

White Paper

EV-Ready India

Part 1: Value Chain

Analysis of State EV Policies

In collaboration with Ola Mobility Institute

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Forewords



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The opportunities for India's mobility future are massive. Urban mobility demand will only continue to grow as the country's total population swells and urban migration becomes more acute. As an oil-import dependent country, the energy scarcity is another challenge that will be affected by this growth. Despite significant and complex mobility challenges, India is poised to lead the way globally towards a decarbonized and sustainable mobility future through an interplay of young demography, technological advancements and smart governance.

Just like India showcased leapfrogging to smart phone usership by reaching 300 million, more users than in the US, it can do so in the case of mobility. India's current vehicle ownership rate is low with only 20 vehicles per 1000 people. The burgeoning middle-class should be nudged to bypass the traditional model of mobility that entails internal combustion engine and move towards a mobility system that is powered by shared and electric mobility. It is uniquely qualified to leapfrog due to low-vehicular penetration, openness for shared mobility powered by smart phone penetration and cultural affinity for frugal Jugaad innovation applicable to battery swapping and e-rickshaws.

The national government's determination is evident through the mobility policies and regulatory measures put in place offering regulations and strong incentives to switch to electric vehicles. As a result, 10 Indian States and Union Territories have published their draft electric vehicle (EV) policies or notified their final policies. The role of public-private collaboration cannot be emphasised enough in the diffusion and adoption of electric vehicles in support of India's goals to be a leader in sustainability and inclusive development.

World Economic Forum and Ola Mobility Institute provide a first of its kind analysis of EV policies across all States in this report. Using a value-chain framework to review all 10 State's draft or final EV policies, this report allows for policymakers, businesses and practitioners alike to highlight focal point policies and identify new opportunities for public-private collaboration. The analysis should continue to be developed further to provide recommendations to States on the sustainability and longevity of the different EV policies.

India has a significant potential to become one of the largest EV markets in the world. And given the scale and complexity at hand, solutions tested for connectivity and sustainability in India can be scaled up and customized for the rest of the world.



Anand Shah
Senior Advisor
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Policy-makers around the world are beginning to believe that electric and zero-emission mobility have the potential to be a practical solution to some of the largest problems human society faces.

India's own aspiration of becoming a \$5 trillion economy by 2023 is bold, especially as the country takes determined steps towards an environmentally sustainable future. India is in a unique position to leverage electric mobility – by leapfrogging the historical evolution of personal mobility – and finding synergy with strategic imperatives for energy security, renewable production and urban decongestion.

Taking these steps at this point in the economy's development has real promise to create millions of jobs and make India a leader in an emerging area of global importance.

By taking an enthusiastic, consultative and progressive approach to encouraging clean mobility, central and state governments across India have made significant commitments towards promoting an electric future.

Within this context, the Ola Mobility Institute has taken steps to understand the electric vehicle (EV) ecosystem and analyse electric mobility policies across key states in India.

This report exists to encourage EV adoption and intelligent policy development across the country. The research uses a Value Chain Framework to analyse policies in 10 Indian states, to provide actionable intelligence and recommendations. The framework also allows for comparisons with policies in international markets like Europe and the United States.

The analysis of EV policies in the identified states had varied findings that included Bihar's efforts to convert all paddle rickshaws to e-rickshaws by 2022, Karnataka's focus on a venture capital fund for e-mobility start-ups and Delhi's efforts towards 50% e-bus in public transportation by 2023. The report also calls out the need for common framework to bring consistency and accelerate EV adoption in India.

It also goes on to provide recommendations for a robust and holistic enabling ecosystem for faster adoption of e-mobility based on lessons from the US, Taiwan, China and Europe. The lessons from OMI's Nagpur report gave us tangible insights to believe India can be a global pioneer in scaling up electric mobility. We are confident that governments across the country are actively committed to ensuring that a policy environment will aid rapid adoption.

Executive summary



India is charged to become a global hotspot for electric mobility. Over the past few years, the national government has created **momentum** through several policies that encourage the adoption of electric mobility. Following suit, 10 states and union territories (UT) have published draft electric vehicle (EV) policies or notified final policies detailing fiscal, non-fiscal and other incentives to accelerate a value chain of electric mobility activities. Manufacturers have joined in by launching diversified products in various categories: rickshaws, two-wheelers (2Ws), three-wheelers (3Ws), passenger vehicles, buses and power trains. Start-ups are developing viable products for battery technologies, charging infrastructure and more. Despite these developments, the uptake of electric vehicles has been slow due to the high upfront cost and range anxiety. Given the nascent market, the **role of government** is important in accelerating adoption, diffusion and deployment of electric mobility. For a price-sensitive market such as India, developing incentives for **electric (clean) kilometres run versus electric vehicles purchased** makes economic sense and is suggested as the guiding principle for the national strategy.

State governments are empowered to design options based on localized objectives, assets and needs. This is evident in the **varied approaches** taken by the 10 states and UTs. While such variation is understandable, a **common framework** for gauging the sustainability and longevity of EV policies across India is necessary for policy-makers, businesses and practitioners alike. The framework also allows for global comparisons with policies such as those of EU countries and California.

This report uses a **value chain framework** to analyse the EV policies in 10 Indian states. The value chain framework pays attention to the multisectoral and multistakeholder aspects of EV policies, divided into three different value chains: electric vehicles; charging; and the surrounding network. It ensures that overall sustainability is considered from cradle to grave and, finally, it helps to highlight the gaps in the value chain that need investment and further policy attention.

The three value chains of the 10 states and UTs were analysed based on this framework. The analysis examines a full list of provisions per state, and in each case a summary of the state's notable policies is given. Most states emphasized the **production of an EV value chain**, an aspiration to be manufacturing hubs for EV and EV components and a wish to align well with the national "Make in India" agenda. Production of clean-fuel batteries, recycling and storage was encouraged across the board. Analysis of the life-cycle cost of batteries will determine whether the total life-cycle cost of EVs is economically viable, but this is not yet measurable. Thus, circular value chains of batteries is an important provision. In the **infrastructure value chain**, most states provided for the installation of charging infrastructure in public and private locations to address range anxiety. Many states emphasized the **services of an EV value chain** by creating public awareness, skilling programmes, fiscal incentives such as pollution cess (tax) and non-fiscal incentives such as retrofitment services, real-time information on charging infrastructure and payment facilities. This is good because services can be the missing link between consumer demand and manufacturing supply.

Most states focus downstream in the vehicles value chain; it was clear that the focus on **research and development (R&D)** was limited. Stimulating R&D by setting up funds for research centres and centres of excellence would lead to a strong manufacturing base. It is important to note that as downstream fiscal and non-fiscal incentives sunset, long-term investment in R&D will create sustained growth. Lastly, many of the policies seem to pile up aspects of the three value chains, but more emphasis on network value chains that create self-enforcing loops in the environment and instigate societal dynamic towards EVs is missing.

Finally, **recommendations** are made based on the lessons from leading geographies such as the US, China, Taiwan and Europe. This includes policies that legally mandate production and services for EVs. Fiscal incentives for the production of charging infrastructure and services for such infrastructure are also recommended.

1. Introduction: India and the promise of electric mobility

With the 75th year of Indian independence – 2022 – fast approaching, India is set to arrive on the global stage of sustainable development with a bang. Over the past few years, India has announced a plethora of electric mobility policies and regulatory measures, including the recent budgetary announcements¹ as well as an allotment of INR 10,000 crore (= INR 100 billion; \$1.4 billion) by the cabinet² to promote the faster adoption and manufacture of electric vehicles across the country. Electric mobility – efficient, sustainable, decarbonizing – holds tremendous promise for India. It will curb pollution and reduce reliance on import-dependent fossil fuels. The economy will thrive as it creates a diverse set of entrepreneurial opportunities and augments advanced skills and jobs. And finally, it will spur innovation in the manufacturing of electric vehicles, their components (including batteries) and the generation and use of renewable energy. The Indian automobile industry is one of the global Big Four – the others are China, the USA and Japan – in terms of the manufacture and sale of passenger and commercial vehicles.³ EVs present India with the opportunity to change the global automobile and energy landscape.

