

greenhouse

JOURNAL

PROFITABLE GROWTH UNDER ACRYLIC MAY 2007

A queen with a conscience

Against the backdrop of rising energy costs and the ongoing debate about CO₂ emissions, companies that squander energy will probably have a hard job staying in the market. Energy will account for an increasing share of the overall costs of running a greenhouse.

Growing orchids consumes a great deal of energy, so orchid growers keep a keen eye on costs. That's why more and more greenhouses, especially in the Netherlands, are glazed with PLEXIGLAS® because its excellent heat insulation offers significant benefits.

[Keynote] — Grace, purity, elegance and beauty are the attributes of a queen. So it's no wonder orchids are seen as the aristocrats of pot plants. They also call for right royal treatment during their cultivation. Lavishly tended, nurtured and checked, they feel happiest at 27 degrees Celsius.

Not exactly the average temperature in the Netherlands, the world's largest supplier of orchids. To thrive in Europe, these tropical plants are raised under artificial conditions of heat and humidity. That makes them real energy fiends. Good heat insulation and energy conservation have long been particularly important in this branch of industry, and call for efficient glazing. Double glazing with U-values of less than 3W/m²K should be the rule.

Many growers rely on PLEXIGLAS® to keep heating costs down to an acceptable level. "It transmits more light than other materials, insulates better than conventional single glazing and therefore saves energy. It's also highly resistant," explains Michael Haussmann, responsible for the greenhouse market in Degussa's Acrylic Sheet Business Line.

Double-skin sheets for pot plants

Growers of pot plants in particular opt for energy-saving, light-transmitting

PLEXIGLAS® when it comes to converting existing greenhouses or building new ones. The insulating air cushions in the double or triple-skin sheets offer particularly high thermal resistance and are therefore more suitable than single glazing. The more layers of air, the better the heat insulation. Greenhouses are normally built with two skins at most, to retain the highest possible light transmission.

These facts also convinced Arjen Peerdeman, an orchid grower from Zaagdijk-Oost. This cost-conscious and environment-minded operation chose PLEXIGLAS ALLTOP® SDP as the economical solution to energy consumption in greenhouses. "Not only do plants flower better thanks to the UV transmission of PLEXIGLAS ALLTOP® SDP, the air cushions in the double-skin sheets help us save energy. That means I can do my bit for the environment and get better results at the same time. PLEXIGLAS ALLTOP® SDP has convinced us, and that is why we are presently

adding another 6,800 square metres of greenhouse capacity."

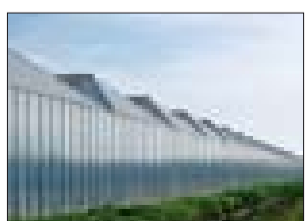
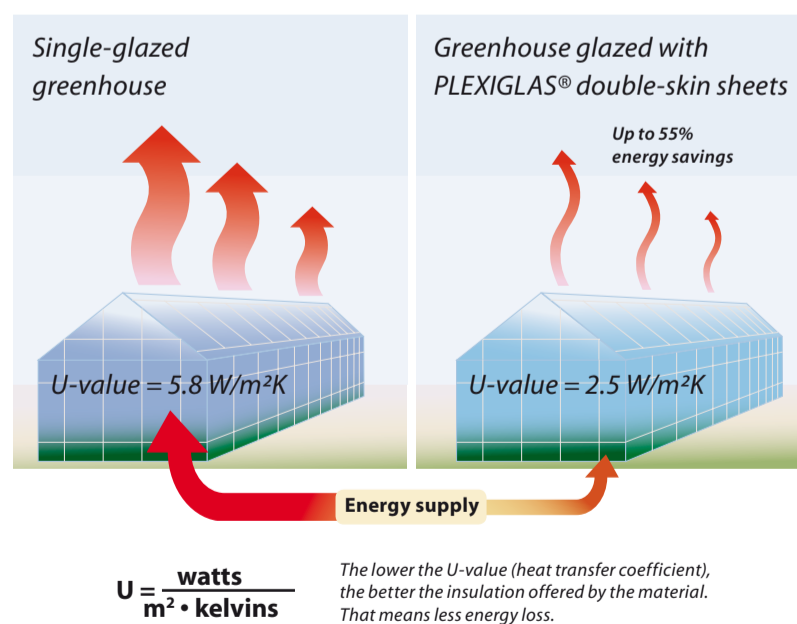
"The Netherlands is our most important market at present, and one the whole world is watching. A total greenhouse area of 200 hectares are glazed with PLEXIGLAS® in the Netherlands. This is where trends are set," Michael

Haussmann says. "The crucial factor is that we can provide these leading global plant specialists with exactly what their plants need."

