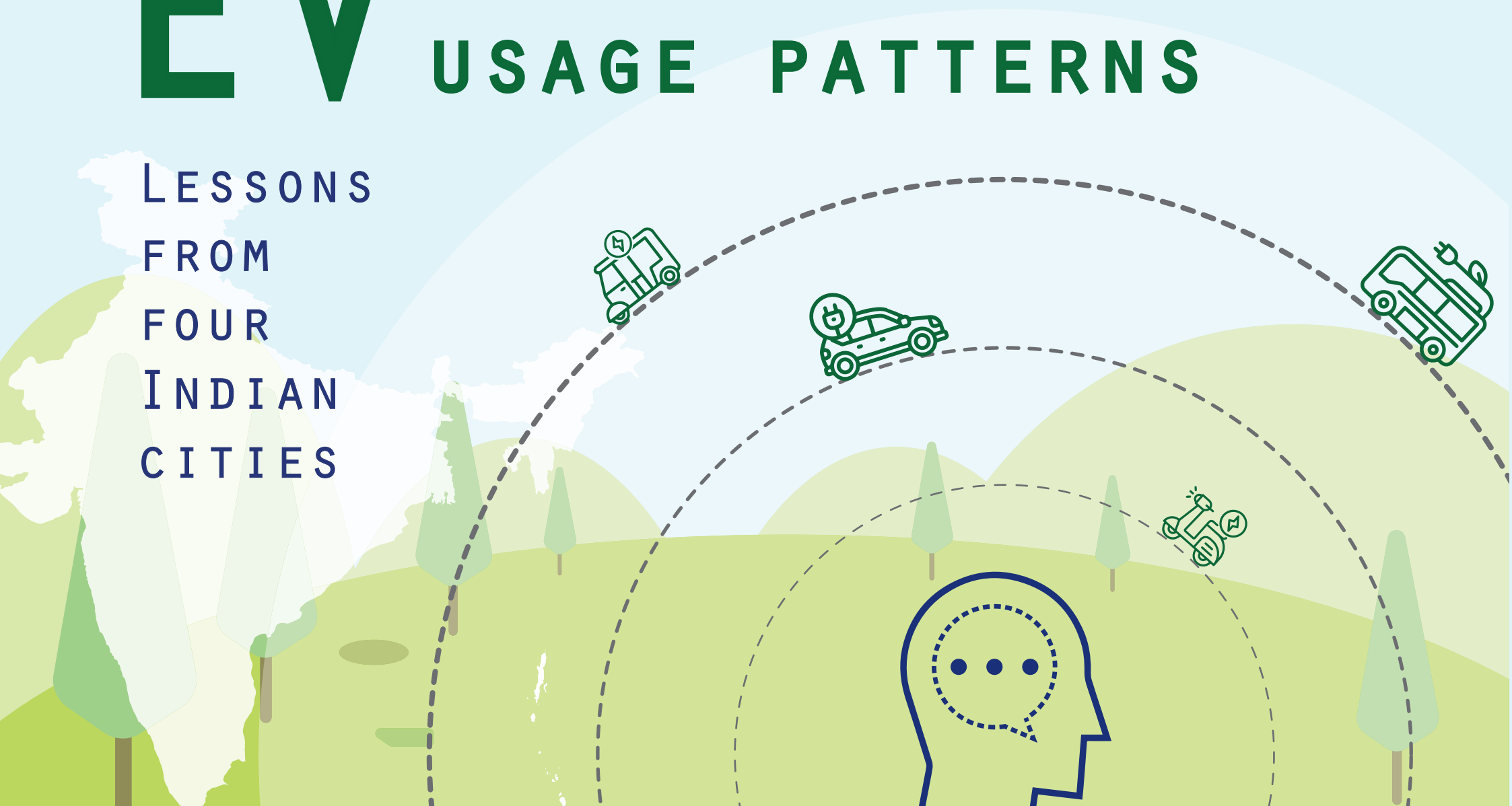


EV PERCEPTIONS AND USAGE PATTERNS

LESSONS
FROM
FOUR
INDIAN
CITIES



Designed and Edited by CSTEP

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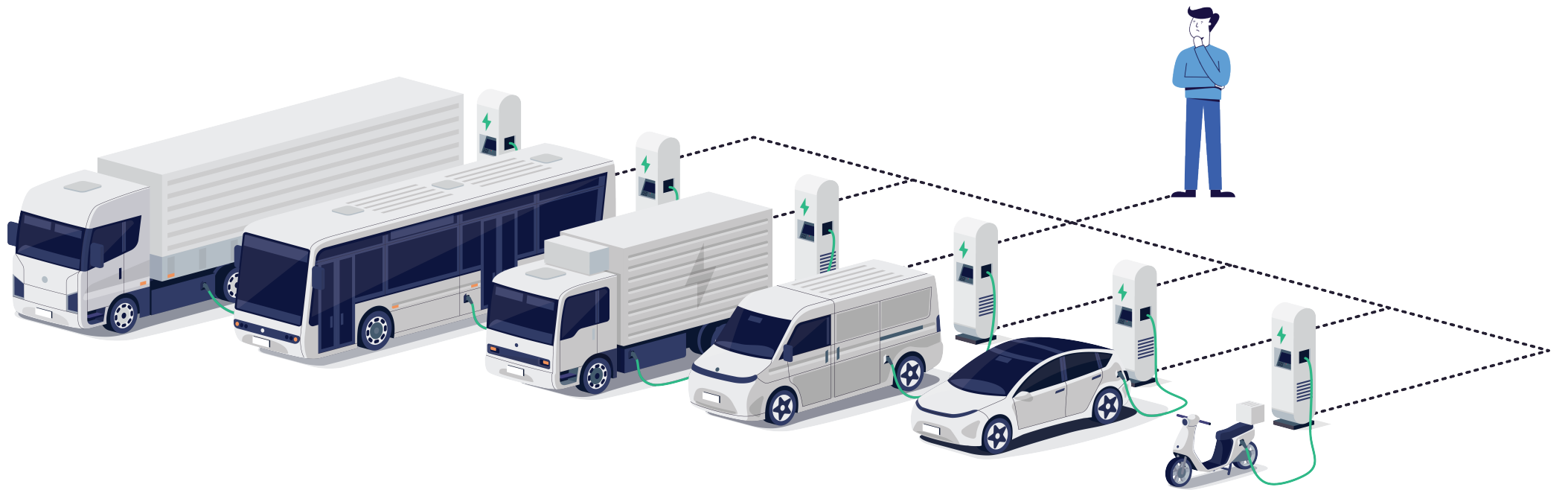
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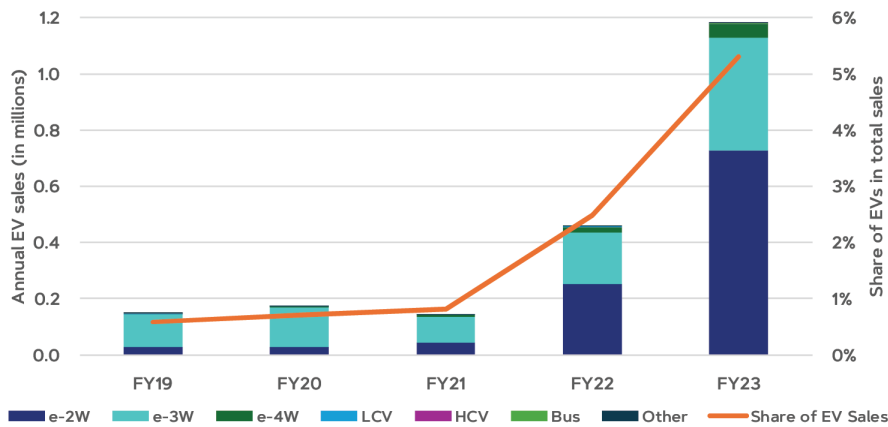


1. Introduction

Electric vehicles (EVs) are a technologically evolving industry that can help reduce fossil-fuel consumption and the associated import dependency. EVs can also help India achieve its net-zero goals and improve the deteriorating urban air quality.

In line with the global trends, EVs are gaining popularity among Indian consumers. This is evidenced by a greater than 2000% rise in EV registrations in the last 7 years (Ministry of Road Transport and Highways, 2023).

Currently, EVs constitute 6% of the overall automobile market share, indicating a growing presence. Cumulatively, over the past few years, more than 2.5 million EVs are currently plying on Indian roads. This growth was predominantly fuelled by the electric two-wheeler (e-2W) segment.

