Gas consumption savings from bead and mineral wool cavity wall insulation

Introduction

This article gives estimated domestic gas consumption savings from installing bead and mineral wool cavity wall insulation. It covers installations during 2013-2015 in England and Wales.

Summary

- The cavity walls of existing properties are classified as either hard to treat or easier to treat and are filled with two main types of insulation; bead or mineral wool.

- Bead insulation has a single lambda value (0.034 w/mK). There are two varieties of mineral wool insulation, with lambda values 0.034 and 0.040. A lower lambda means lower thermal conductivity and higher performing insulation.

- All hard to treat properties have bead or the lower lambda (0.034) mineral wool insulation installed. This isn't the case for easier to treat properties, where the proportion of the two mineral wool varieties (lambda 0.034 and 0.040) installed is unknown in the data.

- To find the savings the National Energy Efficiency Data-Framework (NEED) "Impact of Measures" method was used[1].

- For hard to treat properties no difference was found in median gas consumption savings between bead and mineral wool insulation (wool had 0.3% higher savings in 2013, and bead had 0.3% higher savings in 2014). This is consistent with the two types of material sharing the same lambda value.

- For easier to treat properties, bead insulation showed higher average savings (1.2% in 2014; 0.4% in 2015; 2% in 2016) than mineral wool insulation. This is likely to reflect the lower average lambda value of bead installations.

- All other factors being equal, cavity wall insulation materials with lower lambda values result in higher gas savings.

Background

Many properties in the UK have a cavity walls, or walls with a gap between two layers of masonry. These gaps, or cavities, can be empty or filled. Filling an empty cavity with an insulating material is known to improve the energy efficiency of the home by reducing heat leakage[2].

Until now, the relative gas savings from different cavity fill materials has not been analysed on a large scale. There are two main cavity fill materials: mineral wool and polystyrene beads. This project aimed to find out whether there are different savings in gas consumption from installing these two types of insulation materials.

Different materials have different thermal conductivity properties, measured by the lambda value. A lower lambda means lower heat transfer and therefore more heat can be expected to be retained in the property.

[1] Full details of the method are available in the Impact of Measures chapter of the NEED methodology note

[2] NEED has been used to estimate the energy savings from cavity wall insulation, with the results presented in Headline impacts of measures 2016. This found median gas savings of 7.3% for 2016 installations

Bead insulation generally has a lambda of 0.034 w/mK, whereas mineral wool has a value of either 0.034 or 0.040 w/mK.

When installing cavity wall insulation, properties are classified as either 'hard to treat' or 'easier to treat'[3].

Comparing gas consumption following bead and mineral wool insulation with the same lambda values is possible for hard to treat properties. This is because the mineral wool deployed in these properties was exclusively the 0.034 lambda variety.

For easier to treat properties, the mineral wool installed was either the 0.034 or 0.040 lambda varieties but this isn't identified in the data available for analysis. Because of this a direct comparison between materials with the same lambda values isn't possible for easier to treat properties.

Method

Data on installation date, difficulty to treat and type of cavity fill was provided to BEIS by the Cavity Insulation Guarantee Agency (CIGA). This was linked to the NEED data[4], which includes annual gas consumption at the property level. It also includes property characteristics, household characteristics and the installation of energy efficiency measures under government schemes.

NEED is used to assess the impact of energy efficiency measures including solid wall insulation and solar panels (the results of which are here). The method used for these assessments was applied to each combination of difficulty to treat, insulation material and year of installation. This gave a total of 10 combinations to test.

Properties which had another energy efficiency measure installed during the period of interest were removed from the group. Other filters were also applied, such as requiring annual gas consumption to be between 2,500 and 50,000 kWh to remove outliers. This excludes properties using electricity or other fuels for heating. The sizes of the filtered samples are shown in Table.

