

Next Gen Large Area Lighting: HIDs, Automation and Energy Efficiency

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ABSTRACT

Lumetric has reinvented lighting for large areas, combining advanced energy control features with high output lamps to create the bright, energy-efficient lighting. Simple to install and easy to upgrade, Lumetric's SmartPOD plug-and-play units provide dramatic energy savings. Networked together and ultimately connected to the Smart Grid, the SmartPOD offers up to 80% energy savings over legacy lighting systems while improving light quality and brightness, something LEDs and fluorescents will never achieve in high bay applications, despite ambitious claims. Originating in the science hub of Oak Ridge, Tennessee as a collaboration of motion control and robotic software scientists and inventors, the SmartPOD controls any HID lamp with continual, linear dimming, daylight harvesters and motion detectors, among others. Lumetric invented a solid-state direct drive system capable of controlling with unprecedented accuracy the light arc generated within the plasma field of the bulb, so that large areas can continue to be lit with the brightest, highest quality, light – most similar to the sun -- preferred by occupants of large areas for 150 years. The SmartPOD was also built with the Smart Grid in mind, offering future-ready demand response capabilities.

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1 THE CHANGING RELATIONSHIP BETWEEN LIGHTING AND ENERGY

While advances in renewable energy technology have struggled to make a dent in our global consumption of fossil fuels, energy efficiency measures in our built environment are allowing us to significantly cut energy use at the source of consumption. With the goal of conserving energy in “large areas” where efficiency measures have traditionally proved difficult (factories, high-bay facilities, warehouses, big box retailers, parking structures, gymnasiums, etc.), the engineers at lighting innovator Lumetric set out to develop an energy efficient lighting solution that still offers exceptional light quality.

Lighting is amongst the largest consumers of energy in industrial and commercial facilities, representing roughly 25% of total energy use. With so much at stake, energy efficient lighting has the potential to make a huge

environmental impact. The key to maximizing efficiency is controlling output depending on constantly changing lighting needs. Introducing control capabilities to legacy high intensity discharge (HID) technology provides a simple and cost-effective, energy saving alternative for large facilities that have traditionally been huge energy wasters.

2 IMPROVING ON TRADITIONAL HID

HID light has been the technology of choice for large areas for the better part of the past century due to the quality of light they provide. This technology offers bright, illuminating light quality most similar to the sun. HID lamps are also known for being an incredibly energy efficient light source. Unfortunately, the ballasts that have traditionally been used with HIDs are legacy technologies counteract the efficiency attributes of HID lamps. These ballasts' are unable to efficiently control the energy current traveling through the lamp. Due to this short-coming, HIDs have wrongly been labeled as inefficient in the lighting industry. Lumetric's challenge was to reverse this misunderstanding by designing a fixture that embraces the HID bulb while reducing overall energy use.

Lumetric's SmartPOD achieves these energy savings without sacrificing lighting quality or output by taking a unique approach to the design of the HID driver within the ballast. Through this re-design, the SmartPOD is able to offer a range of tailored control capabilities that deliver up to 80% in energy savings. Even with this considerable energy reduction, the SmartPOD still delivers the greatest light output and highest color-rendering index (CRI) in the industry. As a result of these superlative features, the SmartPOD has been installed in everything from high temperature factories to warehouses and retail stores. To date, the SmartPOD has surpassed 2 million hours of operation in industrial facilities, warehouses and retail spaces.

3 BREAKTHROUGH IN ARC CONTROL AND BALLAST DESIGN

Previous attempts to reduce energy consumption while controlling the lamp arc have failed or had limited success, including the electronic HID technology developed during the 1990s. Originating in the science hub of Oak Ridge, Tennessee as a collaboration of motion control and robotic

software scientists and inventors, Lumetric's solid-state direct drive system is capable of controlling the light arc generated within the plasma field of the HID bulb with unprecedented accuracy. The ability to control the light arc, coupled with an innovative and unique method of igniting the lamp, also considerably extends the life of the HID lamp, resulting in additional cost and materials savings.

By reengineering the light ballast and forgoing the use of a transformer, the SmartPOD luminaire produces little excess heat, limiting energy waste. The SmartPOD ballast was designed specifically with ambient environmental temperature in mind since HID lamps are used in many large factories and facilities where hot and cold temperature needs are a factor.

4 ADDRESSING LINEAR DIMMING

The SmartPOD also includes a feedback system that enables rapid dimming (complete range within 200 milliseconds), therefore avoiding the problem of "collapsing the arc" which occurs with slower and less capable control technology. This breakthrough in linear dimming for HID bulbs was believed to be impossible until Lumetric applied an innovative solution based in robotics design. Linear dimming capabilities are essential to truly controlling light use and achieving energy efficiency, even more so than motion control. Without linear dimming of HID lamps, daylight harvesting would be impossible. The ability to alter light levels alongside changes in ambient light is crucial to conserving energy resources. Once a building manager has designated the ideal amount of foot candles preferred for a given space, lamps capable of linear dimming can easily factor in ambient light levels and adapt accordingly.

While linear dimming is nothing new in the world of lighting, very few companies have developed technologies that can do so for HID lamps. The few HID lamps capable of dimming only feature step dimming rather than the more efficient and aesthetically pleasant gradual, linear dimming. Other companies that have developed linear dimming technologies need to fine tune the ballast for each HID lamp to get them to work properly, which takes additional time and money. However, the SmartPOD works with any type of HID lamp as soon as they are popped in. This breakthrough would not have been possible without sufficiently addressing control loop theory and addressing frequencies and voltage with the addition of high power levels. By tackling these obstacles, the SmartPOD has full control of the light arc.

5 LIGHTING AND THE SMART GRID

The SmartPOD was also built from the ground up for the Smart Grid, offering future-ready demand response capabilities. The software that interfaces with the SmartPOD offers a user-friendly pathway to demand-response management, providing building owners and facility managers a simple method of further reducing energy use and saving money. Although a majority of utilities are not yet offering demand response services, the introduction of these programs are on the horizon. Additional opportunities such as load shedding and time of use pricing will enable further energy and cost savings. This is all made possible through the fusion of lighting fixtures and advanced software. Light fixtures are now networked together and centrally controlled, with each light operating as an individual network end point complete with its own IP address.