Retire the HPS

Elimination of antiquated technology

LED Smart Inc., January 2023

HPS, high-pressure sodium lights, initially introduced in 1966, is one of the mainstays of greenhouse lighting - WHY? - as new, more energy-efficient technology exists. Could LED technology really replace HPS?

HPS lights continue to be used, as they are cheap, and growers have been using them for decades. When these were initially introduced, they were much more efficient than the mercury vapor lights that they were to replace. However, this old technology is not the future. HPS lights, which have proven effective for some time, are large consumers and wasters of precious resources.

Just as LEDs have come to replace incandescent in your home, saving an average of 90% in electricity costs, LEDs have come to replace HPS in commercial and industrial environments. With the basic benefits, like energy savings, few people would consider going backwards in their energy savings. Let's consider a few other reasons that LEDs are the best replacement for HPS.

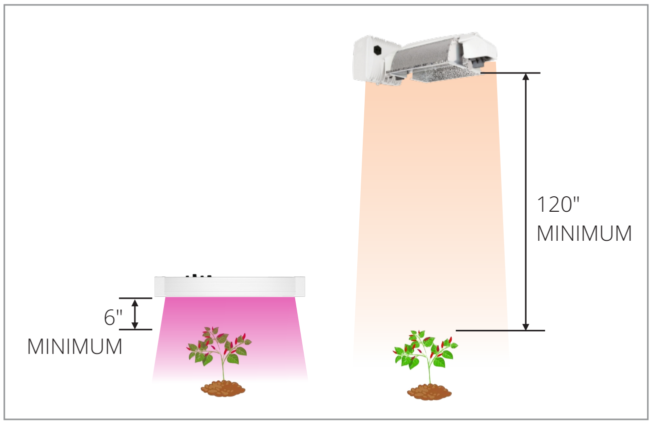
While this antiquated technology may be able to output an equivalent amount of light to an LED system, HPS has many drawbacks. Let's consider the disadvantages of HPS lights.

Greenhouse Illuminated with HPS Lights

Excessive Heat

HPS lights and their ballasts emit a great deal of heat. While some growers use this heat as a direct heat source within their greenhouses, many others see this as a constant source of financial drain, in having to cool their greenhouses through other means.

This excessive heat also means that the HPS lights can never be installed near the crop



LED vs HPS Minimum Mounting Height

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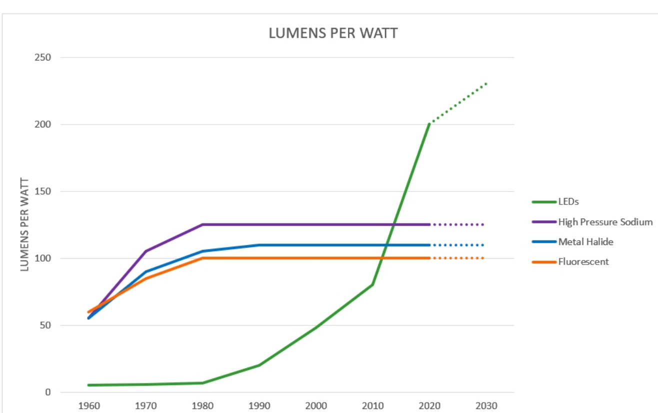
canopy - which is a further waste of energy as the most concentrated light is emitted close to the source. With HPS lights being mounted 10 feet or more from the canopy, this can equate to a significant amount of light loss.

Energy Efficacy

In alignment with the government initiatives for more efficient use of electrical power, HPS will face other basic calls for retirement based on energy efficacy. HPS and other similar technology have reached an efficacy plateau over the past few years, reaching an average of 90 lumens per watt. In comparison, LED technology continues to increase in efficiency, reaching up to 200 lumens per watt for some diodes. Thus, less energy can produce the same amount of light.

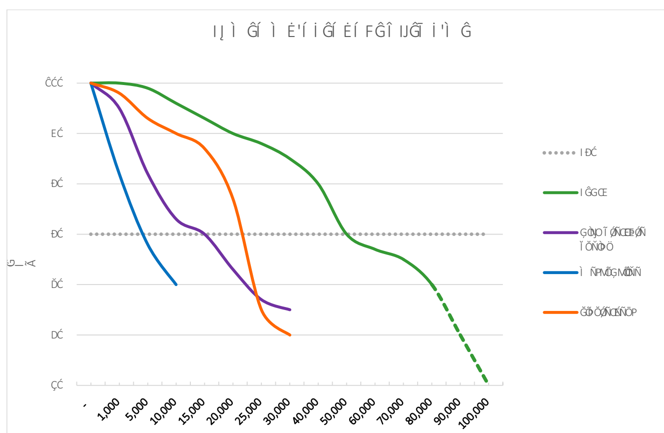
Most HPS systems are not dimmable, meaning the grower is compelled to use 100% of the light emitted. With no ability to dim, the waste of energy to the grower can be significant.



