

Barriers and policy opportunities for public charging infrastructure in Haryana

Palak Thakur, Aravind Harikumar, and Amit Bhatt

BACKGROUND

India has committed to achieving net-zero greenhouse gas (GHG) emissions economywide by 2070 and to reducing the carbon intensity of its GDP 45% by 2030 compared with 2005 levels.¹ In 2020, transport was the source of 14% of total scope 1 energy-related emissions, and 90% of the transport emissions were from road transport.² The state of Haryana contributed 2.56% of India's overall GHG emissions in 2018, and the transportation sector alone contributed 55% of the GHG emissions in the state.³

To decarbonize the transport sector, India has implemented various policies to promote electric vehicles (EVs) at the national and subnational levels. The Haryana Electric Vehicle Policy, notified by the Government of Haryana on July 8, 2022, provides incentives to accelerate EV sales, support the manufacturing of EV components in the state, and develop a robust public charging network to make the use of these vehicles affordable and convenient.⁴

- 1 Government of India, "Cabinet Approves India's Updated Nationally Determined Contribution to be Communicated to the United Nations Framework Convention on Climate Change," press release, August 3, 2022, <https://pib.gov.in/PressReleasePage.aspx?PRID=1847812>.
- 2 Scope 1 emissions are direct GHG emissions that occur from sources that are owned or controlled by the company. "Explaining Scope 1, 2 & 3," India GHG Program, accessed August 6, 2024, <https://indiaghg.org/explaining-scope-1-2-3>; Megha Kumar, Zhenying Shao, Caleb Braun, and Anup Bandivadekar, *Decarbonizing India's Road Transport: A Meta-Analysis of Road Transport Emissions Models* (International Council on Clean Transportation, 2022), <https://theicct.org/publication/decarbonizing-india-road-transport-may22/>.
- 3 Government of India, *Trend Analysis of GHG Emissions in Haryana* (GHG Platform India, 2022), https://www.ghgplatform-india.org/wp-content/uploads/2022/09/GHGPI_Trend-Analysis_2005-to-2018_Haryana_Sep22.pdf.
- 4 Government of Haryana, "Haryana Electric Vehicle Policy," July 2022, <https://investharyana.in/content/pdfs/EV%20Policy%202022.pdf>.

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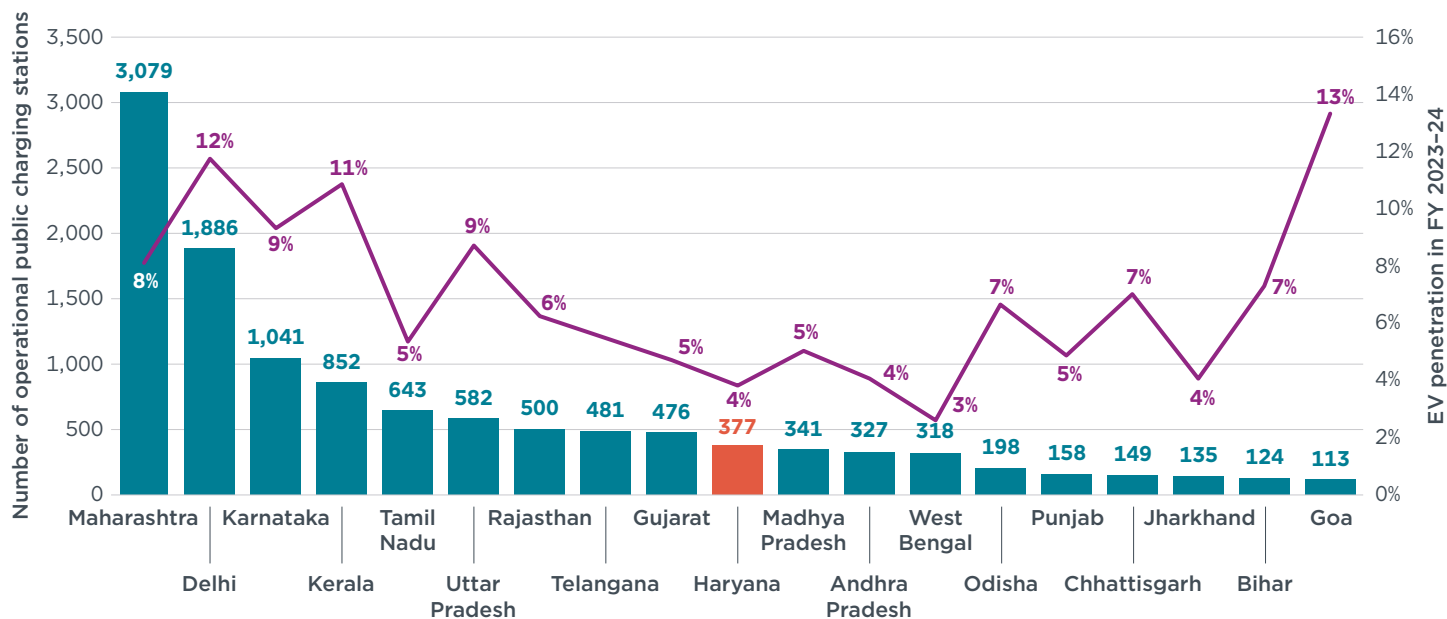
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As shown in Figure 1, Haryana has 377 public charging stations (PCS), or 2.3% of the total in India. These serve the approximately 70,000 EVs registered in the state.⁵ Of the 148 public charging stations incentivized nationwide under the national Faster Adoption and Manufacturing of Electric Vehicles (FAME) II scheme, two were in Haryana.⁶ Haryana recently ranked 10th among states in India in terms of number of PCS, and in FY 2023-24, it was 23rd in terms of EV penetration in new vehicle sales.⁷ There are several states with fewer operational PCS than Haryana but with higher EV penetration.⁸

