Energy
Efficiency
Partnership
for Homes

Identifying and Quantifying the Prevalence of Hard to Treat Homes

Final Report to the Energy Efficiency Partnership for Homes (Insulation Strategy Group and Hard-to-Treat Subgroup)

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IDENTIFYING AND QUANTIFYING THE PREVALENCE OF HARD TO TREAT HOMES (HTTH)

1. EXECUTIVE SUMMARY

This report to the Insulation Strategy Group with the Hard-to-Treat Subgroup of the Energy Efficiency Partnership for Homes (EEPfH) outlines the results of the data mapping and manipulation phase (Phase 1) of research designed to assist the development of a strategy for hard to treat (HTT) dwellings. The commissioned research has successfully:

- Developed SQL statements to produce an output area level database of HTT homes from published post code level datasets
- Used SPSS statistical analysis to profile the prevalence of HTT homes at district level for East of England and England as a whole
- Used SPSS statistical analysis to profile the prevalence of HTT homes at ward level for East of England and England as a whole
- Mapped the prevalence and distribution of HTT homes ('off gas' and solid walled) at output area level for the East of England
- Combined the findings of this research and CSE's previous work for EAGA Charitable Trust to produce a full set of maps of the prevalence and distribution of HTT homes for England (see www.ruralfuelpoverty.org.uk).
- Demonstrated the possibility to use data stored on HEED to profile fuel use solid walled housing[1]

Unfortunately the current structure of the online HEED database meant that the research was unable to profile fuel use in solid walled housing for each district in England. CSE's work with GoSW to help develop a Low Carbon Housing and Affordable Warmth Strategy for the South West meant that the study was able to utilise the raw data stored on HEED for each district in the South West. The study was therefore able to profile fuel use in solid walled housing at district level for the South West. The EST is currently developing a fuel report for HEED and hopes to improve; the functionality of district level profiling and overall query time.

CSE recommends that a number of separate, underpinning pieces of research is now performed to help support the targeting of measures to HTT dwellings and the development of a strategy to treat them. This includes the following activities:

- Completion of CSE's work to map the prevalence and distribution of HEES grants and HTT dwellings in Wales (mid 2006)
- CSE to secure the funding required to map the prevalence and distribution of HTT dwellings in Scotland and Northern Ireland (2006)
- Completion of CSE's updated Fuel Poverty Indicator (FPi 2006), mapping of the findings at output area level and creation of an output area level dataset for HTT dwellings and fuel poverty (end 2006)
- Further expansion of ACE's fuel prophet tool to include more property types, property sizes, heating types and enhanced functionality, e.g. SAP rating (end 2006)

[1] Using pre 1919 data stored in HEED as a proxy indicator for solid walled properties

- Utilisation of the model developed by Richard Moore for GoSW to analyse the number of measures required to improve all HTT dwellings to a target SAP
- Analysis of the economic benefit and energy savings associated with improving HTT dwellings.
- Development of a UK strategy to improve HTT dwellings based on the targeting tools developed and the need identified

2. INTRODUCTION AND CONTEXT

CSE was commissioned by the Insulation Strategy Group with Hard-to-Treat Subgroup of the EEPfH to help develop a strategy to tackle HTT dwellings. The group wanted the work to build upon the research by CSE on behalf of the Hard to Treat (HTT) sub-group of the Fuel Poverty Strategy Group into the prevalence and characteristics of fuel poverty in non-traditional homes.

The study examining fuel poverty in non-traditional homes performed detailed analysis of English Housing Condition Survey (EHCS) data, exploring the prevalence of solid wall and non traditional homes at a regional level. However, the detailed analysis of EHCS data does not allow users to examine the properties of HTT dwellings at a higher geographical resolution than government office region. In order to develop an effective strategy it is essential to analyse both the work required to improve HTT dwellings and their most probable location, i.e. demand for measures.

CSE therefore proposed to analyse RESIDATA and gas connections data supplied by Transco to map the prevalence of HTT dwellings at output area level[2] for the East of England. The maps and datasets produced will enable local authorities and other programme managers to understand and better target solutions at HTT properties.

This work builds upon CSE's research for EAGA Partnership Charitable Trust[3] to quantify rural fuel poverty. The study aims to quantify and report on the extent and characteristics of rural fuel poverty (i.e. prevalence of off-gas areas and solid wall housing), make comparisons with urban fuel poverty and rural deprivation and make recommendations appropriate to both rural policy and anti-fuel poverty policy. The primary focus of this work is the examination of Warm Front uptake and fuel poverty distribution by rurality. The main outcomes of this study are dependent upon the production of CSE's updated Fuel Poverty Indicator (FPi) in spring 2006.

