MechaTronix

www.horti-growlight.com

CoolStack®

The Next Dimension in LED Grow Lights

Performance

- Absolute market leading PPF up to 5.100µmol/s
- Superior photon efficiency of 4 µmol/J
- Various growth spectra developed for optimal results
- Deepest canopy penetration rate

Modularity

- Freedom in growth spectrum composition
- Upgradable LED modules
- Unique light distribution with TIR lenses adaptable to your canopy
- Full dynamic spectrum

Quality

- Extreme lifetime 75.000hrs - L90B10
- 10 years warranty
- Best thermal management
- Full IP67 waterproof

MechaTronix | CoolStack®
The Next Dimension in LED Grow Lights

Introduction

The market leading CoolStack® grow lights offer you precisely what you need!

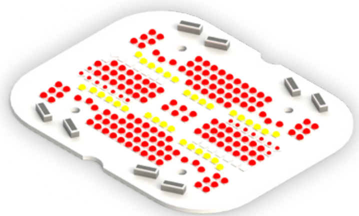
The choice between multiple power and light levels up to a PPF of 5104µmol/s guarantees you an optimal balance between the number of lamps you need to install, a minimal investment cost, and a perfect light distribution.

Our research team has developed a multitude of light spectra, from full spectra for grow rooms to dedicated narrow band spectra for vegetable production, young plants, germination, and each specific process in plant growth that needs to be optimized.

You can choose between static or dynamic lighting, from a single-channel fix spectrum to triple or quadruple channel controls. This way, you can adjust the light spectra to the plant's specific needs at each growth stage.

With over 700 hectares of installed lamps in greenhouses and grow rooms, the CoolStack® became the reference for LED top lights in Europe and gained the trust of many leading growers around the world.

Upgradable LED engines for a sustainable future



Over the last few years, significant big steps have been taken in the efficiency of LED grow lights, which has brought us an exponential increase in the use of LED grow lights for greenhouses for a wide range of crops.

The motivations of the growers have a wide range, with each its specific aims.

- Saving energy compared to HPS SON-T installations is probably the most common driver today for growers to invest in LED grow lights

  As of today, we can replace the light level of a 1000-watt HPS SON-T lamp with just 530 watts of LED grow light energy or a saving of 47%.

- More light for the same power consumption – especially light-loving crops like tomatoes profit a lot from extra light for the same energy cost

  While the standard for lighted tomatoes was 180µmol/sm² just a few years ago, the light levels now increase to 300µmol/sm²

- Better temperature controls during growth – one of the main disadvantages of growing with HPS SON-T lamps are the extensive heat these lamps produce.

  A 1000-watt HPS SON-T generates 700 watts of heat – more specifically the biggest portion of this heat goes to radiated heat which leads immediately to ambient temperature and leaf temperature increase. While growers aim for higher light levels, this heat can become too much for a well-controlled production. In these cases a hybrid or full LED installation can be the way to go.

