BRIEFING PAPER DECEMBER 2025

ZEV TRANSITION COUNCIL

Policy sequencing for electric vehicle charging infrastructure deployment

IREM KOK AND MARIE RAJON BERNARD

The Zero Emission Vehicles Transition Council is an international forum focused on enhancing political cooperation on the transition to zero emission vehicles (ZEVs).

It brings together Ministers that represent over 50% of the global car market. Council members have agreed to collectively address some of the key challenges in the transition to ZEVs, enabling the transition to be faster, cheaper, and easier for all.

This includes collaboration to accelerate the pace of the global transition to ZEVs, reduce emissions and help the global economy meet our goals under the Paris Agreement.

Acknowledgments

Prepared for the Zero Emission Vehicles Transition Council by the International Council on Clean Transportation. The views expressed in this paper are those of the authors and the ICCT, but do not necessarily reflect the views of individual members of the ZEVTC. For more information, contact **communications@theicct.org**.

Executive summary

The global shift to electric vehicles (EVs) is essential both for achieving internationally agreed-upon climate targets and for fostering sustainable transportation solutions. A critical enabler of this transition is the timely and effective deployment of robust charging infrastructure. However, the formulation and implementation of optimal charging infrastructure policies represent a complex and multifaceted challenge for policymakers. This report proposes a structured policy sequencing framework to guide charging infrastructure deployment based on a global analysis of policies across diverse transportation modes, market development phases, and national contexts.

Drawing upon insights from global practices and research, our analysis identifies three foundational pillars for effective charging infrastructure policy:

A market's phase of development determines the necessary policy sequence. An early market can benefit from foundational support such as initial funding, standards development, and power sector planning. As the market enters a developing phase, the focus shifts toward charging network build-out, deployment targets, reliability regulations, and data-sharing frameworks. In a scaling phase, efforts evolve toward promoting long-term market health through initiatives like equity programs, workforce support, competition oversight, and grid-friendly solutions such as smart charging and vehicle-to-grid integration. Aligning policy interventions with the market's maturity level helps to ensure that government interventions are timely, resource efficient, and impactful.

While a market's phase of development sets the overarching policy strategy, vehicle-specific policy tailoring can support effective implementation. Different transportation modes have unique operational needs, requiring distinct approaches. For two- and three-wheelers, policy can support accessible, low-cost home charging and solutions like battery swapping. For passenger cars, the focus remains on convenient home and workplace charging supplemented with a reliable public charging network. Heavy-duty vehicles, with their high energy demands, necessitate policies focused on strategic corridor infrastructure as well as early grid-integration planning and high-power charging standards.

Beyond market phases and vehicle types, a user-centric and equitable policy paradigm forms the foundation of successful charging infrastructure strategies. Effective policies address the diverse circumstances of potential EV users—considering factors such as geography (urban or rural settings), housing type (rented or private ownership), and fleet characteristics (private or company, long-haul or short-haul). This focus can prevent the emergence of "charging deserts," promote accessibility for all communities, and foster a just and inclusive transition to electric mobility.

By presenting an in-depth description of a phased, tailored, and user-centric approach—informed by global examples of existing policies—this report provides policymakers with a comprehensive framework to navigate the complexities of charging infrastructure deployment. In so doing, it offers insights on how to foster collaboration and design government interventions that accelerate the transition to an equitable and sustainable zero-emission road transportation future.

Table of Contents

Introduction

Battery electric vehicles (BEVs) are an important component of efforts to decarbonize transportation and achieve sustainable mobility. Realizing the full benefits of the transition to electric vehicles hinges on establishing robust and accessible charging infrastructure networks. The challenges associated with this transition are not merely technical; they are fundamentally policy challenges. Charging infrastructure requires substantial upfront investment, coordination across multiple stakeholders, and careful policy alignment to support BEV uptake across diverse transport modes. Research by the Zero Emission Vehicles Transition Council (ZEVTC) has emphasized that timely and well-sequenced policies can promote effective charging infrastructure deployment and ensure that the transition to decarbonized transportation is just, fair, and equitable.[1] Governments play an indispensable role in planning and implementing this infrastructure, yet many face uncertainty about which policies to implement and when.

While individual countries have pioneered various charging infrastructure policies, comprehensive guidance on policy sequencing and appropriate interventions for different market development stages remains limited. Policymakers require clarity on which policies are most effective during early market development or scaling phases, how policies should differ across vehicle segments, and how to help ensure that infrastructure deployment serves diverse user groups equitably. Existing policy analyses often focus on single markets or vehicle types, failing to provide the comparative, cross-sectoral perspective needed to design comprehensive charging strategies. Furthermore, countries at earlier stages of BEV adoption lack accessible frameworks that synthesize lessons from pioneering markets, leading to policies that may result in inefficiencies or inequitable outcomes.

This paper addresses this policy challenge by examining charging infrastructure policies in countries and economies around the globe and proposing a tailored policy architecture for road transportation. The analysis spans diverse transportation modes, including two- and three-wheelers, light-duty vehicles, and heavy-duty vehicles (HDVs), and considers market development phases and distinct BEV user groups. The analysis identifies common policy priorities—including addressing initial investment hurdles, promoting interoperability and user convenience, and managing integration with energy systems—while recognizing that implementation should be tailored to each transportation mode's unique operational requirements. By providing a phase-by-phase approach with actionable policy options, this paper offers insights for policymakers to craft policies that promote effective charging infrastructure networks.

Market development framework

To analyze charging infrastructure policies across diverse contexts, this paper uses a framework that categorizes BEV market development into three stages: *early market*, *developing market*, and *scaling market*. This framework is conceptually inspired by Everett Rogers' technology adoption cycle, which divides technology adopters into categories that inform our three-stage model.[2]

---

1 Marie Rajon Bernard et al., *Deploying Charging Infrastructure to Support an Accelerated Transition to Zero-Emission Vehicles* (International Council on Clean Transportation, 2022), https://zevtc.org/deploying-charging-infrastructure-sep22/.

2 Everett M. Rogers, *Diffusion of Innovations*, 5th ed. (Free Press, 2003).

The early market phase, analogous to Roger's "innovators" category, is characterized by initial technology introduction and limited uptake. During this phase, BEV sales typically represent less than 3%–5% of total vehicle sales, infrastructure is nascent, and adoption is driven primarily by early enthusiasts and policy mandates. The developing market phase, which corresponds to Roger's "early adopter" and "early majority" stages, features increasing consumer interest and rapid infrastructure growth. This phase typically sees BEV sales accelerate from 3%–5% to 20%–25%. The scaling market phase encompasses the stages beyond the "chasm"—a term popularized by Geoffrey Moore to describe the gap between early and mainstream adoption—signifying a move toward widespread consumer acceptance.[3] In this phase, BEV sales exceed 20%–25%, infrastructure becomes ubiquitous, and there is mass adoption of BEVs.

While conceptually aligned with the technology adoption cycle, this market development phase framework focuses on market evolution in terms of BEV sales share progression, rather than on overall stock penetration. The sales share thresholds provided above should be understood as loose illustrations rather than rigid boundaries, as the transition between phases can vary based on local conditions, vehicle segments, and policy contexts.

Based on this framework, we can classify the vehicle segments of different global markets. For instance, the current passenger car and van markets in countries like China and Norway would be classified as scaling markets. The European Union and Costa Rica may be understood as developing markets, progressing toward scaling. Meanwhile, the United States, India, Chile, and South Africa can generally be classified as early markets.

While effective policy implementation necessitates tailoring policy approaches to each transportation mode's unique requirements, the overarching policy areas remain consistent across vehicle types during each market development phase. Understanding these common policy needs is important for creating efficient and effective charging ecosystems. The subsequent analysis demonstrates how these policy areas manifest differently across early, developing, and scaling market phases, and how implementation strategies can be adapted for distinct vehicle segments.

Furthermore, an effective charging infrastructure policy considers the diverse needs of different electric vehicle user groups, as policies designed for one group may not adequately serve another. These groups can be systematically categorized by population characteristics (urban or rural), housing situations (rented or privately owned, apartments or houses), fleet type (private or company cars, small- and medium-sized enterprises or large enterprises), and charging technology preferences (wired stationary charging, battery swapping, or wireless in-road charging). For governments seeking to promote a just and inclusive transition to electric mobility, an effective charging infrastructure strategy addresses the specific challenges and opportunities presented by each user segment.

This user-centric lens is applied throughout the policy analysis in this paper, with particular attention to promoting equitable access across income levels, housing types, and geographic locations. As markets progress from the early to scaling phases, the diversity of user groups expands, which necessitates that policies evolve to serve all segments of the BEV-adopting population.

3 Geoffrey Moore, *Crossing the Chasm: Marketing and Selling Disprutive Products to Mainstream Customers* (Harper Business Essentials, 1991).

The policies presented in this paper were selected from a diverse set of countries and economies and offer actionable insights for effective charging infrastructure deployment and market acceleration. This structured, phase-by-phase approach is designed to equip policymakers, key stakeholders (including automotive manufacturers, charge point operators, and electricity utilities), and practitioners with the tools to effectively navigate the complex transition toward electric road transportation. While this framework is applicable across all stages of market development, it may be particularly useful for countries at earlier stages of transportation electrification because it offers a clear roadmap and tested policy options. Ultimately, this framework seeks to foster enhanced collaboration, facilitate knowledge sharing, and promote the design of robust and impactful policy interventions for all countries.

Policy sequencing by market development phase

As showcased in a 2022 ZEVTC briefing paper, strategic government intervention can promote effective infrastructure deployment, especially in early market development.[4] Understanding a country's current level of technological adoption is crucial for informing the timing of policies and programs. For instance, an effective policy approach in a market with a BEV share of 2% of new registrations will drastically differ from one in a market where BEVs already constitute 60% of new registrations.

Based on an extensive literature review of global charging infrastructure policies across 15 markets in North America, Europe, Asia, and Africa—including the EU's comprehensive Alternative Fuel Infrastructure Regulation (AFIR), the U.S. National Electric Vehicle Infrastructure (NEVI) program, India's Faster Adoption and Manufacturing of Electric Vehicles in India, Phase II (FAME II) incentives, and innovative approaches from Canada, China, the Netherlands, Rwanda, and the United Kingdom—we identified consistent patterns in policy priorities across market phases. Although specific policy designs vary by jurisdiction and vehicle segment, the core policy challenges addressed and the types of intervention used show substantial similarity, providing a valuable, structured roadmap for policy sequencing.

