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ELECTRIFICATION STRATEGY FOR THREE-WHEELERS IN SURAT

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On behalf of the German Federal Ministry for Economic
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ELECTRIFICATION STRATEGY FOR THREE-WHEELERS IN SURAT

Table of Contents

List of Figures

List of Tables

List of Maps

List of Abbreviations

3Ws	Three-Wheelers
BRTS	Bus Rapid Transit System
CESL	Convergence Energy Services Limited
CNG	Compressed Natural Gas
CMP	Comprehensive Mobility Plan
CPSEs	Central Public Sector Enterprises
E-3W	Electric Three-Wheeler
EIC	Environmental Improvement Charges
E-Mobility	Electric Mobility
EVs	Electric Vehicles
FAME	Faster Adoption and Manufacturing of (Hybrid&) Electric Vehicles
GoG	Government of Gujarat
IPT	Intermediate Public Transport
kWh	Kilowatt hour
MHI	Ministry of Heavy Industries
OEM	Original Equipment Manufacturers
PM E-DRIVE	Prime Minister Electric Drive Revolution in Innovative Vehicle Enhancement
RTO	Regional Transport Office
SMC	Surat Municipal Corporation
TCO	Total Cost of Ownership

About the Report

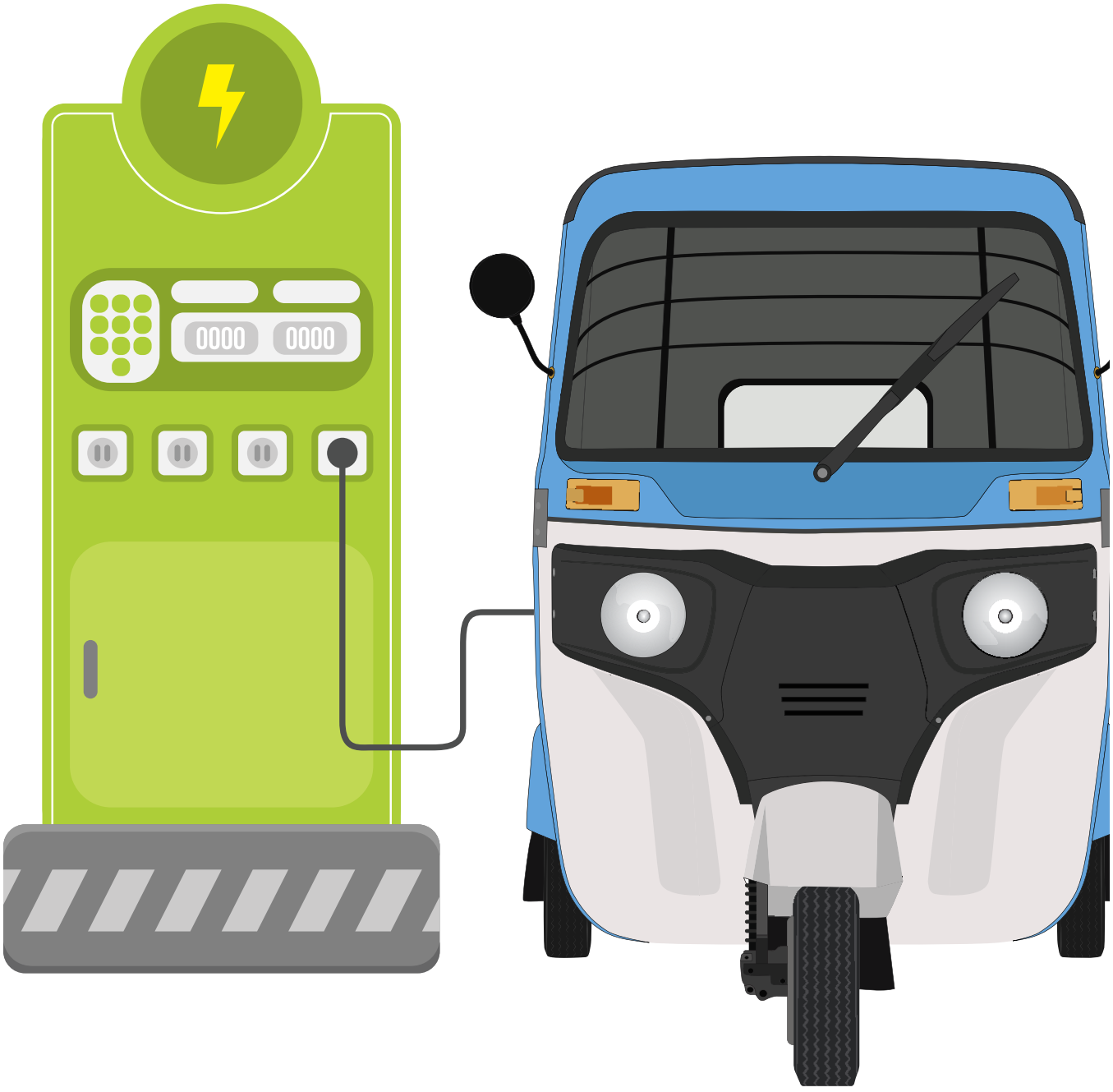
Surat's Intermediate Public Transport (IPT) system is predominantly served by approximately 51,000 three-wheelers (3Ws)[1], commonly known as autorickshaws, which are mostly Compressed Natural Gas (CNG) powered and operate as 'hail and hire' as well as shared shuttle services along major city corridors. IPT accounts for around 17%[2]of all motorised trips in Surat.

This study aimed to develop a strategic framework for transitioning the CNG 3Ws to electric 3Ws, for improving air quality and supporting sustainable urban mobility. It involved assessing the socio-economic and operational characteristics of auto drivers and mapping relevant stakeholders including the Regional Transport Office (RTO) and Traffic Police to understand vehicle registrations process and regulatory frameworks. Interactions with drivers provided insights into their experiences, challenges, and willingness to adopt EVs. The study also evaluated the e-3W market, including available technologies, costs, subsidies, and access to financing.

The strategy addresses infrastructure needs, especially charging stations, and recommends policy, financial, and operational measures to enable a smooth e-transition. The resulting electrification strategy will guide Surat's shift towards electric mobility (e-mobility), aiming to reduce greenhouse gas emissions and support the city's broader sustainability goal.

[1]Regional Transport Office, 2010-2024

[2]Comprehensive Mobility Plan 2016



01

Introduction

1.1 Background

India is undergoing a significant shift towards electrification in urban transport, with 3Ws playing a crucial role in this transition. The adoption of e-3Ws align with the nation's commitment to reducing carbon emissions, improving air quality, and achieving energy sustainability. These vehicles serve as essential last-mile connectivity solutions, operating as Intermediate Public Transport (IPT) services, and supporting the public transport system in cities across India. Transitioning to e-3Ws offer a sustainable alternative to traditional fuel-powered vehicles.

Government initiatives, such as the Faster Adoption and Manufacturing of (Hybrid&) Electric Vehicles (FAME) scheme and Prime Minister's Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme, have boosted electric mobility by supporting infrastructure development and incentivising Electric Vehicles (EVs) adoption in Indian cities. While the passenger e-3W segment has seen encouraging growth in many regions, disparities in adoption persist. States like Uttarakhand, Uttar Pradesh, Delhi, Chandigarh, and Assam have achieved over 65% adoption of electric three-wheelers (refer to Figure 11), indicating strong progress. In contrast, Gujarat ranks 29th, out of 28 states and 8 Union Territories, with only 2% of the total e-3W registrations, approximately 11,000 vehicles.

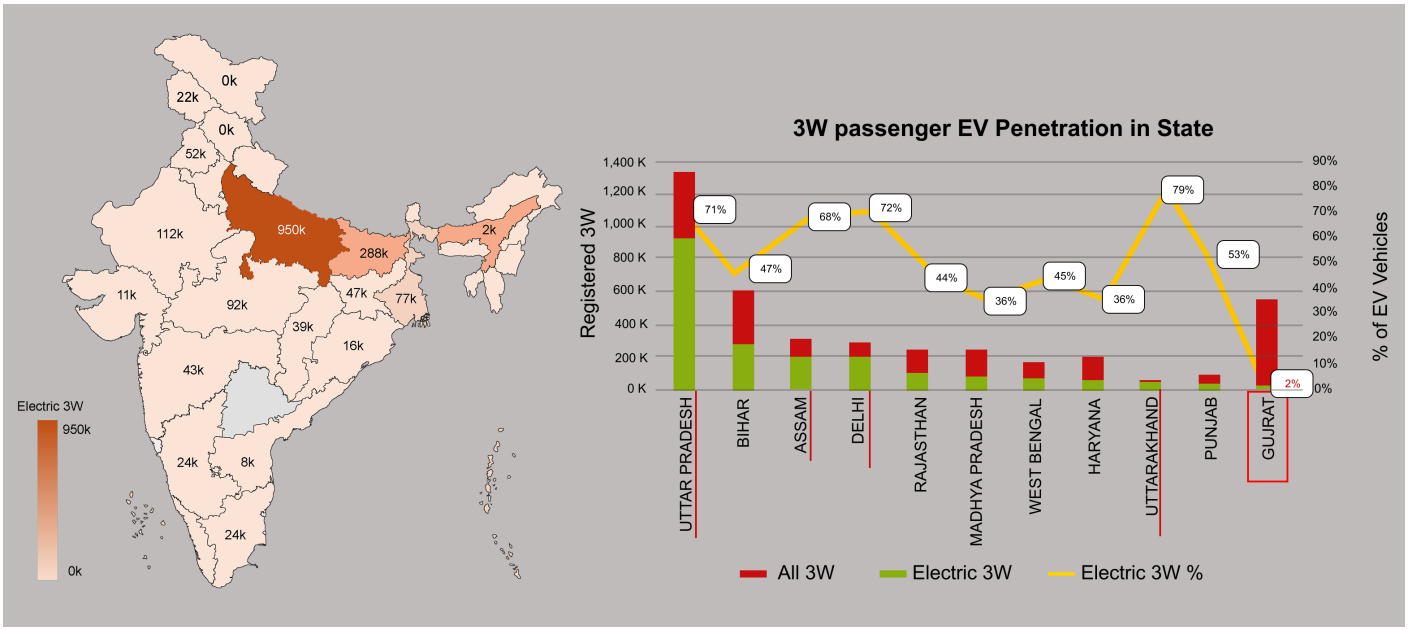


Figure 1.1: Passenger e-3W registration across India

Source: Vahan parivahan data, 2016-2025

Disclaimer: This geographical map is for informational purposes only and does not constitute recognition of international boundaries or regions; GIZ makes no claims concerning the validity, accuracy or completeness of the maps nor assumes any liability resulting from the use of the information therein.

1.2 Study need and aim

Prior to the formal introduction of the Bus Rapid Transit System (BRTS) and city bus service in 2014, shared 3W services functioned as the primary mode of public transportation in the city. Even after the introduction of the formal transit services, IPT services have continued to operate and remain the preferred choice for commuters due to their high accessibility and availability. These IPT services accounted for approximately 17% of all motorised trips, translating to about 10 lakh passengers daily[3].

According to registration data from RTO, approximately 51,000 registered passenger 3Ws were registered in Surat between 2010 and 2024. On average, around 20 new 3Ws are added to the city's fleet each day, of which only 1 to 2 are electric. The overall penetration of e-3Ws in Surat, as well as in the entire Gujarat, is very low despite the subsidies and support from government.

Therefore, the study **aims to create a strategy for the electrification of the IPT services in Surat. It proposes a structured and inclusive approach to facilitate the transition to sustainable mobility.**

1.3 Study approach

The study approach is presented below.

