Ministry of Housing, Communities & Local Government

English Housing Survey

Energy efficiency, 2016

50th Anniversary ENGLISH HOUSING SURVEY 1967 - 2017

Contents

Introduction and main findings

1. The English Housing Survey (EHS) is a national survey of people's housing circumstances and the condition and energy efficiency of housing in England. In its current form, it was first run in 2008-09. Prior to then, the survey was run as two standalone surveys: the English House Condition Survey and the Survey of English Housing. It is one the longest standing surveys in government, with 2017 marking the 50th anniversary since the first survey in 1967.

2. The report is split into three chapters. The first chapter presents an overview of the energy efficiency of the housing stock in 2016 and how this has changed over the previous 20 years. It also discusses smart meters and subjective overheating.

3. Chapter two provides information on trends in different energy efficiency measures and characteristics such as heating systems. It also covers dwelling characteristics such as the type of wall construction and wall finish which impact on current energy efficiency and on the potential to improve it.

4. Chapter three focuses on homes with the poorest energy efficiency in 2016 and examines their potential for improvement. It also discusses dwellings that may be hard-to-treat with cavity and solid wall insulation, and with loft insulation.

Main findings

The energy efficiency of the English Housing stock has increased over the last two decades. This increase was evident in all tenures.

- In 2016, the average SAP[1] rating for all homes was 62, up from 45 in 1996. The proportion of dwellings in the highest SAP energy efficiency rating (EER) bands, A to C, has increased considerably between 1996 and 2016, from 2% to 30%.
- In 2016, private rented homes had a similar average rating (60) as owner occupied homes (61), but a lower average rating than social rented homes (67). In 1996, private rented homes had the lowest rating (40), with owner occupied homes following (44); social rented homes had the highest (49).

Over the same period, and across all tenures, the proportion of dwellings in the lowest energy efficiency bands F or G has decreased.

- Between 1996 and 2016 the proportion of dwellings in the lowest F or G bands fell from 29% to 5%.

[1] SAP is the Standard Assessment Procedure for assessing energy efficiency of dwellings. For further details, please see the glossary.

- The proportion of private rented homes in the F or G bands fell from 39% to 7%. The proportion of owner occupied homes fell from 30% to 5% while the proportion of social rented homes fell from 20% to 1%.

Private rented sector stock is over-represented among the one in twenty homes which have the worst energy efficiency rating.

- Of the estimated 1.1 million homes with the worst energy efficiency ratings (F or G), privately rented homes were over-represented: they comprised 28% of such homes, but only 20% of the total housing stock. In contrast the social sector was under-represented, comprising just 4% of these homes (but 17% of the total housing stock).

Around one in fifteen privately rented homes have the poorest energy efficiency rating (F or G), most of which failed the Decent Homes Standard. These dwellings were more likely to be built before 1919, converted flats or rural homes. A lower proportion had central heating or one of the more energy efficient type of boilers.

- 7% of homes in the private rented sector were in SAP bands F or G. Most (93%) of these energy inefficient private rented homes failed to meet the Decent Homes Standard.
- Almost two thirds (64%) of these 320,000 homes were built before 1919. Converted flats, which were predominantly built before 1919, made up almost one quarter (24%) of privately rented homes in SAP bands F or G but only 10% of the sector's other (A to E rated) homes. Rural homes, which contain a higher proportion of older homes compared with urban and suburban areas, formed a higher proportion of the least energy efficient private rented homes (36%) than they did of the other private rented stock (10%).
- Only 36% of private rented homes with the poorest energy efficiency were centrally heated compared to 87% of private rented homes in bands A to E. Almost two thirds (64%) of band F or G privately rented homes did not have a boiler for their water heating, compared with only 15% of homes in bands A to E. Of the F or G homes with boilers, only 12% had the more energy efficient condensing or condensing combination boilers, compared with 71% in the private rented sector as a whole.

Many dwellings have features that may make cavity wall insulation, solid wall insulation or loft insulation more difficult to install.

- Of the 21% of all dwellings (5 million) with uninsulated cavity walls, 44% (2.2 million) had uninsulated walls which were harder to treat (using the ECO definition of hard to treat cavity walls).
- In 2016, 35% of all dwellings (8.2 million) could possibly have some form of (external or internal) solid wall insulation installed. This included not only those with uninsulated solid walls, but other types of non-cavity walls such as system built and timber frame dwellings and dwellings classed as having harder to treat

cavity walls, for which the type of insulation applied to solid walls provides a potential alternative insulation option. Of these, 7.0 million (85%) had hard to treat walls.

- In 2016, 87% of dwellings (20.7 million) had a loft. 36% of dwellings (8.6 million) could possibly have loft insulation installed or upgraded, as the existing level of insulation was 150mm or less. The presence of a loft and its type will impact on the relative ease of fitting insulation in the roof space. For example, the installation or upgrading of loft insulation could be more difficult for dwellings with a loft with fully boarded floor across the joists, a habitable room in the roof, or a shallow pitch or flat roof. Almost half (46%) of these homes, had lofts that could be harder to upgrade.

The most common form of space heating is gas central heating, the prevalence of which has remained stable since 2013. Further growth is restricted by the proportion of homes without a mains gas supply.

- The proportion of dwellings with gas central heating steadily increased from 73% in 1996 to 85% in 2013 but has since remained stable, and remains 85% in 2016. Further growth is restricted by the proportion of homes without a mains gas supply (14% in 2016).

Central heating systems using boilers and radiators tend to be fairly new, with a third of the boilers in these systems less than three years old. In contrast, almost two thirds of warm air systems and storage radiators are over 12 years old.

- Central heating systems using boilers and radiators were the newest form of heating systems, with 31% of the boilers in these systems less than 3 years old and a further 47% between 3 and 12 years old. This reflects primarily that 79% of gas central heating systems were 12 years old or less.
- In contrast, the oldest heating systems were warm air systems with 66% over 12 years old, followed by storage radiators (59%) and communal heating systems (41%).

The most common type of energy improvements work done by households in the last 12 months was maintenance or replacement of parts of the central heating system.

- The three most common improvements were servicing the central heating boiler (36%), replacing central heating boiler (11%) and replacing central heating thermostat (6%).

In 2016, 4% of homes had a photovoltaic panel, unchanged from 2015 but up from 2010.

- Across the whole stock there were an estimated 856,000 homes (4%) with photovoltaic panels.

Acknowledgements and further queries

5. Each year the English Housing Survey relies on the contributions of a large number of people and organisations. The Ministry of Housing, Communities and Local Government (MHCLG) would particularly like to thank the following people and organisations, without whom the 2016-17 survey and this report, would not have been possible: all the households who gave up their time to take part in the survey, NatCen Social Research, the Building Research Establishment (BRE), CADS Housing Surveys and the Department for Business, Energy and Industrial Strategy.

6. This report was produced by Tad Nowak, Ana Slater and Helen Garrett at BRE in collaboration with NatCen Social Research and MHCLG.

7. If you have any queries about this report, would like any further information or have suggestions for analyses you would like to see included in future EHS reports, please contact ehs@communities.gsi.gov.uk.

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Ministry of Housing, Communities & Local Government

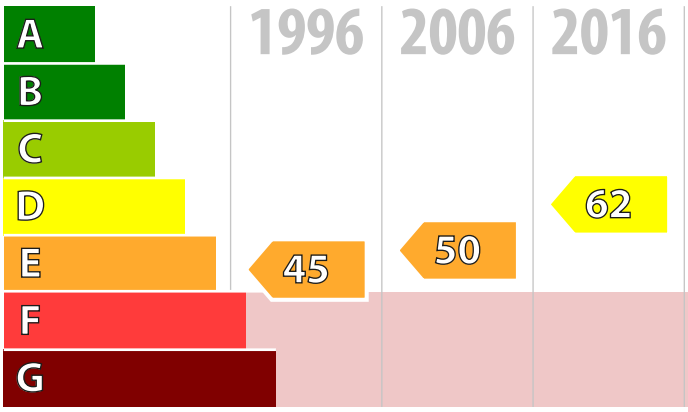
50th Anniversary ENGLISH HOUSING SURVEY 1967 - 2017

NatCen Social Research

bre

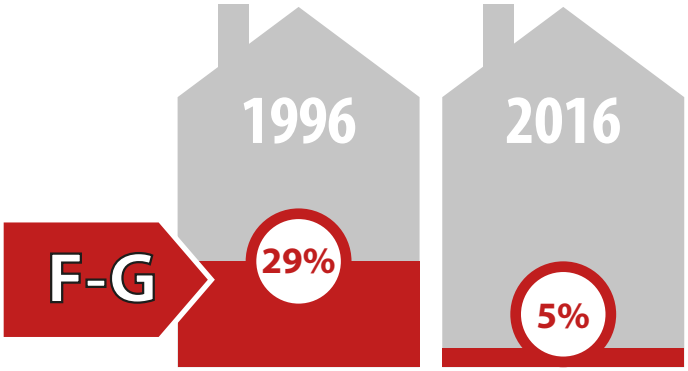
Energy Efficiency

The energy efficiency of homes has improved over the last two decades.

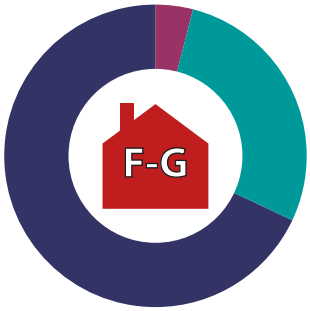


The figures are the average SAP rating.

In the last two decades the proportion of dwellings in the lowest energy efficiency bands F or G has decreased.



Of the one in twenty homes with an F or G rating:



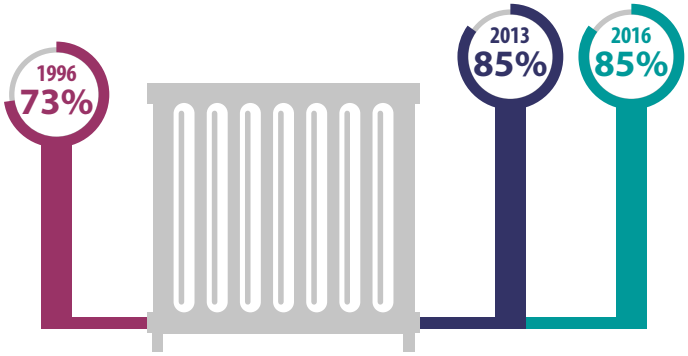
68% were owner occupied homes

28% were private rented sector homes

4% were social rented sector homes

Central heating

The most common form of space heating is gas central heating, but the prevalence of this has remained stable since 2013.



The three most common types of energy improvements work in the last 12 months were maintenance or replacement of parts of the central heating system.

36% serviced the central heating boiler

11% replaced the central heating boiler

6% replaced the central heating thermostat

See English Housing Survey *Energy Efficiency report, 2016* **for more information.**

Chapter 1

Energy efficiency of the English housing stock

1.1 This chapter presents an overview of the energy efficiency of the housing stock in 2016 and how this has changed over the previous 20 years. It also discusses subjective overheating and smart meters.

1.2 The English Housing Survey uses the Government's Standard Assessment Procedure (SAP 2012) to monitor the energy efficiency of homes. It is an index based on calculating annual space and water heating costs for a standard heating regime and is expressed on a scale of 1 (highly inefficient) to 100 (highly efficient with 100 representing zero energy costs)[2].

1.3 In 2016, the average SAP rating (also known as the Energy Efficiency Rating or EER) for all homes was 62. Private rented homes had a similar average rating (60) to owner occupied homes (61), but a lower average rating than social rented homes (67). From 1996 to 2016 average SAP increased from 45 to 62. The increase was evident in all tenures[3].

Trends in EPC rating bands

1.4 In 2016, just under a third of homes (30%) were in the most energy efficient rating band, A to C, on the cost-based SAP rating measure (the energy efficiency rating, EER). Around half (51%) of social rented homes had A to C ratings, compared with 27% of private rented homes and 25% of owner occupied homes, Annex Table 1.1.

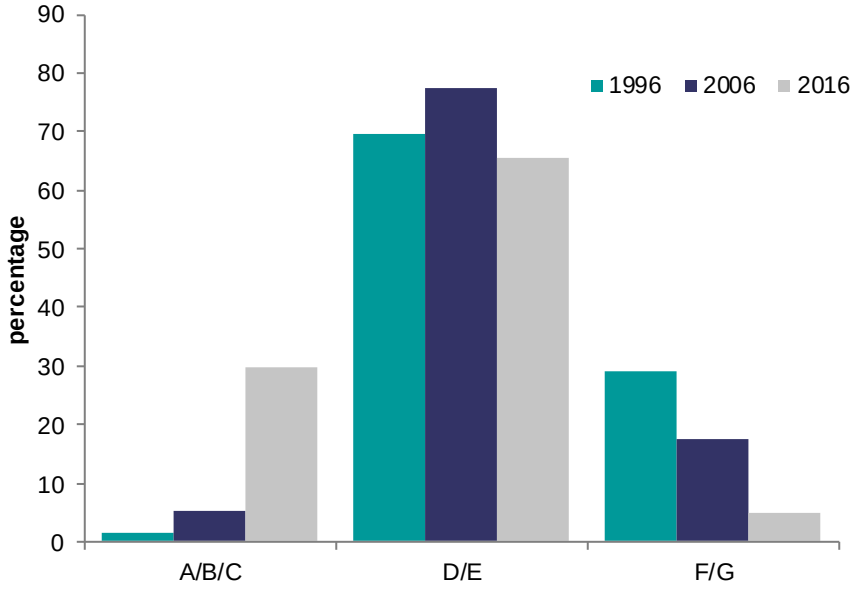
1.5 Private rented sector stock is over-represented among the one in twenty homes which have the worst energy efficiency rating. Around 1.1 million (5%) homes in England had a SAP energy efficiency rating band of F or G in 2016. Of those, 28% (320,000) were in the private rented sector. That represents 7% of the overall PRS stock.

[2] To ensure that the energy performance findings in this report are as compatible as possible with energy performance assessments and certificates issued in England during 2016-17, findings presented in this report were calculated using Reduced Data SAP (RdSAP) version 9.92. RdSAP is the version of SAP used for existing buildings. Please see the SAP entry of the glossary for further details.

[3] English Housing Survey Headline Report 2015-16 Figure 2.8.

1.6 The proportion of dwellings in the highest SAP energy efficiency rating (EER) bands, A to C, has increased considerably between 1996 and 2016, from 2% to 30%. Over the same period, the proportion of dwellings in the lowest F or G bands fell from 29% to 5%. This increase in energy performance was more marked between 2006 and 2016 than between 1996 and 2006, which is likely to have been driven by the introduction of new building regulations and energy efficiency policy initiatives from around 2002 onwards, Figure 1.1.