As shown in Figure 1, government intervention occurs in all market phases and across all transportation modes, but the focus of these interventions shifts. In an early market, governments typically encourage market development by providing funding for charging infrastructure deployment (from grid connection to charger purchases and installation), establishing foundational standards, and fostering cross-sector collaboration. In the developing phase, governments support the mass market adoption of EVs by setting charging infrastructure deployment targets, potentially using tenders, and developing regulations to foster user-friendly, reliable, transparent, and fairly priced charging. Lastly, in the scaling phase, government actions to promote equitable access to charging include implementing equity programs, supporting workforce adaptation, and monitoring market competition to prevent unfair pricing.

4 Rajon Bernard et al., *Deploying Charging Infrastructure.*

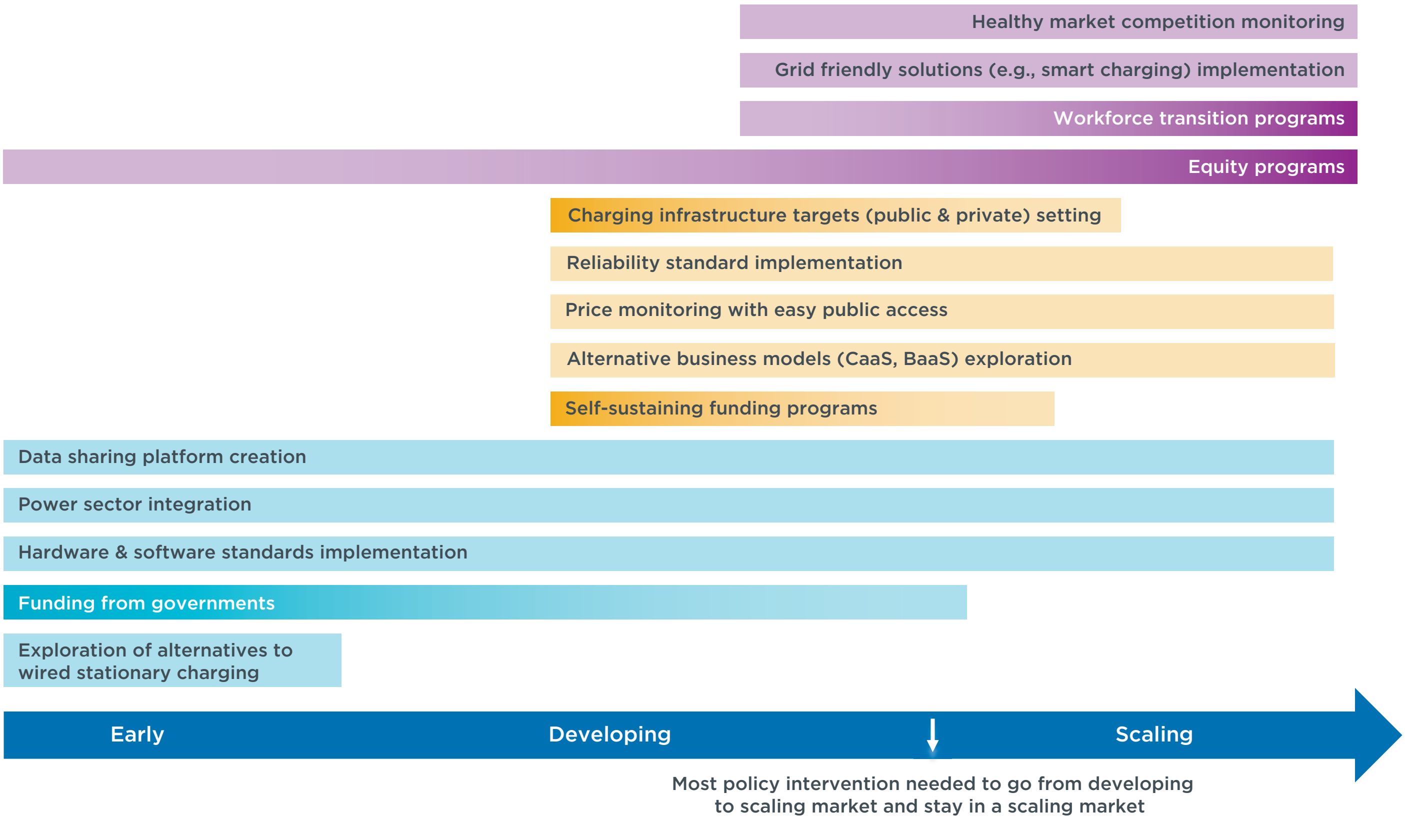

Figure 1. Policy sequencing for each market development phase. The colors indicate the phase for which the policy area is most important (blue for early, yellow for developing, and purple for scaling); the darker shades indicate that the policy area could slowly fade in or out, respectively.

The following subsections examine each phase in detail, highlighting key policy areas and providing illustrative examples from pioneering jurisdictions. Policies are categorized by their optimal timing for implementation rather than when they were actually enacted; consequently, some policies may be listed with a phase that comes earlier or later than when the jurisdiction enacted the policy. The appendix provides information on selected policies relevant to different BEV market development stages and road transportation modes, in addition to transferable lessons.

Early market

Policies implemented in the early market phase are foundational, aiming to kickstart the charging network and foster long-term viability by providing initial funding, setting hardware and software standards, and fostering cross-sector coordination, including through strategic grid integration.

Establishing charging infrastructure standards

Establishing charging infrastructure standards for both hardware and software in the early phase can help to ensure a cohesive market from the outset. These standards typically take two forms: (1) charging connector and communication protocols and (2) battery interoperability for swapping systems.

As the early market phase progresses, interoperability policies can foster charging options for all BEV types for both public and private charging infrastructure. The joint

EU-U.S. commitment to developing the Megawatt Charging System (MCS) standard—a shared charging standard specifically for HDVs—exemplifies proactive international coordination.[5] The MCS standard, endorsed by global standards bodies like IEC and ISO, aims for compatibility in both physical connectors and communication protocols, supporting international interoperability and seamless cross-border trade.

For battery swapping, standardization addresses the requirement of physical interchangeability. One example of such standards is NITI Aayog's draft battery-swapping policy in India; this policy establishes technical standards for batteries and swapping stations to facilitate operation across different providers.[6] This approach allows the market to scale while preventing proprietary lock-in that would limit consumer choice and operational flexibility.

Beyond hardware standards, smart charging mandates can be implemented in the early market phase to manage grid load. The UK's Smart Charge Points Regulations, which includes pre-configured default charging schedules for home and workplace chargers, reflect this proactive approach to grid management.[7] This policy demonstrates how governments can target private chargers for smart charging, leveraging their long dwell times for effective load shifting potential. While today's charging infrastructure is still undergoing substantial innovation and therefore some later-stage markets like the United Kingdom are in the process of implementing smart charging policy, these mandates can be used in the early market stage to allow sufficient time for grid planning and upgrades that may be needed in the longer term, as discussed below.

Providing public funding

Public funding programs in the early stages can help to bridge the gap until market self-sufficiency is achieved. These incentives can take various forms. Some are direct financial subsidies for charging infrastructure deployment (targeting charge point operators) and for the recharging process such as free or subsidized public charging (targeting consumers). Others are funding for alternative charging solutions such as battery swapping and wireless charging. However, funding programs typically demonstrate three characteristics: diversification across use cases, targeting of specific user groups, and built-in transition mechanisms toward market sustainability.

Canada's Zero Emission Vehicle Infrastructure Program offers distinct funding schemes tailored for public spaces, workplaces, residential buildings, fleets, and Indigenous communities.[8] This segmentation recognizes that different user groups face distinct barriers and can require targeted interventions.

Enabling strategic grid integration

Grid integration is a critical consideration across all transportation modes, but it is especially important for HDVs because their high-power charging demands place a significant and concentrated strain on the electricity grid. Thus, early coordination between transportation and energy stakeholders is essential.

5 European Commission, *Joint Statement EU-US Trade and Technology Council of 31 May 2023 in Lulea, Sweden*, May 31, 2023, https://ec.europa.eu/commission/presscorner/detail/en/statement_23_2992.

6 NITI Aayog, *Draft Battery Swapping Policy*, April 20, 2022, https://www.niti.gov.in/sites/default/files/2023-03/20220420_Battery_Swapping_Policy_Draft_0.pdf.

7 The Electric Vehicles (Smart Charge Points) Regulations, SI 2021/1467 (United Kingdom), https://www.legislation.gov.uk/uksi/2021/1467/contents/made.

8 "Zero Emission Vehicle Infrastructure Program (ZEVIP)," Government of Canada, updated October 25, 2025, https://natural-resources.canada.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876.

California's EnergIIZE program exemplifies a strategic approach to HDV grid integration by funding both chargers and the underlying energy infrastructure and research needed to manage the high-power demand from electric trucks.[9] Early engagement and adaptation within the energy sector are important due to the time required for grid upgrades and process adjustments.

Institutional coordination mechanisms can formalize early cross-sector coordination. The United State's Joint Office of Energy and Transportation, created in 2021, leverages the combined expertise of the U.S. Department of Energy and the U.S. Department of Transportation to facilitate the alignment of infrastructure deployment with grid planning and capacity development.[10] The office works to bridge institutional silos, providing technical assistance and building capacity among stakeholders, including state utility commissions that regulate the grids, to streamline sub-national implementation. Such structures enable efficient BEV grid integration and pave the way for innovative solutions like bi-directional charging to be implemented as the market matures. Early engagement across sectors can prevent the costly retrofits and deployment delays that occur when transportation and energy planning proceed independently.

Developing market

As EV markets progress beyond the early stages of adoption, the policy focus shifts from stimulating initial demand to building a robust, user-friendly, and geographically comprehensive charging network. In the developing market phase, governments can use regulatory and financial tools to promote the scale-up of charging infrastructure and support a positive user experience. Three key policy areas for this stage are: (1) setting legally binding deployment targets to drive expansion, (2) using public funds to stimulate private investment in underserved areas, and (3) implementing reliability and data-sharing standards to guarantee a seamless user experience.

Setting legally binding deployment targets

Legally binding public and private charging infrastructure deployment targets support widespread charging development on par with BEV uptake. Deployment targets balance two objectives: ensuring total charging capacity scales with fleet growth and guaranteeing geographic coverage to eliminate range anxiety and enable long-distance travel. The most sophisticated policies employ dual approaches that address both dimensions simultaneously.

The European Union's AFIR exemplifies this dual approach for passenger cars and vans through fleet-based and distance-based targets.[11] The fleet-based target mandates that the Member States ensure a total public charging power output of at least 1.3 kW for each registered BEV and 0.8 kW per registered plug-in hybrid electric vehicle, so that overall capacity grows with EV adoption. Complementing this, distance-based targets mandate the installation of fast-charging pools every 60 km along major EU transport corridors. This dual approach aims to ensure total capacity scales with EV uptake while guaranteeing geographical coverage and minimum service levels.

