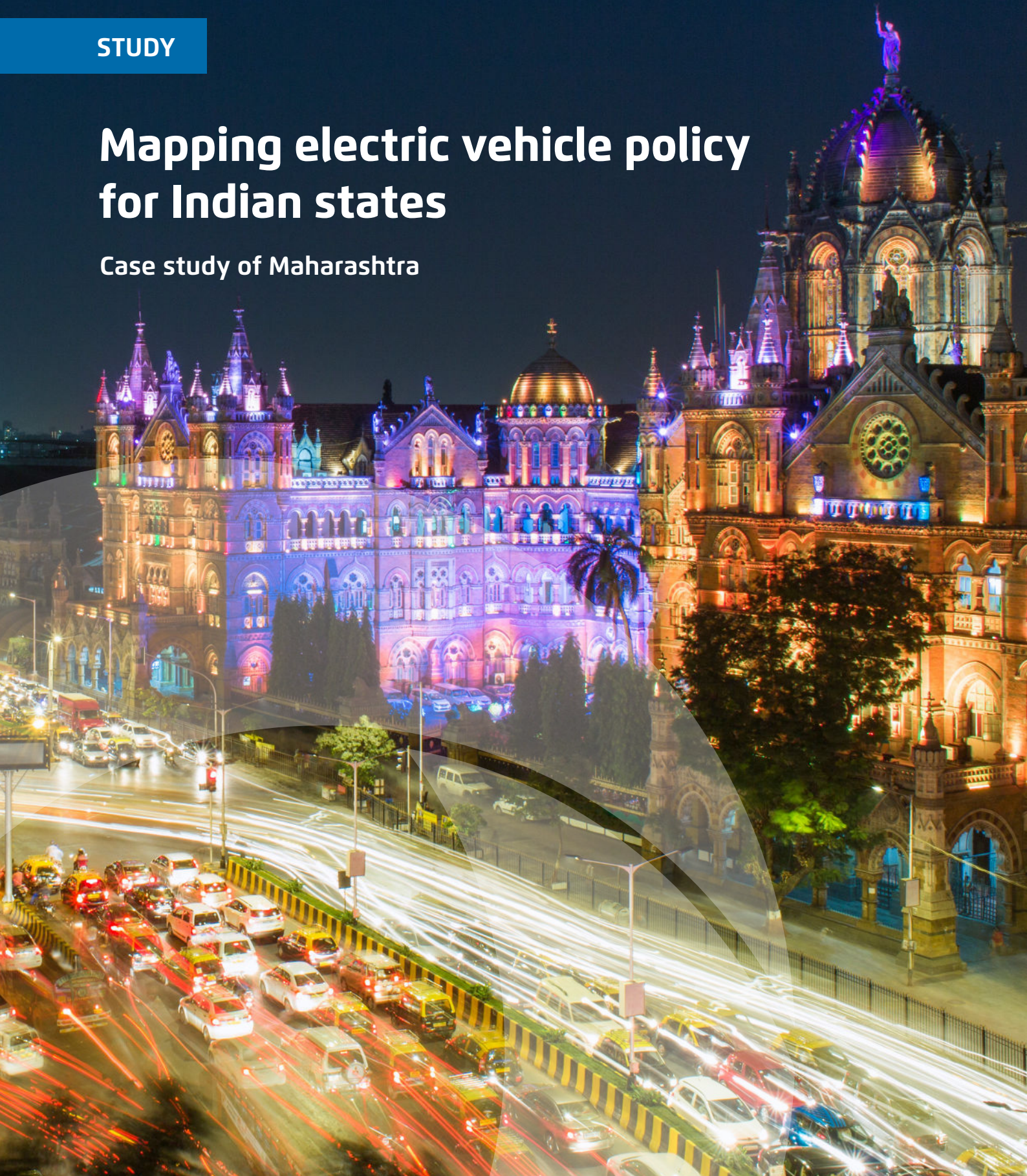
Agora Verkehrswende

STUDY

Mapping electric vehicle policy for Indian states

Case study of Maharashtra



Imprint

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Preface

Dear readers,

As part of its G20 presidency in 2023, India affirmed its dedication to pursuing global leadership in climate action. India has the lowest emissions per capita among G20 countries and can showcase a comparably low climate impact for past decades. At the same time, India became the most populated nation in the world 2023, reaching a population of 1.4 billion and aspires to become one of the leading industry nations as well. "Make in India" is the core governmental initiative which aims to boost the local economy and make the country a global manufacturing hub.

To be sure, India's economic ambition and size make it an extremely important player at this unique moment of human history, as the global community strives to decarbonize. India has committed itself to achieving carbon neutrality by 2070, and, to this end, has adopted various interim milestones and sector targets. The transport sector is crucial for both economic growth and climate neutral development. The electrification of road transport serves the intention of the "Make in India" aspiration as well as the country's ambition on climate action.

India's geographic size and large population make the decarbonization of the transport sector a monumental task. Against this backdrop, state-level policy within India can serve as an important and effective complement to the federal government's road-transport electrification efforts. In line with this insight, this report seeks to highlight opportunities for the further development of EV policies at the state level in India by conducting a case study of the state of Maharashtra. Based in part on the extensive policy experience that has been gathered in India and other parts of the world over the past fifteen years, we present various options for the enhancement of policy to promote transport electrification at the state level in India.

Germany and India can look back on many decades of good relations and partnership. In 2022 both countries entered into new cooperative commitments that aim to support industrial development and climate action. Furthermore, as part of the International Climate Initiative, which is funded by the German Federal Ministry for Economic Affairs and Climate Action, Germany and India have been cooperating on the NDC Transport Initiative Asia, which is dedicated to the transformation of the transport sector.

We trust that the strong collaboration of the project partners and the governmental Think Tank NITI Aayog will provide additional impetus to all states to enhance their strategies. NITI Aayog has shown commendable skill and dedication as a thought leader and driver of sustainability in India, and we are pleased and honoured to support the work of NITI Aayog with this publication. We wish the states of India all the best in their efforts to advance the transformation of the transport sector.

Best regards,
Christian Hochfeld
Executive Director

On behalf of the Agora Verkehrswende Team
Berlin, January 2025

Key takeaways

1. Indian states can play a pivotal role in accelerating the EV transformation in India in the coming years. India's national government adopted a comprehensive policy strategy for enabling EV transformation in 2013. Today, almost all Indian states and union territories have adopted or announced additional EV policies of their own. India's states possess invaluable knowledge of local circumstances and steering mechanisms, thus positioning them to adopt efficient and effective policies that can support the national goal of achieving climate neutrality by 2070.

2. Maharashtra is a leading Indian state in terms of EV policy ambition. In 2021 Maharashtra expanded its goals to include EV penetration targets for almost all vehicle types and also set ambitious targets for charging infrastructure expansion. The state's 2021 EV policy comprises around 40 policy instruments, which cover a wide range of policy dimensions. However, at the time of writing this report, several measures have yet to be implemented

3. Maharashtra and other Indian states should set even higher EV targets to achieve full road transport electrification and to provide reliable investment conditions for the vehicle industry. The introduction of the 2021 EV policy had a considerable effect on EV adoption rates. However, to achieve full road transport electrification, we would suggest the adoption of long-term targets for EV adoption in combination with policy to bolster the EV share in new vehicle registrations – not only Maharashtra, but in other Indian states. Such measures would have the additional benefit of improving the international competitiveness of Indian EV manufacturing.

4. To be future proof, EV policy must take the circular economy into account, including the entire range of sustainability challenges in the EV lifecycle. While this report provides suggestions for the state of Maharashtra with a view to material availability, industry transformation, EV market ramp-up, the convenient use of EVs, and circular vehicles, our recommendations can also be used as a basis for policy development in other Indian states. By addressing the full spectrum of challenges to EV sustainability, state governments can ensure policy that is efficient, effective, and comprehensive.

5. Establishing institutions throughout India responsible for monitoring the implementation of state EV policy would help to ensure continued progress in the EV transformation. We recommend the establishment of an independent council composed of representatives from research institutions and think tanks that would be tasked with monitoring the implementation of policy measures and their impact on EV registration rates. A council of this nature could also exercise an advisory function, consulting with state governments on policy matters.

Contents

1 | Introduction and purpose of this publication

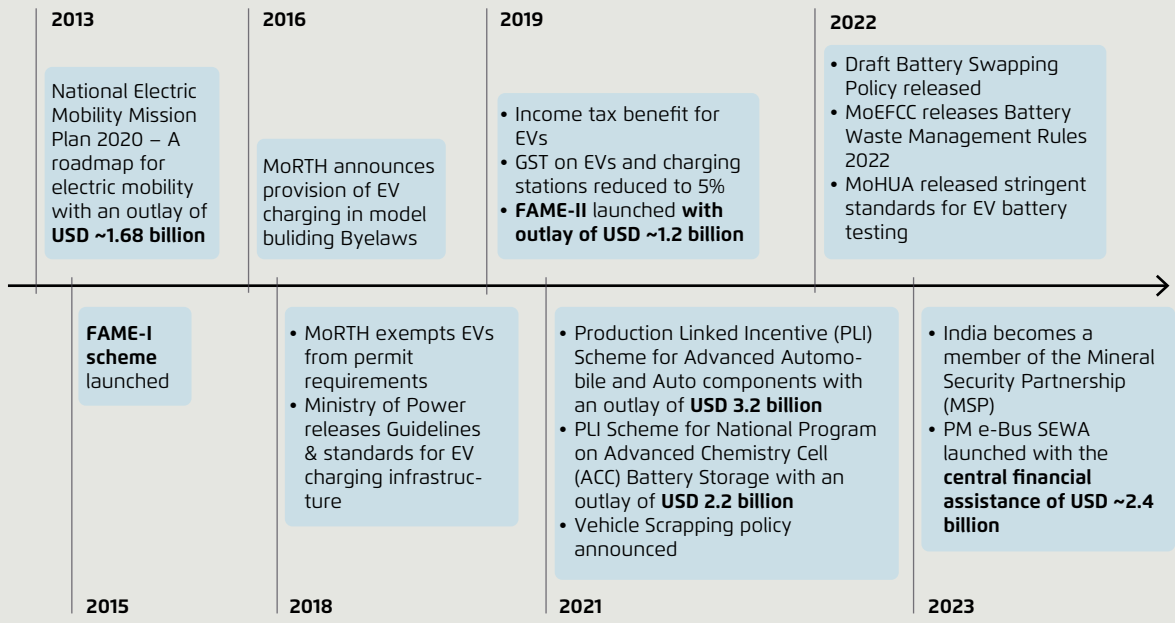
India plays a key role in the historic task of addressing the climate crisis, as it is the world's most populous country and the third-largest emitter of CO_2 worldwide.[1,2] The Indian government plans to achieve net zero by 2070, necessitating transformation in all sectors of the economy, including transport. The transport sector is India's third largest emitter of energy-related CO_2 emissions, with an emissions share of approximately 12 percent.[3] Furthermore, India has the world's second largest road network[4] and has seen almost a tripling of registered motor vehicles between 2010 and 2020.[5] Accordingly, large emissions increases have been accompanied by worsening air quality problems in urban areas.

Electric vehicles (EVs) are considered the key technology for road transport decarbonization, and they also promise to reduce air pollution. Furthermore, electric vehicles are more energy efficient than ICE vehicles, and thus reduce overall energy demand in the transport sector. The Indian government has recognized the potential offered by electric vehicles and has thus committed to a clear strategy for electrifying road transport. In specific terms, the country endorses the global EV30@30 campaign, which aims for at least 30 percent of new vehicle sales to be electric by 2030. Furthermore, at COP26 in 2021, India signed the Clean Transport Breakthrough, which aims for zero-emission vehicles to become "the new normal in all regions" and "accessible, affordable and sustainable by 2030". Represented by NITI Aayog, India participated in the 4th ministerial dialogue of the ZEVTC[6] (a global forum dedicated to enhancing political cooperation on the transition to zero-emission vehicles). India has

1 UN Population Census Estimates 2023
2 USAID 2022
3 IEA 2023
4 MoRTH 2023
5 MOSPI 2022

6 e-AMRIT 2023

National level policy initiatives for EVs in India — Figure 1



Agora Verkehrswende (2025) | Source: WRI 2024

also expressed its support for the COP26 declaration on accelerating the global transition to ZEVs.

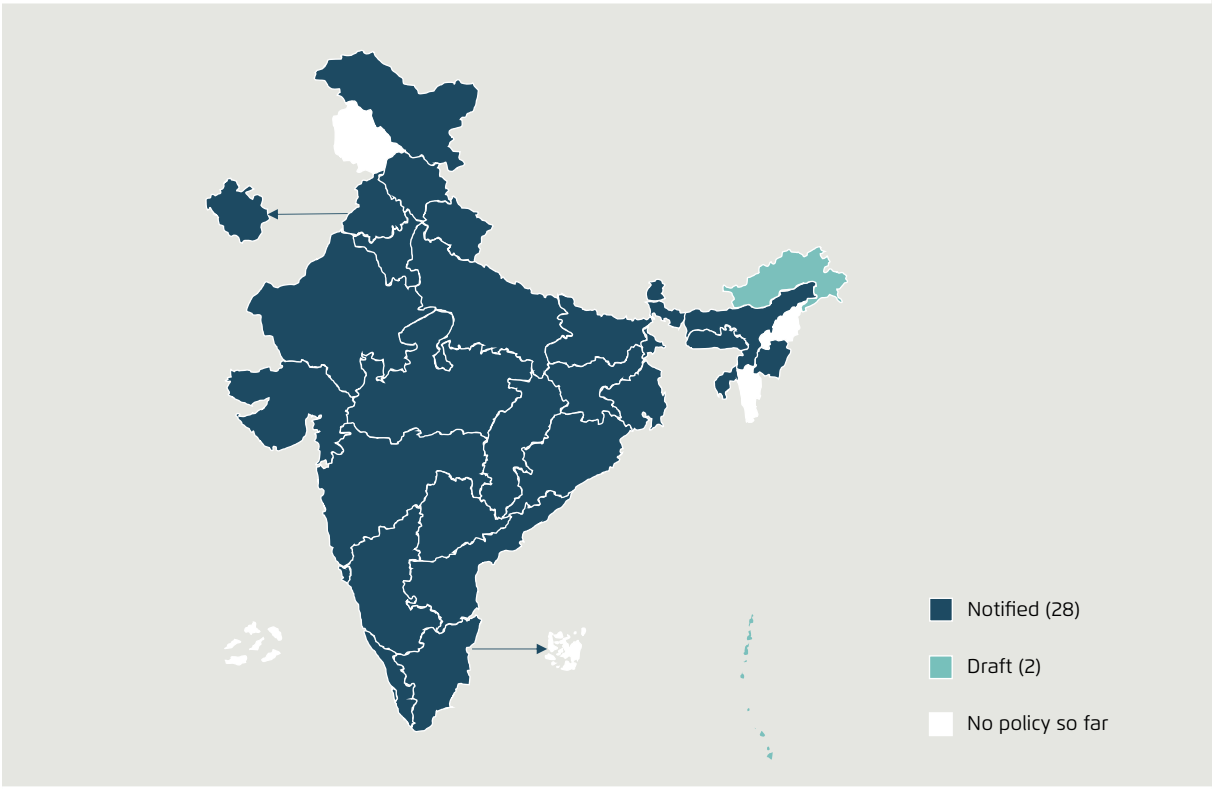
India's national policy strategy commenced in 2013 with the adoption of the National Electric Mobility Mission Plan 2030, which envisages reducing dependence on fossil fuels and promoting sustainable transport in India by adopting electric and hybrid vehicles. To this end, the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme was launched in 2015, providing 8.95 billion rupees (100 million euros) to fund incentives for vehicles and charging infrastructure, technology platforms, and pilot projects.[7] A second version of the FAME scheme was launched in 2019 with a higher investment amount of 100 billion rupees (1.1 billion euros); it aims to bring more electric and hybrid buses and electric 2, 3 and 4 wheelers to the road and to support the further roll-out of charging infrastructure.[8] Additional national policies addressing various aspects of EV adoption – raw materials, batteries, industry development, charging infrastructure, and the circular economy – were launched between 2016 and 2023 (see Figure 1).

In addition to measures at the national level, Indian states began in 2017 to draft their own EV policies. As of 2023, 26 states and 4 union territories had launched an EV policy (see Figure 2); some of these policies have already been revised and strengthened. This development is very important, as many Indian states are very large in terms of area and population and are comparable to entire countries in other regions (e.g. EU Member States, Southeast Asian countries, etc.). Furthermore, state governments in India are very well positioned to drive ambitious EV adoption thanks to their knowledge of the specific circumstances and steering mechanisms within their jurisdiction. Accordingly, Indian states are anticipated to play a pivotal role in the coming years when it comes to setting ambitious targets and optimizing their state EV policies to accelerate the transformation of the transport sector.

The purpose of this publication is to support Indian states and to identify potential for the future development of their EV policies by comparing them to international best practice. While our analysis focuses on the state of *Maharashtra*, the policy opportunities that we identify can serve as a template for EV policy development in other Indian states as well. The state of Maharashtra was chosen for our analysis due to its large size, densely populated cities, significant transport infrastructure, strong vehicle industry, and early adoption of a comprehensive e-vehicle policy. All of these aspects make the state highly compelling and well-suited as a case study for this report.

7 IEA 2021
8 MHI 2021

Status of Indian state EV policies Figure 2



Agora Verkehrswende (2025) | Source: Bureau of Energy Efficiency 2024

2 | Methodology

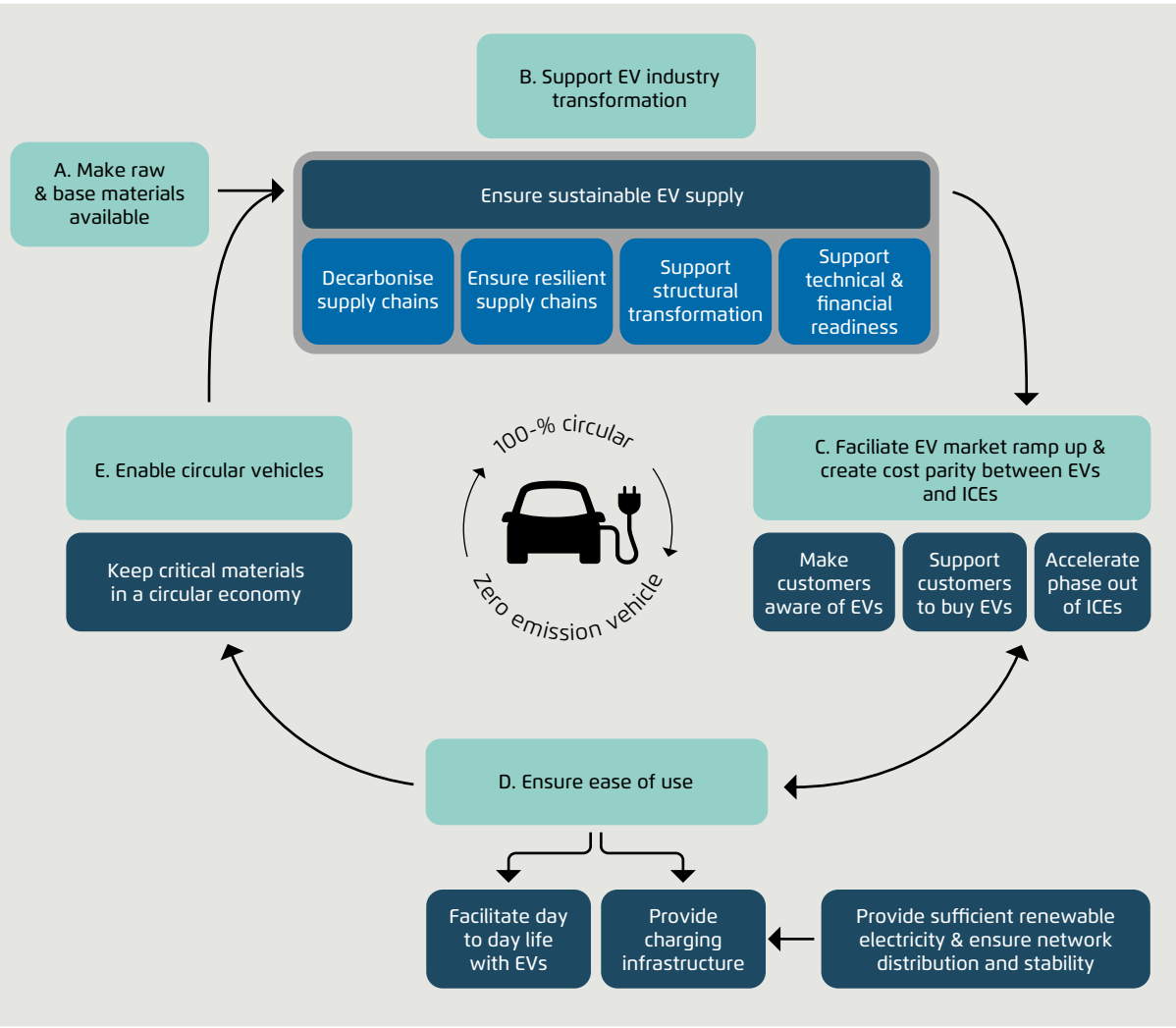
To identify potential for the future development of EV policies at the state level in India, a promising starting point is to assess best practice both within India and internationally.

2.1 Ensure that all challenges are addressed

In our analysis, we first discuss the various challenges that governments are facing as they seek to support a successful transition to electric vehicles. Figure 3 provides an overview of challenges across the EV lifecycle.

This lifecycle framework provides a basis for analyzing EV policy instruments in Indian states, particularly with a view to their comprehensiveness. However, in the present context, rather than furnishing a foundation for examining specific technical details or policy funding issues, this framework seeks to serve as a tool for identifying potential blind spots and gaps in relation to international best practice. This, in turn, constitutes a starting point for further research, to delineate and describe necessary action areas. In total, the framework describes five categories of challenge (see next page).

Challenges in EV adoption — Figure 3



Agora Verkehrswende (2025)

1. Category A refers to the **availability of raw and base materials**, especially critical materials needed for the production of EVs, including lithium, cobalt, nickel and permanent magnets.
2. Category B highlights challenges related to the transformation of the vehicle industry as it pivots to EV manufacturing. This category consists of several domains: First, **supply chains need to be decarbonized** to enable the lifecycle decarbonization of EVs. To establish a robust EV industry, it is also important to ensure **resilient supply chains** through the diversification and localisation of suppliers. Aside from the need to ensure that companies have the **technical and financial capability** to produce EVs, the transformation entails other challenges. For one, workforce skill sets need to evolve as EVs supplant ICEs. Furthermore, various parts used in ICEs are no longer needed, forcing many small and medium ICE component manufacturers to revamp their business models. These problems can affect entire regions that are specialized in the production of ICE components. These challenges fall under the category of **structural transformation**.
3. Category C relates to the challenge of organizing **the market ramp-up of EVs and creating cost parity with ICEs**. Consumers have to be informed about the availability of EVs and also need to receive financial support prior to EVs becoming fully cost competitive. At the same time, ICEs must become less attractive as a mobility option.
4. Category D pertains to the convenient use of EVs and encompasses various issues, including **charging infrastructure expansion** and **energy demand management**, particularly in a grid with a high share of variable renewables. **Convenient use of EVs in day-to-day contexts** can be also facilitated through various measures (e.g. free parking for EVs, dedicated lane access, etc.).
5. Finally, **retention of EV materials in a circular economy** (Category E) following an EV's end-of-life (EOL) can increase the availability of critical materials and enhance the sustainability of the entire product cycle. However, building up recycling capacities and establishing circular processes is a challenging endeavour, as conventional vehicles are usually exported rather than scrapped, and large-scale recycling capacities are not yet available.

We conducted a survey of international policies in order to identify instruments that are suitable for addressing each of the aforementioned categories of challenge (A–E). Some examples are presented in the following.

A. Make raw and base materials available

The availability of materials is very important for building up and maintaining a robust electric vehicle industry. Different measures are available to reduce materials demand and increase supply. Policymakers can support the availability of materials to EV manufacturers and parts suppliers by means of various measures, including the following suggestions.

- Enabling and expanding local mining
- Raising recycling rates
- Securing and diversifying raw material imports
- Establishing raw material partnerships and joining trade agreements
- Reducing critical raw material intensity

In countries with significant raw material deposits, government can help companies **to expand domestic mining and mineral processing**. However, many countries do not possess rich domestic deposits of raw materials and thus have to rely on imports. In such cases, it is important for governments and companies to diversify material imports in order to avoid excessive dependency on a small number of supplier countries.

The EU's Critical Raw Materials Act is one example of a policy in this area. Adopted in 2023, it defines minimum shares of raw materials that must be obtained from local mining, processing, and recycling. Furthermore, no more than 65 percent of a strategic raw material used in the EU may be imported from one specific third country.[9]

B. Support EV industry transformation

The transformation of the vehicle industry is an extremely important topic area, especially in countries with a strong tradition of vehicle production and many jobs that depend on vehicle manufacturing. In Germany, for example, 1.7 million jobs depend on the automotive sector (a figure that includes EV manufacturers, parts suppliers, and adjacent industries, such as the energy

9 EU Commission 2023

sector).[10] In India, nearly as 30 million employees work in the automotive sector.[11] Accordingly, the automotive sector is extremely important in both Germany and India, underscoring the need to develop a robust transformation strategy that not only ensures continued value creation and employment, but is also actively supported by the broader public. The associated challenges and respective measures can be divided into four domains.

