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Title:

Using existing building stock to predict the electricity load profiles of new supermarkets

Authors & affiliations:

Ramon Granell[1,2], Colin J. Axon[2], Maria Kolokotroni[2], David C. H. Wallom[1]
[1]University of Oxford, UK, [2]Brunel University London, UK

Abstract: (Your abstract must use **Normal style** and must fit in this box. Your abstract should be no longer than 300 words. The box will 'expand' over 2 pages as you add text/diagrams into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.
2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Introduction: Clearly state the purpose of the abstract
Methods: Describe your selection of observations or experimental subjects clearly
Results: Present your results in a logical sequence in text, tables and illustrations
Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them

The food retail sector accounts for 3-5% of total electricity consumption in the UK; supermarkets are energy intensive buildings due to refrigeration, HVAC and lighting. We have been given access to a data-set of hourly electricity demand readings for 196 UK supermarkets from 2012 to 2015. Our work aims to predict the electricity demand of a new supermarket to help with energy management, i.e. what *should* be normal for that new property.
Traditional energy usage estimation methods rely on thermal engineering models of the building which have the disadvantage of missing the usage drivers of energy consumption. We have developed a data-driven approach to forecast the 'electricity daily load profile' (EDLP) of a new supermarket, applying data mining techniques to profiles of stores with similar (though not identical) building and retail-related features.

One method used is based on the K-nearest neighbours algorithm. It combines the profiles of the K most similar stores to the new one based on a set of features (F) to predict its EDLP. The features are floor area divided by usage such as general merchandise, food, offices, and cafeteria. We also account for geographical differences and weather. Performing an n-1 analysis over the set of current supermarkets the parameters K* and F* are selected that minimise the average Euclidean distance between the average DLP of the K most similar stores and the real EDLP. The search space for K goes from 1 to 50 and F comprises 127 different feature combinations.

Our preliminary results show that we can accurately predict the EDLP of smaller supermarkets but our method can be improved for larger stores. We show the real and estimated Winter EDLPs of two supermarkets that use just electricity: Store 1 is the best prediction (in proportion) and Store 2 is the worst prediction.

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