9 "About," EnergIIZE Commerical Vehicles, accessed October 31, 2025, https://www.energiize.org/about.

10 "About," Joint Office of Energy and Transportation, accessed October 31, 2025, https://driveelectric.gov/about.

11 Regulation (EU) 2023/1804 of the European Parliament and of the Council 13 September 2023 on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU (Text with EEA Relevance), OJ L 234, 1–47 (2023), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1804.

For HDVs, the AFIR sets progressively tighter requirements for the deployment of high-power charging stations, starting with a minimum total aggregated power of 1,400 kW every 120 km along the core Trans-European Transport Network by the end of 2025 and increasing coverage and power over time at urban nodes and safe parking areas through 2030. By setting binding, distance-based targets for public charging along key corridors, the AFIR provides the investment certainty necessary for private capital to flow into heavy-duty charging infrastructure despite longer payback periods and higher capital costs compared with light-duty charging, helping to provide comprehensive network coverage across vehicle segments.

Directing public investment to underserved areas

Even with binding targets, market forces alone often fail to deliver equitable geographic coverage, as private operators naturally gravitate toward high-traffic, profitable locations. Strategic public investment can help ensure that charging networks serve both commercially attractive urban centers and less profitable rural or low-traffic areas. Two effective approaches that have been taken by governments are competitive tenders with coverage obligations and targeted funding programs with explicit geographic equity criteria.

Germany's Deutschlandnetz program, for example, uses competitive tenders to award contracts for building and operating 9,000 fast-charging points. This design includes coverage requirements in less profitable rural locations, supporting comprehensive national coverage.[12]

India's PM E-DRIVE initiative illustrates a targeted funding approach.[13] With a dedicated ₹20 billion in funding (roughly $240 million in U.S. dollars), the framework aims to expand the national network by strategically targeting both urban charging density and inter-city highway connectivity. This dual focus recognizes that comprehensive networks require both destination charging (where vehicles park for extended periods) and en-route charging (to enable travel between cities). By explicitly targeting both dimensions with dedicated funding, PM E-Drive addresses the chicken-and-egg problem where consumers hesitate to purchase BEVs due to inadequate infrastructure while operators hesitate to invest due to insufficient vehicle populations.

Implementing reliability and data-sharing standards

Having chargers on the ground is an important first step, but maintaining the good functioning of the chargers is equally important, because infrastructure availability means little if chargers are frequently broken or if users cannot easily locate, access, and pay for charging services. In the developing market phase, reliability standards with enforcement mechanisms can be implemented in addition to data-sharing requirements that enable user-friendly experiences.

The UK's Public Charge Point Regulations, implemented in 2023, set a stringent 99% uptime requirement for direct current (DC) fast chargers (50 kW or above) to help ensure charger reliability and performance.[14] Enforcement for this regulation relies

12 "The Deutschlandnetz," The National Centre for Charging Infrastructure, accessed on March 21, 2025, https://nationale-leitstelle.de/en/deutschlandnetz/.

13 Ministry of Heavy Industries, "India Accelerates National EV Charging Grid under PM E-Drive," press release, May 21, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2130225#:~:text=With%20a%20financial%20outlay%20of,charging%20stations%20across%20the%20country.

14 The Public Charge Point Regulations, SI 2023/1168 (United Kingdom), https://www.legislation.gov.uk/uksi/2023/1168/contents/made.

on annual operator reporting using the standardized Open Charge Point Interface protocol, with potential penalties for non-compliance. This approach creates clear performance expectations while leveraging standardized data formats that reduce reporting burdens.

Data sharing can prevent fragmented information across multiple proprietary networks, which creates friction that deters adoption. Transparent data access is key for properly planning for charging infrastructure, and seamless access to information on charger locations, real-time availability, pricing, and payment options can help to provide a user-friendly charging experience. The EU's AFIR addresses this by requiring operators to share both static and dynamic data, including availability and price information, with newly established National Access Points. These centralized repositories facilitate standardized data exchange across the EU, enabling value-added services and improving user experience. While this regulatory approach is highly viable in jurisdictions with strong centralized rulemaking, the necessity of transparent data access is universal for building consumer confidence and enabling a functional, integrated charging system.

Ultimately, the developing market phase represents a critical transition: from early-stage experimentation to systematic deployment and from government-funded demonstrations to private sector delivery. This phase can be helped by policies that build a user-friendly, reliable, and data-driven charging network capable of supporting a rapidly growing BEV fleet.

Scaling market

As BEV markets transition into the scaling phase, the primary policy focus broadens significantly. With widespread deployment underway, the government's role can shift from incentivizing EV adoption and baseline charging network coverage to managing the long-term impacts of the shift and prioritizing sustainability, inclusivity, and healthy functioning of the charging ecosystem. Guaranteeing equitable access to charging for all residents involves supporting the workforce transition in related industries and fostering a competitive and transparent charging market. Three policy areas in this phase are: (1) implementing comprehensive equity programs to prevent charging deserts, (2) facilitating just workforce transitions in affected industries, and (3) fostering competitive markets with transparent pricing.

Implementing comprehensive equity programs

As BEV markets mature, the risk emerges that electrification benefits accrue primarily to affluent, urban populations while underserved communities—rural areas, lower-income neighborhoods, and renters without home charging access—are left behind. In a scaling market, the policy focus is ideally shifted toward ensuring that the benefits of electric mobility are accessible to all segments of society, preventing "charging deserts" in underserved communities and guaranteeing equitable access for all users.

Initiatives like California Senate Bill 1000 exemplify proactive approaches to equitable charging deployment.[15] This bill requires the California Energy Commission to assess charging infrastructure deployment against demographic and income data. The assessment analyzes metrics—such as drive time to the nearest fast charger—across

15 "Electric Vehicle Infrastructure Deployment Assessment – SB 1000," California Energy Commission, accessed November 5, 2025, https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/electric-vehicle-infrastructure.

different communities. The findings of such assessments can then directly inform investment decisions so that funding is targeted to bridge equity gaps. By embedding equity analysis into the policy process rather than treating it as an afterthought, the framework aims to ensure that infrastructure expansion serves all communities rather than following purely market-driven patterns that can replicate existing inequalities.

China's Tackling Areas of Weakness program demonstrates a complementary geographic approach. This program identifies and provides dedicated funding to the counties with lagging EV charging infrastructure deployment. This county-level targeting recognizes that national or provincial averages can mask significant local gaps, and that rural and remote areas require explicit attention to prevent permanent infrastructure divides. By focusing on these "areas of weakness," the program thus promotes a more comprehensive and equitable EV charging infrastructure network.[16]

Supporting just workforce transitions

As the BEV market scales, supporting a just workforce transition is equally important. The shift to electric mobility will impact traditional automotive and energy sector jobs and thus necessitate proactive measures to support workforce adaptation. Some traditional automotive jobs will decline—particularly in internal combustion engine production and maintenance—while new roles in battery manufacturing, charging infrastructure installation, and electric powertrain maintenance will expand. Proactive workforce policies are essential to provide affected workers with pathways to new opportunities rather than leaving them displaced.

The EV Infrastructure Training Program (EVITP) in the United States provides a model for skill development in the emerging charging infrastructure sector. Although not a direct government program, its curriculum was developed collaboratively with a wide range of stakeholders, including auto industry, utilities, and educational bodies. The program offers comprehensive, certified training programs that prepare electricians to install and maintain EV charging equipment, directly addressing the skills gap in the growing EV sector.[17] Government programs, such as the NEVI program and state initiatives like those in California, often incentivize or require the use of industry-recognized training to ensure consistent quality and support workforce adaptation. National certification programs ensure consistent quality standards across providers while providing workers with portable credentials recognized by employers nationwide.

Beyond training programs, initiatives like incentives for companies to invest in regular workforce training and university curricula aligned with evolving needs can facilitate a smooth and equitable transition. Just transition frameworks recognize that while aggregate employment may remain stable or grow, individual workers face significant adjustment costs. Policies that smooth these transitions—through training subsidies, wage insurance during retraining periods, and placement services—enable electrification benefits to be broadly shared rather than creating winners and losers.

16 Ministry of Finance, Ministry of Industry and Information Technology, and Ministry of Transport, 关于开展县域充换电设施补短板试点工作的通知 [Notice on the pilot work of county-level charging and exchange facilities to make up for short boards], April 9, 2024, https://www.gov.cn/zhengce/zhengceku/202404/content_6945040.htm.

17 "About Us," Electric Vehicle Infrastructure Training Program (EVITP), accessed on March 21, 2025, https://evitp.org/about-us/.

Fostering competitive markets

As the EV market grows, a few dominant players in the charging infrastructure space may emerge with significant market power, particularly in specific geographic areas or along key corridors. Without regulatory oversight, this concentration can lead to unfair pricing, reduced service quality, and barriers to entry that prevent new competitors from challenging incumbents. Hence, governments play a crucial role in fostering healthy market competition and transparent pricing.

Competition agencies, such those in the European Union, are increasingly monitoring the BEV charging market to identify and address potential anti-competitive practices, including abuse of local market power, market tipping, and vertical integration, all of which can limit market access.[18] The findings from these analyses inform regulatory interventions before significant issues fully materialize, helping to maintain a competitive landscape and uphold fair and transparent pricing for BEV charging.

Tailored policies for different transportation modes

While overarching charging infrastructure policies provide a foundational framework, achieving effective charging infrastructure deployment requires tailored approaches that acknowledge the unique operational characteristics and needs of different vehicle segments. Two- and three-wheelers, passenger cars and vans, and buses and HDVs each have distinct charging requirements and usage patterns, and a one-size-fits-all policy strategy is insufficient to unlock the full potential of electric mobility for all vehicle segments. More specifically, vehicle segments differ in typical daily distance traveled, dwell time patterns, charging location preferences, and power requirements. Therefore, specific interventions are necessary to optimize charging solutions for each transportation mode.

The following subsections examine policy approaches optimized for each transportation mode, highlighting how the general policy priorities outlined in the sequencing framework manifest differently across segments.

Two- and three-wheelers

The electrification of two- and three-wheelers requires a mix of charging policies tailored to the segment's diverse applications. Personal mobility applications can benefit most from low-cost stationary charging. Small battery capacities (typically 2–5 kWh) enable full overnight charging from standard household outlets, eliminating the need for dedicated charging infrastructure in many cases. India's FAME II program prioritizes deployment of affordable AC slow chargers, which are well-suited for this application.[19] This approach minimizes both user costs and infrastructure investment requirements while serving the majority of personal two-wheeler owners who park vehicles at home overnight.