Fuelled by the national agenda of electrification and bolstered by government-led initiatives, the public and private sectors alike have commenced their transitions to electric mobility. In May 2017, India witnessed its first multimodal⁴ electric mobility project in Nagpur, in the state of Maharashtra. As of January 2019, the electric fleet in Nagpur – a combination of e-rickshaws and e-cabs operated by the ride-hailing and rideshare platform Ola – had served more than 350,000 customers, clocked more than 7.5 million clean kilometres, saved more than 5.7 lakh (570,000) litres of import-dependent fossil fuel and reduced CO₂ emission by more than 1,230 tons since its inception.⁵ This pilot, and the subsequent projects in the country – such as the state-run Energy Efficiency Services Limited (EESL) inviting tender for 10,000 electric vehicles,⁶ or several manufacturers and new-age EV and charging enterprises partnering to offer sustainable first and last-mile connectivity to public transit,⁷ as well as the introduction of e-buses by several state governments – are all measures geared towards increasing the clean kilometres travelled by India's vehicular fleet.



2. Research methodology

2.1. Context of the study

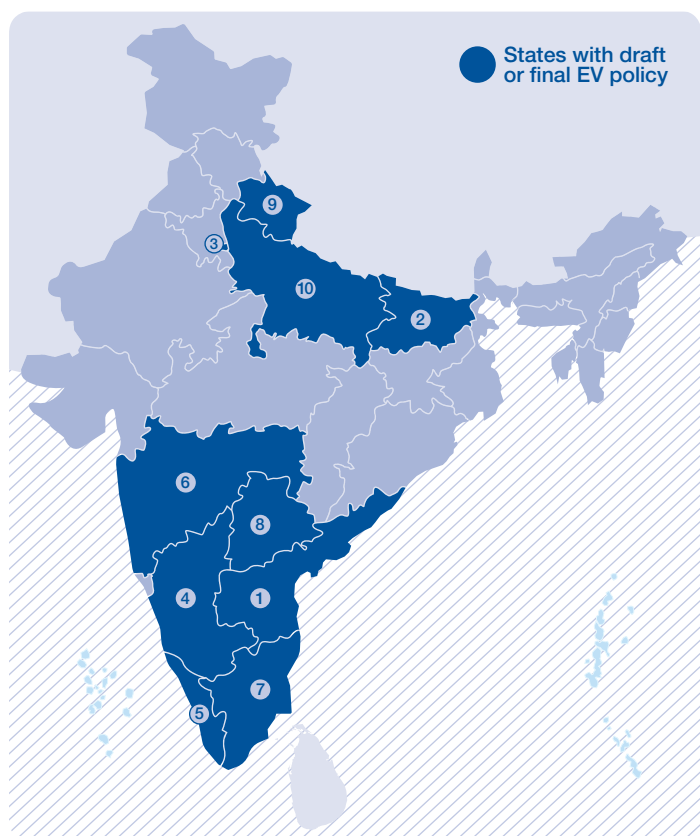
The interplay of technology and mobility is expected to transform our mobility patterns. The dynamic transition to sustainable mobility, particularly electric mobility, underpins the critical role of policy. For India, too, this transition to e-mobility is a typical “wicked policy” problem wherein there are many actors and a great degree of complexity in the arena of e-mobility.⁸ The role of the government cannot be emphasized enough in the diffusion, adoption and deployment of electric vehicles in support of larger societal goals such as sustainability and urban livability.⁹ Considering the strong governmental push towards EVs, India has huge potential to become one of the largest EV markets in the world.

Cities today face many challenges such as a lack of robust charging infrastructure causing range anxiety among users and the high upfront cost of EVs, among others, that need to be overcome to facilitate smooth and swift adoption of electric vehicles at scale. States, for their part, have been instituting guidelines and policies to ensure faster and seamless adoption of EVs. However, the action on the ground is varied. To date, 10 states and UTs have published their draft EV policies or released their final policies. But these policy documents outline different approaches. Some states treat the EV paradigm as a manufacturing boon and, therefore, a job-creation opportunity, while

others are focused on building the public infrastructure of electric vehicles and charging stations. For instance, the Uttar Pradesh and Maharashtra EV policies emphasize the promotion of EV manufacturing. States such as Delhi and Kerala, on the other hand, have policies that seek to reduce the number of vehicles running on fossil fuels and support the electrification of public and shared transport. With many more states in the process of designing their EV policies, policy-makers, businesses and practitioners alike should now develop a common framework for analysing state EV policies. This would make it possible to identify and compare the sustainability and longevity of EV policies across India. The analysis of policies through such a framework would also derive findings from EV policies implemented across the globe.

2.2. Objective and scope

This paper, *EV Ready India – Part 1: Value Chain Analysis of State EV Policies*, analyses the electric mobility policy provisions laid out by states and UTs in India on the basis of a predetermined framework, in an effort to encourage a holistic approach to EV adoption and acceleration in the country. The framework uses a value chain approach to analyse EV policies. The analysis focuses on 10 Indian states that have a notified EV policy or a draft policy published: Andhra Pradesh, Bihar, Delhi, Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana, Uttarakhand and Uttar Pradesh.



1 Andhra Pradesh

2 Bihar

3 Delhi

4 Karnataka

5 Kerala

6 Maharashtra

7 Tamil Nadu

8 Telangana

9 Uttarakhand

10 Uttar Pradesh

2.3. Value chains in the e-mobility ecosystem

A value chain is a series of activities that adds value to a final product or service, covering its life cycle from beginning to end. A sustainable value chain encourages a full life-cycle perspective, and not just a focus on the (upstream) procurement of inputs.¹⁰ A value chain, therefore, involves upstream and downstream activities: Upstream refers to the material inputs required for production; downstream is the opposite end, where products are produced and distributed.¹¹ The overall activities in a value chain – primary and support – range from the procurement of raw materials and manufacturing a product to its usage and, later, reuse, recycling or scrapping of the product.

With several countries transitioning to an electric mobility future, a value-chain approach of introducing sustainable practices across all aspects of the life cycle of an EV is gaining credibility. For instance, California – deemed an environmental leader – carried out a life-cycle analysis comparison of a battery electric vehicle and conventional gasoline vehicle, to measure the overall environmental impact of vehicles of the two technologies.¹² Similarly, the IEA Sustainable Development Scenario¹³ emphasizes GHG emission reductions from EVs on a well-to-wheel basis. Such a scenario includes sustainable sourcing of minerals, power-grid decarbonization, end-of-life management for vehicles and batteries, including second-life applications of automotive batteries, standards for battery waste management and environmental requirements for battery design, increasing taxes on carbon-intensive fuels, and more.¹⁴

Sustainability of all aspects of the e-mobility value chain, therefore, is important. How might we classify the various activities undertaken to make possible a sustainable mobility future? Van der Steen et al.¹⁵ identify three distinct value chains in the e-mobility ecosystem – a) the EV value chain, which also includes components of EVs such as batteries; b) the charging infrastructure value chain; and c) the network value chain. This will be described in later sections of the report.

2.4. The need for a value-chain approach in policy analysis

Businesses and nations alike have adopted the value-chain approach to sustainability for decades now. For instance, an industry-led coalition identifies a five-step approach to transforming the six different phases of a standardized value chain – material extraction, material processing, manufacturing, retail, use and disposal and recycling – to achieve sustainability. At the core of these six phases is logistics, which also has to be sustainable.¹⁶ The United Nations,¹⁷ while distinguishing between supply chain and value chain, posits that the value chain also encompasses the value created by the chain, particularly for end-use customers, which include a range of stakeholders, for instance, communities and governments. Similarly, the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) encourage businesses to assess their entire value chain greenhouse-gas emissions impact and identify where to focus reduction activities.¹⁸ It is recognized that the development of the e-mobility value chain lays the foundation for a new energy paradigm the world over.

