Bright IDEAS

Georgia Power

GEORGIA POWER OUTDOOR LIGHTING SERVICES

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Welcome to Bright IDEAS,

your source for information on outdoor lighting issues, products and ideas. Georgia Power's Lighting Services group works to bring you the most up-to-date information about the industry and your options for outdoor lighting.

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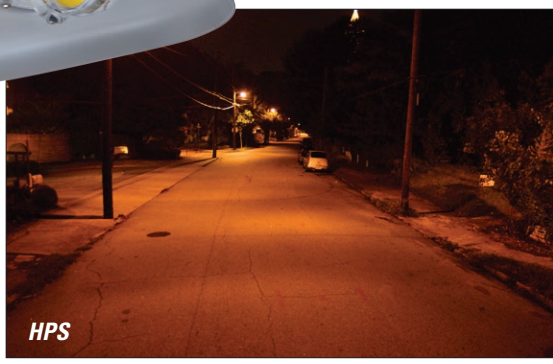
UPDATE:

Georgia Power's LED Roadway Lighting Initiative

The last issue of Bright IDEAS (Volume 12 • Summer 2015) reported on the February 2015 launch of Georgia Power's initiative to convert approximately 400,000 high-pressure sodium roadway lights to LED over the next four years.



Since conversions began, Georgia Power has removed over 135,000 high-pressure sodium cobra head roadway fixtures and replaced them with new LED fixtures. To date (August 2016), more than 200 governmental customers representing more than 230,000 lights, have made their request to be included in the LED Roadway Lighting Initiative.

The conversion to LED Roadway Lighting is being done in phases.

- Phase I began in 2015 and replaced 100,150, 250 and 400 watt HID cobra head roadway fixtures with LED roadway fixtures. Phase I installations began in 2015 and will carry over into 2017.
- Phase II will replace HID post-top fixtures with LED post-top fixtures. It is expected that the post-top conversions will begin in 2017.
- It is expected that work will continue through 2018 for all phases.

In addition, Georgia Power continues to make LED area lighting available to its commercial and industrial outdoor lighting customers. Since LED area lighting was added to its product offering in January 2012, Georgia Power has installed over 120,000 LED area lights.

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LED Lighting is a Top Priority for U.S. Cities

At the 84th winter meeting of the U.S. Conference of Mayors held in January 2016 in Washington, D.C., the results of its "How Energy Technologies are Reshaping America's Cities" survey were released. LED lighting is the technology of choice for mayors to implement, and is ranked ahead of 17 other clean technologies and low-carbon solutions to reduce energy use and carbon emissions over the next two years. Low-energy buildings and solar electricity generation were the next two most promising options for the mayors participating in the survey.

The survey indicated that 77% of cities are directing their energy-efficiency efforts to public buildings, and 64% are prioritizing outdoor lighting for improvements.

When asked to identify the most significant challenges to increasing energy efficiency and conservation in these areas, the respondents cited the following:

- Local budget/local funding constraints 77%
- High up-front costs 49%
- Limited/no available federal funding 33%
- Limited/no available state funding 29%
- Current infrastructure still working/hard to justify upgrades 20%
- Low/uncertain rate of return 18%

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Survey results regarding LED lighting:

- 83% of cities surveyed have already deployed LED lighting
- 74% of cities have deployed LED lighting in city-owned buildings
- 73% of cities have deployed LED lighting in street lighting
- 45% of cities have a plan for deploying LED lighting
- 81% of cities are targeting street lights in their LED lighting plans

Respondents identified the most significant barriers to deployment of LED street lighting plans:

- Lack of resources 56%
- Ownership of light poles 39%
- Existing lighting system performing/not fully amortized 29%
- Utility practices/return on investment (e.g., staff tariffs) 27%
- Bid or procurement systems 14%
- Other 14%

Connected Lighting Systems:

- 67% of cities responding are familiar with Connected Lighting Systems
- 61% of cities responding are considering deployment of Connected Lighting Systems

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The LED Lighting Revolution

The media has reported on energy-saving technology adoption in solar, batteries, and electric vehicles but given relatively little coverage to what is happening in lighting.

A recent report from Goldman Sachs stated that "The rapid adoption of LEDs in lighting marks one of the fastest technology shifts in human history. LEDs for general lighting were only recently commercialized, but will dominate sales by the end of this decade." The report also stated that accelerated deployment of LED lighting is on track to save U.S. consumers and businesses $20 billion a year in electricity costs in a decade and lower U.S. CO2 emissions by 100 million metric tons a year.

The November 2015 U.S. Department of Energy report "Revolution…Now – the Future Arrives for Five Clean Energy Technologies" reported that as recently as 2009 the United States had less than 400,000 installations of common home LED bulbs. By 2012, it had 14 million and by 2014, it had 78 million installations. LEDs now account for over half of U.S. lighting sales and are on track to cut power consumption by more than 40%.

This revolution in the adoption of LED bulbs for home use has been driven by sharp cost reductions and performance improvements, relatively short replacement cycles for incumbent lighting technologies, and aggressive public policy support. Since 2008, prices for LED light bulbs have dropped 90 percent. Goldman Sachs forecasts that LEDs will account for 69 percent of light bulbs sold and over 60 percent of the installed global base by 2020.