Table 1: combinations and sample sizes

Material	Treatment type	Year of installation	Sample size
Bead	Hard to treat	2013	6297
Mineral wool	Hard to treat	2013	1914
Bead	Hard to treat	2014	10654
Mineral wool	Hard to treat	2014	4248
Bead	Easier to treat	2013	8246
Mineral wool	Easier to treat	2013	20154
Bead	Easier to treat	2014	5350
Mineral wool	Easier to treat	2014	10260
Bead	Easier to treat	2015	5516
Mineral wool	Easier to treat	2015	8405

Hard to treat installations in 2015 are not included due to small sample sizes.

[3] Detailed definitions of "easier to treat" (also known as "standard fillable") and "hard to treat" are shown in Box 1 of Chapter 2 of the English housing survey 2012: energy efficiency of English housing report

[4] For an overview of NEED, see Annex D: What is NEED? of the 2018 NEED publication

Features other than the type of insulation used will affect the measured savings. These include property type, behaviour of residents and quality of installation. With the large sample sizes in this analysis, the behaviour of residents and quality of installations is assumed to have a net effect of zero.

The method matches the intervention groups to comparator properties to control for factors which could affect year-on-year energy use (e.g.: an unusually cold winter). Properties are matched by various characteristics, including banded gas consumption and property type[5].

The results are weighted to provide estimates which are representative of the housing stock in England and Wales.

Results

Table 2 shows the weighted and unweighted median and mean gas consumption savings. These savings are comparable to those estimated for all cavity wall installs in these years (median savings of 8.4%, 9.5% and 7.3% for 2013, 2014 and 2015)[6].

Table 2: Gas savings by material, treatment type and year of installation

Material	Treatment type	Year of installation	Sample size	Median savings	Weighted median	Mean savings	Weighted mean
Bead	Hard to treat	2013	6297	11.3%	9.9%	11.0%	10.0%
Wool	Hard to treat	2013	1914	10.0%	10.2%	9.6%	9.8%
Bead	Hard to treat	2014	10654	8.9%	7.5%	8.7%	7.7%
Wool	Hard to treat	2014	4248	7.0%	7.2%	7.0%	6.7%
Bead	Easier to treat	2013	8246	9.3%	9.3%	9.2%	9.0%
Wool	Easier to treat	2013	20154	8.6%	8.1%	8.4%	8.1%
Bead	Easier to treat	2014	5350	11.5%	9.5%	11.3%	9.9%
Wool	Easier to treat	2014	10260	8.7%	9.1%	8.5%	8.6%
Bead	Easier to treat	2015	5516	7.8%	7.0%	7.8%	7.0%
Wool	Easier to treat	2015	8405	5.7%	5.0%	5.6%	5.0%

Figure 1 shows the savings for hard to treat properties with a point for each year and material. Fluctuation between years is expected for the method used; the important comparison is between materials in the same year. There is no difference in median gas consumption savings between mineral wool and bead in hard to treat properties (wool has 0.3% higher savings in 2013, and bead has 0.3% higher savings in 2014). As these properties have insulation with the same thermal conductivity, these data are consistent with the hypothesis that the savings from different cavity wall insulation materials can be attributed in large part to the lambda values of the materials.

[5] The Impact of Measures chapter of the NEED methodology note gives further information on the matching and weighting process used

[6] Estimates of gas savings from cavity wall insulation installed for each year between 2010 – 2015 are published in the table Impact of Measures Time Series (2005 – 2015). The method used has been updated for the results presented in this report, so the estimated savings published will not exactly match those presented here.

Figure 1: Weighted median gas savings for mineral wool and bead for hard to treat properties