As part of this work CSE has used a Geographical Information System (GIS) to map 'off gas' areas and the prevalence of solid wall housing at output area level for the EAGA Warm Front phase one regions[4]. The work commissioned by the EEPfH's has enabled CSE to produce a complete data set and series of maps for HTT dwellings in England (see www.ruralfuelpoverty.org.uk). This website contains the combined outputs of both pieces of research. Annex I contains further details about the methodology and data used to map 'off gas' areas and the prevalence of solid walled housing.

CSE has now secured further funding from the Welsh Assembly Government (WAG) to undertake a similar mapping exercise for 'off gas' areas, solid walled properties

[2] Currently published housing datasets do not allow the examination of the distribution of non-traditional homes at a high geographical resolution
[3] http://www.cse.org.uk/cgi-bin/projects.cgi?policy&&1022
[4] England excluding the Yorkshire and Humberside, East and East Midlands Regions

and HEES grant distribution for Wales. CSE plan to integrate these results into the existing website to help develop a complete picture of the UK.

This report details the findings of the first phase of the work identified by CSE to help develop a strategy for HTT dwellings: The project's outputs include:

- Stage 1 - Maps showing the distribution of solid walled properties and 'off gas' areas at output area (OA) level for England and Wales[5]
- Stage 1 – A database of the distribution of solid walled properties and 'off gas' areas at OA and district level for England

3. METHODOLOGY

DATA MAPPING AND MANIPULATION

3.1 MAPPING WORK TO PROVIDE COMPLETE DATA SET FOR ENGLAND AND WALES

Annex I contains the full methodology employed to profile and map the data on HTT dwelling characteristics. CSE used SQL statements and OA 'look-up' tables to convert the postcode datasets (solid wall and access to gas) to OA level for the three government office regions of Yorkshire and Humberside, East of England and East Midlands regions. The study team then used GIS Mapinfo to combine the different datasets into one database and map these at county level.

3.2 IDENTIFYING THE DATA

OAs are a powerful tool for analysis of housing, social and economic data. The high geographical resolution of OAs (approximately 125 households) increases the likelihood of OAs containing households with similar characteristics. Furthermore, as 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).

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.

The study therefore used OA 'look-up' tables to add post code sector (e.g. BS1 6), ward and district data to the database for England (the team are currently conducting similar analysis for Wales). Energy professionals, housing managers and contractors will now be able to assign a location to the areas with the highest prevalence of HTT housing. The team has also produced aggregate tables to quantify the data at ward and district level.

3.3 PROFILING ENERGY USE BY DISTRICT

[5] CSE are currently undertaking the mapping work and database production for Wales

The EST's updated online HEED database contains HEC data collated by the network of 52 EEACs across the UK. The team planned to use the HEED database to profile the main heating fuel used in solid walled properties at district level. It was hoped that energy and industry professionals would then be able to identify areas with a high prevalence of HTT homes using the fuels with the highest carbon emissions i.e. coal or electricity.

4. RESULTS

CSE has mapped off-gas and solid wall data for the government office regions of Yorkshire and Humberside, East of England and East Midlands not covered by EAGA during phase 1 of Warm Front, thus providing a complete picture for England. These maps have been added to the rural fuel poverty website created as a result of the EAGA funded project to examine the extent and characteristics of rural fuel poverty (see www.ruralfuelpoverty.org.uk).

CSE has produced an OA level dataset which supplies the data used to produce the maps. Annex II contains a list of the variables contained within the dataset and summarises their meaning. The file has been saved as a tab delimited text file as it contains over 150,000 records. The file can therefore only be opened in programmes such as MS Access or SPSS (Excel will only read a maximum of 69,000 records). The dataset is available on request from the Energy Efficiency Partnership for Homes (mary.wise@est.org.uk).

CSE has also produced summary tables at ward and district levels for the total number of households and HTT (off gas and solid walled) dwellings. These tables can be downloaded directly from the website (see key findings section of www.ruralfuelpoverty.org.uk). The tables also contain the proportion of HHT dwellings expressed as a percentage. These percentages have been combined to produce a simple index of HTT dwellings. It is important to note that this index does not account for number of households or levels of fuel poverty. Future research could use the findings of the updated fuel poverty indicator to develop an indicator of need, based on HTT and fuel poverty characteristics.

The team planned to use the HEED database to profile the main heating fuel used in solid walled properties at district level. Unfortunately the HEED database is still in the early stages of its development and currently does not allow users to profile heating system. The EST plans to develop the HEED database further to allow users to access simple district level profiles which include heating system fuel use. CSE's work with the GoSW to produce a Low Carbon Housing and Affordable Warmth Strategy meant that CSE already had access to the raw data stored on HEED. This data was analysed to produce fuel profiles for the South West districts.

