Assessing the effects of energy efficiency policies applied to the UK housing stock

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Abstract
Over the past twenty five years or so, policies to improve energy efficiency in the UK housing stock have generally fallen into three basic categories:

- grants and other forms of subsidy
- energy labelling and minimum standards (i.e. the market transformation approach)
- Building Regulations

This paper examines the effectiveness of each of these three mechanisms using analyses based on market research data and other available statistics. A number of specific examples are presented to clearly illustrate the effects of the individual mechanisms. Variations in effectiveness within the individual mechanisms (e.g. showing the different results achieved by different types of grant and subsidy) are also assessed where possible.

The paper quantifies the overall effectiveness of each mechanism in terms of energy savings and carbon emission reductions. The results show overall carbon emission reductions in 2001 due to these mechanisms of approximately 5 MtC/year, of which grants and subsidies account for 39%, Building Regulations account for 50% and energy labelling and minimum standards account for 11% (made up of about 7.5% due to boiler labelling and 3.5% due to labelling of cold and wet appliances). Not surprisingly, the labelling savings are much less than those for grants/subsidies and Building Regulations because labelling was only introduced in the 1990s whereas the other mechanisms have both been applied since the mid-1970s.

Grants and other forms of subsidy
Government grants for energy efficiency improvements to existing homes were first introduced in the UK in 1978. Initially, under the Homes Insulation Scheme, these addressed the insulation of roof spaces (loft insulation) and the insulation of hot water storage tanks and they were aimed very widely. As a result, the ownership of these measures grew very rapidly in the late 1970s and early 1980s (Shorrock and Utley 2003). During the late 1980s and early 1990s the grants were restricted to low-income households and were extended to include draught proofing. Such grants continue to this day through the Warm Front scheme (formerly known as the Home Energy Efficiency Scheme) which now also covers other measures such as cavity wall insulation and heating system improvements.

In the mid-1990s a new form of subsidy was introduced via the Standards of Performance (now called the Energy Efficiency Commitment) whereby energy suppliers apply a levy on energy bills and use this to provide energy efficiency measures to their customers at reduced cost. The energy suppliers are required to meet targets for the improvements made, and these are laid down by Government and policed by the UK's energy regulator, Ofgem. In recent times, there have also been various one-off schemes, such as the Energy Saving Trust's "Cashback" scheme for condensing boilers. Furthermore, even more recently, grants have been introduced for various types of renewable energy technologies.

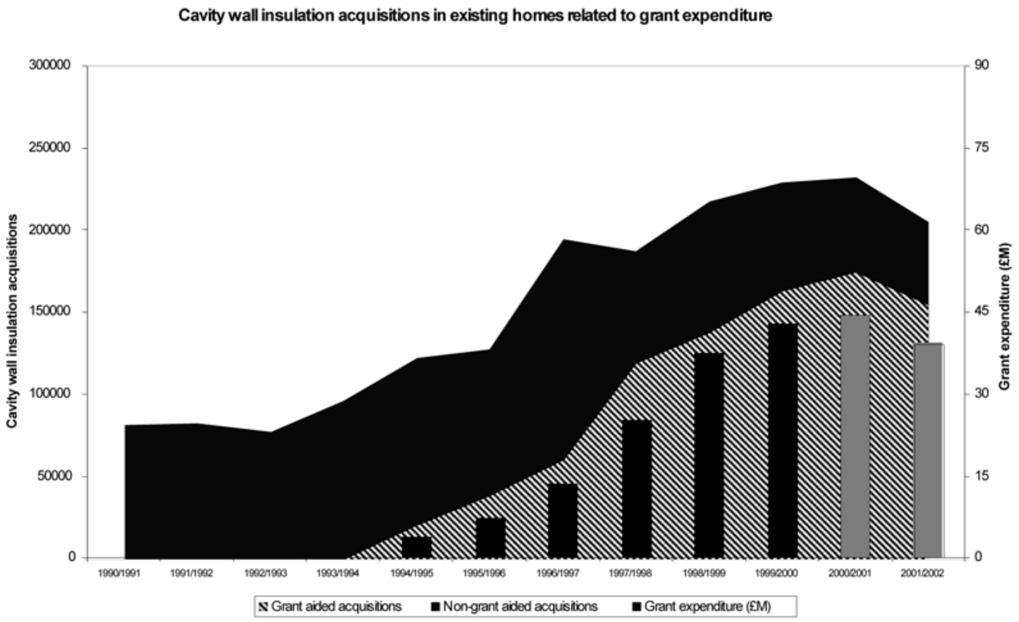

Figure 1. *Cavity wall insulation acquisitions related to grant expenditures.*

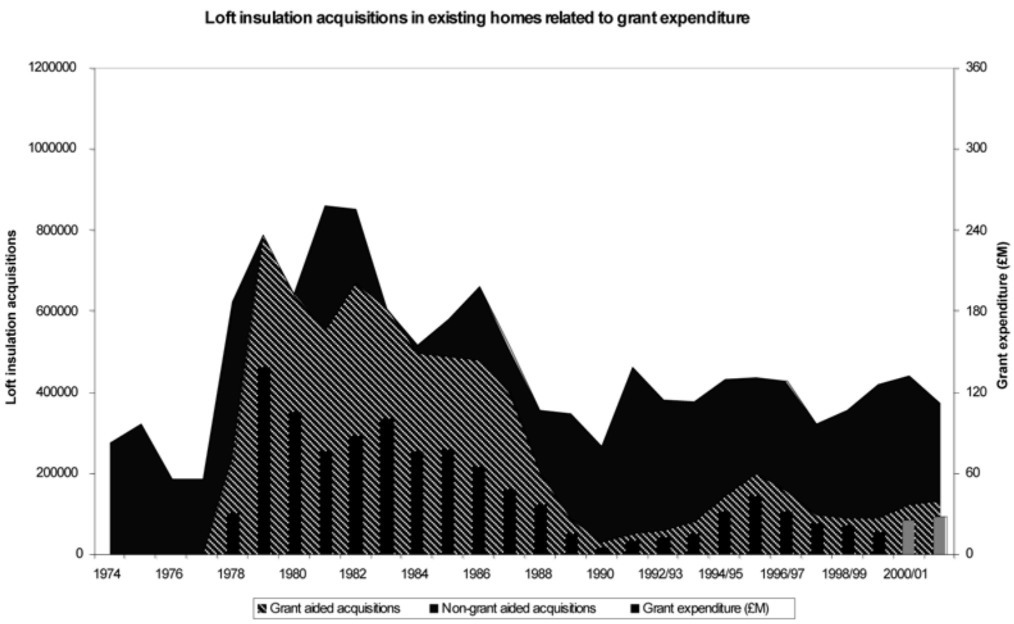

Figure 2. *Loft insulation acquisitions related to grant expenditures.*

Thus, the diversity of schemes has increased enormously which has made the overall situation extremely complex, and hence rather difficult to analyse.

