Insulation – more than just U-values

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NATURAL FIBRE INSULATION GROUP

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

backtoearth

ecological BUILDING SYSTEMS

ecomerchant ETHICAL · HEALTHY · SUSTAINABLE

lime|green®

MIKE WYE & ASSOCIATES

NBT Natural Building Technologies SOPREMA

pavatex SOPREMA

SCHOOL OF NATURAL BUILDING

STEICO engineered by nature

therma fleece® Nature's finest insulation

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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

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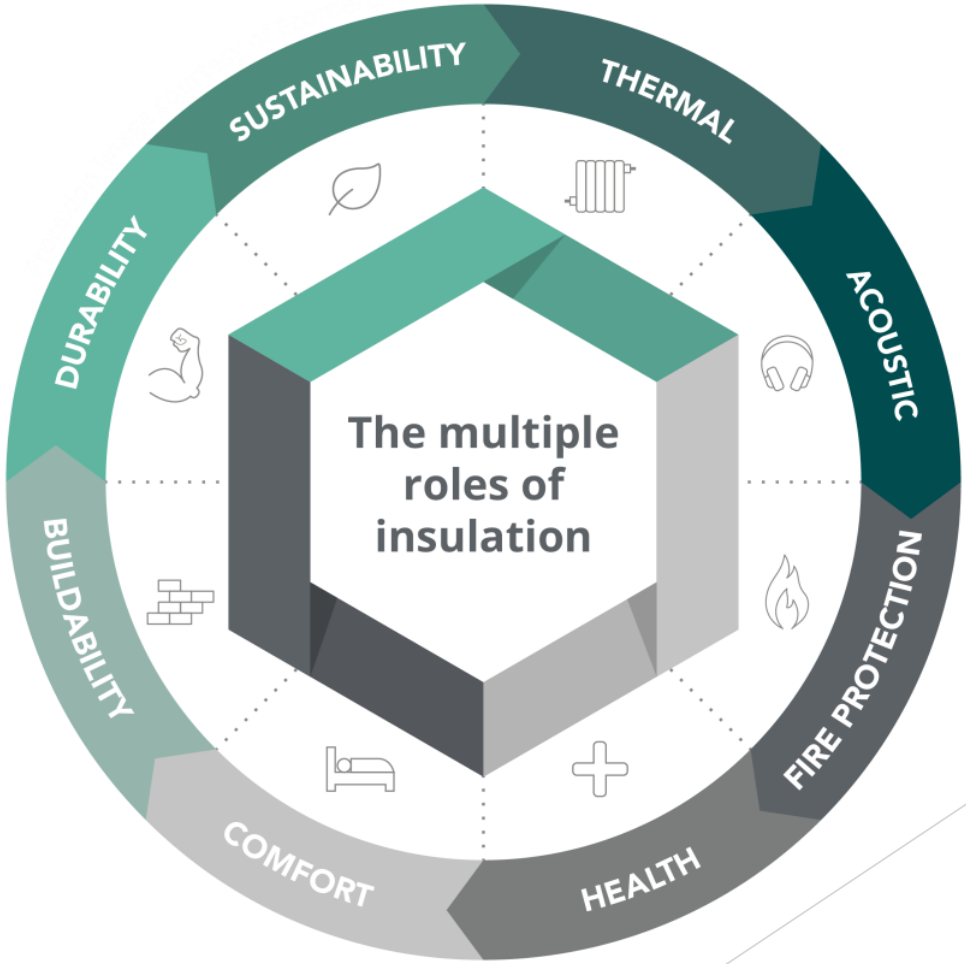
The Multiple Roles of Insulation

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



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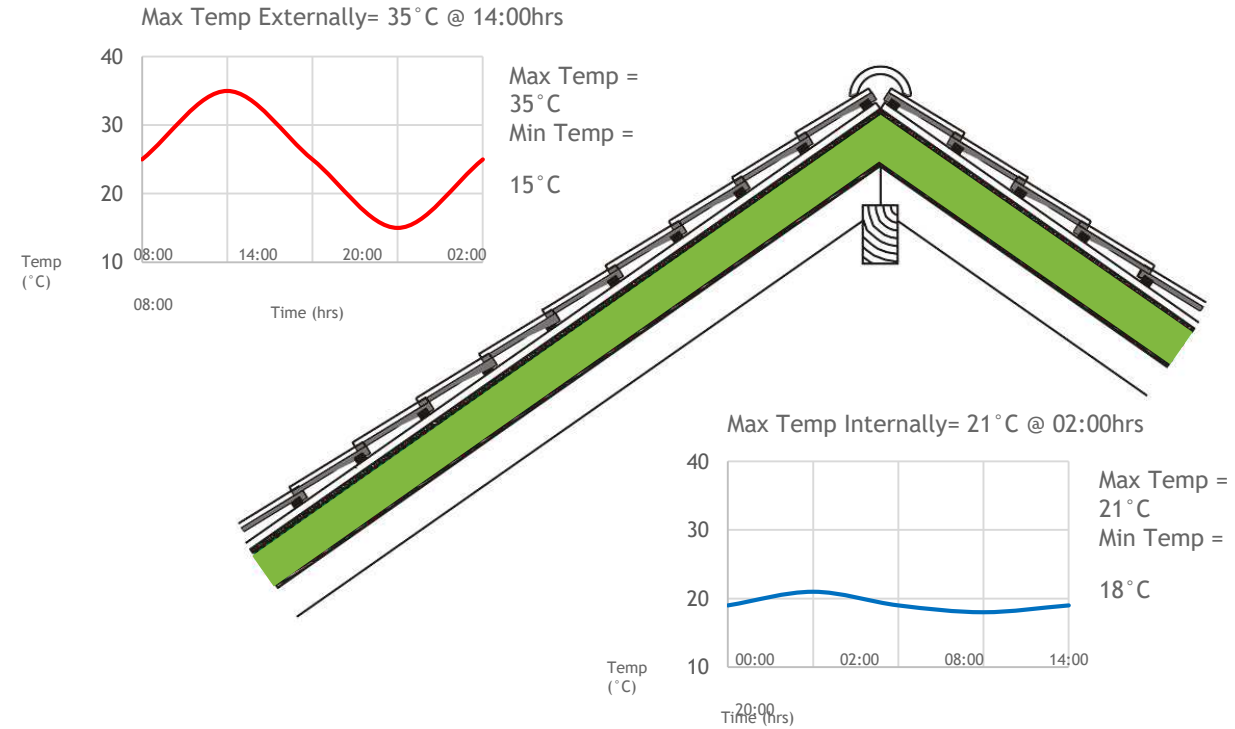
Thermal Performance

