Navigating EV charging challenges for tomorrow's e-mobility

As more EVs hit the roads, the demand for charging infrastructure continues to grow, raising concerns about the potential strain on the electricity grid. Public and private EV chargers play a crucial role in supporting the transition to electric transportation, but their impact on the grid must be carefully managed to ensure reliability and efficiency.

The widespread adoption of electric vehicles (EVs) presents both opportunities and challenges for urban energy systems. EVs are key to smart city[1] evolution, offering reduced CO_2 emissions and lower maintenance. Integrating them into urban transport systems addresses both environmental and noise pollution, with varying power needs across different times and locations.

Balancing the power

Public EV chargers, located in car parks, streets, and public spaces, are essential for EV owners, particularly if they don't have access to private charging facilities. These chargers are often high power and fast charging, capable of quickly replenishing EV batteries, which means that they are placing significant demands on the grid, especially during peak hours.

On the other hand, private EV chargers, installed at home or work, offer convenience and flexibility to EV owners but can lead to localized grid congestion if not coordinated effectively. Electric appliances such as cooking, air conditioning, and lighting already put a strain on the grid connection. Adding multiple EV chargers may push the grid to its tipping point.

In short, the total grid impact of public and private EV chargers can manifest in increased electricity demand, distribution system constraints, and potential overloading of transformers and substations.

To mitigate these challenges and ensure the seamless integration of EV charging infrastructure into urban energy systems, a combination of technological solutions, policy interventions, and smart grid strategies is essential.

Electrifying tomorrow's transportation

Electric vehicles are no longer limited to the private domain. As urban areas become more complex, evolving into smart cities[1], integrating battery storage technologies into urban energy systems, becomes crucial. Increasing numbers of trucks and public transport are being electrified. This electrification trend aims to reduce the CO_2 footprint of operators, lower maintenance costs, and enable inner city driving.

To fulfill their commitments to carbon dioxide reduction and reduce urban noise pollution, the integration of electric vehicles into the transportation infrastructure of major cities is an indispensable strategy for the future. Both types of EVs, the private owner's vehicle, often charged at or near their home overnight, and high power demanding trucks and public transport, require a significant amount of power. However, their power needs occur at different times of the day and in different locations.

Another notable trend is the ability of new generations of EV batteries to recharge in 15 minutes or even faster. Manufacturers and battery developers strive to match the speed of replenishing the fuel in an internal combustion engine (ICE) vehicle. While this rapid charging capability may benefit public transport and trucks, its added value for private vehicles is limited, except perhaps during the holiday season. Nonetheless, the impact on the grid will be substantial.

Navigating EV charging challenges

Most people in Europe have a commute time of less than 30 minutes. Estimating an average

speed of 60 km/h, this would sum up to a distance of less than 30 km between their home and workplace. Without the possibility of charging the vehicle's battery at the place of work, this would result in a 60 km drive, a distance that today's EVs can easily cover without any in between charging.

Obviously, there is a segment of the population that spends significantly more time on the road. Round trips of 300 to 400 km are not uncommon for individuals in professions such as sales or courier services. Therefore, for these people, fast charging, preferably along main roads, is essential.

Trucks and public transport present their own challenges: for trucks, the routes they follow vary, and the ability to fast charge during the driver's mandatory resting time is crucial to optimize the use of these expensive vehicles. Unexpected stops for recharging lead to missed loading or unloading windows, additional downtime, and, most likely, frustration.

Public transport is generally more straightforward. The routes and schedules are known, allowing for planned charging.

Strategies for overcoming EV charging obstacles

To navigate the challenges of grid infrastructure limitations for EV charging, various strategies and innovations are essential, including smart software, flexible energy storage solutions, and proper project calculation.

An ICT layer[2] can be added to existing EV chargers, controlling and activating them based on total power usage. However, upgrading older, already installed EV chargers poses a considerable cost for the grid operator.

