AN INTRODUCTION TO NATURAL FIBRE INSULATION

NATURAL FIBRE INSULATION GROUP

UNDERSTANDING INSULATION

HIGH-PERFORMANCE, SUSTAINABLE INSULATION

Insulation is essential in addressing the climate crisis, reducing fuel poverty, and improving the health of our homes. Poorly insulated homes not only waste energy but also contribute to cold, damp conditions, and with millions of buildings requiring energy upgrades, the retrofit challenge is urgent.

From clothing to interiors, many of us already choose between natural and man-made fibres in our daily lives. Just as natural textiles offer breathability, comfort, and reduced environmental impact, natural fibre insulation brings similar benefits to the way we build and live.

As the construction industry moves toward lower-carbon, healthier, and more resilient buildings, natural fibre insulation is playing a growing role as a high-performance, sustainable alternative to conventional insulation materials in both new-build and retrofit projects.

It offers strong thermal and acoustic performance, and supports healthy moisture movement in buildings, making it ideal for maintaining indoor air quality and preserving the building fabric.

Whether you're a designer, builder, homeowner, or policymaker, this guide explores the key benefits of natural fibre insulation to help you understand its value and potential.

COLD, DRAUGHTY AND EXPENSIVE

7.7 MILLION

UK homes have solid walls – and zero insulation

That's 90% of all solid wall properties, leaving millions of homes uninsulated, inefficient, and uncomfortable.

Data from House of Commons Research Briefing Paper, February 2025: Energy efficiency of UK homes

MORE THAN PREVENTING HEAT LOSS

Alongside the prevention of heat loss and saving energy, insulating materials can do much more than keeping a building warm.

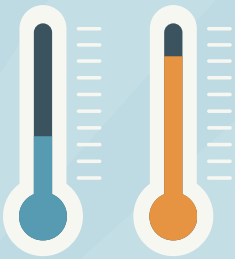
Considering that insulation can make up over half of a building's fabric, it's important to understand its wider impact.

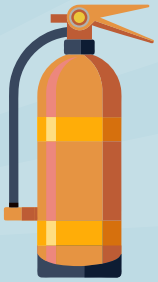
BEYOND THERMAL CONTROL: THE MANY ROLES OF INSULATION

Insulation can play a significant role in many aspects of a building's performance:

7: CONSTRUCTION
The type of insulation can impact site safety and installation complexity.

1: THERMAL
Thermal mass and thermal conductivity, which both influence heat flow through a building fabric, vary depending on the insulation material.





6: INTEGRITY
Well-insulated buildings are more durable, as appropriate insulation prevents decay and degradation.

2: FIRE SAFETY
The choice of insulation can affect the developmental stages of fire, and some insulation materials may release toxic gases when combusted.

5: SUSTAINABILITY
Insulation not only enhances a building's energy efficiency, but can also reduce its embodied carbon footprint, depending on the type of material and its manufacturing process.

4: ACOUSTIC
By helping to reduce the movement of sound and noise through a building, insulation contributes to a quieter and more comfortable environment for occupants.

3: OCCUPANT WELLBEING
Insulation can enhance occupant wellbeing by improving indoor air quality, regulating temperature and humidity, reducing draughts, and preventing mould growth.

CHOOSING INSULATION

CHOOSING INSULATION: A BALANCED VIEW

There are a variety of insulation materials available in the UK. As they all have varying properties, choosing the right insulation ensures a balance between performance, sustainability, the building's integrity and occupant wellbeing. Chasing the lowest U-value with the thinnest layer of insulation is tempting, but there's more to consider.

ENVIRONMENTAL IMPACT

The high insulative qualities of some man-made insulations may suggest that they are energy-efficient, but many options require significant energy to produce.

Natural fibre insulations tend to have lower environmental impact during manufacture and are inherently sustainable.

When it comes to thermal performance, there is a common misconception that natural fibre insulations underperform, but when we look at broader performance, they often match or exceed man-made alternatives.

As a result, natural fibre options are increasingly favoured for creating warm, healthy, and comfortable buildings.

BIOGENIC CARBON BENEFIT

It's important to consider the entire carbon footprint of a material, including biogenic carbon; the carbon absorbed and stored in the fibres during their growth.

This carbon is 'locked' in for the lifetime of the material, which means natural fibre insulation acts as a long-lasting carbon store. Delaying carbon emissions **today** is key to mitigating climate change.