Commercial applications—particularly food delivery or taxi services—present contrasting requirements. These vehicles operate on tight schedules, making

18 European Commission, *Competition Analysis of the Electric Vehicle Recharging Market across the EU27 + the UK* (Publications Office of the European Union, 2023), https://op.europa.eu/en/publication-detail/-/publication/c9f5b4eb-72ee-11ee-9220-01aa75ed71a1.

19 Sumati Kohli, *Electric Vehicle Demand Incentives in FAME II Scheme and Considerations for the Next Phase* (International Council on Clean Transportation, 2024), https://theicct.org/publication/electric-vehicle-demand-incentives-in-india-the-fame-ii-scheme-and-considerations-for-a-potential-next-phase-june24/.

traditional plug-in charging impractical. Battery-swapping and battery-as-a-service (BaaS) emerge as particularly effective solutions. For example, through government incentives, Taipei in the Taiwan province of China has built a dense network of battery-swapping stations to support its growing electric scooter fleet, demonstrating how this model enables intensive commercial use.[20] Similarly, Rwanda's supportive policy environment through its National Sustainable Mobility Policy has enabled the BaaS model for electric motorcycle taxis, lowering upfront costs and maximizing vehicle availability.[21]

Policies for this segment therefore require flexible strategies for personal and commercial use. Policymakers could adopt distinct solutions—such as low-cost stationary charging and BaaS models—to match each group's unique operational demands and accelerate the electrification of two- and three-wheelers.

Passenger cars and vans

In terms of passenger cars, our analysis indicated that policies prioritizing the convenience and accessibility of charging, particularly at homes and workplaces, is of central importance. This is largely due to the fact that most passenger car charging is expected to occur at private locations.[22] Policies therefore can support improving access to private charging while aiming to ensure that strategic public charging networks address gaps for long-distance travel and users without home charging access.

Two primary barriers to enabling private charging at scale are technical obstacles in multi-unit dwellings and regulatory or financial constraints on installation. Multi-unit dwellings present particular challenges, as shared electrical infrastructure, split incentives between landlords and tenants, and complex approval processes often prevent charger installation even when technically feasible.[23]

France's national decree offers a model for addressing the financial barrier. By enabling the utility Enedis to prefinance electrical upgrades in apartment buildings, this decree allows the utility to recoup costs through a fixed price for EV owners installing chargers, thereby facilitating charging at multi-unit dwellings.[24] The EU's Energy Performance Building Directive further promotes private charging by mandating pre-cabling in new residential buildings, requiring charging points, and emphasizing

20 Asian Development Bank, *Electric Motorcycle Charging Infrastructure Road Map for Indonesia,* 2022, https://www.adb.org/sites/default/files/publication/830831/electric-motorcycle-charging-infrastructure-indonesia.pdf.

21 Cheng Zhang and Hong Miao, *Solar-Powered Battery Swap Stations Could Speed Rwanda's Shift to Electric 'Motos'* (World Resources Institute, March 25, 2024), https://www.wri.org/insights/solar-powered-battery-swap-stations-rwanda-shift-electric-motos.

22 Logan Pierce and Peter Slowik, *Home Charging Access and the Implications for Charging Infrastructure Costs in the United States* (International Council on Clean Transportation, 2023), https://theicct.org/publication/home-charging-infrastructure-costs-mar23/.

23 Alexander Tankou et al., *Policies and Innovative Approaches to Maximizing Overnight Charging in Multi-Unit Dwellings* (International Council on Clean Transportation, December 21, 2023), https://theicct.org/publication/izeva-maximizing-overnight-charging-in-multi-unit-dwellings-dec23/.

24 Délibération de la CRE du 12 Avril 2023 Portant Proposition sur l'Encadrement de la Contribution Prévue par le Décret n° 2022-1249 du 21 Septembre 2022 Relatif au Déploiement d'Infrastructures Collectives de Recharge Relevant du Réseau Public de Distribution dans les Immeubles Collectifs à Usage Principal d'Habitation [Deliberation of the CRE of April 12, 2023 on a proposal on the framework of the contribution provided for by Decree No. 2022-1249 of September 21, 2022 on the deployment of collective charging infrastructures under the public distribution network in collective buildings for main residential use], Deliberation 2023-103, April 12, 2023, https://www.cre.fr/documents/deliberations/encadrement-de-la-contribution-prevue-par-le-decret-n-2022-1249-du-21-septembre-2022-relatif-au-deploiement-d-infrastructures-collectives-de-recha.html.

interoperability and smart charging features, including the "right to plug."[25] Together, these policies address barriers to private charging for both new construction and existing buildings.

Public charging networks have two distinct functions: enabling long-distance travel through corridor fast-charging and providing access for drivers without home or workplace charging options (e.g., renters, apartment dwellers, on-street parkers). Effective public charging policy must therefore ensure both sufficient corridor coverage to eliminate range anxiety and adequate urban charging density to serve those dependent on public infrastructure.

Technical standards can promote seamless user experiences across public charging networks. The NEVI program in the United States mandates software interoperability across key areas like vehicle-to-charger communication and payment methods to facilitate a seamless user experience.[26] While this mandate applies to government-funded chargers and deployment remains in its early stages, this standardization can help to transform public charging from a collection of incompatible proprietary networks into an integrated system comparable to the gasoline station experience.

Finally, policies supporting proactive grid planning and streamlined utility permitting can complement these efforts. Policies like the Netherlands' National Grid Congestion Action Programme support the widespread deployment of charging infrastructure through anticipatory grid planning that uses forecasts of future electricity demand to identify and schedule necessary grid infrastructure upgrades.[27] Programs such as this represent a shift away from a reactive approach, thereby helping grid capacity keep pace with the growing demand from EV charging. Smart charging regulations like the United Kingdom's Smart Charge Point Regulations can optimize charging times and grid integration, particularly in residential settings where vehicles are parked for extended periods.

Ultimately, an effective charging strategy for passenger cars and vans involves removing private charging barriers, establishing strategic public networks, and implementing proactive grid planning.

Buses and heavy-duty vehicles

Heavy-duty vehicles require a dedicated charging strategy to meet their unique physical characteristics and energy demands, as well as their diverse operational patterns. Charging for HDVs necessitates larger parking spaces, higher-power connections—which can place significant strain on the grid—and strategic locations that align with freight logistics rather than passenger travel patterns. The energy demand from trucks is also highly concentrated, primarily occurring at depots, key industrial areas, and along the major freight corridors that connect them.

The most cost-effective and grid-friendly approach for many HDV fleets, especially those with return-to-base operations, is low-power overnight depot charging. Utilizing long dwell times for slower charging minimizes electricity costs, reduces the need for

25 Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the Energy Performance of Buildings (recast) (Text with EEA relevance), OJ L 2024/1275, May 8, 2024, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L1275.

26 "National Electric Vehicle Infrastructure (NEVI) Formula Program," United States Department of Energy, accessed October 6, 2025, https://afdc.energy.gov/laws/12744.

27 Zsuzsanna Pató, *Gridlock in the Netherlands* (Regulatory Assistance Project, 2024), https://www.raponline.org/wp-content/uploads/2024/01/RAP-Pato-Netherlands-gridlock-2024.pdf.

expensive grid upgrades, and enables managed charging to align with periods of high renewable energy generation.

When depot charging is not sufficient, particularly for regional and long-haul applications that require charging mid-route, a public network along strategic freight corridors becomes essential. Unlike passenger cars, where corridors primarily serve occasional long-distance travel, HDV corridors serve regular freight routes with predictable patterns. This concentration enables strategic, targeted deployment rather than comprehensive coverage: focusing infrastructure investment on major freight corridors can produce substantially higher utilization and faster payback than dispersed deployment.

Policies like the EU's AFIR, which sets binding distance-based targets for high-power HDV stations, and the U.S. National Zero-Emission Freight Corridor Strategy,[28] which provides a phased roadmap and strategic guidance for infrastructure alignment, are both designed to help build this foundational network. These frameworks provide investment certainty and a baseline of coverage to support the market's development by mandating or signaling the deployment of high-power charging stations at specified intervals along key routes.

While existing high-power chargers (up to 350 kW) can serve many needs, megawatt-level charging standards—like the EU-U.S. joint commitment to the MCS standard—can enable the most demanding, high-mileage trucks to refuel during mandatory driver breaks. This makes electric powertrains viable for long-haul operations where depot charging alone is insufficient.

However, deploying megawatt-level charging at scale presents hurdles, including high infrastructure costs and strain on local electricity grids. To address these challenges, some markets are exploring alternative solutions. In China, battery swapping for HDVs has been deployed at scale, driven by national pilot programs that target specific high-use applications where minimizing downtime is paramount like heavy-duty tractors at ports, mining trucks, and urban construction vehicles.[29] Meanwhile, Sweden's REEL project analyzes the optimal mix of depot charging and opportunity charging coupled with charging management systems and grid integration planning.[30] These examples underscore that a successful HDV charging strategy can rely on a tailored mix of solutions: prioritizing cost-effective depot charging wherever possible, building a strategic corridor network, and carefully planning for the grid integration of high-power technologies.

In conclusion, the policy examples presented underscore how charging infrastructure policies can be tailored to the specific characteristics of each transportation mode. From affordable slow-charging and battery swapping for two- and three-wheeler commercial fleets, to increased home, workplace, and public charging for passenger cars, depot-charging, battery swapping, and strategic corridor development for HDVs, targeted policy interventions can unlock the full potential of electric mobility across the road transportation landscape.

---

28 Joint Office of Energy and Transportation, *The National Zero-Emission Freight Corridor Strategy*, March 2024, https://driveelectric.gov/files/zef-corridor-strategy.pdf.

29 Hongyang Cui et al., *China is Propelling its Electric Truck Market by Embracing Battery Swapping* (International Council on Clean Transportation, 2024), https://theicct.org/china-is-propelling-its-electric-truck-market-aug23/.

30 Closer, *REEL Regional Electrified Logistics: Charging Infrastructure for Trucks,* 2024, https://closer.lindholmen.se/sites/default/files/2024-02/reel-charging-infra-for-trucks-2024.02.pdf.

Targeted policies for different BEV users

The results of our global policy review revealed that governments can play an active role in helping all potential EV users be effectively served, but this requires moving beyond vehicle-centric and technology-centric approaches and considering the diverse circumstances and needs of different user groups. Two individuals purchasing identical BEVs may face radically different charging experiences: a homeowner with a garage can install a dedicated charger for convenient overnight charging, while an apartment renter relying on street parking may struggle to find accessible public charging. These disparities—if unaddressed—create barriers to adoption that disproportionately affect certain populations, undermining both equity objectives and market growth.

