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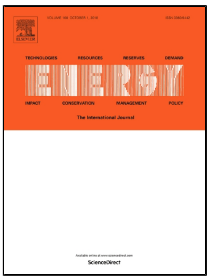

Placement and Sizing of Multiple Distributed Generation and Battery Swapping Stations using Grasshopper Optimizer Algorithm

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Abstract: High energy losses and voltage instability issues in distribution system are prevalent for energy planners and utilities due to high penetration of Electric Vehicles (EVs). Battery Swapping Stations (BSS) are important component for energizing EVs equipped with battery charging mode. In this paper, energy loss reduction and voltage stability factor are enhanced by optimal allocation of Distributed Generation (DG) and BSS, using new Grasshopper Optimizer Algorithm (GOA). The zone based strategy with dispersed DG ensures sufficient distance among BSS's to adequately serve the motorists and enhance system performance. The operational constraints of BSS, DG and loads in each zone for 33-and 69-bus networks are considered. GOA method is compared with established and well-known techniques, namely Artificial Bee Colony (ABC), Gravitational Search Algorithm (GSA), and Particle Swarm Optimization (PSO). Using GOA, energy losses are reduced to 82% and 92%, while loadability is increased to 13% and 19% in 33- and 69-bus systems, respectively. The results have shown superiority of GOA in terms of system performance and convergence characteristics. Optimal sites and sizes for DG-BSS placement in the system are beneficial to EV users, BSS developers, electricity grid and utility.

Key words: Grasshopper optimizer algorithm, voltage stability, energy loss, battery swapping station, distributed generation, distribution system