Chapter 2
Potential for energy improvements

2.1. The previous chapter described the energy performance of the housing stock in 2013 and how this had improved over time. This chapter examines the potential for further energy efficiency improvements in the housing stock and how energy performance, as measured by the SAP rating and energy costs, would change if this potential for improvement were fulfilled. It looks at the profile of dwellings which would still remain among the least energy efficient even if these potential improvements were implemented, and the types of households who were living in them.

2.2. The cost improvement measures described in the analysis are based on the lower and higher cost recommendations covered by the Energy Performance Certificate (EPC)[1]. For the EHS, measures are only recommended for implementation if that measure alone would result in the SAP rating increasing by at least 0.95 SAP points. This limitation reduces the potential for some measures which would provide only a minimal improvement in energy efficiency in a dwelling and that, as a result, may not be cost effective to install. Furthermore, it should be noted that the suggested measures do not imply that current energy performance measures in the home are defective or that the home is deficient in terms of any particular standard.

2.3. For the potential reduction in carbon emissions through EPC measures see Chapter 1 of the 2012 EHS: Energy efficiency of English housing report.

Energy improvement measures and average costs of work

2.4. In 2013, around 16.3 million homes (70% of the total housing stock) could theoretically benefit from at least one of the energy improvement measures listed in Table 2.1. Some 10.8 million homes (48% of homes to which a low cost measure could apply) could potentially benefit from one or more of the lower cost measures, most commonly installing cavity wall insulation (5.4 million) or installing or topping up loft insulation (5.3 million). Overall, 12.1 million (52%) homes could potentially benefit from one or more of the higher

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

cost measures, the most common of which was replacing an existing conventional central heating boiler with a condensing boiler (9.0 million).

Table 2.1: EPC recommended energy efficiency measures, 2013

all dwellings

	size of applicable group[1] (000s)	number of dwellings (000s) that would benefit from the measure	percentage of applicable group
low cost measures (less than £500)			
loft insulation	20,264	5,329	26.3
cavity wall insulation	15,951	5,392	33.8
hot water cylinder insulation	11,494	2,951	25.7
any low cost measure	**22,601**	**10,779**	**47.7**
higher cost measures (more than £500)			
hot water cylinder thermostat	11,494	926	8.1
heating controls	20,692	4,639	22.4
boiler upgrade	20,580	8,965	43.6
install biomass system[2]	593	43	7.2
storage heater upgrade	2,125	1,438	67.7
replacement warm air system	113	67	59.5
any higher cost measure	**23,254**	**12,168**	**52.3**
any low or higher cost measure	**23,254**	**16,343**	**70.3**
mean cost of measures per dwelling (£)		*1,042*	
total cost of measures (£billion)		*17.03*	
sample size	*12,498*		

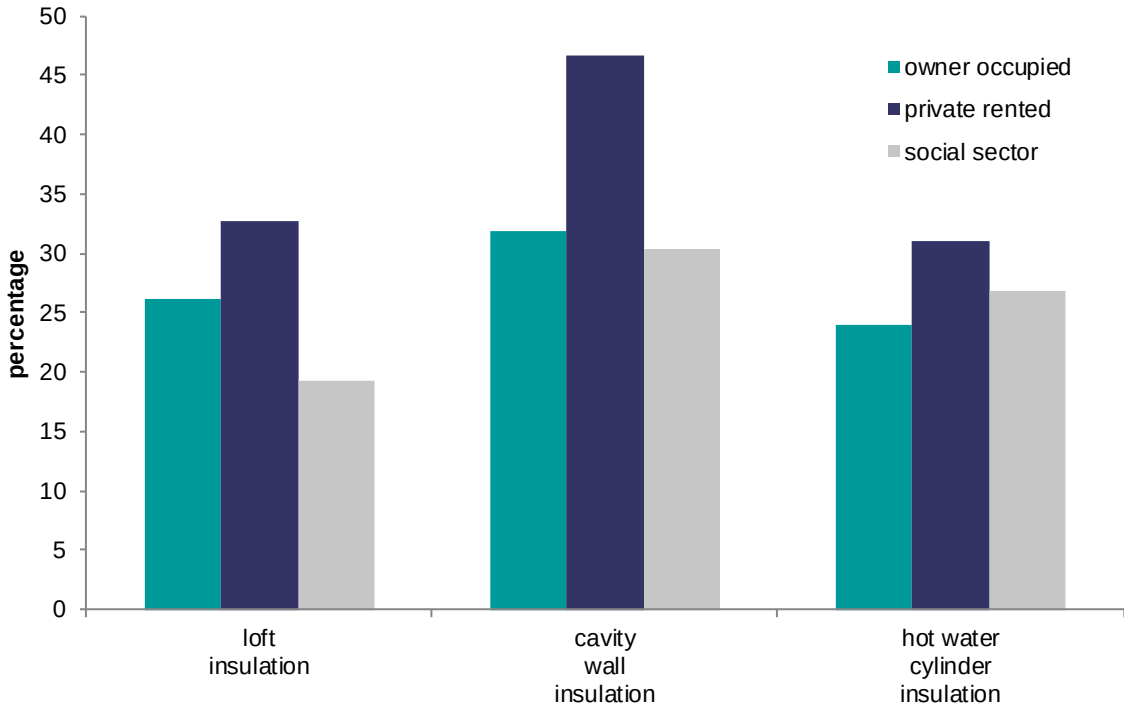
[1] size of applicable group is the number of dwellings where this improvement might be possible, e.g. for cavity wall insulation this is the number of dwellings with cavity walls, whether insulated or not.
[2] improvement only applied to homes with solid fuel heating
Notes:
1) improvement costs of low and high cost measures at 2013 prices
2) data in columns do not sum to the sub totals as dwellings may be able to benefit from more than one EPC measure
3) underlying data are presented in Annex Table 2.1
Source: English Housing Survey, dwelling sample

