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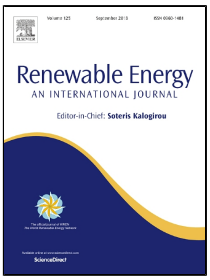

Bi-objective Economic Feasibility of Hybrid Micro-Grid Systems with Multiple Fuel Options for Islanded Areas in Egypt

Farag K. Abo-Elyousr, Ahmad N. Nozhy

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Farag K. Abo-Elyousr, Ahmad N. Nozhy
Electrical Engineering Department, Faculty of Engineering, Assiut University, Assiut 71516, Egypt
Email: ahmed.alnozahy@aun.edu.eg

Abstract: The main target of this research is to allow modern distributed energy resources (DERs) to contribute effectively in the economic feasibility of hybrid renewable power generation system. There are several factors such as the net present cost (NPC), levelized cost of energy (COE), amount of greenhouse gases (GHG) emissions, and the ability of the hybrid system to meet the load at different meteorological conditions to consider when evaluating the effectiveness of hybrid generation system within microgrids. A multi-objective based optimization algorithm to reduce cost, emissions, and a combined solution between cost and emissions is investigated in this research. This research presents an approach to optimize a hybrid microgrid (HMG) system with different fuel options. The power management approach determines the optimal sizing of DERs based on ant colony optimization (ACO) algorithm. In order to find the best configuration, the obtained results are compared with genetic algorithm (GA), particle swarm optimization (PSO), and HOMER. Three isolated areas in Egypt with different metrological conditions are selected for optimization of HMG system, namely: Kharga, Saint Katherine, and Qussair. The results show that the combined optimal configuration of HMG system is better in satisfying load demands without violating any restraints.

Keywords: Hybrid microgrids, economic feasibility, multi-objective, Ant colony, greenhouse gases.

Acronyms

ACA: Ant colony algorithm
AD: Autonomy days
BOACA: Bi-objective ant colony algorithm
COE: Cost of energy ($/kWh)
CUF: capacity utilization factor
DERs: Distributed energy resources
DG: Dispatchable generator
DOD: Depth of discharge (%)
FC: Fuel cell
GHG: Green-house gas
GA: Genetic algorithm
PSO: Particle swarm optimization
HMG: Hybrid Microgrid
LCA: life cycle assessment
LSPS: Loss of power supply probability
MH: Microgrid
NG: Natural gas
NGT: Natural gas turbine
$NOCT$: Normal operating cell temperature (^{o}C)
NPC: Net present cost
PV: Photovoltaic cell
TNPC: Total net present cost