

DuPont™ Energain® - The story so far... Key participants comment on the development process

“Anyone who has spent any time in a timber, glass or steel framed building in the height of summer understands the discomfort of steeply rising temperatures. Anyone who has had to meet the bill for the air-conditioning – or who is concerned about climate change from the resulting CO₂ emissions – understands the real cost of this problem...”

Mission:

Tom Powell - Vice-President and General Manager, DuPont Building Innovations

“Sustainable growth is our mission as a company. This means creating shareholder value while decreasing our environmental footprint throughout the value chain. We have recently announced a new set of sustainability goals for 2015 which raise the bar on the environmental footprint reductions we have already achieved. Many of our new goals are market-focused revenue and R&D targets that will help our customers be more sustainable.

Within our Building Innovations business, we are focused on bringing the global building industry solutions that integrate safety, durability, beauty, and energy efficiency. DuPont™ Energain® is perfectly aligned with our business strategy, our sustainability goals, and the needs of our customers. DuPont™ Energain® adds to our broad portfolio of products and services that help our customers reduce their energy consumption - saving them money and helping them reduce their impact on the environment.”

Katja Gross - Project Manager – DuPont™ Energain®

“An important part of the DuPont Building Innovations mission is to develop products and systems that improve the safety and performance of the built environment. DuPont invents materials that offer meaningful, long-term usefulness for society, plus intrinsic value in terms of fitness for purpose, cost-efficiency and sustainability.

Our understanding of the needs of the construction market, gained through businesses such as Tyvek® vapour membranes for roofs and walls, led us to realise the potential value of a product that could offer significant benefits in comfort and energy saving, while also meeting the practical needs of installation.

Inspired by the drive towards sustainability in all sections of public, political and commercial life, we put together some of our best minds in various fields to come up with a solution to the problems faced by lightweight structure buildings. From concept to realisation, testing and documenting, the project has taken approximately a year and a half.”

Invention:

Raymond Reisdorf, Research Engineer - R&D DuPont Tyvek® / Typar® (DuPont™ Energain® concept creator)

“Anyone who has spent any time in a timber, glass or steel framed building in the height of summer understands the discomfort of steeply rising temperatures. Anyone who has had to meet the bill for the air-conditioning – or who is concerned about climate change from the resulting CO₂ emissions – understands the real cost of this problem.

Cont'd/...

So, how to stabilize uncomfortable temperature peaks (which can also have a debilitating effect on workplace performance) while also saving energy and money? How to create a product that adds thermal mass to low-inertia buildings – and can be installed in the construction - or even the retro-fitting stage - in a realistic way?

From the earliest thinking it was clear that Phase Change Materials held the key. I had a good idea about the various types of Phase Change Materials (there are more than 100 different materials, inorganic and organic) that are usually used in the range of peak temperatures that I was interested in (18°C to 27°C). The paraffins are from the organic group and the carbon chain is very similar to that of polyethylene. It was at this point that I began working with Loïc Rolland and his team in the Packaging & Industrial Polymers business unit in DuPont, where they have expertise in producing all types of polymers based on ethylene.”

Dr Loïc Rolland - Technical Programs Manager - DuPont Packaging & Industrial Polymers (DuPont™ Energain® compound and panel creator)

“When Raymond Reisdorf came to me with the idea to develop a panel based on phase change material that would work in a building environment, it was an exciting challenge. ***The wealth of experience within the DuPont Building Innovations platform meant there was a strong knowledge of the construction market - on the other hand the DuPont P&IP division had the laboratories, resources and expertise to develop both the core ingredients and the process to manufacture on an industrial scale both the compound and the panel.*** The challenge was to capture various technologies in a form that would be both stable and easy to install.

Products comprising phase change materials have been around for some time, such as blisters or pouches, but these are not suitable for construction as they cannot be punctured and are too bulky. When something goes into a wall, one needs to be able to cut or drill without leakage.

