ASBP The Alliance for Sustainable Building Products

Insulation thickness and energy savings and maximising ROI

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Rethinking IWI with Natural Fibre Insulation

NATURAL FIBRE INSULATION GROUP

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Rethinking IWI

Why?

Because we are making little headway against the retrofit challenge with our existing perceptions.

What?

- Rethinking not reinventing – Understanding what exists, revealing what's hidden and looking at the problem from a different perspective, e.g.
  - What thermal values (e.g. U & k values) mean and what they tell us.
  - How this relates to current Building Regulations.
  - How these translate into the best design choices for retrofit from a performance and financial perspective.

Thermal Efficiency Values

U – Value (W/m^2K)

How much energy (heat) is lost per second for every sq.m of building element for each degree of temperature difference from inside and out.

Lambda(λ) or k – Value (W/mK)

The amount of heat moving through 1m thickness of a material for every degree of temperature difference either side of the insulation. Because λ is based on 1m of material it doesn't vary with insulation thickness.

Both are steady state measurements so they ignore the ability of the materials to absorb and release heat.

Energy Savings

The difference between energy loss from the insulated element and energy loss from the uninsulated element.

For retrofit - we need to let Energy Savings guide us not U-values.

Building Regulations L – Renovated and Retained Elements

Solid Walls should meet the limiting values in table 4.3 which contains 2 limiting values for solid walls:

a) Threshold – 0.70 W/m^{2}K – the maximum we should be looking to achieve.

b) Improved - 0.30 W/m^{2}K – the principle target.

Regulations allow a very sensible degree of latitude for solid wall upgrades.

Any U-value below 0.70 W/m^{2}K for IWI/EWI is in the “allowable zone”

0.70 W/m^{2}K is achievable with 50mm or less of almost all commercially available insulation including NFI

Insulation	U-Value (220mm Solid Wall)
25mm PIR Fixed with Battens (50mm total)	0.45 W/m2K
40mm Wood Fibre	0.69 W/m2K
50mm sheep's Wool	0.63 W/m2K
50mm Diathonite Insulated Plaster	0.64 W/m2K

Insulation thickness is not a barrier to achieving limiting values for IWI and EWI in sold walls.

Building Regulations L – Which Limiting Value

If achieving the improved U-value of 0.30 W/m^{2}K

a) is not technically or functionally feasible or

b) would not achieve a simple payback of 15 years or less

then the element should be upgraded to the lowest U-value that both:

a) is technically and functionally feasible and

b) can achieve a simple payback not exceeding 15 years.

Generally, a thermal element once upgraded should not have a U-value greater than 0.7W/m^{2}K a lesser standard for the thermal element may be acceptable where work complies with Part C of the Building Regulations on protection from the harmful effects of interstitial and surface condensation.

Better guidance on technical and functional feasibility needed

Justifying the threshold value (0.70 W/m²K)

