



30 Sept. & 1 Oct. 2025

Graz, Austria

Submission to the Call for Presentations and Posters

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Corresponding topic (please tick)	<input checked="" type="checkbox"/> Power Electronics in Automotive & Charging Applications <input type="checkbox"/> Power Electronics in Medium Voltage Applications <input type="checkbox"/> DC Industry <input type="checkbox"/> Sustainability & Circular Economy in Power Electronics
Proposed presentation title (you can indicate a preference for oral or poster presentation in the submission form)	Smart Integration of Wireless Electric Vehicle Charging Infrastructure for Provision of Grid Flexibility Services
Authors (please highlight corresponding author / speaker)	Alireza Ramezan Ghanbari (corresponding author), Amir Babaki (Amirbabaki@sdu.dk)

Abstract (1,500 – 3,000 characters), you are encouraged to add graphs/images to highlight your research

The electrification of the transportation sector is essential for achieving global decarbonization targets, given that transport accounts for a substantial portion of total greenhouse gas emissions [1]. While battery electric vehicles (BEVs) are rapidly gaining adoption, charging infrastructure limitations and energy system integration challenges hinder their widespread use [2]. Dynamic Wireless Power Transfer (DWPT) offers a transformative solution by enabling electric vehicles (EVs) to charge while in motion, thereby reducing battery size, range anxiety, and stationary charging delays [3], [4].

DWPT systems rely on inductive power transfer technologies embedded beneath road surfaces, with wireless charging pads interacting with vehicle receivers through electromagnetic coupling [5], [6], [7]. This emerging approach provides the dual benefits of convenience and efficiency while supporting real-time energy demand balancing and reduced grid stress when integrated with renewable energy sources [8], [9]. However, the realization of DWPT at scale involves multidisciplinary considerations in system design, standardization, safety, and grid interoperability [10], [11].

This study presents a comprehensive analysis of a DWPT system integrated into a Grid with renewable energy-powered microgrid. The microgrid is modelled with solar photovoltaic (PV) and wind energy sources supplying electricity to the grid and DWPT infrastructure through smart power electronic interfaces and control systems [12] - [14] as shown in Figure 1. Bidirectional power flow, demand-side management, and predictive algorithms are incorporated to ensure system stability, especially during variable renewable output conditions [15], [16].

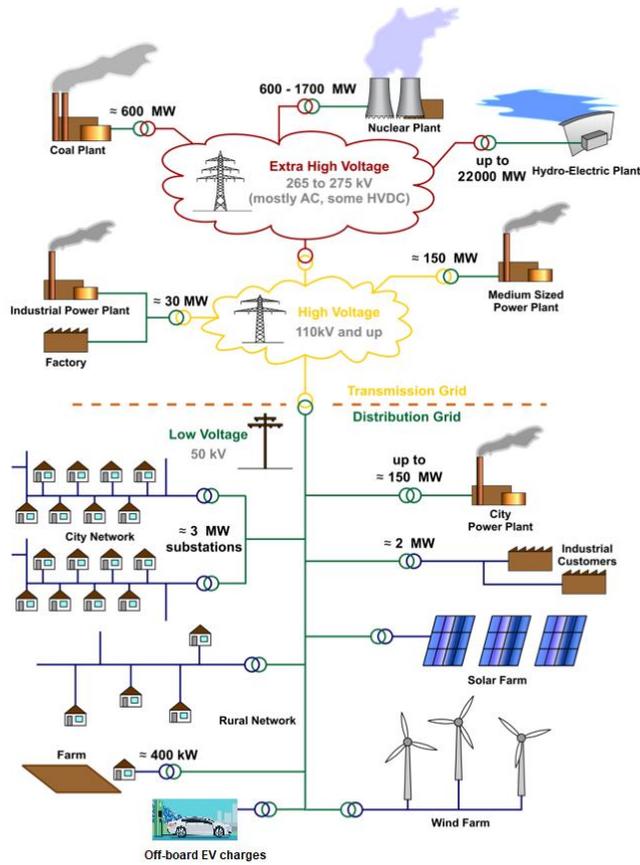


Figure 1: General layout of electrical grid

A novel contribution of this work is the proposed optimization of wireless charging intervals based on traffic patterns and renewable availability forecasts, ensuring minimal power losses and efficient vehicle-grid coordination. The study also evaluates vehicle-to-grid (V2G) capabilities, where EVs act as mobile storage units, enhancing flexibility and resilience in energy supply. Compliance with international standards such as SAE J2954 ensures compatibility and safety across infrastructure components. Wireless Electric Vehicle Charging (WEVC) technologies, whether static, semi-dynamic (e.g., at traffic intersections), or fully dynamic (embedded in roadways), present a paradigm shift in how EVs interact with the power grid as shown in Figure 2.

Simulation results indicate that DWPT integrated with a renewable energy-powered microgrid can reduce peak loads by up to 30%, cut EV battery size requirements by 20%, and improve overall system efficiency. These findings underscore the potential of combining DWPT and renewable microgrids to enable a sustainable, efficient, and user-friendly EV ecosystem. Future directions include real-world pilot deployment, economic feasibility studies, and advanced control strategies for large-scale integration.

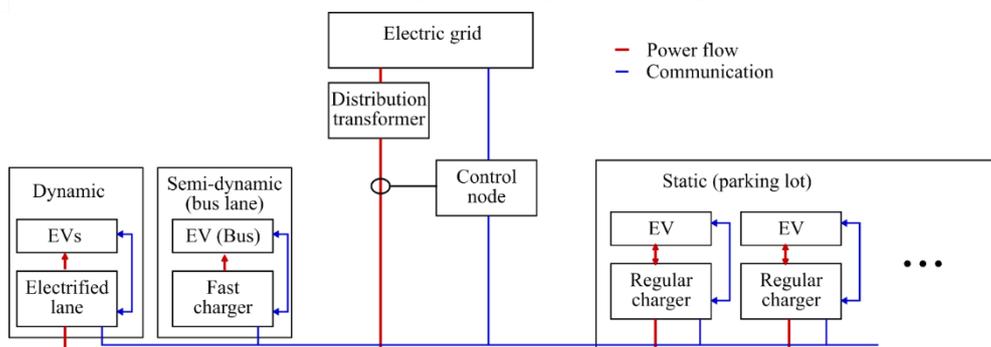


Figure 2: The model case for integrated WEVC infrastructure development

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