USEFUL TERMS

U-VALUE

Definition: how much heat a building element loses.

Measured in (W/m²K) and a key metric in insulation performance. Lower U-values mean less heat loss and more effective insulation.

THERMAL CONDUCTIVITY

Definition: a material's ability to transfer heat, independent of thickness.

U-values, by contrast, account for heat loss through a specific thickness, so while related, they are not the same.

THERMAL MASS

Definition: a material's ability to absorb and release heat slowly.

This is different to thermal conductivity, which tracks how fast heat passes through.

MOISTURE MOVEMENT IN BUILDINGS

Using insulating materials that are both vapour-open and moisture buffering will ensure moisture moves safely through the building fabric. This reduces the risk of condensation and damp or mould issues. The result? Buildings can stay dry, warm and healthy for the people inside.

VAPOUR OPENNESS

Definition: a material's ability to let water vapour pass through it.

Since water vapour wants to move in and out of a building, vapour-open materials help ensure moisture doesn't get trapped in the building fabric.

Natural fibre insulations are highly vapour-open, reducing the risk of condensation and structural damage.

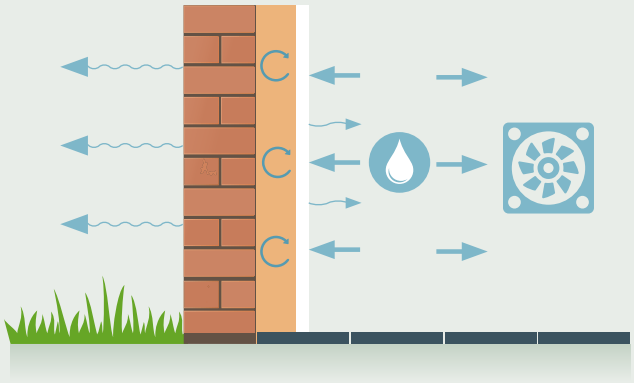
MOISTURE BUFFERING

Definition: a material's ability to capture, store, and release water vapour.

This helps to regulate indoor humidity, and supports healthy moisture movement in buildings.

Natural fibre insulations are particularly effective at moisture buffering, without compromising performance.

Ventilation + vapour openness + moisture buffering = healthy moisture movement



'Breathable' solid wall with natural fibre insulation

HISTORIC BUILDINGS

While moisture management is important in all buildings, it's particularly important in historic ones.

With solid, cavity-free walls, they require vapour-open, moisture-buffering, insulating materials to keep the building fabric dry and healthy.

WHAT ABOUT AIRTIGHTNESS?

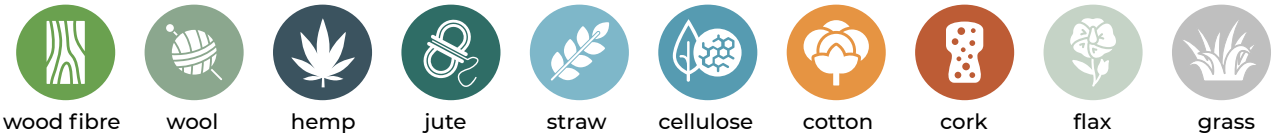
Airtightness is about reducing draughts and heat loss in a building by minimising or eliminating gaps and cracks. Airtight buildings offer several benefits including helping to reduce energy costs and improving occupant comfort.

We need to save energy without trapping moisture.
As we increase the airtightness of buildings, ventilation becomes more critical. The best balance is an effective ventilation strategy, combined with vapour-open and moisture buffering insulating materials that will help keep a wall dry, yet still reduce energy losses.

Head to page 10 for a comparison of different insulating materials, including how they perform when it comes to carbon footprint and moisture movement.

INSULATING WITH NATURAL FIBRES

WHAT IS NATURAL FIBRE INSULATION?



Natural fibre insulations are made from organic materials such as wood fibre, hemp and wool. The fibres are mechanically processed, not chemically altered, keeping them as natural as possible. The amount of processing varies between different types, as does the addition of other fibres and binders. Often sourced from by-products of other processes, natural fibre insulations typically have a low environmental impact. Most production takes place in the UK and Europe.

TYPES OF NATURAL FIBRE INSULATION

Use them in a similar way to other insulation types within floor, wall and roof build-ups.

Flexible: Batts or rolls, used in most areas where conventional mineral wool is used, such as between rafters, studs and joists.

