

Natural Fibre Insulation: What, why, where and how

The Riverside Sunderland online University Design Challenge 2021

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NATURAL FIBRE INSULATION GROUP

*An industry collaboration to better communicate the
benefits of natural fibre insulation products and systems*

backtoearth



ecomerchant
ETHICAL · HEALTHY · SUSTAINABLE



MIKE WYE
— & ASSOCIATES —



STEICO
engineered by nature

therma
fleece®
Nature's finest insulation

Group activities

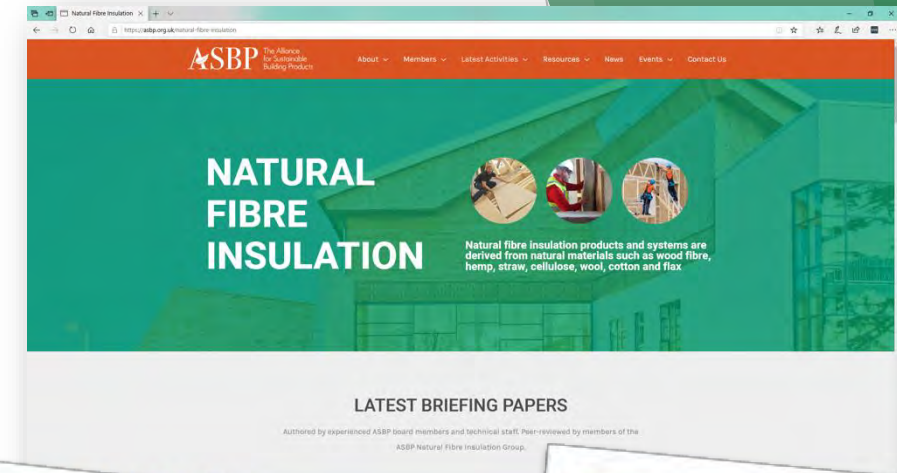
Education, training and events

CPDs/events/trade shows

- Developed a CPD - 'An introduction to natural fibre insulation'.
- Regular appearances at trade shows such as Futurebuild, Timber Expo/UK Construction Week.

Briefing papers

- 3-part series on Environmental Product Declarations (EPDs)
- The multiple roles of insulation
- An introduction to breathability
- Health and wellbeing benefits of natural fibre insulation products and systems



WHY

- ▶ Natural materials are widely accepted and used in UK construction in the form of structural and non-structural timber.
- ▶ NFI's are widely accepted by our largest neighbours - 10% of market share.
- ▶ Yet NFI in the UK <0.1% of the market.

WHY NOT NFI?

WHERE

- ▶ Natural fibre insulation can be used where ever timber is used in a building.

WHAT

- ▶ Insulation composed mostly of natural fibres.
- ▶ Rigid, flexible, loose-fill.



**Cellulose
Paper**



Coir



Straw



Cotton



Flax



Jute



**Wood
Fibre**



Hemp

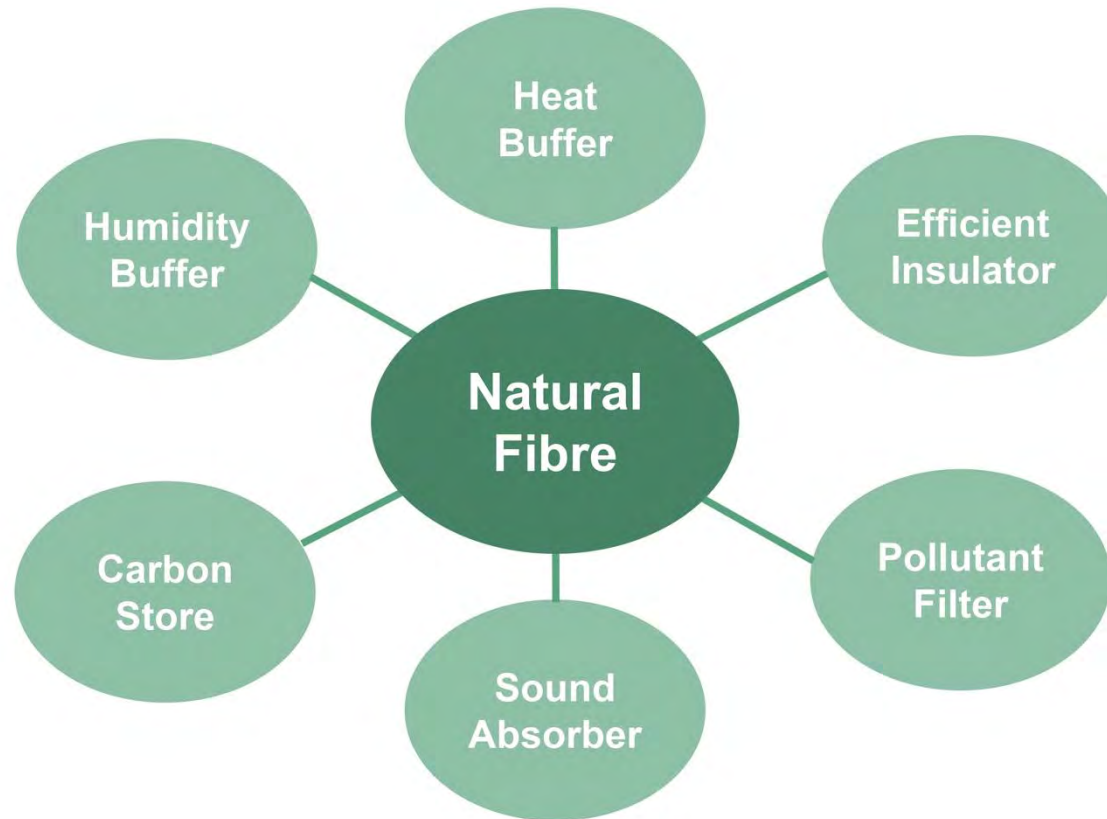


Wool



Sisal

Natural fibre...