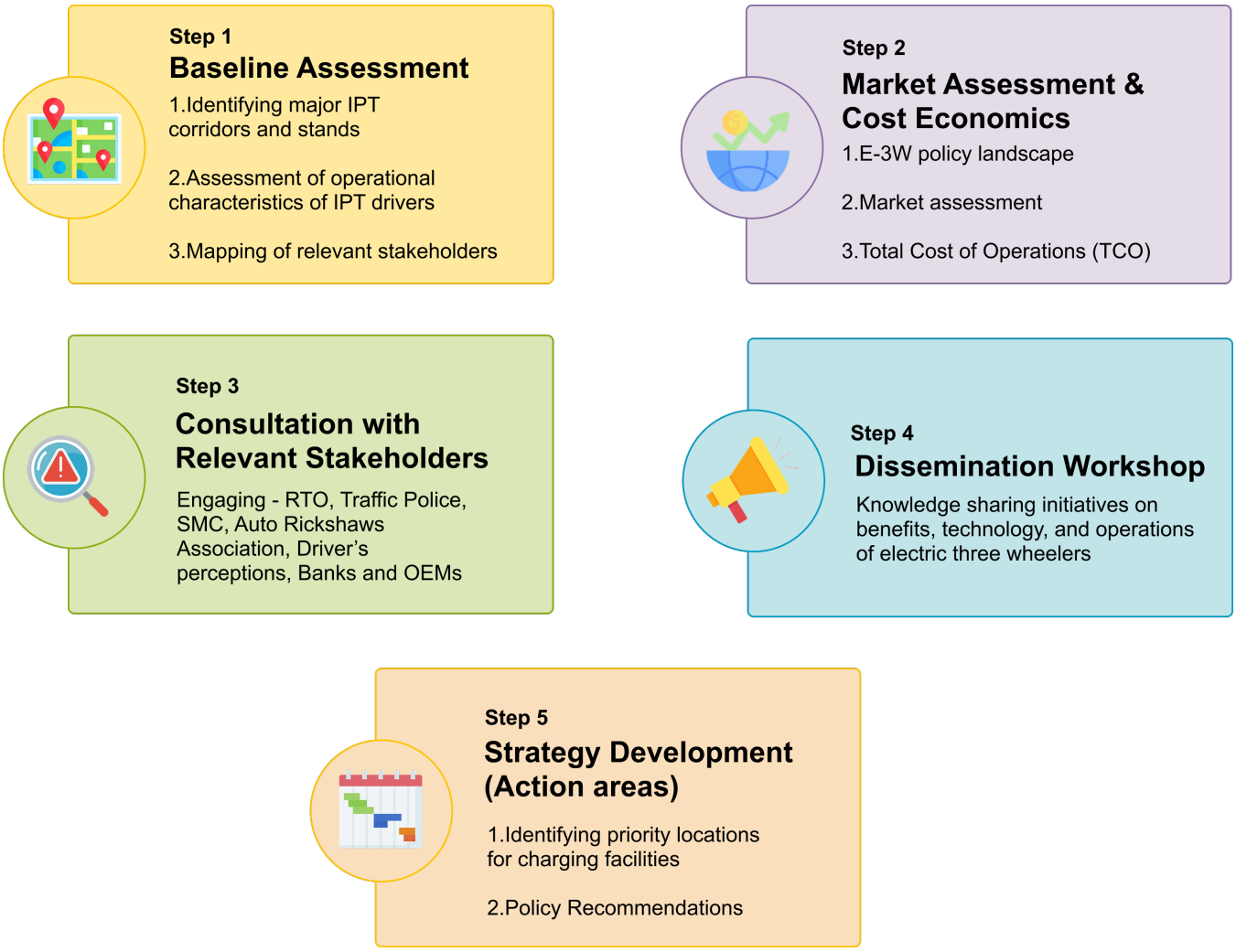


Figure 1.2: Study approach for electrification strategy of IPT system

[3]Comprehensive Mobility Plan 2016

02

Policy Landscape for Electric Three-wheelers

The section outlines policies, and interventions aimed at accelerating the adoption of e-3Ws at the national, state, and city levels, in context of Surat.

2.1 National policy and scheme

FAME II (April 2019 – March 2024)

The Ministry of Heavy Industries (MHI) launched Phase II of the Faster Adoption and Manufacturing of (Hybrid&) Electric Vehicles (FAME) Scheme on April 1st, 2019 with an outlay of ₹10,000 crore in the EV sector. The scheme provided incentives on per kilowatt hour (kWh) basis for e-2W, e-3W, and e-4W vehicles, based on the size of their batteries. The eligibility criteria for vehicle segments under e-3Ws are described in the table below[4]

Vehicle Segment	Minimum Range (km)	Maximum Electric Energy Consumption (kWh/100 km)	Minimum Max Speed (km / hr)	Minimum Acceleration (m/s2)
E-Rickshaw and E-Cart	80	Not Exceeding 8	NA	NA
L5 e3W	80	Not Exceeding 10	40	0.65

Table 2.1: Eligibility criteria for e3Ws (FAME II)

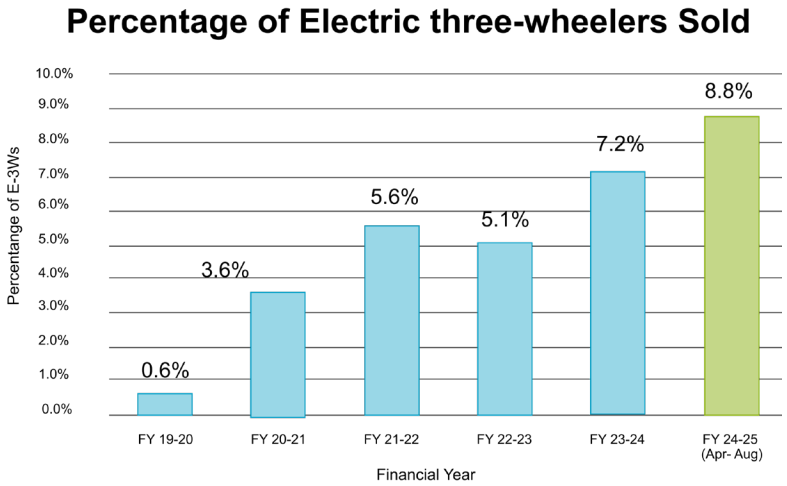


Figure 2.1: Percentage of total e3Ws sold[5]

[4]https://heavyindustries.gov.in/sites/default/files/2023-09/7-e_didm_writereaddata_userfiles_notification_dated_28_march.pdf

A subsidy of ₹10,000 per kWh was offered for e-3W, capped at 20% of cost of vehicle. The share of e-3W out of total 3Ws sold has been increasing slightly year by year (refer to **Figure 2.1**)The scheme concluded on March 31st, 2024, with a target to support the electrification of 5,00,000 three-wheelers, including e-rickshaws, e-carts and e-3Ws of L5 category. However, only 1,65,806 units were sold under the scheme, utilising ₹1,116 crore in subsidies.

PM E-DRIVE (September 2024 – Valid till 31st March 2026)

The PM E-DRIVE Scheme, launched on September 29th, 2024, by the MHI, Government of India, will be in effect until March 31st, 2026. It subsumes the Electric Mobility Promotion Scheme (EMPS) 2024, which was implemented from April 1, 2024, to September 30, 2024, making its effective duration two years. With a ₹10,900 crore outlay, the scheme aims to accelerate EV adoption, charging infrastructure development, and the EV manufacturing ecosystem across the country. It supports multiple vehicle segments, including e-2Ws, e-rickshaws, e-carts, e-3Ws (L5), e-ambulances, e-trucks, and e-buses.

The scheme allocates ₹907 crore for e-3Ws, covering both registered e-rickshaws & e-carts and L5 category e-3Ws. A subsidy of ₹5,000 per kWh in FY 2024-25 and of ₹2,500 per kWh in FY 2025-26 is offered based on the battery capacity of the vehicle.

The incentive for e-3W is further capped at 15% of the ex-factory price. The table below showcase the details of demand incentives for the e-3W segment through this scheme.

Vehicle segment	Target vehicles		Incentive for vehicles		Maximum ex-factory price to avail incentive	Total fund support from MHI
	FY 2024-25	FY 2025-26	FY 2024-25	FY 2025-26		
Registered e-Ricshaws & e-Cart	43,371	67,225	₹5,000/ kWh, capped at ₹25,000 per vehicle	₹2,500/ kWh, capped at ₹12,500 per vehicle	₹2.5 lakh	₹192 crore
Registered e-3 wheelers L5	80,546	1,24,846	₹5,000/ kWh, capped at ₹50,000 per Vehicle	₹2,500/ kWh, capped at ₹25,000 per vehicle	₹5 lakh	₹715 crore

Table 2.2: Demand incentive details for e-3Ws

Additionally, ₹2,000 crores have been allocated to develop public charging infrastructure for various categories of vehicles to instil confidence amongst EV users. This will be implemented through involvement of Central ministries/ authorities, State Governments, Central Public Sector Enterprises (CPSEs), etc.

[5]https://heavyindustries.gov.in/sites/default/files/2024-09/mohi_fame-2_book_design.pdf

2.2 State policy

Gujarat State Electric Vehicle Policy-2021 (Valid 30th June 2025)

The policy was launched by the Ports and Transport Department, Government of Gujarat, on June 23rd, 2021, and is valid for four years, starting from July 1st, 2021. The policy aims to promote e-mobility by supporting the adoption of 70,000 e-3Ws over its duration. To encourage uptake, a subsidy of ₹10,000 per kWh is offered for e-3Ws based on battery capacity, capped at 5 kWh, for vehicles with a maximum ex-factory price of ₹5 lakh.

Additionally, the policy incentivises the development of public EV charging infrastructure, offering a 25% capital subsidy on equipment and machinery for commercial public EV charging stations catering to 2W, 3W, and 4W. This subsidy is capped at ₹10 lakh per station and is available for the first 250 commercial public EV charging stations established under the policy.

2.3 City policy

Surat City Electric Vehicle Policy – 2021 (Valid till 30th June 2025)

In 2021, the Surat Municipal Corporation (SMC) launched the Surat City Electric Vehicle Policy, making Surat the first city in Gujarat to introduce a city-level EV policy. The policy is valid from October 1st, 2021, to June 30th, 2025, and aims to ensure that at least 20% of the state's EV adoption target is met within Surat.

Under this policy, SMC targets to support 15,000 e-3Ws and extends benefits to all vehicle segments covered under the FAME II scheme. To promote EV adoption, the policy provides a gradual vehicle tax exemption, starting with 100% in the first year, 75% in the second year, 50% in the third year, and 25% from the fourth year onward until the policy's operative period ends. Additional incentives include 100% reimbursement of Environmental Improvement Charges (EIC) and free parking at SMC's Pay & Park locations for three years.

Further, an additional incentive of ₹5,000 per vehicle is offered under the "Pink Auto Project", encouraging the adoption of e-3Ws. The policy also emphasises public charging infrastructure development, with plans to create a publicly accessible database, maintained by the Energy Efficiency Cell of SMC, providing real-time information on charging locations, slot availability by vehicle type, payment details, and pricing structures. Private charging operators will be required to share their database with SMC to ensure seamless access to charging facilities.

2.4 Summary

Currently, the central government subsidy is only available for e-3W purchase under the PM e-DRIVE scheme, offering incentives up to ₹25,000, based on battery capacity. However, the previous ₹50,000 subsidy offered by the Government of Gujarat (GoG) has been unavailable since March/April 2025 due to issue with accessing the application portal in accessing the portal. To encourage continued adoption of electric vehicles, the Gujarat government has reduced the vehicle tax from 6% to 1%, effective April 1, 2025[6]

[6] https://timesofindia.indiatimes.com/auto/news/good-news-this-state-slashes-ev-road-tax-to-just-1-till-march-26-details/articleshow/120549454.cms

03

Mapping of Stakeholders

Identification and participation of key stakeholders are crucial when discussing the transition to EVs, specifically e-3Ws.Support and encouragement from each stakeholder is essential to help drivers, particularly from lower and middle-income groups understand the economic significance, legal aspects and benefits of this transition.

Following are the key stakeholders and their role in creating awareness among drivers:

1. City Authority: The city authority (SMC) encourages drivers by offering incentives through city's EV policy and government subsidies. As the decision-making body, the SMC has the power to provide land, develop charging infrastructure and resolve any incentive-related issues.

