

P.L. LIGHT SYSTEMS

RETROFIT GUIDE

LED, HPS & Hybrid Lighting Systems



The comprehensive guide to retrofitting with LED, HPS and hybrid lighting systems

Lighting is one of the biggest capital expenses for greenhouse and indoor grow operators and it is conceivably the most important factor for optimizing plant growth—with light being used as both an energy source and as a signal for development. With LEDs being quickly adopted by more growers, and with the evolution of high-efficiency HPS (high pressure sodium) electronic ballast technologies, many growers are looking to upgrade their lighting systems to improve their energy efficiency, yields, quality, and crop times. One of the greatest advantages of working with **P.L. Light Systems** is that we manufacture both LED and HID (HPS) technologies and offer complete hybrid solutions. What this means for the grower, is that we can help assess all options when it comes to retrofitting. This gives customers complete options, when it comes to horticultural lighting, that take into account the exact goals the grower wants to achieve with whatever type of lighting they want to use.

In this guide, we will examine everything you need to know when switching from HPS to LED luminaires; retrofitting older magnetic-ballast HPS to new electronic ballast HPS luminaires; as well as upgrading to a hybrid (LED-HPS) lighting systems which takes advantage of existing infrastructure—including HPS luminaires—but adds in new LEDs.

Biggest Reasons to Retrofit:

- Reduce electrical consumption & operating costs
- Replace older fixtures that have discontinued parts
- Take advantage of LED rebate programs
- Increase plant quality
- Increase yields
- Decrease crop cycle times
- Increase light intensity
- Decrease lighting system maintenance requirements
- Improve light uniformity
- Improve plant productivity and health



RETROFIT: HPS TO LED

One of the most common retrofits we're currently seeing, is growers replacing their legacy HPS luminaires with LED technologies. Now is a great time to do this, since many states and provinces are offering rebate incentive programs for growers looking to install LEDs. LEDs can offer growers more control, as they have a spectrum that is more efficient at converting photons into usable photosynthetic energy, (referred to as photosynthetically active radiation or PAR). LEDs can also be dimmable, and they start up and power down more quickly than HPS luminaires—making them easier to manage and control your environment. Below, we have outlined some things to consider when deciding to retrofit your grow to LED.

Spectrum

When choosing LEDs for your retrofit, you need to evaluate the type of spectrum you need. Today, there are two broad categories for LED spectra: static and dynamic. Static fixtures feature fixed light spectrum recipes. Dynamic or tunable fixtures feature customizable light spectrum recipes.

Broad spectrum LEDs offer the plants a more complete spectrum, including blue, green, yellow, orange, and red—like natural sunlight. Broad spectrum LEDs are also great for workers because white light is easier to work under than blue/red light, making plant assessment. They can be used for all stages of growth, including vegetative and flowering growing stages.

Broad spectrum LEDs can also work to replace MH or CMH luminaires in vegetative growth stages for cannabis or leafy greens production. Some greenhouse growers of vine crops and ornamentals also use them for various stages of production depending on their needs.



Red and blue LEDs, where lights can appear pink or purple, are usually recommended for supplementary lighting in greenhouses, where plants are already receiving full spectrum sunlight from the outdoors. Since photosynthesis peaks in the blue and red spectrums, photons are more easily converted into photosynthetic energy at these wavelengths and therefore increase the overall energy efficiency of the lights.

The Design of the Luminaire

Another aspect to consider, when thinking of retrofitting, is the design of the luminaire. LED luminaires can come in different shapes, sizes and lengths—based on the intended application. For example, in a greenhouse application, luminaires often have a linear form factor to minimize shadowing on the crop. Other luminaires may have a larger, more rectangular form factor to accommodate more powerful drivers and more LEDs for applications where super high light output is required. The best form factor for your application, will depend on multiple factors including: whether your facility is a greenhouse or indoors, the mounting height of the luminaires, and the light intensity required.

One key design aspect to be aware of when purchasing an LED system, is the thermal design and engineering of the luminaire. Some companies use water or fans to cool their LEDs, which on top of being more expensive to operate, can cause problems such as corrosion and biological growth build up causing increased failure rates. Excessive heat can also lead to catastrophic failure of the LEDs, in which case the entire luminaire will have to be replaced. All P.L. Light Systems' LED products, are designed to use passive conduction to move heat away from the diodes and circuit boards—resulting in zero corrosion, higher efficiencies and longer lifetimes.

