Bolton House Case Study

As part of a trial into solid wall insulation by the Energy Saving Trust, Saint-Gobain Isover installed its newly launched Optima Internal Wall Insulation (IWI) system into a three bedroom family home in Bolton, Greater Manchester.

Recent figures have revealed that the installation resulted in a reduction of the wall U-values by 84 per cent, contributing to 26 per cent less fuel being used to heat the house – a saving of £312 per year (a figure that will of course increase as fuel prices rise). As a solid wall property, this work would eligible for significant grant funding under the current Energy Company Obligation (ECO), as well as being a measure suitable for a Green Deal plan.

Background

At the end of 2011, the Energy Saving Trust (EST) commenced the largest in situ solid wall insulation trial ever undertaken in England. By gathering a detailed data set from more than 75 houses across the country, the EST aimed to develop a clearer understanding of building performance in relation to domestic solid wall insulation.

As part of this project, Isover's Optima IWI system was installed at the Bolton property, in order to better understand the effectiveness of internal solid wall insulation in a variety of areas:

- Reducing energy bills through lower fuel consumption
- Decreasing CO_2 emissions, as a result of minimised fuel consumption
- Controlling internal ambient temperatures
- Reducing energy waste through heat leakage
- The effectiveness of internal wall insulation, as a way to address the problem of Britain's un-insulated, solid wall housing stock – approximately 7.5 million homes

The house

This particular property is a post-1900, three storey, mid-terrace house with solid, natural stone walls. The home has three bedrooms and two bathrooms, as well as a kitchen-diner, living room, study and a utility room. Double glazing is installed throughout and a single storey extension has recently been constructed at the rear of the house.

Because the home has ‘conservation status’, and was constructed of natural stone, external wall insulation (EWI) was not considered suitable for the property and, as such, IWI was decided on as the most appropriate and effective form of insulation by the owners and architects.

Action taken

The Bolton house was fitted with Isover’s Optima IWI system, an insulation solution specifically designed to improve the thermal performance of solid or ‘hard to treat’ walls.
System components[1] were assembled in-line with installation guidelines, insulating all walls within the property, with the exception of the extension (which had been built to more recent Building Regulations with an insulated cavity wall), and the two bathrooms. In addition, Isover’s Protect external wall treatment was applied to the external surface of the masonry wall to control moisture ingress.

[1] Isover Renovation Roll Thermal, Isover Optima IWI Supports, Isover Vario KM Duplex Membrane system, British Gypsum Gypframe GL1 Lining Channel, British Gypsum Gypframe GL8 Track and Isover Protect

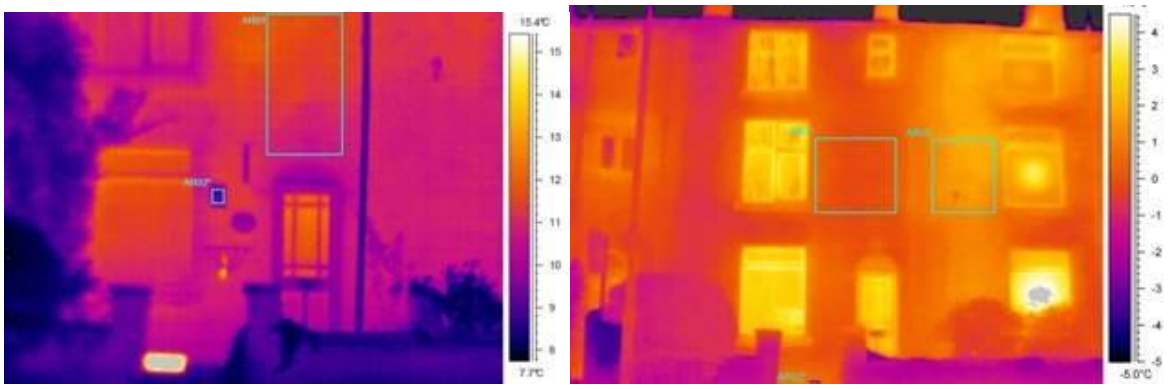
Measurement, assessment and results

To accurately assess the effectiveness of Optima IWI, a variety of data from the insulated property was collected and analysed. This included thermal imaging, measurement of the U-value and air permeability. Temperature and humidity sensors were also installed to monitor environmental conditions and smart meters were fitted to track gas consumption.

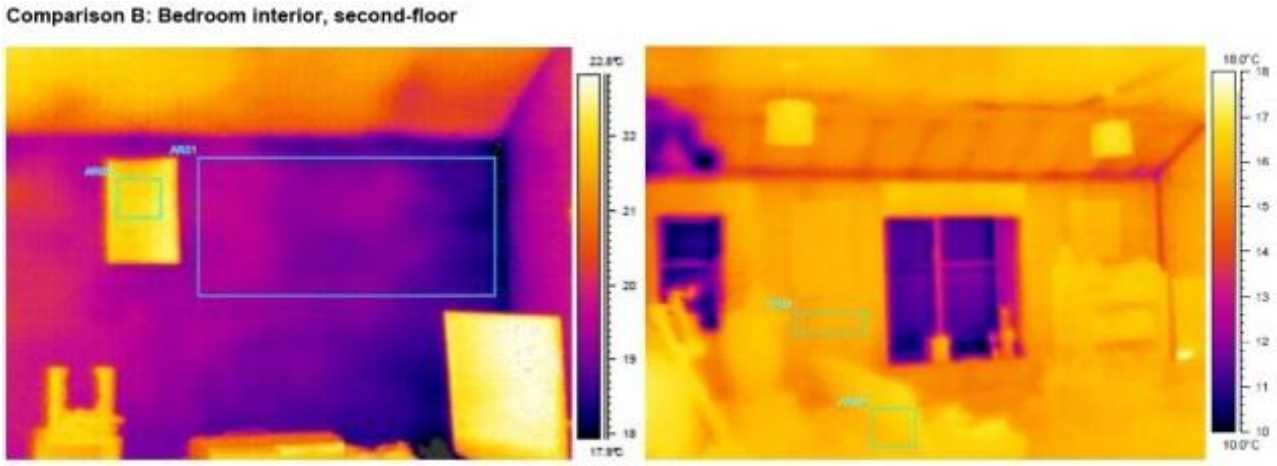
Heat leakage

Thermal imaging demonstrated a clear improvement in heat leakage from the house, from pre- to post-insulation, as the internal insulation had an effect on reducing internal heat from escaping through the walls. The post-insulation image clearly shows the difference between the insulated and un-insulated property (to the right), showing an approximate two degree difference in wall temperature.