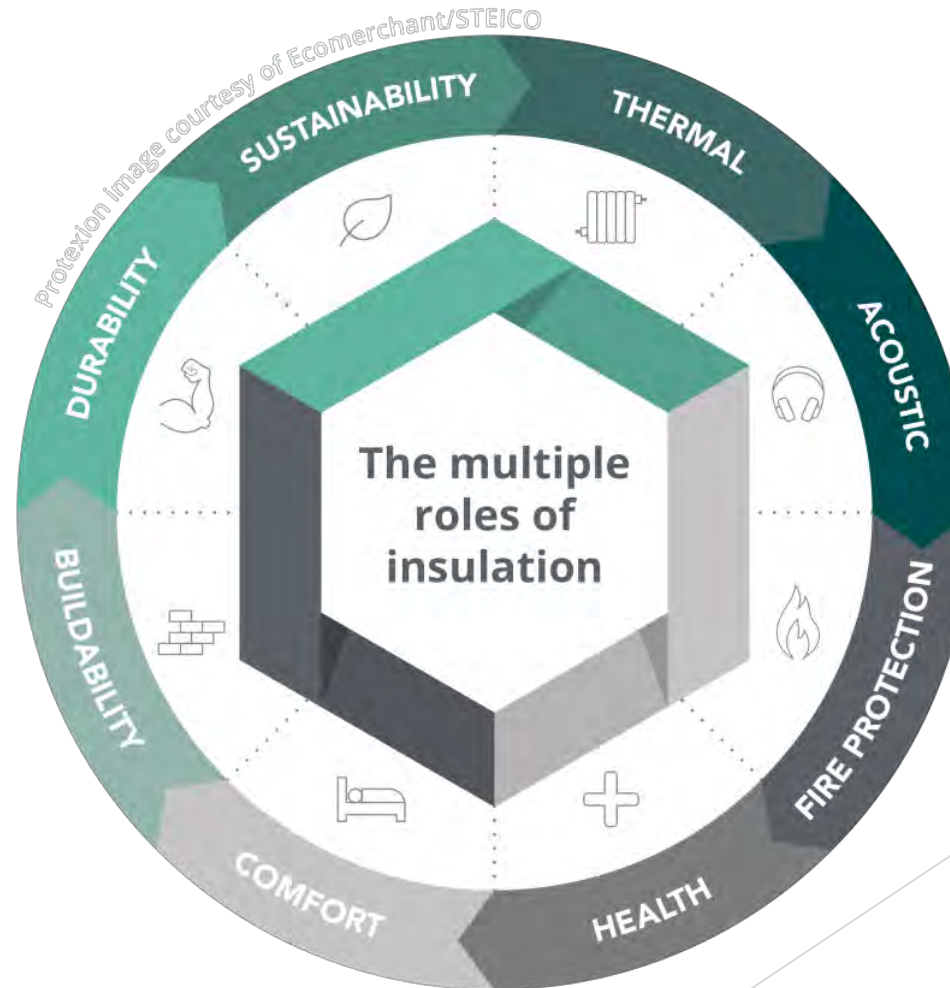
...makes ideal insulation

The Multiple Roles of Insulation

Insulation is approx. 50% of the volume of a building's fabric and profoundly influences many aspects of building performance

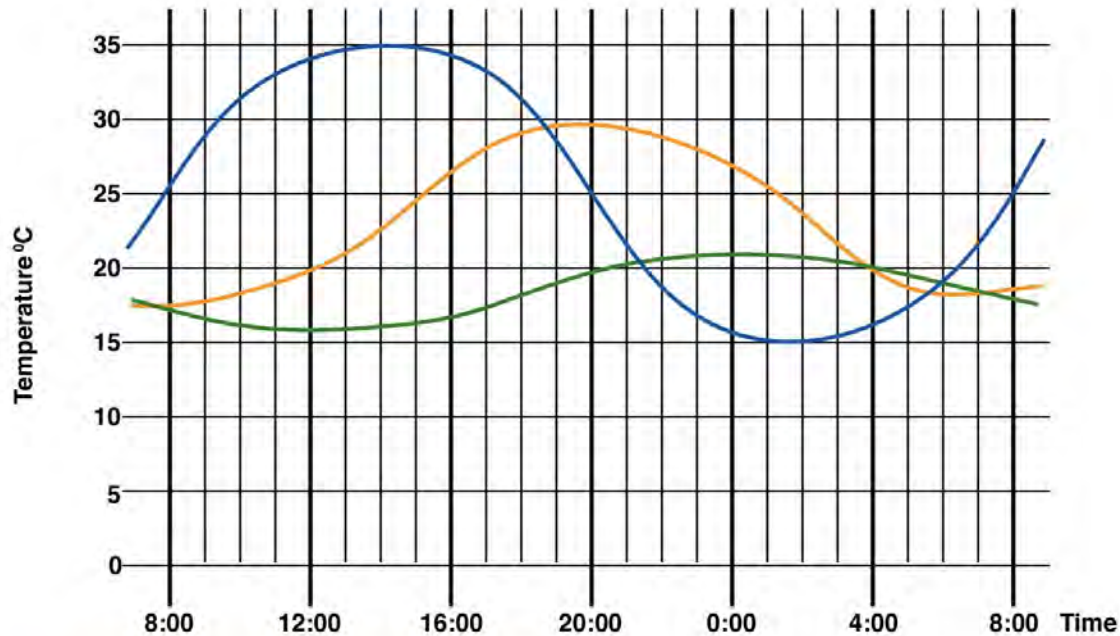
Balanced consideration of this multi-functionality often makes natural fibre insulation the superior choice