Low cost measures

2.5. The potential to improve energy performance through low cost measures was highest among private rented dwellings, even though the average SAP rating for these homes was similar to owner occupied homes (Annex Table 1.1). Almost half (47%) of private rented dwellings with cavity walls could potentially benefit from insulation; the remaining 53% either had filled cavity walls or could not feasibly have insulation installed. Loft insulation would improve a third (33%) of these homes (the applicable group comprised all

houses and top-floor flats). Due to its relatively newer stock, and to work already done under the Decent Homes programme, the social sector had less potential for improving loft insulation and hot water cylinder insulation, Figure 2.1.

Figure 2.1: Eligible dwellings that would benefit from lower cost EPC recommended measures by tenure, 2013



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 2.2
Source: English Housing Survey, dwelling sample

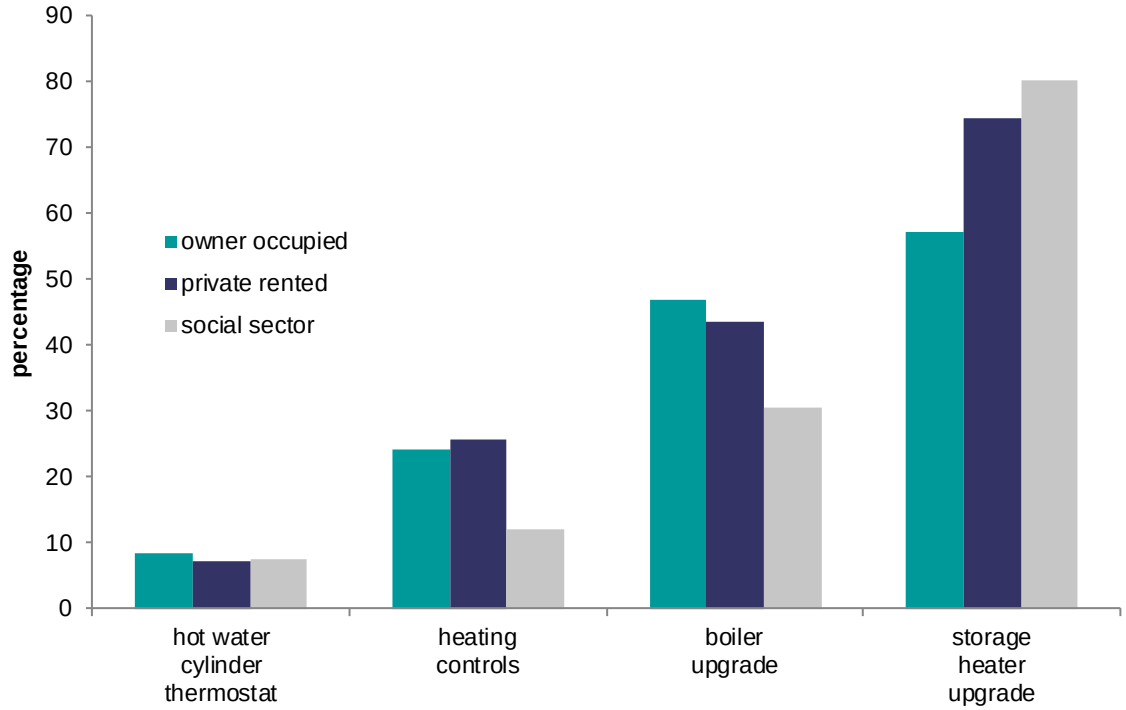
2.6. There was greater potential for flats to benefit from installing low cost energy efficiency measures particularly cavity wall insulation (44% of applicable homes), Annex Table 2.2.

