

Analysis of hard-to-treat housing in England

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38% of English housing stock is considered hard-to-treat (where 'hard-to-treat' (HTT) is defined as having no mains gas heating system and/or a solid wall property).

The Centre for Sustainable Energy (CSE) has analysed English Housing Survey (EHS, 2007-08) data to understand a little more about the make-up, nature, geography, occupancy and general characteristics of the HTT housing stock.

Table 1. Total hard-to-treat households

	N ('000s)	%
Off gas	2,600	12.1%
Solid wall	6,370	29.8%
Total 'HTT'	8,196	38.3%

Table 2. Make-up of HTT housing stock

	N ('000's)	% of HHT	% of All HHs
Off gas only	1,826	22%	8.5%
Solid wall only	5,596	68%	26.1%
Off gas & solid wall	774	9%	3.6%
Total	8,196	100%	38.3%

The graphs below illustrate some of the key characteristics of hard-to-treat housing in England.

Rurality and regions

- 70% of properties in the most rural areas of England ('hamlets and isolated dwellings') are defined as hard-to-treat; double the proportion in urban areas.
- In urban areas the presence of solid walls is what defines most of the HTT housing stock, with 30% of properties having a solid wall (i.e. 28% solid wall only plus 2% solid wall and off-gas (figure 1)).
- In rural areas a lack of a mains gas heating systems dominates the make-up of hard-to-treat properties (45% and 51% of properties are without mains gas heating in villages and isolated areas respectively). In the most isolated rural areas the majority (28%) of HTT houses are both without mains gas and have solid walls.
- London has the highest proportion of hard-to-treat properties of all the regions, with 58% being solid-walled properties.
- The South West has the highest proportion off-gas (23%, figure 2).

Figure 1.

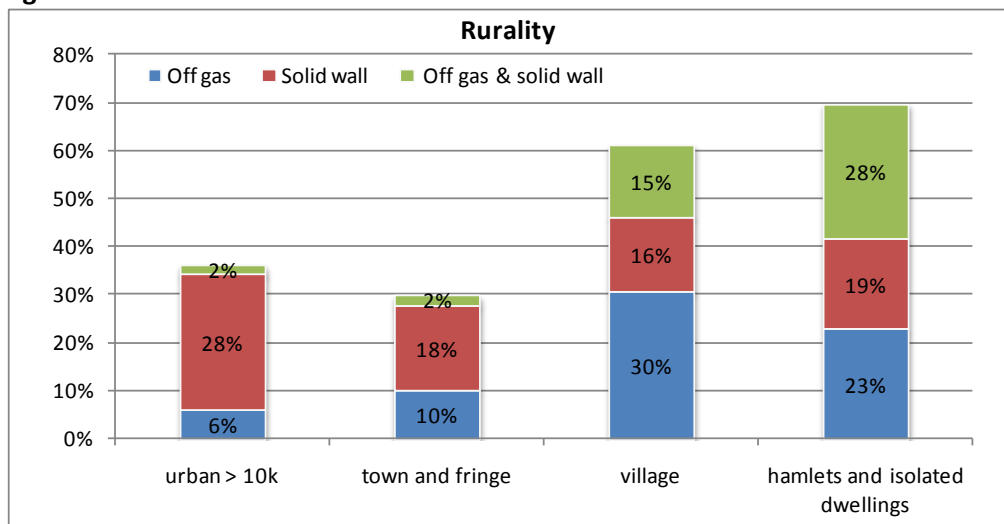
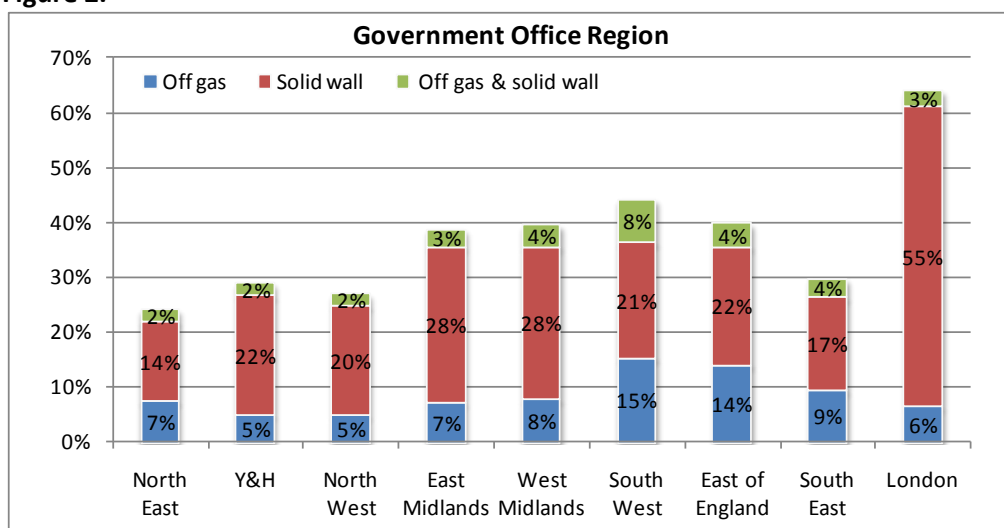