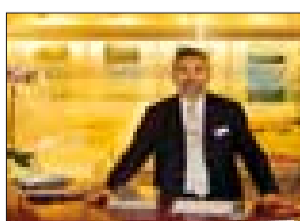
For Eric Moor, that means PLEXIGLAS RESIST® double-skin sheet. The Dutch horticulturalist produces flowering Phalaenopsis orchids in Europe's most modern greenhouse. His colleagues, who grow Phalaenopsis seedlings, have slightly different requirements and therefore depend on PLEXIGLAS ALLTOP® SDP. These sheets transmit UV light and let the entire solar spectrum into the greenhouse.

Kees Schoone has 60,000 square metres of ultramodern production space at his disposal at Floricultura in the Dutch town of Heemskerk. Energy conservation was what prompted him to choose PLEXIGLAS ALLTOP® double-skin sheets. "I save about 40 per cent in energy costs as compared with traditional single-glazed greenhouses," he reckons. This figure is confirmed by

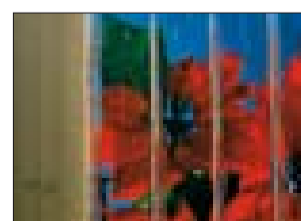
Energy saving: how PLEXIGLAS® compares



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The face of climate protection: Phalaenopsis seedlings in one of Europe's most modern PLEXIGLAS RESIST® greenhouses in De Lier, Netherlands

the Institute of Agricultural and Environmental Engineering (IMAG-DLO), which established that energy savings of 24 to 55 per cent can be achieved using PLEXIGLAS ALLTOP®. "The UV transmission also has a positive effect on seedling growth. So we are investing in vigorous growth and energy saving," says Kees Schoone, whose business grows some 30 million orchids per year.

The same applies to the Phalaenopsis orchid "nursery" of specialist Ed Meeuwissen at Orchids4ALL in Aalsmeer near Amsterdam. The greenhouses built there in 2001 by greenhouse specialist Bosman using PLEXIGLAS ALLTOP® SDP have now been extended to 25,000 square metres.

Scandinavia and North America are catching up

"PLEXIGLAS® is not just the trend in the Netherlands – Scandinavian countries and North America are catching up," Haussmann says. But there are climatic differences that influence the choice of material. Andy Matsui in Salinas Valley, California, chose PLEXIGLAS RESIST® SDP in 8mm thickness. That is important because California is very hot in the daytime, but cool at night, so the temperature deficit has to be balanced and the heat level kept constant.

America's largest grower of potted orchids is presently expanding again. The Matsui Nursery is glazing a further 15,000 square metres of greenhouse with PLEXIGLAS RESIST® SDP 8, bringing the total area glazed with PLEXIGLAS® to 50,000 square metres. Matsui also began several years ago to refit his older greenhouses successively with the long-lasting eight-millimetre-thick double-skin sheets. His total greenhouse capacity is an impressive 30 hectares. "The 21st century belongs to the orchid," Matsui says. He expects the demand for orchids to grow steadily.

The greenhouse of the future

Orchids are not the only pot plants and ornamental varieties to thrive under PLEXIGLAS®, which is often chosen to cut energy costs. "There is clearly a trend towards the low-energy greenhouse, and the Netherlands plays a pioneering role, with plans for greenhouses that can be heated completely without fossil fuels," Michael Haussmann tells us. (See also interview on page 3). *sew*

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30 years of value for money

Plant grower Teun Van der Eijk built his first greenhouse with PLEXIGLAS® in 1977

[Users] — Thirtieth birthdays are usually celebrated in style, and Teun Van der Eijk in the Dutch town of Woubrugge has every reason to follow suit.