Nonetheless, previous work has reported on the overall effect of grants and subsidies in some detail (Shorrock, Henderson, Utley and Walters 2001, Shorrock 1999), focusing on loft insulation, cavity wall insulation and condensing boilers. These analyses will not be repeated here but, by way of an example, Figure 1 shows an updated version of the overall assessment of the effects of grants and subsidies (for the sake of brevity referred to on the figure and in the following as "grants", except where there is a need for the distinction to be made) for cavity wall insulation (Figures 2 and 3 similarly show the updated charts for loft insulation and condensing boilers). This shows that there is a very clear relationship between the acquisition of cavity wall insulation and the grant expenditure (note that all expenditures are expressed in 1999/2000 money values). Further analysis allows this to be quantified in terms of the extra acquisitions per £M of expenditure. For this measure it is found that for each £M (approx 1.5 million Euro) the number of acquisitions increases by about 3 400. Equivalent figures for loft insulation are about 4 100 per £M (prior to 1988), 1 700 per £M (from 1988), and for condensing boilers 1 800 per £M. It is even possible to assess the magnitude of the free-rider effect, whereby households that would have undertaken the improvement anyway take advantage of the grant (Shorrock, Henderson, Utley and Walters 2001). Such an analysis relies

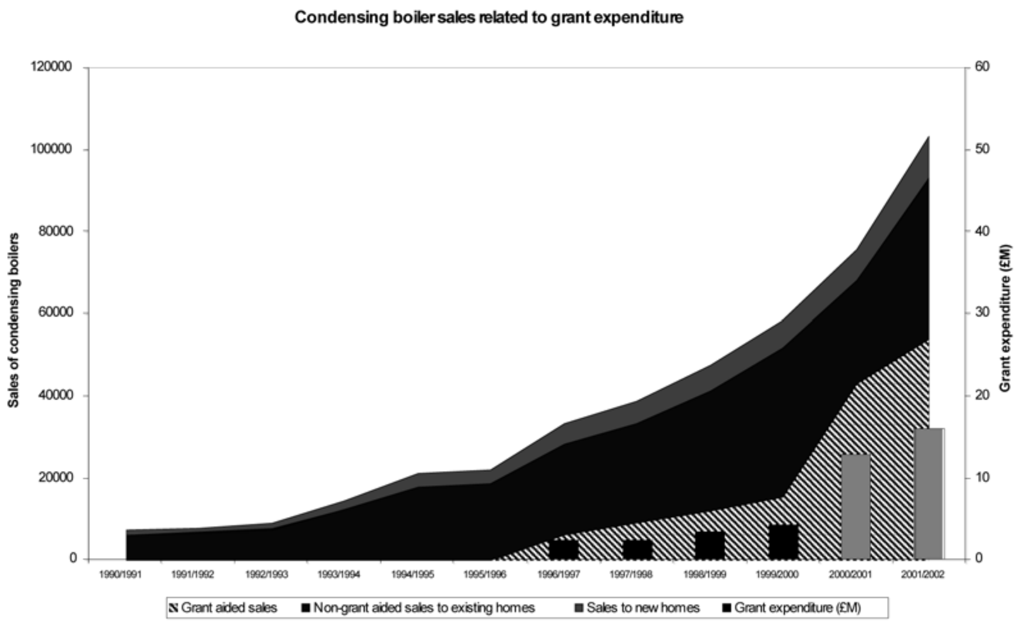

Figure 3. *Condensing boiler sales related to grant expenditures.*

on identifying the difference between the gradients of the lines for number of grants against expenditure and number of acquisitions against expenditure respectively. Such analyses indicate that free riders have only accounted for about 13% of cavity wall insulation grants, but about 40% of loft insulation grants and 50% of condensing boiler grants.

It will be noted that for the last two years in the above figures the expenditures are shown shaded in grey rather than black. The reason for this is that since 1999/2000 it has not been a requirement under the Energy Efficiency Commitment for suppliers to disclose the expenditures. Consequently, the figures after this year can only be estimated from the known number of grants and the relationship between grants and expenditures for the years up to 1999/2000. This illustrates a recurring difficulty with this type of analysis work; namely that the available data is often subject to limitations which restrict the analyses that are possible.

EFFECTS OF INDIVIDUAL SCHEMES

It was noted earlier that the grants for loft insulation were initially aimed very widely, but that they were subsequently targeted on low-income households. The earlier analyses allowed these two different situations to be assessed separately for loft insulation, thereby providing some indication of the effects of different types of grant. This work has since been taken further by considering the specific targeting of individual grant schemes and filtering the acquisitions data (which is obtained through a market research organisation) to match as closely as possible.

For example, Figure 1 includes acquisitions that occurred under the Home Energy Efficiency (HEES) grant scheme as well as through the Standards of Performance (SoP) subsidy scheme, but it is possible to undertake some assessment of each of these separately as outlined in the following.

The SoP scheme between 1994/1995 and 1999/2000 applied exclusively to electrically heated homes (the scheme was extended to include gas heated homes in 2000/2001). Moreover, for the first two of these years this was the only scheme addressing cavity wall insulation. Even in later years where other schemes (dominated by HEES) provided grants for this measure, these would have tended to be complementary (i.e. principally addressing non-electrically heated homes). Thus, by filtering the data into electrically heated and non-electrically heated we should obtain a fairly reasonable estimate of the effects of each of these two schemes. There are some caveats to note, however. Firstly, it is possible that in the later years some electrically heated homes could have received grants through HEES rather than SoP. Secondly, the numbers of homes using electric heating are comparatively small so there are inevitably sampling-related uncertainties in the market research data. Thirdly, the definition of electrically heated may not be identical in the market research data and in the SoP scheme. Indeed, there is strong anecdotal evidence that many of the homes that benefited from SoP subsidies used other fuels for heating as well as electricity (Henderson, Staniaszek, Anderson and Phillipson 2003).

Not considering these complications Figures 4 and 5 present the figures for cavity wall insulation acquisitions for SoP and non-SoP (principally HEES) respectively. The noise problem is evident on Figure 4 but nonetheless it is clear that there is a relationship. Further analysis shows that under SoP the acquisitions increase by about 3 600 for each £M of expenditure, whereas for HEES the corresponding figure is about 3 100 per £M. This indicates that the SoP subsidies were slightly more effective than the HEES grants when assessed using this particular metric.

Similar analyses can be undertaken for loft insulation using data from the mid 1970s up to 1990 for the Homes Insulation Scheme (HIS, which applied to private households only) and the Energy Conservation Programme (ECP, which was for the improvement of local authority homes). Again, suitable filtering of the market research data, this time by tenure, allows the effect of these two schemes to be sepa-

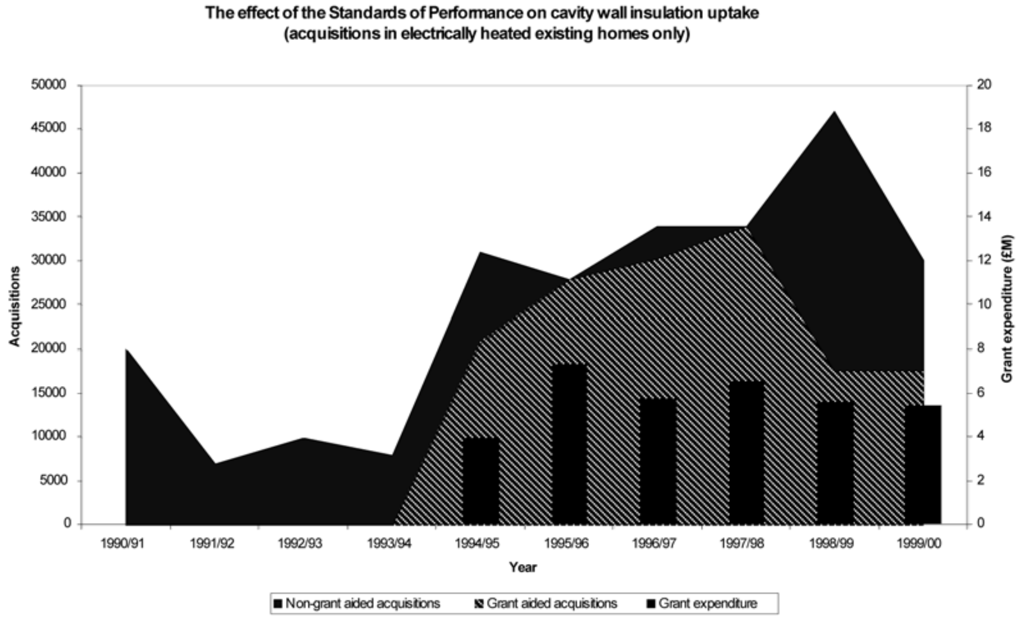

Figure 4. The effect of the Standards of Performance on cavity wall insulation uptake.