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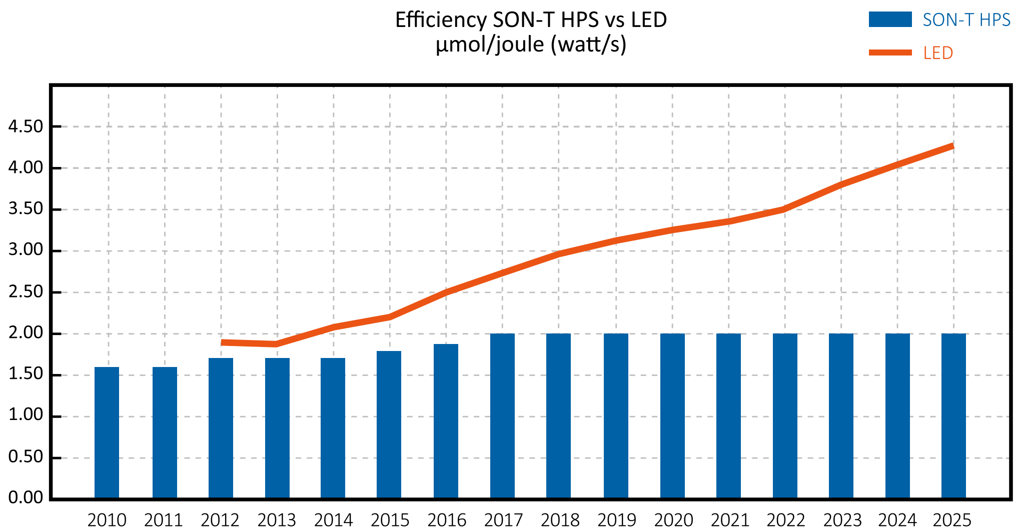
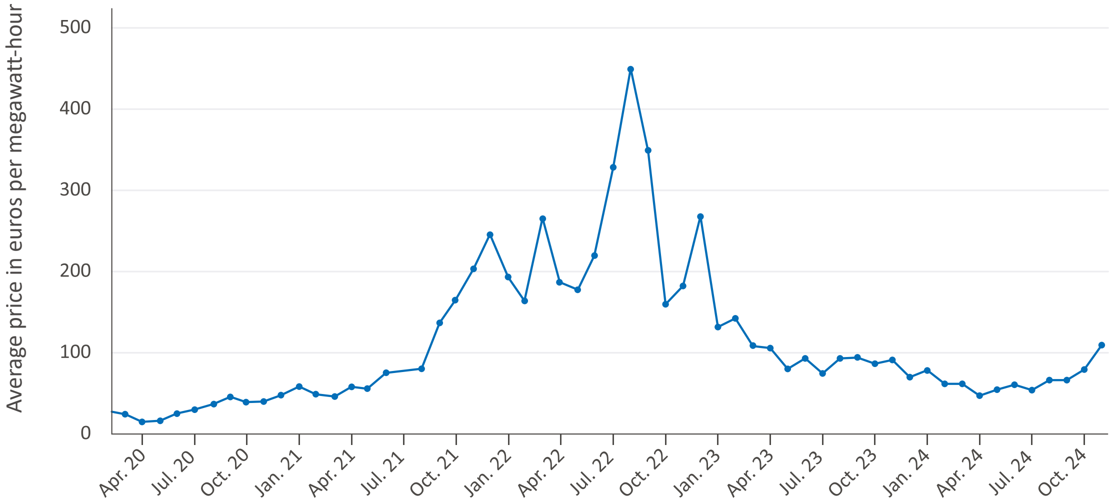
- Specific crop improvements during various growth stages. One of the biggest advantages of LED grow lights are the potential to steer plants with specific supplemental light spectra.

  In this way, germination can be sped up, stronger root production can be achieved or stretching of the plant can be avoided. Higher blue rates improve germination and root development, end-of-day treatments with far-red can induce length growth from trusses and stems.

Today we can say that the efficiency of LED grow lights is significantly higher than that of traditional SON-T lamps, but the world of Horti cultural lighting is constantly evolving. MechaTronix is continuously investing in research and collaborating with market-leading universities and specialists. To anticipate future findings we have developed our grow lights in such a way that the light engines can be upgraded individually without having to re-invest in a completely new grow light installation.



Why would you upgrade your grow light LED engines over time?



Electricity prices evolution in €/Mwh Belgium

- When you would save more energy cost than the upgrade of the LED engines would cost over time.

  This is mainly the case for growers who pay high energy prices, like in west and north Europe, and crops that run with many lighted hours per season, like tomatoes, cucumbers, bell peppers,...

- When your crops would benefit more from the extra light you get after an upgrade than the cost of upgrade.
  Especially for light loving crops which would give a higher produce at a higher light level.

  For example, a tomato grower who installed a light level of 180µmol/sm² in 2018 at an efficiency of 2.5µmol/W.
  This grower, could today move for the same power consumption to a light level of 280µmol/sm² with a simple upgrade.

- When new light recipes are proven to be more efficient.

  Up to 2020 strawberries were grown under the classic 90/5/5 RBW spectrum. In 2021 new research stated that the use of far-red has been proven to give a higher growth results.

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Advanced light distribution with TIR lenses

The importance of light distribution in LED grow light systems is often seriously underestimated.

