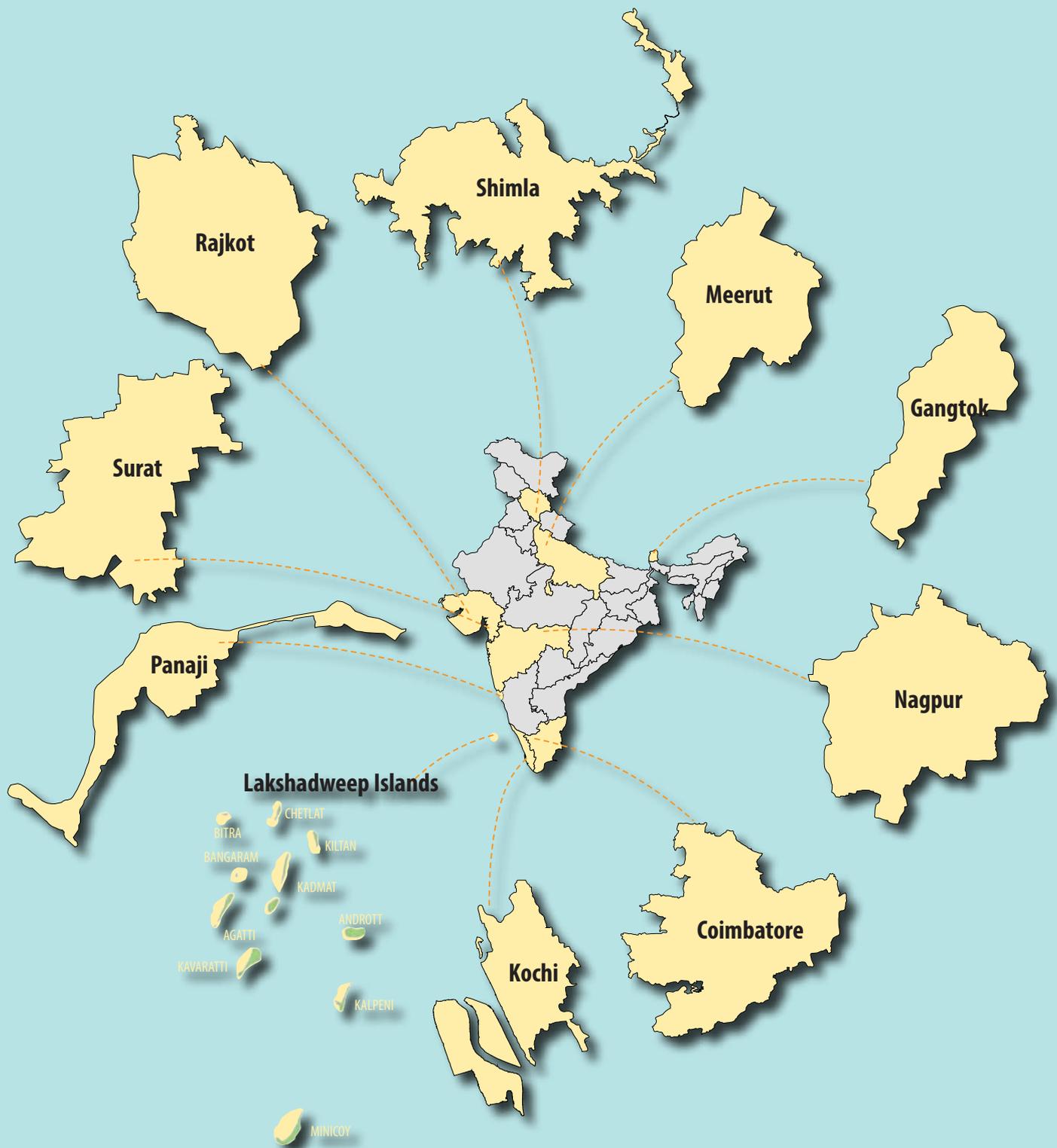


# Handbook - Planning Approach to Mainstream E-Mobility Adoption in Indian Cities





### **Acknowledgement**

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### **Disclaimer**

This document includes preliminary recommendations and way forward, based on the interactions, fieldwork and background research conducted in the ten cities/island and may require detailing as per the dedicated studies

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# Executive Summary

Deteriorating air quality in cities has become a major factor that impacts the quality of life in cities. As per the World Air Quality Report 2021, 63 Indian cities were placed among the 100 Most Polluted World Cities. The poor air quality can be attributed to various factors along with a high motorisation rate of Internal Combustion Engine (ICE)-based vehicles. In this context, electric mobility with zero tailpipe emissions provides a timely opportunity to make a transition away from ICE-based mobility that is impacting the health of urban citizens and is contributing to global warming. The Government of India is also highlighting electrification and modal shift as two important focus areas to help reduce emissions from the transport sector.

E-mobility can encourage cities to focus on the issues of accessibility, safety, age and gender responsiveness, affordability, and sustainability. It provides scope for integration of transport and mobility plans into comprehensive urban and territorial plans and the promotion of a wide range of transport and for the mobility options that enables people to have meaningful participation in social and economic activities in cities. Electrification of public transport (buses), shared mobility and urban freight could lead to rapid emissions reductions as “these vehicles tend to represent a major share of the vehicles kilometres travelled”.

While the national and state governments have taken various actions to accelerate the adoption of electric vehicles (EVs) in the country, Indian cities have largely been missing in the action with regard to their role in promoting e-mobility in the country. To achieve any realistic transition towards e-mobility, cities need to play important roles. Local governments have a significant role to play in the deployment of charging infrastructure. Through the adoption of charging infrastructure mandates in building byelaws, they can ensure that new private parking spaces are EV ready. However, there are technical, infrastructural, market and policy-related barriers in the adoption of electric mobility.

ICLEI South Asia involved local governments and other stakeholders for developing a comprehensive understanding of the existing status of EV ecosystems, infrastructure availability, readiness, governance, and institutional capacity at the national, state and city government levels under the initiative to “Support Indian Cities in Taking Leadership on Electric Vehicles (EV)”. The initiative aims to help the cities identify priority interventions and take necessary steps towards an accelerated transition to e-mobility. This included several interactions and discussions with stakeholders in 10 project cities - Coimbatore, Gangtok, Kochi, Lakshadweep, Meerut, Nagpur, Panaji, Rajkot, Shimla and Surat. These stakeholders including advisory groups, industry experts including the advocacy group, charging infrastructure developers, vehicle technology/OEMs and financial institutions were consulted between May and September 2022, on developing the way forward for electrification at the city level. The deliberations and interactions were used to prepare detailed city-specific information notes that can guide the way forward for various stakeholders in individual cities.

The current report is a synthesis of the city information notes and summarises the findings of the project to make it more relevant for other cities to take timely actions to mainstream e-mobility. The cities engagement approach in the report can be used to formulate city-level roadmaps to identify strategic actions for e-mobility. The reports also details several approaches for cities to achieve faster results. These include:

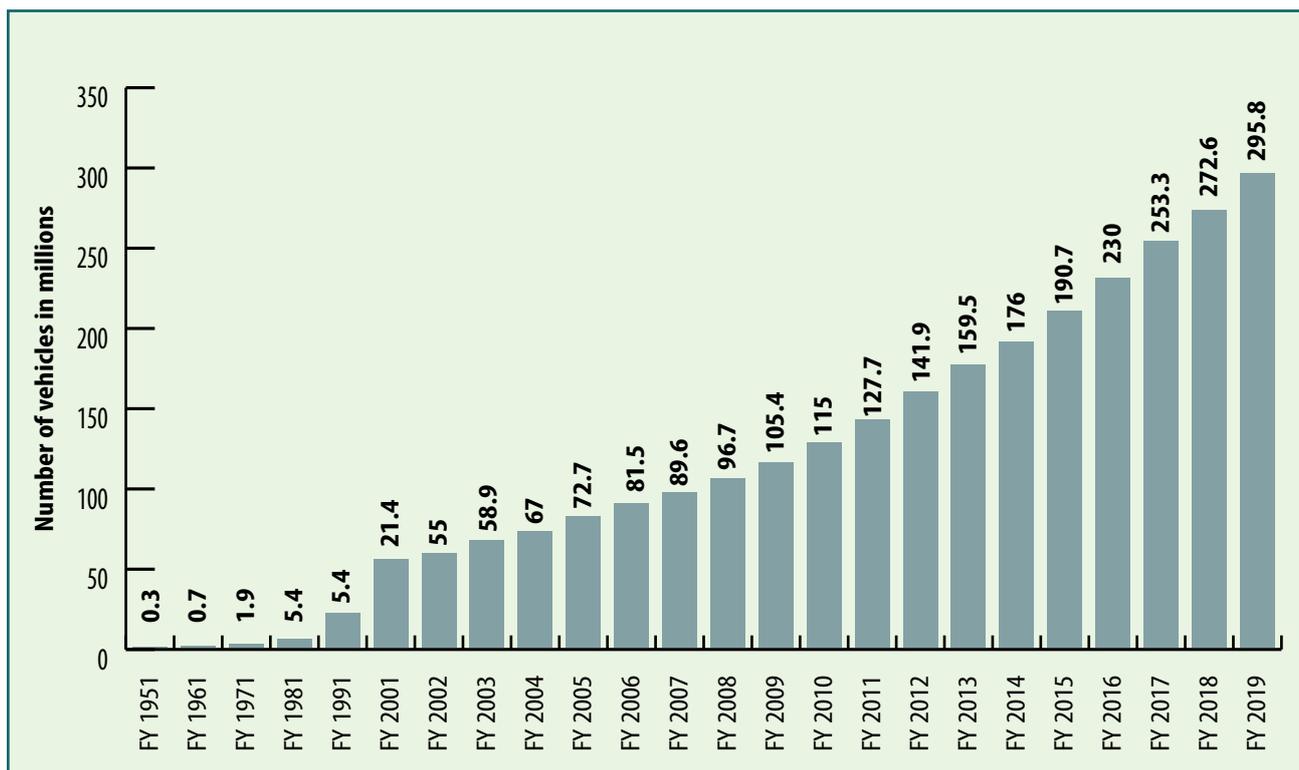
- Priority fleets, conversion into EVs and deploying electric vehicle supply equipment (EVSE)
- Expanding EVSE infrastructure
- Electrification of urban freight sector
- Incentivizing individuals to purchase EVs
- Balancing the new electricity demand on the grid both spatially and temporally
- Design standards for existing buildings for EV integrations
- Retrofits for existing buildings

# 1. The Case for Electric Mobility in Indian Cities

## 1.1. Indian cities are dealing with issues related to air pollution

The deteriorating air quality in cities has become a major factor impacting the quality of life. As per the World Air Quality Report 2021, 63 Indian cities figured among the 100 Most Polluted World Cities. The poor air quality can be attributed to various factors, along with a high motorisation rate of Internal Combustion Engine (ICE)-based vehicles that are one of the major sources of airborne pollutants and are a major public health risk.

A 2016 study by the Indian Institute of Technology Kanpur on the sources of air pollutants in Delhi revealed that the transport sector is the second-largest contributor in winter, and is responsible for 19.67% and 25.14% of PM10 and PM2.5 pollutants respectively. ICE-powered vehicles emit greenhouse gases (GHG) and saturate the air with toxic pollutants such as nitrogen oxides, sulphur oxides, particles, carbon monoxide and hydrocarbons. As per a report of the World Health Organisation released in 2018, this mix of harmful pollutants is directly responsible for acute and chronic illnesses, including strokes, heart disease, lung cancer, chronic obstructive pulmonary diseases, diabetes, high blood pressure, and respiratory infections. The graph below illustrates rapid increase in operational vehicles in India over seven decades.



