zooz

ZOOZTER™-100 Kinetic Power Booster For Ultra-Fast EV Charging

www.zoozpower.com

Introduction

The electric vehicle (EV) market is experiencing a remarkable surge in demand, prompting a significant evolution in public EV charging infrastructure. As reported by the International Energy Agency (IEA), the end of 2022 saw a global tally of approximately 2.7 million public charging points, with over 900,000 of these installed in that year alone. This number is projected to expand by over 40% by the conclusion of 2023.

Shifting Market Demand

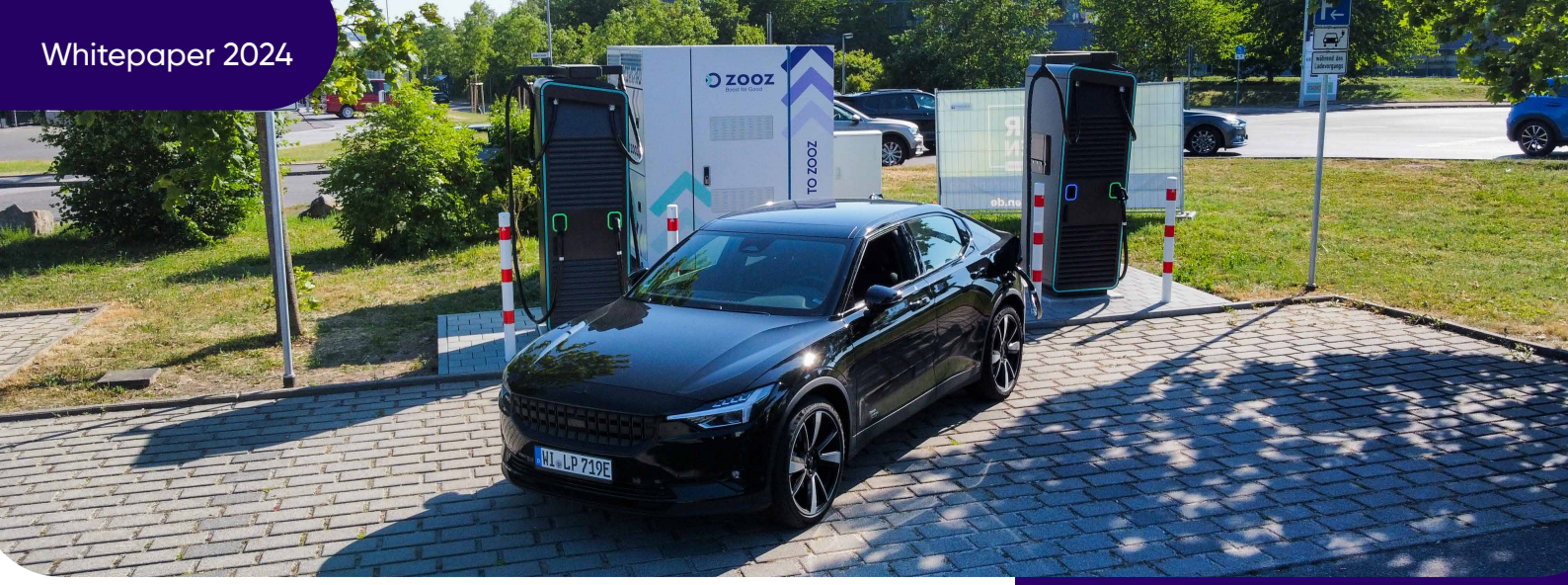
While home charging currently satisfies a significant portion of the charging demand, the requirement for publicly accessible chargers is increasing, particularly for on-the-go charging in rural and highway areas, surpassing even the needs of densely populated urban areas. Ultra-fast public charging infrastructure thus emerges as a pivotal factor in fostering wider EV adoption.

Current Challenges in Ultra-Fast EV Charging

Timely and Expensive Grid Upgrades

Most current electrical grids were not constructed with the foresight to support the impending surge in electric vehicle (EV) adoption. This presents a significant obstacle for charging stations in their initial phases. A constrained grid capacity hampers seamless operations, prevents high levels of utilization, and slows the rate at which these locations can become popular. A Grid upgrade will enable these features, but it involves a costly, complex, and time-consuming process which typically takes 6 to 24 months for small-medium size stations. EPRI* recent research in the USA reveals that about 45% of the small to medium hubs (<1MW load) will need a grid upgrade to support the increasing charging utilization. This means that a large and irrational investment should be put into the site, while its utilization rate is low, and the high charging demand still not proved. Consequently, until the grid is upgraded, the station may operate at reduced capacity, with limited income and utilization.