Technical and Functional Feasibility

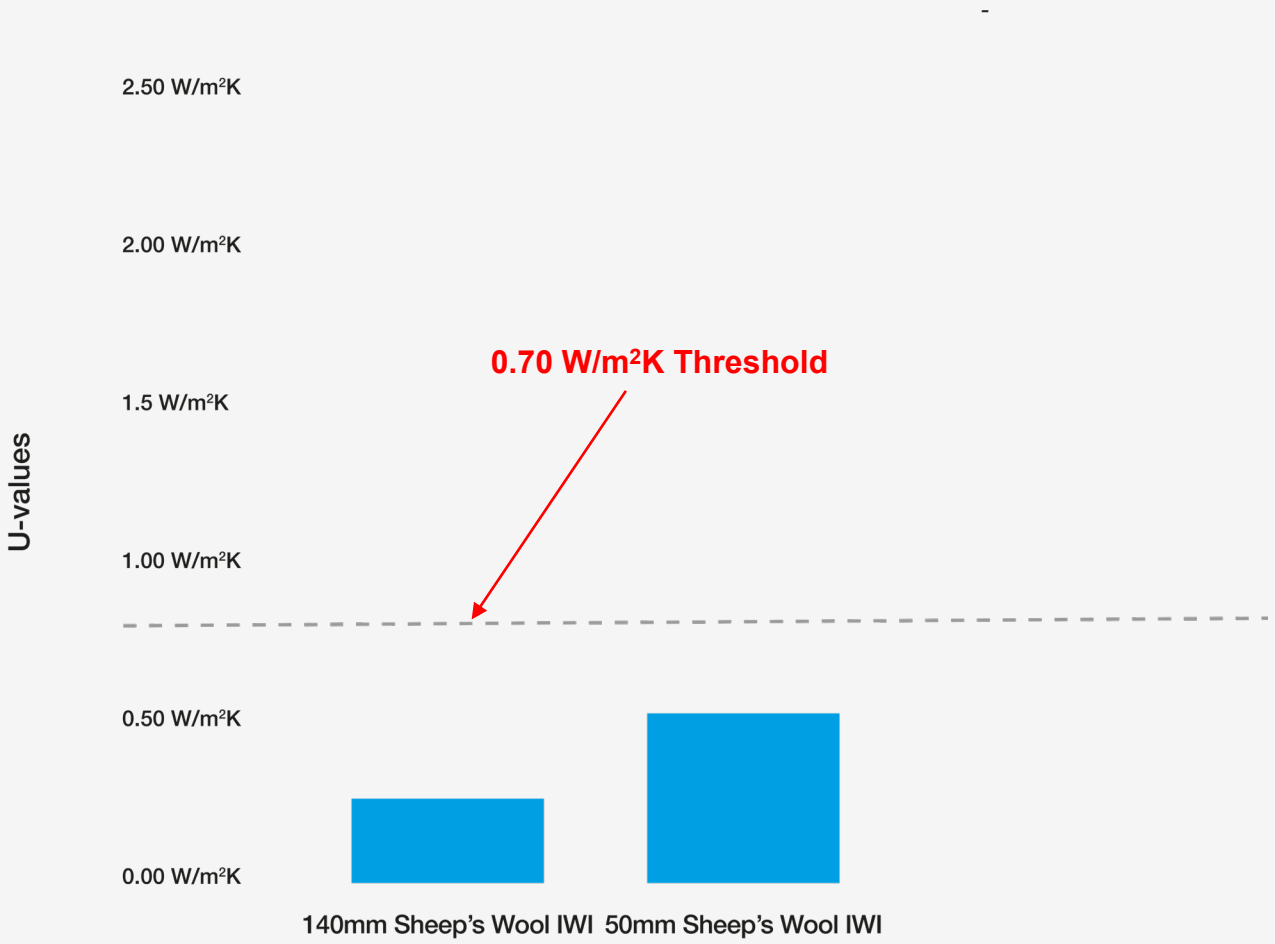
- Analysis shows lower risk of harmful effects of surface or interstitial condensation with NFI
- Analysis shows lower risk of harmful effects of surface or interstitial condensation with thinner insulation layer
- Whole life carbon targets can only be met with NFI
- IAQ targets can only be met with low source materials such as NFI
- Loss of >5% internal area – in almost all situations >5% floorspace is lost with >80mm (inc. lining and finishing)

Achieving a Simple Payback <15 years

- Need to determine energy savings. Usually hidden in the SAP calc.