Figure 1

Number of public charging stations and electric vehicle penetration in new sales in Indian states in FY 2023-24



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Understanding the impediments faced by the various stakeholders and the policy opportunities that can be leveraged by the state could help further accelerate the development of the public charging network in Haryana. Based on interviews with industry stakeholders and an examination of existing policies, government-issued notifications, and tender documents concerning public charging, this brief aims to identify some key barriers in Haryana. We then suggest opportunities for policies that could address these barriers, based on a review of related policies and interviews with senior officials in the Government of Haryana, including those in the transport and industries departments, engineers, and various others.

5 Government of India, Ministry of Power, Bureau of Energy Efficiency, “Public Charging Stations,” accessed July 28, 2024, <https://evyatra.beeindia.gov.in/public-charging-stations/>; Government of India, Ministry of Road Transport & Highways “Electric Vehicles,” press release, August 10, 2023, <https://pib.gov.in/PressReleasePage.aspx?PRID=1947389>. Electric vehicles includes all two-, three-, and four-wheelers.

6 Government of India, Ministry of Heavy Industries “12,146 Public EV Charging Stations Operational Across the Country,” press release, February 6, 2024, <https://pib.gov.in/PressReleasePage.aspx?PRID=2003003>.

7 Ministry of Heavy Industries “12,146 Public EV Charging Stations”; Government of India, “Vahan Dashboard,” accessed July 28, 2024, <https://vahan.parivahan.gov.in/vahan4dashboard/vahan/vahan/view/reportview.xhtml>.

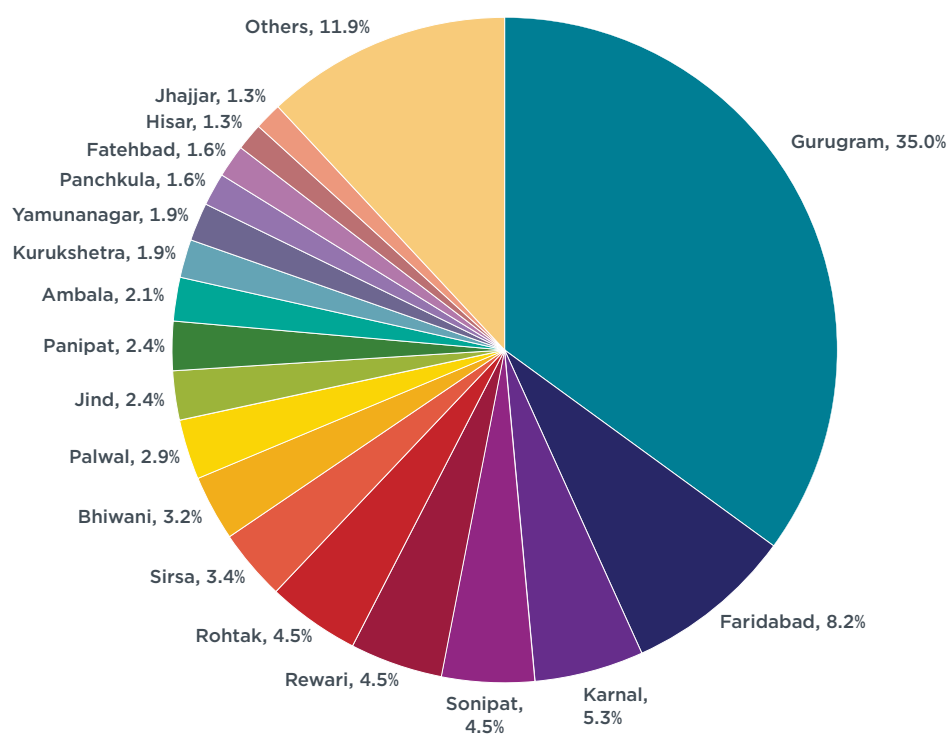
8 Nibedita Dash and Sunitha Anup, *India’s Public EV Charging Infrastructure Readiness: A Case Study of Haryana State* (International Council on Clean Transportation, 2024), <https://theicct.org/publication/indias-public-ev-charging-infrastructure-readiness-jan24/>.