To assess what policies are best targeted to different BEV users, we categorize user groups based on four characteristics: population (e.g. urban or rural), housing (e.g. depot charging, rented or privately owned, house or apartment), and fleet characteristics (private or corporate, short- or mid- or long-haul). While the specific demands of each category will vary depending on the unique regional context, a comprehensive charging infrastructure strategy would consider all of these characteristics.

Population and housing type

Addressing the needs of different populations in different housing types requires differentiated policy approaches. Users with dedicated parking and electrical infrastructure can charge overnight during low-cost, off-peak periods, paying residential electricity rates that typically are substantially lower than public fast-charging rates. Conversely, users dependent on public infrastructure face higher costs, limited availability during peak times, and the inconvenience of traveling to charging locations rather than charging where vehicles are typically parked.

This access divide creates systematic disparities. Urban apartment dwellers can face multiple barriers: lack of dedicated parking spaces, shared electrical infrastructure requiring collective decision-making and investment, split incentives between landlords (who bear installation costs) and tenants (who receive benefits), and regulatory obstacles where building codes or homeowner associations prevent charger installation.[31] Rural populations encounter different challenges: lower population density makes business cases for public charging infrastructure weak, longer average trip distances increase range requirements, and dispersed destinations mean fewer natural locations for destination charging.[32] Policy approaches must be differentiated to address these distinct contexts.

In urban areas where apartment buildings are typically highly concentrated, policies prioritizing public overnight and destination charging solutions, or promoting private shared charging solutions, can help address the charging needs of BEV users. Policies could mandate or incentivize DC residential charging hubs, as these provide dedicated, centralized, and fast-charging access to residents who lack private parking or dedicated home-charging spots, thereby addressing the challenges of high-density living. These hubs offer faster charging than alternating current (AC) alternatives, reducing dwell time requirements and increasing utilization.

31 Tankou et al., *Policies and Innovative Approaches.*

32 Kyle Morrison and Sandra Wappelhorst, *Battery Electric Vehicle Access in Europe: A Comparison of Rural, Intermediate, and Urban Regions* (International Council on Clean Transportation, 2022), https://theicct.org/publication/bev-access-europe-jun22/.

Furthermore, policy measures that grant renters the right to install charging infrastructure can help address disparities in access to charging infrastructure for property owners versus renters; these measures often include financial support mechanisms to facilitate implementation in apartment buildings. As an example, the European Energy Performance Building Directive mandates minimum charging infrastructure deployment in residential and business buildings and ensures renters can install chargers by requiring member states to develop right-to-plug regulations. In addition, regulated utility financing models, like the one used in France allowing the utility Enedis to pre-finance electric upgrades in apartment buildings, can overcome high upfront costs and the split incentive problem associated with shared electric upgrades.[33]

Conversely, rural areas typically see an emphasis on fast or ultra-fast on-road charging at fixed distances to enhance connectivity and mitigate the long-distance travel concerns prevalent in less dense regions. The policy focus can therefore shift to promoting strategic corridor coverage that enables long-distance travel and provides baseline access where private charging is available but public options are needed for occasional longer trips. Germany's Deutschlandnetz program, for instance, uses competitive tenders that include specific geographic requirements aimed to ensure comprehensive coverage in less commercially attractive rural areas.[34]

Fleet characteristics

Fleet characteristics are also influential factors in the design of effective charging policies. Distinct driving patterns and user behaviors associated with personal vehicles and company cars require differentiated charging needs and locations. Policies that work for personal vehicles with predictable commuting patterns and long overnight parking may fail for commercial fleets with high utilization, unpredictable routes, or time-sensitive operations. User-centric policy design requires matching infrastructure and business model support to specific fleet profiles.

For personal vehicles and company cars used for commuting, the ideal policies maximize convenience and leverage long dwell times outside the home. Incentives for workplace charging infrastructure, such as Canada's Zero Emission Vehicle Infrastructure Program, are a key policy lever.[35] By offering financial assistance to employers, governments enable the private sector to utilize long work dwell times for convenient charging. This policy enables employees who lack home charging access, such as renters or apartment dwellers, to have reliable daytime charging options.

For commercial fleets, the focus shifts to operational uptime, high-power energy supply, and total cost of ownership. Policies could streamline the high-power needs of return-to-base operations. This requires utility assistance in anticipatory grid planning and streamlined permitting for depot charging infrastructure. Funding programs, such as California's EnergIIZE initiative, providing grants for electric infrastructure upgrades beyond just the charger purchase help to address the unique grid strain of HDVs.[36]

The prevalence of small urban trucks versus regional or long-haul distribution fleets—as well as the industry sectors and types of goods handled by companies operating them—similarly informs the selection of appropriate charger types, the strategic location of chargers, and optimal funding and business models. In addition, the financial and spatial

33 Délibération de la CRE du 12 avril 2023.

34 The National Center for Charging Infrastructure, "The Deutschlandnetz."

35 Government of Canada, "Zero Emission Vehicle Infrastructure Program."

36 EnergIIZE, "About."

limitations potentially encountered by small and medium-sized enterprises in deploying on-premises charging infrastructure suggest that the charging-as-a-service business model—where a third party owns and operates the charging infrastructure—may support fleet electrification in this segment.[37] Incentive programs could therefore be designed to financially support various business models, including subscription services like charging-as-a-service, not just direct hardware purchases.

Institutional structures

Institutional structures shape policy implementation by influencing the legally permissible scope of policy interventions and determining which levels of government have authority to act, what policy instruments are legally permissible, and how coordination across jurisdictions can be achieved. User-centric policy design must therefore adapt to institutional contexts rather than proposing identical approaches regardless of governance structures.

Centralized government systems may facilitate streamlined policy development and implementation processes. China's approach exemplifies this model: national infrastructure plans and 5-year development goals guide the rapid and coordinated roll out of charging infrastructure, setting clear, top-down goals for network density, technological standards, and geographical coverage that direct the actions of both state-owned enterprises and local governments. Centralized planning therefore facilitates comprehensive network design that optimizes national coverage. It also enables cross-subsidization, where profitable urban deployment funds rural infrastructure, and standardization enforcement that prevents the fragmentation that can occur when subnational jurisdictions adopt incompatible approaches.

Conversely, decentralized systems often empower subnational governments to design and implement their own strategies, enabling responsiveness to local contexts. The U.S. NEVI Formula Program exemplifies this approach: While the federal program provides funding and sets minimum standards for reliability and interoperability, it delegates the responsibility for detailed planning and program implementation to individual states. Each state must develop its own EV infrastructure deployment plan, allowing them to tailor corridor locations, site selection, and equity considerations to their unique geography, population density, and policy priorities.[38]

Conclusion

The global transition to EVs is essential for meeting climate goals and adopting sustainable transportation, and charging infrastructure deployment will play a key role in determining whether this transition succeeds or stalls. Deploying effective charging infrastructure is a policy challenge that requires careful planning and consideration of multiple interconnected factors. This paper addresses this challenge by providing a structured policy framework that sequences interventions according to market maturity, tailors the approach to individual vehicle segments, and embeds equity considerations throughout. Three core insights emerge from our global policy review.

First, effective charging infrastructure policy is guided by the stage of market development. The prevailing market phase—early, developing, or scaling—is the most

37 Irem Kok et al., *Accelerating ZEV Adoption in Fleets to Decarbonize Road Transportation* (International Council on Clean Transportation, 2023), https://theicct.org/publication/fleets-accelerating-decarbonization-zevtc-may23/.

38 United States Department of Energy, "National Electric Vehicle Infrastructure (NEVI)."

important determinant of policy priorities. While vehicle type and country-specific contexts require policy adaptations, the overarching policy framework benefits from dynamic sequencing to align with the maturity of the EV market. Early markets require foundational investment in standards, catalytic public funding, and cross-sector collaboration to establish viable infrastructure. Developing markets benefit from binding deployment targets, strategic gap-filling through tenders, and user-friendly, reliable, transparent and fairly priced charging through regulation. Lastly, scaling markets necessitate equity programs addressing systemic access disparities, workforce transition support, and competition oversight to prevent market consolidation.

In this sequence, policies are layered and cumulative; foundational support from the early market remains essential to enable the more complex regulations required as the market matures. This phased approach helps ensure that government interventions are not only timely and relevant but also progressively targeted to address the most pressing challenges and opportunities at each market stage. This maximizes the impact of public resources and fosters a sustainable trajectory for electric mobility.

Second, effective implementation of the phased policy framework involves tailoring policies to the unique needs of different vehicle segments. While broad policy categories provide a common foundation, the diverse operational characteristics and charging requirements of two- and three-wheelers, passenger cars and vans, and HDVs require distinct policy instruments in conjunction with the phased approach. For instance, for two- and three-wheelers, particularly in price-sensitive early markets, the framework points toward policies that address personal and commercial use separately. Policies could support cost-effective, slow AC charging solutions for homes and depots while enabling innovative business models like battery-as-a-service for high-use commercial fleets. For passenger cars and vans, which are predominantly charged at private locations, a successful approach to implementation might involve policies that remove barriers to home and workplace charging, such as grants for workplace charging, “right-to-plug” laws, and incentives for pre-cabling in buildings. This strategy requires removing private charging barriers, establishing strategic public networks, and implementing proactive grid planning to keep pace with BEV adoption. Finally, for HDVs, where distinct operational needs require a range of charging solutions, applying the phased approach can involve prioritizing depot charging, strategic corridor development, and robust grid integration. High-power charging standards and battery swapping can also play a role, particularly in the scaling phase, in meeting the stringent demands of long-haul segments that require rapid recharging. This vehicle-specific differentiation is essential for addressing the unique challenges and unlocking the specific electrification potential of each transportation segment.

Third, a successful transition to electric mobility hinges on a user-centric and equitable policy paradigm within the policy framework from the outset. Effective charging infrastructure strategies extend beyond technological and economic considerations to actively address the diverse needs and circumstances of all potential EV users across all market phases. By categorizing users by population density, housing type, and fleet characteristics, policymakers can identify and overcome distinct accessibility challenges. The analysis shows that intentionally designed policies—such as targeted funding for underserved communities, “right-to-plug” laws for renters, and support for diverse business models—can prevent “charging deserts” and ensure that the benefits of electric mobility are broadly distributed across all segments of society. This proactive focus on equity from the early market stage onward is fundamental for achieving a truly just and inclusive transition for all.