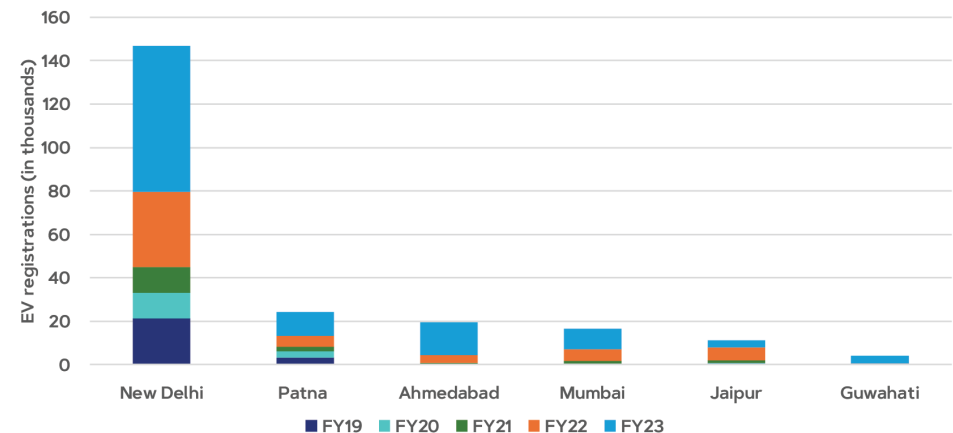


Historical EV Adoption Trends

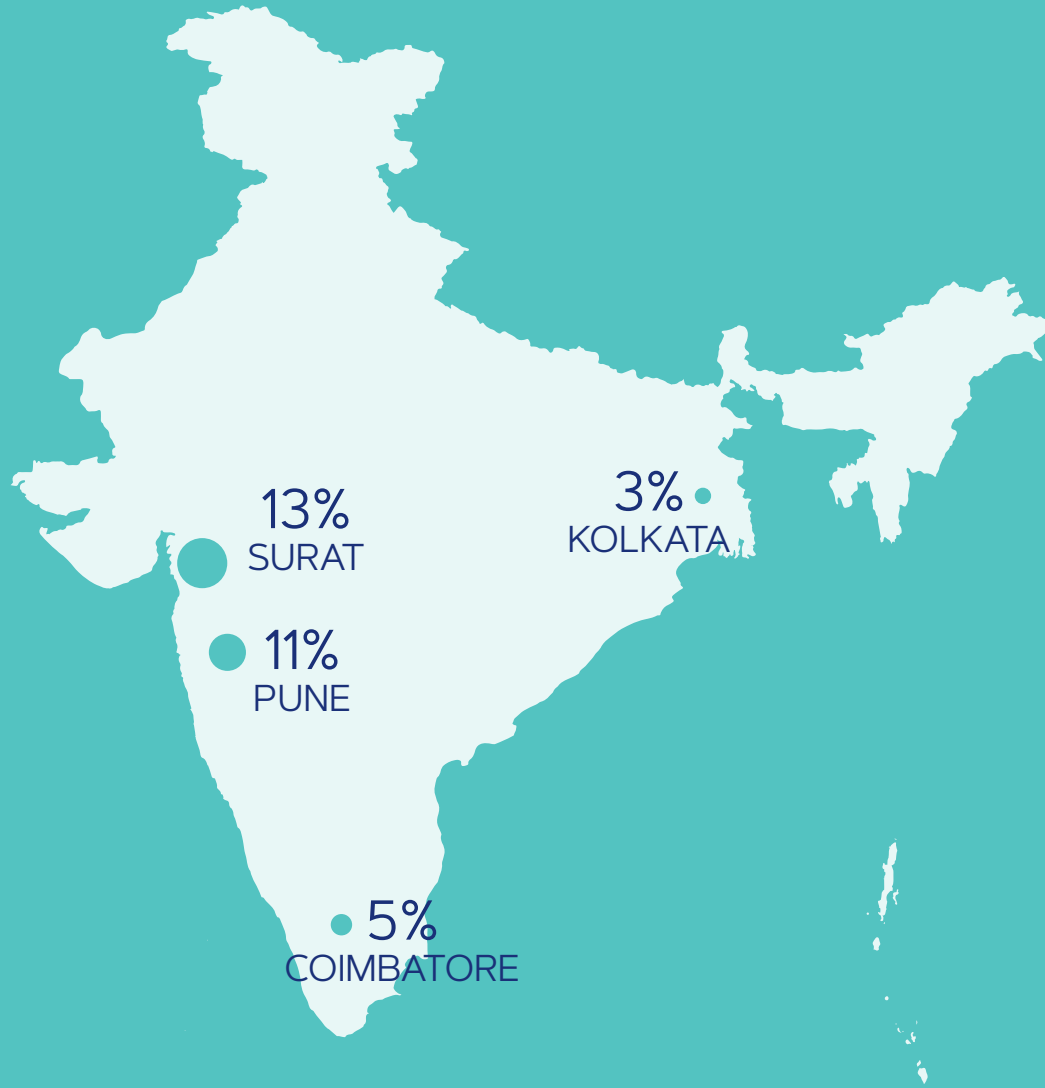
This surge in uptake can be attributed to several reasons including purchase incentives provided by the government, which lower the acquisition cost, and rising fuel prices, making EVs an economical option.

The adoption of EVs across various Indian states exhibits a diverse landscape influenced by regional (state-specific) policies, infrastructure, and consumer preferences. Some states such as Maharashtra lead in terms of e-2W registrations owing to favourable incentives (up to INR 10,000 per e-2W) and the development of a charging infrastructure. However, other states such as Delhi demonstrate a higher uptake of electric four-wheelers (e-4Ws), driven by government initiatives (e.g. subsidies of INR 10,000 per kWh battery capacity). Assam and Uttar Pradesh boast a significant uptake in the electric three-wheeler (e-3W) category owing to the local- and micro-level demand for affordable connectivity and attractive subsidies (INR 12,000 per e-3W in Uttar Pradesh). This divergence in EV registrations across vehicular segments underscores the importance of tailored strategies at both state and national levels to accelerate the transition towards a greener and more resilient transportation ecosystem in India.

A closer examination at the city-level EV penetration reveals a significant growth in EV sales during FY 2023, compared with previous years, with New Delhi (National Capital Region) leading the way. Other major cities such as Patna, Ahmedabad, and Mumbai have also shown promising uptake.



EV Penetration in Major Cities



EV penetration in study cities

Study description

Understanding EV perceptions across the country and gaining deeper insights into the factors influencing EV adoption can help evaluate current EV policies and inform future policy decisions. Accordingly, this study was conducted to capture EV perceptions in four Indian cities with varying EV penetration rates and to determine the factors underlying EV adoption. Surat, Kolkata, Pune, and Coimbatore were selected for a comprehensive and representative (Tier-1 and Tier-2 cities) analysis in India.

Face-to-face interview surveys were conducted during August–November 2023 with potential vehicle owners¹ to obtain first-hand information about their views on EVs. In total, 1,656 potential vehicle owners in the four selected cities were surveyed. Among them, 37% were aged between 25 and 35 years, 78% were males, more than 50% were graduates, 45% were employed in the private sector, and 47% had a monthly income of INR 25,000–50,000. Similar surveys were conducted with EV users (who currently own or use EVs) to assess their usage and charging patterns. Overall, 1,733 EV owners were interviewed in the four cities. Among them, 878 were personal users² and 855 were commercial users³.

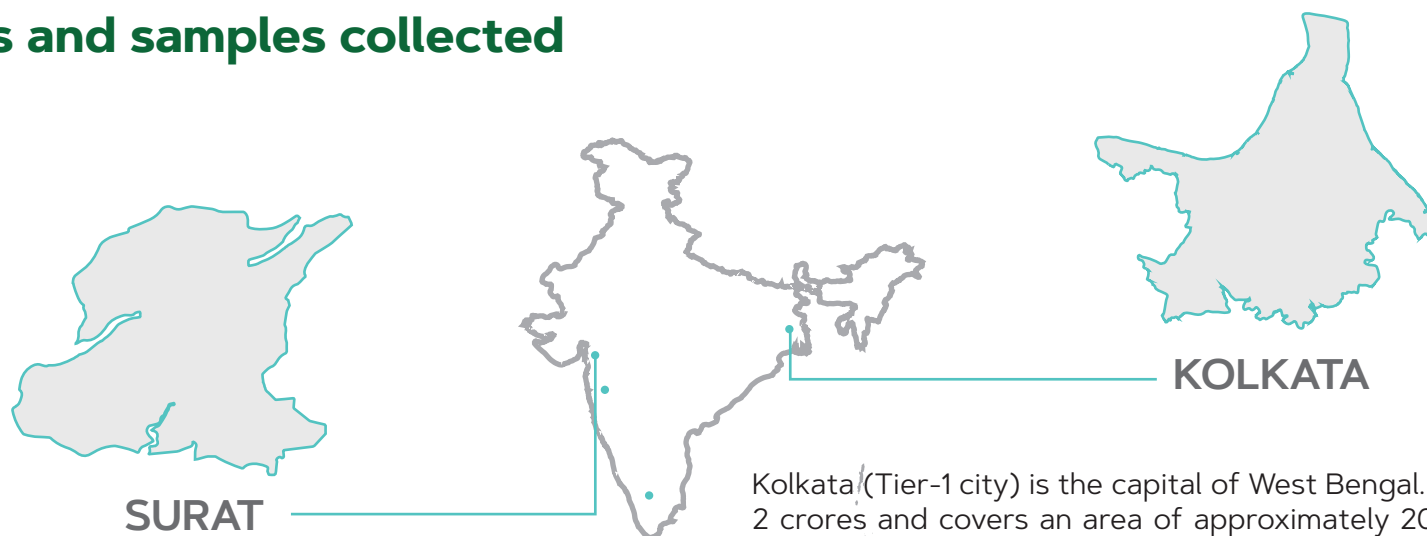
Section 2 presents the trends in EV perception in these cities and across different socio-economic groups. Section 3 highlights the factors influencing EV adoption based on a choice model, and Section 4 presents the charging and usage patterns of EV users in selected cities. Finally, Section 5 highlights the conclusions of the study.

¹ Individuals planning to buy a vehicle for personal use in the next 5 years were included in the survey and those who had no plans were omitted

² Individuals using EVs for personal purposes such as commuting to office or college

³ Individuals using EVs for commercial purposes such as food delivery

City profiles and samples collected



Surat (Tier-2 city) is located in the state of Gujarat. It has a population of approximately 80 lakhs and covers an area of 462 km². The city's gross domestic product (GDP) is approximately USD 60 billion. The most common modes of transportation include buses, auto- and cycle-rickshaws, and taxis. Further, a metro-rail line is currently under construction. Nearly 25,000 EVs were registered in the city during FY 2022–23. Some measures adopted by the Government of Gujarat (Ports and Transport Department, 2021) to increase EV adoption are given below:

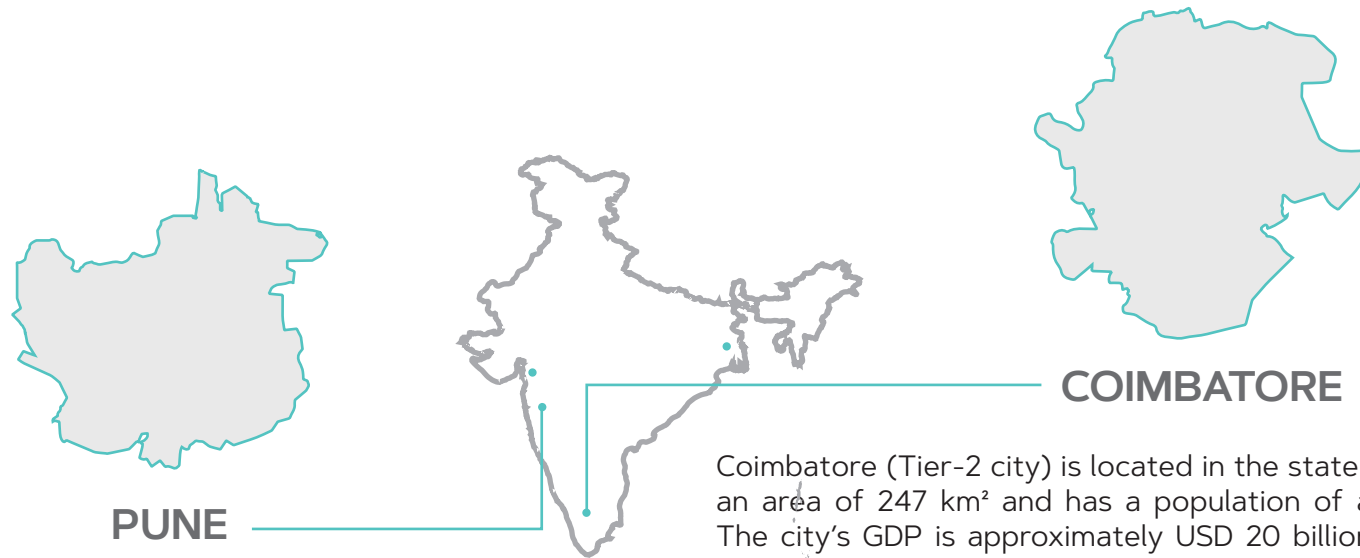
- Cash incentives or subsidies of INR 10,000/kWh for e-2Ws, e-3Ws, and e-4Ws
- Exemption from road tax for EVs for a specific period after purchase

In Surat, 413 potential vehicle owners and 407 EV users were interviewed. Among the EV users, 201 used EVs for personal purposes and 206 for commercial purposes.

