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Abstract

A hybrid micro grid system (HMG) is a new avenue that offers an optimal, reliable, and

cost-effective solution for utilizing localized renewable energy resources over individual DC or AC micro grids. Nonetheless, the performance of the HMG varies greatly depending on the availability of renewable resources, desired services to provide, and demand system parameters. These parameters have a high impact on decision-making, reduced costs, and improved system reliability. Therefore, in this work, a reliable and robust developed multi-objective optimizer based on the hunger game search optimizer (HGSO) is proposed to attain HMG scheduling energy management schemes over a long-time horizon of 96 hours under uncertain real-time prices. The proposed strategy's main targets are retaining uninterruptible power to the load with minimal operating costs and minimal emission from the storage systems with achieving a high renewable factor. Moreover, a case study is discussed for including the battery degradation cost in the optimization process. These targets expressed via four objective functions for HMG include grid-connected with photovoltaic and wind as renewable energy resources, besides battery, fuel cell, and super capacitor as a storage system. The integrated system has been designed to supply the power demand for different load profiles in Egypt and the United Arab Emirates. The proposed Multi- Objective Hunger Game Search Optimizer (MOHGS) is compared with the recent state-of-the-art optimizers, including Multi- Objective versions of Marine Predators Algorithm (MOMPA), Slime Mould Algorithm (MOSMA), Golden Eagle Optimizer (MOGEO), grasshopper optimization algorithm (MOGOA), Multi-Verse Optimizer (MOMVO), Antlion Optimizer (MOALO), and Grey Wolf Optimizer (MOGWO) to evaluate the performance of the proposed power management system based MOHGS. The scheduled HMG performance is compared with the baseline system to clarify the essential outcomes for the proposed energy management approach. The obtained results confirm the proposed systems' reliability in reducing the power loss, saving the lifetime of the proposed energy storage elements, and minimizing the emissions by 43 % and 34.1 %. Furthermore, the proposed approach saves money for the customers by 184% and 4427% throughout the two studied locations via selling power for the grid compared to the baseline approach. The proposed approach achieves RF values of 86.5% and 94.2%; meanwhile, the baseline approach offers 79.3%

and 93.6% for the studied locations, respectively.