CENTRE FOR SUSTAINABLE ENERGY

Targeting energy efficiency resources in Wales

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Report to Welsh Assembly Government

October 2006

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SUMMARY

This report describes the findings of the 'targeting energy efficiency resources in Wales' research carried out for the Welsh Assembly Government, with funding from the New Ideas Fund. The project aimed to provide a resource for improving the targeting of energy efficiency programmes in Wales.

The research gathered small area data on three factors that were considered particularly important for targeting policy:

- access to gas
- solid wall properties
- distribution of Home Energy Efficiency Scheme (HEES) grants[1]

The databases were converted to Census Output Area (OA) as the common geographic unit. A fourth 'composite' indicator was also developed that merged the 'access to gas' and 'solid wall' data. This was designed to differentiate areas according to whether they contained large numbers of 'easy to treat' properties (i.e. with both gas connection and cavity walls) at one extreme to large numbers of 'very hard to treat' properties (i.e. no gas connection and built with solid walls) at the other.

Local authority maps of the four indicators were produced for each of Wales' 22 local authority areas. The maps, datasets and research report are mounted on a dedicated website: www.energyefficiencywales.org.uk/. This report makes occasional reference to the website by way of illustrating the geographic distribution of the four indicators.

A comparative statistical analysis between 'urban' and 'rural' areas[2] in the four economic regions of Wales was carried out for each of the four factors to establish whether there were any significant differences. The analysis found that:

- 32% of properties in Wales are solid walled, compared to 27% in England. 37% of properties in 'rural' areas of Wales are solid walled, compared to 29% in 'urban' areas. A similar difference between urban and rural areas is found in all of Wales' four regions.
- There are particularly high proportions of solid wall properties in 'hamlets & isolated dwellings' (51%), compared to other settlement types; Mid Wales (40%), compared to other regions; and Blaenau Gwent and Rhondda Cynon Taf (52% each), compared to other local authority areas.
- 37% of properties in Wales are off the gas network, compared to 15% in England. 53% of rural properties in Wales are off the gas network, compared to 28% of urban properties. A similar difference between urban and rural areas is found in all of Wales' four regions, although the difference in South East Wales (a predominantly urban region) is relatively small.
- A number of urban areas in South East Wales have unusually high proportions of 'off-gas' properties, e.g. Blaenau Gwent, Caerphilly, Cardiff and Newport. This may be due to relatively high use of coal as the main heating fuel in these areas.

[1] Based on all HEES grants provided for 'major measures' (i.e. excluding grants for CFLs and draught proofing only) delivered between 2000 and 2005.

[2] The definitions of 'urban' and 'rural' are based on the ONS 'rural and urban area' classification (ONS, 2004). This developed 4 categories of settlement type: urban, town & fringe, village, hamlet & isolated dwellings. The latter 3 categories are all classified as 'rural' under this system.

- There are particularly high proportions of 'off-gas' properties in 'hamlets & isolated dwellings' (86%), compared to other settlement types; Mid Wales (64%), compared to other regions and Ceredigion (77%), compared to other local authority areas.
- The average 'hard to treat' score[3] for all rural areas in Wales is 0.90, compared to 0.56 for all urban areas. A similar difference between urban and rural areas is found in all of Wales' four regions, although the difference in South East Wales is relatively small.
- The highest scores on the 'hard to treat' index occur among 'hamlets & isolated dwellings' (1.36), compared to other settlement types; Mid Wales (1.04), compared to other regions; and Ceredigion (1.15), compared to other local authority areas.
- Take-up of HEES grants was higher in urban areas of Wales (5.6% of all households) than rural areas (3.9%). Similar differences between urban and rural areas were found in South West Wales and North Wales but not Mid Wales and South East Wales.
- Take-up of HEES grants was much lower in Mid Wales (0.7% of all households), compared to other regions and 'all Wales' (5.0%). Take-up was also low in 'hamlets & isolated dwellings' (2.1%), compared to other settlement patterns; and Powys (0.6%), compared to other local authority areas.
- Areas with low HEES take-up rates appear to correlate with areas with high levels of hard to treat properties, possibly reflecting the lack of major measures that can be offered to many hard to treat properties under the HEES programme. However, take-up rates are also likely to reflect variations in levels of need across different geographical areas. Nevertheless, the particularly low take-up rate in Mid Wales (14% of the 'all Wales' rate) does give cause for concern.
- It is difficult to disentangle the relative impact of hard to treat factors, levels of need and possible spatial inequities (e.g. rural areas 'missing out') on HEES take-up rates. The report therefore recommends that further research is carried out into the relationship between fuel poverty and the four factors investigated at small area level.

[3] The 'hard to treat' index was constructed by summing the number of properties 'off gas' in any given area with those built with solid walls and dividing this by the total number of properties.

1 INTRODUCTION

This report describes the findings of the 'targeting energy efficiency resources in Wales' research carried out by the Centre for Sustainable Energy (CSE) for the Welsh Assembly Government (WAG), with funding from the New Ideas Fund. The report describes the findings of CSE's investigation into the distribution of 'hard to treat'[4] housing and Home Energy Efficiency Scheme (HEES) grants at small area level across Wales.

The project was set up to provide a resource for the WAG, programme managers, health organisations and others that would help them gain a better understanding of spatial variations in 'hard to treat' housing and HEES take-up. It therefore aims to identify areas with high levels of 'hard to treat' housing and areas where HEES take-up might be improved (although the research does not explore variations in level of need – a key determinant of take-up rates). The project therefore aims to improve the targeting of energy efficiency programmes, for example those provided by local authorities, fuel companies and the Welsh Assembly Government etc.

The objectives of the research were as follows:

1. To assemble data on the distribution of solid wall properties and properties with no access to gas (collectively referred to as 'hard to treat') and take-up of HEES grants in Wales.
2. To map the distribution of solid wall properties, properties with no access to gas and take-up of HEES grants in Wales for each unitary authority area in Wales.
3. To mount the maps on a publicly accessible website.
4. To analyse the distribution of solid wall properties, properties with no access to gas and take-up of HEES grants, for example comparisons between urban and rural areas in Wales[5].

The definitions of 'urban' and 'rural' are based on the ONS 'rural and urban area' classification (ONS, 2004). This is an authoritative classification that is widely used in comparative analyses of urban and rural areas. The classification developed four categories of settlement type: urban, town and fringe, village, hamlet & isolated dwellings. The latter three categories are all classified as 'rural' under this system.

It should be noted that spatial variations in HEES take-up will reflect a number of factors, of which variations in level of need (i.e. fuel poverty) are likely to be central. The research did not investigate the contribution of this factor to HEES take-up rates. The report therefore recommends that further research is carried out into the relative contributions of 'hard to treat' factors, 'rurality' and fuel poverty at small area level.

The remainder of this report is structured as follows:

[4] In brief, 'hard to treat' is the collective term used for properties for which it is difficult to provide cost effective insulation and heating measures. Lack of access to gas and solid wall construction are the principle causes of 'hard to treat' housing.

[5] Using the 4 categories (urban, town and fringe, village, hamlet/isolated dwellings) described in the Office for National Statistics (2004), *Rural and urban area classification 2004,* ONS

Chapter 2 outlines the research methodology.

Chapter 3 presents the research findings.

Chapter 4 presents some concluding comments on the research findings.

2 METHODOLOGY

The research, in brief, involved the following tasks:

1. Gather datasets, namely:
   - Urban and rural area classification
   - Distribution of HEES grants
   - Access to gas
   - Solid wall properties
2. Development of a composite, 'hard to treat' indicator that brings together the 'off gas' and 'solid wall' data
3. Conversion of all datasets to one common geographic unit, namely Census Output Areas; 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 HEES grants, solid wall properties and properties off the gas network to establish whether there were any significant differences between different geographical areas, e.g. urban and rural, economic regions.

These tasks are described in more detail below.

2.1 Datasets

The following gives more information about the datasets used for the research. It also describes how a fourth, composite 'hard to treat' indicator was developed through merger of the 'off gas' and 'solid wall' datasets.

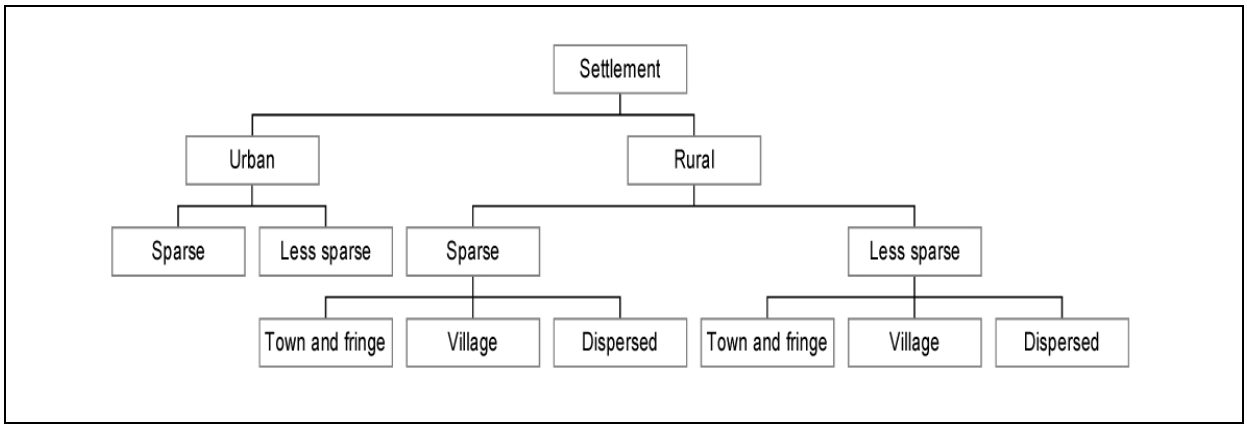
2.1.1 Urban and rural area classification

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 published a new 'rural and urban 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 broad structure of the classification is illustrated in Figure 1 below:

Figure 1: ONS 'rural and urban area' classification



The ONS classification allocates every Census Output Area in England and Wales to one of four categories of settlement type (see Section 2.2 for further explanation of Output Areas):

- Urban > 10k households
- Town and fringe
- Village
- Hamlet and isolated dwellings (described as 'dispersed' in the above diagram).

