GameChanger Law Advisors

SPECIALE INVEST

Charging Ahead

Part II

A Cross-Jurisdictional, Regulatory and Industry Analysis of Electric Vehicle Charging Infrastructure

A GameChanger Law x Speciale Invest Report

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Foreword

Electric Vehicles (EVs) are the cornerstone of the global transition towards sustainability. India's ambitious climate commitments make EVs not just an environmental imperative, but an economic opportunity. They represent our path to both decarbonization and energy independence, while providing opportunity to accelerate innovation and manufacturing.

When we started Ather in 2013, we were met with glaring scepticism. The common narrative was that India wasn't ready for EVs – our infrastructure couldn't support them, our consumers wouldn't pay for them, and our weather wasn't suited for battery technology. A decade later, I'm writing this foreword in a transformed landscape where EVs, particularly in the two-wheeler segment, are no longer a question of 'if' or 'when', but 'how fast' can we electrify. And the biggest accelerator to EV adoption here on is charging infrastructure. When we launched AtherGrid in 2018, we did it because we understood that without reliable charging infrastructure, even the best EVs would fail to gain consumer confidence. Our experience has shown that building charging infrastructure isn't just about installing charging points – it's about creating an ecosystem that gives users the confidence to transition to electric mobility. This means reliable hardware, intuitive software, standardized protocols, and a seamless user experience. No single player – whether it's a vehicle manufacturer, charging provider, or the government – can solve this challenge alone. When we opened up AtherGrid to other OEMs, it was our recognition that the industry needs to work together.

This report comes at a crucial time when India's EV charging landscape is at an inflection point. The challenges we face are unique – from installing charging points in crowded urban areas to building networks that withstand everything from Rajasthan's heat to Kerala's monsoons. 'Charging Ahead-Part II' delves into the intricate interplay of policy, regulation, and industry trends shaping this crucial segment, providing cross-jurisdictional analysis that contextualizes India's efforts within a global framework. The insights from markets like California, Singapore, and the UK offer invaluable lessons for our path forward, from integrating renewable energy to deploying innovative business models. The collaboration between GameChanger Law Advisors and Speciale Invest in producing this report exemplifies the interdisciplinary approach needed to build a sustainable future.

As we stride toward a greener tomorrow, remember that the journey of electric mobility is not just about vehicles but about creating an equitable, sustainable infrastructure that benefits all. I am optimistic that this report will inspire actionable insights and galvanize efforts to make India a global leader in electric mobility.

Tarun Mehta
Co-Founder & CEO
Ather Energy

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The information provided regarding the laws and regulatory framework of India, Singapore, California and the United Kingdom, and is based on information that is available in the public domain, as of January 2025. This report seeks only to provide information; it is not a legal opinion on any aspect of regulations related to charging stations in any of the jurisdictions analysed i.e., Singapore, California and the United Kingdom. Any questions regarding the interpretation of the laws mentioned in this report should be addressed to attorneys who are qualified to practice law in Singapore, California and the United Kingdom accordingly.

[The Authors took a decision to exclude China from the comparative analysis due to limited access to publicly available information on the laws governing Charging Stations in China. Furthermore, this decision was also made due to various other factors, including language barriers and the restricted availability of comprehensive data. Furthermore, within the European Union, the decentralized nature of governance resulted in each individual member setting their own rules and regulations regarding Charging Station infrastructure.]

Certain links in this report connect to other websites maintained by third parties over whom we have no control. We do not make any representations as to the accuracy or any other aspect of information contained in other websites.

Our Collaborators

We are privileged to have Vishesh Rajaram, Arjun Rao and their wonderful team at Speciale Invest as collaborators of this Report. Since 2017, we have had the privilege of working with, and supporting them, on a number of groundbreaking investments in deep technology startups, including those in the domains of electric mobility, space tech, robotics, gaming and SaaS.

We also extend our gratitude especially to Sunil Cavale, Investment Manager at Speciale Invest. Sunil, who has a focus on startups operating in the electric mobility sector, kindly contributed his unique perspectives that have led to this Report being a truly unique collaboration between lawyers, investors and electric mobility industry operators.

About Us

Our journey as a firm began in October 2011. More than a decade later, we have built a team of seasoned, ambitious, dedicated, dynamic and versatile lawyers.

We have been consistently recognized for our work across industries and practice areas that we have chosen to practice in. We are driven by a desire to innovate, create value, build sustainable partnerships, and to learn, as well as to share knowledge with various stakeholders across the world. Our purpose is clear- we use our legal expertise to enable progress. We believe in the power of law to drive positive change. We take the India Story to the World and bring best practices from around the World to play within the Indian context.

We are proud of the deep sector-specific expertise that we have developed in multiple industries, including Climate, Electric Mobility, Healthcare, Impact Investing, Social Enterprises, Sports, Technology and Venture Capital.

Based in Bengaluru, India, we have built deep and long -term relationships with clients, business schools, law schools, incubators, accelerators and thinktanks across the globe.

In October 2023, we, in collaboration with Speciale Invest, released a first of its kind report titled “Charging Ahead”, which contains a cross-jurisdictional, regulatory and industry analysis of electric vehicle battery packs. To our knowledge, it was the first instance of a collaboration between a law firm and venture capital firm to provide legal and commercial insights on the electric mobility industry in India. This Report seeks to build on that collaboration. We are proud and grateful to have Speciale Invest as our collaborators!

About Us

SPECIALE INVEST

Founded in 2017 by Co-founders Vishesh Rajaram and Arjun Rao, Speciale Invest is a seed-stage venture capital firm that invests in founders building technologies of tomorrow. The firm backs ingenious entrepreneurs who use disruptive technologies to find innovative solutions that make an impact. The fund is a SEBI-registered Category-II alternative investment fund (AIF) and has seen participation from high-net-worth individuals (HNIs), ultra-HNIs, and other family offices.

Speciale's investment philosophy is centered around providing capital to startups with the potential to disrupt and transform their industries, with a focus on emerging technology areas such as SpaceTech, Aerospace, Green Hydrogen, Robotics, Batteries, Quantum Tech, AI-led SAAS, Dev tools, Data Infrastructure, and Large Language Model (LLM) Applications/Infrastructure amongst others.

The fund has a successful track record of investing in pioneering deep-science & tech companies, including Morphing Machines, Ultraviolette, Agnikul Cosmos, ePlane Company, Cynlr, Qnu Labs, Galaxeye Space, Uravu Labs, Peptris Technologies, NewTrace, e-TRNL Energy, Wingman, StreamAlive, Airboxr, Trainn, and more. Led by a strong leadership team with decades of experience building tech products and managing technology funds, Speciale Invest is committed to working closely with founders to guide, mentor, and help them scale and grow their businesses.

Vishesh Rajaram
Managing Partner
Speciale Invest

Preface

Why should we care about EV Charging Infrastructure in India?

Any debate on why the world needs to transition to electric mobility in an urgent manner begins by placing electric mobility within the broader context of the climate crisis that the world is currently grappling with. There is near universal unanimity that the climate crisis is an existential threat to life on Earth, as we know it now. And, despite dilly-dallying on the actions to be taken to reduce this threat, policymakers from all over the world came to the conclusion in the Paris Agreement that the world needs to limit global warming to 1.5°C. So why is electric mobility being held out to be a panacea for the challenges posed by climate change?

Because, as the **United Nations Environment Programme**[1] puts it "*The transport sector is the fastest-growing greenhouse gas (GHG) emitting sector, expected to reach a share of more than 30% of total GHG emissions in the future. It is also a leading emitter of short-lived climate pollutants and it contributes greatly to air pollution. The global vehicle fleet is set to double by 2050, with more than 90 per cent of future vehicle growth projected to take place in low and middle-income countries. To achieve a cleaner transport sector, a combination of measures needs to be implemented world-wide: better-designed cities; safe and comfortable walking and cycling facilities; more public transport; and cleaner and more efficient on-road fleets, including electric vehicles.*"

Last year, we published the first of our reports, "Charging Ahead", where we unravelled the intricacies of regulations and the commercial landscape surrounding electric vehicle battery packs. We chose to do an in-depth study of electric vehicle battery packs because, as is well known, battery packs comprise of 40 - 50% of the total cost component of EVs.

This year, we have made an attempt to further join the dots in the policy, regulatory and commercial landscape for electric mobility in India by examining another key component-that of a robust charging infrastructure for electric vehicles. India's transition to electric mobility will remain stunted if she is not able to develop charging infrastructure that can support the growth of electric vehicles. The Government of India has instituted various enabling policies to promote the development of the charging infrastructure

[1] See "*Supporting the global shift to electric mobility*" at https://www.unep.org/topics/transport/electric-mobility/supporting-global-shift-electric-mobility-0

network. However, it is still early days for India, and there is a recognition even from the Government of India[2] that "*given the novel characteristics of this new infrastructure type, there is a need to customize it to the unique Indian transport ecosystem and build capacity among stakeholders to support its on-ground expansion*. *A contextual approach is needed to ensure the efficient and timely implementation of EV charging infrastructure, such that it meets local requirements and is optimally integrated within the electricity supply and transportation networks*."

While we recognize the need for a contextual approach, we are also firm believers in learning from the experiences of jurisdictions such as USA, UK and Singapore, which are ahead of the curve in terms of a transition to electric mobility, and bringing those best practices into play within India. Hence, we have dived into understanding the legal, policy, commercial and regulatory frameworks that have enabled these countries to develop an advanced charging infrastructure network.

Yet again, we have been joined in our endeavour by the team at Speciale Invest, who are the best collaborators that we could have ever hoped for. They have thrown open to us, their networks in the electric mobility sector. They have helped us verify and validate the commercial datapoints that have been included within this Report. And they have helped refine this Report by providing extensive feedback to our team members over several months. It is also an honour for us at GameChanger Law Advisors to have Mr. Tarun Mehta, Co-Founder and CEO at Ather Energy, one of India's leading electric two-wheeler manufacturers, author the Foreword to this Report. We deeply value the unique privilege that we have been accorded with, and hope that the end product is a report that discerning readers will find to be useful and informative. Yet again, our sincere hope is that this Report can go further and help shape India's legal and regulatory frameworks for the development of charging infrastructure.

Amrut Joshi
Founder
GameChanger Law Advisors

[2] See "HANDBOOK of ELECTRIC VEHICLE CHARGING INFRASTRUCTURE IMPLEMENTATION" at https://www.niti.gov.in/sites/default/files/2023-02/EV_Handbook_Final_14Oct.pdf

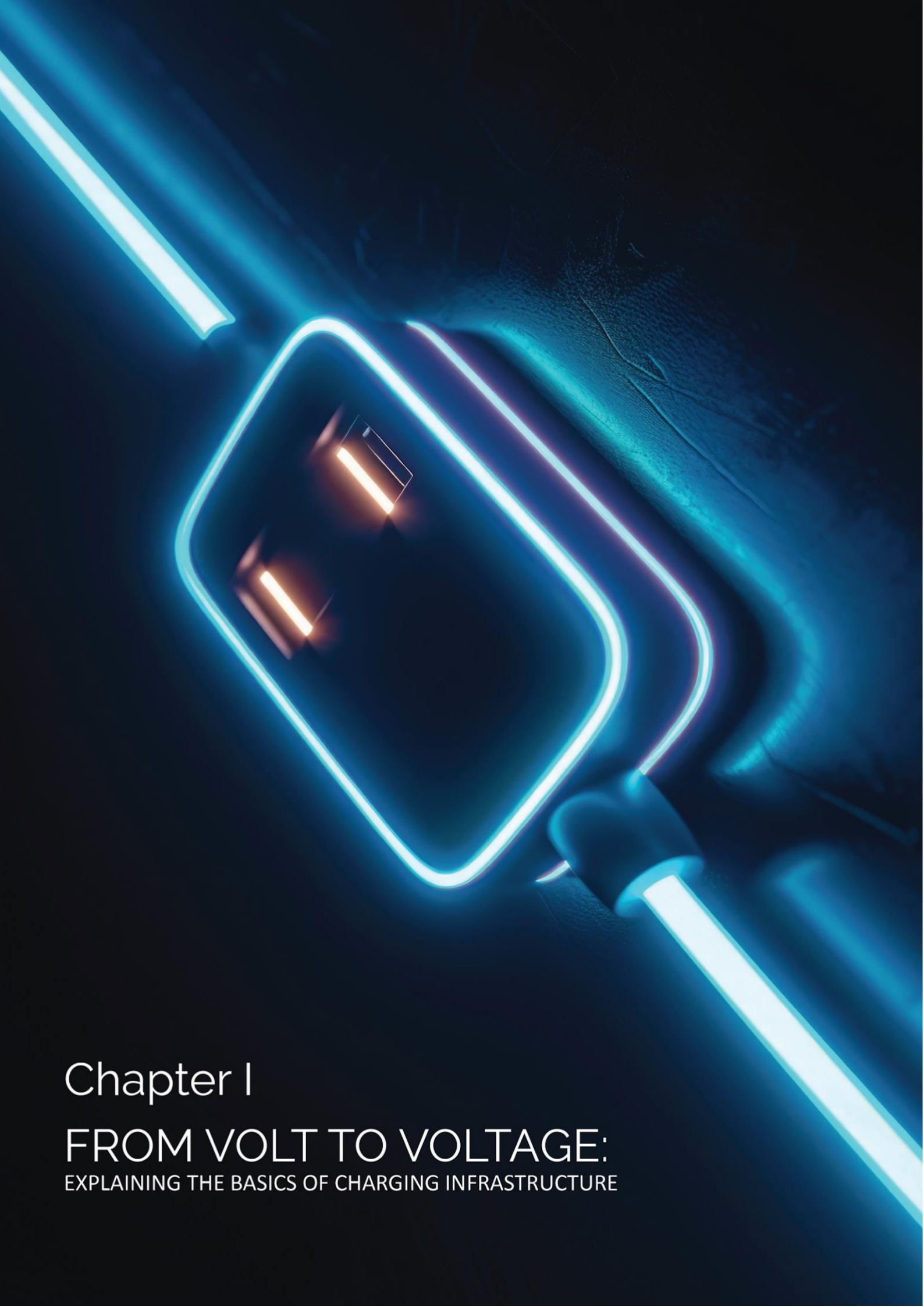
Table of Contents

Glossary

This glossary provides a basic overview of terms used in this Report. We will dive deeper into some of these terms in subsequent Chapters in this Report. We have relied on electric mobility industry publications to create this glossary, with the sources being duly acknowledged and credited in the footnotes.[3]

Sl. No.	Term	Description
1.	AC Charging	Alternating current charging, which is typically slower than DC fast charging but is more common for home and workplace charging.
2.	Charging Gun	A device connected with a Charging Station/power outlet that is used to charge an EV.
3.	Charging Station	A location equipped with electric chargers where electric vehicles can be charged. Charging stations vary in speed, with some providing fast charging and others slower charging.
4.	Charging Connector/Plug	The physical connector that links the electric vehicle to the Charging Station.
5.	DC Fast Charging	A fast-charging method that provides direct current (DC) to the electric vehicle battery, allowing for quicker charging compared to alternating current (AC) charging.
6.	EV / Electric Vehicle	Any vehicle that uses electric power for propulsion, including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).
7.	Kilowatt (kW)	A unit of power used to measure the rate of energy transfer or consumption. In the context of EVs, it is often used to express charging power.
8.	Kilowatt-Hour (kWh)	A unit of energy that represents the amount of energy consumed or stored over time. It is commonly used to measure the capacity of electric vehicle batteries.
9.	OEM	Original Equipment Manufacturer
10.	Range	The distance an electric vehicle can travel on a single charge or with a full tank of fuel in the case of plug-in hybrids.
11.	SOC (State of Charge)	The current level of charge in an electric vehicle battery, expressed as a percentage.

[3] Read definitions at Electric Vehicle Glossary: Terms & Definitions | GM and EV Dictionary - Electric Vehicle Terminology Explained (myev.com).



Chapter I

FROM VOLT TO VOLTAGE:

EXPLAINING THE BASICS OF CHARGING INFRASTRUCTURE

Chapter I of the Report provides a brief overview of the various elements of a Charging Station, beginning with an explanation on a Charging Station and Charging Gun. It also explains classifications of Charging Stations based on (i) ownership and operations of a Charging Station, and (ii) accessibility of a Charging Station to the public at large.

