

Advances in Dynamic Wireless Charging Infrastructures for Electric Vehicles: Design, Optimization, and Implementation Challenges

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Abstract: *The surge in electric vehicles (EVs) has really ramped up the need for charging infrastructures that are efficient, reliable, and sustainable. While traditional plug-in systems do the job, they come with some notable drawbacks, like convenience issues, range anxiety, and limitations in power delivery rates. Enter Wireless Power Transfer (WPT), a game-changing technology that allows for both stationary and dynamic charging meaning Evs can recharge on the go thanks to embedded road systems. This paper offers a thorough review of dynamic wireless charging systems for electric vehicles, focusing on design architectures, electromagnetic coupling methods, energy transfer efficiency, and how they fit into smart grids. It also dives into optimization strategies for scheduling, profitability, and network sustainability. In conclusion, the paper highlights key technical, environmental, and economic challenges while exploring the road ahead for large-scale wireless charging implementation.*

Keywords: Wireless Power Transfer (WPT), Dynamic Charging, Electric Vehicles (Evs), Smart Grid, Infrastructure Design, Charging Optimization, Power Electronics, Sustainable Transportation