2.7. It is not surprising that the newest homes built after 1990 were generally least likely to benefit from these lower costs measures. For homes built before this period, however, there was no clear relationship between the age of the dwelling and the potential for each lower cost EPC measure; for example, some 27% of homes built before 1919 with a loft space could potentially benefit from insulation compared with 25% of homes built between 1945-64 and 30% built between 1981-90.This suggests that many of the older homes in the stock had already received energy improvement measures to bring them up to modern standards, Annex Table 2.2.

Higher cost measures

2.8. Some 80% of social sector homes and 74% of private rented homes with storage heating would benefit from upgrading this type of heating system, compared with just over half (57%) of eligible owner occupied homes that would benefit from this measure. The social sector had less potential for installing heating controls and undertaking boiler upgrades (for the reasons provided for low cost measures above). Relatively few dwellings had the potential to install hot water cylinder thermostats, as most dwellings with hot water cylinders already had this feature regardless of tenure.

Figure 2.2: Eligible dwellings that would benefit from higher cost EPC recommended measures by tenure, 2013



Base: number of dwellings where this improvement might be possible, e.g. for a boiler upgrade the dwelling must have an existing boiler system, with the upgrade assuming the same fuel is used
Notes:
1) costs for 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
2) replacement warm air systems and installation of biomass systems have been omitted due to the small numbers of dwellings that would benefit
3) underlying data are presented in Annex Table 2.3
Source: English Housing Survey, dwelling sample

2.9. Houses were more likely to benefit from the installation of these higher cost measures (except storage heating upgrades), including the upgrading of the boiler. Over three quarters of flats with storage heating as the main form of heating (76%) would benefit from upgrading storage heating systems, Annex Table 2.3.

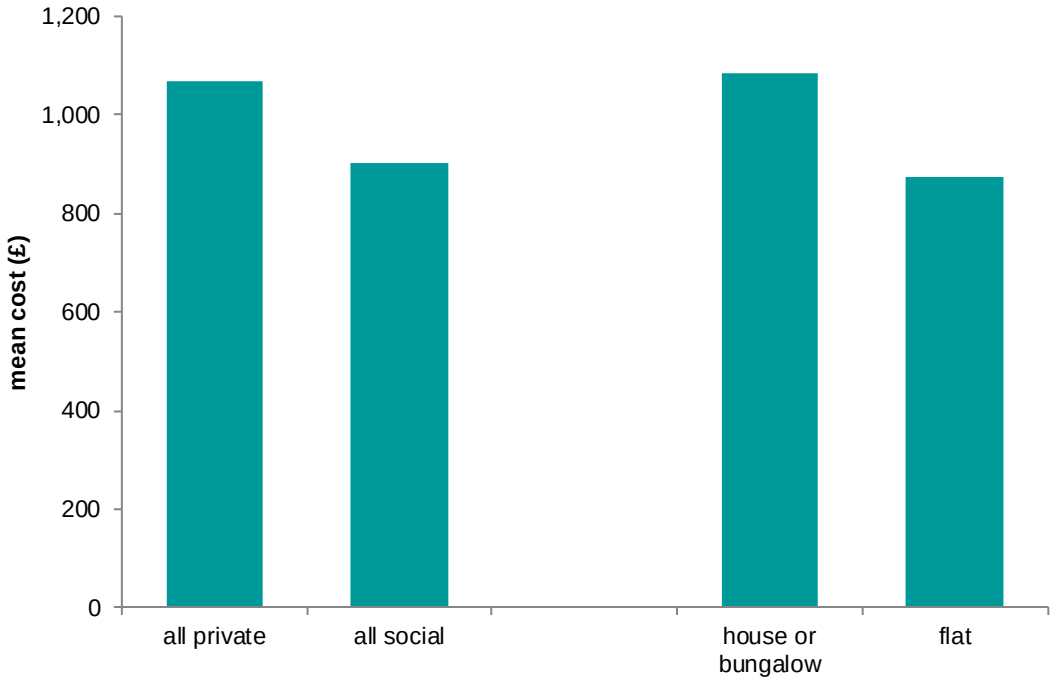
2.10. Overall there was no clear relationship between the age of the dwelling and the potential for each higher cost EPC measure, supporting the suggestion that many of the older homes in the stock had already received energy improvement measures. However, the proportion of eligible homes that would benefit from either a hot water cylinder thermostat or heating controls was lower for homes built after 1990, Annex Table 2.3.