1. What is a Charging Station?

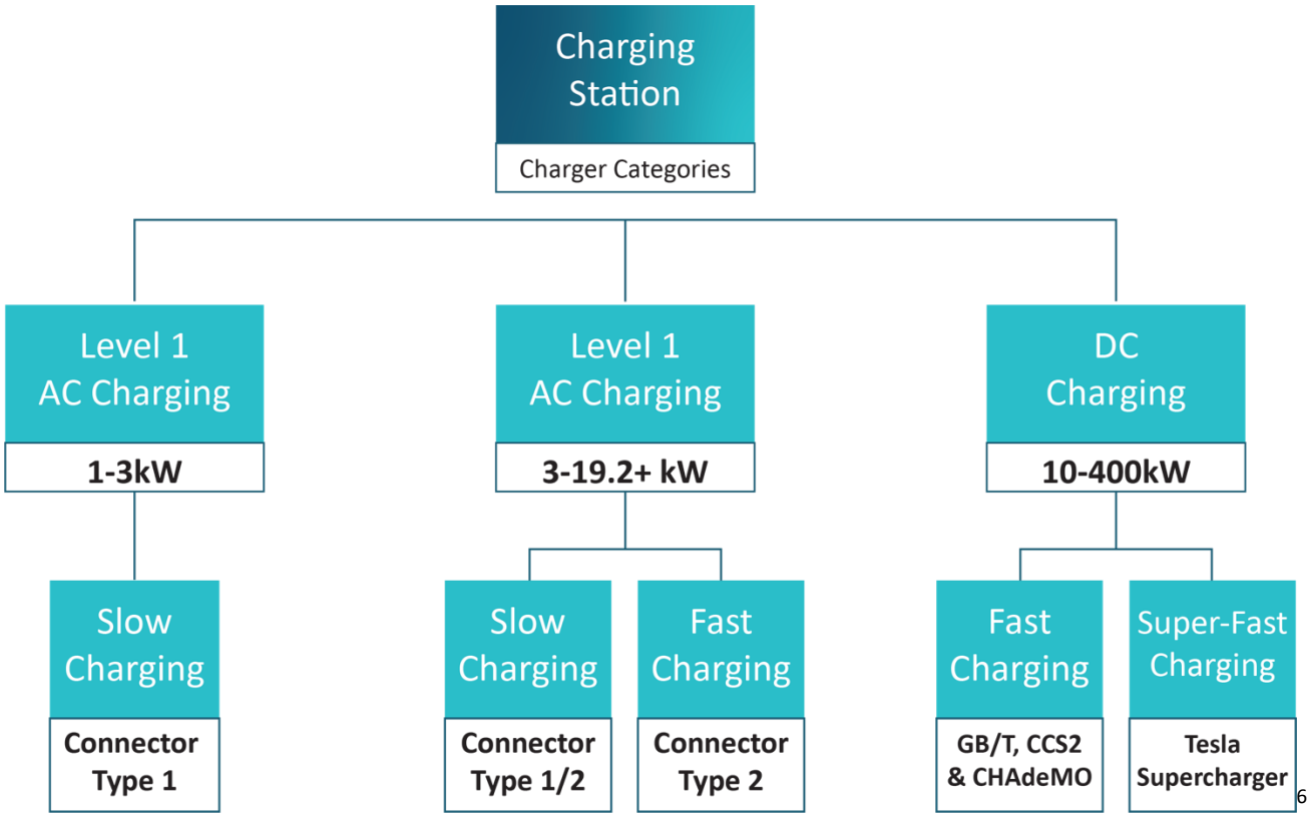
As per the United States Department of Energy, a Charging Station is equipment that provides electrical energy for recharging EVs.[4] Charging Stations come in various forms and charging levels, and may be installed in different settings, including public spaces, parking lots, shopping centres, and private homes.

2. What is a Charging Gun?

A Charging Gun is a device that is used to charge an EV from an external power source, and typically, cannot be used interchangeably with different kinds of Charging Stations and EVs. Each Charging Station is programmed differently to give a particular outflow of electricity to a certain EV and the Charging Guns are distinguished based on the type of pins and the particular electricity output they can give.[5]

Hence, it is important for EV users to be aware of which Charging Station is required to charge their EV in order to avoid potential hazards, damage to their EV, battery inflammation/damage etc.

3. What are the different types of Charging Stations?

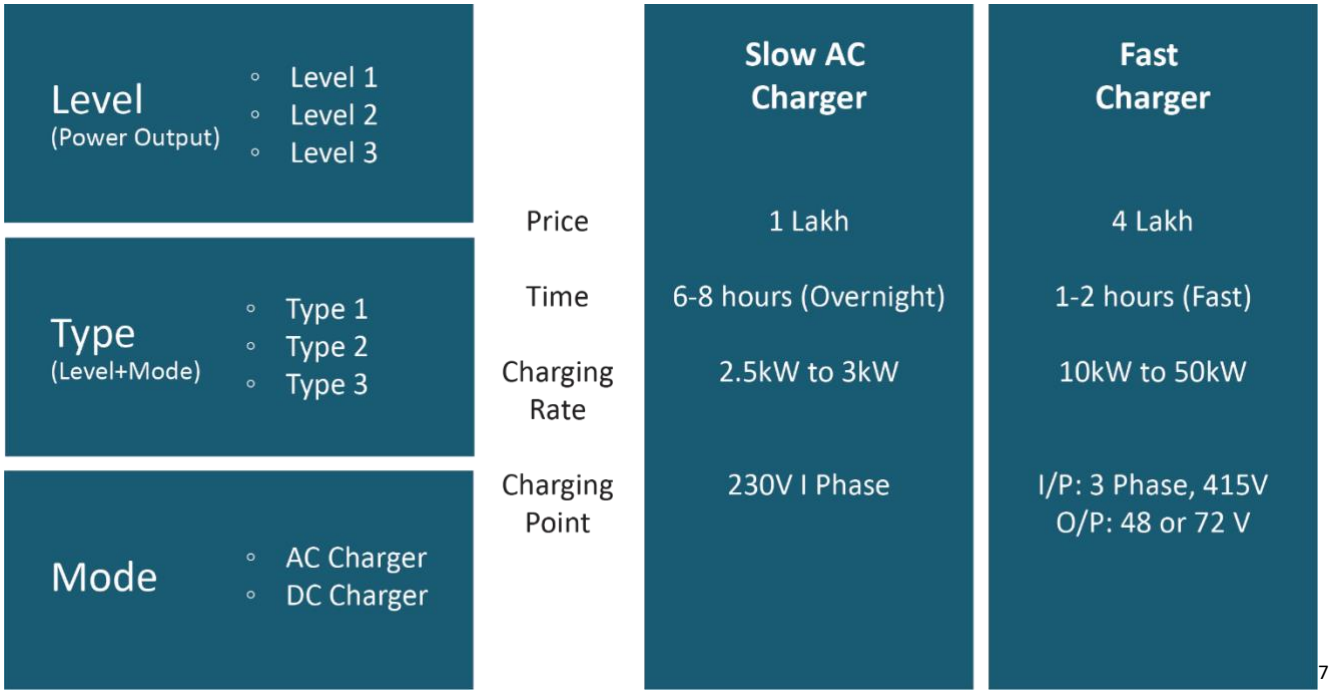


[6]

[4] See "Developing Infrastructure to Charge Electric Vehicles" at https://afdc.energy.gov/fuels/electricity_infrastructure.html

[5] Read about "What is an EV Charging Gun and How to use it?" at https://www.campuscomponent.com/blogs/post/what-is-an-ev-charging-gun-and-how-to-use-it#:~:text=The%20charging%20gun%20is%20a,grid%20to%20the%20electric%20vehicle.

[6] See "Charging of Electric Vehicles" at https://indiaesa.info/resources/ev-101/3915-charging-of-electric-vehicles



[7]

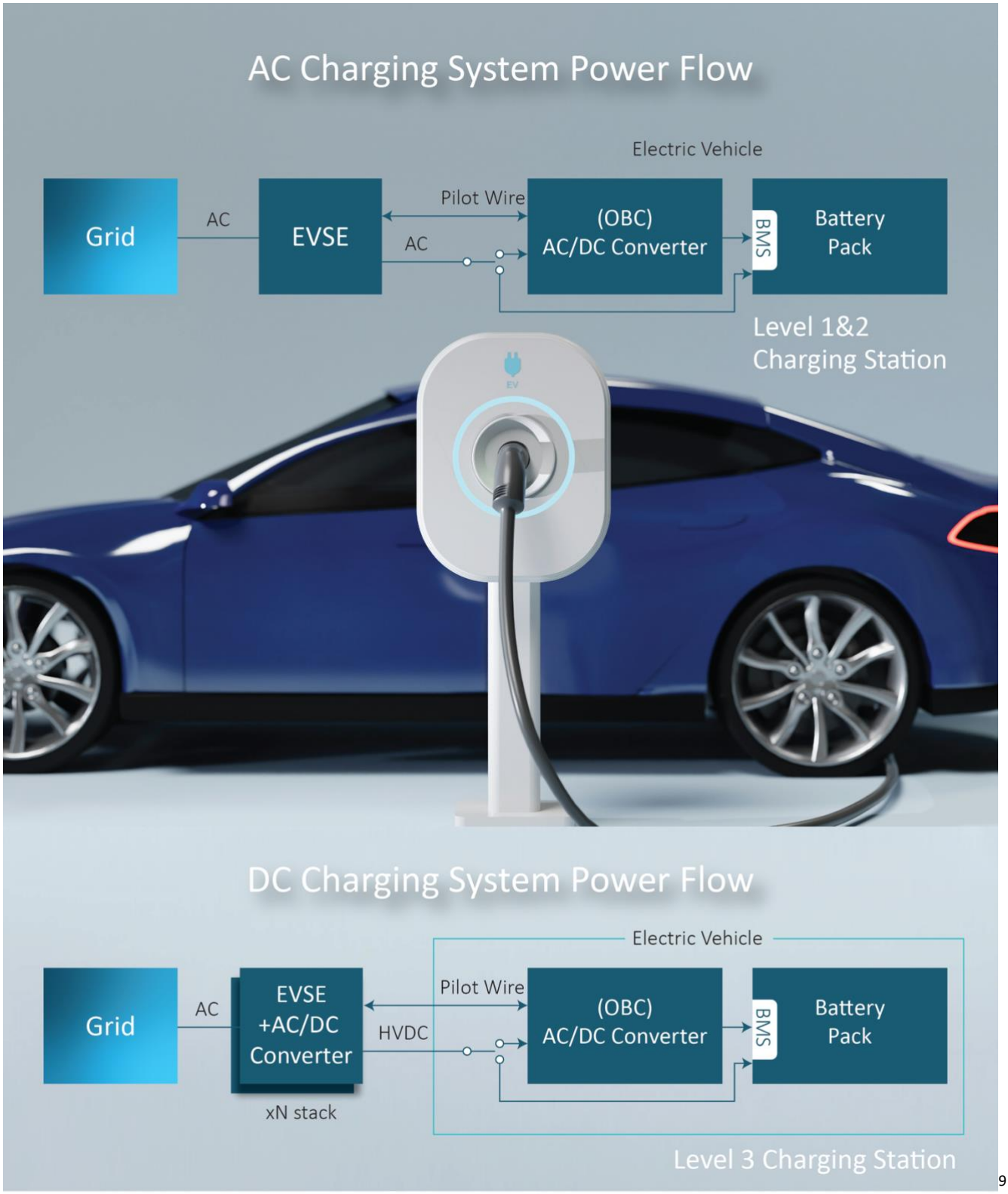
AC and DC Charging Stations: According to the Indian Automotive Industry Standards, which are issued by the Automotive Research Association of India formed by the Ministry of Heavy Industries, AC and DC Charging Stations undertake different procedures for the transfer of electricity owing to the different requirements of current for each battery pack within an EV.[8]

a. **AC Charging Circuits**: In AC Charging Stations, the EV must be equipped with an on-board rectifier and the entire process of communication between the Charging Station and the EV is through a Pulse Width Modulation (PWM) signal. The AC power should be delivered to the onboard charger of the EV and then this is converted to DC before being supplied to the battery pack in the vehicle.

b. **DC Charging Circuits**: DC Charging Stations does not need an on-board rectifier and DC Current is able to transfer a larger amount of electric energy while charging the EVs directly to the battery pack by bypassing the onboard charger in the EVs.

[7] See "Electric Vehicle: Charging Into the Future" at https://www.researchgate.net/figure/Charger-type-India-overview_fig4_353357190

[8] Read about "EV Conductive Charging System" at cea.nic.in/wp-content/uploads/2020/04/arai_138_2.pdf



[9]

The Charging Station Levels[10]: The Accelerated e-Mobility Revolution for India's Transportation (eAMRIT) is an online portal which was launched in November 2021, by the NITI Ayog as part of the UK-India Joint Roadmap programme. It aims to be the 'one stop' solution for all information related to electric mobility

[9] Read about "EV On board chargers and Charging Stations" at https://circuitdigest.com/article/electric-vehicle-on-board-chargers-and-charging-stations

[10] See "EV Charging Guide' at https://chargehub.com/en/electric-car-charging-guide.html https://afdc.energy.gov/fuels/electricity_infrastructure.html

in India.[11] As per the eAMRIT standards and specifications, three kinds of EV Charging Stations are differentiated based on output requirements, as follows:

a. **Level 1 Charging Stations -** Level 1 Charging Stations are the slowest form of charging and are mainly suitable for overnight charging at home. Public Charging Stations do not employ the use of Level 1 Charging. The charging time depends on the capacity of the EV's battery. Level 1 charging is convenient for daily commuting but may not be sufficient for long trips.

   - **Level 1 AC Charging Stations:** These Charging Stations give a maximum output voltage of 240V and power output of less than 3.5kW. The type of compatible chargers are Type 1 Chargers and Bharat AC-001 and these chargers are suited for 2W, 3W and 4W.

   - **Level 1 DC Charging Stations:** These Charging Stations have an output voltage of 48V / 72V and also have power outputs of 10 kW / 15 kW with a maximum current of up to 200A. They are suited for 2W, 3W and 4W.

b. **Level 2 Charging Stations –** These Charging Stations allow for a faster charging rate compared to Level 1 and are suitable for both home and public charging locations. The charging makes it suitable for daily charging needs and longer stops at public locations/long drives etc.

   - **Level 2 AC Charging Stations:** These Charging Stations give a maximum output voltage of 380V-400V and power output of less than 22kW. The type of compatible chargers are Type 1 Charger, Type 2 Chargers, GB/T and Bharat AC-001 and these chargers are suited for 2W, 3W and 4W.

c. **Level 3 Charging Stations -**

   - **Level 3 AC Charging Stations:** These Charging Stations give a maximum output voltage of 200V-1000V and power output between 22-4.3kW. The type of compatible chargers are Type 2 Chargers and these chargers are suited for 4W vehicles only.

   - **Level 3 DC Charging Stations:** These Charging Stations give a maximum output voltage of 200V-1000V and power output between 400kW. The type of compatible chargers are Type 2, CHAdeMO, CCS1, and CCS2 Chargers and these chargers are suited for 4W vehicles only.

   Along with the aforementioned Charging Station types mentioned above, the eAMRIT scheme of India has also outlined the type of chargers that are compatible with each type of Charging Station:

[11] See "NITI Aayog Standards and Specifications" at STANDARDS AND SPECIFICATIONS (niti.gov.in)

Sl. No.	Charging Station	Voltage (V)	Power (kW)	Type of Vehicle	Type of compatible charger
1	Level 1 (AC)	240	<=3.5kW	4w, 3w, 2w	Type 1, Bharat AC-0001
2	Level 1 (DC)	>=48	<=15kW	4w, 3w, 2w	Bharat DC-0001
3	Level 2 (AC)	380-400	<=22kW	4w, 3w, 2w	Type 1, Type 2, GB/T, Bharat AC-0001
4	Level 3 (AC)	200-1000	22 to 4.3kW	4w	Type 2
5	Level 3 (DC)	200-1000	Up to 400kW	4w	Type 2, CHAdeMO, CCS1, CCS2

[12]

d. CCS (Combined Charging System): CCS, a global fast-charging standard, is gaining traction in India. It supports both AC and DC charging. It supports a wide range of voltages, including high-voltage DC charging. The chargers can deliver power output up to 350 kW, allowing for faster charging. It offers faster charging for compatible EV and the charging times are faster than Level 2.

e. CHAdeMO: The '*Charge De Move*' or CHAdeMO charging is another fast-charging system that has been used in India. It is *a first-generation charging system* that can deliver up to 62.5kW by 500V and 25A of DC, which can amount to 120 km of range in half an hour of charging. It offers fast-charging capabilities for compatible EVs and is primarily used by Japanese and Korean automakers, such as Nissan and Kia.[13]

Types of Connectors:[14] The two key types of AC Connectors being used in the Indian market are the IEC 60309 and IEC 62196. The Bureau of Indian Standards ("**BIS**") has adopted these internation standards in India, which have been issued by the International Electrotechnical Commission[15], a global non-profit membership organization, which more than 700 countries are a part of, including India.

[12] Read more on 'eAmrit Standards and Specifications' https://e-amrit.niti.gov.in/standards-and-specifications.

[13] Read about " EV Charging Stations- India to use Three Technologies" at https://www.thehindubusinessline.com/economy/logistics/ev-charging-stations-india-to-use-three-technologies/article28388553.ece#:~:text=Will%20deploy%20Bharat%20Standard%2C%20CHAdeMO%20and%2Combined%20Charging%20System&text=India%20will%20deploy%20both%20CHAdeMO,public%20electric%20vehicle%20charging%20stations.

[14] Read about "EV Specifications" at Bharat EV specifications for AC and DC charging - PluginIndia Electric Vehicles

[15] Read more on the 'International Electrotechnical Commission' at https://www.iec.ch/national-committees.

a. **IEC 60309:** This Industrial Blue connector has been recommended by Bharat EV and is used by vehicles such as Indian e-Rickshaws, Mahindra e2o, and Mahindra e2o Plus P6.

b. **IEC 62196**: The European Union has selected this as the official Charging Plug within the European Union and is the officially recommended connector by the European Commission.

