

Cellulose as Insulation

By Gunter Pauli

This article introduces cellulose waste converted into high quality insulation as one of the 100 innovations that shape "The Blue Economy". This article is part of a broad effort to stimulate entrepreneurship, competitiveness and employment.

The Market for Natural Insulation

The world market for natural insulation may reach the one billion dollar mark in 2015. Based on data gathered from individual corporations and extrapolations from corporate data from both small scale enterprises and globally operating multinationals, the present market can be estimated between 500 and 600 million dollars. Since the case on insulation paint (case 37) covered the insulation market, the market information will focus on natural insulation only. The use of renewable plant and animal sources to produce insulation is increasing in popularity since there is less energy required for the extraction of the desired ingredients, its production and conditioning. The leading renewable insulation product is a soy-based polyurethane foam. It is expected that the approximately 7 billion pounds of polyols, the core material to produce polyurethane consumed in the OECD will increasingly rely on natural-oil polyols (NOPs).

BAYER Material Science (Germany) and BioBased Technologies, a start-up company based in Arkansas (USA) have developed technologies to increase the renewable content. This is much needed. Even when the product states that it is soy-based, it seldom qualifies as a bio-based product with the minimum percentage set forth by the US Secretary of Agriculture. BAYER's NOP can contain anywhere from 40 to 70 percent renewable material which means that the final product could only reach 10 to 15 percent bio-based content and therefore this product barely qualifies for a biopreferred stamp. Even at such low bio-content, the label does not represent much. However, it has been calculated that by replacing one ton of petroleum or mineral substances with bio-based content as much as 5.5 tons of carbon dioxide equivalent is either removed or prevented from entering the atmosphere. These facts motivated Liebherr, the German manufacturer of white goods to use insulation foam made from NOP. Hyundai and Kia are now integrating cushions with NOP-based foam into selected models, as does Ford Motor for the seats of the Mustang car. This would be considered an example from the Green Economy.

Innovations

Foams derived from renewable oils offer a popular solution. Traditional uses for insulation like straw panels, flax boards, wool, cellulose and jute increasingly compete with fiberglass, and mineral wool. Sheep offer the most traditional one, since these animals have been domesticated for 8,000 years. Wool is one of the traditional insulation materials for both body and home. Several US and UK Wool-based insulation companies are registering double digit

growth rates offering a welcome additional revenue for a sector that has had difficulties competing with synthetic substitutes. Straw-based buildings have also enjoyed growing demand. However, apart from the case of recycled newspaper print, that was not de-inked, most renewable materials mentioned can hardly be qualified as sustainable since their use as a raw material for insulation competes with other primary uses, including food production. Whereas the reduction of our dependency on petroleum is a laudable objective, our long term sustainability requires innovations that focus on materials that do not compete with each other, looking for input streams that are readily available, lacking commercial use, and are therefore in search for value added applications. This generates a complementary economy, with value added chains that generate value and jobs, instead of substituting products.

Reidar Berglund, trained as a construction engineer with a specialty in heat, ventilation and sanitation started his career as an advisor in energy efficiency. He designed energy savings systems for both industrial and home applications. He had been working with saw dust as an insulator, a traditional product that has withstood the test of time. He studied the options for the development of a pure natural insulation material that is made of the same material and enjoys the same level of sophistication as the cellulose based absorption fluff in diapers. He created a highly efficient, fully recyclable and natural insulation starting from the short left-over fibers from the paper mills. It took Reidar a decade to come up with a competitive product that turned the fibers more airy through the fine distribution of minute strings of cellulose, combined with the build-up of microscopic air bubbles both in the fibers as in the space between them. He then went on to obtain all the necessary permits, including fire safety. Reidar was not only committed to design a product with performance, he also worked out a production process whereby no external inputs are required. Actually, Reidar succeeded in the reconditioning of the physical conditions and properties of cellulose based on the most stringent environmental and quality requirements. After setting up product and process, in 1989 he created the company Termoträ (pronounced termotree), developed his own direct sales and distribution system working closely with a limited number of local and certified installation experts.

The First Cash Flow

Reidar was able to sustain his research and development investments out of his existing cash flow from energy consulting and engineering. He established a close cooperation with Anders Nyquist, the pioneering eco-cycle architect who is always searching for local solutions made from local materials. Termoträ applied the proven technology in the Nydala Housing Complex in Umeå, and the now famous Laggarberg School in Timrå. These buildings quickly proved the efficiency of the insulation material in one of the most quality conscious regions: the North of Sweden, three to four hours train ride from Stockholm. A close monitoring of performance of his material for a family home concluded that energy savings of 15,000 kW/hr per year is attained across the board. In addition, the installation requires no vapor barriers or plastic sheets, substituting something. The home made product impressed to the point that even the Royal Palace in Stockholm is now insulated with this local and natural product.

The market expanded and the fully integrated production and distribution system starting from left-overs that were previously dumped into landfills or incinerated now provide high grade insulation for 6,500 family homes already. A competitive product starts with a left-over, is reconditioned physically, is fully reconditionable and recyclable, competes on performance and price in a high cost country with the cheaper alternatives imported from overseas, generating jobs and building social capital. It is also mold free and therefore contributes to the indoor air quality and the health of the occupants. This meets the characteristics of the Blue Economy.

The Opportunity

With the advent of prefabricated houses, the cellulose fluff supplied by Termoträ can also be injected into the building modules increasing the efficiency of assembly. Old houses can be retrofitted quickly with an insulation layer sprayed in the appropriate locations in the walls or over the ceiling with a vacuum cleaner like apparatus with a 60 meter long hose, reaching nearly anywhere into the house. Reidar and his team do not engage in advertising, they prefer word-of-mouth. The outstanding results lead to the introduction of the technology to Germany, with a first project in Borkwalde (Berlin) and soon multiple initiatives were pursued in Norway. Every community around a pulp and paper mill could embark on a production and distribution business model tailored after the breakthrough of Reidar. He already expressed his willingness to transfer his know-how to Bhutan and other nations rich in fibers and poor in insulation will only require the entrepreneurs to turn this into a real business opportunity.

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... Further information on the 100 innovations at www.theblueeconomy.org

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