Bright Ideas

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Georgia Power
Outdoor Lighting Services

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.

In this issue, you'll find the latest on lighting industry news; lighting industry standards, regulations and legislation; intelligent lighting systems; market transformation in lighting and more.

Call 1-888-768-8458 or visit outdoorlighting.georgiapower.com for more information about Georgia Power Outdoor Lighting. Our lighting experts will be happy to help you learn more about creating a bright, inviting outdoor environment for your business.

Newly Revised Georgia Power Outdoor Lighting Website

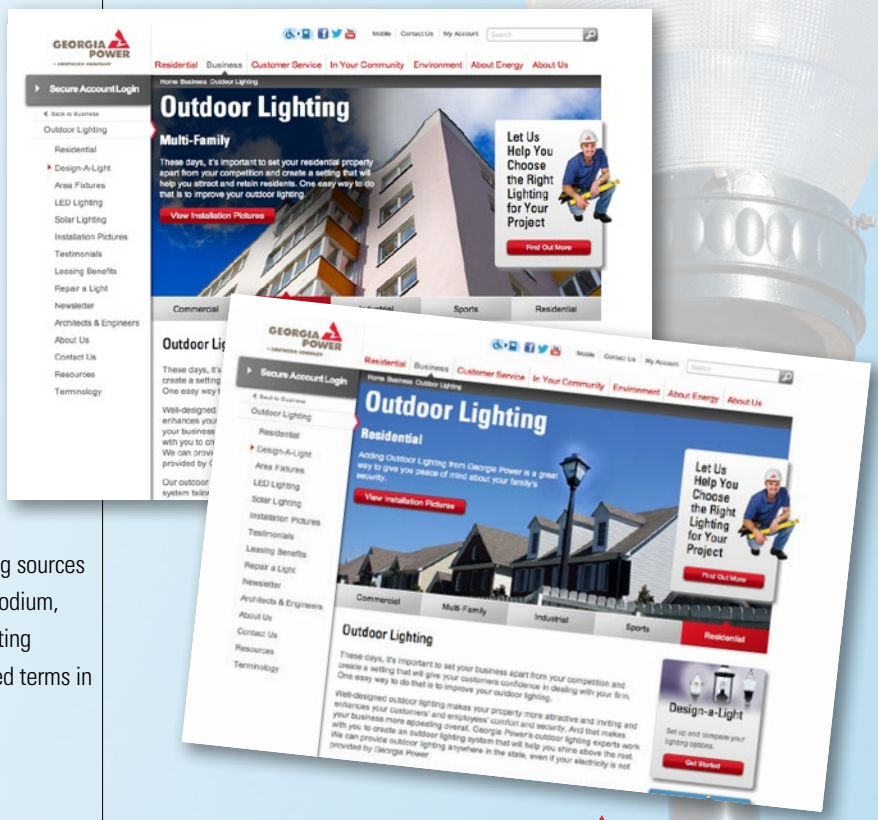
We're happy to announce that our updated and expanded Outdoor Lighting website is now online.

Changes were made to make the site easier for visitors to use and provide more useful information for our customers and prospective customers. In addition to a new look, improved graphics, and expanded content, here are some highlights of the new content added to the site.

- **New LED lighting page**
- **New Solar lighting page**
- **New Resources page** containing:
  - **Position Statements** on LED Lighting and Light Pollution
  - **Outdoor Lighting Rates**
  - **Helpful Links** – Illuminating Engineering Society; International Dark-Sky Association; U.S. Green Building Council/LEED; U.S. Department of Energy Solid-State Lighting Program; Municipal Solid-State Street Lighting Consortium; California Lighting Technology Center
  - **Lighting Sources** – Basic information on HID lighting sources (mercury vapor, low-pressure sodium, high pressure sodium, and metal halide) and LED, induction and plasma lighting
- **New Terminology page** – A glossary of commonly used terms in outdoor lighting

We encourage you to visit the website at outdoorlighting.georgiapower.com or www.georgiapower.com/business/outdoor-lighting/.

The site has been designed to be compatible with all popular Web browsers as well as with mobile devices. Please note that if you still have Internet Explorer 7 on your computer, some of the functionality of the website will not work optimally as IE 7 is no longer supported by Microsoft.



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The Future of Lighting in the United States

During 2013, several prominent market research firms specializing in the electronics and lighting markets reported on the current state of the LED technology for general lighting applications, which includes outdoor lighting.