The classification also uses a separate and combined classification according to whether OAs are 'sparse' or 'less sparse'[6]. The 'sparsity' classification was not used by this research. The classification is available as a spreadsheet on the ONS website at: www.statistics.gov.uk/geography/nrudp.asp. 'Rural' areas consist of the 'town & fringe', 'village' and 'hamlet & isolated dwellings' categories, as shown in Figure 1 above. The categories also give an indication of the level of dispersal of settlement types, with 'urban' representing 'least dispersed' and 'hamlet & isolated dwellings' representing 'most dispersed'.

This research uses the ONS classification for its analysis of the distribution of 'hard to treat' factors and HEES take-up across urban and rural areas.

2.1.2 Distribution of HEES grants

Eaga supplied CSE with a database of all HEES grants awarded between 2000 and October 2005 by 6 digit postcode area (further information about the HEES scheme can be found at: www.eagagroup.com/grants/hees/index.htm). CSE, in consultation with the Welsh Assembly Government, excluded HEES grants awarded for 'minor measures' only (CFLs and draught-proofing) from the database. Major measures include heating systems, cavity wall insulation, loft insulation and boiler repairs.

CSE calculated the level of HEES take-up within any given area by dividing the number of households receiving HEES grants by the total number of households in that area.

[6] '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).

The HEES indicator used for this research does not give an indication of the extent to which HEES is reaching its target audience or the relationship between HEES take-up and levels of fuel poverty. The former would require data on the total number of eligible households at small area level, i.e. those on means-tested benefits that include pensioners, disabled people or young children (the full HEES eligibility criteria are available on the Eaga website). Such data is not available at small area level. Analysis of whether HEES is reaching areas with high levels of fuel poverty requires data on fuel poverty at small area level. This data will be available in the near future through the small area fuel poverty indicator CSE and Bristol University are developing for the Welsh Assembly Government (Welsh Assembly Government, 2006a).

2.1.3 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).

CSE 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. The database is more detailed than that made publicly available on Transco's website. CSE acknowledges the support of Professor John Chesshire in acquiring this database.

CSE has 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.

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

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

CSE 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 in the analysis and mapping work conducted.

1.1.4 Solid wall housing

'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.

The 2004 Living in Wales Survey provides property age data according to 5 broad categories: pre-1919, 1919-1944, 1945-1964, 1965-1980 and post 1980 (Welsh Assembly Government, 2006b). The Survey also provides data on properties built with solid walls and cavity walls, broken down by the 5 age bands. CSE used the Living in Wales data to estimate the ratio of pre-1919 to solid wall properties. This reflects the fact that all properties built before 1919 were built with solid walls, whereas most properties built after this date were built with cavities.

Two multipliers were calculated through this process: one for urban (1.154) and one for rural (1.081). The multipliers were then applied to the 'pre-1919' category within the RESIDATA[7] database, which provides post code data on age of property, to produce a small area database of solid wall properties in Wales.

The procedure assumes that the additional number of solid wall properties built after 1919 are evenly spread across postcodes. This is unlikely to be the case. However, given that the vast bulk of solid wall properties were built before 1919, this error was not considered significant.

1.1.5 'Hard to treat' indicator

A simple, 'composite' hard to treat indicator was created by summing the number of 'properties off the gas network' in any given area with 'properties built with solid walls' and dividing the total by 'number of households'. The indicator is represented by the following equation:

$$HTT\ indicator = \frac{(no.\ of\ off\text{-}gas\ properties + no.\ of\ properties\ with\ solid\ walls)\ in\ area}{total\ number\ of\ properties\ in\ area}$$

The indicator therefore produces a score for each area within a range of 0.00 to 2.00, where 0.00='very easy to treat' and 2.00='very hard to treat'. This is illustrated in Table 1 below:

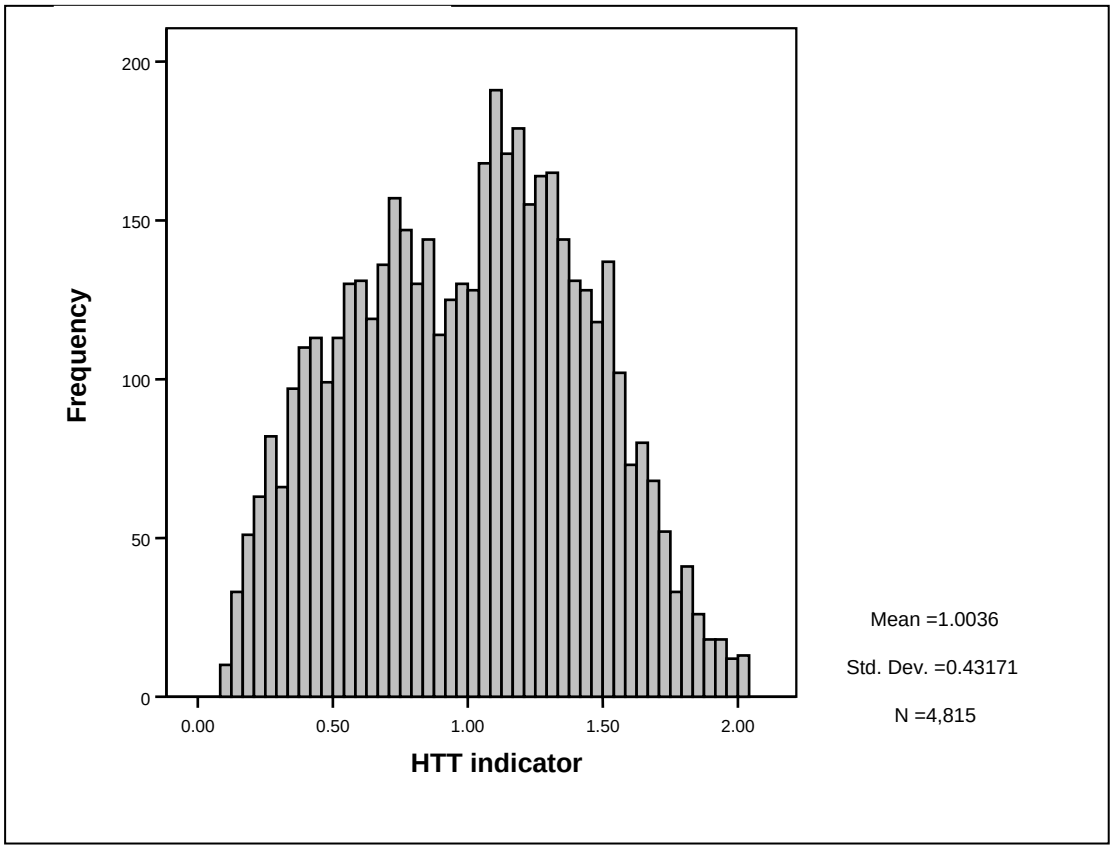
Table 1: 'hard to treat' indicator

Score	Property characteristics of area	Ease of 'treatment'
0.00	All properties connected to gas network and all built with cavities	Very 'easy to treat'
↓	Examples of areas with score of 1.00:	↓
1.00	a) all properties in area are off gas but all contain cavities b) all properties in area are 'on gas' but all are built with solid walls c) mix of properties 'off gas' and built with solid walls	
2.00	All properties are both 'off gas' and built with solid walls	Very 'hard to treat'

Figure 2 overleaf shows the frequency of HTT scores for Output Areas in Wales. The graph broadly represents a normal distribution, although there are two small 'peaks' in the curve. These are likely to reflect differences in the distribution of the two constituent elements of the indicator (i.e. 'off gas' and solid walls).

[7] 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.

Figure 2: Distribution of 'hard to treat' indicator



The 'hard to treat' indicator therefore combines the 'off gas' and 'solid wall' data to illustrate the extent of combined 'hard to treat' problems in any given area. The indicator is therefore designed to predict the extent to which the standard[8] package of cost effective energy efficiency measures can be provided to properties in that area.

It can be seen from Table 1 that it would be very easy to provide cost effective energy efficiency measures to properties in an area with a score of 0.00, since every property will have cavities and access to gas. By contrast, it would be very difficult to provide measures to an area with a score of 2.00 since every property will be 'off-gas' and built with solid walls. An area with a score in the middle of the range (i.e. around 1.00) is likely to contain a mix of property types, including some 'hard to treat' (due to being either 'off gas' or built with solid walls or a combination of both) and some 'easy to treat'.

The indicator can be used to give an indication of the potential contribution standard measures within the HEES programme (or any other energy efficiency programme) can make towards improving properties in any given area. However, the score does not take the socio-economic characteristics (i.e. level of need) of that area into account. This is also, of course, an important influence on the extent to which HEES measures can be installed in properties in an area. The score also does not take into

[8] 'Standard measures' refers to cavity wall insulation, loft insulation and gas central heating boiler. The 'hard to treat' indicator does not take into account the feasibility or otherwise of installing loft insulation to properties in an area.

account whether or not standard measures are already present within properties in an area.