1. Decarbonize supply chains:
- Track CO_2 footprints throughout supply chains
- Introduce obligations for companies to report their CO_2 footprints
- Support the establishment of industry associations dedicated to common CO_2 footprint measuring systems

2. Ensure supply-chain resilience:
- Diversify suppliers
- Promote local value creation and encourage local investment in parts production

3. Support the structural transformation of industry:
- Establish strategy platforms for industrial transformation
- Organize platforms for the retraining and reallocating workers
- Launch regional transformation hubs

4. Promote the technical and financial readiness of industry:
- Grant subsidies to establish or transform manufacturing sites
- Create EV research hubs
- Facilitate employee qualification measures and professional development
- Adopt ZEV mandates

EVs tend to emit significantly less CO_2 than ICEs, especially during the usage phase. However, EVs are also increasingly outperforming ICEs in terms of lifecycle emissions (LCE). This trend is gaining momentum due to the increasing share of renewable energy in vehicle production. Tracking the CO_2 footprint of supply chains is very complex, however. Due to a lack of transparency, particularly at the lower levels of the supply chain, it is difficult to accurately assess the carbon footprints and to manage suppliers accordingly.[12] This problem is compounded by the prevalence of non-standardized data metrics and different CO_2calculation approaches. IT solutions are being developed to address this challenge and enabling the effective collection of emissions-related data. Open data sharing networks are particularly promising as a solution for increasing transparency. For example, Catena X is a data ecosystem being jointly developed by BMW, Mercedes-Benz, and Siemens in order to network automotive suppliers. It provides an open and secure network for the exchange of standardized emissions data.

Supply chain resilience is another important factor for robust EV production capacities. Reducing excessive reliance on individual countries by means of diversification strategies is one important measure in this regard. An additional method of reducing supply risks is to encourage companies throughout the supply chain to invest in domestic production. In this vein, the European Raw Materials Alliance aims to achieve a 20 percent self-sufficiency rate in the EU market for permanent magnets by 2030. In pursuit of this goal, the EU is supporting the development of a magnet factory and associated upstream production capacities in Estonia.

In the area of structural change, employee retraining and reassignment measures are required to transfer human capital from ICE to EV production. The shift from ICEs to EVs may have wide reaching impacts on employment in related sectors and in upstream supply chains. As a result, entire regions could be particularly hard hit by job losses. To address this challenge, **close and trusting communication and collaboration** is needed not only between the public and private sectors, but also between different industrial branches and regions within a country. Various strategies are available to prevent job losses, including retraining measures and programmes to transfer employees between economic sectors (e.g. between the vehicle manufacturing and energy utility sectors). National and local governments should actively support regions with a strong reliance on ICE manufac-

10 Agora Verkehrswende 2021
11 WRI 2022a
12 Deloitte 2023

turing to attract new industrial investment, and in this way actively shape regional economic development.

The financial and technical readiness of vehicle manufacturers to produce EVs can be supported in several ways. Government can support supplementary investment in R&D to help promote the competitiveness of industry. The government can also encourage the establishment of educational centres and networks in order to enable the training and further professional development of automotive industry workers. Regulatory instruments such as **ZEV mandates** are needed as a supplement to funding support and related soft measures. In the US and UK, for example, ZEV mandates have been implemented to accelerate the ramp-up of EV production. California is a notable pioneer in this regard, as it first introduced ZEV mandates in the 1990s. More recently, in 2023, California announced it would end the sale of traditional combustion trucks by 2036 – the first jurisdiction worldwide to do so.[13]

C. Facilitate EV market ramp-up and create cost parity between EVs and ICEs

Measures designed to convince and enable end customers to buy EVs are no less important than investments in production capacities. Because ultimately, buying an EV remains an individual purchase decision made by consumers. Yet in addition to positive incentives that encourage consumers to shift to EVs, ICEs must become less attractive. Three areas of policy instruments and respective measures are important for supporting the development of the EV market (see below).

Categories 2 and 3 are listed alongside each other as many of the instruments for supporting EVs and disincentivizing ICEs can be considered as equivalent mechanisms that work in opposite ways. Furthermore, often the instrument on the ICE side can be used as a financing mechanism to promote EVs. The instruments related to **company car taxation** are highlighted, as they represent a significant lever in countries with a high share of company cars. In Germany, ~20 percent of new passenger car registrations each year are company cars,[14] and many other EU member states have high shares in this segment. The fact that such vehicles are purchased by companies, and not by private consumers, helps with the challenge of high upfront costs. Furthermore, the promo-

13 State of California 2023

14 German Watch 2023

1. Making customers aware of EVs:

- Public outreach campaigns
- Green vehicle plates or vehicle labels (and different privileges tied to those plates; see below)
- Electrification of public fleets as showcase examples

2. Supporting customers to buy EVs:		3. Accelerating the phase out of ICEs:
		Company fleet related
• EV privilege in company car taxation	⟷	• CO_2 differentiated company car taxation
• EV privilege in annual taxation	⟷	• CO_2 differentiated annual taxation
• EV purchase subsidies, exemption from registration taxes	⟷	• ICE (tax) malus system
• Attractive charging tariffs	⟷	• Emission trading systems/Carbon pricing
• Lower road charges for EVs	⟷	• Road charges for ICE vehicles
• Facilitated registration of EVs	⟷	• Limited registration of ICE vehicles
• Enabling of low/interest-free loans		• Scrappage incentive
		• CO_2 fleet standards

tion of EVs as company cars can support the build-up of a secondary EV market, as companies buy and sell vehicles in shorter time intervals than private vehicle owners. However, it is important that company car taxation does not specifically incentivize the purchase of large, expensive, and energy-consuming vehicles; in order to broadly stimulate EV uptake, including among households with lower incomes (e.g. via the second-hand market), the tax rules should encourage the adoption of EVs in smaller vehicle segments.

In Norway and the Netherlands, significant **registration tax breaks** have been introduced for buyers of low-emission cars, while higher taxes are levied on cars with higher emissions. This method has supported the successful ramp-up of EVs in these two countries, which at the vanguard of EV adoption as a share of new vehicle registrations.

China has started to **limit the number of license plates issued** in order to combat congestion and air pollution in cities. Seven Chinese cities, including Shanghai, Beijing, and Guangzhou, had this measure in 2014.[15] Some Chinese cities then began exempting EVs from license plate lotteries, thus creating an incentive for citizens to buy EVs instead of ICEs.

CO_2 fleet standards represent one of the most important measures in the EU (and also in other countries worldwide, such as China and the US) to promote the market ramp-up of EVs and the phase out of ICEs. These standards obligate vehicle manufacturers to limit the emissions of newly sold vehicles. At the beginning of 2020, the EU strengthened its CO_2 fleet limits from 160 g/km to 95g CO_2/km for 95 percent of manufacturer's car fleets, and it will successively decrease this limit to zero up to 2035.

With regard to measures for raising public awareness, many countries such as India, Canada, and the UK have introduced **green license plates**. In the UK, green plates were implemented in 2020. In addition to bolstering awareness for EVs, the plates help local authorities to design and implement policies that encourage EV adoption (e.g. cheaper parking and cost-free entry into zero-emission zones, as green plates allow clear recognition of eligibility).[16] These kinds of measures are very important, as public scepticism with regard to EVs is still widespread. "Range anxiety" and the risk of fire from battery damage are particularly common concerns that can be effectively addressed through consumer education.

D. Ensure ease of use

Policy measures that ensure consumers have a convenient environment for EV operation is yet another important piece of the puzzle. The development of broad charging-infrastructure coverage is certainly one of the largest challenges in this regard. The setting up of charging points requires a great deal of technological and operational expertise, and the electricity grid must accommodate the additional energy demand. Another related issue is that consumers may be unfamiliar with EV charging procedures. The government's role is to establish the regulatory and market conditions for the development of charging infrastructure and to provide start-up capital in the form of subsidies. With time, investment decisions and operations can be fully taken over by private companies, once the market is self-sustaining. Targeted policy measures can support many aspects of EV adoption beyond charging infrastructure development. Accordingly, there are three dimensions of measures to support the use phase of the EV lifecycle.

1. Setting the right regulatory and market conditions for the development of charging infrastructure

- Establish a central office for charging infrastructure expansion to coordinate roll-out
- Develop an overall strategy for roll-out, including:
  - Roadmap for scaling up infrastructure development
  - Map of the stakeholder and investor landscape for charging infrastructure
  - Strategies for slow vs. fast charging, private vs. public charging, no. of vehicles vs. no. of charging points, etc.
- Establish inter-departmental working group to facilitate charging infrastructure roll-out
- Provide subsidies for the installation and/or the operation of charging points

15 He, Jin, Cui et al 2018

16 Gov UK 2020

- Streamline permitting processes
- Ensure availability of land for charging points
- Adopt legislation calling for the mandatory installation of charging points in new buildings, gas stations, etc.

2. Provide sufficient renewable energy and ensure power grid expansion

- Model future EV energy demand and ensure the strategy for grid decarbonization and renewable energy expansion reflect this demand
- Provide funding for grid expansion
- Create time variable charging tariffs
- Promote "vehicle to grid" (V2G) charging

3. Encourage EV ease of use:

- Parking fee exemptions or free parking
- Discounts on vehicle insurance
- Preferential lane access
- Zero emission zones

To support the roll-out of charging infrastructure, we would advise establishing a **central office for charging infrastructure expansion** that coordinates the overall long-term strategy for roll-out while also monitoring infrastructure development. This central office would serve as a liaison to regional and municipal governments. The overarching purpose of the central office would be to ensure the planning of an efficient network of charging points that can effectively serve future EV fleets, ideally up to 100 percent EV share. With a view to privately owned cars, this strategy must consider the distribution between private and public charging infrastructure, and the shares of different charger types (slow, medium, fast).

As the topic of charging infrastructure requires the collaboration of different sectors such as the energy sector, transport sector, and buildings sector, we would also advise forming an **interdepartmental working group** that can drive the roll-out forward. From the perspective of electricity grid expansion, a forward-looking strategy is more cost-effective than a demand-driven one, and enables easier **integration of renewable energy**. Once a roll-out plan is established, the development of charging infrastructure can be supported through investment subsidies, the granting of land-use permits, and through legislation that requires mandatory installation of charging points in various locations (new buildings, gas stations).

Integrating renewables into the broader energy system and using it to charge EVs poses two types of challenge for the management of electricity grids: First, variable renewables such as solar PV and wind turbines do not provide electricity on a constant basis; rather, there are feed-in peaks when the weather is particularly sunny or windy. Second, electricity demand from EV charging is not distributed evenly over the day and week; rather, there are notable demand peaks, particularly during evening hours, when people return home and charge their vehicles. However, there are various strategies and methods for smoothing out these peaks and strengthening grid stability. **Vehicle to grid (V2G)** is a bidirectional charging solution that allows vehicles to send energy back to the grid and "shave" demand peaks. Furthermore, **variable power tariffs for EV charging** can encourage electricity users to charge EVs during off-peak hours. Various EU countries, including the Netherlands, Austria, and Germany, have implemented dynamic power tariffs for EV charging.

Various measures can bolster the attractiveness of EVs by improving ease of use in everyday settings – for example, preferential parking spots, special lanes, and dedicated zero emission zones. Many European cities (including Amsterdam, Berlin, Brussels, London, Madrid and Paris) have introduced reduced parking fees and preferred issuance of residential parking permits for EVs.[17]

E. Enable circular vehicles

A large share of used vehicles in Europe are currently exported abroad to various regions, including Africa, Central Asia, and Eastern Europe.[18] In 2021, Germany exported 2.5 million used vehicles; only 397,000 vehicles were scrapped in Germany.[19] However, as noted previously, the ramp up of EV production requires large quantities of raw materials, including some that are valuable and scarce. Reliance on recycled materials rather than newly extracted resources has the added benefit of reducing emissions. Accordingly, end-of-life domestic scrapping and associated material recovery rather than export could be a strategy that yields both environmental and economic

17 Wappelhorst, Hall, Nicholas et al 2020
18 UNEP 2021
19 UBA 2024

Dimensions of policy instruments — Table 1

Policy instrument types	Direct/indirect policy instruments	Policy instruments regarding different vehicle types
• Fiscal instruments • Regulatory instruments • Soft policies	• Direct: EV uptake is directly promoted • Indirect: ICE vehicles are disincentivized and phased out	• 2W • 3W (for both people and goods) • 4W (passenger cars) • Light duty vehicles • Buses • Heavy duty vehicles/trucks

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benefits. Various policy initiatives can promote a circular economy for EVs and EV component materials.

- Incentivizing end-of-life recycling
- Specifying mandatory minimum recycling quotas
- Establishing and coordinating recycling sites and processes
- Regulating responsibilities for recycling
- Setting standards for safety and environmental protection

Some of the most valuable materials in an EV are contained in the batteries. However, battery recycling capacities in the EU currently remain low. Accordingly, there is clear need for policymakers to incentivize recycling and to support the establishment recycling infrastructure and standards. In 2023, the EU launched a new Battery Regulation that aim to promote a circular economy by improved management of the battery life cycle. The regulation includes battery collection targets for producers, obligating them take back all EV waste batteries. Furthermore, the regulation prescribes recycling efficiency targets (e.g. 70 percent by 2030 for lithium batteries), recycling quotas (e.g. 50 percent by 2027 and 80 percent by 2031 for lithium batteries) and mandatory minimum rates of recycled content to be used in industrial batteries (which have been initially set at 16 percent for cobalt, 85 percent for lead, 6 percent for lithium, and 6 percent for nickel by 2031). The Battery Regulation also includes a carbon footprint reporting requirement for the battery supply chain, and sets forth associated safety requirements.

2.2 Ensure an effective and comprehensive policy mix

Table 1 provides an overview of the policy instruments that are available to overcome the hurdles to EV adoption discussed in the foregoing. We draw a distinction between fiscal instruments (purchase subsidies, differentiated tax rates) and regulatory instruments (such as license plate lotteries to limit vehicle registration). In our typology, "soft policies" represent a third type of instrument. Examples in this regard include awareness campaigns or collaborative platforms to interlink stakeholders in the EV sector.

Policy instruments may support EV adoption in a highly **direct** manner (e.g. through purchase subsidies or parking benefits) or in an **indirect** manner (e.g. by disincentivizing ICEs with "malus systems" that impose higher registration or parking fees).

The enactment of policy measures that target specific vehicle types is another necessary point of consideration (e.g. measures that specifically promote the electrification of passenger cars, 2 wheelers, or heavy duty trucks).

2.3 Discussions with experts

Following our evaluation of the various challenges to EV adoption and our identification of promising policy options for surmounting these challenges, we conducted expert discussions with Indian EV stakeholders in order

Overview of interview partners Table 2

Type of organization	Interview partner
Maharashtra authority	Head of Department
Mumbai local authority	Deputy Officer
Public transport company	Vice Chairman and Managing Director
University	Professor
OMI Foundation	Neha Gupta, Lead - Centre for Clean Mobility; Pradeep Karuturi, Lead - Centre for Clean Mobility
The Energy and Resources Institute (TERI)	Sharif Qamar, Associate Director
Saahas Zero Waste	Cassius Castellino, Consultancy Lead
Component manufacturer	Deputy General Manager of Division
Vehicle manufacturer	Head of Sales

Agora Verkehrswende (2025)

to solicit practitioner feedback and criticism. Table 2 lists the organizations that were interviewed as part of this project. The interviews were conducted in person (in Mumbai), in online meetings, and in written form between July 2023 and May 2024. In order to allow for an open discussion, the expert discussions were conducted as semi-structured interviews. The insights obtained through these interviews crucially inform chapter 4, in which we outline opportunities for the further development of EV policy in Maharahstra.

All in all, the landscape of policy instruments used to promote EV adoption is very diverse, as demonstrated by the numerous examples presented in chapter 2. Yet there is no "one-size-fits-all" solution or set of policy instruments that will guarantee a successful EV implementation in Indian states or in other jurisdictions. The countries and states of the world are simply too diverse. Some countries have large, well-established vehicle manufacturing industries, while others rely on import vehicles. Furthermore, in some countries, most vehicles are 2 and 3 wheelers, while in others, 4-wheeled vehicles are the dominant form of motorization.

However, no matter what the jurisdiction, an effective mix of policy instruments is required to enable successful EV adoption. Specifically, this means that the enacted policy instruments should not only address the various categories of challenge identified in section 2.1, but also to address all vehicle types (see section 2.2). To evaluate the gamut of policy instruments that are available against the backdrop of the local conditions that prevail in individual states and countries, we have consulted experts from various domains, including government, academia, and industry.

3 | Maharashtra case study – status quo of EV policy and transformation

Maharashtra is India's second largest state in terms of population, with over 120 million inhabitants (as of 2020, based on projections from 2011 Census data)[20] and covers an area of 308,000 km^2 [21] (making it approximately the same size as Italy). The capital of Maharashtra is Mumbai, the most populous urban agglomeration in India. Maharashtra is divided into 6 divisions and 36 districts; the largest cities (after Mumbai) are Pune, Nagpur, and Nashik. Maharashtra plays an important role in India's economy, as it is responsible for 13 percent of nominal GDP.[22] Maharashtra is also one of the most industrialized states, and has a strong vehicle manufacturing industry. Many manufacturers, including Tata Motors, Mahindra & Mahindra, Bajaj Auo and Ashok Leyland have production sites for vehicles and components in Maharashtra. Several of these plants produce some 200,000 vehicles annually each.[23] Various foreign manufacturers, including Mercedes Benz, Piaggio, Volkswagen, Fiat, and Skoda, also operate manufacturing and assembly sites in Maharashtra.

With over 37 million reigstered vehicles, Maharashtra is the leading Indian state in terms od registered vehicle fleet.[24] It also boasts the highest number of new registrations per annum (approx. 2 million).[25]

Maharashtra's State Electric Vehicle Policy sets forth measures and targets designed to promote the adoption of electric vehicles. In the following, we present the two versions of this policy that were released in recent years (in 2018 and 2021).

3.1 Maharashtra State Electric Vehicle Policy

Maharashtra was among the first states in India to adopt EV policy measures and a dedicated EV policy. In 2018 and 2021, two versions of the State Electric Vehicle Policy were adopted to complement the national FAME support scheme.

3.1.1 2018 policy version

"Maharashtra's Electric Vehicle and Related Infrastructure Policy – 2018" sought to increase registered EVs in Maharashtra to 500,000, generate investment worth 250 billion rupees (2.8 billion euros), and create 100,000 jobs.[26] Further stated goals included promoting R&D; human capital development; and the export of EVs, components, batteries, and charging equipment. In pursuit of these goals, the policy laid out various policy instruments, which are divided into three main categories:

1. The promotion of EV, battery, and components
2. Incentives and assistance for EV charging infrastructure
3. Incentives and provisions for EV buyers

Regarding the supply side (Category 1), the policy states the intention of setting up and subsidizing EV, EV component and battery manufacturing sites of different sizes, ranging from MSME (Micro, Small and Medium Enterprises) to "Ultra-Mega Enterprises", which are defined as enterprises with a minimum of 15 billion rupees (167 million euros) in fixed capital investment or the potential to create up to 3,000 jobs.

To promote charging infrastructure (Category 2), the policy states that electrical power required for EV charging is to be made available at residential rates across the state. The policy also prescribes amending the Development Control Rules (DCR) of all local self-government and special planning authorities to allow for the setting up of public and semi-public charging facilities at malls, residential properties, and parking lots. Furthermore, a 25 percent capital subsidy on physical equipment is foreseen for the first 250 charging stations. After a permit application for installing a charging point is received, the concerned planning authority and electricity supply utilities are called upon to grant permission within 15 days.

20 MoHFW 2020
21 Maharashtra State Data Bank 2011
22 Maharashtra Economic Advisory Council 2024
23 Mahindra & Mahindra Annual Report 2023-24, Bajaj Auto Annual Report 2023-24
24 MoRTH 2019-20
25 Vahan database 2024
26 Government of Maharashtra 2018

The policy also lists measures to support end customers (Category 3) through subsidies (see Table 5) and road tax exemptions.

The law additionally foresees the establishment of a high-level committee at the state level to monitor and guide implementation of the policy where required. The policy defines the composition of the committee in terms of the number and functions of the members as well as their areas of responsibility.

The 2018 policy version sets forth a total of 10 policy instruments and measures to promote the uptake of electric vehicles in Maharashtra.

3.1.2 2021 policy version

EV adoption rates remained low despite the support offered under the FAME scheme and enactment of the 2018 policy. Accordingly, the Maharashtra government reviewed the 2018 policy and ultimately adopted an amended version on July 23, 2021 (the "Maharashtra State EV Policy – 2021"). The policy targets the five major agglomerations in Maharashtra – namely, Greater Mumbai, Pune, Nagpur, Nashik, and Aurangabad.

Tables 3 and 4 present the targets established by the 2021 version of the policy.

Besides these targets related to vehicles and charging infrastructure, the policy names further objectives:

- Make Maharashtra the country's top producer of BEVs in India, in terms of annual production capacity.
- Establish at least one gigafactory in the state for the manufacturing of advanced chemistry cell (ACC) batteries.
- Promote research and development (R&D), innovation, and skill development across the EV ecosystem in the state.

Table 5 and 6 show the financial incentives provided for vehicle buyers and charging infrastructure under the 2018 and 2021 versions of the policy. The 2021 policy provides for more differentiated vehicle subsidies (including expanded support in some categories).

Maharashtra policy targets for vehicles — Table 3

Parameter	Maharashtra EV policy target	Remark from policy document
All vehicles	10 percent	Share of EVs in new vehicle registrations in the state in 2025
2 wheelers	10 percent	
3 wheelers	20 percent	
4 wheelers	5 percent	
Fleet operators	25 percent	Target 2025 penetration rate for urban fleet. Applies to e-commerce, last-mile delivery/logistics players and mobility aggregators operating in urban areas
Buses	i) In the five targeted UAs, 25 percent electrification of public transport by 2025 ii) MSRTC to convert its existing bus fleet to 15 percent electric fleet	---
Government vehicle fleet	Starting April 2022, all new govt. vehicles (owned/leased) operating within the major cities to be electric	---

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021

Maharashtra policy targets for charging infrastructure — Table 4

Parameter	Maharashtra EV policy target	Remark from policy document
Charging infrastructure	**Cities**: Targets for public & semi-public charging stations by 2025: Greater Mumbai UA: 1500 units Pune UA: 500 units Nagpur UA: 150 units Nashik UA: 100 units Aurangabad UA: 75 units Amravati: 30 units Solapur: 20 units **Highways**: Make following highways fully EV ready by 2025 i. Mumbai Nagpur Expressway ii. Mumbai Pune iii. Mumbai Nashik iv. Nashik Pune	i. Setup at-least one public charging stations in a 3 km x 3 km grid or a minimum of 50 charging stations per million population, whichever is higher. ii. Setup public charging stations on highways at 25 km intervals (on both sides of the highway). These stations should cater to requirements of long-haul passenger & freight vehicles.

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021

Vehicle subsidies under Maharashtra EV policy — Table 5

Vehicle type	2018 EV policy: max. incentives per vehicle	2021 EV policy: max. incentives per vehicle
2 wheelers	5,000 rupees (55 euros) for the first 70,000 vehicles	*e-2W (L1 and L2*):* 10,000 rupees (110 euros) for the first 100,000 vehicles
3 wheelers	12,000 rupees (134 euros) for the first 20,000 vehicles	*Autos (L5M):* 30,000 rupees (330 euros) for the first 15,000 vehicles *Goods carrier (L5N):* 30,000 rupees (330 euros) for the first 10,000 vehicles
4 wheelers	100,000 rupees (1,115 euros) for the first 10,000 vehicles	*Cars (M1):* 150,000 rupees (1670 euros) for the first 10,000 vehicles *Goods carrier(N1):* 100,000 rupees (1,115 euros)for the first 10,000 vehicles
Buses	2,000,000 rupees (22,300 euros) for the first 1,000 vehicles	2,000,000 rupees (22,300 euros)for the first 1,000 vehicles

** The designations indicate the vehicle categories of the Indian homologation*

Agora Verkehrswende (2025) | Source: 2018 and 2021 Maharashtra EV policies

Charging infrastructure subsidies under Maharashtra EV policy — Table 6

2018 EV policy: max. incentive amount for commercial public charging stations	2021 EV policy: max. incentive amount for PCS and SPCS
1,000,000 rupees (1,165 euros) for the first 250 charging points	*Slow charging:* 10,000 rupees (110 euros) for the first 15,000 charging points *Moderate/fast charging:* 500,000 rupees (5580 euros) for the first 500 charging points

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2018 and 2021

The 2021 policy version also includes fixed incentive amounts for the scrappage of used ICE vehicles in addition to battery warranties and assured battery buyback. The scrappage incentives are available for 2 wheelers (max. 7,000 rupees, or 78 euros), 3 wheelers (max. 15,000 rupees, or 168 euros) and 4 wheelers (max. 25,000 rupees, or 280 euros). If OEMs offer buyback schemes for vehicles which are up to 5 years old at a reduced value of no less than 7.5 percentage points per year of vehicle age, the policy foresees additional incentives for OEMs. To address customer anxiety about the resale value of electric vehicles, the policy also provides incentives to OEMs to be passed on to customers in the form of a minimum 5-year battery warranty. The maximum funding amount for this instrument is 6,000 rupees (67 euros). If OEMs opt to make use of both the buyback and warranty subsidies, the highest total funding amounts to 12,000 rupees (134 euros).

