



“Assessing Electric Vehicle (EV) Readiness of an Indian City : A Case Study of Lucknow, Uttar Pradesh”

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Background

Increasing share of Internal Combustion Engine (ICE) mode of transport is one of the major contributor for increasing carbon emissions.

In India ~ **80%** of transport fossil fuel need is met by imported crude oil from other countries.

There is huge potential in India to increase the EV market share through government subsidies and incentives for adopting EV technology (Lieven, 2015).

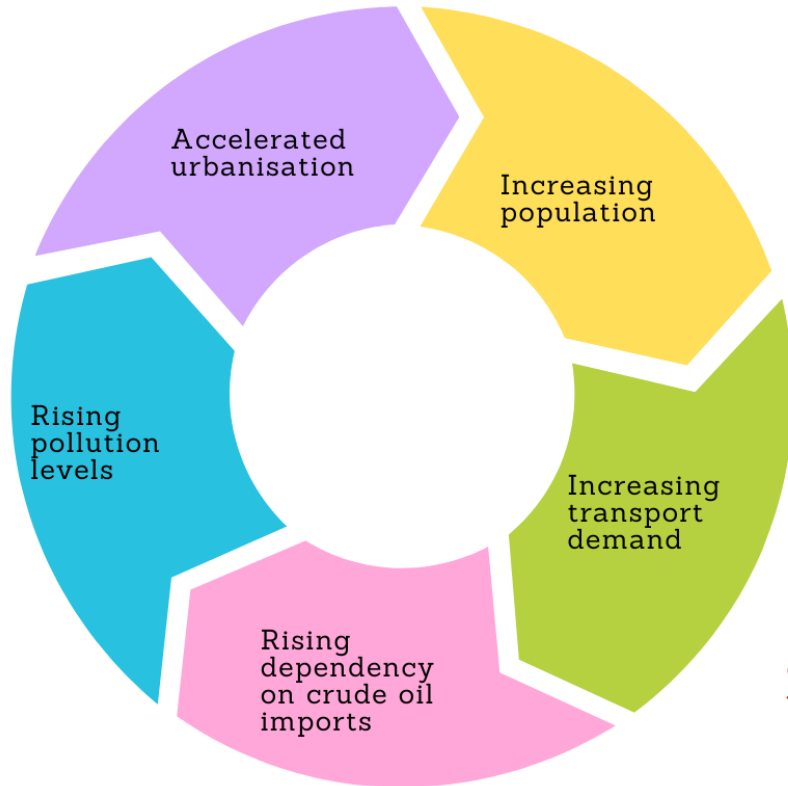


Road transport accounts for **75%** of transportation sector related greenhouse gas (GHG) emissions (International Energy Agency, 2020).

Global share of EVs is very less in India.

Globally, countries such as Germany, France, Norway have set targets for total EV transition by the year 2030-40.

Significance of EVs in Indian Context



6-7 million

EVs by the year 2020

India's target as per National Electric Mobility Mission Plan

30%

EV share by the year 2030

India's commitment as part of CEMs EVI

842 mt

CO₂ saved over lifetime

Achievement of 30% EV transition will save CO₂ emissions (World Economic Forum,2019)

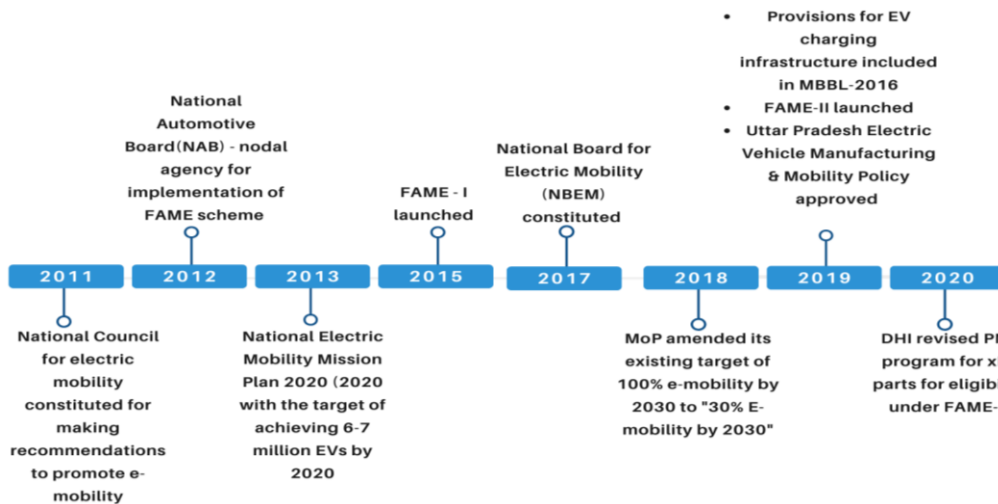
\$250 billion

Vehicle industry by 2026

India's vehicle industry is expected to reach \$25-\$280 billion by 2026 (IBEF,2017)