Rigid: Boards, used under or over timber frames, for flooring, lining solid walls, and on warm pitched roofs.

Loose: Blown into cavities and voids to achieve a prescribed density. Useful for irregular cavities.

Other: Bales, for example, that are used as part of the wall structure in straw-bale construction.

Natural fibre insulations are not suitable in below ground applications, or where a non-combustible insulation is required.

NATURAL FIBRE INSULATION HAS KEPT BUILDING OCCUPANTS COMFORTABLE FOR DECADES

A NOTE ON FIRE

Fire resistance and reaction to fire classifications vary by material. Natural fibre insulations are proven to be fire-safe and regulation-compliant for their intended end uses.

When it comes to fire performance, natural fibre insulations generally char on the surface, limiting the spread of a flame, and increasing the fire resistance of a building element.

It's important to also consider what is released during combustion. Natural fibre insulations typically produce low amounts of smoke and rarely drip any hazardous material.

Refer to Part B of the UK Building Regulations for more details on fire requirements, and ask your supplier for more information on specific products.

6 REASONS TO CHOOSE NATURAL FIBRE INSULATIONS:

1: THERMAL PERFORMANCE

The initial cost of natural fibre insulation will be quickly repaid through reduced energy bills.

2: THERMAL MASS

Natural fibres have optimal thermal mass, meaning they can store and slowly release heat effectively. This helps to stabilise indoor temperatures, keeping them warmer in winter, and cooler in summer.

3: CARBON

Natural fibres typically require less energy to produce (embodied carbon). They also capture and store carbon (biogenic), reducing their environmental impact.

4: MOISTURE REGULATION

Natural fibres are vapour-open and moisture buffering, helping to regulate humidity and prevent condensation.

5: HEALTHIER INDOOR AIR QUALITY

Natural fibres do not contain any Volatile Organic Compounds (VOCs), which are harmful to health and can exacerbate conditions such as asthma. The moisture control benefits of natural fibres also help prevent mould, further promoting a healthier indoor environment.

6: ACOUSTIC PERFORMANCE

Natural fibre insulations can provide better soundproofing performance, due to their structure and density.

BUILDING WITH NATURAL FIBRE INSULATION

THE CHOICE FOR NEW CONSTRUCTION

Natural fibre insulations can be used in a wide range of applications and they are equally suited to both new build construction and retrofit projects.

In new build, natural fibres such as cellulose, woodfibre and hemp are often utilised in modern methods of construction, for example alongside a timber frame. There are also load bearing options, such as compressed straw panels.

Natural insulations have been used in a wide range of award-winning new build projects including major residential, commercial and education buildings, often built to Passivhaus standards.

An example is the Welsh language school shown below. Turn to page 11 for more examples of natural fibre insulation in action.

RETROFIT: LOOKING PAST U-VALUES

The vapour openness and moisture buffering qualities of natural fibre insulations make them particularly well-suited for retrofitting older buildings, which were originally constructed to let moisture move through the building fabric.

The natural fibres help maintain moisture balance by allowing walls to dry out from both sides, which is key for the long-term health of the building and its occupants.

Building Regulations set strict U-value targets but there's some flexibility when retrofitting existing homes. This allows a 'sweet spot' to be found, which returns excellent energy savings whilst minimising condensation risk.

This 'allowable zone' for retrofit U-values shown in the graph to the right shifts the focus away from just heat loss, and considers added benefits like moisture control, and lower embodied carbon. U-values matter, but they're not the whole story. Retrofitting insulation should work with the building and not against it.