One of the firms reported that the market for packaged LEDs – an LED die with a protective covering and contacts that enable it to be directly soldered to an electrical circuit – will grow from $3.6 billion in 2013 to $7.1 billion in 2016. The same report noted that rapid growth of the packaged LED market was, in the past, due to use for display backlighting in TVs, notebooks and mobile phones and that most of these applications have completed their transition to LED technology. The next wave of accelerated growth is predicted to be the lighting market. In 2012, the lighting sector overtook TV backlighting to become the largest end-application for packaged LEDs.

Another firm reported that the lighting segment of the packaged LED market grew from $1.5 billion in 2011 to $3.1 billion in 2012 and that going forward, the real growth in packaged LED sales will be in general solid-state lighting applications.

Other trends noted in the reports are that LED efficacy (lumens per watt) is steeply rising while price, measured by dollars per kilo lumen ($/klm), is dropping.

Solid-state lighting was also a main topic at several of the major lighting industry conferences and trade shows in 2013. The LED Show in August had a session that posed the question, "Can LEDs continue to improve at the rate they are now?" to LED and luminaire manufacturers. Manufacturers tended to focus on how to meet solid-state lighting system cost and quality goals with their different approaches to LED technology.

One manufacturer stated that future efficacy (lumens per watt) advances will come more at the system than the component level, that LEDs will continue to improve but at a slower rate than in the past, and that LED systems will continue to drive the improvement. The manufacturer said that the lighting industry needs efficacy balanced with functionality, good light quality and cost. Another manufacturer pointed out that LEDs are a decreasing cost factor in SSL products relative to other things such as drivers, thermals and optics.

The U.S. Department of Energy (DOE) published a new report in May 2013 titled "Adoption of LEDs in common lighting applications." The report documents energy saved to date in the U.S. by LED usage in nine specific applications (including street and parking lot lighting) and projects potential savings if there was a complete transition overnight to solid-state lighting in these applications.

LED usage today across these nine applications is saving 71 trillion BTUs (British Thermal Units) annually, equivalent to $675 million in energy costs. The DOE report projects that with a full U.S. transition to LEDs in the nine applications, savings could reach 3.9 quadrillion BTUs, equivalent to almost $37 billion in energy costs, a figure representing approximately half of the country's total lighting energy consumption in 2012.

Market Transformation in Lighting

Thomas Edison invented the first successful incandescent light bulb in 1879 and patented it in 1880. There have been improvements over the years, but indoor and outdoor lighting – using electric current applied to a filament inside a glass enclosure to produce light – has, for all intents, remained essentially the same as Edison's first light bulb up until now. Small improvements over the years increased bulb life and improved light quality, and new variations of the concept, such as high-intensity discharge (HID) mercury vapor, low- and high-pressure sodium, fluorescent and induction lighting, were introduced. Light bulbs and fixtures were

See **Market Transformation in Lighting,** *page 3*

Market Transformation in Lighting

continued from page 2

produced by a relatively small number of manufacturers and the lighting industry could be described as mature. Recently, things have started to change in the lighting industry, a change described by some as a lighting renaissance. A main driver of the change is solid-state light-emitting diode (LED) technology.

The first practical visible-spectrum (red) light-emitting diode, or LED, was developed in 1962 by Nick Holonyak Jr. while working at General Electric. Holonyak is seen as the "father of the light-emitting diode." While LEDs have been in use for more than 50 years, it's only in the last 10 years that the technology developed and improved to the point that it became suitable for use in general lighting applications.

The last five years have seen tremendous LED technology improvements, most of which we re spurred by legislation requiring energy-efficient lighting products. Designers and manufacturers recognized the benefits of LED technology such as light quality, energy efficiency, long life and reduced maintenance requirements, and started developing and producing lighting products that met energy mandates and customer expectations.

LED lighting has been described as a disruptive technology – that is, a new technology that displaces an established technology and isdisruptive enough to reshape industries. Examples of disruptive technologies are digital cameras, wireless technology, Internet, email, tablet computers, etc. New players have entered the lighting market, many of them coming from the semiconductor industry. Longtime lighting manufacturers face challenges to their traditional market and the need to make critical decisions about their future. Ignore the new technology or accept it? Modify existing products and spend money on R & D to produce incremental improvements in energy efficiency or invest in LED technology R & D, production equipment, etc.?