**Figure 1: Trend of vehicles registered in India (1951-2019)**

In this context, EVs with zero tailpipe emissions support a transition from ICE-based vehicles that produce direct emissions, which impact people's health and contribute to global warming. The Intergovernmental Panel on Climate Change (IPCC) recognises electrification of short-distance vehicles as a powerful means for reducing emissions. The strong increase of renewable energy sources in electricity generation, observed over the past decade and expected to grow further, maximises the climate benefits of electric mobility.

## 1.2. E-Mobility as a tool for a paradigm shift towards sustainable Urban Mobility

ICLEI's Eco-Mobility and EcoLogistics programmes on sustainable mobility, influencing 45 million+ people around the world, advocates a people-centred approach to mobility planning and decision making. E-mobility allows cities to redesign mobility with a focus on accessibility, safety, age and gender responsiveness, affordability, and sustainability. It also provides scope for integration of transport and mobility plans into comprehensive urban and territorial plans and the promotion of a wide range of transport and mobility options, which would enable citizens to participate meaningfully in social and economic activities in cities.

		
<p>Integrated electric mobility in the context of improved urban planning and “Avoid-Shift-Improve” framework</p>	<p>Segment that <b>prioritises people, shared mobility and public transport</b> over private cars</p>	<p><b>Integrated transport policy</b> approach seeking synergies between urban planning and e-mobility</p>
		
<p><b>Multi-stakeholder engagement</b> strengthens public-private partnerships</p>	<p>Promotes <b>equity and inclusion</b> in the deployment of electric mobility</p>	<p><b>Increased share of renewable energy</b> for powering e-mobility</p>

## 1.3. E-Mobility and Sustainable Development Goals (SDGs)

Additionally, if planned carefully, e-mobility can help India in achieving various SDG's as listed below:

<p>TARGET 3-9</p>		<p>By tackling air pollution and related health effects</p>	<p>TARGET 7-2</p>		<p>Transition towards renewable energy powered e-mobility can assist in increasing the share of renewables in the energy mix</p>		
<p>TARGET 8-3</p>		<p>The EV ecosystem shall assist in job creation, entrepreneurship, and formalisation and growth of micro, small and medium-sized enterprises</p>	<p>TARGET 9-2</p>		<p>TARGET 9-3</p>		<p>Promotion of sustainable and inclusive industrialisation for EV's</p>
<p>TARGET 11-2</p>		<p>Providing access to safe, affordable, accessible and sustainable transport systems by mainstreaming e-mobility across all vehicular segments, including buses, for emission-free public transport</p>	<p>TARGET 12-2</p>		<p>TARGET 12-5</p>		<p>Battery recycling policies and efficient resource management for EVs</p>

## 2. Existing Status Related to E-Mobility

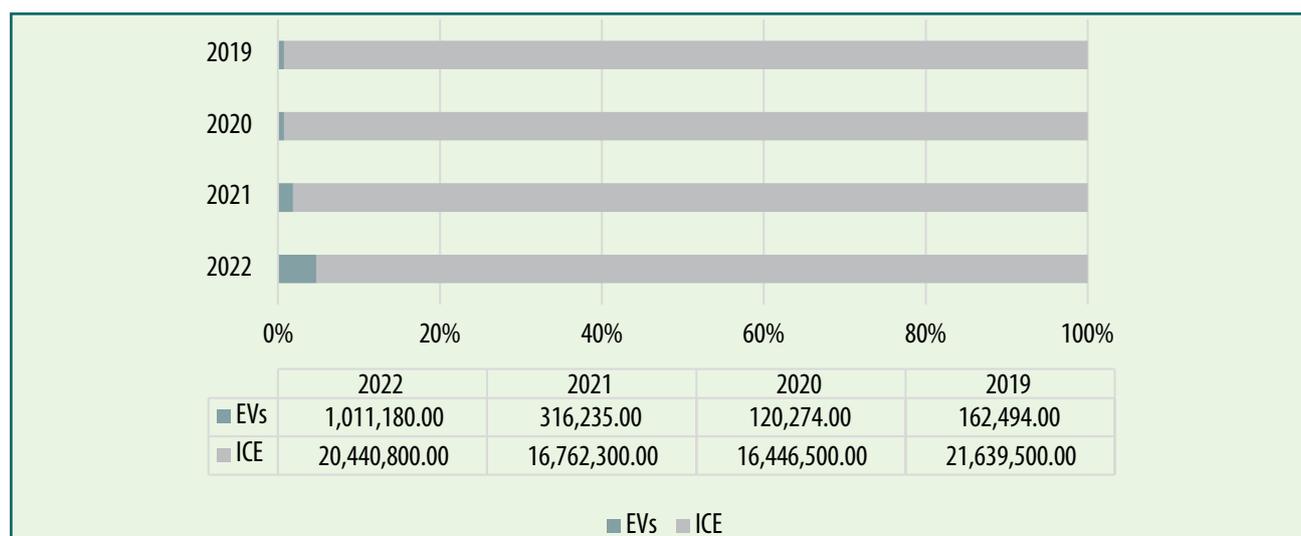
### 2.1. National Government is acting swiftly for initial demand creation

Government of India has taken several initiatives to mainstream electric mobility in the past few years. An ambitious target of at least 30% of total vehicle sales to be electric by 2030 in the country has been set. To achieve it, several central ministries and departments have been involved in supporting the electric mobility transition, including the Ministry of Road Transport and Highways (MORTH), Department of Heavy Industry (DHI), Department of Industrial Policy and Promotion, Ministry of Finance, Ministry of Housing and Urban Affairs, Ministry of Power, Ministry of New and Renewable Energy, Department of Science and Technology and the NITI Aayog.

In the recent past, the Union Cabinet approved the National Mission on Transformative Mobility and Battery Storage that aims at the creation of a Phased Manufacturing Programme (PMP) to support the setting up of large-scale, export-competitive integrated batteries and cell-manufacturing plants in India, as well as localizing production across the entire EV value chain. Additionally, the Government of India second phase of the national scheme for Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME II), providing incentives for public and shared electric mobility modes. In 2022 the Union Cabinet announced the Production-Linked Incentive (PLI) Scheme in the Automobile and Auto Components sectors. The PLI scheme (with an outlay of \$ 3.5 billion) for the automobile sector proposes financial incentives of up to 18% to boost domestic manufacturing of advanced automotive technology products and to attract investments in the automotive manufacturing value chain for a period of five consecutive years.

### 2.2. The stage for EV mass-market adoption is almost set

The use of EVs is rising in India, especially in urban areas. Analysis of EV sales data from VAHAN Dashboard shows that the share of EVs in newly registered vehicles has increased from 0.75 % in 2019 to 4.75% in 2022.



**Figure 2: Share of EVs registered from 2019 to 2022**

Additionally, substantial technological progress has increased the mass-market compatibility of EVs and charging infrastructure has been expanding. This is coupled with governments tightening regulations and offering incentives to foster greater EV adoption. However, despite the potential benefits of e-mobility, EVs make up less than 0.5 % of the total registered fleet of 331 million. Irrespective of the decline in EV

costs, accelerating the transition to e-mobility at scale will require robust fiscal, regulatory and infrastructure policy frameworks that engage all relevant stakeholders in the development of an EV ecosystem, especially the city government.

## 2.3. Need for long-term sustainability of initial surge in EV demand – Focus on ecosystem is missing

Electric mobility offers huge potential for sustainable urban mobility planning, but only if it is embedded in a wider strategy. Looking at the big picture, it becomes clear that in many cases low-tech solutions – like walking and cycling – are smarter for urban mobility than a pure focus on technology applications. There is still scope for greater action on this front. The SDGs can be integrated in EV promotions, providing principles that push for city-level policy. E-mobility also needs to be integrated in ASI framework for sustainable mobility. In this regard, the electrification of public transport (buses), shared mobility and urban freight could provide rapid emissions reductions as “these vehicles tend to represent a major share of the vehicles kilometres travelled”.

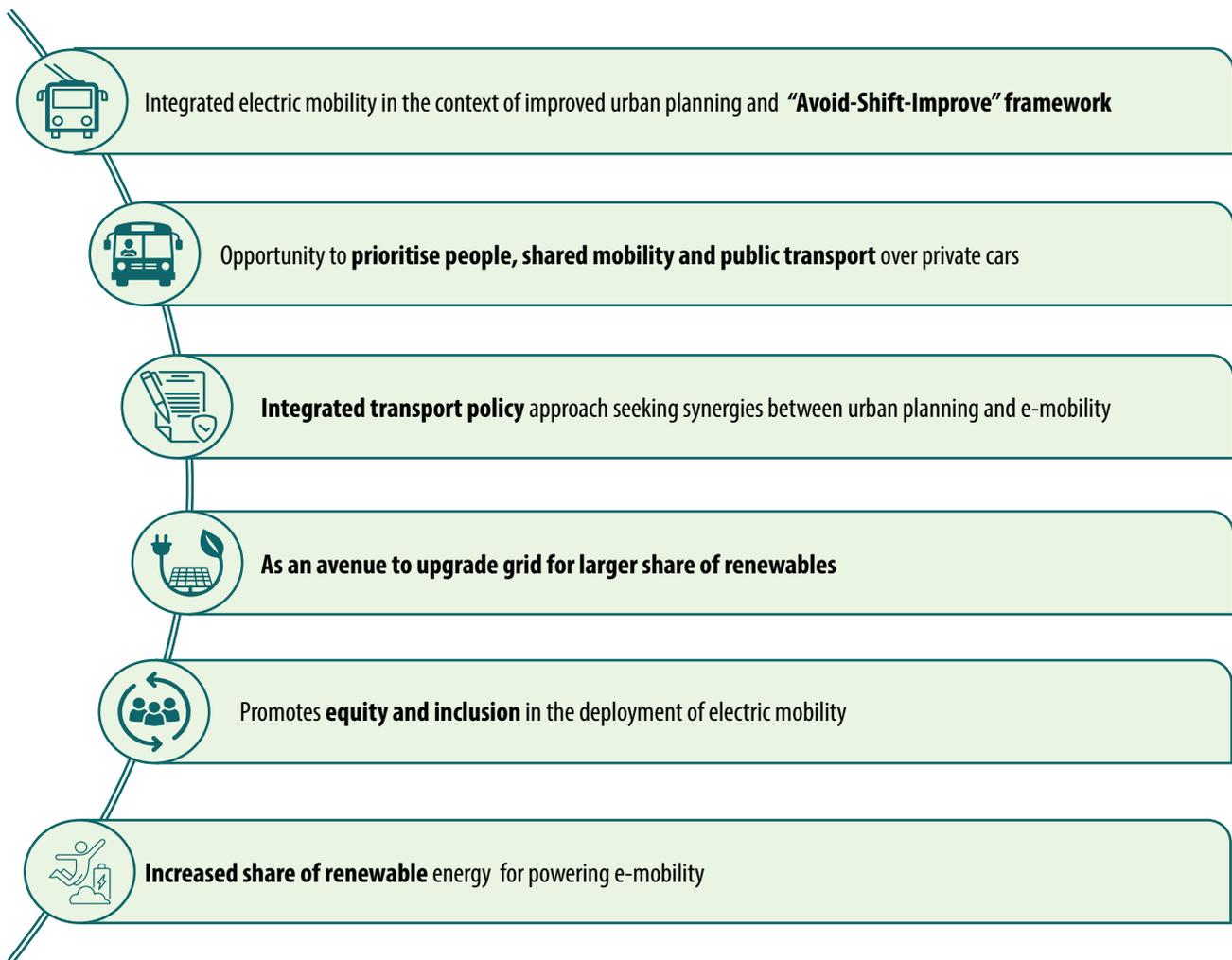


Figure 3: EV adoption potential in sustainable mobility

## 2.4. Cities are crucial for sustainable electrification of mobility

As evident from figure 4, there is a visible increase in EV adoption across categories in cities. However, to achieve major long-term sustainability and an EV shift target of more than 30 % of vehicles, the city’s EV readiness and involvement are pre-requisites. Currently, a city-level focus on long-term sustainability is missing. Moreover, the roadmap for integration of a larger number of EVs into city mobility is crucial for integrating a high density of charging stations into mobility/ parking plans/city infrastructure plans.



