

PHILIPS

Horticulture
LED Solutions

GreenPower LED
production module



LED lighting for multilayer cultivation

Helping your business to blossom

Deliscious
Culpa culpa culpa

Growing value with more control

A multi-tiered indoor hydroponic farm. The structure consists of several levels of dark metal frames. Each level holds white trays containing green leafy plants, likely lettuce. The plants are illuminated by rows of purple LED light strips mounted on the frames. The perspective is from a low angle, looking up at the tiers, creating a sense of depth and scale. The overall lighting is a deep purple hue.

“

Improve crop yield and quality, and **save on costs.**”

In horticulture, LED lighting is most effective when the spectrum and level of the light are exactly tuned to the particular crop and growing conditions. To this end, Philips has carried out over 1,000 projects around the world to determine the optimum spectrum and light level for (multilayer) production. The results of these projects have enabled Philips to develop and refine the GreenPower LED production module.

The GreenPower LED production module can be used in a new installation, as a replacement for fluorescent lamps or as an energy-efficient supplement to natural daylight. It can even be used in greenhouses and in conditioned environments which are not suited to conventional lighting, thanks to its significantly lower heat radiation.

Key benefits

- Controlled, uniform, high-quality (young) plant output
- Proven for different growth characteristics, including full spectrum versions
- Less heat radiation, so ideal for conditioned environments
- Ideal for multilayer installations
- Energy savings of up to 75% compared to fluorescent tubes

The GreenPower LED production module delivers all the proven benefits of LED technology as a complete solution. For example, Philips offers city farmers and greenhouse growers extensive support in the form of calculations and light plans by technical experts, as well as cultivation advice from in-house plant specialists. On top of this we can even provide support on tailor-made financing solutions.





The right light, in the right place, at the right time.”

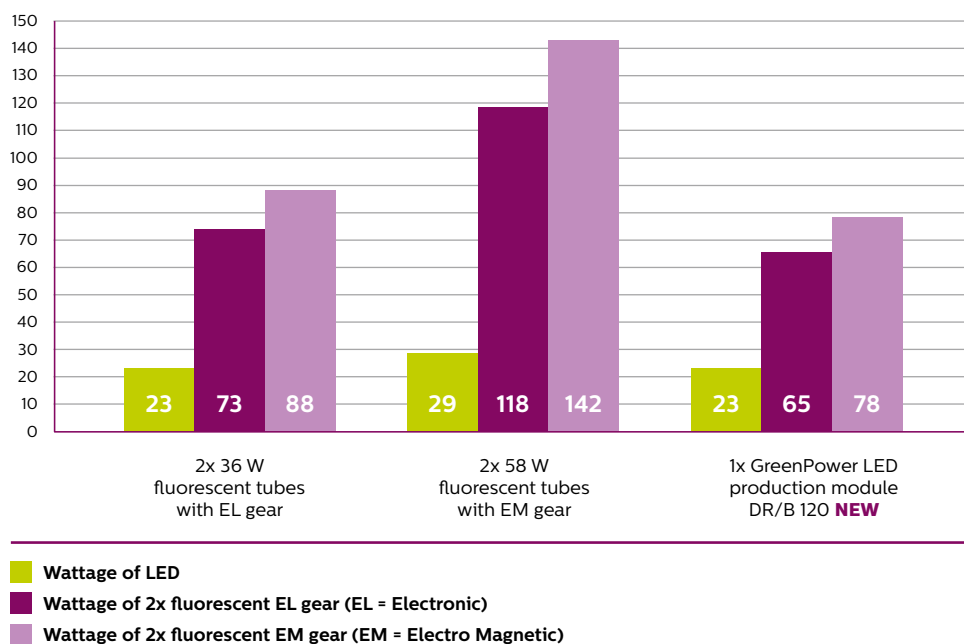
Different plants have different light needs. Philips offers a choice of ‘light recipes’ – dedicated combinations of spectrum, intensity, moment of lighting, uniformity and positioning – that it has developed over many years of cooperation with city farmers, greenhouse growers, universities, and research organizations. These light recipes make it possible to steer specific plant characteristics such as compactness, color intensity and branch development, resulting in optimized crop yield and quality.

Spectral versions of the GreenPower LED production module have been developed, with different colors for different growing requirements:

Blue (B)	positive effects on compactness and hardening
White (W)	working light, full spectrum
Deep red (DR)	most efficient for photosynthesis, vegetative reproduction and stimulating shoot development
Far red (FR)	positive effect on generative properties, flower formation and rooting

Energy savings with LED production module

LED benefits go far beyond energy saving alone, but looking at energy in isolation, the potential savings are enormous. Up to 75% at comparable grow light levels ($\mu\text{mol}/\text{J}$). An existing installation with 2x 36 W or 2x 58 W can be replaced by just one GreenPower LED production module producing a comparable light level.