Clear data on energy savings at elemental level needed outside the SAP calc

Comparing Different thickness of insulation

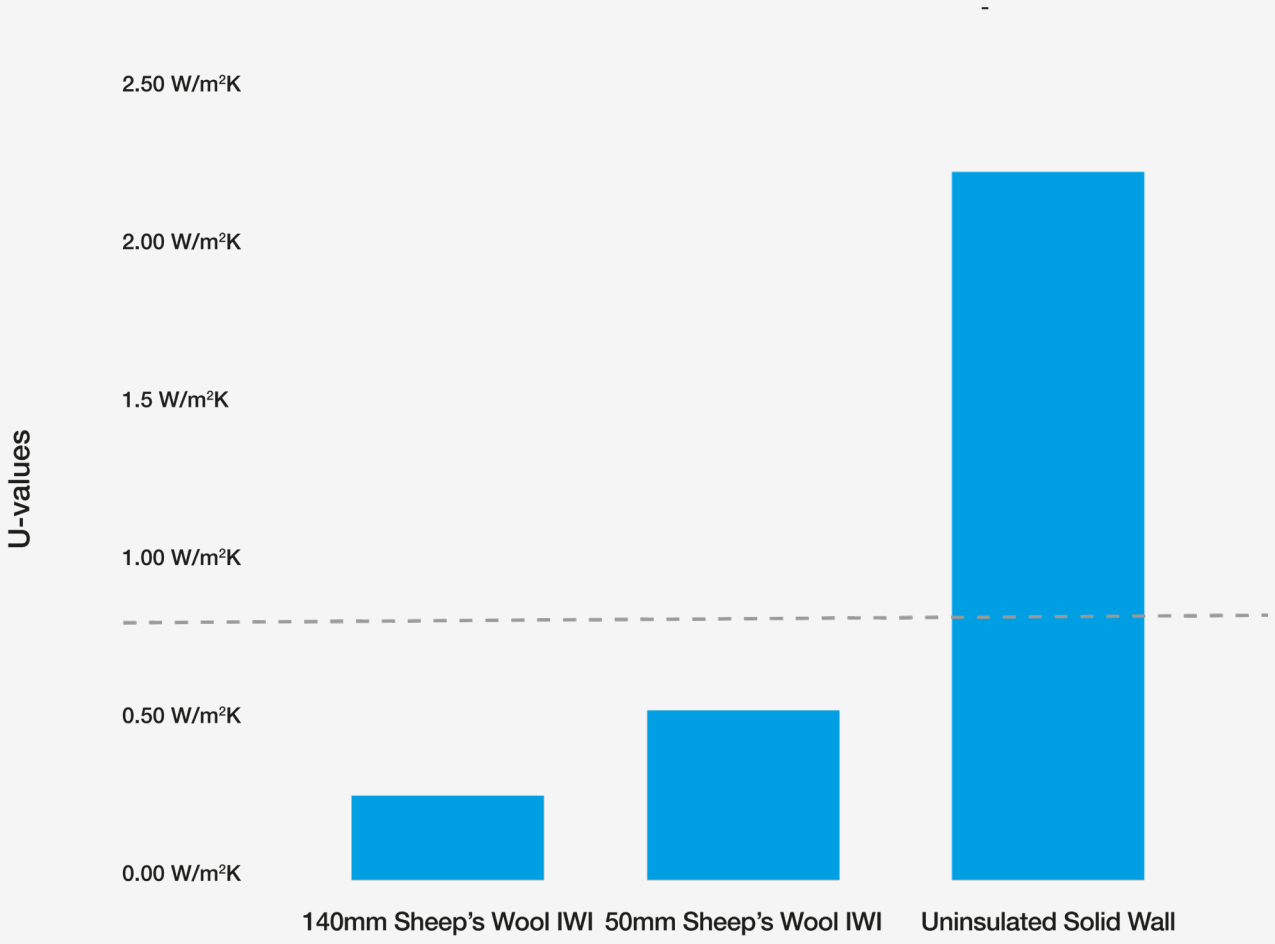


U-value tells us the energy **loss** per sq.m for every degree of temperature difference.

So when we compare U for one insulated element with another we are only comparing energy **loss** of each.

Insulation upgrades exist to **save** energy so we should compare energy **savings** rather than energy loss.