Figure 4: EV Adoption across cities

## 2.5. Cities are missing in electrification of mobility

While the national and state governments have taken various actions to accelerate the adoption of EVs in the country, Indian cities have largely been missing in the action with regards promoting electric mobility in the country. Local governments have a significant role to play in the deployment of charging infrastructure and through the adoption of charging infrastructure mandates in building byelaws, they can ensure that new private parking spaces are EV-ready. As the primary landowner in the city, local governments can leverage this land to provide curb-side charging facilities and EV- ready public parking lots. As EVs owner and operator of various kinds of fleets (such as e-buses and refuse collection vehicles) they can meet a substantial part of the demand for a variety of EVs.

The limited participation of ULB's can be attributed to a lack of capacity and extensive experience related to electric mobility at present. As there are technical, infrastructural, market, and policy-related barriers in the adoption of electric mobility, it is important to identify them along with specific gaps and opportunities at the urban level.



## 3. Supporting Indian Cities to Take Leadership on Electric Mobility

ICLEI South Asia involved city governments as well as other stakeholders to develop a comprehensive understanding about the existing status of EV ecosystems, infrastructure availability, governance, and institutional capacity at the national, state and city government levels. As long-term actions are required for mass adoption of e-mobility in Indian cities, ICLEI South Asia launched an initiative to “Support Indian Cities in Taking Leadership on Electric Vehicles (EV)” to aid the cities to identify priority interventions and take necessary steps towards an accelerated transition to EVs.

This initiative included several interactions and discussions with stakeholders in 10 project cities - Coimbatore, Gangtok, Kochi, Lakshadweep, Meerut, Nagpur, Panaji, Rajkot, Shimla and Surat. Consultations were held with the major stakeholders impacting EV transition in cities, such as advisory groups, industry experts including the advocacy group, charging infrastructure developers, vehicle technology/OEMs and financial institutions. The ICLEI South Asia team visited the 10 cities between May to September 2022 to interact with the stakeholders and understand the existing EV transition situation in the cities, challenges, opportunities and to suggest the way forward.

### 3.1. Assessment of existing situation in cities

#### 3.1.1. Methodology

##### Part A: Secondary Research and Consultation

- Assessment of e-mobility ecosystem
- Stakeholder mapping and interaction
- Identification of key barriers and opportunities related to e-mobility

##### Part B: Cities Engagement and Visit

- Formulation of cities engagement framework
- Assessment based on interaction with stakeholder in cities
- Validation in 10 Indian cities

#### 3.1.2. Secondary research and consultation

The existing status of EV adoption in cities was analysed through secondary study and was discussed with representatives from the Shakti Sustainable Energy Foundation (SSEF). The team reviewed and documented major publications related to EVs to understand the available information related to the role of cities. It was followed by analysis of the state-level EV-related policies across the country. The process includes review of approved the final EV policy of 27 states (Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand, West Bengal, excluding Chhattisgarh where the Industrial policy (2019-24) mentions about EV manufacturing incentives, draft EV policies of four states (Bihar, Chandigarh, Goa, Punjab) and the efforts of three states that are in the process of developing draft state-level EV policies (Himachal Pradesh has proposed to develop its EV Policy as of July 2021, and Jharkhand has given the nod to the Jharkhand Industrial and Investment Promotion Policy 2021 (Aug 2021)). The major parameters considered included analysis of the regulatory ecosystem, policy framework, stakeholders, infrastructure, financial availability, and the existing fleet of EVs in cities (refer annexure 1). The barriers and gaps are also analysed with regard to the financial, technical, infrastructural and policy status for electric buses, electric four-wheeleders, electric three-wheeleders and electric two-wheeleders.

Table 1: Assessment of State-level EV policies

Parameter	GNCTD	Andhra Pradesh	UP	Maharashtra	Uttarakhand	Karnataka	Madhya Pradesh	Kerala	Tamil Nadu	Bihar	Punjab	Telangana	Orissa	Gujarat	Meghalaya	Rajasthan	Assam	Bihar	Chandigarh	Goa	Haryana	West Bengal
<b>Institutional Mechanism and Target</b>																						
EV target	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓		✓	✓		✓	✓	✓
Institutional setup	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓			✓					✓
Model EM cities		✓	✓	✓																		✓
<b>Policy Mandates</b>																						
EV adoption mandate to institutions		✓		✓								✓										
Plan for induction of EVs in government department	✓	✓		✓			✓				✓	✓			✓		✓					
Mandate for Discoms	✓	✓	✓	✓		✓	✓	✓	✓		✓											
Mandate for Transport Department		✓				✓						✓										
<b>Demand Incentives</b>																						
Fiscal Incentives -2 W	✓		✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fiscal Incentives -3 W (e-auto, e-rickshaw and e-cart)	✓		✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fiscal Incentives -4 W	✓		✓	✓			✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Fiscal Incentives -2W fleet/ 4 W (Fleets)		✓		✓			✓		✓		✓							✓				
Fiscal Incentives - Bus				✓			✓		✓	✓	✓				✓			✓		✓	✓	
Fiscal Incentives - Goods carrier	✓				✓		✓		✓		✓									✓		
<b>EV Charging infrastructure</b>																						
Incentive for public charging deployment	✓		✓	✓			✓		✓		✓	✓	✓	✓	✓		✓					✓
Incentive for Energy Operator/Battery Swapping station	✓		✓			✓	✓			✓	✓	✓			✓		✓	✓				
Incentive for Home/ Workplace charging	✓		✓				✓					✓			✓		✓			✓		
Manufacturing						✓																
Incentive to manufacturer		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	
Provision for Industrial Parks and Clusters for EV/ Ancillary manufacturing		✓	✓			✓		✓	✓	✓	✓	✓	✓	✓				✓			✓	
Battery OEM			✓	✓	✓	✓	✓	✓	✓	✓	✓			✓								
<b>Scrapping and recycling</b>																						
Vehicle scrapping incentive	✓			✓			✓				✓							✓				
Battery recycling related provision	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		✓		✓					

Parameter	GNCTD	Andhra Pradesh	UP	Maharashtra	Uttarakhand	Karnataka	Madhya Pradesh	Kerala	Tamil Nadu	Bihar	Punjab	Telangana	Orissa	Gujarat	Meghalaya	Rajasthan	Assam	Bihar	Chandigarh	Goa	Haryana	West Bengal
<b>Miscellaneous</b>																						
Payment system and information exchange	✓	✓					✓	✓														
Identification of source of funding for various incentives declared in policy	✓			✓			✓								✓							✓
Skill Development/ Job creation, capacity building	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓						✓	✓
R&D	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓					✓				✓
Public awareness	✓						✓				✓											
Changes in building bye-laws	✓	✓	✓	✓		✓	✓					✓									✓	

### 3.1.3. Consultation with sectoral experts

A two-hour long online consultation was held to develop a comprehensive understanding of the existing EV ecosystem, infrastructure availability, governance and institutional capacity at the city government level. The various aspects that were discussed included:



**Policy and Regulations**



**Financial Ecosystem**



**Charging Infrastructure**



**Vehicles / OEM's**

Forty-one representatives from over 25 organisations working to promote electric mobility; government representatives, policy advocacy group/think tanks/not-profit companies, charging infrastructure development firms, Original Equipment Manufacturers (OEMs) and financing institutions were part of online consultation.

**41**

**Participants**

**25**

**Organisations represented in deliberations**

**4**

**Thematic areas related to EV ecosystem**

## 3.2. Engagement with cities

### 3.2.1. Assessment cities finalisation

Based on initial assessment of the state-level EV policy discussion with sectoral experts and NITI Ayog followed by an analysis, the project team developed a scientific approach for the selection of 10 Indian cities for rapid assessment. It was ensured that all the zones were represented as well as cities of various sizes and economic features.

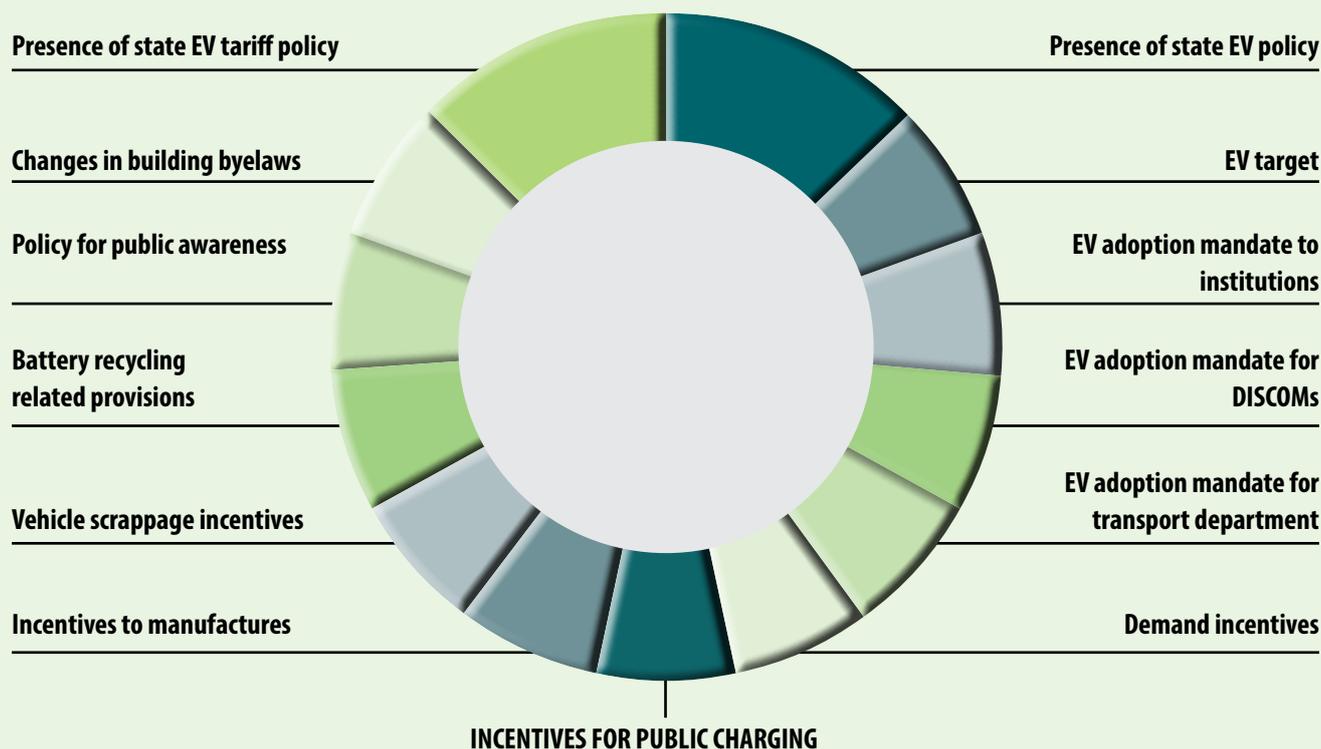


Table 2 showcases the detailed scoring that formed the basis for selection. The final list of identified cities includes:

**Table 2: City scores**

City	State	Presence of State EV Policy	Presence of State EV Tariff Policy	EV Target	EV adoption mandate to institutions	Plan for induction of EVs in government department	EV Mandate for Discom	Mandate for Transport Department	Demand Incentives	Incentive for public charging deployment	Incentive to manufacturer	Vehicle scrappage incentive	Battery recycling related provision	Policy for Public awareness	Changes in building bye-laws	Total Score
Ahmedabad	Gujarat	20	20	2	5	2	2	2	5	0	5	0	0	0	0	63
Bangalore	Karnataka	20	20	0	2	2	0	2	5	0	5	0	0	0	5	61
Bhopal	Madhya Pradesh	20	0	0	0	0	0	0	5	0	0	0	0	0	0	25
Bhubaneswar	Odisha	20	0	2	0	2	0	0	5	0	0	0	0	0	0	29
Chennai	Tamil Nadu	20	10	0	0	0	0	0	5	0	5	0	0	0	0	40

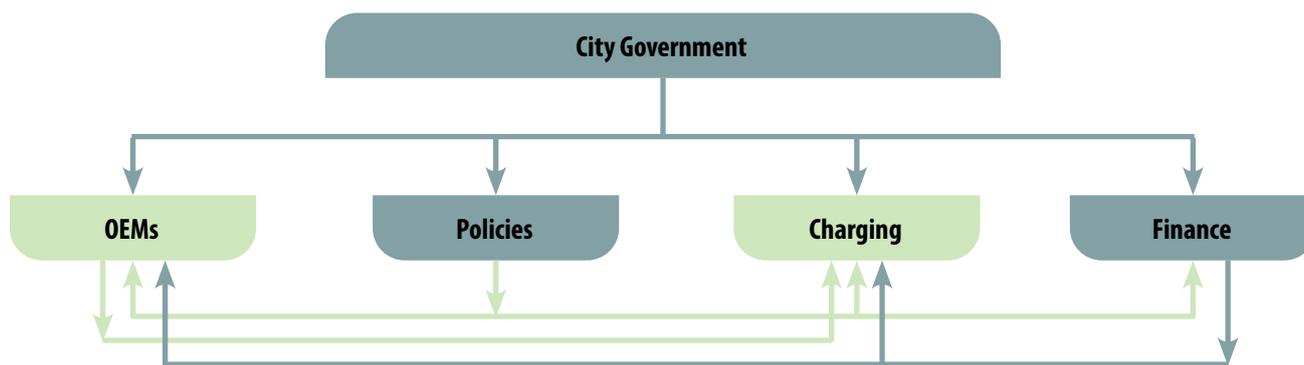
City	State	Presence of State EV Policy	Presence of State EV Tariff Policy	EV Target	EV adoption mandate to institutions	Plan for induction of EVs in government department	EV Mandate for Discom	Mandate for Transport Department	Demand Incentives	Incentive for public charging deployment	Incentive to manufacturer	Vehicle scrappage incentive	Battery recycling related provision	Policy for Public awareness	Changes in building bye-laws	Total Score
Coimbatore	Tamil Nadu	20	10	0	0	0	0	0	5	0	5	0	0	0	0	40
Dehradun	Uttarakhand	10	10	0	0	0	0	0	5	0	5	0	0	0	0	30
Delhi	Delhi	20	20	5	5	5	5	5	5	5	0	0	0	5	2	82
Gangtok	Sikkim	20	0	0	0	2	0	0	2	0	5	0	0	0	0	29
Gurgaon	Haryana	20	20	2	5	2	0	2	5	0	5	0	0	0	2	63
Guwahati	Assam	10	0	0	0	0	0	0	2	0	0	0	0	0	0	12
Hubli and Dharwad	Karnataka	20	20	0	2	0	0	0	5	0	5	0	0	0	0	52
Hyderabad	Telangana	20	10	2	0	0	0	0	5	0	5	0	0	0	0	42
Indore	Madhya Pradesh	20	0	0	0	0	0	0	5	0	0	0	0	0	0	25
Jabalpur	Madhya Pradesh	20	0	0	0	0	0	0	5	0	0	0	0	0	0	25
Jaipur	Rajasthan	20	20	2	0	0	0	0	5	0	0	0	0	0	0	47
Kochi	Kerala	20	20	5	2	2	2	2	5	0	5	0	0	0	0	63
Kolkata	West Bengal	20	0	0	0	0	0	0	5	0	5	0	0	0	0	30
Lucknow	Uttar Pradesh	20	10	0	0	0	0	0	5	0	5	0	0	0	0	40
Meerut	Uttar Pradesh	20	10	0	0	0	0	0	5	0	5	0	0	0	0	40
Mumbai	Maharashtra	20	20	5	2	5	2	5	5	2	5	5	0	0	0	76
Nagpur	Maharashtra	20	20	5	2	5	2	2	5	2	5	5	0	0	0	73
Nashik	Maharashtra	20	20	5	2	2	2	2	5	5	5	5	0	0	2	75
Navi Mumbai	Maharashtra	20	20	5	2	5	2	2	5	2	5	5	0	0	0	73
Panaji	Goa	20	10	5	2	2	0	2	5	2	5	0	0	0	0	53
Patna	Bihar	10	0	0	0	0	0	0	5	0	2	0	0	0	0	17
Pune	Maharashtra	20	20	5	2	5	2	2	5	2	5	5	0	0	0	73
Rajkot	Gujarat	20	20	2	5	2	2	2	5	0	5	0	0	0	0	63
Shimla	Himachal Pradesh	10	10	0	0	0	0	2	5	0	0	0	0	0	0	27
Surat	Gujarat	20	20	2	5	2	2	2	5	0	5	0	0	0	0	63

### 3.2.2. Stakeholder Mapping

Based on the process explained earlier, the cities listed below were shortlisted for final engagement

North	South	West	Central and South West	North East	Union Territory
Shimla	Coimbatore	Surat	Nagpur	Gangtok	Lakshadweep
Meerut	Kochi	Rajkot	Panaji		

It was followed by identification of various stakeholders and their roles, who need to be engaged for making a transition towards sustainable e-mobility in cities.



The project team identified priority stakeholders to document views and perceptions about the level of readiness, gaps and barriers at the city level, which was followed by compilation and analysis of the information and formulation of the approach for engagement of cities on the EV transition.

### National Level

NITI Ayog	MoHUA	MoRTH	CESL
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### City/Island Level

City	Stakeholders consulted
Coimbatore	<ul style="list-style-type: none"> <li>Coimbatore City Municipal Corporation (CMC)</li> <li>Tamil Nadu State Road Transport Corporation (TNSRTC)</li> <li>Local Planning Authority (LPA)</li> <li>Tamil Nadu Electricity Board (TNEB)</li> <li>OEMS and dealers</li> <li>Regional Transport Office, Coimbatore (RTO)</li> <li>Traffic Police</li> </ul>
Gangtok	<ul style="list-style-type: none"> <li>Gangtok Municipal Corporation (GMC)</li> <li>Sikkim Nationalised Transport (SNT)</li> <li>Urban Development and Housing Department, Sikkim (UDHD)</li> <li>Power Department, Sikkim</li> <li>OEMS and dealers</li> <li>RTO, Gangtok</li> </ul>
Kochi	<ul style="list-style-type: none"> <li>Kochi Municipal Corporation (KMC)</li> <li>Kochi Metropolitan Transport Authority (KMTA)</li> <li>The Department of Town and Country Planning LSGD</li> <li>Kerala State Electricity Board Limited (KSEBL)</li> <li>Cochin Smart Mission Limited (CSML)</li> <li>Kochi Metropolitan Transport Authority (KMTA)</li> <li>Regional Transport Officer (RTO)</li> <li>OEMS and dealers</li> <li>Kochi Metro Rail Limited (KMRL)</li> <li>Ernakulam Jilla Auto-Rickshaw Drivers' Co-Operative Society</li> <li>Kleen Smart bus Limited (KSBL)</li> <li>Agency for New and Renewable Energy Research and Technology (ANERT)</li> </ul>

City	Stakeholders consulted
Lakshadweep	<ul style="list-style-type: none"> <li>● Lakshadweep Development Corporation Limited (LDCL)</li> <li>● Smart City Limited, Kavaratti, Lakshadweep</li> <li>● Transport Department, Kavaratti, Lakshadweep</li> <li>● Electricity Department Kavaratti</li> <li>● Power Department, Lakshadweep</li> <li>● Urban Development and Town Planning Department Lakshadweep</li> </ul>
Meerut	<ul style="list-style-type: none"> <li>● Meerut Municipal Corporation (MMC)</li> <li>● Uttar Pradesh State Road Transport Corporation (UPSRTC)</li> <li>● Meerut Development Authority (MDA)</li> <li>● Pashchimanchal Vidyut Vitran Nigam Ltd. Meerut (PVVNL)</li> <li>● OEMS and dealers</li> <li>● Meerut Citizen forum</li> <li>● RTO</li> </ul>
Nagpur	<ul style="list-style-type: none"> <li>● Nagpur Municipal Corporation (NMC)</li> <li>● Nagpur Mahanagar Parivahan Limited (NMPL)</li> <li>● Town Planning Department, NMC</li> <li>● Maharashtra State Electricity Distribution Company Limited (MSEDCL)</li> <li>● OEMS and dealers</li> <li>● RTO</li> <li>● The Confederation of Real Estate Developers' Associations of India (CREDAI)</li> <li>● Maharashtra Metro Rail Corporation Limited (MMRCL)</li> <li>● Nagpur Improvement Trust (NIT)</li> <li>● Nagpur Smart and Sustainable City Development Corporation Ltd (NSSCDCL)</li> </ul>
Panaji	<ul style="list-style-type: none"> <li>● Corporation of the city of Panaji (CCP)</li> <li>● Kadamba Transport Corporation (KTC)</li> <li>● Town and Country Planning department, Goa</li> <li>● Goa State Electricity Board</li> <li>● OEMS and dealers</li> <li>● RTO</li> <li>● Goa Energy Development Agency (GEDA)</li> <li>● Imagine Panaji Smart City Development Limited</li> </ul>
Rajkot	<ul style="list-style-type: none"> <li>● Rajkot Municipal Corporation (RMC)</li> <li>● Rajkot Rajpath Limited (RRL)</li> <li>● Rajkot Urban Development Authority (RUDA)</li> <li>● Paschim Gujarat Vij Company Limited (PGVCL)</li> <li>● OEMs and dealers</li> <li>● RTO</li> <li>● Builders' association</li> </ul>
Shimla	<ul style="list-style-type: none"> <li>● Shimla Municipal Corporation (SMC)</li> <li>● Directorate of Transport, Himachal Pradesh</li> <li>● Himachal Pradesh Road Transport Corporation (HRTC)</li> <li>● Himachal Pradesh State Electricity Board (HPSEB)</li> <li>● Town &amp; Country Planning, Shimla, HP</li> <li>● RTO</li> </ul>
Surat	<ul style="list-style-type: none"> <li>● Surat Municipal Corporation (SMC)</li> <li>● Surat Sitalink Limited (SSL)</li> <li>● Town Planning department, SMC</li> <li>● Dakshin Gujarat Vij Company Limited (DGVCL)</li> <li>● OEMS and dealers</li> <li>● RTO</li> <li>● CREDAI</li> <li>● Southern Gujarat Chamber of Commerce &amp; Industry (SGCCI)</li> <li>● Torrent Power</li> </ul>

### 3.2.3. Framework for engagement in 10 Indian Cities

The team held extensive consultations with the national government and stakeholders. However, to maximize the impact of the interactions, the team finalised city engagement specific assessment, which shall assist to identify potential opportunities for e-mobility transition and the priority interventions required. The framework was developed on the basis of guiding principles related to clarity, readiness, awareness and responsiveness for faster adoption of e-mobility. The details of the engagement framework are presented in chapter 5.

### 3.2.4. Outcomes of city assessments

Based on cities engagement framework, the project team visited the shortlisted 10 cities and interacted with all relevant stakeholders identified for the e-mobility transition. The table below showcases the situation at the state and city levels related to policy, charging infrastructure availability, development related to financial incentives and vehicles technology.