The other type of LED luminaire design would be a multi-bar unit, which is usually designed for vertical racking systems in indoor applications. Their slim design makes them ideal for very close-to-crop spacing, as well as propagation cycles. Our VertiMax unit is also ideal for replacing MH and CMH luminaires traditionally used in vertical or indoor grow operations, as they have a broad spectrum light with a higher blue content.





Light Output and Uniformity

HPS luminaires use special reflectors to widely distribute the light over the crop surface, and the crossover of the light helps achieve a layout with fewer luminaires and higher uniformity. LEDs, however, deliver a more directionally focused distribution of light (unless they have optics incorporated into the luminaire design). In situations where the mounting height of the luminaires is limited, a wider light distribution is highly beneficial. So, while you can achieve the same PPFD with LEDs as you would your existing HPS, LED luminaires deliver better light quality and intensity at a lower energy consumption (typically 30-40% less) while achieving the same uniformity over the crop.

So, it's always recommended to have a professional lighting company create a customized light plan that will show the best coordinates to place the luminaires to get the highest uniformity.

INSTALLATION

Depending on your building design, some growers may need to install additional track to hang the LED luminaires to ensure uniform light distribution over the crop. A light plan, designed specifically for your application, will take these things into consideration to ensure you have the highest uniformity, while ensuring the target light level is achieved by engineered placement of fixtures at optimal mounting heights and X-Y positioning.





PAR LIGHT

LEDs have the advantage over HPS in that they can convert more photons into PAR (photosynthetically active radiation) light energy for plants to use for photosynthesis. For HPS luminaires, we are able to reach up to 2.1 $\mu\text{mol/J}$ with our NXT2, however LEDs are much more efficient at utilizing energy and converting photons into PAR. Today, LED efficacies for premium commercial fixtures range between 2.9-3.9 $\mu\text{mol/J}$. This increased efficacy allows growers to reduce their overall energy load, when compared to HPS luminaires—while achieving greater levels of photosynthetic light.



WATERING & NUTRIENT UPTAKE

Since LEDs dissipate heat differently than HPS fixtures, you may also need to adjust your watering, as transpiration and water uptake will be different. One area to keep an eye on is nutrient management, as switching lighting technologies can impact nutrient uptake and translocation. Always consult with your head grower on which adjustments to water and nutrient uptake and airflow



ENVIRONMENTAL FACTORS

LED fixtures dissipate heat differently than traditional lighting, while being able to maintain higher light intensity compared to HPS luminaires. This is because they dissipate heat through convection, so it moves away from the crop rather than directed towards it, as with HPS lighting. **For crops like lettuce, strawberries, and leafy greens** this can be a big advantage since they need cooler temperatures to grow.

It should be noted that all luminaires create heat, whether LED and HPS, but they do so in different ways. LEDs create radiant and convective heat, but the majority is convective being emitted upwards away from the crop. HPS luminaires emit more light as radiant or infrared heat, and less convective heat, meaning that more light is converted to heat than PAR energy. However, many growers of heat-loving crops have come to value this heat and the benefits it can bring to crop growth and development by affecting leaf surface temperature and developmental processes.

For greenhouse grown crops like tomatoes, cannabis, and ornamentals, which are heat-loving crops, they can use the radiant heat from the HPS luminaires to help with growth and development, and many growers have become accustomed to growing these crops under HPS conditions. This is to say that growers will probably have to adjust their environment when making the switch to LEDs.

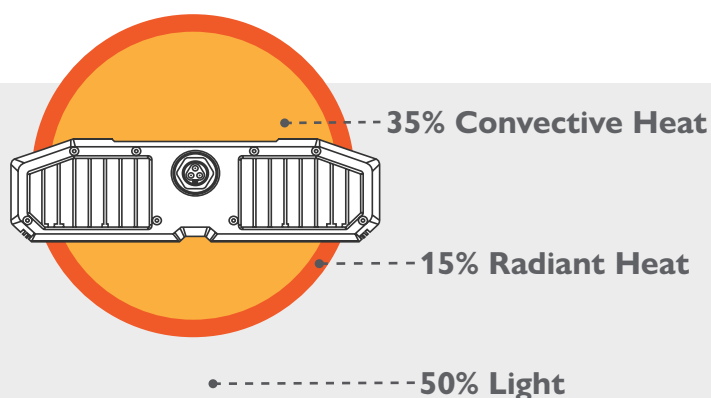
Even if your light levels remain the same with the LEDs, the plant can't use all the light for growth and development, unless grown under the same temperature as the older HPS lights. This refers to the law of limiting factors where in plant cultivation—light, CO₂ and temperature need to remain in balance for optimal crop growth. When one is too high or too low, productivity will suffer and yields and quality compromised.

