



**CENTRE FOR  
SUSTAINABLE  
ENERGY**

# Quantifying rural fuel poverty

Interim report

William Baker and Ian Preston

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Centre for Sustainable Energy  
The CREATE Centre  
Smeaton Road  
Bristol BS1 6XN

Tel: 0117 929 9950  
Fax: 0117 929 9114  
Email: [info@cse.org.uk](mailto:info@cse.org.uk)  
Web: [www.cse.org.uk](http://www.cse.org.uk)  
Registered charity no.298740



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## SUMMARY

This report describes the findings of the first stage of the research carried out for the 'Quantifying rural fuel poverty' research project.

The research gathered small area data on three factors that were considered particularly problematic in rural areas:

- Access to gas
- Solid wall properties
- Distribution of Warm Front grants<sup>1</sup>

The databases were converted to Census Output Area (OA) as the common geographic unit. OAs are particularly suitable for rural analysis in that their size is sufficiently small (average size: 125 households) to allow the identification of 'pockets' of rural deprivation. They also allow comparison between the three factors investigated and the ONS 'urban and rural area' classification. This divides OAs into 4 settlement types: 'urban', 'town & fringe', 'village' and 'hamlet & isolated dwellings'.

County maps of the three indicators were produced for 6 Government Office regions as part of this research project. County maps of 'solid walled properties' and 'access to gas' (but not 'Warm Front distribution') were later produced for the remaining 3 Government Office regions, as part of a separate project for the Energy Efficiency Partnership for Homes Insulation Group. The maps and research reports are mounted on a 'rural fuel poverty' website: [www.ruralfuelpoverty.org.uk](http://www.ruralfuelpoverty.org.uk). This report makes occasional reference to the website by way of demonstrating the geographic distribution of the three indicators.

The 6 regions investigated by this research correspond to the regions covered by Eaga during the Warm Front phase 1 franchise (Eaga is now responsible for delivering Warm Front in all regions). They are the North East, North West, South East, South West, West Midlands and London.

A comparative statistical analysis between urban and rural areas in 5 of the 6 regions<sup>2</sup> was carried out for each of the three factors. This found that:

- The proportion of solid walled properties increased substantially with each increase in level of settlement dispersal (from 'urban' to 'town' to 'village' to 'hamlet'). The proportion of solid wall properties in 'hamlets' ranged from 50% to 60% across the 5 regions. By contrast, solid wall properties in 'urban' areas ranged from 21% to 27%.
- The increase in solid wall properties was found to be statistically significant for each move upwards in dispersal level in all 5 regions (separately and combined), with one exception. The exception was the difference between the 'urban' and 'town' categories in the North West, where the proportions of solid wall properties were fairly similar.
- 36% of rural properties were off the gas network, compared to 5% of urban properties – a ratio of 7:1. This figure rose to 47% of 'all rural' properties and 76% of 'hamlets' in the South West.

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<sup>1</sup> Based on all Warm Front grants delivered between the start of the programme (2000) and 2003.

<sup>2</sup> London was not included in most of the analyses because the region is almost entirely urban.

- The proportion of properties off the gas network increased substantially with each increase in level of settlement dispersal. This difference was found to be statistically significant for each move upwards in dispersal level in all 5 regions (separately and combined).
- The take-up rate of Warm Front grants in urban areas was over twice the rate in rural areas across the 5 regions (4.4% and 2.0%, respectively).
- The difference in take-up rates between the 'urban' and the 3 separate rural categories was significantly different for the 5 regions combined.
- The difference in Warm Front take-up rates between the 'urban' and 3 rural categories was significantly different in each of the 5 regions, with the exception of the difference between 'urban' and 'town & fringe' in the North East.
- The difference in take-up rates between 'village' and 'hamlet' was not significantly different in any of the 5 regions.
- The national rate of rural fuel poverty is broadly comparable, if not higher, than the national rate of urban fuel poverty. However, levels of rural income deprivation, while substantial, are generally lower than urban income deprivation on a range of indicators.
- The lower levels of rural income deprivation may in part explain the lower Warm Front take-up rate in rural areas, compared to urban.
- The extensive problem of 'hard to treat' properties in rural areas is considered to help explain the relatively high fuel poverty levels found in rural areas.

The report suggests that the use of passport benefits as a means of accessing Warm Front grants is problematic in rural areas. This is because many more households live in fuel poverty than might have been expected, given income levels in rural areas, due to the high proportion of 'hard to treat' properties in rural areas.

Benefit take-up campaigns in rural areas may help increase Warm Front take-up to some extent. However, the report concludes that the problem of 'hard to treat' properties is so extensive in rural areas that new approaches to targeting the rural fuel poor are required.

The report also considers that the analysis presented in this report, coupled with the maps presented on the accompanying website, will provide a useful resource for targeting fuel poor households and hard to treat housing. The value of this resource should increase with completion of the second stage of the research. This is because the second stage research will explore relationships between the distribution of hard to treat properties, Warm Front take-up and fuel poverty at the small area level.

# 1 INTRODUCTION

This is the interim report of the ‘Quantifying rural fuel poverty’ research project for Eaga Partnership Charitable Trust. The project was originally set up to address the following aims and objectives:

“To quantify and report on the extent and characteristics of rural fuel poverty in England, make comparisons with urban fuel poverty and rural deprivation and make recommendations appropriate to both rural policy and anti-fuel poverty policy.”

This would be achieved by addressing the following questions:

- What is the overall extent of rural fuel poverty as opposed to urban fuel poverty within England?
- Which rural wards have the highest instances of fuel poverty and why?
- What is the relationship between housing characteristics, access to gas and other indicators of rural fuel poverty?
- Is it possible to produce a simple classification of rural wards according to their fuel poverty characteristics?
- Is take-up of Warm Front grants significantly lower in rural areas than urban?

The original intention was that the main output of the project would be a final report of the research, which would include regional ward maps of rural fuel poverty and factors related to fuel poverty. This report would focus on small area analysis of fuel poverty, using the CSE/Bristol University updated fuel poverty indicator (FPI), and related factors.

The research terms of reference were later slightly amended, as follows:

- Mapping of data at Census Output Area level, rather than ward, since this should allow identification of possible ‘pockets’ of rural deprivation (given the more dispersed nature of rural deprivation and fuel poverty, compared to urban)<sup>3</sup>.
- Production of maps at county level, rather than regional, since it is not possible to identify Output Areas at regional level, given their small geographical size.
- Presentation of the maps on a rural fuel poverty website, rather than inclusion within the report, given the large number of maps produced for the research.
- Dissemination of the research in two stages. Because the full research required access to the updated FPI, and work on this was considerably delayed, it was decided to release an interim report of the research.

This is the interim report. It outlines the results of the research that did not require access to the updated FPI. In brief, this includes:

- Initial comparisons between rural fuel poverty and rural deprivation, based on 2003 EHCS analyses and information from the ‘State of the countryside 2005’ report (Commission for Rural Communities, 2005).

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<sup>3</sup> Census Output Areas contain on average 125 households, whereas wards contain anything between 1000 and 12,000 households (see Section 1.2).

- Development of the small area off-gas, solid wall and Warm Front maps.
- Design and construction of a demonstration website for mounting the maps.
- Comparison of the urban and rural distribution of Warm Front grants, off-gas properties and solid wall properties at the regional level.

We consider that the analysis presented in this report, together with the maps presented on the website, will help policy makers and practitioners target fuel poverty and hard to treat housing more effectively.

The final report, due late summer 2006, will complete the research programme by outlining the results of an analysis of the small area incidence of fuel poverty (as revealed by the updated FPI) and the small area incidence of 'off-gas', solid wall and Warm Front grants. The Warm Front analysis should be particularly valuable since it will be able to compare any differences in take-up of Warm Front, relative to need, between urban and rural areas. The report should therefore help further improve understanding of how to target fuel poor households.

This report is structured as follows:

Chapter 2 outlines the research methodology.

Chapter 3 presents the findings of the research conducted to date.

Chapter 4 describes the remaining research tasks, which will be reported in the final report, due summer 2006.

## 2 METHODOLOGY

The research, in brief, involved the following tasks:

1. Regional comparisons of urban and rural fuel poverty, plus comparison of rural fuel poverty with general rural deprivation.
2. Gather datasets, namely:
  - Urban and rural area classification
  - Distribution of Warm Front grants
  - Access to gas
  - Solid wall properties
  - ‘incidence of fuel poverty’, as revealed by the updated FPI
3. Determine the most appropriate geographic unit for analysis and convert all datasets to this unit; followed by GIS extraction of data to allow statistical analysis
4. Development of a website to present, in map format, geographical data collected
5. Statistical analysis of the small area distribution of rural fuel poverty and related factors, i.e. Warm Front grants, solid wall properties and properties off the gas network, focussing on any urban/rural differences.

These tasks and current progress are described in more detail below.

### 2.1 Rural fuel poverty and general deprivation

The comparisons of urban and rural fuel poverty and between rural fuel poverty and rural deprivation were carried out in two stages. The first stage, outlined in this report, broadly compares urban and rural fuel poverty and urban and rural deprivation at the national level. The second stage, which will be described in the final report, extends the comparative analysis to small area level and will use the updated fuel poverty indicator (see 2.2.5 below). Further details of this work are described in 2.5 below.

