PU EUROPE
EXCELLENCE IN INSULATION

The benefits of polyurethane insulation

Today's solution for tomorrow's needs

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Did you know that...

Whenever you get into a car, open a fridge door, lie on a hospital bed or put on a pair of sport shoes, the chances are that some part of these everyday items of modern living will contain polyurethane.

Polyurethane, or PU, includes both PUR and PIR products and is an extremely versatile material with valuable properties such as strength, durability and comfort.

In many cases we don't choose to use it – it is simply there in the fridge or the car because it is the best material for that particular job. However, there is one situation where we do have a choice about whether or not to use PU, and that choice is building insulation.

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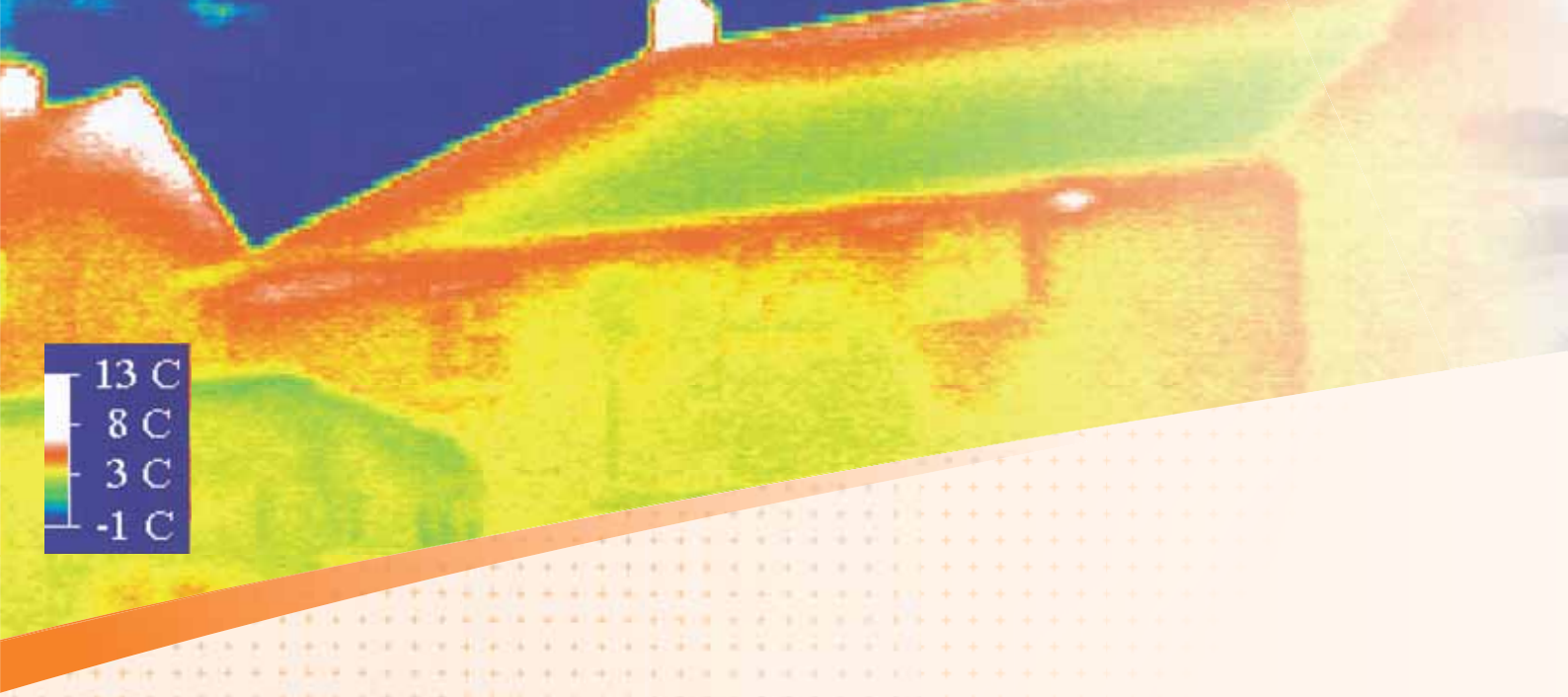
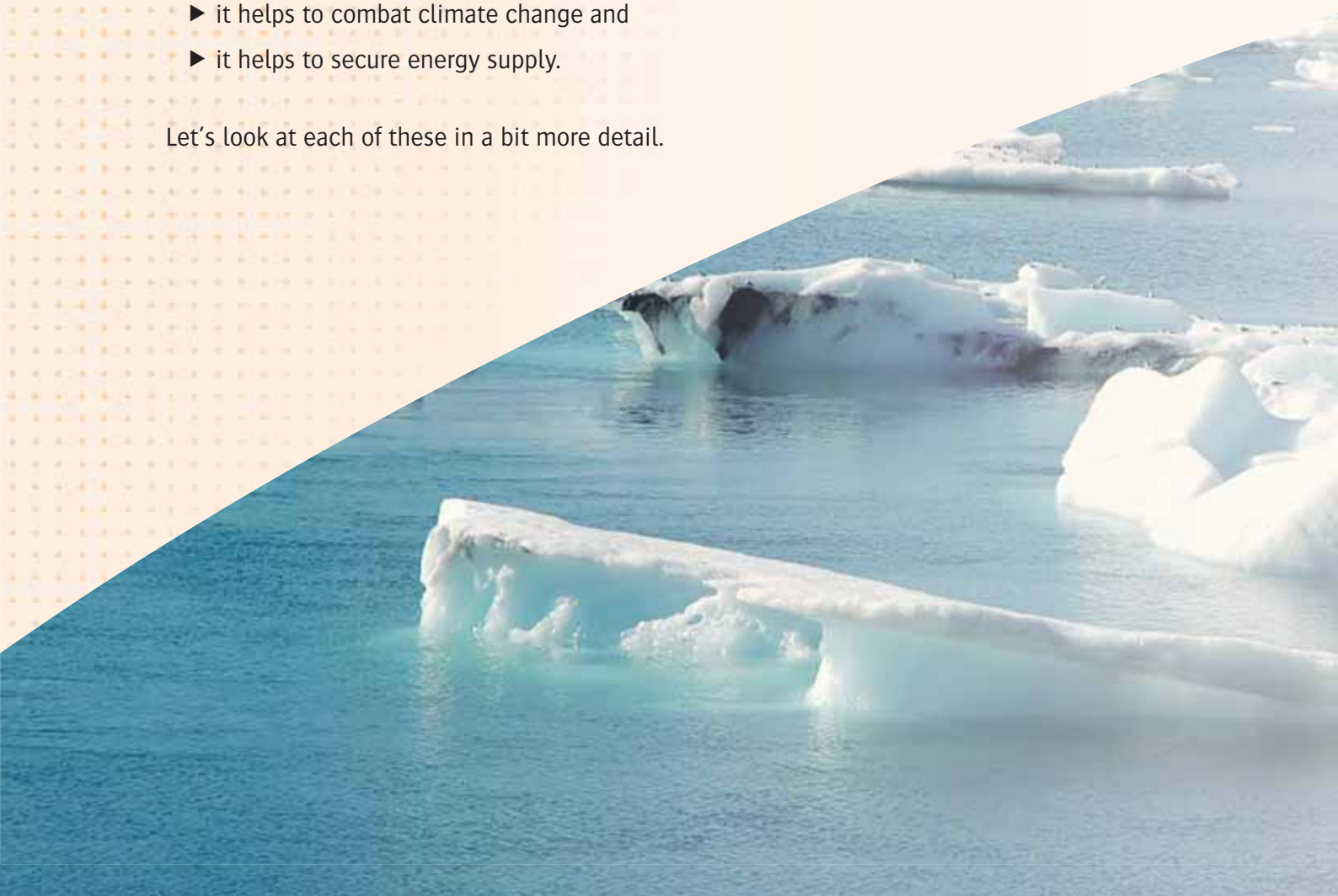