Kolkata (Tier-1 city) is the capital of West Bengal. It has a population of 2 crores and covers an area of approximately 206 km². It is the sixth-largest economy in the country by GDP (approximately INR 17.19 lakh crore). Public transport in the city can be availed through sub-urban railways, metro-rail, trams, rickshaws, taxis, and buses. EV registrations in the city during FY 2022–23 witnessed a greater than 200% surge from the previous year. Key EV policy measures adopted by the Government of West Bengal (2022) are as follows:

- Subsidies of up to INR 1.5 lakh for the purchase of electric cars and up to INR 10,000 for e-2Ws
- Waiver or reduction of road tax, vehicle registration fees, and parking fare for EVs

Overall, 437 potential vehicle owners, 209 personal EV users, and 224 commercial EV users in the city were interviewed.



Pune (Tier-1 city), located in the state of Maharashtra, has a population of approximately 72 lakhs and covers an area of 331 km². The city has a GDP of USD 69 billion. The public transportation system comprises metro-rail, buses, and sub-urban railways. During FY 2022–23, more than 10% of all vehicles registered in the city were EVs. Initiatives undertaken by the Government of Maharashtra (Environment and Climate Change Department, 2021) to boost EV adoption are as follows:

- Subsidies of up to INR 1.5 lakh for the purchase of electric cars and up to INR 10,000 for e-2Ws
- Rebates or discounts on electricity tariffs for consumers charging their EVs at home

About 400 potential vehicle owners were interviewed on their views about EVs. In addition, the EV usage patterns of 202 personal users and 209 commercial users were observed.

Coimbatore (Tier-2 city) is located in the state of Tamil Nadu. It covers an area of 247 km² and has a population of approximately 30 lakhs. The city's GDP is approximately USD 20 billion. The city is served by government and private buses, auto-rickshaws, and taxis. Almost 5,000 EVs were registered in the city during FY 2022–23. Some efforts by the Government of Tamil Nadu (Industries, Investment Promotion and Commerce Department, 2023) to encourage EV adoption are listed below:

- Subsidies of up to INR 1.5 lakh for the purchase of electric cars and up to INR 10,000 for e-2Ws specifically used for commercial operations
- Reduction or exemption of road tax, vehicle registration charges, permit fees, and toll charges for EVs till 31 December 2025

In total, 405 potential vehicle owners, 266 personal EV users, and 216 commercial EV users were interviewed in Coimbatore.

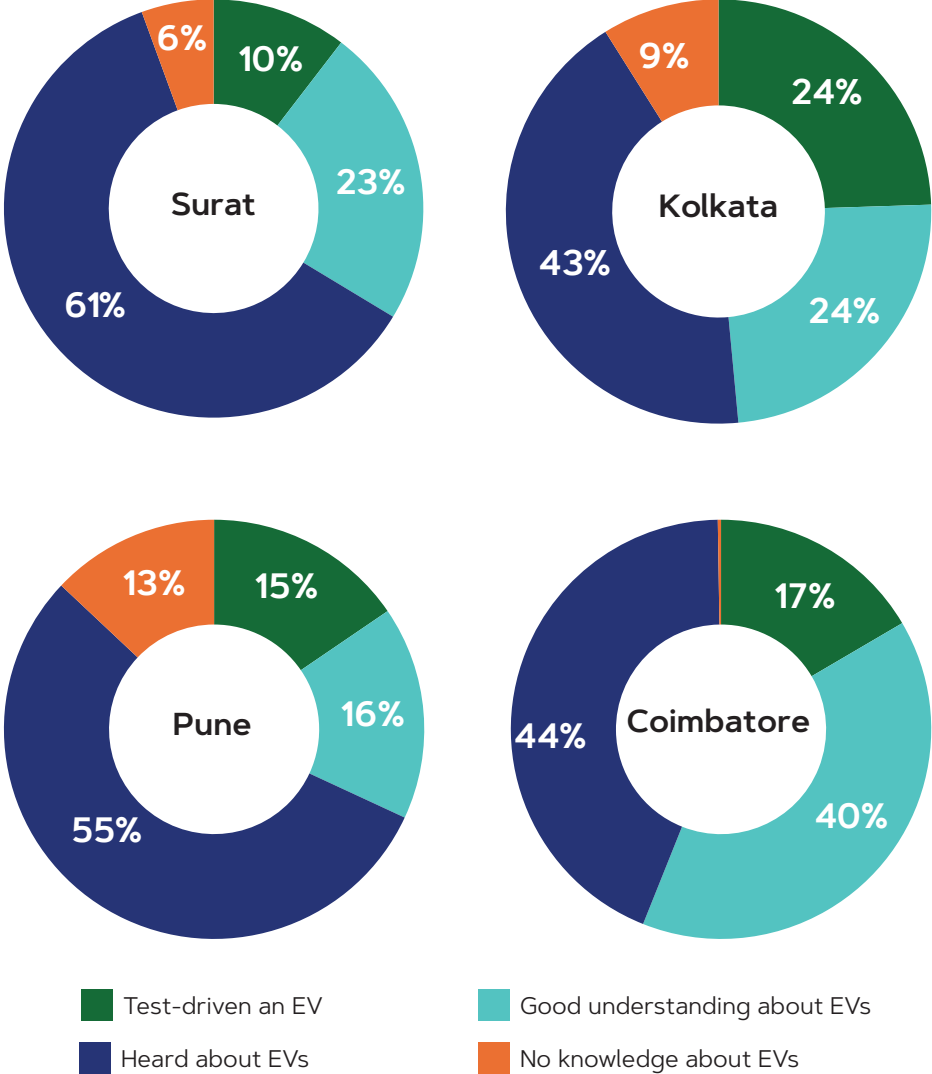
2. Personal EVs: knowledge, awareness, and preference

EV knowledge

EVs are relatively newer entrants to the vehicular market; thus, it is vital to capture the familiarity and know-how about EVs among consumers. Accordingly, the knowledge about EVs was gauged on an increasing scale based on the following levels: no knowledge about EVs, basic knowledge through social interactions or media (heard about EVs), good understanding about EVs, and test-driven an EV.

About 1,540 (93%) of the respondents had some knowledge about EVs, including a good understanding out of interest and by test driving and hearing about EVs through social interactions. Overall, 835 (54%) of 1,540 individuals knew about EVs through social interactions and 279 (18%) of them had test-driven an EV. **This indicates that social influence is a major contributor to EV knowledge among consumers.**

Of note, all participants from Coimbatore were aware of EVs. However, in the other three cities, 6%–13% of individuals did not have any knowledge of EVs. This lack of awareness and education may hinder them from switching to EVs. Hence, awareness campaigns and educational initiatives should continue to address these barriers.



EV knowledge in selected cities

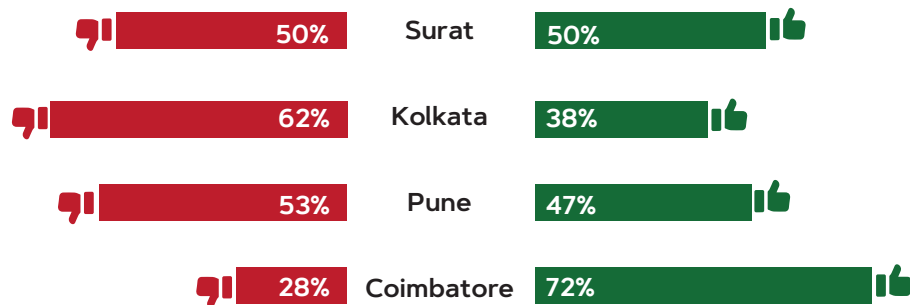


Awareness about government schemes

EVs have higher upfront costs than their internal combustion engine (ICE) counterparts. However, subsidies provided under the FAME scheme, as well as tax reliefs offered by state governments, help reduce these upfront costs. Thus, awareness about these incentives is essential to promote EV adoption and was captured through the surveys.

Awareness about Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) subsidy

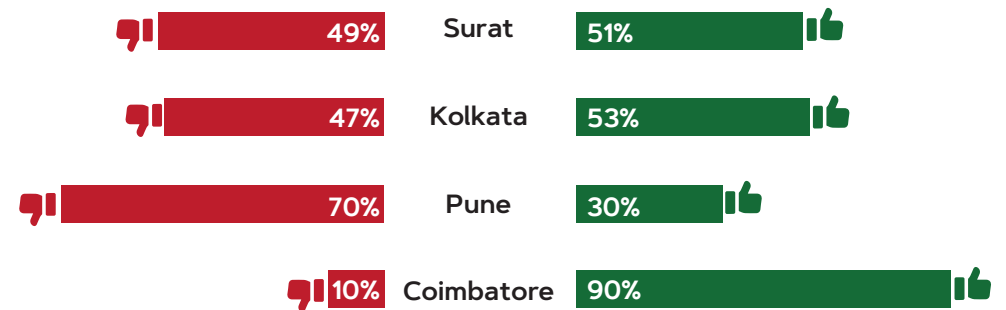
More than 49% of potential vehicle buyers in Kolkata, Surat, and Pune were unaware of the FAME subsidy. Among the four cities, Coimbatore residents had the highest awareness (72%), whereas Kolkata residents had the lowest (38%). This lack of awareness could hamper EV adoption. Thus, it is necessary to continue (or increase) public awareness campaigns⁴ regarding the scheme.



Awareness about FAME subsidy in selected cities

Awareness about road tax relaxations for EVs

Similar to FAME awareness, except for Coimbatore, more than 45% of respondents in the other three cities were unaware of road tax relaxations for EVs, with Pune residents having the lowest awareness (30%). This highlights the need to continue (or increase) the budget allocation for promotional activities for these schemes and relaxations.



Awareness about EV road tax relaxation in selected cities

Coimbatore residents had the highest awareness (90%), with 72% knowing about the FAME subsidy and 90% being aware of road tax relaxations for EVs. Overall, it was evident that about 50% of the participants in Surat, Pune, and Kolkata lacked awareness on the subsidies provided under the FAME scheme and tax benefits provided by state governments for EVs.

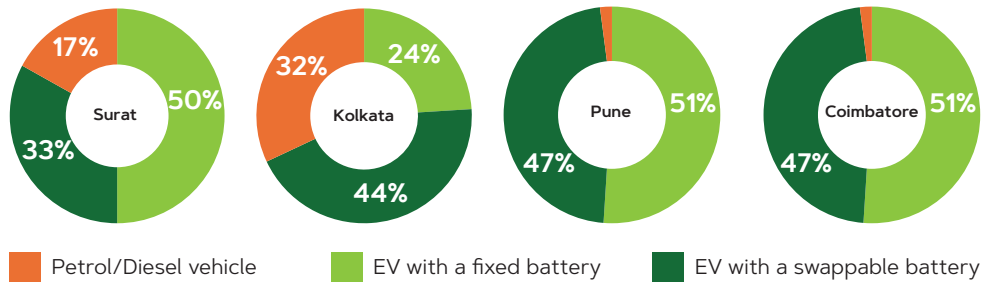
4 Information, Education, and Communication (IEC) activities under FAMEII



Purchase preferences: EVs vs ICE vehicles

The EV preference of respondents in the four cities (whether they would opt for an EV or ICE vehicle) was recorded.

