



Whitepaper: PHORMITEX NOCTIS THERMO

MORE INSULATING THAN CONVENTIONAL SCREENS

The current energy prices require more than ever energy saving measures. But also in the long term, as the horticulture industry is aiming to be climate neutral in the future, lower energy consumption is very much needed. Two or even three climate screens in a greenhouse are undeniably part of the solution because an extra screen significantly increases the insulation value of a greenhouse. But have you realised that this extra screen better be not transparent?

With that approach Phormium introduces a new type of screen: the night screen. However, the concept itself is not new. Night screens are frequently mentioned in studies about energy saving and the theory of **Plant Empowerment**. Until now, however, they were not yet commercially available at an affordable price.

In addition to higher energy saving than conventional energy screens, **PhormiTex Noctis Thermo** offers also other benefits. It lowers the crops heat emission, increases the crop temperature, and mitigates the risk for diseases. Furthermore, the screen goes hand in hand with the transition to LED lighting that is in full swing today.

ENERGY SAVING: GETTING THE MAXIMUM OUT OF IT

Today, the switch to an extra energy saving screen is smaller than ever. At the current energy prices the investment of an extra screen pays off in about 1 year thanks to the extra energy saving. But an extra screen means also extra light loss.

Therefore, extra energy screens are often only used during the night. As soon as the sun rises the screen is opened. After all, the biggest savings can be achieved during the night. During the day, plants should be able to take maximum advantage of the scarce sunlight.

It might be wondered why the second energy saving screen should be transparent in that case. After all, a transparent energy saving screen is far from the best energy saving screen, those are the aluminized ones.

Therefore, whoever chooses **PhormiTex Noctis Thermo** as an extra screen instead of a conventional transparent energy screen is really getting the maximum out of it.



Simulations show that PhormiTex Noctis Thermo saves 7% more energy on a yearly basis on top of the 15% savings that a second transparent screen already accomplishes. On top of that comes the durability and solidity of its woven structure, backed up by a unique 8-year warranty that Phormium offers on all its woven screens.



A LIGHT RESTRICTION SCREEN AS WELL

Thanks to the presence of aluminium **PhormiTex Noctis Thermo** has also excellent light blocking capabilities. Therefore, it can be used as a more energy saving light restriction screen for lighted crops. That makes two for the price of one: **light restriction + energy saving**.

In particular, **PhormiTex Noctis Thermo** is valuable for those greenhouses where LED lighting is used. The excellent energetic efficiency and optimised light spectrum make LED the lighting technology of the future. It is not surprising that today more and more growers invest in an installation that partially or completely consists of LED lamps.

For the same amount of PAR light, a LED lamp supplies less radiative energy to the crop which results in a lower crop temperature. To compensate, the temperature of the heating pipes is often increased. Thanks to the insulating aluminium **PhormiTex Noctis Thermo** realises a higher crop temperature than conventional screens. Therefore, a higher pipe temperature is less needed.

PhormiTex Noctis Thermo enables growers to year-round grow a healthy crop with less energy than a conventional light restriction screen.