U-Value of the Uninsulated Element is Key

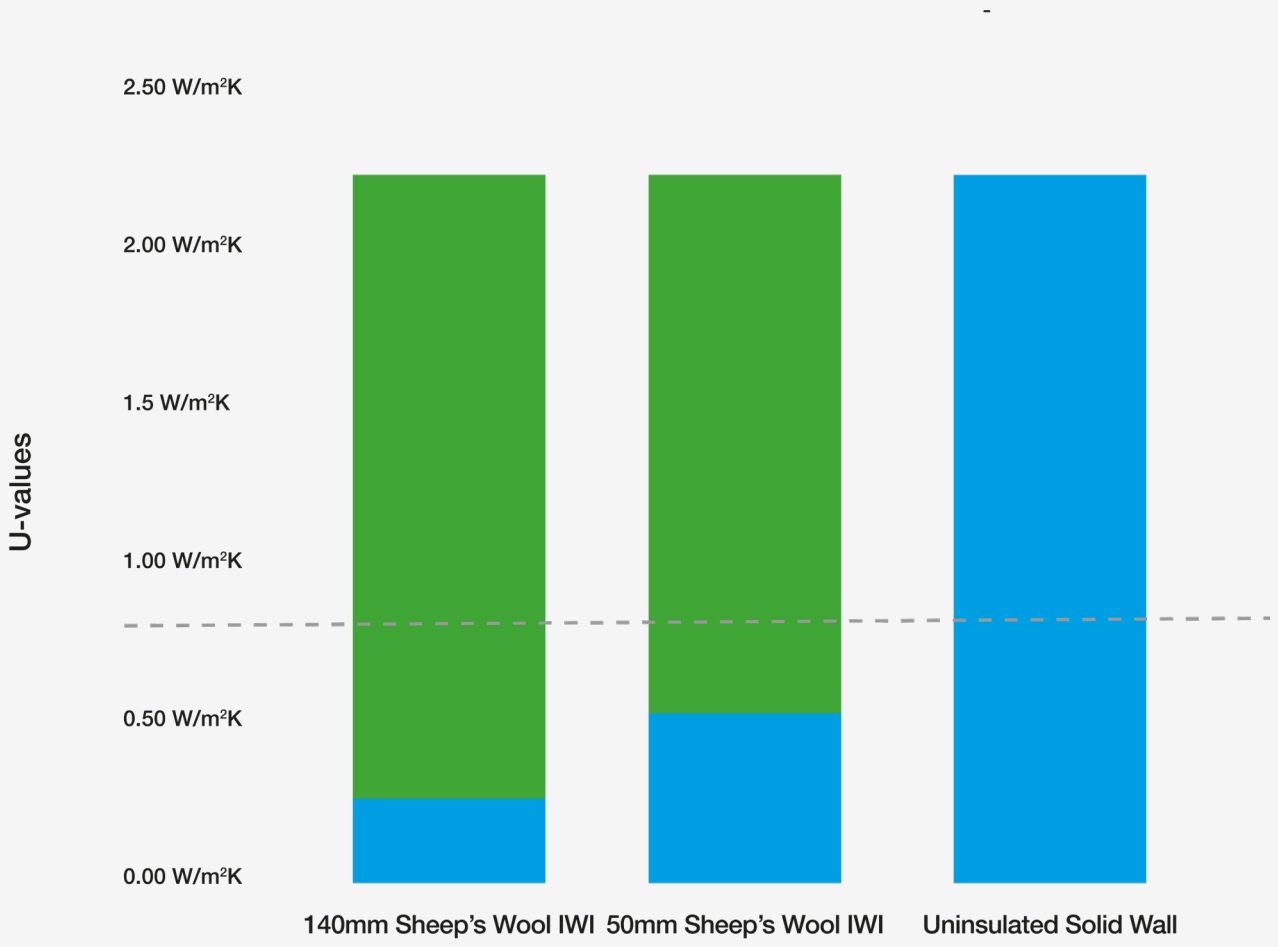


U-value for almost any level of insulation is much lower than the uninsulated element.

