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Citation: Goodwin, S. & Dykes, J. (2012). Visualising Variations in Household Energy Consumption. Poster presented at the IEEE Conference on Visual Analytics Science and Technology (VAST), 14 - 19 Oct 2012, Seattle, Washington, US.

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Visualising Variations in Household Energy Consumption

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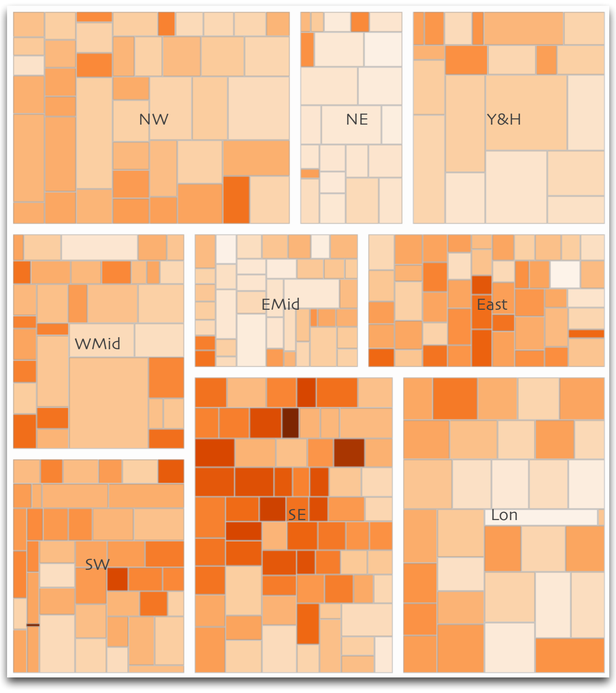
Domestic energy consumption in the UK correlates with household disposable income, tenure, composition and urban/rural location[1], but the relationship between energy use and geodemographics has scarcely been investigated. We are analysing variations in energy consumption together with geography and geodemographics. A greater understanding of this complex relationship will benefit energy providers, local government and consumers as it will allow realistic comparisons and enable better targeting for services and schemes to encourage more sustainable energy use.

Visual Exploration: Household energy consumption varies by ...

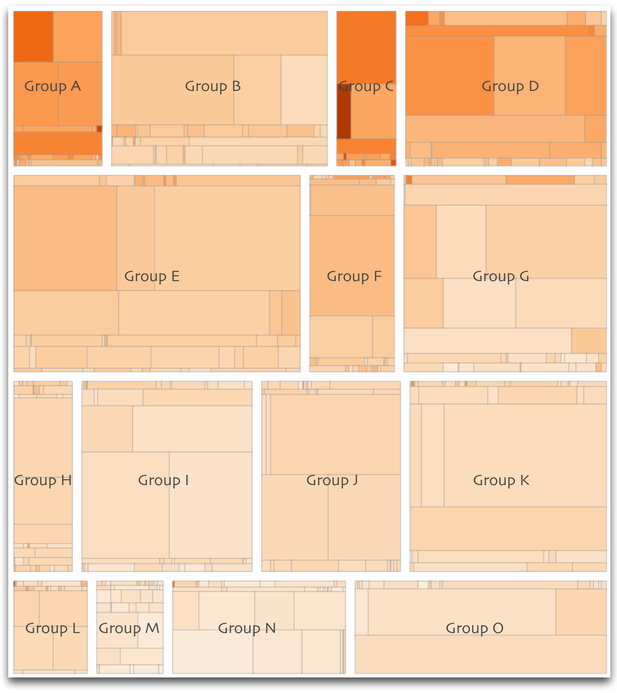
Geography



Geographically arranged Regions containing Local Authorities, sized by number of electricity meters, coloured by average annual consumption

3000 - 5400 (kWh)