   In India, the IEC 60309 and IEC 62196 has been incorporated in the BIS standards IS/IEC 60309-2 and IS 17017 (Part 2) respectively.

4. Classification of Charging Stations

Charging Stations can broadly be classified depending on the following:

(a) the accessibility of a Charging Station to the public at large; i.e., (i) private, (ii) semi-public or (iii) public Charging Stations (*as detailed below*); and

(b) the ownership and model for operating the Charging Station; i.e., (i) company owned - company operated, (ii) company owned - franchisee operated, or (iii) franchisee owned - company operated model.

These Charging Stations can be a combination of (a) and (b), i.e., it may be a private Charging Station that is company-owned – franchisee operated, or a public Charging Station that is company owned – company operated.

Different Models of Operating a Charging Station[16]: We have sought to provide an elaborate explanation as regards the different models that are prevalent in terms of how Charging Stations are operated. This explanation flows from the extensive work that we have performed for clients in the electric mobility industry in India.

a. **Company Owned - Company Operated:** In the company owned - company operated model, the company owns and operates the Charging Station. The company is in charge of maintaining the Charging Station, and its day-to-day operations, including installing and commissioning the Charging Station at a particular location, collecting the charging fee from the customers, obtaining relevant registrations from the authorities as per law and payment of applicable taxes with respect to the Charging Station.

b. **Company Owned - Franchisee Operated:** In this model, while the company owns the Charging Station, the franchisee is required to own / lease out the premises at which Charging Station is to be installed. The franchisee is responsible for the day-to-day operations and maintenance of the Charging Station, along with collecting the charging fee from the customers. Typically, in such a model, the Company is responsible for obtaining relevant registrations from the authorities as per law prior to installing and commissioning the Charging Station.

[16] Typically, Charging Station owners do contract with franchisee partners to help with operating the Charging Station. See few examples at https://www.goecworld.com/; https://go-tou.com/en/news/ev-charging-station-business-model

c. **Franchisee Owned - Company Operated:** In this model, the franchisee owns the Charging Station, but the company is responsible for installing and commissioning the Charging Station, the day-to-day operations and maintenance of the Charging Station, along with collecting the charging fee from the customers. Typically, in such a model, the franchisee is responsible for obtaining relevant registrations from the authorities as per law.

When the Charging Stations are owned or operated by franchisees, the manufacturing companies typically prefer to execute contracts to govern the roles and responsibilities of each entity in terms of operating and maintaining the Charging Station. These contracts essentially set out which entity (a) owns the Charging Stations, (b) is responsible for commissioning and installing the Charging Station, (c) is required to conduct maintenance checks, and (d) is responsible for the day-to-day operations of it, including collection of the charging fees from the users.

Classification of a Charging Station based on Accessibility: The classification of Charging Stations based on its accessibility to the public at large has been set out in the Economic Commission for Europe report on EV Charging Infrastructure Data Collection issued in January 2024, which outlines the progress and challenges in electric vehicle charging infrastructure data collection across member States of the Economic Commission for Europe.[17] Similarly, in India, this classification is also reflected in the Handbook on EV Charging Infrastructure Implementation issued by the Niti Aayog, which is the apex public policy think tank of the Government of India:

a. **Private Charging Stations:** These are owned by one entity, and are typically company owned - company operated. Since private Charging Stations are meant for charging personal EVs or a fleet of EVs owned by the one entity, the Charging Station owners generally install them at their customers' private houses, and also in dedicated slots in apartment and office complexes.

b. **Semi Public Charging Stations:** These may be owned by original equipment manufacturers, or charging point operators (CPOs), and may follow either of the above-mentioned models of operating. Since semi-public Charging Stations are meant for a particular set of EVs, they are generally installed at slightly larger premises, such as gated communities, malls, hospitals, universities and so on.

c. **Public Charging Stations:** These are owned by Government authorities, public sector undertakings, and CPOs, and may follow either of the above-mentioned models of operating. Public Charging Stations are meant for all EVs, and will be found at public parking lots, petrol stations, on the highways and metro stations.

5. Charging Stations used for different Vehicle Segments:[18]

[17] See "Electric Vehicle Charging Infrastructure Data Collection" at https://unece.org/sites/default/files/2024-02/ECE-TRANS-WP.6-2024-05e.pdf

[18] Read "Types of EV Charging Guns That Exist in India?" https://1charging.com/top-5-types-of-ev-charging-guns-are-there-in-india/; Read "EV Simplified: Types of Electric Two-Wheeler Chargers" https://www.zigwheels.com/news-features/ev-guide/ev-simplified-types-of-chargers/44695/.

a. **Two-Wheeler EVs**: AC and DC Charging Stations, or battery swapping for charging, is typically used for these EVs. AC Charging Stations include Type 1 (up to 3.7 kW) and Type 2 (3.7–22 kW). DC fast Charging Stations like CCS (50–350 kW) enable rapid charging, reaching 80% in about 30 minutes.

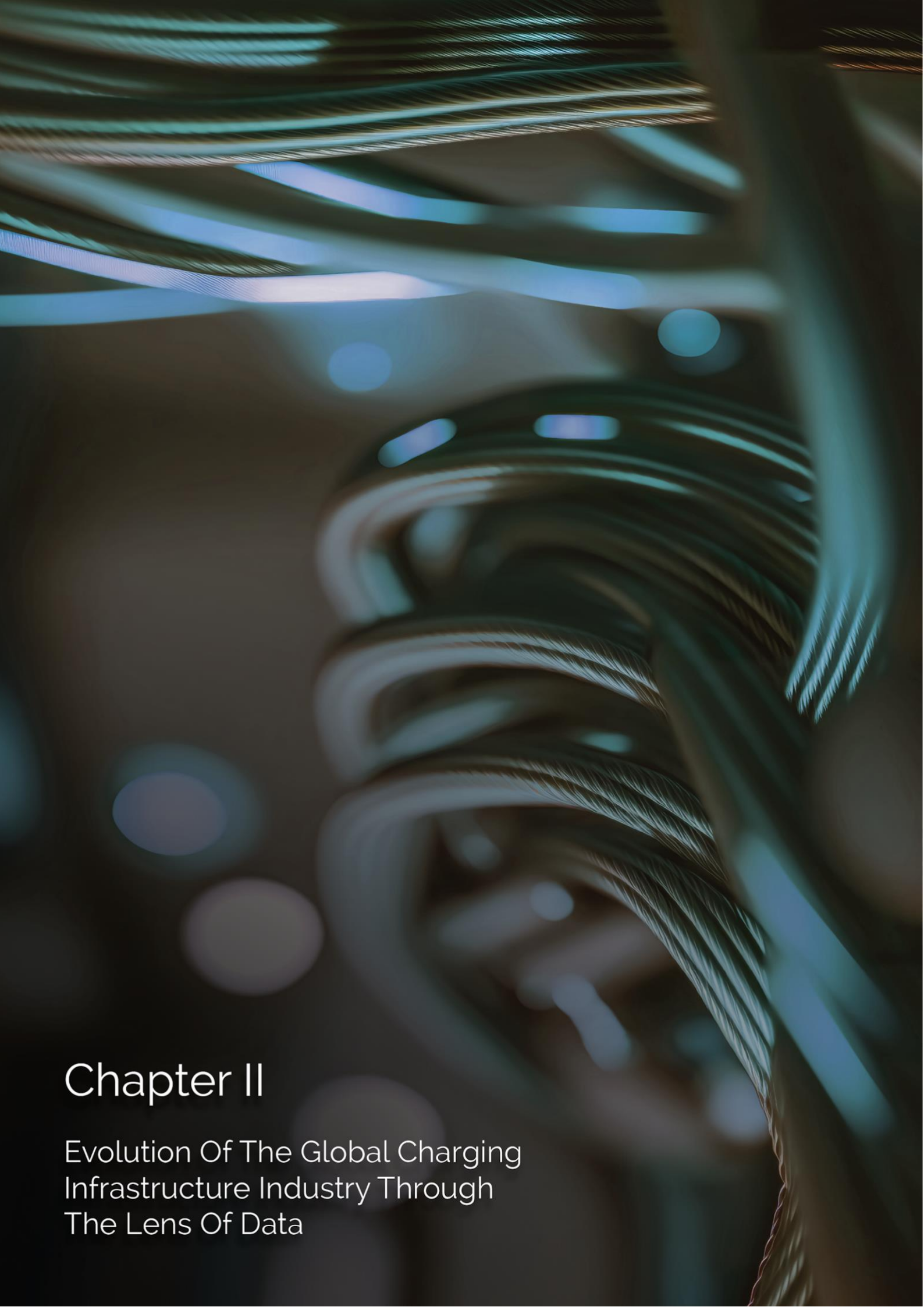
b. **Three-Wheeler EVs**: For three-wheelers, AC Charging Stations like Type 2 (up to 22 kW) are widely used in public and home settings, compatible with various auto-rickshaw models. DC fast Charging Stations include Bharat DC 001 (up to 15 kW), which efficiently charges many electric three-wheelers. Battery swapping stations are also available, ensuring minimal downtime for commercial operators.

c. **Four-Wheeler EVs**: Four-wheelers rely on AC Charging Stations such as Type 2 (7.4–22 kW), standard for most modern electric cars in home and public settings. DC fast Charging Stations include CCS (50–350 kW), adopted by many manufacturers for rapid charging, and CHAdeMO (up to 62.5 kW), used by certain brands.

Type of Vehicle	Private Charging Infrastructure	Public Charging Station	Generally Established Charging Place
2 Wheelers	Slow Charging/ Battery Swapping	Slow Charging	Resident and Workplace
3 Wheelers	Slow Charging/ Battery Swapping	Slow Charging/ Battery Swapping	Residential Spaces/ Parking Spaces
Cars	Slow Charging/ Battery Swapping	Fast Charging	Residential Spaces/ Parking Spaces/ Workplace
Buses	-	Fast Charging/ Battery Swapping	Depot/ Bus Terminals

[19]

[19] Read "Electric Vehicle Charging Infrastructure and its Grid Integration in India" at https://www.niti.gov.in/sites/default/files/2023-05/Final-smaller_Electric-Vehicles-Charging-Infrastructure.pdf



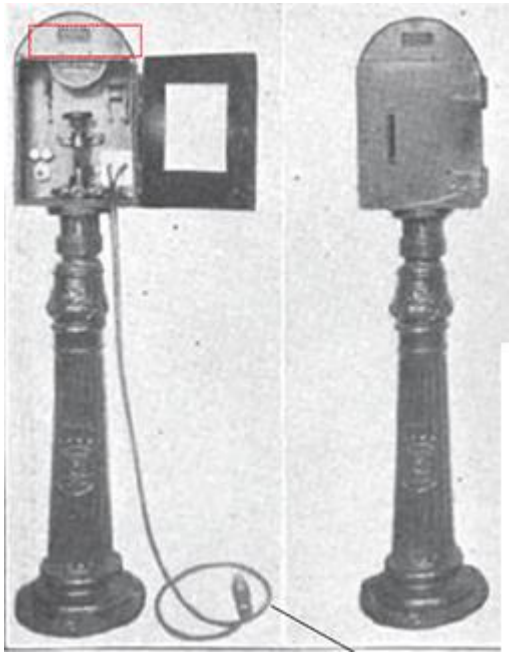
Chapter II

Evolution Of The Global Charging Infrastructure Industry Through The Lens Of Data

A. The History of EV Charging Infrastructure

The earliest EVs were in fact manufactured back in the 1900s. For instance, the Woods Motor Vehicle Company produced the Dual Power with both an internal combustion engine and an electric motor.[20] EVs even made up approximately 40% of the US Vehicle Fleet in the early 20th Century with multiple cities having EVs as taxis. Parallelly, the first charging station was installed in 1914 in New York City, U.S.A by General Electric and they named the Charging Station 'Electrant'.[21] The Electrant was designed as a telephone booth (see image below), and was installed across New York City, to charge tens of thousands of EVs.

[22]



Although there was a growth in the production of EVs in the 1960s and 1970s, it wasn't until the early 1990s that a more considerable push for driving EVs, which was backed by the legislative authorities, like the California Air Resources Board, which set a goal for producing more emissions-free vehicles to address climate change matters.[23]

In the more recent years, several countries have made major advancements in their bid to reduce emissions and excessive reliance on fuel powered vehicles, as recorded in the 2023 - G20 Leaders' Declaration[24] and the COP28 United Nations Climate Change event[25], which has resulted in EVs and Charging Stations becoming a regular sight on roads around the world.

In India, Ola Electric launched the first multimodal electric mobility project in Nagpur, Maharashtra, in January 2018, where the first commercial fast Charging Station in India was opened at a fuel station in the city. The Charging Station was set up in collaboration with Indian Oil.[26] In explaining the reason for choosing to implement this pilot programme in Nagpur, the Ola representatives explained that factors including (a) favourable Government policies, (b) convenient sized and controlled ecosystem, (c) smaller average trip lengths of drivers, and (d) extreme climate conditions, allowed Ola to understand and test out the EVs and operations of Charging Stations. Pursuant to this, Ola went on to deploy multiple fast and slow Charging Stations at various locations in Nagpur, to encourage the use of EVs in the city.[27]

This advancement towards the increase in adoption of EVs and installation of Charging Stations has seen significant progress over the past few years, driven by Government policies supporting sustainable

[20] Read about "The Electric Vehicle Evolution" at https://www.advancedenergy.org/news/the-electric-vehicle-evolution

[21] Same as above.

[22] See "A Brief Discussion on the history of EV Charging Technology" https://www.setec-power.com/a-brief-discussion-of-the-history-of-ev-charging-technology/

[23] See "The Electric Vehicle Evolution- Advanced Energy" https://www.advancedenergy.org/news/the-electric-vehicle-evolution

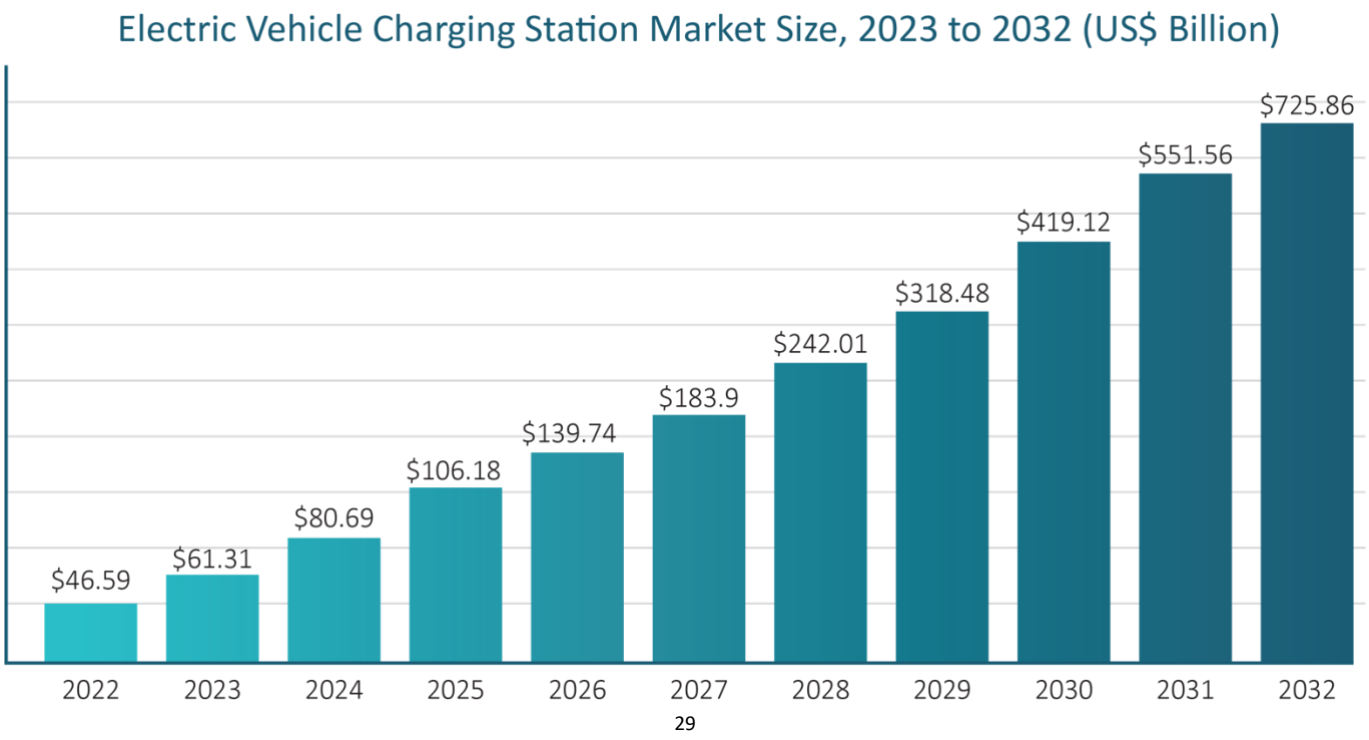
[24] See "G20 New Delhi Leaders' Declaration" https://www.mea.gov.in/Images/CPV/G20-New-Delhi-Leaders-Declaration.pdf

[25] See "UN Climate Change Conference- United Arab Emirates" https://unfccc.int/cop28

[26] See "Beyond Nagpur: The Promise of Electric Mobility" at https://olawebcdn.com/ola-institute/nagpur-report.pdf .