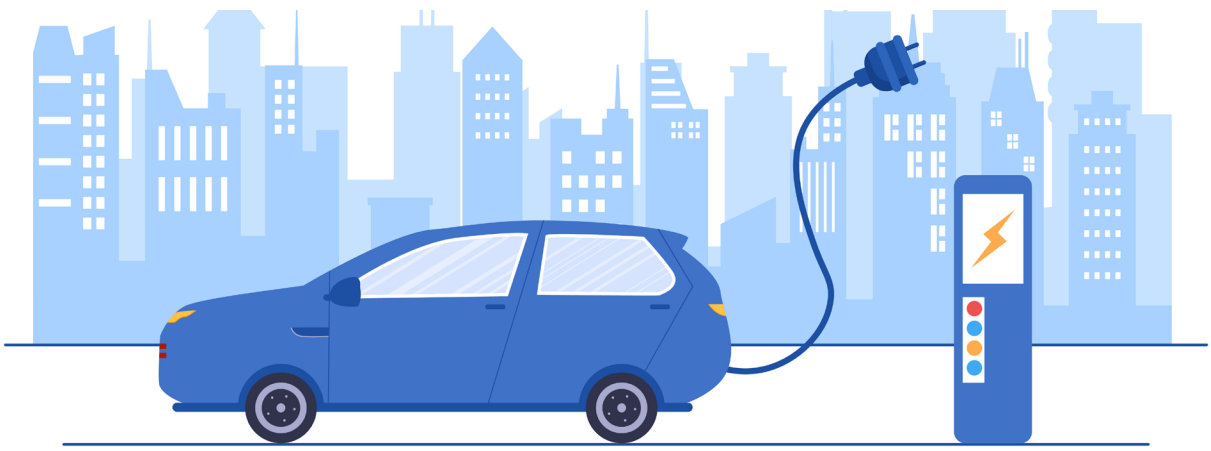
2. Regional Transport Office (RTO): The RTO provides insights into the various registration fees, applicable taxes, and procedural steps involved in vehicle registration, while emphasising the importance of adhering to relevant rules and regulations.

3. Traffic Police: Traffic police educate drivers about the necessity of following all traffic rules and safety compliance to avoid accidents. Also support compliance with regulations such as the vehicle aging norms and Pollution Under Control (PUC) norms, that make EVs more appealing to the public.

4. Auto Rickshaw Associations: Leaders of auto rickshaw associations play a crucial role as mediators between the SMC, traffic police and RTO. They communicate with drivers in the local language, helping them make informed and legally compliant decisions about adopting e-3Ws. This approach builds trust, ensures drivers receive essential information, and makes the transition economically beneficial for both drivers and society.

5. Original Equipment Manufacturer (OEM): OEMs offer information about the updated features in e-3W models with integrating feedback from past experiences. Encourage drivers to adopt EVs and commit to offering robust service and support to ensure a smooth transition.

6. Nationalised Bank: Banks encourage drivers to opt for loans with a lower rate of interest instead of choosing Non-Banking Financial Companies (NBFCs). However, availing loans and completing the necessary procedures can be challenging for drivers, often due to low education background or incomplete documentation, making the process time-consuming. To address these, it is essential to simplify the EV loan application procedure and make it more accessible and use-friendly for drivers.



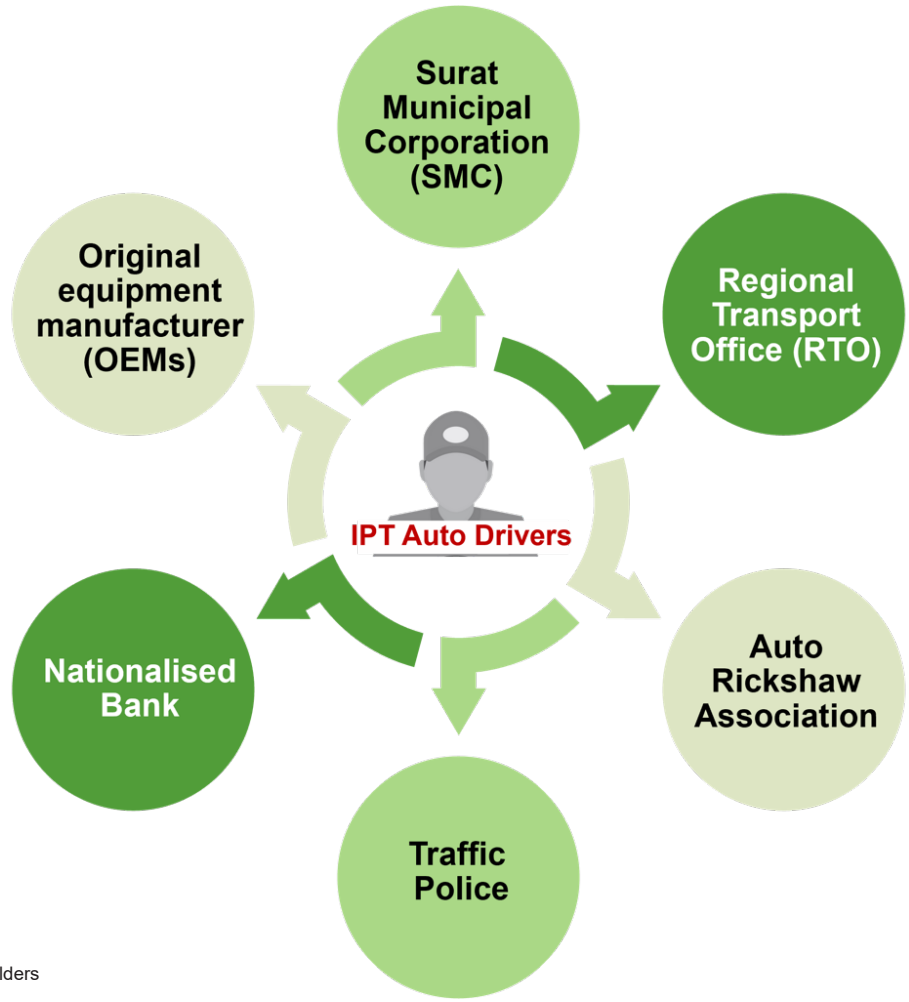


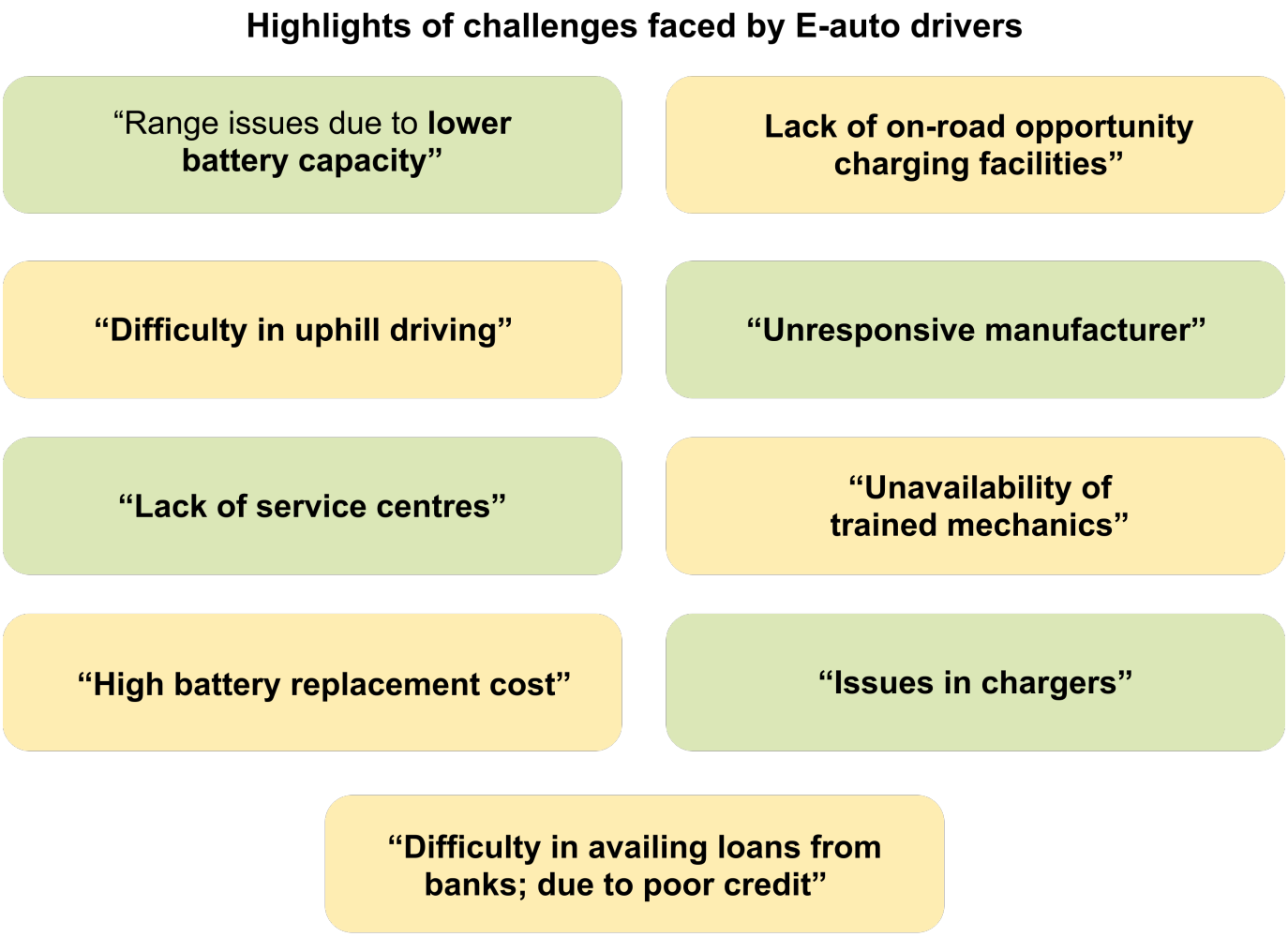
Figure 3.1: Key stakeholders

Interaction with female E-3W drivers – Pink Auto

(Focus Group Discussion)

Pink Auto," an initiative launched by SMC in 2016, aimed to empower women to drive 3Ws and support their families in generating income. Initially, 30 women benefited from owning CNG-powered autos through subsidies. With SMC's support, 12 women transitioned to an eco-friendly option of e-autos. However, within three years, many faced operational and financial challenges. Discussions held on February 21, 2024, highlighted negative experiences with early-generation electric 3Ws, including limited kilometre range, high battery replacement, and maintenance.

Highlights of challenges faced by e-auto drivers



04

Baseline Assessment of IPT Services in Surat

Surat has long been recognised for its extensive reliance on auto-rickshaws as a primary mode of urban transport. With an estimated population of approximately 7.6 million in 2024[7]and spanning over an area of around 466 sq. km, the city continues to depend on IPT services. As previously mentioned, IPT accounts for about 17% of motorised trips[8], serving an estimated 1 million passengers daily. This high usage is largely due to the city's relatively short average trip distance of approximately 5 km and the high accessibility and availability of auto-rickshaws, making them a convenient choice for city commuters.

4.1 Passenger three-wheeler vehicles registration details

According to RTO data from 2024, Surat has witnessed a 17% increase in vehicle registrations over the past two years. Currently, around 51,600 auto-rickshaws operate in the city, with approximately 20 new vehicles being registered each day. Despite this growth, the penetration of e-3Ws remains extremely low at just 6%, translating to about 350 registered e-3Ws (as of March 2025). This figure is significantly lower compared to adoption level of several other Indian cities. At a broader level, the state of Gujarat has low penetration of e-3Ws despite substantial subsidies and policy support from national, state and local government authorities. Several contributing factors behind it which have been highlighted in following sections.

The figure below illustrates the penetration of e-3W passenger vehicles and total 3Ws registered in Surat over the past 15 years. It is to be noted that the CNG 3Ws renewed in last five years is approximately 39,740; whereas vehicles scarped is around 4,200 vehicles (as of April 2025 RTO). This indicates that a significant number of older vehicles continue to operate on city roads, leading to increased emissions and operational inefficiencies for vehicle owners.