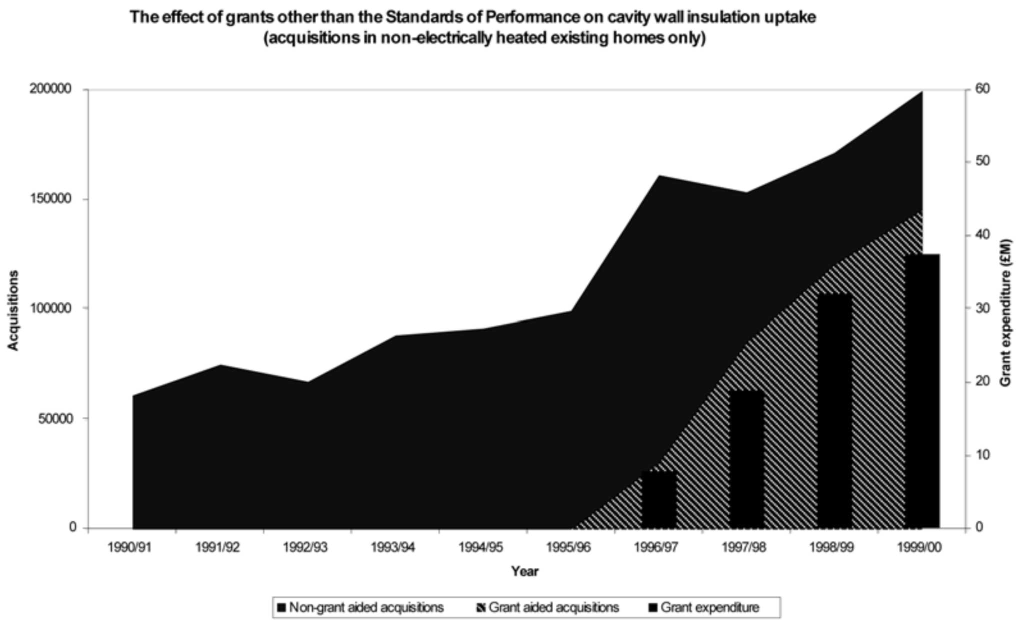

Figure 5. The effect of grants other than the Standards of Performance on cavity wall insulation uptake.

rately identified. It turns out that the HIS managed to increase acquisitions of loft insulation by about 5 400 for each £M of expenditure. The corresponding figure for the ECP was about 2 400 per £M. Again, there are various caveats on these figures. In particular, although the grants covered both loft insulation and hot water tank insulation, and the large difference in costs for these measures means that the expenditures can effectively be associated with loft insulation alone for the purposes of analysis, there will have been some dwellings that benefited only from tank insulation (i.e. mainly apartments not on the top floor). The effect of such cases will probably have been more pronounced in the ECP because a relatively high proportion of local authority dwellings are apartments, which might help explain why the figure noted above is so much lower than that for the Homes Insulation Scheme. Nonetheless, even taking this into account, it does seem clear from the data that the HIS was more effective than the ECP when assessed by this metric, perhaps reflecting inevitably higher costs for larger, more expensive, insulation jobs in local authority properties.

We have thus managed to separately assess the effects of four different schemes, those actually representing the key schemes that have been applied over the period between 1978 and 2000 or so. However, the two measures that have

Table 1. Summary of the effectiveness of four different grant / subsidy schemes.

	Acquisitions per £M expenditure	Acquisitions per £M expenditure (adjusted to cavity wall insulation equivalent where the assessment was done for loft insulation)
Homes Insulation Scheme (loft insulation)	5.4 thousand	4.3 thousand
Standards of Performance (cavity wall insulation)	3.6 thousand	3.6 thousand
Home Energy Efficiency Scheme (cavity wall insulation)	3.1 thousand	3.1 thousand
Energy Conservation Programme (loft insulation)	2.4 thousand	1.9 thousand

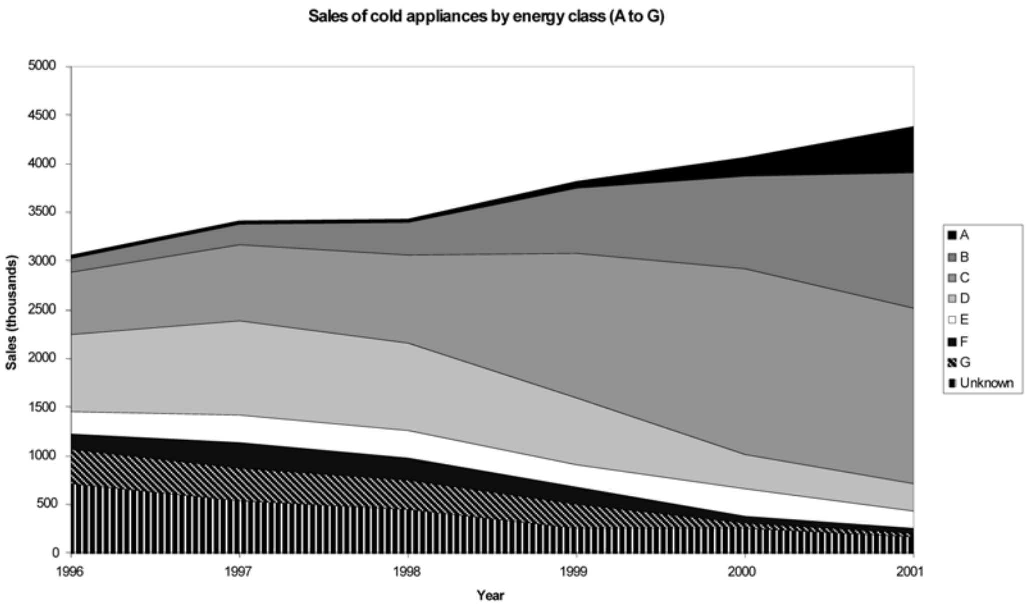

Figure 6. *Sales of cold appliances by energy class.*

been used for these assessments are of very different costs so the figures we have obtained above cannot be directly compared. But knowing the relative costs of cavity wall insulation and loft insulation we can adjust the figures to be on the same basis and thereby indicate a ranking of the schemes, as shown in Table 1.

This indicates that there is roughly a factor of two between the responses achieved in the most and least effective schemes. Interestingly, the subsidy approach (Standards of Performance) sits between the two grant based approaches, suggesting that it is broadly equivalent to the grant approach (the HIS provided 66% grants to private householders and was very widely taken up, whereas HEES provided essentially full grants but these were targeted just on low income households). The local authority scheme, ECP, appears to have been the least effective which is slightly surprising. Received wisdom suggests that it is hard to achieve energy efficiency improvements where the responsibility for those improvements is distributed amongst many householders, but it is much easier where there are fewer decision makers who are making the choice on behalf of many households and where economies of scale should come into play. This result suggests that, in this case at least, received wisdom is incorrect.

Later we shall examine the energy and carbon savings achieved by all forms of grants and subsidies for the key measures (loft insulation, cavity wall insulation and condensing boilers) which have been applied to the housing stock between 1978 and 2001. Next, however, we shall examine data relating to the effects of energy labelling and minimum standards.