STATUS OF PUBLIC CHARGING INFRASTRUCTURE IN HARYANA

To encourage the buildout of public charging, Haryana's EV policy offers a one-time subsidy of up to 20% of the fixed capital investment for privately owned public charging infrastructure operators.⁹ According to data shared by the Government of Haryana, as of February 2024, there were 377 PCS with 2,314 charge points in the state, and they were managed by 18 charge point operators (CPOs). The four model cities in Haryana (these cities are to act as examples for other cities in the state) have about 50% of the total PCS in the state; 35% are in Gurugram, 8% in Faridabad, and about 7% in Karnal and Panchkula combined (Figure 2).

Figure 2

Spatial distribution of public charging stations in Haryana in February 2024



Source: Government of Haryana data

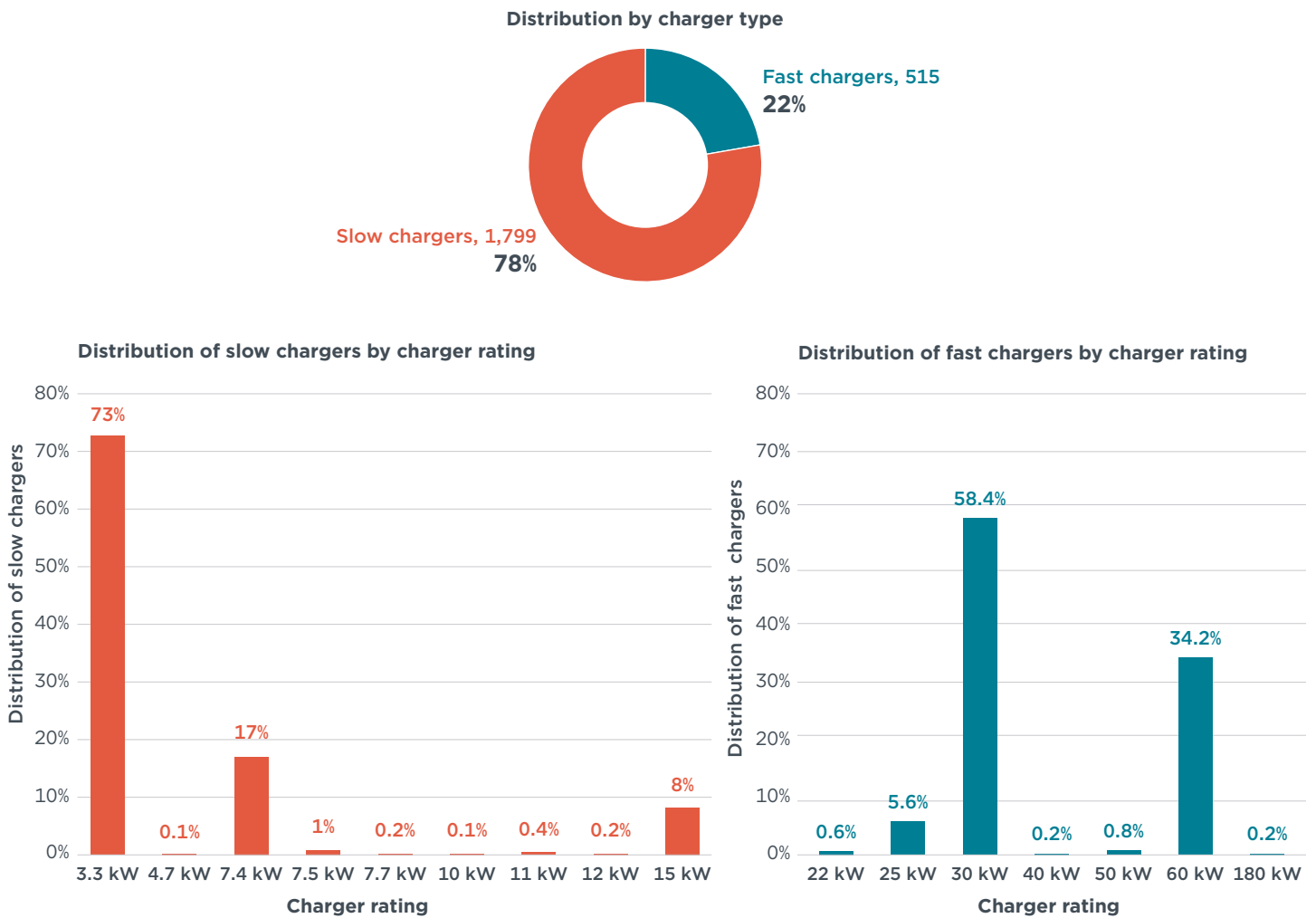
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Of the 377 PCS, 78% are slow chargers, defined as those with power ratings ranging from 3.3 kW to 15 kW, and 22% are fast chargers, which have power ratings between 22 kW and 180 kW (Figure 3). The majority of slow chargers in Haryana have a power rating of 3.3 kW; 7.4 kW Type II chargers are the second most common (17%), and 15 kW Bharat DC-001 chargers are third at 8% (bottom left panel of Figure 3). Most fast chargers have a power rating of 30 kW (58%), followed by 60 kW CCS-II chargers (34%), and 25 kW CCS-II and Chademo chargers at 6% (bottom right panel of Figure 3).

