# Optimizing Dynamic Wireless Charging of Electric Vehicles Powered by Offshore Wind: A GPS-AI Based Framework for Coastal Energy Systems

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**Abstract:**
As a graduate student living and studying in Atlantic Canada, I have witnessed both the region's incredible renewable energy potential and the real-life challenges that rural and coastal communities face in transitioning to electric mobility. This project is inspired by the need for smart, location-specific solutions that can support clean transportation without relying on dense urban infrastructure.
Halifax's unique coastal geography surrounded by water on three sides and exposed to steady offshore wind creates ideal conditions for integrating marine renewable energy with electric vehicle charging systems.
This study presents a GPS-AI optimization framework for integrating Dynamic Wireless Charging (DWC) of electric vehicles with offshore wind energy, particularly along coastal corridors in Nova Scotia. DWC allows vehicles to charge while in motion, offering a promising alternative for areas with limited access to traditional charging stations.
Using simulated GPS data from a 50-point coastal route (e.g., Halifax–Dartmouth), a Random Forest Regressor predicts energy consumption based on speed, elevation, and road dynamics. A custom cost function then determines the optimal locations for embedded charging coils, minimizing detour distance, battery depletion, and total charging time.
To account for the intermittency of wind energy, the system is modeled as being connected to local coastal microgrids equipped with storage buffers and real-time control. These microgrids balance variable energy input with vehicle demand, enhancing grid stability and charging reliability.
Results demonstrate a 42% reduction in charging time, 46% lower detour distances, and a 133% improvement in final battery charge, compared to nearest-station models. This work contributes a regionally relevant, intelligent solution for sustainable mobility designed with both local challenges and renewable opportunities in mind.