### 2.2 Datasets

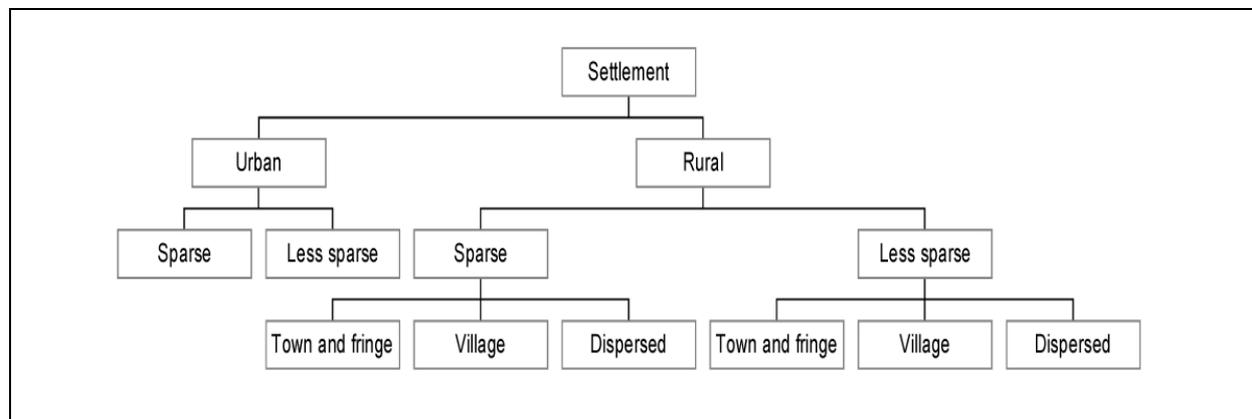
The following datasets were gathered for the research.

#### 2.2.1 Urban and rural area classification

In 2004, the Countryside Agency, Department for Environment, Food and Rural Affairs, Office for National Statistics (ONS), Office of the Deputy Prime Minister and Welsh Assembly Government produced a new urban and rural area classification (ONS, 2004). The classification provided a single statistical framework for defining different settlement types and context categories. The classification is based on population densities across the whole spectrum of ‘settlements’ or ‘built-up’ areas. It therefore does not include any socio-economic variables in its construction but is rather meant to provide a common standard for interpreting socio-economic issues, as they affect people living in urban and rural areas.

The classification is available at the level of Census Output Area (see Section 2 for further explanation of Output Areas).

The broad structure of the classification is shown below:



This research uses the new classification for its analysis of rural fuel poverty and related issues. All analysis will use the following 4 categories:

- Urban > 10k households
- Town and fringe
- Village
- Hamlet and isolated dwellings

The ONS classifies all Output Areas (OAs) according to 1 of these 4 categories. It uses a separate and combined classification according to whether OAs are ‘sparse’ or ‘less sparse’<sup>4</sup>. The ‘sparse’ classification was not used by this research due to the small number of OAs, 0.2%, that fall into the category in England (the equivalent figure for rural areas in England is 1.2%).

## 2.2.2 Distribution of Warm Front grants

Eaga supplied CSE with a database of all Warm Front grants awarded between 2000 and October 2003 by 6 digit postcode area. This did not include grants awarded in the Eastern region since the Powergen Warm Front team was responsible for administering the scheme in this region at the time of data collection. The database did not distinguish the type of measure funded by grants, e.g. CFLs, insulation, heating systems.

The research therefore relates to Warm Front phase 1, rather than the current phase. It is important to note, therefore, that the analysis does not take account of important changes that were made to the Warm Front programme in 2005, including:

- Seeking to achieve a SAP 65 target for properties helped through Warm Front, wherever practical.

<sup>4</sup> ‘Sparsity’ refers to the density of a population within a broad area. The ONS classification measures sparsity by calculating for every 1ha cell the density of households across areas of 10km, 20km and 30km. A weighted total of 1ha cells within each OA was then calculated. OAs are classified as ‘sparse’ if they fall within the sparsest 5% of OAs at all 3 scales (Bibby & Shepherd, 2004).

- Providing all eligible households with central heating, not just people over 60.
- Offering oil central heating, once other low carbon solutions have been considered (regarded as particularly useful to rural households off the gas network).
- Raising the grant maxima to £2,700, or £4,000 if an oil central heating system is installed.
- Offering Benefit Entitlement Checks to all households enquiring about Warm Front but not on a passport benefit and to households already on a passport benefit but whose property cannot be brought up to SAP 65 (i.e. to establish whether such households might be eligible for further benefits over and above the passport benefit).

### 2.2.3 Access to gas

Lack of ‘access to gas’ is an important predictor of ‘hard to treat’ housing. It is a problem particularly associated with rural areas, although it also occurs in certain urban areas (e.g. areas that traditionally used solid fuel as the main heating source) and property types (e.g. high rise).

We obtained gas connectivity data from Transco’s Demand & Generation Forecasting Department in 2003. The database lists 6 digit postcode areas with a gas supply in 2003 (there are 1.2m postcode areas in England). The database is more detailed than that made publicly available on Transco’s website. We acknowledge the support of Professor John Chesshire in acquiring this database.

We have assumed that all properties within listed postcodes receive gas, although this may not always be the case. This will lead to a slight overestimate of gas connectivity. There may also be some properties that are connected to gas but do not use it. The database does not include postcodes supplied by independent gas operators in 2003 (while this number has grown significantly over the past 2 years, it was still relatively small in 2003). This will lead to a slight under-estimate of gas connectivity.

We estimated the number of households receiving gas at Output Area level by applying the following ratio to the Output Area household population:

$$\frac{\text{no. of postcodes with gas in OA}}{\text{total no. of postcodes in OA}}$$

We acknowledge that this is only an approximate guide to gas connectivity and probably represents an over-estimate. We have used both the ‘estimated % of households with gas’ and the ‘% of postcodes with gas in OA’ indicators for the analysis and mapping work conducted. We intend to carry out a sensitivity analysis of the impact of possible over/under estimates for the final stage of the research.

### 2.2.4 Solid wall housing

A higher proportion of rural properties than urban are built with solid walls (see section 3.2). ‘Properties built with solid walls construction’ is another predictor of ‘hard to treat’ in that they, on average, have lower SAP values than those built with cavities. While insulation options are available for solid walls, e.g. dry lining, external

cladding and insulating plaster products such as Wall reform, they are much less cost effective than the cavity wall insulation option for properties built with cavities.

We originally intended to use the simple English multiplier recommended by the Association for the Conservation of Energy (ACE) for constructing the small area database of solid wall properties (ACE, 2002). ACE suggests that the number of solid wall properties in any given area in England can be estimated by multiplying the number of pre-1919 properties by 1.44. The English House Condition Survey provides property age data according to 5 broad categories: pre-1919, 1919-1944, 1945-1964, 1965-1980 and post 1980 (ODPM, 2004a). The multiplier is designed to give a broad reflection of the fact that properties built before 1919 do not contain cavities but a proportion of properties built between 1919 and 1945 do<sup>5</sup>.

We built upon the ACE approach by developing a set of regional multipliers, derived from the 2001 EHCS, which could be applied to small area data on property age to produce a proxy for solid wall properties. This is because there are considerable regional variations in the distribution of solid wall properties. The regional multipliers were further differentiated according to the urban/rural categories used within the EHCS<sup>6</sup>. This still leads to inaccuracies when applied at the small area level, although it does provide a more accurate guide than use of a simple all-England multiplier.

We used RESIDATA to provide post code area data on age of property. RESIDATA is a commercial database produced for the building insurance industry which is updated annually. It provides good quality and reasonably accurate data on a range of property characteristics, including property age<sup>7</sup>. We applied the urban and rural regional multipliers to 'number of pre-1919 properties' in each postcode to produce a small area database of solid wall properties.

### 2.2.5 Fuel poverty indicator

In 2002, CSE and the University of Bristol developed a methodology for predicting the level of fuel poverty in small areas (Baker, et al 2002). In brief, the work involved modelling the 1991 Census and 1996 English House Condition Survey (EHCS) to produce a 'proxy' indicator of fuel poverty based on Census variables. The resultant fuel poverty indicator (FPI) was used to predict the fuel poverty level for every ward in England (available at: [www.cse.org.uk/fuelpovertyindicator](http://www.cse.org.uk/fuelpovertyindicator)). The FPI is widely used to target energy efficiency and fuel poverty programmes at areas with high levels of fuel poverty, as well as a research tool.

CSE and University of Bristol have recently started work on updating the FPI, with funding from Eaga PCT, DTI, Ofgem and the Energy Retail Association. The work will develop a new FPI, using data from the 2001 Census, 2003 EHCS and property database, RESIDATA. The research is also using the recently revised methodology

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<sup>5</sup> It is not always possible to fill the cavities of some pre-45 properties built with cavities; however, even without cavity wall insulation, properties containing cavities are more energy efficient than solid wall properties.

<sup>6</sup> It should be noted that the EHCS methodology for classifying urban and rural areas is different to the ONS methodology.

<sup>7</sup> The English House Condition Survey, for example, uses RESIDATA for drawing its sample.

for calculating fuel poverty, following the peer review that took place over 2004/05 (Sefton & Cheshire, 2005).

The updated FPI will include a substantial dissemination element, including county maps of the FPI results at Lower Level Super Output Area level, a website to access the maps and data and a launch conference. The new FPI should be available by late summer 2006, with the maps and website ready by December 2006. A summary of the FPI update methodology is given in Appendix 2.

We will cross reference the updated FPI with the various small area indicators we have investigated for this research (see 2.5 below) at the second stage of the project.

### **2.3 Determine common geographic unit**

The databases collected by CSE provide data at a variety of geographies (postcode sector, Output Area etc). We decided to use Census Output Areas as the common unit for the rural analysis we conducted. Output Areas (OAs) represent the smallest geographic unit at which Census data is outputted. They were defined by identifying socially homogenous housing areas, defined by housing type and tenure, and typically contain about 125 households (80% of OAs contain between 110 and 139 households). Further information on OAs is given in Appendix 1.