Figure 2.



Dwelling type and tenure

- Nearly 90% of converted flats are classed as hard-to-treat, mainly due to having solid walls (figure 3).
- Just under one third of purpose built flats are without a mains gas heating system. 5% are both without mains gas and have solid walls.
- The privately rented sector has the highest proportion of HTT housing (55%) with some 43% having solid walls (figure 4). This relates to a high proportion of converted flats being occupied by the private rented sector (table 3).

Table 3. Dwelling type and tenure

	own with mortgage	own outright	privately rent	social rented	Total
terrace	41%	25%	17%	17%	100%
semi	44%	34%	9%	12%	100%
detached	51%	42%	6%	1%	100%
bungalow	16%	58%	6%	20%	100%
converted flat	24%	13%	50%	14%	100%
purpose built flat	18%	13%	22%	47%	100%
Total	37%	31%	14%	18%	100%

Figure 3.

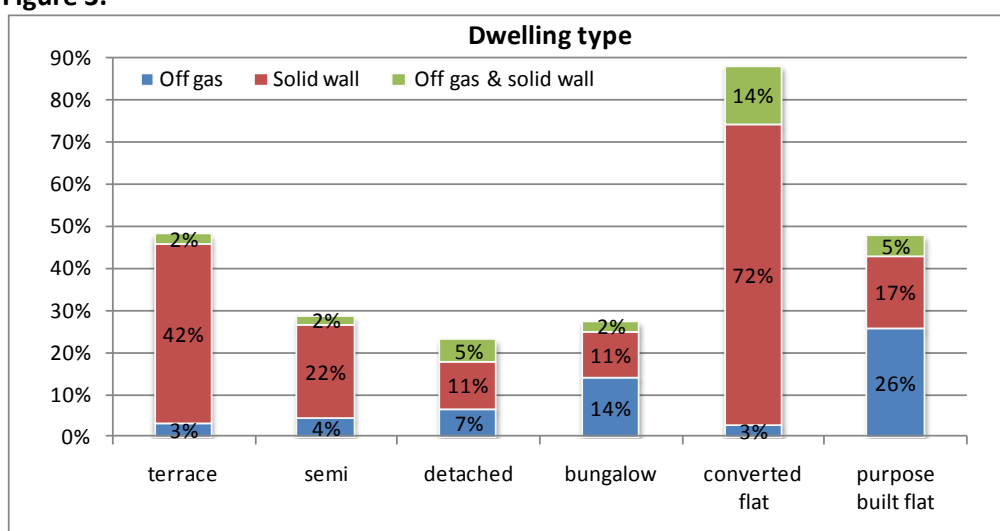
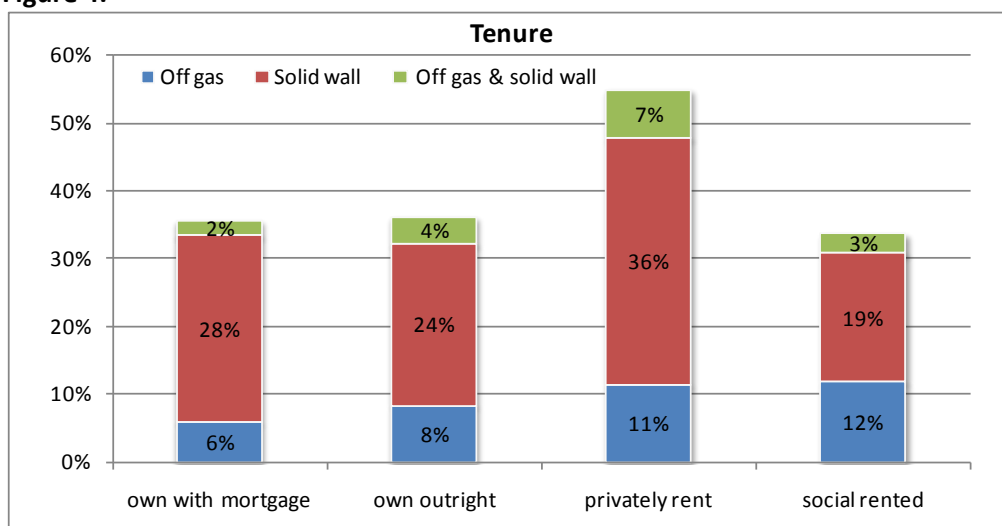


