

EV adoption policies for Delhi and Impact of EV charging on the grid in 2030

Objective and background

EV transition requires investment planning for charging facilities and local distribution grids

Discussions - important stakeholders in EV ecosystem and responsible for the grid infrastructure to support EV penetration.

Important for discussions to plan for the growth in EVs and likely impact on the grid.

Project Research to project present and future scenario of EVs in Delhi, charging patterns, and distributed transformer (DT) level electricity demand etc.

Project aimed at assessing the EV charging patterns of current EV users in Delhi

Estimating the hourly load patterns due to EV charging in Delhi based on current charging patterns

Identify factors that impact EV growth and project EV stock in Delhi in 2030

Projecting the impact on electricity demand on the local grid in Delhi in 2030 based on projected

Key Questions

What is the existing EV consumer's profile (2W, 3W, 4W) in Delhi?

How expectations vary for different categories of EVs?

The existing charging behaviour of EV user (home, workplace, public, battery swapping) and time of charging for various segments of EV users?

What will be the medium term implication for the five to ten years depending on consumer profiles?

What kind of demand will emerge from various types of EVs?

How should the distribution utility estimate electricity demand at Distribution Transformer (DT) level?

Methodology

Primary surveys of current and prospective users of EV in Delhi

45 EV consumer segments survey of covering 500 respondents across Delhi

Private EV users

Existing private users (early adopters) of EV 2W-4W.

Prospective consumers - Who intend to buy a vehicle in next 6 months

52% of 2W buyers and 53% of 4W buyers prefer EV (EV intenders) others are conventional intenders

3W, Taxi and Institutional users

Institutional users of EV 4W

e-rickshaw drivers

Survey Questionnaires designed to assess the respondents

Socio economic profile

Travel patterns

Accesses to parking and preference & availability of charging infrastructure

Charging patterns - frequency of charging and plug in time & SOC, plug out time & SOC during each charging is the reference period

used to estimate the charging load on the grid for each mode of EV

Consumer Profile of Private EV buyers in Delhi



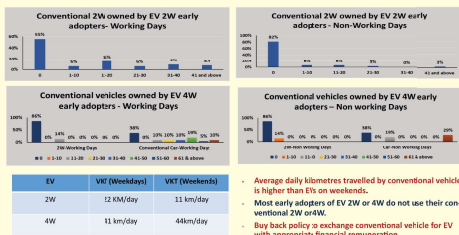
Early adopters of EV	Household Expenditure	
	(Rs/month)	Average
2W	7,000-40,000	18,506
4W	40,000-50,000	44,286
	Conventional	EV
Prospective Consumers	ev	12,000
	ev	23,971
	ev	28,382
	ev	34,230

Driver and Vehicle Profile of EV Public Transport	
Taxi aggregators and Institutional users of EV 4W	
> Belongs to the age group of 20-39 years	
> 72% of the EVs surveyed belong to private firms	
Travel Pattern	
	Operational days
Government	7 days a week
Private Organizations	6 days a week
	Daily Average Distance Travelled
Government	30 km/day
Private Organizations	134 km/day

e-rickshaws	
> Belongs to the age group of 20-39 years	
> The average income is 16,786 Rs./month.	
> 83% were owners and 17% had it on rent. (Rent is between 150-300/day)	
> 87% used for passenger transport and 2% for passenger & freight.	
Travel Pattern	
	Charging Time
Government	10 hrs
Private Organizations	Weekends - 2.5, Weekdays - 1.15
	average trip rate (Rs./hour)
Government	3.64
Private Organizations	average daily 100-120 (Govt), 100-120 (Private)

Findings from the survey on behavioural aspects of EV buyers in Delhi

Private owners of EV - 2W & 4W



Early adopters of EV 2W

- Have access to parking facilities
- 90% charging from home and 9% have office charging options.
- 94% not aware of public charging facilities near their home or office. Among those who are aware, 60% have charging station within 5 km of their home, 50% have charging station within 5 km of their office
- None visited a public charging station and unaware of waiting time
- Respondent suggestions
 - charging station within 2-3 km
 - all around servicing centres and free servicing in the first year
- Early adopters of EV 4W
 - Most have access to home or garage parking
 - None opted for public charging despite 60% having

charging stations within a 5 km.

On a working day, 15% opt for home charging and 5% opt for office charging.

On non-working days only one-third charge through home charging.

