

## Making greenhouses more efficient: a novel technology with lenses made from PLEXIGLAS® molding compounds

January 21, 2019

Temperature and lighting conditions in greenhouses need to be as uniform as possible for crops to prosper. For this reason, commercial greenhouse operators generally have to spend a great deal of money on heating, climate control, and shadowing.

**Contact person specialized press**  
**Thomas Kern**  
Global Communication  
Molding Compounds  
Performance Materials  
Phone +49 6151 18 3071  
Fax +49 6151 18 84 3071  
thomas.kern@evonik.com

The Dutch company Technokas has developed a solution: their Daylight Greenhouse not only consumes less resources than a traditional greenhouse—but it harvests energy as well. The technology also eliminates the need for an additional shading system.

“Conventional greenhouses cannot utilize the entire radiation energy of the sun. A significant portion of the provided energy is lost,” says Hans van Tilborgh, one of the three managing directors of Technokas, which has been planning and implementing greenhouse construction projects, climate control systems, and business facilities in the Netherlands for 26 years.

Experts know only a portion of the sun light is used by the plants to grow. “The first thing we thus asked ourselves was, ‘How do we make use of the excess energy that a greenhouse absorbs but cannot otherwise utilize?’” Van Tilborgh recalls. The solution? A canopy that collects the direct sunlight and converts it to energy. The diffuse part of the light passes through the roofing and is made available for good plant growth. The Daylight Greenhouse idea was born.

### *Harvesting energy*

More than a decade was required for the engineers at Technokas to develop the initial idea into series-production readiness. A unique roof construction consisting of well-insulated, double-glazed panels with embedded Fresnel lenses is the heart of the new generation of greenhouses. The lenses focus the sunlight onto a collector mounted on a 2-axis sun tracker, which in turn converts the light energy to thermal energy. “The concept

**Evonik Performance  
Materials GmbH**  
Rellinghauser Straße 1-11  
45128 Essen  
Germany  
Phone +49 201 177-01  
Fax +49 201 177-3475  
www.evonik.com

**Supervisory Board**  
Dr. Harald Schwager, Chairman  
**Managing Directors**  
Johann-Caspar Gammel, Chairman  
Dr. Michael Pack  
Magdalena Wagner  
Rainer Wobbe

Registered Office Essen  
Register Court  
City Local Court Essen  
Commercial Registry B 25779

wouldn't work without the interaction between the various components," Van Tilborgh explains. "The harvested energy in terms of hot water is then stored and used for heating during night hours or winter months."

In addition to the development of a movable solar collector that tracks the movement of the sun, another technical challenge was the design of the lenses, Van Tilborgh recalls. "The lens material had to be able to collect and focus the direct sunlight, without absorbing diffuse sunlight which is required by the plants." After testing a few different materials, the clear choice was acrylic, particularly PLEXIGLAS® Solar. Injection-molded lenses made from PLEXIGLAS® are manufactured by the plastics specialists at Pekago Covering Technology. "We decided on PLEXIGLAS® because it transmits light extremely well and offers long-term stability—especially compared to other plastics," Van Tilborgh explains. PLEXIGLAS® Solar is a specialty molding compound that has been modified to transmit the wavelengths of light that plants need for their growth, while at the same time offering even higher UV stability. "That means it will retain its high light transmittance for decades," notes Peter Battenhausen, Senior Business Manager at Evonik. "Plus, PLEXIGLAS® is capable of reproducing surfaces with tremendous precision, and without that we wouldn't even have been able to produce the highly precise, 1,25 mm prism structures."

### *Proving its merit*

The first Daylight Greenhouse, which covers an area of 4,000 square meters, was completed in the Netherlands in 2014 and is operated by Ter Laak Orchids. The company was so convinced that it immediately put another greenhouse in operation in the summer of 2018—more than ten times larger than the first. "In our new greenhouse we're saving 40 percent of our heating costs, and the greenhouse produces roughly half of the energy we need all by itself," says Richard ter Laak, Managing director of Ter Laak Orchids. "Moreover, the climate in the greenhouse is more uniform, which means we lose fewer plants to disease and fungus." The greenhouse functions without extra shadowing which is a huge benefit in the winter months, where up to 40

percent more diffuse sunlight finds its way to the plants. “That’s perfect for our orchids,” says Ter Laak.

In addition to orchids, Daylight Greenhouses are also suitable for all other plants that like the shade. “That’s especially common for a lot of houseplants, for example. As opposed to vegetables like tomatoes or cucumbers, which usually need as much sunlight as they can get,” Van Tilborgh says. Daylight Greenhouses can be used anywhere in the world, “but regions where it gets relatively cold at night really showcase their advantages.” In hot regions, however, the energy they collect could also be used for absorption cooling. A new generation of greenhouses for many uses—enabled by PLEXIGLAS® molding compounds.

#### **Two brands, one product**

Evonik is a worldwide manufacturer of PMMA products sold under the PLEXIGLAS® trademark on the European, Asian, African and Australian continents and under the ACRYLITE® trademark in the Americas.

#### **About Evonik**

Evonik is one of the world leaders in specialty chemicals. The focus on more specialty businesses, customer-orientated innovative prowess and a trustful and performance-oriented corporate culture form the heart of Evonik’s corporate strategy. They are the lever for profitable growth and a sustained increase in the value of the company. Evonik benefits specifically from its customer proximity and leading market positions. Evonik is active in over 100 countries around the world with more than 36,000 employees. In fiscal 2017, the enterprise generated sales of €14.4 billion and an operating profit (adjusted EBITDA) of €2.36 billion.

#### **About Performance Materials**

The Performance Materials Segment is managed by Evonik Performance Materials GmbH. The segment focuses its global activities on developing and manufacturing polymer materials and intermediates, especially for use in agriculture and in the rubber and plastics industry. In 2017, the segment’s roughly 4,400 employees generated sales about €3.8 billion.

#### **Disclaimer**

In so far as forecasts or expectations are expressed in this press release or where our statements concern the future, these forecasts, expectations or statements may involve known or unknown risks and uncertainties. Actual results or developments may vary, depending on changes in the operating environment. Neither Evonik Industries AG nor its group companies assume an obligation to update the forecasts, expectations or statements contained in this release.