[7]CoEUT CRDF estimates

[6]Comprehensive Mobility Plan 2016

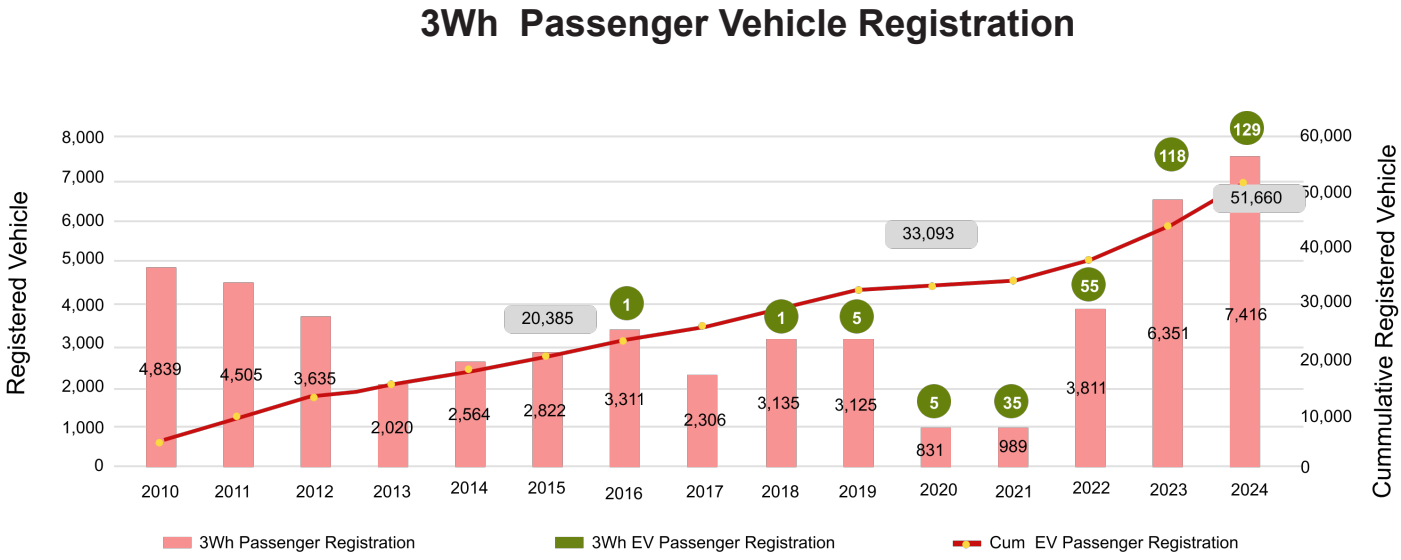


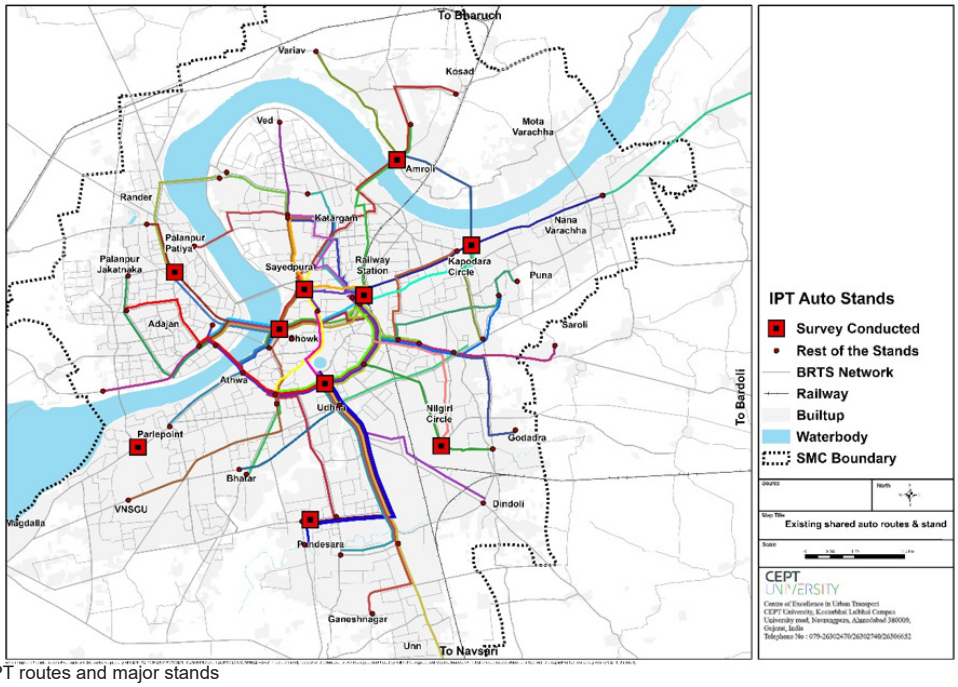
Figure 4.1: Three-wheeler passenger vehicle registration over the past 15 years

4.2 IPT routes and stands in the city

In Surat, approximately 53 shared auto-rickshaw routes operate across the city, providing the last-mile connectivity from the railway station and city center to the peripheral areas including Ved, Kosad, Kamrej, Dindoli, Sachin, Pandesara, and Palanpur. These shared auto-rickshaws are powered by CNG and can accommodate 5 to 6 passengers.

Assessing the feasibility of e-3W transition, it is essential to gain a comprehensive understanding of 3W vehicle usage patterns, operational costs, maintenance expenses, capital investment, and earnings. To collect relevant information, a survey was conducted with around 150 auto drivers from 10 key intersections across the city. The objective was to assess the socio-economic status, operational characteristics and financial capacity of these drivers. The survey questionnaire is provided in Annexure A. Map 4.1 below illustrates the shared auto-rickshaw routes and the specific locations selected for the IPT auto driver survey within the city.

Map 4.1 below illustrates the shared auto-rickshaw routes and the specific locations selected for the IPT auto driver survey within the city.



Map 4.1: Shared IPT routes and major stands

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4.3 Auto drivers survey analysis

The analysis is based on a survey of 150 auto drivers conducted in Surat in March 2025. Figure 4.2 highlights key operational characteristics of these drivers. The survey reveal that shared auto rickshaws operate an average of approximately 110 km per day, carrying about 50-60 passengers daily. This results in a daily income around ₹1200-1500.

The maintenance cost for the drivers is approximately ₹1800 -2000 per month. For those paying Equated Monthly Installments (EMI), the average earnings are about ₹18,000 to ₹20,000, while those without EMI earn approximately ₹24,000 to ₹26,000. This indicates that operating expenses account for about 7% to 10% of their earnings.

Figure 4.2: Inferences form auto drivers' Survey -operational characteristics, income and expenditure

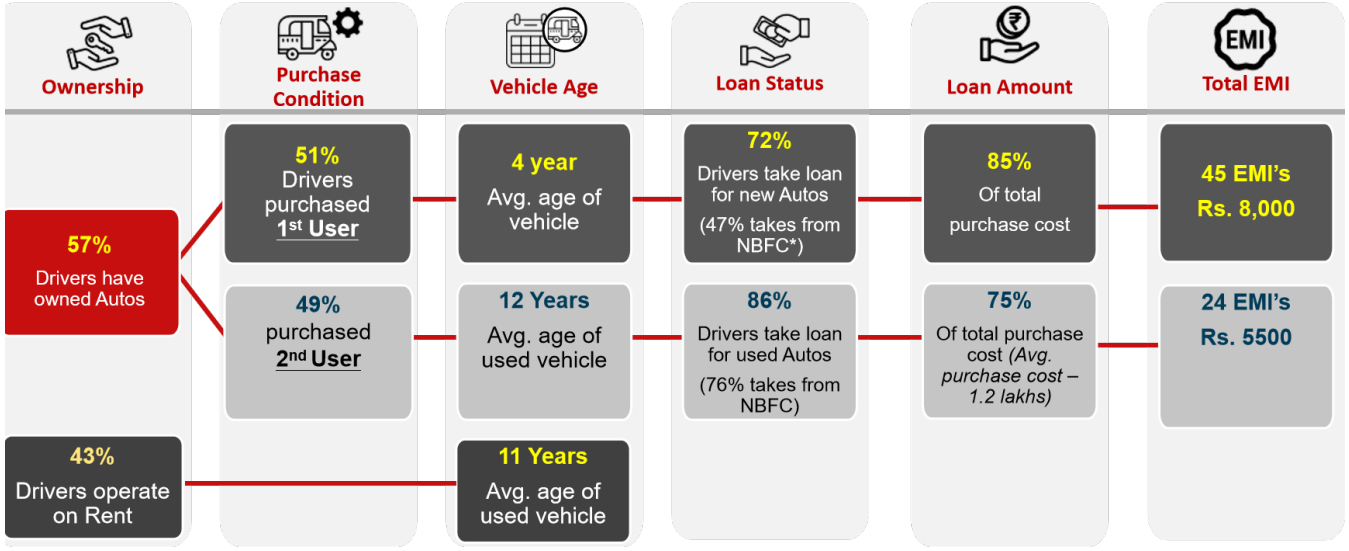
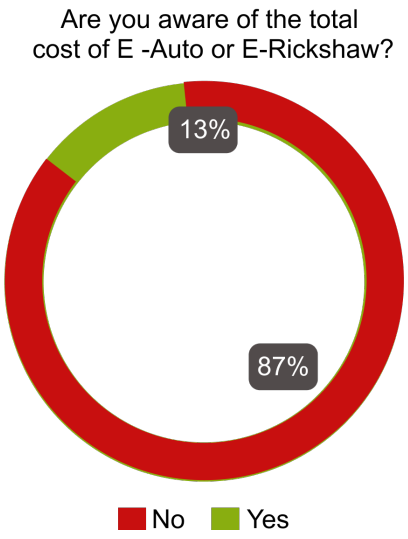


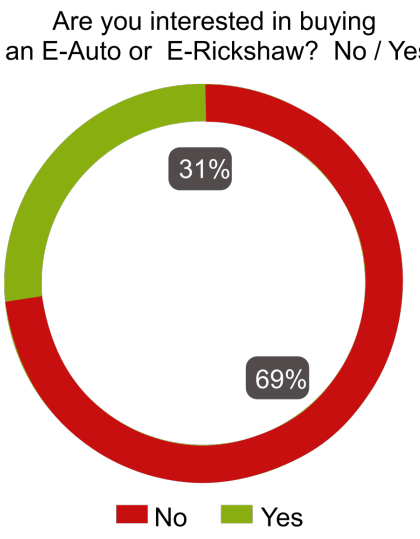
Figure 4.3: Inference from auto drivers' survey- status of ownership and financial capabilities

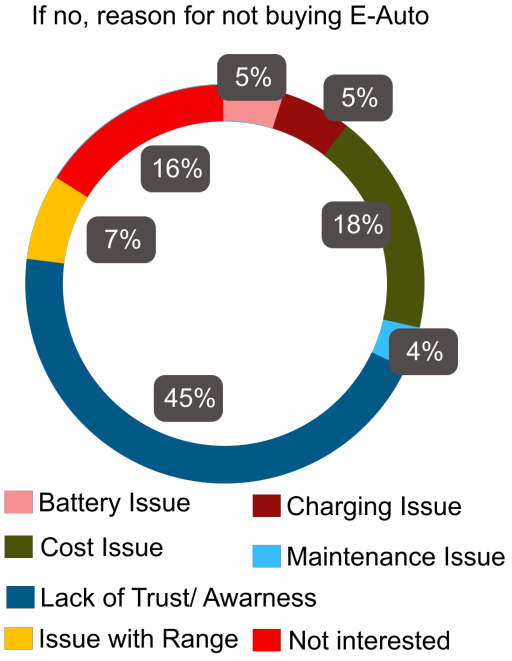
Figure 4.3 illustrates the vehicle ownership pattern and financial status of auto drivers. The survey indicates that approximately 57% of the vehicles are owned by the drivers themselves, while the remaining operate on a rental basis. Among the owned vehicles, about 49% are second-hand, with an average age of around 12 years. This means that 51% of three-wheelers currently operating on the roads are over 10 years old, highlighting the presence of vehicle aging, less efficient vehicles within the city's urban transport ecosystem.

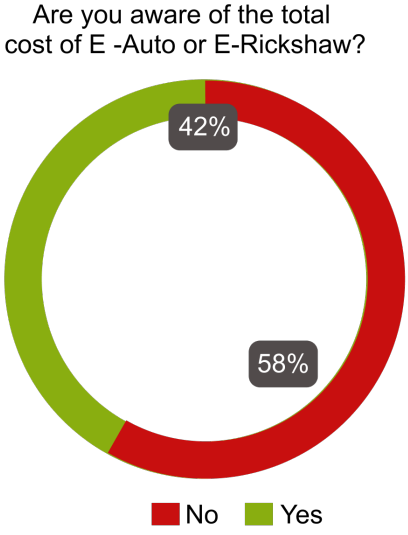
In terms of educational background, nearly 80% of drivers have only a primary level education, which limits their understanding of the long-term operational and financial benefits of EVs compared to CNG vehicles. As a result, a substantial proportion of drivers depend on non-financial banks for loans—approximately 75% of drivers opt for second-hand vehicle purchase, while 47% of drivers for first-hand purchases.