The very method of constructing OAs lends itself well to analysing the distribution of rural fuel poverty and related factors, for the following reasons:

- Housing represents a key element of the ‘fuel poverty problem’; the method of constructing OAs therefore increases the likelihood of OAs containing households with similar levels of fuel poverty.
- The small size of OAs is appropriate for analysis of rural problems; since it is more likely to identify ‘pockets’ of rural deprivation (while recognising that some elements may still be more dispersed).
- Because OAs contain similar numbers of households, it is easy to compare the extent of a problem across areas. By contrast, electoral wards, for example, can vary from 1200 to 12,000 households (usually according to whether they are wards in rural or urban areas).

The disadvantage of Output Areas relates to their sheer number. There are some 175,500 OAs in England. Databases using this unit are therefore very large. It is also very difficult to present OA data in map format unless maps are confined to a fairly small area. OAs are purely a statistical unit. They are not ‘named’ and do not represent a political or administrative unit. However, they do tessellate with postcodes, electoral wards and other geographical units. Presentation of, for example, ward names in which OAs are located can therefore help with interpretation of OA data.

We used Structured Query Language (SQL) statements and OA ‘look-up’ tables to convert the postcode datasets (Warm Front, solid wall and access to gas) to Output Area. We then used the GIS Mapinfo software package to combine the different datasets into one database which could be imported into SPSS. This allowed us to

carry out statistical analysis and cross tabulations across the databases. The work required considerable data checking to ensure accuracy, for example:

- Checking the process of aggregating postcodes to OAs by manually selecting all the postcodes listed for a single OA and confirming that this correlated with the automation process. This was performed numerous times for both the Warm Front and off-gas data.
- Initially, errors occurred due to misalignment of the 'white space' in postcode fields. Once corrected, the automation was performed successfully.
- Updating the postcode-to-OA lookup table. Version Autumn 2005 was used for the research since earlier versions failed to select many postcodes.

## 2.4 Data mapping and website development

County maps of the 'off-gas' and 'solid wall' indicators for all of England's nine Government Office regions<sup>8</sup> can now be accessed at a 'rural fuel poverty' website: [www.ruralfuelpoverty.org.uk](http://www.ruralfuelpoverty.org.uk). Ward level<sup>9</sup> versions of the two databases can also be accessed from the website. The website includes maps of 'Warm Front take-up' for the 6 regions investigated for this project and links to this research report and the report produced for the Energy Efficiency Partnership for Homes Insulation Group.

The website's search function is contained within one menu for the site which directs the user to their area via combination boxes or 'clickable' maps. Maps are displayed at 'ceremonial county' level (this is slightly different to a county and unitary local authority classification). This is sufficient for identifying rural output areas; however, it is generally not possible to identify urban OAs, due to their small geographical size.

This report makes occasional reference to the website maps; readers may therefore find it useful to consult the website on such occasions. The final version of the website will include the final report of the research and selected analytical tables. It will also include links to the ONS urban/rural areas classification and the updated fuel poverty indicator, when ready.

## 2.5 Statistical analysis

The interim report presents summary statistics and charts for each of the three factors investigated up, i.e. solid wall properties, 'off-gas' and Warm Front take up. We used one-way analysis of variance (ANOVA) to test whether there was a statistically significant difference between the 4 categories of settlement type (i.e. 'urban', 'town & fringe', 'village' and 'hamlet & isolated dwellings') for each of the 3 factors. The Tukey 'post hoc' test was used to establish if differences between any pairs of settlement types were significant at the  $p=0.05$  level. Tukey is generally considered a fairly 'rugged' and conservative test, i.e. if it shows there is a difference, it is almost certain such a difference is 'real'.

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<sup>8</sup> CSE acknowledges the support of the Energy Efficiency for Homes Partnership Insulation Group with respect to producing 'hard to treat' maps for the 3 remaining Government Office regions and ward level 'hard to treat' databases for all of England.

<sup>9</sup> It is not possible to mount the Output Area level databases on the website due to their considerable size.

This analysis therefore allowed the research to investigate whether there were any differences with respect to the degree of rurality for each of the 3 factors, as well as between urban and rural in general.

The urban/rural analysis was carried out for each of the Government Office Regions (GOR) covered by the Eaga Warm Front Phase 1 franchise, i.e. London, North East, North West, South East, South West and West Midlands.

Any differences between settlement types revealed for the Warm Front analysis may have reflected differences in socio-economic factors, rather than 'rurality' as such. It is therefore important to investigate Warm Front take-up, relative to need, to ensure comparisons by rurality are valid. The second stage of the research intends to use the small area fuel poverty indicator as the basis for assessing 'need' in rural areas. The final report will present the results of the Warm Front/need analysis at small area level for each GOR.

The analysis planned for the second stage of the research should provide a useful guide to whether Warm Front is hitting its target group in rural areas. However, it is important to appreciate that because eligibility for Warm Front is based on benefit status, rather than fuel poverty status, any differences found in Warm Front take-up between urban and rural may reflect mis-match between fuel poverty and benefit status, rather than necessarily poor targeting of Warm Front. That is to say, it is possible that the 'mis-match' issue is a more extensive problem in rural areas than urban.

By way of preliminary investigation of this issue, the research compared national urban/rural differences in fuel poverty with those in general deprivation. The data sources used for this analysis were the 2003 English House Condition Survey and the 2005 'State of the Countryside' report (DTI, 2005b; Commission for Rural Communities, 2005). The results of the comparison are outlined in this report.

## 2.6 Further developments

### 2.6.1 Wales

The Welsh Assembly Government has funded CSE to develop a 'targeting energy efficiency' resource for Wales<sup>10</sup>. This will be similar to the English rural fuel poverty website. The resource will include:

- Maps of 'HEES take-up', 'off-gas' and solid walls at Output Area for all of Wales's Unitary Authorities.
- A website for accessing the maps.
- Direct access to the databases underpinning the maps from the website, ordered by Unitary Authority and accessed via combination boxes or 'clickable' maps.

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<sup>10</sup> Further details of this work can be found at: <http://www.cse.org.uk/cgi-bin/projects.cgi?policy&&1078>

- A report analysing relationships between urban and rural areas and incidence of HEES take-up, off gas and solid wall properties.

We also plan, depending on funding, to carry out a second stage of the research. This will involve cross referencing the above indicators with the small area fuel poverty indicator CSE and Bristol University are developing for the Welsh Assembly as part of a separate research project.

We will set up a link between the ‘rural fuel poverty’ website and the ‘targeting energy efficiency in Wales’ website upon completion of the latter project.

### **2.6.2 East of England**

The Energy Efficiency Partnership for Homes Insulation Group has funded CSE to produce county maps of ‘off-gas’ and solid wall properties (but not Warm Front grant take-up) in East of England. We have therefore been able to map the whole of England with respect to these two indicators. We have now added this information to the rural fuel poverty website.

We will include analyses of ‘off-gas’ and solid wall properties for all the English GORs, including those that make up the East of England, in the final report of the ‘quantifying rural fuel poverty’ research. It is not envisaged, at this stage, that the research will include an analysis of Warm Front take-up in the three East England regions covered by the Powergen Warm Front team for the Warm Front phase 1 period.

### **2.6.3 Possible further development of the rural fuel poverty website and research**

CSE could add a further ‘functionality’ to the website that would enable users to access the source small area data for the ‘off-gas’, ‘solid wall’ and ‘Warm Front take-up’ indicators at Output Area level. Because the Output Area databases for England are very large, it would not be appropriate to create links to the entire databases without some prior structuring and ordering into smaller units. Users would be able to access databases by ‘clicking’ onto the map of the area they are interested in. We have mounted ward-level databases of ‘off gas’ and ‘solid walled properties’ (but not Warm Front take-up) on the current website, although these cannot be accessed direct from the maps.

We consider the addition of the functionality proposed would help make the data more accessible, particularly with respect to allowing users to visualise the distribution of the databases in map format. However, we have made arrangements with the EST for researchers and other users to obtain the full ‘off-gas’ and ‘solid walled’ Output Area databases in CD format, on request.

CSE could also create district (local authority) maps of the data that would allow users to identify the distribution of Warm Front, off-gas and solid wall properties for urban OAs reasonably clearly. This would increase the size of the website considerably and turn it into a more general fuel poverty/energy efficiency resource (i.e. not just rural fuel poverty). The value of carrying out such an exercise is likely to

increase with the increasing focus of fuel poverty policies on tackling fuel poverty in 'hard to treat' properties. We consider such a resource will help improve the targeting of policies in both urban and rural areas.

CSE would also like to carry out its urban/rurality analysis of the distribution of Warm Front grants with more up to date Warm Front data and for the whole of England, i.e. inclusion of Warm Front phase 1 data for the East of England. We would also like to mount maps of the updated data on the rural fuel poverty website. It would be relatively straightforward to update the statistical analyses (assuming Eaga is able to supply the data and in a 'clean' format); however, updating the Warm Front maps would entail significant additional work.

### 3 RURAL AND URBAN AREAS: ANALYSIS

This chapter presents the analysis of the following characteristics of rural and urban areas for the 6 regions investigated:

- Solid wall properties by settlement type and region
- Off-gas properties by settlement type and region
- Take-up of Warm Front grants (2000-2003) by settlement type and region
- Trends in national fuel poverty and deprivation.