Respondent suggestions

Disappointed of availability of charging infrastructure and waiting time

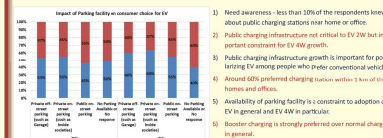
Having public charging infrastructure within 1 km preferably or within 2 to 3 km.

Battery swapping facility at every station.

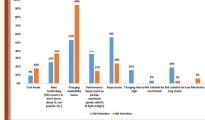
Fast charging within 90 minutes

Need awareness and increased availability of public charging infrastructure.

Prospective private consumers of EV



Reasons to not buy an EV by Conventional Vehicle Intenders



Determinants of consumer decision: Range, Charging Time, Operating & Maintenance cost, Resale value and Government policy

Choice of vehicles of conventional intenders based on different factors

Awareness of major EV attributes

Choice cards provided to Conventional Intenders Comparing different models of EV and conventional 2W and 4W based on capital cost, operating cost, EM, Range or Mileage (Assuming development of INR 60/kWh, electricity price INR 6/kWh, the annual run of 12,000 km).

14% of 4W and 52% of 2W Conventional Intenders Ripped their choices to EVs.

Promotion and Awareness campaign for EVs needed highlighting range, utility in short distance, new battery based technology, less noise, less mechanical parts and availability of public charging points.

Public EV Transport operators

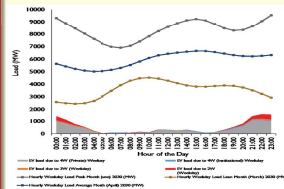
- 90% mentioned range and 54% mentioned availability of public charging infrastructure as an issue to improve.
- Respondent drivers are least satisfied about availability of public charging infrastructure & higher waiting time for charging, so 25% recommended hybrid vehicles and 75% preferred battery EVs.
- Improvement in Range (100km) drivers reported range as an issue
- Free servicing, maintenance, repair and battery replacement services are high on wish list of the drivers
- 13% suggested improvements in the range of EV 4Ws
- 80% parked in office premises, 16% in streets or public space and 4% used garage
- 75% charge at the office and 22% at public charging stations.
- 13% suggested improving the charging time for EV 4Ws
- 86% preferred a less than 1 hour, 43% suggested 2 hour, 21% suggested more than 1 hour
- Unlikely factors
 - Drivers prefer fast charging to save time during working hours.
 - No parking charges
 - No-liable factors
 - Drivers do not prefer to charge in public stations due to the long waiting time
 - Unavailability of public charging infrastructure - mentioned by 54%
 - Poor infrastructural amenities
- Perceptions of respondent drivers of e-rickshaws
 - All e-rickshaw drivers believe to be low income group
 - Drivers suggested improvement in e-rickshaws for better utility
 - 93% of the drivers said e-rickshaws are good return on investment.
 - 62% of e-rickshaw driver suggested that increase in range can increase their incomes
 - 46% suggested lower cost e-rickshaws
 - Lack of parking facilities in private charging stations constraint to the growth
 - 53% charge at private parking facilities and 43% were charging at their homes
 - 15% wanted more charging points
 - 10% wanted improvement in batteries
 - Charging at home or at commercial charging points
 - 6% suggested lower charging cost
 - Drivers had a preference for fast charging.
 - 4% wanted fast charging facilities

Findings on charging patterns and impact on Grid of 2030 due to EV charging

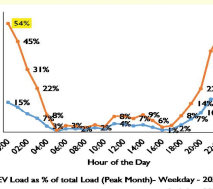
Impact of EVs on Delhi Grid in 2030

Weekday

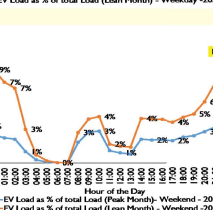
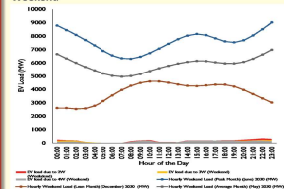
2030 Peak demand from CEA adjusted on 2019-20 load curve