Figure 1.1: Energy efficiency rating bands, 1996, 2006 and 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 1.1
Sources:
1996 and 2006: English House Condition Survey, dwelling sample;
2016: English Housing Survey, dwelling sample

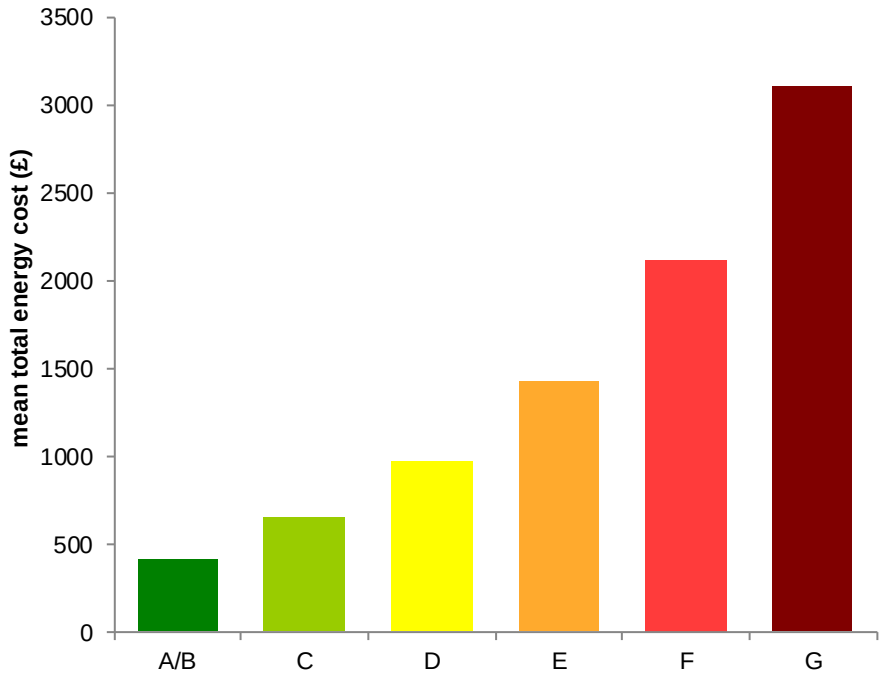
1.7 In 1996, a higher proportion of private rented homes (39%) were in F or G bands compared with the proportion of owner occupied (30%) and social rented (20%) homes. By 2016, the proportions of the tenures in F or G bands had decreased to 7%, 5% and 1%, respectively. The most notable fall in the prevalence of F or G banded homes occurred in the social sector where energy performance improvements were undertaken as part of the Decent Homes programme in addition to other planned housing improvement and maintenance programmes. The fall in the proportion of the most energy inefficient homes in the private rented sector may reflect the growth of the numbers of newer homes in the tenure[4].

1.8 Increasing the energy efficiency rating of a dwelling could make a significant difference to the cost of energy. In 2016, the difference between the modelled

[4] See Live Table DA1101 for housing stock by tenure, https://www.gov.uk/government/statistical-data-sets/amenities-services-and-local-environments

running costs of a typical Band E and F home was around £700 per year. The annual modelled running costs of a Band C rated home was around £310 lower than the average Band D rated home and about £770 less than the average Band E rated home. Actual spend varies from modelled amounts and is often lower than modelled spend, as the model assumes people heat their homes to a set standard which may not be achieved in reality, Figure 1.2[5].

Figure 1.2: Average modelled annual cost of energy in homes by energy efficiency rating, 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 1.2
Source: English Housing Survey, dwelling sample

Subjective overheating[6]

1.9 During the physical survey of the home, occupants were asked whether their home got uncomfortably hot even when their heating was turned off and the windows were open. Overall, 1.4 million (6%) households stated that at least one part of their home got uncomfortably hot, Annex Table 1.3.

[5] A similar chart was published on page 73 of The Clean Growth Strategy (October 2017, HM Government, https://www.gov.uk/government/publications/clean-growth-strategy), using estimated energy costs based on BREDEM, which takes into account factors such as actual occupancy levels and cooking and appliance use. Therefore, the mean costs, based on SAP, for each energy efficiency band are generally lower in Figure 1.2 than in the Clean Growth Strategy chart.

[6] Analysis excludes all vacant homes.

1.10 Subjective overheating did not vary by tenure or the energy efficiency rating of the home. The newest homes built after 1990 were more likely to be reported as uncomfortably hot (9%) compared with homes built prior to 1980 (6% or less, depending on the period when built).

1.11 Homes with wall types other than solid or cavity walls (for example, timber framed, concrete or steel) were more likely to feel uncomfortably hot (13%).

1.12 Homes located in London and the South East were more commonly reported as uncomfortably hot (7%) compared with homes in northern areas (6%) and in the rest of England (5%).

1.13 This year's findings on subjective overheating are very similar to those from last year[7].

Smart meters

1.14 The English Housing Survey captures information on the presence of gas and electricity smart meters. The government has a target that, by the end of 2020, all households should have been offered a smart meter by their energy supplier.

1.15 In 2016, 9% of homes with mains electricity had an electricity smart meter and 8% of dwellings with mains gas supply had a gas one. For further details, please see EHS Headline Report 2015-16[8].

[7] Reported in the English Housing Survey Potential for Stock Improvements report, 2015

[8] English Housing Survey Headline Report 2015-16, Figure 2.13. The EHS results are broadly in line with smart meter statistics from the Department for Business, Energy and Industrial Strategy (BEIS) which show that 5.76 million electric and gas meters (or 12% of all meters) were operated in smart mode by large energy suppliers on 31 March 2017. Differences are likely to reflect the differing time periods for data collection and the definition of smart meters (EHS surveyors may not be able to differentiate between the most modern 'SMETS-compliant' smart meters and 'smart-type meters' or between meters operating in smart and non-smart mode). See BEIS (2017) Smart Meters Quarterly Report to end March 2017 Great Britain for further information: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/615057/2017_Q1_Smart_Meters_Report_final.pdf.

Chapter 2

Energy efficiency measures in English homes

2.1 This chapter explores trends in energy efficiency measures in the English housing stock over the past 20 years. The first part focuses on trends in the main space and water heating systems. The chapter then examines the prevalence of renewable energy and double glazing across the English housing stock.[9] As the construction method and materials impact on the relative ease of insulating walls, the chapter profiles the types of walls and wall finish present in the stock and how this has changed since 1996. Finally, the chapter examines the types of work carried out by homeowners and landlords to improve the energy efficiency of their dwelling.

Heating and hot water systems

Heating systems

2.2 The most common form of space heating was gas central heating. The proportion of dwellings with gas central heating steadily increased from 73% in 1996 to 85% in 2013 but has since remained stable, remaining at 85% in 2016. Further growth is restricted by the proportion of homes without a mains gas supply (14% in 2016[10]), Annex Table 2.1.

2.3 Amongst the less common heating systems, the most notable changes were:

- In 1996, room heaters were the second most popular heating system in England (12%) whereas in 2016 they provided the main heating system in only 3% of dwellings. A large reduction in homes with gas room heaters, from 9% to less than half a per cent, explains most of the decreased use of room heaters.

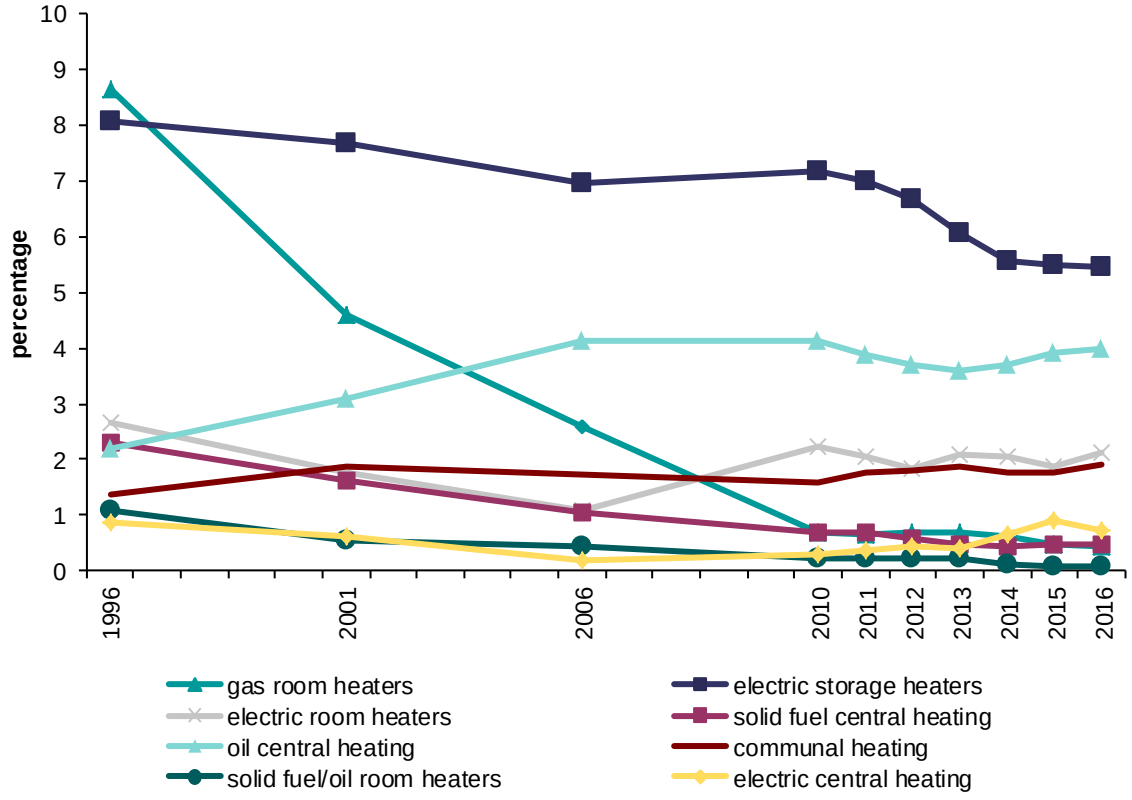
- Over the same period, the use of electric storage heaters decreased from 8% to 5%.

[9] For further information on solid wall insulation and cavity wall insulation, please see the English Housing Survey Headline Report, Fig 2.11. https://www.gov.uk/government/statistics/english-housing-survey-2016-to-2017-headline-report.

[10] See Live Table DA2201, https://www.gov.uk/government/statistical-data-sets/amenities-services-and-local-environments

- While solid fuel central heating decreased from 2% in 1996 to less than 1% in 2016, oil fuelled central heating increased from 2% to 4%, Figure 2.1.

Figure 2.1: Main changes for less common heating types, 1996 to 2016



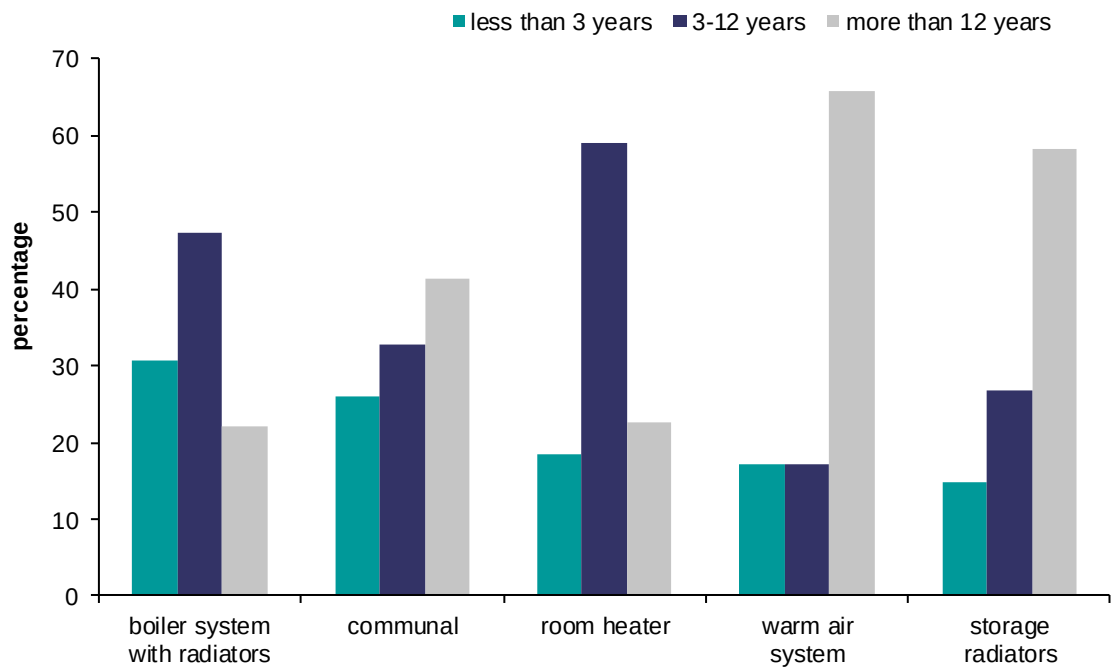
Base: all dwellings
Note: underlying data are presented in Annex Table 2.1
Sources:
1996 to 2007: English House Condition Survey, dwelling sample;
2008 onwards: English Housing Survey, dwelling sample

2.4 The age of different types of heating systems varied. Central heating systems using boilers and radiators were the newest form of heating systems, with 31% of the boilers in these systems being less than 3 years old and a further 47% between 3 and 12 years old. This reflects primarily that 79% of boilers in gas-fuelled central heating systems were 12 years old or less.[11] In contrast, the oldest heating systems were warm air systems (66% over 12 years old), followed by storage radiators (58%) and communal heating systems (41%), Figure 2.2.

[11] Please note that this figure comes from the second half of AT2.2.

2.5 In 2016, almost two thirds of room heaters (59%) were between 3 and 12 years old. This reflects that almost two thirds (65%) of electric room heaters are between 3 and 12 years old, Annex Table 2.2.[12]

Figure 2.2: Age of main heating system, 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 2.2
Source: English Housing Survey, dwelling sample

Hot water systems

2.6 Condensing boilers are generally the most efficient boiler types and since the mid-2000s have been mandatory for new and replacement boilers.[13] As expected, the proportion of dwellings with condensing or condensing combination boilers has increased considerably since 2001. In 2001, just 2% of homes had these types of boilers but by 2016 this proportion had risen to 63%[14].