Thirty years on, his greenhouse made of PLEXIGLAS® double-skin sheet still looks just like it did in 1977, when it was built. The double-skin sheets have withstood almost 11,000 days of sun, rain, wind, storms and hail. Van der Eijk reckons they have long paid off: "I save 40 per cent on energy as compared with single-glazed greenhouses." The 10,000 square meters of PLEXIGLAS® installed in 1977 are still fully functional and just as light-transmitting as on day one. "We opted for PLEXIGLAS® back then because the double-skin sheets keep heat levels constant, so we can save energy. And we were also convinced by the material's strength and loadbearing capacity. Here in the Netherlands, we have lots of storms, and ordinary glass wouldn't stand up to them for very long," says Van der Eijk.

Turning back time

When Teun Van der Eijk glazed his first greenhouse with PLEXIGLAS®, he had no idea that, 30 years later, he would own not only the world's largest PLEXIGLAS® greenhouse, but also one of the oldest. Today,

house plants and flowering pot plants spread out as far as the eye can see over an area of 8 hectares, under 100,000 square meters of PLEXIGLAS® multi-skin sheets. These have by far exceeded the expectations placed in the material.

Part of the 100,000 square meters were glazed with highly heat-insulating, 32mm thick triple-skin PLEXIGLAS® sheets. These provide energy savings of up to 60 per cent. "We use triple-skin sheets particularly for growing non-flowering plants, because they require less light, but are cost-critical". PLEXIGLAS ALLTOP® double-skin sheets were also used to glaze the eight-hectare greenhouse.

Teun Van der Eijk employs environmentally friendly growing methods, not just by saving energy thanks to PLEXIGLAS®. "We do our best not to pollute the environment. So we water most of our plants with an 'ebb and flood' system. The water that is not absorbed by the plants is collected in a special reservoir and used again," he reports. "That also collects the fertiliser that doesn't stay in the soil." In 1998, Van der Eijk won the National Horticultural Prize for his exemplary methods. "So it's worthwhile saving energy, and by choosing the right glazing, we can go a long way towards reducing environmentally harmful CO₂ emissions as well." *sew*



Durability as a success factor: Teun Van der Eijk in his "anniversary greenhouse"

A walk down memory lane with Teun van der Eijk, Woubrugge, Netherlands

Year	Event
1977	The first 10,000 m ² of PLEXIGLAS® double-skin sheets were installed. Energy saving of some 40%.
1978	Area increased with 4,000 m ² of PLEXIGLAS® double-skin sheets
1981	The first 9,000 m ² of PLEXIGLAS® triple-skin sheets were installed. Energy saving of some 60%.
1984	Area increased with 7,000 m ² of PLEXIGLAS® triple-skin sheets
1985/1986	Area increased with 30,000 m ² PLEXIGLAS® triple-skin sheets
1989/1991	Area increased with 23,000 m ² PLEXIGLAS® NO DROP double-skin sheets
1998	V.D.E. plant won the "Nationale Tuinbouw Ondernemersprijs 1998" (NTO, National Horticultural Prize)
2006	Area increased with 16,000 m ² PLEXIGLAS ALLTOP® double-skin sheets

"The first greenhouse with PLEXIGLAS® double-skin sheet was built in 1969. After the first energy crisis in the 1970s, more and more gardeners built PLEXIGLAS® SDP greenhouses."



Greenhouse specialist Michael Haussmann at the Hortifair exhibition in Amsterdam

"It will become increasingly important to save energy"

Michael Haussmann on environmental consciousness in the greenhouse market

[Interview] — Michael Haussmann is the greenhouse construction specialist at Degussa. He has been in charge of this segment for over 20 years, and the extensive knowledge of the market he has acquired makes him a highly qualified contact for customers. Within the company too, Haussmann's experience has driven further developments to meet market requirements. In past years, there has been a lively demand for PLEXIGLAS® in the greenhouse construction market. In our interview with Michael Haussmann, he looks back in time and into the future.

How does the greenhouse market of 20 years ago compare with today's market?

Michael Haussmann: Single glazing was widespread throughout Europe, and remains so today. In southern Europe, especially in Mediterranean countries, single film glazing is the dominant form. The world's largest film-covered greenhouses are found in Asia, due to the low price. But film-covered greenhouses have to be renovated at regular intervals.