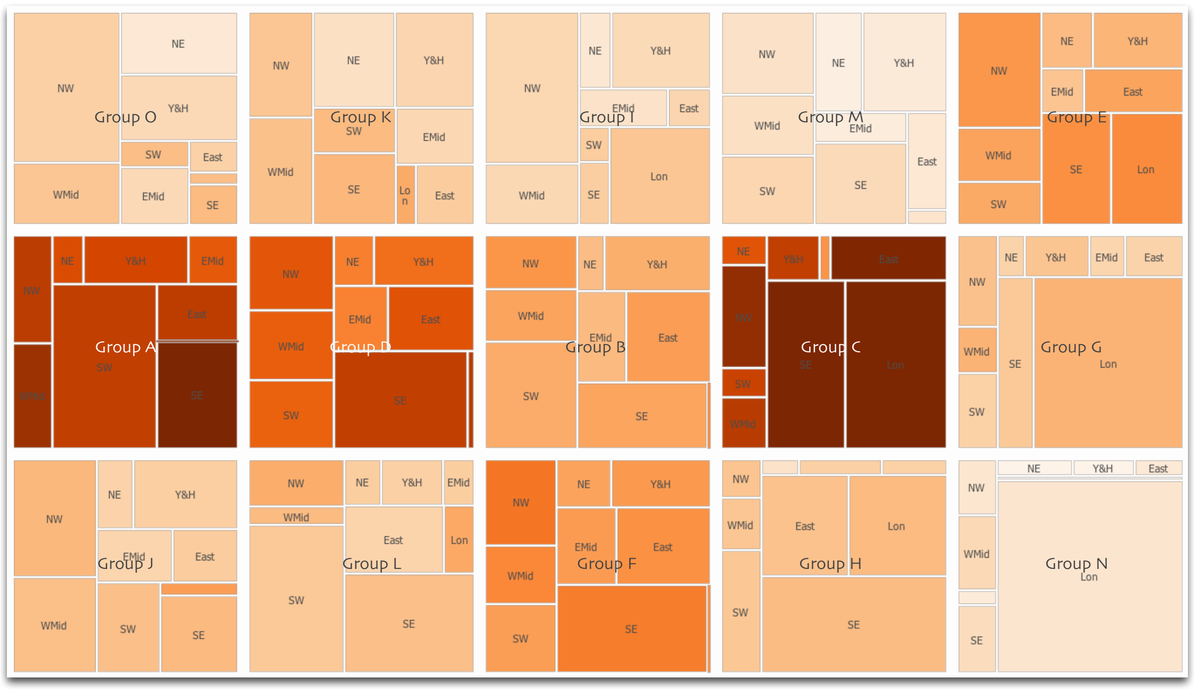
Geodemographic Group



Mosaic Groups containing Mosaic Types, sized by number of electricity meters, coloured by average annual consumption

2900 - 6850 (kWh)

Geodemographic Group & Geography



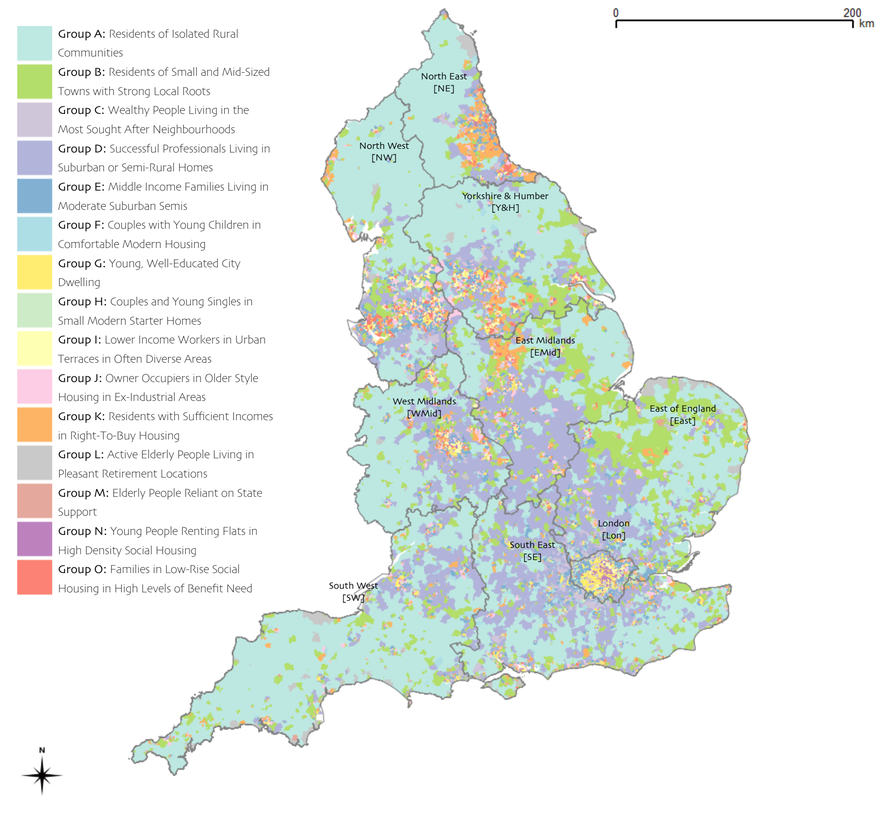
Mosaic Groups with fixed square size containing geographically arranged regions which are sized by number of electricity meters and coloured by average annual consumption