#### 3.1 Summary results

Table 1 below presents the summary statistics for the 3 factors investigated for the research.

**Table 1: Summary results**

Region	Rural/ urban	Total no. WF grants	No. of properties: solid walls	No. of properties off gas	% h/hds receiving WF grants	% solid wall properties	% properties off gas	Total no. households
London	Rural	31	1,559	847	0.5%	27%	14%	5,849
	Urban	49,736	1,195,956	134,432	1.6%	39%	4%	3,049,073
North East	Rural	13,724	73,430	50,811	6.3%	34%	23%	218,432
	Urban	69,936	188,713	36,857	7.6%	21%	4%	917,542
North West	Rural	9,777	130,766	89,974	2.8%	37%	26%	351,974
	Urban	171,992	716,733	89,042	6.5%	27%	3%	2,644,326
South East	Rural	7,770	226,463	236,834	1.0%	30%	32%	747,181
	Urban	52,769	578,937	158,658	1.9%	21%	6%	2,710,462
South West	Rural	10,555	255,544	346,895	1.4%	35%	47%	733,938
	Urban	29,567	342,014	84,709	2.0%	23%	6%	1,458,336
West Mids	Rural	5,335	117,958	142,767	1.5%	34%	41%	346,660
	Urban	99,796	403,063	86,040	5.2%	21%	4%	1,917,452
All regions	Rural	47,192	805,720	868,128	2.0%	34%	36%	2,404,034
	Urban	473,796	3,425,416	589,738	3.7%	27%	5%	12,697,191
All regions - London	Rural	47,161	804,161	867,281	2.0%	34%	36%	2,398,185
	Urban	424,060	2,229,460	455,306	4.4%	23%	5%	9,648,118

Table 1 conflates the 3 rural categories (town & fringe, village and hamlet) into 1 'all rural' group. The final row removes the London results from the 'all region' total. This is because the region is almost entirely urban and accounts for 20% of all households; this tends to distort some of the analyses. The following inferences can be drawn from the results:

- Take up of Warm Front grants in urban areas is more than twice the rate in rural areas for the 5 regions combined (not including London).
- There are significant differences in Warm Front take-up rates between regions; however, take-up is higher in urban areas than rural in all 5 regions.

- There are a number of factors that may explain the differences in take-up rates between urban and rural areas, including variations in social composition, Warm Front eligibility criteria, benefit take-up rates and energy efficiency standards.
- 34% of properties in rural areas are solid walled, compared to 23% in urban areas (not including London). However, it is notable that London has a particularly high proportion of solid wall properties (39%).
- A higher proportion of rural properties are built with solid walls than urban in each of the 5 regions.
- 36% of rural properties in rural areas are off the gas network, compared to 5% of urban properties – a ratio of 7:1.
- The proportion of rural properties off the gas network is particularly high in the South West at 47%.
- The South East has the largest number of rural properties and the second largest number of properties off the gas network (after the South West) among the 5 regions.

The above suggests that ‘hard to treat’ problems affect rural properties to a much greater extent than urban properties. The problem of ‘off gas’ is particularly severe in rural areas. However, it is worth noting that in absolute numerical terms, the difference between urban and rural areas is not so significant. There are 867,000 properties off the gas network in rural areas, compared to 455,000 properties in urban areas. This of course reflects the England’s urbanised character: there are over 5 times as many properties in urban areas compared to rural (all 6 regions). This ratio drops to 4 when London is excluded.

The following considers the three factors in more detail.

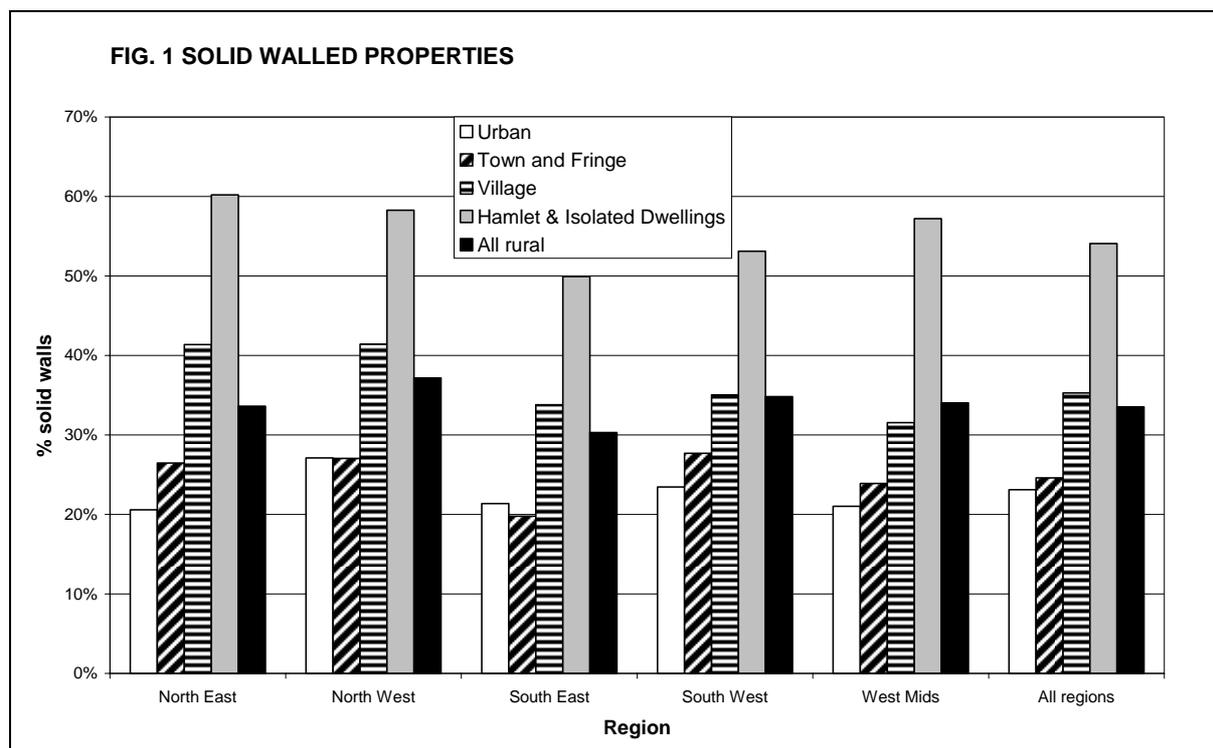
### 3.2 Properties built with solid walls

County maps of solid wall properties are shown on the website for all of England’s 9 regions. Output Area (OA) boundaries are not included on the maps because they tend to cause a grey ‘smudge’ where OAs are small in size. The maps therefore do not distinguish coterminous OAs which have the same proportions of solid wall properties. OAs in which solid wall properties account for more than 75% of the total are shown in red. The maps clearly suggest that solid wall properties are more extensive in rural OAs<sup>11</sup>. We therefore investigated whether this impression was borne out by statistical analysis of the 6 regions investigated for this research.

The total number and % of solid wall properties in each settlement type and for each region is given in Appendix 3. Figure 1 overleaf shows the results plotted. The graph clearly shows a marked increase in % of solid wall properties with each increase in level of settlement dispersal. This pattern occurs in every region. Table 2 overleaf gives the Tukey results for establishing whether the difference between

<sup>11</sup> Since rural OAs tend to be larger than their urban equivalents, rural OAs ‘stand out’ more than urban OAs. Even taking this factor into account, there does appear to be a strong association between rurality and solid wall properties. The later statistical analysis investigates whether this is significant.

each pair of settlement types is statistically significant. Figure 1 and Table 2 do not include London because the region is almost entirely urban.



**Table 2: Significance test results (% of solid wall properties) for pairs of settlement type by region**

		North East	North West	South East	South West	W Mids	All regions
Urban	Town	0.000	0.999	0.024	0.000	0.037	0.014
	Village	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Town	Urban	0.000	0.999	0.024	0.000	0.037	0.014
	Village	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Village	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Hamlet	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.000	0.000	0.000	0.000

**Note:** Figures show whether there is a significant difference between ‘pairs’ of categories. The difference is significant at the 95% confidence level when  $p < 0.05$ .

Table 2 shows that the difference between each pair of settlement types is statistically significant level for every region and for the 5 regions combined (i.e.  $p < 0.05$ ). The only exception is the difference between the ‘urban’ and ‘town & fringe’ categories in the North West, where the proportions are fairly similar (see Fig. 1). In effect, the extent of solid wall properties increases with increased settlement dispersal and this increase is significant for each move upwards in dispersal level.

Across the 5 regions, between 50 and 60% of properties in the ‘hamlets and isolated dwellings’ category are built with solid walls. By contrast, the range in urban areas is between 21% and 27% (see Appendix 3).

### 3.3 Households off the gas network

County maps of ‘% of postcodes with gas supply/OA’ are shown on the website for all of England’s 9 regions. Output Area (OA) boundaries are shown for those OAs that do not have a gas supply. However, they are not shown for OAs that have a gas supply. This means that the maps do not distinguish coterminous OAs that have the same proportion of postcodes with a gas supply. Again, this was done to avoid the problem of ‘smudging’. The maps clearly show that many rural areas do not have a gas supply.

The total number and % of ‘off-gas’ properties in each settlement type and for each of the 6 regions investigated for this research is given in Appendix 3. As noted in the methodology, the figures are based on estimates derived from the ratio of postcodes without gas to the total number of postcodes in an Output Area. Figure 2 below shows the results plotted.

