



## Wool Insulation Wales Ltd – Feasibility Study

Commissioned by Gwnaed â Gwlan // Made with Wool Project





## **Feasibility Study - Welsh Wool for Insulation Applications**

**Commissioned by: 'Gwnaed a Gwlan' / 'Made with Wool' Project**

### **Brief & Scope for the Feasibility Study;**

The brief for study was to explore the qualities and potential for Welsh Wool as an Insulation product with the aim of producing prototypes for testing.

The core aim of this study is to explore the potential of creating a 100% Bio Based product with exclusive use of Welsh Wool that can provide a solution to decarbonizing our built environment here in Wales whilst influencing the value of Welsh Wool with the aim of returning a premium to farmers via the British Wool Traceability Scheme.

The prototype testing will cover 2 samples of wool comprising of different Welsh Wool blends including a 100% Pure Welsh Mountain and a Welsh Mountain with a 40% blend of lowland. The aim of this research is to inform us of the varying thermal characteristics within breeds farmed in Wales with the aim of innovating in the market space allowing us to achieve greater thermal efficiency from a higher percentage of wool within the product without compromising on the thermal, lofting, and structural qualities of the end product.



### **The Opportunity for Bio based materials in Construction.**

The Sixth Carbon Report published by the committee for climate change in 2020 provides details on the key recommendations for the UK to reach net zero. Including a national programme to improve insulation across the UK and the take up of low-carbon solutions with the phase out of high carbon options.

Poorly insulated Homes, Commercial Buildings, Public Buildings etc account for a 1/3 of the country's total carbon emissions and to meet the legally binding target of net zero we will not only have to make our buildings more energy efficient but also lower the embodied carbon within our buildings using low-carbon products to do so.

## **The Benefits of Wool in Construction**

- Low embodied carbon (WIW Ltd currently has an Insulation Life Cycle Analysis ongoing)
- Supportive of the circular and foundational economies which is a key deliverable of Welsh Government Policy
- Wool is a Smart Technical Fibre that can lend itself to many applications within the construction industry including Thermal, Acoustic and Composites.
- Wool is readily available and a Bi - Product of Farming and whilst it is currently undervalued and underused the shift in building practices and interest in bio-based solutions to meet the carbon reduction targets allows wool to regain its popularity and help solve a challenge.
- A particular quality that makes wool fibre far superior to man-made alternatives is its natural ability to absorb Volatile Organic Compounds (VOC's) commonly found in indoor spaces.
- The use of wool widely in construction products will ensure a volume-based outlet for the annual wool clip that will raise the base value.

## **The Challenges for Wool fibre in Construction**

- Scouring of wool fibre for commercial use is extremely volume dependent and whilst you can scour small quantities you will pay a significantly higher price per kg for scouring batches that are less than 1000kg and usually an additional batch charge.
- The infrastructure for commercial scouring is located outside of Wales which is not supportive of the local foundational economies and means wool fibre grown and produced in Wales has to travel a significant distance for processing before being returned to Wales for use.
- Man made Insulation is a much more cost efficient product to produce and holds the market share across all of the global market and Bio Based alternatives are going to need government policy backing to gain popularity.
- Moth Proofing the product. (WIW Ltd currently has a project ongoing for alternative moth proofing treatments).

## Prototype Thermal Test Results

Thermal conductivity measurements were performed at the BioComposites Centre in Bangor using a thermal heat flow meter model FOX 314 (TA Instruments/LaserComp, Inc.), which measures according to ASTM C518 and ISO 8301. Samples with dimensions 300 x 300 cm (width~ length) were prepared. For the measurements, the sample was placed between the two plates, promoting a temperature gradient through the material thickness. The temperature gradient ( $\Delta T$ ) was set to 20C in every case. The active area of the FOX 314 heat flux transducers is 100 ~ 100 mm, and the absolute thermal conductivity accuracy is 2%.

100% Welsh Mountain Wool - Sample size 300mm x 300mm					
Sample Letter	Depth	Method	Sample Thickness	Thermal Conductivity (W/mk)	S.D
A	100mm	very light needling	single	0.0287	0.00038
A	100mm	very light needling	double	0.0276	0.00034
B	75mm	light needling	single	0.0295	0.00084
B	75mm	light needling	double	0.0283	0.00031
C	50mm	medium needling	single	0.0299	0.00038
C	50mm	medium needling	double	0.0286	0.00038
60 / 40 Welsh Mountain / Lowland Blend 300mm x 300mm					
D	75mm	light needling	single	0.0256	0.00032
D	75mm	light needling	double	0.0275	0.00049
E	50mm	medium needling	single	0.0255	0.00022
E	50mm	medium needling	double	0.0264	0.00012

Thermal Conductivity also known as Lambda Value  $\lambda$  measures a products thermal conductivity in untis of W/m-K. The lower the lambda value the better the thermal performance of the product.

The results from the initial indicative tests carried out at Bangor University show an excellent Thermal Conductivity value across all of the samples and blends.

The results also show that mixing lowland wool into the blend further increased thermal conductivity.

Thermal Test at the BioComposites Centre, Bangor University



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The table below displays a comparison of Sheep's Wool Insulation and alternative products:

Insulation Type	Thermal Conductivity
Glass wool	0.044
Rockwool	0.044
Welsh Sheep's Wool	0.0255
Hemp	0.035

The conclusion for this study is that Welsh Mountain grade wool is a great insulator without the use of a blend as it has reached Thermal Conductivity figures that indicate better performance than alternative products in the market space subject to further accredited testing. WIW Ltd will begin manufacture in 2023 and will aim to conduct further Research & Development over the coming year to stay ahead of our challenges.

Feasibility study carried out by Wool Insulation Wales Ltd

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