Department for Communities and Local Government

English Housing Survey

Energy Report, 2014

ENGLISH HOUSING SURVEY

Contents

Introduction and main findings

1. The English Housing Survey 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. This report provides the findings from the 2014-15 survey, focusing on energy related issues.

2. The report is split into four chapters. The first chapter analyses how energy is paid for and perceptions about the ease of paying fuel costs by different groups.

3. Chapter 2 looks at the remaining potential for energy improvements, focusing on trends over time in wall types and the potential to install measures included in the Energy Performance Certificate methodology.

4. Chapter 3 provides information on long term trends in space and water heating, and also information on the current existence of heating controls.

5. Chapter 4 explores what EHS data can say about any potential links between energy efficiency measures and condensation/mould.

Main findings

Most households paid for their energy using direct debit, but a considerable minority paid in other ways, such as prepayment methods.

- For electricity, 69% of all households paid by direct debit, 15% paid by standard credit and 16% paid by prepayment in 2014. For gas, 62% of households paid by direct debit, 13% by standard credit and another 13% by prepayment methods. The remaining 12% of households did not have a gas supply.

Payment through direct debit, generally the cheapest payment type, was most common amongst those with higher incomes, while those on lower incomes were more likely to use prepayment meters.

- Paying for energy by direct debit was most prevalent among those who lived in detached houses (87% of whom paid by direct debit), in the highest income quintile (87%), and owner occupiers (84%).

- Meanwhile, paying for electricity through a prepayment meter was more prevalent among social renters (50% of whom had a prepayment meter), lone parents with dependent children (46%), and those in the lowest income quintile (31%).

Around one in five households found it difficult to meet their heating and fuel costs.

- 18% of all households said that it was 'fairly difficult' or 'very difficult' to meet their heating/fuel costs, while 61% of households indicated that it was 'very easy' or 'fairly easy' to do so. The remainder found it neither easy nor difficult.

Households with prepayment meters, lone parents, social renters and those with the lowest income were more likely to say they felt it was difficult to meet their heating and fuel costs.

- Of those paying for electricity by prepayment meters, 42% found it fairly or very difficult to meet heating/fuel costs, as did 36% of social renters, 42% of lone parent households with dependent children and 34% of those in the lowest income quintile.

Wall types matter to the ease of insulation, with cavity walls generally easier to insulate than solid walls. The dominant type of wall construction is masonry cavity, which has increased over time, while solid walls have decreased but remain the second most common type.

- In 1996, over half (52%, or 10.5 million) of dwellings had masonry cavity walls with pointed brickwork, rising to 56% (13.1 million) of dwellings by 2014. This change is to be expected, as building standards have changed.

- Masonry solid walls with pointed brickwork were used in 20% (4.1 million) of dwellings in 1996, but this had fallen to 15% (3.5 million homes) by 2014.

About two thirds of the housing stock could benefit from at least one further energy efficiency improvement.

- In 2014, 65% of the housing stock (around 15.3 million homes) could theoretically benefit from at least one of the energy efficiency improvements set out by the Energy Performance Certificate methodology.

Over 10 million homes could benefit from at least one lower cost energy efficiency measure, such as insulating cavity walls, whereas over 11 million homes could benefit from at least one higher cost measure, such as upgrading to a condensing boiler. Some homes could benefit from both lower and higher cost measures.

- Lower cost measures (costing less than £500) could be applied to 10.1 million homes (44% of homes where these measures are possible), most commonly insulating cavity walls (5.1 million, 31% of dwellings with uninsulated cavity walls) or installing or topping up loft insulation (4.7 million, 23% of dwellings with lofts with none or low levels of insulation).

Water tank insulation could also be applied to 2.9 million homes (26% of those with a hot water tank with none or low level of insulation).

- Higher cost measures could potentially be applied to 11.1 million (47%) homes. The most common measure was the upgrading of a conventional central heating boiler to a condensing boiler (8.0 million, 38% of dwellings with a boiler).

The proportion of dwellings with gas central heating has steadily increased, while the proportion with gas room heaters has declined.

- The proportion of dwellings with gas central heating has steadily increased from 73% in 1996 (14.8 million dwellings) to 85% (19.9 million) in 2014.

- Amongst the less common heating systems, the most notable changes between 1996 and 2014 were:
    - a large reduction in homes with gas room heaters, from 9% to 1%
    - a small reduction in the proportion of homes with electric storage heaters from 8% to 6%

Most homes with gas central heating had heating controls such as timers, thermostats and thermostatic radiator valves, but only a quarter of homes with electric storage heaters had automatic charge controls, limiting energy use in warmer weather.

- Among homes with gas central heating, 99% had a timer, 85% had at least one room thermostat and 76% had thermostatic radiator valves. About a quarter (26%) of homes with storage heating had automatic charge controls.

The number of homes with a combination boiler has increased dramatically over the last two decades, alongside a decrease in the number of dwellings with a hot water tank.

- Over the last two decades, the use of combination boilers for central heating have increased. Such boilers provide hot water from the central heating without a separate tank and have increased dramatically from 12% in 1996 to 52% in 2014. This has meant that fewer homes have a hot water tanks, down from 63% to 38%.

After the introduction of Feed-in Tariffs in 2010, the proportion of dwellings with photovoltaic panels tripled, while those with solar hot water panels have remained fairly constant.

- In 2010, 1% of dwellings had photovoltaic panels and the same proportion had solar hot water panels. By 2014, the proportion of dwellings with photovoltaic panels had increased to 3%, while solar hot water panels remained at 1%.

Severe condensation and mould was more prevalent in homes with inadequate ventilation, fixed room heaters, a lower energy efficiency rating or no loft insulation.

- In 2014, 3% of English homes had severe condensation and mould. In dwellings with inadequate room ventilation in one or more rooms this increased to 20%. Severe condensation and mould was also more prevalent in homes where fixed room heaters were used as main heating system (10%), in dwellings with SAP below 30 (7%) and in dwellings without loft insulation (7%).

Acknowledgements and further queries

6. Each year the English Housing Survey relies on the contributions of a large number of people and organisations. The Department for Communities and Local Government (DCLG) would particularly like to thank the following people and organisations, without whom the 2014-15 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) and CADS Housing Surveys.

7. This report was produced by Helen Garrett, Busola Siyanbola and Maggie Davidson at BRE in collaboration with NatCen Social Research and DCLG.

8. 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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Chapter 1
Payment for energy and energy efficiency measures

1.1. This chapter aims to provide an understanding of how different types of households pay for their energy and their perceptions of the ease of meeting their fuel bills, as well as the dwelling characteristics of these households. Finally, it examines the characteristics of households who have taken up specific financial energy efficiency schemes.

How energy is paid for

Overview

1.2. There are three main ways households can pay their energy bills:

- Direct debit[1] (the cheapest means of payment)
- Standard credit[2]
- Prepayment meters

1.3. For electricity, in 2014, 69% of all households paid by direct debit, 15% paid by standard credit and 16% paid by prepayment. For gas, 62% of households paid by direct debit, 13% by standard credit and another 13% by prepayment methods.[3] The remaining 12% of households did not have a gas supply, Annex Table 1.1.

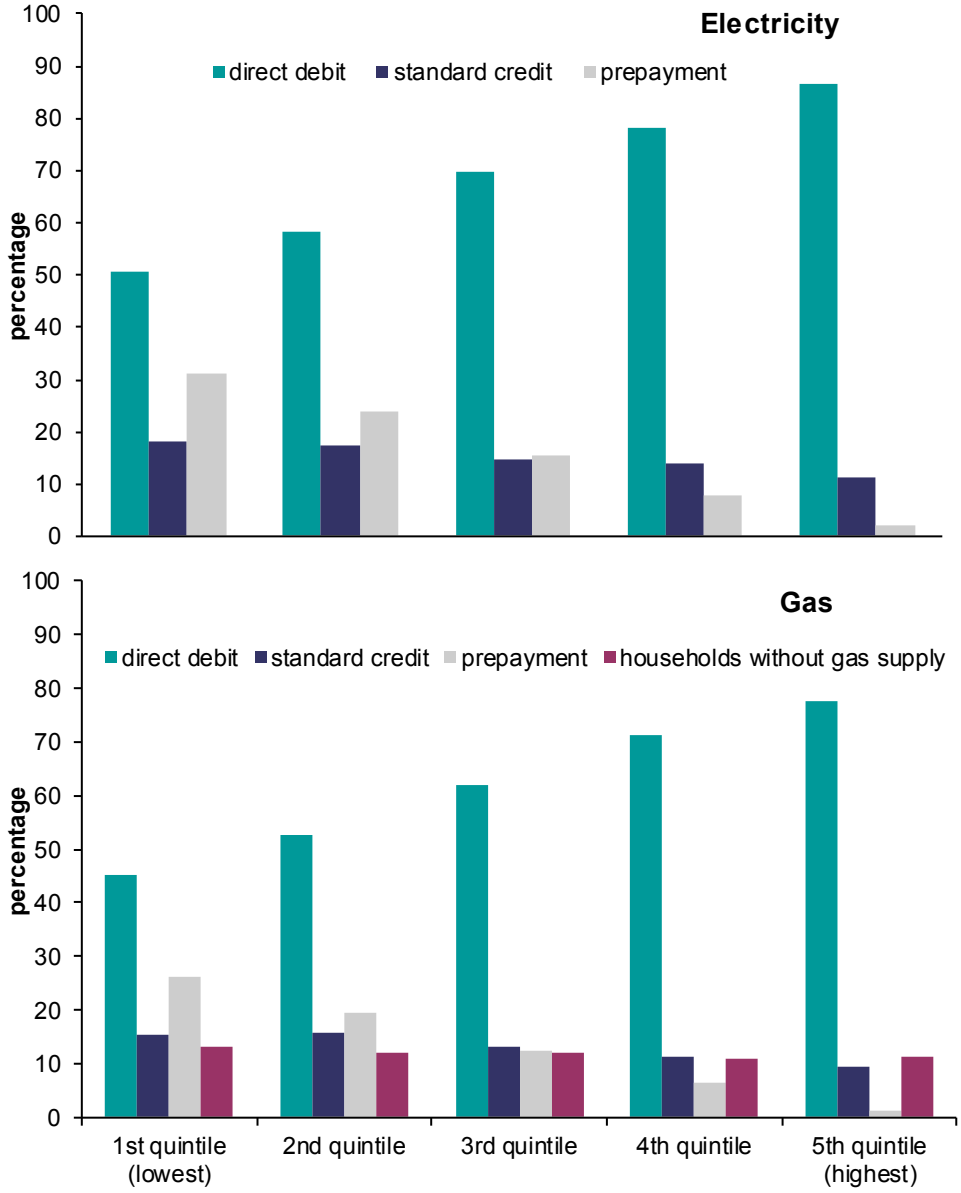
How energy is paid for by different types of households