Need to put a value on all aspects of performance



Heat Buffer

Daily Temperature Profile with various insulations



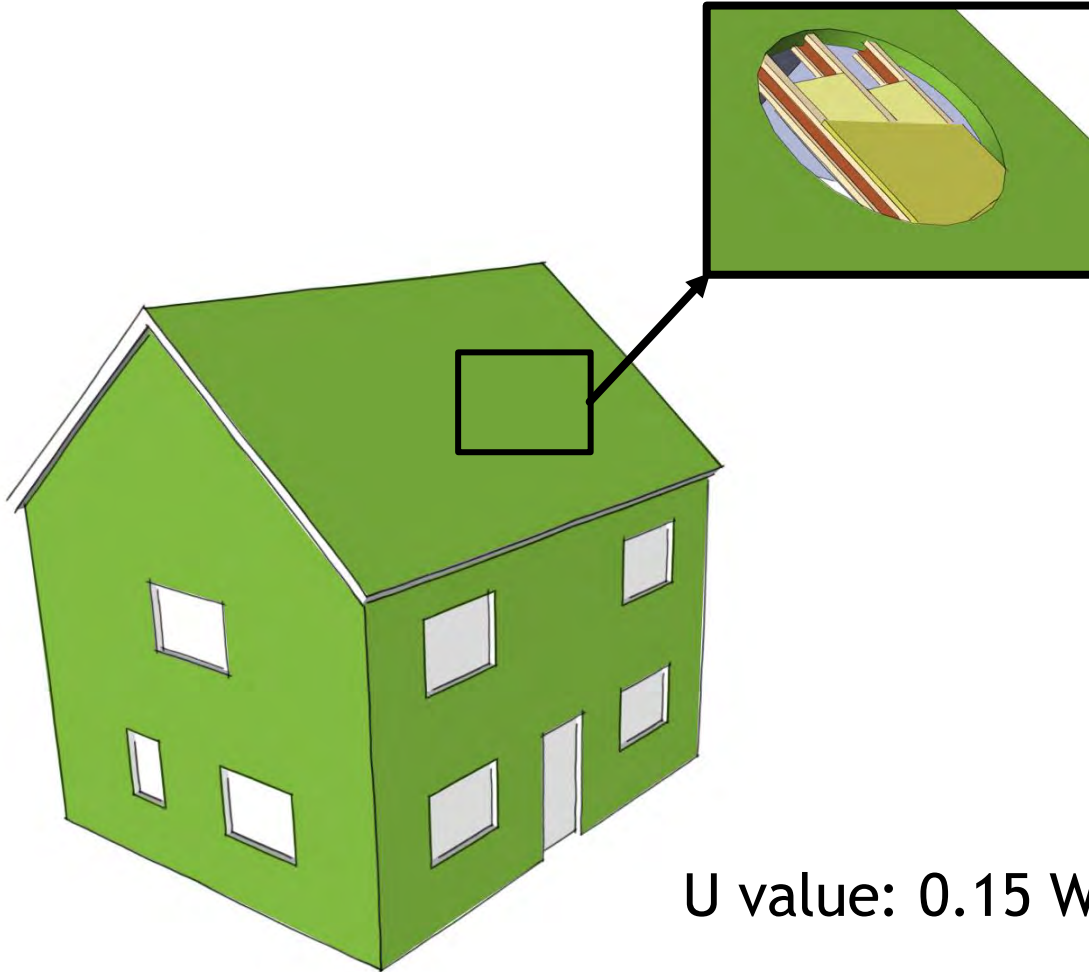
Temperature under the roof covering

Internal room temperature with mineral wool

Internal room temperature with wood fibre insulation

- ▶ Heat buffering shifts frequency of heat cycles out of phase.
- ▶ Wood fibre - heat maximums out of phase by 12hrs = **12hr phase shift**.
- ▶ Mineral wool - heat maximums out of phase by 6 hrs = **6 hr phase shift**
- ▶ Achieved by:
 - ▶ Higher density
 - ▶ Higher specific heat capacity
 - ▶ Low thermal conductivity