2.7 As combination boilers provide hot water from the central heating without a separate cylinder, the proportion of homes with central heating with a

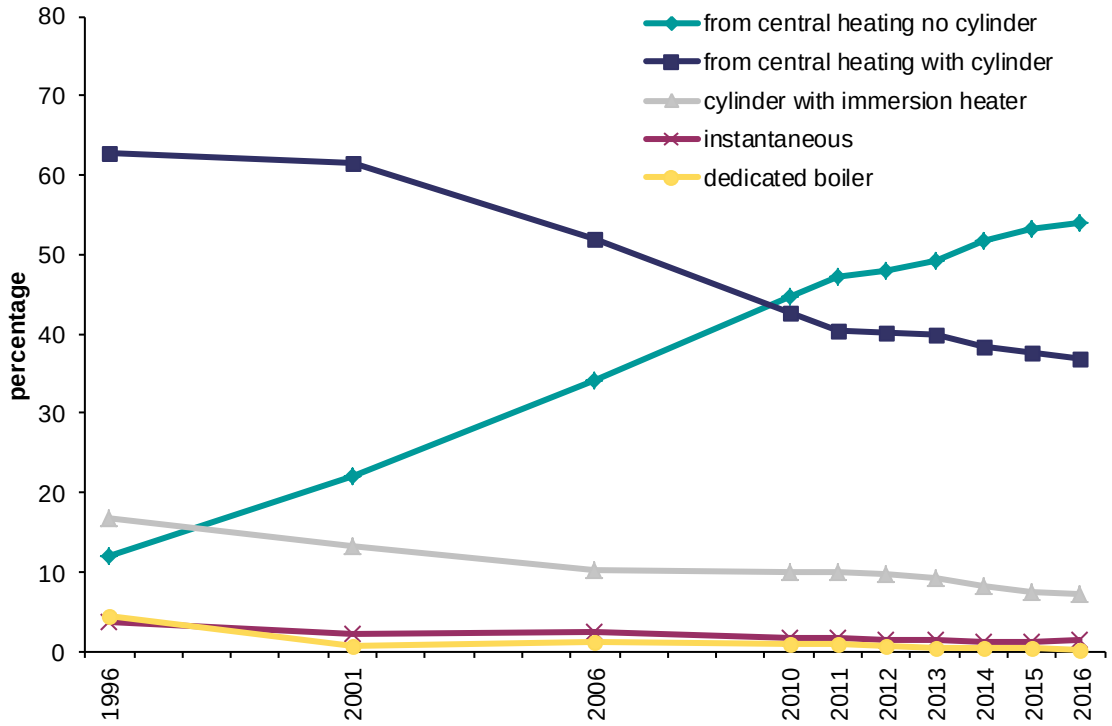
12 Please note that this figure comes from the second half of AT2.2.

13 https://www.planningportal.co.uk/info/200130/common_projects/7/boilers_and_heating/2

14 EHS 2015-16 Headline Report, Figure 2.10 at https://www.gov.uk/government/statistics/english-housing-survey-2016-to-2017-headline-report

separate hot water cylinder decreased from 62% in 2001 to 37% in 2016. The proportion of dwellings with a hot water cylinder and immersion heater as its primary means of water heating has also decreased steadily from 17% in 1996 to 7% in 2016, Figure 2.3.

Figure 2.3: Homes with different types of hot water system, 1996 to 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 2.3
Sources:
1996 to 2007: English House Condition Survey, dwelling sample;
2008 onwards: English Housing Survey, dwelling sample

Solar hot water heating and photovoltaic panels

2.8 Feed-in Tariffs were introduced in 2010 to provide small scale generators of electricity, such as those from small photovoltaic (PV) panels, with tariff payments on both generation and export of renewable and low carbon electricity. The level of Feed-in Tariff available has reduced over time.[15]

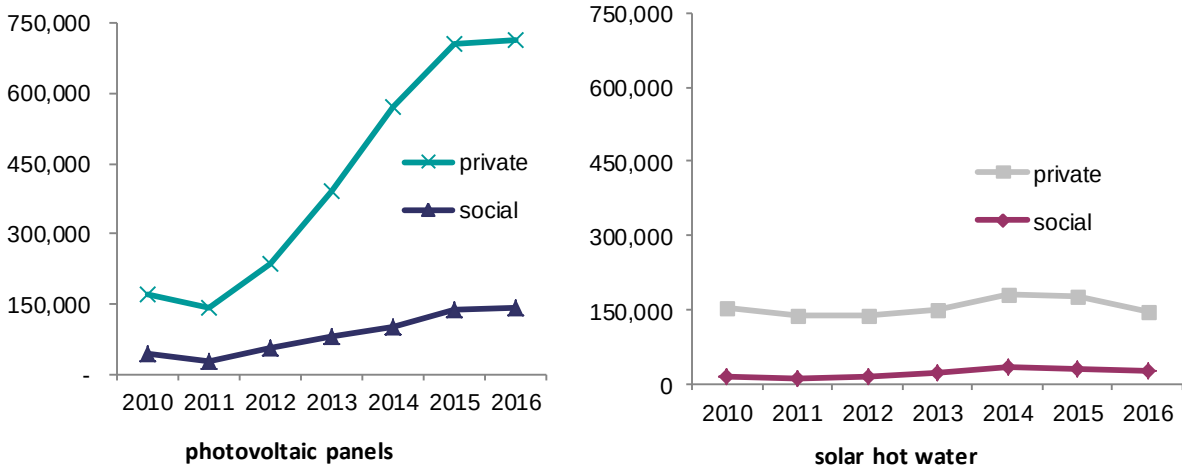
2.9 Across the whole stock in 2016, there were an estimated 856,000 homes (4%) with photovoltaic panels and 170,000 homes (1%) with solar panels for hot water, Annex Table 2.4.

[15] https://www.gov.uk/feed-in-tariffs and https://www.ofgem.gov.uk/environmental-programmes/fit/about-fit-scheme/changes-fit-scheme

2.10 Although the proportion of dwellings with solar hot water panels has remained constant since 2010, there has been an increase in the proportion of dwellings with photovoltaic panels, though the proportion had not changed since 2015. In 2016, 4% of homes had a photovoltaic panel, unchanged from 2015 but up from 1% in 2010.

2.11 The number of private sector dwellings with photovoltaic panels increased from around 172,000 in 2010 to around 712,000 in 2016. In the social sector the number of dwellings with photovoltaic panels increased from around 45,000 to around 144,000. This represents an increase from 1% to 4% in both the private and social sector stock, Figure 2.4.[16]

Figure 2.4: Number of homes with solar hot water heating and photovoltaic panels, by tenure, 2010 to 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 2.4
Source: English Housing Survey, dwelling sample

Heat pumps

2.12 The number of dwellings with a heat pump system was low. In 2016, around 76,000 dwellings (less than 0.5% of the stock) had heat pumps for space and/or water heating, Annex Table 2.5[17].

[16] In earlier reports, the proportions were given out of the entire stock, i.e. they represented the proportion in the entire housing stock that is in a particular and has photovoltaic panels or solar water heating. This year we have changed this so that the figures present the proportion with the renewable technology *within* the tenure.

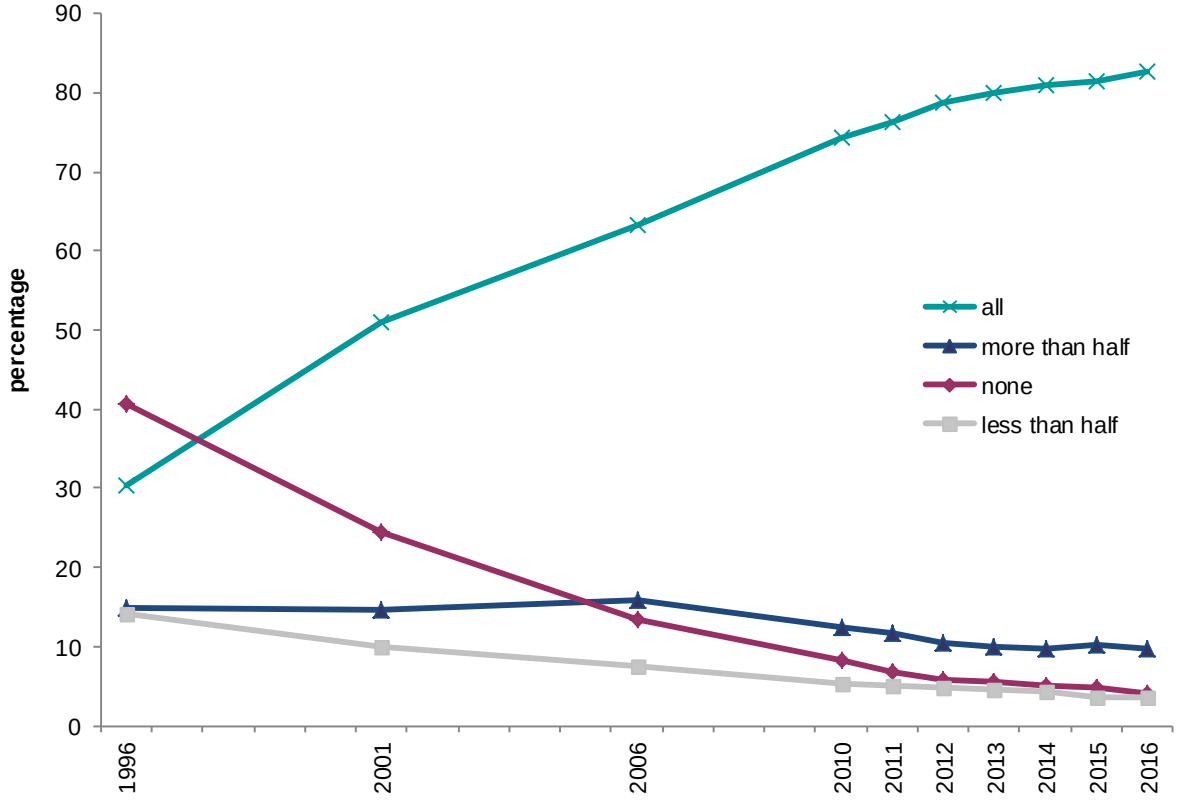
17 These figures are from the physical survey. The quantities of energy improvement work done that were provided by respondents differ from the findings of the physical survey e.g. for heat pump installation and solid/cavity wall insulation (see later in this chapter). These differences are likely to be due to interview respondents' understanding of the type of 'work done'.

Characteristics of windows and walls

Double glazing

2.13 Since 2006 Building Regulations have required that all windows in new dwellings and any that are replaced in older dwellings are double glazed. The proportion of dwellings completely double glazed increased substantially even before these changes in Building Regulations. In 2016, the majority (83%) of homes were fully double glazed and a further 10% had more than half of their windows double glazed, Figure 2.5.

Figure 2.5: Extent of double glazing, 1996 to 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 2.6
Sources:
1996 to 2007: English House Condition Survey, dwelling sample
2008 onwards: English Housing Survey, full dwelling sample

2.14 While there has been a significant increase in the proportion of homes with full double glazing over the last 20 years, the rate of increase has slowed somewhat. Between 2011 and 2016, the proportion of homes with double glazing across the whole dwelling increased by 7 percentage points.

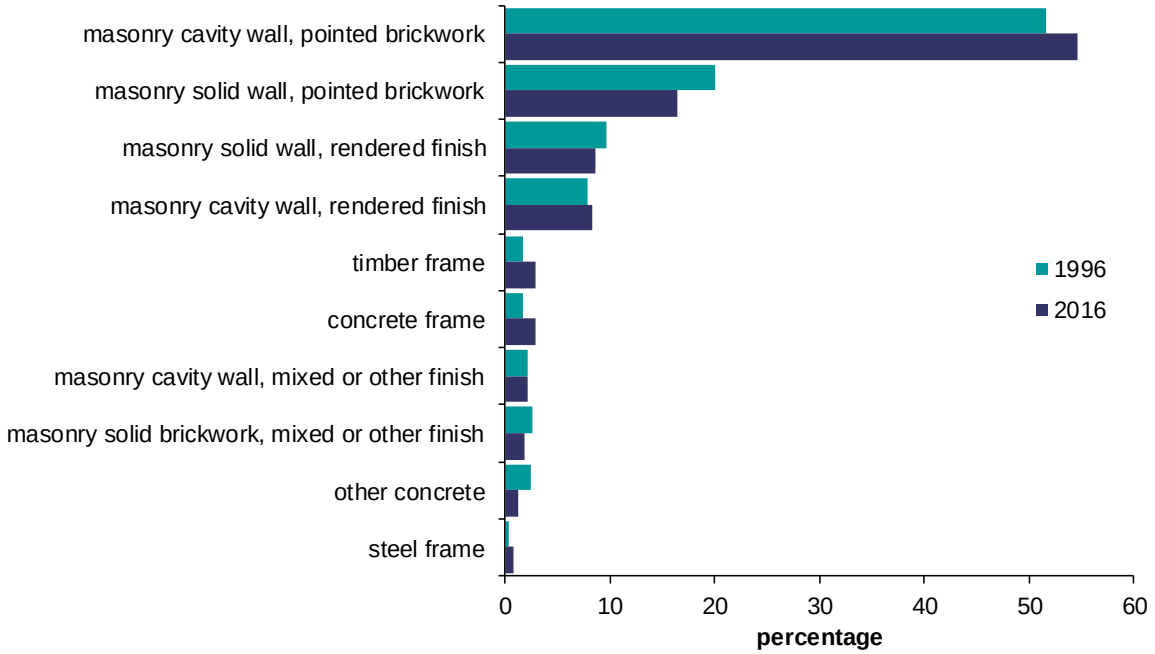
Wall construction

2.15 In both 1996 and 2016, the most common construction type was masonry cavity walls with pointed brickwork, increasing from 52% in 1996 to 55% in 2016, Figure 2.6.[18]

2.16 The second most common type of construction in 2016 was masonry solid wall with pointed brickwork (16%), down from 20% in 1996, as new homes are rarely built with masonry solid walls.

2.17 Non-masonry dwellings (timber, concrete and steel frame construction) increased from 6% of all dwellings in 1996 to 8% in 2016. Both timber framed and 'non-traditional' construction methods, such as concrete and steel framed structures, make the installation of additional wall insulation more problematic. For example, when insulating timber framed dwellings, it is necessary to ensure that damp and its associated timber decay are not triggered.

Figure 2.6: Construction type, 1996 and 2016



Base: all dwellings
Note: underlying data are presented in Annex Table 2.7
Sources:
1996: English House Condition Survey, dwelling sample;
2016: English Housing Survey, dwelling sample

[18] Masonry refers to brick, block, stone and flint.

Wall finish

2.18 The wall finish is the outer layer of the wall structure, with the construction material either left exposed (e.g. bricks) or covered (e.g. rendered). Walls with a predominantly non-masonry finish, such as walls finished with render, stone cladding or tiles may prove problematic when improving the energy efficiency of a home. For example, such wall finishes may give an uneven surface on which to attach external wall insulation.

2.19 Over the last 20 years the two most common types of wall finish in England have been masonry pointing and render. In 2016, masonry pointing and rendered finishing accounted for 75% and 19% of the stock, respectively. Other wall finishing methods such as shiplap timber, panels or mixed types remained relatively rare, used in only 5% of homes, Annex Table 2.8.

Wall insulation

2.20 Around half (49%) of homes in England had cavity or solid wall insulation, an increase from 38% in 2008.

2.21 The increase in wall insulation was mostly driven by a growth in the proportion of insulated cavity walls. Between 2008 and 2016, the proportion of dwellings with insulated cavity walls increased by over 9 % whereas solid wall insulation rose by only 2%.

2.22 Within the private sector, 68% of cavity walls were insulated compared with 7% of solid walls. Solid wall insulation is more prevalent in the social sector with 30% of solid wall dwellings insulated, but this remains below the proportion of insulated cavity walls in the tenure (72%). The EHS Headline Report 2016-17 examines the relationship between wall insulation and tenure in more detail and provides graphs of the trend over time[19].