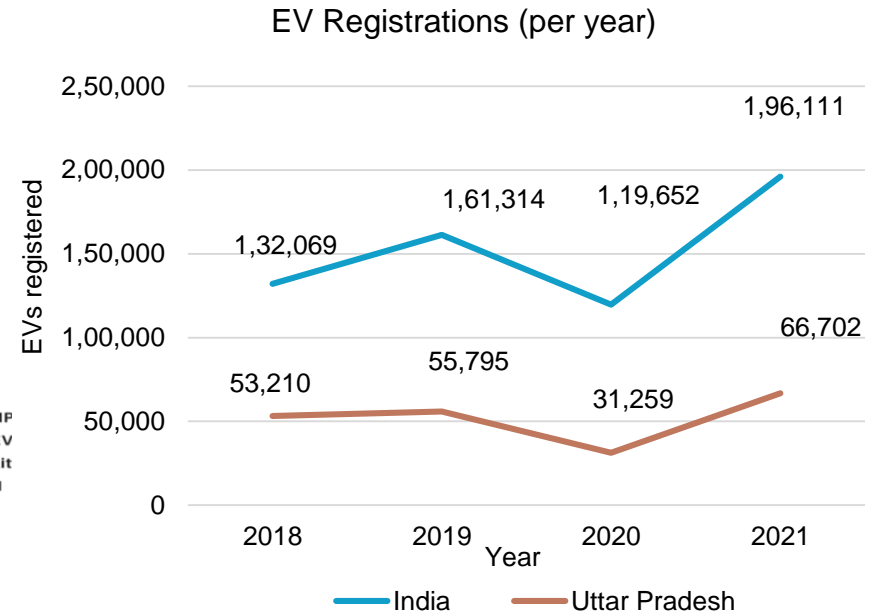
EV transition is best suited to break this cycle.

Indian EV ecosystem – Targets & Schemes



Timeline representing major steps in e-mobility by the Central government

Source: Ministry of Heavy Industries



Source: Vahan database

- India's National Targets at Paris Agreement & COP-26 for e-mobility
- Union Budget 2022-23** promotes shift to use of public transport in urban areas with the main focus on special mobility zones & EV vehicles.
- More than 20 states in India have declared their **state specific EV policies**.

Research Objectives

1. To project the EV growth in Lucknow by 2030 and estimate infrastructure requirements.
2. To assess the current EV readiness of Lucknow and understand the challenges in EV adoption.

