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Title: Data-Driven Cluster Analysis with Dynamic Programming for Residential Electricity Customers using Time-Series Load Profiles for Demand-Response Events - A Case Study in Dallas, Texas

Abstract: This project develops means to analyze and cluster residential households into useful homogeneous groups for electricity usage. The understanding of customer classification and having electricity load profiles for different customer classes are top priorities for retail energy providers (REPs) so that they can plan and conduct demand response (DR) effectively. A dataset of 10,224 residential households in 2017 located in Houston, Texas was used. The study applied the two-step Partitioning Around Medoids (PAM) algorithm to cluster residential customer based on energy load profiles in combination with a dynamic program and grey-box thermodynamic modeling for demand response to best determine the number of cluster segments. The approach represents a practical compromise between identifying the most DR-profitable customer groups and computational considerations as opposed to tailoring DR programs for each separate household. As a result, the analysis provides computational business insights for REPs and other power market participants.

Key words: Demand response, cluster analysis, machine learning