5. FUTURE RECOMMENDATIONS

There are a number of future pieces of research that are required before a comprehensive strategy can be developed and implemented to tackle HTT dwellings. There are two key questions that need to be answered before a strategy is developed:

1. Where are the largest concentrations of HTT dwellings that contain fuel poor households?
2. What work is required to fuel poverty proof HTT dwellings in the UK[6] i.e. the number of measures required, the associated cost of these measures, the economic benefits of this activity and the savings achieved (both financial and carbon)?

The recommendations for the second stage of this research help to answer the first question about targeting resources. CSE have also made some recommendations for future research to identify the scale of the task to improve HTT dwellings.

STAGE 2 – DEVELOPING TARGETING TOOLS FOR HTT DWELLINGS

CSE will initially seek funding from the Energy Efficiency Partnership for Homes Insulation Group and / or Hard to Treat Sub Group for the second phase of this work.

ENABLING USERS TO ACCESS THE DATA ONLINE

Users of the rural fuel poverty website can not currently download the data from the website. Funding for a second stage of this research would enable CSE to develop an interface to download the data. Users would be able to download the data through a series of drop down menus that filter the dataset or clickable maps that enable them to identify their area of interest. It is hoped that this interface would also enable users to download the updated FPi 2006 and the findings of the Welsh Assembly Government research.

TESTING DATA VALIDITY

CSE plan to work with members of the Insulation Strategy Group and Hard-to-Treat Subgroup of the EEPfH during the second stage of this research to test the validity of the mapped data. CSE will request a sample of surveyor reports / data from these organisations and review the wall type and heating fuel used against the HTT data set. CSE will also work with the group to examine the possibility of piloting a targeted data validation exercise for a sample of mapped OAs.

MANIPULATING AND MAPPING THE DATA FOR SCOTLAND AND NI

CSE would also hope to map 'off gas' and solid walled data for the remaining countries i.e. Scotland and Northern Ireland. These two countries have not developed output area boundaries, but they have established their own similar areas (see Annex I for a further explanation).

Stage 2 would be completed between 01st July 2006 and 30th January 2006.

DEVELOPING A STRATEGY FOR HTT DWELLINGS

IDENTIFYING THE MEASURES REQUIRED, ASSOCIATED COSTS AND CARBON SAVINGS

[6] Increase SAP to level that means risk from fuel poverty is no longer directly related to the thermal efficiency of the property i.e. SAP 65. This will have increased as a result of fuel price rises and any future study will have to set the target for analysis at an appropriate level.

CSE has recently been involved in a study commissioned by GoSW to develop a strategy for Low Carbon Housing and Affordable Warmth in the South West. This work has enabled CSE, ACE and Richard Moore to produce a collaborative methodology to examine the number of measures required to meet target SAP ratings of 65 and 80 for all housing in the South West, the carbon savings associated with these measures, the economic value to the region (GDP), current installation rates and the increase in activity required to meet targets.

CSE recommend's that the HTT sub-group and the Insulation Group consider the merits of performing a specific analysis to explore the work required to improve all HTT dwellings in the UK to a minimum SAP rating e.g. 70. This work could run concurrently with the development of a comprehensive and inclusive strategy i.e. ensuring that issues such as income maximisation and social inclusion are also included now.

SUMMARY OF PLANNED ACTIVITY AND RECOMMENDATIONS

CSE would recommend that a number of separate, underpinning pieces of research are now performed to help support the targeting of measures to HTT dwellings and the development of a strategy to treat them. This includes the following activities:

- Completion of CSE's work to map the prevalence and distribution of HEES grants and HTT dwellings in Wales (mid 2006)
- CSE to secure the funding required to map the prevalence and distribution of HTT dwellings in Scotland and Northern Ireland (end 2006)
- CSE to secure the funding to test the validity of the data with industry partners (end 2006)
- CSE to secure funding to add a data download function to the website (CSE 2006)
- Completion of CSE's updated Fuel Poverty Indicator, mapping of the findings at output area level and creation of an output area level dataset for HTT dwellings and fuel poverty (end 2006)
- Further expansion of ACE's fuel prophet tool to include more property types, property sizes, heating types and enhances functionality, e.g. SAP rating (end 2006)
- Utilisation of the model developed by Richard Moore for GoSW to analyse the number of measures required to improve all HTT dwellings to a target SAP value
- Analysis of the economic benefit and energy savings associated with improving all HTT dwellings.
- Development of a UK strategy to improve HTT dwellings based on the targeting tools developed and the need identified

ANNEX I: METHODOLOGY EMPLOYED TO MAP THE DATA

GEOGRAPHICAL RESOLUTION

The databases collected by CSE provide data at a variety of geographies (postcode sector, Output Area etc). Output Areas (OAs) represent the smallest geographic unit at which Census data is outputted. They were defined for the 2001 Census 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).