Proper light distribution is needed for plants such as ornamental plants and leafy greens because they are sensitive to fluctuations in the canopy's received PPFD.

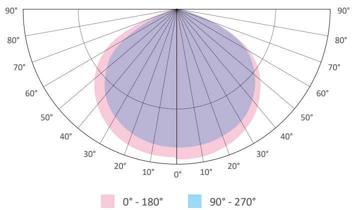
High-wire crops such as tomatoes and cucumbers face an even bigger challenge due to the short distance between the grow light and the top of the plants.

A perfectly even light distribution over the plant canopy from a single luminaire is still something most grow lights seem to have difficulties with.

A lot of horticulture grow lights use grow LEDs spread out over a cooler without the use of any optics to control the beam distribution, just with a simple glass or plexi cover.
With these lamps, the light output always comes as a 120 degree beam.

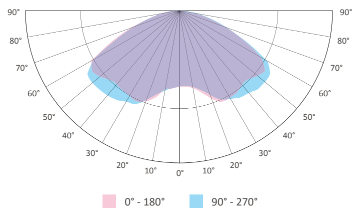
With the CoolStack® grow lights you can choose from various TIR or "Total Internal Reflection" lenses for an optimal balance between light distribution and canopy penetration.

‣ Narrow Beam NB



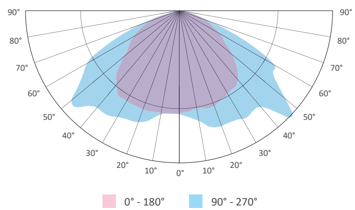
*120 degree standard beam
For bigger distances from
lamp to crop*

‣ Wide Beam WB



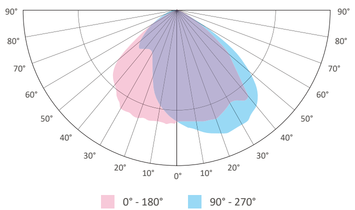
*150 degree wide beam
For high wire crops and
lower light levels*

‣ Ultra Wide Beam UWB

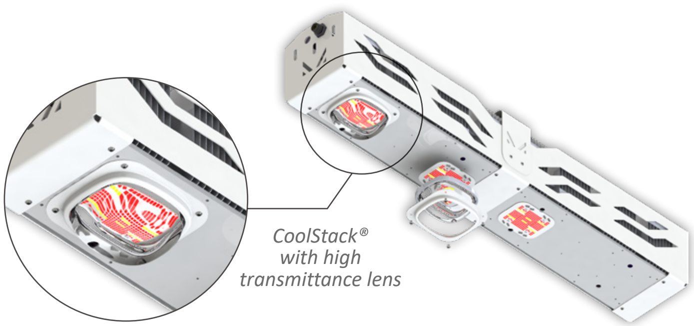


*ultra wide beam
For high wire crops and
smaller distances
from lamp to crop*

‣ Pathways Optics HCP



*155 degree path beam
Specific lenses for those
lamps next to the
pathway and the side walls
of the greenhouse*



More light output per lamp to reduce installation costs

While the easiest way to compare grow lights is probably the price per µmol, there are many variables that make comparisons between various systems somewhat difficult.

One of the bigger influences comes from the installation cost.
Cables, connectors and circuit breakers, ... can add up to over 100€ per lamp on top of the grow light itself.

Therefore, it is of utmost importance to optimise the number of grow lights in a project to make a perfect balance between the required light level and a good light distribution, all with a minimal number of lamps.

While a few years ago it was already a big step to come on the market with an LED grow light that could replace a 1000 watt HPS SON-T lamp, today we offer a broad range of lamps that can significantly reduce the number of grow lights for your project!

Example: 1ha TOV tomatoes with PPFD light level of 280µmol/sm²

	CoolStack®	Output max (µmol/s)	Channels	No. of lamps	Cost lamps (€/µmol)	Installation Cost (k€)
	MICRO PRO	1.280	Quadruple	2562	0.25	125
	COMPACT	2.640	Single	1172		
	COMPACT DYNAMIC	2.430	Triple	1281		
	COMPACT PRO	2.550	Quadruple	1281		
	BOOST	3.940	Single	761		
	BOOST DUAL		Dual	789		
	BOOST DYNAMIC		Triple	747	0.21	
	BOOST PRO		Quadruple	747		
	MAX	4.900	Single	639		
	MAX DYNAMIC		Triple	638		
	MAX PRO	5.100	Quadruple	638	0.15	50

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Longest lifetime and lowest light decay over time

Maybe it doesn't show from the outside, but the CoolStack® is a true masterpiece of technology.