* https://msites.epri.com/evs2scale2030



High Operating Costs

The new EVs models support ultra-fast charging with higher and intensified power. The charging behavior of such multiple EVs results in a profile characterized by brief yet intense power bursts that can lead to high demand charges. The demand charge can sometimes stem from a single charge, which turns the charging site to lose money for the operator especially when utilization is still low. Finding ways to optimize energy usage and reducing operational expenses is crucial for making ultra-fast charging economically viable.

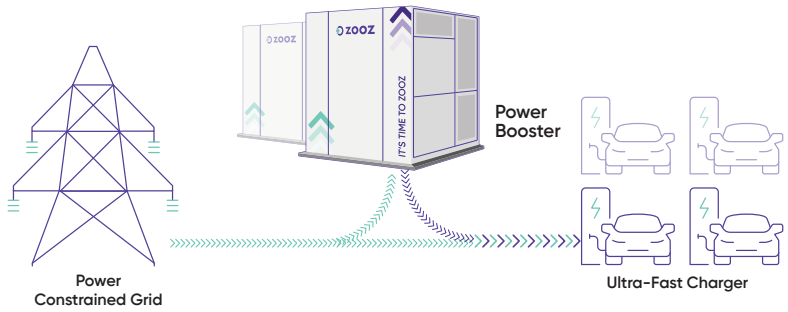
Efficient & Cost-Effective Network Deployment

Deploying a widespread network of ultra-fast charging stations requires careful planning to ensure efficient utilization of resources and cost-effectiveness. Factors such as site selection, permitting processes, and infrastructure installation can significantly impact deployment timelines and costs.

Accelerating Fleet Electrification

Fleet electrification presents a unique challenge due to the large-scale infrastructure requirements and operational considerations of fleet vehicles. To accelerate the adoption of electric fleets, it is essential to develop specialized charging solutions tailored to fleet management needs, such as centralized hubs with ultra-fast charging capabilities.

Introducing ZOOZTER™ - 100 Power Booster

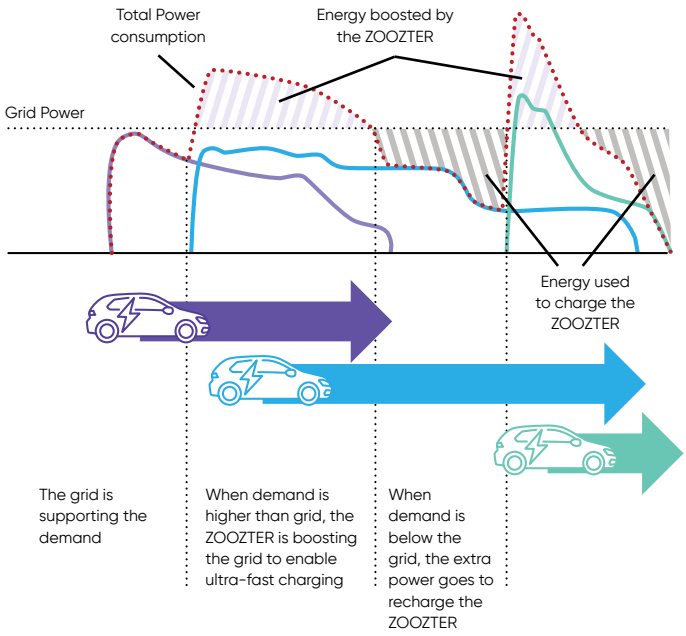


ZOOZTER™-100, particularly in the context of ultra-fast EV charging, represents an innovative energy storage system designed to augment the existing power supply capabilities of the electrical grid. This system rapidly supplies high-power surges to meet the intense, short-duration energy demands typical of ultra-fast electric vehicle (EV) charging stations. Unlike traditional energy storage solutions that primarily focus on storing energy for later use, this power booster actively enhances the power infrastructure by delivering stored energy at high rates for immediate consumption. It charges itself using grid power and then "flashes" this stored energy to the EV charging station when a vehicle is plugged in, thereby significantly reducing charging times. This mechanism not only stabilizes the grid by managing peak loads efficiently but also enables the installation of more charging stations within a given grid capacity. ZOOZTER™-100, therefore, play a crucial role in facilitating the widespread adoption of EVs by ensuring that the charging infrastructure can meet the demand for quick and efficient charging without necessitating extensive grid upgrades.