Before



After



Internal thermal images pre- and post-installation (above) show the dramatic effect of insulating the walls in equalising the fabric temperatures (the now-insulated internal walls are a similar temperature to the already insulated ceiling).

Ambient internal room temperature versus internal wall surface temperature

Table 1 below details the difference between the ambient internal room temperature and the wall surface temperature. Pre-installation, the difference was as high as 5°C, due to heat leaking from the walls. This, along with convection currents within the room, will likely have contributed to drafts and a feeling of cold in the house. However, post-insulation, this difference was vastly reduced, with little or no difference observed over the measurement period.

Table 1

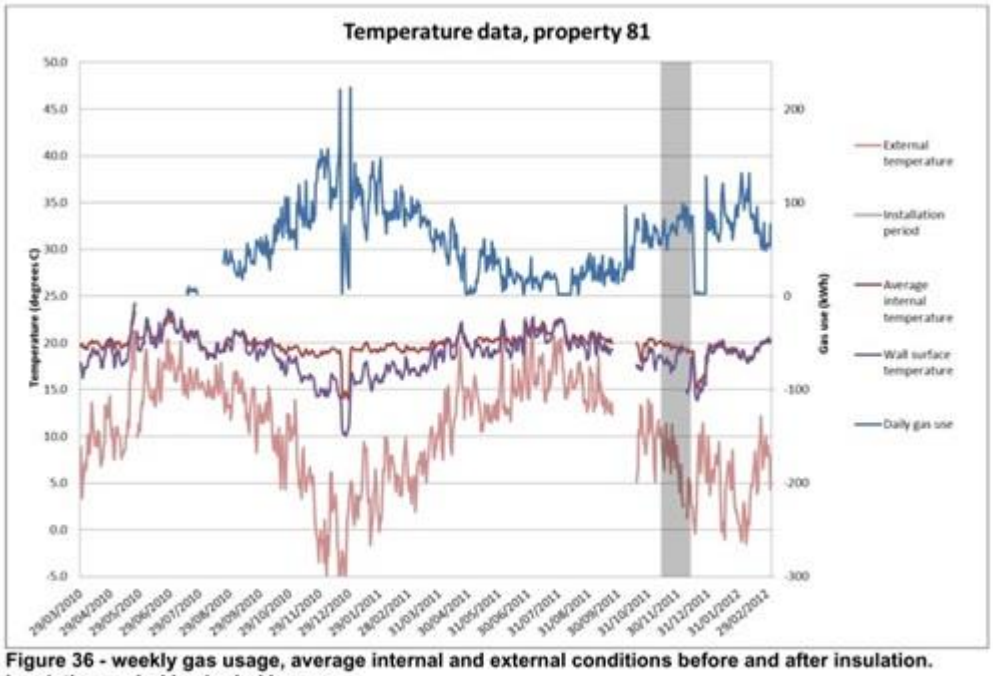


Figure 36 - weekly gas usage, average internal and external conditions before and after insulation. Insulation period is shaded in grey

Table 1

Comparison of energy performance

Table 7 also shows the recorded gas consumption before and after Isover's Optima IWI system was installed. As external temperature has a large impact on the amount of gas used to heat the house, data collected from sensors measuring environmental conditions was taken into consideration when analysing the figures. Comparing energy consumption data collected pre and post-insulation, the trial found that yearly gas use decreased from 26685 kWh to 19748 kWh, a significant 26 per cent reduction. This equates to a 1271 kg reduction in CO_2 emissions from the property and a saving for the homeowner of £312 over the course of a year. With energy prices rising significantly, these Savings will only improve further over time.

	Recorded Gas Consumption (kWh)	Monitoring period (weeks)	DDH[12] Total	Normalised total gas consumption per year (kWh)
Pre	19695	20	1519	26685
Post	5527	9	576	19748
			Reduction	6937
			Percentage	26.0%

Average DDH / year	2058	degC/degK

Table 7 - Gas use calculations

The normalised total gas consumption – a category covering all gas usage including heating, cooking and hot water – fell by 6937 kWh/year.

	Normalised yearly savings		
	Energy	Cost[13]	Carbon dioxide emissions[14]
	kWh/yr	£	kgCO2
Pre	26685	£1,199	4889
Post	19748	£887	3618
Reduction	6937	£312	1271
Percentage	26%	26%	26%

Table 8 - Adjusted normalised yearly savings (pre insulation adjusted up to include estimated impact of loft conversion)

Condensation

Significant investment was made during the project to analyse condensation. Measurements of wall surface temperature were taken in all EST trial houses, along with humidity and ambient temperature and this information was used to calculate the dew point of the wall surface and identify any risk of condensation. Condensation could have occurred before insulation was installed due to cold external walls, but was unlikely to occur post-insulation, unless poor ventilation and humidity had allowed it to build up. In this property, no risk of condensation was identified after Optima IWI, Vario membrane system and Isover Protect had been installed.