Received: 27 January 2021 | Revised: 13 September 2021 | Accepted: 13 October 2021

DOI: 10.1002/2050-7038.13186

WILEY

RESEARCH ARTICLE

Combination of Side-Blotched Lizard and Chaos Game Optimization based distributed energy management for microgrid system

T. Logeswaran[1] | P. Rajesh[2] | Francis H. Shajin[3] | A. Prakash[4]

[1]Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, India

[2]Department of Electrical and Electronics Engineering, Anna University, India

[3]Department of Electronics and Communication Engineering, Anna University, India

[4]Department of Electrical and Electronics Engineering, QIS College of Engineering & Technology, Ongole, India

Correspondence

T. Logeswaran, Department of Electrical and Electronics Engineering, Kongu Engineering College, Perundurai, Erode.
Email: tlogeswaran0823@gmail.com

Abstract

In the last decade, numerous energy management techniques have been presented. All of them have common objectives of minimizing the cost, PAR, and carbon emissions. In this manuscript, an optimal energy management (EM) on grid connected micro grid (MG) choosing energy scheduling with low emission and cost using hybrid technique is proposed. The proposed system is combination of Side-Blotched Lizard Algorithm (SBLA) and Chaos Game Optimization (CGO) Algorithm; thus it is called SBLA-CGO technique. The micro grid system consists of Photo-Voltaic (PV) system, Wind Turbine (WT), Battery Storage (BS), and Fuel cell (FC). The needed load demand of the grid connected MG system is continuously measured by SBLA method. Perfect combination of MG is increased via CGO along forecasted load demand circumstance. Moreover, the renewable energy (RE) predicting errors are assessed twice by micro grid EM to diminish the control. Several renewable energy source (RES) are considered by MG scheduling process to reduce the cost of electricity utilizing first method. The second method consists of balancing the power flow (PF) and reducing the effects of forecast errors according to rule given as programmed power reference. The major purpose of proposed method is assessed through the incorporation of FC, variation of hourly power of electrical network, cost of operation through preservation of system of microgrid linked to the network. According to RES, the power requirement and SOC of storage elements are the conditions. Batteries are

List of Symbols and Abbreviations: η_{PV}, efficiency of comparative units of PV; p_{PV}, PV array of output power; p_{MPV}, under standard condition the rated power of PV; n, maximum size of PV panels; gt, faculty of global irradiance of tilted plane; p_{WG}, optimum unit of wind power; v_{Rated}, v_{cut} and v_{Ci}, rated wind speed, minimal wind speed, cut out and cut in wind speed; η_{Charge}, efficiency of battery charging; $e_{\text{RES}}(T)$, the overall energy produced; e_{Load}, overall provided energy; c_{PV}, c_{WT}, c_{FC}, annualized cost of system is expressed as c, the annual cost of the PV, WT and FC; c_{GS}, c_{GP}, overall cost of electricity; C_{wt}, unit cost of the WTs; A_{wt}, wind turbine generator blades swept area; C_{Mnt-wt}, each WT annual maintenance cost; C_{wt}, sum of the WT installation fee and the WT price; C_{Mnt-FC}, FC annual maintenance cost; C_{HM-FC}, hourly maintenance cost of FC; N_{Bt}, number of batteries; C_{Mnt-Bt}, annual maintenance cost of battery; ACO, Ant Colony Optimization; ANFIS, adaptive neuro fuzzy inference system; BESS, Battery Energy Storage System; BFA, Bacteria Foraging Algorithm; BS, Battery Storage; CGO, Chaos Game Optimization; DER, Distributed energy resource; DR, demand response; EDE, Enhanced Differential Evolution; EM, energy management; FC, Fuel cell; GA, Genetic Algorithm; GSA, Gravitational Search Algorithm; GWO, Grey Wolf Optimization; HSA, Harmony Search Algorithm; j, rate of interest; LC, line capacity; LF, Load Forecasting; MG, micro grid; MGA, microgrid aggregator; n, life of the system; Ni-MH, nickel-metal-hydride; PF, power flow; PI, proportional-integral; PSO, Particle Swarm Optimization; PV, Photo-Voltaic; RE, renewable energy; RES, renewable energy source; SBLA, Side-Blotched Lizard Algorithm; SOFC, solid oxide fuel cell; UC, unit commitment; WT, Wind Turbine.