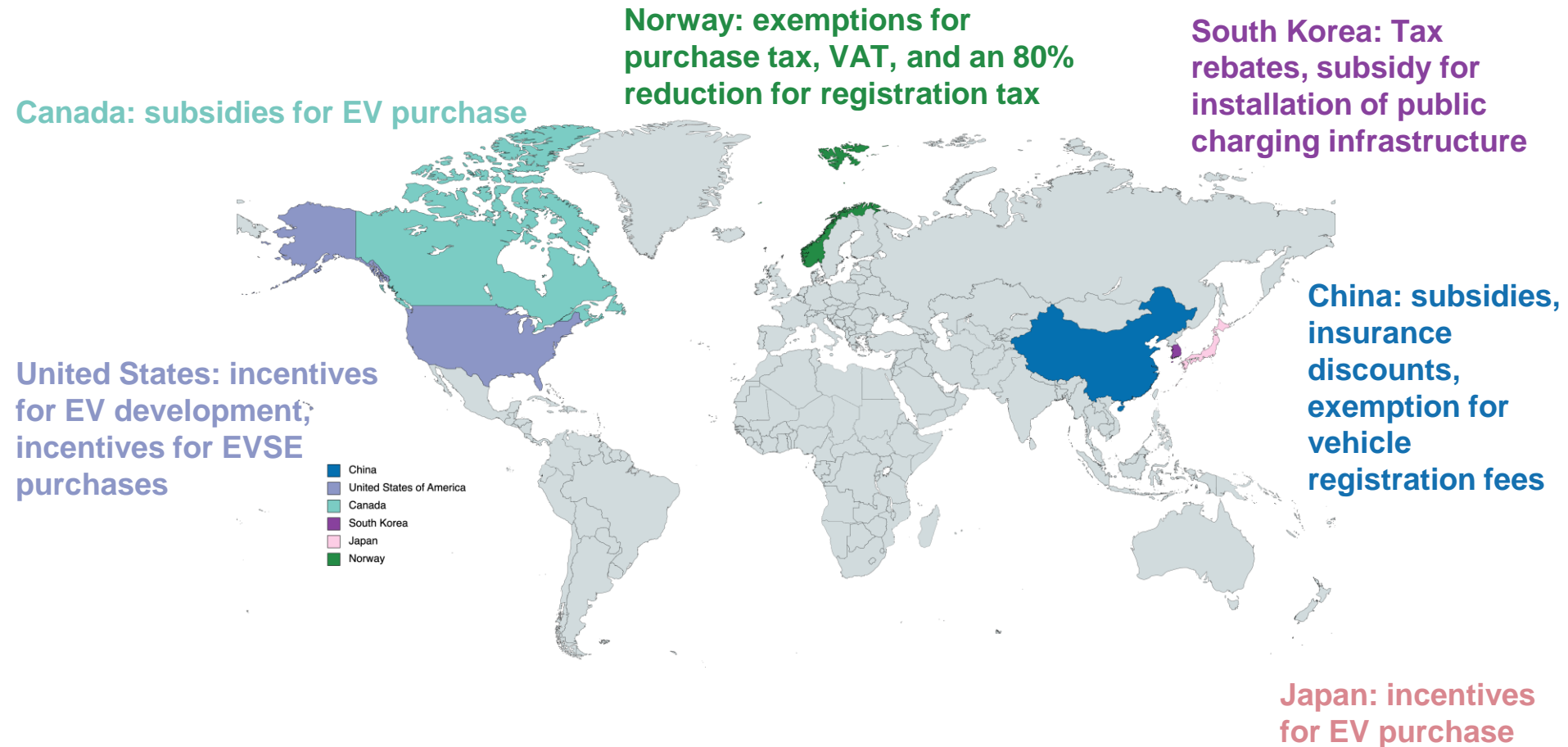
Purpose of the Study

To analyse EV growth in Lucknow till the year 2030 based on two scenarios as well as to assess EV readiness of Lucknow in terms of availability of EV infrastructure, policy interventions taken by state governments and penetration of EVs in the study area.

EV readiness?

EV readiness is defined as the degree to which adoption of EVs is supported, as reflected in the presence of various types of policy instruments, infrastructure development, municipal investments in PEV technology and participation in relevant stakeholder coalitions (*Clark-Sutton et al., 2016*).

Review of EV Policies around the globe – Fiscal Incentives



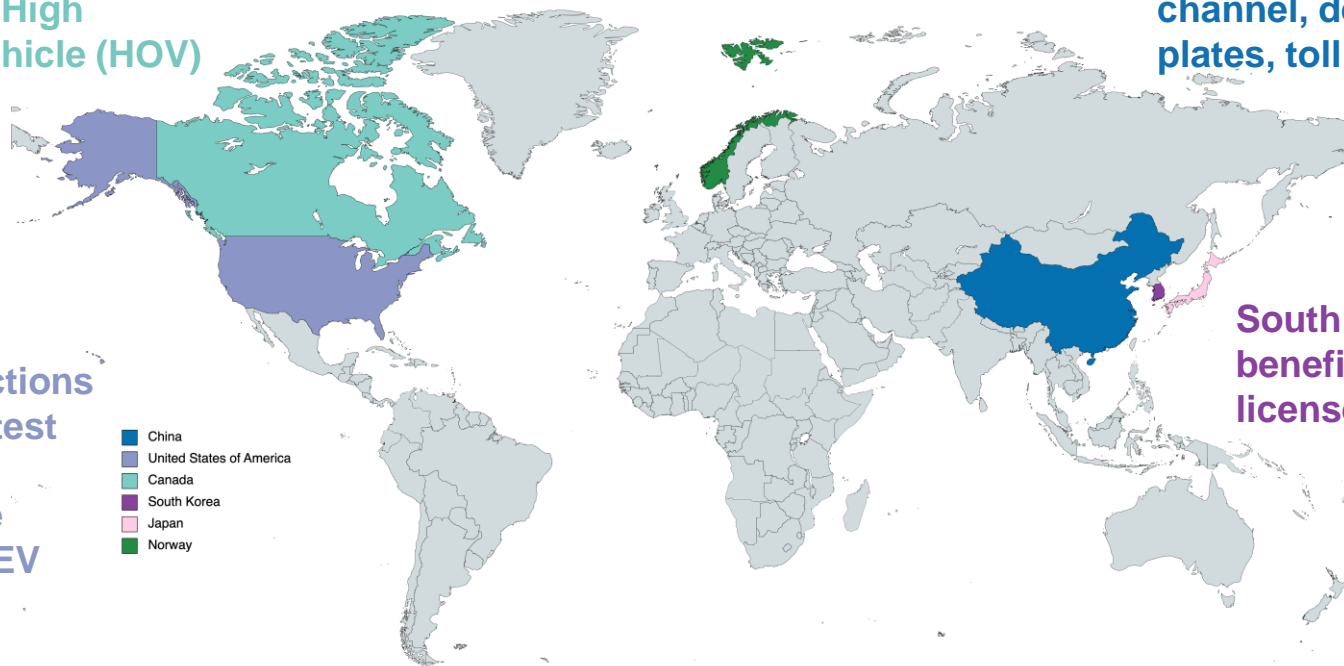
Review of EV Policies around the globe – Non-Fiscal Incentives

Canada: Zero emission vehicle, unrestricted access for EVs in the High occupancy Vehicle (HOV)

Norway: Toll exemption, electricity rate reduction for EVs

China: parking benefits, dedicated EV registration channel, dedicated license plates, toll exemption

United States: vehicle inspections or emissions test exemptions, electricity rate reduction for EV charging



South Korea: parking benefits, dedicated license plates

Why Uttar Pradesh?

