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Design and Simulation of Solar-Wind Hybrid EV Charging System using MATLAB

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Abstract: *This report outlines a comprehensive MATLAB-based simulation of a hybrid electric charger that integrates both solar and wind energy sources. The system is designed to charge a 48V, 24Ah battery using power generated by photovoltaic panels and a wind turbine. To enhance energy conversion efficiency, a Maximum Power Point Tracking (MPPT) controller is employed. This controller dynamically adjusts the input parameters to extract the maximum possible energy from each renewable source. The simulation covers several key components of the system, including the power output from solar and wind generators, the battery charging process, and the system's overall energy efficiency. By leveraging both solar and wind inputs, the system delivers a more consistent and dependable power supply, even under variable weather conditions. The MPPT controller is essential in this setup, as it fine-tunes energy capture to ensure optimal performance. Simulation results reveal the battery's charging behavior under fluctuating environmental inputs and assess the MPPT's performance in managing energy flow. The analysis underscores the viability of solar-wind hybrid systems in promoting sustainable power solutions, especially in applications such as electric vehicle charging. This project demonstrates that combining multiple renewable sources can serve as a high-efficiency, environmentally friendly alternative to conventional energy systems.*

Keywords: Solar-wind hybrid system, renewable energy, electric vehicle charger, MATLAB modeling, photovoltaic panels, wind energy, 48V battery, MPPT controller

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