Comparative Performance

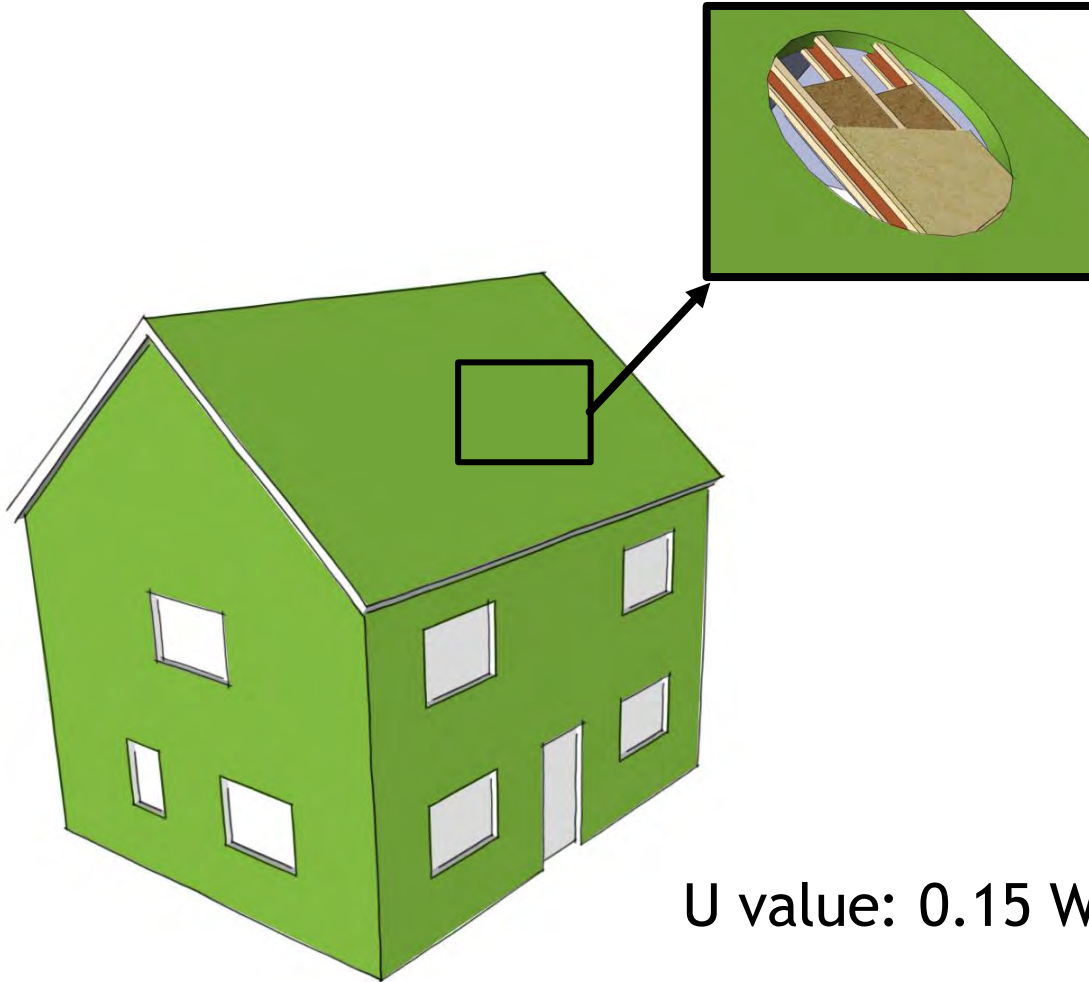


Roof build up:

- ▶ 12.5mm Plasterboard
- ▶ Vapour control layer
- ▶ 240mm I-joist with Glass wool insulation
- ▶ 40mm Mineral wool
- ▶ External roof finish