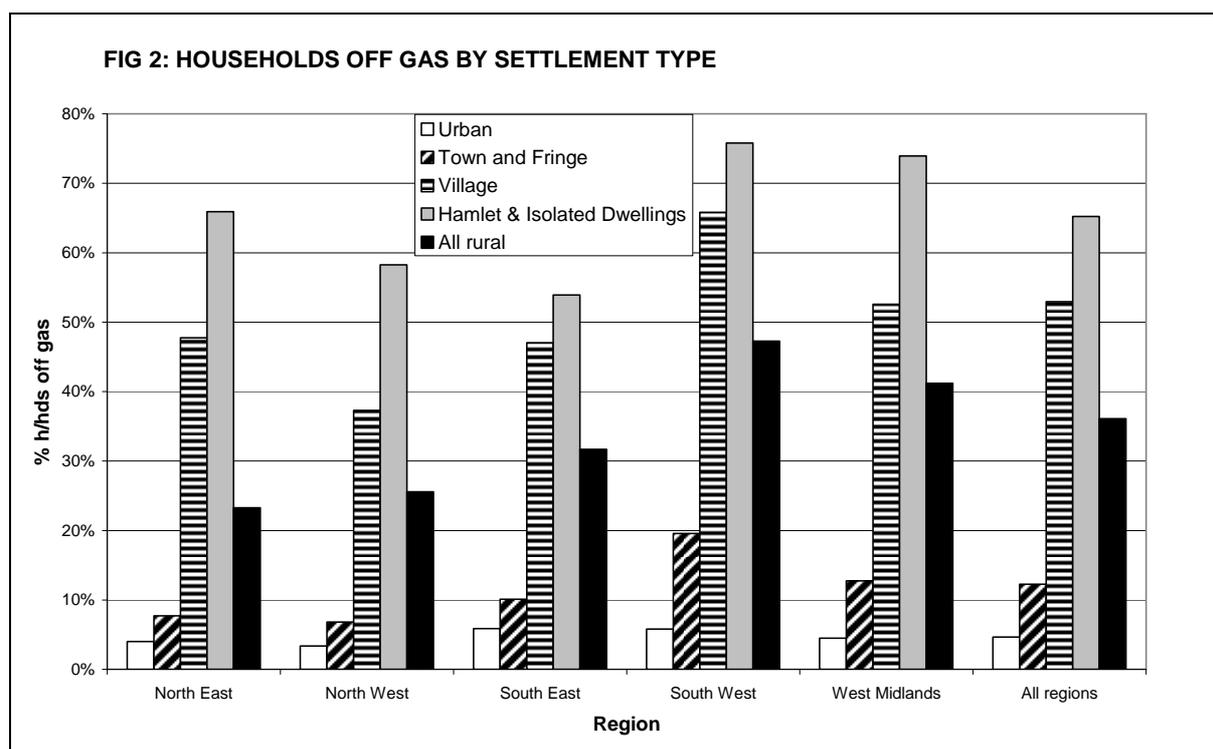


Figure 2 clearly shows a marked increase in % of properties off the gas network with each increase in level of settlement dispersal. Again, the issue is particularly marked in ‘hamlets & isolated dwellings’. ‘Hamlets & isolated dwellings’ without access to gas range from 54% of properties in the South East to 76% in the South West. By contrast, the figure for urban areas hovers around the 5% level in all regions.

Table 3 below gives the Tukey results for establishing whether the difference between each pair of settlement types is statistically significant. Note that the tests

are based on the ‘mean proportion of postcodes without gas by Output Area’, rather than the estimated number of households without gas.

**Table 3: Significance test results (mean % of post codes without access to gas) for pairs of settlement type by region**

		North East	North West	South East	South West	W Mids	All regions
Urban	Town	0.000	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Town	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Village	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Hamle	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.000	0.000	0.000	0.000

Table 3 shows that the difference between each pair of settlement types is statistically significant at the  $p=0.05$  level for every region. In effect, the extent of ‘off-gas’ properties increases with increased settlement dispersal and this increase is significant for each move upwards in dispersal level.

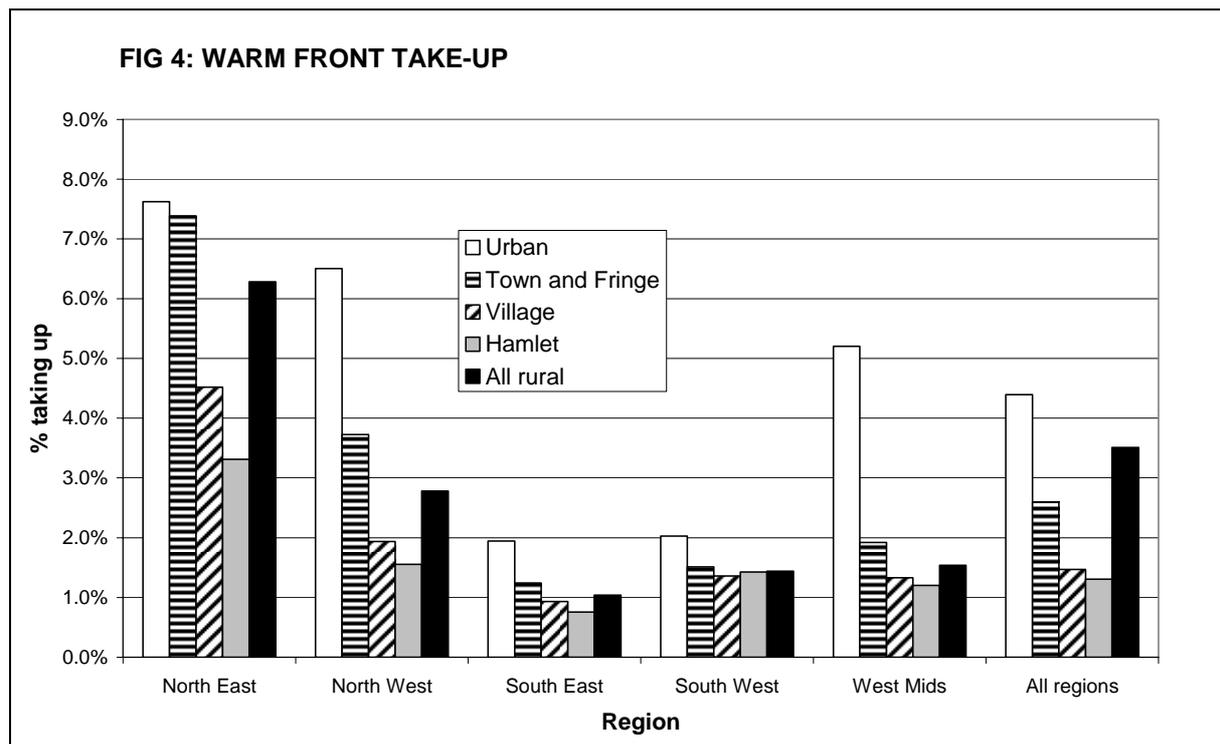
The analyses above reinforce the earlier finding that ‘hard to treat’ is a significant problem for many properties in rural areas. Furthermore, the analyses show that the extent of ‘hard to treat’ problems increases with each increase in level of settlement dispersal.

### 3.4 Take-up of Warm Front grants (2000-2003)

County maps of ‘Warm Front grant take-up’ are shown on the website for the 6 regions served by Eaga during the Warm Front phase 1 period. Output Area (OA) boundaries are included on these maps because the problem of ‘smudging’ only tends to occur in large urban areas. This was not considered an issue, given that the website is concerned with rural fuel poverty. The maps clearly suggest that Warm Front take-up tends to be lower in rural OAs than urban. We therefore investigated whether this impression was borne out by statistical analysis.

The number and % of Warm Front grants taken up in each settlement type and for each region is given in Appendix 3. Figure 3 overleaf shows the results plotted. The graph shows a marked decrease in Warm Front take-up rate with each increase in level of settlement dispersal, with the exception of the difference between ‘village’ and ‘hamlet’. This pattern occurs in every region. The graph suggests that take-up rates are fairly similar in the two most dispersed settlement categories for most regions, with the possible exception of the North East.

Table 4 overleaf gives the Tukey results for establishing whether the difference between each pair of settlement types is statistically significant.



Source: Eaga – all WF grants delivered between 2000 and 2003

**Table 4: Significance test results (Warm Front take-up rate) for pairs of settlement type by region**

		North East	North West	South East	South West	W Mids	All regions
Urban	Town	0.636	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.000	0.000	0.000	0.000
	Hamlet	0.000	0.000	0.000	0.000	0.000	0.000
Town	Urban	0.636	0.000	0.000	0.000	0.000	0.000
	Village	0.000	0.000	0.001	0.169	0.080	0.000
	Hamlet	0.000	0.000	0.000	0.593	0.043	0.000
Village	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.001	0.169	0.080	0.000
	Hamlet	0.180	0.675	0.446	0.974	0.964	0.509
Hamlet	Urban	0.000	0.000	0.000	0.000	0.000	0.000
	Town	0.000	0.000	0.000	0.593	0.043	0.000
	Village	0.180	0.675	0.446	0.974	0.964	0.509

The following conclusions can be drawn from Table 4:

- The difference in take-up rates between the 'urban' and 3 separate rural categories was significantly different in the 5 regions combined.
- The difference in Warm Front take-up rates between the 'urban' and 3 rural categories was significantly different in each of the 5 regions, with the exception of the difference between 'urban' and 'town & fringe' in the North East (although there was still a significant difference between 'urban' and 'village' and 'urban' and 'hamlet' in this region).
- The difference in take-up rates between 'town & fringe' and 'village' was significantly different in the North East, North West and South East, but not in the South West or West Midlands.