**Table 3: Outcomes of city assessment**

City	Policy	Charging Infrastructure	Financial Incentives	Vehicle technology/OEMs
Coimbatore	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- No</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- 1 public charging station (25 PCS proposed by CCMC)</li> <li>Public transport charging depot- No (E-buses are not yet included in the fleet)</li> </ul>	State -level incentives- Yes <ul style="list-style-type: none"> <li>Charging infrastructure- Exemption from paying stamp duty, road tax and electricity charges; land and employment incentives</li> <li>PCS connection with RE at no cost</li> </ul> City-level incentives: No	<ul style="list-style-type: none"> <li>Lack of reliable and durable electric SWM vehicles</li> <li>E-2W are used for freight delivery</li> <li>Issues of charging EVs during peak hours</li> <li>Multiple cells packed together in a EV battery pack</li> </ul>
Gangtok	<ul style="list-style-type: none"> <li>State-level policy- No (under discussion)</li> <li>City-level policy- No</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- Yes (one in the premises of the Power Department of Sikkim)</li> <li>Electric bus charging - No (e-buses are not operational)</li> </ul>	State-level incentive- No <ul style="list-style-type: none"> <li>(State is working on a draft EV policy)</li> </ul> City-level incentive- No	<ul style="list-style-type: none"> <li>Range issues -An EV covers a shorter distance in Gangtok (100-110 km percharge) than on a plain terrain (about 200 km oer charge)</li> <li>Vehicle supply chain</li> </ul>
Kochi	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- No</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- No (discussions are underway for the locations of PCS)</li> <li>Public transport charging depot- Yes (1 charging depot for e-buses at Vytilla Bus Depot)</li> </ul>	State-level incentives- Yes <ul style="list-style-type: none"> <li>Charging infrastructure - 25% capital subsidy on first 300 charging stations (max. INR 10 lakhs) and first 50 swapping stations (max. INR 6 lakhs)</li> <li>EV buyer - Subsidy of INR 30000 or 25% of EV (whichever is less) for 3-wheelers</li> <li>Exemption from paying road tax (for three years), toll charges and parking fees</li> </ul> City-level incentives - No	<ul style="list-style-type: none"> <li>Absence of second-hand market for EVs</li> <li>Voltage fluctuations during peak hours while charging EVs</li> <li>Lack of end-of-life solutions for batteries</li> </ul>
Lakshadweep	<ul style="list-style-type: none"> <li>UT/State-level Policy- Yes</li> <li>Island-level Policy- No</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>City-wide public charging network- No (yet to initiate discussion for commercial vehicle charging station network; public charging stations not required for private vehicles, due to small size of islands)</li> <li>Public transport charging depot- No (buses are not operational on the islands)</li> </ul>	UT level incentive- Yes <ul style="list-style-type: none"> <li>15% subsidy for E-2Ws and E-4Ws</li> <li>50% subsidy (max. Rs. 50,000) for E-rickshaws</li> </ul> Island level incentive- No	<ul style="list-style-type: none"> <li>No service centres – E-2-Ws (250-watt electric motor) models exist, and must be sent to the mainland for repair work.</li> </ul>

City	Policy	Charging Infrastructure	Financial Incentives	Vehicle technology/OEMs
Meerut	<ul style="list-style-type: none"> <li>State-level Policy- Yes</li> <li>City-level Policy- No</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- No (discussions are underway for the locations of PCS)</li> <li>Public transport charging depot- Yes (1 charging depot for e-buses)</li> </ul>	<p>State-level - Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure - 25% subsidy on first 100 station (investment up to 6 lakhs)</li> <li>EV buyer - Exempted from paying motor vehicle tax, registration fee and road tax (100% for E-2W, 75% on other EVs)</li> </ul> <p>City-level- No</p>	<ul style="list-style-type: none"> <li>Visible missing after sales service</li> <li>High proliferation of non-registered E-rickshaws</li> <li>Safety concerns due to e-rickshaw vehicle design which overturns on collision (E-IPT)</li> </ul>
Nagpur	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- No</li> <li>Other Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- Yes</li> <li>Public transport charging depot- Yes (one charging station at the Wardhaman Nagar Bus Depot)</li> </ul>	<p>State-level – Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure - Demand incentive for setting up slow/moderate/fast charging station, single-window process for approvals</li> <li>EV buyer - financial incentive, exemption from paying motor vehicle tax; zero-emission vehicle (ZEV) credit programme, scrappage incentive, assured buyback (vehicles) and warranty incentives</li> </ul> <p>City-level -No</p>	<ul style="list-style-type: none"> <li>Shortage of EV parts</li> <li>Safety concerns due to e-rickshaw vehicle design which overturns on collision (E-IPT)</li> </ul>
Panaji	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- No</li> <li>Initiatives- Yes (Charging Infrastructure- Concessional land for charging stations)</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations (PCS)- Yes (6 PCS existing in the city, 8 locations finalised, EoI for installing more PCS underway)</li> <li>Public transport charging depot - No (E-buses not operational, two locations for bus depots identified, 36 charging points for e-bus planned)</li> </ul>	<p>State-level incentive - No (financial incentives withdrawn w.e.f 31.07.2022)</p> <p>City-level incentive- No</p>	<ul style="list-style-type: none"> <li>Vehicle design- charging locking system creates problems when mud deposits on that part of EV</li> <li>Fire safety hazard</li> </ul>
Rajkot	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- Yes (city is working on Draft EV Policy)</li> <li>Initiatives- No</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- No (absence of DC fast chargers)</li> <li>Public transport charging depot- Yes (14 chargers at the depot in Ram Nagar-12 operational and 2 on standby)</li> </ul>	<p>State-level incentive- Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure - 25% capital subsidy on first 250 commercial public stations (investment up to 10 lakhs)</li> <li>EV buyer - Subsidy as per FAME-II scheme</li> </ul> <p>City-level incentive- No</p>	<ul style="list-style-type: none"> <li>Low tolerance of high temperature</li> <li>Manufacturing and supply shortage of E-2W</li> </ul>
Shimla	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- No</li> <li>Initiatives- Yes</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- No (plans to setup public charging stations)</li> <li>Public transport charging depot- Yes (two locations for e-buses, Dhalli Workshop and Old bus stand)</li> </ul>	<p>State-level incentive- Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure- Land concession for setting up PCS</li> <li>EV buyer- Road tax exemption, toll tax exemption for the policy duration</li> <li>Separate tariff for EV charging</li> </ul> <p>City-level incentive- No</p>	<ul style="list-style-type: none"> <li>Challenges due to the weather conditions</li> <li>Low confidence among users about EV performance in hilly terrains</li> </ul>

City	Policy	Charging Infrastructure	Financial Incentives	Vehicle technology/OEMs
Surat	<ul style="list-style-type: none"> <li>State-level policy- Yes</li> <li>City-level policy- Yes</li> <li>Initiatives- Yes</li> </ul>	<ul style="list-style-type: none"> <li>Public charging stations- Yes</li> <li>Public transport charging depot- Yes</li> </ul>	<p>State level - Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure - 25% capital subsidy for first 250 commercial public stations (investment up to 10 lakhs)</li> <li>EV buyer - Subsidy as per FAME-II scheme</li> </ul> <p>City level- Yes</p> <ul style="list-style-type: none"> <li>Charging infrastructure - Land from SMC on PPP mode, exempted from Environment Improvement Tax</li> <li>EV buyer - Exempted from paying vehicle tax for registered EVs (75%, 50% and 25% exemption from 2<sup>nd</sup> to 4<sup>th</sup> Year) Exempted from Environment Improvement Tax, Free parking in SMC parking areas</li> </ul>	<ul style="list-style-type: none"> <li>Delay in delivery of E-buses</li> <li>Issue of electricity load management during peak hours required due to rise in electricity demand for EV charging</li> <li>Lack of charging infrastructure on highways</li> <li>Lack of locally manufactured spare parts</li> <li>Limited availability of service stations (after purchase of EV)</li> <li>Lack of awareness related to EV technology</li> </ul>

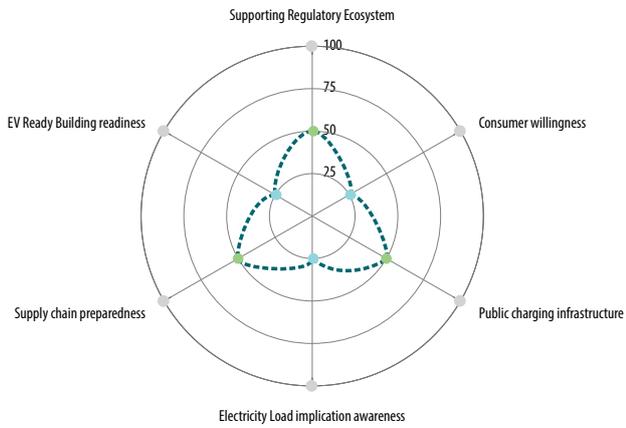
### 3.2.5. EV readiness of cities

The EV readiness of all 10 cities was synthesised after the parameters impacting EV transition were scored. **Twenty-five parameters were listed under 6 categories, as listed below:**

These graphs below presents the detailed readiness accessed on the basis of twenty five parameters.

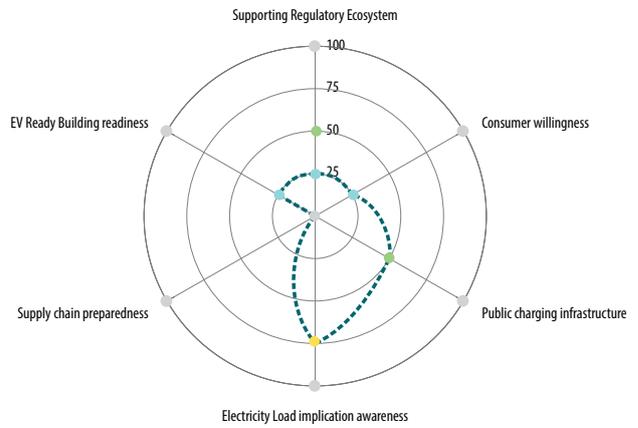


### Coimbatore



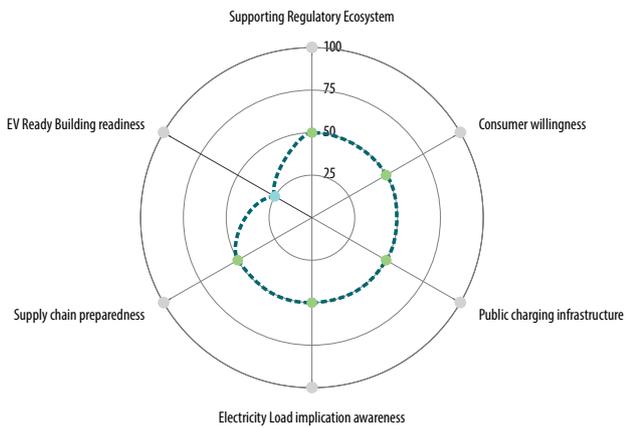
Very Low-0    Low-25    Medium-50    Good-75    Proactive-100

### Gangtok



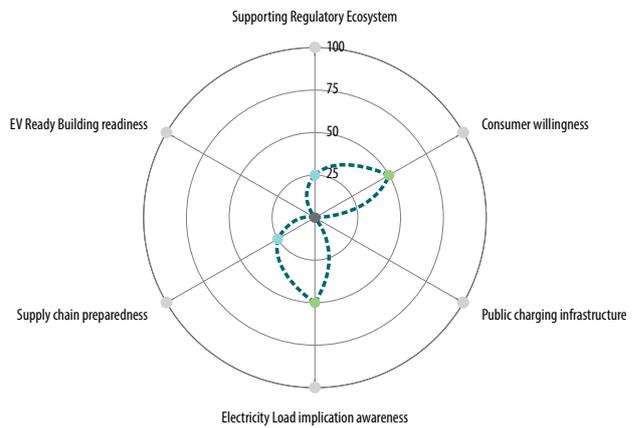
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### Kochi