HEAT DISSIPATION

One thing to note, is that the heat from HPS lights can also help offset heating costs in cold climate regions. In a recent study by Wageningen University, they set out to see how much energy is saved with an LED system versus an HPS system in a greenhouse application, when considering additional heating costs. They found that LEDs will reduce electricity costs by around 40%, but will increase heating by 25%, making the total energy savings around 15%. **So, the financial benefits of a transition to LEDs will depend on the energy and environmental costs associated with the application.** This study helps demonstrate that in order to understand the true energy savings of LEDs, you must look at the whole picture and include other areas of energy usage that can be affected by a switch in lighting technologies.

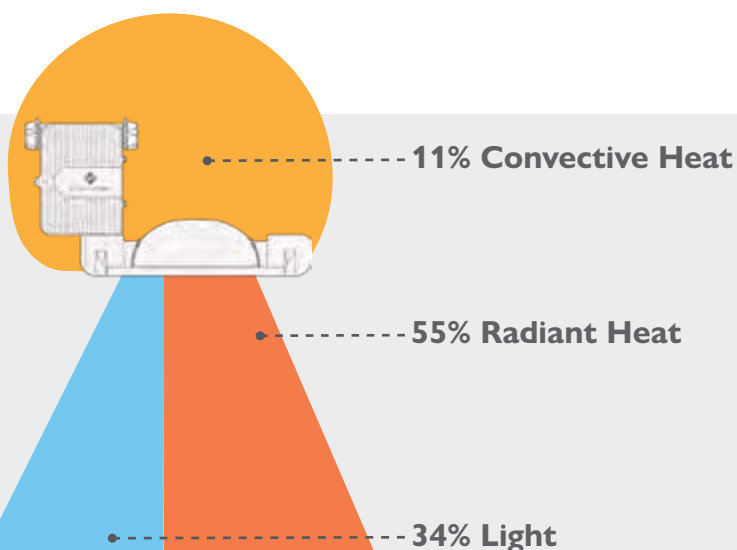
LEDs dissipate heat away from the illumination field in the form of convective heat.

This is contrary to HPS lamps which emit radiant heat in the direction of illumination. Since heat is directed away from the crop, lights can be placed very close to the crop canopy without any burning. Because of the lack of heat, this also means in cooler months of the year, heating costs will be higher—especially in northern climates. On the other hand, low heat from LEDs can be of benefit to growers in the south who would otherwise need to spend money on cooling their operation.



HPS lamps emit a significant amount of radiant heat in the plane of illumination.

This radiant heat is very effective in transferring heat to crops like cannabis, that require high temperatures for growth and development. The heat emitted from the lamps can help to offset the cost of heating with natural gas or electricity. HPS lamps need to be placed further away from the crop to reduce crop burn and watering schedules need to be adjusted to account for the higher amount of evapotranspiration.



Setting Up A Trial

If you are used to growing under HPS and plan on making the switch to a full LED installation, switching to LED will not be “plug and play” from a crop management perspective—you will need to rebalance your inputs. It is recommended to first set up a small trial area to grow your crops under LEDs, to monitor how they perform. Varieties within the same species can react differently to the same spectrum, so it will be important to see what happens and how you will need to adjust your growing environment. This will allow for a smoother transition when you decide to go full LED. You may also investigate adding different crop varieties that perform better under LED.



Rebate Programs & Energy Use

One big reason for making the switch to LEDs, is that they use less energy for the same unit of light—allowing growers to save more on energy costs when compared to HPS technologies. However, LEDs overall capital purchase cost per unit can be 2-4 times higher than HPS lights, which can be off-putting to some growers. Still, most provinces and states, now offer rebate incentive programs on LED installations, which can help decrease your payback period and make them more economically feasible. For more information on how to access rebate programs in your area, we advise checking with your local energy provider or local P.L. Light Systems sales manager.



Do LED luminaires reuse the same type of cable and connectors? Is it as easy as swapping out one for the other?