1.4. The following analysis focuses on direct debit and prepayment, as there was less variation in the use of standard credit, though information on this is available in Annex Table 1.1.

[1] Includes energy payments included in rent, payments direct from benefits, internet payments and fixed annual bill.
[2] Includes standing order, quarterly bill, payments by cash or cheque, 'Secure homes'/'Easypay'/'Moneyway' payments.
[3] These proportions vary somewhat from those published by BEIS in their Quarterly Energy Prices, section on payment methods in https://www.gov.uk/government/statistics/quarterly-energy-prices-june-2016. The BEIS statistics give a smaller proportion paying via direct debit and a higher proportion via standard credit. This is likely to be due to differences in methodology as the BEIS data is collected direct from energy companies. EHS respondents may not be aware off, or mistake, their payment type, for example thinking that standing order (classed as standard credit) is a type of direct debit.

1.5. For both gas and electricity payments, households in the highest income quintile[4] were most likely to pay by direct debit and the least likely to use prepayment. Conversely, prepayment methods were most prevalent among households in the lowest income quintile, Figure 1.1.

Figure 1.1: Gas and electricty payment method, by household income, 2014

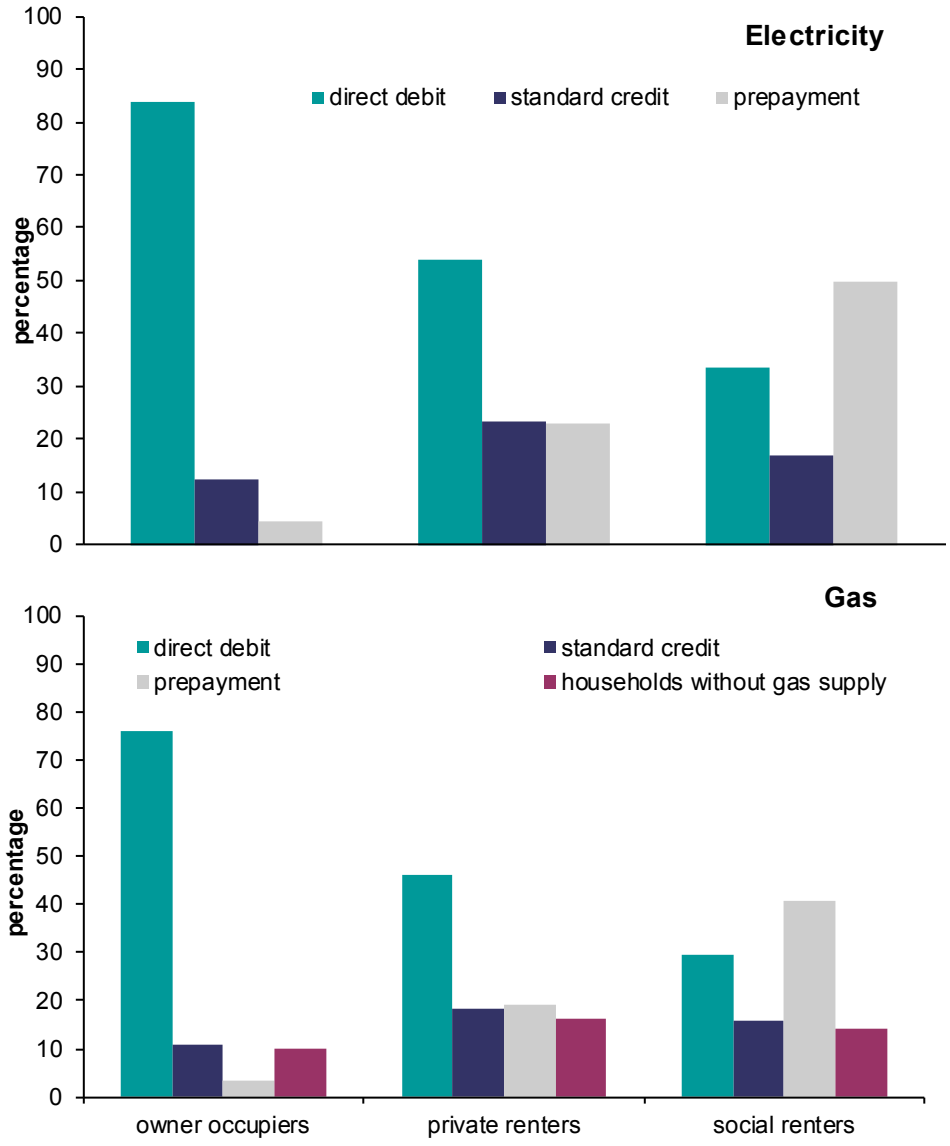


Base: all households
Note: underlying data are presented in Annex Table 1.1
Source: English Housing Survey, household sub-sample

[4] Household income before housing costs has been used for this analysis. See Glossary 'Income/equivalised income' for further details.

1.6. Paying by direct debit was most prevalent among owner occupiers but least prevalent among social renters who were most likely to use prepayment methods of payment, Figure 1.2.

Figure 1.2: Gas and electricty payment method, by tenure, 2014



Base: all households
Note: underlying data are presented in Annex Table 1.1
Source: English Housing Survey, household sub-sample

1.7. Payment of electricity by direct debit was most prevalent among couples with no dependent children, owner occupiers, and those living in detached homes or rural areas. It was least prevalent amongst those whose length of residence was one year or less, who lived in cities and urban centres and in flats, Table 1.1

Table 1.1: Comparison of the prevalence of paying for electricity by direct debit

	direct debit most prevalent		direct debit least prevalent
			percentages
dwelling characteristics			
detached properties	87	flats	53
owner occupiers	84	social renters	33
located in rural areas	78	located in city and other urban centres	58
household characteristics			
5th income quintile (highest)	87	1st income quintile (lowest)	51
couple, no dependent children	78	lone parent, dependent children	43
length of residence 30 years or over	74	length of residence one years or less	60

Notes:
1) percentages are within each group. For example, 88% of residents in detached homes paid by direct debit while 12% did not.
2) underlying data are presented in Annex Table 1.1
Source: English Housing Survey, household sub-sample

1.8. The use of prepayment meters to pay for electricity was most common among social renters, lone parent households, and those in the lowest income quintile or living in flats, Table 1.2

Table 1.2: Comparison of the prevalence of paying for electricity by prepayment

	prepayment most prevalent		prepayment least prevalent
			percentages
dwelling characteristics			
social renters	50	owner occupiers	4
flats	28	detached properties	2
located in city and other urban centres	23	located in rural areas	7
household characteristics			
lone parent, dependent children	46	couple, no dependent children	8
1st income quintile (lowest)	31	5th income quintile (highest)	2
length of residence four years and under[1]	20	length of residence 30 years or over	7

Notes:
1) prepayment most prevalent for those resident for four years or less varied from 20 to 21%
2) percentages are within each group. For example, 50% of social renters paid by prepayment methods while 50% used other payment methods.
3) underlying data are presented in Annex Table 1.1
Source: English Housing Survey, household sub-sample

