

City-Wide Simulation on the Effects of Optimal Appliance Scheduling in a Time-of-Use Residential Environment

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Abstract : Household Appliance Scheduling Systems (HASS) coupled with a Time-of-Use (TOU) pricing scheme, a form of Demand Side Management (DSM), is not widely utilized in the Philippines' residential electricity sector. This paper's goal is to encourage distribution utilities (DUs) to adopt HASS and TOU by analyzing the effect of household schedulers on the electricity price and load profile in a residential environment. To establish this, a city based on an implemented survey is generated using Monte Carlo Analysis (MCA). Then, a Binary Particle Swarm Optimization (BPSO) algorithm-based HASS is developed considering user satisfaction, electricity budget, appliance prioritization, energy storage systems, solar power, and electric vehicles. The simulations were assessed under varying levels of user compliance. Results showed that the average electricity cost, peak demand, and peak-to-average ratio (PAR) of the city load profile were all reduced. Therefore, the deployment of the HASS and TOU pricing scheme is beneficial for both stakeholders.

Keywords : appliance scheduling, DSM, TOU, BPSO, city-wide simulation, electric vehicle, appliance prioritization, energy storage system, solar power

Conference Title : ICDRSGLF 2023 : International Conference on Demand Response in Smart Grids and Load Flexibility

Conference Location : New York, United States

Conference Dates : January 30-31, 2023