This will likely be manufacturer dependent. For many LED luminaires, a direct swap out may not be that straight forward. Due to several reasons (including the varying form factor / dimensions of the luminaires), different connectors would potentially need to be used between the two technologies. There are, however, some manufacturers that have already addressed this issue for ease of retrofit. P.L. Light Systems has done this with all their product lines.

The majority of our LED products feature an RST device connector, while the rest offer RST connector cables—allowing for them to be plugged into previously hardwired RST power cords. This allows for true plug and play retrofit installations where our NXT RST luminaires have previously been installed.

Are there any situations where I would need to upgrade my electrical to be able to install LEDs?

You should first review your facility and electrical infrastructure with your certified electrical designer. LEDs draw less power than HIDs, so an existing electrical infrastructure with 1000W HPS lights can accommodate an equal or greater number of LED luminaires up to 1000W.

However, if you are currently operating a 400W or other lower wattage HID systems, that infrastructure may not be sufficient to power higher output LED luminaires. Likewise, if you're contemplating retrofitting your existing lighting with super high output LED luminaires, which actually draw more power than 1000W HPS luminaires, then you also need to consider your current electrical supply capacity. Always consult with your local certified electrician to understand the electrical infrastructure modifications you will need to make, if any.



CASE STUDY: B&G VISSCHER GREENHOUSES

B&G Visscher is a perfect example of retrofitting a greenhouse from original magnetic ballast HPS luminaires to a full LED lighting system. The Visscher's have been using supplemental lighting for 20+ years to grow top-quality cut flowers for their customers year-round. For two decades, they grew under P.L. Light Systems' HSE2000 magnetic ballast HPS luminaires. Despite taking great care in maintaining their legacy luminaires over the years, the replacement lamps and other parts like capacitors and ignitors were becoming near impossible to find. As electronic luminaires took hold in the market, the magnetic component manufacturers discontinued making the parts and the older, magnetic ballast technology is now considered obsolete. So, this combined with the fact that the existing local power grid was at maximum electrical supply capacity, meant the only logical solution was for B&G Visscher to upgrade their greenhouse lighting to a far more efficient LED system.

KEY OBSERVATIONS:

- Force time of lilies is 1-2 weeks faster (depending on the variety of lily) under the LED lights vs. previous years when the plants were grown under the HPS light.
- Overall improvements to the crop quality under the LED vs. HPS lighting—including a darker green leaf colour, significantly increased stem strength and greatly reduced bud abortion.
- Significant reduction in electrical power consumption.



Original Lighting System:
Magnetic Ballast HPS



New Lighting System:
LED - RWMB Spectrum

RETROFIT: HYBRID LED-HPS LIGHTING SYSTEM

For growers who can't decide between LED or HPS, hybrid lighting is an easy solution that is fast becoming one of the most popular ways to light CEA crops. By choosing to install an LED-HPS system, growers can keep their existing infrastructure, including HPS luminaires, but install additional LEDs onto existing track/truss. Hybrid lighting systems can be used for any crop type such as vine crops, cannabis, leafy greens and ornamentals and can be used in both greenhouse and indoor applications.

One reason hybrid is so popular, is that it allows you to take advantage of the heat from HPS luminaires during winter, while extending the lighting season into early fall and spring with LEDs. Another main advantage, is lower energy costs since you have the additional LEDs replacing some of the HPS in your facility. A hybrid installation therefore allows for a quicker payback period, and growers can still take advantage of the rebate programs LEDs have to offer.

KEY BENEFITS:

- Take advantage of radiant heat from HPS in winter months, while extending lighting season into fall/spring by using LEDs (which produce far less heat)
- Reduces total costs since you can:
 - Keep existing infrastructure
 - Help mitigate some of the high capex from an all-LED solution
 - Still apply for rebates for LEDs
 - Lower energy load compared to all HID installation
- Take advantage of both diffuse and directional light
- Better control over spectrum by combining the two technologies
- Better control over light intensity
- Provide a balance of PAR wavelengths for plant growth with the HPS spectrum and LED spectrum





ENERGY SAVINGS AND COSTS

One of the biggest reasons for adopting LEDs, is to save on energy costs since HPS luminaires can use up to 40% more energy, as compared to the same wattage output HPS luminaire (1000W LED compared to 1000W HPS). When you adopt a hybrid system you begin to realize the benefits of energy savings with the LEDs by reducing your total energy load, as well as being able to receive rebate incentives through local energy programs.