Why does insulation matter?

Although you may not think it, insulation is one of the most important aspects of the specification of a building for a number of reasons:

- It helps to maintain a comfortable indoor temperature and therefore living and working environment for the people using the building;
- it helps to keep energy consumption and costs down;
- it helps to combat climate change and
- it helps to secure energy supply.

Let's look at each of these in a bit more detail.



Providing comfortable living and working environments

Putting good levels of insulation in our roofs, walls and floors makes it easier to keep our buildings at a comfortable temperature all year round. It does this by forming a barrier which stops heat transferring through the fabric of the building, bringing us better control of the temperature inside, whatever the weather is doing outside.

Keeping energy consumption and costs down

Insulation is one of the cheapest and easiest ways to improve the energy efficiency of buildings, whether they are old or new. Greater energy efficiency means that less energy is needed to either warm or to cool buildings. In turn this leads to lower fuel consumption, lower energy bills for the consumer and fewer carbon emissions to damage the environment.

Best of all, provided the right insulation is used and installed correctly, it will carry on being energy efficient over the life of the building without needing any maintenance, and the cost of putting the insulation in will be paid back in just a few years through the savings made on energy bills.

Combating climate change

In Europe, around 40 % - 50 % of all energy used is in buildings, and up to 60 % of that comes from heating them. The burning of fossil fuels to create energy makes carbon dioxide – a 'greenhouse gas' that increases global warming and brings about climate change. So energy use in buildings, especially heating, creates a lot of carbon dioxide.

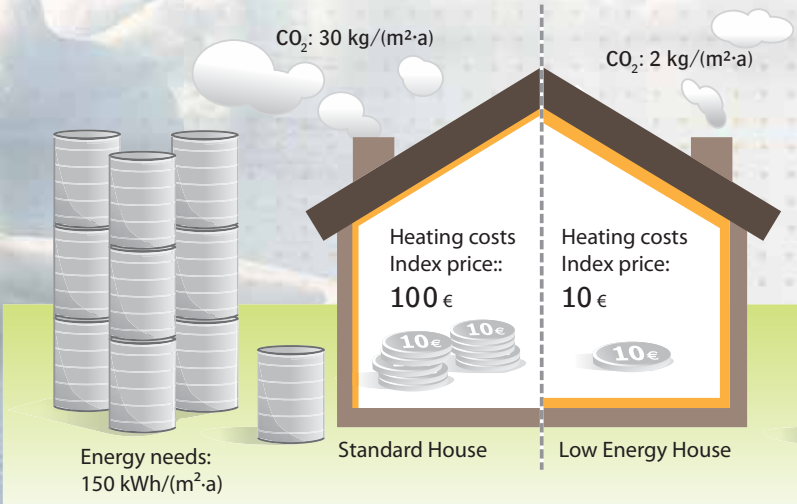
It is now widely accepted that global warming is one of the greatest threats to our way of life, even to our existence, that we have ever faced, and that strong action is needed to stop its acceleration and combat its effects.

There are a number of ways we can tackle this. Many people believe that investment in renewable or nuclear energy is the answer, but these technologies are expensive and each has its own limitations and potential problems.

A far more responsible approach is to first reduce energy and resource demand, making it easier to meet that demand through other, more environmentally friendly sources. The simplest, most cost effective way to reduce demand is by improving the energy efficiency of our buildings, in other words to insulate them.

Helping to achieve energy security

War, politics, even natural disasters, all pose a threat to supplies of fossil fuel, and this has become a concern for many countries who want to make sure that their sources of energy are secure. Our current rates of demand cannot be met by alternative sources of supply such as wind or solar power, but if demand can first be reduced it then becomes possible to meet a greater proportion of it in this way, and therefore increase levels of both local and national energy security.



Recommended U-values for low energy houses

U-Value building envelope		U-Value windows and doors	
- Moderate countries:	0.10 - 0.15	- Moderate countries:	0.80
- Hot countries:	0.15 - 0.45	- Hot countries:	1.10
- Cold countries:	0.04 - 0.07	- Cold countries:	0.60

So insulation is important, what next?

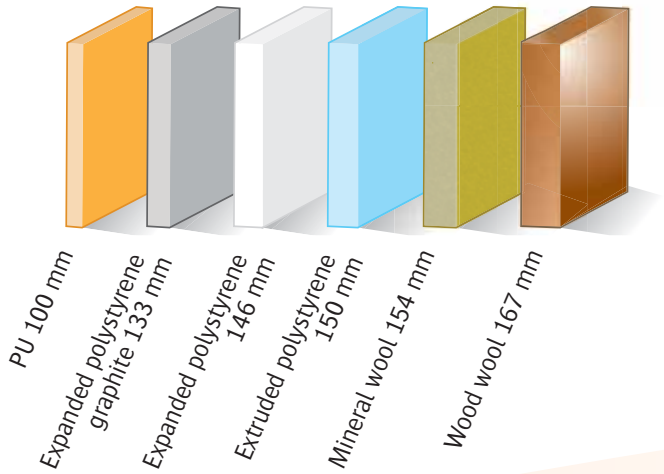
Choosing the right material is as important as investing in insulating our buildings in the first place – there is little point doing it if the insulation can't offer good enough performance to really make a difference, or isn't going to be up to the job in the long term.

Isn't all insulation the same?

No it certainly is not, and people need to understand the differences if they are to make an informed choice about which material to use in order to do the job they want and get a good return on their investment.

