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Miscellaneous energy profile management scheme for optimal integration of electric vehicles in a distribution network considering renewable energy sources

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Abstract
The integration of renewable energy and electric vehicles in smart grids aims to improve the grid network and reduce carbon emissions. In this regard, this study presents a new Energy Management Scheme (EMS) for the optimal charging and discharging of electric vehicles in a photovoltaic-present distribution network based on the availability of solar energy and power from the grid. For effective scheduling, the model splits a distribution network into residential and commercial areas, which are handled separately by two Electric Vehicle (EV) aggregators. A newly developed hybrid algorithm, named Chaotic Whale optimization Algorithm and Gravitational Search Algorithm (CWOAGSA), is integrated into a multiobjective framework to simultaneously minimize power loss, improve voltage stability, and reduce carbon emissions. Simulation results show that the proposed model can inject real power at a 60% EV penetration level without destabilizing the distribution network. The comparison of the CWOAGSA to the WOA, PSO, and GA shows a better minimization of real power loss. The CWOAGSA minimizes the total real power network losses with a 55% margin from the increased power loss due to the uncoordinated scheduling, and a 7% margin to the WOA.