U value: 0.15 W/m²K. Phase Shift: 7.1 hours

Comparative Performance

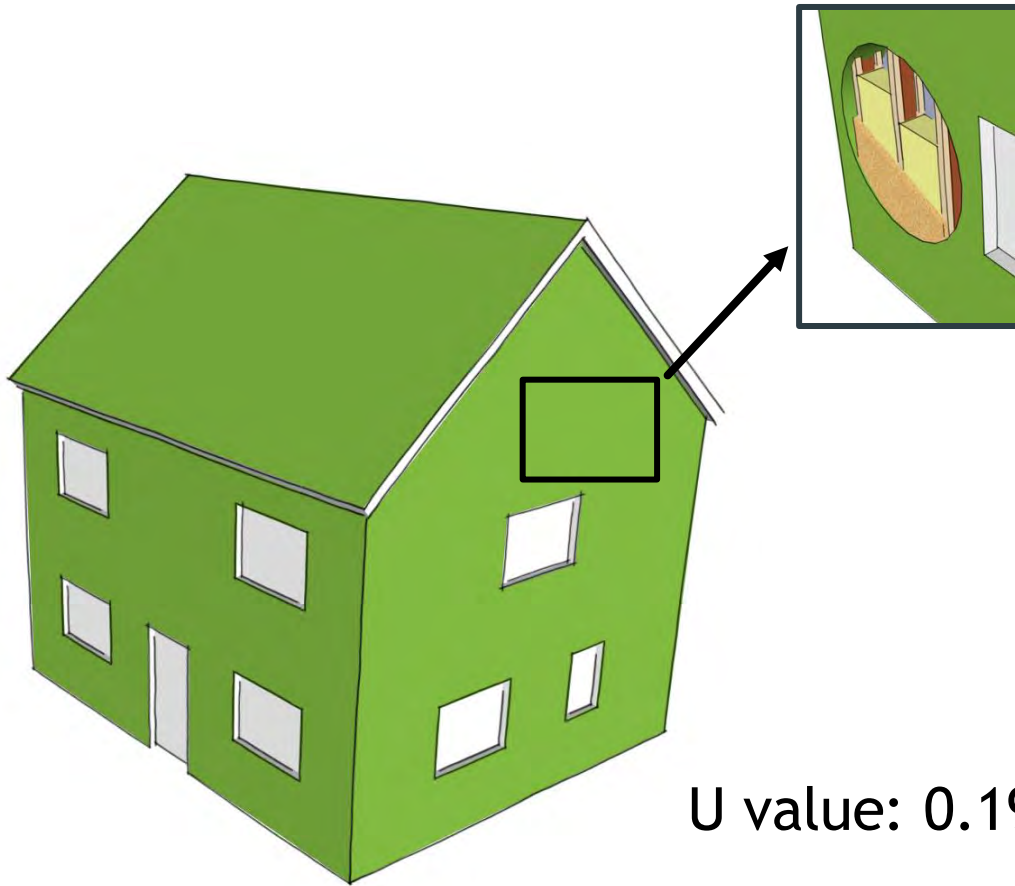


Roof build up:

- ▶ 12.5mm Plasterboard
- ▶ Vapour control layer
- ▶ 240mm I joist with flexible wood fibre insulation
- ▶ 40mm wood fibreboard
- ▶ External roof finish

U value: 0.15 W/m²K. Phase Shift: 13 hours

Comparative Performance

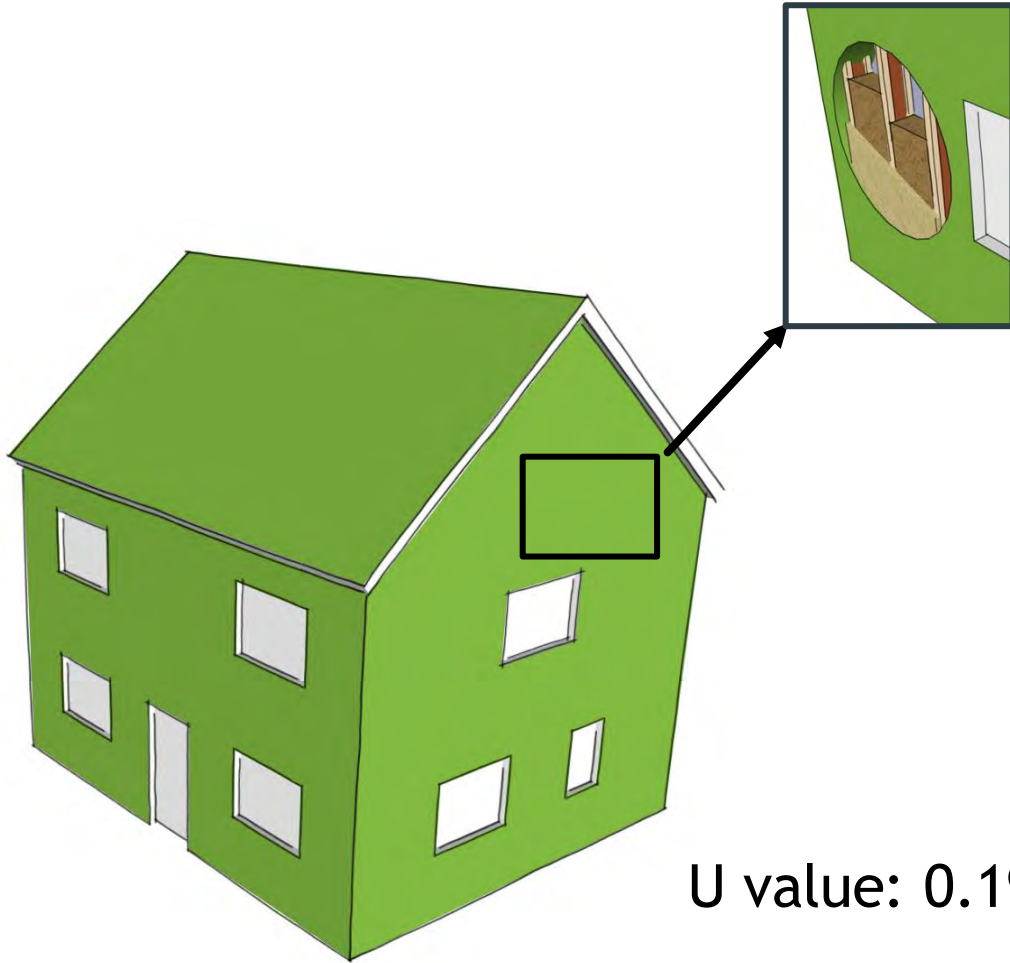


Conventional Wall build up:

- ▶ 12.5mm Plasterboard
- ▶ Vapour control layer
- ▶ 140mm PIR
- ▶ 11mm OSB
- ▶ Breather membrane
- ▶ Cavity / Brickwork

U value: 0.19 W/m²K. Phase Shift: 6.8 hours

Comparative Performance



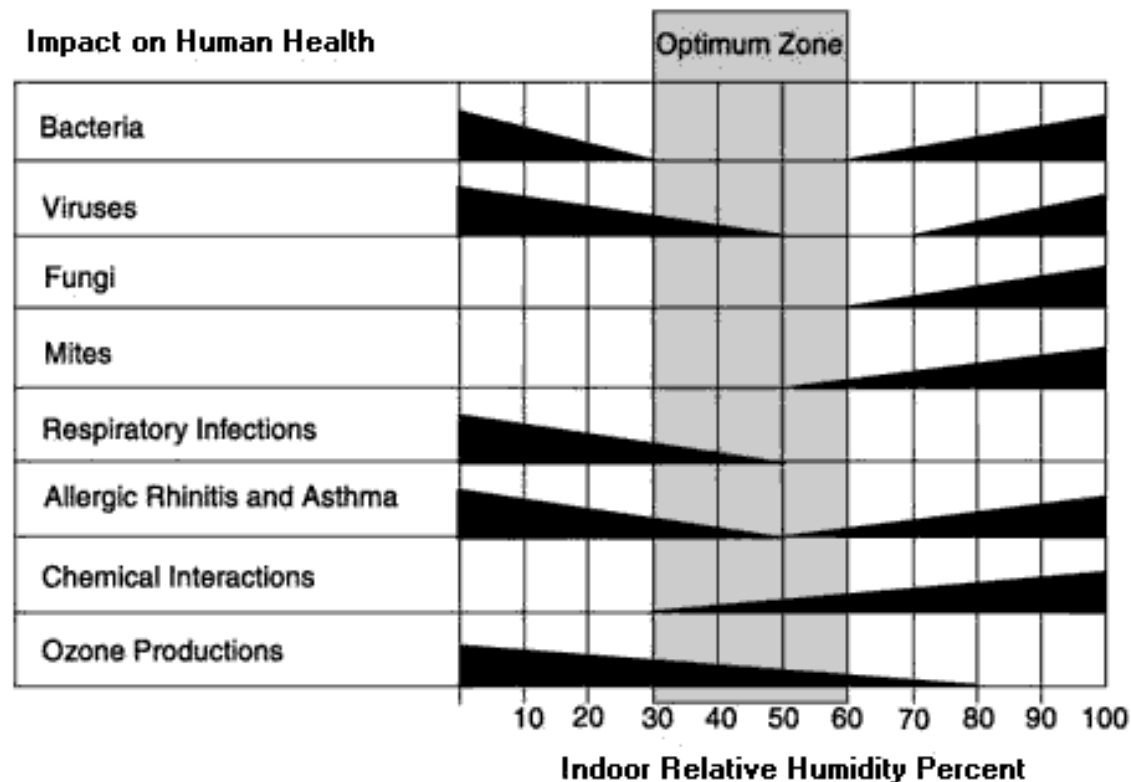
Reverse Wall build up:

- ▶ 12.5mm Plasterboard
- ▶ 15mm OSB
- ▶ 140mm flexible wood fibre
- ▶ 60mm wood fibreboard
- ▶ Cavity / Brickwork

U value: 0.19 W/m²K. Phase Shift: 12 hours

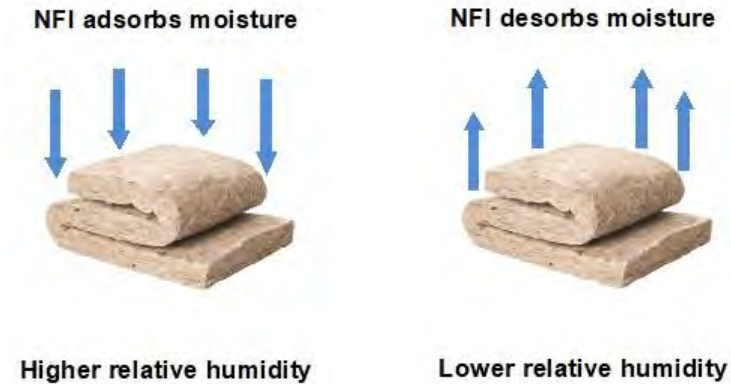
Humidity & Water Activity Regulation

- ▶ Moisture can cause health problems and damage the building fabric
- ▶ Breathable materials help keep humidity within the optimum zone for human health.
- ▶ Breathable materials bind moisture in a harmless way.