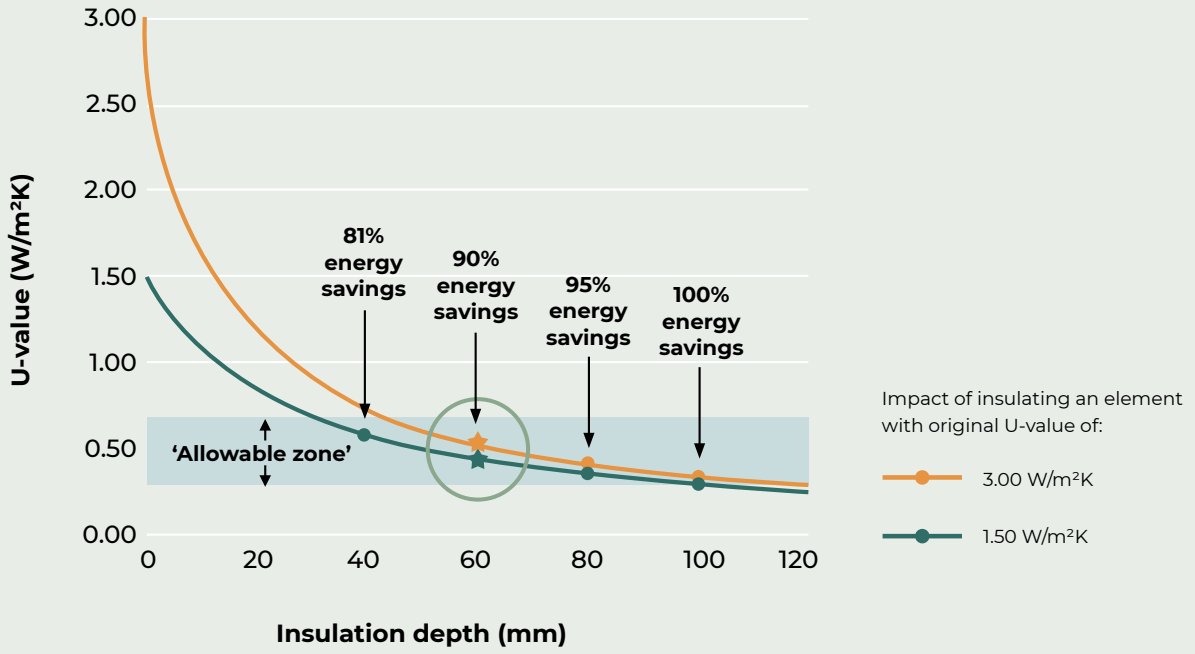
"We regularly specify and rely on the combined performance benefits of natural fibre insulation. Combined with a furnace-tested timber structural system and optimised building physics, natural fibre insulation has reliably and consistently supported our Passivhaus schools, saving clients tens of thousands of pounds a year, whilst delivering very healthy environments."

Architype | Ysgol Gymraeg y Trallwng, Powys

ENERGY SAVINGS VS INSULATION THICKNESS: FINDING THE SWEET SPOT

For internal wall insulation on a solid wall, the majority of energy savings (against the target improved value) in a retrofit project can be made in the first 60mm of insulation depth. The energy saving benefits of adding more insulation diminish as the thickness increases.

For other applications, greater thicknesses of insulation may be more appropriate, but it is important to balance the condensation risk.



★ **The sweet spot:** An uninsulated solid wall with a U-value of 1.5–3.0 W/m²K can be retrofitted with just 60mm of natural fibre insulation to meet the 'allowable zone' for U-values, cut heat loss by up to 90%, and still support healthy moisture movement.

READ MORE ABOUT THE SWEET SPOT

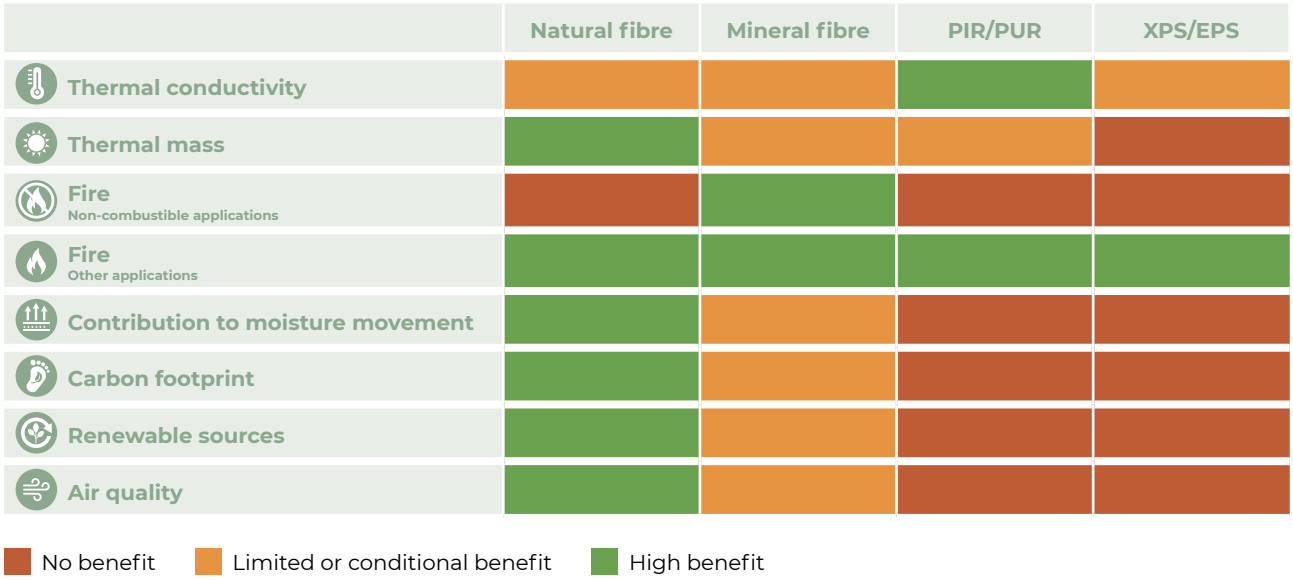
U-VALUES NEED TO BE CONSIDERED ALONGSIDE MOISTURE CONTROL, ENVIRONMENTAL IMPACT, AND OCCUPANT WELLBEING.