The 2021 version of the policy includes around 40 instruments. Chapter 4 provides a detailed assessment of the associated instrument types. Given the large number of instruments contained in the 2021 policy and its broad coverage, it is one of the most comprehensive state EV policies in India.

The 2021 policy has links to various other policies, including the so-called Package Schemes of Incentives, a funding policy of the Maharashtra government that aims to support industry investment in less developed areas. There are also links to federal government policy, including production-linked investment schemes (PLI) and the building code of the Ministry of Housing and Urban Affairs.

The 2021 policy will be in force until 31 March 2025, after which it will be reviewed and potentially extended. As the 2021 version is the most current, in the following, we intend to refer to the 2021 policy when mentioning "Maharashtra EV policy" or "2021 EV policy".

3.1.3 EV policy targets compared to other Indian states

In the following, we summarize the most notable EV targets of Indian states in order to provide context to the ambition level exhibited by Maharashtra's latest EV targets.

All EV policies that have been published so far set quantitative targets for the electrification of vehicles. The targets are formulated as percentage shares of new registrations. Quantitative goals have also been defined for the installation of charging stations. Nine states have set electrification targets (market penetration rates as a percent of new sales) for all vehicle segments, as detailed in Table 7 (even though the term "all" vehicles or "all vehicle registrations" does not include heavy duty trucks in some cases).

Thirteen states have set 100 percent sales penetration targets for one or several vehicle segments (see Table 8). The majority of targets are set for the latter half of this decade.

Eight states have set specific targets for the development of charging infrastructure (see Table 9). Many more states (17 in total) are providing subsidies or tax cuts for rolling out charging infrastructure, but without setting target numbers.

Indian state EV sales penetration targets for all vehicle segments[1] Table 7

No.*	State	2021 EV policy: max. incentives per vehicle
1	**Maharashtra**	**10% (2025)**
2	Odisha	20% (2025)
3	Assam	25% (2026)
4	Chhattisgarh	15% (2027)
5	Himachal Pradesh	15%(2025)
6	Meghalaya	15% (2025)
7	Manipur	20% (2026)
8	Goa	30%(2025)
9	Andaman and Nicobar	30% (2026)

Agora Verkehrswende (2025) | Source: State EV policies of respective states;
[1] In some cases "all vehicles" does not include trucks; *ordered by population

Indian state targets for 100 percent electric vehicle sales Table 8

No.*	State	Vehicle/transport type and target year	Electrification target
1	Uttar Pradesh	Public Transport (2030)	100%
2	Bihar	Rickshaws (2022), Public Transport (2030)	100%
3	Madhya Pradesh	Public Buses (2028), Government Vehicles (2028), Commercial & Logistics Vehicles (2028)	100%
4	Tamil Nadu	Public Buses (2028), Government Vehicles (2028), Commercial & Logistics Vehicles (2028)	100%
5	Karnataka	Rickshaws (2030), Corporate Fleets (2030), School Buses (2030), Commercial & Logistics Vehicles (2030)	100%
6	Andhra Pradesh	Government Vehicles (2024), Commercial & Logistics Vehicles (2030)	100%
7	Assam	Public Buses (2030), Government Vehicles (2030) Commercial & Logistics Vehicles (2030)	100%
8	Punjab	Government Vehicles (2026)	100%
9	Chandigarh	2W & 3W (2025), 3W & 4W Commercial & Logistics (2027), Public Buses (2027)	100%
10	Haryana	Government Vehicles (2024), Public Buses (2029), Commercial & Logistics Vehicles (2028)	100%
11	Manipur	Public Buses (2027)	100%
12	Goa	Government Vehicles (2022), 2W Public Transport (2025), 2W Private Transport (2031)	100%
13	Andaman and Nicobar	Public Buses (2025), 2W (2030), Government Vehicles in Port Blair (2031)	100%

Agora Verkehrswende (2025) | Source: State EV policies of respective states; *ordered by population

Indian state targets for EV charging infrastructure — Table 9

No.*	State	Target value and year
1	**Maharashtra**	**City: 3 km x 3 km grid or a minimum of 50 charging points/ 1 mio. inhabitants; highways: 1/25 km**
2	Jharkhand	City: 3 km x 3 km grid or a minimum of 50 charging points per 1 mio. inhabitants; highways: 1/25 km
3	Punjab	Minimum 1/15 EVs; fast charging: minimum 1/25 km of travel
4	Haryana	1/50 km on "prominent highways"
5	Himachal Pradesh	National highways: 1/50 km; state highways: 1/25 km; 4 model cities: 1x1 km grid
6	Goa	City: 3 km x 3 km grid; highways: 1/25 km
7	Arunachal Pradesh	City: 3 km x 3 km grid; highways: 1/25 km
8	Chandigarh	At least 1 charging station at every parking space

Agora Verkehrswende (2025) | Source: State EV policies of respective states; *ordered by population

As the above tables make clear, the state of Maharashtra is a leading Indian state in terms of EV targets. Maharashtra has set EV sales penetration goals for almost all vehicle types, as well as specific and ambitious targets for charging infrastructure. However, with a view to EV penetration as a share of new vehicle registrations, Maharashtra shows a somewhat lower level of ambition than some other states. As shown in Table 7, several Indian states aim to achieve 100 percent sales penetration rates for numerous transport and vehicle types. By contrast, Maharashtra's targets are 10 percent (2 wheelers), 20 percent (3 wheelers) and 5 percent (4 wheelers); see Table 3.

It is important to note that Maharashtra has the largest number of registered vehicles among Indian states and is also the state with the highest number of new registrations each year. Accordingly, in comparison to smaller states, greater efforts are required to achieve higher sales penetration rates. At the same time, the Maharashtra transport sector is responsible for high emissions, due to the number of vehicles on the road, thus spotlighting importance of rapid electrification. Accordingly, section 4.1 presents opportunities for the further development of EV targets.

3.2 Maharashtra electrification trends

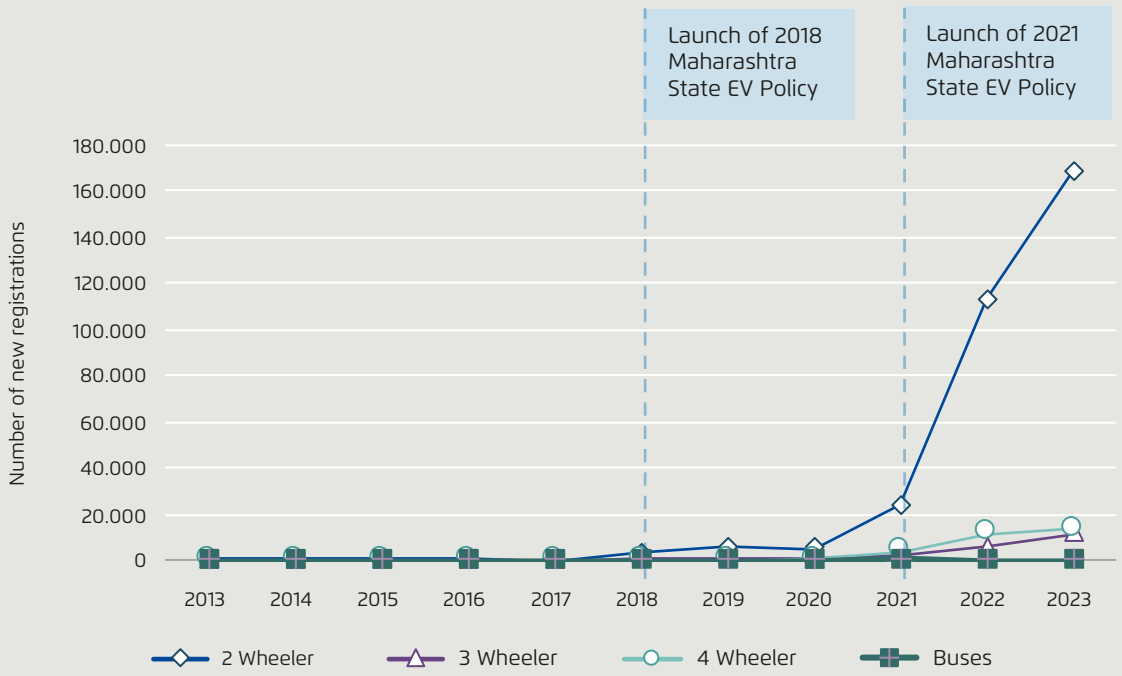
This section provides an overview of EV and charging infrastructure development trends to shed light on how Maharashtra's EV policies have promoted electrification.

EV growth rates in Maharashtra

Figure 4 shows annual growth in EV registrations for different vehicle segments in the state of Maharashtra. The highest growth can be observed in the category of 2 wheelers, which saw a more than 300-fold increase between 2013 and 2023. Especially in the years after the introduction of the EV policies in 2018 and 2021, YoY growth in the registration of electric 2 wheelers was particularly strong, hitting +790 percent in 2018 and +367 percent in 2021. This strong increase is likely attributable to the effect of subsidies, which improved the cost differential between electric and ICE vehicles in the 2-wheeler segment.[27] The relative growth in registration rates for other vehicle types was also strong, especially in 2021–23 (CAGR of +81 percent for 3 wheelers in 2021–23 and +54 percent for 4 wheelers in the same period). Electric buses also saw strong growth, especially in 2021, when YoY growth of nearly 650 percent was achieved.

27 Ministry of Heavy Industries 2023

Growth in EV registrations in Maharashtra — Figure 4



Agora Verkehrswende & ICCT (2025) | Source: Vahan database* 2024
*Vahan vehicle categories are summarized as follows: M-cycle/scooter + Moped = 2 Wheeler; 3W(passenger)+ 3W(goods)+ e-rickshaw(p)+e-rickshaw(with cart) = 3 Wheeler; Motorcab + Motorcar = 4 Wheeler

Electric vehicle registration in Maharashtra – 2025 targets vs. 2023 penetration rates — Table 10

Vehicle type	2025 target	EV share of new registrations in 2023
All vehicles	10%	8.4%
2 wheelers	10%	9.4%
3 wheelers	20%	14.9%
4 wheelers	5%	3.2%
Buses	i) 25% electrification of public transport fleet by 2025 in five targeted UAs ii) MSRTC to convert its existing bus fleet to 15% electric fleet	4.6%

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021, Vahan

Table 10 shows that, as of 2023, the state of Maharashtra has nearly achieved its policy targets for 2025 in numerous vehicle segments.

EV sales rates in the 4-wheeler segment are still relatively low, which is not surprising in this category, as the EV ramp-up in the car segment is more challenging, due in part to higher upfront costs compared to ICE vehicles and the need to roll out adequate charging infrastructure. (In the case of 2 wheelers, by contrast, home charging can take place through standard power sockets, and the upfront costs are lower.)

There is a large gap between current EV bus registration rates and the policy goal for 2025. However, state bus company MSRTC (Maharashtra State Road Transport Corporation) has ambitious plans for achieving the 15 percent goal and intends to purchase some over 5,000 electric buses (the total bus fleet currently stands at approximately 16,000 buses).[28, 29] The electric buses acquired by MSRTC thus far were purchased with the support of the FAME I scheme as well as the subsidies offered by the Maharashtra EV policy.

Charging infrastructure development

This section evaluates progress achieved in rolling out charging infrastructure while focusing on five districts: namely, Greater Mumbai, Pune, Nashik, Nagpur, and Aurangabad (see Figure 8 at the end of this section for more on state districts). Specifically, we conduct an inventory of charging stations in these districts and place them in relation to the targets established as part of the 2021 EV policy.

Figure 5 shows the absolute number of public chargers in each district of Maharashtra as of 2023.

Accordingly, among the five urban agglomerations in which EV adoption is to be promoted, Pune and Nashik have met their charging infrastructure development targets, while the other agglomerations have not (see table 11). According to power utility officials, Pune's leading position in this area can be attributed in part to its to its good connectivity with highways, which means there are many suitable locations for installing charging stations.[30]

Figures 6 and 7 present additional measures of charging infrastructure: charger density per 9 square kilometres of urban area (Figure 6) and charging density per 1 million inhabitants (Figure 7). These data are presented to enable evaluation of the 2021 EV policy objectives: namely, one public charging station in every 3x3 km^2 quadrant, or a minimum of 50 chargers per 1 million inhabitants

Among the five districts being considered, Mumbai city has the highest charger density per quadrant, followed by Pune. All of the other districts fall short of the 2021 target for charger density per quadrant.

28 MSRTC, ASRT, ITDP 2024
29 MSRTC 2024

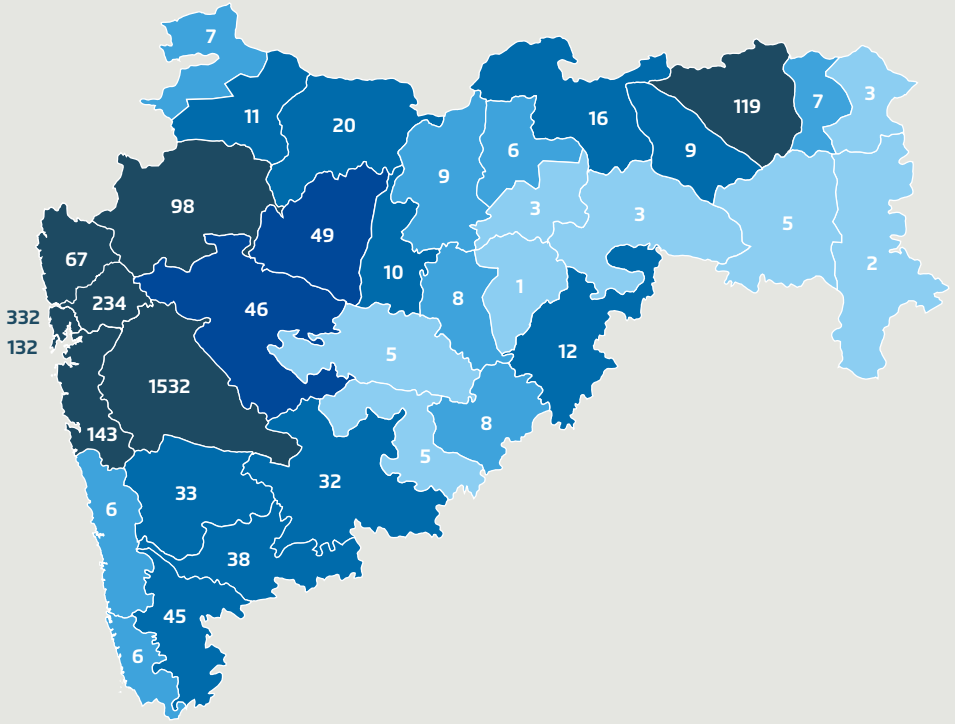
30 iFEVA 2023

Electric vehicle registration in Maharashtra – 2025 targets vs. 2023 penetration rates — Table 11

Urban agglomeration	Absolute number of chargers in the district	2021 EV policy target	Target met?
Greater Mumbai	464	1500	×
Pune	1532	500	✓
Nagpur	119	150	×
Nashik	~100	100	✓
Aurangabad	49	75	×

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021, BEE 2023

Absolute number of chargers per district Figure 5



Agora Verkehrswende & ICCT (2025) | Source: BEE 2023

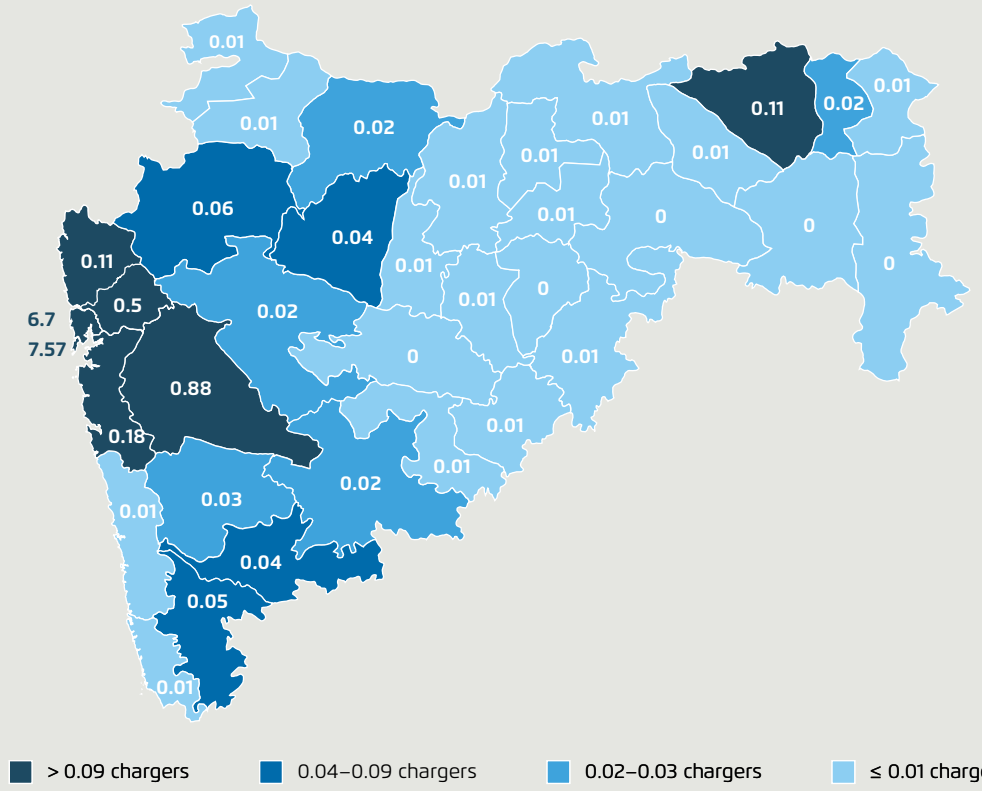
Pune and extended Mumbai meet the population-based charger availability criteria set by the 2021 policy guidelines. However, the other districts fall short of the target, highlighting the need for additional charging infrastructure development efforts.

As the foregoing discussion shows, Maharashtra's EV policies have had a considerable effect on the adoption of EVs, promoting particularly strong growth in registrations in the 2 wheeler segment. Significant progress has also been achieved in the development of charging infrastructure, with Greater Mumbai and Pune already meeting the targets set forth in the 2021 EV policy, both in terms of density per 9 km^2 and density per one million inhabitants.

Despite these positive trends, there are still many milestones to be passed on the road to complete road transport decarbonization in Maharashtra. In light of rising emissions in Maharashtra's transport sector (with carbon emissions increasing three-fold between 2008 and 2018[31]) in combination with the ongoing health hazards posed by air pollution and the commitment of the national government to achieve climate neutrality by 2070, there is a clear need maintain the current positive momentum in EV adoption and pursue strategies to bring about the complete electrification of road transport. This report therefore turns in the next chapter to identifying opportunities for the further enhancement of EV policy in the state of Maharashtra, predominantly by highlighting best practice examples from around the globe.

31 T.V. Ramachandra, 2009 , GHG platform India, 2018

Number of chargers per 9 square kilometer of urban area Figure 6



Agora Verkehrswende & ICCT (2025) | Source: BEE 2023

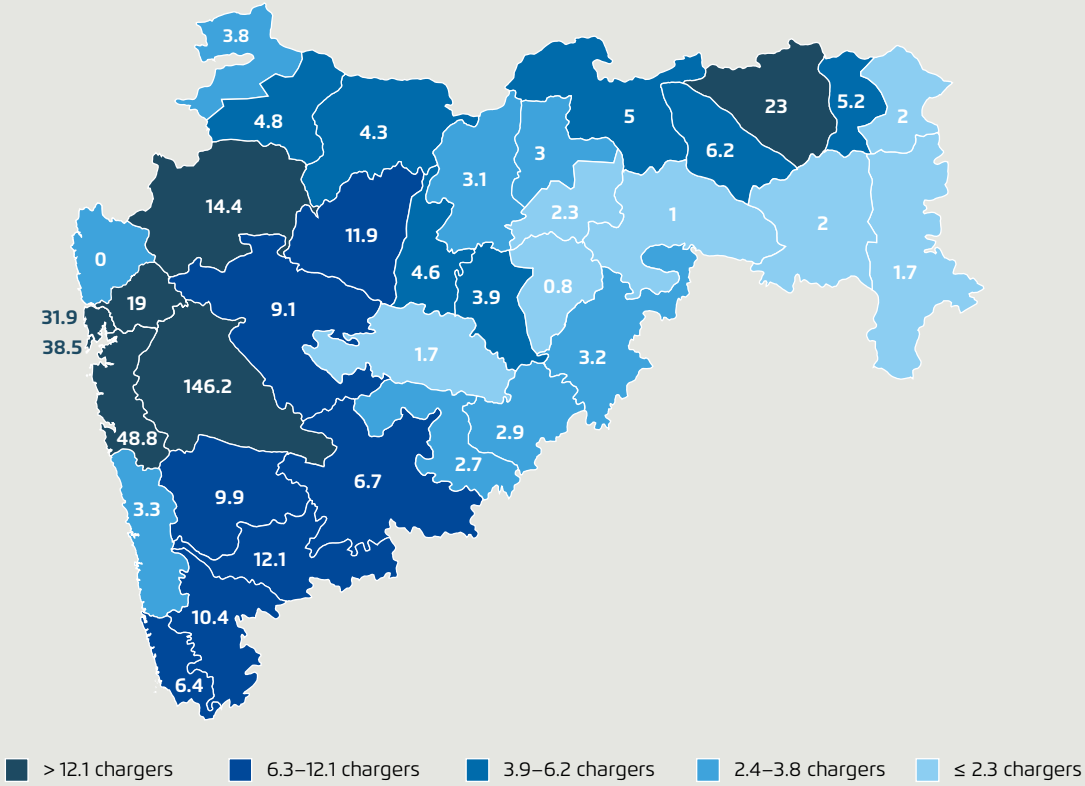
Maharashtra charging infrastructure – Charging point density Table 12

Urban agglomeration	Number of chargers per 9 km² of urban area	2021 EV policy target met?	Charging density per 1 million population	2021 EV policy target met?
Greater Mumbai	14.31	1 / ✓	71	50 / ✓
Pune	~1	1 / ✓	146	50 / ✓
Nagpur	0.1	1 / ×	23	50 / ×
Nashik	0.1	1 / ×	14	50 / ×
Aurangabad	0.04	1 / ×	12	50 / ×

Agora Verkehrswende (2024) | Source: Maharashtra EV policy 2021, BEE 2023

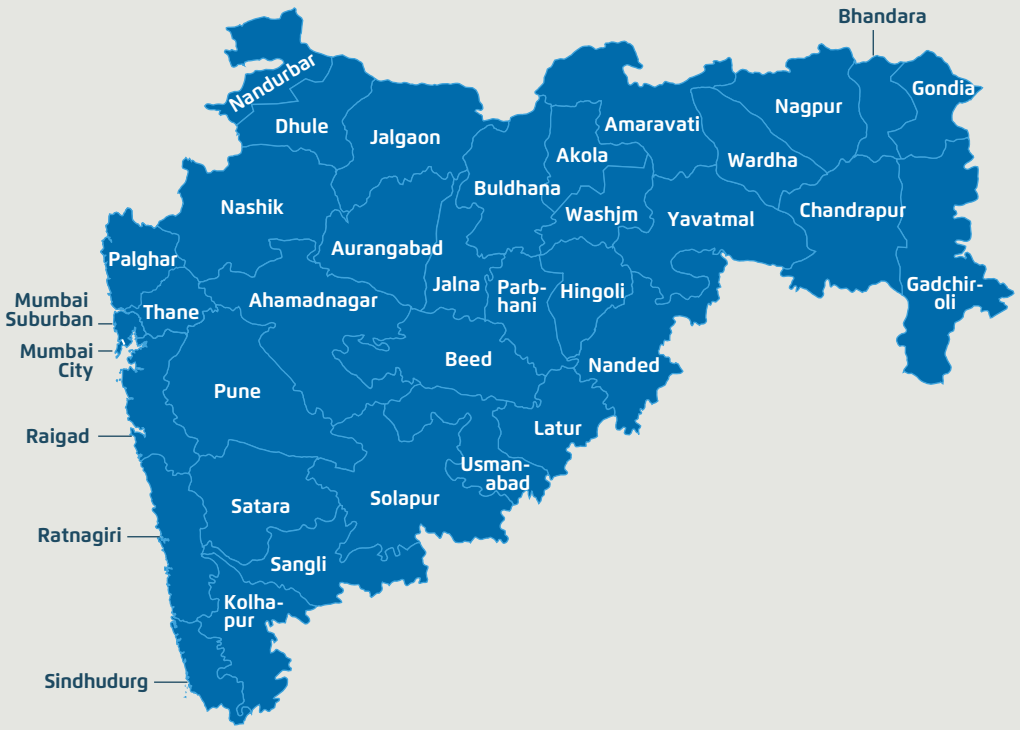
Number of chargers per 1 million population

Figure 7



Agora Verkehrswende & ICCT (2025) | Source: BEE 2023

Maharashtra district names Figure 8



Agora Verkehrswende & ICCT (2025) | Source: Integrated Government Online directory 2024

4 | Prospects for EV policy in Maharashtra

This chapter evaluates Maharashtra's 2021 EV policy in relation to international best practice and highlights opportunities for the policy's further development. Chapter 4 comprises seven sections.