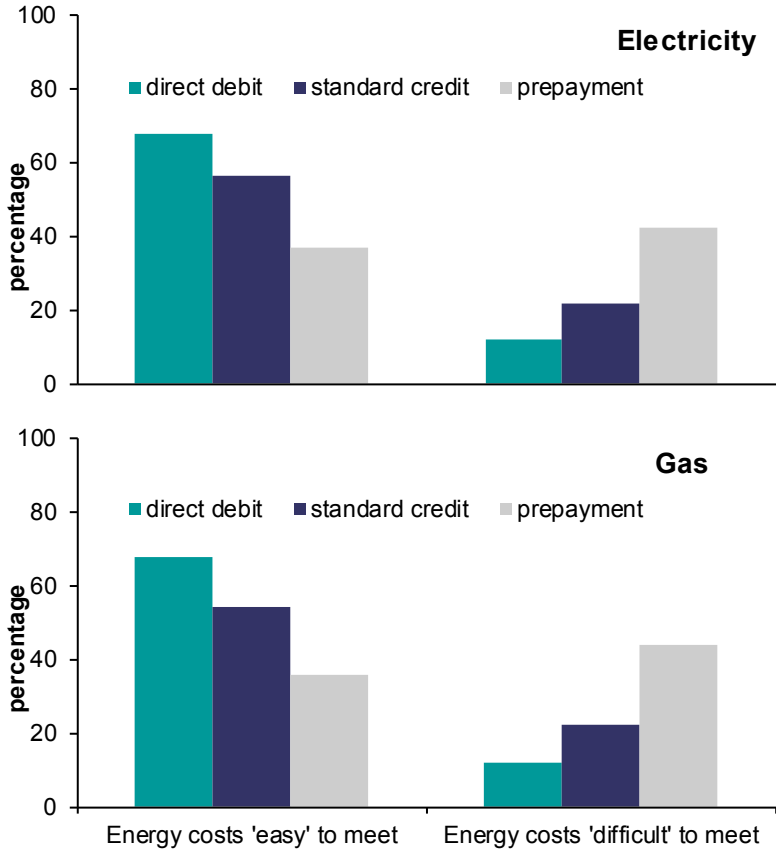
Perceived ease of meeting energy costs

1.9. Households were asked how easy or difficult they find meeting their heating/fuel costs. This section examines household perceptions of ease of meeting costs by how they pay for their energy and other household characteristics.

1.10. Overall, 61% of households indicated that it was 'very easy' or 'fairly easy' to meet their heating/fuel costs while 18% of households said that it was 'fairly difficult' or 'very difficult' to do so, Annex Table 1.2.

1.11. Households who found it 'easy' to meet their fuel bills were most likely to use direct debit payments compared with households who found it 'difficult' or 'neither easy nor difficult' . Conversely, households who paid by prepayment methods were most likely to find it 'difficult' to meet their fuel bills, Figure 1.3.

Figure 1.3: Gas and electricty payment method, by perceived ease of meeting energy costs, 2014



Base: all households
Notes:
1) underlying data are presented in Annex Table 1.2
2) households who responded 'neither easy nor difficult' are not displayed in chart
Source: English Housing Survey, household sub-sample

1.12. Analysing the prevalence of ease of payment, residents in less energy efficient homes (lower SAP rating) found it more difficult to meet fuel costs than those in more efficient homes (higher SAP rating). The relative ease of meeting energy costs also varied by the fuel type and main heating system in the home. Households using electricity for heating found it most difficult, and, linked to this, as did those using storage heaters, Table 1.3.

Table 1.3: Groups perceiving it as easy or difficult to meet energy costs

	easy to meet fuel costs highest prevalence		difficult to meet fuel costs highest prevalence	
				percentages
dwelling characteristics				
detached properties		73	end terrace properties	25
heating fuel: oil		71	heating fuel: electricity	23
owner occupiers		70	social renters	36
located in rural areas		70	located in city and other urban areas	25
boiler type: condensing boiler		68	boiler type: combination boiler	22
SAP more than 70		63	SAP less than 30	26
main heating type: central heating		62	main heating type: storage heaters	23
household characteristics				
5th income quintile (highest)		82	1st income quintile (lowest)	34
couple, no dependent children		71	lone parent, dependent children	42

Notes:
1) percentages are within each group. For example, 73% of households in detached homes found it *easy* to meet their energy costs while 25% in end terraces found it *difficult*.
2) underlying data are presented in Annex Table 1.2
Source: English Housing Survey, household sub-sample

Uptake of energy efficiency schemes

1.13. Less than 2% of households recalled that they have participated in one or more of the following financial schemes: Green Deal Cashback, Green Deal Finance, Renewable Heat Incentive and Feed-in Tariffs for solar photovoltaic panels.[5]

1.14. Of households who have participated in one of the energy efficiency schemes listed above, 87% had resided in their property for five years or more and 27% lived in rural areas (compared to 65% and 17% of non-participants respectively). The majority (88%) of these were owner

[5] The EHS figures do not include the ECO scheme. For more on these schemes and the uptake of them see the "Household Energy Efficiency National Statistics", Department for Business, Energy and Industrial Strategy, 23 June 2016, https://www.gov.uk/government/collections/household-energy-efficiency-national-statistics. Differences in reported figures are likely to relate to reporting breakdowns (e.g. differences in the geography or time period referred to) as well as potential recall issues among EHS respondents.

occupying households and 41% lived in detached homes (compared to 63% and 22% of non-participants), Annex Table 1.3.

Chapter 2
The potential for energy improvements

2.1. This chapter examines the potential for installing energy improvement measures to the English housing stock. As the construction method and materials impact on the relative ease of insulating walls, the first part of the chapter profiles the types of walls in the housing stock in 2014 and how this has changed since 1996. The chapter then provides an overview of the remaining potential for installing measures recommended in the Energy Performance Certificate methodology.

2.2. Last year's English Housing Survey report on energy efficiency examined the ease of installing wall or loft insulation in dwellings where this had not yet been installed. As the 2014 findings were very similar to those in 2013, readers are asked to refer to the 2013 report for analysis, explanation of the methodology and definitions of terms[6]. While not referred to here, 2014 data have been provided in Annex Tables 2.6 to 2.9.

Trends in wall construction

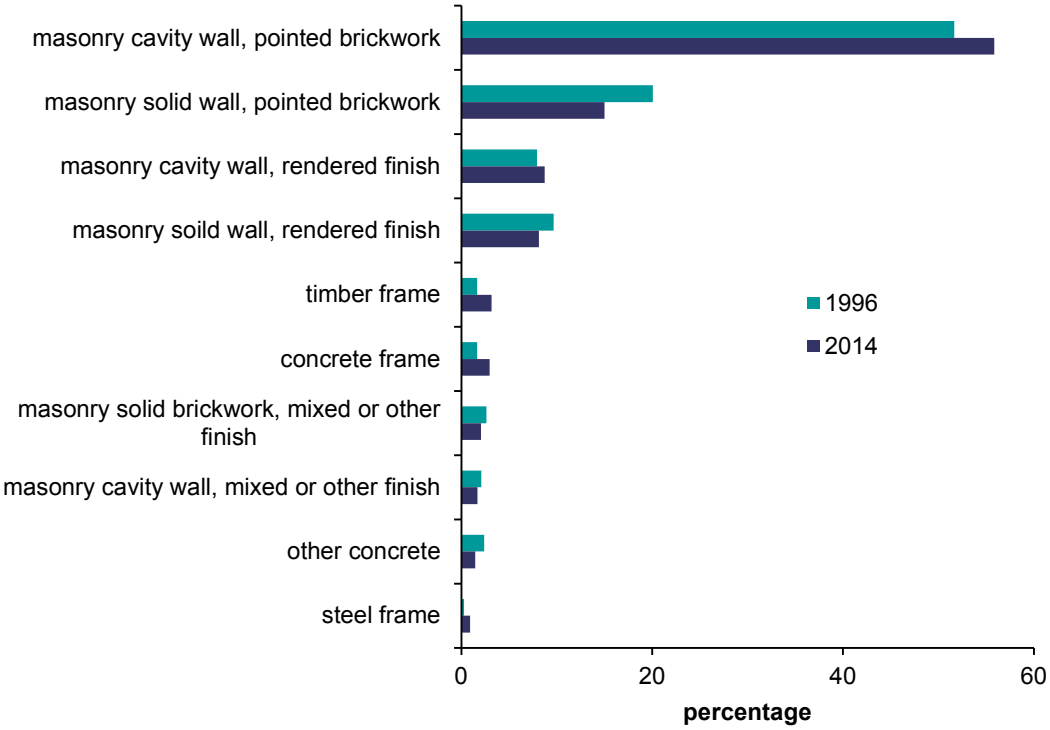
2.3. As in 1996, the most common wall type in 2014 was masonry[7] cavity walls with pointed brickwork, up from 52% of the stock in 1996 to 56% in 2014, Figure 2.1.

2.4. The second most common wall type was masonry solid walls with pointed brickwork, down from 20% of the stock in 1996 to 15% in 2014, partly reflecting the dominance of masonry cavity walls in newer homes.

2.5. Non-masonry dwellings (timber, concrete and steel frame construction) increased from 6% of all dwellings in 1996 to 9% in 2014. 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 pay particular attention to preventing damp and its associated timber decay.

[6] See Chapter 3, available here: https://www.gov.uk/government/statistics/english-housing-survey-2013-energy-efficiency-of-english-housing-report.
[7] Masonry refers to brick, block, stone and flint.