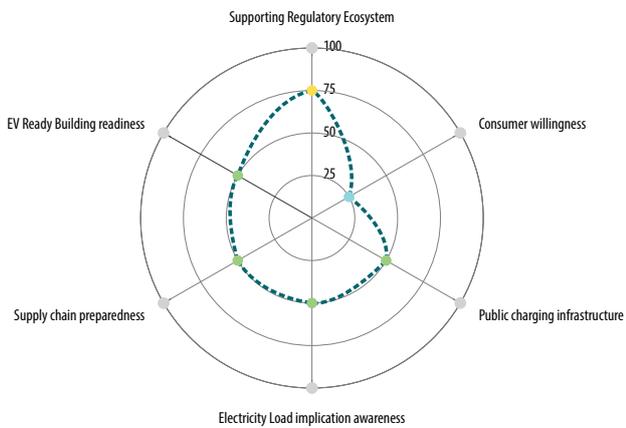
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### Lakshadweep



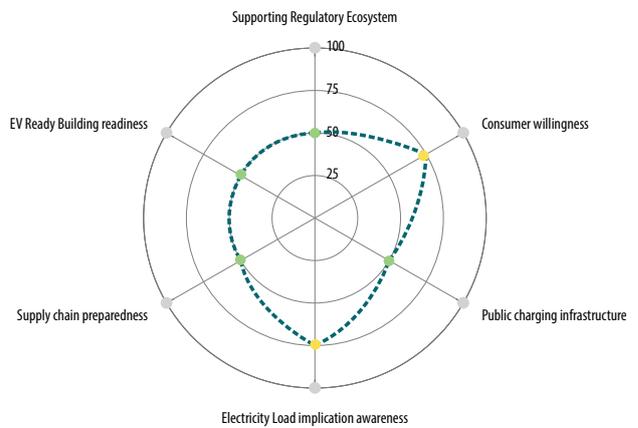
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### Nagpur



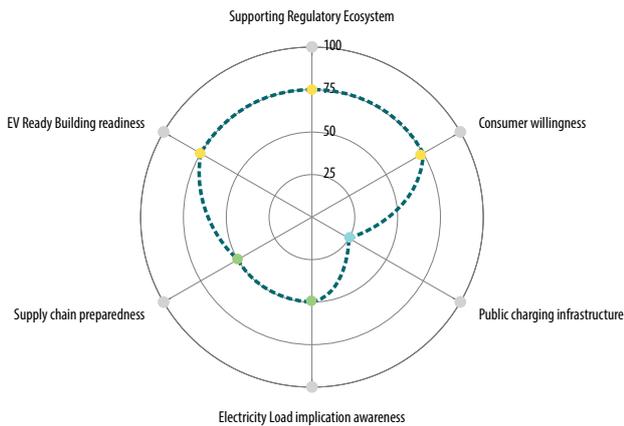
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### Panaji



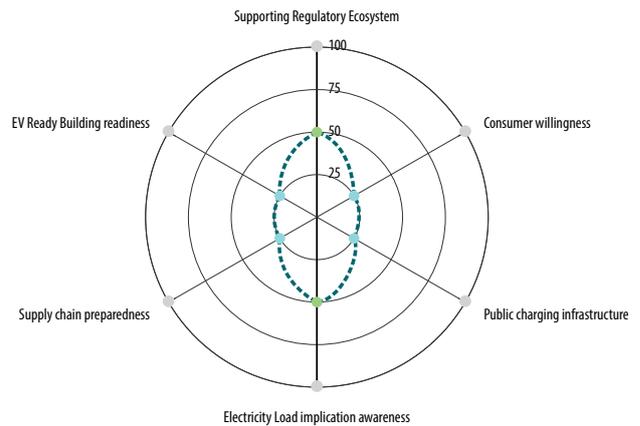
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### Rajkot



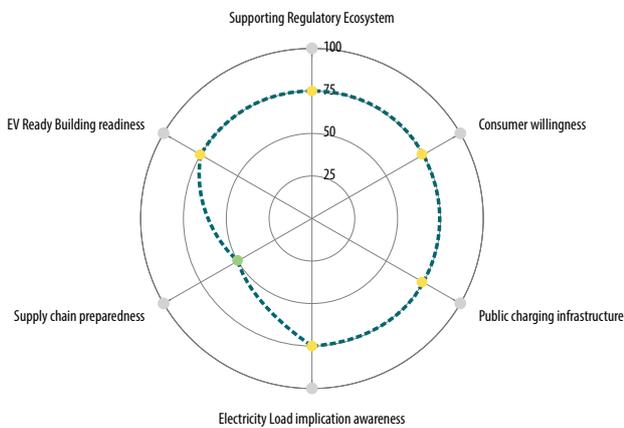
Very Low-0    Low-25    Medium-50    Good-75    Proactive-100

### Shimla



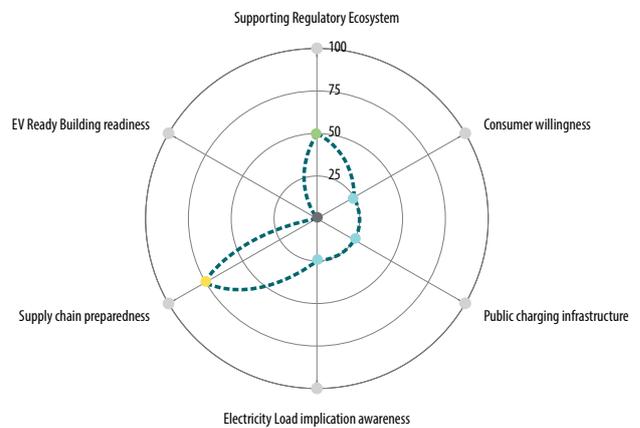
Very Low-0    Low-25    Medium-50    Good-75    Proactive-100

### Surat



Very Low-0    Low-25    Medium-50    Good-75    Proactive-100

### Meerut



Very Low-0    Low-25    Medium-50    Good-75    Proactive-100

## 3.3. City-level barriers

A few observations, based on interactions with stakeholders in the 10 cities, are listed below:

#### Coimbatore

- No approach/guidelines for location of public charging stations to ensure accessibility and safety along with utilisation
- Low awareness of aspects related to EV-ready buildings
- Low awareness of grid readiness and the impact of a larger uptake of e-mobility on power requirements during peak hours
- Doubts about EV performance for municipal fleet conversion
- Lack of a roadmap for integrating e-mobility strategy into mobility plans
- Limited coordination amongst stakeholders

#### Gangtok

- No approach/guidelines for location of public charging stations to ensure accessibility and safety along with utilisation
- Low awareness about grid readiness and the impact of a larger uptake of e-mobility on power requirements during peak hours
- Challenges related to EV-operations on steep terrain
- Absence of a State EV Policy
- Limited awareness about performance of EVs in extreme cold
- Lack of a roadmap for integrating e-mobility strategy into mobility plan
- Limited coordination amongst stakeholders

### Kochi

- No approach/guidelines for the location of public charging stations to ensure accessibility and safety along with utilisation
- Lack of awareness related to grid readiness and the impact of a larger uptake of e-mobility on power requirements during peak hours
- Absence of a market for resale of vehicles
- Lack of awareness about EV ready-buildings
- Absence of a financial plan and strategy for municipal fleet conversion
- Lack of a roadmap to integrate e-mobility strategy into the mobility plan
- Limited coordination amongst stakeholders
- Absence of guidelines for kerbside charging location.

### Lakshadweep

- High dependency of the islands on diesel for generation of energy is a big deterrent in EV adoption
- High cost of electricity generation from DG sets
- Disconnected EV Supply chain. No after-sales service.
- Long wait times for repair of EVs

### Meerut

- Limited synergy/coordination between different agencies
- Lack of public charging stations
- Lack of charging infrastructure location guidelines-the operational E-bus need to go 30 kms outside the city for charging, therefore reducing the operational range
- Absence of provision to enable larger uptake of EV-ready buildings
- No city-level strategy or roadmap to realise the targets mentioned in the state EV Policy
- Limited awareness about load implication of EV charging
- Lack of a roadmap to integrate e-rickshaws into e-mobility strategy
- Limited coordination amongst stakeholders

### Nagpur

- Lack of awareness about aspects related to EV-ready buildings
- Lack of awareness about grid readiness and impact of a larger uptake of e-mobility on power requirements during peak hours
- Doubts about EV performance for municipal fleet conversion
- Absence of guiding parameters for the location of e-bus depot
- Lack of a roadmap to integrate e-mobility strategy into the mobility plan
- Limited coordination amongst stakeholders



### Panaji

- No approach/guidelines for the location of public charging stations to ensure accessibility and safety along with utilisation
- High tariff at public fast charging stations (@ INR 19/ unit compared to the domestic charging EV tariff @ INR 5/ unit)
- Low awareness related to grid readiness and rise in power demand during the peak hours due to larger uptake of e-mobility
- Withdrawal of state EV subsidy, creating uncertainty amongst users
- Absence of market for resale of EVs
- Low awareness about EV-ready buildings
- Absence of a financial plan and strategy for municipal fleet conversion
- Lack of a roadmap for integrating e-mobility strategy into the mobility plan
- Limited coordination amongst stakeholders

### Rajkot

- Absence of guidelines for EV-ready buildings
- No retrofitting guidelines to enable installation of residential charging stations
- No approach/guidelines on location of public charging stations for ensuring accessibility and safety along with utilisation
- Low awareness related to grid readiness and rise in power demand during the peak hours due to larger uptake of e-mobility
- Absence of market for resale of EVs
- Absence of a financial plan and strategy for municipal fleet conversion
- Lack of a roadmap for integrating e-mobility strategy into the mobility plan
- Limited coordination amongst stakeholders

### Shimla

- Lack of awareness related to grid readiness and impact of larger uptake of e-mobility on power requirements during peak hour
- Challenges related to EV-operations on steep terrain
- Absence of State EV Policy
- Limited awareness about performance of EVs during extreme cold
- Limited coordination amongst stakeholders

### Surat

- Absence of guidelines for EV-ready buildings
- Guidelines for retrofit to enable residential charging
- No approach/guidelines for location of public charging stations to ensure accessibility and safety along with utilisation
- Lack of awareness about grid readiness and the impact of a larger uptake of e-mobility on power requirements during peak hour
- Absence of a market for resale of vehicles
- Absence of a financial plan and strategy for municipal fleet conversion
- Lack of a roadmap to integrate e-mobility strategy into mobility plan



### 3.4. Summarising city-level barriers for faster adoption of electric mobility

Even though the list of technical, financial, institutional and capacity related barriers is extensive, the table below summarises some of crucial barriers that need to be addressed first. The list includes:

#### Lack of clarity on roles of different stakeholders

- When it comes to e-mobility, the purpose of the engagement is poorly defined due to which all the activities that follow are affected, including the identification of stakeholders.

#### Differing capacity of stakeholders

- There are differences in the levels of skills and experience of different stakeholders who are engaging with government. This affects their ability to fully participate in an initiative, as well as the quality of the information they provide. Therefore, there may be a need for different models of engagement.

#### Unfocused dialogue on charging infrastructure creation

- Stakeholder engagement can cover a range of issues that are important to **them, but may be less so to the initiative**. If this happens, it can distract from obtaining the relevant inputs. **The engagement plan should be clear on what issues are relevant and how to manage and respond to any ad hoc issues that are raised.**

#### Limited capacity to review and evaluate

- Without proper review and evaluation, it is difficult to know if the approach is working and whether changes are needed. The engagement plan should include review points throughout the action plan design and implementation, with flexibility to adjust the approach if needed.

#### Missing long-term planning

- Lack of in-depth **discussion and analysis** amongst the **state and city government** for larger EV adoption.