[27] Same as above.

transportation. According to a study conducted by NovaOne Advisors, the global Charging Station market was valued at $60 billion at the end of 2023, and as per the estimations provided by the IMARC group, it is expected to exhibit a compound annual growth rate of 31.52% from 2024-2032.[28]



[29]

B. Countries with the Highest Number of Publicly Available Charging Points

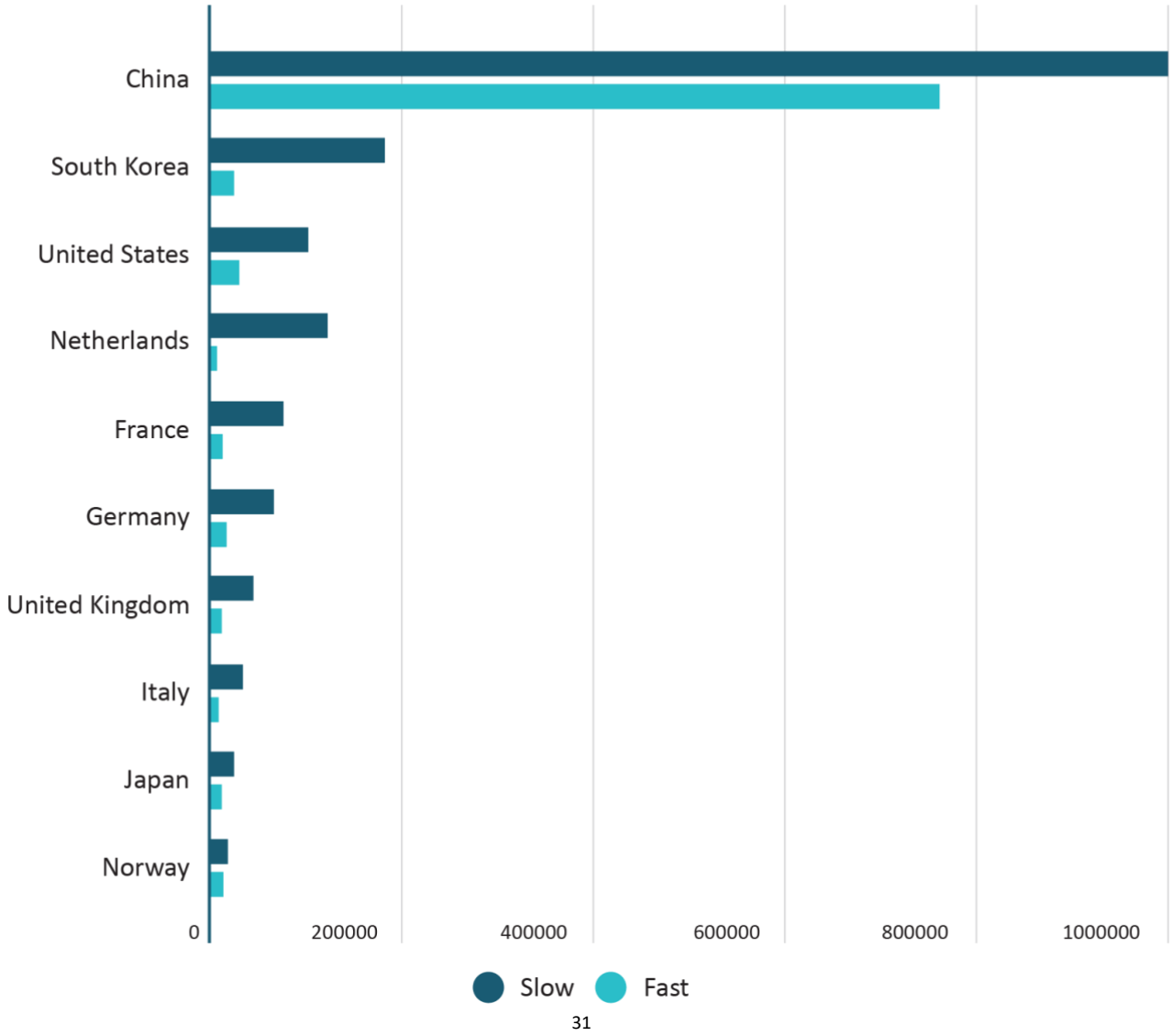
As per the Global EV Outlook report published by the International Energy Agency, which identifies and assesses developments and progress in the electric mobility industry across the world, publicly available charging points worldwide reached more than 1.8 million charging points in 2021, of which one-third were fast chargers. China takes the lead in terms of the number of publicly available chargers, and accounts for about 85% of the world's fast chargers and 55% of slow chargers.[30]

[28] See "Electric Vehicle Charging Market Report 2024-32" https://www.imarcgroup.com/electric-vehicle-charging-station-market

[29] See "Electric Vehicle Charging Station Market" https://www.novaoneadvisor.com/report/electric-vehicle-charging-station-market

[30] See "Global EV Outlook 2022" https://iea.blob.core.windows.net/assets/ad8fb04c-4f75-42fc-973a-6e54c8a4449a/GlobalElectricVehicleOutlook2022.pdf

Nations with most publicly available electric vehicle charging points
Source: Statista, IEA



[31]

There are over 3,600 public Charging Stations in Singapore, and the target set to be achieved by 2030 is the installation of 60,000 Charging Points across the country.[32] California has over 15,201 Charging Stations currently and has increased the number of charging stations significantly as part of its goal to set up 250,000 Charging Stations across the state.[33]

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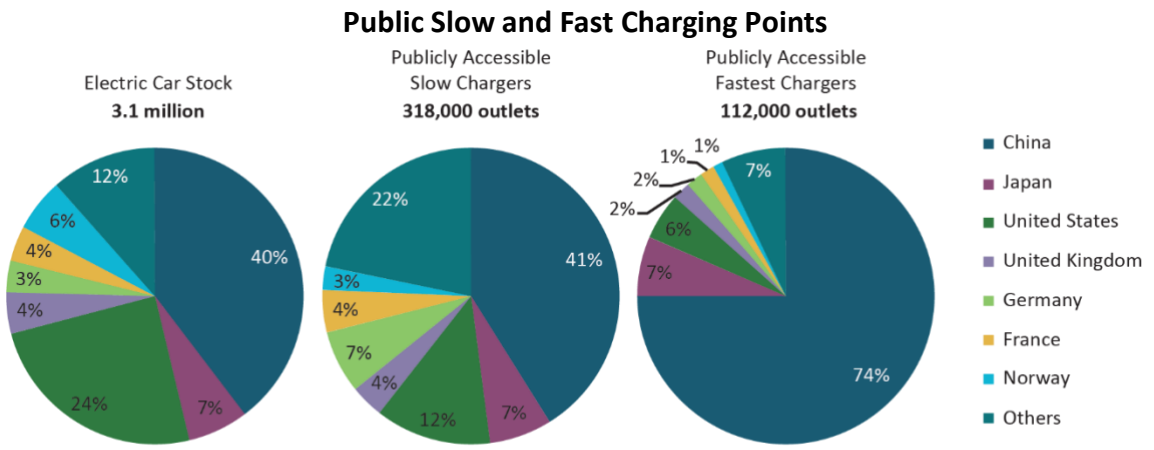
[31] See "Nations with most Charging Stations" https://www.statista.com/statistics/993121/china-p and South Korea: publicly accessible EV chargers 2022 | Statista and U.S. public EV charging stations and charging outlets | Statista and Netherlands: public and semi-public EV charging stations 2022 | Statista and France: public EV chargers 2022 | Statista and Electric vehicles: charging points Germany 2023 | Statista and UK: available public charging points by quarter 2023 | Statista and Italy: charging points in selected cities | Statista and Japan: number of EVs per charging point 2021 | Statista and Norway: charging points for electric cars by county | Statista.

[32] See "Our EV Vision" https://www.lta.gov.sg/content/ltagov/en/industry_innovations/technologies/electric_vehicles/our_ev_vision.html

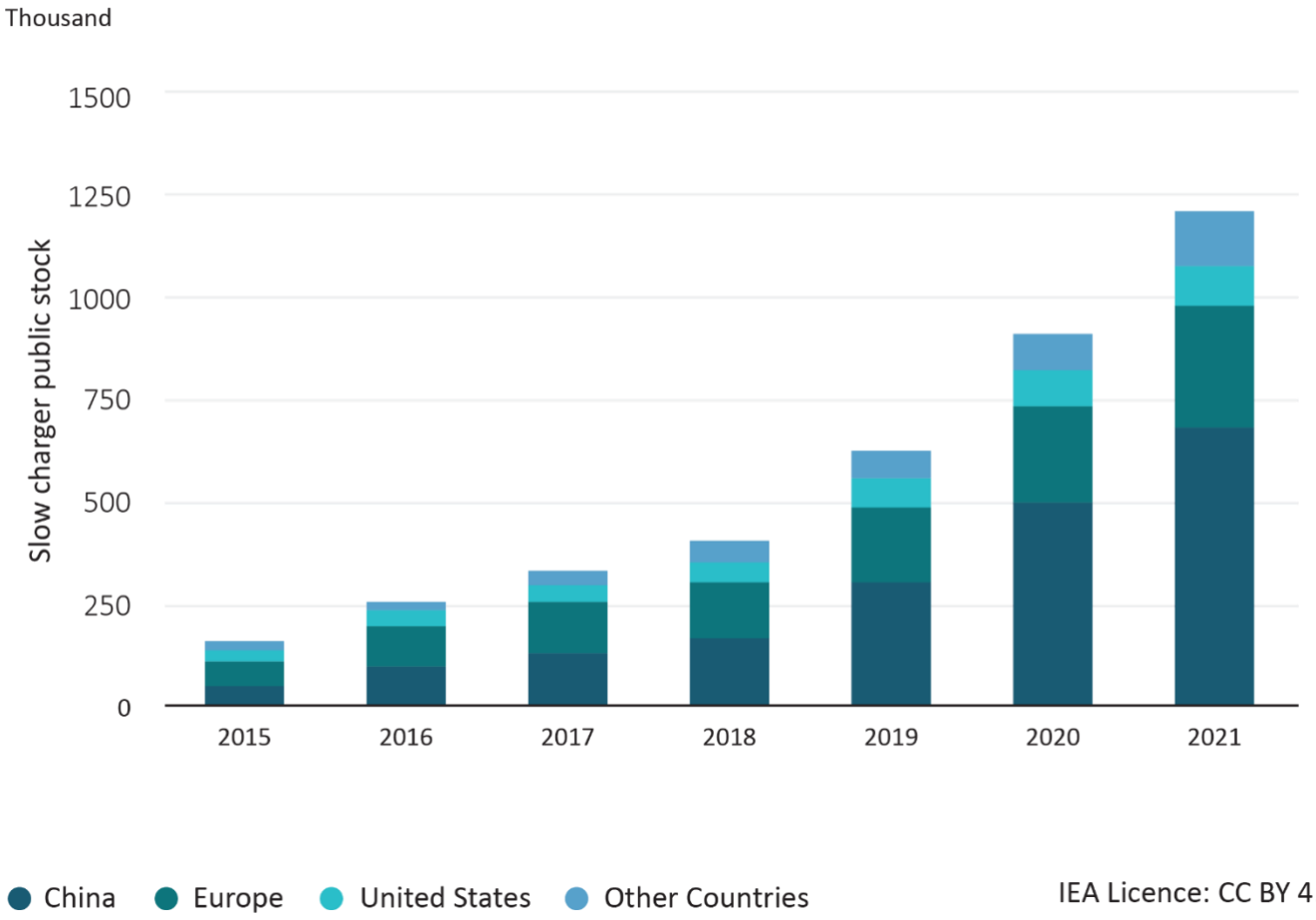
[33] See "Charging Ahead: California Achieves Yet Another EV Goal Ahead of Schedule As More Dollars Go to Communities to Support Transition https://www.gov.ca.gov/2023/09/18/charging-ahead-california-achieves-yet-another-ev-goal-ahead-of-schedule-as-more-dollars-go-to-communities-to-support-transition/ https://www.strategicmarketresearch.com/blogs/ev-charging-statistics



Sources: IEA analysis based on EVI country submissions, complemented by EAFO (2018b)

[34]

Slow publicly available chargers, 2015-2021



IEA Licence: CC BY 4.0[35]

Public Slow Charging Points: As per the data of the International Energy Agency, in 2022, the number of public slow Charging Points globally exceeded 600,000, with China having installed more than 360,000 public slow Charging Points, resulting in the country having a cumulative stock of over 1 million slow Charging Points. By the end of the same year, more than half of the worldwide supply of public slow chargers was located in China.

[34] Read about "EV Charging Station Growth – India & Global AC & Fast DC Electric Vehicle Charging Trends" at https://www.eai.in/blog/2018/12/growth-trends-in-global-india-ev-charging-station.html

[35] Read about "Trends in Charging Infrastructure" https://www.iea.org/reports/global-ev-outlook-2022/trends-in-charging-infrastructure

Europe secured the second position globally, where a total of more than 460,000 slow chargers were in operation in 2022, marking a 50% increase compared to the previous year. The Netherlands took the lead in Europe with 117,000 slow chargers, followed by approximately 74,000 in France and 64,000 in Germany. Meanwhile, the United States experienced a 9% growth in slow charger stock in 2022, representing the slowest expansion rate among major markets.[36]

Public Chargers: As per the data of the International Energy Agency, in 2022, the global count of fast chargers saw an increase of 330,000, with nearly 90% of this growth originating from China. The deployment of fast charging infrastructure addresses the challenge of limited access to home chargers in densely populated cities and aligns with China's objectives for accelerated EV deployment. China has a total of 760,000 fast chargers.

In Europe, the collective stock of fast chargers surpassed 70,000 by the close of 2022, marking a 55% increase from 2021. Germany leads in fast charger numbers with over 12,000, followed by France with 9,700 and Norway with 9,000.[37] In the United Kingdom, more than 10,000 rapid and ultra-fast chargers were installed in 2023.[38]

[36] See "Data on EV Charging Stations" at Global EV Outlook 2021 (windows.net) and https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf

[37] Same as above.

[38] Read about "BP Pulse Claims Significant Progress in Ultra-fast EV Charging Infra in UK" at https://etn.news/iesa-contacts-menu/6694-bp-pulse-ultra-fast-ev-charging-network-uk-2023

Chapter III

Extent Of Charging Station Infrastructure Availability Globally

We have provided an overview on Charging Stations in California, Singapore and the United Kingdom. The reason that these jurisdictions in particular were chosen, are because (i) in California, which has the highest EV penetration in the United States of America, more than 44,612 public and private Charging Stations are installed in the State, out of the total 138,23 Charging Stations in the United States of America; (ii) Singapore has set a goal to deploy more than 60,000 Charging Points in its national EV charger network by the year 2030, and as per the Ministry of Transport, Singapore, all vehicles are set to run on cleaner energy by the year 204; and (iii) in the United Kingdom (UK), there were 53,906 Charging Points across 31,056 different locations in the UK, which is a 45% increase in the total number of charging points in the UK since 2022.

1. California

For several years now, California has been at the helm of EV charging infrastructure, with the largest EV charging infrastructure network of any state in the U.S. As of 2024, the state is home to a quarter of all public EV charging stations in the U.S., though this represents a slight decrease since the past few years. In 2021 California contained 31% of all public EV charging stations in the U.S.[39]

However, despite having the most charging stations of any state, California's estimated 43,780 individual public charging ports must provide service for the more than 1.2 million electric vehicles registered to its residents. This amounts to around one public port for every 29 EVs, a ratio that ranks California 49th across all 50 states in the U.S.

Electric vehicles held an estimated 31.1 percent of the new vehicle market in California in 2022, including 17.1 percent of new battery-electric vehicles. Counties such as Los Angeles and Santa Clara were among the largest charging infrastructure networks. With around 8,854 public chargers and around 18,161 shared private chargers in Los Angeles in 2022, most of which were Level 2 chargers using alternating current electricity to charge a vehicle at 208 to 240 volts, providing around 14 to 35 miles of range for each hour of charging.

2. United Kingdom

The United Kingdom government has, in 2023, published the 'Plan for Drivers', an initiative that included measures to accelerate the country's transition to zero-emission driving.[40] This also included initiatives and plans to accelerate the distribution of the country's public electric vehicle charging infrastructure and make private charging installation easier and cheaper. The UK is already investing in expanding its public charging network, with the volume of available public charging points in the country steadily rising since January 2015.

However, even until very recently, in September 2023, despite this increase, several consumers believed that the number of charging points available were not enough to meet their demands. On an

[39] Read about "Electric vehicles and charging infrastructure in California - Statistics & facts" at https://www.statista.com/topics/10827/electric-vehicles-and-charging-infrastructure-in-california/#topicOverview

[40] Read about "Electric vehicle charging infrastructure in the United Kingdom - Statistics & facts" at https://www.statista.com/topics/11913/electric-vehicle-charging-infrastructure-in-the-united-kingdom/#topicOverview

analysis, it is evident that various factors, including demographic features, play a part in this disconnect between consumer perception and governmental measures.