- The difference in take-up rates between ‘village’ and ‘hamlet & isolated dwellings’ was not significantly different in any of the regions.

In summary, the analysis suggests that Warm Front take-up is considerably lower in each of the 3 rural categories compared to take-up in ‘urban’ areas. The difference between ‘urban’ and each of the three rural categories is statistically significant for all regions, with the exception of the difference between the ‘urban’ and ‘town & fringe’ categories in the North East.

These results are not surprising, given the statistics presented in Table 1 and Appendix 3. Take-up of Warm Front in urban areas is over twice the rate in ‘all rural’ areas for the 5 regions combined. This ratio rises to over three when ‘urban’ is compared to ‘hamlet & isolated dwellings’.

It has already been noted that the analysis does not take account of any differences between relative need in the different types of settlement category. The second stage of the research will explore this factor by using the small area fuel poverty indicator as a guide to ‘need’.

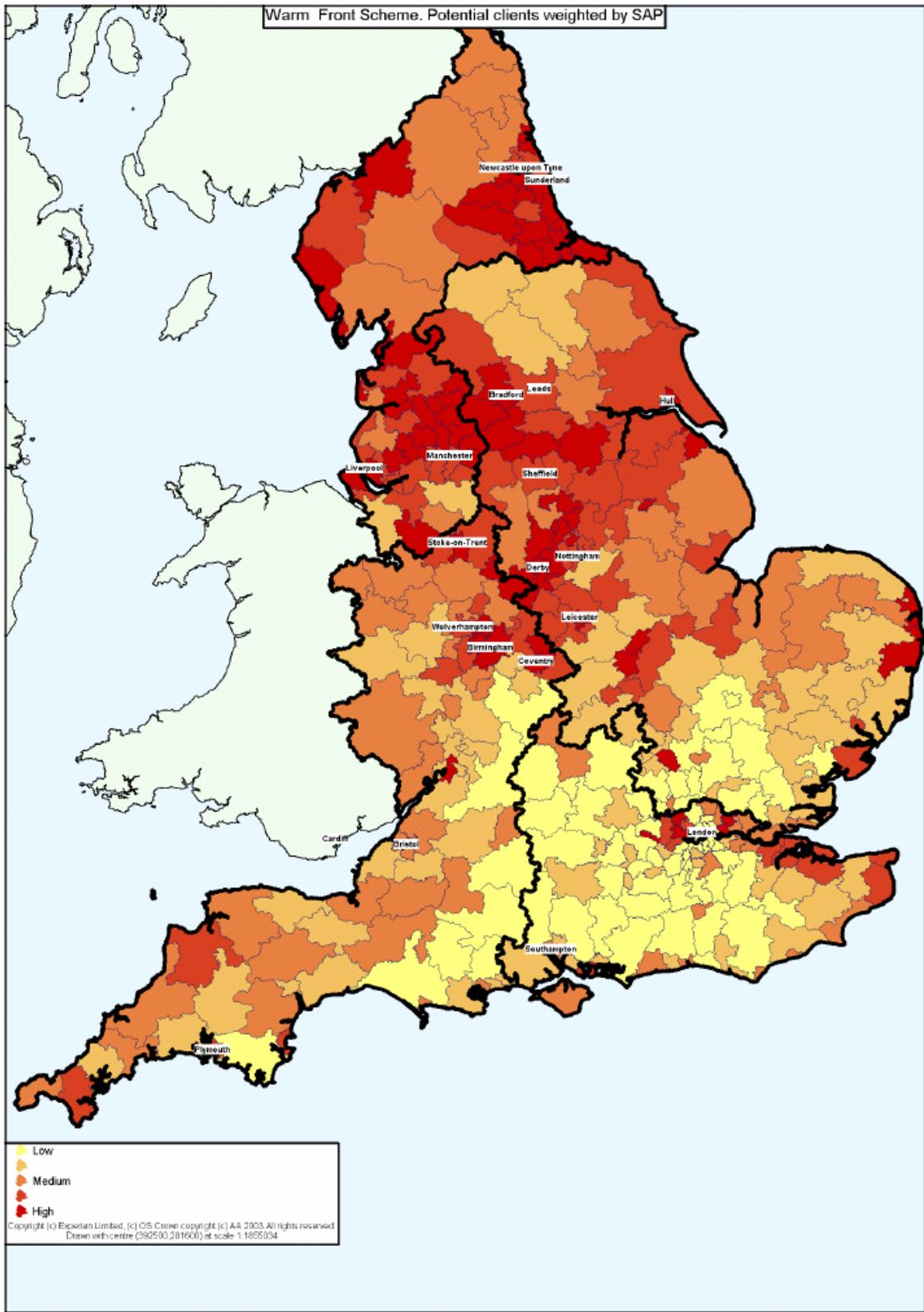
Figure 3 also clearly illustrates the difference in take-up rates between the different regions. Take-up is highest across all settlement categories in the North East and lowest in the South East. Eaga argues that this reflects regional differences in ‘propensity for Warm Front eligibility’. Eaga has plotted this indicator at local authority level for all of England. The resultant map is reproduced in Figure 4 overleaf (source: Eaga)<sup>12</sup>.

Eaga was not able to supply the database used for producing the map or the methodology employed for calculating the indicator due to issues of commercial confidentiality. However, the map shows a clear North/South divide in potential Warm Front eligibility, with the exception of parts of London. This may therefore help to explain the large regional differences in take up shown in Table 1 and Figure 4. Low take-up in London may be due to other factors, e.g. difficulty in getting contractors to carry out work at Warm Front rates, due to higher labour costs in the capital.

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<sup>12</sup> The indicator (potential Warm Front clients weighted by SAP) is based on a combination of Eaga and Experian data.

Figure 4: Potential Warm Front clients, weighted by SAP



### 3.5 Comparing rural fuel poverty and rural deprivation

#### 3.5.1 Rural and urban fuel poverty

Table 5 shows how fuel poverty rates (full income definition) in urban and rural areas have changed between 1996 and 2003. Caution should be taken in comparing the rates, due to a number of changes in the methodology used for calculating fuel poverty that have taken place over the years.

**Table 5: Urban and rural fuel poverty rates (full income def.)**

Year	Rural	Urban
2003	7.6%	5.4%
2001	11.6%	7.6%
1996	23.4%	21.3%

**Source:** 1996, 2001 & 2003 EHCS

Table 5 suggests that fuel poverty appears to have been consistently higher in rural areas than urban over the years on the 'full income' definition. In 2003, for example, the proportion of rural households living in fuel poverty was 40% higher than the proportion of urban households<sup>13</sup> (DTI, 2005b).

Table 6 shows how fuel poverty rates compare on the 'basic income' fuel poverty definition. This is useful because the definition, to some extent, takes into account any differences in housing costs that may exist between urban and rural areas. An 'After Housing Costs' definition would be required to fully take into account any differences in housing costs between urban and rural areas. This definition is currently not available. However, the DTI has announced it may release figures on this definition in the future (DTI, 2005a).

**Table 6: Urban and rural fuel poverty rates (basic income def.)**

Year	Rural	Urban
2003	7.2%	7.2%
2001	13.4%	11.0%
1996	26.1%	26.8%

**Source:** 1996, 2001 & 2003 EHCS

Table 6 suggests that there is no clear trend between urban and rural areas, with respect to differences in fuel poverty levels, when the 'basic income' definition is used.

Nevertheless, both Tables 5 and 6 suggest that fuel poverty levels in urban and rural areas are comparable, if not higher in rural areas. This suggests that differences in fuel poverty do not account for the much lower Warm Front take-up in rural areas reported in 3.4 above (i.e. 50% of take-up in urban areas). This issue will be further explored in the second stage of the research, which will investigate Warm Front take-up relative to need at the small area level.

<sup>13</sup> It should be noted, however, that in numerical terms there are nearly three times more urban households in fuel poverty than rural households in England (893,000 compared to 329,000).

### 3.5.2 Comparing urban and rural deprivation

The '2005 State of the Countryside' report includes a number of comparative indicators of urban and rural deprivation (Commission for Rural Communities, 2005). Table 7 below summarises these indicators:

**Table 7: Indicators of rural deprivation**

Indicator <sup>1</sup>	Urban	Town	Village	Hamlet	All rural
H/hds with an income < 60% English median (source: CACI, 2004, Paycheck)	26%	24%	20%	18%	22%
% of SOAs in least deprived quintile: income deprivation score <sup>2</sup>	17.9%	35.7%	22.8%		N/A
% of SOAs in most deprived quintile: income deprivation score <sup>2</sup>	24.0%	1.2%	0.4%		N/A
% of SOAs in most deprived quintile: employment deprivation score <sup>2</sup>	23.4%	8.3%	1.4%		N/A
Income support claimants 2003 <sup>3</sup> (source: DWP, 2003)	7.4%	4.7%	3.4%		4.1%
State pensioners 2003 <sup>3</sup> (source: DWP, 2003)	17.3%	21.1%	21.1%		21.1%
Median household income pa (source: ONS, 2004, ASHE)	£25.9k	£27.2k	£30.5	£32.1	N/A
Unemployment rate <sup>4</sup> (source: ONS, 2003. Labour Force Survey)	4.5%				2.9%

#### Notes

<sup>1</sup> The 'State of the Countryside' report distinguishes 'less sparse' and 'sparse' areas. The results presented here amalgamate the two categories for consistency with previous analyses.

<sup>2</sup> Indicators taken from Indices of Deprivation (ODPM, 2004). The 'village' and 'hamlet & isolated dwelling' categories are amalgamated, due to sample size.