Energy and climate benefits of LEDs are the reason that the U.S. Department of Energy (DOE) has been working to advance the technology and promote deployment of LED lighting in the U.S. Most major countries in the world have worked to hasten the adoption of LEDs, mainly through the mandatory phase-out of inefficient incandescent lighting. The DOE and many in the lighting industry are looking toward even greater potential energy savings in commercial and industrial application of LED lighting.

The LED lighting revolution may not be frequently reported on by mainstream media, but it is taking place at a very rapid pace in all parts of the lighting industry worldwide.

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The Internet of Things, Big Data, Connected Lighting and Intelligent Cities

Chances are you've recently seen or heard news references to something called "The Internet of Things" or IoT. But what exactly is it and why is it being highlighted in a lighting newsletter? IoT refers to interconnecting disparate devices and networks of devices that previously operated in isolation from one another. IoT is growing fast, with estimates that by 2020 there will be as many as 200 billion connected "things."

One of the main reasons for this rapid growth of "connected things" is that sensors are becoming more numerous and diverse as well as smaller and more affordable. It's now possible to add a sensor to a device to detect a variety of conditions, such as location coordinates, environmental conditions, noise levels, or various performance metrics. Ever increasing numbers of sensors and connected devices generate "big data" and the "big data" generated by millions of connected devices presents huge opportunities to alter how we live, work and play. But capitalizing on this opportunity requires something more than just connected devices and sensors.

IoT devices and sensors need to be supported by a method of moving data among the devices and a system that turns the data collected into useful information, and this must be practical and affordable to implement. This is where lighting becomes a part of the IoT.

Most anywhere that people are doing any activities of importance, you'll find lighting. Lighting systems are connected to power sources, a key element needed for the IoT. The advent of digital solid-state LED lighting technology has enabled additional functionality in lighting (real-time performance monitoring, diagnostics, GPS locating, etc.) via wireless network controls. The wireless networks being deployed in LED street lighting systems are viewed as an ideal platform for enabling IoT connectivity.

A number of high-tech companies are now active in developing and scaling technologies that will allow cities to run more efficiently and meet sustainability goals. Among those companies is AT&T with its Smart Cities Initiative, launched in January 2016. Smart Cities is working to help build more connected cities, more environmentally sustainable communities, and help cities save money, preserve natural resources, and improve the quality of life for their citizens. AT&T announced that Georgia Tech, Atlanta, Dallas and Chicago were set as Smart Cities, pilot cities and universities. IBM, Intel, Cisco, Deloitte, Ericsson, GE and Qualcomm are partner companies in the initiative. Recently added as pilot cities were Montgomery County, Maryland, and Chapel Hill, North Carolina, along with Nokia and Atlanta's Southern Company as additional partner companies.

Beyond LED: Lighting in the Future

While LED technology is rapidly becoming the accepted technology for many lighting applications and the technology continues to evolve and improve, researchers are looking at a number of options for future lighting technology.

- Oregon State University is working on advances in manufacturing technology for "quantum dots" that may lead to a new generation of LED lighting to produce a more user-friendly white light using low-cost continuous flow chemical reactor manufacturing processes that use microwave heating and less toxic materials. Quantum dots are nanoparticles that can be used to emit light.

- Recent research at the Niels Bohr Institute of the University of Copenhagen, published in the journal ACS Nano, shows

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Beyond LED *continued*

that LEDs made from nanowires (very small wires made of semiconducting materials), will use less energy and provide better light. Researchers predict that the technology will progress quickly and that nanowire LEDs may be in use within five years.

- Dr. Shuji Nakamura, one of the three Noble Prize winning inventors of the blue LED which led to the game-changing LED lighting technology, has co-founded a company to commercialize laser diodes. Dr. Nakamura believes that laser diodes are the future of lighting. According to Dr. Nakamura, laser diodes have unique properties that provide compelling advantages over LED, OLED, and legacy lighting sources. He adds that while laser diodes produce highly directional output with superior delivered lumens per watt compared to other light sources, there is still some way to go before laser diode technology will reach its full potential.

- A team of researchers at Arizona State University has developed a laser that can produce pure white light that is brighter and more efficient than even the best LEDs using nanomaterials along with red, blue and green laser beams to produce white light. The basic design needs to be refined before the technology is ready for use in commercial lighting.

- Researchers at the Massachusetts Institute of Technology (MIT) are not ready to give up on the incandescent lighting technology invented by Thomas Edison in the early 1880's. These filament light bulbs are generally only 5% efficient with 95% of the energy used to produce light being lost as heat. The MIT researchers have shown that by surrounding the filament with a special crystal structure coating on the interior surface of the light bulb glass, the energy usually lost in heat can be bounced back to the filament where it can create new light while still allowing light through the glass. Scientists believe that this new bulb could increase efficiency levels to 40% and provide near-ideal color rendering. MIT's experimental device is, at this point, a proof-of-concept and at the low end of performance that could ultimately be achieved by this approach.