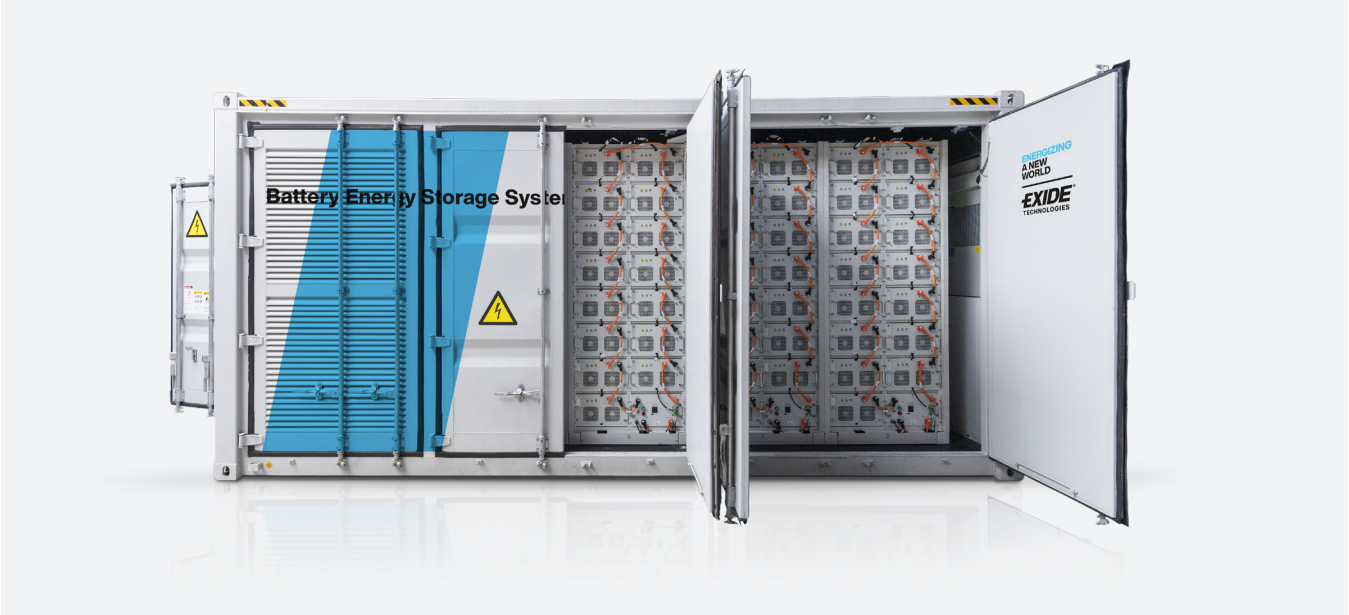
Neighborhood battery storage solution

A solution for the charging of cars for private car owners who don't possess their own EV charger can be sought in a neighborhood battery, which can provide stored solar power from the area, so the cabling to this area does not need an expensive upgrade.

In case the existing cabling throughout the territory is insufficient for handling this additional power, charging islands could be created. These islands, preferably equipped with PV canopies, allow people to charge their electric vehicles centrally using energy stored in batteries, which are located at the charging stations.

Special considerations for commercial vehicle charging

For trucks, the situation is much more complex: finding space for a large enough charging area in the city will often be difficult. Also, larger trucks might not even be allowed to enter the city limits. Therefore, it is expected that most truck charging areas will be created along major roads at existing fuel stations and parking lots.



While space is often less of an issue, sufficient power remains a challenge. Long distances along motorways make upgrading cables an expensive endeavor: time consuming and with the high power demanded for truck chargers, this is no simple remedy.

Battery energy storage offers a solution

Incorporating a battery as a substantial peak shaver and supplying power to EV chargers that exceed what can be delivered by the grid will yield a solution. Careful planning is required since, in the current situation, it is difficult to predict how many chargers are needed to reduce, or better, prevent waiting times.

Additionally, the battery capacity of trucks is not fixed, and manufacturers are still searching for the optimum in installed kWh. The larger the battery pack, the longer the distances between recharging; however, this also increases the recharge time once the batteries are empty.

Thoughtful consideration and flexible design are needed to address this issue. Installing too many chargers will lead to high capital expenditures (CAPEX) and under utilization if the growth in the number of electric trucks is slower than expected. Conversely, having too few chargers will result in trucks bypassing those locations, as they may face extended waiting times.

Additionally, accurately estimating the duty cycle[3] is crucial. For many truck and EV charge point operators, this 'chicken and egg' situation is hindering progress. Insufficient chargers could leave trucks stranded, while a shortage of electric trucks on the roads delays the investment in EV charging infrastructure.

Empowering EV charging infrastructure

Exide Technologies and its Customized Energy Systems (CES) division offer flexible energy storage systems with customizable battery capacity and converter power. These systems have already been supplied to Germany, Norway, Saudi Arabia, and the Benelux. The experts are happy to assist customers in sizing, designing, and installing these battery buffer systems.

To learn more about a recent case study, where battery chargers were combined with EV charging stations for a public transport company in Norway, please click on the QR code or visit:

www.exidegroup.com

About Exide Technologies

Exide Technologies is a leading provider of innovative and sustainable battery storage solutions for automotive and industrial applications.

With more than 135 years of experience, Exide has developed and globally marketed innovative batteries and systems, contributing to the energy transition, and driving a cleaner future.

Exide's comprehensive range of lead acid and lithium ion solutions serves various applications, including 12 V batteries for combustion and electric vehicles, traction batteries for material handling and robotics, stationary batteries for uninterruptible power supply, telecommunication, utility in front of and behind the meter energy storage and propulsion batteries for submarines and more.

Exide Technologies' culture and strategy are centered around recycling, sustainability, and environmental responsibility, reflecting the commitment to being a responsible corporate citizen.

The company has 11 manufacturing and three recycling facilities across Europe, ensuring resilience and a low CO_2 footprint with a local supply chain.

Exide Technologies is committed to superior engineering and manufacturing. With a team of 5,000 employees, the company provides €1.6bn of energy storage solutions and services to customers worldwide, every year.

Footnotes

[1] Smart cities are urban areas that focus on long-lasting economic, social, and environmental well-being, providing answers to the demands of all shareholders.

[2] An ICT layer is a digital framework that can be integrated with existing EV chargers to manage and optimize their operation based on the overall power consumption.

[3] The term "duty cycle" refers to the ratio of time a system, device, or component is active (or "on") compared to the total period of operation. In the context of electric trucks and EV charging stations, understanding the duty cycle is essential for optimizing the number of chargers, needed to meet demand without overspending on infrastructure that may be underutilized.