Figure 2.1: Wall types, 1996 and 2014



Base: all dwellings
Note: underlying data are presented in Annex Table 2.1
Source: English Housing Survey, dwelling sample

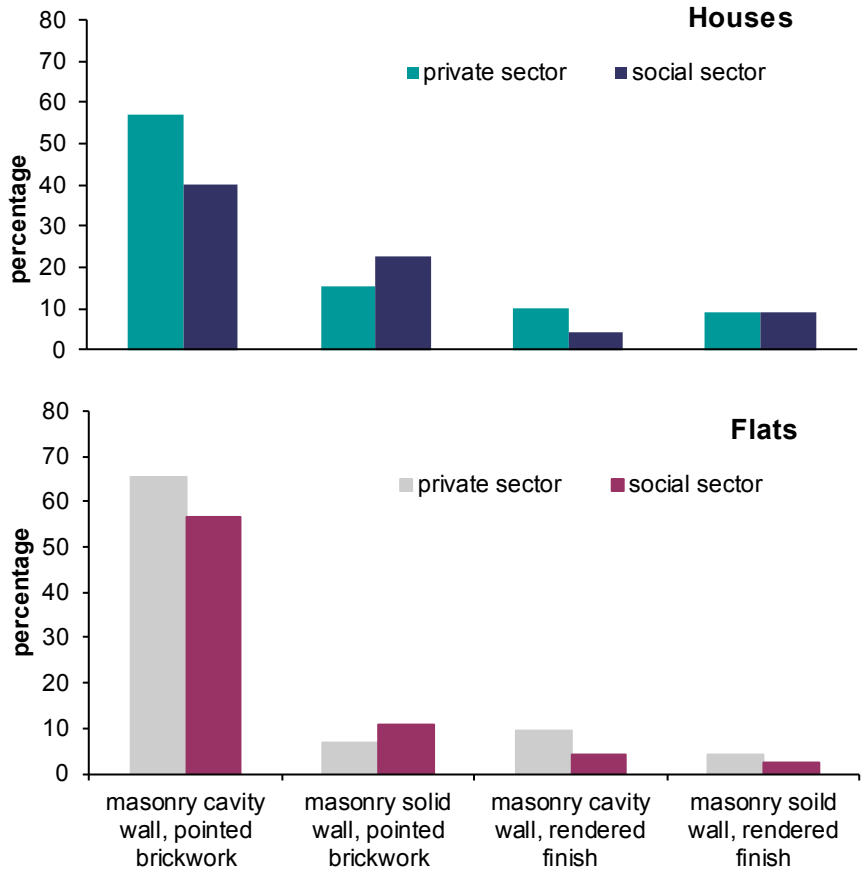
2.6. The type of wall construction varies by tenure and type of home. As these variations were largely similar in 1996 and 2014 this analysis focuses on the 2014 stock profile, with figures for 1996 in Annex Table 2.2.

2.7. Masonry cavity walls with pointed brickwork were more common in private flats (65%) than in social sector flats (57%). It was also more common in private (57%) than in social sector houses (40%), Figure 2.2.

2.8. Private sector dwellings were also more likely (10%) to have rendered masonry cavity walls than social sector dwellings (4%).

2.9. Social sector dwellings were much more likely to be of concrete construction (16%) than private sector dwellings were (1%). The use of concrete frames increased after the Second World War, when the social sector expanded rapidly, Annex Table 2.2.

Figure 2.2: Main wall types by tenure and dwelling type, 2014



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

The potential to install energy improvement measures

2.10. This section examines what energy efficiency improvement measures could potentially be installed in English dwellings. The measures discussed here are selected from the lower and higher cost recommendations considered by Energy Performance Certificate (EPC) assessments[8]. In the analysis, energy efficiency measures are only recommended for implementation if that measure alone would result in the SAP rating increasing by at least 0.95 points. This slightly reduces the potential number of installations for some measures that would provide only a minimal improvement in energy efficiency and that, therefore, may not be cost effective to install. Some homes could benefit from both lower and higher cost measures. Although further measures are suggested this does not imply that the dwelling or existing energy efficiency measures in the home are defective.

[8] See Glossary for further information. Details of the modelling are described in Chapter 5 of the Technical Report, Annex 6

2.11. In 2014, 65% of the housing stock (around 15.3 million homes) could theoretically benefit from at least one of the energy efficiency improvements assessed by the EHS and listed in Annex Table 2.3.

Lower cost measures

2.12. Lower cost measures, costing less than £500, could be applied to 10.1 million homes, or 44% of homes where these measures are possible, most commonly insulating cavity walls (5.1 million, 31% of dwellings with uninsulated cavity walls) or installing or topping up loft insulation (4.7 million, 23% of dwellings with lofts with none or low levels of insulation). Cylinder insulation could also be applied to 2.9 million homes (26% of those with a hot water tank with none or low level of insulation), Annex Table 2.3.

2.13. The potential to improve energy performance varied by tenure, with the potential to apply low cost measures highest among private dwellings, particularly private rented dwellings. Around 43% of private rented dwellings with uninsulated cavity walls could potentially benefit from insulation and 27% with a loft could benefit from loft insulation. Almost a third (31%) of private rented homes with a hot water cylinder would benefit from insulating it compared with 25% of owner occupied homes, Figure 2.3.

2.14. Due to work already undertaken through the Decent Homes programme and its relatively newer stock, the social sector has less potential for further improving loft insulation (15%) and cavity wall insulation (28%). However, the potential to apply hot water cylinder insulation was fairly similar in the social sector (28%) and the private sector (26%).

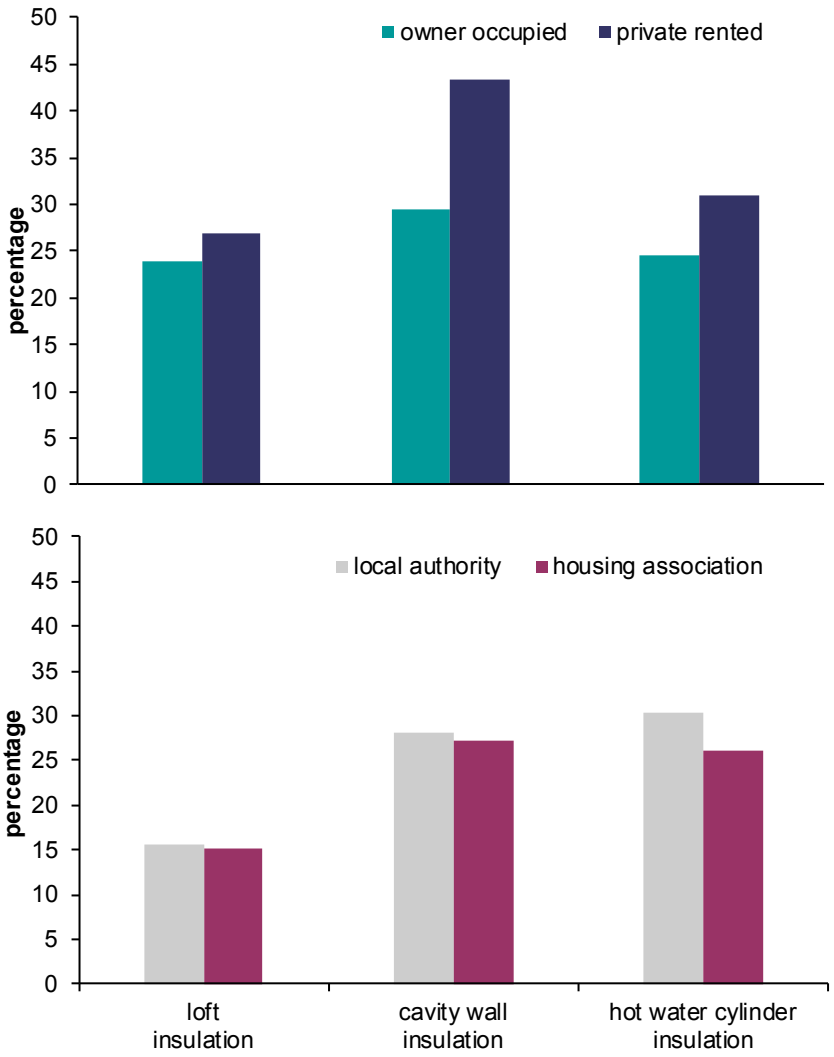
Higher cost measures

2.15. Higher cost measures, costing more than £500, could potentially be applied to 11.1 million (47%) homes. The most common measure was upgrading a conventional central heating boiler to a condensing boiler (8.0 million, 38% of dwellings with a boiler) Annex Table 2.3.

2.16. As with the lower cost measures, there was generally more potential to apply higher cost measures in the private sector than in the social. Of dwellings with a boiler, 41% of private sector homes would benefit from upgrading the boiler, whereas 21% of homes with a boiler-driven heating system would benefit from upgrading heating controls. The comparative figures for social sector homes were 26% and 10%, Annex Table 2.5.

2.17. In contrast, around 79% of social rented homes with storage heating would benefit from upgrading this type of heating system, compared with 62% of private sector homes with storage heating (or other electric heating systems).