- **Section 4.1** identifies the importance of a long-term vision for effective policy.
- **Sections 4.2–4.6** compare existing EV policy instruments in Maharashtra with international best practice. This discussion is structured according to the challenge categories A–E. This section is organized as follows:
  - First, existing policy instruments in Maharashtra are described in detail and categorized;
  - second, suggestions for enhancing the policy instruments are offered;
  - and finally, the existing measures and opportunities for enhancement are summarized.
- **Section 4.7** provides discusses factors of relevance for the effective monitoring of policy implementation.

4.1 The importance of a long-term vision for ambitious EV policy

EV adoption targets are much more than a metric for assessing progress on the road to decarbonisation. They are also extremely important as a signal of political commitment – not least to the investors who would risk their capital investing in electric vehicle manufacturing or associated infrastructure. Many countries have declared their intention of achieving a 100 percent EV share in new vehicle sales by the end of the current decade. China aims to reach a 72 percent share of NEV (new energy vehicles) by 2030; Canada is aiming to achieve a 60 percent EV share in new LDV and a 35 percent share in in medium and heavy duty vehicles by 2030; and Germany wants to bring 15 million fully electric vehicles on the road by 2030. Some targets also reach beyond 2030 – including, for example, the US goal of realizing a 100 percent ZEV share in federal vehicle procurement by 2035.

Robust and ambitious EV adoption targets provide an important basis for reliable planning on the part of the private sector. Furthermore, the higher the targets, the stronger the political commitment conveyed. In this connection, it is important to adopt a medium to long term time horizon for a target (i.e. beyond 5 years) in order to signal to stakeholders that electrification is not a passing fancy. However, if the targets are unrealistically high or set too far into the future, they may not be taken seriously or pursued with insufficient ambition. Given a very ambitious target or long time horizon, the adoption of supplemental interim targets can be important for ensuring an actionable vision.

→ **Insight for policy:** In light of the foregoing considerations, there would be distinct advantages to adopting long-term targets that seek to achieve high EV sales penetration rates as part of future revisions to Maharashtra EV policy. Numerous global players in the automotive industry have decided to go fully electric (e.g. Volvo, Ford, Volkswagen) and various companies have been launched with a sole focus on EVs (e.g. BYD, Tesla). The robust commitment to electrification shown by vehicle manufacturers will ensure healthy competition in the EV sector moving forward while also supporting the achievement of climate targets.

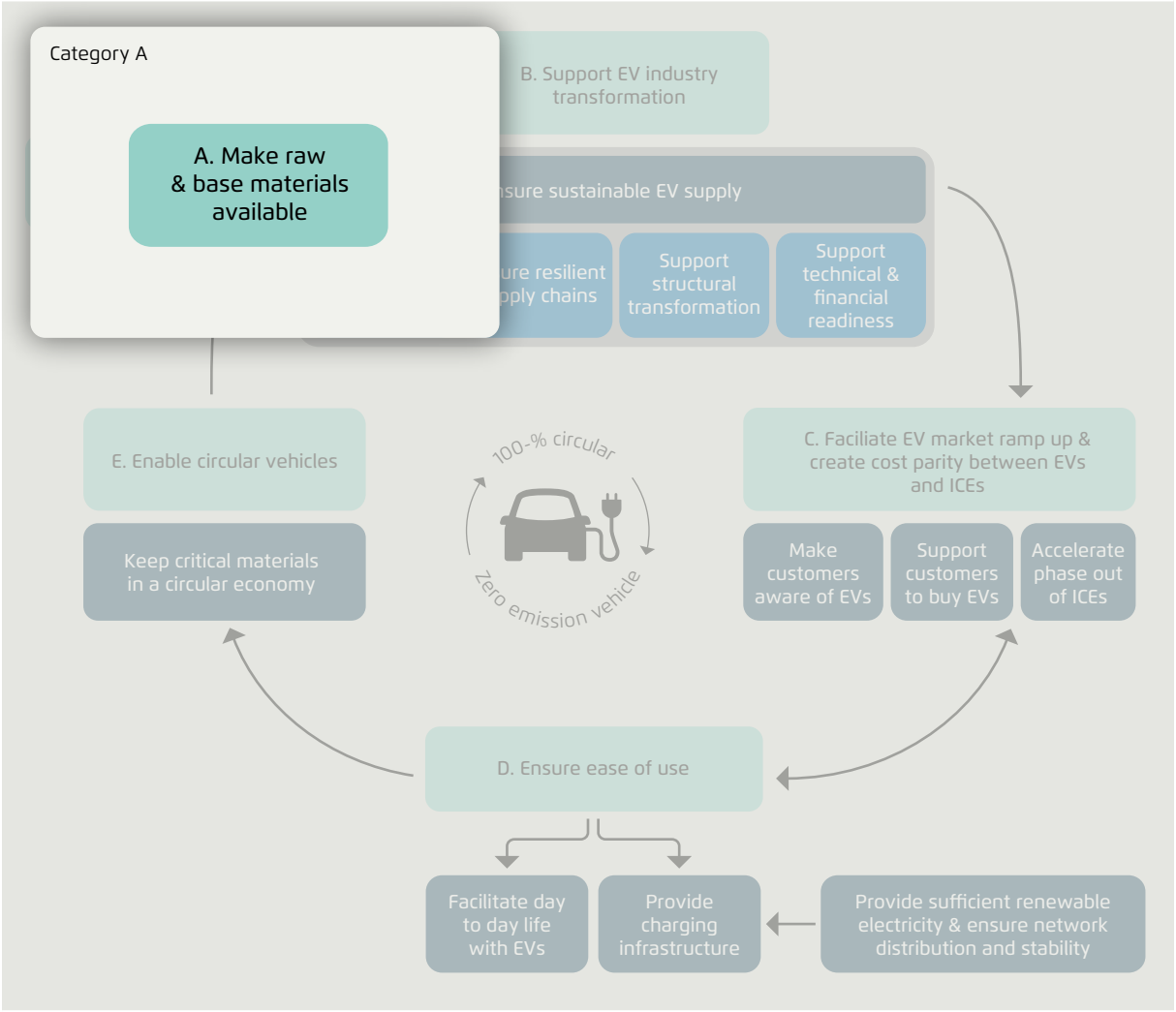
In our view, it would be beneficial to adopt a roadmap that includes interim targets on the journey to a long-term goal of achieving a 100 percent EV share in new vehicle registrations. This roadmap could be related directly to Indian climate target for 2070 or the COP26 declaration targets. Ideally, the interim targets could cover 5 to 10 year intervals. As state EV policies in India are usually valid for 5 years, in would make sense to relate them specifically to the long-term roadmap, which provides a long-term vision for the overall process.

Lastly, we would point to the benefit of incorporating specific targets for heavy duty vehicles. In this connection, public charging stations on highways represent an important prerequisite for electrifying road freight. While Maharashtra's 2021 policy sets forth targets for highway charging infrastructure, the addition of sales penetration goals for trucks would help to bolster EV adoption in this important vehicle segment.

4.2 Activities that can support material availability

Activities concerned with the availability of raw materials are generally pursued at the national level in India. One prominent example in this regard is the National

Challenges in EV adoption – Category A Figure 9



Agora Verkehrswende (2025)

Mineral Exploration Trust, which was established in 2015 to increase domestic exploration for materials; in 2015 and 2016, India also implemented reforms to mining law, primarily to improve the allocation of mining rights. Many critical raw materials that are needed for EV production have to be imported. The Indian Ministry of Mines constituted a seven-member committee in 2022 which compiled a list of critical minerals for India including lithium, cobalt, nickel and graphite.[32] In 2023, India joined the Mineral Security Partnership, a US-led alliance of 14 countries and the European Union that invest in critical mineral projects worldwide.[33]

Maharashtra's 2021 EV policy only supports category A ("Making raw and base materials available") in an indirect fashion. The policy's subsidies for battery recycling provide knock-on support for the availability of raw materials, as the recycled materials can be reused to produce new vehicles. However, this measure has not been

32 Ministry of Mines 2023

33 CEEW 2023

implemented in Maharashtra at the time of writing this report (according to the interviewed experts).

While general industrial policies in Maharashtra address raw material issues and mining, we conclude that it would be beneficial to address raw material issues specifically in relation to EVs in collaboration with the vehicle industry and to develop associated strategies for ensuring raw materials availability.

Opportunities for policy development

→ Opportunity 1: Monitor raw material demand and make it transparent

An important measure for avoiding supply shortages is to ensure sufficient transparency regarding raw material availability. State/regional government can support this transparency by maintaining close ties to local companies to understand their raw material needs. Raw material supply and demand should be monitored, and if supply bottlenecks occur, responsive measures can be taken. Implementation of advanced IT solutions can support the process and provide real-time transparency regarding supply chains, price levels, and the supply of important commodities and components. An example of a technical solution in this regard is Germany's Catena-X Automotive Network, which aims to digitally map automotive supply chains.

→ Opportunity 2: Develop partnerships in the area of raw material procurement and refining

The development of partnerships in the area of raw materials procurement can offer numerous advantages, including lower costs and reduced risk of price spikes. Collaborative procurement can also help to improve the reliability of supply chains while reducing risk of disruption or delay. In Maharashtra, opportunities for joint procurement could be explored by fostering partnerships between companies and also potentially between Indian states. The EU's Critical Raw Materials Act of 2023 is one example of an initiative in the domain of joint procurement. It aims to establish a joint purchasing mechanism for EU member states to ensure efficiency in sourcing materials and to leverage the collective purchasing power of multiple countries.[34]

In this connection, another opportunity is to form partnerships between Indian states for the supply of raw materials, as natural resources are unequally distributed throughout the country.[35]

Once raw materials have been procured, in most cases they need to be refined and further processed. For example, the conversion of lithium ore into a battery grade raw material involves complex and energy intensive processes. Insofar as domestic material processing facilities are to be established, the formation of partnerships between companies and regions can help to ensure the availability of requisite expertise.

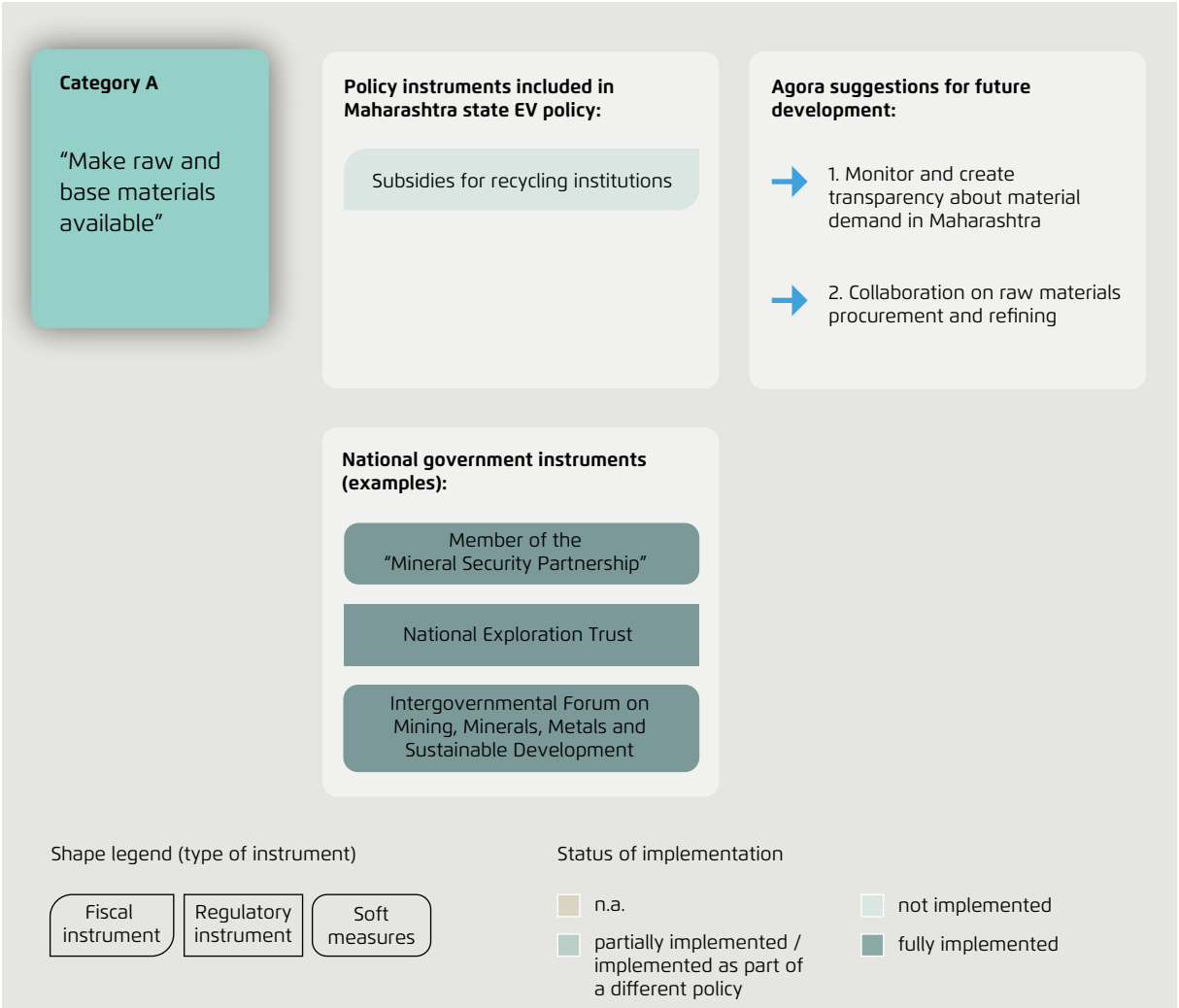
Summary

Maharashtra's existing EV policy does not devote significant attention to the topic of raw materials or their availability. One measure from the policy – the promotion of recycling – indirectly strengthens material availability, as recycled material can be reused in the production of batteries and EVs; however, this measure has not yet been implemented. Beyond EV policy, Maharashtra industrial policies deal with raw material issues, but not in a way that is specifically orientated to the EV industry and its material demands. For the future development of material availability for EV production in Maharashtra, we would tender two suggestions: First, material demand in Maharashtra should be monitored, to ensure transparency regarding the supply situation and potential bottlenecks; and second, partnerships between different companies and Indian states should be fostered in the area of raw materials procurement and refining.

34 European Union 2023

35 NITI Aayog/Ernst and Young 2023

Summary of available policy instruments and development suggestions for category A Figure 10



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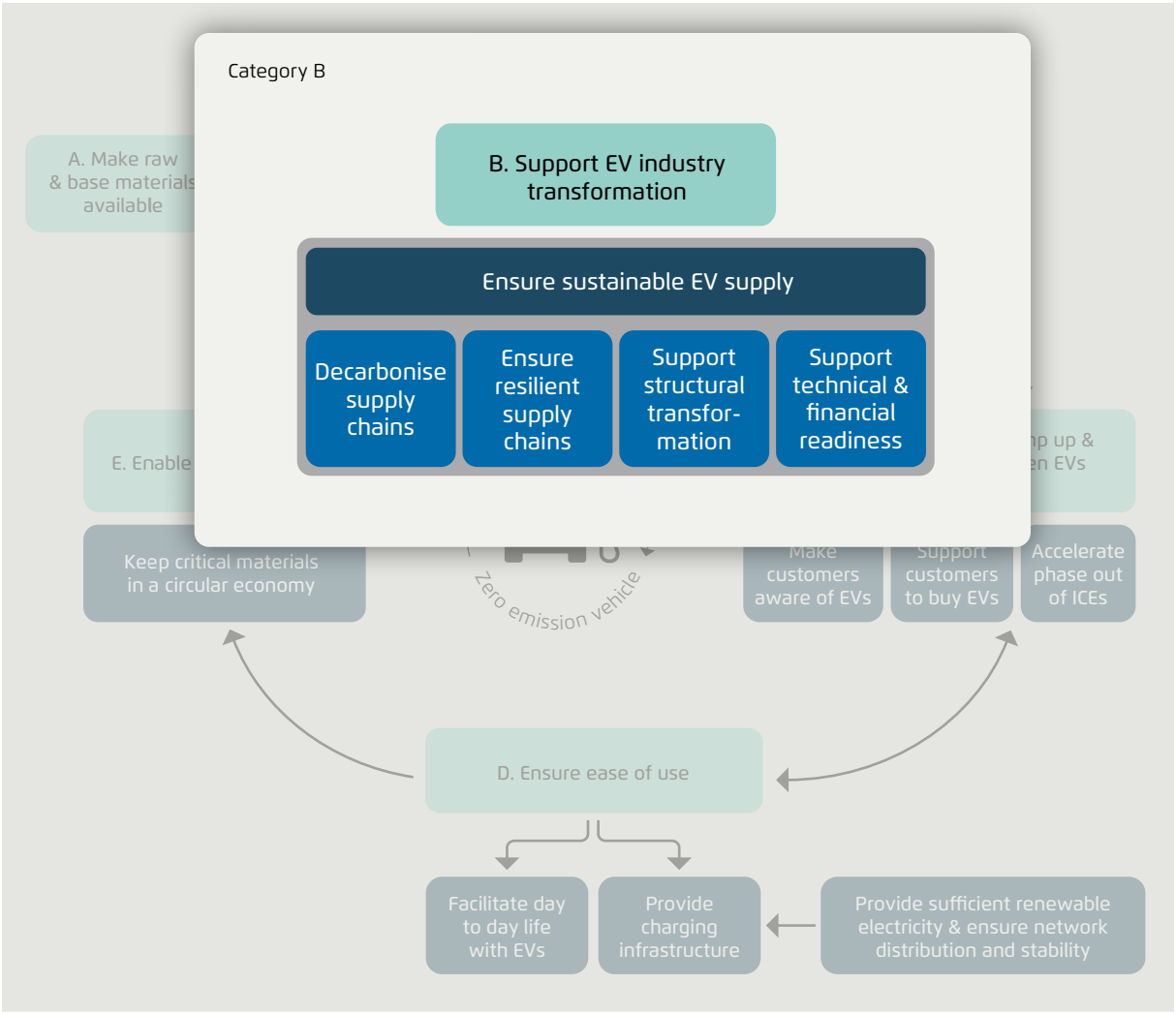
4.3 Place additional focus on supply chains and structural transformation

Maharashtra's 2021 EV policy contains in total 6 policy instruments that can be classified under category B (see Table 13).

Three of these measures are financial instruments: First, the policy foresees incentives to make the state more attractive for investment in manufacturing and R&D facilities related to EVs. Manufacturing subsectors eligible for these subsidies include component manufacturing, vehicle assembly, battery assembly, cell manufacturing, electronics parts manufacturing, and the recycling of EVs and EV batteries. As a second financial measure, Maharashtra's 2021 EV policy proposes a subsidy programme for the manufacturing of advanced chemistry cells as a complement the incentives offered by the central government's Production Linked incentive Scheme (PLI). The 2021 EV policy additionally expresses the goal of attracting at least one gigafactory to Maharashtra. First steps regarding government-backed investments in a gigafactory for batteries and EV production facilities were initiated in

Challenges in EV adoption – Category B Figure 11



Agora Verkehrswende (2025)

2021 and 2022, but the current status of such projects could not be verified at the time of writing this report. MSMEs (micro small and medium enterprises) can take advantage of a 25 percent subsidy on capital equipment acquired for technology upgrading in Maharashtra; however, these incentives are defined in a different policy (the Package Scheme of Incentives). The maximum support granted under this incentive is 2.5 million rupees (28,000 euros).[36]

Third, the policy foresees that EV start-ups will be encouraged on a priority basis under the Maharashtra State Innovation Society, a governmental nodal agency that supports an innovation-driven entrepreneurial ecosystem in the state of Maharashtra, in part through the granting of financial assistance. Support for EV start-ups has not been directly implemented through Maharashtra's 2021 EV policy. However, other Maharashtra government policy programmes provide support for start-ups, according to sector experts.

Two soft measures are included in Maharashtra's 2021

36 WRI 2022b

Maharashtra policy instruments supporting category B – distribution by type Table 13

Instrument type / Vehicle type	Fiscal instruments	Regluatory instruments	Soft measures
All vehicle types[1]	Subsidies for EV companies and R&D facilities	ZEV requirement	Industrial Staff training on EV ecosystem
	Battery manufact. incentives complementing PLI scheme		Development of skill enhancement centres
	(Financial) promotion of EV start-ups under the MSINS*		
HDV / trucks	---	---	---

Direct support of EVs Strengthening phase out of ICEs

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021

[1] except trucks; * Maharashtra State Innovation Society

EV policy under category B, both related to employee training: On the one hand, the policy recommends the establishment of employee courses on the electric vehicle ecosystem at state industrial-training institutes. On the other hand, the policy foresees state-government development of skill enhancement centres for delivering vocational courses dedicated to the EV ecosystem in partnership with relevant or interested OEMs and service providers. This training is to focus on competency development in the area of ICE mechanics and repairing and servicing EVs and charging stations. It should be noted that programmes that foster skill development exist in Maharashtra as part of different government programmes, and are only partially attributable to Maharashtra's EV policy.

Finally, one regulatory instrument relating to category B is proposed by the 2021 EV policy: The policy calls on the government of Maharashtra to explore the feasibility of a ZEV requirement and credit programme for the state. No measures have been implemented in this area thus far.

All of the measures included in the Maharashtra policy relating to category B are direct measures – that is, they directly promote the uptake of EVs. No specifications are made about vehicle types, so it can be assumed that the measures generally apply to all vehicle types.

Opportunities for policy development

→ Opportunity 1: Consider non-fiscal instruments to support EV manufacturing

As the automotive industry is responsible for a significant share of CO_2 emissions worldwide, automotive companies have a particular responsibility to reduce their emissions in line with the Paris agreement. Accordingly, governments should hold automotive companies accountable for their emissions – for example, by requiring them to electrify their product portfolios.

Various jurisdictions with notable vehicle industries and robust EV production, such as California and the UK, have implement ZEV mandates. California was an early mover in this regard, introducing its first ZEV mandate in the 1990s. While this policy originally sought to reduce the air pollution caused by gasoline vehicles, the instrument evolved to incorporate GHG emissions. The latest Californian regulations, published in 2022, establish a year-by-year roadmap for a gradual transition to 100 percent ZEV car and light truck sales by 2035. The roadmap includes intermediate goals of a 35 percent ZEV sales share by 2026 and 68 percent by 2030[37]. ZEV mandates in the UK require that 22 percent of all new cars and 10 percent of all new vans sold from 2024 onwards

37 CARB 2022

must be zero-emission vehicles. This quota will increase gradually to 80 percent in 2030, before all new cars sold are required to be zero-emission vehicles in 2035[38].

In combination with various other EV support measures, ZEV mandates provide significant support for EV market uptake (enabling, by way of example, a 25 percent EV share in new vehicle sales in California). Maharashtra's 2021 EV policy specifically encourages the exploration of a ZEV requirement. Accordingly, there is good reason to consider the adoption of ZEV quotas in Maharashtra as well. Specifically, we recommend development of a proposal for a ZEV mandate, including examination of the factors necessary for its implementation.

→ Opportunity 2: Encourage decarbonized and resilient supply chains

Reducing EV lifecycle emissions to zero necessitates fully decarbonizing upstream supply chains and energy inputs. This is a complex challenge, in part because supply chains are very diverse, and upstream companies rely on different types of data and CO_2 calculation methods. Divergence in data metrics makes it very difficult to obtain a consistent picture of overall emissions. Furthermore, the manufacturing of base materials such as steel is very energy intensive, and many of the associated industrial processes are difficult to decarbonize.

Despite the attendant challenges, the automotive branch has a powerful lever for persuading upstream companies to decarbonize their processes, as the vehicle industry is one of the most important buyers of materials and primary products. The decarbonization of base materials and components also promises to foster innovative new markets (e.g. for green steel, plastic, glass). The development of these markets will engender new opportunities for value creation. In this connection, there are also various benefits to be obtained from domestic or local investment in innovative production processes, as a shift away from reliance on individual providers can strengthen the resilience of supply chains. In addition, local production means that transport distances are reduced, and disruptions within the delivery chains are easier to track and manage. Potential measures to promote the decarbonization and localization of supply chains include the following suggestions.

- *Support local companies and set standards for decarbonized production techniques*
  Helping companies to establish local production sites can promote economic development and bolster supply chain resilience. The Indian central government's production-linked incentive schemes already include promotional measures for local production. These kinds of policies can also be established at the state level to provide CAPEX and OPEX investment subsidies for local manufacturing. OPEX subsidies are particularly important for energy-intensive production processes (e.g. battery cells, permanent magnets, green steel). By setting minimum standards and providing incentives in line with state-of-the-art production methods (including standards for decarbonized manufacturing), the government can actively support and advance green value creation.