LESS HEAT EMISSION AND A HIGHER CROP TEMPERATURE

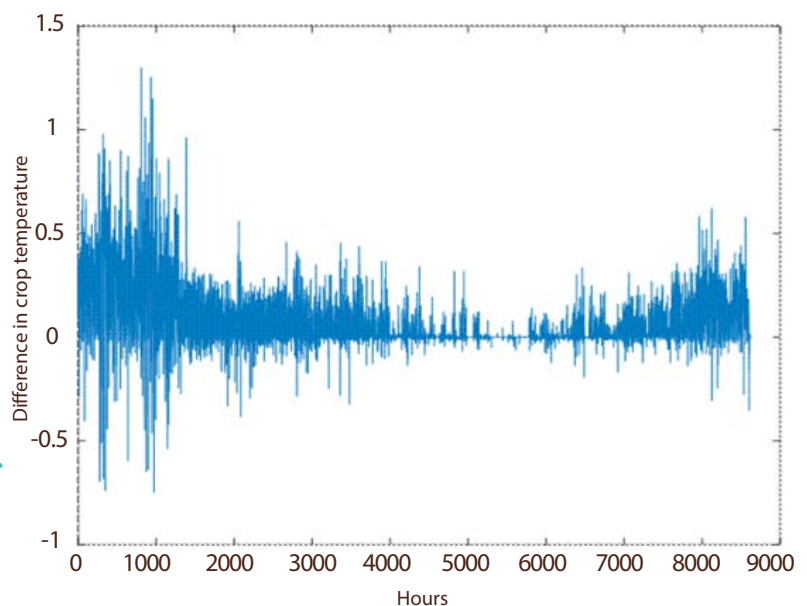
The theory of **Plant Empowerment** stresses the importance of low heat emission. Heat emission equals energy losses. Lower energy losses result in more residual energy which the crop can use to keep evaporation ongoing.

Lower heat emission means also higher crop temperature which in turn reduces the risk of condensation on the crop. Condensation must always be avoided to prevent fungal diseases like Botrytis.

The aluminium particles in **PhormiTex Noctis Thermo** reflect thermal radiation back to the plant. In other words, the screen is a barrier to radiative energy losses resulting in lower heat emission and risk of condensation.

The graph shows how many degrees the crop is warmer when using a transparent energy screen + **PhormiTex Noctis Thermo** instead of two transparent energy screens over a full year.

Source: Simulated by Future Farms, Esteban Baeza





WHAT MAKES THE SCREEN SO UNIQUE?

PhormiTex Noctis Thermo answers current questions because of high energy prices, the need for sustainability and the switch to new assimilation technologies. It optimises the thermal properties of energy and light restriction screens but maintains the moisture transporting properties.



This is possible through the combination of moisture transporting yarns and Phormiums unique **MeP™-technology**. With this technique microparticles of aluminium are encapsulated in the screen. Unlike certain coatings this encapsulation assures a long-lasting mechanical bond over time.



Microscopic photo of the aluminum particles encapsulated in PhormiTex Noctis Thermo

On top of that the screen meets the strictest standards for fire retardancy in the horticulture industry. Furthermore, Phormium is in full control of the production process. Tape extrusion, weaving and finishing of the screen is all done inhouse. This makes the screen durable and affordable.

WHICH GREENHOUSES ARE ELIGIBLE?

In greenhouses where one wants to install an extra energy screen it is advisable to consider **PhormiTex Noctis Thermo**. Also, in greenhouses where currently two or more screens are installed it is worth considering replacing one of those by the night screen. The screen to be replaced can be an energy or light restriction screen.

In general terms the setup of the screens has to meet the conditions below.

- ◆ There is one screen that is used as a daytime screen. This can be an energy or shading screen.
- ◆ There is (possibility of) a second screen that is used as a nighttime screen. The second screen will then be **PhormiTex Noctis Thermo**.

HOW IS PHORMITEX NOCTIS THERMO USED?

PhormiTex Noctis Thermo is engineered to behave the same as a conventional energy or light restriction screen in terms of moisture transport. Growers who have already experience with growing with two screens will not have to adjust the screening strategy too much.

Who is not familiar with using multiple screens will have to undergo a learning curve. The use of two screens has consequences for the moisture and heat management in the greenhouse.

Phormium has developed services in collaboration with experienced third parties that make it possible to give growers tailor-made advice. For more information one can contact the Phormium specialist team.