The first greenhouse with PLEXIGLAS® double-skin sheet was built in 1969. After the first energy crisis in the 1970s, more and more gardeners built PLEXIGLAS® SDP greenhouses. The first greenhouse with PLEXIGLAS® SDP measuring one hectare in size has stood on Teun Van der Eijk's premises in the Netherlands for 30 years. He is so satisfied with the material that he has now expanded his capacity to eight hectares.

Röhm shook up the greenhouse market 20 years ago with the improved NO DROP sheet. This prevents dripping and condensation for better light transmission. The idea was born at the Darmstadt

Greenhouse Forum in the presence of many international horticulturalists and spelled the breakthrough for PLEXIGLAS® double-skin sheet in the gardening sector. For the first time, it was possible to combine high energy savings with excellent light transmission. That is extremely important for plants, which are, after all, what greenhouses are all about.

Further optimisation led to the ALLTOP sheet, with improved properties. It now offers a light transmission of 91 per cent, which puts it in the same league as single glazing. Low-energy greenhouses with ALLTOP double-skin sheets and heat shielding save over 50 per cent of heating costs. The double glazing of greenhouses with highly transparent PLEXIGLAS® ALLTOP SDP is therefore a very successful and extremely effective measure to save heating costs, as well as being the perfect solution in terms of ease of installation and plant growth.

What will the greenhouse of the future look like, and how will it evolve?

Michael Haussmann: Attempts will be made to shake off the dependence on conventional fuels such as natural gas and oil. Obviously, the aim is to cut consumption drastically. Horticultural research is also looking into this issue.

The Netherlands has made the most progress in this direction. Research competitions like "Kas 2020" (Greenhouse 2020) and "Kas als Energiebron" (The greenhouse as a source of energy) are in full sway. Greenhouse builders and operators have set themselves the aim of building only zero-energy greenhouses by 2020. Pilot projects entitled "Kas zonder Gas" (Greenhouse

without gas) are meeting with lively interest, as was recently shown by the visit of Dutch Prime Minister Jan Peter Balkenende to orchid specialist Maurice Van der Hoorn. At his premises, a high-tech greenhouse was built last year with a roof containing 15,000 m² of PLEXIGLAS® ALLTOP that make a major contribution to energy savings.

Where do you see the main market in greenhouse construction?

Michael Haussmann: The Netherlands clearly remains the major market. The highly specialised businesses there secure a global edge for the Netherlands in the field of horticulture. The country is also home to the leading international horticultural exhibition "Hortifair" in Amsterdam.

The Netherlands has the world's most modern greenhouses, which can grow everything from pot plants and cut flowers to vegetables. Five per cent of all ornamental plants grown in Dutch greenhouses grow under PLEXIGLAS® double-skin sheet. That corresponds to some 200 hectares.

What are the national differences in the choice of material?

Michael Haussmann: Obviously, differences do exist. Demand is growing sharply in all U.S. states. Even in the Sunshine State (California), we detect a clear trend towards energy-saving and therefore environmentally friendly cultivation. Andy Matsui in Salinas, for example, the major producer of orchids in the USA, has been using energy-saving PLEXIGLAS® RESIST double-skin sheets for his greenhouses for several years. Toni Barcelo, a big producer of pot plants, and vegetable producers like

Hollandia in California cultivate their plants under energy-saving PLEXIGLAS® double-skin sheets.

In Asia, Japan presently holds first place, with many small family businesses that cultivate orchids, pot plants and cut flowers, but also fruit and vegetables, in greenhouses glazed with PLEXIGLAS®.

In Europe, we have the largest number of PLEXIGLAS® greenhouses in the cool North, in Scandinavian countries. But on average, the greenhouses here are a good deal smaller than in the Netherlands.

Throughout the world, 700 hectares of greenhouse area are covered with PLEXIGLAS®.

What will be the trend in years to come, and how will it influence the greenhouse market?

Michael Haussmann: The need to save energy is growing, and awareness of that need is also becoming keener. Everyone is talking about how to reduce CO₂ emissions at the moment. Single glazing is simply no longer state-of-the-art, and the trend is towards low-energy greenhouses. The solutions offered by PLEXIGLAS® are a step in the right direction. *sew*

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PLEXIGLAS® – cream of the crop

Materials for greenhouse construction



Visible quality: on the left, conventional polycarbonate double-skin sheets showing pronounced signs of weathering that let in less sunlight. Right: clear view with PLEXIGLAS ALLTOP® double-skin sheets.