Raymond had the idea to use paraffin wax but we needed to create a consistency that would not leak. The solution was to incorporate the paraffin wax into a copolymer that could absorb a high concentration of the material, retain it over time, allow it to be re-processed indefinitely and give it a stable performance.”

Raymond Reisdorf

“The ‘Eureka’ moment came when my colleague found the exact copolymer of ethylene which had the best compatibility with paraffin and we discovered a process to encapsulate the liquid paraffin into this polymer. For practical reasons (the ratio between elasticity and cohesion of the compound) the best loading ratio of the paraffin in the polymer came out as 60% paraffin and 40% polymer.

It was a very exciting development for us because it gave us the possibility to create an easy, practical and patented solution in the form of a panel that could be easily installed into the building envelope and would not leak when cut or drilled.”

Dr Loïc Rolland

“The next steps were to develop the processes, equipment and conditions to manufacture the polymer compound on one hand and the panels on the other, firstly on a lab scale and then on an industrial scale. The aluminium foil “wrapping” on either side of the panel and the aluminium tape were essential elements of the development, not in terms of thermal properties, but rather to protect against fire.

Cont'd/...

In terms of thermal performance, the research undertaken by the architectural and building professions suggest that the most comfortable temperature in a room is 22°C and so the copolymer was designed with melt point of 22°C. The material was designed to absorb heat at that temperature and then begin releasing it again at 18°C. This stabilization effect can bring real comfort, especially in countries where AC is not so widely used, plus the savings on energy are significant.

The next step – the independent testing process – has so far fulfilled all our technical hopes and expectations for the product – we are positive that the market will be as excited by these results and adopt the technology accordingly!”

Testing:

Joseph Virgone, Maitre de Conférence, INSA, University of Lyon

“This new product is an important development because a solution has been found to encapsulate a phase change material into a construction material which is easy to incorporate between other materials such as insulation and plasterboard, without technical difficulty.

There is a great importance for energy saving materials in construction. Although internal temperatures may temporarily rise, buildings with light structures cannot store the heat accumulated from solar gains during the day – and so cannot then release this energy gradually during the night. Heating systems must be activated as soon as the temperature drops. In spring and autumn, thermal inertia in buildings is particularly beneficial as it can avoid such night-time energy consumption.

With the thermal inertia provided by a material such as DuPont™ Energain™, in summer, if the nights have been cool, air conditioning systems could be kept off during the day if temperatures in the room do not reach high levels.

So, at certain times of the year, in theory, it could be possible to save 100% of the energy normally used for cooling or heating. In this case, numerical simulations have demonstrated savings which can reach 45% depending on the AC set point (above 22°C) and night ventilation above 2 vol.air/hr. Savings in heating are also possible during winter, but these are moderated if the solar gains or internal gains from other heat sources are low.

To test the product we created a special room at the INSA University of Lyon called the MiniBat station, where we recreated specific climatic conditions. The room was a light structure of 3m x 3m, surrounded by a second room in which the outside conditions of different seasons were simulated. The solar radiation was created by a ramp of lights which have the same wave length as the sun. The light radiation was passing through a window taking the entire space of one of the exterior walls.

The tests were conducted with and without the Phase Change Material and comparisons were made between the air temperatures reached and the energy consumption of the heating or air conditioning devices. The outputs were the resulting air temperatures for both cases. Delta t °C of maximum 4 to 5°C was recorded during the summer and inter-seasons periods.

Cont'd/...

The tests gave us exactly the same results as we'd calculated beforehand using a special version of the CoDyBa numerical software. The value of such software is that it can rapidly test various configurations and show the efficiencies of the proposed solutions. It makes it possible to numerically test various factors: the influence of DuPont™ Energain® in a room, the influence of the climate, the orientation of facades, the dimensions of windows and so on. So it is possible to provide a case study of the project and the impact that DuPont™ Energain® installation will have.