3rd Largest beneficiary of FAME Scheme

3rd Largest automobile consumer in India

Highest EV sales during FY 2021-2022

Uttar Pradesh EV & Manufacturing Policy, 2019

Policy Duration	5 Years
Incentives	For first 1 lakh buyers of EVs manufactured within UP – 100% exemption from registration fees 100% exemption from road tax(2-W) 75% exemption from road tax(other EVs) {These incentives are over and above as provided by Central Government}
Targets	<ul style="list-style-type: none">• To create employment potential for 50,000 People• To launch 1,000 E-buses• To achieve 70% EV public transportation on identified 10 EV cities by 2024 and all cities by 2030.• To roll out nearly 10 lakh EVs combined across all segment of vehicles by 2024.• To set up nearly 2 lakh slow and fast charging, swapping stations by 2024.

Source: UP EV Policy

Introduction to the Study Area : Lucknow



Area¹ = 2,258 sqkms



Population¹ = 45,89,838



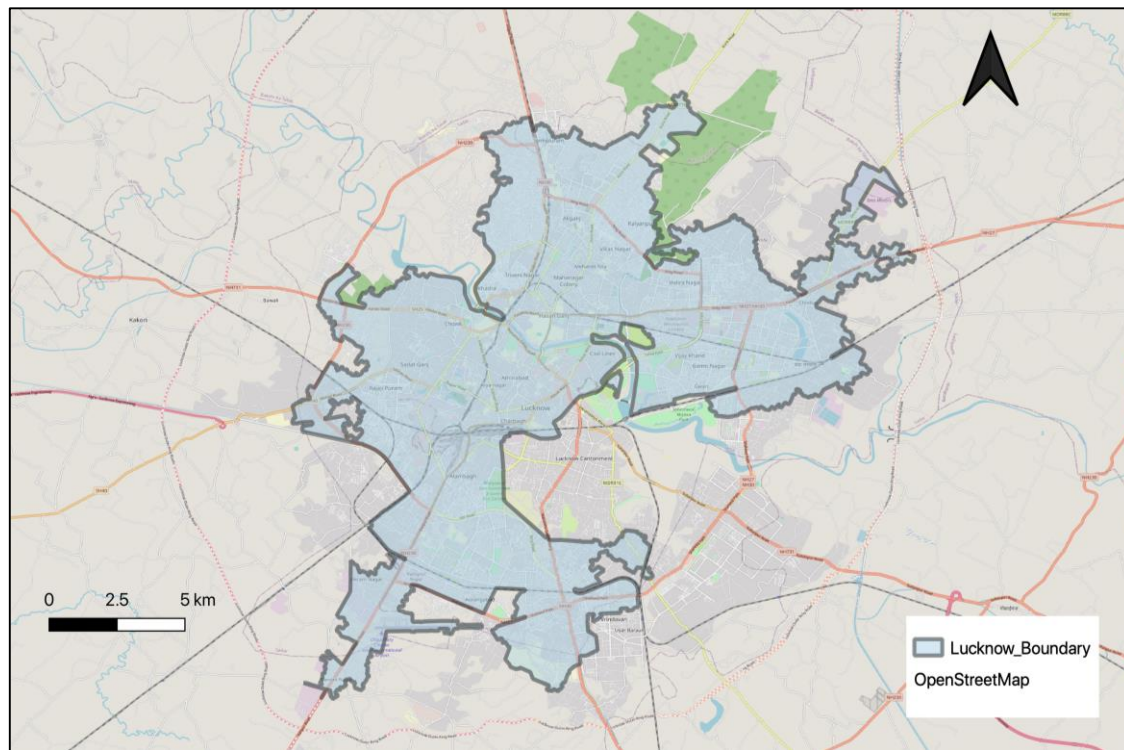
Total vehicle registrations* = 25,77,750



Total EV registrations* = 34,704



73% vehicle market dominated by two wheeler segment



Source : QGIS



Share of EVs out of total vehicle = 1.35%

*Vahan Database (till March 2022)