The 'hard to treat' indicator would have considerably more potential as an indicator of the extent to which effective HEES measures can be provided when it is combined with small area data on levels of fuel poverty. CSE, working with Bristol University, plans to develop a small area fuel poverty indicator for Wales in the near future (see Welsh Assembly Government, 2006a). The new fuel poverty indicator could therefore be used to research the extent to which HEES measures are targeted on areas in need.

2.2 Conversion of datasets to common geographic unit

The databases collected by CSE provide data at a variety of geographies (postcode sector, Output Area etc). Census Output Areas (OAs) were used as the common unit for analysis since they allow detailed differentiation of geographical areas. Output Areas 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 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 allows local small 'pockets' of fuel poverty to be identified which might otherwise have been 'masked' by ward (for example) averages. This is particularly useful in rural areas where fuel poverty, like deprivation in general, tends to 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 1,200 to 12,000 households (usually according to whether they are wards in rural or urban areas).
- OAs tessellate with postcodes, electoral wards and other geographical units – this makes interpretation of OA data more straightforward in terms of identifying the larger geographical units in which OAs fall.

The disadvantage of OAs relates to their sheer number. There are some 9,800 OAs in Wales. Databases using this unit are therefore very large. Further, OAs are purely a statistical unit – they are not 'named' and do not represent a political or administrative area. This makes databases consisting of OAs difficult to interpret. This problem can be partly addressed by presenting OA data in map format.

CSE 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. GIS Mapinfo software was then used to combine the different datasets into

one database which could be imported into SPSS. This allowed statistical analysis and cross tabulations to be carried out 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 HEES 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.

2.3 Regional analysis

The Welsh Assembly Government divides Wales into 4 regional economic forums. Table 2 below shows the local authority areas that fall into each of the regions.

Table 2: Regional economic forums in Wales

North Wales	Mid Wales	South West Wales	South East Wales
Conwy	Ceredigion	Carmarthenshire	Blaenau Gwent
Denbighshire	Meirionnydd	Neath Port Talbot	Bridgend
Flintshire	Powys	Pembrokeshire	Caerphilly
Anglesey		Swansea	Cardiff
Wrexham			Merthyr Tydfil
Gwynedd (exc Meirionnydd)			Monmouthshire
			Newport
			Rhondda Cynon Taf
			Torfaen
			Vale of Glamorgan

CSE used the above regions for its statistical analysis (see 2.5 below). This allowed us to explore whether there were any statistical differences in the distribution of the different factors investigated between the 4 regions. It was not possible to carry out such an analysis at local authority level because there were insufficient cases to reveal possible statistically significant differences at this level.

2.4 Data mapping and website development

Local authority maps and data for the ‘off-gas’, ‘solid wall’, ‘hard to treat index’ and ‘HEES take-up’ indicators for every local authority area in Wales can now be accessed at a ‘targeting energy efficiency resources in Wales’ website: www.energyefficiencywales.org.uk/.

The number and proportion of properties ‘off gas’ and built with solid walls is available for every Output Area in Wales on the website. Data is also provided on the number and proportion of households receiving HEES grants in each OA. Finally, the website gives the ‘hard to treat’ score, using the combined ‘hard to treat’ indicator, for each OA. This report makes occasional reference to the website maps; readers may therefore find it useful to consult the website on such occasions.

2.5 Statistical analysis

Summary statistics and charts for each of the four factors investigated are presented in the next chapter, i.e. HEES take up, solid wall properties, 'off-gas' and the derived 'hard to treat' indicator. One-way analysis of variance (ANOVA) was used to test whether there were any statistically significant differences between the distribution of the four factors across the four settlement types ('urban', 'town & fringe', 'village' and 'hamlet & isolated dwellings').

The Tukey 'post hoc' test was used to establish if differences between 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'.

This analysis therefore allowed investigation of the influence of the 'degree of rurality' on each of the 4 factors and whether any differences between settlement types were statistically significant. 'Degree of rurality' refers to the level of dispersal of rural settlement types, where 'town & fringe' represents least dispersed and 'hamlet & isolate dwellings', most dispersed.

Any differences between regions and settlement types revealed through the HEES analysis may have reflected differences in socio-economic factors, rather than spatial variation or 'rurality' as such. It would therefore be useful to investigate HEES take-up, relative to need, to ensure comparisons are valid. The planned development of the small area fuel poverty indicator for Wales would make such a comparative analysis possible (using 'level of fuel poverty' as the basis for assessing 'need').

Eligibility for HEES is of course based on benefit status, rather than fuel poverty status. This means that the fuel poverty indicator can only give a partial indication of the extent to which HEES is reaching its target audience (i.e. households on benefits that contain pensioners, disabled people or young children) through the proposed comparative analysis. However, given that the elimination of fuel poverty is an explicit objective of the HEES programme, it would be useful to investigate whether it is reaching the fuel poor at small area level.

3 SPATIAL ANALYSIS: RESULTS

This chapter presents the results of the spatial analysis of the following factors:

- Solid wall properties by settlement type and region
- Off-gas properties by settlement type and region
- Take-up of HEES grants (2000-2005) by settlement type and region
- 'Hard to treat' by settlement type and region

3.1 Summary results

Table 3 below presents the summary results for the 4 factors investigated for the research. The full set of results is given in Appendix 2.

Table 3: Summary results

Region	Settlement Type	Total h/hds	No. HEES grants	No. solid wall properties	No. off gas properties	HTT score	% grants	% solid wall	% off gas	% of all h/hds in category
Mid	Urban	13,611	104	3,844	3,138	0.51	0.8%	28.2%	23.1%	12.8%
	All rural	93,136	609	38,615	65,368	1.12	0.7%	41.5%	70.2%	87.2%
	Total	**106,747**	**713**	**42,458**	**68,506**	**1.04**	**0.7%**	**39.8%**	**64.2%**	**100.0%**
North	Urban	141,127	8,396	24,441	24,163	0.34	5.9%	17.3%	17.1%	50.2%
	All rural	139,885	5,186	47,238	71,241	0.85	3.7%	33.8%	50.9%	49.8%
	Total	**281,012**	**13,582**	**71,679**	**95,403**	**0.59**	**4.8%**	**25.5%**	**33.9%**	**100.0%**
South East	Urban	492,113	27,719	160,852	166,570	0.67	5.6%	32.7%	33.8%	80.6%
	All rural	118,720	7,351	44,235	46,089	0.76	6.2%	37.3%	38.8%	19.4%
	Total	**610,833**	**35,070**	**205,087**	**212,660**	**0.68**	**5.7%**	**33.6%**	**34.8%**	**100.0%**
South West	Urban	180,629	9,984	49,130	34,777	0.46	5.5%	27.2%	19.3%	61.1%
	All rural	114,861	4,875	40,252	65,408	0.92	4.2%	35.0%	56.9%	38.9%
	Total	**295,490**	**14,859**	**89,383**	**100,185**	**0.64**	**5.0%**	**30.2%**	**33.9%**	**100.0%**
Wales	Urban	827,480	46,203	238,267	228,649	0.56	5.6%	28.8%	27.6%	63.9%
	All rural	466,602	18,021	170,341	248,106	0.90	3.9%	36.5%	53.2%	36.1%
	Total	**1,294,082**	**64,224**	**408,608**	**476,754**	**0.68**	**5.0%**	**31.6%**	**36.8%**	

Table 3 conflates the 3 rural categories (town & fringe, village and hamlet) into 1 'all rural' group. The following inferences can be drawn from the results:

- 32% of properties in Wales are solid walled, compared to 27% in England (Baker & Preston, 2006). 37% of properties in rural areas in Wales are solid walled, compared to 29% in urban areas. Similar differences between rural and urban areas are found in all of Wales' four regions.
- Rural areas in mid Wales have the highest proportion of solid wall properties (42%) and the highest proportion of properties off the gas network (70%). The figures for 'all properties' in mid Wales are not much lower (40% and 64% respectively), a reflection of the rural nature of the region.
- 37% of properties in Wales are off the gas network, compared to 15% in England (Baker & Preston, 2006). 53% of rural properties in Wales are off the gas network, compared to 28% of urban properties. The higher prevalence of 'off gas'

properties in rural areas occurs in all of Wales' four regions, although the difference between urban and rural areas in South East Wales is relatively small.