Costs of EPC improvement measures

2.11. It is estimated that the total cost for implementing all these potential measures would be over £17 billion, with an average cost per dwelling of around £1,000 for homes that could have at least one energy upgrade given in Table 2.1. This figure conceals a considerable level of variation. The average cost to apply the required measures would be less than £325 in 20% of applicable homes. At the other end of the scale, the most expensive 20% would cost in excess of £1,500 to improve, Annex Table 2.4.

2.12. On average, private homes were more expensive to improve (£1,066) than social sector dwellings (£900). All types of rented homes were generally less expensive to improve, in part because they contained a higher proportion of flats. Flats were less expensive to improve on average (£875) than houses (£1,082), Figure 2.3.

Figure 2.3: Mean costs of potential EPC measures by tenure and dwelling type, 2013



Base: all dwellings where the installation of any EPC measure is feasible
Note: underlying data are presented in Annex Table 2.4
Source: English Housing Survey, dwelling sample

2.13. Due partly to EPC and other energy improvement works already undertaken, the oldest dwellings (pre-1919) did not have significantly different average costs from more recently built homes. (The type of wall insulation most suitable for these homes, solid wall insulation, is not one of the measures considered by this analysis). The lowest average costs were for homes built from 1945 to 1964, when the majority of social homes were built, Annex Table 2.4.

Households in homes which need improvements

2.14. Around 15.9 million households (70%) lived in a home that could theoretically benefit from at least one of the energy improvement measures. This section focuses on certain key household groups examined in Chapter 1 of this report[2]. Overall there were moderate variations between the types of households that would benefit from any of the EPC measures.

2.15. Households where the HRP was 60 years old or more were a little more likely to live in a home that could benefit from an EPC measure (73%) compared with households where the HRP was younger (69%), Annex Table 2.5.

2.16. Households containing someone with a long term illness or disability were slightly less likely to benefit from at least one of these EPC measures (69%) compared with households that did not have a member with this type of difficulty (71%). Households with children under 5 (65%) were also less likely to reside in a home requiring some form of energy improvement compared with households with older children (71%), Annex Table 2.5.

2.17. Ethnic minority HRP households and those in poverty were no more likely to live in a home that could potentially benefit from an EPC measure compared, respectively, with white HRP households and households not in poverty, Annex Table 2.5.

2.18. There was no clear relationship between the need for improvement measures and net household income[3], (Annex Table 2.5), although the average weekly income for households whose home would benefit from at least one measure was around £540 compared with £575 for households where no improvement measures were needed, Annex Table 2.6.

[2] As per Chapter 1 of this report, these groups comprise households containing people who may be considered vulnerable on account of their age, long term illness or disability, and households which tend to be disadvantaged: those with an ethnic minority HRP and those in relative poverty. See glossary for definitions.
[3] This is net household income before housing costs are deducted. See Glossary or 2013 Technical Report, Chapter 5, Annex 5.4 for further details.

Post-improvement performance

Post improvement – SAP and tenure

2.19. If all the potential energy improvement measures[4] were installed in all eligible dwellings, the mean SAP rating for the stock would rise from 60 to 65. The rise in the average SAP rating would be greater for both owner occupied and private rented dwellings (up 6 points) than for social sector homes (up by 4 points), although we need to bear in mind that the latter homes were already more energy efficient in 2013, Annex Table 2.7.