Labelling and minimum standards

Energy labels on major electrical appliances were introduced throughout Europe in the mid 1990s. These major appliances included cold appliances (refrigerators, fridge-freezers and freezers) and wet appliances (washing machines, washer dryers and dishwashers). The following considers the actual effect that these now familiar A to G labels had on the market in the UK.

COLD APPLIANCES

Figure 6 shows how sales of cold appliances by energy band changed between 1996 (the year after the label was introduced and the first year that sales data by band was actually collected) and 2001. For all cold appliances a mandatory minimum standard of C-rated or above (except for chest

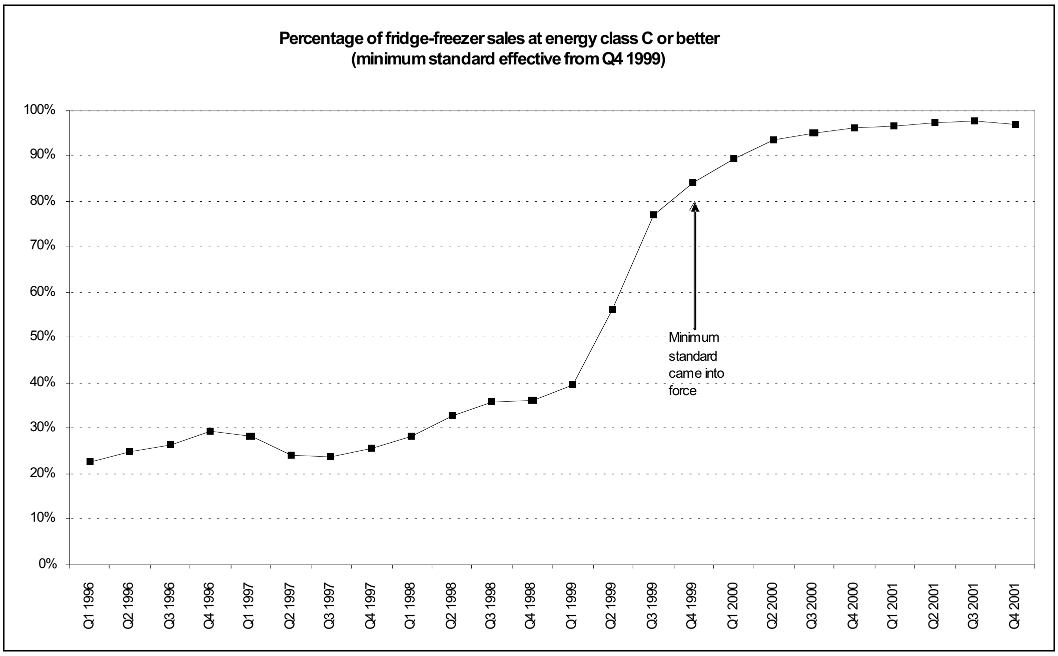

Figure 7. *Percentage of fridge-freezer sales at energy class C or better.*

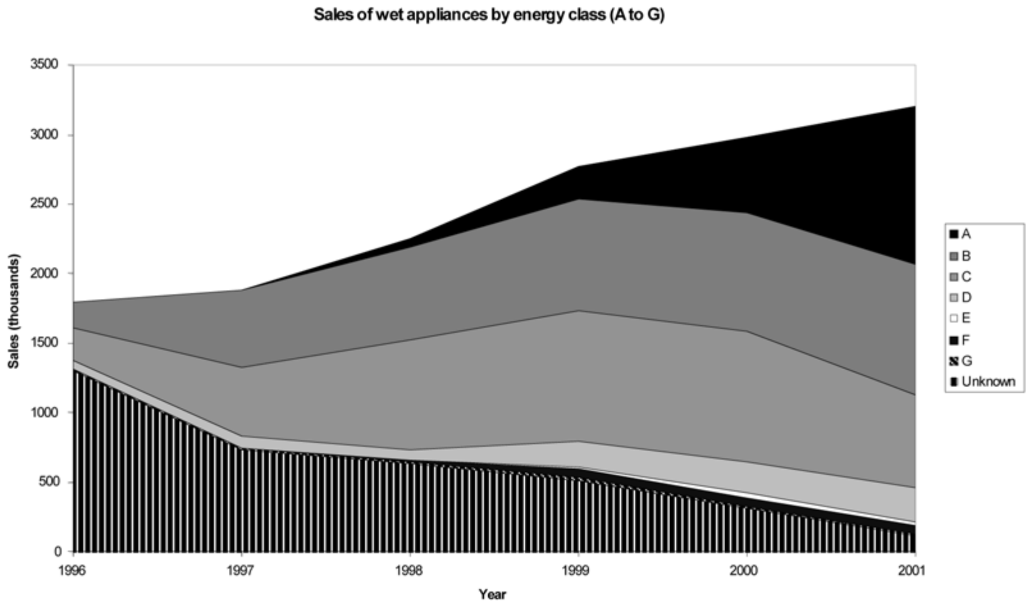

Figure 8. *Sales of wet appliances by energy class.*

freezers where D and E rated appliances were permitted) became a requirement in Quarter 4 of 1999. It is clear from Figure 6 that this had a major effect on the market, but that full compliance did not appear to have been achieved by this time. This may be because of retailers having stocks of old appliances or perhaps because of difficulties in identifying the energy bands (note the "unknown" category which suggests that it was not always easy to establish the band).

Figure 7 shows the progress to meeting the minimum standard for fridge-freezers concentrating on the proportion of sales that were C rated or better. This indicates that compliance reached about 85% in Quarter 4 1999 and that it took another year to get to full compliance (the residual small shortfall is probably due to problems with the data rather than actual non-compliance). Similar results are obtained for the other cold appliances, with slightly different compliance levels in Quarter 4 1999 (ranging from about 74% to 90%), and hence slightly different times to reach full compliance (times between about one and two years).

Thus, for cold appliances generally, at the time of the minimum standard becoming a requirement (which was five years after the introduction of the labels) compliance reached between 74% and 90% and it then took another year or two to reach full compliance.

WET APPLIANCES

Figure 8 shows a similar plot to that of Figure 6 but this time considering wet appliances (washing machines, dishwashers

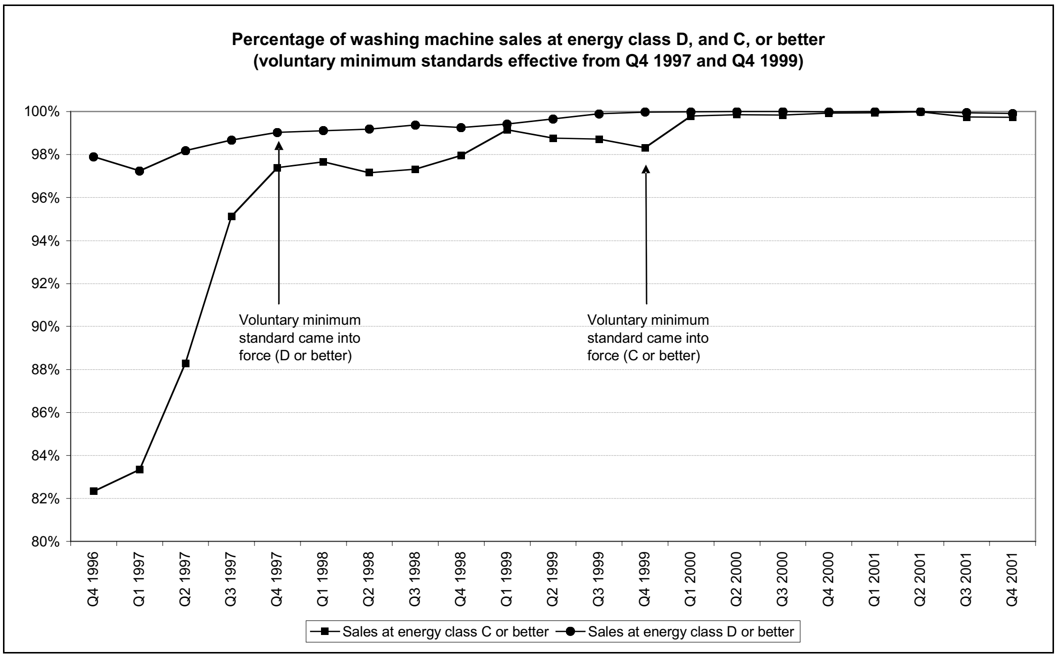

Figure 9. *Percentage of washing machine sales at energy class D, and C, or better.*

and washer-dryers). Note that the data by efficiency band are incomplete for washer-dryers and dishwashers, such figures only becoming available in quarter 1 1999 and quarter 3 1998 respectively (in contrast, the washing machine figures by band commence in 1996). This is the reason why the "unknown" category is initially so large.

