

**EXPERT
VIEW**

The trouble with external insulation

External insulation is not a silver bullet. **Niall Crossan** looks at new thermal upgrade solutions that don't create more problems than they solve



Thermally upgrading both commercial and residential existing buildings presents significant challenges and opportunities for the construction industry. There is no doubt that there is huge potential in the area of external insulation of existing buildings. This presents the most efficient means of addressing heat loss, thermal bridges, and offsetting the risks of introducing interstitial condensation risk. There are a range of manmade and natural external insulation products and solutions now available on the market. Some such solutions are illustrated in figure 1. External insulation is not a silver bullet solution for the thermal refurbishment of all buildings however. In 2008 Part L of the Building Regulations was revised to achieve a 40% improvement in primary energy consumption and CO₂ emissions in new dwellings; a 60% improvement in primary energy consumption and CO₂ emissions standards are expected to follow this year. The government has funded the development of tools such as DEAP and NEAP, to assist building professionals in the delivery of more efficient buildings. These tools focus on the energy performance of buildings. Using materials which are compatible with the proposed building, particularly existing buildings and which not only deliver energy efficient buildings, but buildings which are durable and healthy are also as, if not even more important. Otherwise we may deliver a low energy, uncomfortable, poorly built, unhealthy living environment, which may require further refurbishment in the future.

Buildings which feature details of architectural significance which a client may wish to preserve on the external facade or exposed stone work for instance can only be insulated internally. Thermally upgrading such buildings presents major challenges. Without sufficient analysis, introducing an unsuitable insulation in terms of its material properties or depth, into such buildings, may introduce major condensation problems, mould growth and a reduction in indoor air quality and comfort levels. Internally insulating buildings also presents major challenges in terms of addressing the thermal bridges which may be introduced. Numerous innovative solutions have been developed to address issues which may arise when refurbishing single leaf solid walls on existing buildings internally. One such product is called Calsitherm Climate Board. This board is made from calcium silicate, a micro porous mineral building material with effective insulating properties, its high capillary action ensures humidity regulation and the nature of the material means that mould cannot form on its surface. Figure 2 illustrates the application of this innovative insulation material. In the future the market will require more innovative thermal solutions

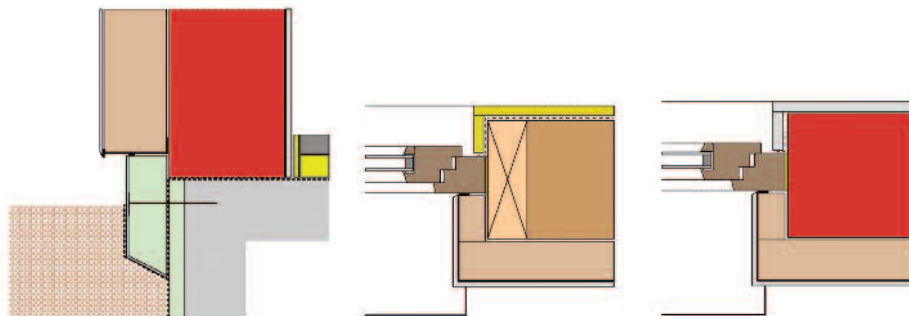


Figure 1 (above): GUTEX Thermowall external insulation solutions. (From left to right), foundation detail, timber frame window detail, block wall window detail

Figure 2 (below): Thermally upgrading a building internally with Calsitherm Climate Board



such as this to address heat loss in existing building.

Once a single leaf solid wall is insulated internally this greatly reduces if not eliminates, the potential for any moisture which may penetrate the wall externally to dry to the interior. This has been validated in many studies now. When this is combined with the potential for warm air to leak through the inevitable gaps in the internal insulation, condensation on the now cooler wall surface may occur. The combination of these two factors may lead to an annual increase in moisture between the wall and the insulation. Given the unique climate conditions we are exposed to in Ireland, this is particularly critical for walls which are unplastered externally.

Introducing interior insulation on the inside of single leaf solid walls in existing buildings should be addressed by carrying out the required analysis. It is essential to speak to the relevant experienced building professionals and to request an in depth condensation risk assessment be carried out based on the latest calculation programs. The menu-driven PC program WUFI (Wärme und Feuchte instationär - Transient Heat and Moisture) is such a program, developed by the Institute for Building Physics in Germany and validated using data derived from outdoor and laboratory tests. This software facilitates the realistic calculation of the transient hygrothermal behaviour of multi-layer building components exposed to natural climate conditions. WUFI is based on the latest research regarding vapour diffusion and liquid transport in building materials.

WUFI can use measured weather data - including driving rain and solar radiation - as boundary

conditions, thus allowing realistic investigations on the behaviour of the component under exposure to natural local weather. WUFI can be used to:

- Assess the drying time of masonry with trapped construction moisture;
- The danger of interstitial condensation;
- The influence of driving rain on exterior building components;
- The effect of repair and retrofit measures;
- The hygrothermal performance of roof and wall assemblies under unanticipated use or in different climate zones.

WUFI complies with standards as set out in BS 15026 - Hygrothermal Performance of Building Components and Building Elements.

While there are countless existing buildings which require to be thermally upgraded, there is little point in spending precious money on such projects, if it introduces other problems. Thermally upgrading the many thousands of poorly insulated existing buildings throughout the country presents the construction industry with a major opportunity. It is critical that prior to the introduction of insulation on the inside of the existing buildings, particularly single leaf solid walls, that a hygrothermal analysis should be carried out according to the standard highlighted above, and that the relevant building professionals are consulted prior to work been carried out. ■

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