The proposed phased approach elucidated in this paper, coupled with vehicle-specific tailoring and a user-centric equity lens, provides a comprehensive framework that can be used to design effective and future-oriented policies. As BEV markets continue to evolve and mature, ongoing policy adaptation and innovation are important for addressing emerging challenges and capitalizing on new opportunities. This includes continuous monitoring of market dynamics, technological advancements, and societal impacts, as well as fostering ongoing dialogue and collaboration among governments, industry stakeholders, and user communities. This framework provides a structured approach to help ensure that charging infrastructure deployment is timely, targeted, and equitable—enabling EVs to deliver their full climate and social benefits across all transportation segments and user populations.

Appendix: List of policies per transportation mode and market development stage

This appendix presents selected examples of charging infrastructure policies implemented in various jurisdictions worldwide, categorized by primary transportation mode (two- and three-wheelers, passenger cars and vans, and trucks and buses) and the market development phase (early, developing, and scaling). The market development phase listed reflects our assessment of optimal timing for policy effectiveness and may differ from the phase when the jurisdiction actually enacted the policy. These examples are illustrative rather than exhaustive, showcasing different approaches to key policy areas relevant at each phase of market growth.

Two- and three-wheelers

Early market

FUNDING PROGRAM

Jurisdiction: India

Policy name: Faster Adoption and Manufacturing of Electric Vehicles in India, Phase II (FAME II)[39]

Description: FAME II provides significant financial support, with a total outlay of ₹100 billion (approximately $1.2 billion), for establishing roughly 2,877 public charging stations across 68 cities in 25 states, including those specifically designed for two- and three-wheelers.[40] This funding program lowers the capital expenditure for charging networks, covering 50%–100% of costs associated with EV charging equipment, with emphasis on the deployment of lower-cost AC slow chargers suitable for these vehicle types. State governments retain flexibility in determining the distribution of charger types based on their local needs and projected EV adoption patterns.

Transferrable lessons:

- Utilize central government funding to overcome high upfront capital barriers for charging networks, particularly in early market phases.
- Tailor funding support to encourage the deployment of charger types most suitable for the target vehicle segments and their typical usage patterns (e.g., slow chargers for two- and three-wheelers).
- Allow sub-national flexibility within national programs to enable the adaptation of charging strategies to diverse local conditions, such as urban or rural population density, varying grid capacity, and geographical challenges like hilly terrain.

39 Kohli, *Electric Vehicle Demand Incentives*.

40 Sumati Kohli, *Charging Infrastructure in India: Incentives under FAME II and Considerations for PM E-Drive* (International Council on Clean Transportation, 2024), https://theicct.org/publication/charging-infrastructure-india-fame-ii-pm-e-drive-oct24/.

STANDARDS AND INTEROPERABILITY

Jurisdiction: India

Policy name: NITI Aayog Draft Battery Swapping Policy[41]

Description: This draft policy aims to accelerate battery swapping solutions for two- and three-wheelers by addressing key barriers. It proposes establishing common technical standards for batteries and swapping stations to ensure seamless operation across different providers. Complementing the technical framework, it outlines potential financial support for network deployment, proposes reduced goods and services taxes to lower battery costs for users, and considers viability gap funding to de-risk initial operator investments in select cities.

Transferrable lessons:

- Prioritize technical standards for emerging solutions like battery swapping systems to ensure compatibility across manufacturers and enable market scaling.
- Combine technical standards with financial mechanisms (e.g., user incentives, operator funding) to reduce early investment risks and attract private sector participation.
- Consider phased or targeted rollouts (e.g., specific cities or vehicle segments) to manage complexity and gather insights for broader implementation.

Developing market

FUNDING PROGRAM

Jurisdiction: Taipei, Taiwan province of China

Policy name: Electric Scooter Industry Environmental Value-Added Subsidy Program

Description: Taipei employs a multi-pronged strategy to foster a dense battery swapping network for electric scooters. This includes subsidies of up to 50% of the cost of charging and battery swapping station construction, provision of land, and requirements for strategic station placements (e.g., high density in urban areas, lower density in rural areas).[42] Non-financial measures like preferential parking for e-scooters and restrictions on older gasoline-powered scooters further bolster the program, aiming to establish battery swapping as a convenient and widespread recharging method.

Transferrable lessons:

- Combine direct financial support (e.g., subsidies, land provision) with non-financial incentives (e.g., parking benefits) to accelerate deployment of targeted infrastructure like a dense battery swapping network.
- Implement strategic placement mandates or guidelines (e.g., based on population density) to ensure network accessibility and user convenience.

---

41 NITI Aayog, *Battery Swapping*.

42 Asian Development Bank, *Electric Motorcycle Charging*.

- A comprehensive policy package addressing infrastructure cost, land access, and user convenience and discouraging legacy technologies can drive rapid market transformation.

INNOVATIVE BUSINESS MODELS

Jurisdiction: Rwanda

Pilot program: Supportive policy environment for battery-as-a service (BaaS) business model for electric motorcycles

Description: Rwanda actively promotes electric motorcycle taxis by creating a supportive policy environment to attract and enable BaaS providers.[43] The National Sustainable Mobility Policy is a key driver of this effort, signaling government commitment and potentially including incentives for charging and swapping solutions.[44] This fosters private sector investments from companies like Ampersand in battery swapping networks, allowing BaaS models to flourish.[45] The BaaS model lowers upfront costs for drivers, eliminating the need for individual charging.

Transferrable lessons:

- Establish supportive national policies to explicitly encourage and de-risk innovative business models like BaaS that address critical adoption barriers like high upfront cost.
- Signal clear government commitment to specific electrification pathways (e.g., motorcycle taxi BaaS) to attract targeted private sector investment and partnerships.
- Leverage the potential of BaaS to significantly improve affordability and accessibility, particularly in price-sensitive or commercial segments.

Passenger cars and vans

Early market

STANDARDS AND INTEROPERABILITY

Jurisdiction: United States

Policy name: National Electric Vehicle Infrastructure (NEVI) program[46]

Description: The NEVI program leverages federal funding ($5 billion) to expand charging infrastructure along highway corridors and fill gaps in rural, disadvantaged, and hard-to-reach locations. The program requires chargers to meet specific

43 Zhang and Miao, *Solar-Powered Battery Swap Stations*.

44 Rwanda Ministry of Environment, “Supercharging Rwanda’s E-mobility Transition,” 2022, https://www.environment.gov.rw/index.php?eID=dumpFile&t=f&f=55460&token=6003242e29667513f33c128466ffc760c62d81d8

45 Caitríona Palmer, “Kigali’s Big Shift to Small Electric Motorcycles Brings More Than Just Climate Benefits,” *International Finance Corporation*, May 6, 2024, https://www.ifc.org/en/stories/2024/kigali-shift-electric-motorcycles-brings-climate-benefit.

46 United States Department of Energy, “National Electric Vehicle Infrastructure (NEVI).”

standards, including software interoperability across key public charging interfaces: EV-to-charger, charger-to-charger network, charging network (CPO)-to-mobility service provider (MSP) or e-roaming platform, and payment methods.

Transferrable lessons:

- Utilize funding program requirements as a lever to mandate the adoption of standards, including software interoperability, especially where direct federal regulation of standards might be complex.
- Recognize that achieving functional software interoperability typically requires promoting the use of open-sourced standardized protocols, alongside establishing certification processes and supporting collaborative testing to ensure that systems using the same protocol can work together.

FUNDING PROGRAM

Jurisdiction: Canada

Program name: Zero Emission Vehicle Infrastructure Program[47]

Description: The Zero Emission Vehicle Infrastructure Program is Canada's national funding program designed to accelerate EV charging and refueling infrastructure deployment. The goal is to deploy 84,500 EV chargers and 45 refueling stations by 2029. This program has distinct funding schemes specifically tailored for various deployment scenarios: public spaces, on-street locations, multi-unit residential buildings, workplaces, and commercial fleets. Notably, it also includes dedicated streams for delivery organizations and Indigenous communities, reflecting an approach that combines broad market support with targeted equity considerations.

Transferrable lesson:

- Design diversified funding streams tailored to the unique barriers and needs of different charging deployment segments (e.g., residential, highway, public destination, fleet).
- Implement targeted funding approaches to ensure infrastructure reaches specific priority areas, user groups or deployment partners.
- Integrate equity considerations directly into funding program design, potentially through dedicated funding allocations or preferential criteria for underserved communities and lower-income groups.

POWER SECTOR INTEGRATION

Jurisdiction: United States

Action name: Creation of the U.S. Joint Office of Energy and Transportation[48]

Description: Established under the Bipartisan Infrastructure Law in 2021, the Joint Office formally coordinates efforts between the U.S. Departments of Energy and

47 Government of Canada, "Zero Emission Vehicle Infrastructure Program."

48 Joint Office of Energy and Transportation, "About."

Transportation. Its primary role is to leverage combined expertise to accelerate the planning and deployment of zero-emission transportation infrastructure. The Joint Office provides technical assistance, supports state-level planning, and facilitates stakeholder collaboration to ensure energy and transportation systems evolve cohesively.

Transferrable lessons:

- Establish formal mechanisms or dedicated bodies for cross-sector coordination between transportation and energy authorities early in the EV transition.
- Recognize that bridging institutional silos is crucial for aligning infrastructure deployment with grid planning and capacity development, especially given that grid upgrades often require longer lead times than EV adoption rates.
- Centralize expertise and resources with a coordinating body, actively building technical capacity to address the novel challenges of transportation electrification, particularly for utilities adapting to new mobility topics, streamline planning processes, and support sub-national implementation.

Jurisdiction: Netherlands

Action name: National Regulatory Authority[49]

Description: The Dutch National Regulatory Authority is mandated to review the current regulatory framework to ensure proactive, forward-looking electricity planning. This involves aligning grid development with national goals (affordability, security of supply and sustainability) and anticipated EV growth, focusing on improved forecasting, timely expansions, operator efficiency, and smart grid solutions deployment within future regulatory periods starting in 2027.

Transferrable lessons:

- Empower national energy regulators to enforce forward-looking grid planning cycles that anticipate future demands like EV charging.
- Require explicit alignment between electricity grid development plans and transportation electrification forecasts or targets (e.g., ZEV mandates, carbon dioxide [CO_2] emission standards).
- Integrate objectives such as improved forecasting, timely grid expansion, and smart solution deployment into the regulatory requirements and oversight of network operators.