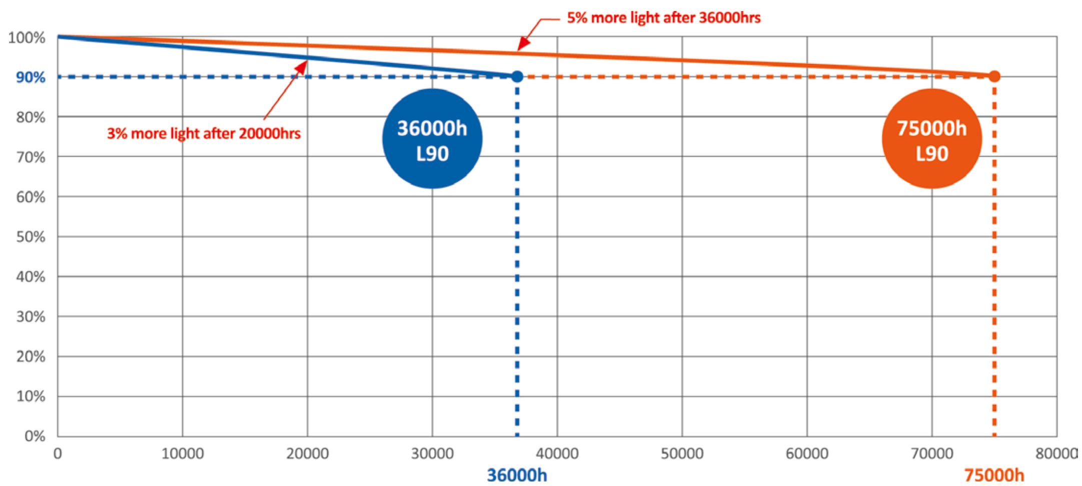
Where most LED grow lights use simple cooling principles like a block of aluminum, watercooling, or cooling fans, the heart of the CoolStack® has a sophisticated passive heat pipe and a stack fin cooler.

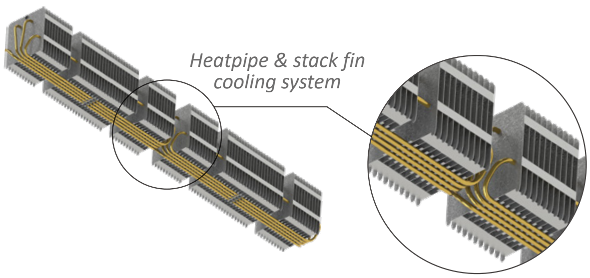
This technology, which is implemented in a lot of high-end devices like laptops, iPads, and smartphones, guarantees you the best thermal management of the LEDs on the market.

The light efficiency, the lifetime and the light decay (how fast or slow the light reduces over time) are all directly related to the LED temperature of the grow light.

So with the CoolStack® which runs the internal LEDs as cold as possible, you as a customer will have a grow light that lives longer, has a higher efficiency of light per watt and, maintains its light at a higher light level over time.

With a lifetime of 75.000 hours L90B10 and a warranty of 10 years, there is qualitywise nothing even close to what the CoolStack® offers.





	MICRO	COMPACT	BOOST	MAX
Cooling surface	0.804m²	1.66m²	3.32m²	
Temperature rise	50°C max	45°C max		
The LED temperature is 25°C to 35°C lower than classic cooled grow lights with the same power				

Growth Spectra for Yield and Advanced Morphology

To understand how your crops are going to react to different wavelengths and colors, you have to keep in mind that every crop and every growth stage requires an individual approach.

The amount of light affects the photosynthesis process in the plant.