The ZOOZTER™-100 functions in three different modes contingent on the demand:

- Once the grid meets with the vehicle's power demand, the ZOOZTER™-100 stays in its levitating (standby) mode.
- If the grid's capacity is not sufficient to provide the required power, the ZOOZTER™-100 boosts the grid, enabling it to perform ultra-fast charging.
- As the power demand decreases, the grid's surplus energy is used to recharge the ZOOZTER™-100.

Consequently, the ZOOZTER™-100 is fully charged and prepared for subsequent use.



Leveraging Flywheel Power Booster

The Mechanism of ZOOZTER™-100's Flywheel

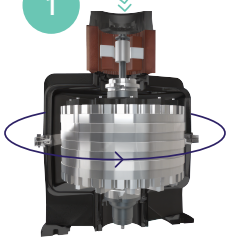
ZOOZTER™-100 flywheel technology represents a pivotal advancement in the realm of energy storage and power boosting, particularly for applications demanding high-power, rapid discharge cycles such as ultra-fast Electric Vehicle (EV) charging stations. At its core, a flywheel is a kinetic energy storage device, where energy is stored in the rotation of a dreidel-shaped rotor. The energy capacity of the flywheel is directly proportional to the square of its rotation speed, offering a robust and resilient solution to energy storage with a long lifespan due to its ability to withstand multiple high-power charge/discharge cycles without degradation in performance. Efficient operation of flywheels requires high-speed rotation, though this is inherently limited by the centrifugal forces acting upon the rotor.

To ensure safety and efficiency, modern flywheels, like ZOOZ's design, are constructed from laminated steel allowing for above-ground installation even in densely populated areas. This design is not only safer but also more cost-effective compared to other materials like forged steel or carbon fiber. A critical innovation in flywheel technology is the use of a vacuum environment and magnetic bearings to minimize operational losses. The vacuum eliminates aerodynamic drag, while the magnetic bearings provide a frictionless, wear-free operation, significantly enhancing the efficiency and lifespan of the flywheel system. Flywheel power boosters, distinct from traditional energy storage systems, are engineered to support high-power, short-duration energy surges, effectively enhancing the existing infrastructure's capacity. This capability is particularly valuable in scenarios like EV ultra-fast charging, where power boosters can supply the necessary energy rapidly, allowing for shorter charging times and higher utilization of grid infrastructure without the need for upgrades.

The ZOOZTER™-100, a pioneering flywheel-based kinetic power booster, exemplifies this technology's potential, offering 100kW of additional power for 15 minutes, enabling ultra-fast charging by significantly increasing the available grid power.

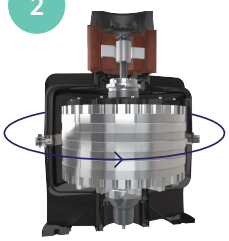
The Flywheel Booster Charging Cycle

The ZOOZTER™-100 flywheel booster charging cycle encompasses three critical phases for energy storage and release, enabling efficient ultra-fast EV charging.



Accelerating
=
Charging

(Converting electricity to Kinetic Energy)



Levitating
=
Storing

Kinetic Energy

Decelerating
=
Discharging

Kinetic Energy
(converted to electricity)

Charging Phase

Initiates with accelerating the flywheel, converting electrical energy from the grid into kinetic energy.
A motor spins the flywheel up to speeds around 17,000 RPM, storing energy as it increases in speed.

Levitating Phase

Once at target speed, the flywheel enters a waiting phase, where it levitates via a magnetic bearing in a vacuum, minimizing energy loss. This phase keeps the stored kinetic energy ready for immediate use.

Discharging Phase

Triggered when an EV connects for charging, the flywheel decelerates, converting the kinetic energy back into electrical energy to supply an additional power boost, facilitating ultra-fast charging in about 15 minutes.

This cycle allows the ZOOZTER™-100 flywheel booster to provide quick, high-power energy bursts, enhancing the efficiency of EV charging stations by supporting peak power demands without continuous grid reliance.

