



Life Cycle Assessments of Natural Fibre Insulation Materials

NNFCC Project No.07-007

NNFCC Project Factsheet

This Factsheet gives an overview of one of the projects in NNFCC's work programme, funded by Defra.

The full report will be available on the NNFCC's website at <http://www.nnfcc.co.uk>

Objectives

- To develop a scientific and transparent basis on which the environmental impact of natural fibre insulation materials can be evaluated.
- To undertake a cradle to grave life cycle assessment comparing natural fibre insulation to market-leading conventional materials, following the principles of ISO 14040 series of international standards for life cycle assessment.
- Use the life cycle assessment to identify any benefits or drawbacks that may be offered by the use of NFI and explore the areas of possible improvements.

Report Summary

The purpose of this study was to address the current lack of reliable, independent data about the environmental impact of Natural Fibre Insulation (NFI) materials. The goal was to develop a scientific and transparent basis on which the environmental impact of natural fibre insulation materials can be evaluated.

The study conducted a cradle to grave Life Cycle Assessment (LCA) of natural fibre insulation materials for construction use. As it is perceived that NFI will have an inherently low environmental impact, the chosen benchmark products were BREEAM A rated.

A major motivation for the study was to identify and evaluate the main areas of improvements to NFIs that may be possible in the near future.

The NFI products studied here were 'Isonat', a hemp/recycled cotton based material and 'Thermafleece' which is produced mainly from waste sheep wool. Both are still in relatively early stages of product development. These materials were chosen on the basis of their current UK market availability. Information on the current market leading materials produced by Knauf and Rockwool were used as benchmarks for evaluating the environmental performance of the NFIs.

The Study

The Functional Unit for the study was for the insulation of one square metre within the cold roof space of a given dwelling described as:

The manufacture, installation, use and disposal of insulation material for the central part of a first floor plasterboard/timber ceiling in a UK domestic house to a U-value of 0.16 W/m²k for a period of 60 years service.

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Thermafleece



Wool scouring plant



Hemp straw



Isonat



Mineral wool



For the NFI, data was obtained from the manufacturers and a transparent inventory was produced. The data for the benchmark products mainly consisted of aggregated whole-system datasets from previously conducted LCAs that had been commissioned by the companies.

The different ways in which the data has been compiled for the NFIs and benchmark products means that caution is required in drawing conclusions from the benchmarking exercise. However, a comparison of the NFI and benchmark materials indicates that the NFI materials are comparable to BREEAM A rated materials in many impact categories.

The dataset for NFIs in the category of toxicity were compiled from the Ecoinvent database.

Due to the transportation required to take material to the current production facility in France and for the return journey to the UK for the finished product, the impact of the Hemp/cotton product is marginally higher than that of 'Thermafleece' and of the benchmark products in some impact categories.

The end of life scenarios studied showed only a partial release of sequestered CO₂ in, for example, landfill and composting.

Next Steps – Improving Environmental Profiles

Analysis of the LCA data has indicated several promising and feasible opportunities for improvement of the environmental 'profile' of the NFIs. These improvements are also the logical next steps for this emerging industry. NFIs can deliver positive contributions to reducing global warming potential by the sequestration of atmospheric CO₂ in the fibre and binder materials and its storage during the service life (and potentially on disposal).

Areas for near-future improvements in the environmental profiles of NFIs are;

- The polyester binders used in the NFI could be replaced with polylactic acid materials derived from crops, but economic constraints exist
- Although 'Isonat' provides 'added value' as a sound insulator because of its density, there is potential for a reduction in the density of both the NFIs without a compromise in their basic function
- A wider range of products could be produced by NFI manufacturers including optimised 'single-function' products, (for example, thermal only) to meet the basic need for simple loft insulation materials

- A reduction in flame retardant use is feasible. The fibres for both NFI products are presently dipped in a flame retardant solution and then dried. Alternative approaches such as a surface coating, could also meet the standards required
- Scaling up production, even using relatively unrefined non-woven textile machinery, would halve the energy requirements for plant fibre production
- Manufacturing 'Isonat' in the UK from UK-grown hemp, would substantially reduce the environmental impacts from transportation
- New technology is being patented by Plant Fibre Technology (the importers for 'Isonat') involving very low energy inputs to blend fibres with thermoset binders and the fire retardants. Further improvements in scaling up and binder development could result in environmental and commercial advantages

Several of the above developments are also likely to deliver benefit through reduced production costs. This could be reflected in the price of NFIs, increasing their market share.

Targeted research funding, government procurement and increased public awareness could also improve the market share of NFIs in the UK.

The study has shown that NFIs have the potential to offer positive contributions to the issue of global warming through the sequestration of CO₂ and that the UK has potential for increased production. Focused R&D, commercial development and promotion of optimised NFIs is recommended to release this potential and contribute towards satisfying climate change goals.

The Full Report and Further Information

'Life Cycle Assessments of Natural Fibre Insulation Materials' (Murphy and Norton, 2008) will be published on the NNFCC website at www.nnfcc.co.uk Details of NFI suppliers can be found on our website at the above address, along with the *Spring 2007 issue of the NNFCC Newsletter 'Build a Better Building'*.

BREEAM <http://www.breeam.org/>

Ecoinvent database <http://www.ecoinvent.ch/>