- Urban areas in South East Wales have a fairly high proportion of 'off-gas' properties (34%), compared to urban areas in other regions. This may be due to the former dominance of the coal mining industry in the region. This led to relatively low penetration of the gas network into the region due to many properties relying on coal as the main heating fuel.
- Mid Wales, not surprisingly, also has the highest score on the 'hard to treat' index at 1.04 (1.12 for rural mid Wales). The comparable score for 'all Wales' is 0.69.
- The average 'hard to treat' score for all rural areas in Wales is 0.90, compared to 0.56 for all urban areas. Urban areas in South East Wales also have a relatively high score (0.67), compared to urban areas in other regions. This is likely to reflect the relatively low level of gas connectivity in the region. (Note that the score for 'all properties' in South East Wales is only slightly higher at 0.68, a reflection of the urbanised nature of the region).
- The relatively high level of hard to treat problems in South East Wales is of particular significance, given the large concentration of the Welsh population in the region (South East Wales accounts for almost half of the total population of Wales).
- Take-up of HEES grants is higher in urban areas of Wales (5.6% of all households) than rural in Wales (3.9%). Similar differences between urban and rural areas were found in South West Wales and North Wales but not in Mid Wales and South East Wales (the latter is predominantly an 'urban' region).
- Take-up rates of Warm Front grants were also found to be higher in urban areas of England (3.7% of all households) than rural areas (2.0%). However, the English analysis only covered grants delivered between 2000 and 2003 and did not include grants delivered in East England (Baker & Preston, 2006).
- Take-up of HEES is much lower in mid Wales (0.7% of all households) than the other regions and 'all Wales' (5.0%). This applies to both urban and rural areas in mid Wales, although mid Wales is predominantly a rural region (87% of households in mid Wales live in 'rural' areas, compared to 36% for 'all Wales').
- The spatial variations in HEES take-up may reflect a number of possible factors:
  - differences in socio-economic characteristics and levels of need/fuel poverty;
  - differences in the suitability of properties for installing major HEES measures, since few major HEES measures can be offered to 'hard to treat' properties;
  - spatial inequities due to, for example, difficulties in marketing HEES measures to households in rural areas.
- Further research is required to investigate the relative contribution of each of these three factors to spatial variations in HEES take-up.

The following considers the four indicators in more detail.

3.2 Properties built with solid walls

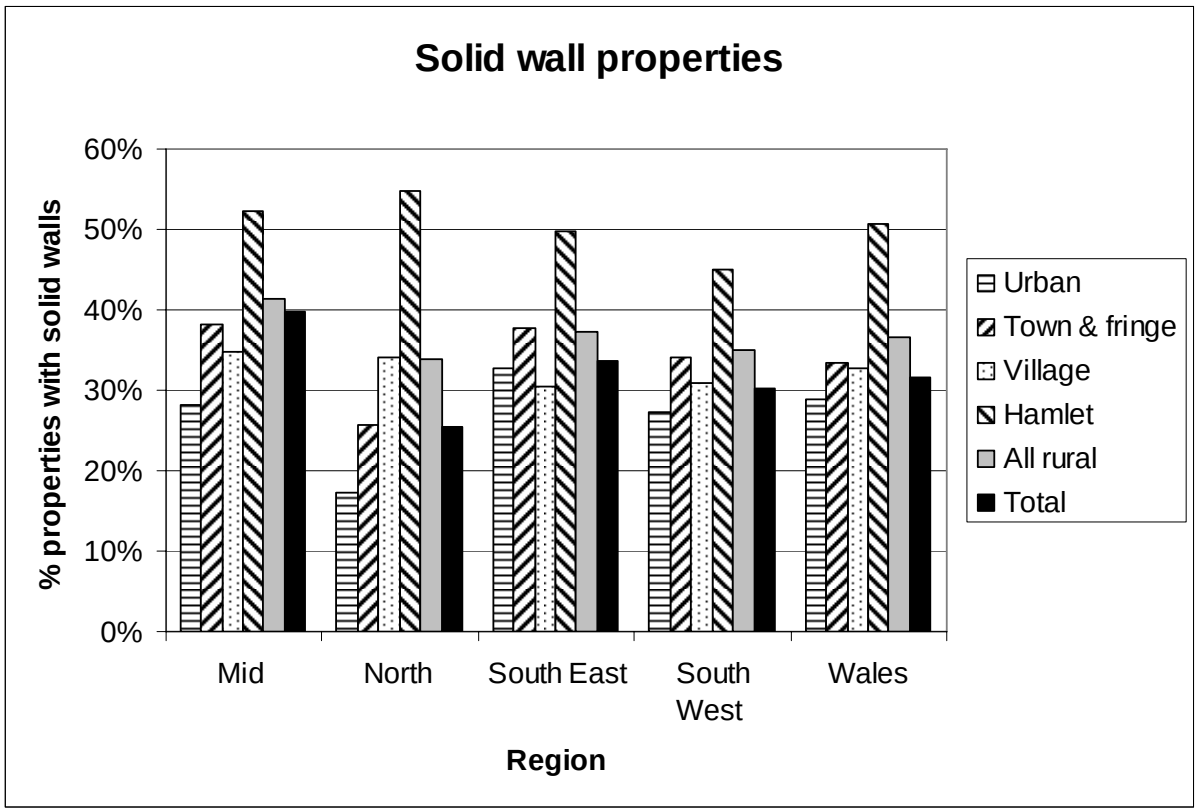
Local authority maps of solid wall properties are shown on the 'targeting energy efficiency resources in Wales' website. OAs in which solid wall properties account for more than 75% of the total number of households are shown in red on the maps. The maps suggest that solid wall properties tend to be particularly common in rural areas of Wales.

The total number and proportion of solid wall properties in each settlement type and for each region and local authority area is given in Appendix 2. Figure 3 below shows the regional results plotted. The graph suggests that the proportion of solid wall properties in 'hamlets & isolated dwellings' is particularly high (51%), compared to other settlement types. There does not appear to be a clear observable trend between the other 3 settlement types. However, the graph does illustrate the higher proportion of solid wall properties in 'all rural' areas, compared to 'urban' across the 4 regions.

Blaenau Gwent and Rhondda Cynon Taf have the highest proportion of solid wall properties of the 22 local authority areas in Wales, at 52% each. Flintshire has the lowest proportion, at 16% (see Appendix 2).

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

Figure 3: Solid wall properties by region and settlement type



Source: RESIDATA and 2004 Living in Wales Survey

Table 4: Significance test results (% of solid wall properties) for pairs of settlement type for Wales

Settlement Type	Settlement type	North Wales	Mid Wales	SW Wales	SE Wales	All Wales
Urban	Town & fringe	0.00	0.15	0.01	0.03	0.00
	Village	0.00	0.48	0.11	1.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Town & fringe	Urban	0.00	0.15	0.01	0.03	0.00
	Village	0.00	0.78	0.79	0.33	1.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Village	Urban	0.00	0.48	0.11	1.00	0.00
	Town & fringe	0.00	0.78	0.79	0.33	1.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Hamlet	Urban	0.00	0.00	0.00	0.00	0.00
	Town & fringe	0.00	0.00	0.00	0.00	0.00
	Village	0.00	0.00	0.00	0.00	0.00

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 4 shows that the higher proportion of solid wall properties in 'hamlets & isolated dwellings', when compared with all other settlement types, is statistically significant across all regions of Wales. The increase in proportion of solid wall properties with increased dispersal of settlement pattern is significant in North Wales. However, this trend is not repeated in other regions or 'all Wales'.

Figure 3 suggests that there are considerably higher proportions of solid wall properties in 'all rural' areas compared to 'urban' in all four regions of Wales, although the difference in South East Wales is relatively small (37% for 'all rural', compared to 33% for 'urban').

3.3 Households off the gas network

Local authority maps of properties 'off the gas network' are shown on the 'targeting energy efficiency resources in Wales' website. The maps illustrate the level of gas connection in OAs, as follows:

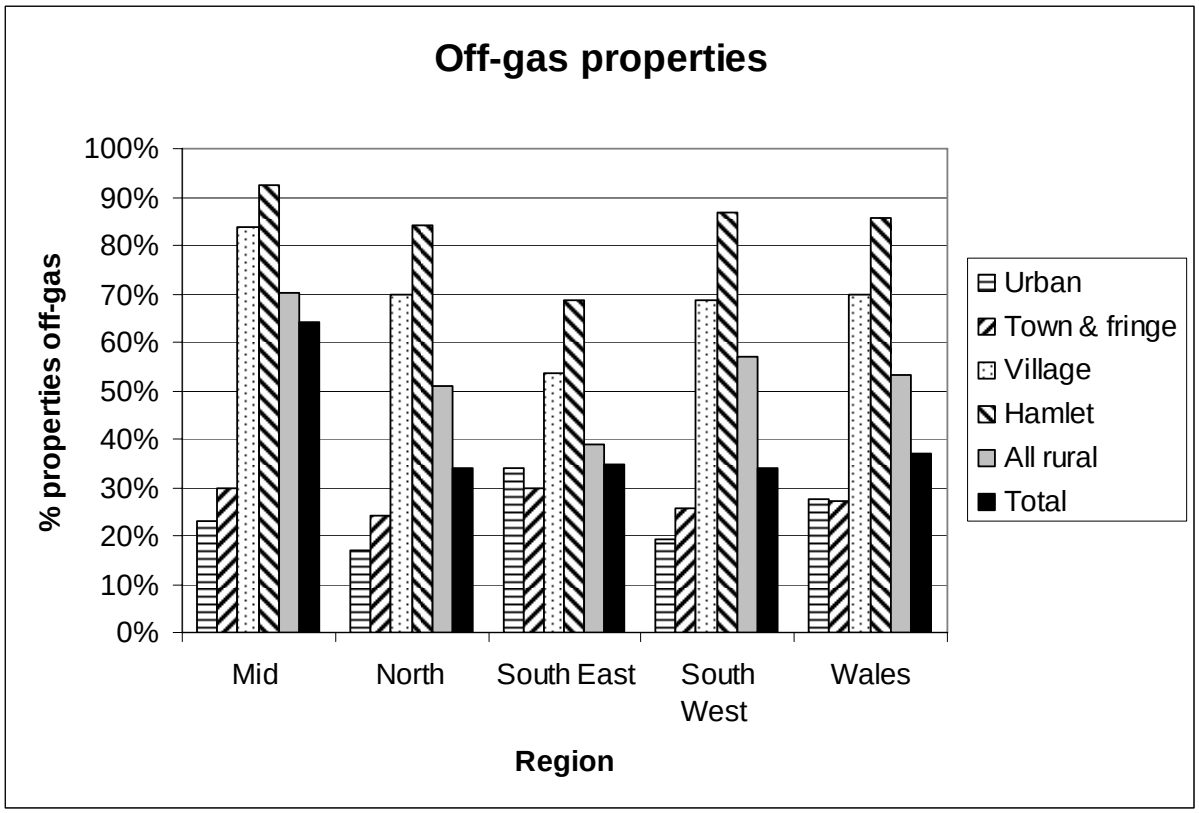
- OAs in which there are no properties with a gas supply are shown as 'white'
- OAs in which 1% to 24% of properties have a gas supply are shown as 'green'
- OAs in which 25% to 49% of properties have a gas supply are shown as 'yellow'
- OAs in which 50% to 74% of properties have a gas supply are shown as 'amber'
- OAs in which 75% to 100% of properties have a gas supply are shown as 'red'

The maps therefore distinguish between areas with high levels of properties connected to the gas network, medium levels of gas connection, low levels of gas connection and no gas connection at all.

