ABSTRACT

The Impact of Electric Vehicles (EVs) and Renewable Energy Sources (RES)-based Systems on DC Microgrid Stability, designed to investigate the integration of EVs and RES into a DC microgrid and analyze their effect on voltage stability and energy balance. The system is simulated using MATLAB/Simulink and includes an AC grid interface, solar PhotoVoltaic (PV) array, wind turbine, battery storage, and two electric vehicles with Vehicle-to-Grid (V2G) functionality. The model uses realistic irradiance and wind profiles to simulate generation variability and implements state-of-charge (SoC) control logic for EV and battery energy management. The system's behavior is evaluated during load fluctuations, EV charging/discharging events, and grid disconnection, demonstrating how simple control strategies can ensure stability and resilience.

The simulation replicates a 24-hour operational cycle and monitors DC bus voltage, SoC, and power flow across various energy sources and loads. The model incorporates a dump load to clamp voltage surges, maintaining system safety during grid disturbances. This project shows that reliable microgrid performance is achievable using simple control algorithms, without advanced optimization or AI techniques, which makes the approach practical for rural applications and educational prototypes.

Keywords—DC Microgrid, Electric Vehicles, Renewable Energy Sources, Grid-to-vehicle, Vehicle-to-Grid, Stability, MATLAB/Simulink.