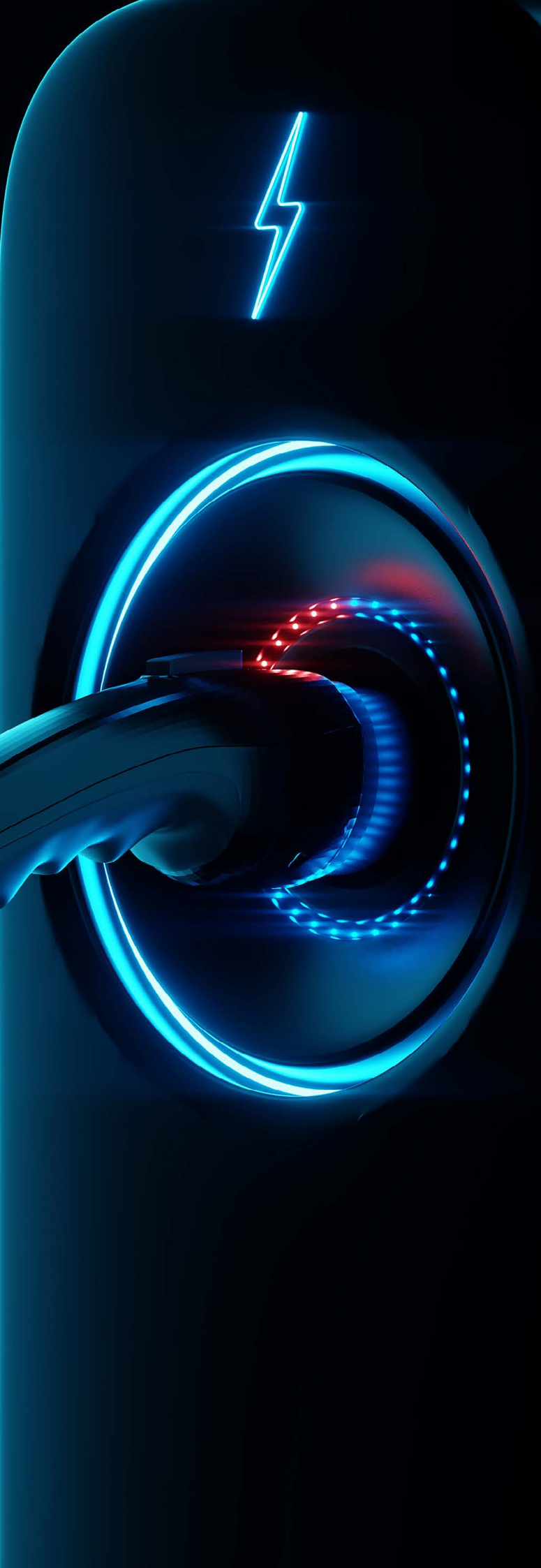




The Future of EV Charging: Accelerating EV Infrastructure to Meet Surging Demand



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Executive Summary

With over 250,000 new electric car registrations per week, and electric vehicles (EVs) representing nearly 18% of all car sales, the demand for reliable charging infrastructure is becoming increasingly urgent. Here we explore the charging market, the underlying trends, and why connectivity is fundamental to the future success of EV charging stations.



EV Adoption

The rise of electric vehicles is undeniable. The International Energy Agency (IEA) reported that in 2023, nearly one in five cars sold worldwide was electric, with almost 14 million new electric cars hitting the roads, bringing the total global count to 40 million¹.

This marks a significant increase from 2022, with electric car sales rising by 3.5 million, a 35% year-on-year growth and over six times higher than in 2018.

What's more, there was over 250,000 new electric car registrations per week in 2023, surpassing the entire annual total in 2013², according to the IEA's 2024 Global EV Outlook report indicating sustained robust growth as the electric vehicle market matures.

Geographical Distribution

Despite the global increase, the distribution of electric car sales remains heavily concentrated in specific markets. Nearly 60% of new electric car registrations occurred in China, followed by nearly 25% in Europe and 10% in the United States, accounting for nearly 95% of global electric car sales combined, the study reveals.

In these leading markets, electric cars represent a significant share of new car registrations, with over one in three cars in China, one in five in Europe, and one in ten in the United States being electric.