2.20. Applying all EPC measures assessed would almost double the overall proportion of dwellings in bands A to C (green colours in Figure 2.4) from 23% to 40%. In addition, the percentage of homes in the least efficient bands, (E to G, orange and red colours in Figure 2.4) would fall from 26% to 12%. Applying all these EPC measures would, therefore, represent a further marked improvement to the energy efficiency gains made from 2001 to 2013 (see Chapter 1). Nonetheless there would still be 12% of dwellings in the poorest energy efficient SAP bands (E to G). The energy characteristics of these homes (post improvement) are examined later in this Chapter. The dwelling characteristics of homes in SAP Bands F or G in 2013 are also examined in Chapter 3 of this report, providing an insight into why homes with the poorest energy efficiency are often more problematic to improve.

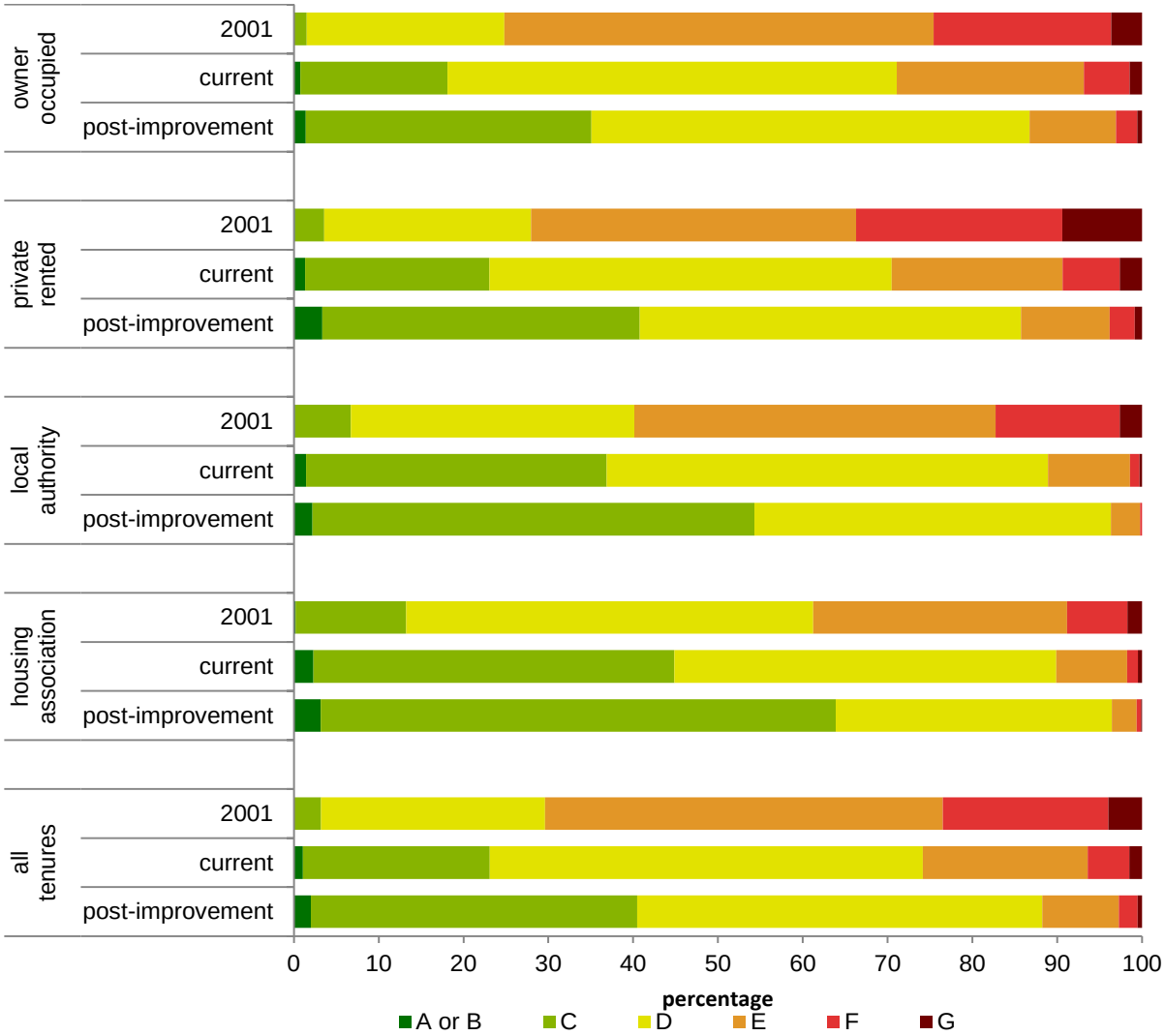
2.21. With regards to each tenure, if the full range of measures were applied this would result in:

