Optimal Allocation of Distributed Generation Units and Fast Electric Vehicle Charging Stations for Sustainable Cities

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Abstract

The rise of electric vehicles (EVs) in sustainable cities has fuelled interest in DG unit allocation. A well-planned and efficient charging infrastructure is required for effective e-mobility. The paper examined the single-objective frameworks of optimal simultaneous allocation of DG units and fast EV charging stations (EVCS). The applications are employed on the IEEE 69 bus network and a real part of the Ghana network in the Ashanti region. The optimization tasks are carried out by using Particle swarm optimization (PSO) and artificial bee colony (ABC) algorithms. The impact of optimal placement on the networks was analyzed. The results show that with high penetration levels of DG units (up to 40%) and fast EVCS, PSO, and ABC can achieve a significant power loss reduction that reaches 68%. Furthermore, PSO outperforms ABC in relation to the voltage deviation index on both the test network and the Ashanti region network, while still satisfying the IEC standards' 5% margins. The results indicate that PSO and ABC are viable swarm algorithms for mitigating active power loss and enhancing the voltage profile of a system through concurrent allocation

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