The maps clearly show that many rural areas do not have a gas supply. Further, many more rural areas only have relatively low levels of gas penetration.

The total number and proportion of 'off-gas' properties in each settlement type and for each region and local authority area is given in Appendix 2. Figure 4 below shows the regional results plotted.

Figure 4: Off-gas properties by settlement type and region



Source: Transco

Figure 4 suggests that particularly high proportions of properties in 'villages' and 'hamlets & isolated dwellings' are off the gas network in 'all Wales' (70% and 86% respectively). There are similarly high proportions of 'off gas' properties in 'villages' and 'hamlets & isolated dwellings' in all of Wales' four regions. The graph also suggests that there is little difference between 'urban' and 'town and fringe' areas. The difference between 'all rural' and 'urban' areas appears fairly high in most regions, with the exception of South East Wales (a predominantly urban region).

Figure 4 also illustrates the relatively high levels of 'off-gas' properties in urban areas of South East Wales (34%), compared to urban areas in other regions. There are particularly high proportions of 'off-gas' properties in the urban areas of Blaenau Gwent (36%), Caerphilly (45%), Cardiff (37%), Newport (56%) and the Vale of Glamorgan (56%) (see Appendix 2). This may be due to the former dominance of the coal mining industry in these areas. This led to relatively low penetration of the gas network since low cost coal (at the time) was considered an adequate mainstream heating fuel.

Ceredigion has the highest proportion of properties off the gas network among the 22 local authorities at 77%. Torfaen has the lowest proportion at 14% (see Appendix 2).

Figure 4 shows that, in general, levels of gas connection decrease with increased dispersal of settlement pattern (i.e. moving from 'urban' to 'hamlets & isolated dwellings').

Table 5 below shows that the decline in gas connectivity with increased dispersal of settlement pattern is statistically significant for each pair of settlement types in North Wales and South West Wales. The difference between pairs of settlement type is also significant between 'town & fringe', 'village' and 'hamlet & isolated dwellings' in all four regions and 'all Wales'. However, the difference between 'urban' and 'town & fringe' is not significant in mid Wales and 'all Wales'. While the difference is significant in South East Wales, this is because, unusually, there is a higher level of gas connection in 'town & fringe' areas (70%), compared to 'urban' (66%).

Table 5: Significance test results (households without access to gas) for pairs of settlement type by region

Settlement Type	Settlement type	North Wales	Mid Wales	SW Wales	SE Wales	All Wales
Urban	Town & fringe	0.00	0.10	0.00	0.00	0.96
	Village	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Town & fringe	Urban	0.00	0.10	0.00	0.00	0.96
	Village	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Village	Urban	0.00	0.00	0.00	0.00	0.00
	Town & fringe	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Hamlet	Urban	0.00	0.00	0.00	0.00	0.00
	Town & fringe	0.00	0.00	0.00	0.00	0.00
	Village	0.00	0.00	0.00	0.00	0.00

Differences are significant at the 95% confidence level when $p<0.05$.

3.4 'Hard to treat' indicator

Local authority maps of the composite 'hard to treat' indicator are shown on the 'targeting energy efficiency resources in Wales' website. Areas with particularly high levels of hard to treat properties are shown in red on the maps. The maps suggest that 'hard to treat' problems tend to be more common in rural areas than urban.

The 'hard to treat' score for each settlement type and for each region and local authority area is given in Appendix 2. Figure 5 overleaf shows the regional results plotted. The graph shows a clear difference between 'all rural' and 'urban' areas across all regions. It also shows that 'hard to treat' problems appear to increase substantially from 'town & fringe' to 'hamlets & isolated dwellings' in all 4 regions.

The 'hard to treat' score is particularly high for 'hamlets & isolated dwellings' (1.36), compared to other settlement types. It is also very high in Mid Wales (1.04), compared to other regions (average for 'all Wales' is 0.68).

Ceredigion has the highest 'hard to treat' score among the 22 Welsh local authority areas, at 1.15. Torfaen has the lowest score, at 0.36 (see Appendix 2).

Table 6 below gives the Tukey results for establishing whether the difference between each pair of settlement types is statistically significant.

Figure 5: 'Hard to treat' score by settlement type and region

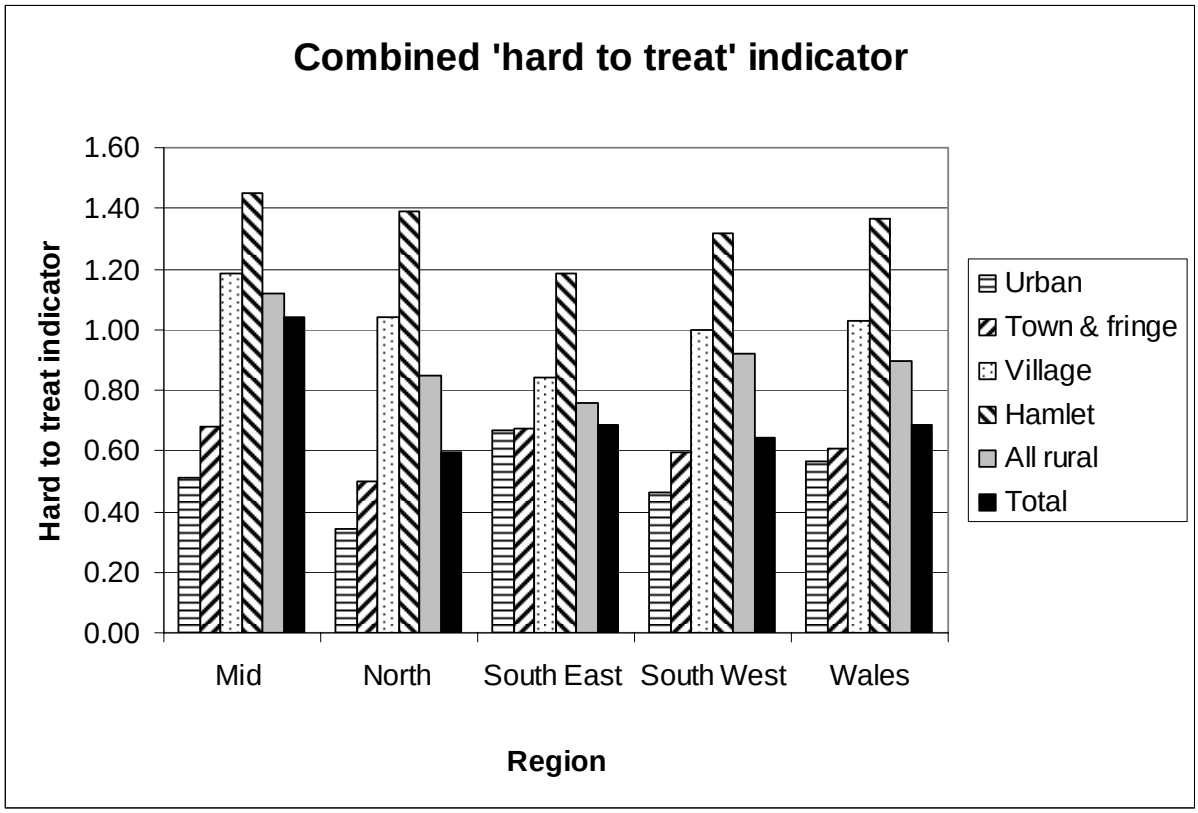


Table 6: Significance test results ('hard to treat' indicator) for pairs of settlement type by region

		North Wales	Mid Wales	South West	South East	Wales
Urban	Town	0.00	0.02	0.00	1.00	0.02
	Village	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Town	Urban	0.00	0.02	0.00	1.00	0.02
	Village	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Village	Urban	0.00	0.00	0.00	0.00	0.00
	Town	0.00	0.00	0.00	0.00	0.00
	Hamlet	0.00	0.00	0.00	0.00	0.00
Hamlet	Urban	0.00	0.00	0.00	0.00	0.00
	Town	0.00	0.00	0.00	0.00	0.00
	Village	0.00	0.00	0.00	0.00	0.00

Differences are significant at the 95% confidence level when $p<0.05$.