⁹ Haryana, "Electric Vehicle Policy."

Figure 3

Distribution of public charging stations in Haryana by charger type and connector rating



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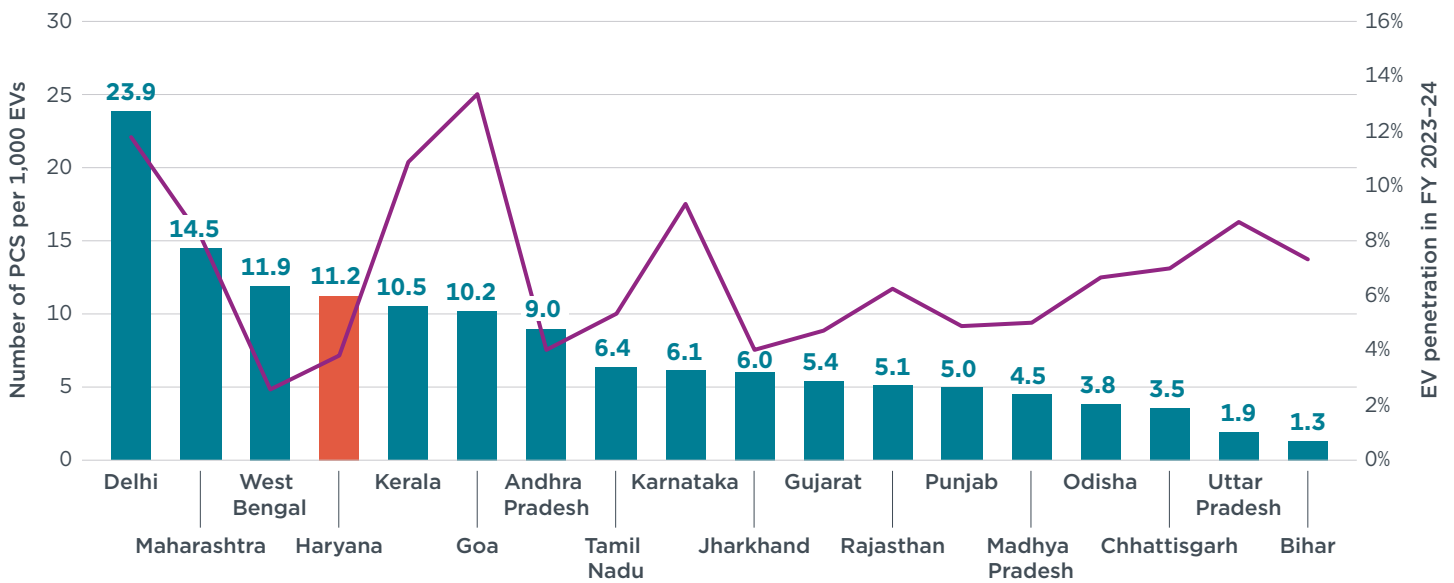
According to data obtained from the Vaahan EV Dashboard, 54% of new vehicles registered in Haryana between 2021 and 2023 were two-wheelers, but only 2% of those were electric models.¹⁰ In the same period, 27% of new vehicles registered in Haryana were four-wheelers or passenger cars, and only about 0.4% of those were EVs. Electrification rates were highest in the three-wheeler segment, with 3% of new passenger three-wheelers and 12% of new goods three-wheelers being EVs.