As mentioned, one of the downsides to LEDs for some growers, is the lack of radiant heat which, when it comes to energy costs, means you need to make up for heat lost in a full LED system. HPS luminaires can help Northern growers offset some heating costs, so a hybrid system may be an advantage when it comes to balancing the environment and reducing your total heating costs in winter. HPS luminaires also benefit the crop by increasing leaf surface temperature.

Save on up front costs

LEDs can be much more costly than HPS luminaires, so a hybrid system can help you save on initial capex costs, since you will require fewer LED luminaires (compared to a full install). You also shouldn't need to install extra infrastructure to hang the LEDs (as you might in a complete LED installation), thus saving you money on building costs and installation costs.



LIGHT EFFICIENCY

We know HPS luminaires have wavelengths that dominate in the red spectrum. Red is valued for flowering and fruiting growth stages, but having a more balanced spectrum, including blue, may be beneficial in the overall morphogenesis of the plant. LEDs on the other hand, offer a variety of spectral options, which can help to optimize photosynthesis of the plants.

Red and blue wavelengths are the most efficient at converting photons into usable photosynthetic radiation. By combining HPS and LEDs (which often have higher blue ratios), your plants will receive a more uniform spectrum of light enabling them to grow better.

This can in turn have benefits on crop performance such as increased yields, quality, crop times, etc. You are also converting more photons into usable PAR for photosynthesis, thereby increasing efficiencies in both energy consumption and plant development.

RETROFIT: LEGACY HPS (MAGNETIC BALLAST) TO ELECTRONIC BALLAST HPS

Well-maintained HID luminaires can last decades, however, many growers see huge benefits when they replace their old magnetic ballast luminaires with more efficient electronic ballast luminaires. Some of the biggest improvements are:

- Increased light levels
- Improved energy efficiency
- They require fewer luminaires due to improved reflector technology
- Faster start up times
- Improved light quality
- Improved crop yields and quality

HPS luminaires have come a long way in their 40+ years on the market, and there is a reason they remain the most popular type of horticultural lighting. For many growers, they become accustomed to growing under HPS, and many crops like tomatoes, cucumbers, flowers and cannabis grow very well under HPS conditions. So, if you want a lighting upgrade, you don't have to go full LED to reap the benefits of improved lighting technology.

Energy Efficiency

Upgrading your magnetic ballast luminaires to electronic ballast luminaires will decrease your energy usage. Houweling's tomatoes saw a decrease of 2.2GWh of electricity per year when upgrading their legacy lighting to electronic ballast luminaires.





INSTALLING YOUR LUMINAIRES

To upgrade HPS luminaires, it should not require any major infrastructure changes, or changes in electrical. One of the best parts of newer HPS technologies, is that they can deliver the same amount of light with fewer luminaires than older legacy lighting. This is due to their higher wattage, increased light intensity and improved reflector technology, which helps spread light further. For this reason, you likely will not need additional track/truss added to your facility since they can be mounted on existing track/truss.

Improved Light Levels

A big reason growers want to upgrade their lighting is to achieve higher light levels, which will in turn increase yields, quality and decreases crop times. Possibly with your older luminaires you could only achieve 50-75 μ mol, but need an extra 75-150 μ mol to improve areas like yield and quality. With newer HPS or LED luminaires, you can easily increase the light intensity while also decreasing your energy usage and improving overall light uniformity.

Replacement Parts & Maintenance

Since magnetic ballast HPS luminaires have become obsolete, electronic ballasts are the only option for growers opting for HPS luminaires. Whether upgrading to hybrid or electronic ballast, keep a 'graveyard' of older lamps on hand for replacing or servicing any obsolete parts. Sourcing compatible lamps for new HIDs is considerably easier and installation is much more straightforward. Electronic ballasts make it simple for growers to start up their luminaires and make maintenance and repairs much faster and easier. With our NXT2 and NXT-LP, maintenance is very easy and the reflectors can easily be removed annually and cleaned with a vinegar water solution.

