Cost-effective energy and carbon savings in the UK housing stock

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1. SYNOPSIS

This paper presents energy and carbon savings from cost-effective energy efficiency measures in UK housing for now and for 2010.

2. ANALYSIS AND FINDINGS

A group of housing energy efficiency measures were selected based on them being either commonly used or of current interest. For each, an estimation was made (using BRE's domestic energy model) of the potential annual energy saving to be made by its installation in every applicable UK household. Each was then converted to a monetary saving (based on 3.56 £/GJ and 19.08 £/GJ respectively for gas and electricity – 5.40 and 28.90 Euro/GJ) and used along with each measure's cost (high and low, marginal costs where appropriate) and lifetime to judge cost-effectiveness. For each, the assumption of discount rates of 8% and 15% were used, reflecting attitudes to investment in government and commercial organisations. The judgement of cost-effectiveness was based on the net annual cost (NAC) of the measures where:

NAC = [cost * discount rate / {1 - (1 + discount rate)$^{-\text{lifetime}}$}] – annual saving

The same analysis was repeated to look at potential savings in 2010, assuming current trends in the uptake of measures continue (but assuming the same savings per installation). To do this, the potential number of homes that measures will be applicable to in 2010 was estimated by fitting S-curves through past ownership data and projecting these into the future. From this, the number of homes in 2010 to which each saving might still apply was obtained. Thus, 2010 figures are slightly more speculative, but they should give a good approximation. A tabulated summary of the results follows.

Year	Costs	Discount rate	Total carbon saving / MTC/yr	Cost-effective carbon saving / MTC/yr	Total energy saving / PJ/yr	Cost-effective energy saving / PJ/yr
2000	Low	8%	22.0	19.9	925	835
		15%	22.0	14.4	925	560
	High	8%	22.0	8.0	925	250
		15%	22.0	4.9	925	100
2010	Low	8%	14.0	12.0	800	680
		15%	14.0	8.2	800	465
	High	8%	14.0	4.1	800	205
		15%	14.0	2.0	800	85

Figures 1, 2 and 3, attempt to show graphically both the potential carbon saving and the degree of cost-effectiveness for each measure, as well as the overall saving. The width of each bar represents the carbon saving and the height represents the degree of cost effectiveness (measures with a negative figure pay back more than they cost).

Figure 1 shows graphically the full results for the first set of assumptions from the table (year 2000, low costs and 8% discount rate). Here, 90% of the 22 million tonnes of carbon per year (MTC/yr) total saving is cost-effective. Figure 1 suggests that the biggest savings come from condensing boilers and wall insulation. Solar water heating is shown to offer a big saving too, but not to be cost-effective at present due to its high cost.

Figure 1 - Potential National Carbon Savings - 2000
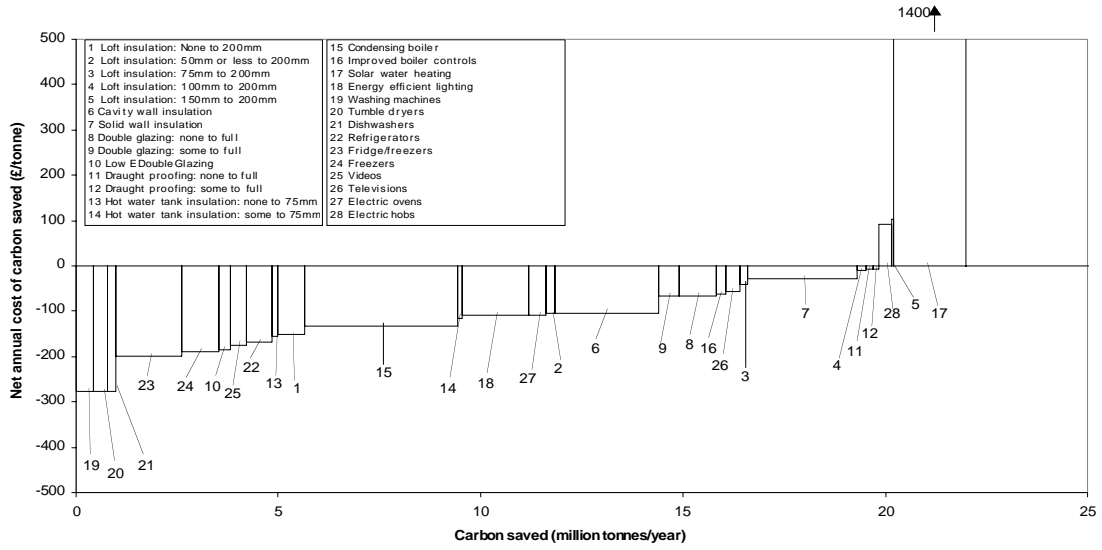**(Low costs - 8% discount rate)**

Figure 2 shows the situation in 2000 with high costs and a 15% discount rate. Now only those measures that pay back quickly remain cost-effective - 4.9 of the 22 MTC/yr.