More than 65% of respondents in each study city were interested in purchasing EVs instead of ICE vehicles, indicating a similar preference for EVs across metropolitan, Tier-1, and Tier-2 cities. EVs with a swappable battery were most preferred in Kolkata, whereas EVs with a fixed battery were most preferred in the other three cities.



Preference for purchasing personal EVs in selected cities

Variations in EV preference

The variations in EV preference based on age, gender, education, employment, income, and vehicle ownership are presented below.

Age: Compared with other cities, Kolkata showed that people aged above 55 years did not prefer EVs. Further, more than 70% of young adults (age: 25 years or less (Massachusetts Institute of Technology, n.d.)) in each of the four cities expressed an interest in buying EVs. The preference for EVs among respondents aged less than 55 years was similar across the four cities.

Gender: The percentage of females purchasing personal vehicles, particularly two-wheelers, for work or household chores is increasing in India (SMFG India Credit Co. Ltd, 2024). EV preference among males and females was examined in the selected cities. Females expressed a (marginally) higher preference for EVs than males in Kolkata and Pune

but vice-versa in the other two cities. Interestingly, almost all female respondents from Pune (99%) and Coimbatore (98%) preferred EVs.

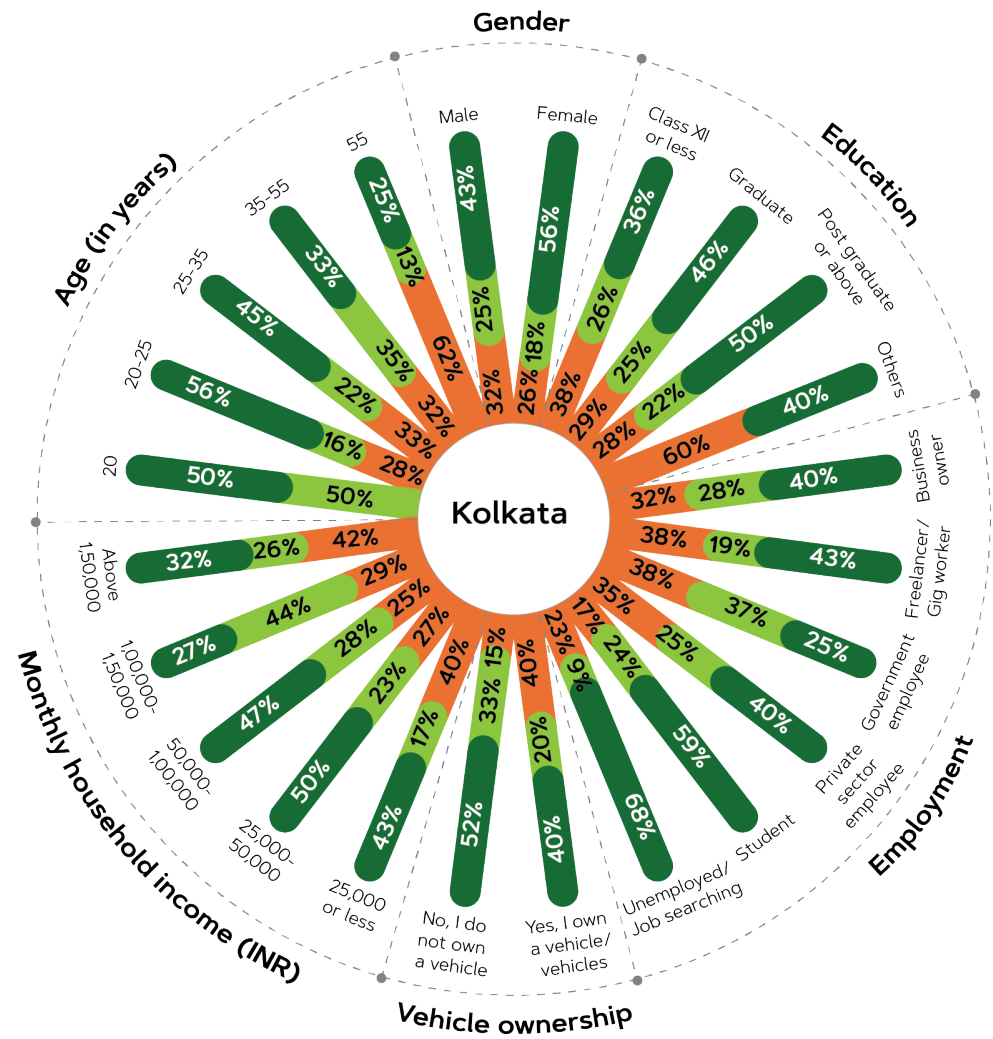
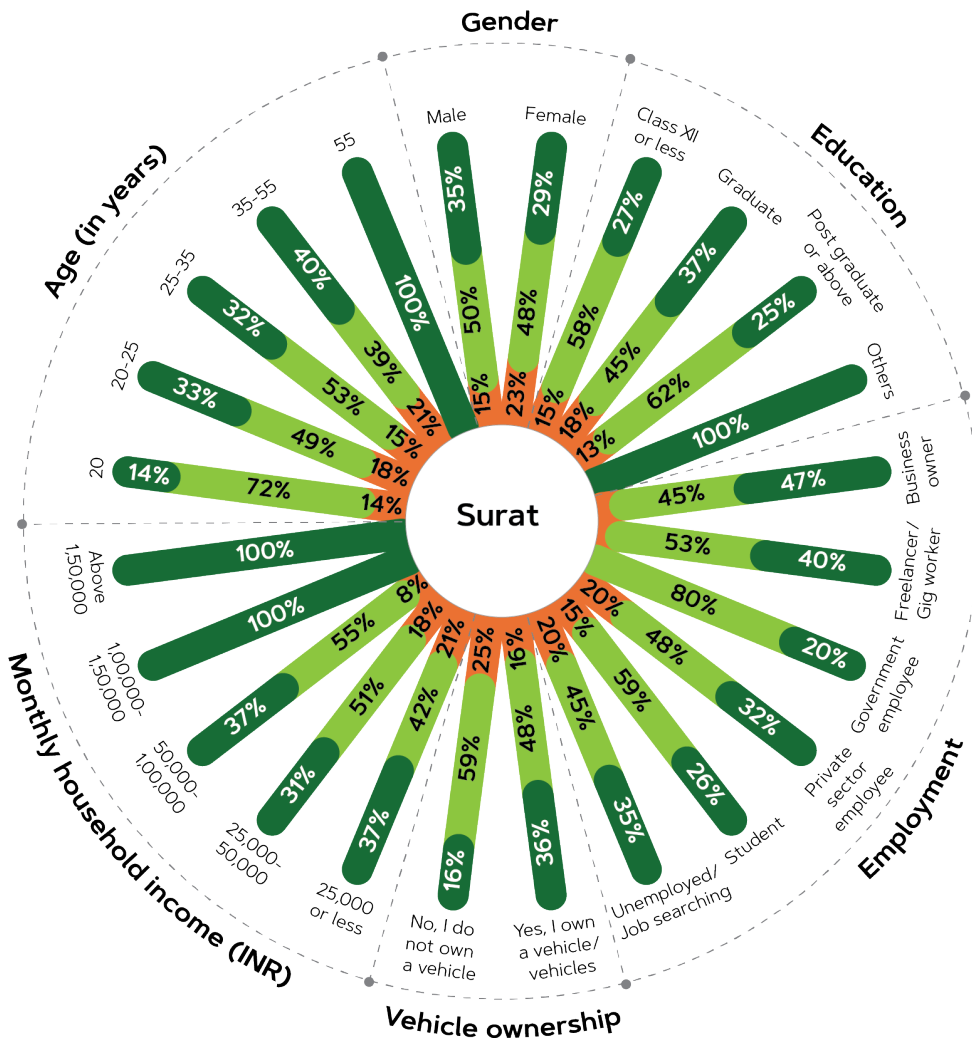
Education: More than 25% of graduates and postgraduates in Kolkata did not prefer EVs, compared with those in other cities. Overall, participants across all education levels from Surat, Pune, and Coimbatore showed a similar preference for EVs.

Employment: In Kolkata, 20%–30% of individuals in each employment category preferred ICE vehicles over EVs as their next purchase. More than 85% students, followed by business owners (67% or more), in all cities favoured EVs over ICE vehicles. Excluding Kolkata, the preference for EVs was similar among all professionals in the other three cities.

Income: Individuals with higher income levels showed a greater preference for EVs in all four cities. Overall, 100% EV preference was observed among respondents with a monthly income of more than INR 50,000 in Coimbatore and more than INR 1,00,000 in Pune and Surat.