- U-value uses steady state thermal conductivity measurements.
- Ignores ability of materials to absorb, diffuse and release heat.
- Doesn’t consider how building fabric modulates heat cycles.
- We should consider how Internal and external heat cycles are phased in relation to each other.
- We should consider how peaks and troughs in internal temperature are moderated.
- Means **Phase Shift** should be a design consideration.

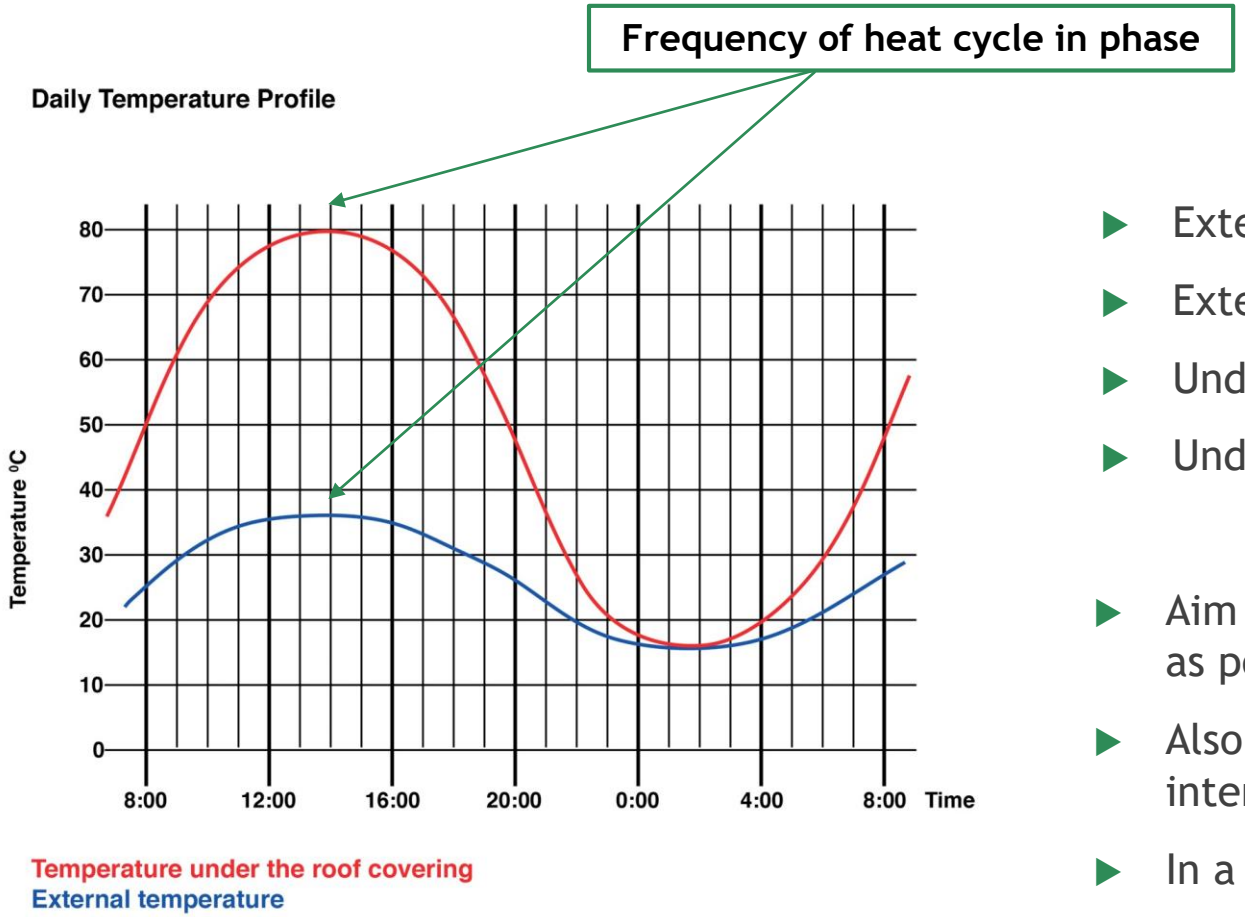
Phase Shift Explained

- Internal and external temperature goes in cycles.
- When the peaks of each are in line, the temperature cycles are in phase.
- When they don't the cycles are out of phase.