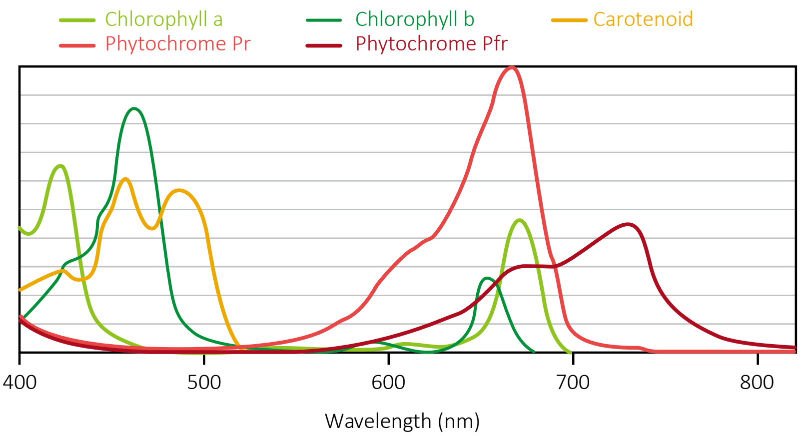
This process is a photochemical reaction within the chloroplasts of the plant cells, in which CO_2 is converted into carbohydrates under the influence of light energy.

The spectral composition of the different wavelength regions (blue, green, yellow, red, far-red or invisible e.g. UV or IR) is important for the growth, shape, development and flowering (photomorphogenesis) of the plant.

For photosynthesis, the blue and red regions are most important.

The timing / light duration which is also called the photoperiod, is mainly affecting the flowering of the plants. The flowering time can be influenced by controlling the photoperiod.

Absorption curves of plants



Photosynthetic efficiency is mainly driven by chlorophyll a and b.

Chlorophyll a and b are the primary pigments responsible for absorbing light energy during photosynthesis. These chlorophyll pigments primarily absorb light in the blue (400–500 nm) and red (600–700 nm) regions of the spectrum, which defines the Photosynthetically Active Radiation (PAR) range.

The Photosynthetically Active Radiation (PAR) shows further photosynthetic pigments, also known as antenna pigments, like carotenoids (carotene, zeaxanthin, lycopene, lutein, etc.).

The Phytochromes Pr (red) and Pfr (far-red) are mainly influencing germination, plant growth, leaf building and flowering.

The photomorphogenic effects are controlled by applying a spectrum with a certain mix of 660nm and 730nm to stimulate the Pr and Pfr phytochromes.

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Each crop and growth stage has a specific optimal light spectrum

We are strong disbelievers of the “one spectrum fits all” philosophy.

MechaTronix has been investing tremendous capital in plant trials over the past years, and is a proud sponsor of most advanced plant research centers in Western Europe.
Through this approach, we have clearly proven what can be reached with the ideal spectrum per crop and per growth stage.

Plant trials we have been running for the past years:

- Tomato / Cucumber / Bell peppers / Eggplant
- Strawberries / Blackberries / Raspberries / Red currents
- Salads various cultivars / Micro Greens
- Algae vertical and horizontal reactors
- Roses / Phalaenopsis / Anthurium / Chrysanthemum / Bromeliad / Kalanchoë / Gerberas / Lilies / Lisianthus

For specific questions on plant lighting knowledge, contact us to get in touch with one of our plan specialists.

What light level for what type of crop?

Plant	Min (µmol/s.m²)	Max (µmol/s.m²)	Typical (µmol/s.m²)
Tomato	170	350	270
Pepper	120	300	230
Cucumber	120	350	230
Cannabis Vegetative growth	280	550	350
Cannabis Flowering	650	1,500	1,000
Orchid / Phalaenopsis	80	230	160
Bromelia	40	120	90
Potted chrysanthemum	40	80	50

Fixed light spectrum or dynamic spectrum – advanced morphology and energy saving

While all MechaTronix LED grow lights are dimmable and controllable by the climate computer since 2018, a lot of research has been conducted over the last few years with a strong focus on the potential of controllable light spectra in greenhouses.

Besides interesting insights into what plants need spectrum wise in each growth phase, dynamic lighting, where the light spectrum is changed during the day, has been proven to be highly beneficial to improving the morphology of the plant and to generate a higher yield for many crops.