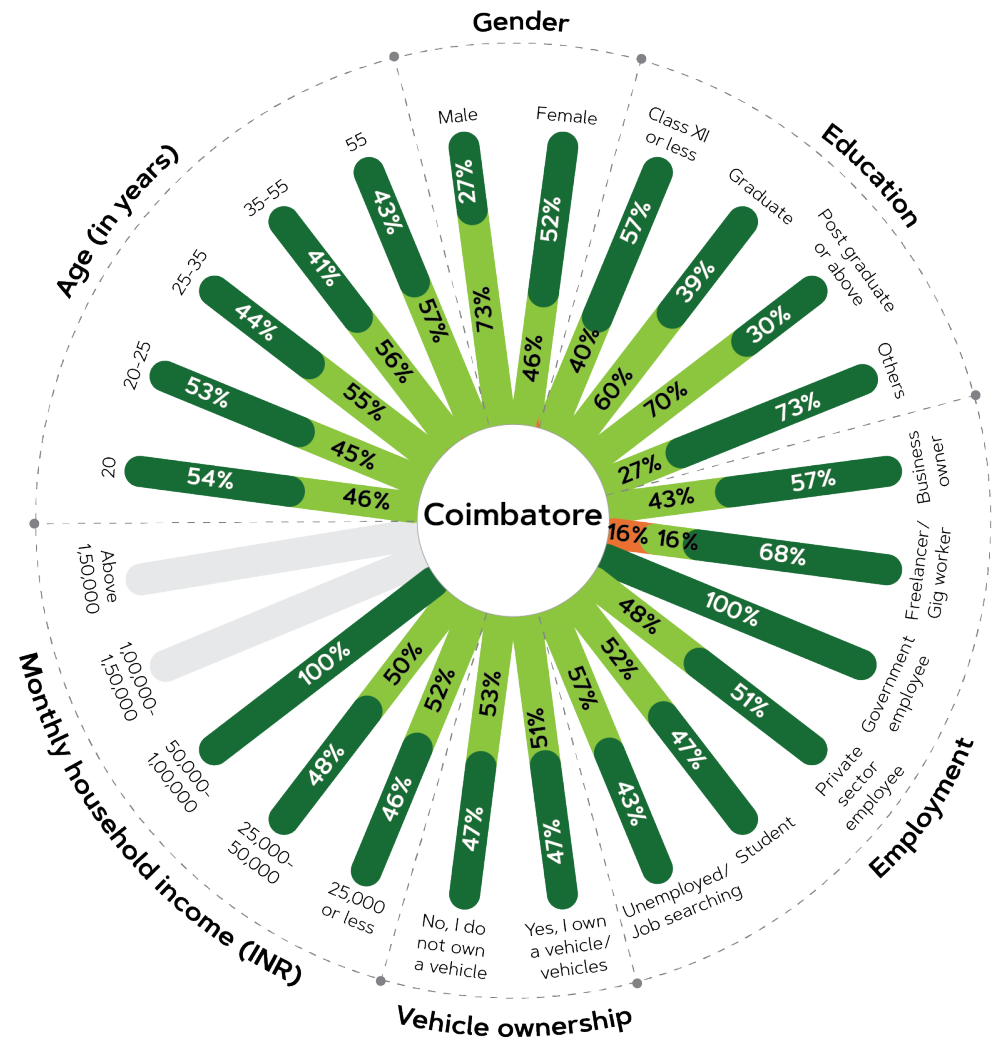
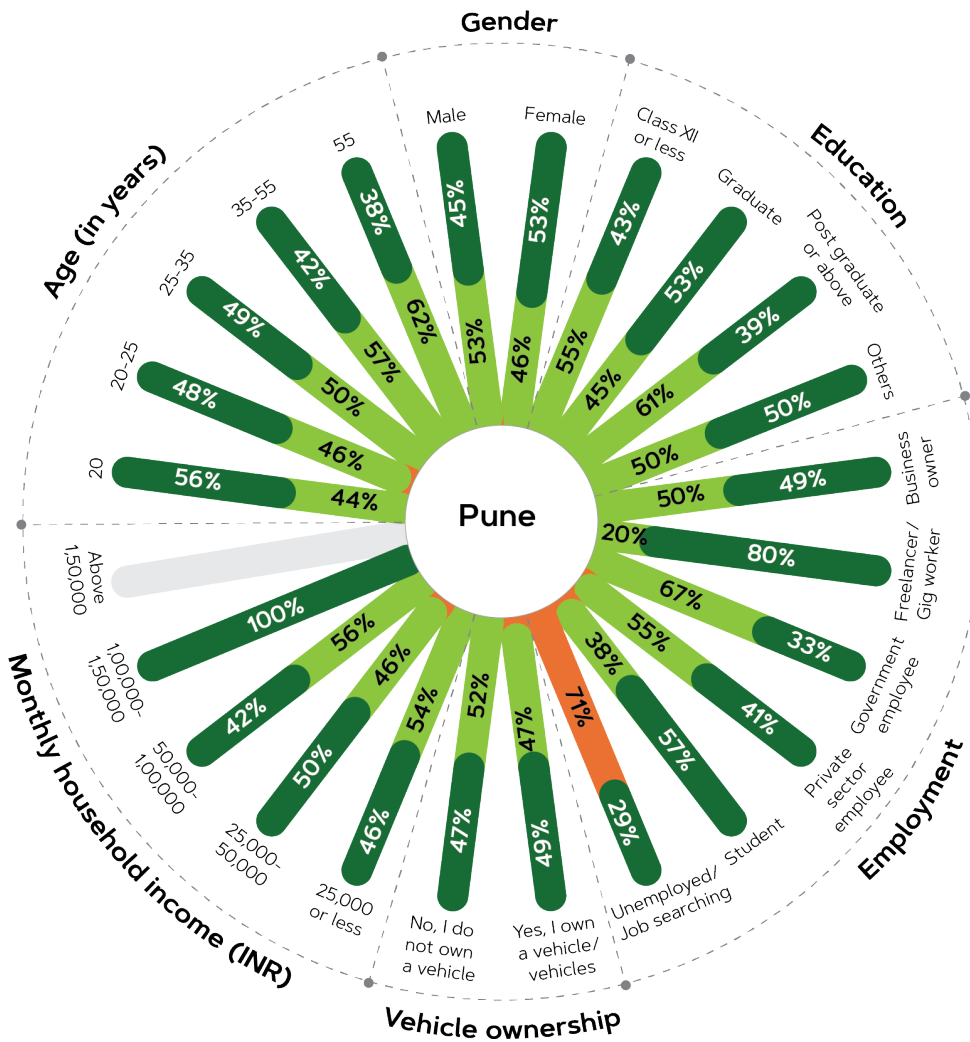
Vehicle ownership: Except for Surat, EV preference in the other three cities was greater among respondents not owning any vehicle than among those owning at least one, indicating that EVs could be the first vehicle they would buy.

In addition to these socio-economic factors and awareness about FAME subsidy and road tax relaxations, respondents' knowledge about EV benefits (e.g. lower operating and maintenance cost) and their level of environmental consciousness were also captured. Individuals were surveyed to determine if they performed eco-friendly and energy-conservation household activities, such as composting food waste, separation of wet and dry wastes, and switching off lights/fans before exiting a room. The number of such activities performed by the respondents was noted as their level of environmental consciousness.



■ Petrol/Diesel vehicle
 ■ EV with a fixed battery
 ■ EV with a swappable battery

EV preference (in percentage)



■ Petrol/Diesel vehicle
 ■ EV with a fixed battery
 ■ EV with a swappable battery

EV preference (in percentage)



3. Factors influencing EV adoption

In addition to the variations in EV preferences across socio-economic variables, we examined the impact of each factor on an individual's decision to purchase an EV using a discrete choice model.

Modelling framework

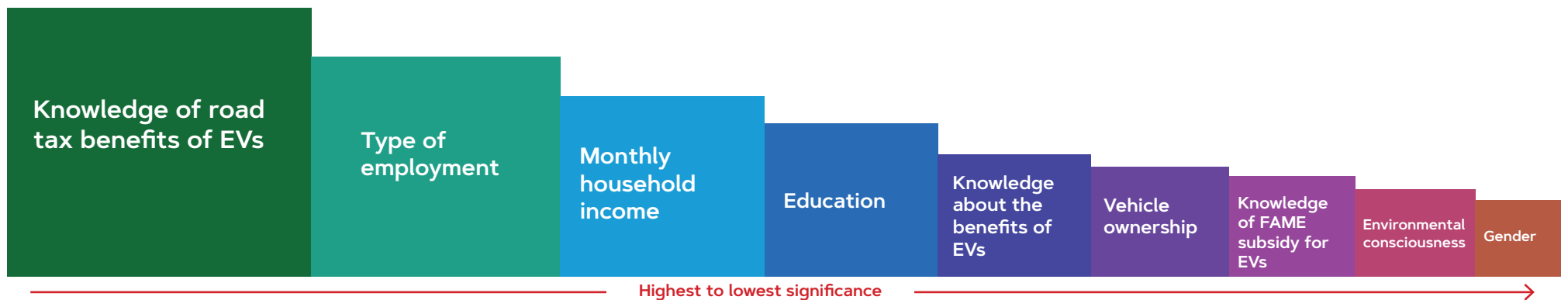
Choice modelling aims to model an individual's decision based on their preferences⁵ made in a particular context. It predicts the individual's decisions by weighing the utility⁶ of each alternative/choice. It has various applications such as retail analysis to determine a product's acceptance in the market and to analyse aspects such as its price sensitivity, business-site selection, and an individual's choice of mode of transport for commute. Airlines use dynamic pricing to adjust flight prices based on factors including booking time, seat availability, and demand. This helps them optimise revenue and fill flight seats efficiently. Product pricing on online retail spaces change multiple times a day based on factors such as competitor prices, customer behaviour, and inventory levels. This approach helps them remain competitive and profitable. Thus, choice modelling is a valuable tool to determine what drives a customer's purchase decision.

5 Preferences indicate the observed purchasing habits of an individual.

6 Utility denotes the usefulness of a choice, as perceived by a user. The same choice may be perceived differently by different users.

A binary logit model (a type of discrete choice model) examines the relationship between a set of explanatory variables and a binary dependent variable (two outcomes or alternatives). A classic application of a binary choice model is found in marketing to analyse consumer preferences between two alternatives (e.g. analysis of the customer churn in telecom industry). In the present case, to identify factors influencing EV adoption, the response of interviewees for the question 'Will you buy an EV?' was taken as a dependent variable, whereas their socio-economic factors, understanding of FAME subsidies and road tax benefits associated with EVs, and level of environmental consciousness were considered explanatory variables.

Further, to examine the relative effect of individual explanatory variables on the willingness to opt for EVs over ICE vehicles and the variation within the explanatory variables, the average marginal effect (AME) was computed. AME refers to the marginal contribution of each variable. It explains how an outcome (preference for EVs) changes when a specific explanatory variable changes, with other covariates assumed to be constant. It should be noted that AME was computed only for the significant variables and insignificant variables were dropped from further analysis.



Variables as per the aggregate model influencing EV preference

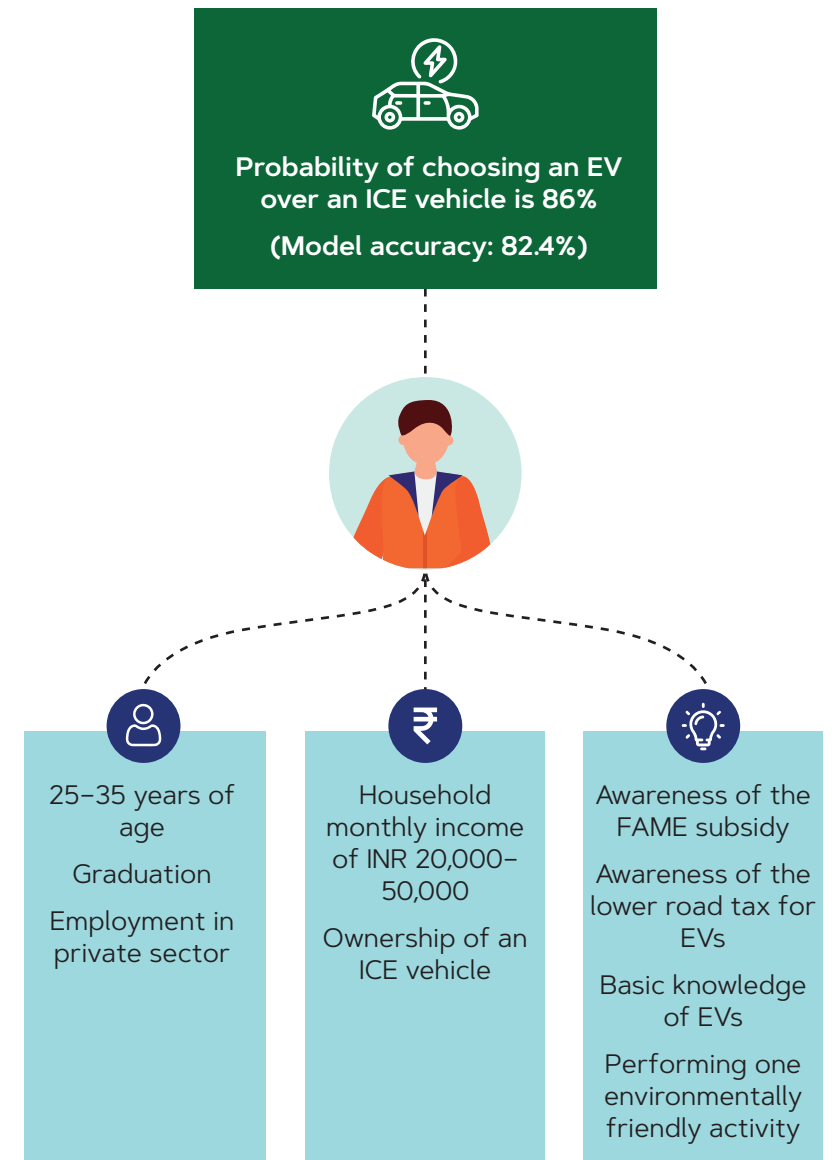
National-level or aggregate model

A model was built with all responses (>1,600) from the four cities (hereafter referred to as the 'aggregate model') to identify factors influencing EV adoption at national level. Based on the aggregate model⁷, the factors influencing an individual's preference for EVs are listed in the figure on Page 15 in the decreasing order of their significance (90% confidence interval). Awareness about lower or no road tax for EVs and the benefits of EVs and socio-economic factors such as respondents' employment status and monthly income significantly influenced EV preferences. In terms of demographic characteristics, gender was the least significant and age was insignificant.