The illustration compares the thicknesses of some commonly used insulation products to achieve a comparable thermal performance (for U-value of 0.22 W/(m²·K) – insulation only). It is evident that the polyurethane significantly outperforms the alternative products.

Insulation thickness at equal thermal insulation value



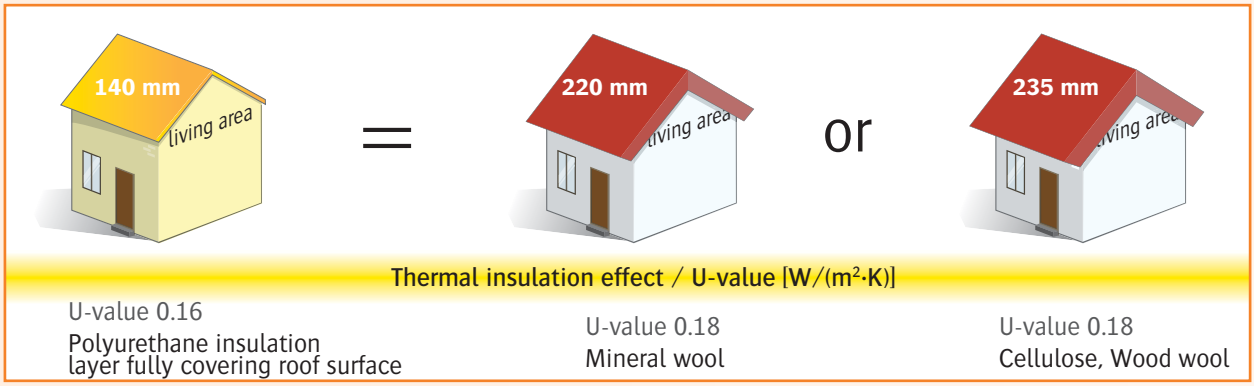
A few questions answered

The question of thickness

The more a building is insulated, the greater the benefits, but because insulation materials perform so differently, the thickness needed to get the same level of performance will vary – a lot!

In construction the thermal performance of the roof, walls or floor is expressed as a 'U-value', which is basically the amount of heat that can pass through the wall, roof or floor measured in watts per square metre. As you can see in the illustration below, PU insulation can achieve the same U-value as the other materials with considerably less thickness.

If we make our buildings more energy efficient in order to try and beat climate change, this question of



Thickness roof

thickness becomes a real issue, as very thick quantities of insulation have a 'knock on' effect on our buildings. For example, wall cavities have to be made deeper, taking up valuable space or increasing the building footprint, roofs and foundations have to be larger, fixings have to be longer and, in the case of timber frame, studs have to be deeper, all of which also adds to the building cost.

Upgrading our existing buildings is just as important as having good standards for new ones, but in this case there could be problems with both space and weight – older buildings were simply not designed to take extreme thickness of insulation.

The question of weight, health and safety during installation

Using PU insulation not only keeps the thickness down, it is also extremely lightweight, helping to minimise structural loading. In the case of flat roofs for example, the weight of alternative insulation materials can be 6-10 times higher. Because PU is so much lighter it is quicker and easier to install in this instance, speeding up the work and reducing risks to health and safety.

Another advantage of PU insulation from a health and safety point of view is that it has no irritating loose fibres so is simple and pleasant to handle, needing no additional equipment such as a face mask and gloves.

Walkability on flat roofs

A flat (or low slope) roof is often exposed to dynamic mechanical loads e.g. by pedestrian traffic or small vehicles. These loads occur during construction of the building or for regular maintenance of installations on the roof. After a few loads some materials tend to lose their compressive strength, resulting in a deeper imprint of e.g. the foot on the waterproofing. The stress in the waterproofing may lead to cracks, or to penetration of a mechanical fixer through the waterproofing if the imprint is close by. Therefore the insulation material and the waterproofing may be severely damaged, resulting in a leaking roof. In contrast to some fibrous insulation products, PU is unaffected by foot traffic and loading incurred in the course of normal maintenance.