Figure 2.3: Eligible dwellings that would benefit from lower cost EPC recommended measures, by tenure, 2014



Base: number of dwellings where this improvement might be possible, e.g. for cavity wall insulation the base is the number of dwellings with uninsulated cavity walls
Note: underlying data are presented in Annex Table 2.4
Source: English Housing Survey, dwelling sample

Chapter 3
Trends in space and water heating technologies

3.1. Space and water heating account for 80% of UK domestic energy use and are therefore of interest when targeting energy efficiency[9]. The first part of this chapter focuses on trends over time in the main space and water heating systems. It then examines the types of controls in place on central heating systems, storage heaters and water heating systems in 2014. Finally, it examines trends in the use of solar hot water panels and photovoltaic panels.

Trends in heating systems

3.2. In 2014, the majority (85%) of homes had a gas central heating system with radiators. A smaller group (5%) had central heating systems using other fuels. Electric storage heaters were used in 6% of homes for space heating and were more common in flats and homes with no mains gas connection[10]. Only a small proportion of homes used individual room heaters that were not part of a central heating system (3%) or communal heating systems/district heating (2%), Annex Table 3.1[11].

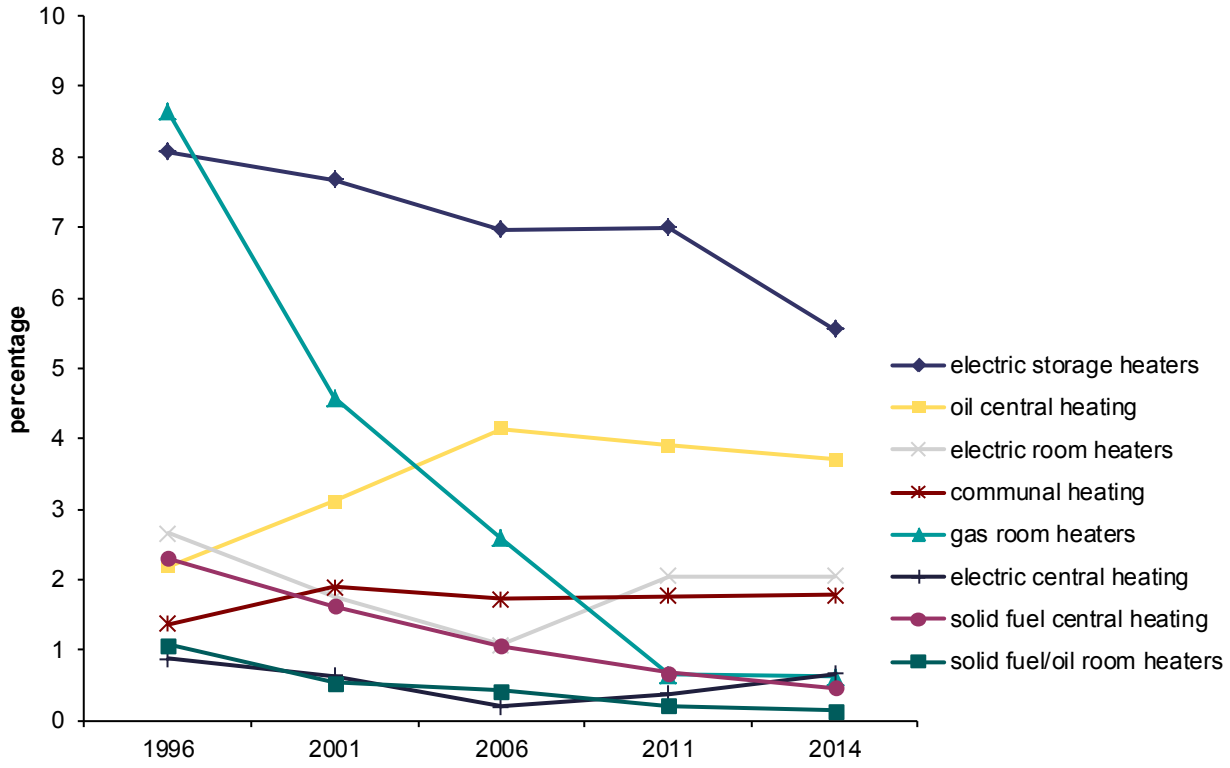
3.3. The proportion of dwellings with gas central heating has steadily increased from 73% in 1996 (14.8 million dwellings) to 85% (19.9 million) in 2014. The increase may be starting to level out as further growth is restricted by the proportion of homes that do not have mains gas supply.

3.4. Amongst the less common heating systems, the most notable changes between 1996 and 2014 were:

- a large reduction in homes with gas room heaters, from 9% to 1%
- a small reduction in the proportion of homes with electric storage heaters, from 8% to 6%
- a small decrease in the proportion of homes with solid fuel central heating, from 2% to less than 1%, and
- an increase in oil fuelled central heating, from 2% to 4%.

[9] Jason Palmer and Ian Cooper, 2013, 'United Kingdom housing energy fact file', DECC: London, available at https://www.gov.uk/government/statistics/united-kingdom-housing-energy-fact-file-2013
[10] See live table DA6101.
[11] Due to rounding the percentages in this paragraph do not add to 100.

Figure 3.1: Main changes in less common heating types, 1996 to 2014



Base: all dwellings
Note: underlying data are presented in Annex Table 3.1
Source: English Housing Survey, dwelling sample

Heating system controls

3.5. The controllability of heating systems matters to occupants for comfort, flexibility and affordability. In addition, for some types of consumers, improved heating controls can result in energy and cost savings (and greenhouse gas emissions savings). The types of controls available for different heating systems vary and therefore this analysis has been split into central heating and storage heating systems.

Central heating systems

3.6. For central heating systems (including communal heating systems), the key types of controls are:

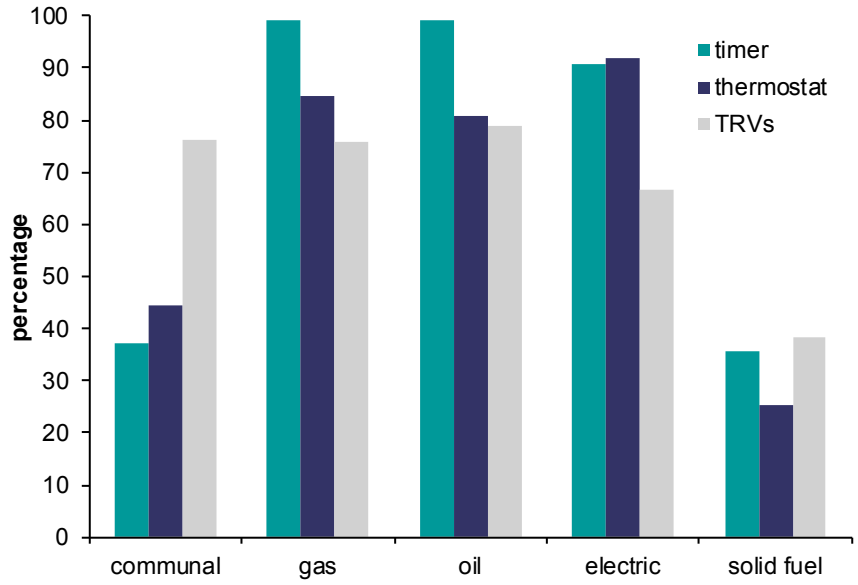
- **Timers** which control when the heating goes on and off. They range from simple manual timeclocks to programmable digital devices. Most include a manual override.
- **Room thermostats** which measure air temperature in the home, and switch the space heating on and off. They can be used to set a single 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.

3.7. Among homes with gas central heating, 99% had a timer, 85% had at least one room thermostat and 76% had TRVs. Homes with solid fuel central heating were much less likely to have any of these controls, Figure 3.2.

3.8. Private rented homes were least likely to have a thermostat (75%) or TRVs (69%) compared to those in other tenures, Annex Table 3.2.

Figure 3.2: Types of controls for different types of central heating systems, 2014



Base: all dwellings with central heating
Note: underlying data are presented in Annex Table 3.2
Source: English Housing Survey, dwelling sample

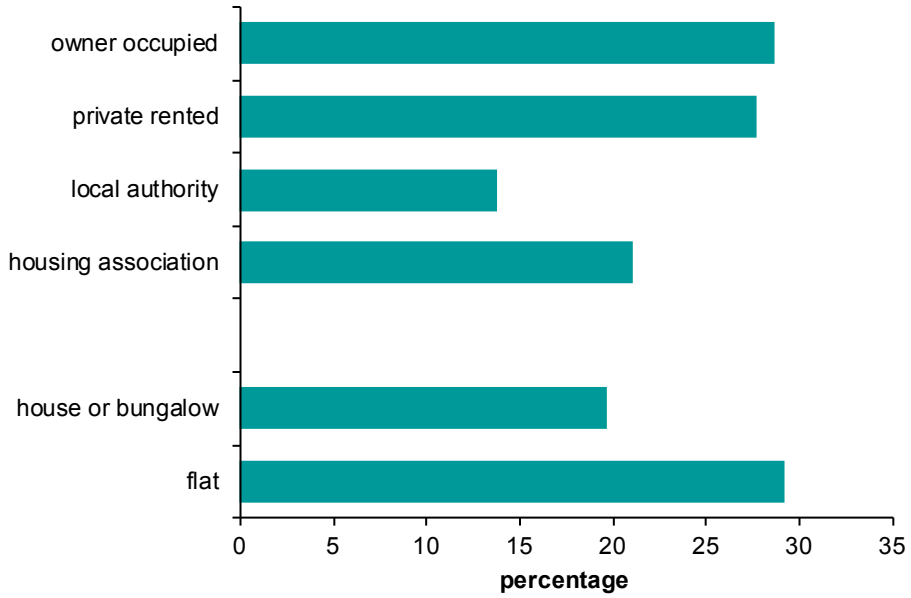
Storage heaters

3.9. In 2014, 6% of homes (1.3 million) had storage heaters, Annex Table 3.1. Storage heaters can have manual or automatic charge controls which adjust the amount of heat stored overnight. The more recently introduced automatic controls[12] 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.