For example, London had the largest network of public charging points, over twice the size of the network in southeast England, which was second in the charging infrastructure ranking. But despite its volume of available chargers, London did not rank among the largest European cities with the highest ratio of public charging stations per 1,000 inhabitants, scoring 50 percent based on that metric compared to Paris' 63 percent.

On-street charging has been the most popular location for EV charging points, as nearly 16,200 of them were located along residential roads. Public and retail car parks were the second and third location types with the most chargers, but on-street charging was over triple the size of the public car park network. This focus on on-street charging seems in line with consumer opinion, as around 48 percent of UK residents surveyed in September 2022 thought governmental measures funding the installation of residential on-street charging points should be prioritized.[41]

3. Singapore

The Electric Vehicle Charging Infrastructure Market in Singapore has been growing steadily along with the introduction of several developments and new projects. The Singapore government has announced plans to deploy a nationwide EV charging grid called the 'National Grid'. Also, the government has been encouraging public-private partnerships to accelerate the deployment of EV charging infrastructure. Moreover, the Housing Development Board (HDB) announced plans to install EV charging points in all new public car parks in Housing and Development Board estates.[42]

Further, the country has also been focused on developing and promoting the use of Electric Vehicles in public transport. Green financing of Charging Infrastructure has aided in the development of Charging Infrastructure. Overall, the EV charging infrastructure market is expected to continue growing as the government and private sector investment in the development of a comprehensive charging network to support the wide adoption of electric vehicles. Apart from this, the general awareness among the consumers of the importance of Electric Vehicles has led to an increase in the demand for EVs and the growth of the charging infrastructure market.[43]

C. How is India Faring in the Global Charging Stations Market?

In December 2023, Research and Markets, which is one of the world's leading sources for international market research reports and market data, published a report titled 'The Indian EV Charging Station Market Report 2023-2028', which provided an overview of the Indian EV Charging Station Market. This report highlighted that in the financial year 2023, a sum total of 9,113 Charging Stations were installed and

[41] Same as above.

[42] Read about "Singapore Electric Vehicle Charging Infrastructure Market Outlook (2020-2025) | Size, Share, Trends, Growth, Outlook & COVID-19 IMPACT" at https://www.6wresearch.com/industry-report/singapore-electric-vehicle-charging-infrastructure-market

[43] Same as above.

operational in India, and by the end of the financial year 2028, more than 68,956 Charging Stations are expected to be operational.[44]

The Indian Government has also set a goal for EVs to constitute 30% of new private vehicle registrations, totalling to 80 million EVs by the year 2030. To accommodate this substantial increase in EV adoption, India will require a total of 3.9 million public and semi-public Charging Stations, maintaining a ratio of 1 station for every 20 vehicles.[45] Additionally, the National Highways Authority of India has announced plans to install EV Charging Stations along national highways, with a goal of having one station every 40 to 60 kilometres (approximately 25 to 37 miles).[46] Separately, the Ministry of Heavy Industries released a press statement in March 2023, indicating that the an amount of INR 800 crores had been sanctioned under the FAME II Scheme to PSU Oil Marketing Companies (OMC) - Indian Oil (IOCL), Bharat Petroleum (BPCL), and Hindustan Petroleum (HPCL) for setting up 7,432 public fast Charging Stations across the country.[47]

Currently, the existing ratio stands at approximately 1 Charging Station per 135 EVs, which is as opposed to the global standard of 1 Charging Station for every 6 to 20 EVs. In response to this challenge, the Government has implemented a series of policies and incentives pertaining to EV charging infrastructure, as highlighted below.

According to data from the Ministry of Power, as of February 2, 2024, there are 12,146 operational public EV charging stations throughout the country, up from 6,586 public charging stations as of March 21, 2023.[48] As of February 2024 and as per the data provided by the Ministry of Power, Maharashtra has the most number of Charging Stations installed in the country, with approximately 3,079 stations located across the state. In Delhi, there are around 1,886 Charging Stations and Karnataka has around 1,041 Charging stations located across the state.

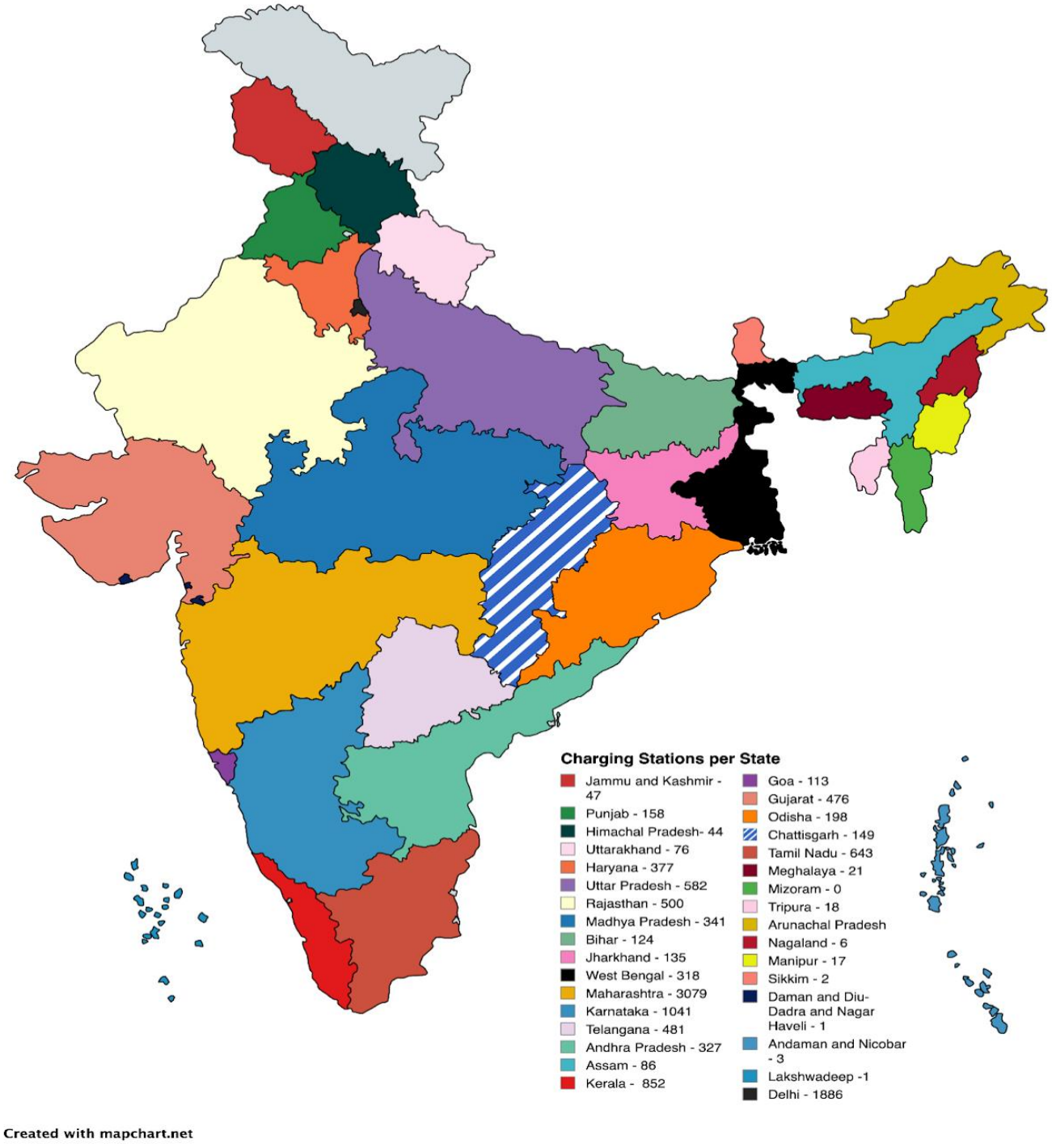
[44] See "India EV Charging Station Market Report 2023-2028 - Government Support and Green Energy Drive Demand" at https://www.prnewswire.com/news-releases/india-ev-charging-station-market-report-2023-2028---government-support-and-green-energy-drive-demand-302003486.html#:~:text=In%20FY%202023%2C%20a%20total,FY%202024%20%2D%20FY%202028%20period.

[45] See "EV Infrastructure in India" at https://bolt.earth/blog/indian-ev-charging-infrastructure-by-2030

[46] See "India to add hundreds of EV charging stations along national highways" at https://www.weforum.org/agenda/2021/10/india-add-hundreds-ev-charging-stations-national-highways/

[47] Read "Centre sanctions Rs. 800 crores under FAME Scheme Phase II for 7432 public fast charging stations" at https://pib.gov.in/Pressreleaseshare.aspx?PRID=1911394.

[48] Read about "EV charging stations operational across the country" at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2003003



49

To promote the EV ecosystem in India, there is a need for (i) strong investments in the EV sector, from both public and private stakeholders, and (ii) a robust legal framework, and in particular, Government incentives, to support and amp up the charging infrastructure in the country.

However, there are several concerns with respect to EV Charging Station Infrastructure in India. According to a JMK Research and Climate Trends report, India needs around 39 lakh semi-public and public charging stations to cater to the charging needs of approximately 8 crore electric vehicles. As per the global

49

scenario in general, 1 charging station can cater to the charging needs of 6 to 20 electric vehicles. On the contrary, India has 1 charging station for around 135 electric vehicles, increasing the chance of the country achieving 40% less than its EV 2030 goals.[50]

D. Top EV Charging Station Companies in India

The list below provides an insight into the top players in the Indian market in EV Charging Infrastructure as of 2024:[51]

Company Name	Charging Infrastructure	Charging Solutions	Other Information
Tata Power	- Installed over 4,000 Public and Semi Public EZ CHARGE points across 450+ cities in India	- Provides AC and DC charging solutions - Tap and charge cards	- Provides charging solutions for 440+ e-buses charging points and over 61,000 home chargers
Charge Zone	- Over 1,750 charging stations and 3,500 charging points across India	- Offers a mix of AC and DC charging solutions	- Gujarat-based startup - Expecting exponential growth and seeking funding from top investment companies in 2024
Ather Energy	- Established over 550 fast-charging grids across 56 cities, creating one of the largest fast-charging networks for two-wheelers in India	- Provides fast-charging solutions specifically designed for two-wheelers	- Leading electric scooter manufacturer
Charzer	- Participated in the Indian government's pilot program to install charging stations in major cities	- Offers charging solutions for both two-wheelers and four-wheelers	- Presence in the early stages of EV infrastructure development

[50] Read "EV Charging Infrastructure in India: Current Scenario and the Road Ahead" at https://www.gridenpower.com/current-scenario-and-road-ahead-of-ev-charging-infrastructure-in-india.php

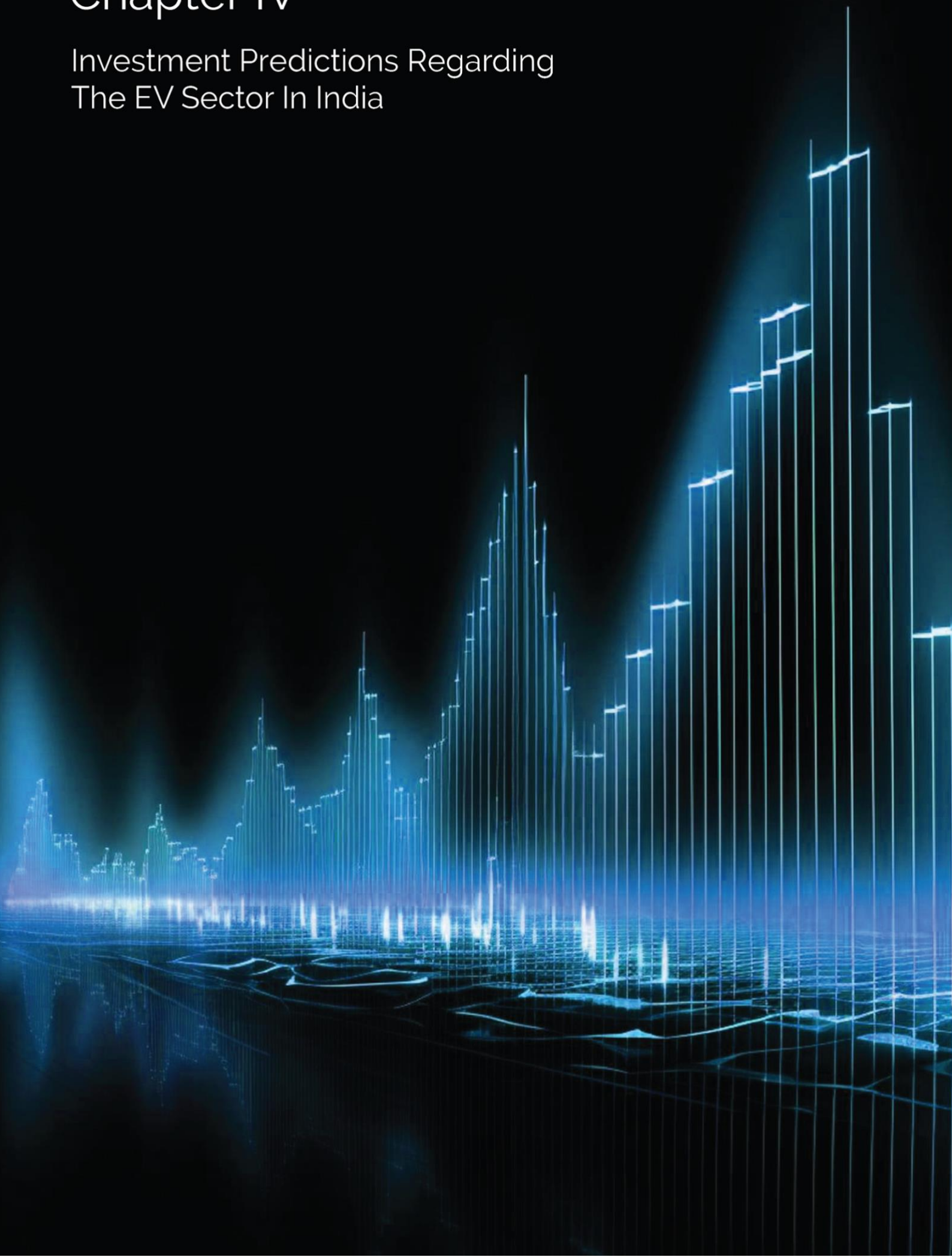
[51] Read "Top EV Charging Station Companies in India" at https://pulseenergy.io/blog/ev-charging-station-companies

Company Name	Charging Infrastructure	Charging Solutions	Other Information
Statiq	- Has a network of charging stations across India	- Provides complete EV charging solutions, including hardware, software, and cloud-based management platforms	- Caters to various applications, including residential, commercial, and public charging stations
ABB Ltd.	- Has installed charging stations in various locations across India	- Offers a range of EV charging solutions in India, including DC fast chargers suitable for highways and commercial areas	- Global leader in power and automation technologies - Contributes to the advancement of charging infrastructure technology
BrightBlu	- Operates a network of charging stations in Mumbai and other cities	- Offers integrated EV charging solutions, combining hardware like AC wall boxes with cloud-based services and support for both drivers and charging station owners	- Mumbai-based company founded in 2019 - Mission is to make EV charging easy and accessible
Delta Electronics Inc.	- Has supplied charging solutions to various EV charging networks in India	- Provides AC and DC chargers, along with energy-efficient power electronics solutions that can optimize charging station operations	- Taiwanese multinational electronics company
Ensto India Pvt. Ltd.	- Has installed charging stations for various clients across India	- Offers a comprehensive range of EV charging solutions in India, including AC and DC chargers, smart charging management systems, and installation services	- Caters to various applications, from residential to public charging infrastructure

Company Name	Charging Infrastructure	Charging Solutions	Other Information
Exicom Tele-Systems Ltd.	- Has supplied charging solutions to various EV charging networks in India	- Manufactures a variety of electrical products, including AC and DC EV chargers	- Indian company - Contributes to the growth of domestic EV infrastructure by providing charging solutions across the country
Fortum India Pvt. Ltd. (GLIDA)	- Operates a network of charging stations in India	- Offers various charging solutions, including AC and DC fast chargers	- Key player in India's EV charging sector - Caters to diverse needs like public charging stations and electric fleet management
Mass-Tech Controls Pvt Ltd.	- Has supplied charging solutions to various EV charging networks in India	- Offers AC and DC chargers along with cloud-based management systems	- Indian manufacturer of electric vehicle charging stations - Contributes to the development of EV charging infrastructure in India

Chapter IV

Investment Predictions Regarding The EV Sector In India



E. Investment Predictions Regarding the EV Sector in India

1. Public Sector Infrastructure

Government owned public sector oil marketing companies (**OMCs**) are responsible for the retail marketing and distribution of petroleum products under the administrative control of the Ministry of Petroleum and Natural Gas. Such companies are responsible for monitoring the pricing of petroleum products and subsidy related decisions. Such OMCs include companies such as Indian Oil Corporation Ltd. (**IOCL**), Hindustan Petroleum Corporation Ltd. (**HPCL**) and Bharat Petroleum Corporation Ltd. (**BPCL**). The OMCs have announced the setting up of 22,000 Charging Stations in prominent cities and on national highways across the country. Out of this, IOCL will install 10,000 Charging Stations, 7,000 will be installed by BPCL, and the rest of 5,000 will be installed by HPCL.