For washing machines, which represent about 70% of wet appliances sales, voluntary agreements to remove E, F and G rated appliances by the end of quarter 4 1997, and efficiency class D by the end of quarter 4 1999 have applied. It is clear that these voluntary minimum standards have successfully transformed the market as is shown more clearly on Figure 9.

The first of these minimum standards was clearly not particularly challenging although it seems to have taken a further two years for complete compliance to be achieved. In contrast, the second much more challenging minimum standard was more-or-less up to 100% compliance on time. This illustrates that voluntary minimum standards can work just as effectively as mandatory minimum standards, as applied to cold appliances. However, the rapid compliance does suggest that perhaps the standards set were not as challenging as the mandatory standards for cold appliances, where achieving compliance clearly took longer.

For the other two wet appliances there were no equivalent minimum standards so it is not too surprising that any improvement that occurred during this period was rather less obvious, as illustrated on Figure 10 for washer dryers. This strongly suggests that labelling in the absence of minimum standards is unlikely to transform the market significantly.

BOILERS

There is currently no EU-wide labelling scheme for boilers but the UK introduced an A to G label, based on a boiler efficiency methodology known as SEDBUK (Seasonal Efficiency of Domestic Boilers in the UK) in the late 1990s. Thus, in recent years boiler sales information has been available by rating. Even in earlier years there is good information available on the boiler market and the likely efficiencies of boilers sold, so it is possible to make reasonable estimates of the ratings long before the rating scheme existed. Indeed, such figures form the basis of a boiler stock model that has been developed to assist the UK government department Defra with its Market Transformation Programme, and figures from this have been used for the following analysis.

The EU Boiler Efficiency Directive of 1992 introduced boiler efficiency regulations that came into force in 1998. These required the removal of boilers having efficiencies below 70% (G-rated on the SEDBUK scale) from the market, with the exception of back boilers. As Figure 11 shows, this minimum standard had a major effect on the market and such boilers were virtually eliminated by 1998. Therefore it took about 6 years between the Directive being introduced and the minimum standard being met. The Building Regulations revision of 2000 introduced a further minimum standard requiring the elimination of boilers below D-rated (78% efficient) by August 2002, again with an exception for back boilers. Once again, the market was able to adapt, this time rather more rapidly. The proposed minimum standard would have been common knowledge before the revision to the Building Regulations was actually published so in effect it probably took about three to four years for the market to adapt, rather than the two years implied by the respective dates of the Building Regulations revision and the minimum standard.

The next revision to the Building Regulations also requires that boilers be B-rated or better (i.e. better than 86% efficient which implies the use of condensing boilers) from April 2005. It is anticipated that there will be some exceptions made as not all dwellings will be suitable for condensing boilers. Nonetheless, it is clear that this is a challenging target, effectively requiring the market to adapt in only two years from the time that the initial proposals were made. As

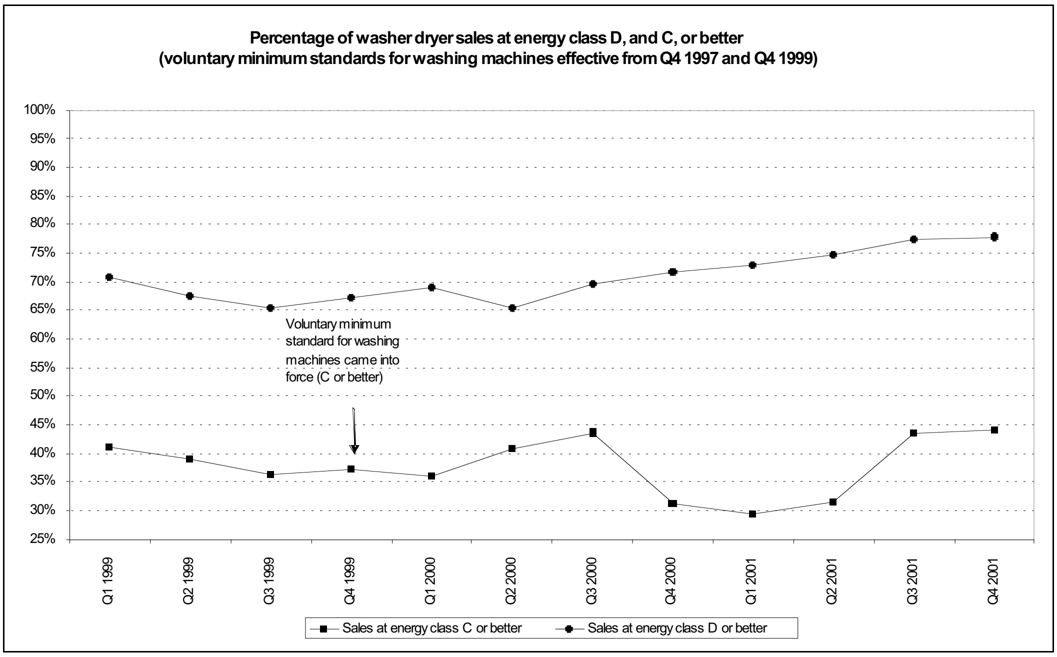

Figure 10. *Percentage of washer dryer sales at energy class D, and C, or better.*

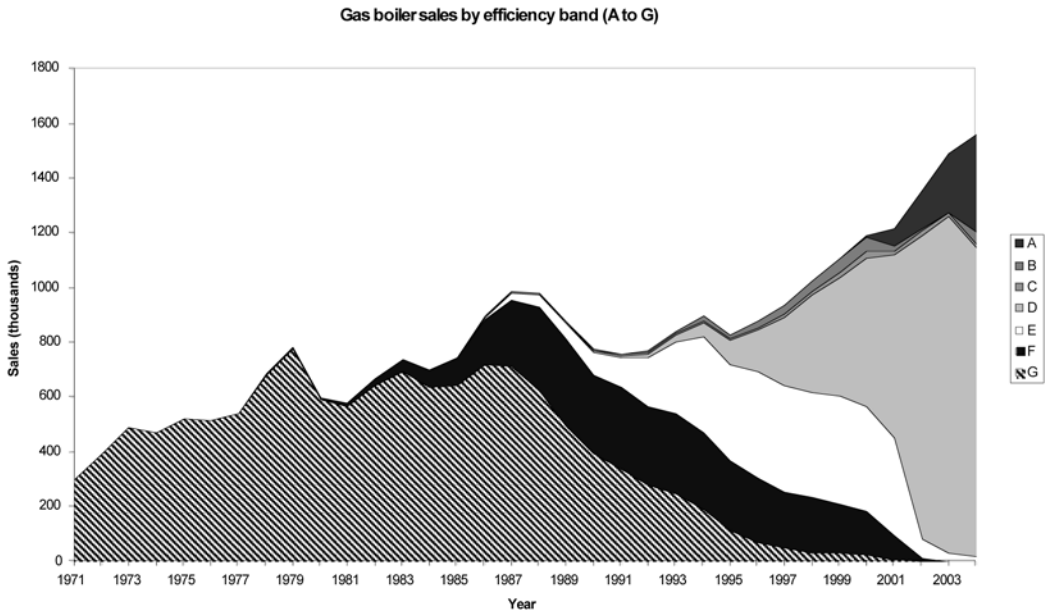

Figure 11. *Gas boiler sales by efficiency bands.*

Figure 12 shows, in 2004 about 26% of boiler sales met this requirement (the percentage in the month of December 2004 was about 29%). Thus, it is evident that the market is being rapidly transformed, but it seems unlikely that full compliance will be achieved by April 2005.