- Phase shifting takes the peaks of heat cycles out of phase as far as possible.
- **NOT to be confused with phase change.**

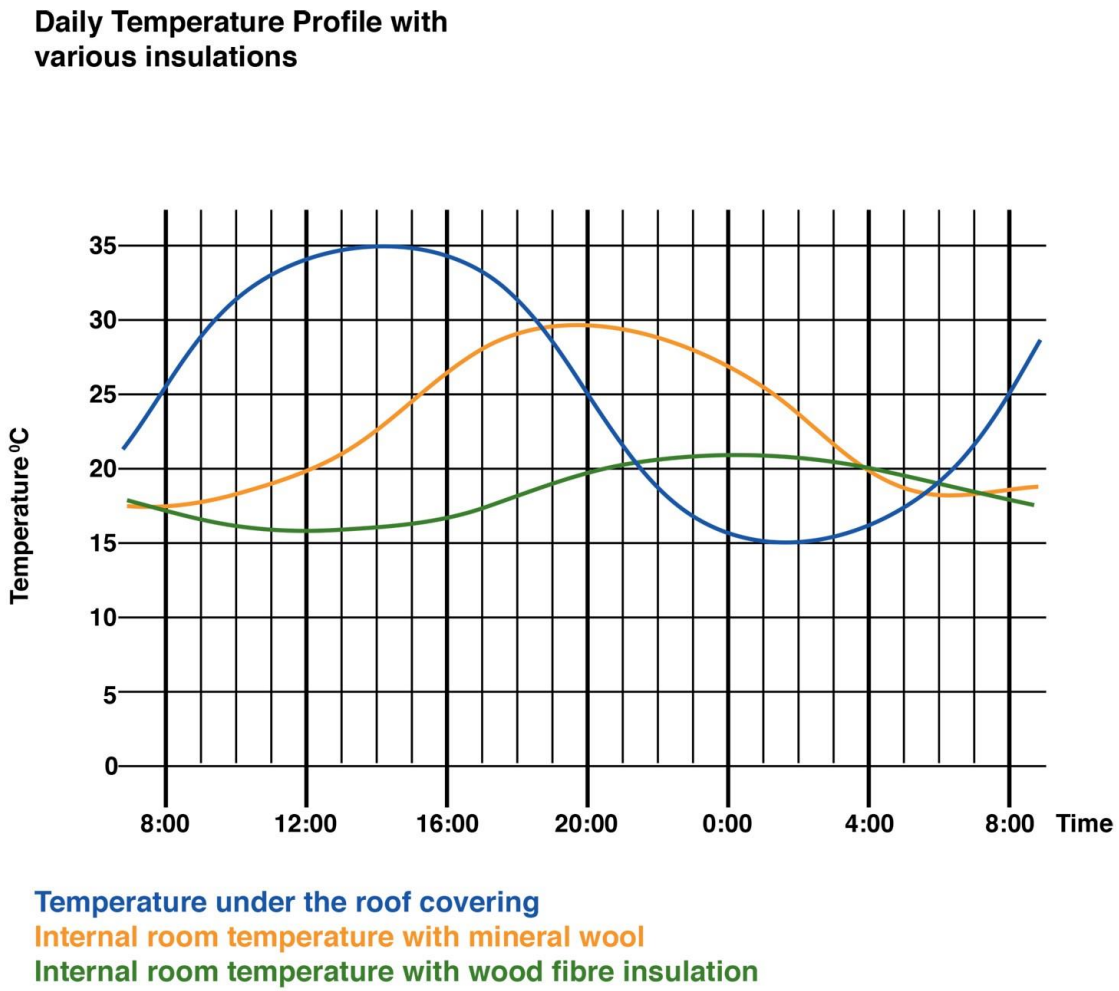
Phase Shift Explained



- External Tº max – 35 °C @ 14:00 hrs
- External Tº min – 15 °C @ 02:00 hrs
- Under Roof Tº max – 80 °C @ 14:00 hrs
- Under Roof Tº min – 15 °C @ 14:00 hrs

