

A man with a friendly smile, wearing a light blue button-down shirt, stands in a greenhouse. He is holding a black tray filled with several bouquets of roses in various colors (yellow, pink, red, white). The bouquets are wrapped in clear plastic and have a circular logo that says "KORDANA QUALITY Approved". The background shows the structure of the greenhouse with rows of plants and bright LED lights hanging from the ceiling.

PHILIPS

Horticulture
LED Solutions

GreenPower
LED toplighting



**Growth like
never before**

Break the barriers of yields and quality



Philips GreenPower **LED toplighting**

Want to take your greenhouse to the next level of productivity ?

Now is the time for LED toplighting in greenhouses to grow better crops and a more profitable business.

Our GreenPower LED toplighting delivers very high light output, while radiating much less heat than HPS toplighting. That means you can control light and temperature more separately from each other to reach unprecedented lighting levels for your plants and gain more control over growing conditions. Your operating costs per kilogram or stem are also lower than ever.

LED toplighting can shorten growth cycles, increase yields, reduce energy and enable more economic use of space. These results may vary depending on the crops being grown and the type of LED installation. Add our proven light recipes and you can further control plant growth, development, and/or nutritional content to produce unique results that differentiate your business in the market.



Improve your production

- Shorten growth cycles
- Improve shelf life, color, shape, and taste
- Grow with more control over your climate
- Grow year round in low greenhouses



Cut operational costs

- Save 32 - 46% on energy costs compared to HPS toplighting
- Reduce cost of power infrastructure to obtain your light level
- Avoid costly remodeling with easy plug and play installation
- Lower maintenance costs with long-lasting LED technology

Improve your greenhouse practices

How can you be sure you are getting the maximum value from your lighting? We provide expert know-how and support for your LED solution. Are you thinking improvement or cost reduction? Draw upon cultivation advice from our in-house plant specialists to address your specific needs. Get accurate calculations and lighting plans from our technical experts to assess your options.

Light recipes - the right ingredients for every plant and phase

Our support also includes advising you on a dedicated "light recipe" that takes your growing strategy into account. A light recipe combines the following elements: light spectrum, intensity, illumination moment, uniformity, and positioning. Our light recipe knowledge has been developed over many years of cooperation with growers, universities, and research sites to enhance growth. Different light recipes allow you to steer specific plant characteristics, from compactness, color intensity, and branch development to flowering and more so you improve your results.



Grow more and grow better

Philips GreenPower LED toplighting combined with our dedicated light recipes, open up new opportunities for every greenhouse grower to increase their quality and yields and move to year-round production. LED toplighting offers light output levels typically ranging from 360-520 $\mu\text{mol/s}$ at a very high efficiency reaching 2.7 $\mu\text{mol} / \text{J}$. It offers growers unique advantages as a direct replacement for traditional lighting systems or as an energy-efficient supplement.



Key benefits of LED toplighting

Give your plants all the light they need

LED toplighting produces significantly less heat, especially less radiation heat, than conventional HPS lamps, so you can adjust light and temperature more independently. This lets you control your greenhouse climate more precisely and grow better crops, faster, year-round. Less heat gives you more flexibility to use light more effectively, for example by increasing light levels, extending lighting periods, or by using light on warmer days without having to ventilate. Less heat also means you can place the light source closer to your plants to reduce light loss – so close in fact that you can now use toplighting even in low-ceiling greenhouses.

“Because LEDs hardly generate any radiation heat, it is possible to control the temperature and the lighting separately.”

Leo van der Harg, Manager, Leo van der Harg BV

Give each plant the right light for growth and development

Philips GreenPower LED technology lets you harness the full power of the light spectrum to stimulate photosynthesis and growth in an effective way and/or steer plant development and morphology. Seven spectral versions have been developed based upon years of intensive collaboration with research facilities and universities around the world. The modules that include white light are convenient when people need light to work.