2600 - 5600 (kWh)

The exploratory analysis combines publicly available sub-national electricity consumption data for 2008 (based on ordinary electricity meters) from the Department of Climate Change (www.decc.gov.uk) combined with Experian's Mosaic Public Sector Classification 2010 available for academic research (www.mimas.ac.uk), which contains 15 demographic Groups and 69 Types. These visualisations were produced using HiDE software (www.giCentre.org/hide) [2].

The above visualisations show that both demographic group and geographic location correlate with energy consumption characteristics. Our research and industrial engagement identifies a need to better understand the patterns between population lifestyles and energy use, habits and behaviour.

Key to Mosaic Groups & Regions

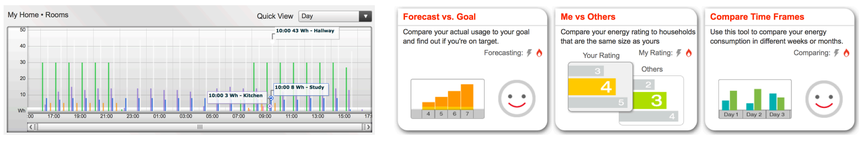


Engagement with Industry: Visualising the Smart Home

The introduction of smart meter technology vastly increases the ability to better understand consumer energy use and behaviour. We are working in collaboration with the UK energy provider E.ON AG to explore new datasets which are becoming available following the initial adoption of smart home technologies. The 'Smart Home' provides many opportunities for visual analytics and data visualisation, with the ability to investigate energy consumption by aggregations of time, appliance and household characteristics. Our work with E.ON is helping to frame our research within the needs of the energy industry.

E.ON are introducing smart energy technologies into typical homes...

...and educating customers about their energy use through a personal Energy Management System:



Household energy consumption is compared to energy saving goals, across time, by appliance, by room and against neighbouring houses.

- Typical Energy Uses?
- Typical User Behaviours?
- Typical User Characteristics?

Aggregated Smart Home Data provides a rich data source to help determine energy user types and to better understand energy consumers.

Our continued research aims to create a specifically defined neighbourhood energy-based classification that combines energy related datasets with relevant geo-demographic variables. Engaging interactive geovisualisation techniques will be applied, developed and evaluated with industry experts to enable better interpretation and understanding of the final classification [3, 4].

[1] Druckman, A & Jackson, T (2008) "Household Energy Consumption in the UK: A Highly Geographically and Socio-economically Disaggregated Model" Energy Policy, vol. 36, pp. 3177-3192.
[2] Slingsby, A., Dykes, J. & Wood, J. (2009) "Configuring Hierarchical Layouts to Address Research Questions". IEEE Transactions on Visualization and Computer Graphics, 15(6), pp. 977 - 984
[3] Choo, J., Lee, H., Kihm, J. and Park, H. (2010) "iVisClassifier: An Interactive Visual Analytics System for Classification based on Supervised Dimension Reduction". In VAST IEEE Symposium, pp. 27 –34
[4] Slingsby, A., Dykes, J. & Wood, J. (2011) "Exploring Uncertainty in Geodemographics with Interactive Graphics". IEEE Transactions on Visualization and Computer Graphics, 17(12), pp. 2545-2554

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