Table 6 suggests that 'hard to treat' problems increase significantly with increased dispersal of settlement pattern in North Wales, Mid Wales, South West Wales and 'all Wales'. A similar pattern is evident in South East Wales, with the exception of the difference between 'urban' and 'town & fringe', where the difference is not significant.

3.5 Take-up of HEES grants (2000-2005)

Local authority maps of 'HEES grant take-up' (i.e. % of all households taking up HEES grants) are shown on the website. Areas with high levels of take-up are shown in red on the maps, whereas areas with zero levels of take-up are shown in white. The maps clearly suggest that HEES take-up tends to be lower in rural OAs than urban. They also suggest that take-up is particularly low in mid-Wales.

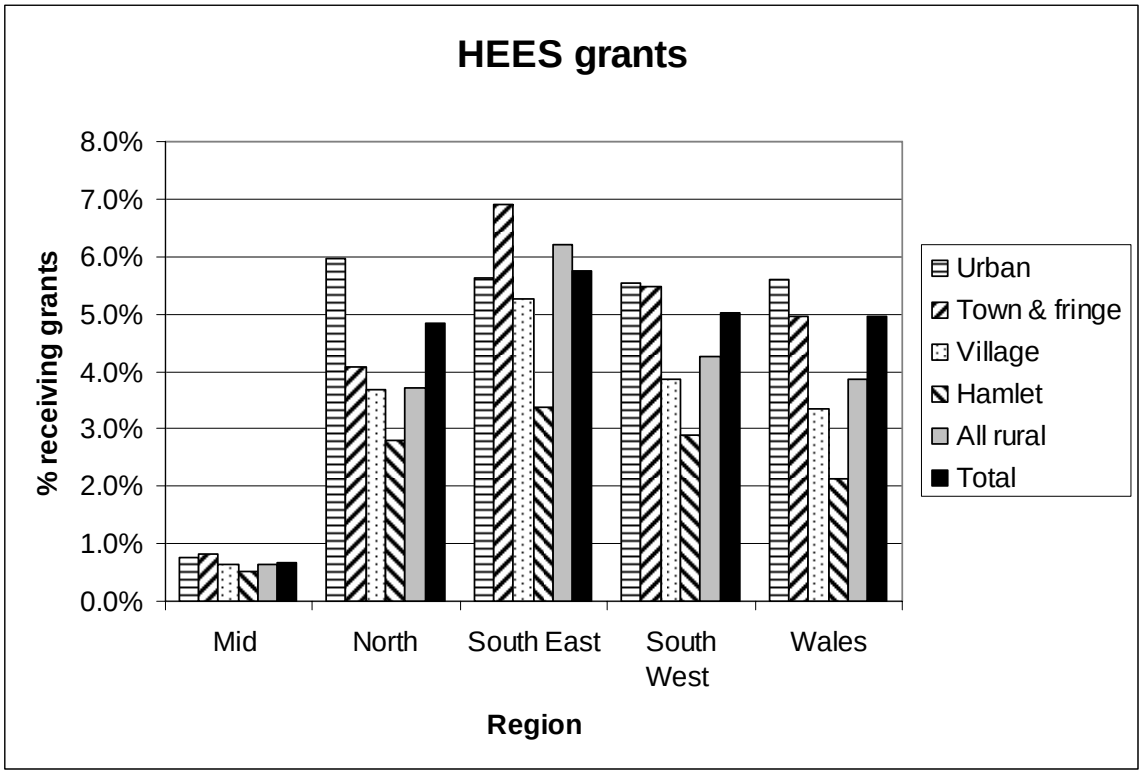
The number and proportion of HEES grants taken up in each settlement type, by region and local authority area, is given in Appendix 2. Figure 6 below shows the regional results plotted. The graph illustrates the particularly low take-up rate in mid Wales. Take-up is also low in 'hamlets & isolated dwellings' (2.1% of all households), compared to other settlement types.

The graph also suggests that take-up decreases with increased dispersal of settlement pattern in North Wales and 'all Wales'. However, there appears to be little difference between 'urban' and 'town & fringe' in South West Wales, while in South East Wales, take-up is slightly higher in 'town & fringe' areas than 'urban'.

Powys has the lowest proportion of households claiming HEES grants among the 22 Welsh local authority areas at 0.6%, with Gwynedd and Ceredigion only slightly higher at 0.7% and 0.8% respectively. Merthyr Tydfil has the highest proportion at 10.3% (see Appendix 2).

Table 7 overleaf gives the Tukey results for establishing whether the difference between each pair of settlement types is statistically significant.

Figure 6: Distribution of HEES grants by settlement type and region



Source: Eaga – all HEES grants (for major measures) delivered between 2000 and 2005

Table 7: Significance test results (HEES take-up rate) for pairs of settlement type by region

Settlement Type	Settlement type	North Wales	Mid Wales	SW Wales	SE Wales	All Wales
Urban	Town & fringe	0.00	0.88	1.00	0.00	0.00
	Village	0.00	0.97	0.00	0.97	0.00
	Hamlet	0.00	0.63	0.00	0.00	0.00
Town & fringe	Urban	0.00	0.88	1.00	0.00	0.00
	Village	0.48	0.43	0.00	0.02	0.00
	Hamlet	0.01	0.08	0.00	0.00	0.00
Village	Urban	0.00	0.97	0.00	0.97	0.00
	Town & fringe	0.48	0.43	0.00	0.02	0.00
	Hamlet	0.20	0.78	0.18	0.02	0.00
Hamlet	Urban	0.00	0.63	0.00	0.00	0.00
	Town & fringe	0.01	0.08	0.00	0.00	0.00
	Village	0.20	0.78	0.18	0.02	0.00

Differences are significant at the 95% confidence level when $p<0.05$.

The following conclusions can be drawn from Table 7:

- HEES take-up rates decrease with increased dispersal of settlement pattern in 'all Wales'. The difference in take-up rates between each pair of settlement types is statistically significant.
- There is no significant difference in take-up rates between settlement types in mid-Wales. This is not surprising, given the very low take-up rates across the whole of the region (0.7% of all households, compared to 5.0% for 'all Wales'). The HEES take-up rate in Mid Wales is therefore only 14% of the 'all Wales' rate.
- A separate analysis of HEES take-up rates across all households in each region found that the take-up rate in mid Wales is significantly different than the take-up rate in the remaining regions and 'all Wales'. Mid-Wales is therefore excluded from the results presented below.
- The difference in take-up rates between 'urban' and 'town & fringe' is significant in North Wales and South East Wales but not in South West Wales.
- The difference in take-up rates between 'urban' and 'village' is significant in North Wales and South West Wales but not in South East Wales. However, there is a significant difference between 'urban' and 'hamlet & isolated dwellings' in all 3 regions.
- The difference in take-up rates between 'town & fringe' and 'village' is significant in South West Wales and South East Wales but not North Wales. However, there is a significant difference between 'town & fringe' and 'hamlet & isolated dwellings' in all 3 regions.
- The difference in take-up rates between 'village' and 'hamlet & isolated dwellings' is significant in South East Wales[9] but not in North Wales and South West Wales.

[9] However, 'villages' and 'hamlets & isolated dwellings' represent only a small proportion of households in South East Wales (4.3% and 1.9% respectively, compared to 12.3% and 7.0% in 'all Wales').

It is notable that the areas with low HEES take-up rates (i.e. Mid Wales, hamlets & isolated dwellings, rural areas in general) also tend to be areas with high levels of hard to treat properties (see Figures 5 and 6). This association is not consistent in every case. Urban areas in South East Wales, for example, have relatively high levels of hard to treat properties ('hard to treat' score=0.67; 34% of properties are off the gas network) yet relatively high HEES take-up rates (5.6%). Nevertheless, the research findings do suggest that high levels of hard to treat factors contribute, to an extent, to low HEES take-up. This may be due to the lack of measures available within HEES packages for hard to treat properties.

It has already been noted that the analysis does not take account of differences in relative need between the different types of settlement category. It is therefore suggested that further research is conducted to explore the relationship between HEES take-up and level of fuel poverty at the small area level. This will help establish whether the HEES programme is effective in targeting fuel poverty.

The proposed further research will not, however, necessarily establish whether the HEES programme is effective in targeting eligible households. While there is likely to be a strong relationship between fuel poverty and HEES-eligible households, there are differences between the two populations. There is evidence in England that between 25% and 33% of fuel poor households are not eligible for Warm Front grants (NAO, 2004 and CSE & NEA, 2006). Similar issues are likely to occur with the HEES programme, given that HEES and Warm Front have similar eligibility criteria.

4 CONCLUSION

The analyses of 'off-gas' and 'solid wall properties' suggest that both issues (collectively referred to as 'hard to treat') are more common in rural areas than urban, particularly 'off-gas'. 'Hard to treat' problems are particularly common in 'hamlets & isolated dwellings', compared to other settlement types, and in the Mid Wales region, compared to other regions. Further, hard to treat problems tend to increase with dispersal of settlement pattern with respect to the three rural settlement types ('town & fringe', 'village' and 'hamlets & isolated dwellings') across the four regions. However, unlike in England, the difference between 'urban' and 'town & fringe' areas in Wales is not very marked.

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 research also found that HEES take-up rates were lower in rural areas than urban in Wales. CSE's analysis of the distribution of Warm Front grants in England found a similar urban/rural difference (Baker & Preston, 2006). HEES take-up was found to be particularly low in Mid Wales, compared to other regions, and 'hamlets & isolated dwellings', compared to other settlement types.