Energy improvement works

2.23 Respondents were asked about any work done to their home in the last 12 months that improved energy efficiency[20].

2.24 Overall, 55% of households reported that at least one of the energy efficiency measures listed in Figure 2.7, had been carried out in the past 12 months. Both owner occupiers (58%) and social renters (56%) were more likely to

[19] For 2016 figures see Annex Table 2.12 in English Housing Survey 2016 to 2017: Headline Report, at https://www.gov.uk/government/statistics/english-housing-survey-2016-to-2017-headline-report

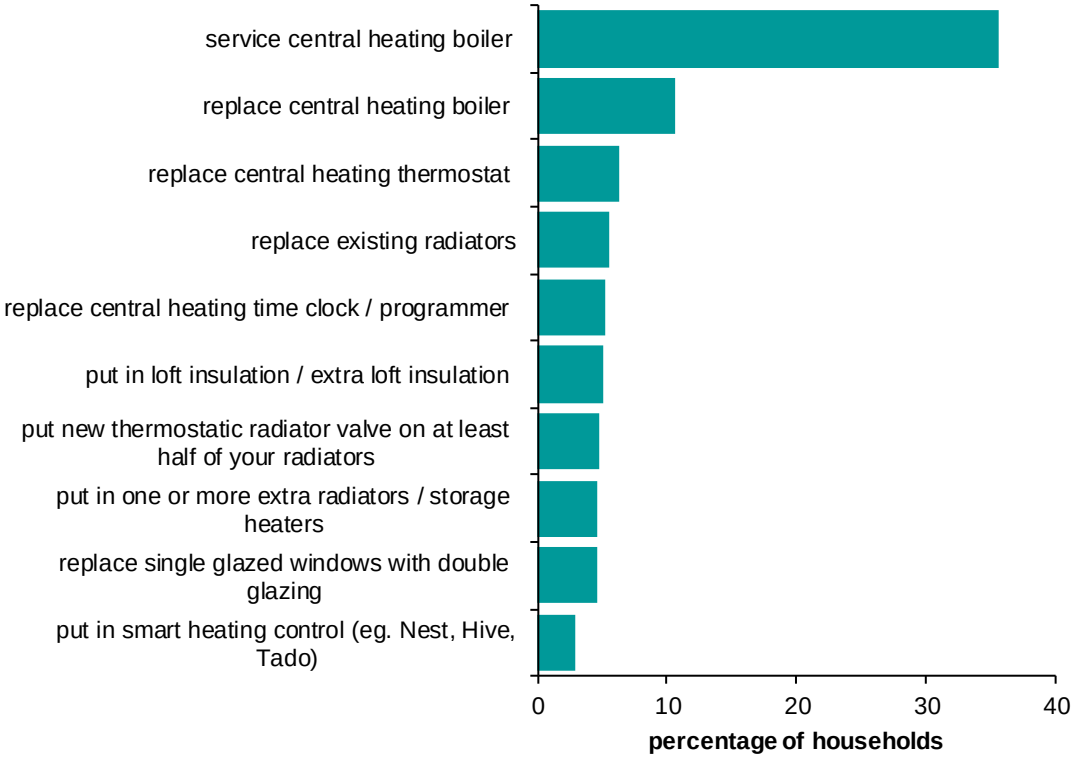
[20] The quantities of energy improvement work done that were provided by respondents differ from the findings of the physical survey e.g. for heat pump installation and solid/cavity wall insulation. These differences are likely to be due to interview respondents' understanding of the type of 'work done'.

have had energy efficiency work undertaken to their home than private renters (45%) Annex Table 2.9. However, some respondents may not be aware of work if they have lived in the property for less than 12 months,.

2.25 The three most common energy efficiency measures were servicing the central heating boiler (36%), replacing the central heating boiler (11%) and replacing the central heating thermostat (6%), Figure 2.7.

2.26 Four of the top 10 most common energy efficiency measures related to either installing or replacing a heating control, for example, replacing a central heating thermostat (6%) or putting in a smart heating control (3%).

Figure 2.7: Top ten most common energy efficiency improvements carried out over the past 12 months, 2016-17



Base: all households
Note: underlying data are presented in Annex Table 2.10
Source: English Housing Survey, full household sample

2.27 Owner occupiers who had not installed any of the listed heating related energy efficiency measures or put in photovoltaic panels in the last 12 months were asked if they had ever done these types of work. Just under one in five (18%) of owners, had done some such work over 12 months ago. The most common changes were to do with replacing or installing central heating systems, Annex Table 2.11..

Chapter 3

Hard to treat and energy inefficient properties

3.1 This chapter focuses on those homes that had the worst energy efficiency (SAP rating in bands F or G) in 2016, using the SAP 2012 methodology. It profiles these homes and examines their potential for improving energy performance. It also analyses where installing energy efficiency improvement measures could be more problematic (so-called 'hard to treat' homes). The chapter explores the degree of difficulty in installing three key types of energy saving improvements: solid wall insulation, cavity wall insulation and loft insulation[21].

3.2 In this chapter, there is a particular focus on the private rented sector. As of 1st April 2018, government regulations require private rented homes to have a minimum energy efficiency standard of Energy Performance Certificate (EPC) rating band E before they can be let on a new tenancy[22]. This requirement is subject to a limited number of exemptions.

The least energy efficient homes (SAP bands F or G)[23]

Profile of dwellings in SAP bands F or G

3.3 In 2016, there were around 1.1 million homes (5%) with the worst energy efficiency ratings (For G). Privately rented homes were over-represented in this group: they comprised 28% of such homes, but only 20% of homes with SAP bands A to E. In contrast the social sector was under-represented, comprising just 4% of these homes (but 18% of A to E rated homes). This reflects the generally newer housing stock in the social sector together with

[21] Additional findings relating to energy inefficient dwellings can be found in the Live Tables DA7101 to DA7104, https://www.gov.uk/government/statistical-data-sets/energy-inefficient-dwellings.

[22] DECC, Private Rented Sector Energy Efficiency Regulations (Domestic) https://www.gov.uk/government/publications/the-private-rented-property-minimum-standard-landlord-guidance-documents
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401381/Dom_PRS_Energy_Efficiency_Regulations_-_Gov_Response_FINAL__04_02_15_.pdf

[23] Chapter 2 of the 2012 EHS Energy Efficiency of English Housing Report provided information on the profile of the least energy efficient homes over time (1996 – 2012). As the findings on trends over time are unlikely to have changed markedly between 2012 and 2016, this section focuses on these homes in greater detail in 2016.

energy efficiency improvements already undertaken by social landlords, Annex Table 3.1[24].

3.4 Detached dwellings and converted flats were over represented in the least energy efficient homes (32% and 9% respectively) than they did of the other housing stock, whereas purpose built flats were under-represented (7%). The majority of the least energy efficient homes (63%) were built before 1919, compared with only 19% of homes in SAP bands A to E. The oldest homes are more likely to be of solid wall construction, which can be more expensive and complicated to insulate.

3.5 Dwellings in rural areas, which have a relatively high proportion of older homes, were over-represented: 50% were in bands F or G, while rural homes were only 16% of those in SAP bands A to E.

Profile of private rented sector homes in SAP bands F or G

3.6 As private rented homes are over-represented among the least energy efficient dwellings, this section looks at some characteristics of the 320,000 private rented homes in SAP bands F or G in 2016. This was 7% of all privately rented homes.

3.7 Almost two thirds of these 320,000 homes were built before 1919 (64%). Homes of that age were typically built with solid walls, which can be more difficult and expensive to insulate. This is one reason that three quarters (76%) of the least energy efficient privately rented homes had uninsulated solid walls. Converted flats, which were predominantly built before 1919, made up almost one quarter (24%) of privately rented homes in SAP bands F or G but only 10% of the sector's other (A to E rated) homes. Rural homes, which contain a higher proportion of older homes compared with urban and suburban areas, formed a higher proportion of the least energy efficient private rented homes (36%) than they did of the other private rented stock (10%), Annex Table 3.2.

3.8 Only 36% of privately rented homes with the poorest energy efficiency were centrally heated compared with 87% of privately rented homes in bands A to E, with a high proportion (40%) of these band F or G dwellings relying on room heaters for primary heating compared with 4% of A to E rated homes. The large majority of these room heaters were fuelled by electricity, a more expensive option for direct heating, Annex Table 3.3.

3.9 Almost two thirds (64%) of band F or G privately rented homes did not have a boiler for their water heating, compared with only 15% of homes in bands A to E. Of the F or G homes with boilers, almost two thirds (62%) had standard

[24] On the age of homes, see English Housing Survey Headline Report 2016-17, Figure 2.2.

floor or wall boilers. A far lower proportion (12%) had the more energy efficient condensing or condensing combination boilers, compared with 73% of private rented sector with A to E SAP ratings.

3.10 Almost half (49%) of band F or G dwellings had a loft, and of these 30% had no loft insulation. In contrast only 3% of private rented homes with A to E SAP ratings had no loft insulation.

3.11 The criteria assessed under the Decent Homes Standard include thermal comfort and also if the home has high risk of excess cold under the Housing Health and Safety Rating System assessment of potential hazards[25]. Most (93%) of these energy inefficient private rented homes failed to meet the Decent Homes Standard, although many of these homes are likely to have additional poor housing issues. Almost half, for example, had serious levels of disrepair (47%),[26] while the A to E rated private rented stock had much lower rates of non-decency (22%) and serious disrepair (18%), Annex Table 3.3.

Profile of households in the least energy efficient homes

3.12 Around 1.1 million households lived in homes with a SAP rating of F or G. Their demographic characteristics differed in some respects from those for other households in England with a SAP rating of A to E, Annex Table 3.4.

3.13 Households with dependent children were under-represented. For example, those where the youngest household member was under 5 years of age comprised 8% of households in the F or G rated homes but 12% of households in other homes. By contrast, households where the HRP was over 60 years of age were over-represented, accounting for 51% of households in the least energy efficient homes compared with 36% of households in other homes.

3.14 Ethnic minority HRP households were also under-represented, comprising 4% of households in the least energy efficient homes compared with 12% of households in other homes.

Profile of households in the least energy efficient private rented homes

3.15 Approximately 295,000[27] households lived in the least energy efficient private rented homes. Some key household groups who may be considered vulnerable were under-represented in these homes. Only 12% were occupied by households where the youngest child was less than 5 years of age and 6%

[25] See Glossary and Technical Report Chapter 5 Annex 5.5 for more details on HHSRS and the Decent Homes standard.

[26] Standardised repair costs of £35m² or more. See Glossary for further details of standardised repair costs.

[27] This number is less than the 320,000 for the whole stock which includes vacant homes.

were occupied by ethnic minority HRP households, while these types of households were 20% and 21% respectively of households in other private rented homes, Annex Table 3.5.

3.16 On the other hand, households where the HRP was aged 60 years or more were over-represented, comprising 25% of households in privately rented homes in SAP bands F or G but 13% of private renters in other homes.

Potential of installing EPC measures in the least energy efficient homes

3.17 This section examines the potential to install a range of energy efficiency measures in the least energy efficient homes (SAP bands F or G). The potential is compared with that in the rest of the housing stock. The range of measures considered by the model are those considered during an Energy Performance Certificate assessment.

3.18 The potential to benefit from each measure is modelled, where an Energy Performance Certificate assessment would recommend its installation. The model does not assess the relative ease of insulation or the cost-effectiveness of installation. However, each measure is only recommended for installation if that measure alone would result in the SAP[28] rating increasing by at least 0.95 points.

3.19 The methodology for modelling the potential improvements to dwellings was significantly updated for the 2015 EHS to better align it to the latest SAP methodology[29]. The new, larger set of efficiency measures has been retained in 2016.

3.20 The lack of many of these measures in SAP band F or G dwellings allows for a large potential for upgrade or installation in these homes when compared with the potential of those in bands A to E. For some measures, the difference is particularly large. For example for roof room insulation, increased insulation in the walls and roof of a habitable loft, around 68% of band F or G homes with rooms in the roof had potential to benefit from this measure compared with only 17% of equivalent band A to E homes. This is partly due to a prevalence of converted flats in bands F or G, a dwelling type that is more likely to include a room in the roof while being older and less well insulated, Annex Table 3.6.

[28] See EHS Technical Report, Chapter 5, Annex 5.5 for further details of SAP modelling.

[29] The new methodology includes many additional measures, a re-ordering of the sequence in which improvement measures are applied, some changes to criteria for individual improvement measures, the use of regional weather to calculate modelled EPC running costs and savings and a substantial revision to the methodology for calculating the costs of the improvement measures. Please see the Technical Report Chapter 5, Annex 5.5 and the EPC improvements modelling review for further details of the new modelling methodology.

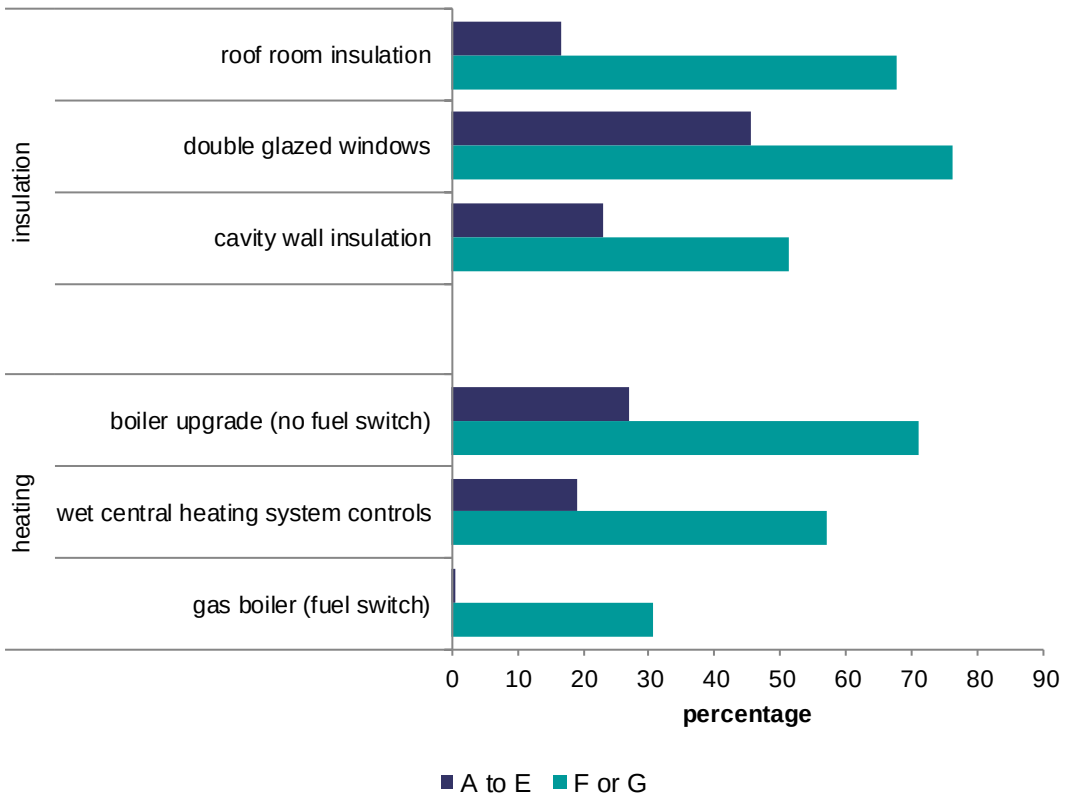
3.21 Similarly, half (50%) of F or G homes could potentially benefit from draught proofing compared with just 7% of other equivalent homes. Upgraded window glazing is recommended by the EPC model if less than 80% of a dwelling has double glazing. This measure could potentially benefit 76% of F or G homes, compared with 45% of those in bands A to E, Figure 3.1.