<sup>3</sup> Proportions based on total 2001 Census population. It would have been more accurate to use 'no. of non-pensioner adults' for the Income Support denominator; however, this information was not available.

<sup>4</sup> A different classification of 'urban' and 'rural' was used for this indicator.

The following conclusions can be drawn from Table 7:

- Average household incomes are generally higher in rural areas than urban, although there are still significant levels of income disadvantage in rural areas.
- Unemployment rates are higher in urban areas than rural.
- A higher proportion of households claim Income Support (a Warm Front passport benefit) in urban areas than rural.
- A higher proportion of households claim State pension in rural areas than urban – a reflection of the demographic composition of rural areas. The proportion claiming Pension Credit (a Warm Front passport benefit) is not known.

The above analysis therefore supports Eaga's assertion that rural areas are, on the whole, more affluent than urban areas. This would help explain the lower Warm Front take-up rates in rural areas, although it is difficult to establish whether it is sufficient to account for the 2:1 urban to rural ratio.

It is notable that the deprivation indicators all tend to reflect income factors, i.e. they do not take housing conditions and price of fuel into account. These factors are considered in the next section.

### 3.6 Conclusion

The analyses of 'off-gas' and 'solid wall properties' suggest that both issues (collectively referred to as 'hard to treat') are more extensive in rural areas than urban, particularly 'off-gas'. Further, the extent of hard to treat problems increase with increased settlement dispersal (with the exception of London, which has a high proportion of solid wall properties).

The British Household Panel Survey reports that rural households spent more than urban households on fuel in 2002 for every single fuel type (oil, electricity, gas and 'other') (Commission for Rural Communities, 2005). This compounds the fact that rural households are generally reliant on more expensive fuels, due to the lack of access to gas.

The problems of 'hard to treat' properties and high fuel expenditure may help explain why fuel poverty appears to be at a similar level, if not higher, in rural areas compared to urban, while income deprivation is generally lower. The second stage of the research will explore this issue further, for example, by comparing SAP data between urban and rural areas (providing sample sizes are adequate).

A number of reports have commented on the 'mis-match' between benefit status and fuel poverty status (e.g. NAO, 2003; CSE/NEA, 2005). These reports estimate that between 25% and 33% of fuel poor households are not claiming the necessary Warm Front passport benefits.

The above analysis suggests that this 'mis-match' may be particularly pronounced in rural areas due to the extensive problems of 'hard to treat' properties. This may go some way to explaining the much lower take-up of Warm Front in rural areas compared to urban, despite having comparable levels of fuel poverty. Other factors may include:

- Lower take up of Warm Front passport benefits among eligible households in rural areas, due to lack of information services and possibly 'cultural factors' associated with rural populations (Baker, 2002; Citizens Advice, 1999).
- Greater difficulty in marketing Warm Front in rural areas, due to the dispersed nature of the target population.
- Few appropriate measures for rural properties available in Warm Front packages (loft insulation is the only major measure available), given the low proportion of cavity walls and lack of access to gas in rural areas, coupled with high oil prices<sup>14</sup>.

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<sup>14</sup> Oil central heating was introduced to the Warm Front package in summer 2005 as a low running cost heating option for rural households. However, it is possible that many fuel poor households will now be reluctant to take up this option, given the large increase in domestic oil prices that has taken place over the past couple of years (considerably larger than the corresponding rise in gas and electricity prices) (Moore, 2005).

The policy implication is that use of passport benefits as a means of accessing Warm Front is problematic in rural areas. This is because the extensive problem of 'hard to treat' properties pushes many more households into fuel poverty than might have been expected, given income levels in rural areas. Benefit take-up campaigns in rural areas may help increase Warm Front take-up to some extent. However, we suspect that the problem of 'hard to treat' properties is so extensive in rural areas that new approaches to targeting the rural fuel poor are required.

## 4 NEXT STEPS

The following research tasks will be undertaken for the second stage of the research:

- Analyse the small area incidence of fuel poverty, using the updated fuel poverty indicator, by rurality.
- Explore the relationships between fuel poverty and gas connectivity and solid walled properties at small area level.
- Explore relationships between rural fuel poverty and other Census-based deprivation indicators.
- Analyse any urban/rural differences in Warm Front take-up, relative to need, as shown by the updated fuel poverty indicator.
- Produce regional commentaries on the above analyses.
- Produce final report of the research, with full explanation of methodology used, and recommendations for policy and programme delivery.
- Provide link from rural fuel poverty website to CSE fuel poverty indicator website to enable access to small area fuel poverty data and maps. Place research report on website.
- Dissemination activities on completion of research (in addition to website), e.g. produce press release, publicise research through CSE and Eaga PCT channels, presentations of research to conferences, e.g. NEA annual conference, and working groups, e.g. Energy Efficiency Partnership for Homes Fuel Poverty Strategy Group.

We plan to produce the final report in late summer/early autumn 2006. The precise timing will be dependent on completion of the research work for the updated fuel poverty indicator.

We would welcome feedback on the findings presented in this report and the maps presented on the rural fuel poverty website.

## APPENDIX 1: CONSTRUCTION OF CENSUS OUTPUT AREAS

Arguably the most significant innovation in the 2001 Census is that the output geography used for the production of Census tables is different from the data collection areas. All previous Censuses since 1841 used Enumeration Districts to both collect Census data and also as a basis for producing Census tables, i.e. the geography of data collection and table output were the same.

Unfortunately, Enumeration Districts have limited social meaning as they are designed primarily to equalise as far as possible the workloads of enumerators (Clark and Thomas, 1990) i.e. in 'difficult' to collect areas they are often smaller or contain fewer people/households than is 'easier' to collect areas. In the 2001 Census, the Output Areas for which detailed tables are published differ from the Enumeration Districts. The Output Areas were constructed by amalgamating the 1.7 million unit postcodes into larger areas containing a minimum 40 households and 100 residents for *Census Area Statistics* and a minimum of 400 households and 1,000 people for *Standard Tables*.

These Output Areas were conducted using the Census data by an automated zone design methodology based on the automated zoning procedure (AZP) originally developed by Openshaw (1977). AZP operates by the iterative recombination of a series of building block zones into Output Areas, in such a way as to maximize the value of some objective functions and thus produce socially homogeneous areas (Martin et al, 2001; Martin, 2002). The homogeneity measure used in the 2001 Census consisted of four tenure categories and seven dwelling types:

### Tenure

1. Owner-occupied
2. Rented privately
3. LA/HA
4. Other

### Dwelling Type

1. Detached
2. Semi-detached
3. Terraced
4. Flat
5. Part-house
6. Commercial
7. Non permanent

Thus, the Output Areas in the 2001 Census are amalgamations of 1.7 million unit postcode areas which contain similar dwellings and occupational tenures, e.g. semi-detached houses in owner occupation, local authority flats, etc. The Output Areas are the smallest areas for which detailed Census tables are available (although four Census statistics are available for all 1.7 million unit postcode areas).

## APPENDIX 2: THE FUEL POVERTY INDICATOR METHODOLOGY

### Overview of original FPI methodology

The original CSE/Bristol University fuel poverty indicator (FPI) involved the creation of a synthetic model using 1991 Census and 1996 EHCS data. The 1996 EHCS was used to produce a multi-variate logistic regression model of the characteristics of the fuel poor in England. A calibrated version of this model was then fitted to ward level data from the 1991 Census, using a harmonised (as far as possible) set of variables that were measured in a similar way in both the 1996 EHCS and the 1991 Census.

The weighted set of 8 variables identified as providing a reasonable proxy of fuel poverty is given in the table below:

#### Weightings applied to 1991 Census variables to predict fuel poverty (derived from 1996 EHCS)

1991 Census Variable	1996 EHCS Total Fuel Cost (N=13,711)
Unemployed	2.9
Under occupied (> 5 rooms per person)	2.6
No car	2.5
Single Pensioner	2.4
No central heating	2.4
Private renter	2.1
Lone parent	2.1
Disabled	1.6

Source: Baker et al, 2003; 1991 Census; 1996 EHCS

The methodology was explored at an Ofgem-hosted expert seminar in 2002 with favourable reaction. Validation of the indicator is ongoing. Some validation has already been undertaken, e.g. comparison of predicted fuel poverty levels with ward results from Stockton Warm Zone (the results showed a close match).

Inevitably there will be some anomalies with the FPI, as with all deprivation indicators. Discrepancies are also likely to arise due to the age of the datasets used. Despite these problems, the FPI gives a more accurate 'picture' of fuel poverty than the use of general deprivation indicators, e.g. the IMD, particularly with respect to comparing the relative positions of wards within any given area.

A full account of the methodology is described in a report available from the Centre for Sustainable Energy (Baker et al, 2002; also accessible at [www.cse.org.uk/pdf/sof1006.pdf](http://www.cse.org.uk/pdf/sof1006.pdf)).

### Overview of updated FPI methodology

CSE and Bristol University are undertaking the following tasks to update the FPI:

- 1) *Harmonisation of 2001 Census and 2003 EHCS data* to enable the different data sets used and definitions applied in the surveys to be analysed consistently.