Case Study: Table 6: Theoretical energy estimation for e-buses operation



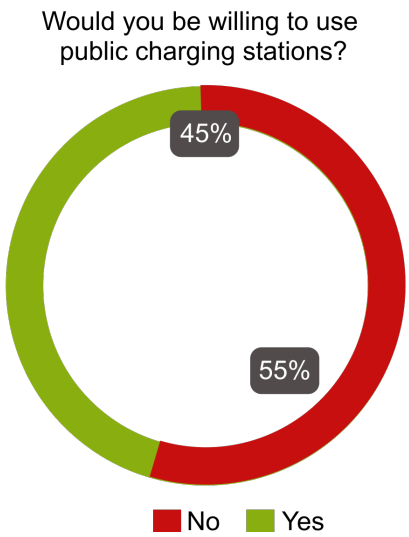


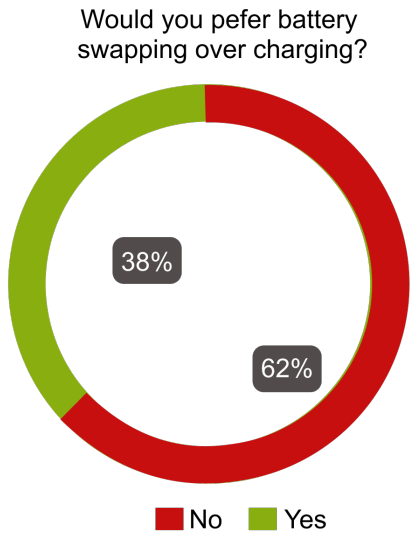




Existing Vehicle Age	Yes	No	Total
<5	7%	23%	30%
5-10	5%	14%	19%
10-15	7%	11%	18%
15-20	9%	17%	26%
>20	3%	4%	7%
Total	**31%**	**69%**	**100%**

19% **32%** **33%**





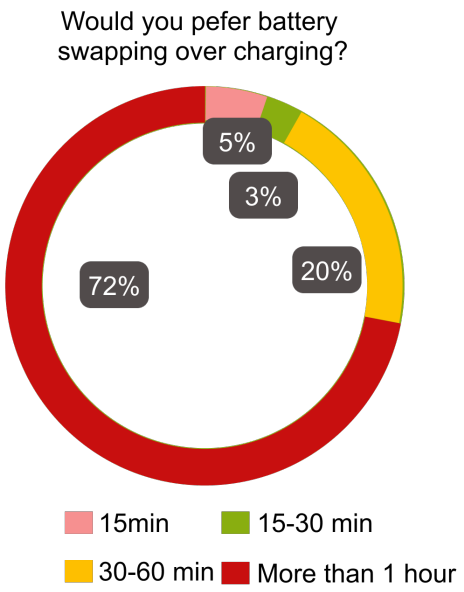
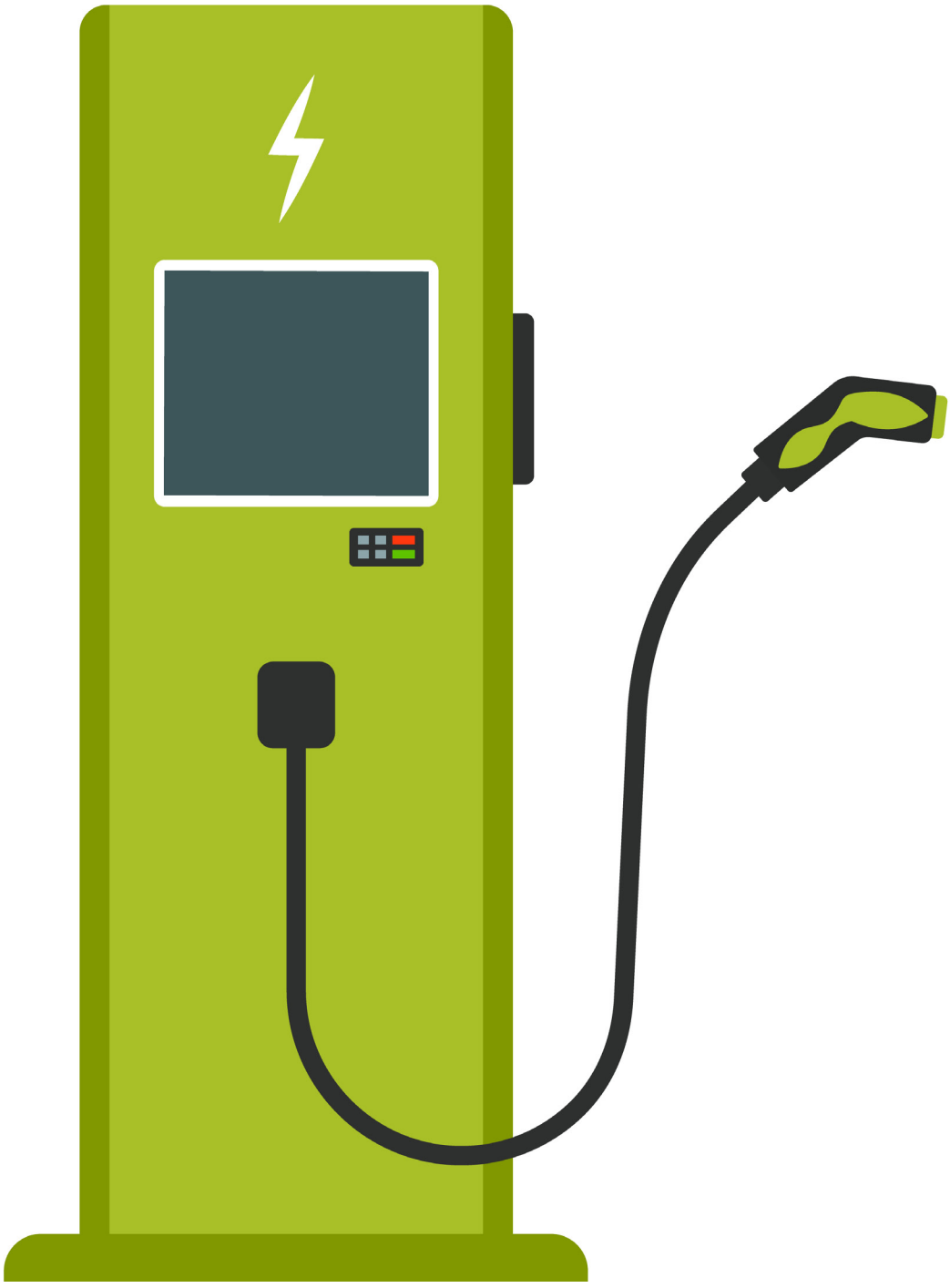


Figure 4.4: Drivers' perception towards E-3Ws

Additionally, the Figure 4.4 showcases few questions explored to understand the drivers' perceptions and challenges concerning the adoption of electric three-wheelers (e-3Ws). The survey reveals that about 69% of auto drivers were hesitant to transition to e-3Ws, primarily due to limited awareness regarding upfront costs, service infrastructure, battery reliability, and driving range. However, it also shows that approximately 45% of drivers are willing to switch to e-3Ws if adequate charging infrastructure were available.

These insights point to a critical need for target awareness campaigns to help drivers better understand the environmental and economic advantages of adopting e-3Ws with provision of charging infrastructure to increase the vehicle kilometer range.



05

Market Assessment and Cost of Operations

5.1 Market assessment

In the e-3W passenger vehicle segment, two categories are available based on the market assessment: (i) E-rickshaws (L3 category) and (ii) E-autos (L5 category). A key distinction features between these categories is the kilometre range, vehicle speed and cost. E-rickshaws are generally more affordable than e-autos, mainly due to their smaller battery size (3-5kWh) which results in a lower cost.

Given the lower vehicle utilisation and limited coverage area associated due to a maximum speed of 25 km/hr or less, conventional e-rickshaws (L3 category) are less suitable for urban operations, as in case of Surat. Therefore, L5 category e-3Ws are comparatively more suitable, offering a driving range of over 100 kilometres.

The figure below illustrates the operational differences between e-rickshaws and e-autos.

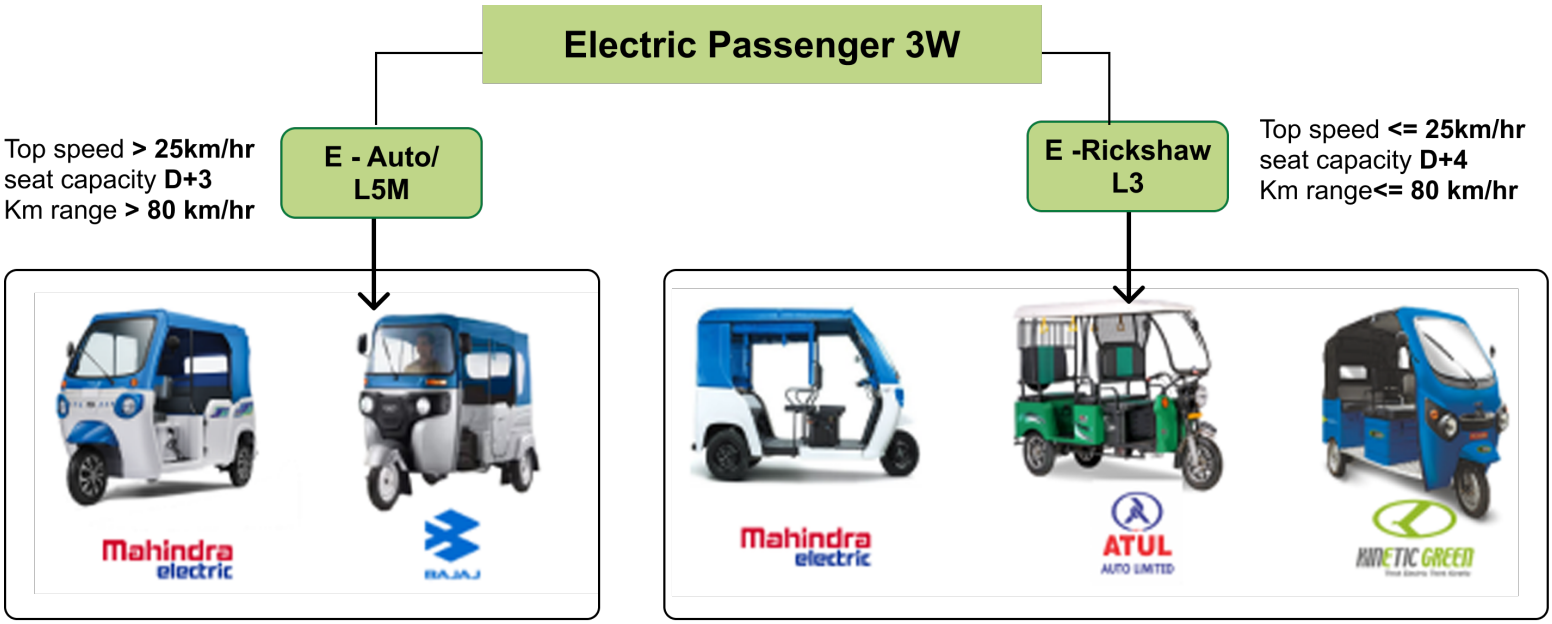
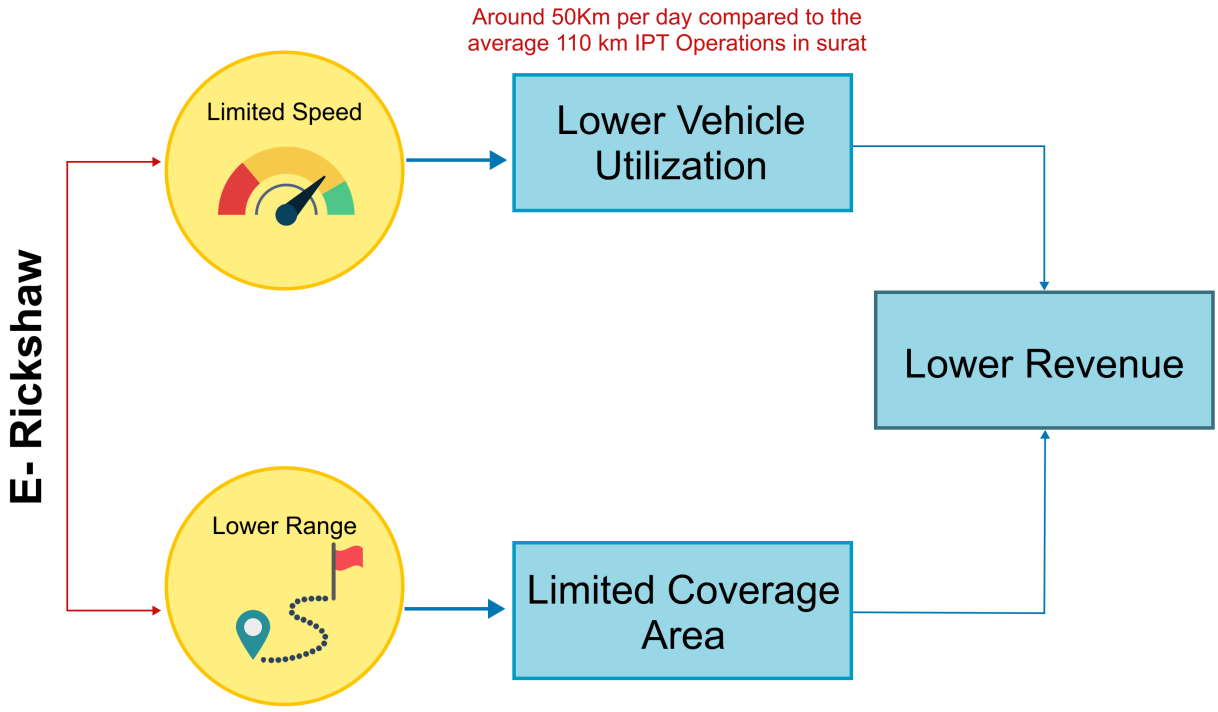