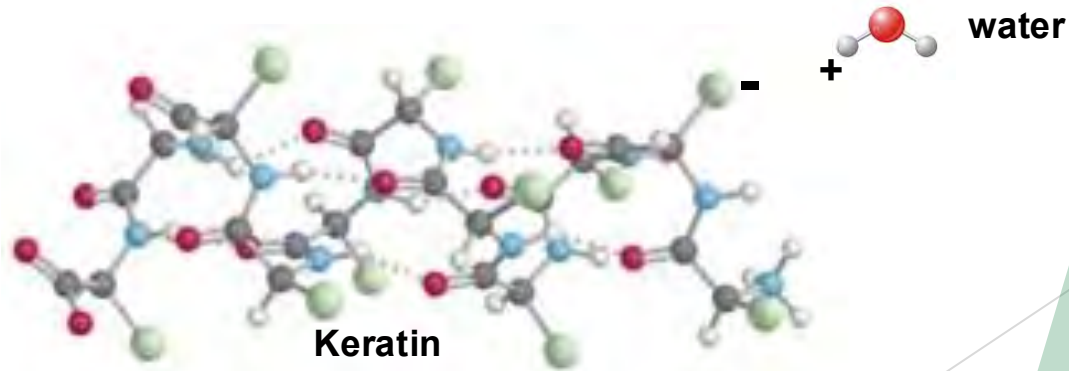


Breathable Natural Fibre Insulation

- Adjusts its moisture content to be in balance with surrounding humidity. Adjusts surrounding humidity to be in balance with its moisture content.

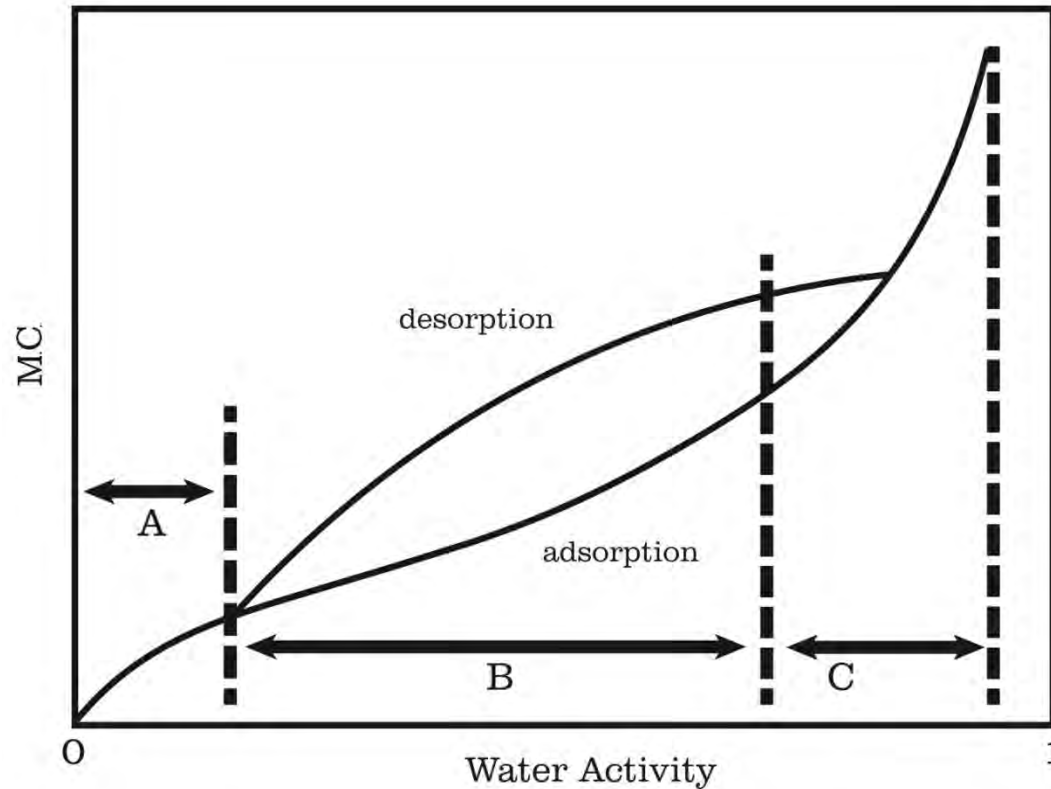


- Is able to bind water molecules in a harmless way.



- Is vapour open

Humidity Buffering



A – strongly bound

B – less strongly bound

C – free water

Zone B is the humidity buffering zone

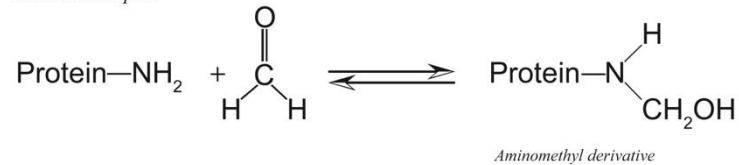
Low VOC's

Parameter	3 Day			28 Day		
	Thermally Bonded Sheep's Wool	Thermally Bonded Flexi Wood Fibre	AgBB Requirement	Thermally Bonded Sheep's Wool	Thermally Bonded Flexi Wood Fibre	AgBB Requirement
TVOC	< 0.01 mg/m ³	2.0 mg/m ³	≤ 10 mg/m ³	< 0.01 mg/m ³	2.0 mg/m ³	≤ 1 mg/m ³
CMR Substances	< 1 µg/m ³	<1 µg/m ³	≤ 10 µg/m ³	< 1 µg/m ³	<1 µg/m ³	≤ 10 µg/m ³
Formaldehyde	< 0.01 mg/m ³	< 0.01 mg/m ³	-	< 0.01 mg/m ³	0.019 mg/m ³	≤ 0.12 mg/m ³