- very few local authority and housing association homes in Bands E to G (4%), (orange and red colours)
- over half of local authority dwellings (54%) and almost two thirds of housing association homes (64%) in Bands A to C (green colours) up from 37% and 45% respectively
- some 35% of owner occupied homes and 41% of private rented homes in Bands A to C (green colours), up from 18% and 23% respectively, Figure 2.4

2.22. These variations in potential improvement by tenure are due to the different dwelling type and age profiles within tenures. The private sector had the largest proportion of both the oldest pre 1919 homes and of semi-detached and detached houses, which were all typically associated with the lowest energy efficiency ratings (see Chapter 1 of this report).

[4] Calculations of post-improvement Energy Efficiency Rating/CO_2 emissions include the effect of replacing a warm air system but, due to modelling complexity, not the effect of installing a biomass boiler. Given the relatively small number of dwellings that could benefit from such a boiler this will not have any significant effect on the overall indicators of post-improvement performance used in this section.

Figure 2.4: Percentage of dwellings in each Energy Efficiency Rating Band by tenure, 2001, current (2013) and post-improvement performance



Base: all dwellings
Notes:
1) improvements refer to those listed in Table 2.1
2) underlying data are presented in Annex Table 2.8
Sources:
2001: English House Condition Survey, dwelling sample;
2013: English Housing Survey, dwelling sample

Post improvement – energy costs

2.23. If all the recommended EPC improvements were applied to the stock this could impact positively on the heating, lighting and ventilation components of average fuel bills. The EHS estimates that, across the whole stock, the application of all measures could lead to a potential 14% reduction in these bills, from £990 per annum to £855 per annum (at standard 2013 energy prices). Furthermore, the total energy bill could potentially fall from £23.0 billion to £19.9 billion, Annex Table 2.7.

2.24. This potential reduction in annual average fuel bills would vary by tenure, reflecting both the current and potential energy performance of each sector. The fall in average fuel costs would be greater among owner occupied homes (£153 or 14%) and private rented homes (£136 or 15%). Falls would be more modest (10%) in both local authority and housing association homes where average costs were lower in 2013, Annex Table 2.7.

Post improvement – carbon dioxide (CO_2) emissions

2.25. The result of applying all the recommended EPC improvements would be a mean reduction in notional carbon dioxide emissions of 1.1 tonnes per dwelling per year, some 22% lower than the pre-improvement measures value. Again, there are variations in the decrease of CO_2 emissions among tenures, both by number of tonnes and by percentage. Private stock shows the largest reductions with owner occupied homes decreasing by 1.3 tonnes per dwelling per year whilst the social sector showed a more modest predicted reduction of 0.6 tonnes (18% less than the pre-improvement value). This is due to the lower current emissions and fewer measures being needed in these dwellings, Annex Table 2.7.

Post improvement – other dwelling characteristics

2.26. This section looks at the likely profile of the 2.7 million dwellings (12% of the stock) which would still have poor energy efficiency (SAP ratings E to G) supposing all the potential energy improvements detailed above were undertaken within the housing stock, Table 2.2.

2.27. Dwellings with certain heating, insulation and construction characteristics would be over represented in this group. These characteristics reflect some of the measures not considered by this analysis, in particular solid wall insulation and double glazing. Around 2.2 million (82% of dwellings with these SAP ratings) would have uninsulated solid walls. Some 38% would have less than 80% double glazing; 23% would have storage or room heaters as their main space heating system; and 13% of those with lofts would have no loft insulation. Around 8% of centrally heated band E to G homes would have non-condensing boilers, Table 2.2.

