

Identifying residential consumption patterns using data-mining techniques: A large-scale study of smart meter data in Chengdu, China

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Abstract The fine-grained electricity consumption data created by advanced metering technologies offers an opportunity to understand residential demand from new angles. Although there exists a large body of research on demand response in short- and long-term forecasting, a comprehensive analysis to identify household consumption behaviour in different scenarios has not been conducted. The study's novelty lies in its use of unsupervised machine learning tools to explore residential customers' demand patterns and response without the assistance of traditional survey tools. We investigate behavioural response in three different contexts: 1) seasonal (using weekly consumption profiles); 2) holidays/festivals; and 3) extreme weather situations. The analysis is based on the smart metering data of 2,000 households in Chengdu, China over three years from 2014 to 2016. Workday/weekend profiles indicate that there are two distinct groups of households that appear to be white-collar or relatively affluent families. Demand patterns at the major festivals in China, especially the Spring Festival, reveal various types of lifestyle and households. In terms of extreme weather response, the most striking finding was that in summer, at night-time, over 72% of households doubled (or more) their electricity usage, while consumption changes in winter do not seem to be significant. Our research offers more detailed insight into Chinese residential consumption and provides a practical framework to understand households' behaviour patterns in different settings.

Keywords Residential electricity; household consumption behaviour; China; machine learning

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