Light efficacy, lumens per watt product development

Poor Lifetime

Additional cons to HPS light are the lifetime. In just 4,000 hours of use, a regular HPS light can be reduced to it's end of useful life, lumen maintenance. Lumen maintenance is expressed as L70 or Lumen Output percentage. This means in some cases, after just one year of use these lights are suggested to be replaced. Whereas, LEDs, being so widely adopted across many industries for almost a decade. Top tier LED brands have successfully proven long lead times. With proper power and heat dissipation design LEDs have been proven to last more than 50,000 hours of use, and in some cases, even longer than 100,000 hours.



Lumen maintenance comparison chart

Government Bans on HPS

All these evident facts have been some of the main contributors to states like California's implementation of a new installation ban on HPS systems.

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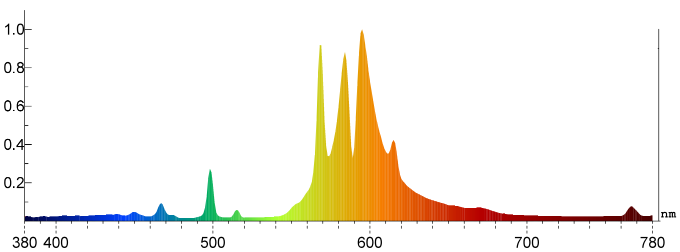
Industry should consider that more bans and regulations for use of out-dated technology, such as HPS, will continue in the years to come. This is especially a fact, in that governments and industry will continue to face added pressure for energy consumption reduction, overloaded power grids, and carbon reduction requirements.

LED vs HPS

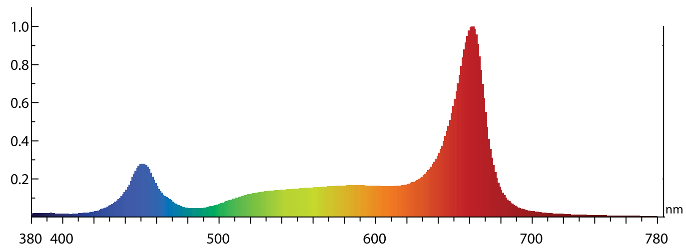
Specially designed combinations of LEDs create a light output spectrum the same as HPS lights, using far less power to produce the same amount of PPFD[1]. The HPS spectrum has enough of a contribution from red and blue light to have proven beneficial to growers. As a typical ratio measured around 3.6:1 (red:blue).



1000W HPS Color Spectrum

There is also a waste of excessive light generated between the green (500nm) and yellow spectrums (630nm). As most chlorophyll absorption occurs within the red and blue spectrums, this portion of green and yellow light does not contribute the most effective light for photosynthesis, which could be contributed to a waste of energy as well. This is also what makes the light appear to the human eye as an 'orange' color.

Specific GROW3™ LED lighting systems have been designed to mimic the beneficial portion of HPS light, while still having a small contribution between 500nm-630nm for a full spectrum light contribution. These light patterns demonstrate a LED spectrum profile that mimics the most beneficial portions of the spectrum for photosynthesis.



HS Models Default HPS Color Spectrum

LED lighting systems have proven energy savings for the user from the day they are installed. In horticulture lighting, additional savings can be achieved through system controls, dimming, scheduling, and monitoring the DLI required from the system. The GROW3™ system has been designed to make your growing experience quicker, more productive, and lower your production costs. With models that are designed to mimic HPS using LED technology, giving you more control of the light, energy, and power delivered to your operation.

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The GROW3™ models of LED lighting allow the grower to position the lights closer to the crop, reduce heat contribution, dim and change the color ratio.

Example Case

Let's consider a very basic case, for comparison between HPS and LED.

A greenhouse that uses 100 units of 400W HPS lights within their operation, replaces their system with 100 units of 200W LED technology. They operate their HPS lights at 14 hours per day, with 79 PPFD delivered at the canopy height. This calculates to 4 DLI and annual operation of 5,096 hours. For the case, we will assume costs at modest rates: Electricity: $0.10/kWh, electrician labor: $80/hour, new fixture: $450/HPS fixture with L_{70} lifetime: 4,000 hours. For LED fixture: $540/LED fixture with a L_{70} lifetime of 50,000 hours, with delivered 156 PPFD per light to the plant canopy, operates for 7.2 hours per day to achieve the same 4 DLI, and annual operation of 2,620 hours.

Using this simplified sample data, to achieve the same 4 DLI for the delivered daily light. The following data is a basic comparison of operation, and savings potential.

The costs savings on energy usage per year is 75% compared to HPS. In this example that equates to more than $15,600 on electricity alone. Including maintenance and fixture annual fixture replacement the costs savings could be as much as $72,000 per year.

Annual energy savings on lighting is more than 15,000kWh, which averages almost 4 tons of carbon.

ANNUAL ENERGY SAVINGS

POWER

15,652 KWH SAVED

CARBON FOOTPRINT

3.75 ESTIMATED TONS SAVED

MAINTENANCE SAVINGS

$ 72,618

Want to find out how you can easily switch from HPS to LED? Would you like an audit of the potential savings your site could achieve? Ask us how.

How to save more energy factoring DLI, see article regarding "How much light do my plants need?" and "Defining the Color of Light" in this series.

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