NITI Aayog

Handbook for EV Charging Infrastructure in India

Relevant for EV

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Introduction

Amid Centre's EV push, NITI Aayog has released a handbook to guide state governments and local bodies to frame policies and norms towards setting up charging networks for electric vehicles (EV).

The objective is to enhance charging infrastructure and facilitate a rapid transition to electric mobility in the country.

The Handbook for Electric Vehicle Charging Infrastructure Implementation - Version 1 has been jointly developed by NITI Aayog, Ministry of Power, Department of Science and Technology, Bureau of Energy Efficiency, and World Resources Institute India.

Context

It provides a systematic and a holistic approach for adoptions by implementing authorities and other stakeholders involved in planning, authorisation and execution of EV charging infrastructure.

It also presents an overview of the technological and regulatory frameworks and governance structures needed to facilitate EV charging.

It focuses on the present needs of charging infrastructure development while considering the evolving nature of the sector.

The transition to electric mobility is a global strategy in the fight against climate change, on which India has expressed ambitious aspirations.

The handbook addresses the common challenges being faced by different local authorities in implementing EV charging networks. It serves as a starting point for the peer-to-peer exchange of best practices between states and local bodies according to Dr Rajiv Kumar, Vice Chairman, NITI Aayog.

The handbook highlights the critical role of planning authorities in integrating EV charging infrastructure into their transport and urban planning frameworks.

Salient Features

Characteristics of EV Supply Equipment

Battery Specifications of Different EV Segments

- In India, transport electrification over the next decade is expected to be driven by light electric vehicles (LEVs), comprising two-wheelers (scooters, motorcycles) and three-wheelers (passenger and cargo).
- Apart from these, cars and light commercial vehicles (LCVs) are the other key vehicle segments being electrified. Electric buses will also be present in significant numbers.

- EV charging requirements depend on the specifications of EV batteries, as power must be supplied to the battery at the right voltage and current levels to permit charging. Typical capacity and voltage of EV batteries vary among the different EV segments.

- E-2Ws and e-3Ws are powered by low-voltage batteries. The first generation of e-cars is also powered by low- voltage batteries. However, these are likely to be phased out in the future, even if they continue in specific use cases such as taxis. The second generation of e-cars, as seen in the upcoming e-car models, is powered by high-voltage batteries. Electric LCVs will comprise of both low-voltage and high-voltage vehicles, depending on their load-carrying capacity. Further, the law provides that any amount paid in these cases would be refunded without any interest thereon.

Charging Methods and Power Ratings

- EV charging involves supply of direct current (DC) to the battery pack. As electricity distribution systems supply alternate current (AC) power, a converter is required to provide DC power to the battery.
- Conductive charging can be AC or DC. In the case of an AC EVSE, the AC power is delivered to the onboard charger of the EV, which converts it to DC. A DC EVSE converts the power externally and supplies DC power directly to the battery, bypassing the onboard charger.
- AC and DC charging are further classified into four charging modes, with Modes 1-3 pertaining to AC charging and Mode 4 pertaining to DC charging.
- Modes 1 and 2 are applicable for connecting an EV to a standard socket outlet, utilizing a cable and plug. Mode 1, also known as dumb charging, permits no communication between the EV and EVSE and its use is not recommended. The portable cable used in Mode 2 has an inbuilt protection and control capability and is typically used for home charging. Modes 3 and 4, which provide a separate charger device to supply power to the EV, have improved control systems and are used for commercial or public charging.

Battery Swapping

An alternative battery recharging method that is receiving global attention is battery swapping, in which a depleted EV battery is removed from the vehicle and replaced with a fully charged one. The technology is being tried out for various EV segments, including e-2Ws, e-3Ws, e-cars and even e-buses.

EV Charging Standards for Interoperability

- Standards ensure interoperability and compatibility of any EVSE with all EVs. The Bureau of Indian Standards (BIS), the national standards body of India, is responsible for formulating EV charging standards for the country.

- BIS is a member of the International Electrotechnical Commission (IEC), which is the global body that is developing reference standards to ensure interoperability and minimize trade barriers for electric vehicles and their components. While Indian standards for EV charging are compliant with global standards, local climate considerations and the difference in vehicle types available in the country necessitate modifications that are specifically applicable to India.

From Charging Stations to Charging Points

Charging stations refer to high-power EVSE, typically Mode 3 or Mode 4 charging, often with multiple charging guns. Charging points refer to normal power EVSE that can be accessed by a portable charging cable. While the initial deployment of public charging infrastructure in India focused on charging stations, it is increasingly evident that most public charging needs can be served by a densely distributed network of charging points.

Multi-Stakeholder Governance of EV Charging

The EV charging ecosystem comprises of multiple components and processes – the provision of land and supply of electricity for EV charging, specification and installation of EV charging equipment, day-to- day operations and maintenance of EV charging facilities, and services allowing EV owners to use charging facilities. Public and private stakeholders are responsible for the governance of EV charging, and there is the need for coordination between stakeholder groups for comprehensive planning and implementation of charging networks.

Classification of EV Charging Infrastructure

Broadly speaking, the governance of EV charging infrastructure depends on its ownership and use. Broadly, EV charging infrastructure can be classified as public, semi-public and private.

Roles and Responsibilities of Government Stakeholders

Many government bodies at the center, state, and local levels are responsible for governance of EV charging. The roles played by these bodies can be categorized as policy-making and regulatory functions, and executive or implementing functions.

Setting Targets for EV Charging Infrastructure

Targets for EV charging provision vary from one place to another, given the levels of vehicle ownership and projected transport electrification trends. They will also vary over time as EV penetration increases. The MoP and MoHUA have set targets for public charging provision and for provision of EV charging in buildings, respectively. State and local planning bodies may adopt these suggested targets or mandate more ambitious targets for their regions.

Principles of Location Planning for Public EV Charging

Location planning for public charging infrastructure helps identify optimal locations for setting up public charging facilities. It can be undertaken at different scales, from a city-level exercise to one at a neighbourhood level. SNAs or ULBs may conduct or commission a location planning study as part of their mandate to ensure a well-planned public charging network. CPOs that are setting up charge point networks may also carry out location planning to identify optimal locations with high charging demand.

Regulatory Framework for EV Charging Connections

Electricity supply in India is a highly regulated market, with regulations at the central and state levels. Provision of electricity connections for EV charging comes under a set of regulations and guidelines, some of which are general and others which have been formulated specifically for charging facilities.

Improving the Utilization of The Electricity Grid

At the feeder and network level, energy management measures and distributed charging network planning can help optimize grid utilization and significantly reduce the immediate need for expensive upgrades.

Typical Roles in Charging Infrastructure Implementation

A typical charging infrastructure implementation model involves multiple roles, which may be taken up by one stakeholder or delivered through partnerships between different stakeholders. Apart from the set up of charging infrastructure, other roles include land provision, electricity supply, EVSE supply, charging software solutions, and customer services.