Europe saw substantial growth, says the IEA, with new electric car registrations reaching nearly 3.2 million in 2023, a nearly 20% increase compared to 2022. In the EU, sales amounted to 2.4 million, with similar growth rates.

Around 25% of all cars sold in France and the United Kingdom were electric, 30% in the Netherlands, and 60% in Sweden. In Norway, despite a contraction in the market, electric car sales shares increased slightly, maintaining its position as the leader in Europe, with almost 95% of new car sales being electric³. More than two-thirds of residents in Oslo, own an EV, leading the world in terms of EVs per capita, according to McKinsey⁴.

Heavy Vehicle Infrastructure

Demand for electric buses and trucks is also rising⁵, which require more dedicated high-power charging solutions along major transport routes⁶.

Europe will need approximately 50,000 charging points for heavy-duty commercial vehicles by 2030, including both ultra-

fast Megawatt Charging Systems (MCSs) and Combined Charging Systems (CCSs), according to Traton⁷. While the EU has approved regulations for expanding public charging infrastructure, current plans fall short of meeting the required demand, highlighting the need for more ambitious efforts. To help address this gap, vehicle manufacturers have started forming joint ventures to invest in charging infrastructure⁸.

Tailored Solutions for Different Use Cases

Further complicating matters is that requirements for heavy-duty electric vehicles vary based on their use cases. Long-haul trucks, which cover extensive distances annually, require high-power charging infrastructure capable of supporting their operational needs. On the other hand, distribution vehicles, such as last-mile delivery trucks and city buses, operate over shorter distances and benefit from strategically placed fast charging stations for efficient top-ups.

¹ <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars>

² <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars#:~:text=In%202023%2C%20there,stock%20in%202023.>

³ <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars>

⁴ <https://www.mckinsey.com/business-functions/operations/our-insights/shaping-the-future-of-fast-charging-ev-infrastructure>

⁵ <https://theicct.org/europes-electric-truck-market-surges-aug23/>

⁶ <https://www.electromaps.com/en/blog/fast-charging-points-60-km-europe-main-roads>

⁷ <https://traton.com/en/newsroom/stories/europes-new-rules-for-commercial-vehicles.html>

⁸ <https://www.volvogroup.com/en/news-and-media/news/2022/jul/news-4307331.html>



Meeting Mass-Market Demand

In 2023, the public charging network saw a significant increase of over 40%, with fast chargers experiencing a growth rate of 55%, surpassing that of slow chargers. By the end of the year, fast chargers constituted over 35% of the public charging network. Despite making progress, charging infrastructure must accelerate to keep pace with growing demand.

Regulatory Support

In response the EU aims to have one million public charging points in 2025⁹, and four million charging points across the continent by 2030. The EU estimates 44 million EVs will be on European roads¹⁰ before the end of the decade.

New regulatory measures like the EU's alternative fuels infrastructure regulation (AFIR) demand the installation of public fast chargers every 60 km along major transport corridors.

Other developed markets are also strengthening support for Electric Vehicle Supply Equipment (EVSE) infrastructure while adjusting funding for vehicle incentives. Despite ending subsidies for private cars, the United Kingdom continues to incentivize private and public charging installations, with a projected 300,000 public chargers by 2030.

In the United States, funding has been allocated for new EVSE projects, contributing to the installation of more than 180,000 public chargers, with a target of reaching 500,000 by 2030.

New regulations focus on payment methods and infrastructure reliability, aiming to improve the overall customer experience.

Interoperability Challenges and Solutions

As the number of public chargers continues to grow, attention has shifted towards ensuring interoperability across different charging networks. Legislative measures like the AFIR regulation will enhance interoperability. However, achieving seamless interoperability on a global scale requires collaborative efforts among stakeholders to establish common standards and protocols.

⁹ <https://www.reuters.com/article/us-eu-autos-electric-charging-idUSKBN2C023C>

¹⁰ <https://www.transportenvironment.org/discover/eu-needs-15-times-more-public-chargers-2030-help-become-climate-neutral-analysis/>



Conclusion: Charging Deployments Must Accelerate

Given the market trends we've described, there is a need for charging point deployments to accelerate to keep pace with EV vehicle sales.