TIME TAKEN TO ACHIEVE MARKET TRANSFORMATION AND LEVELS OF COMPLIANCE

The preceding analyses have provided considerable evidence of the effects that energy labelling, coupled with minimum standards, can have on the market. For the various products considered, the approximate periods of time elapsing between a minimum standard being proposed, being formally introduced and being fully complied with are as indicated in Table 2. Broadly speaking, these results show that it generally takes about five years between a minimum standard being proposed and being formally introduced. At the time of introduction compliance will be high but will not generally be full. The results suggest that even the fastest market transformations have required a minimum of three years to reach full compliance, with five years or slightly longer being more representative.

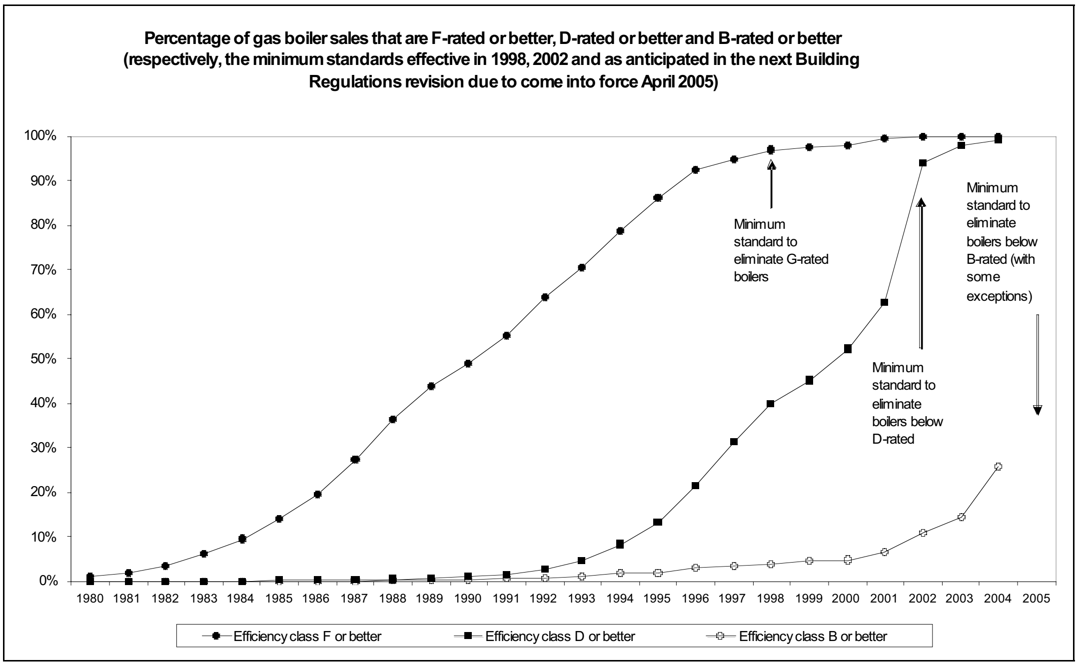

Figure 12. *Percentage of gas boiler sales that are F-rated or better, D-rated or better and B-rated or better.*

Table 2. Times required to achieve market transformation for various products.

Appliance type	Time to minimum standard being formally introduced and % compliance at this time		Time to minimum standard being fully complied with
Refrigerators	5 years	90%	6-7 years
Fridge-freezers	5 years	84%	6-7 years
Upright freezers	5 years	78%	7 years
Chest freezers	5 years	74%	7 years
Washing machines (first voluntary minimum standard)	1 year	99%	3 years
Washing machines (second voluntary minimum standard)	3 years	98%	3.5 years
Gas boilers (EU boiler efficiency Directive)	6 years	98%	6 -7 years
Gas boilers (2000 revision of Building Regulations)	3 - 4 years	95%	4 – 5 years
Gas boilers (2005 revision of Building Regulations)	*2 years*	*?*	*3 – 4 years?*

Building Regulations

The preceding section has shown, in the case of gas boilers, how minimum standards introduced through Building Regulations have successfully transformed the market. The boiler efficiency standards apply to both new and existing homes, but in general the Building Regulations have effectively applied only to new buildings (although that is now beginning to change).

Successive revisions of the Building Regulations for England and Wales [1] have introduced increasingly higher thermal insulation requirements for new dwellings. Changes to Building Regulations regarding thermal insulation standards were made in 1965, 1976, 1982, 1990, 1994 and 2002, with the next revision due to take place in 2005. Various methods of compliance have been allowed over time but it is simplest to compare the different regulations by referring to the U-values that are specified in the "elemental method". Table 3 summarises these U-values for each of the main building elements; walls, roofs, windows and floors. Note that the figures shown for 2005 are indicative values. This is because the elemental method has been removed as an option from the latest revision. The quoted values simply indicate the sort of standards that would have to be met in order to comply with the performance based approach that has been proposed.

1. Note that there are separate Building Regulations in Scotland and in Northern Ireland but these have required broadly the same standards to be achieved as in England and Wales. The timing of introduction of revised regulations has varied slightly between the three regions.

Table 3. U-values required by successive Building Regulations (W/m² °C).

	1965	1976	1982	1990	1994	2002	2005
Walls	1.7	1.0	0.6	0.45	0.45	0.35	0.27
Roofs	1.42	0.6	0.35	0.25	0.25 (0.2)	0.16	0.13
Windows	No requirement (typically 5.6 achieved)	No requirement (typically 5.6 achieved)	No requirement (typically 5.6 achieved)	3.3	3.3 (3.0)	2.0	1.8
Ground floors	No requirement (typically 0.6 to 0.7 achieved)	No requirement (typically 0.6 to 0.7 achieved)	No requirement (typically 0.6 to 0.7 achieved)	0.45	0.45 (0.35)	0.25	0.22

The figures in brackets for 1994 indicate higher standards that were required if the "Standard Assessment Procedure" calculation for the dwelling produced a rating below a certain value. If the rating was above this value the higher values applied. The figures for 2005 are indicative only (see text).