With cities increasingly responsible for most of GDP production, energy use, CO₂ emissions, and waste generation,¹⁹ they aim to keep the products and materials in the value chain for a longer period and to recover the raw materials after the lifetime of products for the next use.²⁰

Overall, such a value chain evaluation, especially analysed globally, increases knowledge about the possibilities and development alternatives of the emerging EV industry and how growing, as well as less-developed markets, could potentially increase their linkages to these industries.²¹

2.5. Methods and limitations

First, the framework analyses policies explicitly categorized as EV policies originating at the state-government level in India. The analysis focuses solely on electric vehicles and their variants such as battery-operated electric vehicles, hybrid electric vehicles (HEV) and plug-in hybrid electric vehicles (PHEV) – collectively called EVs hereafter. Therefore, the study considers only the policies concerning these three categories of vehicles, and not other hybrid vehicles or other zero-emission vehicles.

Second, this study adopts and develops upon the theoretical framework propounded by Van der Steen et al. in their landmark paper, *EV Policy Compared: An International Comparison of Governments' Policy Strategy Towards E-Mobility*.²² In addition to defining the three value chains of e-mobility, the researchers analyse the tools used by governments – as identified by Hood and Margetts²³ – to promote different aspects of the value chain.

Third, while the framework is built on the ideals of circular value chains, the policies analysed hereafter do not measure policies that encourage reuse of batteries and recyclable materials and do not include reverse logistics of distribution of spare parts or scrappage collected in the framework. This would be a valuable addition to the framework in the future.

For the analysis, we first finalized the framework with experts and practitioners from academia and public policy domains. We then mapped the provisions of the state EV policy against every aspect of the value chain analysis framework. We studied global examples of EV transition and included the best methodologies in the analysis chapters of this report.

The study, therefore, presents an objective analysis of state- and government-level EV policy on the basis of a value-chain framework. It suffers from the limitation of not including policies and regulations outside the scope or realm of the EV policy of the concerned state; in its current form, it does not intend to determine if a state's approach to electrification is right or even adequate. Instead, it identifies all areas of intervention required and maps provisions from a published EV policy against these requisites. It is hoped that in the coming months, the framework will be developed further by the authors in collaboration with a diverse research advisory board. Such a proposed framework would also include scoring and ranking methods and would objectively evaluate all policies and regulations of a state or UT and not just the ones categorized as the state EV policy, to evaluate holistically the readiness of the state for electrification in the short run and sustainable mobility future in the long term.

3. The economics of electric mobility: Guiding principle of a national strategy

Despite various policy incentives and non-fiscal measures taken by governments the world over, numerous barriers prevent widespread adoption of EVs. The uptake of electric vehicles is slow because the vehicles are costly – not only upfront but also on a life-cycle cost basis, or in other words, total cost of ownership (TCO).²⁴ Electric vehicle ownership is disproportionately concentrated among high-income households and communities. Data from California’s Clean Vehicle Rebate Project, for instance, suggests that only 6% of the California rebates for BEVs were captured by households in disadvantaged communities.²⁵ Additionally, the lack of robust fast-charging infrastructure, causing range anxiety among users, credit constraints, the limited choice set of vehicle models, and well-established behavioural failures that inhibit adoption of efficient technologies with lower life-cycle cost²⁶ impede EV adoption.

In order to overcome these challenges, the strategy of a country transitioning to electric mobility should include the prioritization of electric miles (or clean kilometres) over electric vehicles. Rajagopal and Phadke²⁷ list a few simple reasons for this approach: a) the payback over the lifetime of the EV is inversely correlated with the vehicle kilometers travelled (VKT);²⁸ b) thereby, suggesting pivoting public

policies to target high-usage vehicles and applications; c) however, the stock of private vehicles with high VKT is small, thus weakening the economic case for public investment in fast-charging infrastructure. It is to be noted that high-VKT users who could benefit from lower life-cycle cost of EVs – even in the absence of subsidies – would still face barriers in the form of range anxiety and credit constraints, among others.

Indeed, India’s national and state policies and regulations prioritize the electrification of high-use vehicles. The Transformative Mobility Mission for India by NITI Aayog and the National Electric Mobility Mission Plan 2020 have laid down the principles and strategies for the transition to e-mobility. These are supported by policies such as the Faster Adoption and Manufacture of Electric Vehicles (FAME) by the Department of Heavy Industries (DHI), the Phased Manufacturing Programme by the DHI, the Amendment to Building Bye-Laws to set up Charging Infrastructure by the Ministry of Housing and Urban Affairs, the Public Charging Station guidelines by the Ministry of Power and more. Overall, these policies outline strategies for demand creation, technology development, robust charging infrastructure and pilot projects.



4. EV Policy Analysis Framework

R&D

Instruments focused on influencing the research and design of electric vehicles and EV components

Production

Instruments focused on influencing the production of electric vehicles and vehicle components such as batteries and other hardware (original equipment manufacturers). This section of the value chain also recognizes the software used in electric vehicles

Services

Instruments focused on influencing service providers for electric vehicles. Different service providers are recognized, such as car dealerships, mechanics, insurance companies, etc.

Customers

Instruments focused on influencing customers of EVs. The study's methodology recognizes not only individual consumers (end users) but also fleet-owners (e.g. authorities and leasing companies) and public/governmental agencies (promoting consumerism)

R&D

Instruments focused on influencing the research and design of the complete charging infrastructure

Production

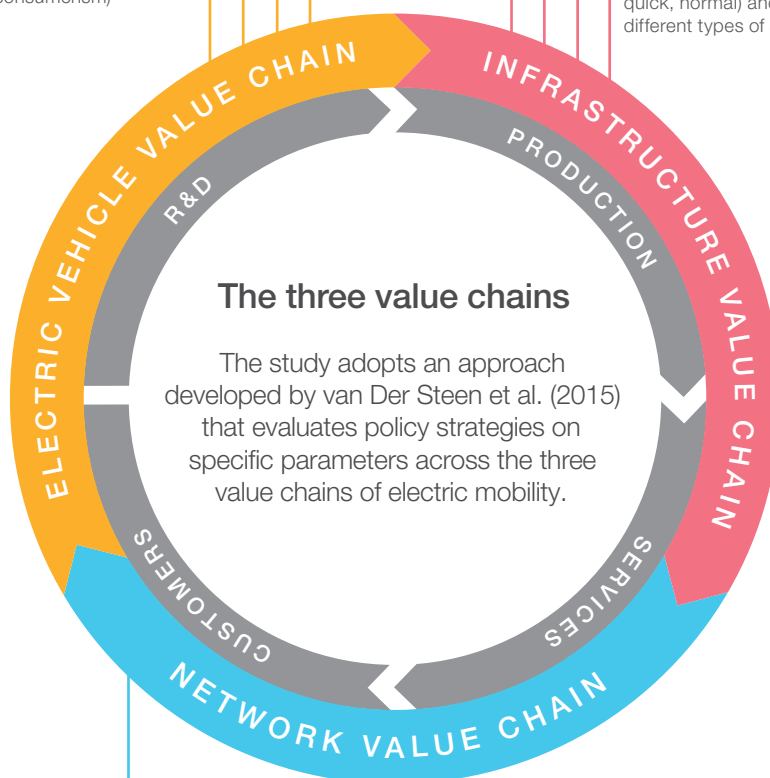
Instruments focused on influencing the production of charging and battery-swapping stations and EV system components such as the electricity network, energy production, etc.

Services

Instruments focused on influencing service providers for charging and battery-swapping stations. Different service providers are recognized, such as energy suppliers, power plants, grid managers, software developers, etc.