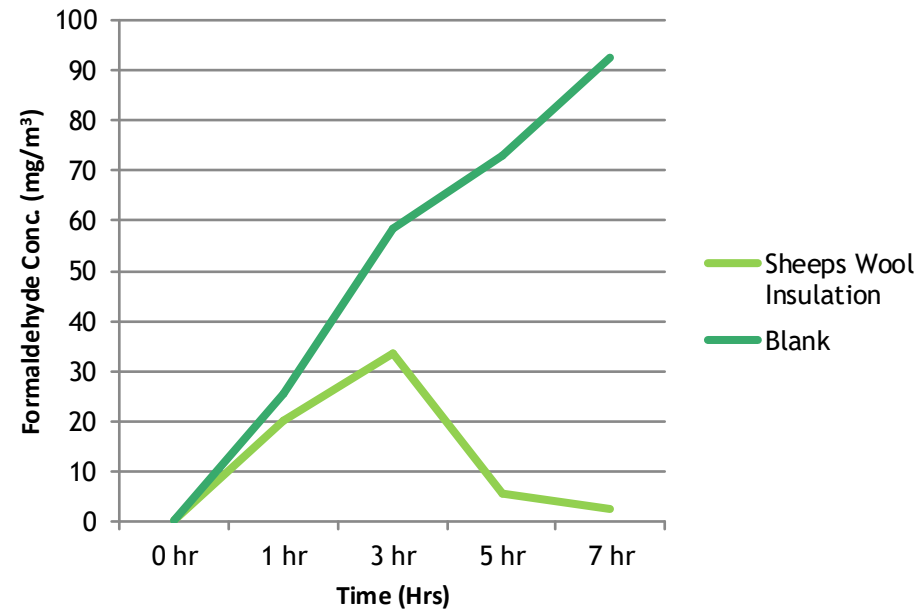
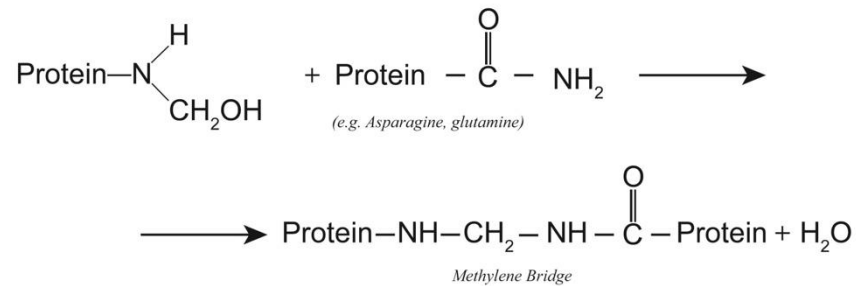
Parameter	Wood Fibreboard (under floor)			
	3Day	AgBB Requirement	28 Day	AgBB Requirement
TVOC	0.52 mg/m ³	≤ 10 mg/m ³	0.02 mg/m ³	≤ 1 mg/m ³
CMR Substances	< 1 µg/m ³	≤ 10 µg/m ³	<1 µg/m ³	≤ 10 µg/m ³
Formaldehyde	< 0.01 mg/m ³	-	0.003 mg/m ³	≤ 0.12 mg/m ³

Formaldehyde Reduction - Sheep's Wool Insulation

Reaction Step 1:



Reaction Step 2 (condensation):



- ▶ Sheep's wool achieved a reduction from 90 mg/m³ to <3 mg/m³ Formaldehyde in 7 hrs with 10-15% desorption.
- ▶ Similar tests by WRONZ achieved reduction from 7mg/m³ to <0.1mg/m³ in 45 mins with no recorded desorption.

Acoustic Absorption

Product	Thickness	Practical Absorption Coefficients (BS EN ISO 354:2003)						
		125 Hz	250 Hz	500 Hz	1kHz	2kHz	4KHz	α_w
Rockwool RWA45	50 mm	0.1	0.54	1	1.05	1.04	1.02	0.85
Thermally Bonded Sheep's Wool 31kg/m ³	50 mm	0.2	0.55	0.85	0.9	1	1	0.85

- Sheep's wool has similar performance to Rock at 70% of the density.

Fire

- ▶ NFI's treated with inorganic mineral based fire retardants - free from halogens & organo-phosphorus.
- ▶ NFI's are appropriate to use in accordance with relevant sections of Part B of UK Building Regulations.
- ▶ NFI's don't play a role in the developmental stages of a fire.
- ▶ NFI's have natural charring behaviour limits flame spread.

Bio and Circular Insulation for Resourceful Construction (BIO-CIRC)

We are a partner in a 2 year EU-funded Interreg research project called BIO-CIRC.

- Investigate the waste bedding sector and the reuse of a problematic waste source - polyester duvets, resulting in the development of 3 novel insulation prototypes.
- Conduct market intelligence of the insulation market to identify growth opportunities for natural and recycled fibre insulation (NRFI) materials.
- Review air quality and health & well-being characteristics, and raise awareness of the benefits of NRFI amongst our diverse networks of construction professionals.



The project has been awarded by Interreg France (Channel) England, which is co-financed by the European Regional Development Fund (ERDF), who will fund 80% of the project budget (€399,600).

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