EV charging infrastructure should be provided at locations where cars are frequently parked rather than in new locations for EV charging hubs. This approach to building out the infrastructure for charging encourages a dispersed network of EV charging stations that users can access at various locations, such as offices, residences, apartment buildings, retail malls, metro stations, and trains, bus depots, etc. For consumers and operators, a distributed network architecture like this has several benefits, from accessibility to economic feasibility. charging points, which are more expensive and can be harmful to the health of EV batteries if overused, is reduced by a compact network of normal-power EV charging stations. Cost Efficiency: In addition to being less expensive, normal power charging stations also take up less room and use less electricity, which further lowers capital expenditures. Low voltage single- and three phase distribution networks, which are prevalent in buildings and public areas, can be used to connect them. Financial Viability: Government subsidies can be cut back by lowering the upfront costs of installing charging infrastructure, which also increases the profitability of private sector involvement in charging operations. Increasing the availability of charging stations is more important than anything else for an effective rollout of EV infrastructure in a developing EV market. It is possible to guarantee that EV charging needs are effectively addressed by distributing the availability of numerous conventional power charging points along with a small number of high-power charging stations. India's plan to sell exclusively electric vehicles by 2030 focuses on integrating mobility with electricity, creating a shared ecosystem platform, and scaling up manufacturing. There are three stages to the implementation. [5] Phase 1's objective is to seize currently available economic possibilities while laying the groundwork for future strategic options. This entails setting up the necessary transportation infrastructure. This infrastructure consists of the actual on-demand transportation vehicles as well as the software platform. [5] 2. The second phase entails enhancing and expanding upon the recommendations made in the previous phase while enticing private players to participate. In this stage, a system-wide mobility solution will be installed. 3. The third phase allows electric vehicles to discharge electricity to the grid and combines electricity with the transportation system. At this point, all government incentives will also gradually disappear. [5] 1.3 7 Need of Study 1. Government's projections and estimation for EV fleet leads to requirement of adequate amount of Electric Vehicle Charging Infrastructure. 2. Un-availability of charging infrastructure has been a major cause of concern for people buying EV. 3. EV adoption because of EV infrastructure will lead to de-carbonization in the atmosphere. 4. Further, release of PPM will also decrease, leading to decrease in rate of respiratory disease. 1.4 Aim Provision of Area based EV charging infrastructure and suggest policies & regulations for faster EV adoption.

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

GOPAL – 9927097948

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) **2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 yrs.

   A) Not interested at all **B) Definitely**

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) **Home** B) Office C) Public Charging Facility D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **NO, YES we want parking space for EV in our society.**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **From a place where we get cheaper price of the EV**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

AKRAM – 9919666908

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- **Not interested at all,** B - Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **no parking space, yes we would like to have**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **at cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ANIL – 8707423767

1. Do you have a driving license? **(Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) **2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 yrs.

   (A- Not interested at all, **B- Definitely)**

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **no parking space, yes we would like to have**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **at cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAMLAL – 9568335468

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (**A- Not interested at all,** B- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility D) Parking Lots E) Petrol Pumps**

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **no space & yes we want space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

LALTA PRASAD – 8958494927

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No space and yes we want space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

UMESH – 6395872211

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, **E) Taxi** (**Ola**, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No parking space & we want**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

MONU – 9350572062

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (**A- Not interested at all**, B- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots E) Petrol Pumps**

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No, yes we want**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAVI – 9056209420

1. Do you have a driving license? (Yes/**No**)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) **F) Not Applicable.**

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & we want**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

AKHILESH – 8006121521

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home **B) Office C) Public Charging Facility** D) Parking Lots **E) Petrol Pumps**

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

YASHPAL – 9634586906

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (**A- Not interested at all,** B- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles **C) not aware about the benefits of EV**

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots **E) Petrol Pumps**

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

PANKAJ – 7351174311

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D)Commercial Vehicle, **E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (**A- Not interested at all,** B- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles **C) not aware about the benefits of EV**

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to haveparking space for EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you getcheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

BALVEER – 9675672718

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) **3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to haveparking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ASLAM – 9810091456

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A)Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have

   Parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you

   getcheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

VIPIN – 7252947128

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (**A- Not interested at all**, B- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles **C) not aware about the benefits of EV**

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility D) Parking Lots **E) Petrol Pumps**

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **no & yes we want**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **Near by Showroom**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

DEEPAK – 8630453757

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. how likely are you to buy an Electric Vehicle in the next 6 years.