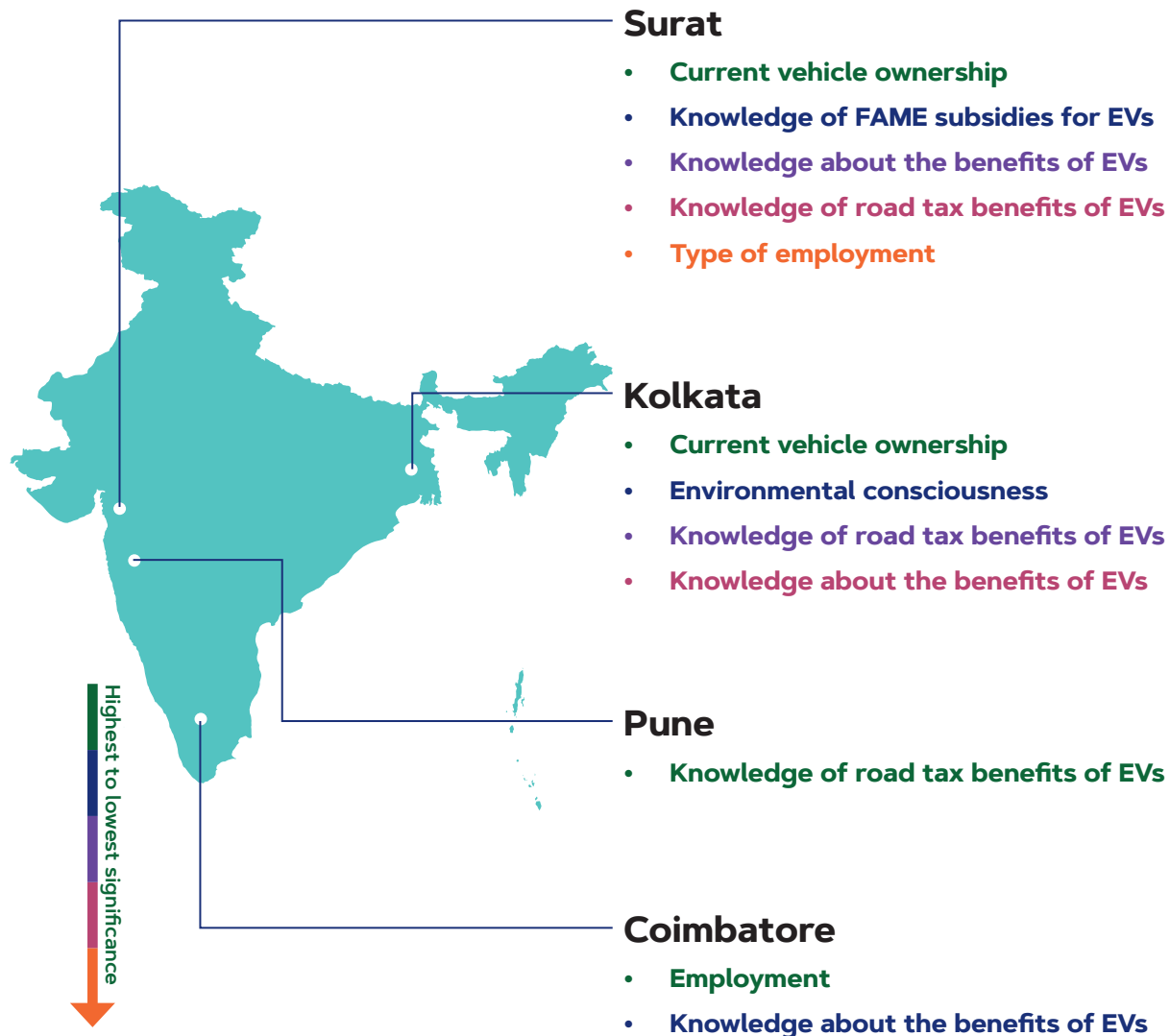
AME results and inferences of the aggregate model are discussed below:

- | | |
|------------------------|--|
| Socio-economic factors | <ol style="list-style-type: none"> 1. Females are 5.5% more likely to purchase an EV than males. 2. Postgraduates are 7.7% less likely to buy an EV than graduates. 3. Freelancers/gig workers are 10.8% less likely to buy an EV than private sector employees. 4. An individual who already owns a vehicle is 5.3% less likely to purchase an EV than an individual who does not own a vehicle. This indicates that people who do not own any vehicles might prefer EVs as their first vehicle. |
| Awareness factors | <ol style="list-style-type: none"> 5. An individual with no knowledge of EV advantages is 8.4% less likely to opt for an EV than an individual who is aware about EVs, which necessitates awareness campaigns for EVs and their benefits. 6. An individual with the knowledge of the road tax benefits of EVs is 8.6% more likely to buy an EV than an individual who is unaware of the benefits. 7. An individual with the knowledge of FAME subsidies is 4.8% more likely to buy an EV than an individual without the knowledge. Hence, increasing awareness of tax benefits and FAME subsidies may positively influence the purchase decision of EVs. |
| Behavioural factor | <ol style="list-style-type: none"> 8. When individuals start realising the significance of their actions and develop habits that contribute to the betterment of the environment, they tend to become more conscious of the negative environmental impacts of ICE vehicles, which could inspire them to switch to EVs. The model results revealed that an individual who is environmentally conscious is 2.8% more likely to purchase an EV than an individual who is not. |

7 Model accuracy: 82.4% correctly predicted and Pseudo-R² > 0.10



EV preference of a typical consumer



Variables influencing EV preferences at the state level

State-level or disaggregate model

Similar to the aggregate model, disaggregate models were built for each of the cities using the respective responses to identify factors affecting an individual's EV purchase (or otherwise) decision in a particular state.

Different significant (90% confidence interval) variables identified using the disaggregate models⁸ are presented in the adjacent figure in the decreasing order of their significance. In Pune, road tax relaxation for EVs was found to be the only significant factor affecting EV preference. In the other three cities, knowledge about EV benefits such as lower operating and maintenance costs was a common influencing factor.

Awareness of the FAME subsidy, which was moderately significant in the aggregate model, was the second-most influential factor among Surat residents. Current vehicle ownership (i.e. owning or not owning a vehicle) in Surat and Kolkata and the type of employment in Coimbatore were the most significant factors determining EV uptake. Environmental consciousness was the second most significant factor for EV adoption in Kolkata.

⁸ Disaggregate model accuracies (% correctly predicted) Kolkata: 61.8%, Surat: 84.5%, Pune: 96%, and Coimbatore: 98%. Pseudo-R²: Kolkata > 0.10, Surat > 0.10, Pune > 0.30, and Coimbatore > 0.40.

Because demographics and socio-economic factors varied across the four cities, EV perceptions also evidently differed among the residents. These observations were captured using the disaggregate models, and the AME of significant variables in each city is discussed below.

Kolkata

- An individual who already owns a vehicle is 22% less likely to purchase an EV than an individual who does not own a vehicle.
- An individual with no knowledge about EV benefits is 20% less likely to purchase an EV than an individual who has heard about EVs.
- An individual with the knowledge of road tax benefits of EVs is 12% more likely to buy an EV than an individual without the knowledge.
- An individual who is environmentally conscious is 9% more likely to purchase an EV than an individual who is not.

Surat

- Business owners are 14% more likely to buy an EV than private sector employees.
- An individual who already owns a vehicle is 23% more likely to purchase an EV than an individual who does not own a vehicle.
- An individual with a good understanding of EVs and who has test-driven an EV is 13% and 26% more likely to buy an EV, respectively, than an individual who has only heard about EVs through social interactions.
- An individual who is aware of the road tax benefits of EVs is 10% more likely to purchase an EV than an individual who has no such knowledge.

Pune

- An individual who is aware of the road tax benefits of EVs is 6% more likely to buy an EV than an individual with no such knowledge.

Coimbatore

- Freelancers or gig workers are 6% less likely to buy an EV than private sector employees.
- Individuals with a good understanding of EV benefits and who have test-driven an EV are 5% less likely to purchase an EV than individuals who have heard about EVs through social interactions. This indicates that social interactions significantly influence EV adoption in Coimbatore city.

In summary, knowledge of EV benefits, FAME subsidies, and road tax relaxations positively impact EV purchase decisions. Hence, it is necessary to educate citizens and increase their awareness about these benefits. Further, EV adoption may increase as individuals tend to become more environmentally conscious.