Right: The NO DROP coating applied on both sides and inside the cavities of PLEXIGLAS ALLTOP® double-skin sheets causes water drops to form a continuous thin film. The sheets thus retain their high light transmission. Left: Double-skin sheets without NO DROP coating. Condensation obscures the view and blocks out sunlight.

[Material] — Depending on the variety, plants require different conditions in order to flourish. Whereas bedding and balcony plants thrive at relatively low temperatures, tropical plants and orchids prefer a very warm climate with high, stable atmospheric humidity. And the greenhouse has to take these conditions into account. So the choice of glazing determines what the greenhouse can be used for.

Glass – plenty of light, little heat insulation

Although conventional single glazing transmits plenty of light, it cannot offer adequate insulation and is liable to breakage.

PLEXIGLAS® double-skin sheets share the high light transmission of glass, but also have many other properties that are particularly beneficial for greenhouses. With their very good heat insulation, superior light transmission, excellent weather resistance, stability and impact strength, they combine the crucial attributes required for growing plants. These double-skin sheets come in two variants: PLEXIGLAS ALLTOP® SDP and PLEXIGLAS RESIST® SDP. PLEXIGLAS ALLTOP® double-skin sheets have the NO DROP coating on both surfaces and inside the cavities. This coating causes water drops to form a continuous thin film of water. Thanks to this water-dispersing effect, there are no reflections, and no water drops that can act as magnifying glasses. This special coating prevents dripping, makes condensation all but invisible and lets in plenty of light, including UV light. Plants can therefore grow under natural lighting conditions. That is a decisive factor for many gardening businesses, because UV light is particularly important for dark green leaves

and colourful blossoms in many varieties of plant. Growers of seedlings appreciate the level of UV light in greenhouses glazed with PLEXIGLAS® ALLTOP because they promote vigorous and compact growth of plants that are highly suitable for further cultivation.

PLEXIGLAS RESIST® double-skin sheets have other strengths, too. They are extremely tough and hail-resistant. In comparison with PLEXIGLAS® ALLTOP sheets, they only have the NO DROP coating on one side. Installed with the coated side facing the plants, this also prevents dripping and provides high levels of light transmission.

The pros and cons of PLEXIGLAS®

PLEXIGLAS® double-skin sheets cost more than other materials, but the difference in price is made up for within only a few years by their durability, energy savings and improved plant growth. In keeping with this superior quality, the guarantee against loss of light transmission and against yellowing has recently been extended to 30 years. Added to this is the ten-year hail resistance guarantee for PLEXIGLAS RESIST® multi-skin sheets.

PLEXIGLAS® quadruple-skin sheets offer even greater energy savings because the added layers and air cushions result in better heat insulation. But since they also reduce the light transmission, they are only used where this property is not so important – say, for tropical plants that require a lot of heat but less light. *sew*

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Overview of PLEXIGLAS® multi-skin sheets for horticulture

	PLEXIGLAS ALLTOP® SDP 16 Clear	PLEXIGLAS RESIST® SDP 8 Clear NO DROP	PLEXIGLAS RESIST® SDP16 Clear NO DROP	PLEXIGLAS RESIST® S4P 32 Clear NO DROP
Light transmission (%)	ca. 91	ca. 84	ca. 86	ca. 76
UV transmission	yes	no	no	no
Sheet thickness (mm)	16	8	16	32
Cavity width (mm)	64	16	32	32
Sheet width (mm)	980 1053 1200	1200	980 1200	1230
U-value (W/m²K)	2.5	3.4	2.5	1.6
Energy savings as compared with single glazing (%)	40 – 50	ca. 30	40 – 50	ca. 60
NO DROP coating	on both sides and inside cavities	on one side	on one side	on one side
ALLTOP grade	yes	no	no	no
Hail guarantee	no	yes	yes	yes
Max. service temperature (°C)	70	70	70	70
Fire rating to DIN 4102	B2	B2	B2	B2
Gable-roof greenhouses Venlo and wide-bay systems	yes	yes	yes	yes
Tunnel greenhouses	no	yes	yes	no