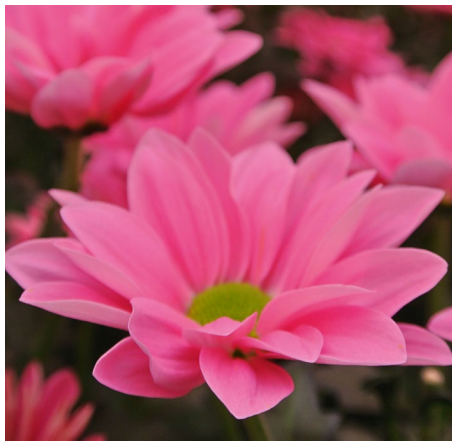
Use for every greenhouse and crop

Philips GreenPower LED toplighting is designed to be used for virtually any greenhouse situation. It comes in linear modules to provide maximum flexibility for designing light plans that can apply different light levels, are highly uniform, easy to install, with low light interception. The modules are compatible with the C-profile (reducing light interception) and can be assembled head-to-tail in continuous lines or clustered together with cables between to fit different layouts and crop needs. You can combine LED toplighting with existing HPS installations or mix various spectral versions in one line. You can even combine different light sources to increase the light level in your installation.

Reduce operational costs

LED toplighting can use up to 43-46% less energy than HPS systems at comparable grow light levels ($\mu\text{mol/J}$). Next to lower energy cost for the same light level, toplighting also reduces the cost of installing and maintaining power to your greenhouse. LED technology provides very uniform and targeted light distribution, which minimizes expensive light losses. While conventional HPS lamps usually need to be replaced after 10,000 hours, LEDs still emit at least 90% of their output after 25,000 hours and can last up to five times longer than conventional HPS light sources. Toplighting requires very little or no maintenance, just clean with a damp cloth when dirty. This reduces maintenance costs even further.

Break the barriers of yields and quality



Cut flowers

Get more out of every square meter

For cut flowers, length, weight, vase life, flower color, and uniformity are important quality and production factors. Our years of experience in applying LED for growing roses, gerberas, chrysanthemums, lisianthus, roses and other cut flowers show positive results. With today's advanced LED technology, you can grow cut flowers under full LED or grow flowers under LED combined with existing HPS lighting.

Marjoland nursery states one of the most important advantages of LED for roses is faster shoot development. LEDs also contribute to greener and more economical production.



Pot, bedding and perennial plants

More control over quality, better results

Ornamental quality and growth speed are the key success factors for a potted plant grower. Now you can use light to gain more control over quality and improve your results. Better pigmentation, larger, denser clusters, more branches. Our GreenPower LED toplighting makes potted plants grow faster and more abundantly and can help reduce growth regulators, so your margins go up while your operating costs go down.

Van der Harg produces 10% more flower buds with potted roses. These results are achieved with the same or even shorter growth cycles.



Leafy vegetables and herbs

Faster crop cycles, better quality plants

Leafy vegetables are often grown at relatively cold temperatures, but they flourish under high light levels. In most regions, maximum light levels that can be reached with HPS are limited by the number of lighting hours because the plants need long nights to prevent tipburn. LED produces high intensity light with hardly any radiation heat. In our test in PSKW in Belgium we found we could double the light levels with the same or better quality (compactness, tipburn) compared to HPS. Red coloration of Oak leaf and Lollo Rosso had greatly improved.

One grower produced 20% more heads of lettuce per square meter with the same weight per head, even during winter. This can allow growers to rapidly earn back the return on their LED lighting investment with the same weight per head.

More information about GreenPower LED toplighting recipes

As well as the above-mentioned greenhouse crop segments there are many other types of crops and growth situations where GreenPower LED toplighting could be used for the light recipe. Please contact your local Philips Horti contact person or certified Philips LED Horti Partner for support.

Take advantage of the efficiency and flexibility of a GreenPower LED toplighting solution to increase yield, improve plant quality, precisely control growing cycles, and reduce energy costs in your greenhouse. Our modules are easy to install and their sleek design does not cast shadows in the greenhouse. That makes them ideal whether you use them as a replacement or supplement for your existing lighting system. Growers in every segment can easily benefit from the unique capabilities of GreenPower LED toplighting.