Figure 5.1: Difference in e-rickshaw and e-autos – market assessment

Limitations of E-rickshaw in comparison with CNG auto and E-auto



Source: Report on Strategy for Electrification of IPT in Ahmedabad, UKPACT, CoE-UT, CRDF

Various Models Available in E-3W Auto Segment (L5 category)

Prior to year 2020, only few manufacturers were producing e-3Ws with models having limited range and functionalities. However, in recent years, the sector has witnessed substantial growth driven by increasing demand and supportive government policies. A market study has shown that advancements in battery technology have led to the manufacturing of newer models offering improved ranges of 130 km to 250 km, which is suitable for Surat's operational requirements.

These vehicles are now equipped with advanced lithium-ion batteries, generally backed by warranties ranging from 3 to 5 years or coverage of 100,000 to 120,000 km. Additionally, charger technology has been upgraded to address earlier reliability concerns and comply with safety protocols.

Below is a list of manufacturers and corresponding model specifications. It has been noted that as battery size increases, so does the cost of the vehicle (refer Table 5.1). The prices listed include central government subsidies, as state-level subsidies in Gujarat have been discontinued as of April 2025.

Parameters	Piaggio Vehicles Pvt. Ltd.	Mahindra Last Mile Mobility		Atul Auto Limited	Bajaj Auto Limited	
Model name	Ape E-city FX	Treo Auto SM	Treo Plus	Mobili | Mobili2	RE E-TEC 9.0	GOGO P5009|P7012
						
Launch year	2019	2018	2024	2023	2023	2025
Seating capacity	D + 3	D+3	D+3	D + 3	D+3	D + 3
Vehicle body	Metal	Fibre	Metal	Fibre	Metal	Metal
Top speed	45 kmph	55 kmph	55 kmph	45 kmph	45 kmph	50 kmph
Appx. range in single charge	110 km	130 km	167 km	110 & 220 km	178 km	171 & 251 km
Battery type	Lithium-ion	Lithium-ion	Lithium-ion	Lithium-ion	Lithium-ion-LFP	Lithium-ion
Battery capacity	7.5 kW	7.37 kW	10.24 kW	6.6 kW& 13.2 kW	8.9 kW	9.2 kW& 12.1 kW
Charging time	3 h 45 min	3 h 50 min	3h 50min	3hr |5 hr	4h 30 min	4h 30 min | 5h 30 min
Total vehicle cost (on road)	₹3.61 lakh	₹3.56 lakh	₹4.04 lakh	NA	₹3.61 lakh	₹3.57 | ₹4.15 lakh

Table 5.1: E-3W models available in Market in L5 category

Source: Details compiled from various manufacturers available in Gujarat as of April 2025

Table 5.2 compares the cost breakdown of CNG 3W and e-3W, along with their actual on-road costs. The prices shown are for the latest used models available in the market. As mentioned earlier, a subsidy up to ₹25,000 is available under the PM e-Drive scheme; based on the battery capacity. Additionally, a state subsidy was previously offered but is no longer in effect. However, in April 2025, the state announced the reduction in RTO taxes on the vehicle's base price from 6% to 1%; that translated to about ₹7000 (i.e. 1% of vehicle base price). This initiative was introduced to support EV adoption following the expiration of the GOG subsidy. Hence, it is observed that the actual on-road cost of e-3W is approximately 46% higher as compared to CNG 3W.

Moreover, Surat EV policy provides a subsidy in the form of waiving the SMC taxes which is valid till June 2025. However, currently the city is in process of revising its EV policy, which may introduce greater financial support for 3W operators to boost EV adoption.

Sr No	Components	CNG (₹)	E-Auto (₹)
A	**Basic cost (including GST)**	**2,59,400**	**3,93,600**
	GST@	28%	5%
B	PM E-Drive Subsidy	-	25,000
C	**Total ex-showroom price (A-B)**	**2,59,500**	**3,71,600**
D	RTO tax* (3% in CNG & 1% in EV on base price)	7348	7650
E	Other Charges (Registration, Insurance, HSRP, SMC TAX)	10,900	21,900
F	**Actual cost on road (C+D+E)**	**2,74,000**	**4,00,400**

Table 5.2: Comparison of 3W purchase cost - CNG vs electric

5.2 Cost of operations and operational economics (CNG-3W and E-3W)

A Total Cost of Ownership (TCO) analysis was performed to evaluate the financial implications of adopting CNG 3W vs. e-3W (L5 segment) over a 10 year. The analysis was based on few key assumptions, which are detailed in Annexure C.

As illustrated in Figure 5.3, the average TCO per kilometre for a CNG is ₹6.5, whereas ₹3.8 for e-3W. This assessment encompasses all capital expenditures, EMIs, and monthly operational expenses over a ten-year operational lifespan. Notably, the TCO for e-3W is approximately 40% lower than that of CNG vehicle, thereby presenting a significant cost-saving opportunity. This translates to an estimated monthly savings of ₹5,000–₹7,000, or total savings of ₹6–₹8.5 lakh over the course of ten years. Such savings are substantial for 3W drivers, particularly given their typically lower socio-economic status.

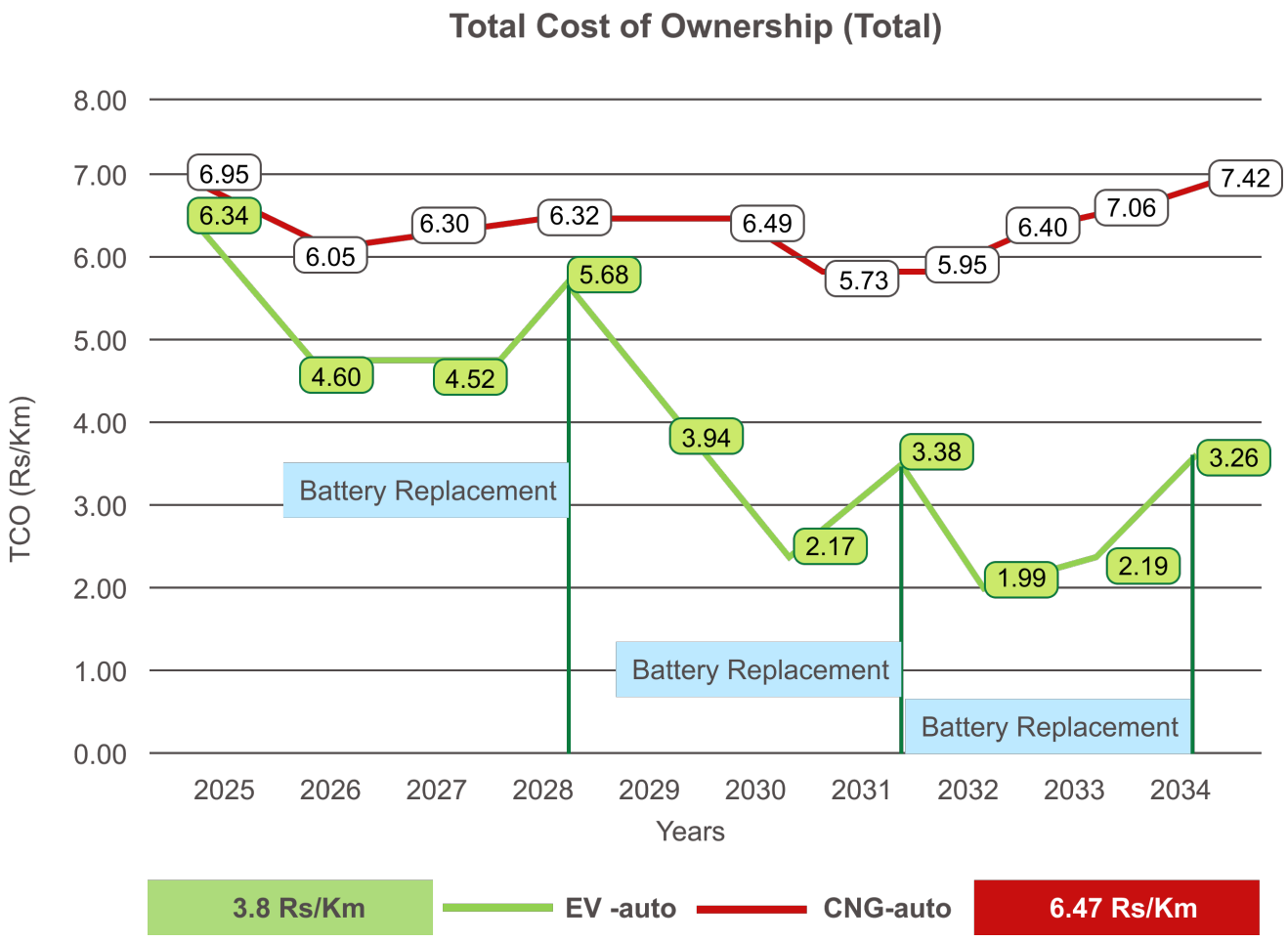


Figure 5.2: Total Cost of Ownership - Overall

While focusing exclusively on operational costs, which include fuel (CNG or electricity), lubricants, maintenance, and related expenses, the analysis reveals a cost of ₹4.4 per km for CNG vehicles, compared to ₹1.08 per km for EVs over the ten-year period (as shown in Figure 5.3). This means that e-3Ws are approximately 75% more economical in operations compared to CNG 3W.