Figure 4.



Income and household composition

- The distribution of hard-to-treat housing overall is fairly even across the income deciles. However, the make-up of hard-to-treat housing in each decile is slightly different: a higher proportion of the lower deciles are without a mains gas system; conversely the highest income decile has the highest proportion of solid wall properties (figure 5).
- Households of multiple occupancy (HMO) and single person households under the age of 60 have the highest proportion of hard-to-treat housing (figure 6). This relates to (amongst other things) the dwelling types occupied by these household groups. For example, single households under the age of 60 (which make up 13% of all households) mainly live in flats and terraced houses, which have the highest proportion of hard-to-treat properties (see table 4 and figure 3 above).

Table 4. Dwelling type and household composition

	couple, no children <60	couple, no children >60	couple with children	lone parent	HMO	one person <60	one person >60	Total
terrace	19%	11%	24%	10%	11%	13%	12%	100%
semi	21%	17%	27%	7%	7%	9%	12%	100%
detached	22%	24%	32%	3%	4%	5%	10%	100%
bungalow	13%	34%	5%	1%	5%	9%	35%	100%
conv. flat	22%	4%	8%	6%	13%	34%	13%	100%
PB flat	15%	7%	10%	8%	7%	29%	25%	100%
Total	19%	16%	22%	7%	8%	13%	16%	100%

Figure 5.