Customers

Instruments focused on influencing customers of charging and swapping stations. By "customers", the study refers both to users (consumers) and owners (consumers, companies, public authorities and government). The different types of charging stations (private, public, fast, quick, normal) and battery-swapping stations require different types of steering by governmental units



Network

All of the instruments that focus on connecting stakeholders in the EV/infrastructure value chain – for instance, efforts intended to intensify contacts between different stakeholders, in order to improve value-chain alignment and a more efficient functioning of the entire value-chain. In addition to the value chain, this includes other policy measures aimed at the e-mobility ecosystem, which are taken into consideration – for instance, policy measures aimed at realizing smart grids, smart economies and smart mobility

Policy and regulatory tools used by the government²⁹

Legal	<p>All of the rules and directives designed to mandate, enable, encourage, limit or otherwise direct subjects to act according to policy goals</p> <p>E.g. local parking legislation, legislation for standards for charging-station accessibility, limited access to urban areas or roads, etc.</p>
Demand/ consumer incentives	<p>Policy instruments involve either the handing out or taking away of material resources (cash or kind), in order to encourage behaviour by subjects. The difference between demand incentives and legal measures is that those affected are not obliged to take the measures involved but are encouraged to do so by their own choice</p> <p>E.g. purchase grants, tax benefits for consumers of EVs, government funding for battery research, subsidies on home chargers or free electricity for public charging</p>
Communication	<p>Instruments that influence the value chain of e-mobility through to the communication of arguments and persuasion, including information and education</p> <p>E.g. education in schools, government information campaigns, etc.</p>
Organization	<p>Actions by government that provide the physical ability to act directly, using its own forces to achieve policy goals rather than others. This includes the allocation of means, capital, resources and the physical infrastructure needed to act</p> <p>E.g. government or public authorities acting as a launching customer, buying own fleet of EVs, government installing public chargers, etc.</p>

5. Analysis of state EV policies

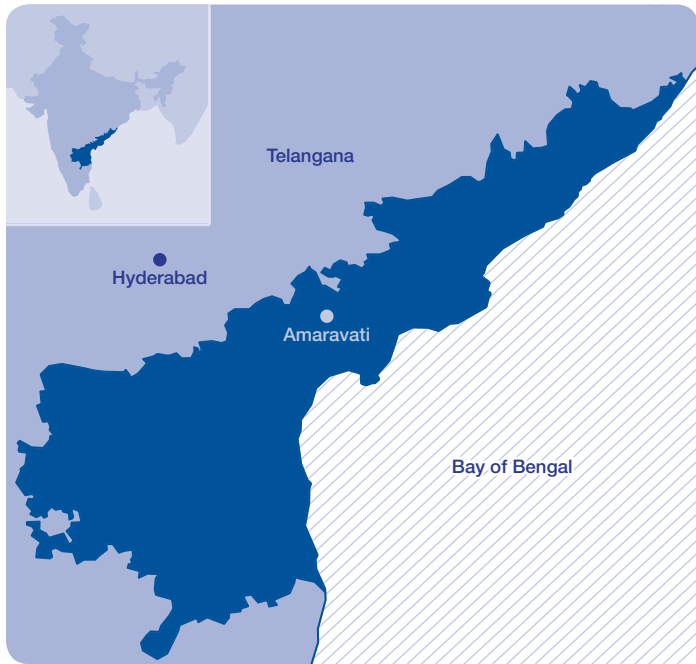


Analysis of state EV policy Andhra Pradesh

Date of notification **8 June 2018**

Status **Final**

Area map



Objectives

- A. Make Andhra Pradesh a global hub for electric mobility development and manufacturing.
- B. Actively promote innovation through grants and venture funds to research organizations, incubators and start-ups working on next-generation battery technology, fuel cell technologies, EV power trains and EV electronics.
- C. Enable investment in charging/battery-swapping infrastructure and hydrogen generation and fuelling station development.
- D. Create a skilled workforce attuned to the needs of the EV ecosystem.
- E. Promote the usage of EVs to enable transition to environmentally friendly cities.
- F. Build next-generation transportation infrastructure using Vehicle to Everything (V2X) platforms.

Summary

Andhra Pradesh has set an ambitious target to be the best Indian state in EV by 2029 and a leading global investment destination by 2050. The state aims to have 1,000,000 EVs on the road by 2024. The policy focuses on the production, services and customer sides of the EV value chain and infrastructure value chain. Highlights: 1) allocation of 200–400 hectares of land for developing EV parks with all of the necessary infrastructure and facilities; 2) 100% reimbursement on stamp duty on the purchase of land for EV production; 3) financial assistance of 50% of fixed capital investments in building and common infrastructure (up to a max. of INR 20 Cr [INR 200 million = \$2.8 million]) for manufacturing centres specific to EVs; 4) capital subsidy for micro-, small- and medium-scale industries; 5) establishing a Smart Mobility Corporation and a nodal agency to coordinate all necessary activities to promote futuristic transport needs; 6) reimbursement

of electricity duty for the first five years; 7) offering a dedicated line along with special discount for night/non-peak time usage for testing of EVs; 8) reimbursement of net State Goods and Services Tax (SGST) for firms involved in services such as leasing, owning or operating EV fleets and providing charging/ swapping stations for EVs, until 2024; and 9) levying of high charges on registration, renewal, parking fees, congestion fees, taxes/cess on sale of highly polluting ICE vehicles. Further, the state has a special focus on public transport and plans to convert all buses to electric by 2029. The first phase of the transition plan will convert all buses in four target cities by 2024. The state will take steps to create awareness among the people for the growth of the EV market. It will provide test rides in collaboration with various manufacturers to popularize EVs among citizens. The state plans to celebrate “green days” in the capital city to promote EVs.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●●	●●●	●●●	●●●
Infrastructure value chain	●	●	●●	●●
Network value chain	●	●	○	○

○ No information found ● Limited information found ●● Relevant information found ●●● Detailed information found

Analysis of state EV Policy Bihar

Date of notification **14 June 2019**

Status **Draft**

Area map







Objectives

- A. Create a manufacturing environment for EVs in the state.
- B. Fulfill sustainable development goals in the transport sector.
- C. Make Bihar the EV sector's preferred investment destination.
- D. Convert all paddle-rickshaws to e-rickshaws by 2022.
- E. Create fast charging stations at intervals of 50 kilometres on state/national highways, attract on-ground investments of INR 2,500 Cr (INR 25 billion = \$350 million) and create direct empowerment opportunities for 10,000 persons in the state.

Summary

Bihar is one of the fastest-growing markets for e-rickshaws. The state aims to use its market strength and promote the manufacture of e-rickshaws. All incentives for industries are governed through the Bihar Industrial Investment Promotion Policy, notified in 2016. The state aims to amend the policy and prioritize the EV sector. Incentives for manufacturers include reimbursement of stamp duty, registration duty, and SGST, as well as other tax benefits. The state will provide a special incentive of INR 10,000 (\$140) on Lithium-ion battery e-rickshaws, in addition to the end-user subsidy of INR 12,000 (\$170). The state has listed a 15% end-user subsidy for all vehicle categories. The government plans to set up charging stations at commercial locations, in residential areas and on state/national highways.

Policy focus area	 R&D	 Production	 Services	 Customers
EV value chain	○	●●	○	●
Infrastructure value chain	○	●	●	●
Network value chain	○	○	○	○

○ No information found ● Limited information found ●● Relevant information found ●●● Detailed information found

Analysis of state EV policy Delhi

Date of notification **27 November 2018**

Status **Draft**

Area map



Objectives

- A. Bring about a material improvement in Delhi's air quality by bringing down emissions from the transport sector. Drive rapid adoption of battery electric vehicles (BEVs) with the goal of their constituting 25% of all new vehicle registrations by 2023.
- B. Support the creation of jobs in driving, selling, financing, servicing and charging EVs.