The uninsulated element provides the reference for energy savings

Energy savings are the difference between u-value of uninsulated element less U-value of insulated element

Insulation thickness has less impact than you think

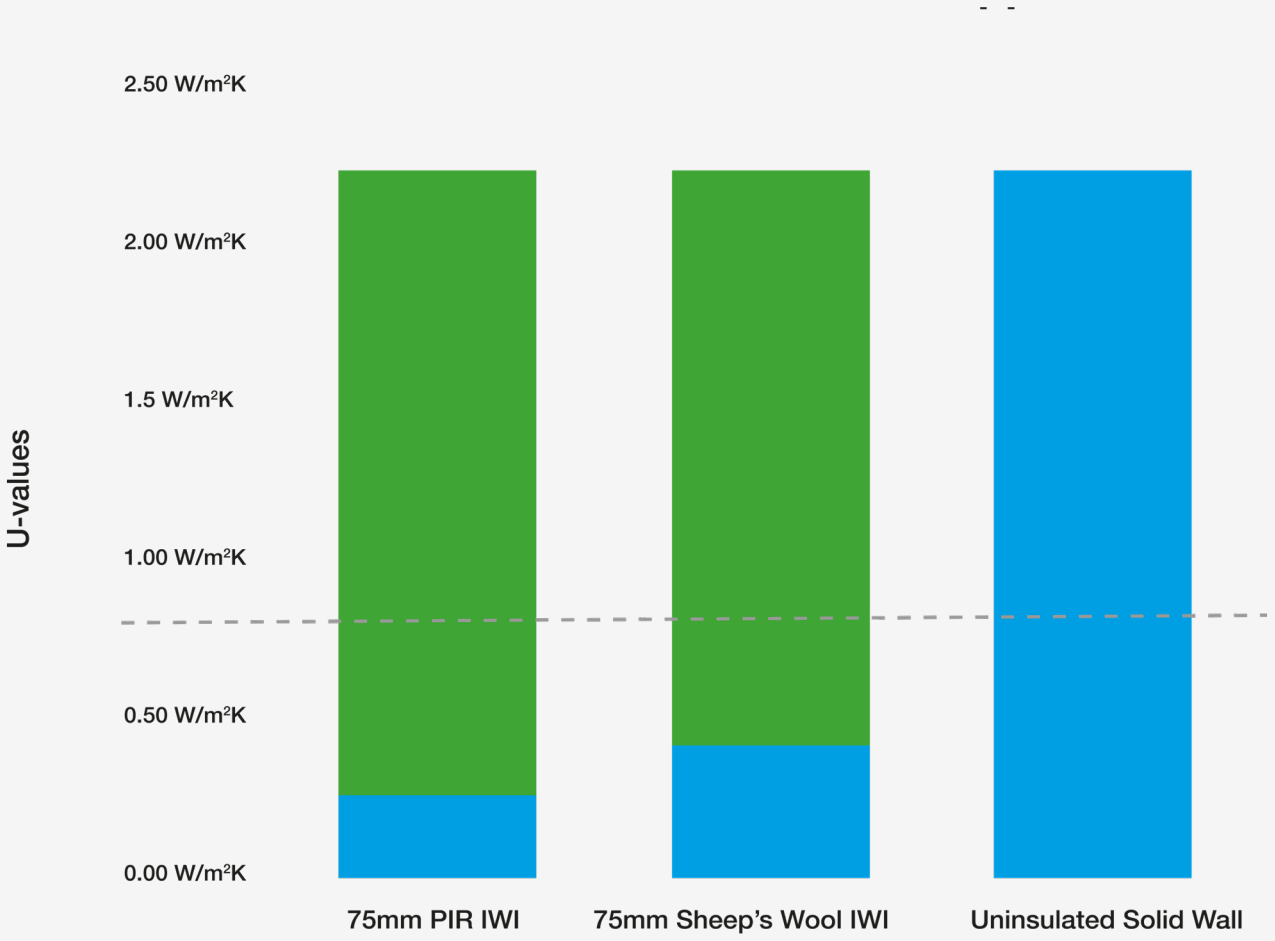


Even thin insulation layers provide significant savings.