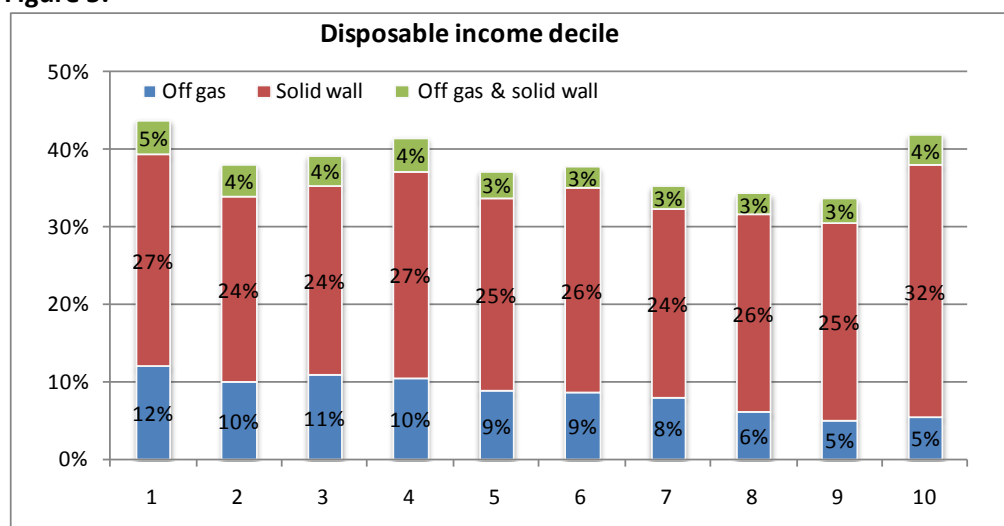
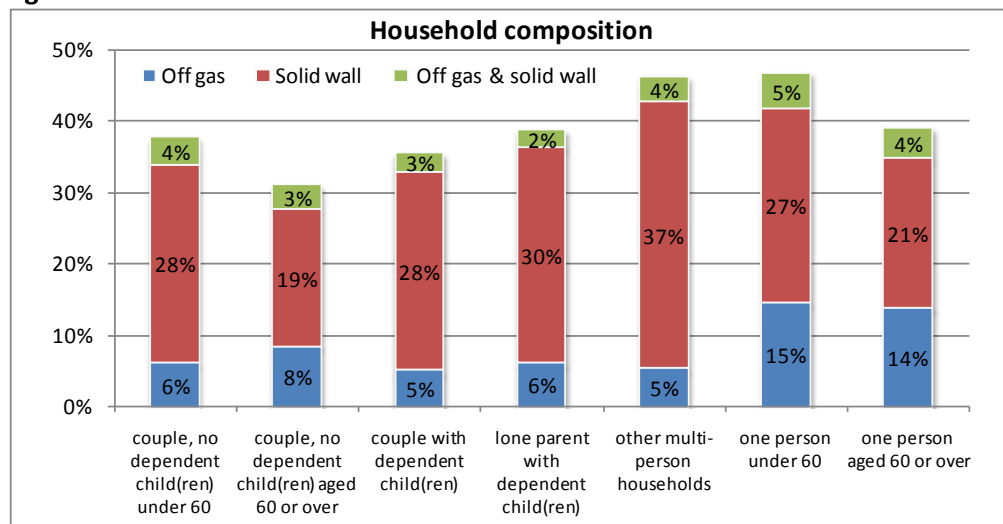


Figure 6.



Identifying key defining characteristics of hard-to-treat properties

The analysis above gives a broad overview of the make-up and distribution of hard-to-treat housing in England. CHAID ('Chi-squared automatic interaction detector') can be used to help further identify any key defining characteristics of hard-to-treat households.

CHAID is a classification tree method which can be used for predicting the class of an object (e.g. "hard-to-treatness") based on a set of predictor variables (e.g. socio-demographics, such as dwelling type, location etc). Running this analysis on the EHS results in groups – or 'nodes' – of cases (households) to which a predicted value for the dependent variable is assigned, in this case 'hard-to-treatness' (i.e. solid wall, off-gas, both or neither). Cross-tabulating these nodes with socio-demographic variables in the dataset can help to reveal any key differences in the nature of hard-to-treat households compared to the dwelling stock as a whole.

The CHAID model results in 17 nodes, a total of 7.75 million houses, all of which are predicted to be hard-to-treat (table 5). (Note the total predicted count of hard-to-treat households will not correspond to the actual count (as shown in table 1) due to some misclassification by the model. The extent of misclassification is shown by the actual counts and proportion of HTT properties in the node in italics in table 5).

The key characteristics of the hard-to-treat nodes identified by the model are described below.