¹ Census 2011

Methodology

Mix Methodological Approach

Secondary Data: Statistical Data for Vehicle Registrations

Primary Data: EV Readiness Survey

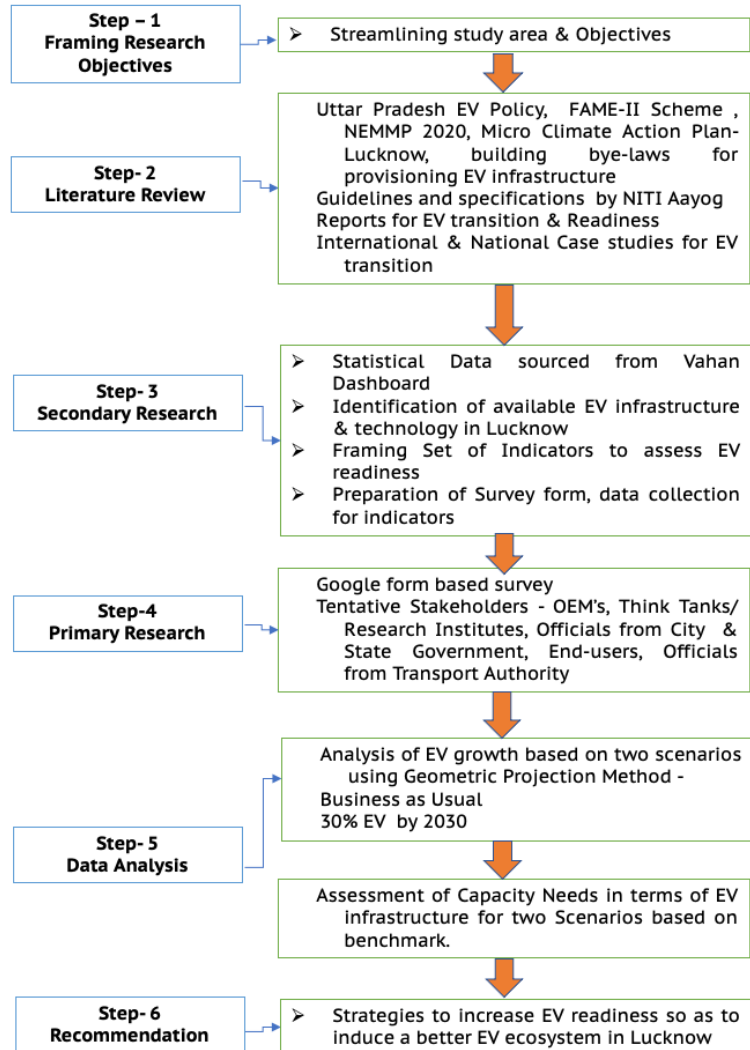
Two Scenarios for projecting future growth of EVs based on geometric population forecasting method

Scenario – 1: Business As Usual

Scenario – 2: EV 30 by 2030

A set of Indicators were framed to assess the EV readiness

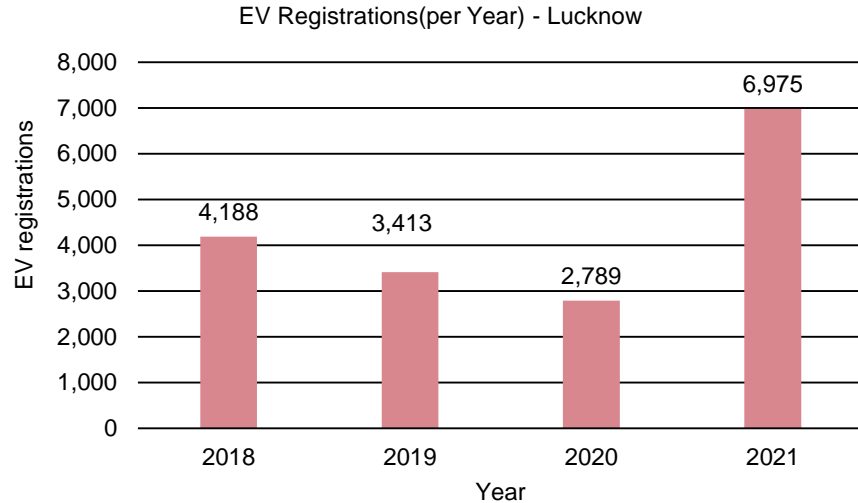
Pilot Survey – Google form based survey to identify the bottlenecks in EV adoption



Selected Indicators for EV Readiness

S.No	Indicators	Unit	Benchmark	Scoring Methodology
1	Share of PCS in Lucknow w.r.t. PCS in India	nos	Maximum share of PCS is 34% in Delhi	Relative scoring w.r.t. maximum in Indian city
2	Ratio of EV per charging station	nos	15	International Benchmark
3	Charging points per 1,000 EVs	nos	1.32 in case of Delhi. (Average charging points per charging station = 2.5)	Relative scoring w.r.t. maximum in Indian city
4	EVs per 1,000 persons	nos	Maximum value = 35.8 (Delhi)	Relative scoring w.r.t. maximum in Indian city
5	Ratio of e-buses w.r.t. total bus fleet(city government)	nos	70%	Relative scoring w.r.t. maximum in Indian city
6	Share of renewable sources of generation (State-wise)	%	National Average Share (2021) - 24.5%	Relative scoring w.r.t. national average share of renewable source
7	Electricity Tariff	Rs/Unit	7.8	Absolute score if electricity tariff is less than national average
8	Presence of Battery Swap Stations	Yes/No	Yes : 6.67 No : 0	Absolute Scoring for these indicators : Yes = 6.67 score No = 0 score
9	Presence of fiscal incentives for EV adoption	Yes/No		
10	Presence of a separate institutional body for EVs	Yes/No		
11	Presence of e-mobility targets in City's Climate Action Plan	Yes/No		
12	Parking Privileges: Whether the city offers free, reduced cost, or reserved parking for EV owners	Yes/No		
13	Mandatory registrations for EV in DCR/ bye-laws	Yes/No		
14	EVSE permitting – Presence of streamlines permitting approach for installing EVSE	Yes/No		
15	Presence of EV car sharing service	Yes/No		

Objective 1 : To project the EV growth in Lucknow by 2030 & estimate infrastructure requirements



Source: Vahan Database

Total Vehicle Registrations

	India	Uttar Pradesh	Lucknow
Total vehicle registrations*	28,49,12,296	4,00,43,111	25,77,750
Total EV registrations*	10,81,139	2,92,555	34,704

*Data till March 2022

Source: Vahan Database

Projections for EV growth

Scenario 1 (Business as Usual)

- Average growth rate was taken to be constant and projections were made based on geometric projection method.