Improved morphology and higher yields

The best examples of morphologic advantages can be seen in the research results for chrysanthemums and everbearing strawberries.

Wageningen University & Research (WUR) conducted deep research in collaboration with Plant Lighting on the ideal light strategy for cut chrysanthemums. They discovered that an end-of-day treatment with only far-red light while the base spectrum was turned off, resulted in clearly longer flowering shoots with very little extra energy.

The spectral research of Proefcentrum Hoogstraten (PCH) on strawberry varieties proved that extra far-red during the day resulted in an average bigger size berries and a higher yield, while end-of-day treatment with far-red led to longer fruit trusses and a larger LAI of the crop.

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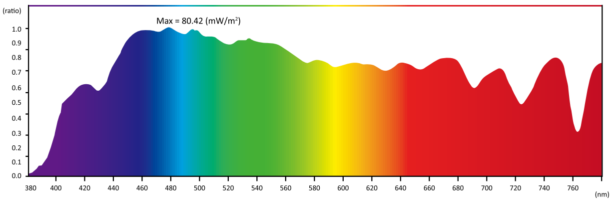
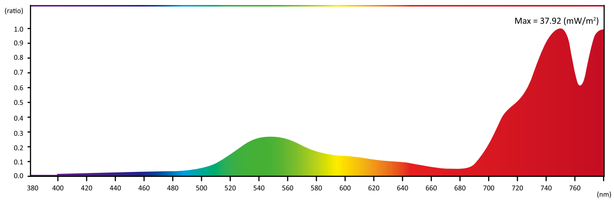
These effects are mainly triggered by the Phytochrome balance in the crop: Red to Far-Red ratio R:FR and Phytochrome Photostationary State PSS are both methods to trigger and control the elongation of crops.

While the Phytochrome Pfr antennas are in the far-red bandwidth (730nm peak) and the Phytochrome Pr in the Red zone (660nm peak), switch between these two tells the plant that it is in the shadow, which triggers the shade escape effect and leads to elongation.

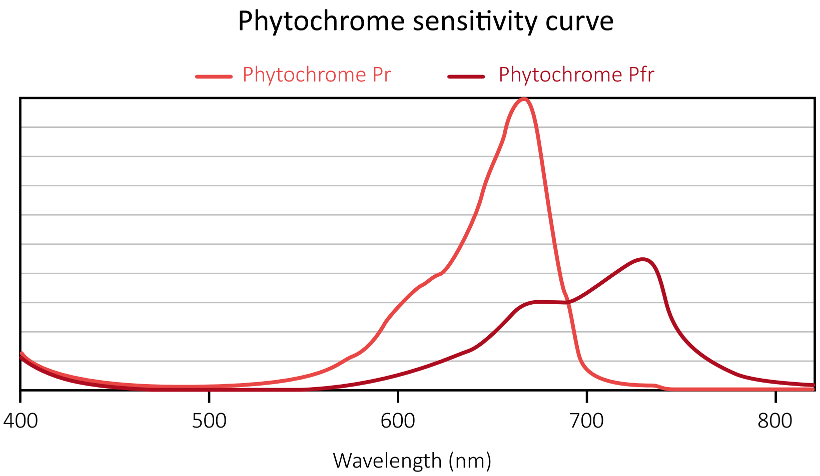
Natural shade plants like anthuriums react in the opposite way. The absence of far-red leads to stretch while a high dose of far-red will avoid this.



Open sun spectrum



Crop under one leaf spectrum



Besides morphologic effects, far-red light also influences various other aspects of plant physiology in most plants.

As the energy of far-red travels deep into the crop it leads to local higher energy, stomatal opening and in general, a more generative growth.

A higher portion of the photosynthetic energy goes to the fruit and a lower portion to the leaf.

For instance, in cucumbers, this results in accelerated fruit production, while in strawberries, it leads to higher average quality and improved yield.

Supplementing light to meet needs leads to high energy savings

Most supplemental spectra in greenhouses are besides the red and blue photons foreseen from a dose of green and crop depending far-red.
With a fixed spectrum grow light, the light spectrum stays unchanged during the lighted hours, separately of the actual sun's radiation.