IOCL has already installed 439 Charging Stations and plans to install another 2,000 Charging Stations over the next year. BPCL has installed 52 Charging Stations, while HPCL has installed 382 EV Charging Stations.[52]

The Department of Heavy Industry, which is an executive agency of the Government of India concerned with the development of the Heavy Engineering and Machine Tools Industry, Heavy Electrical Engineering Industry and Automotive Industry, has recently sanctioned 1576 number of Public Charging Stations for 25 Highways and Expressways which shall be located within every 25 km of range on both sides of these expressways and highways.[53]

2. Private Sector Infrastructure

In the private sector, there are several key players who have made a global impact in this sector. Key players operating in India include Tata Power, Charge Zone, Jio BP, Statiq, GoEgo Network, EVRE, Electriva, Volttic. Among these players, Tata Power, Jio BP and Charge Zone operate on a pure play CPO model, while Statiq, EVRE and GoEgo also have in-house hardware designing/manufacturing capabilities.

In a market such as India, with dozens of EV OEMs coming up every year and incumbents also taking their place in the game, standardization charging infra will be key for widespread adoption.

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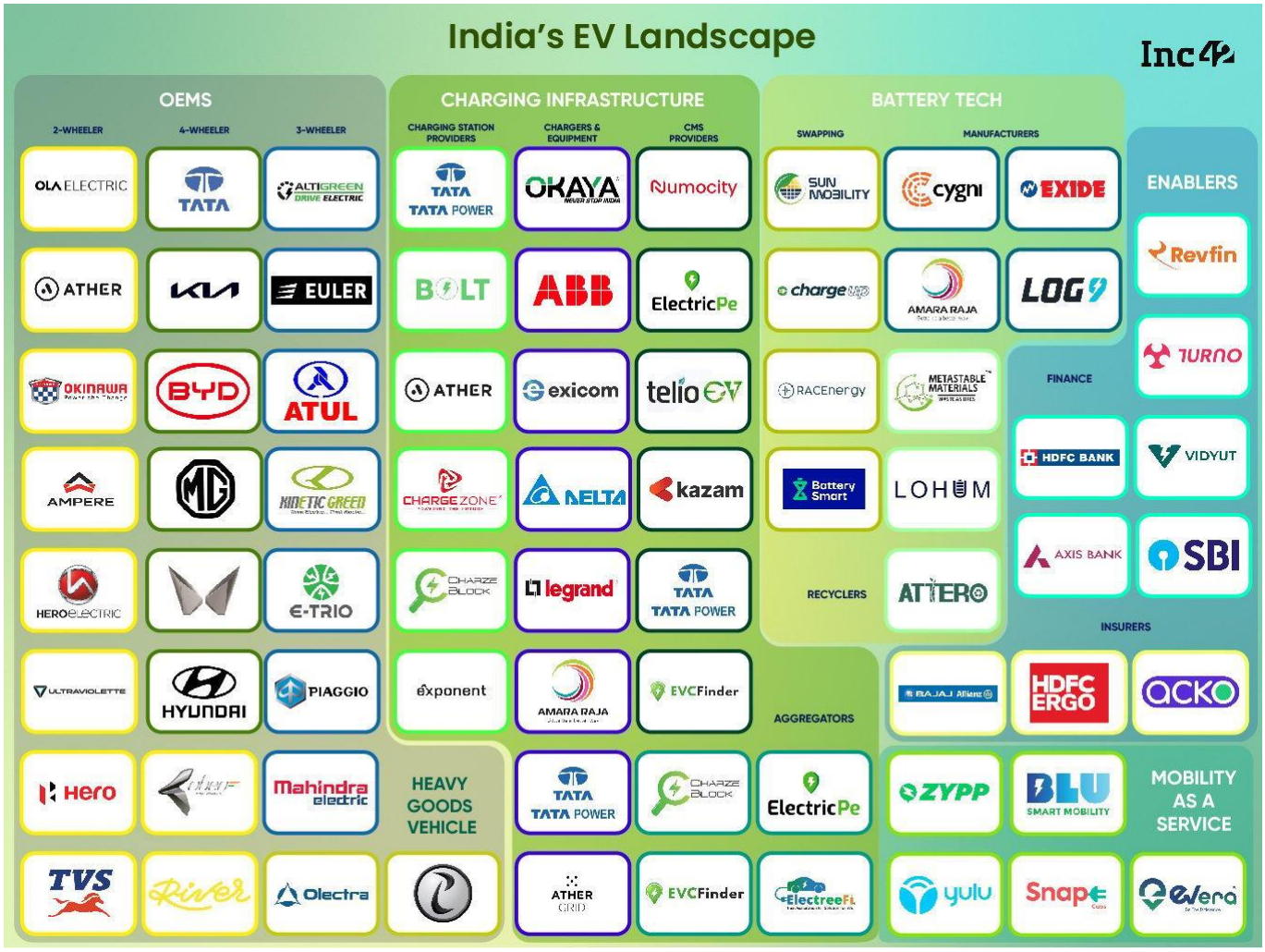
[52] See "Government of India to expand Public Electric Vehicle Charging Infrastructure across the nation" at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1799464

[53] See "Ministry of Heavy Industries sanctions 1576 EV Charging Stations across 16 Highways & 9 Expressways under Phase-II of FAME India Scheme" at https://pib.gov.in/Pressreleaseshare.aspx?PRID=1808115



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Ather Energy, which is arguably the frontrunner when it comes to the fast charging industry currently has more than 1,500 fast-charging points functioning across India. India's leading two-wheeler manufacturer Hero MotoCorp – which holds a significant stake in Ather – has also chosen this connector design for its fast-charging network and its maiden product, the Vida V1. Combined, Hero and Ather have the largest two-wheeler public charging network in the country. Ather Energy has received approval from the Bureau of Indian Standards (BIS) for its recently developed indigenous charging connector called the Light Electric Combined Charging System (LECCS). The LECCS can be used by two, three, and four-wheelers. Globally, this is the first-ever combined AC and DC charger, that has been developed in India.

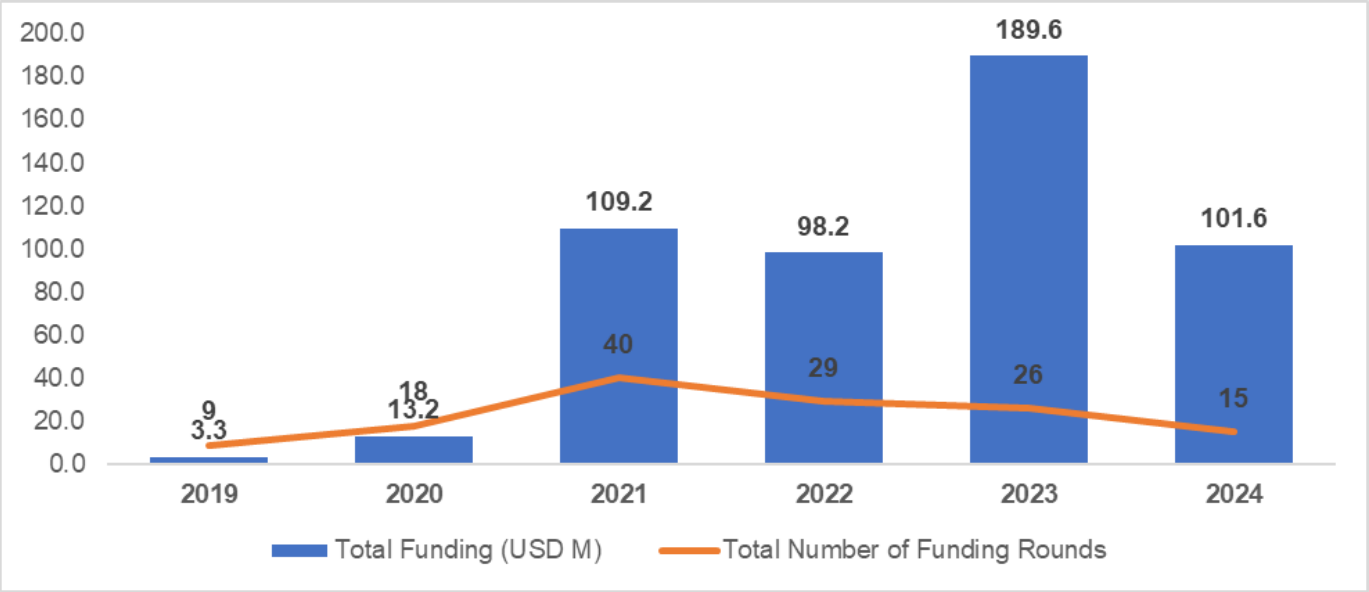
Therefore, in August 2021, Ather Energy announced that the company is opening up the patents for its proprietary fast charger for any OEM to use in their vehicles and chargers for free[55], which presented a unique opportunity to establish India's first charging standard for light EVs. Pursuant to this announcement, in October 2023, the Bureau of Indian Standards (BIS) recognised the country's first combined charging standard for light EVs. The new standard - IS17017 (Part 2 / Sec 7): 2023, is based on Ather Energy's charging connector, and is the world's first charging standard that combines AC and DC

[54] See "Revving Up For A Green Future: Mapping India's EV Landscape & Progress" at https://inc42.com/features/revving-up-for-a-green-future-mapping-india-ev-landscape-progress/

[55] Read about "Ather Energy opens its proprietary fast-charging connector for other OEMs to drive faster adoption of EVs" at https://press.atherenergy.com/wp-content/uploads/2021/10/20-Connector-Standard-10.08.2021.pdf

charging for small EVs, such as electric scooters, motorcycles, three-wheelers and quadricycles.[56] Such standards promote interoperability in the EV ecosystem.

Charging Infrastructure funding landscape in India



The charging infrastructure ecosystem is beginning to mature in India. Over the years the sector has grown to gain investor confidence. Cumulatively over the past five years (2020-2024), over 50 Indian startups have raised close to USD 511 million of capital in close to 128 funding rounds, as per data sourced from Tracxn.

The Indian private equity (PE) market is shifting gears towards a greener future, with electric vehicles (EVs) and charging infrastructure emerging as major investment drivers according to Bain & Company's 2024 India Private Equity Report. The report unveils a remarkable 20% year-on-year growth in PE investments directed towards the EV sector from 2021-2023.

This can be seen in the multiple rounds of capital that a few startups have managed to raise indicating growing conviction in the sector. Battery Smart has raised over $130M to data moving beyond the realm of traditional VCs to include investors such as Leapfrog Investments (private equity), MUFG (Bank), British International Investment (Development Finance Institution).

Established players like Tata Power, Reliance, ABB etc., have also committed to large-scale infrastructure development.

The sector has also witnessed a rise in innovative business models, including pay-per-use public charging and subscription-based services for fleets. Battery swapping networks gained traction for two- and three-wheelers, further expanding the ecosystem.

During this period, government initiatives such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME II) scheme and Production-Linked Incentives (PLI) played a key role in attracting

[56] Read about "BIS Approves Ather-Developed Connector as New Charging Standard for Light EVs In India" https://www.carandbike.com/news/bis-approves-atherdeveloped-connector-as-new-charging-standard-for-light-evs-in-india-3209794

investment. Additionally, various state governments such as Maharashtra, Gujarat, Karnatak etc have introduced EV policies offering subsidies and land support for charging stations, particularly in urban areas. Source

Despite this progress, challenges persist. The capital-intensive nature of building charging stations, land acquisition hurdles, grid reliability, and low EV penetration in rural areas remained roadblocks. However, the promise of a rapidly growing EV market, coupled with technological advances and declining battery costs, continues to attract investor interest.

Looking ahead, the EV charging infrastructure sector in India offers a lucrative opportunity, underpinned by favourable policies, improving economics, and the global shift toward decarbonization. With the rapid growth of infrastructure and having set standards in place, and increasing maturity of the sector, investors across stages are showing a strong interest in investing in this industry, for a promising future in sustainable transportation

Regulatory Incentives provided to Entities Operating in the EV Sector

	India	California	UK	Singapore
Funding	**Faster Adoption and Manufacturing of Hybrid and Electric Vehicles Scheme (FAME II)**[57] - provides financial incentives for the deployment of EV charging infrastructure worth INR 10,000 crores (approximately 1.4 billion USD) over a period of three years, starting from 2019, and which has been extended to March 2024.[58]	**CEC funding -** the California Energy Commission (CEC) approving a significant $3 billion in funding for charging infrastructure.[59]		
Development	**Green Energy Corridor Scheme**[60] - focuses on	**The California Electric Vehicle Infrastructure Project**	**The On-Street Residential Chargepoint Scheme (ORCS)**[63] - is	

[57] See "National Level Policy" NATIONAL LEVEL POLICY (niti.gov.in)

[58] Read about "Govt extends Fame Scheme till 2024" https://www.livemint.com/news/india/govt-extends-fame-scheme-to-promote-electric-mobility-till-2024-11624688932461.html

[59] See "California EV Charging Station Incentives" at https://www.oodlesenergy.com/blog/california-ev-charging-station-incentives-oodles-energy

[60] See "Green Energy Corridor Overview" https://mnre.gov.in/green-energy-corridor-0verview/

[63] See "2024 Guide to Electric Vehicle Charging Grants & Incentives" at https://uk.mer.eco/news/government-guide-incentives-grants-for-evs/#:~:text=EV%20chargepoint%20grant,-This%20grant%20started&text=The%20grant%20can%20be%20used,a%20year%20for%20residential%20properties

	India	California	UK	Singapore
	developing transmission infrastructure dedicated to renewable energy, aiming to minimize transmission losses and facilitate the integration of renewable energy into the grid. The scheme also contributes to the growth of Charging Station infrastructure by expanding transmission lines, particularly in energy-deficient regions, and includes proposals like Himachal Pradesh's Green Corridors Highways to support charging stations along major routes.[61]	**(CALeVIP)[62]** - an umbrella organization for dozens of different rebate programs that may be available to an entity, depending on their location, business, and other factors.	with specific reference to public charging infrastructure. It offers funding for the capital costs of installing public charging infrastructure – both on-street and in local authority-owned residential car parks. The scheme offers funding for 60% of the capital costs involved in procuring and installing on-street electric car charge points and dedicated parking bays, up to a value of £7,500.	
Loans	All UDYAM-registered MSME customers seeking to set up EV Charging Stations can avail a loan of	**California Energy Commission (CEC) Electric Vehicle Supply Equipment (EVSE) Financing Program** - to ensure low-interest loans for EVSE		

[61] Read about "Govt extends Fame Scheme till 2024" https://www.livemint.com/news/india/govt-extends-fame-scheme-to-promote-electric-mobility-till-2024-11624688932461.html

[62] See "EV Charging in California" at https://www.evconnect.com/california

	India	California	UK	Singapore
	up to INR 30 crore.[64]	installations, at all eligible locations throughout the state. The loan coverage can range up to 100% of the total cost of the charging station including its installation charges. Repayment terms range from three to seven years.		
Cost Rebates		**1. Charge Ready Program** - provides rebates of up to 100% of the total cost for eligible applicants to install EV charging infrastructure at commercial, industrial, and public locations. **2. Clean Vehicle Rebate Project (CVRP) -** While primary focus is on vehicle rebates, it also provides incentives for EV charging infrastructure installations. Eligible applicants can receive up to $70,000 per site for the	**1. EV chargepoint grant** - gives financial support to landlords who are considering buying and installing EV charge points at residential or commercial properties in the UK. The grant can be used across a number of properties or for just one property. Under this grant, landlords can receive: • up to 75% of the cost towards the purchase and installation of a charge point socket, limited to £350 per grant. • up to 200 grants a year for residential properties	Singapore's Ministry of Transport aims to deploy 60,000 EV charging points across Singapore by 2030, comprising 40,000 in public carparks and 20,000 in private premises. The aim is to ensure that every Housing & Development Board (**HDB**) town will be EV ready by 2025, with close to 2,000 HDB carparks to be fitted with EV charging points. It is towards the fulfilment of this purpose that the government has

[64] https://economictimes.indiatimes.com/industry/renewables/tata-power-solar-systems-partners-with-bank-of-india-for-solar-ev-charging-station-financing/articleshow/112034427.cms?from=mdr