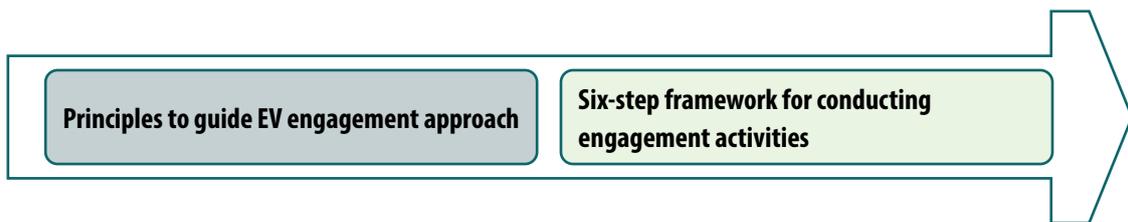
## 4. Framework for Transition Towards E-Mobility

It was observed in all cities that multiple governments and private stakeholders have various roles in the city-level transition, but there is lack of a clear engagement process with many initial efforts that do not go far. Therefore, the team developed a scientific engagement process for cities.

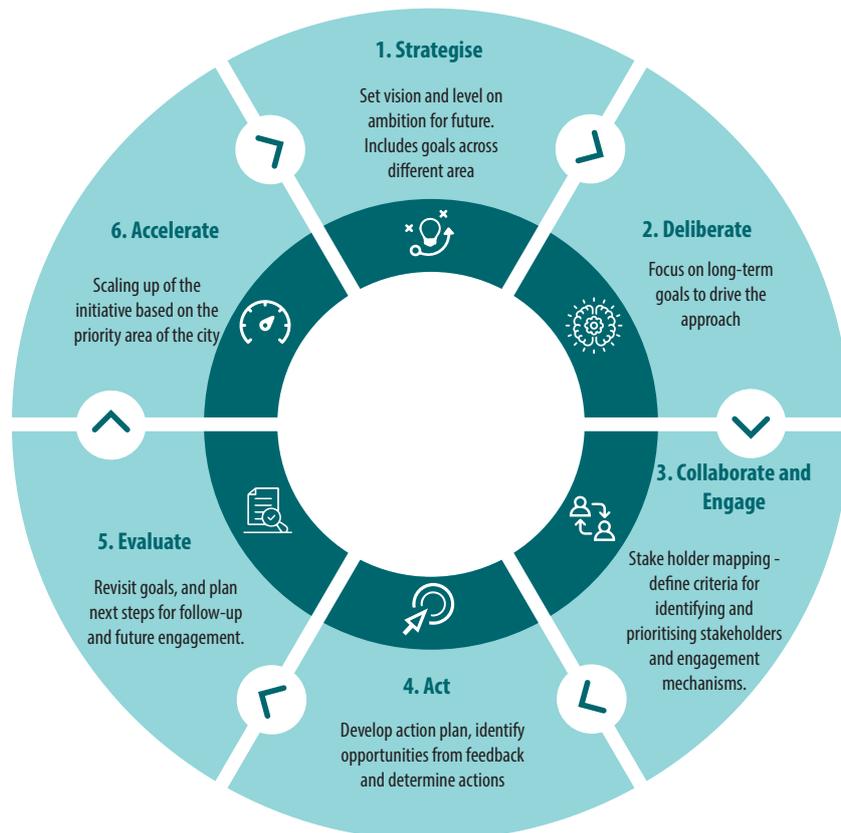
### 4.1. Multistakeholder engagement approach for cities to take leadership on e-mobility adoption

As described earlier, electrification can support a shift towards sustainable modes, but only if it is embedded into a wider strategy. The image below highlights the engagement framework that has been developed.

The approach presents a comprehensive set of principles for stakeholder engagement to jointly deliberate on various strategies and corresponding actions required for faster adoption of e-mobility. The framework sets out a strategic approach to stakeholder engagement that includes:



The illustration below represents the guiding aspects at the core of the engagement approach:



## 4.2. The multistakeholder engagement approach

### 4.2.1. Strategise- Visioning and goal setting

Setting up a powerful vision for the city is a first step towards making radical changes for the city and its citizens. A clear vision helps to set goals and identify strategies and interventions that can be implemented to make a city EV enabled and efficient. The deployment of sustainable electric mobility requires the motivation and alignment of multiple stakeholders - OEMS, operators, consumers, regulators, financing institutions, etc. Clear and tangible timebound targets for the promotion of e-mobility are crucial for integrating with a more comprehensive vision for sustainable mobility. The targets should be articulated, after considering clear and well selected specific actions or mandates to measure progress.



#### 4.2.2. Deliberations on long-term approach to achieve vision of sustainable e-mobility

Local governments, along with their stakeholders and partners, can make meaningful and rapid progress toward the electrification of their mobility sector. Therefore, a multi-stakeholder approach can promote more constructive deliberation over aspects such as:

- Priority fleets conversion into EVs and deploying EVSEs,
- Expanding EVSE infrastructure
- Incentivising individuals to purchase EVs
- Balancing the new electricity demand on the grid, both spatially and temporally
- Design standards for existing buildings for EV integrations
- Retrofits for existing buildings
- Coordination with DISCOMs to support EV charging connections in buildings
- Promote business models for subsidised charging infrastructure to increase the EV adoption
- Mainstream regulatory interventions to make buildings EV-ready through changes in building and parking bylaws

#### 4.2.3. Multistakeholder collaboration and engagement

Collaboration and engagement shall assist cities to gather information on the perspectives and experiences of stakeholders and actors on different aspects, as listed below:

- Barriers and opportunities for e-mobility adoption.
- Ownership challenges.
- Charging needs and preferences.
- The role of EV's in comprehensive city mobility vision
- The role of governments and individuals in accelerating electric mobility adoption.
- Identification of various actors in accelerating e-mobility in synergy with the city vision



#### 4.2.4. Action for faster adoption of e-mobility

The figure below represents some of the priority actions for collaboration:

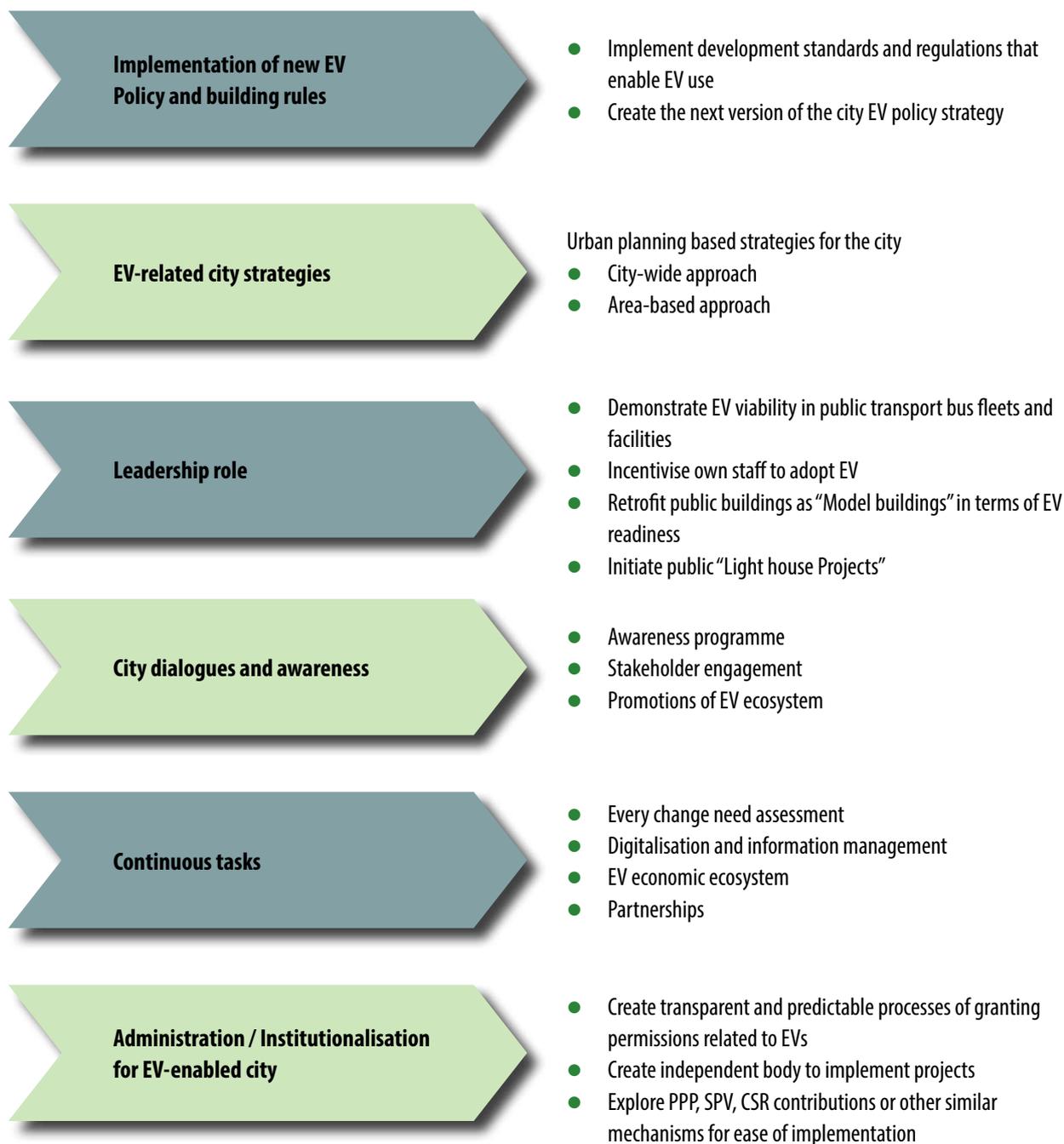


#### 4.2.5. Evaluation

An evaluation plan serves as a bridge between evaluation and programme planning by highlighting program goals, clarifying measurable programme objectives, and linking the programme activities with intended outcomes. Therefore, the actions listed below are recommended as part of the evaluation of various e-mobility projects.

#### 4.2.6. Accelerate to achieve long-term change

Based on the above process, the city can identify acceleration of electrification along the aspects listed below:

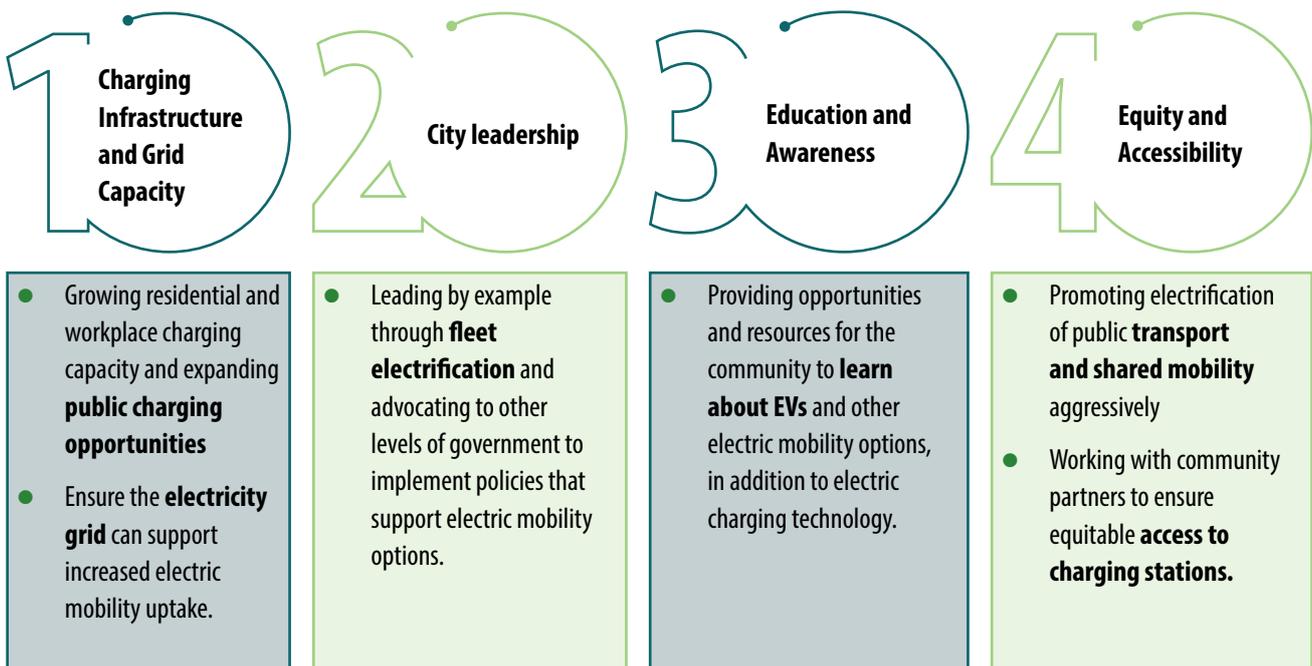


## 5. Priority Actions for Cities to take Leadership on Electric Mobility

Local governments, along with their stakeholders and partners, can make meaningful and rapid progress toward the electrification of their mobility sector. This can be done with a variety of approaches, including:

- Priority fleets conversion into EVs and deploying EVSEs,
- Expanding EVSE infrastructure
- Incentivising individuals to purchase EVs
- Balancing the new electricity demand on the grid, both spatially and temporally
- Design standards for existing buildings for EV integrations
- Retrofits for existing buildings

The city level e-mobility actions should support and encourage the use of electric mobility options. through the implementation of four key action areas:



### 5.1. Charging Infrastructure and Grid Capacity

#### 5.1.1. Evaluate grid capacity assessment for charging infrastructure

Stakeholders related to the power sector need to acknowledge the increase and demand for electricity due to rapid adoption of EVs. They need to be prepared in order to fully realise its GHG emission reduction benefits and to minimise potential grid impacts. Based on the assessment of 10 cities, it was concluded that eventually the grid will require additional preparation in order to fully realise the benefits of e-mobility.

At the current levels of EV deployment, electric grid impacts may be minimal, but increased deployment of these vehicles can substantially increase the electricity load in certain parts of the grid and may require strategies to manage these impacts. Distribution feeders are parts of the city grid that are located downstream of the transformers that reduce the voltage to levels compatible with the area's appliances. In the interactions that were held, it was identified that the load of each of the feeders vis-a-vis their capacity needs to be assessed. The feeder demand analysis of the distribution system would inform the strategies, listed below, that cities could take:

- Target fleets and demographics on underutilised feeders for electrification
- Increase the capacity of feeders that are likely to be over-capacity when a given vehicle electrification rate is achieved.
- Reducing the strain on the grid through management of the time of the day of charging EVs

To determine how much power a fleet will demand, planners should focus on the electric vehicle supply equipment (EVSE) instead of the vehicles since the EVSE sets the top rate at which vehicles use power.

### 5.1.2. Upgrade infrastructure for residential and workplace charging

As we move towards faster adoption of EV's, cities will need greater access to charging equipment, including public chargers. At a same time, the majority of the charging will be taking place at residences or workplaces. The following options are available for installing charging equipment:

- Private charging stations in residential buildings
- Charging stations in apartment complexes – with an owner's corporation
- Charging stations at workplaces.

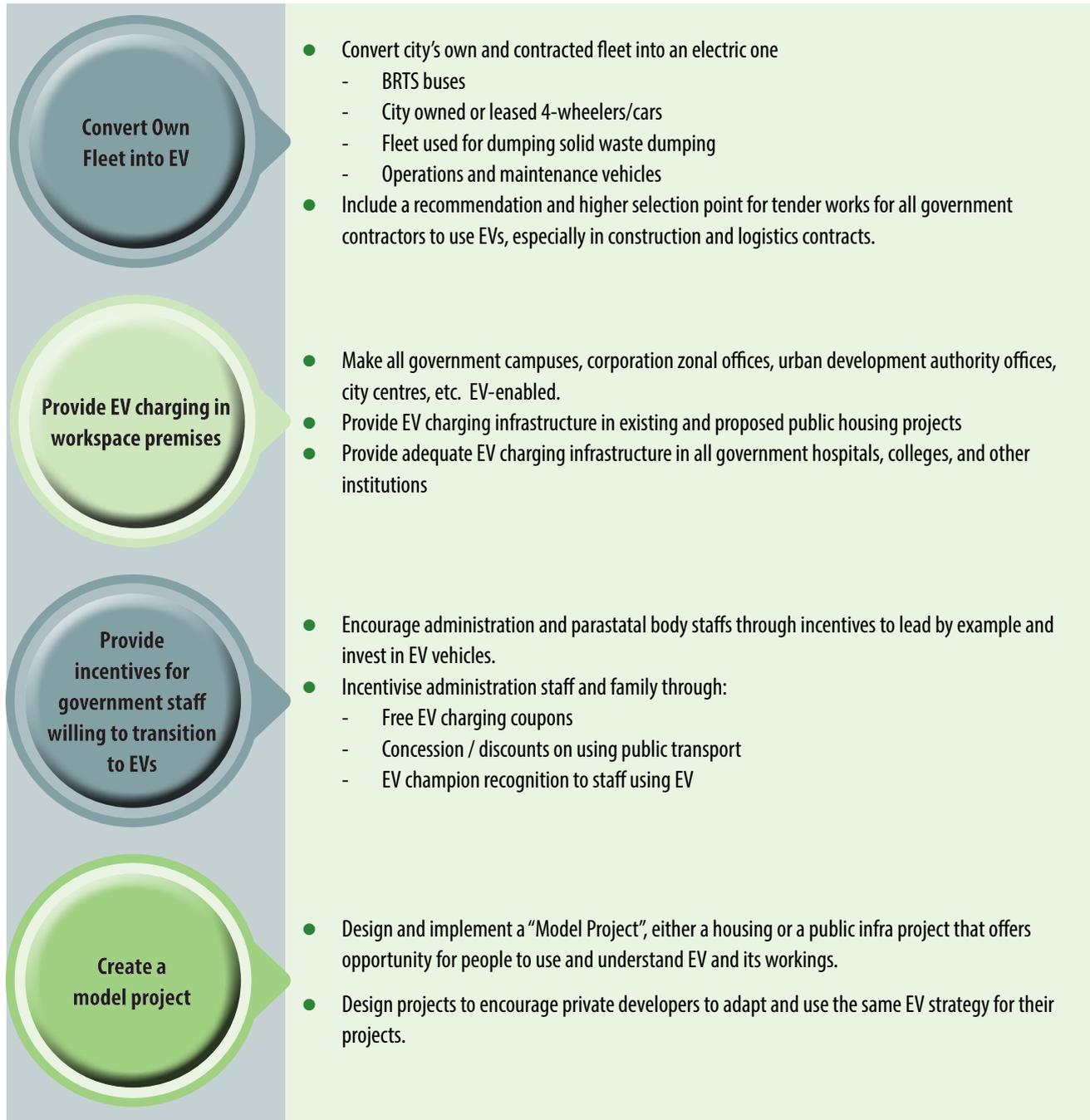
However, to enable larger private charging facilities at the above locations, the buildings need to be EV-ready which means having infrastructure that allows EV charging to be easily installed. This includes physical space and the wiring for future electricity supply equipment.

## 5.2. City leadership - Utilising municipal fleets as early adopters

Municipal fleets can be early adopters of new vehicle technologies because they have centralised decision makers, technicians, professional drivers, and tend to take life-cycle costs into consideration. Furthermore, they can lay the groundwork for adoption by the general public by serving as early EV exposure and, installing EVSE that can also be used by the general public. Additionally, some fleets are more suitable for EVs than others and therefore, more likely to be successfully electrified. These fleets need to be identified and targeted as potential early adopters. The cities engagement approach explains parameters that could help them to determine which fleets would be good candidates as early adopters of EVs. The parameters are:

- Vehicle availability
- Vehicle routes that are compatible with charging needs
- Vehicle owners that value EV co-benefits such emissions reduction
- Fleet vehicles with high annual GHG emissions based on annual fuel use, which is generally a function of fuel economy and distance driven per year.
- Fleet compatibility with electric grid
- Total cost of ownership across life

Listed below are the activities for cities:



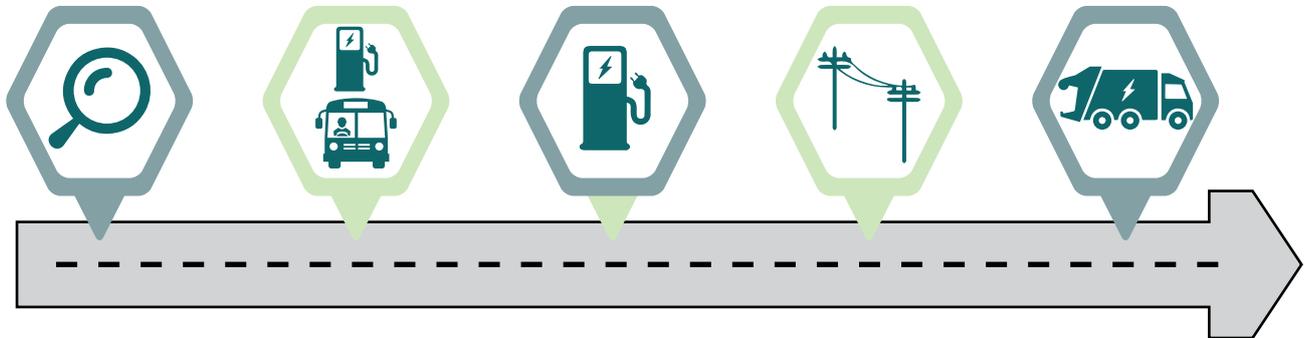
### 5.3. City-level roadmap for e-mobility

As stated earlier, a city-level roadmap is crucial for coordinated and guided efforts towards an e-mobility transition. The roadmap provides strategy to a city with options to select from, based on priorities. The guiding principles for the roadmap are listed below:

- How e-mobility can be embedded in a wider sustainable mobility strategy.
- Who are the crucial stakeholders (private and government relevant for finalising the city-level e-mobility vision)
- What should be a city's priority for electrification
- How electrification can be promoted to improve access and encourage modal shift
- How city level vision related to electric mobility can be developed, considering the GHG emissions and air pollution mitigation potential of different segments

### 5.3.1. City EV Roadmap

The multistakeholder engagement roadmap developed earlier can provide guidance to local stakeholders on the way forward to formulate the EV roadmap.



Segments for high impact	Priority modes for electrification	Developing charging Infrastructure	Ensuring Grid Readiness	Leading by example by Municipal Fleet electrification
<ul style="list-style-type: none"> <li>● Public Transport</li> <li>● IPT</li> <li>● Shared Mobility / Cabs</li> <li>● Freight vehicles</li> </ul>	<ul style="list-style-type: none"> <li>● Buses</li> <li>● 3-Wheeler vehicles</li> <li>● 2-Wheeler vehicles</li> <li>● E-bikes</li> <li>● LCV's</li> </ul>	<ul style="list-style-type: none"> <li>● Residential</li> <li>● Workplace</li> <li>● Public fast charging</li> <li>● Kerbside slow charging</li> </ul>	<ul style="list-style-type: none"> <li>● Assessment of grid impact</li> <li>● Readiness of building to support EV charging</li> <li>● Retrofits required in building and grid</li> </ul>	<ul style="list-style-type: none"> <li>● Phased approach for conversion to EV</li> <li>● Mandated e-mobility in goods and services for all municipal procurements</li> </ul>





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