The low take-up of HEES grants in rural areas may be due to a number of possible factors:

- lower levels of need/fuel poverty in rural areas, although analysis of the 1997/98 Welsh House Condition Survey suggests that fuel poverty is higher in rural areas than urban (Welsh Assembly Government, 2005);
- lower take up of HEES passport benefits among eligible households in rural areas, due to the lack of information services and possibly 'cultural factors' associated with rural populations (Baker, 2002; Naji & Griffiths, 1999);
- greater difficulty in marketing HEES grants in rural areas, due to the dispersed nature of the target population; and
- few appropriate major measures for rural properties available in HEES packages (loft insulation is the only major measure available) due to the low levels of properties with cavity walls and access to gas in rural areas.

The final factor does appear to be important, given the evidence from this research that areas with low HEES take-up rates tend to correlate with areas with high proportions of hard to treat properties.

It is suggested that further research is carried out into the possible contribution of the first factor (i.e. urban/rural differences in levels of need) to HEES take-up rates at small area level. This could use the new small area fuel poverty indicator that CSE and Bristol University will develop in the near future (Welsh Assembly Government, 2006a). The proposed research could also investigate the possible relationships between fuel poverty, rurality and hard to treat factors at small area level.

CSE would welcome feedback on the findings presented in this report and the maps presented on the ‘targeting energy efficiency resources in Wales’ 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: DETAILED REGIONAL & LOCAL AUTHORITY RESULTS

Regional break-downs

Region	Settlement type	Total households	No. HEES grants	No. solid wall properties	No. off gas properties	HTT score	% grants	% solid wall	% off gas	% of all h/hds in category
Mid	Urban	13,611	104	3,844	3,138	0.51	0.8%	28.2%	23.1%	12.8%
	Town & fringe	28,258	236	10,787	8,439	0.68	0.8%	38.2%	29.9%	26.5%
	Village	35,086	223	12,225	29,378	1.19	0.6%	34.8%	83.7%	32.9%
	Hamlet	29,792	150	15,603	27,551	1.45	0.5%	52.4%	92.5%	27.9%
	All rural	93,136	609	38,615	65,368	1.12	0.7%	41.5%	70.2%	87.2%
	Total	**106,747**	**713**	**42,458**	**68,506**	**1.04**	**0.7%**	**39.8%**	**64.2%**	**100.0%**
North	Urban	141,127	8,396	24,441	24,163	0.34	5.9%	17.3%	17.1%	50.2%
	Town & fringe	65,278	2,651	16,806	15,658	0.50	4.1%	25.7%	24.0%	23.2%
	Village	50,299	1,856	17,111	35,112	1.04	3.7%	34.0%	69.8%	17.9%
	Hamlet	24,308	679	13,321	20,471	1.39	2.8%	54.8%	84.2%	8.7%
	All rural	139,885	5,186	47,238	71,241	0.85	3.7%	33.8%	50.9%	49.8%
	Total	**281,012**	**13,582**	**71,679**	**95,403**	**0.59**	**4.8%**	**25.5%**	**33.9%**	**100.0%**
South East	Urban	492,113	27,719	160,852	166,570	0.67	5.6%	32.7%	33.8%	80.6%
	Town & fringe	80,968	5,579	30,505	24,104	0.67	6.9%	37.7%	29.8%	13.3%
	Village	26,296	1,385	8,019	14,118	0.84	5.3%	30.5%	53.7%	4.3%
	Hamlet	11,456	387	5,712	7,867	1.19	3.4%	49.9%	68.7%	1.9%
	All rural	118,720	7,351	44,235	46,089	0.76	6.2%	37.3%	38.8%	19.4%
	Total	**610,833**	**35,070**	**205,087**	**212,660**	**0.68**	**5.7%**	**33.6%**	**34.8%**	**100.0%**
South West	Urban	180,629	9,984	49,130	34,777	0.46	5.5%	27.2%	19.3%	61.1%
	Town & fringe	42,047	2,298	14,298	10,824	0.60	5.5%	34.0%	25.7%	14.2%
	Village	47,829	1,852	14,737	32,926	1.00	3.9%	30.8%	68.8%	16.2%
	Hamlet	24,985	725	11,217	21,658	1.32	2.9%	44.9%	86.7%	8.5%
	All rural	114,861	4,875	40,252	65,408	0.92	4.2%	35.0%	56.9%	38.9%
	Total	**295,490**	**14,859**	**89,383**	**100,185**	**0.64**	**5.0%**	**30.2%**	**33.9%**	**100.0%**
Wales	Urban	827,480	46,203	238,267	228,649	0.56	5.6%	28.8%	27.6%	63.9%
	Town & fringe	216,551	10,764	72,396	59,025	0.61	5.0%	33.4%	27.3%	16.7%
	Village	159,510	5,316	52,092	111,533	1.03	3.3%	32.7%	69.9%	12.3%
	Hamlet	90,541	1,941	45,853	77,547	1.36	2.1%	50.6%	85.6%	7.0%
	All rural	466,602	18,021	170,341	248,106	0.90	3.9%	36.5%	53.2%	36.1%
	Total	**1,294,082**	**64,224**	**408,608**	**476,754**	**0.68**	**5.0%**	**31.6%**	**36.8%**	

Local authority break-downs

Local Authority	Settlement type	Total h/hds	No. HEES grants	No. solid wall	No. off gas	HTT score	% grants	% solid walls	% off gas
Blaenau Gwent	Urban	27166	1451	13,194	9,679	0.84	5.3%	48.6%	35.6%
	Town & fringe	3681	254	2,566	1,248	1.04	6.9%	69.7%	33.9%
	Village	317	10	288	123	1.30	3.2%	90.7%	38.9%
	Hamlet	269	27	212	155	1.36	10.0%	78.9%	57.5%
	All rural	4267	291	3,066	1,526	1.08	6.8%	71.8%	35.8%
	Total	**31433**	**1742**	**16,260**	**11,205**	**0.87**	**5.5%**	**51.7%**	**35.6%**
Bridgend	Urban	38716	2408	7,766	6,231	0.36	6.2%	20.1%	16.1%
	Town & fringe	13667	1066	5,609	2,236	0.57	7.8%	41.0%	16.4%
	Village	4148	355	999	1,520	0.61	8.6%	24.1%	36.7%
	Hamlet	1243	54	617	428	0.84	4.3%	49.7%	34.4%
	All rural	19058	1475	7,225	4,185	0.60	7.7%	37.9%	22.0%
	Total	**57774**	**3883**	**14,990**	**10,415**	**0.44**	**6.7%**	**25.9%**	**18.0%**
Caerphilly	Urban	56833	4665	20,035	25,522	0.80	8.2%	35.3%	44.9%
	Town & fringe	12631	1345	7,488	5,127	1.00	10.6%	59.3%	40.6%
	Village	3006	291	1,574	1,663	1.08	9.7%	52.4%	55.3%
	Hamlet	881	54	422	548	1.10	6.1%	47.9%	62.3%
	All rural	16518	1690	9,483	7,338	1.02	10.2%	57.4%	44.4%
	Total	**73351**	**6355**	**29,519**	**32,860**	**0.85**	**8.7%**	**40.2%**	**44.8%**
Cardiff	Urban	128469	4453	32,372	46,923	0.62	3.5%	25.2%	36.5%
	Town & fringe	2511	43	351	1,131	0.59	1.7%	14.0%	45.1%
	Village	902	20	43	485	0.59	2.2%	4.8%	53.7%
	Hamlet	253	11	89	140	0.90	4.3%	35.0%	55.1%
	All rural	3666	74	483	1,755	0.61	2.0%	13.2%	47.9%
	Total	**132135**	**4527**	**32,854**	**48,679**	**0.62**	**3.4%**	**24.9%**	**36.8%**
Carmarthenshire	Urban	33901	1469	10,567	6,809	0.51	4.3%	31.2%	20.1%
	Town & fringe	11094	505	3,995	3,578	0.68	4.6%	36.0%	32.2%
	Village	19286	674	6,370	14,625	1.09	3.5%	33.0%	75.8%
	Hamlet	13699	343	6,522	12,355	1.38	2.5%	47.6%	90.2%
	All rural	44079	1522	16,887	30,557	1.08	3.5%	38.3%	69.3%
	Total	**77980**	**2991**	**27,455**	**37,365**	**0.83**	**3.8%**	**35.2%**	**47.9%**
Ceredigion	Urban	5780	15	1,981	1,735	0.64	0.3%	34.3%	30.0%
	Town & fringe	5267	73	1,907	3,442	1.02	1.4%	36.2%	65.4%
	Village	10803	86	3,323	9,927	1.23	0.8%	30.8%	91.9%
	Hamlet	9825	89	4,833	9,325	1.44	0.9%	49.2%	94.9%
	All rural	25895	248	10,064	22,693	1.27	1.0%	38.9%	87.6%
	Total	**31675**	**263**	**12,045**	**24,429**	**1.15**	**0.8%**	**38.0%**	**77.1%**
Conwy	Urban	29691	1792	6,470	5,520	0.40	6.0%	21.8%	18.6%
	Town & fringe	13198	584	2,945	1,871	0.36	4.4%	22.3%	14.2%
	Village	5698	313	2,296	3,569	1.03	5.5%	40.3%	62.6%
	Hamlet	3433	104	2,027	3,218	1.53	3.0%	59.0%	93.7%
	All rural	22329	1001	7,268	8,658	0.71	4.5%	32.5%	38.8%
	Total	**52020**	**2793**	**13,738**	**14,178**	**0.54**	**5.4%**	**26.4%**	**27.3%**
Denbighshire	Urban	20936	2053	2,377	3,828	0.30	9.8%	11.4%	18.3%
	Town & fringe	11078	565	2,664	2,189	0.44	5.1%	24.0%	19.8%
	Village	5495	209	1,949	3,980	1.08	3.8%	35.5%	72.4%
	Hamlet	3627	88	2,084	3,025	1.41	2.4%	57.5%	83.4%
	All rural	20200	862	6,697	9,194	0.79	4.3%	33.2%	45.5%
	Total	**41136**	**2915**	**9,074**	**13,022**	**0.54**	**7.1%**	**22.1%**	**31.7%**