3.10. About a quarter (26%) of homes with storage heating had automatic charge controls[13]. Private sector homes were more likely to have such controls than those owned by local authorities, as were flats compared to houses, Figure 3.3.

[12] Only a very small number of homes had a Celect type controller so these have been included in the automatic category.
[13] Where a dwelling has a mix of manual or automatic charge controls, these have been classed as homes with automatic controls.

Figure 3.3 Homes with storage heating that had automatic charge controls, 2014



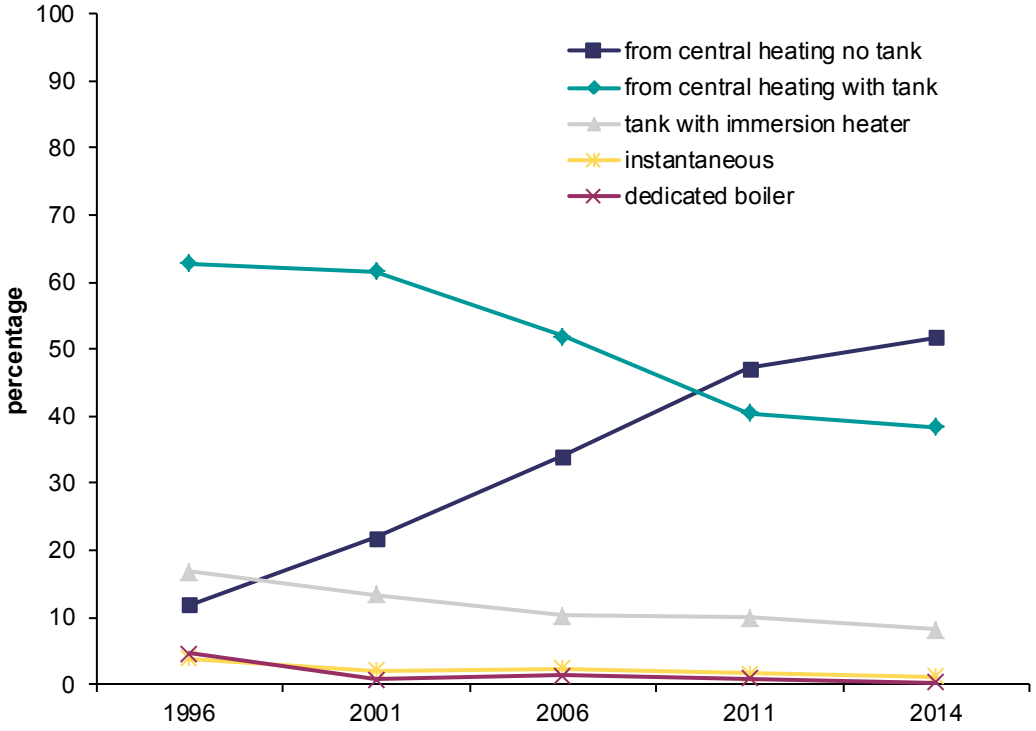
Base: all dwellings with storage heating
Note: underlying data are presented in Annex Table 3.3
Source: English Housing Survey, dwelling sample

Trends in hot water systems[14]

3.11. Over the last two decades, the number of combination boilers (including condensing combination boilers) has increased. These combination boilers provide hot water from the central heating without a separate tank and have increased dramatically from 12% in 1996 to 52% in 2014. This rise has coincided with changes to UK building regulations requiring more efficient boilers from 2005. However, the increase began before 2005 and combination boilers also require less space and are easier to install. This has meant that fewer homes have a hot water tank, Figure 3.4.

[14] Information relates to the main or 'best' hot water system in the dwelling. If there is more than one system, e.g. the dwelling has a central heater boiler that provides hot water and also has an immersion heater as back-up, then this is coded as 'from central heating'.

Figure 3.4 Hot water systems, 1996 to 2014



Base: all dwellings
Note: underlying data are presented in Annex Table 3. 4
Source: English Housing Survey, dwelling sample

Water heating controls

3.12. For the 10.8 million dwellings with a hot water tank the EHS records whether these have controls, namely, a timeclock or a thermostat[15]. Overall, 81% of homes with a hot water tank had a timeclock and 75% had a cylinder thermostat.

3.13. Those most likely to have a timeclock were systems run from a central heating boiler (86%), owner occupied homes (85%) and houses (85%). Findings were similar for cylinder thermostats, with 79% of dwellings with a central heating-based hot water system had cylinder thermostats compared with just 57% of those with immersion heaters and 23% with dedicated boilers, Annex Table 3.5.

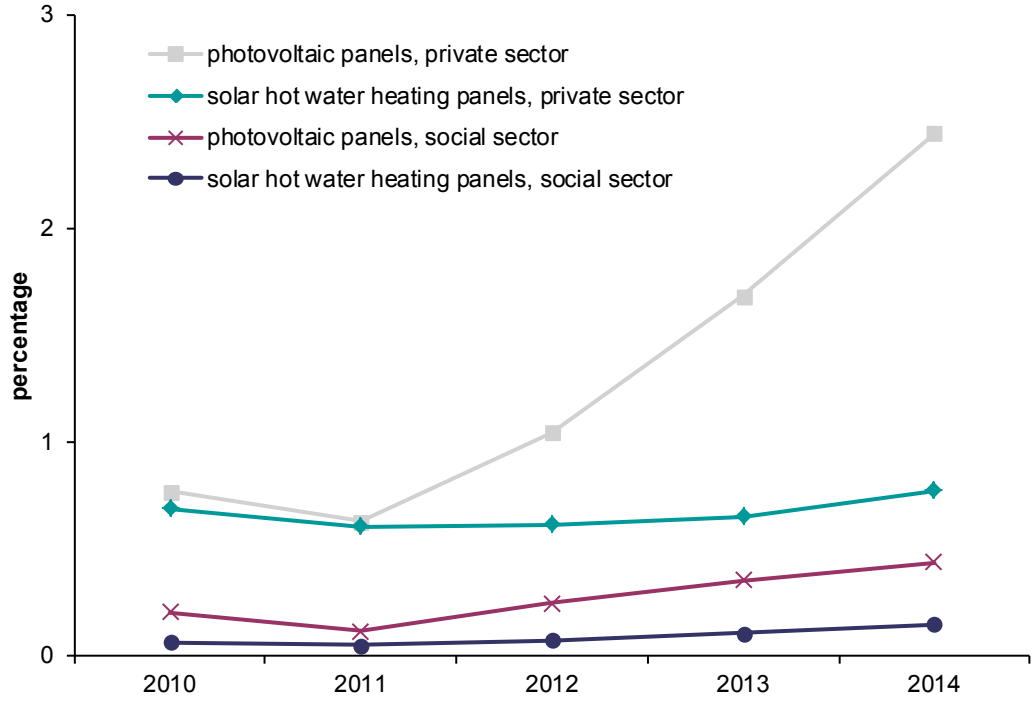
Trends in solar hot water heating and photovoltaic panels

3.14. In 2014, 1% of dwellings had solar hot water heating panels and 3% photovoltaic (PV) panels. In 2010, Feed-in Tariffs were introduced, providing small scale generators of electricity, such as those from small PV panels

[15] 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.

(producing less than five megawatts), with tariff payments on both generation and export of renewable and low carbon electricity. Although the proportion of dwellings with solar hot water panels has remained fairly constant since 2010, the proportion with photovoltaic panels has increased. Most of the increase has been in the private sector rather than the social sector, Figure 3.5.

Figure 3.5: Homes with solar hot water heating and photovoltaic panels, 2010 to 2014



Base: all dwellings
Note: underlying data are presented in Annex Table 3.6
Source: English Housing Survey, dwelling sample

Chapter 4
Exploration of energy efficiency measures and condensation

4.1. Condensation occurs when moisture that is held in the air (water vapour) comes into contact with cold surfaces and condenses into water droplets. Over time, the area can become damp. Mould can grow when relative humidity is above 80%. Whether dwellings have severe condensation and mould growth depends on a number of factors, including:

- The amount of moisture occupants generate from washing, bathing, cooking and breathing.
- How far this moisture can and does escape from the dwelling by passive means (through fixed air bricks, open chimneys etc.) and active means (whether and how often any occupants open windows or use extractor fans).
- The internal air temperature (warm air can hold more moisture than cold air).
- The temperature of surfaces like windows, walls and ceilings, which will depend, to a large extent, on how well they are insulated.

