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A four-stage stochastic framework for managing electricity market by participating smart buildings and electric vehicles: towards smart cities with active end-users

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Abstract-

After the restructuring of the electricity market, one of the challenges of researchers has always been to design markets that can use the maximum potential of smart consumers to improve the economic and technical indicators of the system. Therefore, this article presents a four-stage model in which the scheduling of smart buildings, microgrids and the main grid is done. In the first stage of this model, subscribers of smart buildings do their day-ahead scheduling with the aim of minimizing their electricity bill and send it to the central control unit of the building. In the second stage, the central control unit of the smart building performs its day-ahead scheduling according to the received programs and sends it to the microgrid operator. Then, in the third stage, the microgrid's strategy for participating in the day-ahead market is designed, considering the programs received from smart buildings. Finally, in the fourth stage, the market manager receives buy / sell offers of microgrids and calculates the market settlement price (MSP) with the aim of maximizing the social welfare (SW) index. The simulation results illustrate that equipping smart buildings with solar panels and energy storage systems (ESSs) not only reduces the MSP during peak hour by 6.66%, but also improves the network voltage profile. In addition, the results reflect that changing the behavior of smart subscribers and electric vehicles (EVs) by the incentive programs leads to a significant improvement of the technical and economic indicators of the network.

Index Terms- Microgrids; Electricity market; Smart buildings; Renewable generations; Electric vehicles; Demand response programs

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