- *Strengthen open data sharing networks*
  New IT solutions can help industry to overcome divergent standards and lack of transparency in CO_2 reporting. One prominent example in this regard is the Catena X data ecosystem, a joint undertaking of various Germany companies, including Mercedes-Benz, BMW, and Siemens. Open networks for data exchange such as Catena X can significantly increase the transparency of supply chains and provide valuable insights into emission footprints. Accordingly, to support the decarbonization of upstream supply chains in the Indian vehicle manufacturing sector, we would encourage the development of partnerships between Indian companies that are dedicated to issues surrounding ESG, including the definition of joint approaches for data sharing and reporting.

→ Opportunity 3: Establish a multi-stakeholder strategy forum on electric mobility

When specific regions of a country are significantly dependent on the automotive sector, the transformation of industry must take the broader social and economic context into account. In the German states of Saarland and Lower Saxony, for example, 6.7 percent and 5.2 percent of regular employees work in the automotive sector.[39] This makes the transformation of the automotive industry not only important for climate protection, but also of vital economic importance.

38 Gov UK 2024

39 BMWK; IPE 2020

There is a clear need for government to provide targeted support to regions so that they can successfully master the challenges posed by transformation. In this connection, assistance should be granted in particular to small and medium-sized companies in the automotive sector, as they typically lack the technological and strategic expertise or financial capability to develop and implement transformation strategies.

Strategy dialogues that bring together various stakeholders can represent a valuable instrument in this context. By bringing together voices from industry, government, academia, and civil society, such dialogues can help to clarify challenges, elaborate new business models, and identify broader approaches to managing transformation that are tailored to the region in question (e.g. regarding the retraining of the workforce, or attraction of investment from new industries).

By way of example, the German state of Baden-Württemberg was an early adopter of the strategy dialogue as a transformative tool. Since 2017, a total of 70 innovative projects have been initiated under the umbrella of the state's strategy dialogue. These projects address a range of issues, including knowledge sharing, staff training, and new business models for SMEs. To encourage the development of regional transformation strategies across the country, the German government supports the establishment of "transformation networks". These networks are tasked with: (1) developing regional transformation strategies; (2) enabling knowledge sharing; (3) supporting strategy implementation; and (4) strengthening skill development and human capital formation.

Like Baden-Württemberg, Maharashtra is home to large vehicle technology clusters. Accordingly, we would recommend the formation of a multi-stakeholder strategy forum on industrial transformation comparable to the FICCI association that exists at the national level in India for the entire industrial sector.[40] We would also recommend targeted funding to promote the creation of future-oriented jobs, to support employees in the reskilling process, and to help small and medium sized companies to restructure their business models and supply chains, in part through the granting of financial assistance.

40 FICCI 2024

Summary

Maharashtra's 2021 EV policy addresses the topic of industry transformation through various financial measures (subsidies and incentives), through regulatory approaches such as ZEV requirements, and through facilitative measures such as staff training. While subsidies and incentives for EV and battery manufacturing were announced through public sources, the current status of associated projects and disbursed subsidy amounts are currently unknown. Maharahstra's 2021 EV policy does not directly provide support for EV start-ups, industrial staff training, and skill enhancement centres; rather, these topic areas are addressed as part of separate policy. Furthermore, the 2021 EV policy only suggests exploration of ZEV requirements; such measures have not yet meen realized.

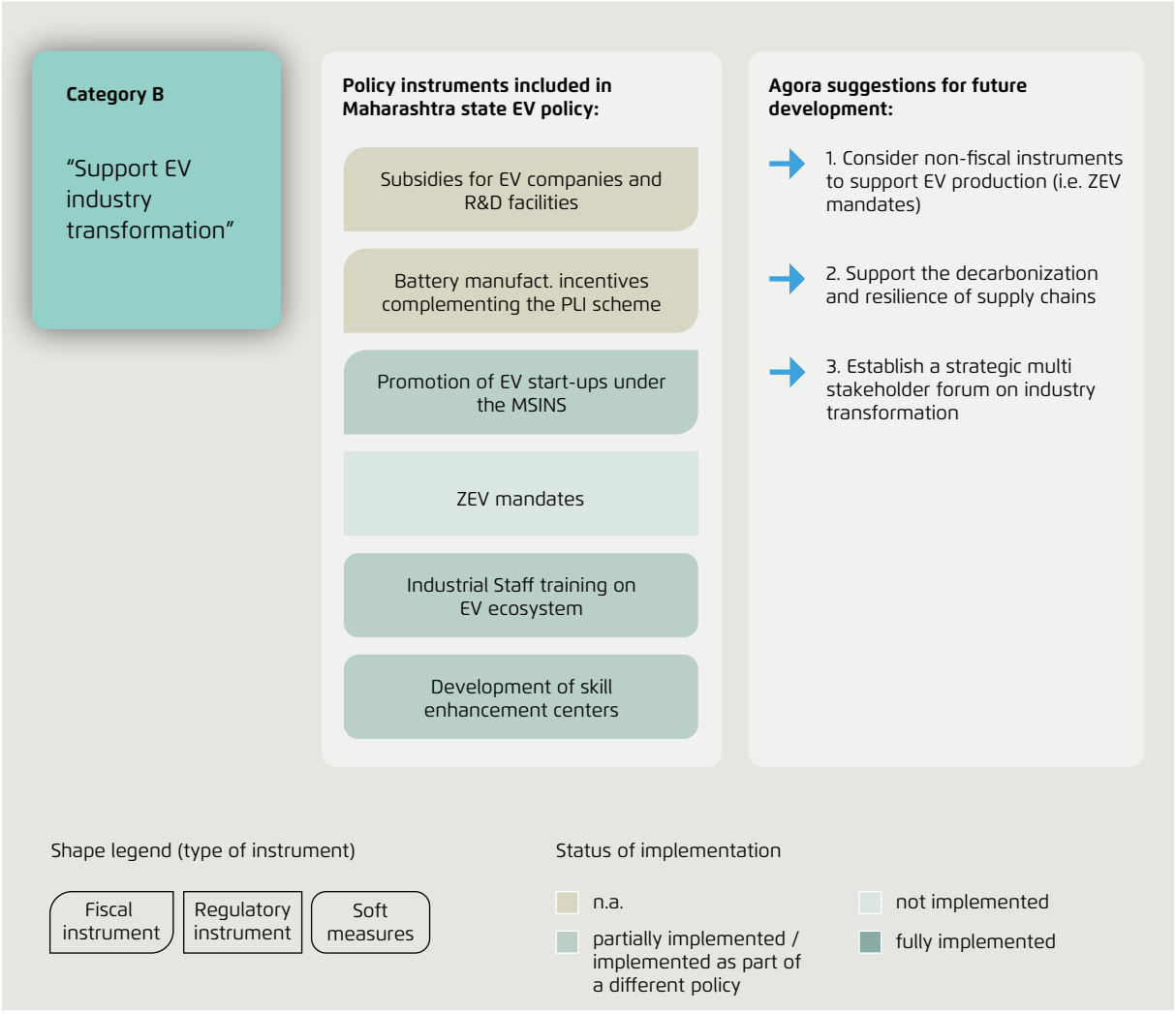
To further encourage positive industrial transformation in Maharashtra, we would highlight three opportunities: First, we would recommend the examination of non-fiscal instruments such as ZEV mandates in a more concrete and binding way. Second, we would propose devoting additional attention to the issue of decarbonized and resilient supply chains by granting targeted support to local companies and encouraging the adoption of IT solutions for emissions data sharing and reporting. Third, we would recommend the establishment of a multi-stakeholder strategy forum on industrial transformation that brings together various actors, including business leaders, government officials, academics, and civil society representatives; this forum should be tasked with identifying transformation strategies that are tailored to the region.

4.4 Extend purchase subsidies and adopt complementary non-fiscal measures

Regarding Category C ("Faciliate EV market ramp up & create cost parity between EVs and ICEs"), Maharashtra's 2021 EV policy provides a total of eleven policy instruments. Table 14 shows the distribution of these measures across the dimensions introduced in section 2.2.

The majority of category C instruments in the Maharashtra policy are fiscal instruments. In addition to purchase subsidies for EV buyers (see Tables 5 and 6), the policy

Summary of available policy instruments and development suggestions for category B Figure 12



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provides exemptions from road charges and funding for battery warranties and assured buyback. All of these measures have been implemented. However, full-scale buyer incentives were initially time limited to 31 December 2021 (as an "early bird" benefit); this was followed by a single extension to 31 March 2022.[41] The policy also foresees engaging and encouraging financial institutions to offer preferential interest rates to EV customers; however, this has not been realized so far. The 2021 policy also envisions a State EV Fund financed through green taxes and green cesses to promote EV adoption, including incentives for EVs and charging infrastructure. However, we were unable to verify the launch of this fund as part of our research. Regarding the acceleration of EV registration, we were unable to identify any sources confirming such a measure had been implemented under Maharashtra's 2021 EV policy. However, national government policy links the process of registering an EV with that of obtaining EV subsidies, thus accelerating both processes. These national policies thus indirectly fulfil the purpose of the registration-acceleration measure foreseen under Maharashtra's 2021 EV policy.

41 Government of Maharashtra 2022a

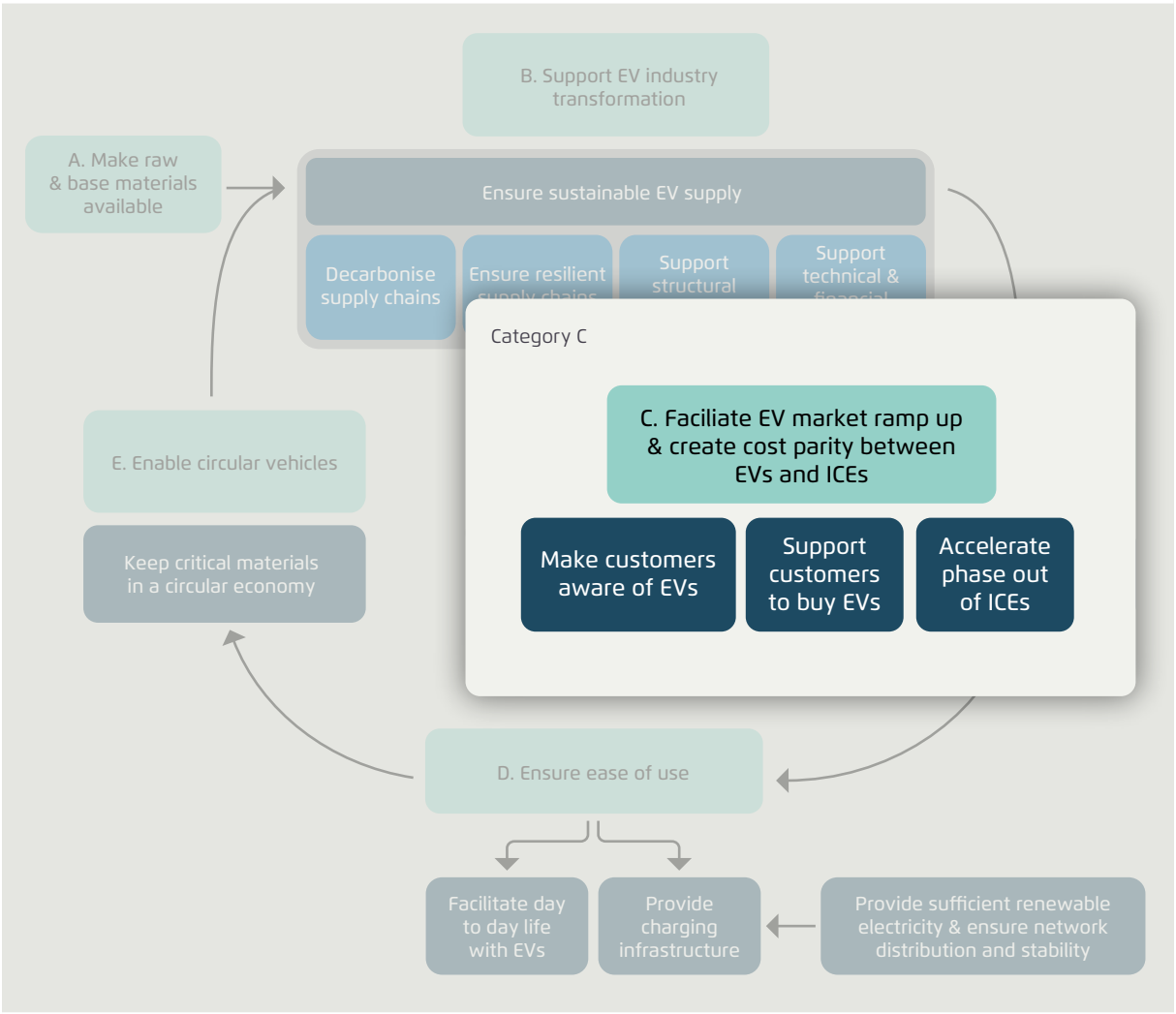
Regarding soft measures, including those designed to bolster public awareness, the 2021 policy prescribes green license plates for all registered EVs, irrespective of vehicle type. This measure, which is also attributable to an initiative of the national government, has been implemented for different vehicle types, including buses (see Figure 14). The Maharashtra policy also foresees the design and implementation of an awareness programme by the state government in partnership with industry players and civil society organizations in order to raise the visibility of EVs, highlight their benefits, and inform the public of incentives available through state and national government policies. However, to date no such programme has been initiated.

The measures contained in the 2021 EV policy predominantly provide direct support for ramping up EV sales. Only one instrument – namely, the scrapping premium – can be considered indirect, as it offers benefits for scrapping a combustion engine vehicle and purchasing an EV instead. A policy that offers scrappage incentives to car owners was approved by the Maharashtra government in 2022.[42]

42 Government of Maharashtra 2022b

Challenges in EV adoption – Category C

Figure 13



Agora Verkehrswende (2025)

Maharashtra policy instruments supporting category B – distribution by type Table 14

Instrument type / Vehicle type	Fiscal instruments	Regluatory instruments	Soft measures
All vehicle types[1]	Purchase subsidies for EVs	---	EV awareness program
	Road tax exemptions for EVs		Green number plates for EVs
	State EV fund		Encouraging of fleet aggrega-tors to operate EVs
	Encouraging banks to offer low-interest or interest-free loans to EV buyers		Endeavouring fast-tracking registration of EVs
	Scrappage incentives		
2W and 3W only	Subsidies for OEMS to offer assured Battery Buyback	---	---
	Subsidies for OEMs to offer Battery warranty		
HDV / trucks	---	---	---

Direct support of EVs Strengthening phase out of ICEs

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021
[1] except trucks;

Nine of the Maharashtra policy instruments under Category C address all vehicle types except trucks. For heavy duty vehicles and trucks, no strategy or promo-tional measure is foreseen. A few measures, including the assured buyback and warranty for batteries, exclusively apply to 2 and 3 wheelers.

Opportunities for policy development

→ Opportunity 1: Build on the existing measures with effective non-fiscal or indirect instruments

The offered purchase incentives for EVs in Maharash-tra led to a significant increase in vehicle registrations. This fiscal instrument is certainly an effective measure for supporting the uptake of EVs – not only in India, but worldwide. However, the instrument also brings disadvantages. The first disadvantage relates to social justice, as taxes are levied on all people (including the very poor) to subsidize vehicles that only the wealthy can buy. Second, the steering effect of EV subsidies may be limited if ICEs remain affordable and highly cost com-petitive. Third, excessively high subsidy expenses may be incurred if EV prices do not decrease sufficiently over time or if a dependence on subsidies persists.

These disadvantages make it advisable to consider alter-nate or complementary policy instruments. International experience shows that incentive policy is particularly effective when "pull" and "push" measures are combined (i.e. measures that encourage EVs in combination with measures that discourage ICEs). At the beginning of 2020, the EU strengthened its CO_2 fleet limits 160 g/km to 95g CO_2/km for 95 percent of manufacturer's car fleets. Penalties are incurred for non-compliance. At the same time, the German government increased the EV subsidy rate as part of their pandemic-related economic stimu-lus package. The combined effect of these measures was to trigger a threefold increase in new EV registrations between 2019 and 2020 (see Figure 15). Other countries have adopted a similar dual-track approach. Norway, for example, has implemented various purchase, parking, and toll benefits for EVs, while disadvantaging ICE

Green number plates on EV buses in Mumbai Figure 14

Agora Verkehrswende (2025) | Source: Agora Verkehrswende

ownership. This has led to strong growth in EV adoption. In this way, there is ample evidence for the effectiveness of combining "push" and "pull" policies. Accordingly, as a complement to the fiscal incentives that have been adopted thus far in Maharashtra, additional non-fiscal and indirect measures to disincentivize ICEs could include the following.

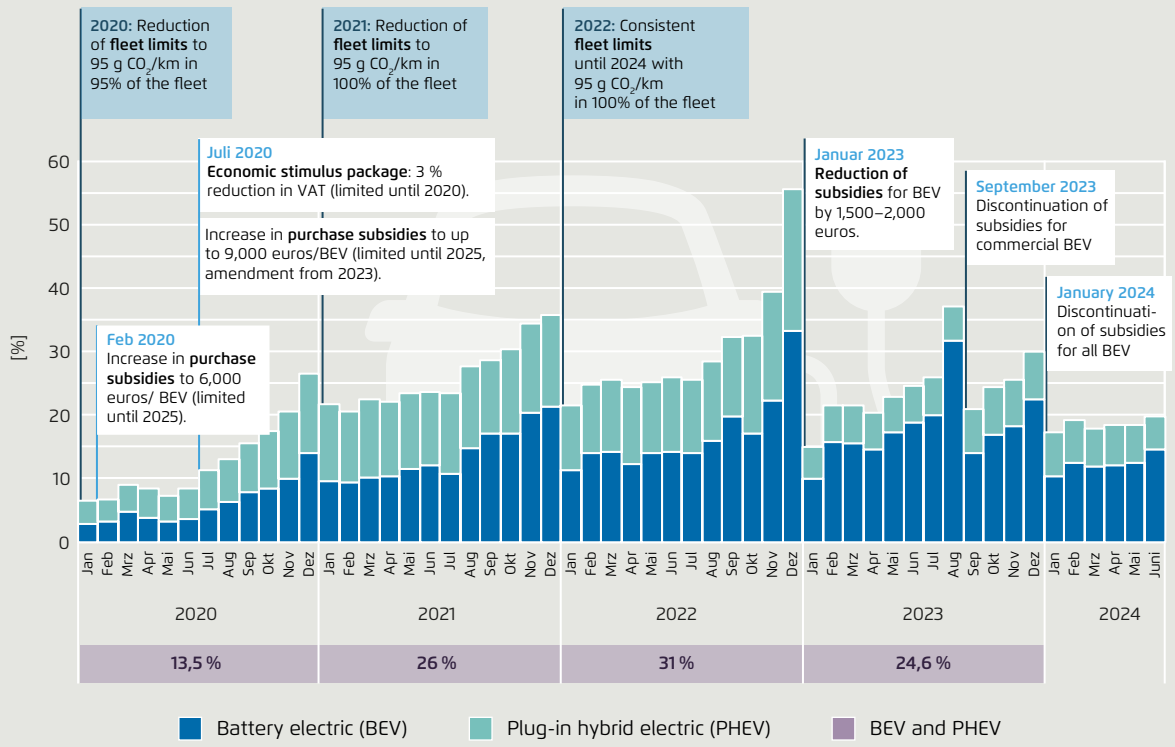
- *Malus systems for ICEs*: One promising option is to strongly tie registration taxes to vehicle emissions, so that zero-emission vehicles receive a tax reduction or exemption, while ICEs pay higher registration costs. In Norway and the Netherlands, particularly high registration taxes are levied on ICEs (see Figure 16). In combination with other tax schemes and measures, this registration tax system has led to significant increases in new EV registrations in these two countries. In Norway, the BEV fleet increased 3-fold between 2018 and 2022.[43] In the Netherlands, the electric vehicle fleet rose by a factor of almost 7 during the same period.[44]

  Malus systems do not have to be introduced for all vehicle types at once but can be initiated in a targeted way for special vehicle types such as commercial fleets. If commercial fleets such as last-mile delivery vehicles or ride hailing fleets experience rapid adoption of electric vehicles, this can have a positive "role model" effect, as such fleets are very visible in cities and raise awareness for EVs.

- *Limited license plate approvals*: In addition to the Indian city of Delhi, numerous Chinese cities with high levels of air pollution and congestion (including Shanghai, Beijing, and Guangzhou) have introduced regulations related to the issuance of license plates. Beijing, for example, announced in 2018 that it aims to keep the number of vehicles below 6.3 million by 2020 by gradually capping new license plate issuance. New licence plates are allocated by lottery and EVs are privileged in the quota system.[45] This policy simultaneously addresses the problems of congestion, air pollution, and transport decarbonization at the same

43 Norsk elbilforening 2023
44 CBS 2023
45 He, Jin, Cui et al 2018

EV share in monthly EV registrations in Germany 2020–2024 Figure 15



Agora Verkehrswende (2025)

time. In early 2016, the Delhi government put into effect an "odd–even" policy for cars. Instead of limiting the number of plate approvals, the Indian city restricted road access to vehicle owners based on the last digit of their license plate numbers. As a promotion of zero emission cars, EVs were exempted from the rule.[46]

→ Opportunity 2: Renew early-bird buyer subsidies and extend purchase subsidies to electric trucks

We would highlight the opportunity presented by reintroducing and extending full-scale buyer's incentives (which were previously only available to "early bird" participants). Recent data from Germany show that EV uptake can slow down if governmental subsidies are reduced or terminated too early. In Germany, EV subsidies for company cars were abolished in September 2023, and purchase subsidies for privately owned EVs were no longer available by the end of that year. These two changes led to significant decline in the rate of new EV registrations in Germany.[47]

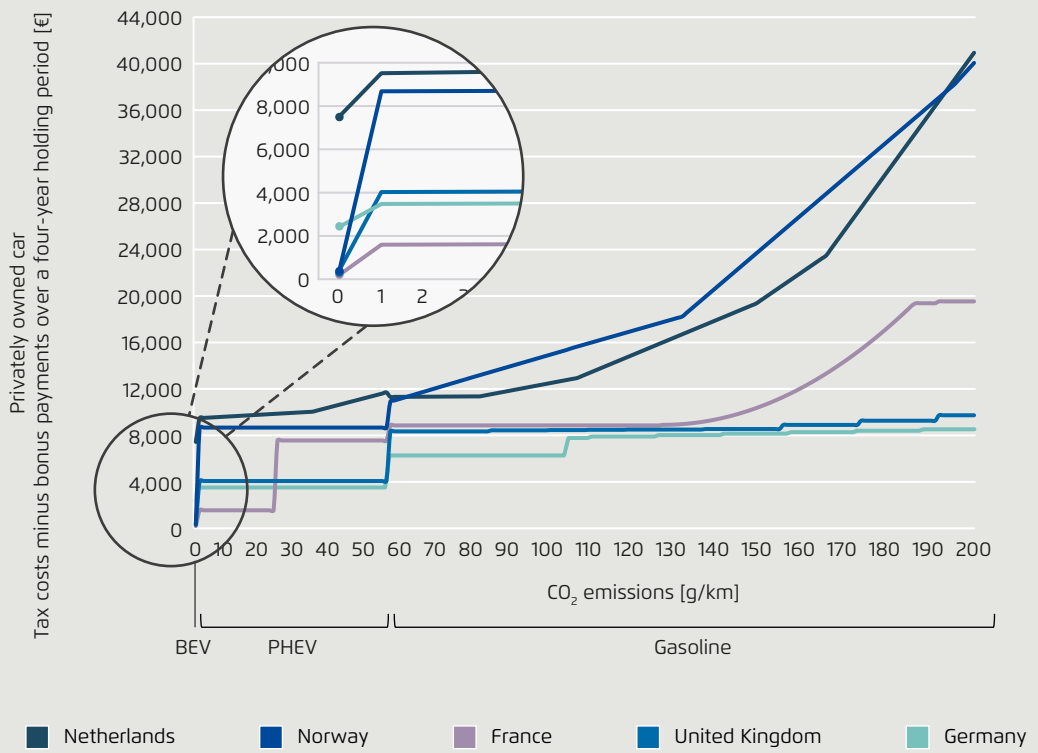
Additionally, we would recommend expanding the purchase incentives from the 2021 EV policy to include electric heavy-duty vehicles and trucks registered in Maharashtra, as trucks account for a significant share of transport emissions (30–50 percent[48] in India). Only if all vehicle types are addressed by policy measures will it be possible to create holistic and comprehensive decarbonization strategies for the road transport sector and to determine the contribution that must be made by vehicle segments to reach net zero goals. A comprehensive perspective that considers all vehicle types is also important for other issues, including grid upgrading to accommo-

46 Government of Delhi 2023

47 Agora Verkehrswende 2024,

48 Kumar, Shao, Braun et al 2022

Privately owned car – Tax costs minus bonus payments over a four-year holding period (€) Figure 16