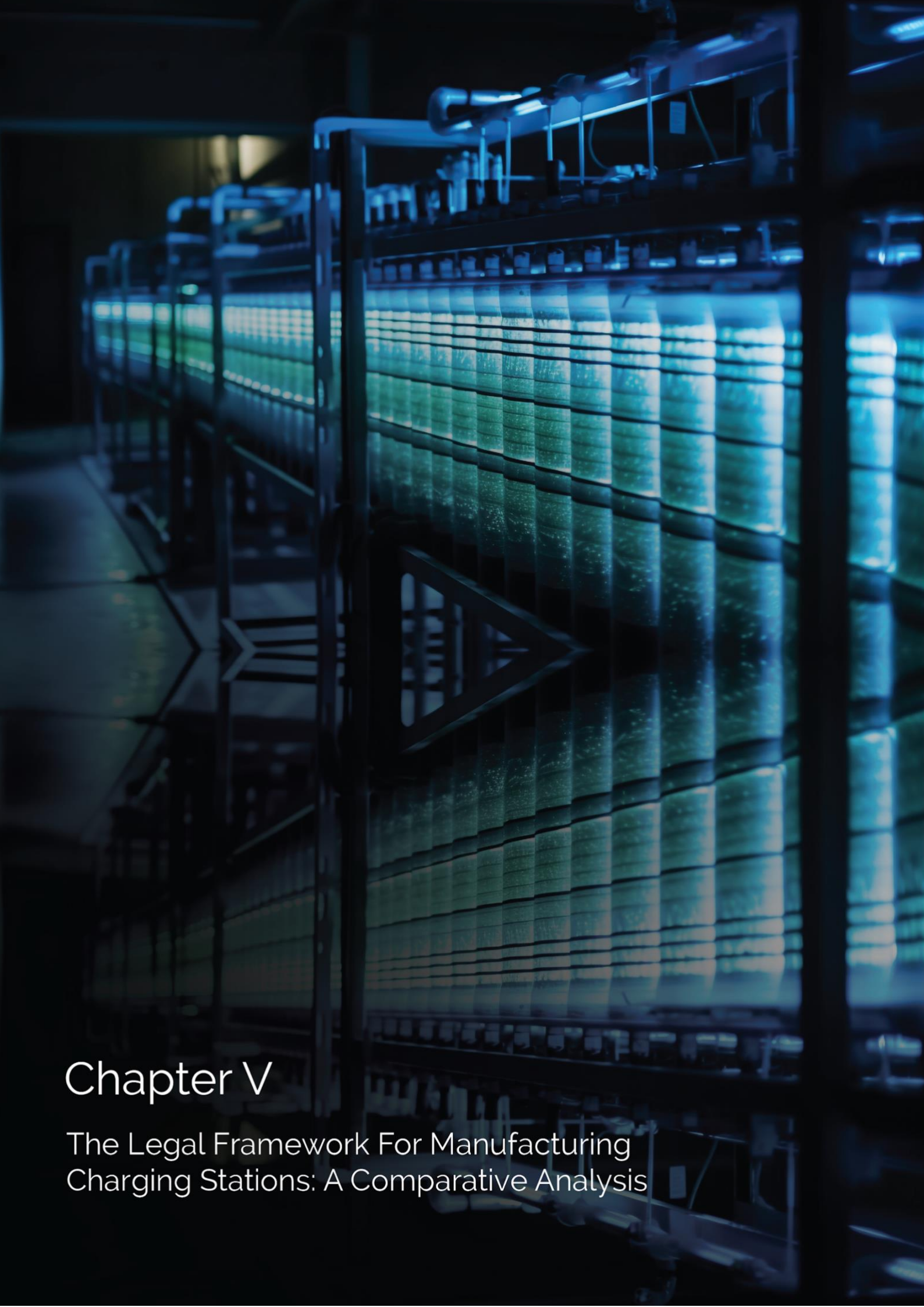
	India	California	UK	Singapore
		installation of Level 2 or DC fast charging stations. However, the amount of the rebate depends on the station's power output and the location of the site. The rebate is limited to a maximum of 50% of the total cost of the EV charging station, and the remaining cost must be paid by the applicant**.**	• a further 100 grants for commercial properties. **2. EV infrastructure grant -** offers landlords money off the building and installation costs associated with installing multiple charge point sockets, such as wiring and posts. Under this grant, the landlords can receive: • Up to £30,000 or 75% off the cost of the work. The amount the landlord is eligible for will depend on how many parking spaces the work covers. • Up to 30 infrastructure grants per financial year. **3. The Workplace Chargin Scheme (WCS) -** provides financial support to businesses towards the cost of purchasing and installing workplace charge points. It was	introduced the EV Common Charger Grant.[65] The Land Transport Authority has launched the Electric Vehicle Common Charger Grant (**ECCG**) to kickstart the installation of shared charging infrastructure in non-landed private residences (**NLPRs**). The ECCG will co-fund installation costs of 2,000 EV chargers at NLPRs, as an early adoption incentive. As NLPRs form a significant proportion of residences in Singapore, improving charger provision and access is an important step towards improving the coverage of Singapore's national EV charging network.

[65] Read about this at https://www.mot.gov.sg/what-we-do/green-transport/electric-vehicles

	India	California	UK	Singapore
			opened up to SMEs, small accommodation businesses, commercial landlords and charities. The scheme allows for up to £350 per charging socket (maximum of 40 sockets) up to a value of £14,000. The scheme covers up to 75% of the costs of the purchase and installation of EV charge points (including VAT), to a maximum of: • £350 per socket • 40 sockets across all sites per applicant.	
Tax Reductions	During the 36th GST Council meeting held in 2019, it was resolved to decrease the GST rate on EV's from 12% to 5% and on Charging Stations from 18% to 5% to foster growth in the EV market.			

The table above highlights the regulations and schemes that have been introduced by the governments of India, California, Singapore and the UK. On a comparative analysis, the Indian Government has not yet provided the same cost rebates or loan structures as can be seen in the other jurisdictions. While

the Government has announced its decision to provided loans with minimal interest with regards to MSME customers setting up Charging Stations, it is equally important to have such schemes in regard to the development and operation of the Charging Station infrastructure. Cost rebates are also an important method which could be implemented to make the construction of charging station infrastructure affordable. The implementation of such programs and schemes very clearly has a positive impact - it allows for commercial charging stations to be opened without facing financial pressure.



Chapter V

The Legal Framework For Manufacturing Charging Stations: A Comparative Analysis

A. The Indian Legal Framework

The Indian Motor Vehicles Act, 1988[66], read with the Central Motor Vehicle Rules, 1989 (Rules)[67], issued by the Ministry of Road Transport and Highways, regulates motor vehicles along with all infrastructure with respect to motor vehicles. In relation to the policy-making and regulatory authorities, the following Government authorities are responsible for issuing and implementing standards and regulations to govern Charging Stations[68]:

1. **The Ministry of Power**: Issued the Guidelines for Installation and Operation of Electric Vehicle Charging Infrastructure – 2024, which are consolidated guidelines for installing and operating Charging Stations.

2. **The Central Electricity Authority (CEA)**: The CEA, which is constituted under the Electricity Act, 2003[69], implements technical standards and regulations of Charging Stations, and in particular, the CEA is responsible for implementing standards related to safety of power grid.

3. **The State Electrical Regulatory Commissions**: set up under the Electricity Act, 2003, sets the applicable EV tariff and other regulations concerning electricity supply for EV charging at the Charging Stations.

4. **Bureau of Indian Standards (BIS):** is the national governing body for EVs and Charging Stations, and is responsible for formulating the following EV charging standards in India (*see below*). Pursuant to Rule 124 of the Central Motor Vehicle Rules, 1989 read with Section 10 the BIS Act, 2016[70], adherence to the technical regulations and Indian Standards issued by BIS for Charging Stations is mandatory.

5. **Automotive Research Association of India (ARAI)**: formed by the Ministry of Heavy Industries, the ARAI has issued the Automative Industry Standards – 138 which sets out the charging requirements for AC and DC Charging Stations[71].

[66] Refer to "Motor Vehicles Act, 1988" at https://www.indiacode.nic.in/bitstream/123456789/9460/1/a1988-59.pdf.
[67] Refer to "Motor Vehicles Rules, 1989" at https://morth.nic.in/central-motor-vehicles-rules-1989-1.
[68] Read about "Electric Vehicle Charging Infrastructure Implementation" at https://www.niti.gov.in/sites/default/files/2021-08/HandbookforEVChargingInfrastructureImplementation081221.pdf
[69] Refer to the Electricity Act, 2003 a https://cercind.gov.in/Act-with-amendment.pdf.
[70] Refer to BIS Standards at https://bis.gov.in/wp-content/uploads/2020/12/BIS-Act-2016-Bilingual.pdf
[71] Read on "Automotive Research Association of India (ARAI)" at https://e-amrit.niti.gov.in/arai-standard#:~:text=These%20standards%20are%20marked%20as,and%20off%2Droad%20industrial%20vehicles.

An overview of the Indian regulatory framework on Charging Stations is set out in the table below:

Sl. No.	Relevant Standard	Scope of the Standard
1.	IS 17017:2018 - **Electric vehicle charging infrastructure**	This standard is applicable to Charging Stations which have a rated supply voltage up to 1000 V AC or up to 1500 V DC and a rated output voltage up to 1000 V AC or up to 1500 V DC.
2.	IS 17017: Part 21: Sec 1 **: 2019/IEC 61851-21-1 Electric Vehicle Conductive Charging System Part 21 Electromagnetic Compatibility (EMC) Requirements Section 1 On-board chargers**	Prescribes the requirements for the conductive connection of an EV to an AC or DC supply. It applies only to onboard charging units either tested on the complete vehicle or tested on the charging system component level (ESA - electronic subassembly).
3.	IS 17017: Part 21: Sec 2: 2019 **Electric Vehicle Conductive Charging System Part 21 Electromagnetic Compatibility (EMC) Requirements Section 2 Off-board chargers**	Defines the EMC requirements for any off-board components or equipment of such systems used to supply or charge EV's with electric power by conductive power transfer (CPT), with a rated input voltage, according to IEC 60038:2009, up to 1000 V AC or 1 500 V DC and an output voltage up.
4.	IS 17017: Part 22: Sec 1 : 2021 **Electric Vehicle Conductive Charging Systems - Part 22 AC Charging Configurations - Section 1 AC charge point for light electric vehicle**	This is applicable to Light EV AC Charge Point (LEV AC Charge Point), which is a basic conductive AC charging option for charging light electric road vehicles with a rated supply voltage 240 V AC and current up to 16A AC.
5.	IS 17036:2018 - **AC Charging Stations for EVs**	This standard specifies the key characteristics of voltage in a network user's (i.e., an entity, being supplied by or supplying to an electricity supply distribution network) supply terminal within the distribution system being utilized.
6.	IS 17036:2018 - **17017 Part 23**	This standard specifically caters to DC Charging Stations with power outputs between 50kw to 200kw.
7.	AIS-138 Part 1 **and** Part 2**- Electric Vehicle Conductive AC and DC Charging System**	Part 1 sets out the charging requirements for AC charging.

Sl. No.	Relevant Standard	Scope of the Standard
		Part 2 specifies the charging requirements for DC charging for all electric vehicles (including two/three and four wheelers), excluding trolley buses, rail vehicles and off-road industrial vehicles.
Operating a Charging Stations: General Requirements		
1.	IS 17017:2018 Part 2 Section 1 **Part 2-Plugs, Socket-Outlets, Vehicle Connectors, and Vehicle Inlets** **Section 1- General requirements**	Applies to EV accessories including plugs, socket-outlets, vehicle connectors, and vehicle inlets. To be used in conductive charging systems with a rated operated voltage not exceeding more than 690 V AC 50 Hz, at a rated current not exceeding 250 A, and 1 500 V DC at a rated current not exceeding 200 A.
2.	IS 17017:2020 Part 2 Section 2- **Electric Vehicle Conductive Charging System - Part 2 Plugs, Socket- Outlets, Vehicle Connectors and Vehicle Inlets - Section 2 Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories**	Covers requirements of plugs, socket-outlets, vehicle connectors and vehicle inlets with pins and contact-tubes, where the nominal rated voltage should not exceed 415 V AC, 50 Hz and a rated current should not exceed 63 A three-phase or 70 A single phase, for use in conductive charging of EVs.
3.	IS 17017:2020 Part 2 Section 3- **Electric Vehicle Conductive Charging System Part 2 Plugs, Socket-Outlets, Vehicle Connectors and Vehicle Inlets - Section 3 Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers.**	Applicable to vehicle couplers with pins and contact-tubes of standardized configuration that are intended for use in EV conductive charging systems which incorporate control means, with rated operating voltage up to 1 500 V DC and rated current up to 250 A, and 1 000 V AC and rated current up to 250 A.
4.	IS 17017:2021 Part 2 Section 6- **Electric Vehicle Conductive Charging System Part 2 Plugs, Socket - Outlets, Vehicle Connectors and Vehicle Inlets Section 6 Dimensional compatibility requirements for DC pin and contact -**	To be used for vehicle couplers with pins and contact-tubes of standardized configuration intended for use in EV conductive charging systems which incorporate control means, with rated operating voltage up to 120 V DC and rated current up to 100 A.

Sl. No.	Relevant Standard	Scope of the Standard
	tube vehicle couplers intended to be used for DC EV supply equipment where protection relies on electrical separation	

The above-mentioned standards are mandatorily required to be adhered to by Charging Station manufacturers and operators. As per Section 177 of the Motor Vehicles Act, 1988, any entity that is in breach of these standards shall be liable to pay a fine of INR 500/- for the first offense, and for any second or subsequent offence, with fine which may extend to INR 1,500/.

These above-mentioned standards are part of the Government's effort to establish a framework for the development and operations of the EV charging infrastructure in India. As the EV sector continues to grow, new standards and regulations will need to be introduced to address emerging technologies and challenges.

B. A Comparative Analysis: The Legal Framework in Singapore, California and United Kingdom

In this Section, we have analysed the regulations on Charging Stations in California, Singapore and the United Kingdom, and compared them with India's current regulatory framework. The reason that these jurisdictions in particular were chosen, are because (i) in **California,** which has the highest EV penetration in the United States of America, with more than 44,612 public and private Charging Stations are installed in the State, out of the total 138,23 Charging Stations in the United States of America; (ii) **Singapore** has set a goal to deploy more than 60,000 Charging Stations in its national EV charger network by the year 2030, and as per the Ministry of Transport, Singapore, all vehicles are set to run on cleaner energy by the year 204; and (iii) in the **United Kingdom (UK)**, more than 53,906 Charging Stations were installed across 31,056 different locations in the UK, which is a 45% increase in the total number of Charging Stations in the UK since 2022.

In selecting Singapore, California, and the UK as focal points for our comparative analysis of the legal framework on Charging Station, we strategically identified jurisdictions where (i) the EV and Charging Station infrastructure is burgeoning, (ii) Governmental support for promoting Charging Station infrastructure is robust, and (iii) the ease of access to publicly available information on the legal framework governing Charging Stations in these jurisdictions.

	California	Singapore	United Kingdom
Authority	● California State Legislature; ● California Air Resources Board; and ● The California Public Utility Commission.	The Singapore Land Transport Authority.[72]	● Department for Transport and Department for Energy Security and Net Zero; and ● Office for Zero Emission Vehicles[73].
Applicable Law	AB 1236 (2015)[74]; and AB 970 (2021)[75]. These are codified in Government Code Sections 65850.7 and 65850.71, respectively.	● The Electric Vehicles Charging Act, 2022 (**ECVA**)[76]; ● Electric Vehicles Charging (Electric Vehicle Chargers) Regulations 2023 (**ECVR**); and ● Technical Reference 25.[77]	● Residential chargepoints: minimum technical specification[78]; ● Commercial chargepoints: minimum technical specification[79]; and ● The Public Charge Point Regulations 2023 (**PCPR**)[80].
Key Compliance Requirements	● **Scope**: applies to all Charging Stations, including: Level 1, Level 2, and DC fast charging; public and private Charging Stations; light-, medium-, and heavy-duty electric vehicle Charging Stations; and Charging Stations that are installed as the accessory or primary use of a site. ● **Streamlined Process**: All cities and counties are required to streamline	● **Charging Station Specifications:** As per the EVCA, manufacturers need to ensure that their Charging Stations comply with the safety and performance standards prescribed in Technical Reference 25 and EVCR. ● **License:** The Electric Vehicles Charging	● **Residential Chargpoints:** the guidelines set out the specifications and technical requirements for electric and plug-in hybrid electric road vehicle conductive charging equipment, which are for residential use. ● **Commercial Chargepoints:** the guidelines set out the specifications and technical requirements for electric and plug-in hybrid electric road vehicle conductive charging equipment, which are for commercial use.

[72] Read "Regulatory, Contractual, and Liability Issues relating to Electric Vehicles Charging Points in Singapore" at https://www.twobirds.com/en/insights/2024/singapore/regulatory-contractual-and-liability-relating-to-ev-charging-points#:~:text=EV%20Charger%20Suppliers&text=Chargers%20must%20be%20type%2Dapproved,the%20EV%20charger(s).