Jurisdiction: United Kingdom

Policy name: Smart Charge Point Regulation[50]

Description: This regulation mandates smart charging capabilities for all new EV private charge points at home and workplace, aiming to manage electricity grid load and enhance security. It requires chargers to be accessible remotely and respond to signals for load shifting based on grid demand and availability of renewable energy. It

49 Pató, *Gridlock*.

50 The Electric Vehicle (Smart Charge Points).

also mandates specific default settings, such as pre-configured off-peak charging schedules and randomized start/end delays, to proactively encourage grid-friendly user behavior, and transparent and secure software updates.

Transferrable lessons:

- Target private chargers (home/workplace) first for smart charging mandates, leveraging their long dwell times for effective load shifting potential.
- Consider mandating specific default settings or applications (e.g., off-peak schedules, randomized delays) to ensure grid benefits are captured even with passive user engagement. Enabling factors like smart meter rollout and time-varying tariffs are often prerequisites to fully leverage dynamic smart charging.
- Integrate cybersecurity requirements alongside smart charging mandates to address the security implications of connected charging infrastructure.

DATA SHARING

Jurisdiction: European Union

Policy name: Alternative Fuels Infrastructure Regulation – National Access Points (NAP)[51]

Description: EU Member States are creating NAPs to streamline access to transportation-related data, facilitating interoperable travel and traffic services across the EU. Operators of public chargers are required to provide specific static data (e.g., location, number and type of connectors, opening hours) and dynamic data (e.g., operational status, availability, pricing) via standardized APIs through these NAPs. This aims to ensure transparent, consistent, and easily accessible charging information for users and third-party service providers across the EU.

Transferrable lessons:

- Mandate centralized access to both static and dynamic public charging data, including crucial real-time availability and price information, to significantly improve user experience and enable value-added services like planning apps.
- Clearly specify required data types, formats, and access protocols (e.g., standardized APIs) to ensure data consistency, usability, and straightforward integration by different parties.

Developing market

FUNDING PROGRAM

Jurisdiction: France

Policy name: Energy savings certificates[52]

51 Regulation (EU) 2023/1804.

52 “Le Programme de Financement de Bornes de Recharge pour Véhicule Électrique” [The electric vehicle charging station funding program], Advenir, accessed March 21, 2025, https://advenir.mobi/.

Description: The Energy Savings Certificate (CEE) system in France mandates energy suppliers to achieve energy savings by funding sustainable actions. The CEE system requires energy suppliers ("obligated parties") to meet savings targets every 3 years. Failure to meet these targets results in penalties. EV charging infrastructure deployment qualifies as such a project, and the dedicated Advenir program was established to channel CEE funds specifically for this purpose, supporting charging installations in locations like apartment buildings, businesses, and public spaces. By 2024, it helped install around 45,000 charging points.

Transferrable lessons:

- Leverage supplier obligation schemes to create dedicated, potentially self-sustaining funding pools for strategic goals independent of direct government budgets.
- Establish clear eligibility criteria and administrative platforms to effectively channel funds from obligation schemes towards specific priority sectors like charging infrastructure deployment.
- Carefully design the crediting and verification rules within such schemes to ensure additionality, prevent double counting of benefits, and clearly define whether the energy supplier or the charge point operator is entitled to the green attributes associated with the electricity used.

Jurisdiction: France

Policy name: National decree on financing the deployment of charging infrastructure in private residential buildings[53]

Description: This decree specifically addresses the barrier of high upfront costs for shared electrical installations needed for EV charging in multi-unit residential buildings. It allows the public utility company Enedis to pre-finance these necessary collective upgrades. Enedis recovers the costs over time by setting a nationally regulated, fixed fee for individual residents when and if they decide to install an EV charger in their parking spot. This regulated fee range effectively creates a cross-subsidy between lower-cost (newer buildings) and higher-cost (older buildings) installations, ensuring broad affordability.

Transferrable lessons:

- Utilize regulated utility financing models to overcome high upfront costs and the "split incentive" problem associated with shared electrical upgrades in apartment buildings.
- Implement cost recovery mechanisms where individual residents pay a regulated fee only upon needing and installing their charger, solving the "who pays now for future benefit" dilemma common in multi-unit residential buildings.
- Employ regulated price bands for the individual connection fee to ensure affordability and equity across residents in buildings with varying upgrade costs.

53 Délibération de la CRE du 12 avril 2023.

- Consider the utility's capacity and potential need for government risk-sharing (e.g., loan guarantees) if adopting this model, especially with smaller utilities or in markets requiring significant initial investment.

Jurisdiction: India

Policy name: PM-EDRIVE: Scheme for Electric Vehicle Public Charging Stations[54]

Description: This initiative provides dedicated funding of ₹20 billion (~$240 million) to expand the public charging network. The program employs a strategic dual focus: (1) densifying the charging grid within cities and (2) establishing robust charging corridors along major highways. While designed to benefit all EV segments, this approach is particularly critical for enabling mass adoption of passenger cars by addressing urban charging gaps and inter-city range anxiety.

Transferrable lessons:

- Provide funding for charging infrastructure beyond the initial market-seeding phases to signal long-term government commitment and build investor confidence.
- Employ a dual-pronged deployment strategy that simultaneously targets both urban charging density and inter-city highway connectivity to address the two primary barriers to widespread EV adoption.
- Leverage public funds to de-risk private investment to charge point operators, a key strategy to accelerate the build-out of a comprehensive public network.

RELIABILITY

Jurisdiction: United Kingdom

Policy name: Public Charge Point Regulations[55]

Description: This regulation addresses public EV charger reliability by mandating a minimum 99% uptime requirement for rapid chargers (of 50 kW and above), measured as an average across each charging network operators' rapid network in a year. Compliance involves mandatory annual reporting to the government using the standardized Open Charge Point Interface (OCPI) protocol and public disclosure of reliability performance on operators' websites. Significant penalties, as high as £10,000 per charge point, can be applied for non-compliance, thus ensuring accountability.

Transferrable lessons:

- Implement quantifiable reliability targets (e.g., minimum uptime requirements) for public chargers, particularly rapid ones, to ensure dependable service and build user confidence. Other metrics like California's "successful charge rate," defined as a charging session that lasts more than 2 minutes, can also be considered.

54 Ministry of Heavy Industries, "PM E-Drive Scheme," press release, April 1, 2025, https://www.pib.gov.in/PressReleasePage.aspx?PRID=2117294.

55 The Public Charge Point Regulations.

- Mandate standardized data reporting and public disclosure of reliability performance by operators to enhance transparency, enable informed user choices, and drive operator accountability.
- Engage stakeholders during regulation development to ensure reliability targets are ambitious yet achievable and the associated costs and implementation challenges are understood.

CHARGING INSTALLATION TARGETS

Jurisdiction: European Union

Policy name: Alternative Fuel Infrastructure Regulation (AFIR)[56]

Description: The AFIR establishes binding installation targets for public chargers for Member States using a dual approach. Fleet-based targets require Member States to ensure a total public charging power output of at least 1.3 kW for each registered BEV and 0.8 kW per registered plug-in hybrid EV, ensuring overall capacity grows with EV adoption. Complementing this, distance-based targets mandate the installation of fast-charging pools along the core Trans-European Transport network every 60 km, increasing in required minimum power output per pool over time, reaching 600 kW by the end of 2027, and including at least one charger of 150 kW minimum power, thus ensuring network coverage and minimum service levels.

Transferrable lessons:

- Employ a dual approach for public charging targets, using both fleet-based and distance-based targets, to ensure total capacity scales with EV uptake, wider geographical coverage, and network availability.
- Define minimum power output requirements within distance-based targets, specifying power levels both for charging location and individual high-power fast chargers. Build in adaptability for future market evolution to allow targets to adjust over time.
- Align infrastructure targets with vehicle deployment policies, directly linking to regulations such as CO_2 emissions standards or ZEV mandates for a cohesive and mutually reinforcing transition strategy.

Jurisdiction: European Union

Policy name: Energy Performance Building Directive (EPBD)[57]

Description: The updated EPBD mandates EV charging readiness within apartment buildings, commercial centers, and offices. For new and majorly renovated residential buildings, it requires pre-cabling of at least 50% of parking spots, ducting for others, installation of minimum charge points, and capabilities for smart (and potentially bidirectional) charging. New and majorly renovated office buildings must install one charging point for every two parking spaces. For all non-residential buildings with more than 20 car parking spaces, Member States must either ensure the installation of at least one charging point for every 10 car parking spaces or ensure ducting for at

56 Regulation (EU) 2023/1804.

57 Directive (EU) 2024/1275.

least 50% of the parking spaces by 2027. Crucially, it promotes a "right to plug," urging Member States to streamline installation procedures and remove regulatory barriers such as the consent of the landlord or co-owners.

Transferrable lessons:

- Utilize building codes and performance directives to mandate EV charging readiness, addressing charging needs at home and destinations.
- Differentiate requirements based on building type (residential vs. non-residential) and status (new vs. major renovation) to tailor mandates appropriately.
- Mandate future-proofing measures like pre-cabling, ducting, and smart charging capabilities in new constructions and major renovations to significantly lower the cost of future charger installations.
- Implement "right to plug" provisions to overcome administrative and consent barriers, particularly for residents in multi-unit dwellings.

Scaling market

EQUITABLE DEPLOYMENT OF PUBLIC CHARGING INFRASTRUCTURE

Jurisdiction: California, United States

Policy name: Senate Bill 1000[58]

Description: This legislation requires the California Energy Commission to regularly assess the equitable deployment of EV charging infrastructure across the state. A 2022 Commission report assessed drive time to the closest DC fast charging station, measured relative to demographic, geographic (urban/rural), and income data. Crucially, the findings from this mandated equity assessment are used to inform and guide investments from the state's Clean Transportation Program.

Transferrable lessons:

- Mandate regular, data-driven assessments of charging infrastructure deployment equity using clearly defined metrics (e.g., accessibility by income, education level, geography, and demographics) to bridge the gaps.
- Explicitly link the findings of these equity assessments to the allocation criteria and priorities of relevant funding programs to ensure investments actively target and bridge identified accessibility gaps.

WORKFORCE TRANSITION

Jurisdiction: United States

Action name: Electric Vehicle Infrastructure Training Program (EVITP)[59]

58 California Energy Commission, "Electric Vehicle Infrastructure Deployment Assessment – SB 1000."

59 Electric Vehicle Infrastructure Training Program, "About Us."

Description: EVITP offers standardized, comprehensive training and certification specifically for installation of EV charging equipment. Notably, the program's curriculum was developed collaboratively with a wide range of stakeholders (including automotive, utility, and charging equipment manufacturers, industry-related professional associations, and educational bodies) ensuring industry relevance. To be eligible for EVITP, a participant must be a state licensed or certified electrician, thus leveraging existing professional standards. Government actions, such as the NEVI program's requirements and California state law (Public Utilities Code 740.20), mandate or incentivize the use of at least one EVITP-certified electrician for publicly funded charging installations, formally integrating the industry model into policy requirements.