Table 5. CHAID nodes identified as being 'hard-to-treat' (compared to actual classification)

Node ID	Predicted Value			Actual value			% actual HTT
	Off gas only	Solid wall only	Off gas & solid wall	Off gas only	Solid wall only	Off gas & solid wall	
54		391,172			384,355		98%
10			359,662	24,674	97,915	227,182	97%
53		436,884		1,855	415,029	3,988	96%
12	365,810			223,309	12,609	103,680	93%
13	463,016			231,270	20,003	175,945	92%
51		622,184		4,597	550,745	6,082	90%
50		414,576		5,461	347,998	16,841	89%
46	572,166			461,377	11,747	29,859	88%
11	504,391			358,997	8,318	61,026	85%
23		410,438		1,535	340,954	4,587	85%
52		430,678		1,772	341,869	16,166	84%
61		430,520		2,577	344,285	2,898	81%
45	482,773			290,047	35,126	62,192	80%
62		358,159			260,861		73%
21		518,356		9,860	352,442	11,113	72%
22		608,699		2,239	385,183	8,371	65%
43		382,761		1,702	223,007	5,296	60%

Node 54 (Solid wall): Higher income families in mortgage-owned terraced and converted flats, with mains gas heating, in urban areas (London)

This group of solid-walled properties are all in London and have mains gas heating. They are predominantly terraced houses (45%) or converted flats (31%) occupied by families (couples with dependent children (41%)) or single adults (22%). The household reference person (HRP) is between the ages of 35 and 54 and in full time employment. The majority (60%) own their property with a mortgage. This is a higher income node with around half in the highest income quintile.

Node 10 (Off-gas and Solid wall): Low income single adults in electrically heated terraced and converted flats in non-urban areas

All properties in this node rely on electricity for heating. Dwellings are predominantly terraced (37%) and converted flats (32%), with a high proportion in non-urban areas (20%) in the South West (24%). Occupants are mainly single adults without children at home and a high proportion privately rent (43%). There is a mix of age ranges and employment status, though a slightly higher proportion of elderly/retired compared to the national average. This is a relatively low income group of householders with around 30% in the lowest income quintile.

Node 53 (Solid wall): Private-renting young professionals in London

Similar to node 54, being solid-walled terraced (48%) and converted flats (30%) all in London, with mains gas heating. However occupants are young (52% under 35) couples (without children) or HMO's, working full or part-time (with some still in full time education). This mixed working status is reflected in the mix of incomes with 25% in quintile 1 and 29% in quintile 5.

Node 12 (Off-gas): Elderly retired in detached houses and bungalows in rural areas with oil central heating

This node is classed by the model to be off-gas only, but does in fact contain some solid walled properties as well (61% are off-gas only, 28% both off-gas and solid wall). All households have oil central heating and the majority are detached houses (34%) or bungalows (31%) in rural areas (62% villages, 23% hamlets) of the East (29%) and South West (22%) regions. Occupants are mainly over 65 (51%) and retired, with a higher than average disabled or with long-term illness (41%). Whilst this is not high-earning group of households (none in decile 7 or above and 30% below the 60% median income threshold), given that 60% of properties are owned outright this group may be considered 'asset-rich'.

Node 13 (Off-gas): High income 'empty-nesters' in detached houses in rural areas with oil central heating

Like node 12 above, the CHAID model classes this group as off-gas only, but some 38% are actually off-gas and solid-walled. Property characteristics are similar to node 12, but occupants fall into the slightly younger age-bracket: All households again have oil-fired heating and are mainly detached houses (59%) in rural areas (55% villages, 32% hamlets). Occupants are mainly couples, either still with children at home, or 'empty-nesters' nearing the age of retirement (54% aged 45-64 and 68% in full-time employment). Occupants own their property (49% with a mortgage, 40% outright) and, being pre-retirement age, are relatively high earners with 58% in the top income quintile.

Node 51 (Solid wall): Working-age couples and families in terraced houses in urban and fringe areas

The group consists mainly of terraced houses (64%) with mains gas heating in urban and fringe areas (of the Midlands, East or South West regions). Occupants are mainly younger (62% under 45) couples, some with children (41%). All own their property with a mortgage and the majority are in full-time employment (83%), as such this is not a low-income node, with 53% being in decile 8 and above.