4. EV usage patterns

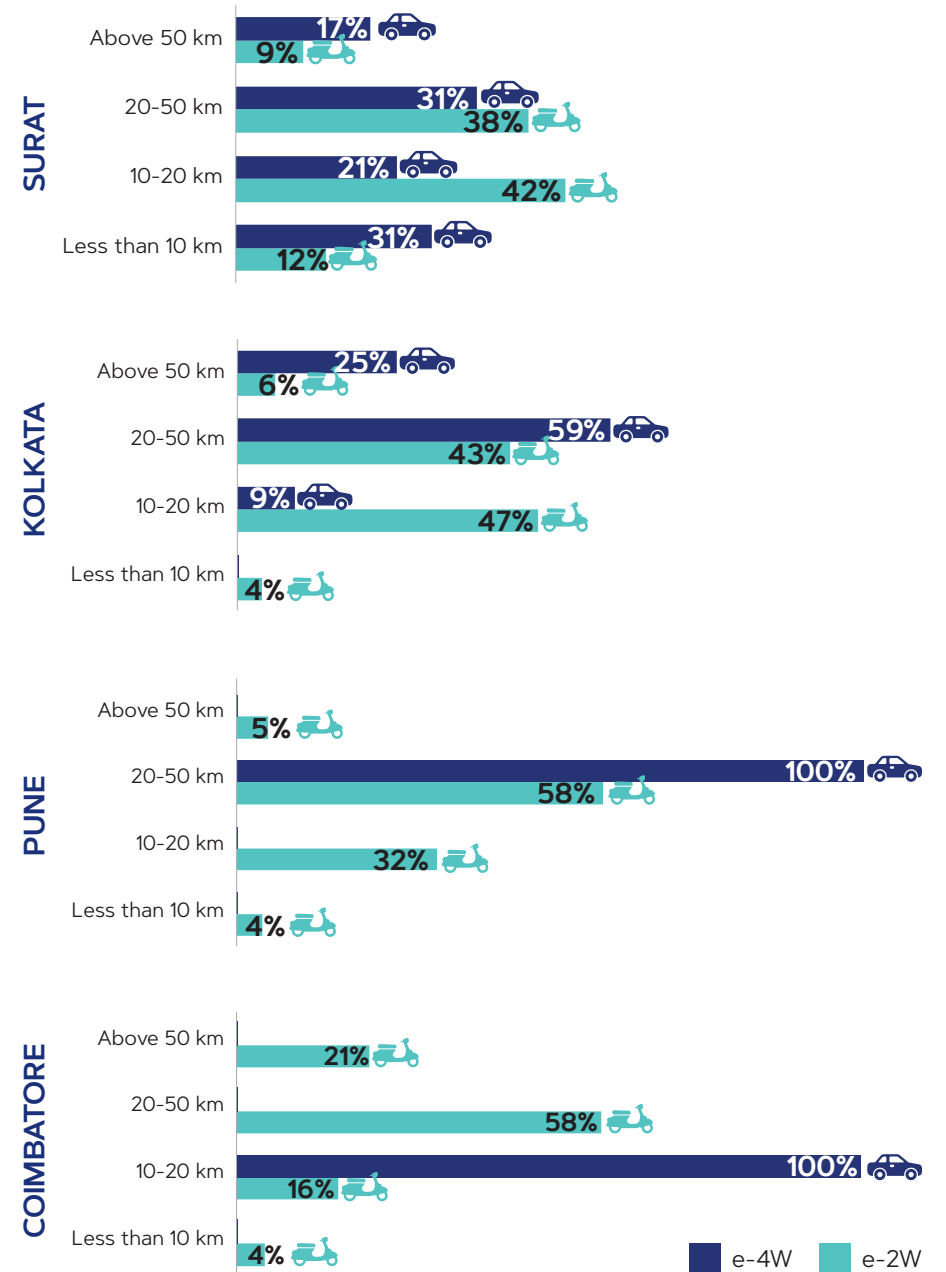
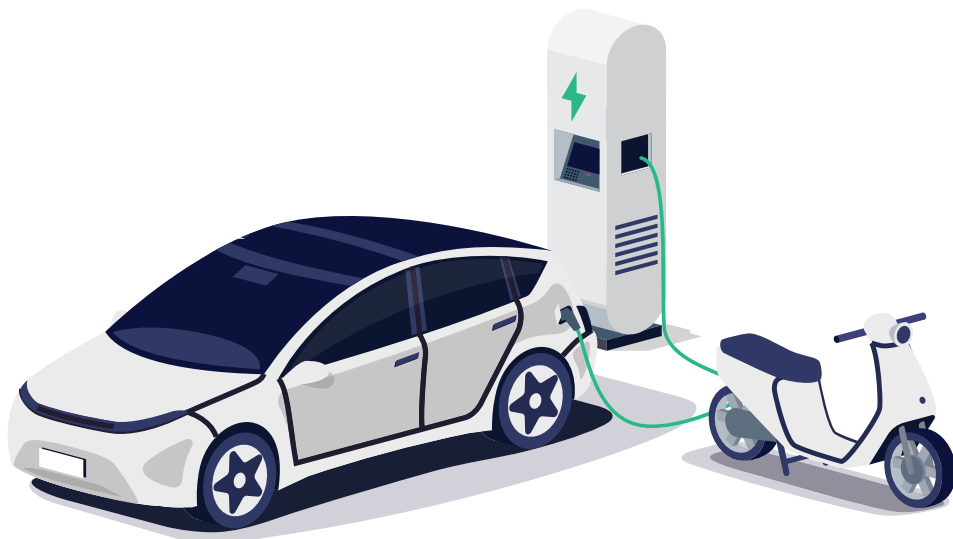
To examine EV usage patterns, the survey included questions such as total distance travelled in a day and charging location, which can help plan charging infrastructure and identify policy levers to support a seamless transition to EVs. The responses from personal and commercial users in the study cities were compared.

EV usage: Personal users

The daily vehicle kilometres travelled (DVKT) and preference for different charging locations among EV owners (personal use) are discussed in this section.

DVKT

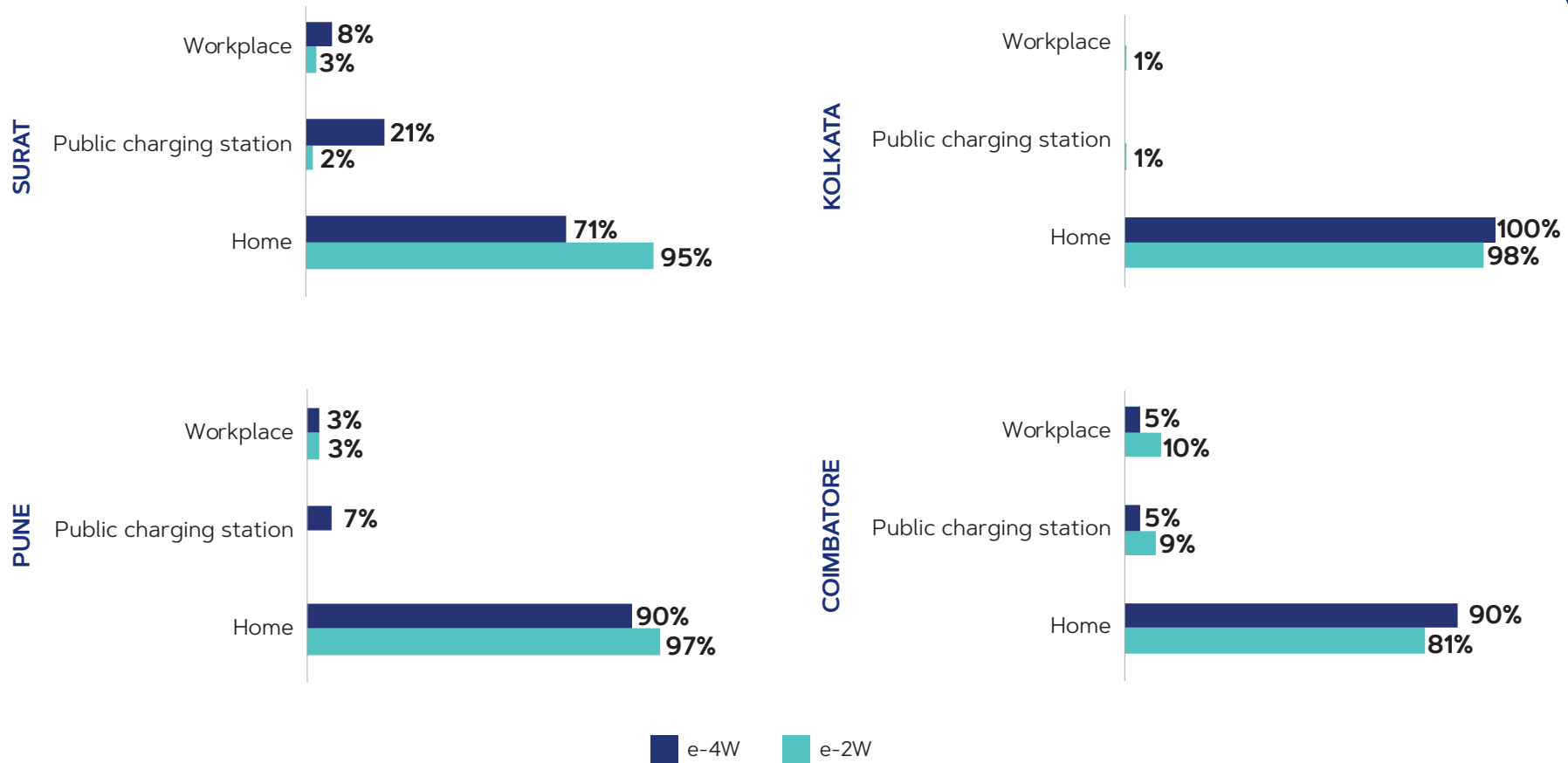
More than 80% of e-2Ws were observed to travel 50 km or less per day. In Kolkata and Pune, e-4Ws mostly travelled 20–50 km per day. About 20% of e-4W owners in Surat occasionally used EVs, covering the least distance.



DVKT of personal-use EVs in the selected cities

Charging location

In all four cities, EVs were primarily charged at home for convenience. However, excluding Kolkata, around 10%–20% of the respondents in the other three cities charged their EVs at public charging stations. Less than 10% of the respondents in all cities opted for workplace charging.



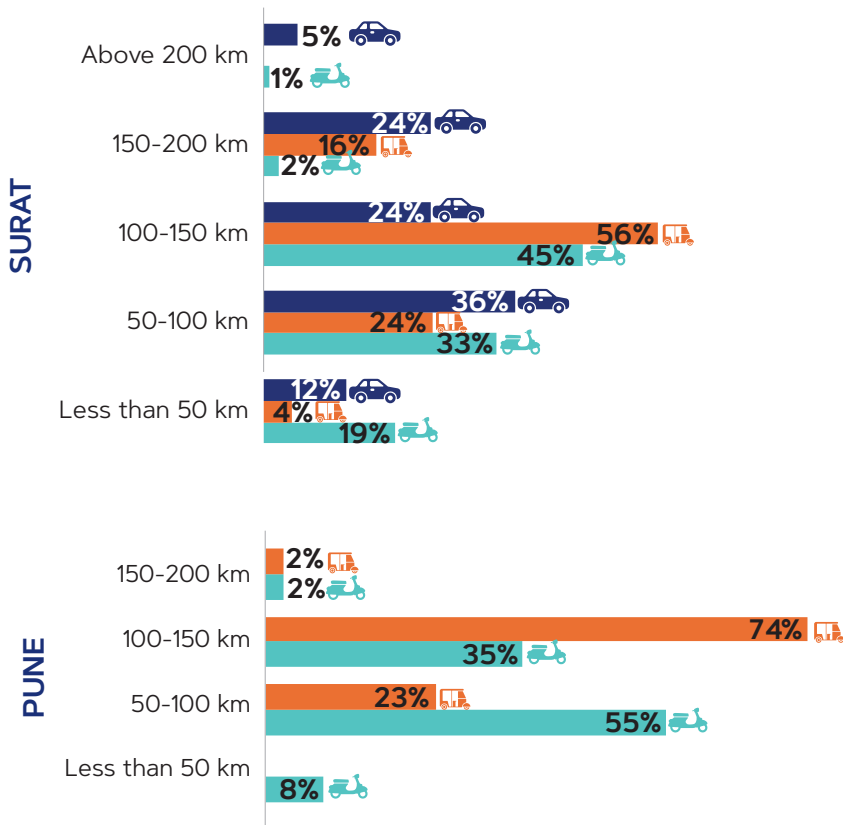
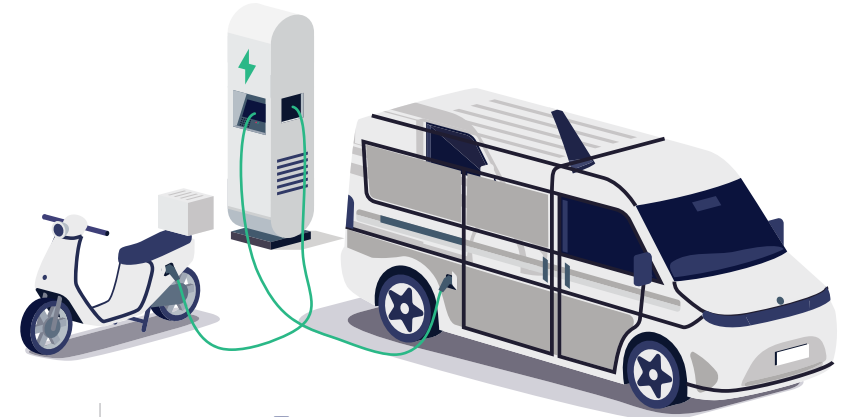
Charging location preferences among personal EV users in the selected cities