Haryana has the 4th highest PCS density in India in terms of PCS per 1,000 new EVs registered as of July 2024 (Figure 4). However, as mentioned above, EV penetration in new sales stands at only 4%.

¹⁰ Government of India, "Vaahan Dashboard."

Figure 4

Comparison of public charging stations per 1,000 EVs and EV penetration in FY 2023-24 across Indian states



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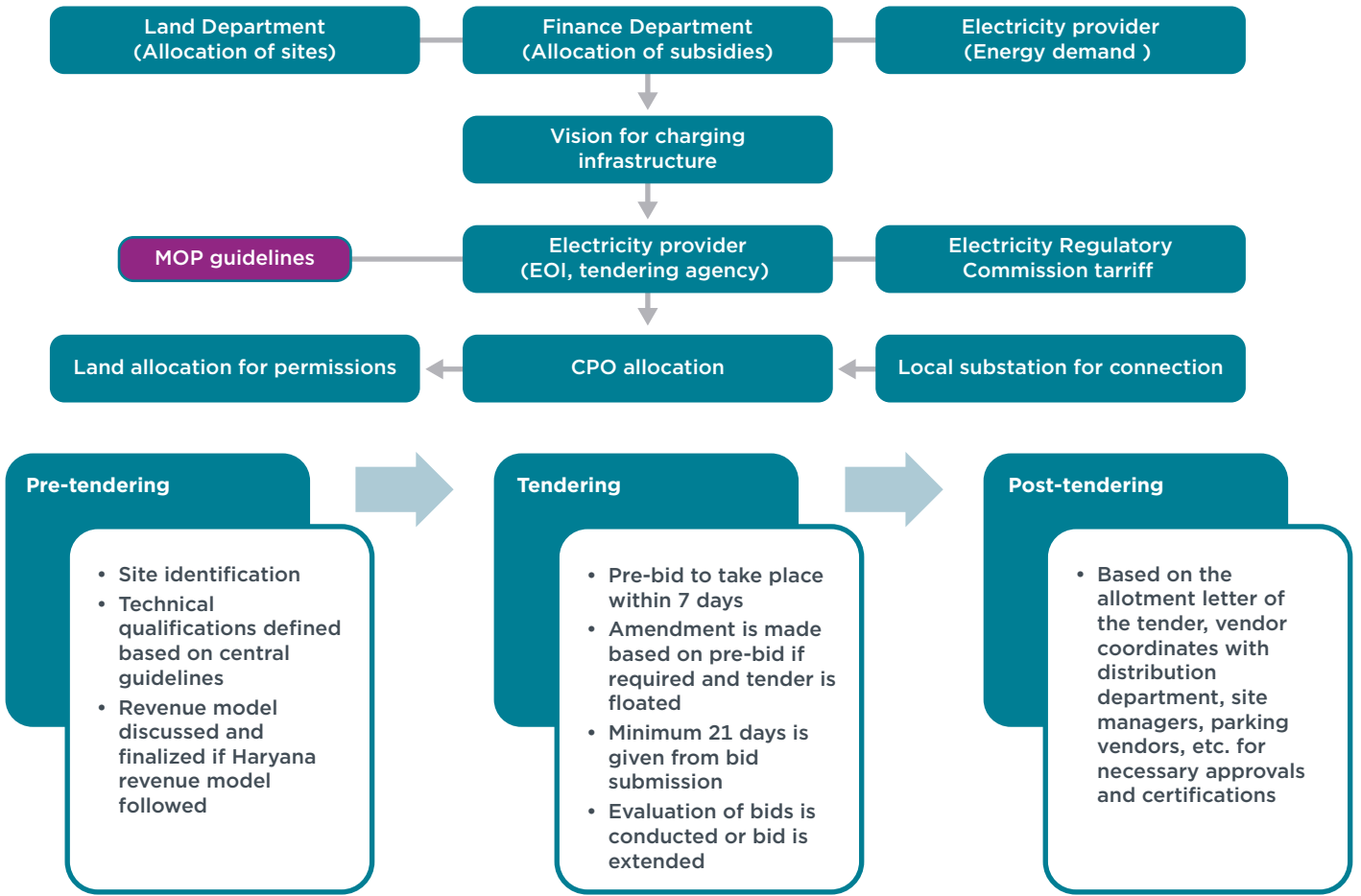
BARRIERS TO IMPLEMENTING CHARGING INFRASTRUCTURE

Based on interviews with individuals in the charging industry, including CPOs, manufacturers, policymakers, and founders, and a review of additional government-issued notifications and tender documents, we identified three broad categories of barriers to the installation of charging: (1) institutional barriers related to coordination among various departments and the time that elapses between application and implementation; (2) technological barriers including outdated infrastructure and lack of capacity to integrate technological advancements; and (3) financial barriers related to the cost of the capital, operations, and infrastructure for the charging station.