3.22 The EPC assessment can recommend a range of upgrades to a dwelling's space and water heating system and controls. Again, some of these were much more likely to potentially benefit F or G dwellings than other dwellings. This included upgrading to a condensing boiler from an existing non-condensing model, using the current fuel. This could potentially benefit 71% of band F or G dwellings, but only 27% of band A to E homes.

3.23 Installing or upgrading central heating system controls, such as a central programmer, room thermostat and TRVs, could potentially benefit 57% of band F or G dwellings with 'wet' central heating (i.e. with water-filled radiators), three times the proportion for band A to E dwellings (19%).

3.24 The least energy efficient category of dwellings includes a high proportion of homes that have access to mains gas but are heated by an alternative, less efficient fuel. Therefore, installing gas condensing boilers could potentially benefit almost a third of F or G dwellings (31%) without a boiler or with a boiler using a different fuel compared with just 1% of band A to E homes.

Figure 3.1: Selected potential energy performance upgrades for dwellings in SAP bands A to E compared with F or G, 2016

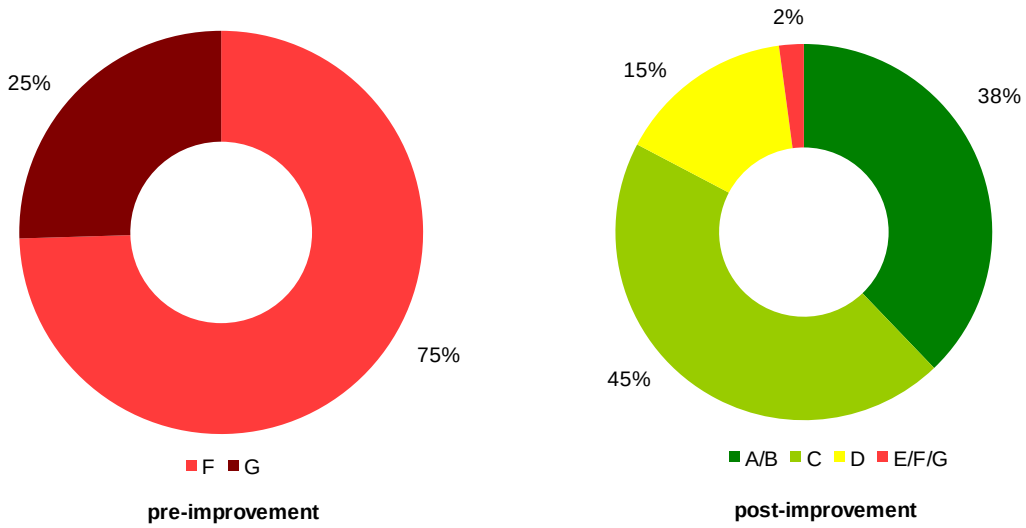


Base: number of dwellings where this improvement might be possible irrespective of the ease of installation, e.g. for cavity wall insulation the base is the number of dwellings with cavity walls
Note: underlying data are presented in Annex Table 3.6
Source: English Housing Survey, dwelling sample

3.25 If all the recommended energy improvement measures were installed (irrespective of cost effectiveness and the ease of installing the measure), the average SAP rating for homes in SAP bands F or G would increase from 26 to 78 points. This would raise their average to only three SAP points lower than post-improvement band A to E dwellings (i.e. the average rating if the A to E homes too had all recommended energy efficiency improvements installed), Annex Table 3.7. The modelling takes into account all potential improvements whereas in reality only a subset of these might be installed.

3.26 Approximately 38% (around 432,000) of dwellings in SAP bands F or G would move up to band A or B. A further 60% (685,000) would move to bands C or D, leaving only 2% at band E or below, Figure 3.2.

Figure 3.2: SAP rating pre- and post-improvement, if all potential energy improvement measures were applied, 2016



Base: all energy inefficient dwellings where improvements might be possible irrespective of the ease of installation, e.g. for cavity wall insulation the base is the number of dwellings with cavity walls
Note: underlying data are presented in Annex Table 3.8
Source: English Housing Survey, dwelling sample

3.27 Installing all the recommended energy improvement measures in homes currently banded F or G would result in an average saving of around £1,770 per year in total modelled energy costs. The equivalent modelled saving for dwellings currently in bands A to E is much smaller, around £490. The average cost for installing all recommended energy efficiency measures in an F or G band dwelling is also higher at £27,400, while the average for A to E dwellings is lower, at £14,500, Annex Table 3.7.

Homes with hard to treat walls and lofts

3.28 As wall insulation and loft insulation are integral components of government energy efficiency strategies, it is important to understand the scope for energy savings through such measures. This section investigates the relative ease of installing each of these measures within the housing stock. It then identifies the types of homes that are most difficult to improve. This analysis seeks to indicate the total number of homes with harder to treat walls or lofts in the housing stock rather than estimate the degree to which multiple difficulties may exist.[30]

[30] The analysis of the relative ease of installing insulation is not intended to provide any definitive guidance on how these homes should or should not be treated in order to make them more energy efficient, as this advice can only be undertaken on a case by case basis.

Cavity wall insulation

3.29 The Energy Company Obligation (ECO) definition categorises buildings with three or more storeys, narrow cavities (less than standard width), concrete, metal or timber frame construction, and those with tiles or cladding, as harder to treat[31]. The EHS cannot fully replicate the ECO definition, because it is unable to identify narrow cavities less than 50 millimetres wide, or cavities that are unsuitable to insulate with standard insulation materials or techniques.

3.30 It is estimated that of the 21% of all dwellings (5 million)[32] with uninsulated cavity walls, over half (56%) had walls which were assessed as relatively easier to treat (using the ECO definition), whilst the remaining 44% (2.2 million) had uninsulated walls which were harder to treat, Annex Table 3.9.

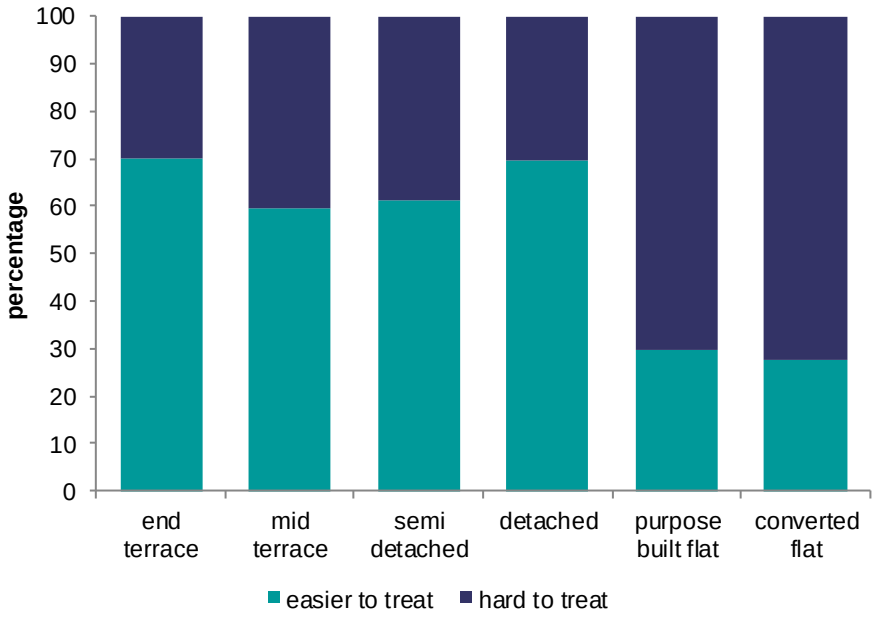
3.31 The ease of cavity wall insulation varied by tenure. Two fifths (39%) of owner occupied homes had uninsulated cavity walls that were harder to treat. The proportion was higher among rented homes, especially local authority homes (60%), but also among private rented (51%) and housing association (46%) homes.

3.32 These findings are due to the distribution of dwelling types in the tenures, with flats more common in the rented sectors. Due to the height of blocks of flats, 70% of purpose built and 72% of converted flats with uninsulated cavity walls were classified as hard to treat. In contrast just 30% of end terraces and detached houses, which are predominantly owner occupied, had hard to treat uninsulated cavity walls, Figure 3.3.

[31] For the ECO definition see https://www.ofgem.gov.uk/sites/default/files/docs/2014/05/eco_supplementary_guidance_on_hard-to-treat_cavity_wall_insulation_0.pdf

[32] For this analysis, the number of dwellings that could potentially benefit from cavity wall insulation will not match the number identified for the EPC improvements discussed earlier in this chapter. This analysis excludes those post 1990 cavity walled dwellings where there is no evidence of insulation (as it assumes homes of this age are likely to have this installed).

Figure 3.3: Ease of installing cavity wall insulation by dwelling type, 2016



Base: all dwellings with theoretical potential to install cavity wall insulation
Note: underlying data are presented in Annex Table 3.9
Source: English Housing Survey, dwelling sample

3.33 Older uninsulated cavity walled dwellings had a higher proportion of harder to treat walls than newer homes. For example, almost three quarters (72%) of such homes built before 1919 had harder to treat walls, compared with around a third (34%) of such homes built between 1981 and 1990, Annex Table 3.9. A high proportion of houses with three or more storeys and of converted flats were built before 1919, and these are both significant factors in the classification of hard to treat cavity-walled homes, Annex Table 3.12.

3.34 Dwellings in SAP bands F or G were no more likely to have hard to treat uninsulated cavity walls than dwellings in SAP bands A to E.

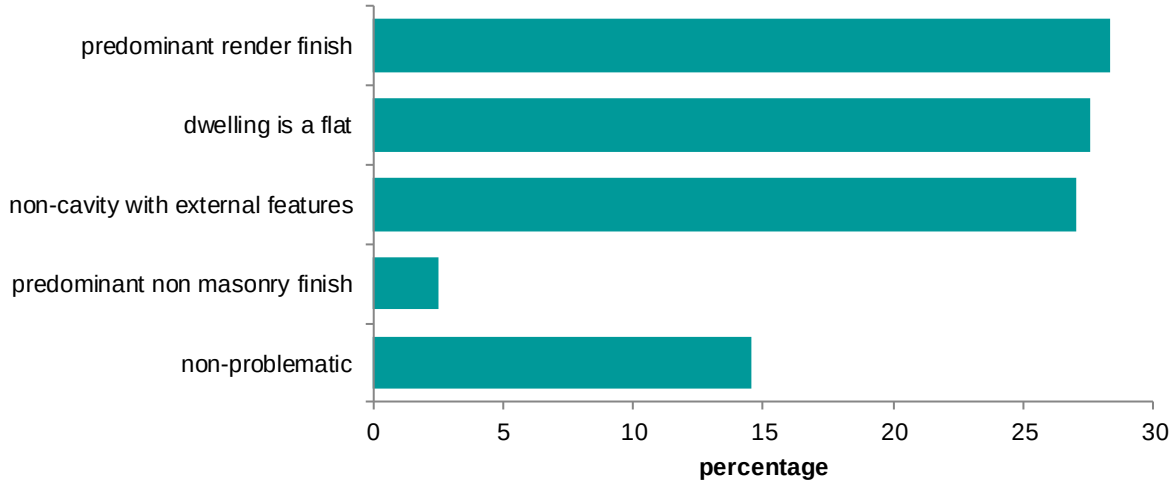
Solid wall insulation

3.35 In 2016, 35% of all dwellings (8.2 million) (Annex Table 3.10) have a construction type that could possibly benefit from having some form of solid wall insulation installed, either externally or internally. This included not only those with uninsulated solid walls, but also other types of non-cavity walls such as system built and timber frame dwellings. It also included dwellings classed as having harder to treat cavity walls, for which the type of insulation applied to solid walls provides a potential alternative insulation option. The report considers four aspects that make a home harder to treat with solid wall insulation: predominant render finish, predominant non-masonry wall finish, the dwelling is a flat or the dwelling has external features (e.g. bay windows).

3.36 It is estimated that of the 8.2 million homes that could potentially benefit from solid wall insulation, 7.0 million (85%) had hard to treat walls. In 28% of

cases, these homes had walls with a predominantly rendered rather than masonry wall finish, whilst a further 28% were flats, Figure 3.4.

Figure 3.4: Ease of installing solid wall insulation, 2016

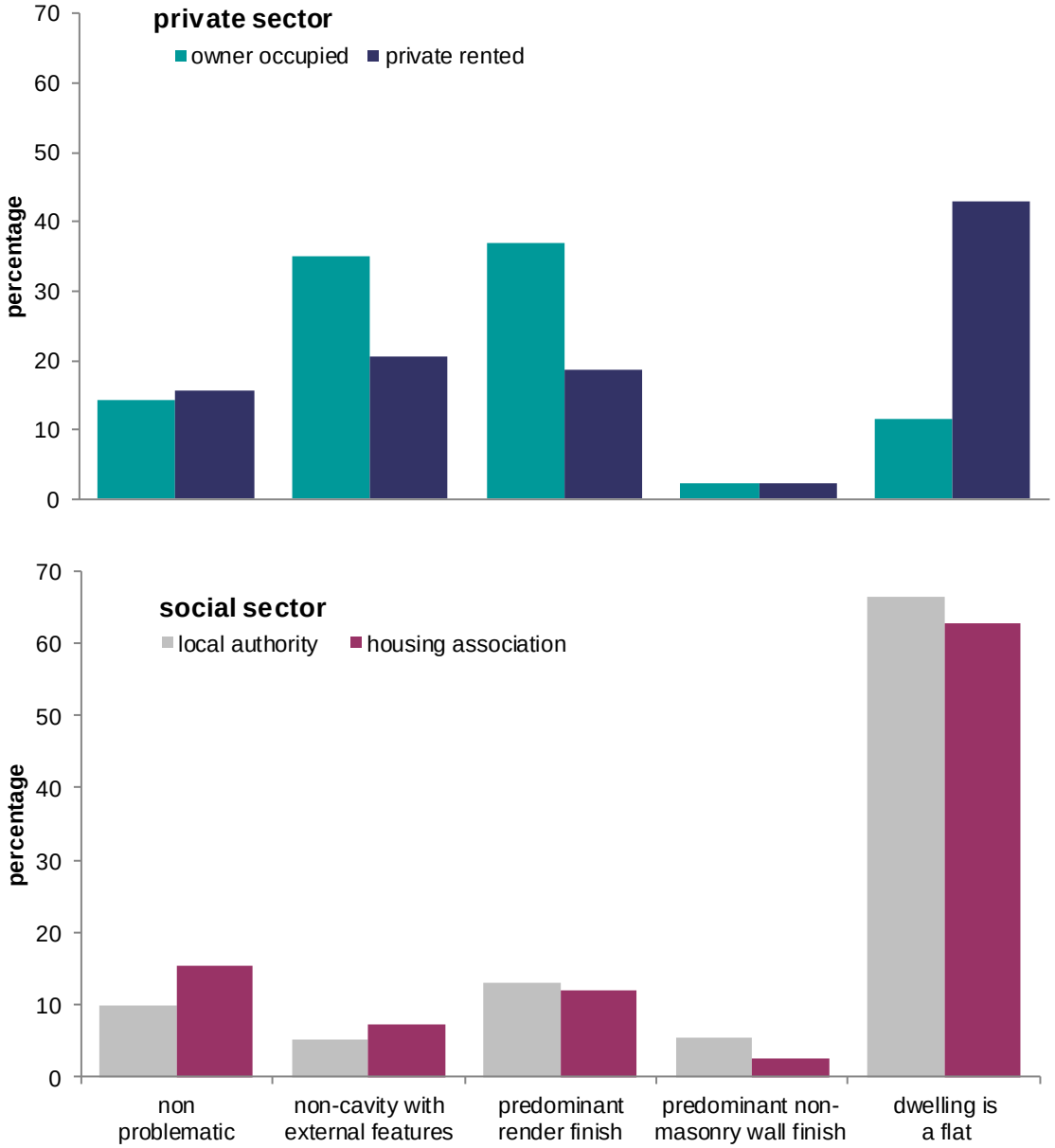


Base: all dwellings with theoretical potential to install solid wall insulation
Notes:
1) for problematic solid wall, percentages show the proportion of homes with the greatest degree of difficulty, for example, flats with rendered walls are categorised as flats
2) underlying data are presented in Annex Table 3.10
Source: English Housing Survey, dwelling sample

3.37 The proportion of homes where it was difficult to install solid wall insulation was similar for most tenures (84% to 86%), though local authority homes had a higher proportion (90%), Annex Table 3.10.