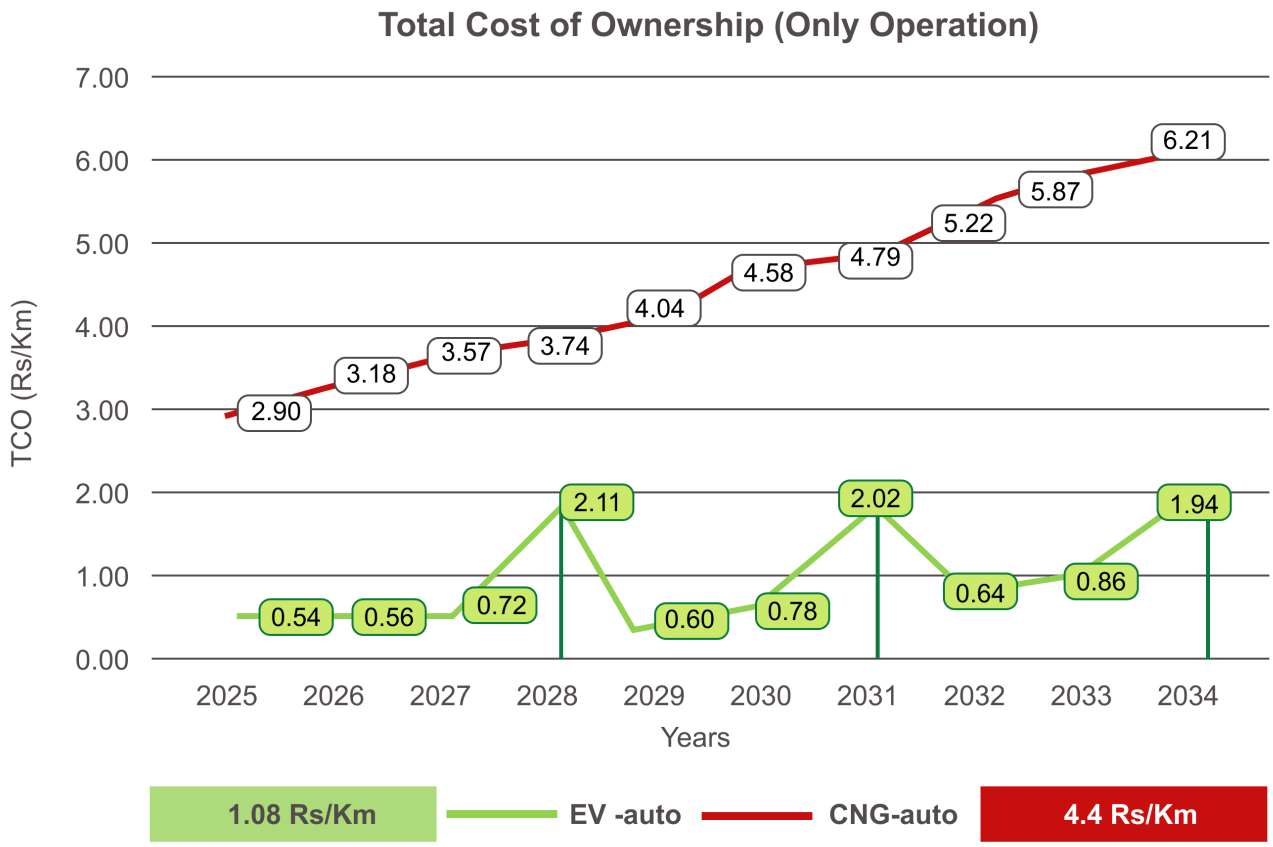


Figure 5.3: Total Cost of Ownership (TCO) –Operation Cost

These figures reflect the impact of existing state subsidies. With the anticipated enhancement of subsidy amounts under the forthcoming city-level EV policy, it is expected that TCO for e-3Ws will decline further.

5.3 Summary

The market assessment indicates the availability of advanced e-3Ws that can meet daily operational requirements on a single charge, with enhanced battery capacity. Although these improvements have led to an increase in upfront costs, they simultaneously reduce the reliance on opportunity charging.

At present, the subsidy from central government has decreased gradually from its initial amount, and state-level subsidy are being phased out as state's EV policy approaches its conclusion. However, the state government has reduced the RTO tax from 6% to 1%, effectively serving as an alternate form of financial support.

As of April 2025, the TCO analysis demonstrates that e-3Ws generate approximately 40% lower operational expenses compared to CNG vehicles. This cost reduction allows operators to increase their monthly income by ₹5,000 to ₹7,000 (30-40%), cumulative savings of ₹6 to ₹8.5 lakhs over a period of ten years.

06

Awareness Workshop

The study revealed that existing auto drivers generally hold negative perceptions about EVs, viewing them as expensive and operationally challenging. This insight is largely influenced by earlier experiences with initial EV models. To bridge this awareness gap, a dedicated workshop was conducted as part of the study to educate drivers on the financial and operational advantages of e-3Ws, including available government subsidies and incentives. The session also highlighted emerging EV technologies and their long-term benefits. Additionally, the workshop promoted financial options through nationalised banks, which offer more secure and favourable terms compared to NBFC. It is recommended that regular awareness initiatives are essential to disseminate accurate information, build trust, and support smoother transition to e-mobility.

Glimpse of awareness programme on E-3Ws in Surat

Since the majority of auto-rickshaw drivers belong to lower and lower-middle income groups, sensitising them to the economic benefits of e-mobility is crucial. A high-impact awareness programme was organised by SMC, with support from GIZ and CEPT-CRDF in Surat. It is aimed to inform and inspire auto-rikshaw drivers about the opportunities of transitioning to e-autos.

Workshop highlights:

- The event was supported by SMC, auto-rickshaw associations, State Bank of India, and EV manufacturers including Mahindra, Atul and Bajaj.
- Around 250 CNG auto-rickshaw drivers participated, including women operating Pink Autos in the city.
- Awareness sessions focused on government subsidies, EV technologies, financial incentives, and the economic benefits of transitioning to EVs.
- Information was shared on simplified loan procedures from national banks like SBI, offering low interest rates.
- Experience-sharing by existing e-3W drivers offered practical insights for participants.
- A vehicle exhibition was organised to showcase the latest e-3W models, allowing drivers to explore and test-ride the vehicles.
- Brochures in the local language were distributed, featuring comparisons between conventional and e-3Ws, details of available electric models, government incentives, and cost-benefit analyses to help drivers make informed decisions. (refer to Annexure Error! Reference source not found.)

The event received a positive response from the participants, and their feedback was collected to further guide the formulation of an electrification strategy for the IPT sector.





CRDF




07

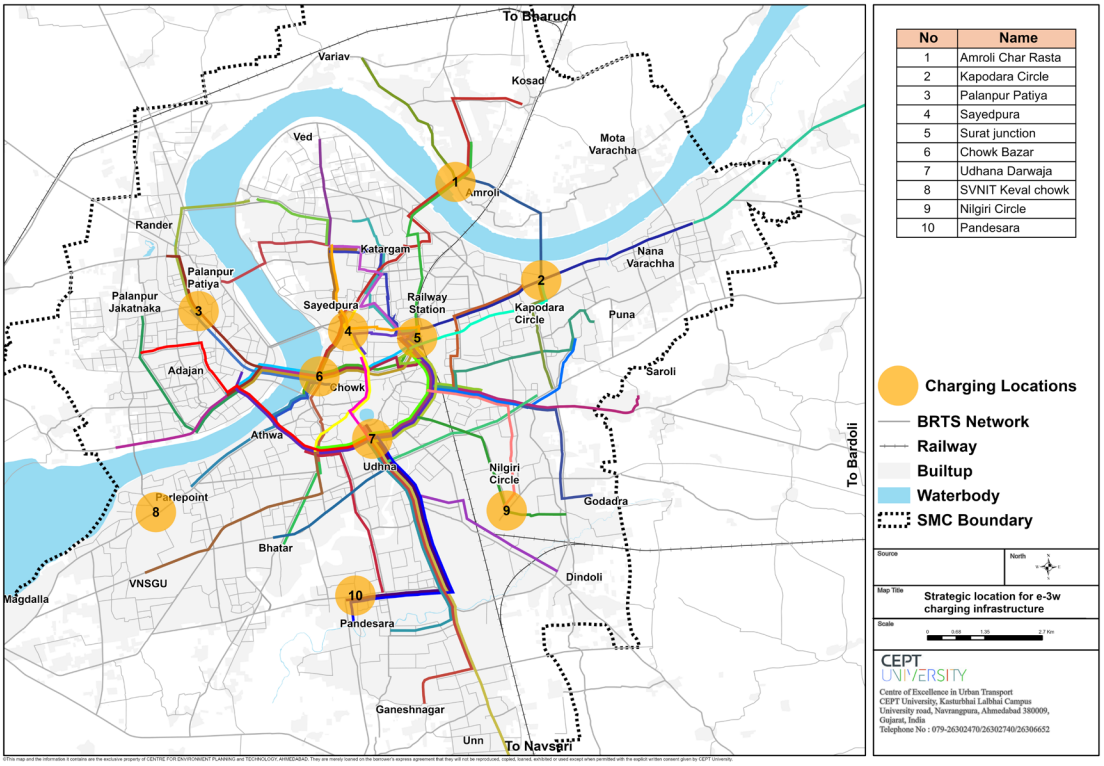
Strategic Location for Charging Infrastructure

Identification of charging infrastructure facilities for e-3W

Insights from the stakeholder consultations and feedback from the awareness workshop highlighted the need for charging facilities at key locations. With evolving EV technology, battery capacities have increased from 7-8 kW to 12-13 kW, offering an average range of 120-150 km per charge, sufficient for most shared 3W operations. As a result, opportunity charging is no longer a critical concern.

However, dedicated charging infrastructure at major IPT stands remain important. It would support operators using smaller battery vehicles (below 10 kW) who may require additional charging for extended operations. Moreover, such infrastructure would help drivers accommodate longer passenger trips beyond 120 km and boost driver confidence in transitioning to EVs.

Based on field surveys, the study identifies ten strategic locations for establishing EV charging infrastructure. These locations were chosen based on the major auto stands in the city and the spatial distribution across the city. The map below illustrates the proposed locations.



Map 7.1: Strategic location for e-3w charging infrastructure

Disclaimer: This geographical map is for informational purposes only and does not constitute recognition of international boundaries or regions; GIZ makes no claims concerning the validity, accuracy or completeness of the maps nor assumes any liability resulting from the use of the information therein.

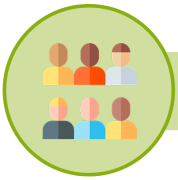
08

Action Areas – Promoting the E-3Ws

The study revealed that the transition to e-3Ws in the passenger segment holds significant potential for community adoption. However, due to limited awareness and the lack of technological upgrades, many users continue to rely on CNG vehicles. Past negative experiences reported by some existing e-3W users have also contributed to hesitation within the user base.

Consultations with various stakeholders indicate a willingness of transition to e-3Ws, though a sudden shift is unlikely. Therefore, it is crucial to outline and implement strategic measures that can facilitate a gradual and sustainable transition, encouraging wider adoption.

The study identifies a set of strategies aimed at supporting the shift from CNG-powered autos to e-autos.



1. Stakeholder engagement and awareness building

Facilitate regular engagement with stakeholders across sectors including vehicle operators, manufacturers, financiers, policy makers and traffic regulator to ensure alignment, address concerns and collaboratively shape the e-mobility segment.

In parallel, conduct targeted dissemination activities to raise awareness about the benefits, financial incentives, and operational advantages of e-autos, helping to build user confidence and correct misconceptions.

2.Strategic locations for developing charging infrastructure

The study identifies 10 strategic junctions for establishing e-auto charging stations, specifically in areas where shared auto stands already exist (refer section 7). These locations are selected to ensure convenient access to drivers and to minimise downtime for drivers.

Charging infrastructure shall be placed based on the availability of land near to the proposed locations through Public Private Partnership (PPP) arrangements, allowing at least 3-4 e-autos to charge simultaneously. To avoid potential conflicts, the use of these stations may be limited to e-3Ws.

Additionally, a simple and driver-friendly payment mechanism should be implemented to ensure ease of use and transparency.

3.Policy recommendation for revised city's EV Policy

With the transition from the FAME scheme to the PM e-Drive scheme, subsidy amounts have declined. At the state level, subsidies have also reduced from ₹48,000 to ₹6,000–₹8,000, now offered mainly as a reduction in RTO taxes (from 6% to 1%). Among cities, Surat is the only one with a dedicated EV policy, though limited emphasis has been placed on e-3Ws segment. As the city's EV policy is currently under revision, this presents a timely opportunity to prioritise the e-3W segment over the next two to three years.

The revised policy should consider the following measures to promote the adoption of e-3Ws:

1.**Subsidy bridging:** Provide an equivalent subsidy to offset the reduction from both FAME and the Gujarat EV policy.

2.**SMC tax waiver:** Completely waive the SMC tax for e-3Ws for the next 2-3 years

3.**Scrappage incentives:** Offer additional financial benefits for purchasing an e-3W against the scrappage of a CNG 3W.

4.**OEM Buy-Back Scheme:** Motivated OEMs to introduce attractive buy-back programs for e-3Ws.