Energy Management System (EMS)

The ZOOZTER™-100 Energy Management System (EMS) is a sophisticated Software designed to optimize the use and distribution of energy within charging stations. This system intelligently manages the power flow between the electrical grid, the ZOOZTER, and the electric vehicles being charged. By continuously monitoring and analyzing the demand for electricity, energy availability, and charging station capacity, the EMS dynamically adjusts the distribution of power to maximize efficiency and minimize charging times. It ensures that the energy supply is used effectively, reducing the risk of overloading the grid during peak demand periods. Through real-time data collection and predictive algorithms, the EMS not only improves the operational efficiency but also supports grid stability, ensuring a reliable and efficient charging process for EV users and cost saving for the charging operator.

The Advantages of the ZOOZTER™-100's Flywheel

Flywheel power boosters stand out in ultra-fast EV charging for their durability, efficient energy cycle management, and minimal environmental impact, offering a notable advantage over battery-based systems. Their resilience to frequent high-power cycles ensures a longer lifespan and consistent performance, free from the capacity degradation and temperature sensitivity issues common in batteries. Flywheels also excel in rapid energy discharge and recharge, making them ideal for grid support during peak EV charging times, without the environmental and disposal concerns associated with batteries. This makes flywheel systems a more sustainable, reliable, and cost-effective solution for enhancing EV charging infrastructure efficiency.

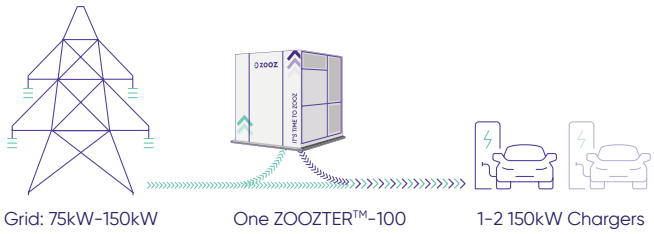
Addressing The Challenges with ZOOZTER™-100

Reducing Grid Dependency

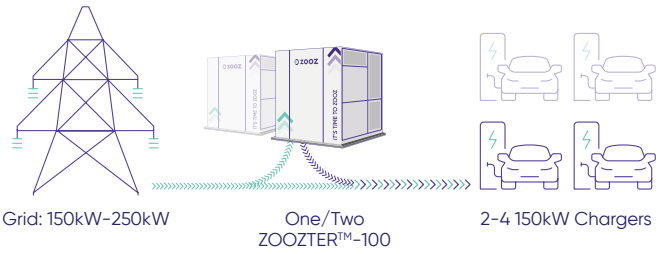
The rapid deployment of ZOOZTER™-100 facilitates the installation of multiple high-power ultra-fast chargers, tailored to grid capacity, ensuring seamless site operation. This proactive approach mitigates the immediate need for grid upgrades, expediting the transformation of charging stations into lucrative and efficient hubs. The following examples are suggested configurations designed to meet the charging stations' efficiency, scalability, and economic viability.

Initial Setup for Emerging Sites: For locations with a limited grid power capacity of up to 150 kW, a setup incorporating a single ZOOZTER-100 (100 kW) and two 150 kW chargers offers an economical solution. This arrangement allows for the early identification of potential sites, postpones the need for grid upgrade, and supports a phased approach by adding any type of chargers in response to the increasing demand.

One or two ZOOZTER-100 units with 2-4 150 kW chargers. This setup optimizes power distribution, elevates charging capabilities, and maintains adaptability in power management. It lays the groundwork for the future expansion of the charging network.

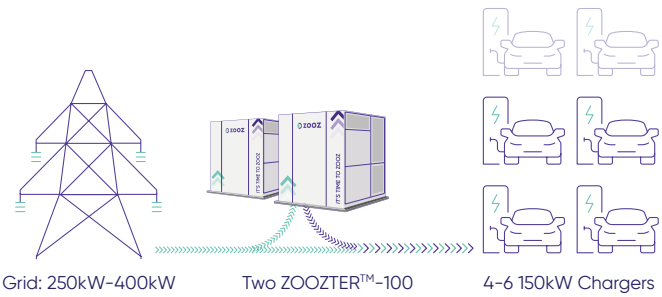


Medium-Sized Charging Hubs: For a medium-sized hub with 250-400 kW of grid power, employing two ZOOZTER-100 units and 4-6 150 kW chargers creates a dynamic solution. This configuration ensures efficient power use across different charger capacities and supports the station's growth by accommodating various charger types.



