Journal of Energy Storage, vol.71, pp.108130-1-108130-17, November, 2023.

A tri-layer stochastic framework to manage electricity market within a smart community in the presence of energy storage systems

S.A. Mansouri; S. Maroufi; A. Ahmarinejad

Abstract-

In recent years, with the restructuring of the electricity market, the main goal of all market participants is to maximize their profits. Among these, the stability of the system as well as the consumers' comfort index (CI) are two important points that should be considered in the scheduling. Hence, this paper presents a tri-layer model for managing a competitive electricity market in the presence of aggregators, in which microgrids determine their strategy for market participation by considering the CI of consumers. In the first layer of the proposed model, the DR aggregator buys part of the consumers load through shiftable and curtailable submit their offers/bids into the market. Finally, in the third layer, the market-clearing price (MCP) is determined by the market manager with the aim of maximizing social welfare. This model is formulated in mixed-integer linear programming (MILP) format and is solved through CPLEX solver in GAMS environment. The simulation results show that the two-objective modelling of the operation problem, despite a 12.18 % increase in total operating costs, increases the average CI by 5.57 %. The results also demonstrate that DR aggregator through the implementation of DRPs leads to a reduction in MCP during the peak period and thus a 5.01 % reduction in total operating costs.

Index Terms- Microgrids; Demand response programs; Aggregators; Electricity market; Smart homes; Energy storage systems

Citation:
Mansouri, S.A.; Maroufi, S.; Ahmarinejad, A. "A tri-layer stochastic framework to manage electricity market within a smart community in the presence of energy storage systems", Journal of Energy Storage, vol.71, pp.108130-1-108130-17, November,

2023.