Agora Verkehrswende (2025) | Source: ICCT 2018

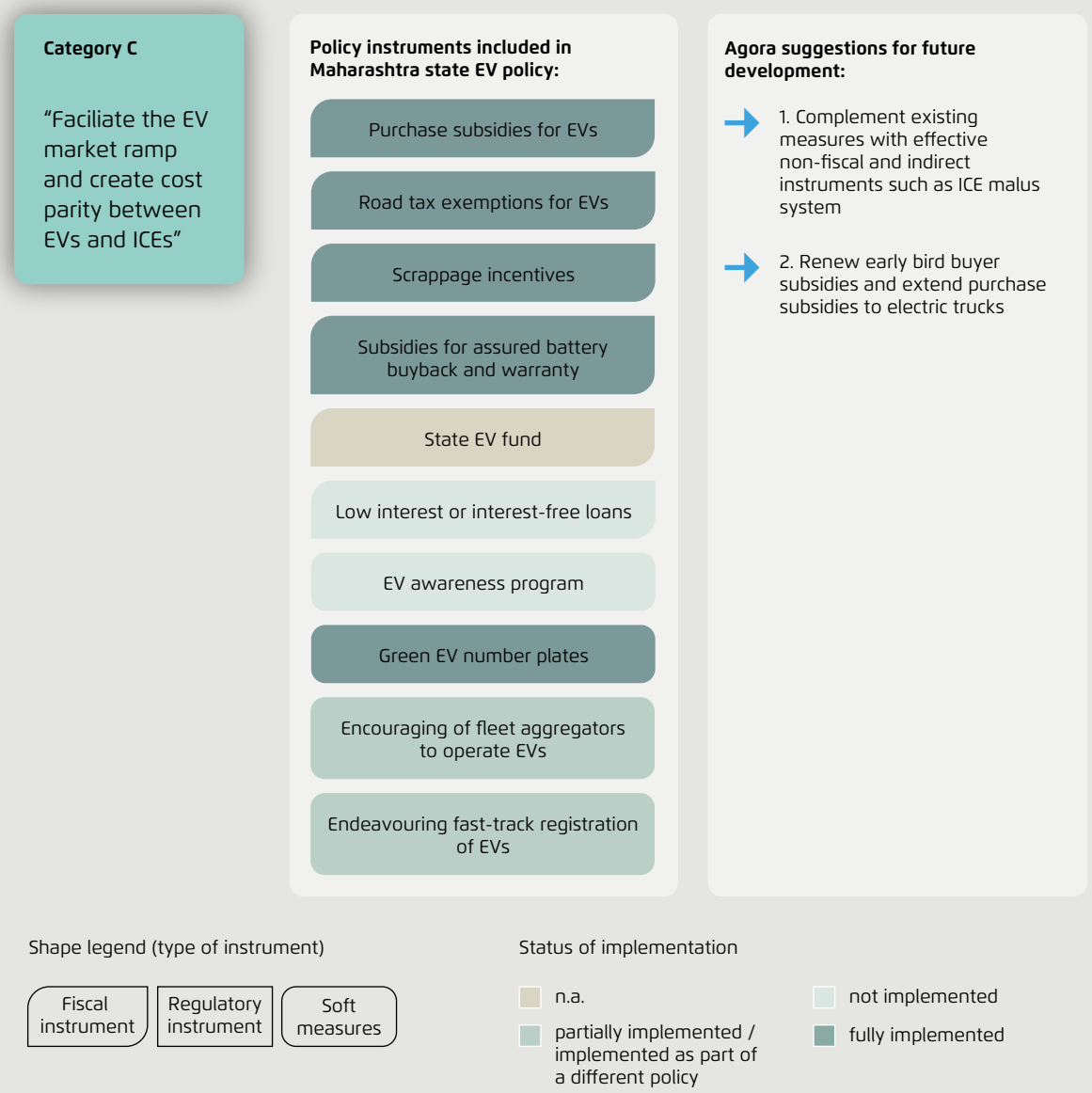
date power demand from charging infrastructure. High power charging, particularly for electric trucks, can create considerable power demand.

Summary

Maharashtra's 2021 EV policy comprehensively addresses category C ("Facilitate the EV market ramp and create cost parity between EVs and ICEs"); over ten policy instruments can be attributed to this category. Most fiscal instruments, such as purchase subsidies and road tax exemptions, have been effectively implemented, leading to significant increases in EV registrations, especially in the two-wheeler segment. However, full-scale buyer incentives were limited to "early birds" who took advantage of subsidies before the end of March 2022. By contrast, some instruments, including the State EV Fund and low/zero-interest loans, have not been implemented or the status of implementation is unclear. The "fast tracking" of EV registration was not directly realized through the 2021 EV policy but rather as part of national government policies that linked registration to subsidy acquisition, thus accelerating both processes. According to public sources, no comprehensive EV awareness programme has been implemented thus far. Green license plates have been introduced for different types of electric vehicles, as prescribed by national policy and Maharashtra's 2021 EV policy. For the future development of policy, we highlight two areas of opportunity.

On the one hand, we suggest building upon existing financial measures by adopting effective non-fiscal and indirect instruments, including in particular an ICE malus system or license plate rules. International experience has shown that combining "pull" and "push" measures can have a particularly strong transformational effect in the transport sector. On the other hand, we suggest renew-

Summary of available policy instruments and development suggestions for category C Figure 17



Agora Verkehrswende (2025)

ing the full-scale buyer incentives (which were previously only available to "early birds") as well as extending purchase subsidies to electric heavy duty vehicles and trucks, as these vehicles account for a significant share of transport emissions (30–50 percent in India). To be sure, the complete decarbonization of road transport depends crucially on the electrification of all vehicle types.

4.5 Build on existing instruments that facilitate EV ease of use

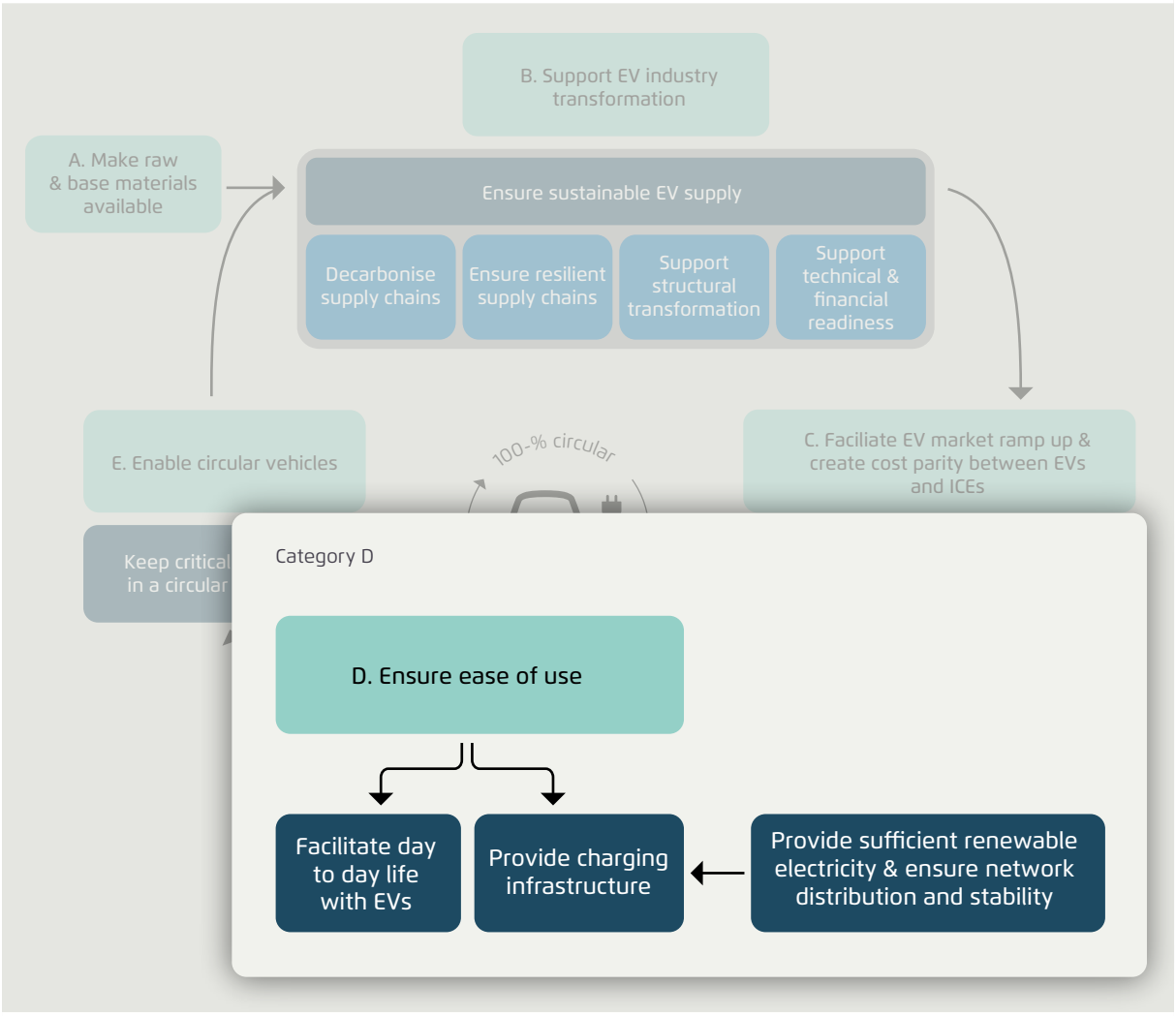
The largest number of measures (over 15) contained in Maharashtra's 2021 EV policy can be allocated to category D ("Ensure ease of use"). The distribution of these measures over different instrument types is shown in Table 15.

Several measures are fiscal instruments: The Maharashtra policy provides demand incentives for public and semi-public charging stations that have not taken advantage of FAME II incentives (see Table 5 for details). These incentives were made available after the launch of Maharashtra's EV policy and led to an increase in charging stations in different cities (see section 3.2). Additionally, the Maharashtra's 2021 EV policy foresees funding for power distribution companies and the upstream upgrading of charging infrastructure through grants under India's National Clean Air Programme. We were unable to verify whether this measure has been realized.

Many of the regulatory instruments relate to EV-ready parking spaces. For example, the policy foresees EV readiness for 100 percent of parking spaces at government buildings, at least 25 percent of off-road public parking spaces, and 20 percent of parking spaces in new residential buildings.

The 2021 policy also calls for future public parking spaces allotted by bidding to provide free parking for EVs. Furthermore, the policy calls for the state to adopt building code amendments implemented by the federal government regarding EV charging stations require-

Challenges in EV adoption – Categroy D — Figure 18



Agora Verkehrswende (2025)

Maharashtra policy instruments supporting category B – distribution by type Table 15

Vehicle type \ Instrument type	Fiscal instruments	Regluatory instruments	Soft measures
All vehicle types[1]	Incentives for public and semi-public charging stations	Zero Emission Zones	Encouraging charging point providers to use EV charging station management system
	Subsidies for Discoms for upstream infrastr. upgrades	Incorporation of national building code amend-ment	MSRDC* to identify charging point locations on national and state highways
	Property tax rebates to residential owners for private charging	Free EV parking on spaces allotted by bid-ding processes	
	CPOs have to align charg-ing fees with state nodal agency/ government regu-lations	Mandatory EV readi-ness of parking spots in new buildings, off-road spaces, commercial and government buildings	
		Lane and parking prefer-ences to EVs	
		Obligation for cities to prepare charging infra-structure plans	
		Earmarking of amenity spaces for EV charging stations in city develop-ment plans	
HDV / trucks	---	---	---

Direct support of EVs Strengthening phase out of ICEs

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021,
[1] except trucks; * Maharashtra State Road Development Corporation

ments in new residential and commercial buildings. The 2021 policy additionally encourages urban local bodies (ULBs) to provide lane and parking preferences to EVs. Urban local bodies are also asked to prepare charging infrastructure plans for their cities to prepare for 2025 levels of EV penetration; such plans are to consider the siting of charging stations.

Regarding soft/facilitative measures, urban local bodies are encouraged to provide property tax rebates to res-idential property owners for the installation of on-site charging infrastructure.

While most instruments directly support the uptake of EVs, one instrument also discourages the usage of ICEs: The policy calls for consideration of low-emission zones in five urban agglomerations. As no specifications are made with regard to vehicle types, it can be assumed that all 16 measures apply generally to all vehicle types.

To the best of our knowledge, as this report was authored none of the parking or charging infrastructure measures mentioned above had been realized, with the exception of the charging infrastructure subsidies. Low-emission zones also have yet to be introduced.

Opportunities for policy development

→ Opportunity 1: Encourage state nodal agencies to address on-the-ground challenges to the development of charging infrastructure

The Bureau of Energy Efficiency (BEE) has been appointed the "central nodal agency" for public EV charging Infrastructure by the Ministry of Power on a national level in India. To support the central nodal agency, every state government has appointed a "state nodal agency" for the roll-out of public EV charging infrastructure. To further improve the charging infrastructure roll-out process, we would suggest efforts by the state nodal agency to address even more specifically the challenges faced by on-the-ground actors responsible for charging infrastructure in Maharashtra (such as CPOs, DISCOMs, users, etc.). A possible solution approach in this regard would be for the state nodal agency to offer educational programmes and facilitate networking between the stakeholders. In Germany, the ministry for Digital and Transport introduced the National Centre for Charging Infrastructure in 2019[49] to coordinate all activities for the expansion of charging infrastructure and to serve as a platform to connect key players in the sector. This organization offers funding, tools, and training programmes to provide municipal employees with knowledge for the development of charging infrastructure and to facilitate the process of identifying suitable locations for the installation of charging infrastructure. As Indian state nodal agencies are energy sector organizations, we would also suggest fostering a continuous dialogue process between state nodal agencies, the transport sector, and the vehicle industry.

→ Opportunity 2: Create a single-window permit process for charging infrastructure

A variety of actors and stakeholders are currently involved in the permit process for new charging points in Maharashtra, including state and municipal administrations, network operators, and power distribution companies. It therefore takes considerable effort for charge point operators to establish charging stations in Maharashtra, as they need to obtain permits and authorization from many different organizations. To enhance efficiency, we would recommend the implementation of a "single window" process. Specifically, an interface organization should be tasked with collecting permits and authorizations from the various involved organizations. In this connection, a centralized online portal that features standardized digital forms could be established to ease the application process for charging point developers. Such a portal should feature automated verification processes, real-time tracking, and GIS integration for location assessment. Collaborative partnerships with utility companies, a public consultation mechanism, and periodic reviews that incorporate stakeholder feedback represent additional desirable aspects of such a solution, which promises to improve transparency and community engagement. In this connection, we would also recommend offering training and support for applicants to ensure users are able to navigate the system effectively. All of the above would contribute to a streamlined and effective administrative process for charging infrastructure permitting.

→ Opportunity 3: Develop an overall strategy for charging infrastructure roll-out

The Maharashtra EV policy 2021 proposes encouraging urban local bodies to prepare charging infrastructure plans capable of meeting the charging demand forecasted for 2025. This is a valuable initiative. Building on this, we suggest supporting cities to develop comprehensive charging infrastructure strategies for establishing charging point networks which, ideally, could serve up to 100 percent EV fleets. For such strategies (especially for charging infrastructure that serves private cars) multiple aspects should be considered.

- *Planning approach*: In European cities, different strategies have been used to develop public charging infrastructure networks for cars, including planning-oriented and demand-driven methods (see Table 16).[50] Paris, for example, has adopted a city-led planning-oriented business model for charging infrastructure development. The city is responsible for selecting the charging station locations, but the installation of the charging station is outsourced to an operator. The locations are selected in such a way to ensure coverage of the entire city area. To establish a DC fast-charging network, Paris is focusing on off-road locations such as petrol stations. Amsterdam, by contrast, follows a demand-driven approach for

49 NOW 2019

50 Rajon Bernard, Hall 2021

their regular AC charging network: In 2009, Amsterdam initially set up a basic charging infrastructure network to promote the uptake of electric vehicles. Building on this, the city has since shifted to a demand-oriented expansion approach that relies on requests for new charging stations by electric vehicle drivers. Both approaches, the demand-driven concept and the planning-oriented method, have advantages and disadvantages. While the demand-driven approach leads to organic growth and avoids inefficiencies and unused charging points, a planning-oriented setup benefits the electricity grid. Power grid expansion costs can be minimized with the latter approach, and it is also easier to incorporate renewable capacity.

- *Public vs. private charging*: It is highly beneficial for electricity grid planning to establish a large number of charging points at homes and at workplaces. This way, vehicle users are more flexible in scheduling charging processes and can choose times outside demand peak hours. Also, in terms of public space usage, it is beneficial to have many private charging stations, as this reduces demands placed on public space.

- *Charging power*: We suggest developing a concept that combines charging stations with different charging power levels as efficiently as possible, while striving to minimize demands on public space. A focus should be placed on fast-charging hubs, as they take up the least space and shorten EV dwell time.

Publicly accessible charging infrastructure development approaches in selected cities — Table 16

Parameter	Regular AC approach	Fast DC approach
Paris	Planning-oriented and with multiple operators. The city selects the charging station operator for given locations.	Mix of planning- and business-oriented and with multiple operators. The city requires fueling stations under concession contract to install a DC fast charger or natural gas station at the time of contract renewal.
Amsterdam	Demand-driven with one operator. The driver requests a charger, the application is reviewed and processed by the operator, and the city gives the formal approval.	Mix of planning- and business-oriented and multiple operators. The city has installed rapid chargers for taxis that are publicly accessible. The development is otherwise left to the market.
London	Mix of demand-driven and planning-oriented and with multiple operators. Local authorities primarily follow drivers' demand, while TfL supplements using planning-oriented approach.	Mix of planning- and business-oriented and with multiple operators. At city-owned locations, TfL conducts upstream work, and private companies operate the stations. Businesses such as parking lots and fueling stations host additional stations.
Oslo	Mix of demand-driven and planning-oriented, and with one operator. The chargers are owned and operated by the city.	Business-oriented. All the stations are operated by private charging station operators.
Stockholm	Planning-oriented and with multiple operators. The charging station operator selects the location.	Planning-oriented and with multiple operators. The charging station operator selects the location.

Agora Verkehrswende (2025) | Source: Rajon Bernard, Hall 2021

Most of the aspects above are important for the roll-out of **private car charging**. Charging for **tuk-tuks** and **buses** is most efficiently implemented through charging points at depots and bus stations. Charging power considerations are important for these vehicle types as well: lower charging power levels work for overnight depot charging, but high power charging levels are needed at bus stops during the day. **Two-wheelers** need comparably low charging power and can even be charged through household sockets at home. With a view to 2 and 3 wheelers, charging strategies should also consider arrangements for battery swapping in line with the Battery Swapping regulation that has been developed at the national level.

→ Opportunity 4: Implement instruments to support effective and efficient grid management and increased renewables integration

Electricity grids are complex systems that serve to reliably distribute power across a given jurisdiction. Innovative technologies such as EVs create large additional electricity demand that the entire system must accommodate. In many cases, the grid and power generation expansion necessary to accommodate EVs is difficult for utility companies to plan and implement, as uncertainty may prevail as to where and how much additional power is needed. This problem highlights the need for forward-looking and robust grid expansion planning. In this connection, power companies and grid operators need to interact closely with EV charging infrastructure providers and all other actors involved in the charging infrastructure roll-out. Various measures and concepts can help to ensure efficient grid management, stability, and power system decarbonization.

- *Variable charging tariffs*: Variable tariffs can "smooth" electricity demand peaks by incentivizing people to charge outside of peak demand hours. This is especially relevant for larger vehicles (4 wheelers) that incur high power usage, as vehicle users can take advantage of lower costs. EU countries such as the Netherlands, Austria, and Germany have already introduced dynamic electricity tariffs. Variable pricing can help to avoid demand peaks, which is beneficial for grid stability. Variable tariffs also facilitate the integration of renewable energy. If electric car drivers base their charging process on variable prices, the demand for electricity increases during the day, when renewable energy is plentiful and the electricity price falls.
- *Bidirectional charging*: Vehicle batteries can be used as buffer storage and bidirectional charging can help to stabilize the electricity grid.
- *Smart meters*: We would advise the government of Maharashtra to encourage network operators to upgrade their IT systems and to support the introduction of smart meters to ease monitoring of local energy demand in different parts of the gird.
- *Renewable energy based charging*: To explicitly promote the integration of renewables, a multitude of instruments are being used in energy sectors around the world, including sustainable energy investment subsidies, property tax exemptions for residential renewable energy, and mandatory solar requirements.[51] From the transport sector perspective, the most important measure regarding renewable energy is to forecast the future energy demand of EVs through modelling and to ensure that the strategy for grid decarbonization and renewable energy expansion reflects this demand. Once again, this aspect requires close collaboration between the transport and energy sectors.

51 GIZ; NITI Aayog 2024

Summary of available policy instruments and development suggestions for category D — Figure 19

Category D

"Ensure ease of use"

Policy instruments included in Maharashtra state EV policy:

- Incentives for charging stations
- Subsidies for DISCOMs
- Property tax rebates to residential owners for private charging
- Alignment of charging fees with State Nodal agency
- Zero Emission zones
- Incorporation of national building code amendment
- Free EV parking on spaces allotted by bidding processes
- EV readiness of parking spots in new buildings, off-road spaces, commercial & gov. buildings
- Lane and parking preferences to EVs
- Obligation for cities to prepare charging infrastructure plans
- Earmarking of amenity spaces for charging in city development plans
- Encouraging CPOs to use EV charging management system
- MSRDC* to identify charging point locations on highways

Agora suggestions for future development:

1. Encourage state nodal agencies to address on-the-ground charging infrastructure challenges more closely
2. Create a single window admission process for charging infrastructure
3. Develop an overall strategy for charging infrastructure roll-out
4. Implement instruments for effective and efficient grid management and increased uptake of renewable energy integration

Shape legend (type of instrument)

Fiscal instrument | Regulatory instrument | Soft measures

Status of implementation

n.a. | not implemented | partially implemented / implemented as part of a different policy | fully implemented

Agora Verkehrswende (2025) | * Maharashtra State Road Development Corporation

Summary

Maharashtra's 2021 EV policy places a strong focus on category D ("Ensure ease of use"), as over 15 instruments address this topic, especially in the field of charging infrastructure. The instruments range from incentives for charging station installation and subsidies for upstream charging point infrastructure to property tax rebates for private charging. Several instruments also address the issue of parking, including proposed rules for EV-ready parking spots in new buildings, off-road spaces, and commercial and governmental buildings. Apart from the subsidies provided for charging stations, most instruments foreseen by the policy are at an early stage of implementation. For some instruments, such as the obligation to incorporate the national building code amendment for the installation of EV charging stations in residential and commercial buildings, the status of implementation is unknown.

To facilitate further improvement in the conditions for EV use in Maharashtra, this report makes four suggestions. First, we would encourage the state nodal agency to address on-the-ground charging infrastructure challenges more closely. Second, we would recommend creating a single-window permit process for charging infrastructure. Third, we would suggest developing a comprehensive and forward-looking strategy for charging infrastructure roll-out (ideally informed by the goal of a 100 percent EV fleet). Finally, we would recommend several measures to support network stability and renewable energy integration, including time-variable EV tariffs.

4.6 Capacity building for EV recycling at the state level

Actions have been taken at the national level in India to support the topic of circularity. In 2022, the Ministry of Environment, Forest and Climate Change (MoEFCC) released the Battery Waste Management Rules. These rules define "extended producer responsibilities" (EPRs) for entities involved in the manufacturing and sale of batteries. The EPRs specify recollection targets for different battery types such EV batteries used in 2 wheelers (70 percent from FY 2027–30), 3 wheelers (70 percent from FY 2025–30), and 4 wheelers (70 percent from FY 2030 onwards). Additionally, specific quotas for recycled material are prescribed for use in new batteries, with stepwise increasing quotas (e.g. up to 20 percent for EV batteries by FY 2031). The Battery Waste Management Rules also stipulate recovery targets for recyclers of up to 90 percent for EV batteries by FY 2027.

Maharashtra's 2021 EV policy foresees incentives for companies to establish EV manufacturing in the state; this includes subsides for EV and EV battery recycling companies. However, these measures have not yet been implemented in Maharashtra, according to a sector expert.