Summary

Delhi's draft EV policy has a number of provisions to reduce air pollution. In order to discourage use of ICE vehicles, it has included pollution cess, an air-quality parking surcharge and an environment compensation charge for existing petrol/diesel vehicles as well as all new ICE vehicles. The state EV policy also provides scrappage and deregistration incentives for a few ICE vehicle categories that will be applicable if someone buys an EV in the same financial year. The policy also focuses on increasing awareness of the benefits of adopting EVs and building customer trust. It has plans, too, to design vocational courses in association with original equipment manufacturers (OEM), energy operators (EO) and battery-swapping operators (BSO). The policy prioritizes vehicle categories based on their proportional representation in the market. Accordingly, 2Ws, 3Ws, public transport (bus) and taxi fleets have been prioritized, and will benefit from a governmental push in the form of a purchase incentive, an additional top-up incentive and a waiver of road tax/registration tax/one-time parking fees/permit fees etc. Delhi plans to add 50% e-buses to public transport by 2023. Under the infrastructure value chain, the state will encourage long-term investment by dealers and charging facility providers to create enabling conditions for private and public charging infrastructure. Delhi provides a special

electricity tariff for EV charging and encourages DISCOMS to work with owners of residential/non-residential buildings to ensure adequate power supply infrastructure for the installation of these charging points. The state will have public charging infrastructure at least every 3 kilometres. The state will opt for competitive bidding to select the energy operators (EOs) for each travel district to instal and operate charging stations for 10 years. The BSOs can set up and operate battery-swapping kiosks themselves or through a business associate/franchisee at bare minimum rental. Under the network value chain, the policy has provisions for common mobility card payment system that will enable EOs and BSOs to accept multiple mode of payments (cash, card, mobile wallets or unified payment interface). To make the system more end user-friendly the state is planning to provide real-time information on charging infrastructure using an open, publicly owned database showing location, numbers, type of swapping kiosks/chargers, queue lengths/availability, pricing etc. The state has nominated the transport department to be the nodal department for implementing the policy, and plans to establish a dedicated EV cell within the transport department for effective day-to-day implementation of the policy.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●	●	○	●●
Infrastructure value chain	○	●●	●●●	○
Network value chain	●	●●	●	○

○ No information found ● Limited information found ●● Relevant information found ●●● Detailed information found

Analysis of state EV policy Karnataka

Date of notification **25 September 2017**

Status **Final**

Area map



Objectives

- Maintain Karnataka's position as a preferred destination for attracting investments in manufacture of EVs.
- Attract investments of INR 31,000 Cr (INR 310 billion = \$4.4 billion) and create employment opportunities for 55,000 people on both supply and demand sides.
- Create a conducive environment for the transition from ICE vehicles to EVs.
- Provide opportunities for developing R&D in e-mobility.

Summary

Karnataka aspires to be the electric vehicle capital of India. The state sees the EV sector as an employment opportunity and wants to create a conducive environment for transitioning from ICE vehicles to EVs. Under the EV value chain and the infrastructure value chain the state is focusing on R&D, production, services and customer aspects. To encourage local manufacturing, the state is planning to provide a special package of incentives and concessions for ultra mega and super mega EV enterprises (EV, EV charging/swapping equipment manufacturer, lithium-ion battery manufacturers). The state is already providing incentives such as interest-free loans on the net SGST for EV manufacturing enterprises. The state will reimburse 100% of land conversion fees for converting land from agricultural to industrial use for setting up EV/component manufacturing units. To encourage EV manufacturers to provide in-plant training, the state will offer a stipend of up to 50% of the cost of training subject to a limit of INR 10,000 (\$140) per month per trainee. The state will constitute a

technical committee to define/certify EV components (including the battery) and EV manufacturing enterprises claiming incentives and concessions under the state EV policy. The state will also encourage the manufacturing units to set up effluent treatment plants (ETP) for which it will give capital subsidy. The policy also highlights the state's interest in battery storage and plans to create a secondary market for batteries. On the infrastructure value chain front, Karnataka plans to develop charging infrastructure as a commercially viable business venture that attracts private investment. In association with industry players and academia, the state will devise standards for battery manufacture, charging infrastructure and swapping mechanisms. The state will provide incentives and concessions to all charging infrastructure/service providers. There will be tax exemptions on electricity tariffs and the state will provide an investment subsidy for setting up the first 100 charging stations. Karnataka also plans to set up a venture capital fund to encourage e-mobility start-ups.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●●●	●●●	●●●	●●
Infrastructure value chain	●●●	●●●	●●●	●●●
Network value chain	●	○	○	○

○ No information found ● Limited information found ●● Relevant information found ●●● Detailed information found

Analysis of state EV policy Kerala

Date of notification **March 2019**

Status **Final**

Area map



Objectives

- A. Promote shared mobility and clean transportation to ensure environment sustainability.
- B. Reduce pollution by making the transport system more energy-efficient.
- C. Create an environment for manufacturing EV components.
- D. Build world-class training and skill centres for EV professionals with niche skills for the global EV industry.
- E. Target 2020: pilot fleet of 200,000 2Ws, 50,000 3Ws, 1,000 goods carriers, 3,000 buses and 100 ferry boats.
- F. Target 2022: 1 million EVs on road.

Summary

Kerala aspires to promote eco-friendly tourism. E-mobility is a step forward for the state in ensuring sustainable development. The policy has a strong focus on the production side in both the EV value chain and the infrastructure value chain. Localized manufacturing within the state will focus on complete vehicle, electric drivetrain, power electronics, energy systems and storage. EV manufacturing units will attract financial and regulatory benefits based on the state's industrial and IT policies; the state is also planning to create a special fund to support local manufacturing. There will be priority allotment of land and speedy execution of land allotment for local manufacturers. Kerala will provide viability gap funding for e-buses and government fleets. The state has allocated funds to encourage local R&D for the development of EVs and will support the establishment of a centre of

excellence for EVs that will focus on battery technology, drivetrain technologies, software development etc. Kerala also has incentives in place such as state tax breaks, road-tax exemptions, toll-charge exemption, free permits for fleet drivers and free parking. The government plans to create a database to help drivers locate the nearest charging/swapping stations. The state has selected a few potential areas such as tourist villages, technology hubs and major cities' central business districts (CBDs) to create e-mobility demonstration hubs. The state plans to build a robust infrastructure for EVs that includes adequate power availability, a network of charging points and a favourable power tariff. Among the state goals are the need to balance the power demand of utilities, bring operational efficiency and increase savings for transport utility and the transport sector in general.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●	●●●	○	●●●
Infrastructure value chain	●	●●	●	●
Network value chain	●	●	○	●

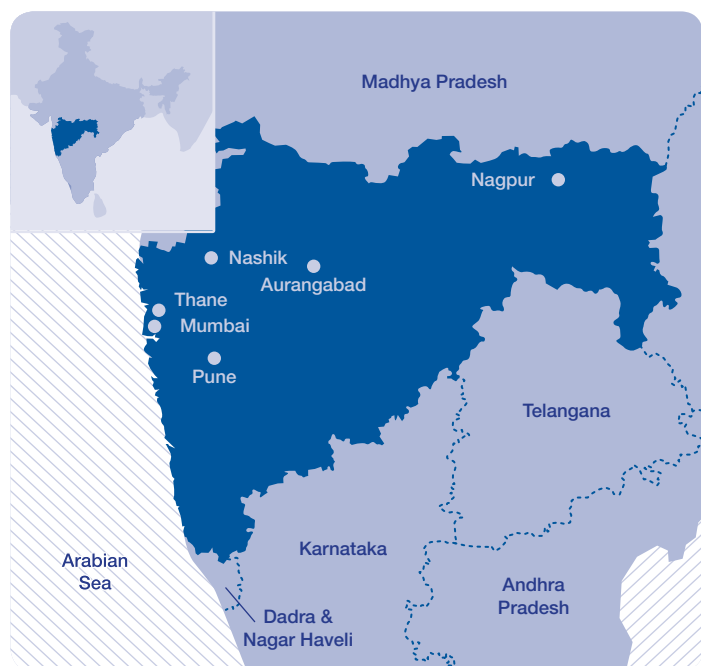
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Analysis of state EV policy Maharashtra

Date of notification **6 February 2018**

Status **Final**

Area map



Objectives

- A. Develop Maharashtra as a leader in EV manufacturing and use of EVs.
- B. Create new employment opportunities.
- C. Promote export of EV, components, battery and charging equipment.
- D. Encourage R&D, innovation and skill development in the EV sector.
- E. Establish a sustainable transport system.