Research firm Berg Insight projects that the installed base of public charging points worldwide will hit 22.8 million units in 2025 but of these there will be just 7.9 million charging points in North America and Europe¹¹. Substantial acceleration in charging point installations is projected towards the end of the decade with IHS Markit's EV Charging Infrastructure Forecast projecting global deployment to exceed 66 million units by 2030¹².

Charging habits differ widely between markets with many European EV owners choosing to charge their cars at home because they favour the convenience,

lower cost and simplicity of using their own chargers.

Approximately 20 million European houses are expected to have domestic charging stations by 2030, but public charging infrastructure will still need to grow substantially to meet the needs of EV users that travel longer distances or simply have no means to charge at home due to lack of on-site parking in cities, for example.

Car makers and energy companies are therefore investing heavily in EV charging infrastructure in order to make the user

¹¹ <https://www.berginsight.com/the-number-of-connected-ev-charging-points-in-europe-and-north-america-to-reach-79-million-by-2025>

¹² <https://ihsmarkit.com/research-analysis/ev-charging-infrastructure-report-and-forecast.html>

experience attractive for consumers and to alleviate concerns such as range anxiety. The cost of public charging needs to come down and the speed of charging needs to accelerate to make long distance EV usage more appealing.

Fast charging is essential because if you consider that a typical ICE vehicle might need a five minute refuel every 600km or more it is obvious that simply switching existing diesel or petrol stations to charging sites won't provide enough terminals to handle charging demand. Even fast charging takes at least 30 minutes for a partial charge so, taking into account those that charge at home or work, it's clear that large charging facilities and infrastructure are needed.

Providers Proliferate

As mentioned, the variety of charging providers presents challenges due to the lack of standardization. These providers include car makers, energy companies, and specialized charging firms, each with different approaches and payment methods. To address this, roaming payment solutions are emerging, allowing users to access various charging stations regardless of their service provider.

Roaming networks enable EV drivers to enjoy a consistent charging experience worldwide, reducing range anxiety and enhancing convenience.

Companies facilitating a global charging experience with unified payment methods appeal to customers seeking hassle-free charging.

Plug and Charge, for example, is one of the simpler ways for drivers to charge their electric vehicles. Instead of having to use a credit card, presenting an RFID tag, or using a mobile app, all drivers need to do is connect their vehicle to the charge point – via cable for AC or DC charging vehicles or Wi-Fi for wireless charging. Plug and charge is enabled by ISO 15118, the international standard for charging electric vehicles.

In addition, starting in April of this year, all charge point operators in the EU are required to ensure that any new charging station accepts contactless payments and payment cards¹³.

Expanding on the goal for unified charging experiences, recent market entrants, including traditional fuel vendors and automotive supply chain companies, reflect the growing interest in EV charging as the market shifts away from fossil fuels.

¹³ <https://www.adyen.com/knowledge-hub/afir-eu-directive-affects-ev-charging-payments>



Charging Challenges

Although charging infrastructure is expanding, challenges persist. The power grid often requires upgrades to meet charging demands, especially at busy locations like highway interchanges and city centers. Additionally, there are significant costs associated with installing charging terminals, particularly for high-power chargers.

Technician shortages and the need to ramp up production of fast charging hardware further complicate matters. Furthermore, the transition to green electricity adds another layer of complexity, requiring providers to ensure sufficient renewable energy availability.

Charging Point Operators also face expenses related to upgrading existing chargers to meet evolving standards. Car manufacturers advocate for fair pricing and transparent regulations to ensure equitable access to charging networks. Standardization efforts, such as the Open Charge

Point Protocol (OCPP), aim to balance demand and supply, fostering a more user-friendly and efficient charging experience.

Aligning EV Charger Deployment with Grid Development

It's crucial to coordinate the deployment of EV chargers with developments in the power grid to ensure alignment with long-term grid planning. Mismanagement of charging infrastructure can strain peak demand, highlighting the need for appropriately sized and equipped transmission

and distribution grids. Strategies like time-of-use tariffs and smart-charging will become increasingly vital as EV adoption expands.

Additionally, integrating Vehicle-to-Grid (V2G) technology into charging infrastructure can enhance grid stability by allowing EV batteries to store and discharge energy based on grid demand fluctuations, contributing to more efficient and resilient energy management systems.