Such products are very important for a sustainable future. We are studying further potential developments for DuPont™ Energain® that may increase energy savings, but even in its most simple application, this material offers improved comfort. The need for improvements in thermal insulation to reduce energy consumption in buildings can only increase – but improved insulation can also actually become contrary to comfort, so it's very important not to neglect thermal inertia. Therefore insulation products, thermal inertia products and heating and cooling systems need to be considered as part of a cooperative and coherent programme.”

Laurent Barthel, EDF R&D, Dept ENERBAT (Energy in Buildings and Territories)

“In my role in the research department of EDF Group I deal with energy management in building and territories. A part of my activity concerns the general field of thermal storage opportunities for domestic hot water and/or space heating renewable equipment, in order to reduce energy consumption and CO₂ emission. In this R&D department, there are also experts in building phenomena managing all types of performance analysis.

Energy saving materials in building construction have a serious role to play. The first approach in a concept of energy demand control is a reduction of building needs. In building retrofitting some configurations could be well adapted for the integration of energy storage materials in to the building structure together with efficient insulation, instead of an air conditioning equipment solution.

To test DuPont™ Energain® we have carried out many measurements in a test house called ETNA ("Essais Thermiques en climat Naturel ou Artificiel") composed of twin attic rooms to compare indoor temperature distribution - with and without DuPont™ Energain® - in a natural climate during summer and parts of autumn. In addition to that we are performing different numerical simulations for family house parametric studies.

Initial testing has shown that DuPont™ Energain® has an important impact on the indoor temperature in summer. We are currently continuing to carry out studies for DuPont to measure the exact performance range but the first measurements are encouraging. If this solution could save on the need for air conditioning equipment installation for a building, it could be a significant contribution to sustainability in construction.”

Path Forward

Katja Gross – Project Manager – DuPont™ Energain®

Launching DuPont™ Energain® in the UK is only the first step. The product concept and patented technology will spread through Europe and then globally, as reducing energy consumption is a worldwide agenda. ***This is reflected in the fact that, in a show of confidence from the European Commission, DuPont™ Energain® has been awarded a LIFE development grant from the European Commission as part of its support package for the “Effenergy” project.***

We at DuPont believe that this new material will have a valuable role to play in the growing demand for sustainable solutions and we are very enthusiastic about the contribution it can make. DuPont™ Energain® is available to order through DuPont and we are happy to assist with any enquiries at www.energain.dupont.com.

Notes to Editors

DuPont™ Energain® is a radical new concept in thermal mass materials that could revolutionise the way the world constructs. Suitable for “low-inertia” structures such as timber, steel or aluminium framed buildings, this thermal mass system can make a significant contribution in the drive toward sustainability.

By stabilizing the effects on room temperature at both ends of the scale, DuPont™ Energain® dramatically decreases both air conditioning costs (by up to 35%) and heating costs - and significantly reduces the CO₂ footprint of a building. The material offers further benefits in terms of comfort as it minimises temperature peaks in a building by up to 7°C. A light-weight and easy-to-install panel in a 5mm thickness, DuPont™ Energain® enables architects and designers to build sustainable, innovative, cost-efficient buildings. **DuPont™ Energain® Thermal Mass Systems is a patented technology made only by DuPont.**

DuPont is a science-based company. Founded in 1802, DuPont puts science to work by creating sustainable solutions essential to a better, safer, healthier life for people everywhere. Operating in more than 70 countries, DuPont offers a wide range of innovative products and services for markets including agriculture and food; building and construction; communications; and transportation.

An introduction to the overall DuPont offer for architecture, interior design, building and construction markets is available at www.buildingonscience.dupont.com. The range of DuPont™ Energain® products is shown at www.energain.co.uk.

#

Media contact DuPont™ Energain®:

Claudio Greco, DuPont Building Innovations, Public Relations and Media Relations Manager (Europe, Middle East and Africa), claudio.greco@dupont.com; Peggy Beicht, DuPont Building Innovations, Public Relations and Media Relations (Europe, Middle East and Africa), peggy.beicht@dupont.com