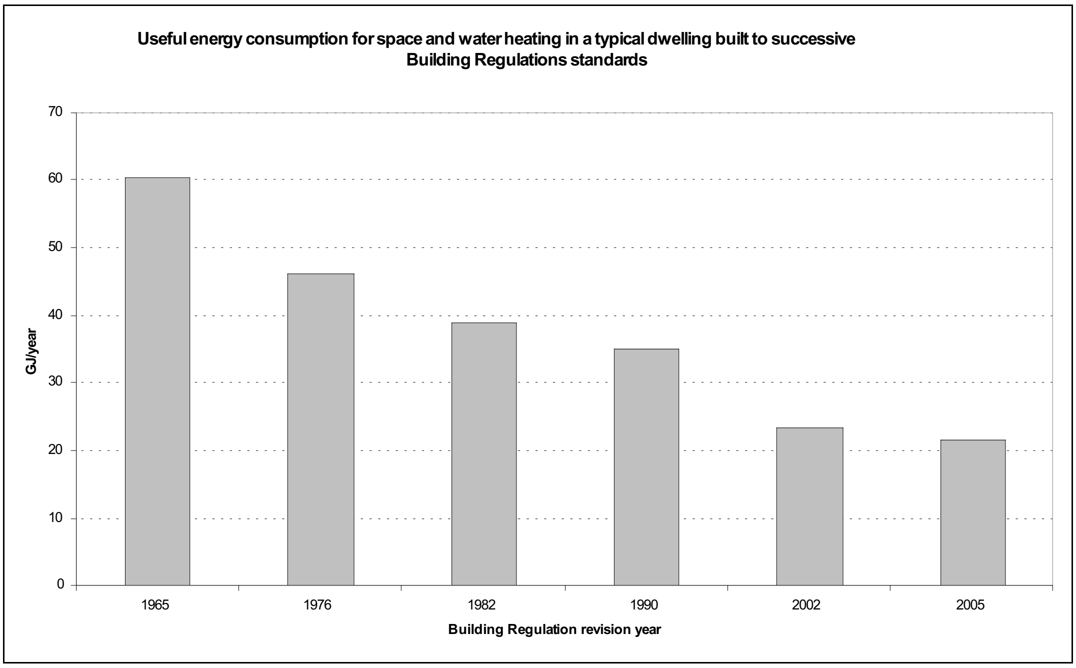

Figure 13. *Useful energy consumption in a typical dwelling built to successive Building Regulations standards.*

There are various other complications behind the figures shown in Table 3 (e.g. changes in the method by which the U-values are calculated mean that the 1994 figures, although shown as being the same as 1990, are actually somewhat better in practice). Also, it has been possible for the insulation standards on a given element to be worse than shown provided this was balanced by improved insulation elsewhere. Such trade off options mean that although window U-values are shown as not improving until 1990, in fact double glazing was quite common prior to this. Despite these complications, it is very clear from Table 3 that there has been a significant improvement in the thermal insulation standards required by the Building Regulations.

The effect of the Building Regulation changes shown above are illustrated in Figure 13 which shows the useful energy consumption (i.e. not allowing for the boiler efficiency) for space and water heating for a typical semi-detached house at the various standards (assuming the same heating standards in every year). It is evident that the Building Regulation improvements have effectively reduced the useful energy consumption of a typical new dwelling by about two thirds between 1965 and the present. The reduction in delivered energy (taking account of boiler efficiency improvements) would of course be even bigger.

It is worth noting also that, although the Building Regulations standards for insulation have only applied to new homes, over time these standards do tend to be adopted within the existing stock as well. This is certainly the case for loft insulation as shown in Figure 14. This figure shows the acquisitions of loft insulation in existing homes by the thicknesses achieved. The standards required for new homes under the 1976, 1982 and 1990 Building Regulations are shown against the years in which they would have become fully effective (generally about two years after the nominal date). It is clear from this that currently 100% of loft insulation acquisitions in existing homes meet or exceed the 1976 standards, about 90% meet or exceed the 1982 standards and about 70% meet or exceed the 1990 standards.

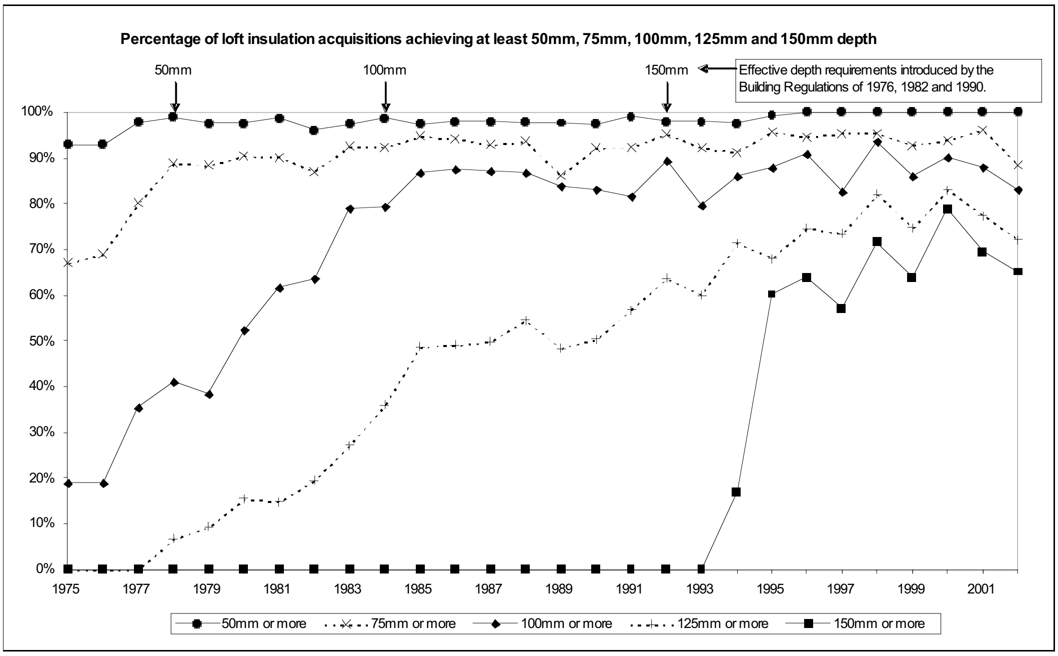

Figure 14. *Percentage of loft insulation acquisitions achieving various depths.*

Energy and carbon savings from each of the three mechanisms

The information presented in this paper has clearly shown that each of the three basic mechanisms for improving energy efficiency in the housing stock has had an effect. However, they have each been discussed using the different metrics that apply in each case which makes it difficult to compare one mechanism with another. It is possible, however, to reduce the effects in all cases to a common measure; namely the energy or carbon savings that they have achieved.

In the case of grants and subsidies, the number of acquisitions due to these grants and subsidies is known. Savings can be calculated for typical dwellings for each of the three measures considered (loft insulation, cavity wall insulation and condensing boilers) so the figures can be grossed up to national savings.

Similarly, for labelling and minimum standards it is possible, knowing the sales by energy band and the definitions of those energy bands, to estimate the savings achieved relative to what might have happened if there had been no labelling and minimum standards introduced. In this case, the appliances considered are all the cold appliances, washing machines and boilers (appliances for which labels but no minimum standards have applied are assumed to have not contributed to such savings – see Figure 10).

For Building Regulations, the savings due to the thermal insulation requirements that have applied to new dwellings, together with statistics on the numbers of dwellings built each year, can be used to estimate savings relative to there having been no improvement (i.e. the 1965 Building Regulation standards having applied throughout). No knock-on effect on existing dwellings has been considered for this calculation, although Figure 14 indicates that there almost certainly is some effect in addition to that for new homes.

There are a number of complications in the calculations. In particular, care is needed to avoid double counting of savings from condensing boilers (this being a measure that has been promoted through grants and subsidies, through labels and minimum standards and through Building Regulations). Thus, savings from condensing boiler grants are subtracted from the estimated savings for labelling and minimum standards for such boilers, and the boiler efficiency assumed in the Building Regulations calculation is capped at the value applying when the minimum standards were introduced.

Savings from labelling and minimum standards on electrical appliances have not been adjusted to take account of the fact that installation of energy efficient appliances reduces the incidental gains in a dwelling, and hence increases the space heating requirement slightly. Thus, the savings for labelling of appliances are probably a little high. On the other hand, it is known that the sales figures that have been used are not completely comprehensive so a relatively small part of the savings will have been missed by the calculations.