Figure 2: Potential National Carbon Savings - 2000
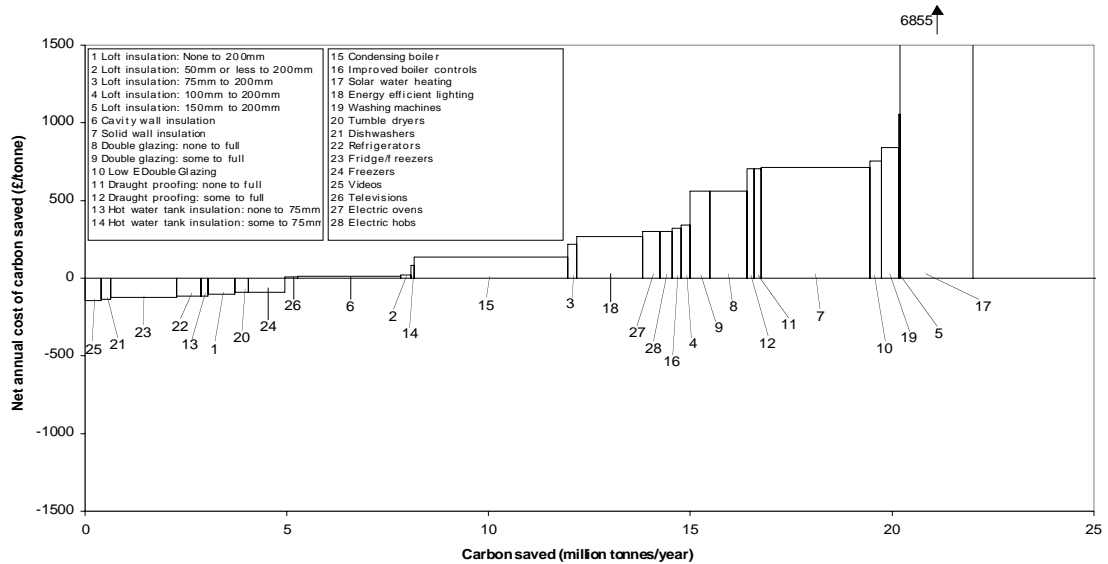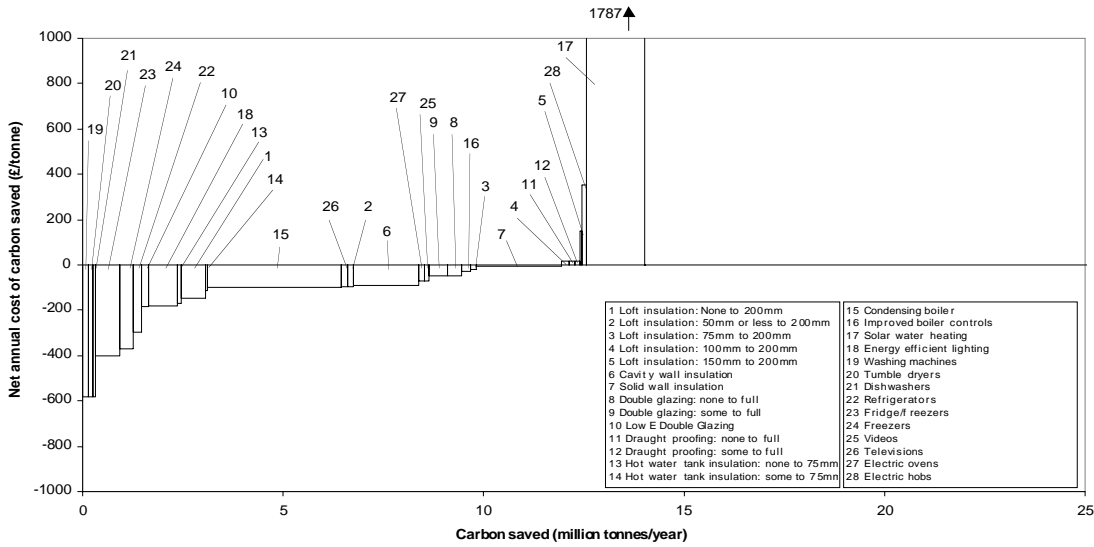**(High costs - 15% discount rate)**

Figure 3 was plotted using the same assumptions as in figure 1, but represents the likely situation in 2010. The predicted national saving is lower (14 MTC/yr), consistent with the expected improvement in homes and appliances over the next 10 years. The majority of this saving is still cost-effective.

Figure 3: Potential National Carbon Savings - 2010
(Low costs - 8% discount rate)

1 Loft insulation: None to 200mm	15 Condensing boiler
2 Loft insulation: 50mm or less to 200mm	16 Improved boiler controls
3 Loft insulation: 75mm to 200mm	17 Solar water heating
4 Loft insulation: 100mm to 200mm	18 Energy efficient lighting
5 Loft insulation: 150mm to 200mm	19 Washing machines
6 Cavity wall insulation	20 Tumble dryers
7 Solid wall insulation	21 Dishwashers
8 Double glazing: none to full	22 Refrigerators
9 Double glazing: some to full	23 Fridge/freezers
10 Low E Double Glazing	24 Freezers
11 Draught proofing: none to full	25 Videos
12 Draught proofing: some to full	26 Televisions
13 Hot water tank insulation: none to 75mm	27 Electric ovens
14 Hot water tank insulation: some to 75mm	28 Electric hobs

3. CONCLUSIONS

There is a substantial potential for energy and carbon savings from the increased use of energy efficiency measures in housing. A large proportion of the savings is likely to be cost-effective to the householder. In 2010, a still substantial potential will exist, assuming the continuation of current trends in the uptake of measures. The biggest savings are likely to come from wall insulation and condensing boilers.