Two-Level Separation of High Air Conditioner Consumers and Demand Response Potential Estimation Based on Set Point Change

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Abstract : In recent years, the development of communication infrastructure and smart meters have facilitated the utilization of demand-side resources which can enhance stability and economic efficiency of power systems. Direct load control programs can play an important role in the utilization of demand-side resources in the residential sector. However, investments required for installing control equipment can be a limiting factor in the development of such demand response programs. Thus, selection of consumers with higher potentials is crucial to the success of a direct load control program. Heating, ventilation, and air conditioning (HVAC) systems, which due to the heat capacity of buildings feature relatively high flexibility, make up a major part of household consumption. Considering that the consumption of HVAC systems depends highly on the ambient temperature and bearing in mind the high investments required for control systems enabling direct load control demand response programs, in this paper, a recent solution is presented to uncover consumers with high air conditioner demand among large number of consumers and to measure the demand response potential of such consumers. This can pave the way for estimating the investments needed for the implementation of direct load control programs for residential HVAC systems and for estimating the demand response potentials in a distribution system. In doing so, we first cluster consumers into several groups based on the correlation coefficients between hourly consumption data and hourly temperature data using K-means algorithm. Then, by applying a recent algorithm to the hourly consumption and temperature data, consumers with high air conditioner consumption are identified. Finally, demand response potential of such consumers is estimated based on the equivalent desired temperature setpoint changes.

Keywords : communication infrastructure, smart meters, power systems, HVAC system, residential HVAC systems

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