- 2) *EHCS Fuel Poverty Modelling* to create 4 fuel poverty models (reflecting different definitions of fuel poverty) to obtain weightings for the best subset of variables to predict fuel poverty. This will also involve analysis and harmonisation of income data from the EHCS and the Family Resources Survey (FRS) and property age data from RESIDATA. The 4 fuel poverty definitions reflect different approaches to measuring income (see below).
- 3) *2001 Census Modelling and Analysis* to identify the best subset of predictors (common to both the new EHCS and the 2001 Census) of fuel poverty. The outcome will result in an indicator which measures whether households need to spend more than 10% of their income on energy, using the 4 definitions of income. With respect to the 'official (full income)' and 'basic income' definitions of fuel poverty, the research is using the new peer reviewed methodology for calculating fuel poverty (Sefton & Chesshire, 2005).
- 4) *Data visualisation and thematic mapping* to assist the analysis by exploring the relationships between different spatial data sets.
- 5) *The report of the research* will give a full account of the methodology used and the research findings to facilitate peer review. This will be accompanied by a database of the FPI results for the 4 income definitions at various levels of geography.
- 6) *GIS mapping of the updated FPI* will present thematic maps of the FPI at regional and county level (using the 'official' Government fuel poverty definition). FPI data will be matched to regional, county, ward and Lower level Super Output Area (LSOA) boundary data to illustrate the varying levels of fuel poverty.
- 7) *Create publicly accessible website* to provide easy explanations and access to the FPI. Users will be able to download data at various geographical resolutions and for the full range of geographies (regions, counties, wards, LSOAs). The website will also include clickable, 'zoomable' maps and data interrogation functions.
- 8) *Dissemination and support* of the FPI at a major launch event for national policy makers, relevant media and other interested parties. This will be backed up by other promotional activities targeted at local authorities, health organisations, researchers, energy suppliers and scheme managers etc. A contact telephone number will be provided to answer queries and provide ongoing support to FPI users.
- 9) *Validation* of the FPI will take place using criteria of reliability, face validity and construct validity. The Energy Efficiency Partnership for Homes Fuel Poverty Strategy Group is also carrying out an independent validation of the indicator.
- 10) *Bi-annual updates* of the FPI and maps will be possible, in line with bi-annual release of national fuel poverty data from the rolling EHCS (2 years' sample data is combined to provide robust measures of fuel poverty).

## **Fuel poverty definitions**

The FPI will be produced according to 4 definitions of fuel poverty, which reflect different approaches to measuring income. The first two correspond to the Government's preferred definitions, with the first representing the 'official' setting definition used for target setting.

1. 'Full' income definition, where income includes Housing Benefit (HB), Income Support for Mortgage Interest (ISMI) and Council Tax Benefit (CTB), while Council Tax payments are subtracted.
2. 'Basic' income definition, where income excludes HB, ISMI and CTB, while Council Tax payments are not subtracted.
3. Income as measured by the Households Below Average Income Before Housing Costs (HBAI BHC) statistical series.
4. Income as measured using the Households Below Average Income After Housing Costs (HBAI AHC) statistical series.

The Government has stated that it intends to develop an AHC income measure of fuel poverty in the future as part of a sensitivity analysis of fuel poverty figures (DTI, 2005).

## APPENDIX 3: RESULTS

### Solid wall statistics

GOR	Settlement Type	No. solid wall	% solid wall	Total h/hds
London	Urban >10K	1,195,956	39%	3,049,073
	Town and Fringe	674	25%	2,748
	Village	457	26%	1,744
	Hamlet & Isolated Dwellings	428	32%	1,357
	<b>All rural</b>	<b>1,559</b>	<b>27%</b>	<b>5,849</b>
North East	Urban >10K	188,713	21%	917,542
	Town and Fringe	38,301	26%	144,661
	Village	20,386	41%	49,281
	Hamlet & Isolated Dwellings	14,743	60%	24,490
	<b>All rural</b>	<b>73,430</b>	<b>34%</b>	<b>218,432</b>
North West	Urban >10K	716,733	27%	2,644,326
	Town and Fringe	48,445	27%	179,130
	Village	45,181	41%	109,110
	Hamlet & Isolated Dwellings	37,140	58%	63,734
	<b>All rural</b>	<b>130,766</b>	<b>37%</b>	<b>351,974</b>
South East	Urban >10K	578,937	21%	2,710,462
	Town and Fringe	66,125	20%	334,392
	Village	95,879	34%	283,689
	Hamlet & Isolated Dwellings	64,459	50%	129,100
	<b>All rural</b>	<b>226,463</b>	<b>30%</b>	<b>747,181</b>
South West	Urban >10K	342,014	23%	1,458,336
	Town and Fringe	88,753	28%	320,599
	Village	102,277	35%	291,851
	Hamlet & Isolated Dwellings	64,514	53%	121,488
	<b>All rural</b>	<b>255,544</b>	<b>35%</b>	<b>733,938</b>
West Midlands	Urban >10K	403,063	21%	1,917,452
	Town and Fringe	33,339	24%	139,400
	Village	41,742	32%	132,317
	Hamlet & Isolated Dwellings	42,877	57%	74,943
	<b>All rural</b>	<b>117,958</b>	<b>34%</b>	<b>346,660</b>
All regions, not including London	Urban >10K	2,229,460	23%	9,648,118
	Town and Fringe	274,963	25%	1,118,182
	Village	305,465	35%	866,248
	Hamlet & Isolated Dwellings	223,733	54%	413,755
	<b>All rural</b>	<b>804,161</b>	<b>34%</b>	<b>2,398,185</b>

## Off-gas statistics

GOR	Settlement Type	Estimated no. h/hds off gas	% h/hds off gas	Total h/hds
London	Urban >10K	134,432	4%	3,049,073
	Town and Fringe	69	3%	2,748
	Village	379	22%	,744
	Hamlet & Isolated Dwellings	399	29%	1,357
	<b>All rural</b>	<b>847</b>	<b>14%</b>	<b>5,849</b>
North East	Urban >10K	36,857	4%	917,542
	Town and Fringe	11,149	8%	144,661
	Village	23,523	48%	49,281
	Hamlet & Isolated Dwellings	16,139	66%	24,490
	<b>All rural</b>	<b>50,811</b>	<b>23%</b>	<b>218,432</b>
North West	Urban >10K	89,042	3%	2,644,326
	Town and Fringe	12,169	7%	179,130
	Village	40,686	37%	109,110
	Hamlet & Isolated Dwellings	37,119	58%	63,734
	<b>All rural</b>	<b>89,974</b>	<b>26%</b>	<b>351,974</b>
South East	Urban >10K	158,658	6%	2,710,462
	Town and Fringe	33,825	10%	334,392
	Village	133,397	47%	283,689
	Hamlet & Isolated Dwellings	69,612	54%	129,100
	<b>All rural</b>	<b>236,834</b>	<b>32%</b>	<b>747,181</b>
South West	Urban >10K	84,709	6%	1,458,336
	Town and Fringe	62,702	20%	320,599
	Village	192,128	66%	291,851
	Hamlet & Isolated Dwellings	92,065	76%	121,488
	<b>All rural</b>	<b>346,895</b>	<b>47%</b>	<b>733,938</b>
West Mids	Urban >10K	86,040	4%	1,917,452
	Town and Fringe	17,774	13%	139,400
	Village	69,578	53%	132,317
	Hamlet & Isolated Dwellings	55,415	74%	74,943
	<b>All rural</b>	<b>142,767</b>	<b>41%</b>	<b>346,660</b>
All regions, not inc. London	Urban >10K	455,306	5%	9,648,118
	Town and Fringe	137,619	12%	1,118,182
	Village	459,312	53%	866,248
	Hamlet & Isolated Dwellings	270,350	65%	413,755
	<b>All rural</b>	<b>867,281</b>	<b>36%</b>	<b>2,398,185</b>

## Warm Front take-up

GOR	Settlement Type	Total WF Grants	WF take-up rate	Total h/hds
London	Urban	49,736	1.6%	3,049,073
	Town and Fringe	11	0.4%	2,748
	Village	10	0.6%	1,744
	Hamlet	10	0.7%	1,357
	<b>All rural</b>	<b>31</b>	<b>0.5%</b>	<b>5,849</b>
North East	Urban	69,936	7.6%	917,542
	Town and Fringe	10,685	7.4%	144,661
	Village	2,228	4.5%	49,281
	Hamlet	811	3.3%	24,490
	<b>All rural</b>	<b>13,724</b>	<b>6.3%</b>	<b>218,432</b>
North West	Urban	171,992	6.5%	2,644,326
	Town and Fringe	6,673	3.7%	179,130
	Village	2,113	1.9%	109,110
	Hamlet	991	1.6%	63,734
	<b>All rural</b>	<b>9,777</b>	<b>2.8%</b>	<b>351,974</b>
South East	Urban	52,769	1.9%	2,710,462
	Town and Fringe	4,149	1.2%	334,392
	Village	2,648	0.9%	283,689
	Hamlet	973	0.8%	129,100
	<b>All rural</b>	<b>7,770</b>	<b>1.0%</b>	<b>747,181</b>
South West	Urban	29,567	2.0%	1,458,336
	Town and Fringe	4,853	1.5%	320,599
	Village	3,970	1.4%	291,851
	Hamlet	1,732	1.4%	121,488
	<b>All rural</b>	<b>10,555</b>	<b>1.4%</b>	<b>733,938</b>
W Mids	Urban	99,796	5.2%	1,917,452
	Town and Fringe	2,676	1.9%	139,400
	Village	1,758	1.3%	132,317
	Hamlet	901	1.2%	74,943
	<b>All rural</b>	<b>5,335</b>	<b>1.5%</b>	<b>346,660</b>
All regions, not inc. London	Urban	424,060	4.4%	9,648,118
	Town and Fringe	29,036	2.6%	1,118,182
	Village	12,717	1.5%	866,248
	Hamlet	5,408	1.3%	413,755
	<b>All rural</b>	<b>47,161</b>	<b>2.0%</b>	<b>2,398,185</b>

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