Most generative spectra foresee about 5% of green light. This is the needed dose to neutralize the purple glow of red & blue which creates a better working environment for the people in the greenhouses.
As known, there is about 25% of green photons available in the sun, so once the radiation from the sun reaches 100µmol/sm^2 there is about 25µmol/sm^2 of green present.
At that point and above, the presence of 5% extra green in the LED light spectrum is mostly useless, it doesn't contribute much to photosynthesis and costs an enormous amount of energy.

White LEDs, which produce the green part of the spectrum are the most energy inefficient part of the grow light and produce green photons with an efficacy as low as 2µmol per watt.
So for 5% of green in a 1000-watt grow light, the white LEDs consume around 100 watts of energy or 10% of the total power!

By using an automated climate computer controls the green part of the spectrum can be dimmed down separately in function of the solar radiation in the greenhouse, which gives a direct huge power saving.

A similar approach can be adopted for the far-red and blue parts of the LED spectrum.

With this approach of automated selective lighting, you can easily save up to 10% of energy over the lighted season.

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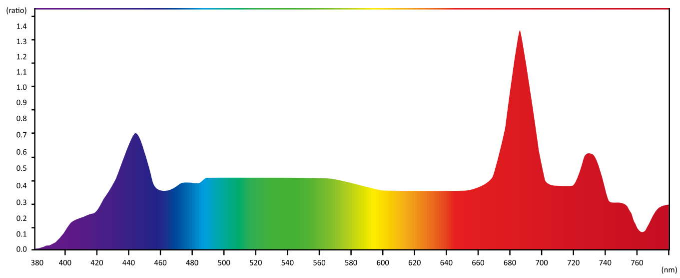
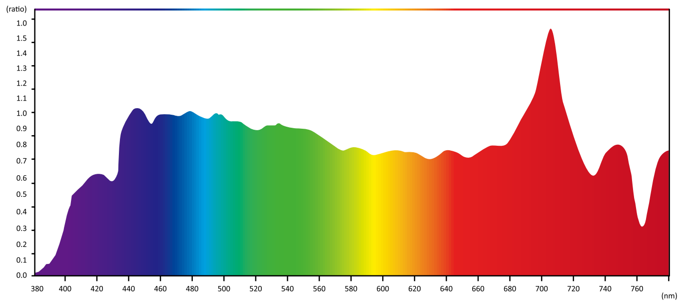
Supplemental lighting in function of solar radiation

- Low solar radiation -
  The whole spectrum Blue - Green - Red - Far-Red is supplemented



- Higher solar radiation -
  Only Blue - Red is supplemented



Dynamic load balancing

All MechaTronix multi-channel grow lights are foreseen with a dynamic load balancing.
This way, when you dim down a part of the spectrum, that energy becomes available for the main channel.
For instance, a 1000-watt grow light equipped with 3 channels is designed to emit 1000 watts of red and blue light, along with 100 watts of green and 100 watts of far-red light.
When there is enough solar radiation you can switch down the green part and use that energy on the red and blue part which gives you a much higher efficacy of photon production and a higher dose of photosynthesis in the crop.
All together, this immediately leads to a higher yield in the production.

MICRO

up to 1280 µmol/s - Max power 312watts

Low power, high efficiency with light weight
Daisy-chain style of up to 4 lamps

CoolStack® MICRO PRO

- 4-channel - individual dimmable
- Energy saving by controlling multi channels
- Separate controllable red, blue, white/green and Far-Red
- Crop flexibility
- End-of-Day treatments for plant length
- Daisy-chain style of up to 4 lamps

COMPACT

up to 2640 µmol/s - Max power 680watts

25% more light with 35% HPS SON-T energy saving compared to a 1000W HPS SON-T
Best deal for more light with less energy

CoolStack® COMPACT

- Single-channel - dimmable
- Best budget for lower light level

CoolStack® COMPACT DYNAMIC

- 3-channel - individual dimmable
- Energy saving by dynamic spectra
- Seperate controllable red/blue, white/green, and far-red
- Crop flexibility
- End-of-Day treatments for plant length