INSTITUTIONAL BARRIERS

The institutional barriers for the installation of chargers in Haryana can be further classified based on the stages in the process: tendering, implementation, and post-implementation. These stages and the stakeholders involved are shown in Figure 5.

Figure 5
Charging infrastructure installation process and stakeholders



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At the tendering stage, Haryana Power Generation Corporation Limited, a state government agency, floats tenders for the installation of EV charging stations at specific locations; the tenders include information on the technical specifications of the chargers requested and the revenue-sharing arrangement with the respective landowner. The CPO responding to the tender is responsible for coordinating with the landowning agency, the tendering agency, the electricity provider, and various other government stakeholders. We learned that the various agencies' requirements sometimes cannot be completed in tandem, and CPOs can have difficulty coordinating.

At the implementation stage, delays can occur while the CPO is obtaining the required traffic permissions and approvals. Coordination with the municipalities, parking agencies, metro or depot authorities, and resident welfare associations for permissions, connections, approvals, and certifications can cause delays in the installation of the charger.

At the post-implementation stage, there are questions of long-term operational assurance for CPOs. In the case of fast chargers, there are no protocols for load assessment and if demand increases, chargers may have to be relocated. Furthermore, lack of compliance by parking operators can mean that dedicated EV parking spots with charging points are somewhat frequently occupied by internal combustion engine vehicles. Additionally, if parking operators are not adequately trained on safety provisions, it can lead to increased risk of damage or fire at charging points.

Data on charger utilization and energy use is important for planning an effective charging network. Such data is imperative for decisions about where to site chargers and for identifying where electricity grid issues may arise that would require upgrades or additional substations. This data is not currently gathered and published at the state level, and data available from the Bureau of Energy Efficiency only includes the aggregate energy consumption of charging infrastructure operated by state electricity providers.

TECHNOLOGICAL BARRIERS

In Haryana, the currently installed chargers are wired as normal or fast chargers. Ensuring a steady supply of power to the PCS is one of the major constraints, particularly in the case of fast chargers. With the increase in charging speeds, the increase in energy demand may require steady power supply and high-quality transformers that are not widely available in the state. There are currently no incentives or provisions from the electricity or renewable energy department to encourage smart charging to better manage energy consumption, and both could aid in load management and the ability to adjust electricity tariffs in real time on a demand basis.

Future network solutions such as conductive or wireless charging are not currently considered by the electricity provider in Haryana and are not integrated with future charging network and grid planning. Solar charging and captive renewable energy regeneration technology are also not planned and are not being explored for integration with the charging network.

Finally, there is no standard dashboard or app for consumers that supplies real-time charger information such as cost, location, operational efficiency, and charger speed. While the charging technologies do collect large amounts of data related to charging pattern and utilization, this data is not currently shared with the government or made publicly available.

FINANCIAL BARRIERS

The upfront costs required for equipment, installation, and land purchase or lease are barriers for mass deployment of charging infrastructure, for both the state and CPOs. The operational costs are also high and relocating chargers in cases where the electricity requirement overloads the grid, or when there is theft or vandalism, will result in additional costs. Grid augmentation or cabling costs may also be incurred by the CPO, depending on the load requirements, and in some cases, it may be necessary to install a high-capacity transformer.

Charger utilization can be low in the early period after implementation, and in such cases profits are low while the operational costs, such as electricity charges, maintenance, and connectivity, are fixed. There is also variation in land lease rates, which leads to variations in profit for the CPOs and variable rates for consumers—these can vary by 10%–15% or more.

The equitable distribution of charging infrastructure to areas that currently have low rates of EV ownership will likely require additional investment from the state.

MEASURES TO ADDRESS BARRIERS

Many barriers to widespread deployment of charging infrastructure are interrelated and could be addressed through better integration, evidence-based decision-making, and holistic planning. Institutional barriers could be addressed by adopting a coordinated approach and establishing procedures for fast implementation through a dedicated

interdepartmental group, or EV cell, to coordinate between government departments. Technological barriers could be addressed with capacity building and infrastructure upgrades. Fiscal barriers could be resolved through innovative business models, safety procedures, and targeted allocation of funding. These solutions, including the responsible stakeholders, are detailed below.