   (A- Not interested at all, **B- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home **B) Office C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **not yet & yes we want**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

MUNENDRA – 8081169651

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No parking space for EV & yes we want**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

DANISH – 9670756501

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots E) Petrol Pumps**

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **NO parking space & we would like to have**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

MOHSIN KHAN – 9675313845

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, **E) Taxi** (Ola, **Uber**, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No, and we want parking for EV**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **Nearby showroom**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

VINEET – 9793637683

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home **B) Office** C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **NO & we want parking space for EV**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

VIVEK - 9453175894

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) **2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots **E) Petrol Pumps**

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SMITA – 9450615051

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. **(1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ADARSH - 7275494044

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all,** 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAJESH – 9336243336

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A)Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

KARAN – 8318893859

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A)Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

MAYA – 8115384302

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

DURGA – 7525024625

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

AKSHAY – 8052283424

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ROHAN- 6342423455

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles **C) not aware about the benefits of EV**

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A)Home B) Office C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SANTOSH- 9456756544

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RIYA – 6452435523

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SUMIT – 9442452567

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ARPIT – 9554665566

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A)Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SUNIL – 9235746665

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ARCHANA – 969634330

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAUNAK – 966634380

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles **C) not aware about the benefits of EV**

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SWATI – 8840650004

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

GOVIND- 7752870004

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RANI – 6392455581

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots E) Petrol Pumps**

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

REHAN – 6393074324

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots **E) Petrol Pumps**

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RATANDEEP – 9415423919

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAMU - 9648503848

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SHYAM- 8299457839

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

HUMA

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAKESH – 7270984060

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler **D) Commercial Vehicle**, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility D) Parking Lots** E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SHUKRMAR – 7394982925

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   a. Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

PRATAP – 9555036303

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   a. Home B) Office **C) Public Charging Facility D) Parking Lots** E) Petrol Pumps

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SHAMS- 8090786557

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility D) Parking Lots E) Petrol Pumps**

5. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

BRIJESH – 8738974876

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   a. Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Charging and High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

JASWANT – 9453807082

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler **D) Commercial Vehicle,** E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   a. Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Chargingand High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

USMAN – 9457865894

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility D) Parking Lots E) Petrol Pumps**

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Chargingand High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ANAM – 9453178694

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Chargingand High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

UMAR – 9478675885

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler **B) 3 Wheeler** C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

BABITA

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Chargingand High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109
(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

SANJAY - 7527864625

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all,** 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Chargingand High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

KARTIK - 8127133163

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

    a. Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Chargingand High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

ABHISHEK – 7786024625

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all**, 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Chargingand High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

NIRMAL – 8127131040

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? **A) 4 Wheeler** B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all,** 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office C) Public Charging Facility **D) Parking Lots E) Petrol Pumps**

6. What would you prefer, **A) Slow charging and low cost bill** B) Fast Chargingand High Bill

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

RAVI – 9678603848

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Chargingand High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

PRAKASH – 9759503848

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler **C) 2 Wheeler** D) Commercial Vehicle, E) Taxi (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (**1- Not interested at all,** 7- Definitely)

4. What is the reason for not interested in buying EV?

   A) Lack of charging infrastructure B) high cost of electric vehicles C) not aware about the benefits of EV

5. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home **B) Office** C) Public Charging Facility **D) Parking Lots** E) Petrol Pumps

6. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

7. Is there any parking space dedicated to EV in your society? Would you like to have parking space foe EV in your society? **No & want parking space**

8. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**

Questionnaire Survey by people of Ward 94 , Ward 98 & ward 109

(Vivekanand puri ward, Begum hazrat mahal ward, Aliganj Ward)

KAILASH – 9648785648

1. Do you have a driving license? (**Yes**/No)

2. What type of Vehicle do you own? A) 4 Wheeler B) 3 Wheeler C) 2 Wheeler D) Commercial Vehicle**, E) Taxi** (Ola, Uber, etc.) F) Not Applicable.

3. On a scale of 1-7, how likely are you to buy an Electric Vehicle in the next 5 years. (1- Not interested at all, **7- Definitely**)

4. If you own an EV, at what place are you likely to charge your Vehicle?

   A) Home B) Office **C) Public Charging Facility** D) Parking Lots E) Petrol Pumps

5. What would you prefer, A) Slow charging and low cost bill **B) Fast Charging and High Bill**

6. Is there any parking space dedicated to EV in your society? Would you like to have parking space for EV in your society? **No & want parking space**

7. Would you purchase an EV from nearby showroom or from a place where you get cheaper price of the EV? **At cheaper price**