NUMBERS

The example below shows the difference between a transparent energy screen and **PhormiTex Noctis Thermo** as second screen on a yearly basis. Assuming a gas price of 1,00 euro/m³ a **yearly extra saving of 35.000 euro** can be realized. **This equals 7% of extra energy savings on top of the 15% savings that a classic transparent 2nd screen already accomplishes.**

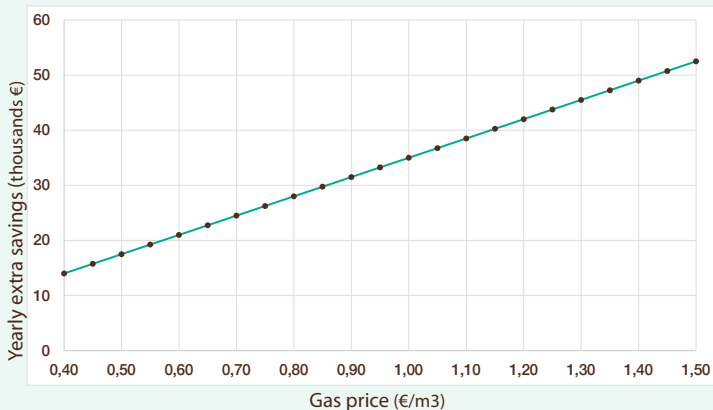
Annual extra savings realized by PhormiTex Noctis Thermo at a gas price of 1,00 euro/m³, tomato cultivation, The Netherlands



	Classic setup	New setup
Screen 1 - Daytime screen	Energysaving screen	Energysaving screen
Screen 2 - Nighttime screen	Energysaving screen	PhormiTex Noctis Thermo
Climate	The Netherlands	The Netherlands
Greenhouse size (ha)	5	5
Crop	Tomato	Tomato
Transplantation date	December	December
Removing date	November	November
Gas price (€/m ³)	1,00	1,00
Yearly heating cost - €/year.5 ha)	1.900.000,00	1.865.000,00
Yearly savings - €/year.5 ha)	490.000,00	525.000,00
Marginal yearly savings - €/year.5 ha)	/	35.000,00

Because no one can predict the future gas price, the annual extra saving as a function of the gas price is plotted below.

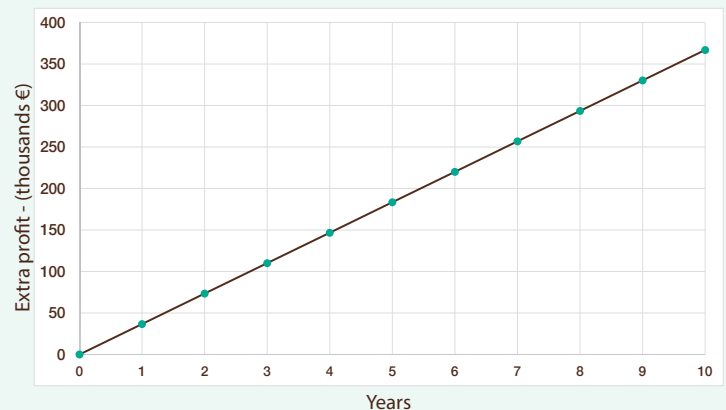
Annual extra savings realized by PhormiTex Noctis Thermo as a function of the gas price, with tomato cultivation, The Netherlands:



Let's also include the payback time and the cost of ownership. At the current gas price, a screen installation that includes **PhormiTex Noctis Thermo** + a classic, transparent energy screen pays off in 7 months. The cost of ownership of this screen installation is also lower than the one of a screen installation that includes two classic, transparent energy screens. This is possible due to the durable, woven structure and the materials used. This guarantees a longer service life.

The higher savings and the lower cost of ownership reinforce each other and lead to higher annual profits. The graph below shows the realized extra profits as a function of time when using **PhormiTex Noctis Thermo**.

Extra realized profit as a function of time when using PhormiTex Noctis Thermo, with tomato cultivation, The Netherlands:



FUTURE FARMS

These results are modelled by use of the simulation software Greensim of Future Farms. This consultancy company is led by Esteban Baeza, former researcher at Wageningen UR.