Optimizing Public Charging Infrastructure

Maintaining high ratios of publicly available charging capacity to EVs in use is crucial, particularly in regions where home charging is less accessible. Sufficient coverage helps address range anxiety and enables the use of vehicles with smaller battery capacities, thus reducing costs and demand for critical materials. However, striking the right balance in planning for

this ratio can be challenging due to the diverse supply and demand dynamics across countries.

Evaluating Charging Capacity per EV

Considering the total charging capacity per EV, rather than the EV-to-EVSE ratio, may offer more relevance, particularly as fast chargers can serve more EVs per day than slow chargers. Initially, during infrastructure development, the ratio of charging capacity to EV tends to be high, given the low charger utilization. However, as the market matures and utilization increases, the capacity per EV typically decreases.

Improving Long Distance Travel

As mentioned, governments in the EU and US are prioritizing the establishment of EVSE networks along major motorways to connect cities.

Why Mobile/Cellular Connectivity?

Integrated IoT solutions redefine the charging experience, enabling real-time incident management, load balancing, seamless billing integration, and support for vehicle-to-grid integration. Connectivity fosters ecosystem integration, enabling standardi-

zation, data-driven insights, and future-ready scalability for charging operators. Connectivity is an essential enabler for charging systems to seamlessly integrate into an interconnected ecosystem.

Leveraging Connectivity for Enhanced Charging Services

In addition to Over-the-Air (OTA) updates, connectivity opens doors to services that enhance the functionality and efficiency of EV charging stations. Beyond mere power delivery, connected services enable:

- 1. Customer Service and Incident Management:** Real-time connectivity enables prompt response to incidents, ensuring seamless operations and efficient issue resolution. Adding proactive monitoring and control functionalities ensures that the parking space is always in service.
- 2. Load Balancing and Network Optimization:** Through intercharger communication, operators can dynamically balance load across stations, optimizing resource utilization and enhance network performance.
- 3. Seamless Billing Integration:** Connectivity enables seamless communication with billing institutes for Charge and Pay (C&P) processes, streamlining payment transactions and enhancing user experience.
- 4. Support for Vehicle-to-Grid (V2G) and Vehicle-to-Home (V2H) Integration:** Connectivity fosters collaboration with energy companies, enabling V2G and V2H functionalities that maximize the utility of EVs and promote sustainable energy practices when providing long-term parking.

Integrating Ecosystems for Charging Operators

Connected services serve as a foundational element in building robust charging ecosystems. By fostering collaboration and integration across various stakeholders, connectivity enables:

- **Standardization and Interoperability:** Standardized communication protocols and interoperable systems facilitate seamless operation across different charging networks, enhancing user accessibility and convenience.
- **Ecosystem Expansion:** Connectivity empowers charging operators to collaborate with energy providers, automotive companies, and other ecosystem players, driving innovation and expanding service offerings.
- **Data-Driven Insights:** Real-time data collection and analysis empower operators with actionable insights into charging patterns, user behavior, and network performance, enabling data-driven decision-making and continuous optimization.
- **Future-Ready Scalability:** With scalable and adaptable IoT solutions, charging operators can future-proof their infrastructure, accommodating evolving technology trends and growing market demands.

By embracing connected services and fostering ecosystem integration, charging operators can elevate the charging experience, accelerate market growth, and pave the way for a sustainable future of mobility.

Telenor IoT and the Future of Energy Management

With two decades of IoT experience, Telenor IoT is uniquely positioned to provide global connectivity, around-the-clock expertise, and all the tools needed to support the mass deployment and connectivity of charging stations.



Telenor Connexion

Telenor IoT is the portfolio of IoT solutions from Telenor Group, one of the world's major mobile operators. With more than 20 years' experience of providing global IoT connectivity, cloud services and expert support to companies of all sizes, Telenor is one of the world's most advanced IoT solution providers. Telenor IoT manages international IoT deployments for global customers in some 200 countries and today operates more than 20 million connected devices to enterprises such as Volvo, Scania, Hitachi, Verisure Securitas Direct and Husqvarna. The IoT solutions are offered to national customers in the Nordics through the local Telenor operations in each country, and on a global level through Telenor Connexion, Telenor's specialized unit that provides IoT solutions for large, international enterprises who need a customized offer with advanced support.

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