High-wire vegetables like tomato and cucumber

Year-round production, more plants, earlier, heavier fruits

For year-round production, high-wire vegetables like tomatoes and cucumbers need to receive light in the most efficient way. The extra heat produced by traditional HPS light sources often restricts the usage of grow lights in a high-wire greenhouse. Our GreenPower LED toplighting changes all that. It gives you more flexibility to light at times of higher outside temperatures.

The GreenQ/Improvement Center in the Netherlands achieved a high yield of 95 kg/m² with their Komeett tomato variety in last year's trials. The Warsaw University of Sciences (SGGW) in Poland compared crops grown under HPS versus 100% LED with the same light sums in mol/m². This resulted in a 23% higher production of a winter cucumber crop grown under 100% LED lighting, and a 14% reduction in water usage per kilogram.



Strawberries

Better quality fruit, year-round production

Traditionally, strawberry production has been limited to the period between April and November when there is sufficient light to grow the plants. Now the strawberry production period can be started up earlier to the winter months by providing the right amount of light and the right temperatures. GreenPower LED toplighting has the benefit of delivering efficient light without the extra heat that can reduce the quality of fruit.

One trial at Wageningen University in the Netherlands showed a 15% increase in production, a 7-12% increase in vitamin C levels, and improved taste when growing strawberries under additional LED toplighting modules.



Propagation

Better control of seedling quality with reduced cost

Plenty of light and suitable temperatures are key to ensuring the healthy growth and successful propagation of seedlings. Toplighting produces very uniform light at low heat levels. Energy costs for lighting and for cooling can be reduced significantly.

Sichuan Academy of Agricultural Sciences in China has found that they can grow more healthy potato seedlings under Philips LED toplighting. They have also seen a vast improvement in the growth of plant roots.

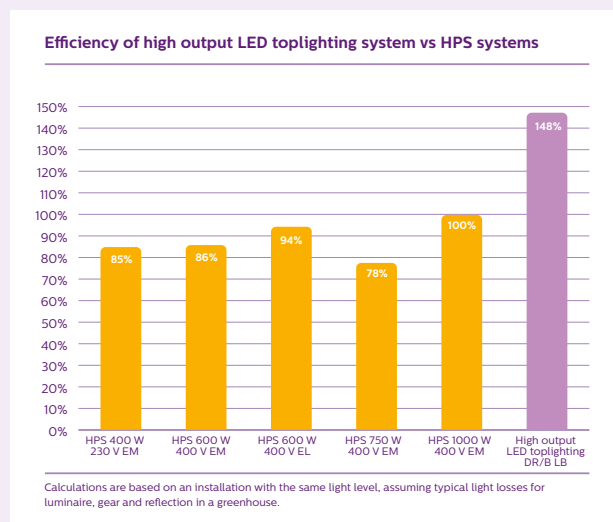
With LED toplighting, Kernock Park Plants improved the propagation success rate for many crops, of which one was even increased from 34% to 96%. Their rooting is quicker, roots are looking much more healthy which has resulted in reduced Botrytis management costs. These results were achieved using 30% less energy compared to HPS lighting.



Produce more light with the same amount of energy

This diagram compares the efficiency of LED toplighting and HPS lighting systems. LED toplighting produces significantly more light using the same amount of energy. That makes it a much more energy efficient choice compared to HPS lighting.

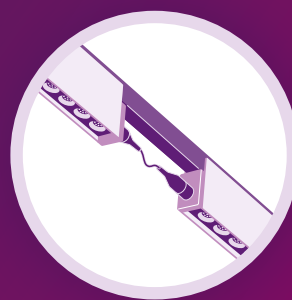
This diagram shows how much more light can be produced in $\mu\text{mol}/\text{J}$ using the same amount of energy.



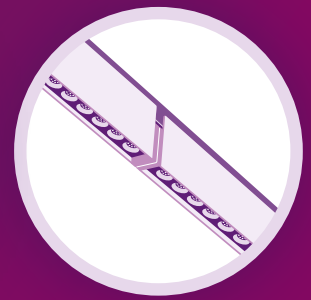
Plug-and-play installation

The modules are designed for easy installation no matter what lighting layout or light levels you need. Depending on the lighting plan for your greenhouse the modules can be simply clicked on to each other head-to-tail, through the integrated connector. Or you can connect them to each other using jumper cables.