Additional EV's load as % of total load in 2030



Weekend



- 53% of Early adopters of EV 2W charge less than once a day and 39% charge them once a day
 - Average time to full charge - 7 to 8 hours.
 - The average Plug in SOC working day is 24% and non-working day is 34%
 - One-third of Early adopters of EV 4W charge 7 times a week and another one-third charge it 3 times a week.
 - Average time to full charge in EV 4W - 9 to 10 hours and up to 2 times in fast charging mode.
 - The average Plug in SOC working day is 34% and non-working day is 36%
 - 40% Taxi and institutional 4W charge once a day and 50% charge twice a day.
 - Vehicle is charged on the working days only, fast charging is used by almost all drivers
 - The average Plug in SOC on working day is 39% with an average charging time of 3.6 hours
 - Majority e-rickshaws charge once a day.
 - Average charging time is 30 hours and average SOC at plug in is 22% in weekdays and 24% in weekend.
- The impact of EVs in 2030 is projected
 - Additional EV Load share in 2030 estimated hourly Demand (without EV Load) on week days
 - Maximum of 17% at 02:00 hrs in Peak month
 - Maximum of 54% at 22:00 hrs in Lean month
 - Additional EV Load share in 2030 estimated hourly Demand (without EV Load) on weekend
 - Maximum of 4% at 02:00 hrs in Peak month
 - Maximum of 35% at 22:00 hrs in Lean month
 - The higher numbers of e-rickshaws is not adding much load on the grid because of the small size of batteries
 - The impact of the noon charging peaks due to 4W (institutional) vehicles is substantially dampened because higher EV-4W private vehicles in 2030
 - Policies for shifting charging time needs to be explored based on Supply pattern of Electricity
 - Sensitivity of Charging time with price of electricity needs to be explored.

Policy recommendation for EV adoption and Grid Infrastructure to support EV Growth in Delhi

EV Policy for Private EV users

Technology Policy

- Price reduction of 16-54% for EV 2W and 40% for 50% and
- 20-40% for Sedans through subsidies or other measures.
- Introducing Hybrid vehicles or improving the range and performance of Battery EV
- Range Improvement: Scooters: 54-150 km/charge, Sedan: 124-300 km/charge, 50% km/charge.

Parking Policy

- Among current users - 90% of EV 2W park at Home, 81% of EV 4W users park at Home and 19% EV Policy for EV Public Transport
- At Office.
- Availability of parking space constraint for EV growth.
- To ease parking constraint, roads and parking places need to be de-congested.
- Parking markings and parking tax on pollution and inefficient vehicles.

Public Charging

- Public charging infrastructure essential for EV adoption and critical for EV 4W growth
- Need awareness and promotion of public charging stations and free public charging points.
- Public charging station within 1 km preferably or within 2-3 km of homes or offices.
- Increasing Battery charging facilities as public charging stations.

Bus/Best Policy

- Most early adoption of EV in Delhi have replaced their previously purchased conventional vehicles with EV.
- Buy back policy that provides EV in exchange for conventional vehicles compensating for the loss of economic life can be implemented.

Subsidy and other incentives

- EV adoption increases with income. Subsidies may be considered to increase EV adoption.
- Preferential access to express/rapid lanes for EVs.
- Special parking places in prime/commercial areas in the city.
- Tax saving or rebate in the purchase of EVs.
- Free public charging points.
- Waiving toll charges/parking charges of EVs.

Promotion and awareness Campaign

- Advertisement campaigns focused on

Professional Groups who are early adopters of EV

- Business Owners, Private consultant/individual - Advertising in Offices and Market areas
- Professional Groups who are working in IT (EV intenders)
- Women, Student, Schoolers - Promote EVs through Mobiles and Social Media, Advertisements, Educational institutions
- Frequent users of public transport like metro, auto-rickshaws, shared cab and e-rickshaws are more likely to buy EVs.
- Advertise in Metro trains and metro stations which are boarding points of e-rickshaws

EV Policy for EV Public Transport

- Technology Policy
 - Range Improvement: 200-254 km/charge or more for institutional 4Ws and 75-100 km/charge for e-rickshaws
- Parking Policy
 - Parking facilities in private charging stations.
- Public Charging
 - Improving the charging time for EV 4Ws at public charging stations to less than one hour.
 - Introduction of EV batteries for e-rickshaws needed to enable fast charging.
 - Increased availability of public charging infrastructure
 - Promote private business for parking and charging facility to electric cabs and e-rickshaws.

Economic and Incentive Policy

Institutional EV 4W

- Tax breaks may be considered for those who use electric cars to meet their transport requirements.
- Electric car use by government can be increased through mandates and policy stipulation.
- e-rickshaw
 - Self financing is the major source to finance e-rickshaw - easy finance schemes required
- Advertisement and awareness Campaign
 - Advertising and awareness campaign to educate drivers of electric taxis and e-rickshaws about after sales services is required.
- Suggested policy for grid load Management
 - Using TOD, the surge loads or EVs in the noon and early evening hours can be shifted to off-peak hours of late night by utilizing ToU tariff for a price-sensitive consumer.
 - Smart Charging/ Managed or Controlled Charging

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