Summary

Under the EV value chain, the state's provisions include the introduction of an EV-based curriculum in technical and skill development boards, and the setting up of R&D centres, centres of excellence, etc. On the production front, the state has identified a packaged scheme of incentives for micro, small and medium enterprises (MSMEs) and large manufacturing units. Organizationally, a high-power committee will be established to decide on the template of incentives for manufacturing units of different scales. The policy details a variety of incentives to promote demand, from incentives for the purchase of e-buses to demand incentives for electric 2Ws, 3Ws and 4Ws. The policy does not distinguish between private and commercial vehicles in the categories of 2Ws, 3Ws and 4Ws. EVs are also exempted from road tax and registration fees. On the charging infrastructure front, the policy lists benefits for customers. Legal provisions for charging points

in residential and commercial properties indicate that building/property rules would be modified to help establish a robust public charging infrastructure in the state. Fuel stations would also be enabled to set up charging points through necessary modifications of the governing regulations. The policy specifies 25% capital subsidy (with a few caps) for commercial public charging stations. The state, as an industry first, has mandated that planning authorities and electricity supply agencies should provide approvals for setting up of charging stations as a priority.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●	●●	○	●●
Infrastructure value chain	○	○	○	●●●
Network value chain	○	○	○	○

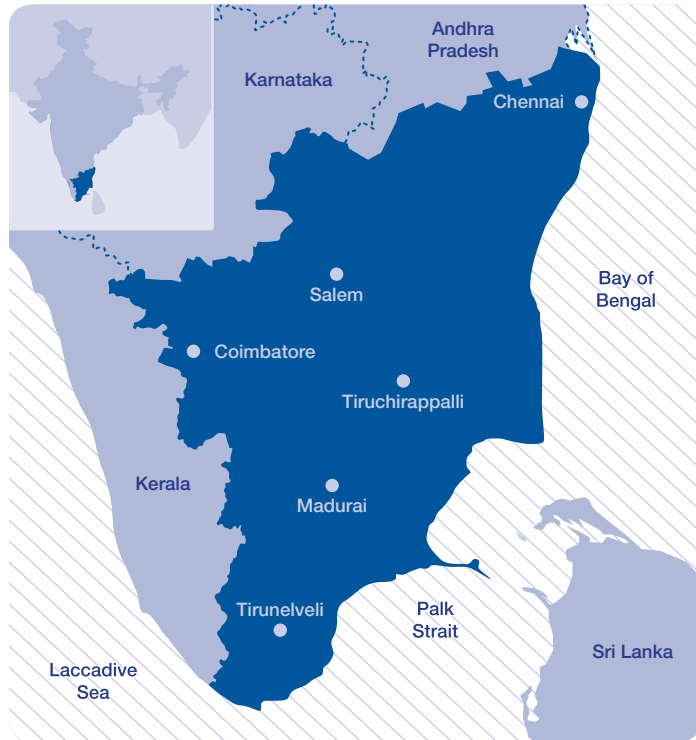
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Analysis of state EV policy Tamil Nadu

Date of notification **16 September 2019**

Status **Draft**

Area map



Objectives

- Make Tamil Nadu (TN) the preferred destination for EVs and component manufacturing units, including battery and charging infrastructure; Attract investment worth INR 50,000 Cr (INR 500 billion = \$7 billion).
- Create a conducive environment for industry and research institutions to focus on cutting-edge research in EV technologies and reap the benefit from the outcome.
- Create a robust infrastructure for electric vehicles, including adequate power supply and a network of charging points with a favourable power tariff.
- Promote innovation in EV and encourage electrification of shared mobility by providing an enabling environment and infrastructure to make Tamil Nadu the EV hub of India.
- Create a pool of skilled workers for the EV industry through the technical institutions available in the state and create new jobs (~1.5 lakh = 150,000) in the EV industry.
- Recycle and reuse used batteries and dispose of the rejected batteries in an environmentally friendly manner to prevent pollution.
- Target 2030: conversion to EVs of 5% of the buses year-on-year, and substantial conversion of shared mobility fleets, institutional vehicles, and e-commerce delivery and logistics vehicles.

Summary

Tamil Nadu is home to major automobile manufacturing companies and, exploiting this, has developed an “EV special manufacturing package” with incentives to strengthen the supply-side environment. To encourage start-ups in the EV sector, the state is establishing a venture capital and business incubation service. Three departments will play an essential role: the transport department, to issue guidelines for achieving the policy objectives; the industry department, to implement manufacturing-related incentives under EV policy; and the energy department, to ensure that public and private charging stations are provided with all necessary facilitations and incentives. Under the EV value chain, the state offers 100% reimbursement of state GST paid on the sale of EVs manufactured in the state, 15% capital subsidy on intermediate products used for manufacturing, 100%

electricity tax exemption for manufacturing industries, 100% stamp duty exemption for transactions related to EV manufacturing, 50% land subsidy if the investment is in the southern districts (15% for other regions), etc. Under the infrastructure value chain, TN will mandate all new constructions to be EV ready, encourage existing apartment associations to install charging stations and have 10% parking space for EVs in all commercial buildings. The state will partner with the public and private sectors to set up charging stations. TN has provisions for charging service providers to set up their own renewable energy generating stations at their own premises for EV charging. Under the network value chain, the state is planning to create a recycling environment by promoting reuse of EV batteries and focusing on urban mining of rare materials within the battery for reuse by battery manufacturers.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●●	●●●	○	●●●
Infrastructure value chain	●	●	●●	●●
Network value chain	●	●	●	○

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Analysis of state EV policy Telangana

Date of notification **22 May 2018**

Status **Draft**

Area map



Objectives

- Make Telangana the preferred destination for EV and component manufacturing.
- Attract investments worth INR 212.4 billion (\$3 billion) and create employment for 50,000 people by 2022 through EVs in shared mobility, charging infrastructure development and EV manufacturing activities.
- Provide best-in-class environment and infrastructure to make Telangana the EV hub of India.
- Develop a proving ground for viable business models through accelerated demand for EVs.
- Develop Telangana as a global centre for cutting-edge research and innovation in EVs and other emerging technologies such as autonomous/connected vehicles.

Summary

Telangana has a legacy of strong electric and electronics manufacturing, led by public-sector undertakings (PSUs) such as the Electronics Corporation of India Limited (ECIL) and Bharat Heavy Electricals Limited (BHEL). The EV policy aims to make Telangana the EV capital of India. The policy emphasizes the promotion of skills development and innovation in e-mobility. Telangana has implemented TS-iPASS, an industrial project approval system based on self-certification as a part of single-window clearance. The state plans to have a designated EV cluster (mega automotive park) spread over more than 600-800 hectares for EV/component manufacturing. The cluster will have facilities such as design, prototyping and testing for all units. It will also have a special “automotive electronics cluster” to manufacture batteries for EVs. The state will identify areas such as high traffic areas, heritage zones and information

technology special economic zones (IT SEZs) in which by 2025 only EVs will be allowed. Under the infrastructure value chain, Telangana will work with the central government on the development of common standards for batteries and charging infrastructure to ensure interoperability wherever possible. It will also encourage local manufacturing of charging equipment. Considering the high volatility and the risk associated with the maturing of EV technologies, the state in consultation with the Government of India is planning to put in place a mechanism for an exit strategy for EV enterprises. The state has prioritized the vehicle segment for EV transition: cabs, public transport and institutional transport as well as freight, logistics firms, delivery services, intra-city goods delivery etc. The policy also has a provision for retrofitment of existing ICE vehicles such as passenger cars, 2Ws and auto rickshaws.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●●	●●●	○	●●●
Infrastructure value chain	●	●	●●	●
Network value chain	○	●	○	○

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Analysis of state EV policy Uttarakhand

Date of notification **5 October 2018**

Status **Draft**

Area map



Objectives

- Promote the adoption of EVs to create a clean Uttarakhand.
- Establish Uttarakhand as a preferred destination for EV and EV component manufacturing.
- Create employment opportunities on demand and supply sides.
- Create a conducive environment to shift from ICE vehicles to EVs; encourage the use of hybrid EVs (HEVs) and plug-in EVs (PEVs) during the transition period.
- Train employees and augment power capacity to meet the needs of the industry promoting e-mobility in Uttarakhand.
- Target 2030: 100% electrification of public transport (e-buses), shared mobility including e-bike-taxis and goods transport using electric 2W, 3W and 4W and other mini goods-transport vehicles in five priority cities.