3.38 There was greater variation in the prevalence of each of the four types of barriers among the different tenures. Flats are more common in the rented sectors, so the difficulties in applying solid wall insulation to flats were more common in those tenures, particularly in local authority dwellings (66%). The main barriers to solid wall insulation for owner occupied homes were rendered walls (37%) and the presence of external features (35%), Figure 3.5.

Figure 3.5: Ease of installing solid wall insulation by tenure, 2016



Base: all dwellings with theoretical potential to install solid wall insulation
Note: underlying data are presented in Annex Table 3.10
Source: English Housing Survey, dwelling sample

3.39 A high proportion of semi-detached homes (88%) and detached homes (86%) had barriers to solid wall insulation. This was often due to these homes having predominantly rendered walls (45% and 43% respectively). Terraced houses with solid or hard to treat cavity walls were somewhat less likely to be hard to treat (71% of end terraces and 75% of mid terraces), Annex Table 3.10.

3.40 A somewhat lower proportion of both pre-1919 and post-1990 homes were hard to treat with solid wall insulation (81% and 76% respectively) compared with homes built in other periods. The most common barrier to solid wall insulation varied by dwelling age. For example, over half of homes built from

1919 to 1944 were hard to treat with solid wall insulation because of rendered wall finishes (52%), while 35% of homes built pre-1919 were hard to treat due to external features.

3.41 Dwellings in SAP bands F or G were no more likely to have hard to treat solid walls than dwellings in SAP bands A to E.

Loft insulation

3.42 In 2016, 87% of dwellings (20.7 million) had a loft[33]. In 2016, 41% of these dwellings (8.6 million) could possibly have loft insulation installed or upgraded, as the existing level of insulation was 150mm or less, Annex Table 3.11. The presence of a loft and its type will impact on the relative ease of fitting insulation in the roof space. For example, the installation or upgrading of loft insulation could be more difficult for dwellings with a loft with a fully boarded floor across the joists, a habitable room in the roof, or a shallow pitch or flat roof. The analysis does not include those dwellings that have no loft, e.g. flats that are not on the top floor of a building.

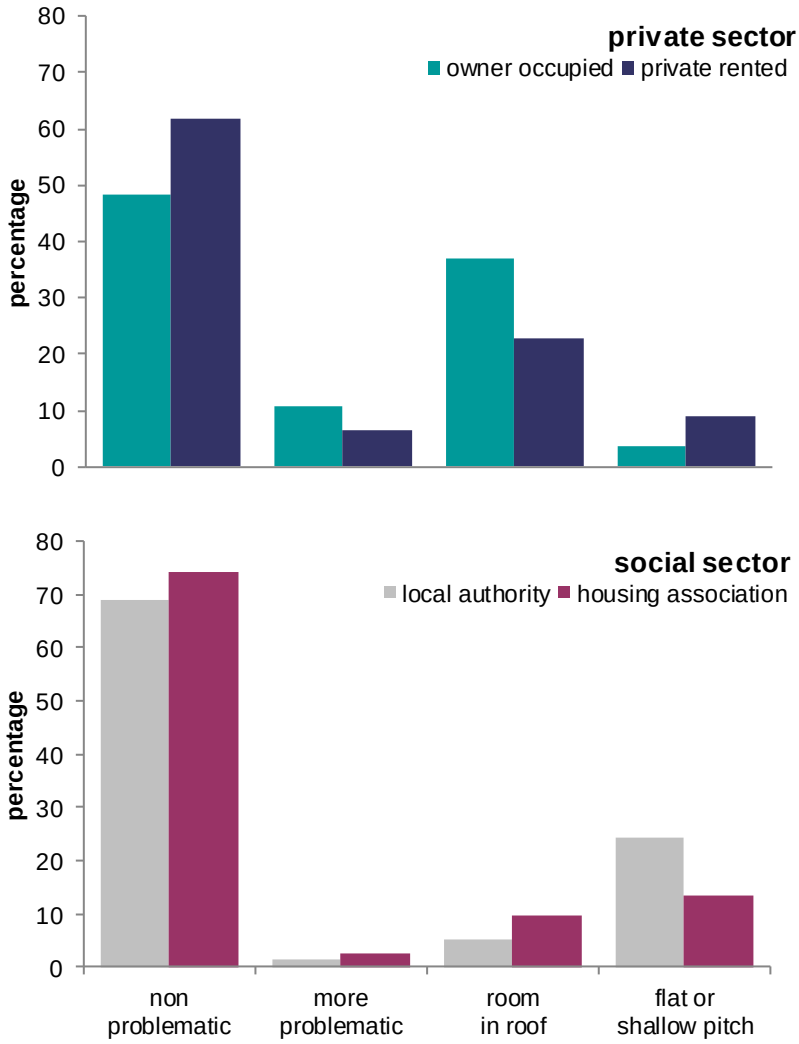
3.43 It is estimated that over half of the homes with 150 mm or less of loft insulation, 4.6 million (54%) had lofts that could be easier to upgrade, leaving 46% harder to treat, Annex Table 3.11.

3.44 The main barrier in these harder to treat homes was the presence of a permanent room in the loft (31%). The loft was fully boarded in a further 9% of homes and 6% had a flat or shallow pitched roof. For those dwellings with either a permanent room in the loft space or a flat or shallow pitched roof, improving thermal insulation may not be feasible or necessary as the existing level of insulation was unknown.

3.45 Owner occupied homes were more likely to have lofts that were problematic to upgrade with thicker insulation (52%) than rented homes, particularly housing association homes (26%). The most common barrier in owner occupied homes was the presence of a permanent loft room (37%). This barrier was less common among rented homes, especially local authority homes (5%). A flat or shallow pitched roof was the most common barrier (24%) in local authority homes, Figure 3.6.

[33] Live Table DA6201, https://www.gov.uk/government/statistical-data-sets/energy-performance

Figure 3.6: Ease of installing loft insulation by tenure, 2016



Base: all dwellings with theoretical potential to improve loft insulation and those that may have insufficient loft insulation
Note: underlying data are presented in Annex Table 3.11
Source: English Housing Survey, dwelling sample

3.46 Dwellings in SAP bands F or G were no more likely to have hard to treat lofts than dwellings in SAP bands A to E.

Technical notes and glossary

Technical notes

1. Results in the majority of this report, which relate to the physical dwelling, are presented for '2016' and are based on fieldwork carried out between April 2015 and March 2017 (a mid-point of April 2016). The sample comprises 12,292 occupied or vacant dwellings where a physical inspection was carried out. Throughout the report, this is referred to as the 'dwelling sample'.

2. Results for the section on Energy Improvement Works in Chapter 2 of this report, which relate to households, are presented for '2016-17' and are based on fieldwork carried out between April 2016 and March 2017 on a sample of 12,970 households. Throughout the report, this is referred to as the 'full household sample'.

3. The reliability of the results of sample surveys, including the English Housing Survey, is positively related to the unweighted sample size. Results based on small sample sizes should therefore be treated as indicative only because inference about the national picture cannot be drawn. To alert readers to those results, percentages based on a row or column total with unweighted total sample size of less than 30 are italicised. To safeguard against data disclosure, the cell contents of cells where the cell count is less than 5 are replaced with a "u".

4. Where comparative statements have been made in the text, these have been significance tested to a 95% confidence level. This means we are 95% confident that the statements we are making are true.

5. Additional annex tables, including the data underlying the figures and charts in this report are published on the website: https://www.gov.uk/government/collections/english-housing-survey alongside many supplementary live tables, which are updated each year (in the summer) but are too numerous to include in our reports. Further information on the technical details of the survey, and information and past reports on the Survey of English Housing and the English House Condition Survey, can also be accessed via this link.

Glossary

Basic repair costs: Basic repairs include urgent work required in the short term to tackle problems presenting a risk to health, safety, security or further significant deterioration plus any additional work that will become necessary within the next five years. See Chapter 5, Annex 5 of the Technical Report for more information about how these are calculated and assumptions made.

Boiler type: The report covers a number of boiler types:

- **standard**: provides hot water or warm air for space heating with the former also providing hot water via a separate storage cylinder.
- **back**: located behind a room heater and feeds hot water to a separate storage cylinder. They are generally less efficient than other boiler types.
- **combination**: provides hot water or warm air for space heating and can provide hot water on demand negating the need for a storage cylinder, therefore requiring less space.
- **condensing**: standard and combination boilers can also be condensing. A condensing boiler uses a larger, or dual, heat exchanger to obtain more heat from burning fuel than an ordinary boiler, and is generally the most efficient boiler type.

Carbon dioxide (CO_2) emissions: The total carbon dioxide emissions from space heating, water heating, ventilation and lighting, less the emissions saved by energy generation as derived from the Standard Assessment Procedure (SAP; defined below) calculations and assumptions. These are measured in tonnes per year and are not adjusted for floor area, but represent emissions from the whole dwelling. The highest and lowest emitting performers have also been grouped with cut-off points set at three tonnes per year for the low emitters and 10 tonnes per year for the highest. CO_2 emissions for each dwelling are based on a standard occupancy and a standard heating regime.

Category 1 hazard: The most serious type of hazard under the Housing Health and Safety Rating System (HHSRS). Where such a hazard exists the dwelling fails to reach the statutory minimum standard for housing in England.

Comprehensive repair costs: Comprehensive repairs include urgent work required in the short term to tackle problems presenting a risk to health, safety, security or further significant deterioration plus any additional work, including replacement of elements that will become necessary within the next ten years. See Chapter 5, Annex 5 of the Technical Report for more information about how these are calculated and assumptions made.

Conversion: An alteration to the original construction which affects the total number of dwellings in the housing stock, for example, conversion of a house into two or more flats.

Cost to make decent: The cost of carrying out all works required to ensure that the dwelling meets the Decent Homes standard. This is the estimated required expenditure which includes access equipment (e.g. scaffolding and prelims). It is adjusted to reflect regional and tenure variations in building prices.

Damp and mould: There are three main categories of damp and mould covered in this report:

- **rising damp**: where the surveyor has noted the presence of rising damp in at least one of the rooms surveyed during the physical survey. Rising damp occurs when water from the ground rises up into the walls or floors because damp proof courses in walls or damp proof membranes in floors are either not present or faulty.

- **penetrating damp**: where the surveyor has noted the presence of penetrating damp in at least one of the rooms surveyed during the physical survey. Penetrating damp is caused by leaks from faulty components of the external fabric e.g. roof covering, gutters etc. or leaks from internal plumbing, e.g. water pipes, radiators etc.

- **condensation or mould**: caused by water vapour generated by activities like cooking and bathing condensing on cold surfaces like windows and walls. Virtually all dwellings have some level of condensation. Only serious levels of condensation or mould are considered as a problem in this report, namely where there are extensive patches of mould growth on walls and ceilings and/or mildew on soft furnishings.

Decent home: A home that meets all of the following four criteria:

- it meets the current statutory minimum standard for housing as set out in the Housing Health and Safety Rating System (HHSRS – see below).

- it is in a reasonable state of repair (related to the age and condition of a range of building components including walls, roofs, windows, doors, chimneys, electrics and heating systems).

- it has reasonably modern facilities and services (related to the age, size and layout/location of the kitchen, bathroom and WC and any common areas for blocks of flats, and to noise insulation).

- it provides a reasonable degree of thermal comfort (related to insulation and heating efficiency).

The detailed definition for each of these criteria is included in *A Decent Home: Definition and guidance for implementation*, Department for Communities and Local Government, June 2006[34].

Dependent children: Any person aged 0 to 15 in a household (whether or not in a family) or a person aged 16 to 18 in full-time education and living in a family with his or her parent(s) or grandparent(s). It does not include any people aged 16 to 18 who have a spouse, partner or child living in the household.

Double glazing: This covers factory made sealed window units only. It does not include windows with secondary glazing or external doors with double or secondary glazing (other than double glazed patio doors, which are surveyed as representing two windows).

Dwelling: A unit of accommodation which may comprise one or more household spaces (a household space is the accommodation used or available for use by an individual household). A dwelling may be classified as shared or unshared. A dwelling is shared if:

- the household spaces it contains are 'part of a converted or shared house', or
- not all of the rooms (including kitchen, bathroom and toilet, if any) are behind a door that only that household can use, and
- there is at least one other such household space at the same address with which it can be combined to form the shared dwelling.

Dwellings that do not meet these conditions are unshared dwellings.

The EHS definition of dwelling is consistent with the Census 2011.

Dwelling age: The date of construction of the oldest part of the building.

Dwelling type: Dwellings are classified, on the basis of the surveyor's inspection, into the following categories:

- **small terraced house:** a house with a total floor area of less than 70m^2 forming part of a block where at least one house is attached to two or more other houses. The total floor area is measured using the original EHS definition of useable floor area, used in EHS reports up to and including the 2012 reports. That definition tends to yield a smaller floor area compared with the definition that is aligned with the Nationally Described Space Standard and used on the EHS since 2013. As a result of the difference between the two definitions, some small terraced houses are reported in the 2014 Housing Supply Report as having more than 70m².

[34] https://www.gov.uk/government/publications/a-decent-home-definition-and-guidance

- **medium/large terraced house:** a house with a total floor area of 70m^2 or more forming part of a block where at least one house is attached to two or more other houses. The total floor area is measured using the original EHS definition of useable floor area which tends to yield a small floor area compared with the definition used on the EHS since 2013.