One important consideration when evaluating new investments in HPS greenhouse lighting is the evolving regulatory landscape around mercury-containing lamps. In Canada, amendments to the Products Containing Mercury Regulations under the Canadian Environmental Protection Act came into force in 2025 as part of Canada's commitments under the Minamata Convention on Mercury. These amendments phase out the manufacture and import of most mercury-containing lamps used for general lighting by 2026, with additional restrictions on HID lamps for general lighting taking effect in 2029. However, horticultural lamps used for plant growth — including HPS — remain exempt at this time, recognizing their specialized application and the need for viable alternatives, though reporting and compliance obligations still apply. In the United States, there is likewise no federal ban on horticultural HPS lamps, as federal efficiency standards target general service lighting and exclude specialty plant-growth applications. Instead, regulatory pressure is increasingly applied through performance-based energy codes. For example, California's Title 24 standards set minimum photosynthetic photon efficacy (PPE) requirements for greenhouse and indoor horticultural lighting in new construction and major retrofits — thresholds that many traditional HPS systems struggle to meet. As a result, while HPS lamps remain legally available for greenhouse use in 2026, ongoing regulatory and efficiency requirements continue to favor higher-efficiency LED solutions for future-proofing new installations.



CASE STUDY:

BURNABY LAKE GREENHOUSES

Burnaby Lake Greenhouses is a great example of retrofitting a greenhouse from old 600W luminaires to 1000W electronic ballast luminaires. Burnaby Lake is a large grower of ornamentals and potted flowering plants, with approximately 1.2 million square feet of greenhouse space. They used our PL2000 600W HPS luminaires for many years but wanted to increase their energy efficiency and increase light levels, so they opted to replace them with our **NXT2 1000W HPS luminaires**.

The original 600W luminaires were only able to emit 80 μ mol of light, and the high light requirements of roses meant they were needing to add about 25 μ mol more (for a total of 105 μ mol) to grow the best roses possible in Vancouver's cloudy and wet winter months. Before beginning the retrofit, they tested a small trial area with twelve NXT2 luminaires. The new NXT2's exceeded their expectations and they saw improved growth, uniformity and performance than with the previous 600W luminaires

	Old 600W PL 2000	New 1000W NXT2
Quantity of luminaires	360	150 - 58% fewer
Power consumption	216 kW	150kW - 53% less
Light level	OK	25% better
Uniformity	OK	Described as better
Quality	OK	Described as better

With the new luminaires performing above and beyond their expectations, they began the conversion of their greenhouses in 2017, switching out 360 of the 600W luminaires with only 150 1000W NXT2s. This new retrofit meant they needed 58% fewer lights than the original installation (thanks to the improvement in the NXT2's design), resulting in higher light intensities and distribution. With the new NXT2 luminaires, they achieved a 25% increase in light levels compared to the old PL2000s. In addition, they used 53% less power as the NXT2's (with high efficiency electronic ballasts) use only 150kW versus the old PL 2000s (with magnetic ballasts) that used 216kW. This saved them approximately \$144 a day in electrical costs, with a payback period of 348 days—less than a year.

ENVIRONMENT

HPS luminaires remain popular among many growers in Northern climates because they generate radiant heat, in addition to light, which helps plant growth and development and can help offset heating costs in winter by up to 40%. HPS luminaires can also help manage humidity and transpiration in crops.

When growers make the switch to LEDs, they may notice that their plants have different needs, transpire less and require additional heat to maintain a consistent climate for photosynthesis. With a hybrid system you have more flexibility when it comes to controlling your environment since you now have the option of using both HPS and LED at the same time, or individually, depending on your needs. For example, in the spring and/or fall, you can turn off the HPS and just use the LEDs to extend the season and maintain your DLI.

If you grow many different varieties in one greenhouse, a hybrid system may also give you the advantage of growing many varieties. This is because some varieties can be more sensitive to LEDs and not perform as well, but when grown under a hybrid system they adapt much easier.



CONTACT US

Our **sales team** is dedicated to supporting our customers throughout the project and beyond.
Contact **your regional sales manager** to find out how P.L. Light Systems can help you grow.

Our friendly, North American based **customer service team** are available Monday – Friday between 8:00am and 4:30pm (EST) to assist with product-specific inquiries and general technical guidance to ensure an experience that is as seamless as possible for all our customers.

Our **website** is also a hub of product information that can be accessed 24/7.



41 Brockley Drive, Unit 11
Hamilton, ON
Canada L8E 3C3

T: 905.563.4133
E: info@pllight.com
W: www.pllight.com

Follow us on all our social media channels



www.pllight.com