Transferrable lessons:

- Establish standardized, industry-recognized training and certification programs for key EV infrastructure roles to ensure workforce quality, safety, and competency.
- Ensure training curricula are developed collaboratively with diverse industry stakeholders to guarantee relevance and alignment with real-world needs and technology.
- Define clear prerequisites or build upon existing professional qualifications for participation in specialized EV training to maintain high standards.
- Integrate adherence to high-quality, standardized industry certifications like EVITP when deploying public funds to ensure workforce competency aligns with public investment.

COMPETITION ANALYSIS AND TRANSPARENCY

Jurisdiction: European Union

Action name: Competition agencies investigations[60]

Description: Anticipating potential competition issues in the rapidly growing EV charging market, European competition authorities proactively conducted sector analyses in several EU countries. Although initial findings indicated no widespread problems, the analyses identified key areas of future risk. These include potential abuse of local market power, market tipping toward concentration, access restrictions due to vertical integration or collusion, and distortions from public funding arrangements such as exclusive concessions.

Transferrable lessons:

- Conduct proactive competition monitoring and sector inquiries in emerging, rapidly scaling markets—before significant issues fully materialize—to anticipate risks and avoid abuse of market power.
- Analyze potential anti-competitive risks stemming from market structure, including vertical integration, incumbent advantages (e.g., utilities, original equipment manufacturers), network effects, and the design of public support mechanisms (e.g., concessions).

60 European Commission, *Competition Analysis*.

- Consider the scope of competition analysis beyond just public charging to include other relevant segments, such as destination or private-residential charging markets.

Trucks and buses

Early market

HIGH-POWER CHARGING STANDARDS FOR HDVS

Jurisdiction: European Union and United States Joint Initiative

Policy name: Joint Statement by the EU-U.S. Trade and Technology Council[61]

Description: The European Union and the United States jointly committed to developing and deploying a shared high-power charging standard for HDVs, endorsing the Megawatt Charging System (MCS) standard. This initiative leverages the existing recognition of the MCS standard by international standards bodies (including the International Electrotechnical Commission, the Society of Automative Engineers, and the International Organization for Standardization). The collaboration aims to ensure interoperability, prevent market fragmentation, and facilitate trade, and it encompasses both physical connectors (plugs) and a common communication interface (including for V2G).

Transferrable lessons:

- Pursue international collaboration when establishing standards for emerging charging technologies to accelerate progress, ensure interoperability, and prevent costly market fragmentation.
- Align standardization efforts with established international standards organizations to leverage existing work and increase the likelihood of global adoption.
- Adopt a holistic approach to interoperability by standardizing both physical components (connectors) and communication protocols (including V2G) concurrently.

ALTERNATIVE CHARGING SOLUTIONS

Jurisdiction: China

Action name: Battery Swapping Mode Application Pilot Program (2021)[62]

Description: To accelerate the adoption of battery swapping, China's Ministry of Industry and Information technology (MIIT) launched a national pilot program across 11 cities. This program specifically targets high-use commercial vehicles where rapid refueling is critical, including heavy-duty trucks used at ports, construction sites, and mining operations. The policy provides a clear signal of government support and

61 European Commission, *Joint Statement*.

62 Lingzhi Jin, *Accelerating New Energy Vehicle Uptake in Chinese Cities: A 2023 Policy Update in a Post-Subsidy Era* (International Council on Clean Transportation, 2023), https://theicct.org/publication/accelerating-new-energy-vehicle-uptake-in-chinese-cities-2023-policy-update-post-subsidy-era-dec23/.

encourages local governments to invest in building battery swapping networks and developing standardized, interoperable battery packs.

Transferrable lessons:

- Initiate targeted pilot programs to test and de-risk emerging technologies like battery swapping for specific, high-impact commercial applications before pursuing a nationwide rollout.
- Provide clear government signaling and financial support for demonstration projects to attract private sector investment and accelerate the development of new infrastructure ecosystems.
- Focus on policy efforts to address key operational barriers (e.g., long refueling times for commercial fleets) where alternative solutions can offer a distinct advantage over slow charging.

CHARGING STRATEGIES FOR REGIONAL ELECTRIC TRUCK FLEETS

Jurisdiction: Sweden

Pilot program: The Regional Electrification of Logistics (REEL) Project[63]

Description: The REEL project is a large-scale demonstration project focused on electrifying regional freight transport in Sweden. The project involves deploying numerous battery electric trucks and testing various charging strategies (e.g., depot vs. opportunity charging), high-power solutions, operational management (charging scheduling), and grid integration impacts. The REEL project is a collaborative effort involving truck manufacturers, logistics companies, charging infrastructure providers, electricity utilities, and research institutions, with support from the Swedish Energy Agency and Transport Administration.

Transferrable lessons:

- Support large-scale demonstration projects to evaluate and compare different charging strategies (e.g., deport vs. opportunity charging) and their operational feasibility for specific commercial applications like regional trucking.
- Utilize pilot projects to gather crucial real-world data on the performance of high-power charging solutions, their grid impacts, and the effectiveness of associated load management techniques for HDVs.
- Incentivize the use of sophisticated charging management systems as critical tools for optimizing fleet charging, managing energy costs, and ensuring grid stability.

63 Closer, *REEL Regional Electrified Logistics*.

Developing market

CHARGING INSTALLATION TARGETS

Jurisdiction: European Union

Policy name: Alternative Fuel Infrastructure Regulation (AFIR)[64]

Description: The AFIR establishes binding targets for building HDV charging infrastructure along the EU's core Trans-European Transport road network. It requires Member States to ensure deployment of high-power charging stations (with at least one 350 kW charger) every 120 km, with a goal of 100% coverage by 2030. This phased approach provides a clear timeline and targets for infrastructure deployment. The AFIR stimulated several pilot projects focused on HDV charging using the MCS standard and private-sector investment in HDV charging (e.g., the Milence joint venture), demonstrating growing industry commitment.

Transferrable lessons:

- Set binding, distance-based deployment targets for public charging infrastructure along key corridors to provide investment certainty and drive network development.
- Employ a phased approach for target implementation to allow for manageable rollout and adaptation.
- Ensure targets include minimum power specifications for HDV chargers to guarantee adequate charging speeds and service levels.

ZERO-EMISSION FREIGHT CORRIDOR DEVELOPMENT

Jurisdiction: United States

Policy name: The National Zero-Emission Freight Corridor Strategy[65]

Description: This national strategy outlines a phased approach for developing EV charging infrastructure along freight corridors. The initial phase focuses on establishing Zero-Emission Hubs at strategic locations (e.g., rail yards, freight terminals, airports) to anchor the network, target high-traffic areas, facilitate operational integration, and enable focused learning before broader network expansion, with the ultimate goal of achieving complete coverage across major freight corridors between 2035 and 2040.

Transferrable lessons:

- Employ a phased deployment strategy for freight corridors, starting with strategic hubs to allow for manageable, targeted, and iterative learning from initial deployments.
- Prioritize initial infrastructure investments at key logistics hubs, where freight activity is concentrated, to maximize impact and ease integration with existing operations.

---

64 Regulation (EU) 2023/1804.

65 Joint Office of Energy and Transportation, *Corridor Strategy.*

Jurisdiction: Germany

Policy name: Power to the Road Project[66]

Description: Germany's Power to the Road Project, a key component of the national Deutschlandnetz strategy, focuses on establishing a robust high-power charging network along highways. The goal is 95% coverage with at least 1,000 high-power charging stations. Critically, the project plans a future transition to megawatt-level charging using the MCS standard, specifically targeting the fast-charging needs of HDVs to reduce charging times and align with the broader European strategy under the AFIR.

Transferrable lessons:

- Focus on high-density charging deployment on essential routes to ensure infrastructure availability for key commercial applications (e.g., long-haul trucking).
- Future-proof infrastructure by deploying current technology while having a clear roadmap for adopting next-generation standards (e.g., MCS) to maintain relevance and interoperability.
- Utilize public-private partnerships to pool resources, expertise, and capital, accelerating the rollout of large-scale charging networks.

FUNDING PROGRAM

Jurisdiction: California

Policy name: Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles Project (EnergIIZE)[67]

Description: EnergIIZE, funded by the California Energy Commission (CEC) and implemented by CALSTART, offers financial incentives for purchasing and installing charging equipment for medium- and heavy-duty vehicles. Moreover, the CEC established the Research Hub for Electric Technologies in Truck Applications to advance high-power charging systems and develop innovative corridor charging strategies for electric trucks.

Transferrable lessons:

- Provide targeted incentives to reduce the high upfront cost of charging infrastructure for fleet operators, accelerating the adoption of zero-emission trucks and buses.
- Adopt a combined approach of incentives and research and development to address the immediate needs of deploying charging infrastructure and navigate the challenges of advancing charging technologies and grid integration.
- Focus on corridor charging strategies along major transportation routes to support long-haul trucking and enable a broader adoption of electric HDVs.

66 "E-Mobilität für alle: Das Deutschlandnetz mit 9.000 Ladepunkten kommt" [E-mobility for all: The German network with 9,000 charging points is coming], Deutschlandnetz, accessed March 21, 2025, https://www.deutschlandnetz.de.

67 EnergIIZE, "About."

Scaling market

EQUITY

Jurisdiction: United States

Policy name: U.S. Environmental Protection Agency Clean Bus Program[68]

Description: EPA's Clean School Bus Program prioritizes funding for school districts in high-poverty, rural areas, and tribal communities, considering that these communities often bear the brunt of air pollution from diesel buses and have limited resources to invest in electrification. The program provides rebates for purchasing and installation of eligible charging equipment, including Level 2 chargers for overnight charging at bus depots and DC fast chargers for operational needs. As the cost of charging infrastructure can be a significant barrier to school districts adopting electric buses, the program helps make electric buses more accessible and affordable for school districts across the country, especially those in underserved communities.

Transferrable lessons:

- Prioritize funding for high-need districts and underserved communities to ensure the equitable distribution of electric bus benefits. Reduce the financial burden of transitioning to electric school buses, including necessary charging infrastructure.
- Incentivize inclusive utility programs and building community charging and grid resilience into depot upgrades.
- Prioritize collaboration between government agencies, school districts, utilities, and community organizations to ensure electric buses benefits all underserved communities.

68 U.S. Environmental Protection Agency, "Clean Bus Program," accessed March 21, 2025, https://www.epa.gov/cleanschoolbus.