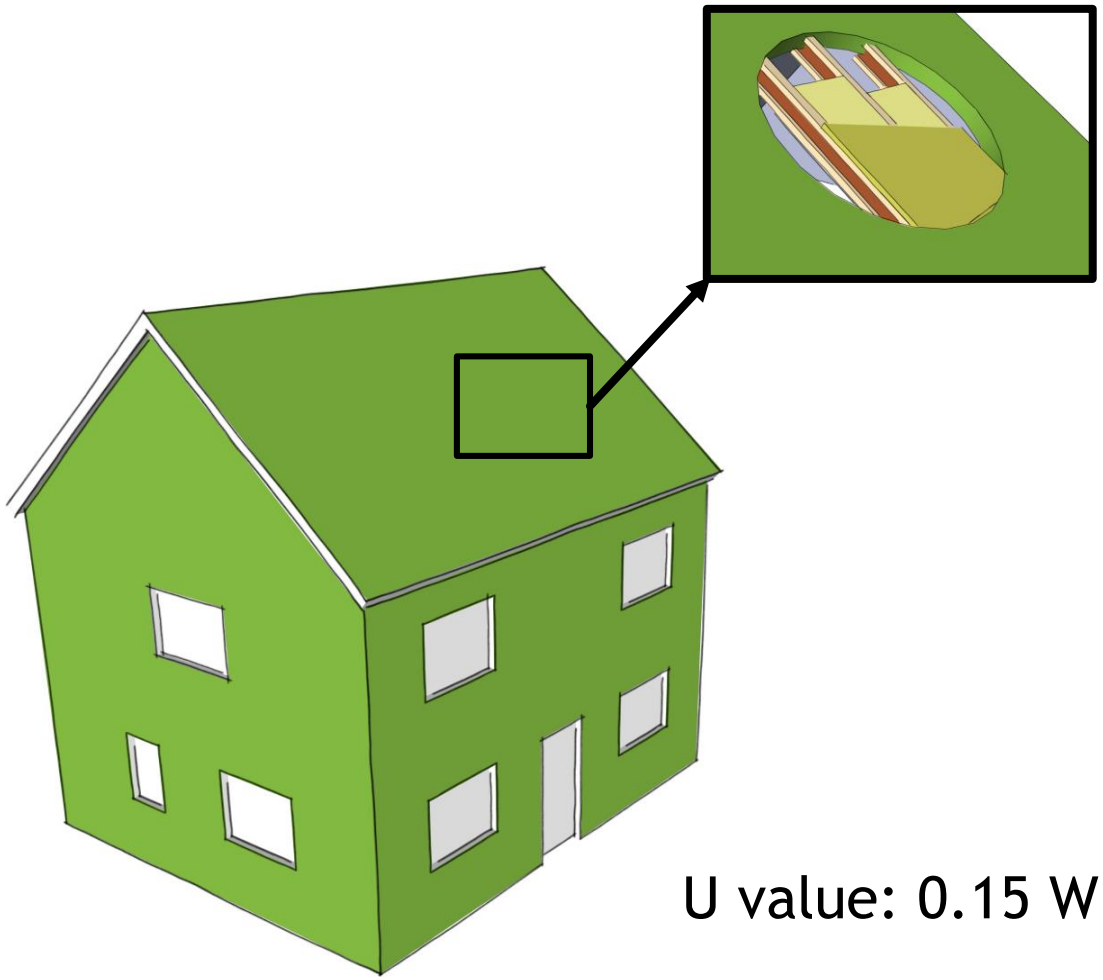
- Aim is to shift maximums as far apart as possible.
- Also need to lower amplitude or intensity of heat inside.
- In a 24hr cycle optimum shift is 12hr.

Phase Shift Explained



- Frequency of heat cycles out of phase.
- Wood fibre – heat maximums out of phase by 12hrs = **12hr phase shift.**
- Mineral wood – 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