50mm sheep's wool provides >80% of the savings from 140mm with 70% less insulation

Energy savings provide the means for calculation ROI.

Comparing insulation with different thermal conductivities



75mm sheep's wool v's 50mm PIR + Low E cavity (75mm total)

U-value comparison shows 50% performance difference between PIR & sheep's wool.

Energy Savings comparison shows 8% difference in performance.

Getting from Energy Savings to ROI

W (Watt) is a measure of power or the rate at which energy is used (lost or gained).

1 Watt = 1 Joule of energy lost per second

So what's a joule?

A joule is a unit of energy in the same way that a kWh is a unit of energy.

1 joule = 0.00000027778 kWh, so 1 W =0.00000027778 kWh lost per second.

Very small, but there are 31,536,000 seconds in a year.

So 1 Watt represents the loss of 8.76 kWh of energy per year.

Enables us to put a financial cost to energy efficiency measures. Essential for gauging ROI.

U-Value and Return on Investment (ROI)

	U-Value	Energy Savings	Annual Energy Savings (AES)/ m^2	AES/m^2	15 Year Payback Limit	Potential Savings against 0.30
	W/mK	W/mK	kWh/m^2.yr	£/m^2	£/m^2	%
Uninsulated solid brick wall	2.21	0	0			
	0.70	1.51	26.97	£4.06	£60.84	79.1%
	0.65	1.56	27.86	£4.19	£62.86	81.7%
	0.60	1.61	28.75	£4.32	£64.87	84.3%
	0.55	1.66	29.65	£4.46	£66.88	86.9%
	0.50	1.71	30.54	£4.59	£68.90	89.5%
	0.45	1.76	31.43	£4.73	£70.91	92.1%
	0.40	1.81	32.33	£4.86	£72.93	94.8%
	0.35	1.86	33.22	£5.00	£74.94	97.4%
	0.30	1.91	34.11	£5.13	£76.96	100.0%

Assumptions:	
Heating 7 months/yr, 6hrs/day	Unit costs based on Ofgem domestic unit price cap Jan 23
ΔT 14°C	Gas - 10p per kWh
Energy 79% Gas, 21% Electricity	Electric - 34p per kWh

A “go regrets approach doesn’t necessarily mean using as much insulation as humanly possible

How Much Insulation is Enough

	U-Value	Energy Savings	Annual Energy Savings (AES)/ m²	AES/m²	15 Year Payback Limit	Potential Savings against 0.30
	W/mK	W/mK	kWh/m².yr	£/m²	£/m²	%
Uninsulated solid brick wall	2.21	0	0			
	0.70	1.51	26.97	£4.06	£60.84	79.1%
40-50mm sheep's wool, hemp wood fibre	0.65	1.56	27.86	£4.19	£62.86	81.7%
	0.60	1.61	28.75	£4.32	£64.87	84.3%
	0.55	1.66	29.65	£4.46	£66.88	86.9%
60-75mm sheep's wool, hemp wood fibre	0.50	1.71	30.54	£4.59	£68.90	89.5%
	0.45	1.76	31.43	£4.73	£70.91	92.1%
	0.40	1.81	32.33	£4.86	£72.93	94.8%
120-140mm sheep's wool, hemp wood fibre	0.35	1.86	33.22	£5.00	£74.94	97.4%
	0.30	1.91	34.11	£5.13	£76.96	100.0%

0.65 – 0.70 W/m²K – The point where doing something is substantially better than nothing

0.45 – 0.50 W/m²K – Best "bang for buck", half the insulation >90% of the savings.

Both in the "allowable zone"

Thank you

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