Scenario 2 (EV 30 by 2030)

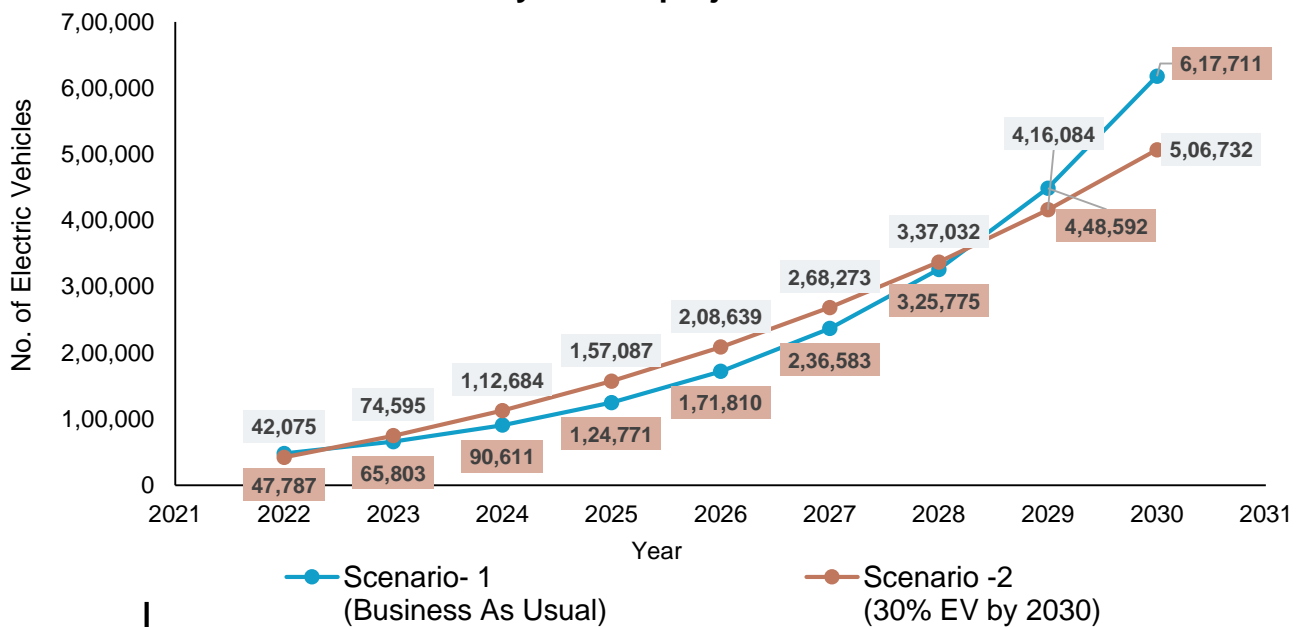
- India's target of achieving 30% e-mobility has been taken into consideration.
- Average Compounded Annual Growth rate (CAGR) of vehicle registrations was used to forecast new registrations nationally.

- Only **1.35%** of the total vehicle registrations were **EVs** (till March 2022).
- This shows the initial level of penetration of electric vehicles in Lucknow, thus leveraging a push for faster adoption of EVs.

EV Projections based on two Scenarios

- Both the scenario clearly showcase that this massive increase in EV registrations would require major push for EV infrastructure in Lucknow.
- As per the amendments in the MBL-2016 by the Ministry of Housing & Urban Affair, at least 1 PCS should be available in a grid of 3Km X 3 Km.
- Therefore, Lucknow will need minimum **281 public charging stations**.

Scenario Analysis - EV projections for Lucknow



Scenario-1	Performance parameters	Scenario-2	
2023	NEMMP Target	2026	Total charging points required by 2030 as per existing provisioning norms: 2,86,206 charging points
2027	UP EV Policy Target	Mid 2025	
11%	Share of EVs by 2030	3.2%	

Objective 2 : To assess the current EV readiness of Lucknow and understand the challenges in EV adoption.

- Due to non-availability of benchmarks for EV readiness, Benchmarking was done based on the best performing Indian city for that particular indicator.
- For this, existing scenario of other cities were studied along with Lucknow.

Equal weightages were given to all the indicators.

