

Synchronous Pattern Matching Principle-Based Residential Demand Response Baseline Estimation: Mechanism Analysis and Approach Description

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Most current customer baseline load (CBL) estimation methods for incentive-based demand response (DR) rely heavily on historical data and are unable to adapt to the cases when the load patterns (LPs) in the DR event day are not similar enough to those in non-DR days. After the error generation mechanism of current methods is revealed, a synchronous pattern matching principle-based residential CBL estimation approach without historical data requirement is proposed. All customers are split into DR and CONTROL group, including DR participants and non-DR customers, respectively. First, all CONTROL group customers are clustered into several non-overlapping clusters according to LPs similarity in the DR event day. Second, each DR participant is matched to the most similar cluster in the CONTROL group according to the similarity between its load curve segments in DR event day, excluding DR part and cluster centroids. Third, the CBL of each DR participant is estimated with an optimized weight combination method using the load data within the DR event period of all the customers in the very matching cluster in the CONTROL group. A comparison with five well-known CBL estimation methods using a dataset of 736 residential customers indicates that the proposed approach has better overall performance than other current CBL estimation methods.