



Fuel Poverty Mapping Methodology

Background

The analysis for producing fuel poverty maps is based on a report released by the Centre for Sustainable Energy; authored by Baker, Starling and Gordon¹. Fuel poverty is dependent on both the amount that a household spends on energy bills (generally dictated by the cost of energy and the energy efficiency of homes) and the total income of the household. Since information on household income and fuel bills is not available at data zone level (i.e. measured in the Census) this makes the determination of fuel poverty at small area level challenging.

Despite this a number of characteristics (which are measured at data zone level) have been shown to be good indicators of low income, including unemployment and when the resident of a home is a single pensioner. Furthermore, EPC information is available at data zone level, which provides information on the energy efficiency of housing stock in a given region. By combining these factors that predispose a household to low income and poor energy efficiency a model can be built to predict the number of homes in fuel poverty at data zone level.

Generation of proxies

The first step required identification of the factors (also known as proxy indicators) that predispose properties to fuel poverty. For this purpose the 2011-2013 Scottish House Conditions Survey (SHCS) was used, which is a national survey of approximately 12,000 Scottish homes and provides a measure of the overall level of fuel poverty across Scotland. The SHCS involves interviews with homeowners and physical inspections of properties to gain income and energy efficiency information. This information can be used to establish a household's fuel poverty status and gains additional information such as tenure, economic status and family size. The 2011-2013 survey data was chosen since this is the most current dataset available and contains information at the time of the 2011 Scottish Census.

Identification of proxy indicators in the first instance (prior to statistical analysis) required knowledge of fuel poverty and what factors were likely to increase its likelihood. For instance, the SHCS reports that 39.1% of households live in fuel poverty across Scotland,

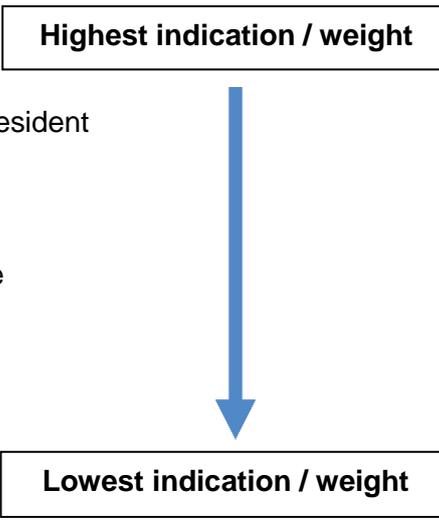
¹ "Predicting Fuel Poverty at the Local Level". William Baker, Graham Starling and David Gordon. Centre for Sustainable Energy 2003.

whereas in households where the highest income householder is unemployed the likelihood of fuel poverty increases to 60%. After considering a number of factors in isolation (and selecting ones where the likelihood of fuel poverty increases) this resulted in a number of potential indicators.

Using different combinations of the potential indicators a multivariate logistic regression was performed with fuel poverty set as the binary predictor.² This resulted in six statistically significant proxies of fuel poverty³ each of which had an associated 'odds ratio'. The odds ratio reflects the increased odds of a household living in fuel poverty if that characteristic (e.g. unemployed) is present (rather than absent). These were used to generate weighted indices for application to Census data. Four of the proxies are mutually exclusive whilst the weighting is designed to minimise any double counting related to factors such as EPCs or central heating system other than gas or electricity.

Using the Census indices below at data zone level the addition of the proxy values calculates the total number of households in fuel poverty in that area. This gives a strong indication of total number of households likely to be in fuel poverty.

Final list of weighted indicators:

1. **Unemployed**; highest income householder is under 60 and unemployed
 2. **Single pensioner**; households with one adult resident aged over 65, if a man, or over 60, if a woman
 3. **EPC rating E-G**
 4. **Permanently sick or disabled**; highest income householder
 5. **Looking after the home or family**; highest income householder
 6. **Central heating system other than gas or electricity**
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- Highest indication / weight
- Lowest indication / weight

² It should be noted that in the SHCS properties are classified as either "not fuel poor", "fuel poor" or "extreme fuel poor"; for our purposes we have grouped the two latter categories to allow for a binary outcome of "fuel poverty" or "not fuel poverty".

³ Proxies with negligible p-values were considered statistically significant

Application of weighting indices to data zones

The weighted indices were applied to the 2011 Census for the “single pensioner”, “unemployed”, “looking after the home or family”, “permanently sick or disabled” and “central heating system other than gas or electricity” proxies. For “single pensioner” the definition in the Census is slightly different to the SHCS as this is defined as a one person household with an adult aged 65 and over, therefore does not disaggregate males and females of pensionable age.

For EPC data at small area level the Scottish EPC register was consulted, which contains the count of EPC ratings A-G at local authority ward level. In order to generate the number of EPC ratings at data zone level, the total number of properties in a given data zone (reported in the Census) was multiplied by the relative proportion of each EPC rating. In instances where data zones span two or more local authority ward boundaries the number of households in that data zone were split, the EPC proportions applied, then the results aggregated. These figures were then used to generate the count of EPC rating E-G properties. After multiplication by the weighted indices, the results for each of the proxies were added together to give a total number of households per data zone in fuel poverty. The division of fuel poor households by the total number of households in that data zone gives a measure of the percentage fuel poverty per data zone.

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