The Future of Electric Vehicle Charging

IoT plays a critical role in fueling the EV charging revolution. Here we explore the charging market, the underlying trends, and why connectivity is fundamental to the future success of EV charging stations.

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High-speed, connected EV charging powers up to meet mass-market demand

Electric vehicle uptake is accelerating as consumers turn away from vehicles with internal combustion engines (ICE). Already, more than two-thirds of residents in Oslo, Norway own an EV, heading the world in terms of EVs per capita according to management consultancy McKinsey[1] and, with European nations aiming to ban sales of new ICE vehicles by 2035, the direction of travel is set for an electric future[2].

McKinsey estimates that EVs will make up 75% of European new car sales by 2030 and the electric vehicle market in general is growing with increased sales of two and three wheeled vehicles in addition to four-wheeled cars. While Norway has already exceeded this goal, overall electric cars accounted for 17% of Europe's auto sales in 2021, according to the International Energy Agency[3].

The largest market in Europe by volume of EVs sold is Germany, where electric cars accounted for 25% of new cars sold in 2021. Germany offers some of the highest subsidies in Europe. The countries with the largest market share for new electric car sales in 2021 in Europe were Norway (86%), Iceland (72%), Sweden (43%) and the Netherlands (30%), followed by France (19%), Italy (9%) and Spain (8%).

Bloomberg New Energy Finance (NEF) estimates that more than 5.6 million EVs were sold in 2021[4], in spite of the pandemic, and EV tax credits and subsidies along with tightening CO_2 regulations and penalties are helping to accelerate adoption. The rate of EV sales is outstripping the deployment of charging stations even as EV makers such as Tesla continue to roll-out their own networks of fast chargers.

The EU has declared an ambition of having one million public charging points in 2025[5], achieving a ratio of ten EVs per charging station and aims to have between three and four million charging points across the continent by 2030 to meet growing demand that it estimates will see 44 million EVs on European roads[6].

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[1] https://www.mckinsey.com/business-functions/operations/our-insights/shaping-the-future-of-fast-charging-ev-infrastructure
[2] https://www.euractiv.com/section/transport/news/eu-countries-approve-end-to-combustion-engine-sales-by-2035/
[3] https://www.iea.org/reports/global-ev-outlook-2022/trends-in-electric-light-duty-vehicles
[4] https://about.bnef.com/blog/electric-vehicle-sales-headed-for-five-and-a-half-million-in-2021-as-automakers-target-40-million-per-year-by-2030/
[5] https://www.reuters.com/article/us-eu-autos-electric-charging-idUSKBN2C023C
[6] https://www.transportenvironment.org/discover/eu-needs-15-times-more-public-chargers-2030-help-become-climate-neutral-analysis/

CHARGING DEPLOYMENTS MUST ACCELERATE

There is an obvious need for charging point deployments to speed up to meet this target. 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 Europe[7]. 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 2030[8].

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. Attractive charging stations have been created to address this market by a large number of companies that offer a wide range of charging stations and cables to make it easier and more efficient to charge electric vehicles.

Approximately 20 million European houses are expected to have domestic charging stations by 2030, according to IHS Markit, 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 experience attractive for consumers and to allay 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, even taking into account those that charge at home or work, it's clear large charging facilities and infrastructure are needed.

PROVIDERS PROLIFERATE

Today, the situation is further complicated by lack of standardization. Charging providers fall into three categories: car makers, energy providers and a new breed of specialist charging provider. Each has different strategies, business models and payment methods that mean not all users can charge their EVs as they roam across multiple countries. To overcome this, roaming payment solutions are provided by a number of companies and chargers will increasingly be equipped with solutions for credit or debit card payments.

For an electric vehicle driver, roaming offers the ability to use various charging stations even if the EV driver is only a customer of one service provider. Roaming networks open up access to thousands of charging stations, all around the world so EV drivers can be offered a consistent and hassle-free charging experience, no matter where they drive. Companies that ensure a global EV charging experience that uses the same payment method or customer account details to offer access to multiple charging point operators (CPOs) will reduce range anxiety and be more appealing to customers. More recently, traditional fuel vendors have entered the market in a bid to derive new value from their outlets as the market moves away from fossil fuels. Now a further wave of automotive supply chain companies, battery providers and real estate businesses are also entering the market.

[7] https://www.berginsight.com/the-number-of-connected-ev-charging-points-in-europe-and-north-america-to-reach-79-million-by-2025
[8] https://ihsmarkit.com/research-analysis/ev-charging-infrastructure-report-and-forecast.html

CHARGING CHALLENGES

Momentum to build new charging infrastructure and facilities is accelerating with government encouragement and the commitment of charging providers or CPOs but there are substantial challenges to be overcome.

The power grid itself is not suitable to address the demands of charging in many locations. Often the electricity grid will need to be upgraded to support charging, especially for the large charging plazas envisaged for busy highway interchanges and city centre parking facilities. In domestic scenarios, if every customer sets their EV to charge at an off-peak rate in the middle of the night, the off-peak suddenly becomes the peak, skewing demand on the grid and affecting power generation decisions. Progress is being made here with EV chargers now utilizing IoT technologies to communicate their status to the energy company and the grid as well as handling user interactions such as payments, location finding and tracking of EVs, especially for ride sharing providers.