4.2. The prevalence of condensation is therefore determined by complex interactions between the occupants, the building structure and services, including heating. There are currently some concerns that increased airtightness from improved energy efficiency in homes could make condensation problems worse.

4.3. Dampness and/or high humidity are associated with increased prevalence of house dust mites and mould or fungal growth, which can adversely affect the inhabitants' physical and mental health. Children under 14 and people with existing respiratory problems are particularly vulnerable[16].

4.4. Analysis of EHS data cannot determine what is causing condensation but can only examine statistical relationships or correlations between current energy efficiency measures and other aspects of building structure and services. Neither can EHS data be used to determine what impact installation of energy efficiency works may have had on condensation, as to do this would require 'before and after' studies.

[16] See the Housing Health and Safety Rating System Operating Guidance https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/15810/142631.pdf

Main factors associated with severe condensation and mould growth

4.5. In 2014, 3% of dwellings (around 598,000) had problems with serious condensation or mould in at least one room. Where dampness and mould was most or least prevalent has been analysed by certain characteristics of the home or household, Table 4.1. For example, when analysing the data by the main heating system, houses with fixed room heaters (e.g. gas fires) had the highest prevalence of severe condensation or mould, whereas those with central heating had the lowest. The figures indicate correlation and not causation.

4.6. Homes with higher energy efficiency (higher SAP[17] ratings), more loft insulation or in the least deprived areas were less likely to have severe condensation and mould growth. The opposite applied to large, lone parent, overcrowded and ethnic minority households[18].

4.7. Differences were also observed in relation to wall type, double glazing and the presence of open chimneys. Homes with insulated cavity walls were slightly less likely to experience condensation problems than homes with uninsulated cavity walls (1% compared with 2%). Dwellings where some, but under half, of all windows were double glazed were more likely (6%) to have these problems than properties that were largely or fully double glazed (2%)[19], Annex Table 4.1

4.8. There are also some indications that the presence of open chimneys is associated with reduced prevalence of severe condensation, as 2% of homes with open chimneys had this problem compared with 3% of other homes.

[17] The Government's Standard Assessment Procedure (SAP) – see Glossary for further details
[18] This refers to households with an ethnic minority HRP – see Glossary for further details
[19] The reasons for this are unknown but partial double glazed dwellings were more likely to be located in the private sector (live web table DA6201) and modified piecemeal

Table 4.1: Prevalence of severe condensation and mould within different characteristics of dwellings and households, 2014

	condensation and mould most prevalent		condensation and mould least prevalent
			percentages
dwelling characteristics			
main heating system: fixed room heaters	10	has central heating	2
low energy efficiency, SAP <30	7	high energy efficiency, SAP >70	1
no loft insulation	7	150mm or more loft insulation	2
private rented	6	owner occupied	1
located in 20% most deprived areas	5	located in 20% least deprived areas	1
household characteristics			
overcrowded	9	under-occupied	2
ethnic minority HRP	6	white HRP	2
household type: lone parent household	5	couple 60 or over	1
occupied by five or more people	5	occupied by one or two people	2
workless	5	not workless	3
lowest income quintile	4	highest income quintile	1
in poverty	4	not in poverty	2

Notes:
1) percentages are within each group. For example, 10% of dwellings with fixed room heaters used as the main heating system have a condensation problem while 90% of those with central heating do not.
2) underlying data are presented in Annex Tables 4.1 and 4.2 and web table DA5103.
Source: English Housing Survey, dwelling sample and household sub-sample

Inadequate room ventilation

4.9. A room is considered to have inadequate ventilation where windows are permanently fixed (painted, screwed or nailed shut) and there is no other adequate form of ventilation to the room. This also includes rooms where window openings are too small or too poorly positioned to allow proper ventilation. In 2014, only about 1% (around 192,000 homes) had this problem in one or more rooms. Inadequate room ventilation is associated with problems of severe condensation and mould, with 20% of these homes also having this problem[20], Annex Table 4.3.

4.10. Dwellings without adequate room ventilation were more likely to be built before 1919 (34% compared to 20% of homes with adequate room ventilation) and more likely to use fixed room heating as the main heating system (11% compared to 3%). They were less likely to be fully double glazed (68% compared to 81%).

[20] The sample size is too small, around 100 dwellings, to permit further analysis.

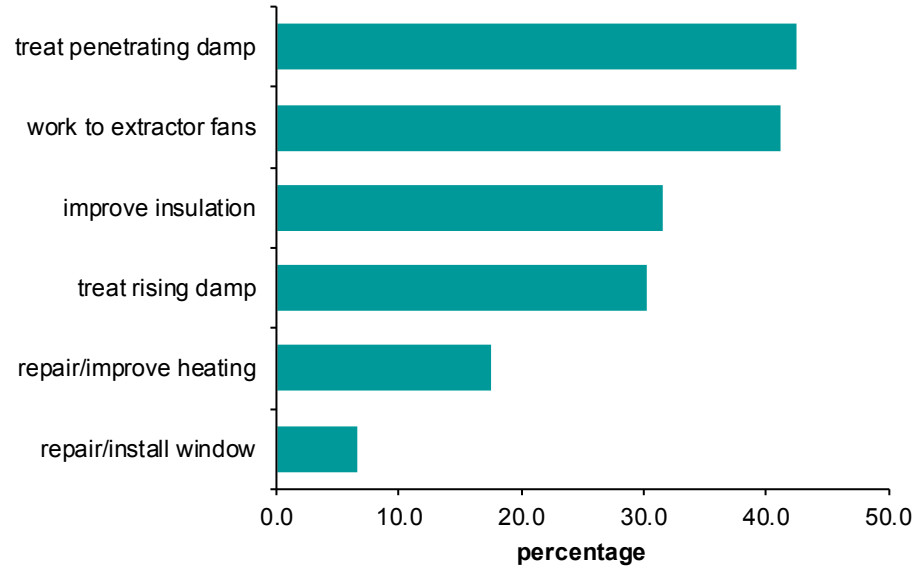
Dampness and mould as HHSRS hazards

4.11. Condensation is only one cause of damp and it needs to be seen in a wider context. As part of the English Housing Survey, surveyors record the presence of any type of damp and mould at the dwelling (rising and penetrating as well as condensation/mould growth[21]) and, for the Housing Health and Safety Rating System (HHSRS)[22] assessment, consider the risks of harm from any dampness and mould present.

4.12. Where such risks are considered to be significantly higher than average, surveyors specify the remedial work that would be required to mitigate these risks so that they are no worse than the national average. By examining the types of remedial work that the surveyors specify, we can identify the likely cause(s) of the damp.

4.13. In 2014, 5% of homes (around 1.1 million) were assessed as having significantly worse than average problems with damp and mould. The most common remedial works[23] specified were treating penetrating damp (caused by leaks due to disrepair) and work to extractor fans (to improve ventilation), Figure 4.1. These findings further demonstrate the complex causes of damp and mould and how different types of work are required to reduce these problems.

Figure 4.1: Dwellings requiring specified work to remedy significantly worse than average risks from dampness and mould, 2014



Base: all dwellings with HHSRS damp and mould assessed as 'significantly worse than average'
Note: underlying data are presented in Annex Table 4.4
Source: English Housing Survey, dwelling sample

[21] See Glossary for further details of each type of damp
[22] See EHS Technical Report Chapter 5, Annex 5 for more information on the HHSRS
[23] This is specified work to reduce the probability of a harmful event occurring to the national average

Technical notes and glossary

Technical notes

1. Results in chapter 1 of this report relate to both the household and the dwelling. They are presented for '2014' and are based on fieldwork carried out between April 2013 and March 2015 (a mid-point of April 2014). The sample comprises of 11,851 households where a physical inspection was also carried out. Throughout the report, this is referred to as the 'household subsample'.

2. Results in the report which relate to the physical dwelling, such as chapters 2, 3 and 4, are presented for '2014' and are based on fieldwork carried out between April 2013 and March 2015 (a mid-point of April 2014). The sample comprises 12,297 occupied or vacant dwellings where a physical inspection was carried out. Throughout the report, this is referred to as the 'dwelling sample'.

3. Where the numbers of cases in the sample are too small for any inference to be drawn about the national picture, the cell contents are replaced with a "u". This happens where the cell count is less than 5. When percentages are based on a row or column total with unweighted total sample size of less than 30, the figures are italicised. Figures in italics are therefore based on a small sample size and should be treated as indicative only.

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, are published on the website: https://www.gov.uk/government/organisations/department-for-communities-and-local-government/series/english-housing-survey alongside many supplementary 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

Area type: At the physical inspection, the surveyor makes an assessment of the area surrounding the dwelling and classifies it according to the following categories:

- **city or other urban centre** which includes

    - *city centre*: the area around the core of a large city.
    - *other urban centre*: the area around towns and small cities, and also older urban which have now become part of a metropolitan area.

- **suburban residential**: the outer area of a town or city; characterised by large planned housing estates.

- **rural** which includes:
    - *rural residential*: a suburban area of a village, often meeting the housing needs of people who work in nearby towns and cities.
    - *village centre*: the traditional village or the old heart of a village which has been suburbanised.
    - *rural*: an area which is predominantly rural e.g. mainly agricultural land with isolated dwellings or small hamlets.