Local Authority	Settlement type	Total h/hds	No. HEES grants	No. solid wall	No. off gas	HTT score	% grants	% solid walls	% off gas
Flintshire	Urban	40890	2155	4,765	6,990	0.29	5.3%	11.7%	17.1%
	Town & fringe	8897	332	1,380	2,076	0.39	3.7%	15.5%	23.3%
	Village	9680	408	2,723	6,578	0.96	4.2%	28.1%	68.0%
	Hamlet	2926	81	1,388	2,237	1.24	2.8%	47.4%	76.5%
	All rural	21503	821	5,491	10,891	0.76	3.8%	25.5%	50.7%
	Total	**62393**	**2976**	**10,256**	**17,881**	**0.45**	**4.8%**	**16.4%**	**28.7%**
Gwynedd	Urban	5923	22	1,585	1,504	0.52	0.4%	26.8%	25.4%
	Town & fringe	21547	114	10,385	6,116	0.77	0.5%	48.2%	28.4%
	Village	19932	219	8,858	14,998	1.20	1.1%	44.4%	75.2%
	Hamlet	8705	58	5,999	7,553	1.56	0.7%	68.9%	86.8%
	All rural	50184	391	25,242	28,668	1.07	0.8%	50.3%	57.1%
	Total	**56107**	**413**	**26,828**	**30,172**	**1.02**	**0.7%**	**47.8%**	**53.8%**
Anglessey	Urban	5250	555	1,760	808	0.49	10.6%	33.5%	15.4%
	Town & fringe	9906	605	2,075	3,312	0.54	6.1%	20.9%	33.4%
	Village	11117	642	3,025	8,921	1.07	5.8%	27.2%	80.2%
	Hamlet	5804	283	2,483	4,986	1.29	4.9%	42.8%	85.9%
	All rural	26827	1530	7,583	17,219	0.92	5.7%	28.3%	64.2%
	Total	**32077**	**2085**	**9,343**	**18,027**	**0.85**	**6.5%**	**29.1%**	**56.2%**
Merthyr Tydfil	Urban	19919	1895	9,735	3,295	0.65	9.5%	48.9%	16.5%
	Town & fringe	4675	616	1,887	692	0.55	13.2%	40.4%	14.8%
	Village	426	33	163	169	0.78	7.7%	38.3%	39.6%
	Hamlet	229	50	48	92	0.61	21.8%	20.8%	40.3%
	All rural	5330	699	2,098	953	0.57	13.1%	39.4%	17.9%
	Total	**25249**	**2594**	**11,833**	**4,248**	**0.64**	**10.3%**	**46.9%**	**16.8%**
Monmouth shire	Urban	16508	439	2,876	5,350	0.50	2.7%	17.4%	32.4%
	Town & fringe	9699	237	1,734	3,697	0.56	2.4%	17.9%	38.1%
	Village	6454	133	2,139	4,931	1.10	2.1%	33.1%	76.4%
	Hamlet	4602	87	2,771	3,934	1.46	1.9%	60.2%	85.5%
	All rural	20755	457	6,644	12,562	0.93	2.2%	32.0%	60.5%
	Total	**37263**	**896**	**9,520**	**17,912**	**0.74**	**2.4%**	**25.5%**	**48.1%**
Neath Port Talbot	Urban	44285	2565	11,931	6,649	0.42	5.8%	26.9%	15.0%
	Town & fringe	9666	707	3,219	2,538	0.60	7.3%	33.3%	26.3%
	Village	6176	492	2,841	2,940	0.94	8.0%	46.0%	47.6%
	Hamlet	1214	72	465	560	0.84	5.9%	38.3%	46.1%
	All rural	17056	1271	6,525	6,038	0.74	7.5%	38.3%	35.4%
	Total	**61341**	**3836**	**18,456**	**12,687**	**0.51**	**6.3%**	**30.1%**	**20.7%**
Newport	Urban	51870	2270	13,815	28,996	0.83	4.4%	26.6%	55.9%
	Town & fringe	4715	152	627	2,099	0.58	3.2%	13.3%	44.5%
	Village	1715	54	383	971	0.79	3.1%	22.3%	56.6%
	Hamlet	808	13	431	544	1.21	1.6%	53.4%	67.3%
	All rural	7238	219	1,441	3,613	0.70	3.0%	19.9%	49.9%
	Total	**59108**	**2489**	**15,255**	**32,609**	**0.81**	**4.2%**	**25.8%**	**55.2%**
Pembroke shire	Urban	12165	611	2,423	2,841	0.43	5.0%	19.9%	23.4%
	Town & fringe	16645	770	5,678	3,060	0.52	4.6%	34.1%	18.4%
	Village	17183	451	4,279	12,454	0.97	2.6%	24.9%	72.5%
	Hamlet	8062	244	3,646	7,533	1.39	3.0%	45.2%	93.4%
	All rural	41890	1465	13,603	23,047	0.87	3.5%	32.5%	55.0%
	Total	**54055**	**2076**	**16,025**	**25,888**	**0.78**	**3.8%**	**29.6%**	**47.9%**

Local Authority	Settlement type	Total h/hds	No. HEES grants	No. solid wall	No. off gas	HTT score	% grants	% solid walls	% off gas
Powys	Urban	7831	89	1,863	1,403	0.42	1.1%	23.8%	17.9%
	Town & fringe	15307	121	5,079	3,141	0.54	0.8%	33.2%	20.5%
	Village	17742	68	5,918	13,795	1.11	0.4%	33.4%	77.8%
	Hamlet	16744	49	8,549	15,359	1.43	0.3%	51.1%	91.7%
	All rural	49793	238	19,546	32,295	1.04	0.5%	39.3%	64.9%
	Total	**57624**	**327**	**21,408**	**33,698**	**0.96**	**0.6%**	**37.2%**	**58.5%**
Rhondda Cynon Taf	Urban	74923	5765	43,326	12,181	0.74	7.7%	57.8%	16.3%
	Town & fringe	22559	1585	8,406	4,869	0.59	7.0%	37.3%	21.6%
	Village	3375	335	1,183	1,206	0.71	9.9%	35.0%	35.7%
	Hamlet	1632	56	698	847	0.95	3.4%	42.8%	51.9%
	All rural	27566	1976	10,287	6,922	0.62	7.2%	37.3%	25.1%
	Total	**102489**	**7741**	**53,613**	**19,103**	**0.71**	**7.6%**	**52.3%**	**18.6%**
Swansea	Urban	90278	5339	24,209	18,479	0.47	5.9%	26.8%	20.5%
	Town & fringe	4642	316	1,406	1,648	0.66	6.8%	30.3%	35.5%
	Village	5184	235	1,247	2,907	0.80	4.5%	24.1%	56.1%
	Hamlet	2010	66	584	1,211	0.89	3.3%	29.0%	60.2%
	All rural	11836	617	3,237	5,767	0.76	5.2%	27.4%	48.7%
	Total	**102114**	**5956**	**27,447**	**24,245**	**0.51**	**5.8%**	**26.9%**	**23.7%**
Torfaen	Urban	35280	2236	6,570	4,617	0.32	6.3%	18.6%	13.1%
	Town & fringe	2622	164	1,529	310	0.70	6.3%	58.3%	11.8%
	Village	846	17	236	329	0.67	2.0%	27.9%	38.9%
	Hamlet	413	14	201	330	1.28	3.4%	48.7%	79.8%
	All rural	3881	195	1,966	969	0.76	5.0%	50.7%	25.0%
	Total	**39161**	**2431**	**8,536**	**5,586**	**0.36**	**6.2%**	**21.8%**	**14.3%**
Vale of Glamorgan	Urban	42429	2137	11,164	23,778	0.82	5.0%	26.3%	56.0%
	Town & fringe	4208	117	309	2,694	0.71	2.8%	7.3%	64.0%
	Village	5107	137	1,012	2,722	0.73	2.7%	19.8%	53.3%
	Hamlet	1126	21	223	850	0.95	1.9%	19.8%	75.5%
	All rural	10441	275	1,544	6,265	0.75	2.6%	14.8%	60.0%
	Total	**52870**	**2412**	**12,708**	**30,043**	**0.81**	**4.6%**	**24.0%**	**56.8%**
Wrexham	Urban	38437	1819	7,483	5,513	0.34	4.7%	19.5%	14.3%
	Town & fringe	8336	493	1,158	1,950	0.37	5.9%	13.9%	23.4%
	Village	4918	134	1,243	2,721	0.81	2.7%	25.3%	55.3%
	Hamlet	3036	77	1,561	2,319	1.28	2.5%	51.4%	76.4%
	All rural	16290	704	3,962	6,990	0.67	4.3%	24.3%	42.9%
	Total	**54727**	**2523**	**11,446**	**12,503**	**0.44**	**4.6%**	**20.9%**	**22.8%**

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