How to connect modules



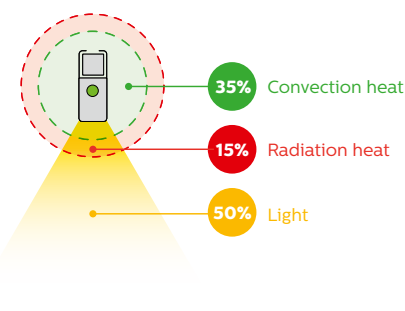
Connect the modules
with a jumper cable...



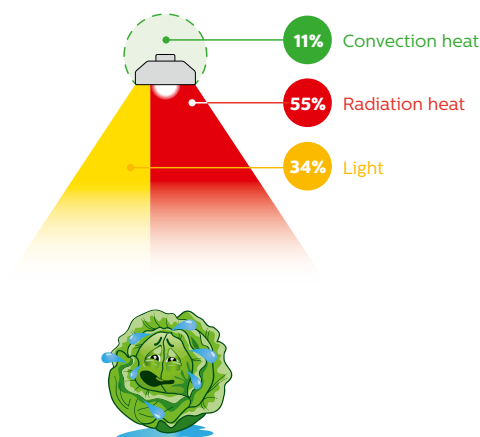
... or click the modules
to each other head-to-tail

High light levels with less heat

Energy Balance LED Toplighting



Energy Balance HPS



This diagram shows how the 100% of energy used by a best-in-class lighting fixture is converted into heat and light. Convection heat radiates upwards and does not affect the crop. A certain amount of energy is converted into radiation heat. High levels of radiation heat can stress or even burn the plants. LED toplighting has low levels of radiation heat, and is therefore ideal for growing cold-loving crops like lettuce and herbs, for warm dark regions and for use in low greenhouses.

Philips GreenPower LED toplighting

Control heat and light separately

Growers no longer have to make trade-offs between the right light and the right temperature in their greenhouse. With GreenPower LED toplighting, you can control light and heat separately to create the perfect solution that makes your crops flourish.

Easy to retrofit

The installed driver makes it easy to install the toplighting module in existing installations without expensive modifications.

Long lifetime of 25,000 hours

While conventional HPS lamps usually need to be replaced after 10,000 hours, LEDs still emit at least 90% of their output after 25,000 hours and can last up to five times longer than conventional HPS light sources.

Thermal design

Each module has a lifetime of 25,000 hours at the initial light level. After that 90% is still guaranteed.



200 V - 400 V
Input voltage

IP66
Ingress protection
rating

**0.95
cos ϕ**
Power factor

Ordering information GreenPower LED toplighting

The unique GreenPower LED toplighting – product range has been fully released in accordance with all safety regulations and has been tested against IEC 60598 by a certified approbation body (Dekra).

Philips has designed several types according to a best practice recipe. This is the outcome of many tests and studies with LEDs we have carried out in recent years in conjunction with universities and growers.