* Result for comparable light level at shelf distance of 50 cm



Designed to deliver

Consistent quality

GreenPower LED production modules specially designed reflective optic minimizes expensive light losses and ensures uniform light distribution across the shelves, so every plant receives the same level and quality of light. This results in better, more uniform plant quality and a more predictable yield.

Efficient heat management

Thanks to its LED technology and optimized thermal design, the GreenPower LED production module radiates very little heat towards the plants. This means that in multilayer applications the layers can be stacked closer to each other, making more efficient use of the space. For most applications it also means that less cooling is needed. Furthermore, thanks to the module's passive air cooling, no additional investment is required in water supply and drainage.

System efficacy

The integrated electronic LED driver has best-in-class efficiency, thereby reducing total heat production and thus increasing the amount of photon flux per watt of input power. The thermal design to extract the heat from the LEDs has also been optimized for guaranteed long lifetime and minimal light output depreciation. The LEDs themselves offer the highest performance available on the market, and the optical design of the module ensures that almost none of the light is lost. All of these factors combined make for a system efficacy of typically 2.2 $\mu\text{mol}/\text{J}$.

Longer lifetime

LED solutions last much longer than conventional light sources – up to five times as long, so you will spend less time and money on replacing them. Please note that we specify lifetime to 90% of initial photon flux. The rated lifetime indicates 25,000 hours. This means that after 25,000 hours the light output is still 90% of the initial value. After this rated lifetime the module is still functioning properly, and light output depreciation will continue in a similar trend. The rated lifetime to 70% of initial photon flux is better than 50,000 hours.

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LED solutions last much longer than conventional light sources – up to five times as long.”



Best business results through solutions tailored to crops and growing conditions.”

Proven in practice

The GreenPower LED production module is used in many applications, e.g. city/vertical farming, propagation, and research. It is used to grow, among others:

- leafy vegetables and herbs
- young plants and potted plants
- bedding plants and perennials
- cut flowers (mainly tulips)
- soft fruits

The GreenPower LED production module can also be used for many other crops and growing situations. Please contact your local Philips Horti contact person or Philips LED Horti Partner to find out more.

The right light recipe for your crop, defined by a Philips plant specialist

You get the ideal light recipe for your crop and proof from our plant expert that it will work before you roll it out.

The best system for your application, correctly installed by a Philips LED Horti Partner in cooperation with a technical specialist/application engineer from Philips

You work with an installer you trust. The solution fulfills your application and local technical requirements. The installer takes care of maintaining and servicing the installation.

Past project successes

We can tell you all about our projects and explain the options available in your particular case, providing accurate calculations (cost of system, installation, energy, heating/cooling, financing, number of plants/m²) in order to jointly develop a good business case for your situation.

Philips GreenPower LED production modules are extensively used by horticultural firms around the world and experts from the global research community. These projects demonstrate the modules' cost-effectiveness and their capacity to optimize crop yield and quality. A number are outlined below; for more detailed descriptions and additional case studies, visit www.philips.com/horti.



City farming – Green Sense Farms (US)

Green Sense Farms renovated a 28,000 m² indoor facility to form two climate-controlled grow rooms. They then equipped the rooms with 14 eight-meter-high growing towers, each stacked with eight growing carousels. 7,000 Philips GreenPower LED production modules were used to illuminate the carousels. Importantly because different plants have different light needs, Green Sense Farms worked with Philips and its LED Horti Partner to identify the optimum light recipe for each of its crops, resulting in optimized crop yield and quality.

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By growing crops vertically, we pack ten times more plants per acre than a field farm.”



City farming – Osaka Prefecture University (Japan)

Philips has supplied GreenClocks New Generation City Farm – a city farm of Osaka Prefecture University, Japan – with 13,000 GreenPower LED production modules, which are used for the production of 5,000 stocks of leafy vegetables every day. As well as a significant reduction in energy costs, one of the main benefits of GreenPower LED modules has been the reproducibility of plant color. The color of the lettuces under the previous LED lights was deep purple, which made it hard to tell what color they really were and therefore what condition they were in. Under Philips LED lighting, however, the color looks almost the same as it does under natural light.

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With our city farm LED solution we aim to harvest lettuce in 38 days.”



City farming – Delicious (Netherlands)

Delicious grows lettuce plants in a seven-layer set-up within a special climate-controlled room measuring 20 x 40 x 40 m (W x L x H). By using GreenPower LED production modules it grows a young plant in just 30 days – throughout the year. Conventional greenhouse growing in the winter takes around 100 days. The farm owners say that an 800 m² multilayered system produces as much crop as a 10,000 m² conventional greenhouse farm.

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We are now able to control the growth process without daylight.”