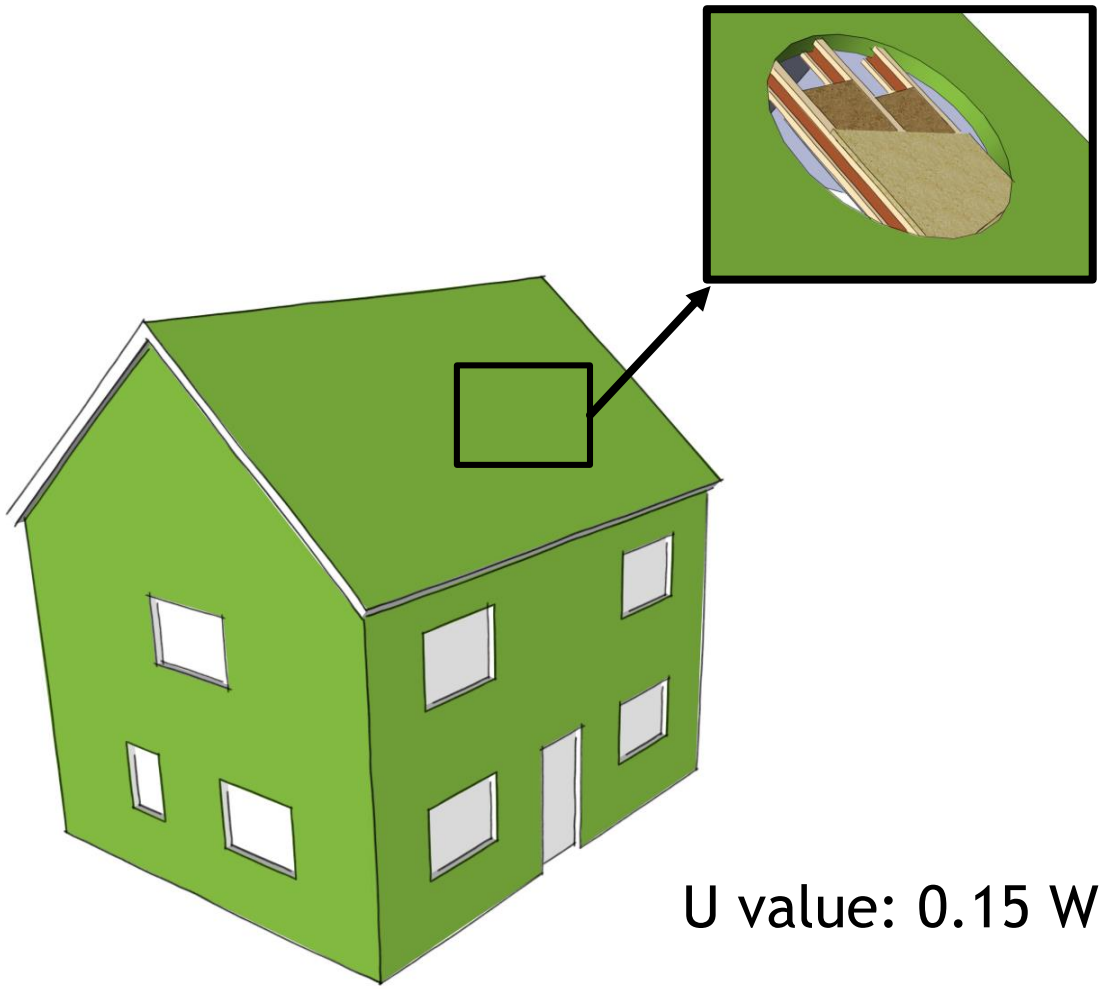


Roof build up:

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

U value: 0.15 W/m^{2}K. Phase Shift: 7.1 hours

Comparative Performance

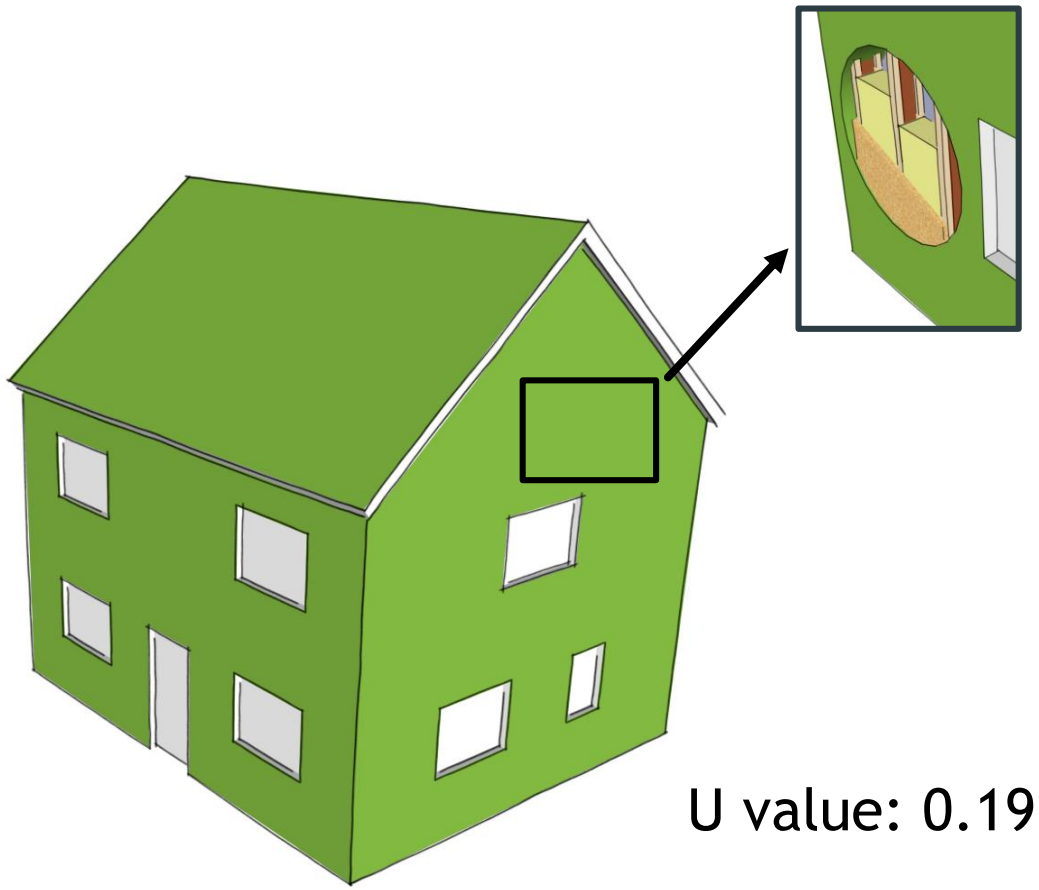


Roof build up:

- 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/m^{2}K. Phase Shift: 13 hours