CoolStack® COMPACT PRO

- 4-channel - individual dimmable
- Energy saving by controlling multi channels
- Separate controllable red, blue, white/green and far-red
- Crop flexibility
- End-of-Day treatments for plant length
- Daisy-chain style of up to 2 lamps

SPECIFICATIONS				
	MICRO PRO	COMPACT	COMPACT DYNAMIC	COMPACT PRO
Channels	4	1	3	4
Input voltage	277 - 480 Vac	249 - 528 Vac or 352 - 500 Vdc		277 - 480 Vac
Power	200W - 312W	400W - 680W	400W - 620W	
PPF Photon Flux	≤ 1.280µmol/s	≤ 2.640µmol/s	≤ 2.430µmol/s	≤ 2.550µmol/s
Efficacy	3.5 - 4.0 µmol/J (Up to 4.3 µmol/J dimmed 50%)			
Inrush current	< 3.38A	< 17.6A	< 6.35A	< 3.38A
Inrush time	< 10.8ms	< 2.16ms	< 11.8ms	< 10.8ms
CosPhi	> 0.95	> 0.96	> 0.95	
Weight per lamp	2.685gr	5.725gr		
Dimension	W167 x L260 x H160.7 (mm)	W170 x L515 x H160.7 (mm)		
Connection	Wieland green / black / white			

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The Next Dimension in LED Grow Lights

BOOST

up to 3940 µmol/s - Max power 1050 watts

75% more light with same energy
HPS SON-T drop-in replacement
Upscales your crop production capacity

CoolStack® BOOST

- Single-channel - dimmable
- Ideal for Hybrid setup
- Best budget for medium to high light levels

CoolStack® BOOST DUAL

- 2-channel - individual dimmable
- Separate controllable PAR and far-red
- Crop flexibility
- End-of-Day treatments for plant length

CoolStack® BOOST DYNAMIC

- 3-channel - individual dimmable
- Energy saving by dynamic spectra
- Separate controllable red/blue, white/green and far-red
- Crop flexibility
- End-of-Day treatments for plant length

CoolStack® BOOST PRO

- 4-channel - individual dimmable
- Energy saving by controlling multi channels
- Separate controllable red, blue, white/green and far-red
- Crop flexibility
- End-of-Day treatments for plant length

MAX

up to 5100 µmol/s - Max power 1250watts

Energy & price efficient
Minimal number of lamps & cost per installation

CoolStack® MAX

- Single-channel - dimmable
- Ideal for heavy hybrid with maximized hours of LED
- Ideal for high light levels

CoolStack® MAX DYNAMIC

- 3-channel - individual dimmable
- Energy saving by dynamic spectra
- Separate controllable red/blue, white/green and far-red
- Crop flexibility
- End-of-Day treatments for plant length

CoolStack® MAX PRO

- 4-channel - individual dimmable
- Energy saving by controlling multi channels
- Separate controllable red, blue, white/green and far-red
- Crop flexibility
- End-of-Day treatments for plant length

SPECIFICATIONS							
	BOOST	BOOST DUAL	BOOST DYNAMIC	BOOST PRO	MAX	MAX DYNAMIC	MAX PRO
Channels	1	2	3	4	1	3	4
Input voltage	249 - 528 Vac or 352 - 500 Vdc			277 - 480 Vac	249 - 528 Vac or 352 - 500 Vdc		277 - 480 Vac
Power	850W - 1.050W	850W - 1.030W	850W - 1.040W	850W - 1.030W	1.030W -1.250W		
PPF Photon Flux	≤ 3.940 µmol/s				≤ 4.900 µmol/s		≤ 5.100 µmol/s
Efficacy	3.5 - 4.0 µmol/J (Up to 4.3 µmol/J dimmed 50%)						
Inrush current	< 13.6A		< 6.35A	< 3.38A	< 21A	< 6.35A	< 3.38A
Inrush time	< 4.32ms		< 11.8ms	< 10.8ms	< 3.36ms	< 11.8ms	< 10.8ms
CosPhi	> 0.95				> 0.965	> 0.95	
Weight per lamp	11.555gr						
Dimension	W170 x L1000 x H160.7 (mm)						
Connection	Wieland green / black / white						

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