Proven in practice

Experience with field tests

Propagation – Bailey Nurseries Inc. (US)

Having tested the GreenPower LED production module, Bailey Nurseries concluded that under the LED lighting lilac tissue culture rooted quickly and with minimum care. The results of this trial, amongst others, indicates that the GreenPower LED production module improves plant stand, reduces crop time, increases overall plant health, and also conserves energy during the winter months. A win-win situation for the nursery and its customers.



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The lilacs got faster root growth with minimum care under these GreenPower LED lights.”

Propagation – Shanghai Dadi (China)

Plants grown under Philips GreenPower LED production modules were more compact and had greener leaves than those grown under normal fluorescent lights, indicating that the plants cultivated with Philips GreenPower LED were stronger. The rooting rate increased dramatically when cultivated with the Philips GreenPower LED production module. Plant rooting times were reduced by 15% compared with those under normal fluorescent lights, resulting in a shorter production period and increased production efficiency.



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The LEDs promote plant growth and reduce rooting times by 15%.”

Tissue culture – Vitro Plus (Netherlands)

Vitro Plus started working with LEDs in its multilayer set-up in 2009. Just by making more efficient use of space, this enabled it to increase its fern propagation by 33%. The quality of the tissue culture also improved. In addition, the company has made substantial savings on energy, partly because the LEDs consume significantly less energy than the fluorescent lighting previously used, but also because substantially less heat is generated by the LEDs, which means that less cooling is required.



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We produce 350,000 plants every week in the multilayer set-up.”

Vegetable seedlings – Shanghai Jiao Tong University (China)

Due to Shanghai’s cloudy, rainy climate, seedlings grown under natural daylight alone do not produce very good results. Shanghai Jiao Tong University’s Faculty of Agriculture and Biology has built a new intelligent greenhouse for its seedling nursery. The aim is to supply local vegetable growers with healthy and robust seedlings all year round. With the help of Philips GreenPower LED modules, the University and Philips expect in the near future to be able to determine the optimum mode for the seedling nursery and vegetable cultivation.



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Thanks to the LEDs it is possible to produce stronger seedlings whilst ensuring low carbon emissions.”

Philips GreenPower LED production module

An outstanding proposition all round

The GreenPower LED production module for multilayer applications will offer you more control, improved and uniform crop quality and energy savings of up to 75%. The energy-efficient LEDs also give off less heat and create a more uniform light distribution, making the module ideal for conditioned environments.

Highly reliable

The module's aluminum housing is strong and waterproof (IP66/dry and damp locations), so when necessary you can clean it with pressurized water. In combination with the module's long rated service life, the result is little or no maintenance.

Easy to deploy

The Philips GreenPower LED production module is available in different lengths – 121 cm/4 feet and 151 cm/5 feet – and so is easy to install in existing installations. No mounting brackets are needed. Thanks to the integrated connector in the end-cap and the integrated driver, the module can simply be connected to the 120-277 V AC mains grid and used right away. For specific installation advice, please contact us or one of our Philips LED Horti Partners.

A complete solution

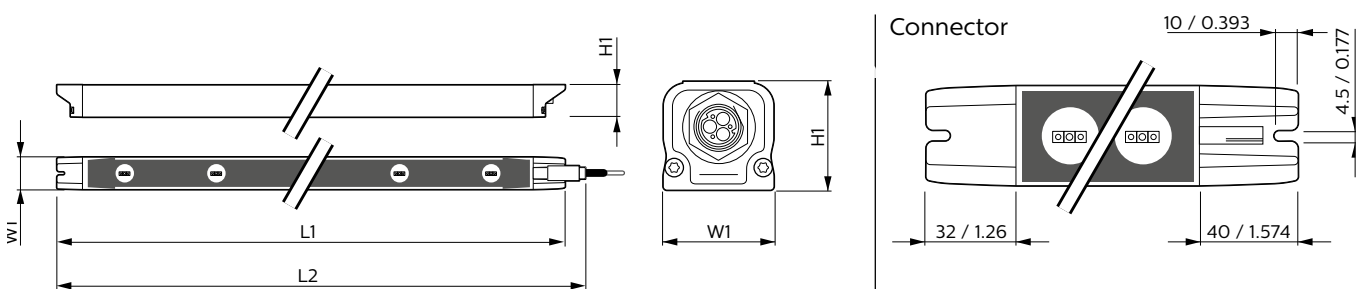
The new generation Philips GreenPower LED production module offers all the proven benefits of LED technology and - as a complete solution - much more besides.