Node 50 (Solid wall): 'Low-income', young single or HMO's privately renting in urban areas

This group largely represents students: occupants are young (21% under 25, 26% 25-34) privately renting (83%), either living alone (25%) or in multi-person households (23%). They live in terraced houses and converted flats, in urban areas (but none in London). Less than half are working full-time, with a high proportion (compared to the population as a whole) being in full-time education (10%), 'other' inactive (14%) or unemployed (9%). As such, this appears a low income node (around 50% in quintile 1). However, the nature of this group suggests householders may have alternative sources of income (e.g. parents, student loans etc).

Node 46 (Off-gas): Single adults in rented purpose-built, electrically heated flats

All households in this group are in electrically heated, purpose-built flats, in urban areas, largely in London and the South East. Occupants are mainly single adults, either young (29% aged 25-34) and working full-time or older and retired (33%), who privately (30%) or socially rent (20%). As such this is a mixed income node, but tending towards lower income.

Node 11 (Off-gas): Low income, social renters in electrically heated properties

Whilst identified as off-gas by the model, in fact 12% of households in this node are both off-gas and solid-walled properties. Similar to the node above, all are electrically heated and occupants are mainly single adults. However, there are a higher proportion of social renters (36%) and retired occupants (39%). Though still mainly purpose-built flats (62%), there are almost double the national average of bungalows (quite likely reflecting the higher proportion of older residents in this group) and properties are in both urban and fringe areas. This is a relatively low income group with over a third (36%) in receipt of benefits.

Node 23 (Solid wall): Young professionals and students in terraced houses in Yorkshire and the Humber

This node is unique as being 100% in Yorkshire and the Humber. Householders are younger (12% under 25), living in terraced houses, which they own with a mortgage (39%) or privately rent (29%). Properties have mains gas heating are in urban and fringe areas of the region. There is a mix of employment status, though 58% work full-time and 4% are students (both higher than national average).

Node 52 (Solid wall): Retired living in terraced houses which they own outright

A of mainly retired single (30%) or couple (28%) householders who own their property (mainly terraced houses) outright, living mainly semi-rural (34% non-urban) areas in the North East and South West regions.

Node 61 (Solid wall): High income families in London

This is a high income (42% in quintile 5) group of working (100% of HRPs in full-time employment) families, living in terraced and semi-detached properties, all in London. Occupants mainly own their home with a mortgage.

Node 45 (Off-gas): Single adults in electrically heated bungalows/houses in rural areas

Whilst the CHAID model identifies this group as off-gas, 13% of households are actually both off-gas and solid-wall. There is double the national average of bungalows (20%) and all properties are electrically heated, mostly in rural areas (22% in villages). Nearly two thirds are single adult households, but with equal proportions under and over the age of retirement. As such there is a mix of ages, working status (36% retired, 47% working full-time) and tenures – 34% are owned outright, 25% socially rented. This is a relatively low income node, with 25% in the lowest income quintile, though some may be asset rich (being home owners).

Node 62 (Solid wall): Low-income, not working London

All households are in London, in terraced houses and purpose-built flats. Occupants are mainly older, with 52% being retired and none working full-time, although a higher proportion are unemployed or not working, reflecting the status of the working-age residents in this group. Half own their property outright; 23% are in social-rented accommodation. A higher than average proportion are registered disabled or long-term sick (13% and 39% respectively) and in receipt of housing benefit (44%). As such, this represents a low-income group.

Node 21 (Solid wall): High income, working age families or couples in the South East

This represents a high income group of full-time employed, 35-44 year olds, living in terraced houses and converted flats in the South East. A higher than average proportion is in villages (13%). Occupants either own their property with a mortgage (47%) or privately rent (26%).

Node 22 (Solid wall): Working age mixed occupants in terraced houses in urban areas of the North West

This represents a mixed occupancy and mixed income node of working-age owner occupiers (with mortgage) and private renters, living in terraced houses in urban areas of the North West.

Node 43 (Solid wall): Young working age, living in semi-detached houses, owned with a mortgage in the West Midlands

Semi-detached (48%) and terraced (36%) houses in urban areas of the West Midlands. There is a mix of occupancy though working age couples dominate slightly, most being in the younger age bracket (21% aged 25-34) and own their property with a mortgage. Though most are in full-time employment, this is not a high income group.