Dr. Roland Haitz LED Pioneer

Dr. Roland Haitz, a pioneer in LED technology, passed away last year at age 80 after a long career with a focus on LED technology. During his career, he filed more than 50 patent applications (with 10 patents filed in the last four years of his life) – the last of which was filed just months before his passing.

Dr. Haitz personally led the development of many families of light-emitting diode technologies that are common today, ranging from displays of hand-held calculators to LED tail lights of vehicles.

Above all, Dr. Haitz was a visionary who foresaw the transition to LED-based technology long before most. He is is perhaps most famous for his projection on the progression of LED technology that came to be known as Haitz's Law. Haitz's Law has long been considered the equivalent for LEDs and lighting of Moore's Law for transistors and integrated circuits.

He first put forth this basic principle at a conference in 2000 when he stated that there would be an exponential increase in lumen output from packaged LEDs and a corresponding reduction in dollars per lumen. He also projected that solid-state lighting products would reach an efficacy of 200 lumens per watt by 2020. His projections have proven to be very accurate through the evolution of LED technology over the last 15 years.

In some of his last comments on solid-state lighting technology, Haitz said, "Solid-state lighting is where the Internet was in the 1980's. Just as we could not then have predicted what the Internet is now, 30 years later, we cannot foresee all that light and lighting will become in the next decades. We know simply that it will be wondrous and beautiful."

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A New Method for Evaluating Color Rendition

The Illuminating Engineering Society (IES), in August 2015, published an important new technical memorandum, TM-30-15, which outlined a new system for evaluating color rendition of light sources. The new metric is intended to fairly and accurately characterize both LED-based solid-state lighting, and conventional legacy sources. It was developed by an IES task group formed in 2013 to address the limitations of the International Commission on Illumination's (CIE) Color Rendering Index (CRI).

CRI is a single metric system that expresses color fidelity, or how closely a light source renders colors, compared to an ideal light source. CRI relies on scientific data developed in the 1930's and its last major revision was in 1974. The CRI metric was established in part to allow fluorescent light sources to attain a reasonably good score of 80 on a scale of 100.

TM-30-15 was developed in response to calls from the LED and solid-state lighting industry for a new and improved metric that better represents the scope of spectral engineering and optimization offered by solid-state lighting. TM-30-15 is a two-metric system which retains the Fidelity Index expressing color fidelity or rendering, and adds a new Gamut Index which expresses average color distortion (saturation or desaturation) compared to the reference source.

While CRI determines color fidelity using only eight pastel color samples, TM-30-15 proposes the use of 99 color samples to provide more accuracy regarding color fidelity, or the way a strong color is distinguished from a weak color.

Although the IES is an influential organization in the lighting industry, the publication of TM-30-15 does not automatically make it an industry standard. The CIE is the standards organization behind CRI and needs to approve and adopt TM-30-15. CIE has previously refused to adopt the Color Quality Scale (CQS) metric developed by the National Institute of Standards and Technology (NIST) as a replacement for CRI.

The CIE published a position statement on TM-30-15 on October 15, 2015, in which it acknowledged that its Color Rendering Index does not agree well with overall perceived color rendering – that it has several significant sources of colorimetric inaccuracy, and that it should be updated with the latest well-accepted formulae and an improved set of test samples. It also stated that the CIE Technical Committee (TC) 1-90 is in the process of developing an improved color fidelity metric that can update CRI. The CIE stated that it supports the study of TM-30-15 and that it was recently proposed for consideration in TC 1-90.

The National Electrical Manufacturers Association (NEMA), in November 2015, issued a position paper on TM-30-15 in which it urged the international lighting community to evaluate TM-30-15 and recommended a thorough vetting process before adoption.

As of August 2016, there has been no further word from CIE on its position on endorsement of IES TM-30-15.

Industry Standards Update

New Outdoor Lighting Standards, Regulations, and Legislation

National Electrical Manufacturers Association (NEMA)

ANSI C136.15-2015 Roadway and Area Lighting Equipment – Luminaire Field Identification

ANSI C136.30-2015 American National Standard for Roadway and Area Lighting Equipment – Pole Vibration

ANSI C136.49-2016 American National Standard for Roadway and Area Lighting Equipment – Plasma Lighting

NEMA LSD 74-2016 Considerations of Field LED Driver Replacement

U.S. Department of Energy

DOE regulatory decision affecting high-intensity discharge lamp industry:
DOE decides not to issue HID lamp standards.

The U.S. Department of Energy issued its December 2, 2015, decision that mandatory energy conservation standards for high-intensity discharge (HID) lamps are not technically feasible or economical. The DOE determined that higher energy conservation standards for HID lamps would not yield significant energy savings for the nation.

Over the past five years, the DOE undertook a careful analysis of earlier technical work and concluded that regulating the efficiency of HID lamps was unwarranted. The DOE's new analysis notes that the market for HID products is changing as new technologies, particularly solid-state lighting, are displacing HID lamps.

Note: Some lighting manufacturers have recently started phasing out incumbent lighting technologies from their product offerings as LED-based lighting is becoming more efficient and cost-effective, and demand for non-LED lighting products has been falling.