These targeted interventions can significantly boost adoption, support drivers in transitioning and strengthen the local e-mobility ecosystem.

4.Promote financing through nationalised banking

Currently, it is observed that approximately 75% of drivers opt for a NBFCs for loan at interest rate of about 20-25%, compared to 8-10% offered by nationalised banks.

Nationalised banks or formal financial institutions should offer simplified loan processes to support this group of people, benefiting both the drivers/operators and banking sectors.

Interest rates significantly affect the TCO, influencing the financial viability of EV adoption.

09

End Note

The study titled “Electrification Strategies for Electric Three-Wheelers in the City of Surat” highlights the significant presence of 3Ws that play a vital role in providing last-mile connectivity to the public transport system. Their widespread availability has made them a preferred mode of transport for many commuters.

The study proposes strategic approaches to support the transition to e-3Ws by examining the socio-economic conditions, operational needs, and challenges faced by drivers. Engaging this group through targeted awareness initiatives is essential, as their participation is critical for successful adoption.

Enhanced financial support and increased awareness of legal procedures will not only encourage adoption but also help improve the livelihood of operators. A successful transition will contribute to reducing both air and noise pollution, aligning with country’s broader mission of achieving net-zero targets through the adoption of EVs by 2070.

Annexure A: IPT Auto Driver Survey Form

Promoting the transformation to sustainable and climate-friendly electric mobility

Electrification of 3W – Surat

Interviewer Name:			Date	_ _ / _ _ / 2025
Location of Survey			Time:	

1.Personal Information

Respondent Name:				
Residential Location:			Age:	
Personal Accident Insurance:	1.Yes	2.No		

2.Choice of Occupation

Household Members	Male:	Female:	No. of Earning Members:	

Household Income:	Personal Earning:	Education Level	Household Vehicle Ownership:
1.Below 20,000	1.Below 20,000	1.Illiterate	
2.20,001-30,000	2.20,001-30,000	2.Up to Class V	
3.30,001-40,000	3.30,001-40,000	3.Class VI to IX	
4.40,001-50,000	4.40,001-50,000	4.Class X pass	
5.Above 50,000	5.Above 50,000	5.Class XII pass	
		6.Graduate	

Type	Yes/ No	Number
Car		
Eco		
Auto		
2W		
Cycle		

Employment Type (to drive auto):

Service	Full-Time	Part-Time
Metered Auto		
Shared Auto		
Ola/Uber/ Rapido		
School Verdhi		

Why did you join this business?

Since, how many years, you are in this occupation?

3.Vehicle Details

Auto Manufacturer (eg: ATUL, Bajaj, Mahindra)		
New Vehicle or Used Vehicle (New/Second/Third Hand)		
Manufacturing model year		
Fuel Type (CNG, Diesel, Petrol, Electric)		
Engine Type (2-stroke / 4-stroke)		
Km Reading of the Auto (as on date)		
Auto Ownership – Owned		

Auto Purchase Price			
Loan Provider (Bank/ Private Lenders)			
Loan Amount (in Rs)			
Down Payment (in Rs)			
Total Number of EMI			
EMI amount per month (in Rs)			
Loan Repayment (EMI on-going or completed)			
Rented Vehicle			
Daily Rent (in Rs)			
Fuel Management:	1.Returning empty	2.Refueling before return	3.Keeping Receipts
Owner's Name & Contact No.			
Number of Autos with Owner			
What maintenance and service charges are spent by rentee?			

Other Details					
Insurance Amount (last yr.)					
Permit issued	Yes/ No	Duration (years)		Cost (in Rs. paid to RTO)	
Fuel Cost per day (in Rs)					
Cost of one service (in Rs)		Servicing Interval (in months)		Tyre life in km/ year	
Maintenance Cost per months (in Rs) (oil, minor repair, break/ clutch/ liner, body spare parts, plug, carburetor, puncture, etc.		Type of repair/ maintenance			
Expected Vehicle Resale Value (current year)		Cost of engine oil (4 stroke): Rs. _____ at how many km?_____ Cost of engine oil (2 stroke): Rs. _____ at how many km?_____			

4.Trip Information		
From where you start operation (location of the auto stand)?		
Predominant Routes and Via Stops 1 2 3 4		
Number of trips in a day (Up + Down)		
Number of Passengers (in a day)		
Working hours / day (time range)	1.Morning time range	
	2.Evening time range	
Average Income (INR per day):	1.weekday	
	1.weekend	

Average km operated per day:	1. Week day	
	2.Weekend	
	1.Within Old City	
	2.Outside Old City	
Do you use Auto for Goods Transport? No / Yes	When? How much do you earn daily?	
Do you use Auto for Goods Transport? No / Yes	If yes, Earning/ month:	
5.Electric Three-wheeler Awareness Details		
Are you aware of e-Auto or e-Rickshaw?	No / Yes	
Do you also operate as a school auto? No / Yes	If yes, then Subsidy amount (in Rs.):	
Are you aware of e-Auto or e-Rickshaw?	If yes, then price:	
Are you interested in buying an e-Auto or e-Rickshaw? No / Yes	If no, reason:	
6.Barriers – shifting towards e-3W		

1.Do you have access to home charging (electricity at parking location/auto stand)? – Yes/ No

2.Would you be willing to use public charging stations? – Yes/ No

3.Would you prefer battery swapping over charging? – Yes/ No

4.How much time would you be willing to wait for charging? 15min, 15-30min, 30-60min, >1 hr

5.What is your biggest concern about shifting to an electric auto-rickshaw?

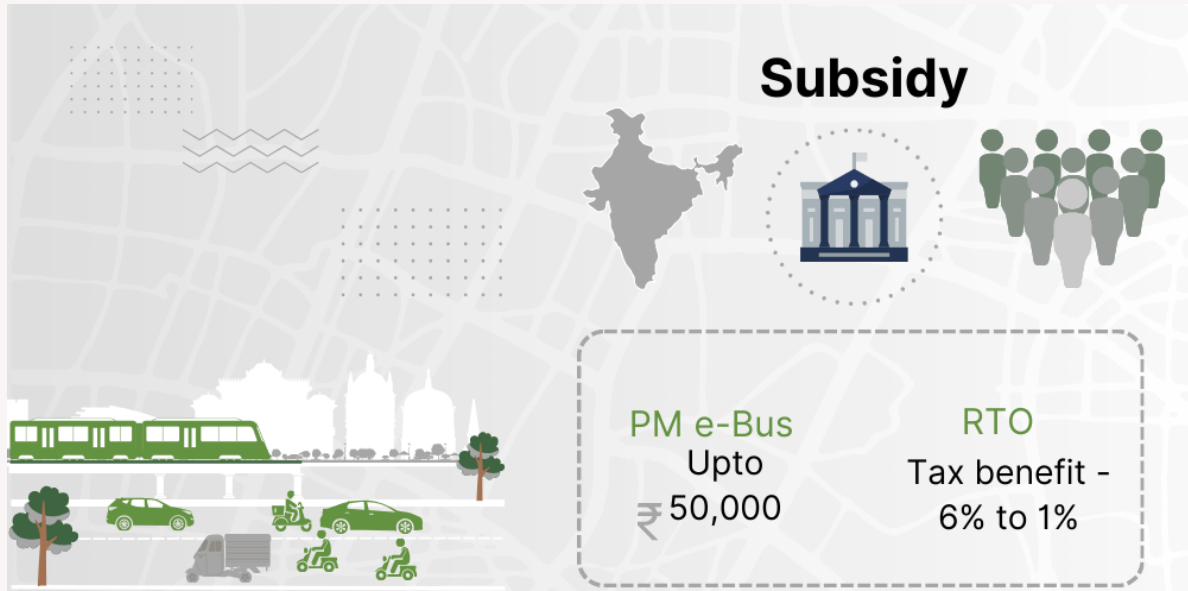
- Initial cost,
- lack of charging stations,
- battery life,
- vehicle performance,
- govt support,
- after sales service
- other, please mention_____

6.Would you participate in a pilot program for E-Autos if given incentives? Yes/ No

7.Would you prefer E-auto on rent/lease? Yes/ No

8.Would passenger preference influence your decision to shift to an E-Auto? Yes/ No

Annexure B: Financial Benefit Assessment Dissemination



Subsidy

PM e-Bus	RTO
Upto ₹ 50,000	Tax benefit - 6% to 1%

Electric Passenger 3W

Electric Auto

	Mahindra Electric	Bajaj	Atul Auto Limited
Model Name:	Treo	RE E-TEC 9.0	E Mobili²
Top Speed (kmph):	55 km/h	45 km/h	45 km/h
Approximate Range on a Single Charge (km):	130 km	178 km	220 km
Battery Capacity (kWh):	7.37 kWh	8.9 kWh	13.2 kWh

Passenger 3W Purchase Information

"Electric cars seem a bit expensive when you buy them...!"

	CNG Auto	Electric Auto
Basic price of rickshaw (with battery + charger)	2,17,500	3,93,000
G.S.T	+ 39,000 (28%)	
P.M e-Drive Subsidy (By Government of India)	Not eligible for subsidy	– 25,000
Price of rickshaw with subsidy (Ex-showroom)	2,56,600	3,68,000
Other Price (Insurance registration cost, meter cost number plate cost)	+ 14,150	+ 24,800
S.M.C Tax	+ 3,700	+ 6,900
On road price (Within 6 months of purchasing the rickshaw)	2,74,000	4,01,000
Gujarat Government Subsidy	Not eligible for subsidy	
Rickshaw price after subsidy	**2,74,000**	**4,01,000**

Monthly cost of running a passenger 3W

"But I have saved Rs 6000 - 6500 every month due to daily usage...!"

	CNG Auto	Electric Auto
EMI (for 5 years)	7,000-8,000	8,000 - 10,000
CNG/Electricity Cost	8,000-9,000	3,000 - 3,500
Maintenance and Repair Cost	1,800 - 2,000	500 - 700
Operational & Maintenance Cost	16,000 - 18,000	
Monthly Income	5,000 - 7,000	11,000 - 13,000

Cost per kilometer for 10 years (TCO)

Compared to CNG Auto Electric Auto is,

30-40% cheaper

If we drive a CNG auto and an electric auto 100 kilometers per day for 10 years and do all the calculations (like EMI, maintenance and repair costs, Battery replacement costs, CNG gas or charging costs), then CNG auto costs **Rs 6.5** per kilometer while electric auto costs **Rs 4** per kilometer.

Annexure C: Assumptions for TCO

Components with Assumptions	E-3W	CNG 3W
Down Payment	15%	15%
Loan	85%	85%
Expected Rate of Return on investment	12%	12%
Interest Rate for loan repayment	12%	12%
Borrowed fund to Paid in years	5.00	5.00
Insurance Cost (assumption 10% increase in cost every year)	₹ 12,898	₹ 8,590
Fuel	₹ 5 (Electricity cost/unit) Assumption: Increase in price by 3% each year	₹ 82.67 (CNG rate April 2025) Assumption: Increase in price by 7.5% each year
Daily Operational km (source: auto driver survey)	110	110
Working days (in a year)	365	365
Auto Maintenance/month	₹600 (source- vehicle manufacturer) Assumption: 1% increase in cost every year	₹1800 (source: auto driver survey) Assumption: 5% increase in cost every year
Tyre Cost (source- vehicle manufacturer) 5% increase in cost every year	₹6000	₹6000
Permit Cost (source- Surat RTO)	0	₹350 (every five years)
Fitness Certificate Cost (source- Surat RTO)	0	₹600 (every two years)
Pollution Under Control (PUC) cost (source- Surat RTO)	-	₹120 (yearly)
Battery Replacement Cost (E-auto)	₹67,100 Assumption: Battery replaced every 5 years with 3% increase in cost	-
Charger cost (source- vehicle manufacturer)	₹7,100	-

The Ministry of Heavy Industries (MHI), Government of India and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH are jointly implementing the Indo-German Development Cooperation project “Promotion of transformation to sustainable and climate-friendly E-mobility”, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). As part of the Green Urban Mobility Partnership (GUMP) between India and Germany, the project aims to improve the conditions for coupling the transport and energy sectors for climate-friendly electric mobility and achieve sustainable, socially balanced, and inclusive urbanisation (SDG 11). The project works with Surat (Gujarat) to promote systematic, safe, and sustainable adoption of electric mobility solutions to reduce the emission intensity of the transport sector.