The updated Fuel Poverty Indicator will be made available at lower level Super Output Area. The Countryside Agency and DEFRA's indicator of rurality is available at Output Area level. CSE therefore decided to use Output Areas as the common unit for its analysis.

MAPPING 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 their 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 (there are 1.2m postcode areas in England). 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. This will lead to a slight under-estimate of gas connectivity.

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. Furthermore, it is of course not possible to install cavity wall insulation in solid wall properties, which is a very cost effective method of improving SAP standards. However, higher cost solid wall insulation options are available, e.g. dry lining, external cladding, and insulating plaster products such as Wall reform.

CSE work to quantify rural fuel poverty for EAGA Charitable Trust has shown 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 Warm Front phase 1 area. By contrast, solid wall properties in 'urban' areas ranged from 21% to 27%.

CSE originally intended to use the simple English multiplier recommended by the Association for the Conservation of Energy (ACE) for constructing its 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, 2004). 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.

Following some work carried out by CSE in Cornwall (where virtually all properties built before 1945 do not contain cavities), CSE decided to use a regional multiplier to arrive at a proxy for solid wall properties, since there are considerable regional variations in the distribution of solid wall properties. This will still lead to inaccuracies when applied at the small area level. However, it is intended to provide a slightly more accurate guide than use of a crude all-England multiplier.

English Multipliers used to estimate total solid walled from pre-1919

Region	Type	Multipliers
North East	Urban	1.274
	Rural	1.121
Yorkshire & Humber	Urban	1.239
	Rural	1.074
North West & Merseyside	Urban	1.244
	Rural	1.155
East Midlands	Urban	1.663
	Rural	1.175
West Midlands	Urban	1.764
	Rural	1.144
South West	Urban	1.259
	Rural	1.096
Eastern	Urban	1.812
	Rural	1.266
South East	Urban	1.370
	Rural	1.277
Outer London	Urban	2.851
	Rural	1.000
Inner London	Urban	1.490
England	**All Areas**	**1.496**

It is also important to appreciate that the indicator is only intended as a predictor of 'hard to treat' housing. There are, of course, a range of other factors that can also contribute to 'hard to treat' but for which there is little small area data. These may have particular significance at a small area level, e.g. use of non-traditional construction types.

CSE has purchased a license for the use of 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 is considered to provide accurate data on a range of property characteristics, including property age. CSE has applied the regional solid wall multipliers to 'number of pre-1919 properties' to produce a small area database of solid wall properties. CSE was therefore able to provide an estimate of the number of solid wall properties for every OA in England.

GEOGRAPHICAL DATASETS FOR SCOTLAND AND NORTHERN IRELAND

In Scotland there are two layers equivalent to SOAs: 'data zones', released in February 2004, and 'intermediate zones', released in February 2005. Data zones are rather smaller in population size than their lower level SOA counterparts in England and Wales. There are 6505 data zones of size 500 -1000 residents. The intermediate geography consists of 'intermediate zones', have a size in between lower and middle level SOAs in England and Wales. There are 1235 intermediate zones of size 2,500 - 6,000 residents.

The Northern Irish equivalent is also called 'Super Output Areas'. There are 896 Northern Irish SOAs of size 1300-2800 residents.

ANNEX II: VARIABLE NAMES AND SOURCE FOR THE ENGLISH HTT DWELLINGS DATASET

The following key provides the variable names and their source for the tab delimited text file produced as a result of the mapping work. The tab file contains over 150,000 records and as such can only be opened in MS Access or SPSS (Excel will only read a maximum of 69,000 records).

Variable: OACode	Output area code
Variable: Total_households	Total number of households
Variable: Total_solidwall	Total number of solid walled properties
Variable: GOR	Government Office Region
Variable: County_name	County Name
Variable: District_name	District Name
Variable: Ward_name	Ward Name
Variable: Postcode	Post code sector i.e. BS1 6
Variable: Morphology	Countryside Agency Rurality Indicator (CARI) morphology code
Variable: MorphName	CARI morphology name
Variable: ContName	CARI morphology sub-category name
Variable: Combined	CARI code for combined morphology
Variable: CombName	CARI combined morphology name
Variable: Total_Gas_Postcodes	Total number of post codes in an OA with a gas supply
Variable: Total_Postcodes_2001	Total number of postcodes in an OA
Variable: Type_Morph	If the OA is urban or rural according to the CARI
Variable: Percent_SolidWall	Percentage solid wall housing in an OA[7]
Variable: Offgas_PCs	Total number of off gas post codes in an OA
Variable: Percent_OffG	Percentage of off gas post codes in an OA
Variable: OffGas_HH	total number of off gas households in an OA

[7] Displayed as a whole number i.e. 1 equals 100%