EV cell for improved coordination and planning. To ensure coordination between various stakeholders and departments, an EV cell could act as specialized unit for implementing EV policy. The EV cell would ideally have representatives from all key departments such as industries, finance, renewable energy, electricity distribution companies, transport, and local urban bodies. The EV cell could be led by a nodal department, which could be the transport department in the case of Haryana. The core function can be defined based on the areas defined in EV policy, such as demand creation, supply management, subsidy and initiatives disbursement, and awareness campaigns. The EV cell can also develop action plans for charging stations.

State-level EV dashboard for monitoring and evaluation. For streamlining processes, assessing resources related to the EV ecosystem and providing real-time data related to charging infrastructure via a digital interface could be developed. This EV dashboard could act as a one-stop solution for monitoring data such as charging station location, usage, and operations. It could also be used for submitting applications, showing project status, and accessing tender documents. Profiles of fleet operators, charging infrastructure operators, and various stakeholders of the charging ecosystem could also be collected through the dashboard. This EV dashboard could also feed information to the Bureau of Energy Efficiency or a national dashboard.

Financial resources and allocating funding. The FAME scheme and Haryana's EV policy provide subsidies for charging infrastructure. There are also potential funds at the city level from initiatives like the National Clean Air Programme and at the state level from the state infrastructure development fund, and these could be utilized for developing public charging infrastructure.¹¹ Another option could be the establishment of a dedicated fund, as has been done in states with high EV penetration, including Delhi.¹² The fund's purpose could be linked to the state EV policy's objectives. Other sources such as the corporate social responsibility fund set up to finance high-tension energy connections, development grants by foreign development agencies (including philanthropies and development banks), long-term infrastructure development loans, and public-private partnerships could also be explored by the EV cell.¹³ Taxing internal combustion engine vehicles, like the fuel cess in Delhi, is another alternative for raising funds.¹⁴ Reviewing and monitoring processes could also be established for fund sustainability and efficient fund management.

Regulations related to charging infrastructure. In 2019, the Ministry of Housing and Urban Affairs issued Amendments in Model Building Bye-laws (MBBL - 2016) for Electric Vehicle Charging Infrastructure.¹⁵ These guidelines will be adapted by the

11 Central Pollution Control Board, "List of 131 Non-Attainment cities," https://cpcb.nic.in/uploads/Non-Attainment_Cities.pdf; Government of Haryana "Haryana Municipal Amendment Act," April 2002, <https://ulbharyana.gov.in/Website/DirectorateofUrbanLocalBodies/Images/036bad7e-4c29-4ec1-ad7b-3d497f0a0f5c.pdf>.

12 Climate Trends, *Analysis of State EV Policies and Their Impact (2023)*, <https://climatetrends.in/wp-content/uploads/2023/02/full-report-digital-with-spreads.pdf>.

13 "HERC Notifies New Rules for EV Charging Stations," *Hindustan Times*, July 27, 2024, <https://www.hindustantimes.com/cities/chandigarh-news/herc-notifies-new-rules-for-ev-charging-stations-101722088996053.html>.

14 Aravind Harikumar, Himani Jain, and Abhinav Soman, *India's EV Transition Managing Fuel Tax Revenue Loss* (Council on Energy, Environment and Water, 2022), <https://www.ceew.in/sites/default/files/ceew-research-on-recovering-fuel-tax-revenue-loss-from-ev-transition-in-india.pdf>.

15 Town and Country Planning Organization, Ministry of Housing and Urban Affairs, "Amendments in Model Building Bye-Laws (MBBL-2016) for Electric Vehicle Charging Infrastructure," February 2019, [https://mohua.gov.in/upload/whatsnew/5c6e472b20d0aGuidelines%20\(EVCI\).pdf](https://mohua.gov.in/upload/whatsnew/5c6e472b20d0aGuidelines%20(EVCI).pdf).

states and disseminated to electricity providers, resident welfare associations, municipal commissioners, and public transit stations for implementation. Regulations related to residential, commercial, and public charging could also be developed and disseminated to the stakeholders. In addition, regulations requiring that parking managers monitor compliance with EV-only parking could be established.

Technological capacity, incentive utilization, and safety regulations. For the buildout of an effective charging network, it is a prerequisite to develop the necessary proficiency, understanding, and resources to aid in the safe, efficient, and effective operation of charging points. Technical training can build a workforce that can operate, maintain, and install charging infrastructure, and support for this is provided in Haryana's EV policy. Technological awareness workshops could be conducted with the relevant government departments so that the integration of renewables into the electricity grid, smart charging, and other advancements can be part of long-term planning. Consumer awareness campaigns could also be established with the aim of increasing the utilization of incentives for charging infrastructure. To explore options to reduce investment risk, workshops could be conducted with industry to deliberate on innovative business models and foster partnerships. Finally, safety protocols for charger operation and maintenance could be established, and training can be offered for parking managers and roadside assistance.

