

# Machine Learning on residential electricity consumption: Which households are more responsive to weather?

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**Abstract** The introduction of smart meters has created opportunities for both utilities and policymakers to understand residential electricity consumption in greater depth. Machine learning techniques have distinct advantages over traditional approaches in dealing with extremely large volumes of high-resolution usage data. We introduce a novel clustering method to detect household behaviour using different types of weather data as proxies. Based on this approach, we combine Irish smart meter and weather data to identify and characterize clear differences in the daily patterns between workdays and weekends in both summer and winter and investigate how households respond to changing weather patterns. We also examine the relationships between response groups and household demographic features using different statistical tests. We find the magnitude of the effect of occupancy-related variables in the clustering of weather sensitivity to be larger than income-related factors. This proposed new approach could be the basis of a classification model to identify households that are more responsive to different types of weather. Tariff design could benefit from such a model and enable specific schemes to be developed that would target weather-sensitive households and result in improved load management.

**Keywords** Weather sensitivity; smart metering data; unsupervised learning; clusters; residential electricity; consumption patterns; Ireland

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