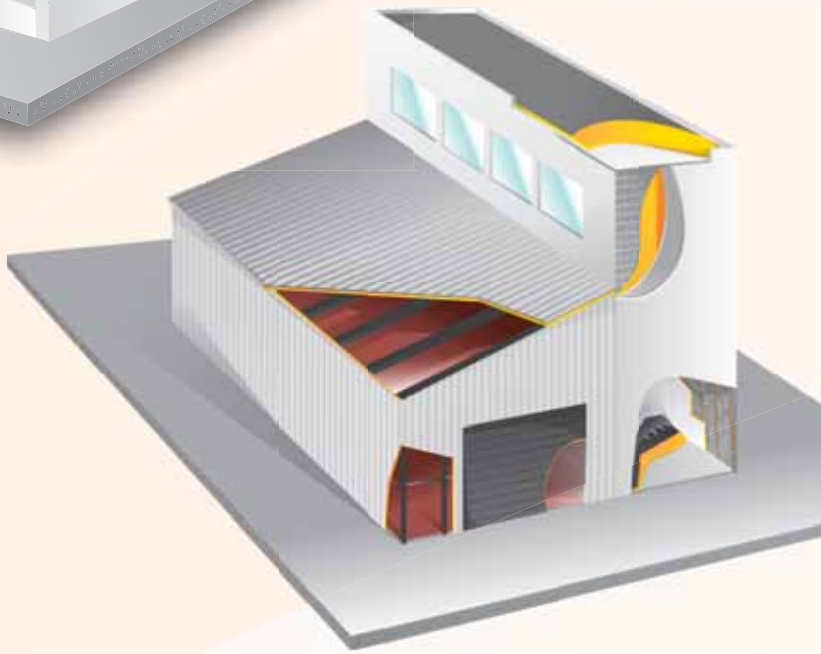
Example of a damaged roof

The question of durability

One of the most important aspects to look out for is how well the insulation will continue to perform over time. After all, it is an investment that is supposed to save you money and protect the environment, and it will only do that if the thermal performance lasts.

Rigid, closed cell PU insulation is not affected by water vapour or air infiltration, it cannot sag or slump, and is very difficult to squash, all of which gives a better guarantee of high performance over the life of the building.

A sample taken from a pitched roof in Germany and tested by the FIW was fully functional and still reached all originally declared values and performances, including thermal conductivity, after 28 years in use.[1]