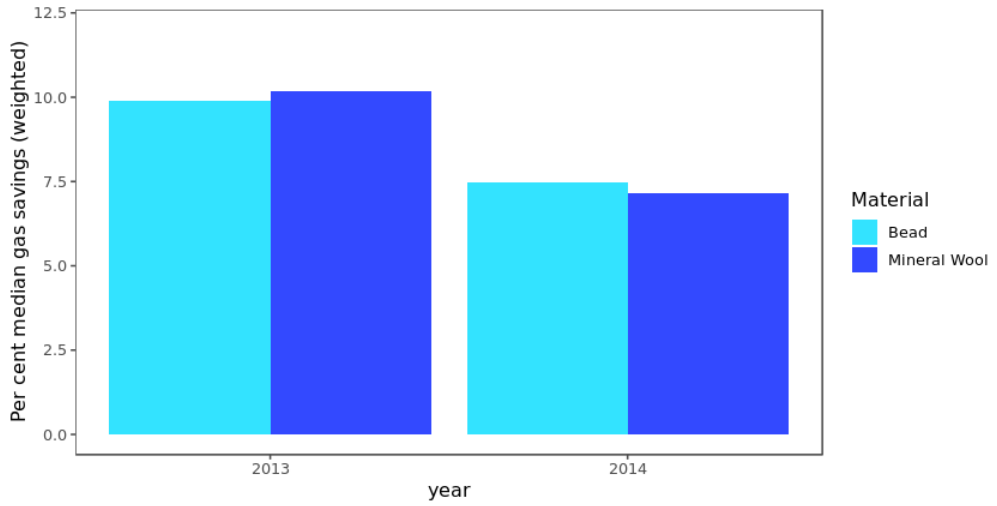
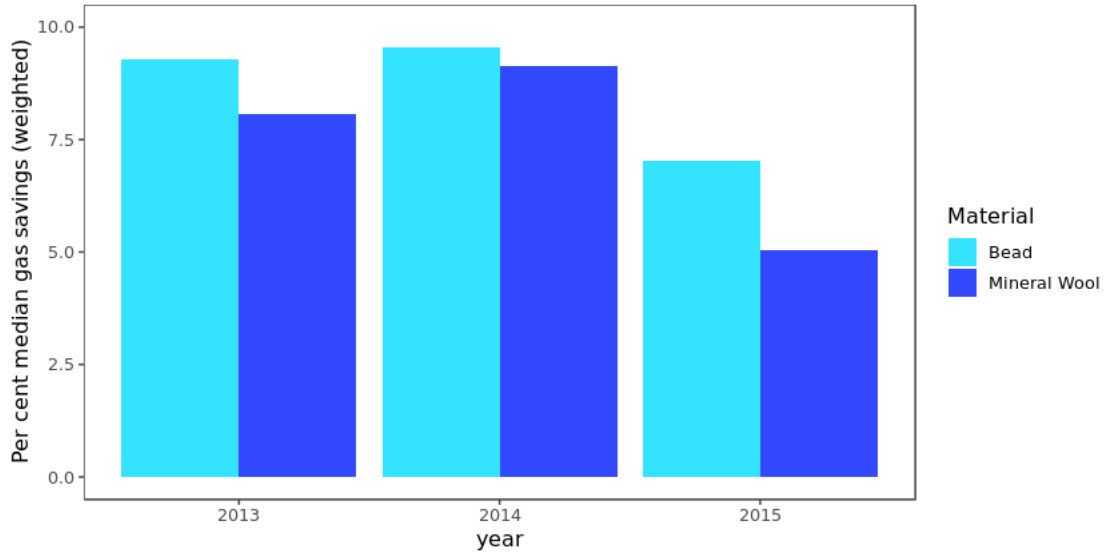


Figure 2 shows the savings for easier to treat properties. Unlike hard to treat properties there is a higher saving for bead in every year. Due to the large sample sizes the difference in savings between bead and mineral wool is statistically significant in every year.

Figure 2: Weighted median gas savings for mineral wool and bead for easier to treat properties



The difference in median gas savings from bead and mineral wool for easier to treat properties ranges from 0.4 to 2% (2013: 9.3% vs 8.1%, 2014: 9.5% vs 9.1%, 2015: 7% vs 5%). These include installations of both the higher and lower lambda valued mineral wool. As the average lambda value of mineral wool installed is not known, it cannot be concluded whether the difference is entirely attributable to the comparatively lower lambda values of bead in easier to treat properties.

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