Summary

Uttarakhand's EV policy complements the state's mega industrial and investment policy, 2015. The policy highlights the state's overall intention to promote research and innovation and enable skills development in the EV domain. Some of the fiscal incentives on the EV production front include interest subsidy, electricity subsidy, electricity duty exemption, stamp duty exemption, Employee Provident Fund reimbursement, state GST subvention, and incentivizing the manufacture of lithium batteries with high mileage. Further, Uttarakhand will set up a single-window clearance system to simplify the process of approvals for manufacturing units, allow manufacturing units to have flexible employment conditions, supply 24/7 reliable-quality power, etc. Dedicated EV manufacturing zones and parks well equipped with common infrastructure, including waste disposal, sewage treatment, testing facilities etc., will be established. The state plans to offer fiscal incentives such as road-tax exemption, registration-fee exemption, SGST subvention to all buyers of EVs and zero-interest loans to state-government employees

to purchase EVs in the state. The infrastructure value chain aspect of the policy places emphasis on public charging infrastructure and augmenting the power supply to cater to the increased energy demands in the state, to fiscal incentives for setting up charging and swapping stations that include capital interest subsidy, electricity duty exemption, concessional land rates for PSUs that set up charging/ swapping stations, and special commercially viable electricity tariff with time-of-day tariff. As regards the network value chain of EVs, Uttarakhand has outlined its intention to promote clean fuels as an alternative to battery-operated EVs, especially in the transition period. The state envisages a subsidy-driven R&D in hydrogen-powered fuel cells and solar-powered cells. The state also aims to develop a battery disposal strategy and offer incentives to companies engaged in battery disposal. Lastly, the state has planned incentives for EV manufacturing and battery units to set up effluent treatment plants to minimize negative environmental impact from large-scale and unsustainable production practices.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●●●	●●●	●●●	●●●
Infrastructure value chain	○	●●●	●●●	●
Network value chain	●	●●●	○	○

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Analysis of state EV policy Uttar Pradesh

Date of notification **7 August 2019**

Status **Final**

Area map



Objectives

- Promote the adoption of EVs to create a green Uttar Pradesh (UP).
- Establish UP as a preferred destination for attracting investments in EV manufacturing.
- Create employment opportunities both on the supply and demand sides of EVs.
- Encourage the use of HEVs and plug-in EVs during the transition phase.
- Train employees and augment power capacity to meet the needs of the e-mobility industry.
- Develop a strong and sustainable environment for battery management, from the production to the disposal stage.
- Target 2024: 2 lakh (200,000) charging (fast, slow and swapping) stations.
- Target 2030: 10 lakh (1 million) EVs on the road in all categories and 70% of public transport to be electric.

Summary

Uttar Pradesh provides various incentives such as capital interest subsidy, infrastructure interest subsidy, industrial quality subsidy, exemption from stamp duty and electricity duty, SGST reimbursement etc. for EV manufacturing units – large, medium, small and micro alike. The state will also provide land subsidy, and a reimbursement of up to 25% of the cost of the land at the prevalent circle rate for EV and battery manufacturing. UP has a single-window system in place for all approvals required for EV and battery manufacturing units, directly monitored by the chief minister's office. UP aims to be a R&D hub for EVs by focusing on the next generation of battery management systems, drivetrain components, battery chemistry, fuel-cell and intelligent transportation systems. The state is also planning to encourage incubation centres and has a start-up fund in place. In addition, the government will tie up with universities and colleges to promote more research. UP is planning to set up EV testing centres,

with 24/7 power back-up and will be accessible to manufacturers and service providers. UP will link up with universities and engineering colleges to promote R&D in e-mobility space to develop low-cost technologies, smart design of vehicles, battery technologies and charging infrastructure. The government will encourage new apartments, high-rise buildings and technology parks to make provision for EV charging infrastructure. The state will facilitate acquisition of land by PSUs that plan to set up charging infrastructure at their premises. UP plans to develop a management environment for EV batteries from production to disposal. The state will encourage EV manufacturers to establish recycling service outlets and cooperate with battery manufacturing units and scrap merchants to build a regional recycling system. UP will also provide a subsidy of 50% on annual interest on loans taken in the form of reimbursement to set up waste treatment plants.

Policy focus area	R&D	Production	Services	Customers
EV value chain	●	●●	●●	●●
Infrastructure value chain	●	●	●●	●
Network value chain	●	●●	●	○

○ No information found ● Limited information found ●● Relevant information found ●●● Detailed information found

6. Summary of essential findings and recommendations

1 Andhra Pradesh

1,000,000 EVs by 2024

Celebrate “green days” to create awareness among public

100% electrification of buses by 2029 (first phase in four targeted cities to be completed by 2024)

2 Bihar

Electrification of rickshaws a priority

Convert all paddle rickshaws to e-rickshaws by 2022

3 Delhi

Pollution cess on existing diesel cars and sale of new petrol/diesel vehicles

Prioritize 2Ws, 3Ws, buses and cabs

50% e-bus in public transport by 2023

Scrappage and deregistration incentives for high-polluting vehicle categories

Common mobility card payment system for energy operators and battery-swapping operators