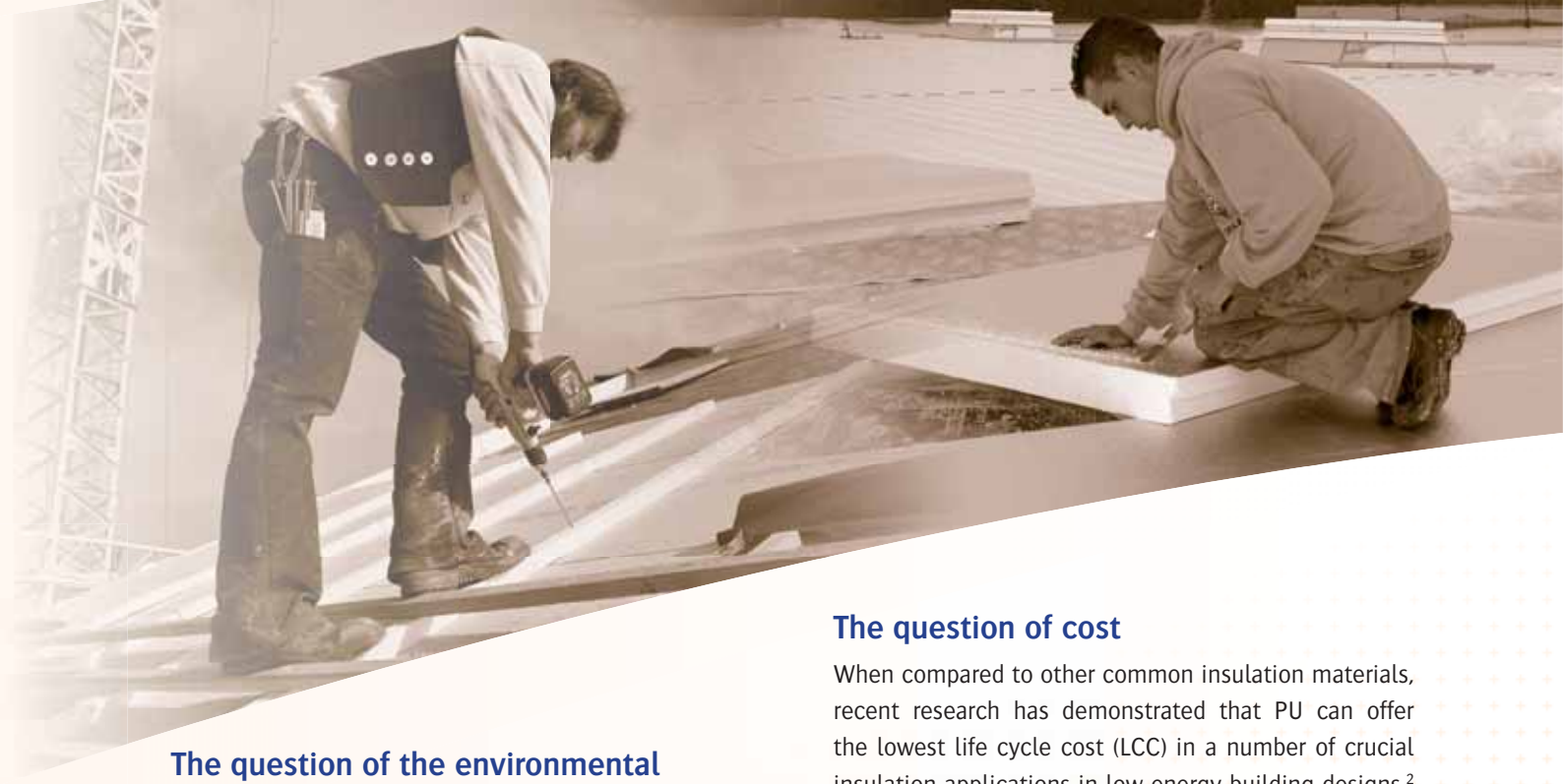


The question of versatility

PU insulation includes both PUR and PIR insulation, is used in all kinds of applications and appears in many different forms:

- Insulation boards for all kinds of roof, wall or floor
- Spray on insulation
- Cavity injected insulation
- Insulated panel systems
- Structural insulated panels
- Pre-insulated ductwork
- Pipe insulation
- Cold stores

It can be used as easily in refurbishment as it is in new residential and commercial buildings. Because it has no loose fibres it is particularly suitable for high specification projects such as laboratories, hospitals or food preparation and storage facilities.



The question of the environmental impact, health and safety

We have already looked at how insulation can reduce carbon dioxide emissions and help to combat climate change. Over its useful life PU insulation saves more than 100 times more energy than was used to make it. It is manufactured without the use of ozone depleting gases, and once it has finished its work it can be mechanically recycled in some cases, or it can be used in energy recovery processes, further reducing our demand for fossil fuel energy.

PU is safe and chemically inert. PU is not considered "dangerous" and no exposure limits have been established. PU insulation products have extremely low indoor air emission levels and easily achieve the best class in countries where testing or classification are practiced.

The low permeability of PU prevents interstitial condensation. PU is not affected by mould growth or dust mites and health problems related to this can be avoided.

The question of air tightness

Thanks to its closed cell content, PU insulation guarantees a high level of vapour and air resistance throughout its product life. This allows for efficient and material-saving solutions to achieve the air tightness of the building envelope – one of the prerequisites for nearly zero energy buildings.

The question of cost

When compared to other common insulation materials, recent research has demonstrated that PU can offer the lowest life cycle cost (LCC) in a number of crucial insulation applications in low energy building designs.[2] This is achieved by its high thermal performance, low weight, low permeability and ease of installation all of which lead to reduced overall material use at the building level.

The question of fire

Most insulation is used behind a barrier such as plasterboard, bricks, blocks or roof decking, and is only a minor factor in fire. Its fire performance should always be looked at as part of the construction as a whole. Although it is classed as a combustible material, PU insulation does not smoulder, melt or drip when heated, and can actually help a building to resist the spread of fire. PU insulation systems exceed the fire safety regulations and insurance requirements for a wide range of applications.

The question of "oil based"

PU manufacturing mainly relies on fossil resources. However, PU insulation accounts for less than 0.04 % of the world's annual crude oil consumption. Furthermore, the share of renewable content in PU insulation products can attain as much as 20 % today. If one now adds the previous statement that PU saves more than 100 times more energy than it contains, then one can clearly state that PU insulation makes the best use of our fossil fuel resources.

[1] PU Europe Factsheet 16: Durability of polyurethane insulation products, October 2010
[2] PU Europe Factsheet 15: Life Cycle Environmental and Economic analysis of Polyurethane Insulation in Low Energy Buildings, October 2010

How to save money and conserve the environment in two easy steps!

1. Insulate buildings to the best possible standards
2. Design out the risk of insulation failure by using polyurethane insulation

Polyurethane insulation: today's solution for tomorrow's needs

For more details on the benefits of polyurethane insulation, see
www.excellence-in-insulation.eu

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