- **end terraced house:** a house attached to one other house only in a block where at least one house is attached to two or more other houses.

- **mid terraced house:** a house attached to two other houses in a block.

- **semi-detached house:** a house that is attached to just one other in a block of two.

- **detached house:** a house where none of the habitable structure is joined to another building (other than garages, outhouses etc.).

- **bungalow:** a house with all of the habitable accommodation on one floor. This excludes chalet bungalows and bungalows with habitable loft conversions, which are treated as houses.

- **converted flat:** a flat resulting from the conversion of a house or former non-residential building. Includes buildings converted into a flat plus commercial premises (such as corner shops).

- **purpose built flat, low rise:** a flat in a purpose built block less than six storeys high. Includes cases where there is only one flat with independent access in a building which is also used for non-domestic purposes.

- **purpose built flat, high rise:** a flat in a purpose built block of at least six storeys high.

Energy cost: The total energy cost from space heating, water heating, ventilation and lighting, less the costs saved by energy generation as derived from SAP calculations and assumptions. This is measured in £/year using constant prices based on average fuel prices for 2012 (which input into the 2012 SAP calculations) and do *not* reflect subsequent changes in fuel prices. Energy costs for each dwelling are based on a standard occupancy and a standard heating regime.

Energy efficiency rating (EER, also known as SAP rating): A dwelling's energy costs per m^2 of floor area for standard occupancy of a dwelling and a standard heating regime and is calculated from the survey using a simplified form of SAP. The energy costs take into account the costs of space and water heating, ventilation and lighting, less cost savings from energy generation technologies. They do not take into account variation in geographical location. The rating is expressed on a scale of 1-100 where a dwelling with a rating of 1 has poor energy efficiency (high costs) and a dwelling with a rating of 100 represents zero net energy cost per year. It is possible for a dwelling to have an EER/SAP rating of over 100 where it produces more energy

than it consumes, although such dwellings will be rare within the English housing stock.

The detailed methodology for calculating SAP to monitor the energy efficiency of dwellings was updated in 2012 to reflect developments in the energy efficiency technologies and knowledge of dwelling energy performance. These changes in the SAP methodology were relatively minor compared with previous SAP methodology updates in 2005 and 2009. It means, however that a SAP rating using the 2009 method is not directly comparable to one calculated under the 2012 methodology, and it would be incorrect to do so. All SAP statistics used in reporting from 2013 are based on the SAP 2012 methodology and this includes time series data from 1996 to the current reporting period (i.e. the SAP 2012 methodology has been retrospectively applied to 1996 and subsequent survey data to provide consistent results in the 2013 and following reports).

Energy efficiency rating (EER)/SAP bands: The 1-100 EER/SAP energy efficiency rating is also presented in an A-G banding system for an Energy Performance Certificate, where Band A rating represents low energy costs (i.e. the most efficient band) and Band G rating represents high energy costs (the least efficient band). The break points in SAP (see below) used for the EER Bands are:

- Band A (92–100)
- Band B (81–91)
- Band C (69–80)
- Band D (55–68)
- Band E (39–54)
- Band F (21–38)
- Band G (1–20)

Energy efficiency schemes:

- **The Energy Company Obligation (ECO)**: This obligation was introduced in January 2013 to reduce energy consumption and support people at greater risk of living in fuel poverty. The larger energy companies are set obligations to install insulation and heating measures in order to achieve reductions in energy usage and heating costs. ECO 1 was from January 2013 to March 2015, and ECO 2 was from April 2015 to March 2017. ECO Help-to heat is from April 2017 to September 2018.

- **Green Deal Cashback**: This scheme rewarded those making energy efficiency improvements under the Green Deal Framework. It let households in England and Wales claim money from Government on energy-saving improvements such as insulation, draught-proofing and double-glazing.

- **Green Deal Finance**: The Green Deal Finance Company offered finance to those installing improvements approved for installation under the Green Deal

Framework. It enabled paying for the installations of Green Deal improvements through the energy bills tied to the property.

- **Green Deal Home Improvement Fund**: This incentive scheme was open to all householders in England and Wales wanting to improve the energy efficiency of their homes. The scheme enabled participants to claim cashback for installing energy efficiency measures, for example solid wall insulation.

- **Feed-In Tariffs**: Introduced in 2010, they provide small scale generators of electricity with tariff payments on both generation and export of renewable and low carbon electricity. Eligible schemes include those producing less than 5 megawatt from photo-voltaic panels, wind, hydro and anaerobic digestion or less than 2 kW from micro-CHP (combined heat and power plants).

- **Renewable Heat Premium Payment (RHPP):** The RHPP scheme was a government financial support scheme which provided one-off grants to help householders and landlords with the cost of installing eligible renewable heat technologies.

- **The Renewable Heat Incentive**: A government scheme which provides a fixed payment for seven years for the renewable heat a household generates through biomass boilers, solar water heating and certain heat pumps. It is similar to Feed-In Tariffs, but the scheme is funded by the Treasury, and there is no 'National Grid for Heat', so importing and exporting heat is irrelevant

Energy Performance Certificate (EPC): Based on current energy performance the EPC provides a range of indicators, such as whether the property would benefit in terms of improved performance from a range of heating, insulation and lighting upgrades and the likely performance arising from the application of those measures.

The EPC assessment is based on a simplified form of the energy efficiency SAP known as reduced data SAP (RdSAP). Following revisions to the way that RdSAP software implements improvements as part of the EPC production process, a new EPC methodology has been applied to the EHS 2015 data. Several additional improvement measures have been added to the methodology, and for some existing measures the criteria and/or improvement specification has changed (see the Technical Report for further information).

The EHS currently provides the following EPC based indicators, calculated using the survey's own approach to SAP (see the Technical Report for further information):

- **current and post improvement performance:**
    - *energy efficiency rating* (EER) and bands
    - *environmental impact rating* (EIR) and bands
    - *primary energy use* (kWh/m^2/year)

- *energy cost* (£/year) for space heating, water heating, lighting and renewables
- CO_2 (carbon dioxide) emissions (tonnes/year)

- **improvement measures:** The Technical Report provides a list of improvements specified in the updated EHS methodology. These include loft insulation measures, wall and floor insulation measures, boiler upgrades, solar water heating, glazing and lighting measures. They are also listed in the relevant Annex Table.

- **the notional costs of installing the recommended measures:** The EHS also estimates the notional costs of installing each of the recommended measures and the total cost of applying all the recommended measures to the dwelling stock. The methodology for estimating these costs has also been revised (see the Technical Report for further information).

Ethnicity: Classification according to respondents' own perceived ethnic group.

Ethnic minority background is used throughout the report to refer to those respondents who do not identify as White.

The classification of ethnic group used in the EHS is consistent with the 2011 Census. Respondents are classified as White if they answer one of the following four options:

1. English / Welsh / Scottish / Northern Irish / British
2. Irish
3. Gypsy or Irish Traveller
4. Any Other White background

Otherwise, they are classified as being from an ethnic minority background.

Excess cold (HHSRS Category 1 hazard): Households living in homes with a threat to health arising from sub-optimal indoor temperatures. The assessment is based on the most vulnerable group who, for this hazard, are those aged 65 years or more (the assessment does not require a person of this age to be an occupant). The EHS does not measure achieved temperatures in the home and therefore this hazard is based on dwellings with an energy efficiency rating of less than 35 based on the SAP 2001 methodology. Under the SAP 2009 methodology, used for the 2010- 2012 EHS reports, the comparable threshold was recalculated to be 35.79 and the latter was used in providing statistics for the HHSRS Category 1 hazard. Since 2013, the EHS Reports have used the SAP 2012 methodology and the comparable excess cold threshold has been recalculated to 33.52.

Gross income of the HRP and partner: The gross annual income of the HRP and partner from wages, pensions, other private sources, savings and state benefits. This does not include any housing related benefits or allowances. This measure is divided by 52 to calculate weekly income. Income is presented in quintiles throughout this report (see income quintiles definition – below).

Gross household income: The gross annual income of all adults living in a household from wages, pensions, other private sources, savings and state benefits. This does not include any housing related benefits or allowances. This measure is divided by 52 to calculate weekly income. Income is presented in quintiles throughout this report (see income quintiles definition – below).

Habitable room: A room in the dwelling that offers 'living accommodation'. Includes bedrooms, kitchens if there is additional space to provide a dining area large enough to accommodate a table and chairs (typically an area of 2m² in addition to kitchen space). A fully converted room in the loft space is classified as a habitable room even if it can only be reached by a fixed ladder or unsafe staircase.

Heating controls:

a) For central heating systems:

- **timers** which control when the heating goes on and off. They range from simple manual timeclocks to complex digital programmers and most include a manual override.
- **room thermostats** which measure air temperature in the home, and switch the space heating on and off. They can be used to set a single target temperature and there may be one or more of these in the dwelling.
- **thermostatic radiator valves** (TRVs) which enable the temperature of radiators in individual rooms to be modified manually.

b) For storage heating systems:

- **manual or automatic charge controls** adjust the amount of heat stored overnight. The more recently introduced automatic controls measure the temperature in the room (or more rarely, outside the house). If the temperature is milder these allow less heat to be stored, saving money.
- **celect type controller** has electronic sensors throughout the dwelling linking to a central control device. It monitors the individual room sensors and optimises the charging of all storage heaters individually.

Heating fuel:

- **gas**: mains gas is relatively inexpensive and produces lower emissions per unit of energy than most other commonly used fuels. Liquefied Petroleum Gas and bottled gas are still associated with slightly higher costs and emissions.

- **electricity**: standard rate electricity has the highest costs and CO_2 emissions associated with main fuels, but is used in dwellings without a viable alternative or as a back-up to mains gas. An off-peak tariff such as Economy 7 is cheaper than bottled gas but with the same emissions as standard electricity.

- **oil**: in terms of both costs and emissions, oil lies between main gas and electricity.

- **solid fuel**: most solid fuels have similar costs to oil, with the exception of processed wood which can be more expensive than off-peak electricity. Fuels included are coal and anthracite, with CO_2 emissions above those of gas and oil; wood, which has the lowest emissions of the main fuels; and smokeless fuel, whose emissions are close to those of electricity. By law, some areas (usually towns or cities) are designated as smoke control areas where the use of solid fuels emitting smoke is illegal.

Heating system: There are three main types of heating covered in this report:

- **central heating system**: most commonly a system with a gas fired boiler and radiators which distribute heat throughout the dwelling (but also included in this definition are warm air systems, electric ceiling/underfloor and communal heating). It is generally considered to be a cost effective and relatively efficient method of heating a dwelling. Communal systems use heat generated in a centralized location for residential space and water heating. This could be from

    - a central boiler using any fuel which supplies a number of dwellings
    - waste heat from power stations distributed through community heating schemes
    - heat from a local CHP (combined heat and power) system

- **storage heaters**: predominately used in dwellings that have an off-peak electricity tariff. Storage heaters use off-peak electricity to store heat in clay bricks or a ceramic material, this heat is then released throughout the day. However, storage heating can prove expensive if too much on peak electricity is used during the day.

- **room heaters**: this category includes all other types of heaters such as fixed gas, fixed electric or portable electric heaters. This type of heating is generally considered to be the least cost effective of the main systems and produces more carbon dioxide emissions per kWh.

Heat pumps: Air source heat pumps absorb heat from the outside air into a fluid which passes through a compressor to increase its temperature. This higher temperature heat is then used to heat radiators, underfloor heating systems, warm air heaters or hot water in the home.

Ground source heat pumps absorb heat from the ground through a loop of pipe buried in the ground containing a mixture of water and antifreeze. The heat is absorbed into the fluid and then passed through a heat exchanger into the heat pump to be used to heat radiators, underfloor or warm air heating systems and hot water. The ground stays at a fairly constant temperature under the surface, so the heat pump can be used throughout the year. The length of the ground loop depends

on the size of the dwelling and the amount of heat required. Longer loops can draw more heat from the ground, but need more space to be buried in. If space is limited, a vertical borehole can be drilled instead.

Household: One person or a group of people (not necessarily related) who have the accommodation as their only or main residence, and (for a group) share cooking facilities and share a living room or sitting room or dining area.

The EHS definition of household is slightly different from the definition used in the 2011 Census. Unlike the EHS, the 2011 Census did not limit household membership to people who had the accommodation as their only or main residence. The EHS included that restriction because it asks respondents about their second homes, the unit of data collection on the EHS, therefore, needs to include only those people who have the accommodation as their only or main residence.

Household in poverty: a household with income below 60% of the equivalised median household income (calculated before any housing costs are deducted). Income equivalisation is the adjustment of income to take into account the varied cost of living according to the size and type of household (see the EHS Technical Report, Chapter 5, Annex 4 for further information).

Household reference person (HRP): The person in whose name the dwelling is owned or rented or who is otherwise responsible for the accommodation. In the case of joint owners and tenants, the person with the highest income is taken as the HRP. Where incomes are equal, the older is taken as the HRP. This procedure increases the likelihood that the HRP better characterises the household's social and economic position. The EHS definition of HRP is not consistent with the Census 2011, in which the HRP is chosen on basis of their economic activity. Where economic activity is the same, the older is taken as HRP, or if they are the same age, HRP is the first listed on the questionnaire.

Household type: The main classification of household type uses the following categories; some categories may be split or combined in different tables:

- couple no dependent child(ren)
- couple with dependent child(ren)
- couple with dependent and independent child(ren)
- couple with independent child(ren)
- lone parent with dependent child(ren)
- lone parent with dependent and independent child(ren)
- lone parent with independent child(ren)
- two or more families
- lone person sharing with other lone persons
- one male
- one female

Housing Health and Safety Rating System (HHSRS): A risk assessment tool used to assess potential risks to the health and safety of occupants in residential properties in England and Wales. It replaced the Fitness Standard in April 2006.

The purpose of the HHSRS assessment[35] is not to set a standard but to generate objective information in order to determine and inform enforcement decisions. There are 29 categories of hazard, each of which is separately rated, based on the risk to the potential occupant who is most vulnerable to that hazard. The individual hazard scores are grouped into 10 bands where the highest bands (A-C representing scores of 1,000 or more) are considered to pose Category 1 hazards. Local authorities have a duty to act where Category 1 hazards are present, and may take into account the vulnerability of the actual occupant in determining the best course of action.

For the purposes of the decent homes standard, homes posing a Category 1 hazard are non-decent on its criterion that a home must meet the statutory minimum requirements.

The EHS is not able to replicate the HHSRS assessment in full as part of a large scale survey. Its assessment employs a mix of hazards that are directly assessed by surveyors in the field and others that are indirectly assessed from detailed related information collected. For 2006 and 2007, the survey (the then English House Condition Survey) produced estimates based on 15 of the 29 hazards. From 2008, the survey is able to provide a more comprehensive assessment based on 26 of the 29 hazards. See the EHS Technical Note on Housing and Neighbourhood Conditions[36] for a list of the hazards covered.

Income (equivalised): Household incomes have been 'equivalised', that is adjusted (using the modified Organisation Economic Co-operation and Development scale) to reflect the number of people in a household. This allows the comparison of incomes for households with different sizes and compositions.