EV usage: Commercial users

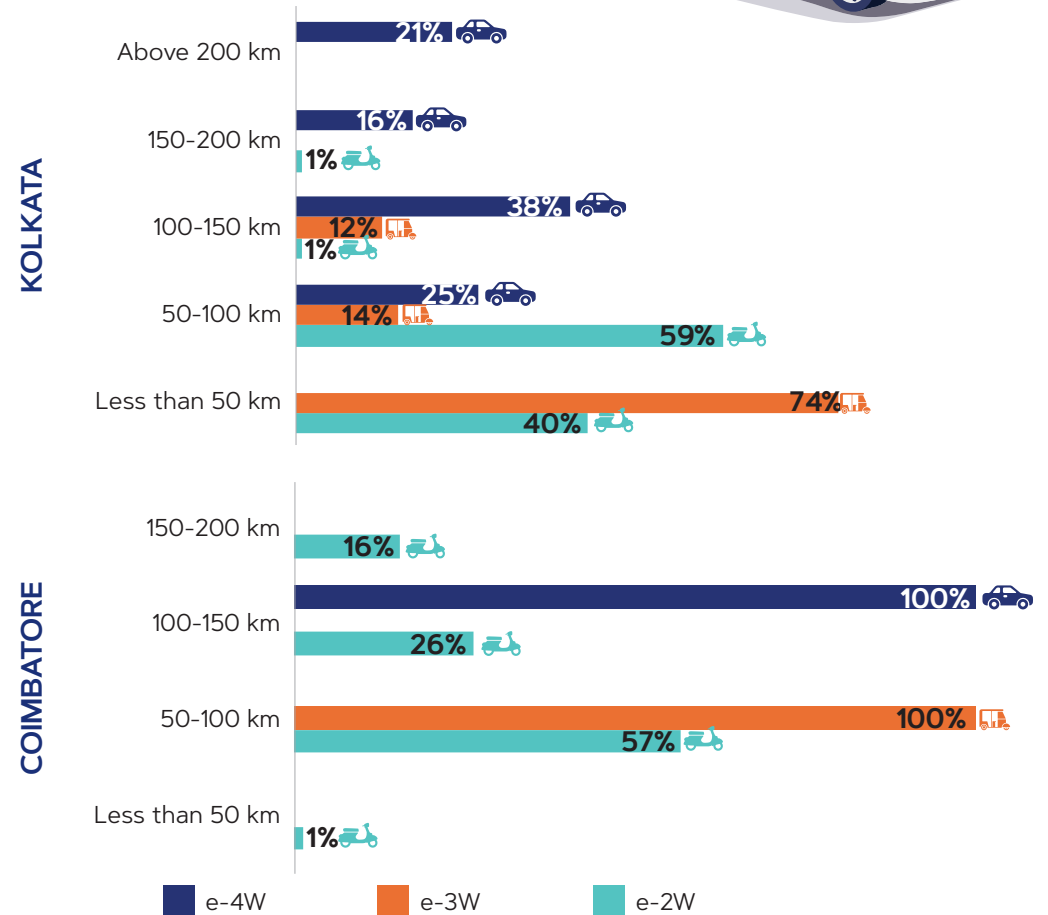
The DVKT and charging location preferences of commercial users are discussed in this section.

DVKT

Across all cities, commercial e-4Ws mostly travelled more than 50 km per day. A majority of e-3W owners travelled for 50–150 km. More than 60% of commercial e-2Ws covered a distance of more than 50 km.



DVKT of commercial-use EVs in the selected cities

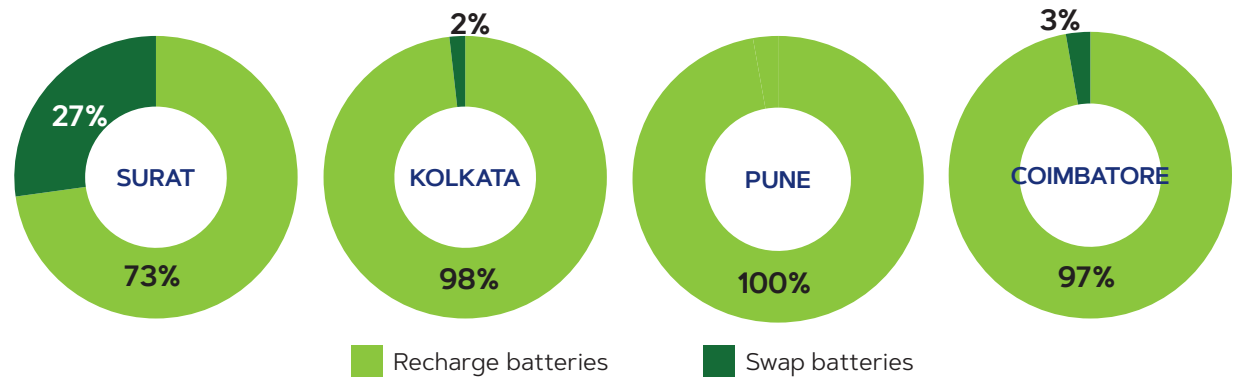


e-4W e-3W e-2W

Charging mode and location

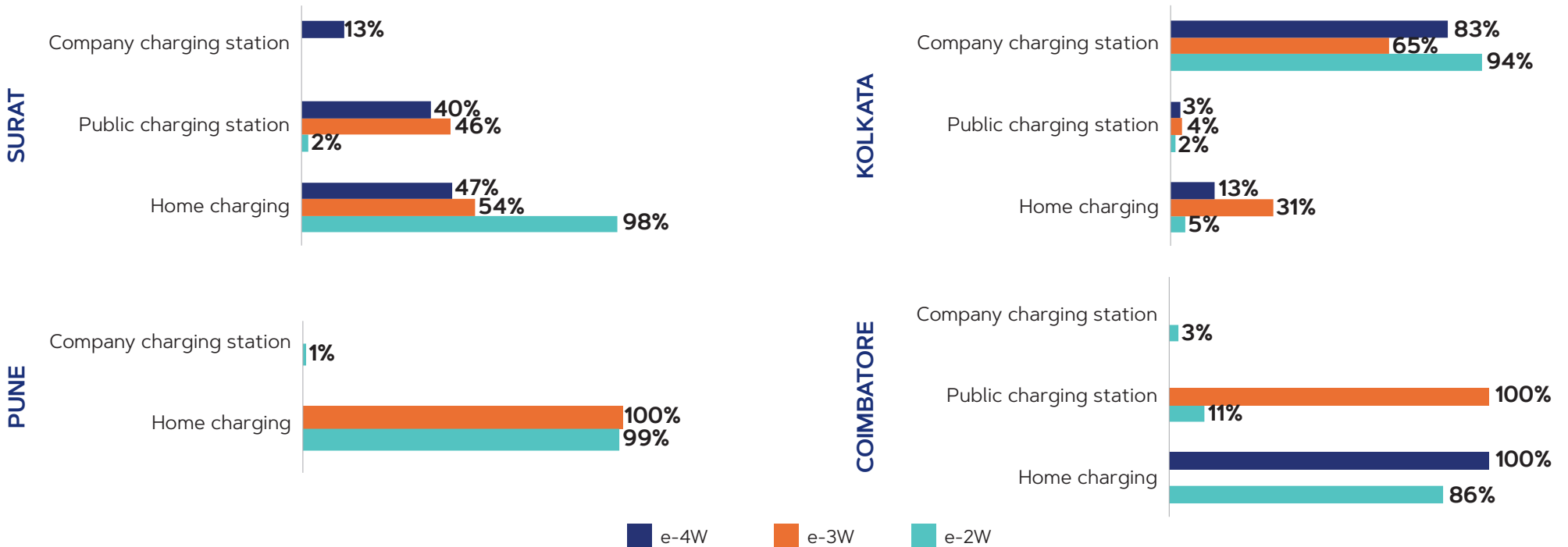
In Surat, 73% and 27% of commercial EV users recharged their batteries and swapped batteries, respectively. In contrast, in the remaining three cities, more than 97% of commercial EV users recharged their EV batteries.

In terms of the charging location, home charging of EVs was predominant in Surat, Pune, and Coimbatore. However, in Kolkata, more than 60% of EV users preferred to charge their batteries at company⁹ charging stations, whereas 5%–31% users preferred home charging.



Charging modes of commercial-use EVs in the selected cities

9 Charging facilities provided by employers



Charging location preferences among commercial EV users in the selected cities



5. Key takeaways

More than 3,300 face-to-face interviews were conducted across four cities (Surat, Pune, Kolkata, and Coimbatore) to capture the public perception about EVs and assess the usage patterns of existing EV owners. The selected cities could be considered representative of the perceptions and usage patterns across Tier-1 and Tier-2 cities in the country owing to their geographical locations, different sizes (area and population), and EV adoption rates.

Based on potential vehicle owner surveys, EV popularity and its variation across different socio-economic groups were analysed. Factors influencing the willingness to buy EVs over ICE vehicles were identified by developing a discrete choice model.

Through interviews with EV owners (both personal and commercial users), the daily commute distance for different EV types (e-2Ws, e-3Ws, and e-4Ws) and charging location preferences were noted.

- A majority of e-2W users travelled for 50 km or less per day, whereas e-4W users travelled for more than 20 km per day. This indicates that EV manufacturers should maintain battery sizes in the range of 2–3 kWh and 30–50 kWh for e-2Ws and e-4Ws, respectively.
- More than 70% of EV owners preferred home charging. Thus, resident welfare associations should be encouraged/mandated to set up charging facilities to support EV adoption and DISCOMs should make necessary upgrades to meet the growing power demand.



Overall, a positive response towards EVs was recorded across the four cities, and more than **55% users were willing to buy an EV** instead of an ICE vehicle in the next 5 years.



More than **60% of young adults (25 years or younger) were willing to buy EVs** rather than petrol/diesel vehicles.



Among socio-economic factors, **type of employment and household income had a greater influence on EV purchase decision** than education and gender.



More than **90% of the surveyed individuals had at least basic knowledge on the advantages of EVs** over ICE vehicles, such as lower operating and maintenance costs and better vehicle features.



Awareness about subsidies and tax relaxations for EVs and knowledge about the benefits of EVs were the key factors influencing users to opt for EVs.



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