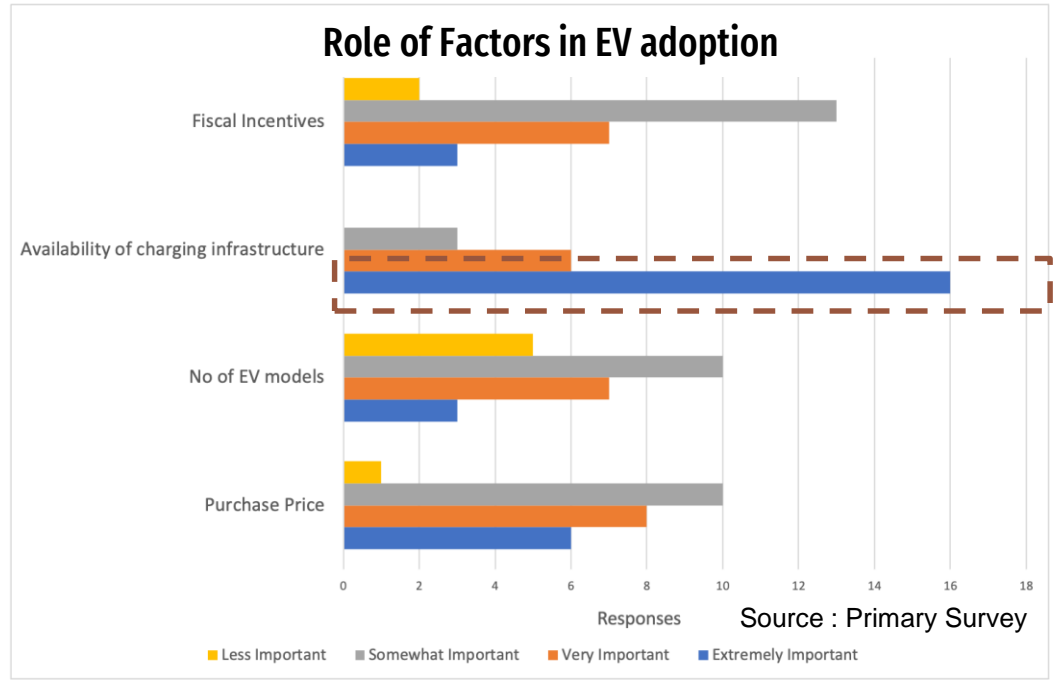
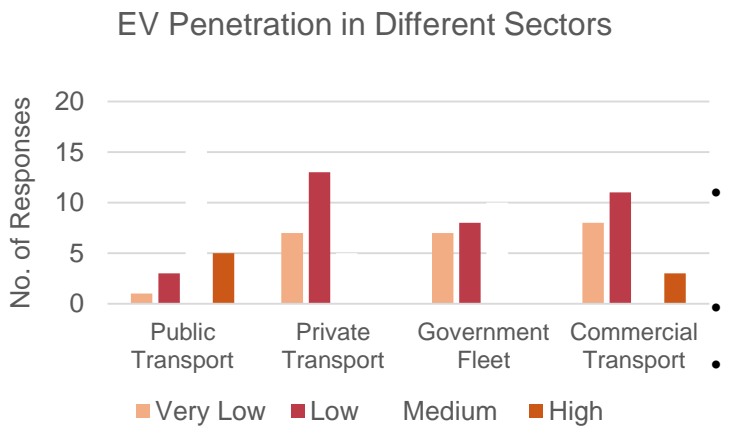
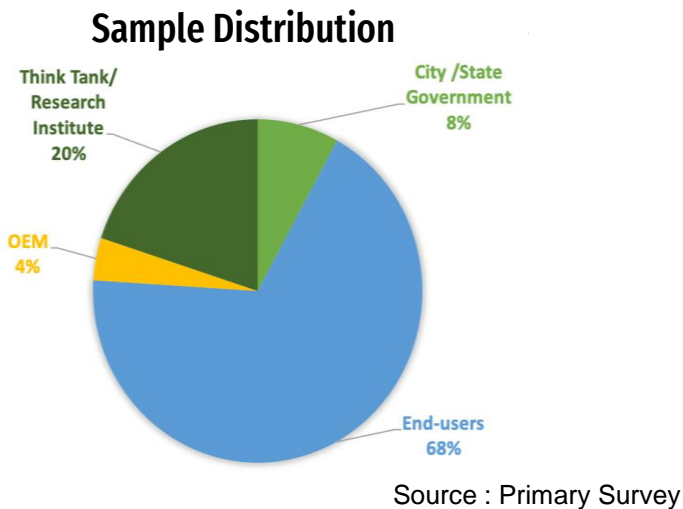
Maximum score = 100