[73] https://www.gov.uk/government/organisations/office-for-zero-emission-vehicles

[74] See "Assembly Bill No. 1236" at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1236

[75] See "Assembly Bill No. 970" at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB970

[76] See "Electric Vehicles Charging Act, 2022" at https://sso.agc.gov.sg/Act/EVCA2022?WholeDoc=1#pr24-#pr24-

[77] See "TR 25-1:2022" at https://www.singaporestandardseshop.sg/Product/SSPdtDetail/a0b2ab60-f613-4cf4-9c11-82235c8a090a

[78] See "Residential chargepoints: minimum technical specification" at https://www.gov.uk/guidance/residential-chargepoints-minimum-technical-specification

[79] See "Commercial chargepoints: minimum technical specification" at https://www.gov.uk/guidance/commercial-chargepoints-minimum-technical-specification

[80] See "The Public Charge Point Regulations 2023" at https://www.legislation.gov.uk/ukdsi/2023/9780348249873

	California	Singapore	United Kingdom
	permitting processes for manufacturing and installing Charging Stations by limiting project review to health and safety requirements in an expedited timeframe. ● **Checklist**: There is flexibility for the city and county authorities to determine how to develop a permitting checklist. based on their permitting process, keeping in mind the AB 970 timelines and requirements of AB 1236 (*refer to image below*).	Act, 2022, establishes a licensing regime for EV charging operators, requiring them to obtain a license to provide services, such as hiring out fixed EV chargers, offering battery swapping services, or renting out non-fixed EV chargers. The Land Transport Authority ("**LTA**") considers factors such as the number of Charging Stations operated and the safety of equipment when granting licenses, which are valid for three years.	● **Public Chargepoints:** the Secretary of State, under its powers conferred under the Automated and Electric Vehicles Act 2018, enacted the PCPR. This regulation has four key compliance requirements – ○ consumers can easily locate the right public charge points for their EVs, ○ ease of payment across public Charging Points, ○ consumers can be confident that public Charging Point will be in good working order, and ○ consumers are able to compare prices across multiple public Charging Point networks.
Penalty	Under AB 970's "deemed approved" process, a jurisdiction may lose its discretion to consider and modify a Charging Station project if it does not meet the statutory review timelines for permit application completeness and approval/denial[81].	First-time offenders found guilty of charging an EV with an unregistered EV charger may be liable to a fine of upto $10,000 and/or imprisonment for a term of up to 6 months.	Public Charging Stations must comply with the PCPR, failure of which attracts a fine up to £10,000. Further, manufacturers need to ensure that residential and commercial charge points adhere to the specifications set out in the guidelines, in order to apply for authorization.

[81] See "AB 1236 and AB 970: Ordinance and Checklist" at https://business.ca.gov/industries/zero-emission-vehicles/plug-in-readiness/frequently-asked-questions/

Chapter VI

The Legal Framework For Setting Up Charging Stations

In this Chapter, we have provided an overview to understand how Charging Stations are typically set up in India, and the compliance requirements to do so. These regulations extend to permissions required for land use, electricity power supply connections, and licenses for safety hazards.

To set up a Charging Station India, the following permissions are required:

1. **Land Use Permissions:** Obtain necessary land use permissions from local authorities for the installation of charging infrastructure, which involves:

    - Applying for a Trade License from the respective Municipal Authority in the area under the relevant state Municipal Corporation Act for use of land for certain purposes, 30 days before commencement of such use under respective state law;
    - Ensuring that the land is meant for commercial use; and
    - Payment of tax as per state Municipalities Act, based on the area of the land and the land value assessment.

2. **Power Supply Connection:** Coordinate with the local electricity distribution company for the power supply connection. Ensure that the electricity infrastructure can support the Charging Station's power requirements. The owners must also:

    - Apply for electricity connection in accordance with Rule 4(11) of Electricity (Rights of Consumers) Rules 2020, by complying with the application procedure under the Technical Standards for Connectivity of the Distributed Generation Resources 2019. The distribution licensee must provide the required connection according to the following timelines specified under Electricity (Rights of Consumers) Rules, 2020 as amended from time to time:

Sl. No.	Area Type	Maximum time period within which distribution licensee shall provide new connection
1.	Metropolitan Area	3 days
2.	Other Municipal Area	7 days
3.	Rural Area	15 days
4.	Rural Area having hilly terrain	30 days
5.	If extension of distribution mains, or commissioning of new substations is required	90 days

    - Refer to Regulation 117 under the Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2010.
    - A sample application form for a state power supply connection is provided here.

3. **Permissions and Approvals:** Obtain necessary approvals and permissions from regulatory authorities, municipal corporations, and other relevant bodies including registration and payment of fees under relevant state Shops and Establishments Act which must be done prior to opening the business. The rules and compliances are listed below:

Sl. No.	Applicable Law	Approvals / Permits Required
1.	**Electricity (Rights of Consumers) Rules 2020**	**Rule 4(11)** Apply for electricity connection by complying with the application procedure under the Technical Standards for Connectivity of the Distributed Generation Resources 2019. If an approval is required from the local state Electrical Inspectorate, inspection will be undertaken to determine the requirements that are satisfied.
2.	**Shops and Establishments Act (S&E)**	Apply for a registration certificate from the appropriate labour inspector within 30 days from which the Charging Station was established.
3.	**Manufacture, Storage and import of Hazardous Chemical Rules, 1989 ("MSIC Rules")**	**Rule 4, Rule 7 and Rule 10** In the event that the owner/operator intends on storing any hazardous or flammable substances at the Charging Station premises, they will need to comply with the requirements of the MSIC Rules. The entity that occupies the premises where the flammable/hazardous liquid is being stored bears the responsibility to identify and prevent major accidents at the sites, provide necessary safety equipment, obtain approval from the Central Pollution Control Board / State Pollution Control Board regarding on site storage of substances.

4. **Metering and Billing Systems:** Install metering and billing systems for accurate measurement of electricity consumed by EVs. Implement a transparent billing mechanism for users.

5. **Network Connectivity:** Establish network connectivity for monitoring and managing Charging Stations remotely. This may include real-time monitoring of charging status, payment systems, and software updates.

6. **Payment Infrastructure:** Implement a secure and user-friendly payment infrastructure to facilitate transactions. This may include mobile apps, RFID cards, or other payment methods.

7. **Safety Measures:** Implement safety measures to prevent electrical hazards and ensure the well-being of users. This includes safety signage, emergency shutdown procedures, and compliance with electrical safety norms.

8. **Grid Connectivity and Upgradation:** Assess the grid connectivity and potential need for grid upgradation to accommodate the additional load from the charging station.

9. **Functionality and user experience:** This is to be in the manner set out in the 2024 Guidelines for Installation and Operation of Electric Vehicle Charging Infrastructure. Requirements include having a well-lit charging station, with sufficient space for vehicle manoeuvring, and security infrastructure such as security cameras.

As India moves ahead in its journey towards 100% electrification of vehicles by 2030, the Ministry of Power has emphasized on the need for accessibility and ease of setting up of Charging Stations in India. The Government of India has actively worked towards this goal by providing subsidies and tax benefits to Charging Station owners - while the average cost for setting up a public Charging Station in India, including land, equipment, installation, maintenance and electricity, varies from INR 10 lakh to INR 50 lakhs, this cost can certainly be reduced by utilizing the Government incentives and subsidies. Moreover, India has seen a massive surge in its ease of doing business rankings as per the World Bank Report 2020. India has gone from rank 142 in 2014 to 63 in 2020 which is a remarkable show of resolve to enhance business undertaking especially for foreign investors. Particularly, the ease of accessing electricity in India has gone from rank 137 in 2014 to 22 in 2019. More importantly, given that unlike in California and Singapore, there is no requirement to have specific licenses for setting up Charging Stations, this encourages individuals and organizations to set up Charging Stations with ease.

The Government has also taken proactive steps to speed up the process of setting up charging stations. The 2024 Guidelines for Installation and Operation of Electric Vehicle Charging Infrastructure stipulate that in case of delay in supplying electricity within the period specified, distribution licensees shall be liable for a penalty as may be determined by the Commission as per Electricity (Rights of Consumers) Rules, 2020 as amended from time to time. Distribution licensees are also required to establish a customer friendly online single window clearance system, following the Standard Operating Procedure and application form outlined in ANNEXURE – III of the Guidelines.

End of Life Treatment of Charging Stations

In India, the E-Waste (Management) Rules, 2022 ("**EWMR**")[82] and the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 ("**HOWMTR**")[83], which have been issued by the Ministry of Environment, Forest and Climate Change under the Environment Protection Act, 1986, govern the end-of-life treatment of Charging Stations.

E-Waste (Management) Rules, 2022	
Particulars	**Compliance Requirement**
Registrations	• All manufacturers, producers, refurbisher and recyclers of electrical and electronic equipment are required to register on the online portal.

[82] See the 'E-Waste (Management) Rules, 2022' at https://cpcb.nic.in/uploads/Projects/E-Waste/e-waste_rules_2022.pdf
[83] See "Hazardous and Other Waste Rules" at https://cpcb.nic.in/displaypdf.php?id=aHdtZC9IV01fUnVsZXNfMjAxNi5wZGY=

	• All entities that are registered shall not deal with any unregistered manufacturer, producer, recycler and refurbisher.
Responsibilities of the manufacturer	• All manufacturers must collect e-waste generated during the manufacture of any electrical and electronic equipment and ensure its recycling or disposal. • Every manufacturer and producer must store e-waste for less than 180 days. • Every manufacturer and producer have to maintain a record of collection, sale, transfer and storage of wastes and make these records available for inspection.
Responsibilities of the Producer	• Every producer must obtain and implement the extended producer responsibility targets set out in Schedule-III and Schedule-IV of the EWMR.
Responsibilities of a Refurbisher	• Refurbishers must collect e-waste generated during the process of refurbishing and hand over the waste to registered recycler.
Transportation of e-waste	• Transportation of waste generated from manufacturing or recycling destined for final disposal to a treatment, storage and disposal facility must be done in accordance with the HOWMTR.
Responsibilities of a Recycler	• Recyclers must ensure that the facility and recycling processes are in line with the standards prescribed by the Central Pollution Control Board. • Recyclers need to ensure that residue generated during recycling process is disposed of in an authorised treatment storage disposal facility.
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	
Key Compliance Requirements	• Hazardous waste that is generated through the use of chemicals and flammable liquids in a Charging Station must be treated appropriately after certification by the State Pollution Control Board. • The responsibility is on the owner of the Charging Station to ensure that there is adequate permission received to conduct operations and ensure an efficient disposal of liquids or hazardous waste that is processed.

Penalty: If any entity violates the E-Waste Rules or the HOWMTR, then as per the Environmental Protection Act, 1986, such entity / individual responsible, may be liable for imprisonment for upto 5 years or to a fine which may extend to INR 1 lakhs only, or with both. With these laws in place, there is an

obligation on Charging Station manufacturers and operators to create a sustainable value chain for the Charging Stations. There is the added responsibility of ensuring that the Charging Stations are sold to refurbishers or recyclers, to ensure that the waste material can be repurposed, reused or recycled.

Chapter VII

Enhancing India's EV Charging Ecosystem: Six Suggestions For Reform

The Report has detailed the compliance requirements to manufacturing and setting up a Charging Stations, and providing a comparative analysis of the regulatory framework governing Charging Stations in India, Singapore, UK and California. Having understood these elements, we now conclude with providing our key takeaways in the form of the following suggestions to the Indian Ministry of Road Transport and Highways and the Bureau of Indian Standards, to advance the Charging Station market in India.

1. Regulations and Policies with respect to Fire Safety

While the Mumbai Fire Brigade is in the process of framing a new policy for fire safety purposes at Charging Stations, and except for broadly worded safety guidelines[84], India currently does not have any regulations or guidelines with respect to fire safety of Charging Stations. Given that there have been several instances in the past where there have been fire breakouts at Charging Stations, the Bureau of Indian Standards must focus on implementing regulations to prevent such incidents in the future.

One reason that Charging Stations have caught fire is due to overheating of the Charging Station. While Charging Station manufacturers are always aiming to reduce the charging time for EVs, this in turn leads to overheating of the Charging Station. The high power (kW) which is typically used to support fast charging generates more heat.

One recommendation is to mandate that Charging Station operators / owners conduct a fire-safety audit from time to time to (a) detect if there is any defect / malfunctioning of the Charging Station that may lead to a fire outbreak, or (b) in the event that a fire outbreak has already occurred, to identify the root cause of the fire outbreak. Another recommendation is to mandate that all Charging Stations must have adequate technological infrastructure in place to ensure that Charging Stations can only operate within the ideal temperature range of -30°C to +50°C and within a relative humidity range of 5% to 95%.

The Indian Ministry of Road Transport and Highways and the Bureau of Indian Standards may also consider the approach adopted in Singapore, where the Singapore Civil Defense Force's Fire Code requires an emergency isolation shut off switch to be installed within 15 metres of the Charging Station, to turn off the main supply of electricity in the event of a fire.

2. Streamlined Registration Process

Currently in India, a Charging Station owner / operator requires various registrations from different Governmental authorities for setting up a Charging Station, including the S&E registration, a trade license, GST registration, and applications for obtaining electricity connection.

In our view, to further ease the process of setting up Charging Stations and promote more individuals and entities to set up Charging Stations, we recommend that each State Government constitute a nodal authority in their respective States, to oversee this entire process of setting up a Charging Station. Individuals and/or entities may obtain all the relevant land, electricity and tax related registrations/licenses/approvals from this nodal authority, in one single streamlined process. While the charging station guidelines of 2024 do place a mandate on DISCOMs to establish a customer-friendly online single window clearance system for procurement of electricity connection, in our view, the

[84] The 2024 Guidelines for Installation and Operation of Electric Vehicle Charging Infrastructure stipulate that reliable wiring needs to be used and that adequate fire protection and facilities are to be made available at the charging station.

mandate needs to go beyond this, such that all licenses and registrations for setting up and operating a Charging Station can be procured in one go.

Additionally, many Charging Station owners in India have sought clarity on whether a registration is required under the relevant State Shops and Establishments Act ("**S&E Act**"), for Charging Stations that have a 'self-service' model; i.e., for unmanned Charging Stations, where EV owners themselves charge their EVs at the Charging Station.

In order for the S&E Act to apply to Charging Stations, it must be considered as an 'establishment' (as per the definition provided under the Act, which is essentially a commercial establishment where services are rendered to customers). However, in certain cases, where Charging Stations are unmanned and customers charge their own EVs, there is ambiguity on whether a Charging Station will be considered as an 'establishment', as there is no 'service' as such being provided to customers.

3. Incorporating Disabled Friendly Charging Station Architecture

In line with the California ADA and ABA, we recommend that the Bureau of Indian Standards draft specific guidelines that can cater to disabled EV drivers, which includes details such as the location of the Charging Gun, parking area, wheelchair holders and other such details can be made mandatory as part of Charging Station set ups. We put forth this suggestion given that in India, more than 2% of its population is considered as 'disabled', and India can take from the California regulations to be more inclusive in terms of EV drivers who are disabled, and may find it difficult to charge their EV at Charging Stations.

4. Adoption of battery energy storage systems for EV charging

In India's growing EV charging infrastructure, Battery Energy Storage Systems (BESS) play a crucial role in addressing the challenges of grid strain and electricity shortages. BESS can store energy during off-peak hours when electricity demand is low and discharge it during peak hours, reducing the load on the grid and ensuring more stable electricity supply for EV chargers. This is particularly important in regions with frequent power outages or unstable supply, as BESS can provide backup energy to keep charging stations operational.

Additionally, BESS allows for better integration of renewable energy sources like solar and wind, storing excess renewable energy and using it for EV charging when generation is low. This supports India's push for clean energy and reduces reliance on fossil fuels. BESS also facilitates fast charging by delivering the high burst of power needed without overwhelming local grid infrastructure, making it ideal for urban and rural areas alike. By minimizing the need for expensive grid upgrades, especially in remote regions, BESS can help scale EV infrastructure in a cost-effective way, ensuring sustainable and reliable electric mobility across the country.

5. Smart Charging

In India, as recorded in the past few years, while there is an extremely high demand for electricity, there are electricity shortages. The exponential growth of EVs has placed power grids under strain, and meeting the growing demand for electricity is a hurdle for India.

To address this issue, the UK government, through the Electric Vehicles (Smart Charge Points) Regulations

2021, has encouraged smart charging as a way to manage power grid loads and optimize energy use. EV smart charging would involve moving vehicle charging to a different time of day, such as overnight, when there is lower demand on the electricity grid, or to times of high renewable energy generation. This can help reduce the need for costly electricity network reinforcement to meet increased demand from EVs. Charging at off-peak times can also be priced differently, so it offers EV users cost benefits from charging their vehicles at a time when the load on the electricity grid is lower.

As also recommended in point 4 above, public EV charging stations with BESS can also be made smarter, such that the storage systems are charged during off-peak hours. If the electricity distributor adopts dynamic pricing (making off-peak electricity consumption cheaper), this would lead to cost benefits for EV charging service providers and, in turn, consumers.

6. Standardization and Interoperability

For an investor investing in any sector, clarity on regulations makes it more conducive to evaluate and make investments. While investors do understand and acknowledge that sunrise sectors (such as EV sector) may have some level of regulatory uncertainty, any level of predictability on how the regulatory framework will shapeout helps investors better underwrite investment risks.

Regulations that enforce **standardization and interoperability** for EV charging systems and networks would likely be viewed by venture capitalists / investors as crucial to developing a strong and dynamic market. Establishing clear standards could ensure that various Charging Stations and EV models work together seamlessly, which would minimize confusion for consumers in terms of locating a Charging Station suitable for their EV, and boost the rate at which EVs are adopted.

Further, stringent safety standards and certification processes would help underwrite risks better. However, any standardization at the technology level can potentially hamper innovation and might deter away investors.