Comparative Performance

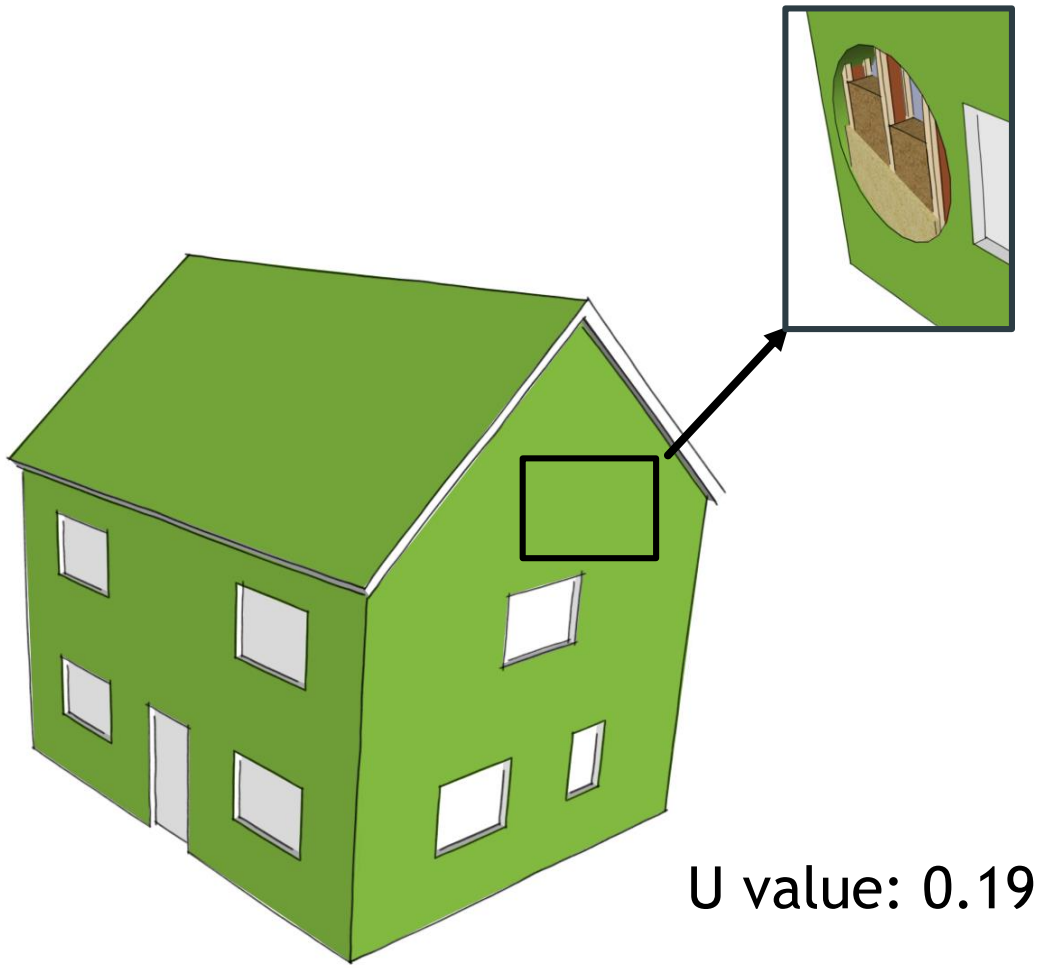


Conventional Wall build up:

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

U value: 0.19 W/m^{2}K. Phase Shift: 6.8 hours

Comparative Performance



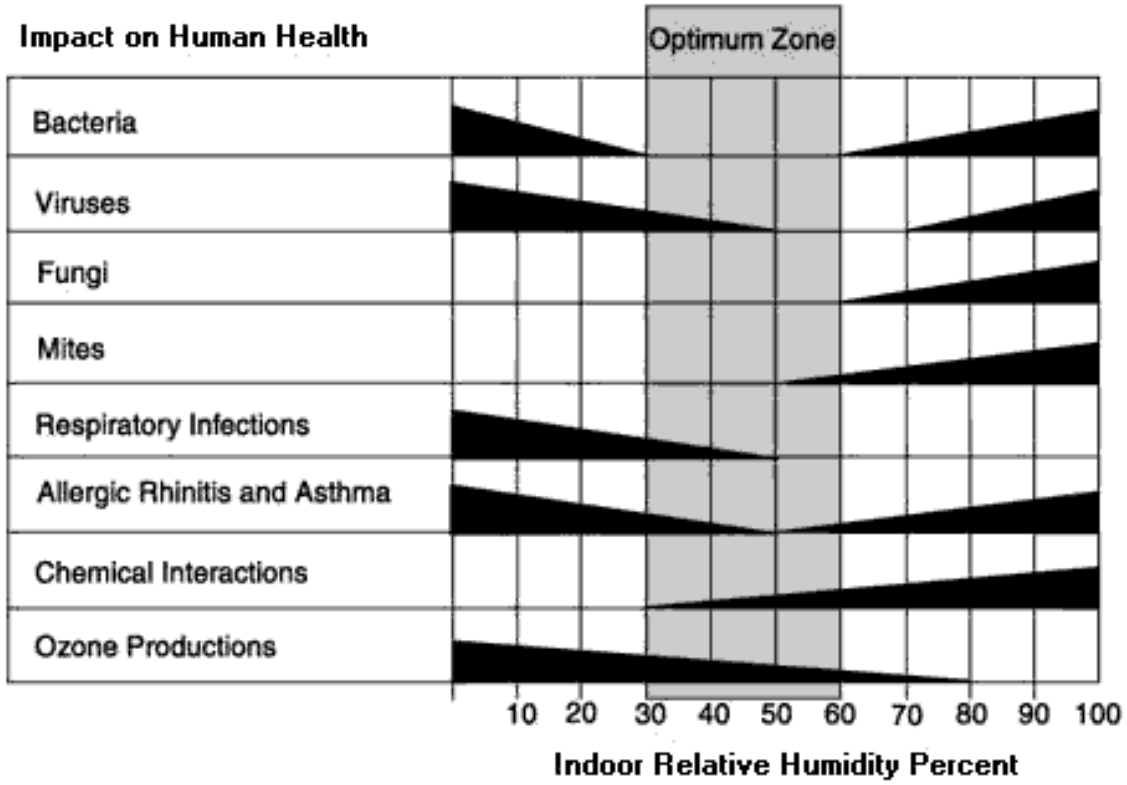
Reverse Wall build up:

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

U value: 0.19 W/m^{2}K. Phase Shift: 12 hours

Humidity 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.