Bedroom standard: The 'bedroom standard' is used by government as an indicator of occupation density. A standard number of bedrooms is calculated for each household in accordance with its age/sex/marital status composition and the relationship of the members to one another. A separate bedroom is allowed for each married or cohabiting couple, any other person aged 21 or over, each pair of adolescents aged 10-20 of the same sex, and each pair of children under 10. Any unpaired person aged 10-20 is notionally paired, if possible, with a child under 10 of the same sex, or, if that is not possible, he or she is counted as requiring a separate bedroom, as is any unpaired child under 10.

This notional standard number of bedrooms is then compared with the actual number of bedrooms (including bed-sitters) available for the sole use of the household, and differences are tabulated. Bedrooms converted to other uses are not counted as available unless they have been denoted as bedrooms by the respondents; bedrooms not actually in use are counted unless uninhabitable.

Households are said to be overcrowded if they have fewer bedrooms available than the notional number needed. Households are said to be under-occupying if they have two or more bedrooms more than the notional needed.

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.

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[24].

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.

Deprived local areas: These are Lower Layer Super Output Areas (LSOAs) scored and ranked by the 2010 Index of Multiple Deprivation (IMD).

Seven domains of deprivation which can be experienced by people are combined to produce the overall IMD. These seven domains relate to:

- Income deprivation
- Employment deprivation
- Health deprivation and disability
- Education skills and training deprivation
- Barriers to housing and services
- Crime
- Living environment deprivation

LSOAs are statistical geography providing uniformity of size. There are 32,482 in England and on average each contains around 1500 people. These ranked areas have been placed into five groups of equal numbers of areas, from the 20% most deprived area on the index, to the 20% least deprived.

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.

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

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 70m2 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 usable 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 Stock Report as having more than 70m².
- medium/large terraced house: a house with a total floor area of 70m2 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.

Economic status: Respondents self-report their situation and can give more than one answer.

- **working full-time/part-time**: full-time work is defined as 30 or more hours per week. Part-time work is fewer than 30 hours per week. Where more than one answer is given, 'working' takes priority over other categories (with the exception that all those over State Pension Age (SPA) who regard themselves as retired are classified as such, regardless of what other answers they give).

- **unemployed**: this category covers people who were registered unemployed or not registered unemployed but seeking work.

- **retired**: this category includes all those over the state pension age who reported being retired as well as some other activity. For men the SPA is 65 and for women it is 60 if they were born before 6th April 1950. For women born on or after the 6th April 1950, the state pension age has increased incrementally since April 2010[25].

- **full-time education:** education undertaken in pursuit of a course, where an average of more than 12 hours per week is spent during term time.

- **other inactive**: all others; they include people who were permanently sick or disabled, those looking after the family or home and any other activity.

On occasions, **full-time education** and **other inactive** are combined and described as **other economically inactive**.

Energy cost (for SAP calculations): 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: 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

[25] For further information see: www.gov.uk/browse/working/state-pension

a 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 2014 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) bands: The 1-100 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 is from April 2015 to March 2017.

- **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): The EPC provides a range of indicators based on current performance, whether the property would benefit in terms of improved performance from a range of low cost and higher cost measures (see below), 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.

The EHS currently provides the following EPC based indicators, calculated using the survey's own approach to SAP (see the Technical Advice Note on Energy Efficiency and Energy Improvements for further information):

- **current performance:**
    - *energy efficiency rating* (EER) and bands
    - *environmental impact rating* (EIR) and bands
    - *primary energy use* (kWh/m^2/year)
    - *energy cost* (£/year), but unlike the EPC these are based on 2012 constant prices
    - CO_2 (carbon dioxide) emissions (tonnes/year)

- **improvement measures:** as part of the EPC, certain improvement measures are suggested which would increase the energy efficiency of the dwelling. These include improvements to both heating and insulation measures.

    a) *higher cost measures* (more than £500):

upgrade to **central heating controls**, for boiler driven systems, typically to a stage where a room thermostat, a central programmer and thermostatic radiator valves (TRV's) have been installed (although the range of upgraded controls can vary depending on the heating system). Eligible dwellings include all with central heating;

upgrading to a **class A condensing boiler**, using the same fuel (mains gas, LPG or fuel oil), where a non-communal boiler is in place (this improvement measure is most appropriate when the existing central heating boiler needs repair or replacement). Eligible dwellings are all with boilers of any type;

upgrading existing storage radiators (or other electric heating) to more **modern, fan-assisted storage heaters**;

installation of a **hot water cylinder thermostat** where a storage cylinder is in use but no thermostat exists. The costs of installing a cylinder thermostat vary and may be relatively inexpensive, however the improvement has been included as a high cost measure to reflect cases where more extensive work is required to the overall heating controls;

replacement **warm-air unit** with a fan-assisted flue, where the original warm-air heating unit is pre-1998;

installation of a manual feed **biomass boiler** or **wood pellet stove** where an independent, non-biomass solid fuel system exists. This measure was assessed to identify the number of dwellings that would benefit from this measure but was not included in the post improvement energy efficiency rating or carbon dioxide emissions due a combination of the small amount of dwellings that would benefit and modelling complexity.

b) *lower cost measures* (less than £500):

installation or upgrade of **loft insulation** which is less than 150mm, where the dwelling is not a mid- or ground-floor flat and where the loft does not constitute a full conversion to a habitable room;

installation of **cavity wall insulation**, where the wall is of uninsulated cavity construction;

installation or upgrade of **hot water cylinder insulation** to a level matching a 80mm jacket. Recommended where the current level is less than 25mm of spray foam or less than an 80mm jacket. Eligible houses are those with a hot water cylinder/tank.

The survey is not able to include the following improvements: draft proofing and low energy lighting. Other more expensive measures that are not included are: solar water heating; double or secondary glazing; solid wall insulation; complete change of

heating system to class A condensing boiler (including fuel switching); solar photovoltaics (PV) panels.

- **Cost of energy efficiency improvement measures**: the cumulative cost of implementing the measures that have been recommended for each dwelling is calculated by applying standard costs on a per unit area basis for loft and cavity wall insulation and a single unit cost for other measures.

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.

Full time education: Full time education is education undertaken in pursuit of a course, where an average of more than 12 hours per week is spent during term time.

Gross annual income: The annual income of the household reference person and (any) partner. This includes income from private sources (regular employment, self-employment, government schemes, occupational pensions, private pensions and other private income), state benefits/allowances and tax credits, as collected on the EHS (this includes housing benefit/Local Housing Allowance but excludes council tax benefit and Support for Mortgage Interest) and interest from savings. It is a gross measure i.e. income before Income Tax or National Insurance deductions.

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.

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 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)** married/cohabiting couple with no dependent children or with independent child(ren) only.
    - **couple, no children**
    - **couple, independent child(ren) only**
- **couple with dependent child(ren)** married/cohabiting couple with dependent child(ren) – may also include independent child(ren).
- **lone parent with dependent child(ren)** lone parent family (one parent with dependent child(ren) – may also include independent child(ren).
- **other multi-person households:**
    - **lone parent, independent child(ren) only**

- **other type of household** (includes flat sharers and households containing more than one couple or lone parent family)

- **one person:**
  - **one person aged under 60**
  - **one person aged 60 or over**

The married/cohabiting couple and lone parent household types (the first three categories above) may include one-person family units in addition to the couple/lone parent family.

Housing Benefit: A benefit that is administered by local authorities, which is designed to assist people who rent their homes and have difficulty meeting their housing costs. Council tenants on Housing Benefit receive a rent rebate which means that their rent due is reduced by the amount of that rebate. Private and social housing tenants usually receive Housing Benefit (or rent allowance) personally, although sometimes it is paid direct to the landlord.

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[26] 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

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

29 hazards. See the EHS Technical Note on Housing and Neighbourhood Conditions[27] 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 Cost (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 Cost (AHC)** income is derived by deducting rent and mortgage payments from the BHC measure.

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**

  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).

  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.

  other walls: these are any dwellings with predominantly non-cavity or masonry solid walls (e.g. timber, metal or concrete frames).

- **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

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

has been converted to a habitable space. Where insulation could not be observed, information is taken from the householder or from imputed estimates based on the age and type of the dwelling.

Independent 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). Independent children may also be referred to as non-dependent children.

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.

Overcrowding: Households are said to be overcrowded if they have fewer bedrooms available than the notional number needed according to the bedroom standard definition. See bedroom standard.

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: The energy cost rating as determined by Government's Standard Assessment Procedure (SAP) is used to monitor the energy efficiency of dwellings. It 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 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 method for calculating SAP was comprehensively updated in 2005 and in 2009 with an update of a more minor nature in 2012. This new SAP 2012 methodology is used in this report.

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.

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).

Under-occupation: Households are said to be under-occupying their property if they have two or more bedrooms more than the notional number needed according to the bedroom standard definition. See bedroom standard.

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.

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.

The United Kingdom Statistics Authority has designated these statistics as National Statistics, in accordance with the Statistics and Registration Service Act 2007 and Signifying compliance with the Code of Practice for Official 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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