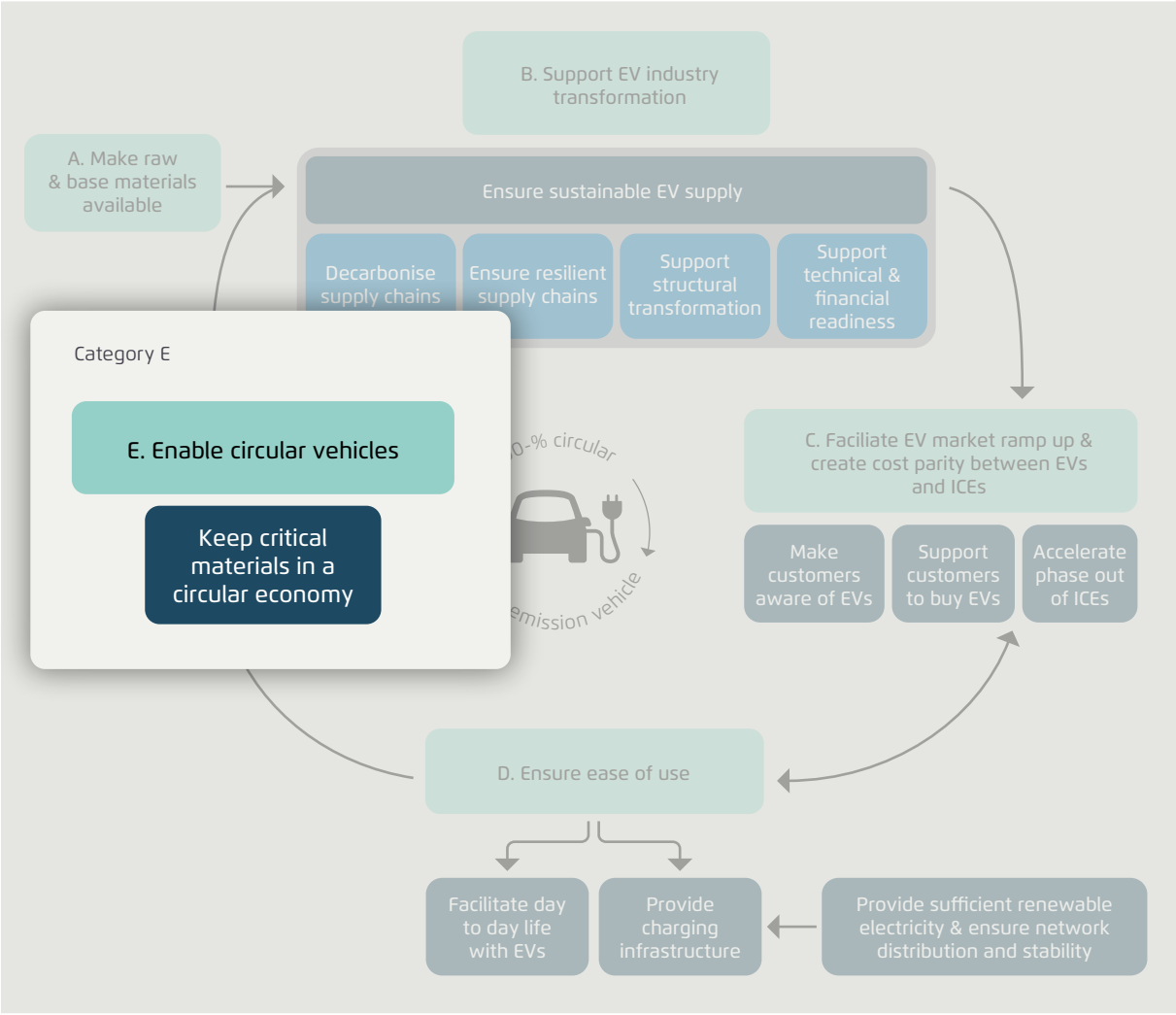
The implementation of state-level initiatives as a complement to the national Battery Waste Management Rules would provide various benefits: First, there is a proximity advantage, as local recycling facilities in the states would reduce transportation costs and environmental impacts. Secondly, solutions tailored to the state would enable targeted action that considers factors such as the industrial landscape, EV adoption rates, and battery types. Finally, state-level recycling industries would generate employment, attract investment, and stimulate economic growth, in addition to their beneficial environmental effects.

We therefore suggest efforts to promote the development of the recycling industry.

→ Opportunity: Strengthen capacity building in the EV recycling industry

The central government's Battery Waste Management Rules provide orientation as to how fast recycling capacities need to be expanded. The state level can support and complement this process by promoting the development of appropriate recycling capacities. To this end, we recommend strengthening capacity building in Maharashtra's recycling industry. Efforts in this area could include: the development of standards and recommendations for safe and efficient recycling management; skill acquisition measures to ensure a supply of trained personnel; and the granting subsidies for investment and R&D in EV recycling generally and battery recycling in particular. Finally, we would recommend the adoption of ecologic design rules that specify the design of primary products and components such that products are more easily recyclable.

Challenges in EV adoption – Category E Figure 20



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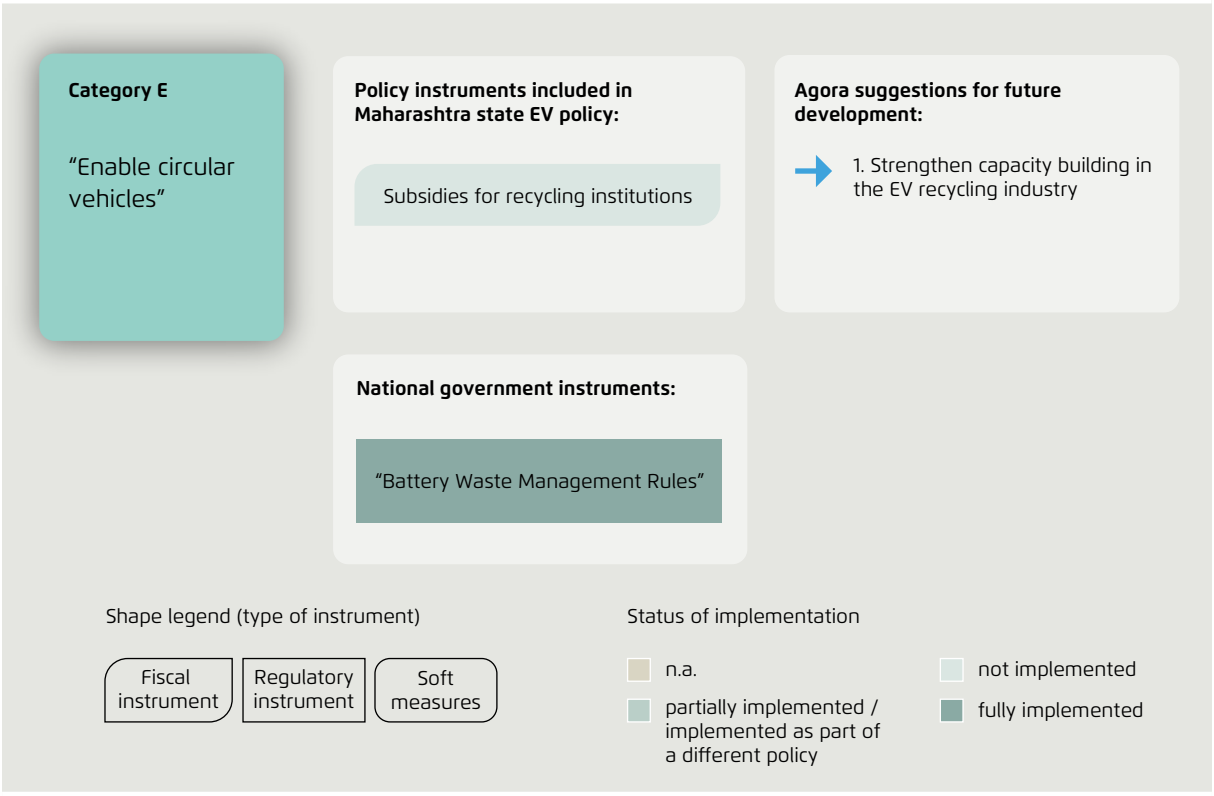
Summary

The issue of circularity is addressed solely by one instrument in the Maharashtra's 2021 EV policy – namely, through incentives for EV battery recycling companies. However, this measure has not been realized so far. With a view to the future development of the circular economy for electric vehicles and batteries in Maharashtra, we would recommend dedicated efforts to expand capacity building (e.g. establishment of recycling standards; skill development; and subsidies for recycling investment and R&D).

4.7 Encourage and monitor policy implementation

A suggestion that is valid for all challenges (A to E) from the diagram in Figure 3 is to encourage and strategically monitor the implementation of policy instruments once they have been laid down in a policy document. Our research shows that various policy instruments foreseen by Maharashtra's 2021 EV policy are still in an early stage of implementation. Alternatively, the status of realization is unknown.

Summary of available policy instruments and development suggestions for category E Figure 21



Agora Verkehrswende (2025)

We would propose the establishment of a board or committee that is responsible for encouraging and monitoring policy implementation and for tracking relevant EV trends. Maharashtra's 2021 EV policy does in fact foresee the formation of a steering committee and state secretariat. A state-level institution that tracks the implementation of state policy and serves as a general point of contact for the questions and concerns voiced by EV stakeholders would be an effective way to bundle the coordination of EV transformation. Based on the example provided by international advisory institutions such as the UK Climate Change Committee and the German Council of Experts on Climate Change, we would recommend establishing such a committee as an independent body that is composed of representatives from research institutions and think tanks; this body should be tasked with advising the government and helping to guide the process of EV adoption in Maharashtra.

5 | Key takeaways for Maharashtra

This report sought to identify opportunities for the future development of EV policies in Indian states. As mentioned, India aims to achieve net zero emissions by 2070 in all sectors, including transport. Subsequent to the national government's initiation of an electrification strategy for road transport in the early 2010s, Indian states began drafting individual EV policies from 2017 onwards. These policies are sure to play a pivotal role in accelerating the EV transformation in the coming years, as state governments are in a unique position to expedite EV adoption, thanks to their knowledge of the specific circumstances and steering mechanisms within their jurisdiction. While this report focused on the state of Maharashtra, the identified policy opportunities can certainly serve as a template for EV policy development in other Indian states.

The "Maharashtra State EV Policy – 2021" sets forth a wide range of policy instruments and targets designed to accelerate EV adoption. Compared to many other Indian states, it exhibits a high level of ambition, as the targets apply to all vehicle types (except heavy duty vehicles) and specific goals are formulated for the roll out of charging infrastructure (see Table 17).

At the outset of this report, we presented a framework for analyzing Maharashtra's EV policy in relation to the challenges that impede EV adoption (see Figure 22). This framework was elaborated to identify blind spots and gaps compared to international best practice; it was not designed with the goal of considering specific technical aspects or problems. The framework provides a valuable starting point for further in-depth research concerning the optimal design of individual policy instruments and related issues.

Maharashtra's EV policy contains over 40 policy instruments. These instruments address most of the categories of challenge (A to E) identified by our framework (see Figure 22). Figure 23 shows the distribution of policy instruments across the five categories. (Although it is important to note that the shares devoted to a given category alone are not a measure of effectiveness.) Most instruments contained in the Maharashtra EV policy address categories B, C, and D, while just a few or no instruments cover categories A and E. Table 15 lists different examples of policy instruments from Maharashtra's EV policy. Looking at the implementation status of individual instruments, several instruments that can be attributed to category B, C, and D are at a very early stage of implementation or have not yet been implemented at all.

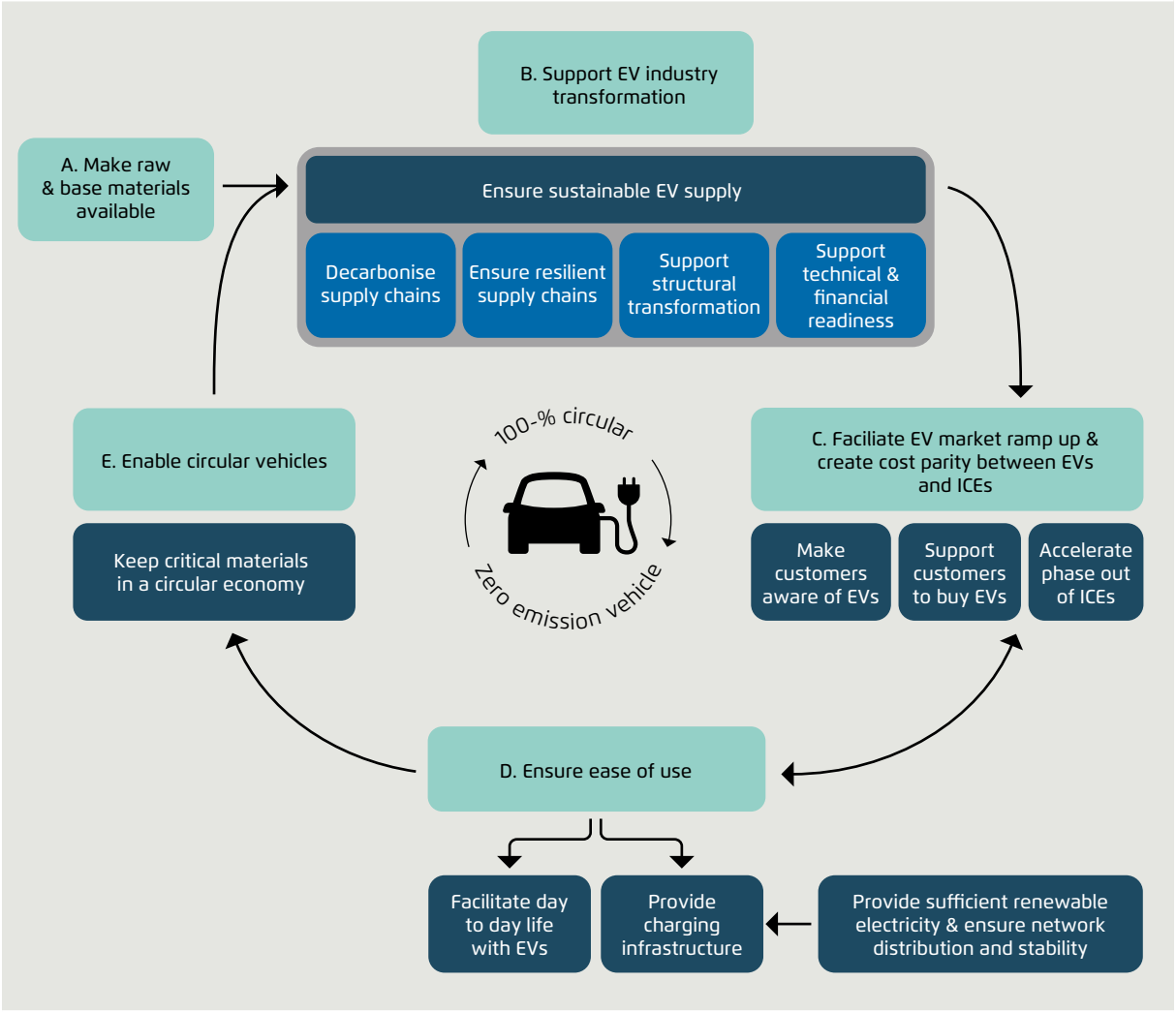
Based on our analysis of the current status of policy instruments and associated targets in Maharashtra, we arrive at the key takeaways shown below:

Maharashtra EV and charging infrastructure policy targets for 2025 Table 17

Parameter	Regular AC approach
All vehicles	**10 percent of new registrations**
Private vehicles sales	2 wheelers: 10 percent, 3 wheelers: 20 percent, 4 wheelers: 5 percent
Fleet operators	At least 25 percent of the urban fleet operated by fleet aggregators
Buses	i) 25 percent electrification of public transport ii) MSRTC to convert its existing bus fleet to 15 percent electric fleet
Government vehicle fleet	Starting April 2022, all new govt. vehicles (owned/leased) operating within the major cities
Charging infrastructure (cities)	Targets for public & semi-public charging stations in five UA (up to 1,500 charging points) and two further cities
Charging infrastructure (highways)	Make four highways fully EV ready

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021

Challenges in EV adoption Figure 22



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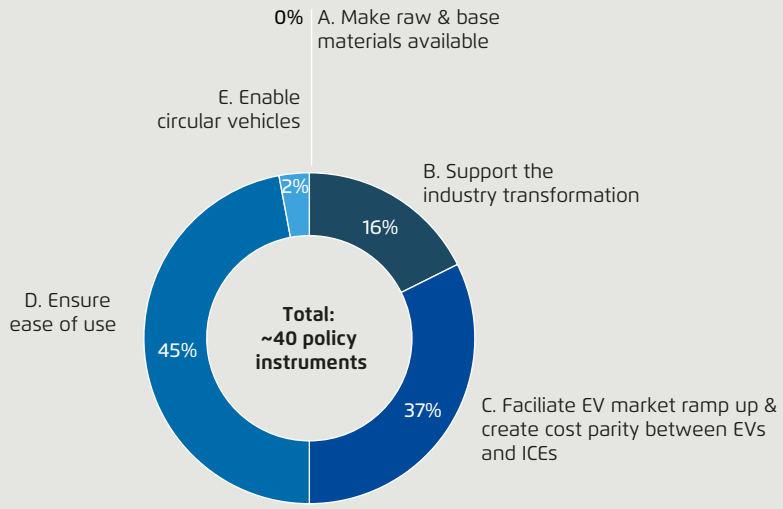
Key takeaways for Maharashtra

1. Set long-term EV targets that are ambitious and actionable

Setting long-term and ambitious targets for EV adoption would demonstrate a strong commitment by the government of Maharashtra to fully electrify road transport. This, in turn, would provide a reliable basis for long-term planning and investment by the vehicle industry. Accordingly, we would recommend revising the EV goals set forth by Maharashtra's 2021 EV policy such that targets are set well beyond the current target year of 2025. Ideally, a roadmap should be drafted that includes medium-term and long-term targets on the journey to a 100 percent EV share in new registrations; this roadmap should also be designed in accordance with overarching goals, such as the 2070 climate target. The roadmap should also feature interim targets at 5 to 10 year intervals. As EV policies in Indian states are usually only valid for 5 years, the long-term roadmap should include an overarching declaration or policy documents to which the 5-year policies refer. With a view to vehicle types, we would also recommend the inclusion of electrification targets for heavy duty

Maharashtra EV policy – distribution of instruments by category Figure 23



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vehicles, to ensure a comprehensive electrification strategy for road transport. Furthermore, we advise to collaborate with relevant national and state authorities to align the targets with broader energy and transport strategies.

2. Establish a multi-stakeholder strategy forum dedicated to industrial transformation

Maharashtra is home to many vehicle and component manufacturing companies that provide numerous jobs and play an important role in the state's economy. As the rise of electric mobility will bring many changes to the industrial landscape – including to business models and associated workforce requirements – there is a clear need to guide developments in a positive direction with proactive and visionary industrial policy. Such a policy can help to avoid job losses and prevent excessive burdens from being placed on small and medium-sized enterprises. In this connection, valuable guidance could be provided by a multi-stakeholder strategy forum that brings together various actors, including business leaders, government officials, academics, and civil society representatives. This forum should focus on creating technology roadmaps, workforce training programs, and financial support mechanisms for SMEs to diversify into EV components. It should also benchmark successful transformation strategies from other regions.

3. Encourage the state nodal agency to address on-the-ground challenges to the development of charging infrastructure and create a single-window permit process for charging infrastructure

We believe that the state nodal agency should devote additional attention to addressing the challenges faced by actors on the ground. This could include the creation of educational programmes or the facilitation of networking between stakeholders. For this purpose, we recommend to conduct periodic workshops with relevant municipal authorities, electricity distribution companies (DISCOMs). Furthermore, we would encourage the state nodal agency to engage regularly with transport sector and vehicle industry actors in order to clarify needs in the area of charging infrastructure. Building on the call made by the 2021 EV Policy for the planning of charging infrastructure, we would suggest the development of comprehensive planning visions for charging infrastructure roll-out in cities, ideally informed by the goal of serving 100 percent EV fleets. A comprehensive vision can help to ensure an efficient roll-out that minimizes total costs, including those related to grid expansion.

Maharashtra policy instruments – distribution by type (examples) Table 18

Vehicle type \ Instrument type	Fiscal instruments	Regluatory instruments	Soft measures
All vehicle types[1]	Incentives for EV OEMs and R&D facilities	ZEV requirements	EV awareness program
	Purchase subsidies for EVs	Lane and parking preferences to EVs	Green license plates for EVs
	Road tax exemptions for EVs	Mandatory EV readiness of parking spots in new buildings, off-road spaces, commercial and government buildings	Industrial staff training on EV ecosystem
	State EV fund		Development of skill enhancement centres
	Incentives for public and semi-public charging stations	Incorporation of national building code amendment	Encouraging CPOs to use EV charging station management system
	Scrappage incentives	Zero Emission Zones	Endeavouring fast-tracking registration of EVs
2W and 3W only	Subsidies for OEMs to offer assured battery buyback	---	---
	Subsidies for OEMs to offer battery warranty		
HDV / trucks	---	---	---

Direct support of EVs Strengthening phase out of ICEs

Agora Verkehrswende (2025) | Source: Maharashtra EV policy 2021,
[1] except trucks;

As a variety of actors and stakeholders are currently involved in the permitting process for new charging points in Maharashtra, operators must obtain permits and authorizations from many different organizations. To enhance efficiency, we would mandate the state nodal agency to implement a "single-window" clearance system for EV charging approvals. Specifically, an interface organization should be tasked with collecting permits and authorizations from the various involved organizations. In this connection, a centralized online portal that features standardized digital forms could dramatically ease and accelerate the application process for charging point developers and operators.

4. Support effective and efficient grid management and encourage renewables integration for EV charging

In the interest of effective and efficient grid management, we believe the government of Maharashtra should establish a regulatory basis for time-variable EV tariffs as well as to encourage grid operators to upgrade their IT systems and introduce smart meters. We also advise to promote advanced grid management solutions such as smart grids and Vehicle-to-Grid (V2G) technologies. For the integration of higher renewables shares in the power mix, it is important to model future energy demand by EVs and to ensure that the strategy for grid decarbonization and renewable energy expansion is in alignment with this demand. . Furthermore, we recommend to

encourage DISCOMs and state energy authorities to integrate renewable energy into EV charging infrastructure, targeting 50 percent renewable energy for EV charging by 2030. Pilot projects in urban centres can demonstrate scalability.

5. Support the central government in making raw materials available, support resilient and sustainable supply chains, and ramp up recycling capacities

The activities of state governments can complement efforts underway at the national level to ensure raw material availability and promote recycling. Potential measures in this regard include the monitoring of companies' raw material needs and the formation of raw material procurement alliances. Moreover, we suggest to advocate for further national policies to secure raw materials. With a view to the circular economy, we recommend to invest in advanced recycling infrastructure and to develop standards and recommendations for safe and efficient recycling management; skill acquisition measures to ensure a supply of trained personnel; and the granting of subsidies for investment in EV and battery recycling. We would also recommend the adoption of ecologic design rules that specify the design of primary products and components such that products are more easily recyclable. Finally, we propose to foster collaboration with ecosystem players to support research and development in battery recycling technologies and to encourage use of AI-based solutions for material traceability.

6. Leverage the benefits of complementary instruments

International experience shows that policy instruments can have a particularly strong effect on transformational developments whenever "push" and "pull" and measures are combined. By way of example, German EV purchase subsidies combined with the strengthening of CO_2 fleet limits at the European level led to a threefold increase in new EV registrations in Germany in 2020 over the prior year. Norway has also implemented a series of pull and push instruments, including emission-based vehicle registration taxes and emission-based tolls. In our view, complementing Maharashtra's supply and demand subsidies with non-fiscal instruments such as ZEV mandates would help to strengthen the momentum of EV uptake without requiring further financial resources. Further examples are emissions caps or other non-financial incentives such as priority parking, toll waivers, and dedicated EV lanes. We also recommend to collaborate with local authorities to implement localized measures and complement state-level initiatives.

7. Encourage and monitor policy implementation

We would propose the establishment of a board or committee that is responsible for encouraging and monitoring policy implementation and for tracking relevant EV trends. Maharashtra's 2021 EV policy does in fact foresee the formation of a steering committee and state secretariat. A state-level institution that tracks the implementation of state policy and serves as a general point of contact for the questions and concerns voiced by EV stakeholders would be an effective way to bundle the coordination of EV transformation. Based on the example provided by international advisory institutions such as the UK Climate Change Committee and the German Council of Experts on Climate Change, we would recommend setting up such a committee as an independent body that is composed of representatives from research institutions and think tanks; this body should be tasked with advising the government and helping to guide the process of EV adoption in Maharashtra. Once established, we advise the committee to create a robust monitoring framework with quarterly progress reviews and to define clear KPIs for each policy and publish annual progress reports to ensure transparency and accountability. Finally, we would propose to introduce a digital dashboard for real-time tracking of policy implementation.