One other small complication is that, according to the data available, some of the preceding analyses have been undertaken on a calendar year basis and some on a financial year basis. For the purposes of the savings calculations such distinctions have been ignored. Thus, 2001 actually means 2001/02 in some cases. Clearly, this slight inconsistency is of little consequence when assessing the effects of the different policies over the long term. Although some of the data extend beyond 2001 this is taken as the final year for the analysis because the available data on appliance sales are limited to this date.

Figure 15 shows the results of the energy saving calculations as outlined above. It shows how the savings have built up over the years and indicates that Building Regulations and grants/subsidies dominate the total savings and are roughly equal in magnitude. Labelling and minimum standards have been applied for a much shorter period of time so it is no surprise to see that the savings from these are much

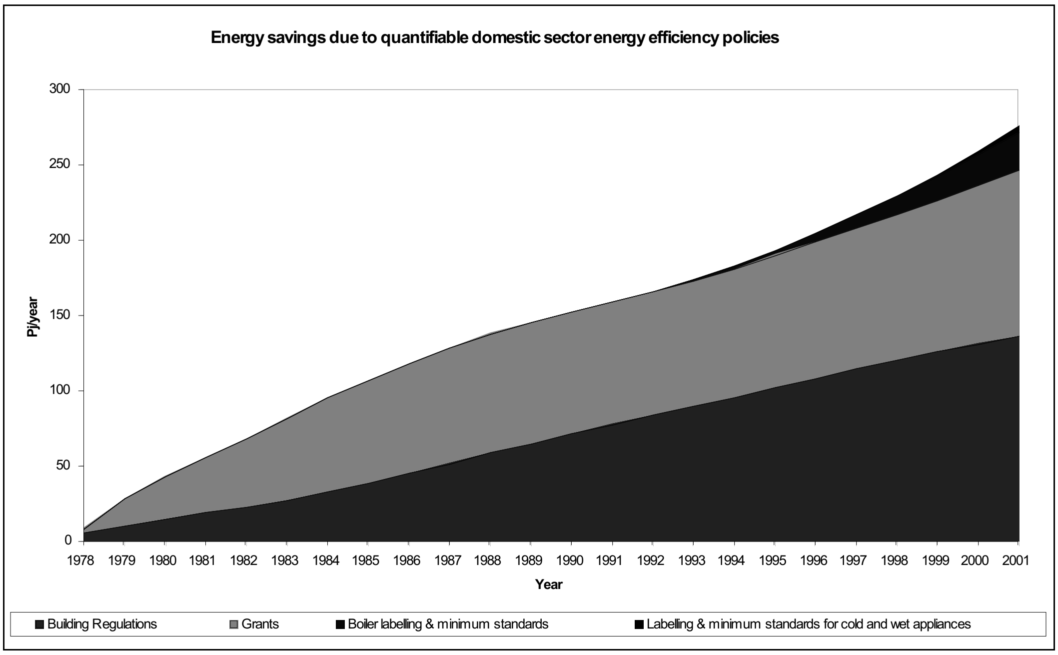

Figure 15. *Energy savings due to quantifiable domestic sector energy efficiency policies.*

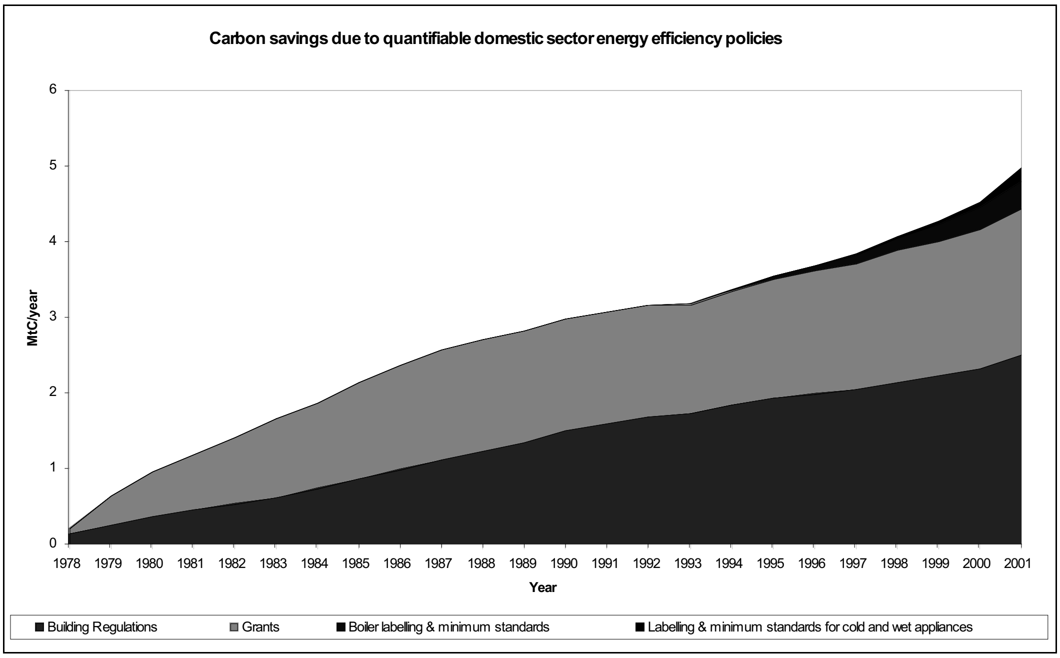

Figure 16. *Carbon savings due to quantifiable domestic sector energy efficiency policies.*

smaller. Nonetheless, it is clear that the savings from boiler labelling and minimum standards have been growing quite quickly since the early 1990s and are now becoming significant. Savings from labelling of appliances have only been accumulating since the mid-1990s and so are still relatively insignificant. Overall, by 2001 the energy efficiency policies considered were saving about 275 PJ/year, which represents about 14% of the current housing stock energy use. Building Regulations account for about 49.5% of this saving with grants and subsidies representing about 40%. Labelling and minimum standards account for the remaining 10.5% (9% from boilers and 1.5% from appliances).

The picture changes a little when the savings are converted into carbon due to the high emission factor associated with electricity and the low factor associated with gas. Thus, as shown in Figure 16, the significance of the appliance labelling savings increases and that from boiler labelling decreases. Overall, savings in 2001 amount to about 5 MtC/year (about 13% of the current carbon emissions associated with the energy use of the housing stock) of which grants and subsidies represent 39%, Building Regulations 50%, with energy labelling and minimum standards accounting for the remaining 11% (made up of about 7.5% from boiler labelling and 3.5% from appliance labelling).

Conclusions

Over the past twenty five years or so, policies to improve energy efficiency in the UK housing stock have generally fallen into three basic categories - grants and other forms of subsidy, energy labelling and minimum standards, and Building Regulations. This paper has analysed data on each of these mechanisms and has clearly demonstrated that they have all had an effect. The effects have been assessed using the relevant metrics for each type of policy but they have also all been examined in terms of energy and carbon savings in order to allow a more direct comparison between them.

Collectively, in 2001 the policies have led to carbon emission savings of about 5 MtC/year. Of this, grants and subsidies account for 39%, Building Regulations account for 50% and energy labelling and minimum standards account for 11% (made up of about 7.5% due to boiler labelling and 3.5% due to labelling of cold and wet appliances). It is not surprising that the labelling savings are much less than those for grants/subsidies and Building Regulations because labelling was only introduced in the 1990s, whereas grants and Building Regulations aimed at improving energy efficiency have been in place since the mid-1970s.

Consequently, the 5Mtc/year saving is the cumulative effect of about 25 years of energy efficiency policies, which emphasises the fact that it takes time for savings to accumulate. Hence, a key conclusion from this work is that it is important to take a long term view when developing energy efficiency policies.

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