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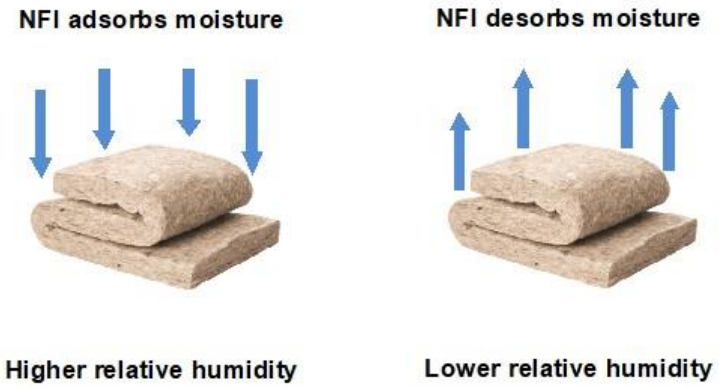
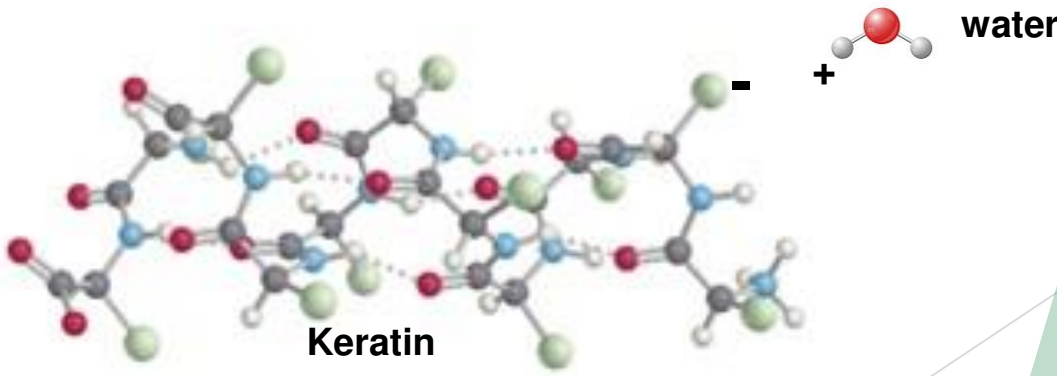
Breathable Natural Fibre Insulation

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

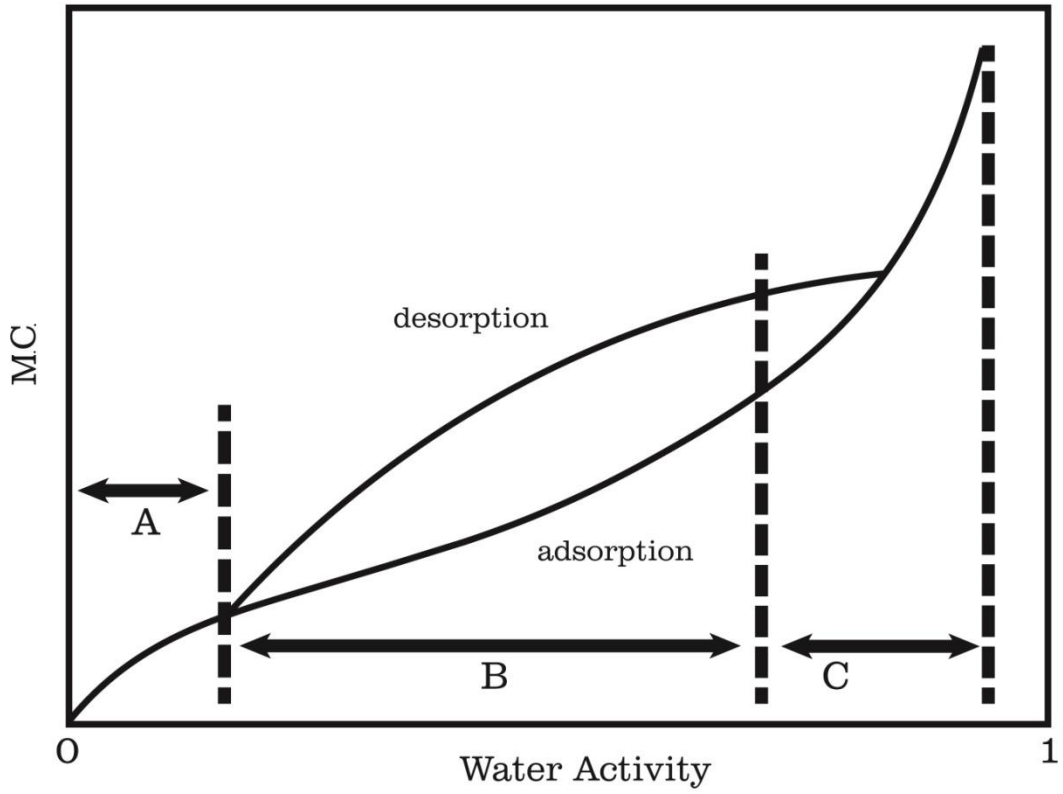


- Is able to bind water molecules in a harmless way.