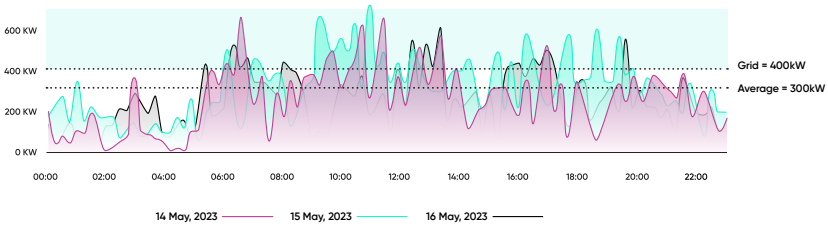
By significantly increasing the number of EVs charged within shorter time frames, ZOOZTER™-100 empowers CPOs, EPCs, utility companies, and fleet operators to accelerate revenue generation.

With optimal performance established from the moment of installation, these sites become dependable and attractive destinations for a consistent influx of EV users.



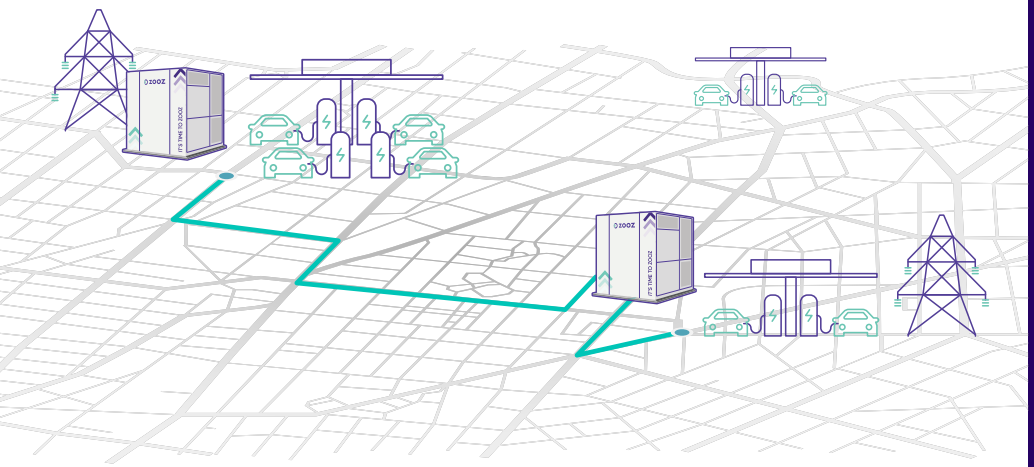
Peak Shaving

ZOOZTER™-100's rapid charge and discharge rate provides the quick response needed in order to eliminate the high frequent peaks, thus saving cost on demand charges. By mitigating the peaks in charging sessions, site operators discover that a mild grid upgrade is more cost-effective.



Streamlining Energy Consumption for Optimal Efficiency

ZOOZTER™-100 is not intended to serve as a complete substitute for upgrading the grid but it can defer it, ensuring efficient site function from the beginning. Following the grid upgrade, ZOOZTER™-100 still remains an asset for operators as it provides additional power thus offering enhanced utilization rates, opening opportunities for increased sales and business growth. The ZOOZTER™-100 offers a distinctive advantage also from a network perspective. As the charging station achieves a grid upgrade and stable utilization, the ZOOZTER™-100 can be redeployed seamlessly to a new site to serve as its catalyst.



Configuration Within Fleets' Charging Ecosystem

Offering reliable, scalable, and cost-effective charging solutions, ZOOZTER™-100 empowers the transition of vehicle fleets to electricity seamlessly while maximizing efficiency and productivity. With ZOOZTER™-100's advanced technology and centralized control systems, fleets can efficiently manage charging operations, optimize vehicle uptime, and minimize downtime. ZOOZTER™-100 enables the in-house charging operations of all fleets and to provide flexibility once a load of vehicles charges simultaneously. In addition, ZOOZTER™-100 offers multiple configurations contingent on the site busyness such to afford prioritization between the different sites based on their use ultra-fast charger.

Summary

In the realm of ultra-fast EV charging, one must think out of the box, or in the case of ZOOZTER™-100 into the box. With its innovative technology and versatile applications, ZOOZTER™-100 is revolutionizing EV charging, offering cost-effective solution and sustainable infrastructure for the future.