Summary of key recommendations for Maharahstra Table 19

No.	Status quo	Challenge	Recommendation
1.	Maharashtra EV targets are set for 2025 with a penetration target of 10 % for all vehicles.	Current targets are not aligned with the ambitious national goal of achieving up to 100 % electrification by 2070.	**Develop long-term, ambitious and actionable EV targets**
2.	Maharashtra has a strong automotive industry but most Original Equipment Manufacturers (OEMs) remain specialized in traditional ICE technologies.	Transitioning the industry to EV production, including reskilling the workforce and supporting small and medium ICE component manufacturers.	**Establish a multi-stakeholder strategy forum involving industry players, associations, and government stakeholders to guide the automotive transformation**
3.	Setting up EV charging points in Maharashtra can be challenging and often faces delays.	Identifying and addressing barriers to charge point installation and simplifying the permission process.	**Mandate the state nodal agency to address on-the-ground challenges and implement a single-window clearance system for EV charging approvals.**
4.	EVs create additional energy demand on an already strained grid which remains largely powered by fossil fuels.	Integrating current and future EV energy demand into the grid while transitioning to a decarbonized energy system.	**Support effective and efficient grid management and encourage renewables integration**
5.	Raw material procurement is primarily managed at the national level, but Maharashtra faces high demand with limited recycling capacities.	Securing a sustainable supply of materials and ramping up recycling capabilities for end-of-life EV components is crucial.	**Support central government in making raw materials available, support resilient & sustainable supply chains, and ramp up recycling capacities**
6.	Most EV policy instruments implemented in Maharashtra so far are financial incentives.	Over-reliance on financial incentives requires substantial funding and does not necessarily accelerate ICE phase-out.	**Diversify policy instruments to include regulatory or facilitative measures.**
7.	Some measures from Maharashtra's 2021 EV policy are in early stages of implementation or remain unrealized.	Inefficient policy implementation and monitoring can hinder progress toward EV roll-out.	**Encourage and monitor policy implementation**

Agora Verkehrswende (2025) | Sources: Maharashtra EV policy 2021, Agora and GIZ analysis

6 | Insights for other Indian states

Specific recommendations regarding the future development of EV policy need to be tailored to individual Indian states, as each state exhibits unique characteristics with a view to population size, economic development, industrial structures, and the status of existing policy, among other factors. However, many of the general principles formulated as suggestions for the state of Maharashtra are applicable to the challenges being faced in other Indian states:

1. EV targets: Many states aside from Maharashtra have set ambitious goals for EV penetration. While some states have set targets for all vehicle types (e.g. **Odisha, Assam, Chhattisgarh**) in their state EV policy,, other states only have targets for some vehicle segments, but with high penetration rates of up to 100 percent (e.g. **Tamil Nadu, Chandigarh**). In many cases, 2025–28 is the time frame for these targets to be achieved. As we have recommended for Maharashtra, it would be advisable for these states to set longer-term goals (e.g., 100 percent electrification by 2040 or 2050) to demonstrate clear commitment and alignment with national decarbonization strategies and thus provide a reliable basis for planning and investment by the vehicle industry, energy companies, and charging station operators. In the case of states that have adopted EV sales penetration targets below 50 percent, we would suggest the adoption of more ambitious targets. Ideally, we recommend to develop a roadmap to achieve 100 percent EV share by setting medium-term (e.g., 50 EV share by 2040) and long-term (e.g., 100 percent EV share by 2050) targets, aligned with national climate goals. For states which only defined targets for certain vehicle types, we suggest to broaden EV targets to include all vehicle types (e.g., trucks, buses, two-wheelers, and three-wheelers), ensuring a comprehensive transition to EVs across all sectors.

2. Industrial transformation: The structural transformation of industry is a particularly salient issue for states with significant vehicle industries, such as Tamil Nadu. While **Tamil Nadu** offers several financial support measures for industry, including capital subsidies and tax exemptions for EV manufacturers,[52] we would suggest building on these policies with "facilitative measures", such as the formation of a multi-stakeholder strategic forum to guide the automotive industry's transition to EVs, focusing on R&D, reskilling, and infrastructure development, as has been suggested for the state of Maharashtra.

3. Charging infrastructure: Eight Indian states, including **Jharkhand, Punjab, Haryana, Himachal Pradesh** and **Goa**, have set specific targets for the roll out of charging infrastructure.[53] Many states have also implemented capital subsidies, provisions for land concessions (e.g. **Andhra Pradesh, Bihar, Delhi, Karnataka, Madhya Pradesh, Punjab**[54]), and other measures to support the installation of charging infrastructure and integration of renewable energy. With a view to enabling future developments in the area, we suggest setting clear, measurable goals for the roll-out of charging infrastructure, with a detailed implementation strategy that aims to achieve a 100 percent electric vehicle fleet. The strategy should be overseen by a single authority (e.g. the state nodal agency) and include timelines, targets, and specific actions to address local barriers to installation.

4. Raw material procurement and recycling: India has various mineral resources spread across different states. For example, **Odisha** has the largest share of nickel and cobalt iron deposits in the country, followed by **Jharkand and Nagaland**.[55] In our view, these states should assess the economic viability of expanding local mining and refining capacities for EV critical raw materials. These efforts should be supported through public-private partnerships and investment in skills development to enable sustainable mining practices. Other states with fewer natural resources can support the process of raw material procurement by creating transparency regarding their material needs and by forming procurement alliances. States like **Delhi, Madhya Pradesh, Punjab, Telangana**, and **Uttar Pradesh** are already supporting battery recycling through various initiatives, including subsidies on loans for investment in battery recycling equipment and machinery.[56] Such efforts should be complemented with skill development measures and regulatory standards for safe and efficient battery recycling.

52 WRI 2022b

53 Indian state EV policies of Goa, Haryana, Himachal Pradesh, Jharkhand and Punjab

54 WRI (n 52)

55 NITI Aayog; Ernst and Young 2023

56 WRI 2022b

5. Combining various instrument types: States and union territories such as **Delhi, Odisha, Bihar**, and **Chandigarh** have established strong demand side incentives, including road tax and registration fee exemption; purchase subsidies for 2, 3, and 4 wheelers and buses; retrofitting and scrappage incentives; and electricity tariff incentives for EV charging.[57] Combining existing incentives with non-fiscal measures to create the "push" and "pull" leverage effects could accelerate the overall momentum for EV adoption. For example, existing incentives could be complemented with non-fiscal measures, such as setting up charging infrastructure, enhancing supply-side support (e.g., battery production), and developing a holistic policy framework that includes subsidies, regulations, and standards for EV manufacturing.

6. Monitoring organizations: **Delhi** established a so-called "EV cell" in 2022 to speed up the implementation of EV policy, facilitate the disbursement of incentives, and accelerate the development of the EV charging network. In May 2023, the organization held a comprehensive meeting with over 100 stakeholders and experts to provide recommendations for a follow-up policy, as Delhi's current EV policy expires in 2023. The establishment of a body that encourages and monitors the success of policies and regularly revises them based on expert consultations and evolving market conditions represents a promising approach. We would highlight this as an option that should be considered by other Indian states.

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Summary of recommendations for other states — Table 20

Relevant states (examples)	Status quo	Challenge	Recommendation
Assam, Chhattisgarh, Odisha	These states have EV targets for all vehicle segments[1], but the target rates are below 30 %	Lower targets can be achieved quicker but are insufficient for complete electrification to fulfil climate targets.	**Develop a roadmap to achieve 100% EV share by setting medium-term and long-term targets**
Chandigarh, Tamil Nadu	These states have targets with high penetration rates (up to 100 %), but only for some vehicle types	Lack of EV targets for certain vehicle types (e.g., trucks) can lower ambitions for complete electrification.	**Broaden EV targets to include all vehicle types**
Chhattisgarh, Himachal Pradesh, Meghalaya	The target year to achieve the EV targets in these states is 2025-2027	Lack of long-term targets and vision in policies hampers clarity on the path to full electrification.	**Set longer-term visionary targets to underline clear commitment and alignment with national decarbonization strategies.**
Tamil Nadu	Tamil Nadu, known for its vehicle industry, still primarily produces ICEs. Fiscal instruments are in place to support EVs.	Industry transformation, especially the 'structural transformation' (see chapter 2 & 4) requires a comprehensive strategy.	**Expand fiscal instruments with facilitative measures, such as creating of a multi-stakeholder strategic forum**
Bihar, Madhya Pradesh, Tamil Nadu, Uttar Pradesh	These states offer subsidies for charging infrastructure but have not set specific goals for the roll-out.	Lack of specific goals and roll-out strategy for charging infrastructure can lead to insufficient and inefficient network deployment.	**Set clear, measurable goals for the roll-out of charging infrastructure with a detailed implementation strategy.**
Jharkand, Nagaland, Odisha, Goa	These states have mineral resources and/or refining facilities for materials such as nickel and cobalt.	While materials are critical for EV production, mining and refining are complex processes that require substantial expertise and investment.	**Assess the economic viability of expanding local mining and refining capacities for EV critical raw materials**
Delhi, Madhya Pradesh, Punjab, Telangana, Uttar Pradesh	These states support battery recycling through measures such as loan subsidies for investment in machinery.	Setting-up of recycling capacities requires not only financial measures but also investment in labor skills, safety standards and technology.	**Include skill development measures and regulatory standards for safe and efficient battery recycling.**
Delhi, Odisha, Bihar, and Chandigarh	These states have established strong demand side incentives for EVs.	Long-term and lasting success could be hindered if other aspects of the EV ecosystem are not addressed.	**Combine demand-side incentives with non-fiscal measures and further instruments addressing the supply side**
Various states (except for those with existing EV cells)	Only a few states have set up EV cells, and some of these have already been dissolved.	Without an entity tracking EV adoption, progress and maintaining momentum in the transformation can be difficult.	**Establish a body that encourages and monitors EV adoption and revises policies in consultation with experts.**

Agora Verkehrswende (2025) | Sources: State EV policies of respective states, WRI 2022b, Climate Trends 2023.

[1] In some cases " all vehicles" does not include trucks

7 | Outlook and future research opportunities

As discussed in this publication, Indian states are well advanced in terms of policy ambition, and have instituted a range of measures to encourage EV adoption. At the outset of this report, we presented a "screening tool" for assessing the current status and coverage of policy in relation to international best practice. This tool represents a valuable starting point for further in-depth research concerning policy development in Indian states (e.g. concerning specific technical details, the allocation of responsibilities, or funding issues).

Another important related topic of research that could be explored in future publications is whether and what extent policy issues would be better managed at the national or state levels, and how these two governance levels as well as different states can best complement and support each other.

Accordingly, the present report necessarily provides only a partial picture that could be significantly expanded upon to further contribute to India's efforts towards complete transport sector decarbonization and climate neutrality by 2070 – a goal that underscores India's role as a global leader in climate action.

8 | List of Figures

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10 | Acronyms

2 W	Two-wheeler
3 W	Three-wheeler
4 W	Four-wheeler
ACC	Advanced chemistry cell
BEV	Battery electric vehicle
BEE	Bureau of energy efficiency
CAPEX	Capital expenditures
CO_2	Carbon dioxide
COP	Conference of the Parties
CPO	Charge point operator
DCR	Development control rules
DISCOM	Electricity distribution company
e-2W	Electric two-wheeler
e-3W	Electric three-wheeler
e-4W	Electric three-wheeler
EPR	Extended producer responsibilities
ESG	Environmental, social, and governance
EU	European Union
EV	Electric vehicle
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles scheme
FCEV	Fuel cell electric vehicle
FY	Financial year
GDP	Gross domestic product
GST	Goods and services tax
ICCT	International Council on Clean Transportation
ICE	Internal combustion engine
INR	Indian rupee
OPEX	Operational expenditures
MSINS	Maharashtra State Innovation Society
MSRTC	Maharashtra State Road Transport Corporation
MoEFCC	Ministry of Environment and Forests
MoHFW	Ministry of Health and Family Welfare
MoHUA	Ministry of Housing and Urban Affairs

MHI	Ministry of Heavy Industries
MoRTH	Ministry of Road Transport and Highways
MSME	Micro, small and medium enterprise
MSP	Mineral Security Partnership
NEV	New energy vehicle
OEM	Original equipment manufacturer
PCS	Public charging stations
PLI	Production linked investment
R&D	Research and development
SGST	State goods and services tax
SPCS	Semi-public charging station
UA	Urban agglomeration
USD	United States dollar
V2G	Vehicle to grid
VAT	Value added tax
ZEV	Zero emission vehicle
ZEVTC	Zero Emission Vehicles Transition Council

11 | References

Agora Verkehrswende. (2021). *Automobile Arbeitswelt im Wandel*. URL: https://www.agora-verkehrswende.de/veroeffentlichungen/automobile-arbeitswelt-im-wandel/. Last accessed on 17.06.2024.

Agora Verkehrswende. (2024). *Marktentwicklung von E-Autos - Infografik zu den Neuzulassungen elektrischer Pkw in Deutschland.* URL: https://www.agora-verkehrswende.de/veroeffentlichungen/marktentwicklung-von-e-autos/. Last accessed on 17.06.2024.

Bajaj Auto 2023-24. (2023-24). *Annual Report 2023-24.* URL: https://www.bajajauto.com/-/media/images/bajajauto/media-kit/press-release/new-annual-reports/fy2023-24/bal-annual-report-fy24.pdf. Last accessed on 22.11.2024.

BEE. (2023). *Public Charging Stations*. URL: https://evyatra.beeindia.gov.in/public-charge-stations-citywise/?id=21. Last accessed on 17.06.2024.

BEE. (2024). *State EV Policies*. URL: https://evyatra.beeindia.gov.in/state-ev-policies/. Last accessed on 17.06.2024.

BMWK; IPE. (2020). *Automobile Wertschöpfung 2030/2050 - Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie.* URL: https://www.bmwk.de/Redaktion/DE/Downloads/Studien/automobile-wertschoepfung-2030-2050-kurzfassung.pdf?__blob=publicationFile&v=10. Last accessed on 17.06.2024.

CARB. (2022). California moves to accelerate to 100% new zero-emission vehicle sales by 2035. URL: https://ww2.arb.ca.gov/news/california-moves-accelerate-100-new-zero-emission-vehicle-sales-2035. Last accessed on 17.06.2024.

CBS. (2023). *Verdeling elektrische personenauto's naar provincie*. URL: https://www.cbs.nl/nl-nl/maatwerk/2024/13/verdeling-personenauto-s-naar-provincie-2023. Last accessed on 17.06.2024.

CEEW. (2023). *How India Joining the Mineral Security Partnership Will Boost Its Critical Mineral Drive*. URL: https://www.ceew.in/blogs/how-india-joining-mineral-security-partnership-will-boost-critical-minerals-supply-chain. Last accessed on 17.06.2024.

Climate Trends. (2023). *Analysis of state electric vehicle policies and their impact*. URL: https://climatetrends.in/wp-content/uploads/2023/02/full-report-digital-with-spreads.pdf. Last accessed on 17.06.2024.

Deloitte. (2023). *Dekarbonisierung der Lieferkette – Einkauf im Fokus*. URL: https://www2.deloitte.com/content/dam/Deloitte/de/Documents/risk/Deloitte-POV-Dekarbonisierung-der-Lieferkette.pdf. Last accessed on 17.06.2024.

e-AMRIT. (2023). *ZEVTC Declaration*. URL: https://e-amrit.niti.gov.in/zevtc-declaration. Last accessed on 17.06.2024.

Ernst and Young; NITI Aayog. (2023). *Mine to market: critical minerals supply chain for domestic value addition in lithium-ion battery manufacturing*. URL: https://www.niti.gov.in/sites/default/files/2023-07/Mine-to-market_NITI-Aayog-Publication_June-2023.pdf. Last accessed on 17.06.2024.

EU Commission. (2023). *Critical Raw Materials: ensuring secure and sustainable supply chains for EU's green and digital future*. URL: https://ec.europa.eu/commission/presscorner/detail/en/IP_23_1661. Last accessed on 17.06.2024.

European Union. (2023). *Critical Raw Materials Act*. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401252. Last accessed on 17.06.2024.

FICCI. (2024). *Federation of Indian Chambers of Commerce and Industry - About us*. URL: https://www.ficci.in/api/about. Last accessed on 17.06.2024.

German Watch. (2023). *Das Dienstwagenprivileg ... einfach erklärt und klimafreundlich umsetzbar*. URL: https://www.germanwatch.org/de/dienstwagenprivileg. Last accessed on 17.06.2024.

GHG platform India. (2018). *Trend Analysis of GHG Emissions of Maharashtra*. URL: https://www.ghgplatform-india.org/wp-content/uploads/2022/09/GHGPI_Trend-Analysis_2005-to-2018_Maharashtra_Sep22.pdf. Last accessed on 17.06.2024.

GIZ; NITI Aayog. (2024). *Recommendations to Enable Renewable Energy Based EV Charging in India*. URL: https://changing-transport.org/publications/recommendations-to-enable-ev-charging-in-india/. Last accessed on 17.06.2024.

Government of Delhi. (2023). *Transport department notification.* URL: https://transport.delhi.gov.in/sites/default/files/Transport/circulars-orders/250180.pdf . Last accessed on 22.11.2024.

Gov UK. (2020). *Green number plates get the green light for a zero-emission future*. URL: https://www.gov.uk/government/news/green-number-plates-get-the-green-light-for-a-zero-emission-future. Last accessed on 17.06.2024.

Gov UK. (2024). *Pathway for zero emission vehicle transition by 2035 becomes law.* URL: https://www.gov.uk/government/news/pathway-for-zero-emission-vehicle-transition-by-2035-becomes-law. Last accessed on 17.06.2024.

Government of Maharashtra. (2018). *Maharashtra's Electric Vehicle and related Infrastructure Policy – 2018.*

Government of Maharashtra. (2021). *Maharashtra State Electric Vehicle Policy 2021.*

Government of Maharashtra. (2022a). *Motor Vehicles Department.* URL: https://transport.maharashtra.gov.in/1035/Home. Last accessed on 22.11.2024.

Government of Maharashtra. (2022b). *Guidelines for Maharashtra Vehicle Scrapping Facility Policy.* URL: https://morth.nic.in/sites/default/files/Maharashtra%20RVSF%20Guideline%20dt.%2018.01.2023.pdf. Last accessed on 22.11.2024.

He, H., Jin, L., Cui, H. et al. (2018). *Assessment of electric car promotion policies in Chinese cities*. URL: https://theicct.org/wp-content/uploads/2021/06/China_city_NEV_assessment_20181018.pdf. Last accessed on 17.06.2024.

IEA. (2021). *Scheme for Faster Adoption and Manufacturing of (Hybrid) & Electric Vehicles in India – FAME.* https://www.iea.org/policies/2647-scheme-for-faster-adoption-and-manufacturing-of-hybrid-electric-vehicles-in-india-fame. Last accessed on 17.06.2024.

IEA. (2023). T*ransitioning India's Road Transport Sector – Realising climate and air quality benefits*. URL: https://www.iea.org/reports/transitioning-indias-road-transport-sector/executive-summary. Last accessed on 17.06.2024.

iFEVA. (2023). *Pune EV Infrastructure Development: A Glimpse into Maharashtra's Electric Vehicle Revolution*. URL: https://fevaev.com/pune-takes-the-lead-in-ev-infrastructure-development-a-glimpse-into-maharashtras-electric-vehicle-revolution/. Last accessed on 17.06.2024.

Integrated Government Online directory. (2024). *Districts – Maharashtra.* URL: https://igod.gov.in/sg/MH/E042/organizations. Last accessed on 24.06.2024.

Kumar, M., Shao, Z., Braun, C. et al. (2022). *Decarbonising India's road transport: a meta-analysis of road transport emission models.* URL: https://theicct.org/wp-content/uploads/2022/05/Meta-study-India-transport_final.pdf. Last accessed on 17.06.2024.

Maharashtra Economic Advisory Council. (2024). *Implementation framework for becoming a $1 Trillion economy.* URL: https://mahasdb.maharashtra.gov.in/files/DSP/home/Maharashtra%20EAC%20report_English%20Version.pdf. Last accessed on 22.11.2024.

Maharashtra State Data Bank. (2011). *Maharashtra's Socio-Economic Indicators Compared With Other States*. URL: https://mahasdb.maharashtra.gov.in/miscReport.do. Last accessed on 17.06.2024.

Mahindra & Mahindra. (2023-24). *Annual Report 2023-24*. URL: https://www.mahindra.com/annual-report-FY2024/6/index.html. Last accessed on 22.11.2024.

MHI. (2021). *Press Release of FAME Scheme*. https://pib.gov.in/PressReleasePage.aspx?PRID=1741569. Last accessed on 17.06.2024.

Ministry of Heavy Industries. (2023). *Notification of 8th March 2019 - Scheme for Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME India Phase II).* URL: https://fame2.heavyindustries.gov.in/content/english/11_1_Policy-Document.aspx. Last accessed on 17.06.2024.

Ministry of Mines. (2023). *Critical Minerals for India – Report of the Committee on Identification of Critical Minerals*. Last accessed on 17.06.2024.

MoHFW. (2020). *Population projections for India and states 2011–2036.*

MoRTH. (2019-20). *Road Transport Year Book 2019-20.* URL: https://morth.nic.in/road-transport-year-books. Last accessed on 22.11.2024.

MoRTH. (2023). *Annual report 2022-2023*. URL: https://morth.nic.in/sites/default/files/MoRTH Annual Report for the Year 2022-23 in English.pdf. Last accessed on 17.06.2024.

MOSPI. (2022). *Statistical Year Book India 2022.*

MSRTC. (2024). *MSRTC History.* URL: https://msrtc.org.in/. Last accessed on 21.11.2024.

MSRTC, ASRT, ITDP. (2024). *Maharashtra State Road Transport Corporation's Electrifying Transformation – E-Bus Project and Beyond.* URL: https://www.itdp.in/wp-content/uploads/2023/11/MSRTCs-Electrifying-Transformation-Final-Report-by-ASRTU-ITDP-India.pdf. Last accessed on 22.11.2024.

Norsk elbilforening. (2023). *Norwegian EV market.* URL: https://elbil.no/english/norwegian-ev-market/. Last accessed on 17.06.2024.

NOW. (2019). *Wir werden Nationale Leitstelle Ladeinfrastruktur*. URL: https://www.now-gmbh.de/aktuelles/pressemitteilungen/nationale-leitstelle-ladeinfrastruktur-bei-now-gmbh/. Last accessed on 17.06.2024.

Rajon Bernard, M., Hall, D. (2021). *Efficient planning and implementation of public chargers: Lessons learned from European cities*. URL: https://theicct.org/publication/efficient-planning-and-implementation-of-public-chargers-lessons-learned-from-european-cities/. Last accessed on 17.06.2024.

Ramachandra, T.V., Shwetmala. *Emissions from India's transport sector: Statewise synthesis,* Atmospheric Environment (2009), doi:10.1016/j.atmosenv.2009.07.015. Last accessed on 17.06.2024.

RMI India. (2022). *Pioneering Electric Buses in Pune - A Case Study of the City's Initial Procurement and Operations.* URL: https://rmi.org/wp-content/uploads/2022/04/pioneering_electric_buses_in_pune.pdf. Last accessed on 22.11.2024.

State of California. (2023). *California Approves World's First Regulation to Phase Out Dirty Combustion Trucks and Protect Public Health.* URL: https://www.gov.ca.gov/2023/04/28/california-approves-worlds-first-regulation-to-phase-out-dirty-combustion-trucks-and-protect-public-health/. Last accessed on 17.06.2024.

UBA. (2024). *Altfahrzeugverwertung und Fahrzeugverbleib.* URL: https://www.umweltbundesamt.de/daten/ressourcen-abfall/verwertung-entsorgung-ausgewaehlter-abfallarten/altfahrzeugverwertung-fahrzeugverbleib#altfahrzeuge-2021-niedrigste-anzahl-seit-beginn-der-aufzeichnungen-in-2004. Last accessed on 17.06.2024.

UN environment. (2021). *Used Vehicles And The Environment: Key Findings*. URL: http://airqualityandmobility.org/usedvehicles/usedvehicles_updatereport_key-findings-eng.pdf. Last accessed on 05.06.2023.

UN Population Census Estimates. (2023). *China and India: most populous countries*. URL: https://www.un.org/en/global-issues/population. Last accessed on 17.06.2024.

USAID. (2021). *India Climate Change Country Profile, Fact Sheet – April 22, 2021.* URL: https://www.usaid.gov/climate/country-profiles/india. Last accessed on 17.06.2024.

Vahan database. (2024). *National Register e-Services, Dashborad for vehicle related services.* URL: https://analytics.parivahan.gov.in/analytics/publicdashboard/vahan?lang=en. Last accessed on 22.11.2024.

Wappelhorst, S., Hall, D., Nicholas, M. et al. (2020). *Analysing policies to grow the electric vehicle market in European cities.* URL: https://theicct.org/sites/default/files/publications/EV_city_policies_white_paper_fv_20200224.pdf. Last accessed on 17.06.2024.

Wappelhorst, S., Mock, P., Yang, Z. (2018). *Using vehicle taxation policy to lower transport emissions: An overview for passenger cars in Europe.* URL: https://theicct.org/publication/using-vehicle-taxation-policy-to-lower-transport-emissions-an-overview-for-passenger-cars-in-europe/. Last accessed on 17.06.2024.

WRI. (2022a). *Just Transition and Skill Development in the Electric Vehicle Industry.* URL: https://wri-india.org/events/just-transition-and-skill-development-electric-vehicle-industry. Last accessed on 17.06.2024.
WRI. (2022b). A review of state government policies for electric mobility. URL: https://www.wricitiesindia.org/sites/default/files/Full_report_EV_State_Policy.pdf. Last accessed on 17.06.2024.

WRI. (2022b). A review of state government policies for electric mobility. URL: https://www.wricitiesindia.org/sites/default/files/Full_report_EV_State_Policy.pdf. Last accessed on 17.06.2024.

WRI. (2024). *Policies for E-Mobility*; WRI figure based on data by the Ministry of Road Transport and Highways (MoRTH), Department of Heavy Industry, Ministry of Power (MoP), Ministry of Environment, Forest, and Climate Change (MpEFCC).

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