- Advice on which lighting strategies are best for your situation
- Support and advice from technical experts
- Partnership with a network of installers and plant experts
- Finance support for public funding and leasing



Product dimensions

Product name	Product dimensions (mm/inch)				Product weight (gr/ounce)
	L1	L2	W1	H1	
GreenPower LED production module 120	1212/47.717	1266/49.843	40.5/1.594	40.2/1.583	1385/48.85
GreenPower LED production module 150	1512/59.528	1566/61.654	40.5/1.594	40.2/1.583	1656/58.41



Specifications

The right colors for your growing needs

The GreenPower LED production module is available in the different colors that a plant can use most effectively at the different stages of its development:

Blue (B)	positive effects on compactness and hardening
White (W)	working light / full spectrum
Deep red (DR)	most efficient for photosynthesis, vegetative reproduction and stimulating shoot development
Far red (FR)	positive effect on generative properties, flower formation and rooting

Product name	Power*	Photon flux	Ordering code	
	W	Micromol/s **	12NC (global)	6NC (NAM)
Deep Red/Blue – DR/B				
GP LED production DR/B 120 LB	23	50	9290 009 08806	301887
GP LED production DR/B 120 LB LO	12	25	9290 009 09006	303321
GP LED production DR/B 150 LB	29	62.5	9290 009 08906	301895
GP LED production DR/B 150 LB LO	15	31	9290 009 10006	303339
GP LED production DR/B 120 MB	23	50	9290 009 43106	303289
GP LED production DR/B 120 MB LO	12	25	9290 009 43506	303347
GP LED production DR/B 150 MB	29	62,5	9290 009 43206	303297
GP LED production DR/B 150 MB LO	15	31	9290 009 43606	303354
GP LED production DR/B 120 HB	23	50	9290 009 43306	303305
GP LED production DR/B 120 HB LO	12	25	9290 009 09806	303388
GP LED production DR/B 150 HB	29	62,5	9290 009 43406	303313
GP LED production DR/B 150 HB LO	15	31	9290 009 09906	303396
Deep Red/Blue/Far Red (when far red is required) – DR/B/FR				
GP LED production DR/B/FR 120 LB	23	50	9290 009 09106	301903
GP LED production DR/B/FR 150 LB	29	62.5	9290 009 09206	301911
GP LED production DR/B/FR_2 120 MB	23	50	9290 009 10106	301929
GP LED production DR/B/FR_2 150 MB	29	62.5	9290 009 09306	301945
GP LED production DR/B/FR_3 120 MB	23	50	9290 009 43706	303404
GP LED production DR/B/FR_3 150 MB	29	62.5	9290 009 43806	303412
GP LED production DR/B/FR_4 120 HB	23	50	9290 009 43906	303420
GP LED production DR/B/FR_4 150 HB	29	62.5	9290 009 44006	303495
Deep Red/White (if work light is needed) – DR/W				
GP LED production DR/W 120 LB	24	50	9290 009 09506	301952
GP LED production DR/W 120 LB LO	12	25	9290 009 09406	303511
GP LED production DR/W 150 LB	30	62.5	9290 009 09606	301960
GP LED production DR/W 150 LB LO	15	31	9290 009 10206	303529
Deep Red/White/Far Red – DR/W/FR				
GP LED production DR/W/FR 120 LB	24	50	9290 009 09706	301978
GP LED production DR/W/FR 150 LB	30	62.5	9290 009 10306	302018
Monocolors				
GP LED production DR 120	23	50	9290 009 44106	303537
GP LED production DR 150	29	62,5	9290 009 44206	303545
GP LED production FR 120	24	50	9290 009 44306	303578
GP LED production FR 150	30	62,5	9290 009 44406	303586
GP LED production B 120 LO	15	25	9290 009 44506	303594
GP LED production B 150 LO	18	31	9290 009 44606	303602
Accessory				
GP LED prod module female connector			9290 009 70106	302026
GP LED Cabletree production module			9290 009 93006	

* Typically at 230 V / ** Typically at 25 °C / 77 °F ambient

Legend:

120 = 121.2 cm +/- 0.5

150 = 151.3 cm +/- 0.5

LB = Low Blue

MB = Medium Blue

GP = GreenPower

Important remark:

For advice on allowed chemicals in combination with these modules (for cleaning, fungicides, surfactants, etc), please see detailed information in the application guide.



Products are certified and tested against safety standards: UL1598, UL8750, IEC60598-1, IEC60598-2-1 and CSA C22.2 No 250.0.0-08

What's in the box? Six modules + integrated drivers. You can order a box with six connectors. The cable permitted in your region is fitted into the connector. The cable needs to be between 8 and 11 mm to make the module waterproof (IP66/dry & damp locations).

For large quantities (>5000 pcs) we can even custom-make a version based on your specific requirements. Feel free to get in touch with your Philips contact person or Philips LED Horti Partner to discuss your particular needs.



Philips GreenPower LED production module

Key benefits

- Controlled, uniform, high-quality (young) plant output
- Proven light recipes for different crops
- Proven for different growth characteristics
- Less heat radiation, so ideal for conditioned environments
- Ideal for multilayer installations
- Energy savings of up to 75% compared to fluorescent tubes



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