The EHS variables are modelled to produce a **Before Housing Costs (BHC)** income measure for the purpose of equivalisation. The BHC income variable includes:

Household Reference Person and partner's income from benefits and private sources (including income from savings), income from other household members, housing benefit, winter fuel payment and the deduction of net council tax payment.

An **After Housing Costs (AHC)** income is derived by deducting rent and mortgage payments from the BHC measure.

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[35] https://www.gov.uk/government/organisations/department-for-communities-and-local-government/series/housing-health-and-safety-rating-system-hhsrs-guidance

[36] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211302/Housing_and_Neighbourhood_Conditions.pdf

Income quintiles: All households are divided into five equal groups based on their income (i.e. those in the bottom 20%, the next 20% and so on). These groups are known as quintiles. These can be used to compare income levels of particular groups to the overall population.

Insulation: There are two main types of insulation covered in this report:

- **wall insulation**

  cavity walls: where a dwelling has external walls of predominantly cavity construction, it is defined as having cavity wall insulation if at least 50% of the cavity walls are filled with insulation. This could have been fitted during construction or retrospectively injected between the masonry leaves of the cavity wall.

  solid walls: where a dwelling has external walls of predominantly masonry solid construction, it is defined as having solid wall insulation if at least 50% of the solid walls are fitted with insulation. This could be applied either externally (e.g. insulated board attached to the external face with a render finish) or internally (e.g. insulated plasterboard fitted to the external walls inside each room, with a plaster finish).

  other walls: these are any dwellings with predominantly non-cavity or masonry solid walls (e.g. timber, metal or concrete frames). If at least 50% of the walls are fitted with insulation, the dwelling is defined as having other wall insulation.

- **loft insulation:** the presence and depth of loft insulation is collected for all houses and top-floor flats. Insulation could be found between joists above the ceiling of the top floor of the dwelling or between the roof timbers where the loft has been converted to a habitable space. Where insulation could not be observed, information was taken from the householder or from imputed estimates based on the age and type of the dwelling.

Insulation – new cavity wall insulation variable: For the 2015 Headline Report, the English Housing Survey introduced a new measure of cavity wall insulation (variable wins95x). This new measure incorporates more up-to-date information regarding the insulation of buildings built since 1991 and aligns the English Housing Survey methodology to a common method for calculating energy efficiency of buildings.

In compliance with new Building Regulations, an increasing proportion of dwellings built in 1991 or after with cavity walls had insulation fitted at the time of construction (known as ’as built‘ cavity wall insulation), although compliance could also be achieved through other techniques. The non-intrusive survey undertaken in the EHS would not always be able to identify as built insulation, and the Survey has to assume that these properties have insulation. To align with current RdSAP methodology and to improve our methodology, the English Housing Survey has for

2015 data introduced a new variable, which assumes that properties built in 1995 or after has as built insulation. This is the assumption used in the RdSAP model, which in turn reflects that cavity wall insulation was not used as often as previously thought to comply with the new Building Regulations in the early 1990s.

In the earlier variable (wins90x), properties built in 1991 or after were assumed to be insulated, as it was thought builders used cavity wall insulation to comply with the new Building Regulations. Due to changes in data collection the new variable can only be taken back to 2008. Trends from earlier reports hold, though the exact numbers produced by the new variable are lower (as properties built in 1991 up to 1995 without evidence of retrofitted cavity wall insulation are no longer assumed to be insulated).

Long-term limiting illness: This is consistent with the core definition of disability under the Equality Act 2010. A person is considered to have a disability if they have a long-standing illness, disability or impairment which causes substantial difficulty with day-to-day activities.

Median income: the amount that divides the income distribution into two equal groups, half having income above that amount, and half having income below that amount.

Non-dependent children: any person aged over 18 or those aged 16-18 who are not in full-time education living in a family with his or her parent(s) or grandparent(s).

Off-peak electricity: This supply is identified by the presence of a multi-rate meter (as opposed to single rate), and is able to provide discounted electricity tariffs during periods of reduced demand (such as at night). This can reduce the cost of heating, most commonly for those with, storage radiator systems. For cases where presence of off peak electricity was unknown we have assumed this to be not present if there is no off-peak heating or hot water system. Any remaining unknown cases were also assumed to not have off-peak electricity for ease of analysis.

Private accommodation: The majority of homes in all three tenures, excluding hotels, bed and breakfast accommodation and institutional residences such as student halls, army barracks and care homes. The EHS only covers private accommodation.

Private registered providers (PRPs): private registered providers refer in this document to private providers of social housing in England that are registered with the social housing regulator (from 1st April 2012 this is the Homes and Communities Agency's Regulation Committee). These were previously termed Registered Social Landlords or housing associations. This term excludes local authority registered providers.

Renewable energy: Data is collected on the presence of three types of renewable technology:

- **solar thermal panels**: these are usually roof mounted and use direct sunlight to heat water, providing an additional source of domestic hot water to the internal boiler or other water heater. The most common types are evacuated tube and glazed flat plate collectors.

- **photovoltaic panels**: a photovoltaic cell is a device that converts light into electric current, contributing to the domestic electricity supply. A large photovoltaic system could provide a surplus of energy, allowing a household to export electricity to the national grid.

- **wind turbines**: a domestic small-scale wind turbine harnesses the power of the wind and uses it to generate electricity. The sample size of dwellings with this feature is currently too small to provide robust estimates for reporting.

SAP rating: See the entries for the Standard Assessment Procedure and Energy Efficiency Rating

Standard Assessment Procedure (SAP): The Standard Assessment Procedure (SAP) is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings. The SAP is used to calculate the energy efficiency rating (EER) of dwellings, also known as the SAP rating. The EER is an index based on calculated energy costs for a standard heating regime and is expressed on a scale of 1 (highly inefficient) to 100 (highly efficient with 100 representing zero energy cost). It is possible for a dwelling to have a rating of over 100 where it produces more energy than it consumes, although such dwellings will be rare within the English housing stock.

Reduced Data SAP (RdSAP) was introduced in 2005 as a lower cost method of assessing the energy performance of existing dwellings. RdSAP is used in the calculation of the energy ratings on the Energy Performance Certificate, a document which is required every time a home is put up for sale or rent. Since the 2015 survey, the EHS has provided a number of indicators on energy performance calculated using an approach which is in line with RdSAP 2012 version 9.92. To ensure that the findings in this report are as compatible as possible with energy performance assessments and certificates issued in England during 2016-17, the energy performance findings presented in this report were calculated using RdSAP version 9.92.

Serious condensation or mould: See ‘damp and mould’

Size: The total usable internal floor area of the dwelling as measured by the surveyor, rounded to the nearest square metre. It includes integral garages and integral balconies but excludes stores accessed from the outside only, the area under partition walls and the stairwell area.

Storeys: The number of storeys *above* ground i.e. it does not include any basements.

Substantial disrepair: Standardised basic repair costs of more than £35/m². Standardised repair costs measure repair costs expressed in pounds per square metre of floor area

Thermal comfort: an assessment from the surveyor as to whether a dwelling has both efficient heating; and effective insulation. Efficient heating is defined as

- any gas or oil programmable central heating
- electric storage heaters; or warm air systems
- underfloor systems
- programmable LPG/solid fuel central heating
- similarly efficient heating systems which are developed in the future

The primary heating system must have a distribution system sufficient to provide heat to two or more rooms of the home. There may be storage heaters in two or more rooms, or other heaters that use the same fuel in two or more rooms.

Because of the differences in efficiency between gas/oil heating systems and the other heating systems listed, the level of insulation that is appropriate also differs:

- For dwellings with gas/oil programmable heating, cavity wall insulation (if there are cavity walls that can be insulated effectively) or at least 50mm loft insulation (if there is loft space) is an effective package of insulation.
- For dwellings heated by electric storage heaters/LPG/programmable solid fuel central heating a higher specification of insulation is required: at least 200mm of loft insulation (if there is a loft) and cavity wall insulation (if there are cavity walls that can be insulated effectively).

Tenure: In this report, households are typically grouped into three broad categories known as tenures: owner occupiers, social renters and private renters. The tenure defines the conditions under which the home is occupied, whether it is owned or rented, and if rented, who the landlord is and on what financial and legal terms the let is agreed.

- **owner occupiers:** households in accommodation which they either own outright, are buying with a mortgage or as part of a shared ownership scheme.
- **social renters:** this category includes households renting from Local Authorities (including Arms' Length Management Organisations (ALMOs) and Housing Action Trusts) and Housing Associations, Local Housing Companies, co-operatives and charitable trusts.

A significant number of Housing Association tenants wrongly report that they are Local Authority tenants. The most common reason for this is that their home used to be owned by the Local Authority, and although ownership was transferred to a Housing Association, the tenant still reports that their landlord is the Local Authority. There are also some Local Authority tenants who wrongly report that they are Housing Association tenants. Data from the EHS for 2008-09 onwards incorporate a correction for the great majority of such cases in order to provide a reasonably accurate split of the social rented category.

- **private renters:** this sector covers all other tenants including all whose accommodation is tied to their job. It also includes people living rent-free (for example, people living in a flat belonging to a relative).

Urgent repair costs: These cover urgent work only which is defined as work required in the short term to tackle problems presenting a risk to health, safety, security or further significant deterioration of the building. See Chapter 5, Annex 5 of the Technical report for more information about how these are calculated and assumptions made.

Usable floor area: The total usable internal floor area of the dwelling as measured by the surveyor, rounded to the nearest square metre. A new modelling approach adopted since the 2013 report uses assumptions aligned with the Nationally Described Space Standard which was published as part of the Housing Standards Review. It excludes integral garages, balconies, stores accessed from the outside only and the area under external walls. The area remaining represents the total of all room areas, hallways and circulation space including cupboards and stairs. The area under internal partition walls is also included. Loft space is not included unless the loft is habitable, with a fixed stair in place to access it. Dwellings are also grouped into the following five categories:

- less than $50m^2$
- 50 to $69m^2$
- 70 to $89m^2$
- 90 to $109m^2$
- $110m^2$ or more.

Vacant dwellings: The assessment of whether or not a dwelling is vacant is made at the time of the interviewer's visit. Clarification of vacancy is sought from neighbours. Both properties in between lets and those that are vacant for a longer period are classified as vacant on the EHS. Surveyors are required to gain access to vacant dwellings and undertake full inspections.

Visitability: Visitability comprises four key features which are considered to be the most important for enabling people with mobility problems to either access their home or visit someone else's home. These four features form the basis for the requirements in part M of the Building Regulations, although the EHS cannot exactly mirror the detailed requirements contained there.

- **Level access**: For all dwellings with a private or shared plot, there are no steps between the gate/pavement and the front door into the house or block of flats to negotiate. This includes level access to the entrance of the survey module (i.e. a group of flats containing the surveyed flat). Dwellings without a plot are excluded from the analysis as access is, in effect, the pavement/road adjacent to the dwelling.

- **Flush threshold**: a wheelchair can be wheeled directly into the dwelling from outside the entrance door with no steps to negotiate and no obstruction higher than 15mm.

- **Sufficiently wide doors and circulation space**: the doors and circulation space serving habitable rooms, kitchen, bathroom and WC comply with the requirements of part M of the Building Regulations.

- **WC at entrance level**: there is an inside WC located on the entrance floor to the dwelling.

Each dwelling is classified according to the highest degree of difficulty of the required work, for example, if work to provide a flush threshold is minor but providing a WC at ground floor involves building an extension, the dwelling is classed as requiring major works in order to make it fully visitable.

- **Minor work:** no structural alterations required. Costs likely to be under £1,000. Examples include replacing a door and frame to create a flush threshold or installing a ramp for level access.

- **Moderate work:** rearrangements of internal space required that will involve removing internal partitions and/or increasing size of doorways. Costs are likely to be in the region of £1,000-£15,000 depending on the size of dwelling and the precise nature of the work. Examples include:

    - internal structural alterations such as using an integral garage, storage cupboard or larder to create a WC at entrance level. This will likely involve partitioning off existing rooms together with associated works to water supplies, wastes and heating.
    - removing some wall partitions (where this does not contravene fire regulations) to create sufficient width for internal doorways or hallways.

- **Major work:** building extensions required. Works will be in excess of about £15,000 and the precise amount will depend on the size of the extension to be built, the scale of work to water and drainage services and ground conditions. A home, for example, may require an extension for a downstairs WC.

- **Not feasible:** it is not physically possible to carry out the necessary work. For example, this could be due to the physical impossibility of building an extension or installing a ramp up to the front door.

Wall finishes: The outer layer or skin of the material of the wall structure or any coating applied to it. Wall finishes include:

- **Pointed brickwork**: The mortar is placed into a masonry joint after the masonry units (e.g. brick, concrete block or stone) have been laid. This creates a finish to the brickwork and adds resistance to weather

- **Rendered finish:** The application of, for example, premixed cement or pebbledash. The render may or may not be painted.

- **Mixed or other finish**: Other types of wall finish include protective and decorative timber, clay or concrete tiles fixed to the wall structure

Wall types: the method of the dwelling construction, including:

- **Cavity wall**: constructed of two brick or block walls separated by a cavity that is at least 50mm wide. They are generally found in houses dating from about 1930 onwards, although some older examples exist. Many dwellings (especially older private sector homes) have a mix of wall types because they have had one or more extensions added at different times. In the EHS dwellings are only classed as 'cavity wall' where at least 50% of the total external wall area is cavity brickwork.

- **Solid wall dwelling**: A dwelling whose structure comprises of solid brickwork i.e. no cavity inside the walls. Solid walls were mainly built until the 1930s in England.

- **Timber frame/concrete frame/other concrete/steel frame dwellings**: This category covers a wide range of building types, ranging from traditional timber frame buildings to non-traditional concrete or steel frame buildings using 'systems' of building focused on speed and economy of construction. They usually use pre-constructed frames of material, e.g. timber, concrete or steel, that are then erected on site. In some cases the frames may be constructed on site. The frames can be clad with other materials or filled to form panels.

- **Masonry walled dwellings:** Dwellings with walls constructed by laying individual masonry units (e.g. brick, concrete block or stone). The masonry units are normally laid with cement mortar, which binds them together to create a structure. They can be either cavity or solid wall.

Water heating controls:

- **Cylinder thermostat**: A thermostat is a device that automatically controls temperature. Thermostats are usually attached to the outsider of the hot water cylinder but can also comprise a diverter valve type arrangement with a thermocouple connected to the tank.

- **Time-clock:** A system whereby the water heating is controlled by the same device that controls the central heating or by an independent timer.

In accordance with the Statistics and Registration Service Act 2007 the United Kingdom Statistics Authority has designated these statistics as National Statistics, signifying that they are fully compliant with the Code of Practice for Statistics.

Designation can be broadly interpreted to mean that the statistics:

- meet identified user needs;
- are well explained and readily accessible;
- are produced according to sound methods, and
- are managed impartially and objectively in the public interest.

Once statistics have been designated as National Statistics it is a statutory requirement that the Code of Practice shall continue to be observed.

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