Table 2.2: Profile of dwellings in Energy Efficiency Rating bands E-G, after all potential EPC improvements have been undertaken

all dwellings in energy efficiency rating bands E to G after recommended energy improvements

	dwellings in EPC bands E-G	
	number of dwellings (000s)	percentage of dwellings
main heating system		
central heating	2,104	76.8
storage heating	325	11.9
room heaters	310	11.3
degree of double glazing		
less than 80% double glazed	1,033	37.7
80% or more double glazed	1,705	62.3
boiler		
standard boiler	113	5.5
back boiler (to fire or stove)	36	1.7
combination boiler	13	0.6
condensing boiler	964	47.0
condensing-combination boiler	927	45.1
loft insulation		
none	340	13.1
less than 100mm	175	6.7
100 up to 150mm	274	10.5
150mm or more	1,816	69.7
wall type and insulation		
cavity with insulation	428	15.6
cavity uninsulated	23	0.8
solid with insulation	23	0.8
solid uninsulated	2,244	81.9
other	20	0.7
all dwellings	**2,739**	**100.0**
sample size	*1,145*	

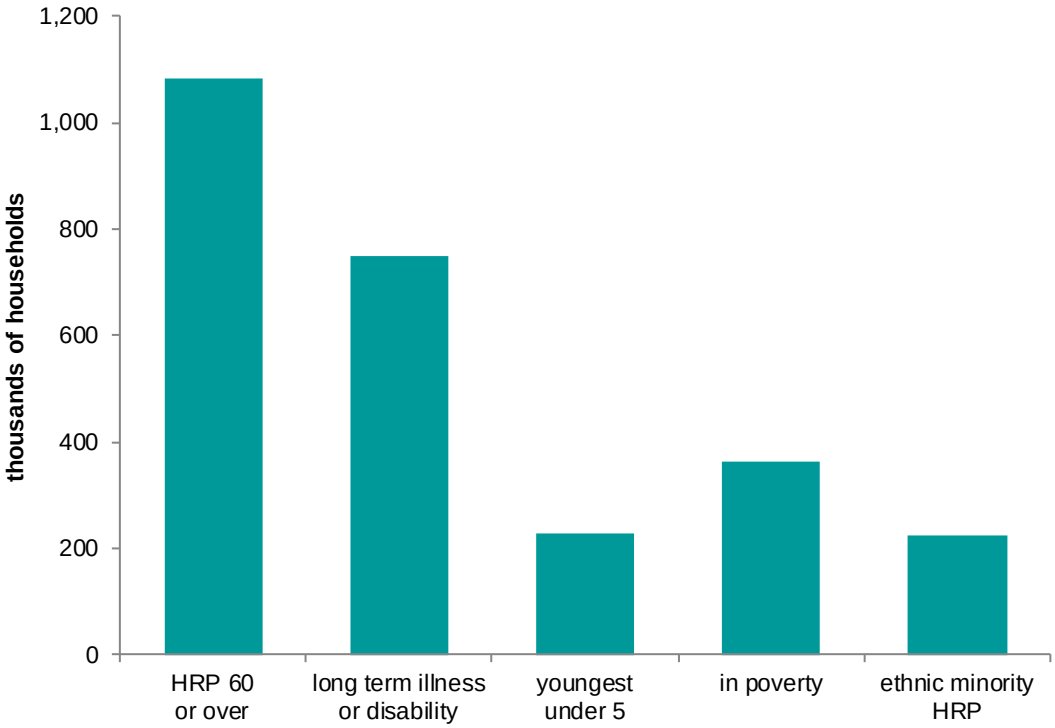
Source: English Housing Survey, dwelling sample

Post improvement – households

2.28. Some 11% of all households (2.6 million) would still live in homes with poor energy efficiency (SAP ratings E to G) even if all the potential energy improvements were undertaken. As above, this analysis will focus on key household groups. Figure 2.5 below shows how many of these potentially

vulnerable household groups would still live in homes with the poorest energy efficiency.

Figure 2.5: Numbers of households by group who would live in homes with poor energy efficiency (bands E to G) post-improvement, 2013.



Base: all households in energy efficiency rating bands E to G after recommended energy improvements
Note: underlying data are presented in Annex Table 2.9
Sources: English Housing Survey, household sub-sample

2.29. Among these 2.6 million households, households with an HRP aged 60 years or more would be over represented: they would comprise 42% of this group but 36% of all households. This is most probably due to the higher proportion of this household group who are owner occupiers, a tenure with relatively high numbers of band E to G dwellings. Households with children under 5, workless households and those containing someone with a long term sickness or illness would be relatively under represented. For other key household groups, such differences would not be noticeable. These findings probably reflect that a higher proportion of some potentially 'vulnerable' household groups reside in the social sector where current and post improvement energy performance is generally better. Households in the highest income quintile would be over represented (26% compared with 21% of all households) in homes with the lowest energy performance post improvement, Annex Table 2.9; again, this is likely to be due to the high proportion of these households who are owner-occupiers.