Can smart meters save consumers and British Gas money and carbon by pinpointing which consumers are most likely and best placed to install insulation in their homes?

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Project Background

British Gas, as with other energy providers, have certain energy-savings targets to fulfil as part of the Government's ECO (Energy Company Obligation) policy. These include providing wall cavity and loft insulation to customers' homes who could benefit from it. With no existing dataset regarding how energy-efficient consumers' homes are, this has to be inferred from other sources. One such source is smart meter data, a new dataset which is both extremely new and offers much higher-temporal resolution insight into customer's energy use than was previously available. As the aim was to focus on customers living in homes with cavity walls, only customers who are homeowners, not living in flats or terraced houses and whose homes were built between 1919 and 1976 were included in the study.

Data and Methods

The smart meter gas consumption data consisted of 48 half hourly daily readings averaged across Tuesday-Thursdays in winter 2013-14, excluding the Christmas and New Year period, to create a 'typical' midweek profile. The cleaned dataset represented approximately 40,000 customers. Customers were segmented into 4 load profile groups formed of 12 individual clusters using the K-means clustering algorithm, according to their average weekday energy use. An index of energy use by affluence for each distinctive load profile shape, which incorporated data about already insulated homes, was created and used to rank neighbourhoods at the Output Area level according to their suitability for targeted marketing of energy-efficiency measures. Areas were ranked according to their Output Area Classification (OAC).

Key Findings

The K-means algorithm was found to be an effective method of segmenting customers by their energy use. The 12 clusters were all distinctive and identified insightful large scale descrepencies between patterns in daily gas consumption between customers. The clusters were also amalgamated into 4 load profile groups (figure 2) which were named; Twin Peak, Flat Profiles, Evening Peak (figure 1) and Afernoon Dwellers. An additional 5th group of continuous high engery use was also identified but it only represented 0.5% of smart readers. Attributes of customers within each of these clusters were compared against the mean and were found to provide insightful information regarding domestic energy use. The data verified the idea that, for example, elderly customers tend to possess more homogenous daily profiles and that more affluent customers use more energy.

The research identified neighbourhoods that;

- contain customers who exhibited higher energy use per their affluence, thus have a higher energy-saving potential
- have customers who have shown willingness to accept energy-efficiency measures in the past, meaning they should be more likely to accept them in the future
- contain a high proportion of residents who are:
  - Homeowners
  - Living in homes built with cavity walls
  - Living in homes where measures can be installed with minimal disruption.

These neighbourhoods could be ranked using the OAC, (mapped in figure 3).

Value of the Research

British Gas were shown a means by which their smart meter data can be used to segment their customers using data other than solely their household composition attribute data. A method for identifying consumers who are most suitable for targeted marketing of energy efficiency measures was created and could be used to pinpoint these customers. I benefited greatly by gaining experience working with a new and real dataset on a meaningful and relevant project, receiving expert assistance and guidance from industry professionals.

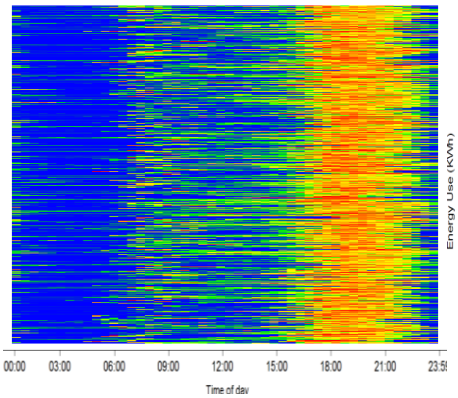

Fig. 1. Heatmap for group 'Evening Peak'

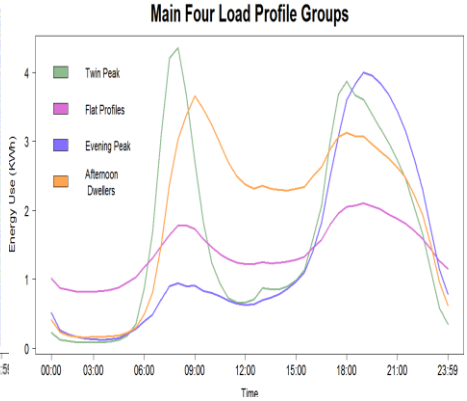

Fig. 2. Four load profile groups

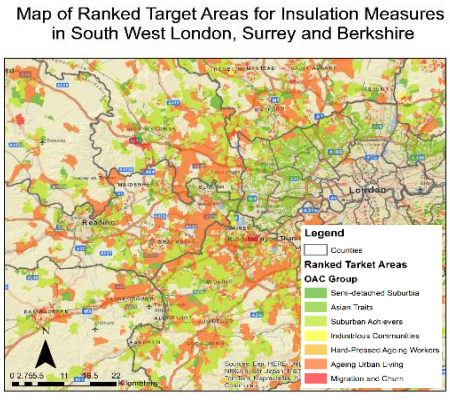

Fig. 3. Ranked output area classifications