4 Karnataka

Policies focused on manufacturing and battery storage

Create a secondary market for batteries

Venture capital fund for e-mobility start-ups

Retrofitment for existing 3Ws

5 Kerala

1 million EVs on road by 2022

6,000 e-buses in public transport by 2025

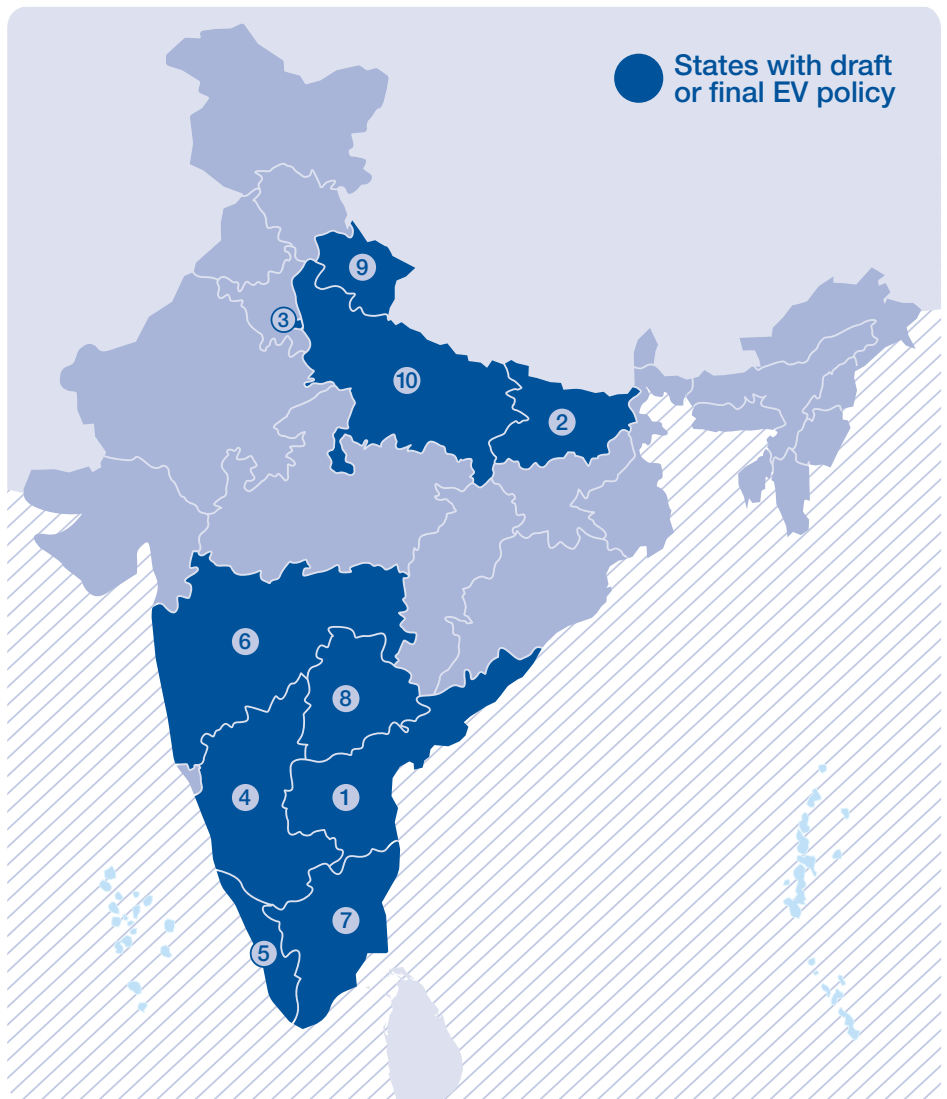
EV component manufacturing a priority

Viability gap funding for e-buses and government fleets

6 Maharashtra

Manufacturing hub for EV and EV components

Package schemes of incentives for MSMEs and large manufacturing units



7 Tamil Nadu

Manufacturing-focused: aims to attract INR 50,000 Cr (\$7 billion) of investment in EV manufacturing and create 1.5 lakh new jobs

50% capital subsidy on land if the investment is in southern districts (15% for other regions)

Priority vehicle categories: e-2Ws, e-3Ws, taxis, public transport (e-bus), e-commerce and logistics fleets and institutional vehicles

One-time reskilling allowance for every employee working with EV manufacturing units

Special number plate for EVs

8 Telangana

Priority vehicle categories: shared mobility, public transport, institutional transport vehicles

Retrofitment for passenger vehicles, auto rickshaws, e-rickshaws

9 Uttarakhand

Manufacturing-focused policy

500 e-buses by 2030

10 Uttar Pradesh

Focused on manufacturing of EV, EV components and batteries

Target 2024: 2 lakh charging (fast, slow and swapping) stations;

Target 2030: 10 lakh EVs on road across all categories and 70% of public transport to be electric

Start-up and innovation programmes

Recommendations

The recommendations below are based on lessons from leading geographies such as the US, China, Taiwan and Europe. These recommendations could further strengthen India's state EV policies by creating a more robust and holistic enabling environment for the faster adoption of e-mobility.

R&D (organization)

States could allocate funds for research in battery chemistry and cell technologies and for recycling centres to reclaim and recycle critical materials (such as cobalt and lithium). States could invest in R&D to encourage pilot programmes to measure the impact of EVs on the existing grid.

Production (legal)

States could implement a zero-emission vehicle (ZEV) mandate requiring original equipment manufacturers to register and sell a minimum share of EVs and gradually increase this over time.

Customers (legal)

New registrations of ICE vehicles non-compliant with Bharat Stage VI emission norms may be curtailed in a phased manner.

High-occupancy vehicle lane exemption – the capital city or large metropolises could have such lanes to promote EV adoption. This would also help in creating public awareness.

Customers (organization)

States could create a "low-carbon city promotion task force" to promote selected cities as "carbon-free, trouble-free" world-class cities by implementing EV policies.

States could mandate the creation of a dedicated EV cell by 2020 uniformly across the nation.

States could operationalize single-window clearance for faster approvals at the earliest opportunity and replicate the policy throughout the country.

Production (demand/consumer incentive – fiscal)

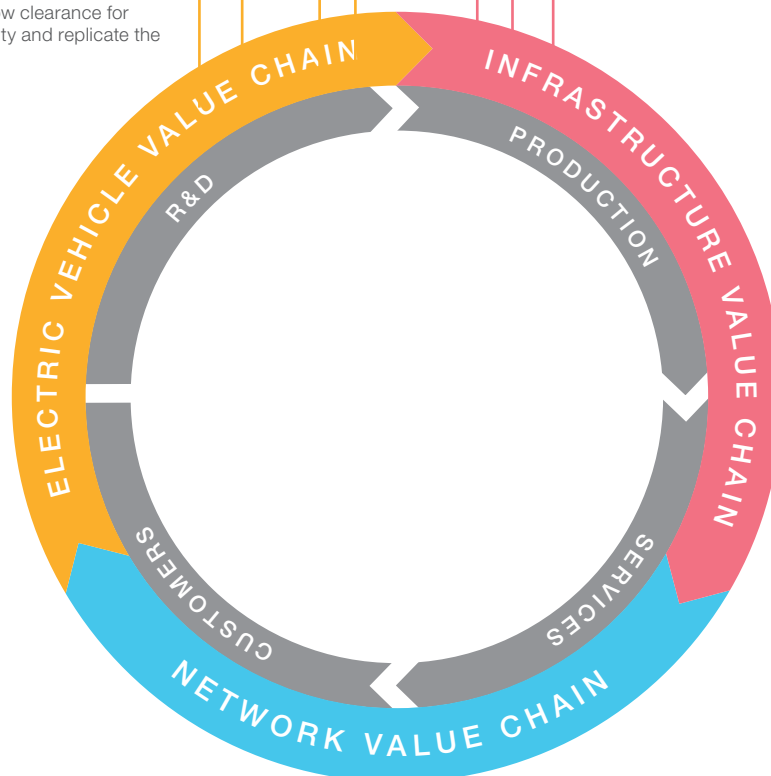
States could provide tax credits to deploy charging infrastructure. To ensure fast implementation they could make it applicable for the first 1,000 charging stations in the state. States could also have city-level targets to implement such incentives smoothly.

Production (demand/consumer incentive – fiscal)

States could implement a "time of use pricing programme" under which they subsidize the cost of purchasing power based on the time slot in which the consumer uses it.

Customers (legal)

The registration of new ICE vehicles - non-compliant with Bharat Stage (BS) VI emission norms - may be curtailed in a phased manner.



7. Conclusion: A collective path towards EV-ready India

This report highlights the immense possibilities for EV value chain growth in India. A collective path towards operationalizing EVs across India is yet to be found. The next stage of policy development should move beyond a “pile-up” of policy incentives along the value chain to a measured “mix of policies” that evaluates the conditions that enable competing and coexisting business models. This would provide practical recommendations for industry actors and insights for policy-makers.³⁰ Further research could focus on evaluating the impact of policy measures across the globe and offer recommendations for India. There are specific challenges in operationalizing electric mobility in India that require further investigation. One is identifying the next steps forward for a large-scale

deployment of public charging infrastructure after the first stage is financed by government. While global case studies describe the challenges and opportunities in early markets and indicate possible financial models,³¹ such a scientific exploration is critical to India with the goal of introducing a sunset clause in EV promotion policies.

Global megatrends such as technological breakthroughs, climate change and resource scarcity, demographic changes and accelerating urbanization³² are having a major effect in India, which is at a critical juncture in showcasing leadership in electric mobility. While the Indian EV ecosystem takes measured steps on this path towards sustainability, how will India as a whole transition?



Further reading

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About OMI

Ola Mobility Institute (OMI) is the policy and social innovation think-tank of Ola, focused on developing knowledge frameworks at the intersection of mobility and public good. The Institute concerns itself with public research on the social and economic impact of mobility as a service, the climate footprint of mobility innovations, future of work, skill development and job creation, transportation-oriented urban planning, and the digitization of mobility, among others. All research conducted at OMI is funded by ANI Technologies (the parent company of brand Ola).

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