Retrofitting wall insulation has been common practice in other countries for decades, but New Zealand and Australia has lagged behind in insulating the walls of both new and older houses.

Although several types of insulation materials – cellulose, rockwool, glasswool and urea formaldehyde foam – are being retrofitted into the walls of New Zealand houses, the number of houses being insulated is minuscule compared to those retrofitted with ceiling and underfloor insulation.

Materials for retrofitting walls

Segment or bonded-style fibrous insulation products are available from DIY stores and can be retrofitted by homeowners. However, having to remove the interior linings or exterior cladding makes this both expensive and disruptive.

Retrofitting loose material with a mechanical blower using holes drilled through the cladding or lining can be a much cheaper and quicker process. It also has the potential to be as thermally effective as the traditional preformed segments, if not better.

Retrofitting without removing linings

The BRANZ project focused on retrofitting insulation without removing linings. Retrofitted wall insulation materials used overseas include cellulose (shredded and pulverised newspaper), glasswool, rockwool, polystyrene (EPS) beads and polyurethane foam.

Urea formaldehyde foam (UFFI) was used in the US and elsewhere, but it has largely been replaced by polyurethane foams due to UFFI’s relatively high cost and shrinkage, which severely undermines its thermal performance. Although these products are available locally in DIY form, they are not retrofitted commercially.

Barriers

Retrofitting wall insulation in New Zealand has been limited by:

- difficulty
- availability and cost of materials
- overseas equipment and processes which are not particularly suited to the variety of wall construction in our houses.

However, at least two of the common retrofitted insulation materials – cellulose and EPS beads – can or could be readily sourced from waste recycling, so availability and cost should not be a barrier to retrofitting wall insulation.

Installation equipment and processes that, however, need to be adapted to cope with a wide range of wall construction methods as possible and to ensure that the other performance aspects of the walls are not compromised.

Building consent needed

Although homeowners with uninsulated walls may be aware that currently there are few options available to them, they are probably not aware that, on top of the high cost, there is also a New Zealand Building Code requirement to obtain a building consent for the work.

A consent is needed even when the work involves the traditional process of removing the linings and installing segment style products.

Weather tightness and electrical concerns

Although retrofitting insulation improves the thermal resistance of walls, it can adversely affect other performance aspects if the construction details of the wall are not considered.

Many New Zealand houses were constructed without the inclusion of building paper between the framing and cladding, or the paper may have been compromised with moisture and age. Installing insulation in these walls may cause any rainwater that penetrates the cladding to accumulate in the insulation or track through to the interior linings.

Another concern is the impact that the insulation material can have on the operating temperature of electrical wiring.

Important to get installation right

The installation process is more important than the material. Too expensive a material could lead to shortcuts with installation. All common retrofit materials, for example, can be installed to minimise or eliminate settlement and slumping. However, this sometimes requires the product to be installed at such a high density that it becomes uneconomic in New Zealand’s temperate climate.

The solution from the installer’s point of view is to install the materials at an economic density and to adjust the performance claims and price accordingly. For homeowners, it is difficult, if not impossible, to assess if they are getting good value for money since the insulation is hidden and the process is likely to be different from that shown in overseas technical literature.

Understanding the R-values

A web search for retrofitted wall insulation products reveals a plethora of claims as to the superior performance of one insulation material over another and may include unrealistic thermal resistance (R-value) claims.

In building standards, retrofitted insulation products are classified as ‘formed on site’ products. Since the performance is largely determined by the installation, the R-value is generally less than what is measured for the material in a laboratory.

It is important to remember that the overall R-value for the wall once insulated is not the...
same thing as the installed performance of the insulation product. In a retrofit situation, it is almost always going to be less since the R-value of the insulation product does not take into account the framing.

All of the common retrofit materials – apart from UFFI foam – will achieve an installed material R-value in the range R2.3–2.6 in a 100 mm wall cavity if installed at sufficient density to minimise settlement. This is expected to deliver an overall R-value, when framing is included, in the range R1.7–2.3, depending on the amount of framing and type of cladding.

**Installation process must dos**

The first step is to get a building consent. **IS THE WALL SUITABLE?**

Carry out an electrical inspection, inspect the condition of the building paper and look for any signs of moisture ingress in all walls where insulation is going to be installed. Since suitable inspection cameras are relatively inexpensive, it is not unreasonable to expect an installer to provide a comprehensive record of inspections. Thermal imaging cameras alone are not reliable for detecting moisture in walls. Any moisture detected requires follow-up confirmation by visual inspection, moisture meter or both before installing insulation.

Insulation should only be retrofit fitted into walls that have building paper. Insulation should never be installed into a drainage/ventilation cavity such as the cavity behind brick veneer. **INSIDE OUT OR OUTSIDE IN?**

Installing insulation from the outside using holes drilled through the cladding is quicker and less disruptive but risks compromising weathertightness. To some extent, it will also permanently damage the building paper.

Installation using holes drilled through the interior lining is recommended as it is not weather dependent and does not interfere with the cladding and building paper. **DENSITY OF INSULATION**

The installer needs to control and monitor the density at which material is installed. The total quality of materials used needs to be independently measured and an accurate determination made of the total volume of wall cavity insulated. The average density should then tally with the density it was being installed at.

The effectiveness of the check systems is dependent on the accuracy of wall volume calculation so needs to be done on a room-by-room basis to be sufficiently accurate. **USING THERMAL IMAGING CAMERAS**

Thermal imaging cameras can be useful to locate framing and missing insulation. However, they can be very expensive, and even the best may not detect missing insulation if conditions are unsuitable – a temperature difference through the wall is needed, so rooms need to be actively heated or cooled.

Cameras are not very good at determining areas where the density is below target. Since the camera images can be easily manipulated, they are only useful as an audit tool in the hands of a properly trained independent person. **COULD CHOOSE ONLY A FEW ROOMS**

Some materials can be installed with relatively simple equipment so it should be economic to retrofit insulation in single rooms. This allows homeowners to prioritise areas, such as a lounge or a child’s bedroom, without having to commit to the total insulation project.

**Adding insulation sometimes difficult**

Not all of the 600,000 houses without wall insulation will be suitable for retrofit. Many brick veneer clad houses, for example, do not have building paper, and of the remaining 440,000, many will require electrical or weathertightness remedial work before insulation can be considered.

While sometimes it may not be practical to retrofit insulation without removing interior linings, the process of thorough inspection and detection of issues is a useful exercise anyway for extending the life of a building.

A significant number of houses will have walls constructed with no building paper above the soffit line, making it difficult, if not impossible, to retrofit insulation into the upper 200–300 mm of the walls. These walls would probably need interior linings to be removed or to have an opening cut into the lining so that preformed insulation can be installed. **This research was funded by the Building Research Levy.**

**Key findings**

BRANZ research demonstrated that:

- there are several suitable retrofit materials
- retrofit can be undertaken without compromising wall weathertightness
- material costs and installation need not be expensive
- the improvement on the overall thermal resistance of the walls is generally significant.