THE ALLOWABLE ZONE

For retrofit of walls, Building Regulations set a target U-value of 0.30 W/m²K with a threshold of up to 0.70 W/m²K, as long as a simple payback is achieved that is 'technically and functionally feasible' within 15 years.

Allowable zone =
0.30 W/m²K – 0.70 W/m²K

INSULATING MATERIALS COMPARISON



FREQUENTLY ASKED QUESTIONS

Q. I've not heard of natural fibre insulations before, are they new?

A. Natural fibres have been used for insulation for many decades, with several European countries leading the way thanks to policies that encourage their use. There is great potential for wider uptake here in the UK.

Q. Are natural fibre insulations more expensive than man-made options?

A. Some natural fibre insulations may have a higher upfront cost, but they offer many technical and environmental benefits such as operational energy savings, making positive contributions to the health of the building and its occupants, and having lower whole life carbon than alternatives. All of these deliver long-term value.

READ MORE FAQS

Q. Won't natural fibres burn?

A. It's easy to think that, because natural fibres are made from materials such as wood, they will burn quickly. This isn't the case. Most natural fibre insulations smoulder in a very slow and predictable way ensuring a robust fire solution. The fibres in natural fibre insulation are generally treated with mineral fire retardants to enhance their natural charring properties and improve fire performance.

Q. Do I need to understand terms like 'diffusion resistance', 'hygroscopic', and 'capillary action' to grasp moisture movement in buildings?

A. These terms all relate to how materials handle moisture, but for most purposes, it's enough to understand *vapour openness* and *moisture buffering*.

Diffusion resistance: how easily water vapour moves through a material.

Hygroscopic: a material that absorbs and releases moisture from the air.

Capillary action: how tiny pores move liquid water through a material.

Natural fibre insulations are vapour open and buffer moisture well, helping manage everyday humidity safely.

NATURAL FIBRE INSULATION IN ACTION

READ MORE CASE STUDIES

"It's 10 years since the Enterprise Centre opened. It's still a wonderful place to work, largely because of the amount of light in the building and the abundance of natural materials."

Angela Macdonald | University of East Anglia

"We have specified natural building products where possible at Niddrie Road. This is because such materials do not contribute to the poor indoor air quality which is found in most modern homes, but also because they have lower embodied energy and carbon than most conventional building materials.

They also tend to be vapour permeable... thereby helping to reduce the wider moisture risks associated with very airtight buildings."

John Gilbert Architects | Niddrie Road, Glasgow

"The team found using natural fibre insulation a pleasure – previous projects with insulated panels have been itchy and unpleasant, whereas this time it was down with ease. We were able to tear the insulation easily and accurately to get a nice snug fit.

Using mineral wool or fibreglass we would have had to use a knife and straight edge to prevent hazardous fibres filling the air in the workshop. This also allowed us to insulate the panels whilst other members of the team worked in the same space."

Westwind Oak Buildings | Jamie's Farm, Monmouth

To find out more about using natural fibre insulation, please contact the Natural Fibre Insulation Group (NFIG), a collective of ASBP members who are the leading manufacturers and suppliers of natural fibre insulation in the UK.

www.asbp.org.uk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