Product specifications and ordering data GreenPower LED toplighting

	Philips GreenPowerLED toplighting	Photon flux ^{1) 2)}	Power consumption (typical) ²⁾	Ordering code
		µmol/s	W	12NC
HIGH OUTPUT	Deep red/blue (DR/B)			
	GreenPower LED toplighting mod. DR/B LB 400V	520	190	9290 009 88506
	GreenPower LED toplighting mod. DR/B MB 400V	520	195	9290 009 88606
	GreenPower LED toplighting mod. DR/B HB 400V	520	200	9290 009 88706
	Deep red/white (DR/W)			
	GreenPower LED toplighting mod. DR/W LB 400V	520	195	9290 009 88806
	GreenPower LED toplighting mod. DR/W MB 400V	520	200	9290 009 88906
	GreenPower LED toplighting mod. DR/W Vision 400V	430	190	9290 009 89006
	Deep red/white/far red (DR/W/FR)			
	GreenPower LED toplighting mod. DR/W/FR_2 MB 400V	410	175	9290 009 89106
REGULAR	Deep red/blue (DR/B)			
	GreenPower LED toplighting module DR/B LB 400V	440	190	9290 008 82206
	GreenPower LED toplighting module DR/B MB 400V	440	195	9290 008 82106
	GreenPower LED toplighting module DR/B HB 400V	440	200	9290 008 82006
	Deep red/white (DR/W)			
	GreenPower LED toplighting module DR/W LB 400V	440	195	9290 008 81906
	GreenPower LED toplighting module DR/W MB 400V	440	200	9290 008 85106
	GreenPower LED toplighting module DR/W VISION 400V	400	190	9290 009 58906
	Deep red/white/far red (DR/W/FR)			
	GreenPower LED toplighting module DR/W/FR_2 MB 400V	360	180	9290 009 59006
	Accessories			
	GreenPower LED toplighting mounting bracket (continuous line) ³⁾			9290 009 15106
	GreenPower LED toplighting mounting bracket (non-continuous line)			9290 009 15206
	GreenPower LED toplighting jumper cable (1,0 mtr) ⁴⁾			9290 009 15306
	GreenPower LED toplighting jumper cable (2,0 mtr) ⁴⁾			9290 009 16006
	GreenPower LED toplighting male connector			9290 009 15406
	GreenPower LED toplighting female connector			9290 009 15506
	GreenPower LED toplighting end cap ⁵⁾			9290 009 15606

¹⁾ Lifetime is given at an ambient temperature of 25 °C rated life to 90% of initial photon flux = 25 khrs.

²⁾ Photon flux and Power consumption values are typical at stable operation at an ambient temperature of 25 °C.

³⁾ Stainless steel ø2.0 mm wire clip including 'locking plate' to fix the modules in an axial direction to prevent the modules working loose as a result of vibrations.

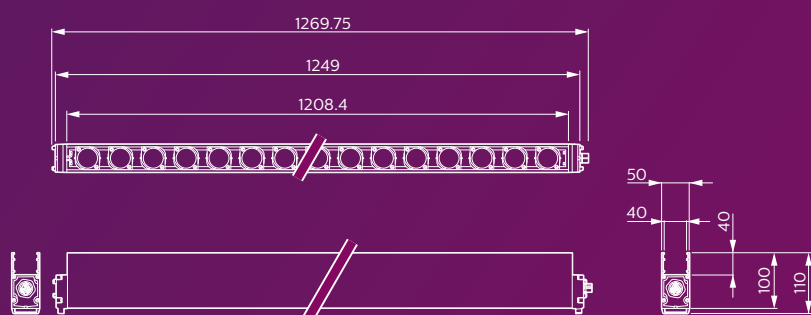
⁴⁾ 3 x 1.5 mm² conductors, 2-sided 'male / female' connector.

⁵⁾ To ensure IP66 rating for every single mounted or last module in a continuous line.

The accessories will be determined per project. This is due to the fact that it depends on the lighting design required for your crop. Please contact your local Philips representative for advise.

Dimensions GreenPower LED toplighting

Product	Dimensions (in mm)		
	Length	Width	Height
GreenPower LED toplighting module	1269.75	50	110
GreenPower LED toplighting module mounting bracket (continuous line)	118	85	47.5
GreenPower LED toplighting module mounting bracket (non-continuous line)	102	55	35.7



GreenPower LED toplighting module mounting bracket (continuous line)



GreenPower LED toplighting module mounting bracket (non-continuous line)

GreenPower LED toplighting Growth like never before

Now is the time to go beyond the current boundaries in your greenhouse business with the new opportunities offered by LED toplighting:

- Grow better quality crops, faster with higher light levels
- Enhance crops with proven light recipes
- Reduce operational cost through reduced energy consumption and long lifetime
- Extend seasons or grow year round as you gain more control over growing climate

What can toplighting do for you?

Please contact Philips or one of our certified Philips LED horti partners for a quick scan to see what LED lighting can do for your greenhouse production, to learn more about local rebate programs, or financing options.



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