Table 1 maps the barriers identified above against the possible measures to address them, and highlights some of the stakeholders involved.

Table 1

Barriers to public charging with the suggested measures and stakeholders

Classification	Barrier	Measure	Stakeholder	Solution
Institutional	CPOs sometimes have difficulty coordinating with multiple government stakeholders	Create a dedicated EV cell with defined functions, administrative roles, and responsibilities to coordinate with stakeholders.	Led by the Transport Department with representatives from other related departments	EV cell
	Limited marketability of the procurement model	Explore different implementation models and standardize revenue-sharing agreements in line with Ministry of Power guidelines.	Electricity companies and land-owning agencies	EV cell
	Approval and process delays when implementing charging infrastructure and disbursing incentives	To help streamline and coordinate timelines, operational guidelines can be established for the faster approval of applications for implementing charging infrastructure. Also, a 5-year roadmap for charging infrastructure is currently being developed by Haryana. This plan will provide a clear mandate and direction for the work done by the proposed EV cell. An online EV portal can also be established for disbursing incentives related to EVs and charging infrastructure.	Nodal department/EV cell to formulate EV cell with other department representatives	EV cell and EV portal
	Lack of long-term assurance of CPO operations	Establish processes for electricity load assessment and include an assurance clause in the tender for minimum of 10 years, as is standard practice.	Electricity providers	Regulations
	Lack of awareness by the parking operator of the need to ensure EV-only parking for spaces with electric chargers	Regular checks can be performed to ensure compliance with EV-only parking spots to increase charger utilization. Establish safety protocols for parking operators.	Municipal corporations and urban local bodies with the parking vendors	Regulations
	Lack of safety provisions			Capacity building
Technological	Power quality concerns	Develop infrastructure plans that include projected EV penetration. The EV cell could be included in the planning process.	Electricity provider	EV cell
	Limited planning to integrate future technology solutions		Electricity provider and IT department	Capacity building
	Limited planning for integrating renewables with EV charging	Increase knowledge capacity in departments about different charging technologies, smart charging, and integration with renewables, and integrate solutions into development plans.	Electricity provider and Haryana Renewable Energy Development Agency	Capacity building
	No policy push for smart charging		Electricity provider and IT department	Capacity building
	Lack of information and data security	Develop an EV dashboard to provide real-time information on operational PCS and their utilization levels, and develop data security protocols.	Electricity provider and IT department	EV portal
Financial	High investment cost	Increase awareness of fiscal and non-fiscal incentives for PCS. Explore innovative business models for charging infrastructure to reduce risk for CPOs.	Electricity provider and EV cell nodal department, along with inputs from others	Capacity building
	High operational cost	Increase charger utilization, which could be done by making information on locations more accessible.	Nodal department /EV cell could integrate this information into the EV dashboard	EV portal
	Grid upgradation cost	Estimate grid upgrade cost and explore alternative financing solutions.	Electricity provider and EV cell	EV cell
	Public investment	Allocate funds for supporting development in low-density areas. Explore options for financing public investment in PCS through innovative private and public sources, such as through an infrastructure development or the corporate social responsibility fund from the electricity department.	Nodal department / EV cell with finance department and infrastructure development corporation could determine fund utilization	EV funding
	Risks of vandalism	Guidelines could be established to ensure the security of the charger. Mandatory insurance clauses could be added in the tender document.	Nodal department/ EV cell in consultation with respective local government, Industries department	Capacity building
	Variable pricing due to variable costs	EV cell can coordinate with land-owning public bodies like Town and Country Planning, Directorate of Urban Local Bodies, Haryana State Infrastructure Development Corporation, or the Municipal Development Authority to create a land pool for charging infrastructure, mitigating the variability of land cost	Nodal department/ EV cell with research groups, electricity providers, and EV user groups	EV cell

CONCLUSION

Based on our interviews with CPOs, government officials, and various other stakeholders in Haryana and a review of current policies, this brief highlighted how barriers to establishing a public charging network to implement the 2022 Haryana EV policy can be categorized as institutional, technological, or financial. When these barriers are mapped with policy measures, we see a way toward the widespread implementation of public charging infrastructure in the state.

Haryana is keen to expand its charging network to support the transition to EVs, and there are additional issues that could be discussed as way forward. These include the effectiveness of incentives for charging infrastructure and how they can be accelerated, the status of private charging infrastructure implementation and its associated processes, plans and timelines for highway and public charging in model cities, and possible alternative business models for public charging infrastructure.



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