There are additional costs beyond upgrading the grid. The charger terminal itself is an expensive piece of hardware and it can cost US$150,000 to plan a site and install the hardware for a 350kw charger. For this reason, prime locations are already being addressed with chargers and these highly profitable sites are important for enabling CPOs to make access to charging capacity ubiquitous in less popular areas.

Further constraints include the relative newness of charging which means technicians are in short supply and production capacity for fast charging hardware still needs to be built up. Some EV users are keen to ensure they use green electricity, and this is an additional complication with providers needing to ensure there is sufficient green energy available in locations where users want to charge.

CPOs also face costs associated with entering the second generation of charging. With only one in nine current charging points offering fast chargers there is a need for existing, slower, chargers to be upgraded. Car makers have been pushing regulators to set targets for coverage and density of charging points and want to see fair and transparent pricing and laws to provide EV users with the right to plug in to charging networks, regardless of the type of provider. The Open Charge Point Protocol (OCPP) offers a uniform system for communicating between charging stations and any central system in the grid so demand can be balanced with supply and prediction of local available capacity for production and generation can be provided.

Ultimately, standardization will help grow the entire EV market and make it more convenient and attractive for users. Car makers and energy providers have been collaborating with and investing in EV charging companies such as Ionity, a joint venture founded by BMW, Daimler, Ford and Volkswagen Group. Ionity allows customers to charge their EVs along highways in 24 European countries and is expanding its network of sites offering carbon neutral charging.

WHY MOBILE CONNECTIVITY?

The business models for charging and the grid management models will need to mature as EVs become routine mass-market products. IoT connectivity will be a critical enabler and offers multiple forms of value to charging point operators, car makers and EV users. Even though public EV charging points are often located close to the wired electricity supply and it appears simple to connect them with fixed line infrastructure this doesn't address the need to network large car parks at highway service areas which mobile connectivity can handle more quickly and cost effectively.

The connectivity is needed so the charging point can meter usage accurately, identify users and bill accordingly. For charging service providers, connectivity means the site can be monitored in real-time so demand can be profiled and understood, and maintenance can be booked. EV chargers need to collect information such as the vehicle and customer ID, service type, charging volume and state of charge (SOC), the capacity of the charging and recharging current and the vehicle's arrival and departure time at the charger. All these inputs and data need to be communicated with the charging point ID and location information to the charging provider and from the charger to the EV itself.

This data can be transformative to the charging experience and enable a frictionless experience for EV users. Advantages include making it simpler to locate an available charger. Apps are commonly used to enable users to search for nearby charging stations and enable time to be booked based on the EV's battery capacity and charging needs. These apps can indicate the cost of charging or offer off-peak alternatives or less popular locations to provide charging more cheaply.

Connectivity also underpins automated operations. This can begin with user authentication which can be performed automatically via a smartphone connecting to the charger and provide the means to bill for the charging. In addition, the charger can communicate to the EV user during the charge to let them know how much times is needed, if there has been an error in the cable connection or if there is an emergency that needs to be responded to.

Of utmost importance for CPOs, automation enables remote management so issues can be resolved quickly and useful data about how chargers are used can be gathered. This feeds into predictive maintenance and enables fault monitoring and remote repair of chargers. A charging station simply has to work at all times or the customer experience will suffer and supplier brands will be damaged.

SMART CHARGING

The next stage enabling users to take advantage of the best available rates. In summer, for example, solar energy availability is high during peak hours in the day so customers can be encouraged to charge at these times of peak availability or discouraged from charging at times of peak demand. This can help to smooth out pressures on the grid.

From a communications perspective, connecting chargers relies today on small amounts of data. Demand for higher speeds and lower latency is increasing to support the improved performance capabilities of new versions of charging points which could be updated over-the-air. The convenience of mobile connectivity should not be underestimated and, as the market matures, powerful 4G and 5G cellular connectivity at charging points will be used to enable additional services to EV owners and to support a growing ecosystem around EVs. This might involve entertainment, advertising, information, in-car services or even vehicle related services such as software upgrades which could be performed while the car is charging.

From an operational point of view, wireless connectivity represents a small additional cost in terms of construction, maintenance of charging points and cellular data usage fees. However, their versatility and ease of deployment across the globe makes them attractive for enabling rapid deployments, global products, and to support interaction between EVs, users and charging points.

After more than ten years in operation, the EV market is only now entering its growth phase and a wide range of CPOs has emerged to roll-out smart charging infrastructure and enable charging to scale-up to support mass-market demand.

TELENOR IOT - UNLOCKING THE FUTURE OF ENERGY MANAGEMENT

Telenor IoT with its 20 years of IoT experience and automotive, payment and energy heritage is ideally positioned to provide global connectivity, the cloud platform and service excellence tools that are needed to underpin the performance of chargers.

Our experience of global mass deployment of connected products means we are ready to provide connectivity for the millions of smart chargers being deployed across the world and to help connect greener more efficient vehicles to the charging capability that is essential.

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 17 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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