- 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/m³	2.0 mg/m³	≤ 10 mg/m³	< 0.01 mg/m³	2.0 mg/m³	≤ 1 mg/m³
CMR Substances	< 1 µg/m³	<1 µg/m³	≤ 10 µg/m³	< 1 µg/m³	<1 µg/m³	≤ 10 µg/m³
Formaldehyde	< 0.01 mg/m³	< 0.01 mg/m³	-	< 0.01 mg/m³	0.019 mg/m³	≤ 0.12 mg/m³

Parameter	Wood Fibreboard (under floor)			
	3Day	AgBB Requirement	28 Day	AgBB Requirement
TVOC	0.52 mg/m³	≤ 10 mg/m³	0.02 mg/m³	≤ 1 mg/m³
CMR Substances	< 1 µg/m³	≤ 10 µg/m³	<1 µg/m³	≤ 10 µg/m³
Formaldehyde	< 0.01 mg/m³	-	0.003 mg/m³	≤ 0.12 mg/m³

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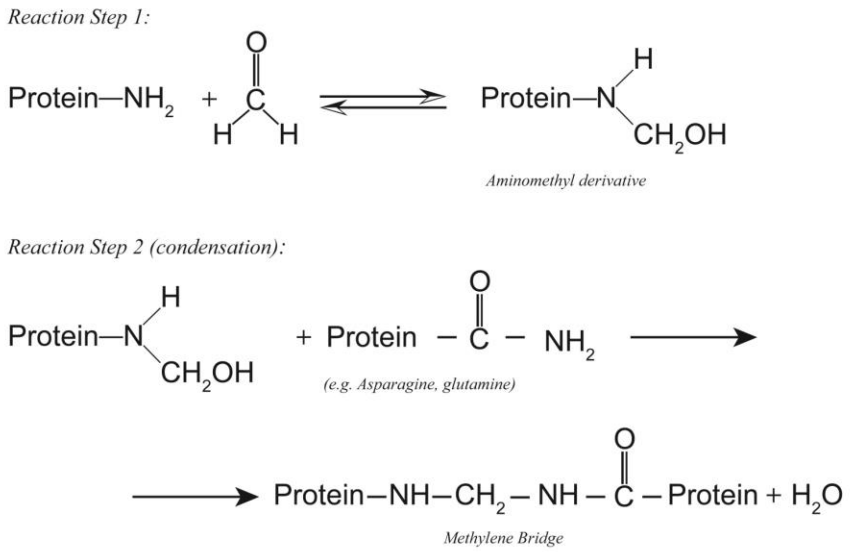
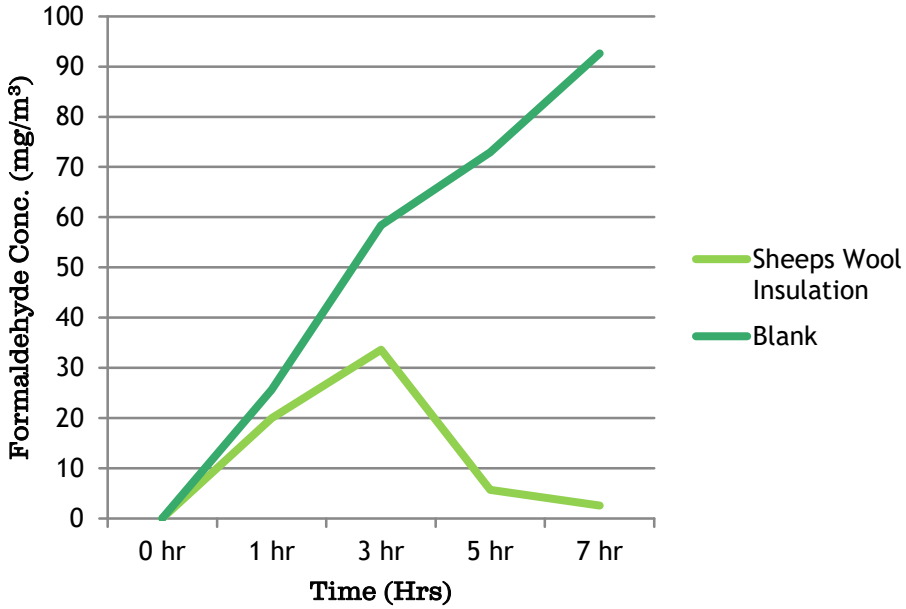
Formaldehyde Reduction – Sheep's Wool Insulation





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

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Acoustic Absorption

		Practical Absorption Coefficients (BS EN ISO 354:2003)						
Product	**Thickness**	**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/m³	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.

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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.

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