Total number of indicators = 15

Weightage of each indicator = $(100/15) = 6.67$

S.no	Indicators	Value	Scoring
1	Share of PCS in Lucknow w.r.t. PCS in India	0.63%	0.12
2	Ratio of EVs per charging station	227.5	0
3	Charging points per 1,000 EVs	0.81	4.09
4	EVs per 1,000 persons	6.526	1.22
5	Ratio of e-buses w.r.t. total bus fleet(city government)	15%	1.43
6	Share of renewable sources of generation (State-wise)	17%	4.72
7	Electricity Tariff	7.5	6.67
8	Presence of Battery Swap Stations	Yes	6.67
9	Presence of fiscal incentives for EV adoption	Yes	6.67
10	Presence of a separate institutional body for EVs	No	0
11	Presence of e-mobility targets in City's Climate Action Plan	Yes	6.67
12	Parking privileges: Whether the city offers free, reduced cost, or reserved parking for EV owners	No	0
13	Mandatory registrations for EV in DCR/ bye-laws	Yes	6.67
14	EVSE permitting	Yes	6.67
15	EV car sharing service	No	0
Total Score			51.60

Inferences from Pilot Survey : Role of factors for EV adoption



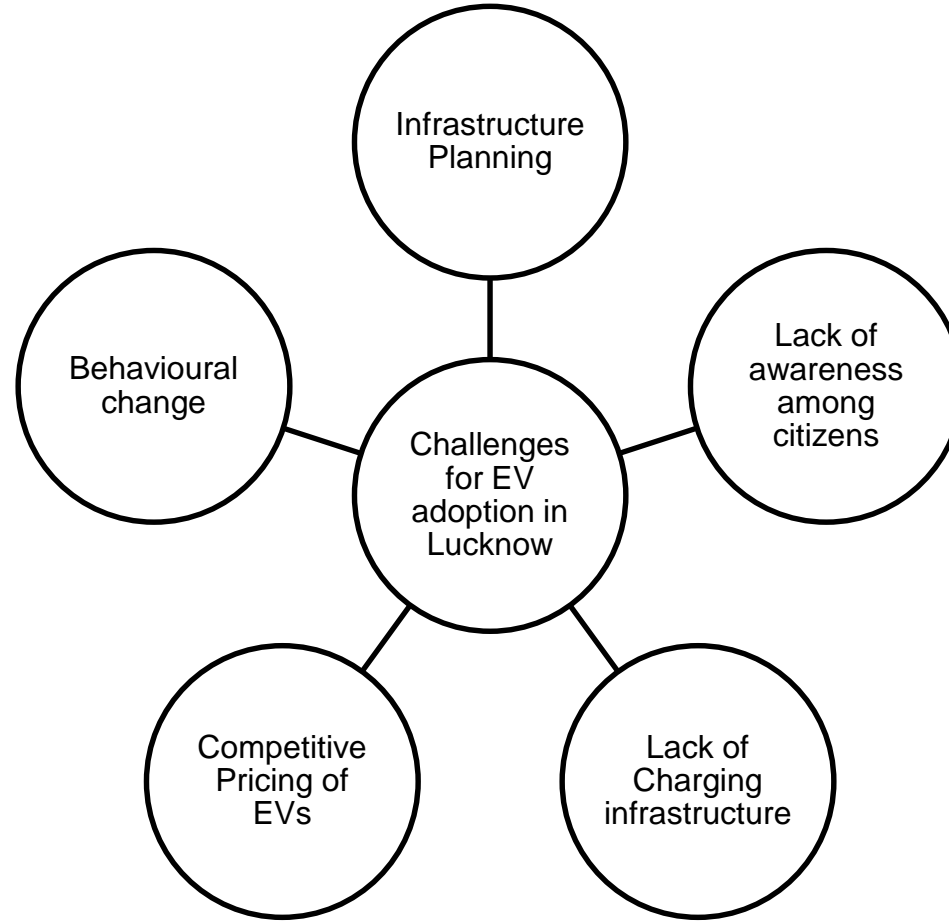
High EV penetration in public transportation with respect to other categories.

Very less EV penetration in private transport which is a major challenge.

Survey also indicated **low penetration in commercial and government fleets.**

Inferences from Pilot Survey : Challenges for EV adoption

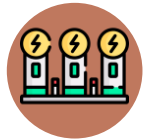
88% of the responses categorised availability of EV charging stations as very important and above



Conclusion



Estimated EV stock in Lucknow by the year 2030 is expected to cross **5lakh+ EVs** (BAU Scenario) & **6lakh+EVs** (EV30by 2030).



Approximately **2,86,206 charging points** will be required by the year 2030. Thus, there is a need for adequate provision of charging infrastructure within the city.



The city lacks public charging infrastructure, non-fiscal incentives and mandatory provision for transition of government fleet. Government should increase the pace of electrification of its fleet to encourage EV transition.



UP EV policy allows incentives for the EVs manufactured only in Uttar Pradesh. Strategic implementation of the policy & creation of a dedicated EV cell will aid in better implementation of EV policy.



50% respondents were not aware of any awareness program for e-mobility in Lucknow, therefore consumer awareness campaigns could be designed to increase the social capacity of the city.

Limitations

- This study is valid for Lucknow only.
- This study was conducted in a duration of 4 months.
- Unavailability of Benchmarks for EV readiness.

Future Scope of Work

This study could be used to develop a framework for assessing EV readiness of different Indian cities, which will aid in comparative assessment of EV readiness of different cities.

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THANK YOU!