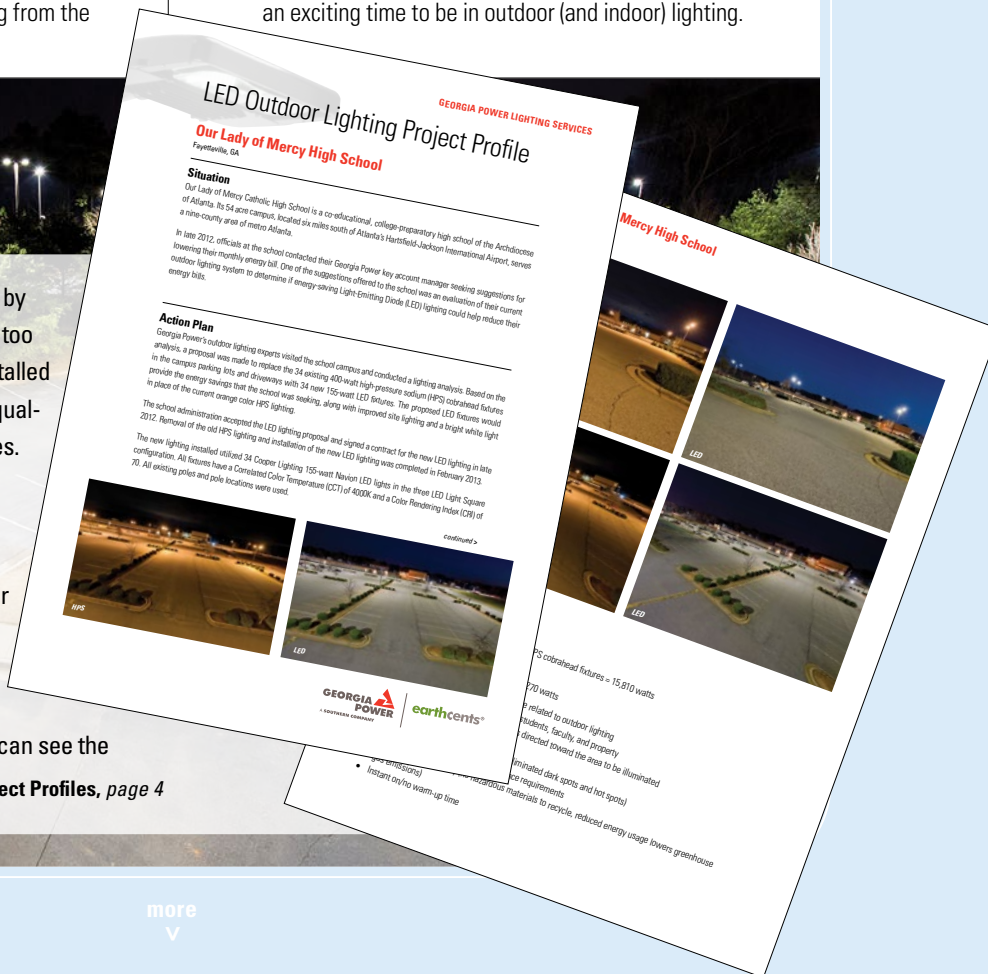
We are truly experiencing a market transformation in outdoor lighting. A number of major lighting manufacturers have embraced the new technology and are developing and producing a wide variety of quality outdoor lighting products, with some manufacturers devoting 75 percent or more of their R & D budgets to LED technology. New manufacturers are entering the market. Constant research and development is producing major improvements in semiconductors, design, materials, manufacturing, drivers, optics, LED packages, etc. In addition, LED technology enables the use of electronic controls to increase the functionality of lighting such as adaptive lighting, dimming and performance monitoring.

LED technology is changing the way Georgia Power designs and maintains outdoor lighting installations. We can now tailor outdoor lighting to specific application needs and provide the right amount of light exactly where it's needed without wasted light or energy. Our customers are experiencing the benefits of LED lighting, including improved lighting quality and energy efficiency. It's an exciting time to be in outdoor (and indoor) lighting.

New Outdoor Lighting LED Project Profiles

To many, the benefits and promises offered by LED lighting for outdoor applications sound too good to be true. Correctly designed and installed LED lighting in outdoor applications, using quality LED fixtures, does deliver on the promises.

The adages "seeing is believing" and "a picture is worth a thousand words" are especially appropriate when it comes to good LED outdoor lighting installations. Over the past two years, Georgia Power has installed thousands of LED lights for hundreds of customers, and we've produced a series of LED Project Profiles so that you can see the



See **Project Profiles,** *page 4*

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Project Profiles

continued from page 3

difference that LED lighting makes in lighting quality and energy savings.

The LED Project Profiles show before and after photographs of the installations, the savings in energy usage related to outdoor lighting, and other benefits from switching to LED lighting. The LED Project Profiles show conversions of both high-pressure sodium and metal halide lighting to LED. You can see all the LED Project Profiles on the LED page of the Georgia Power Outdoor Lighting website at www.georgiapower.com/business/outdoor-lighting/led-outdoor-lighting.cshtml.

Lindbergh Condo Association – Atlanta, GA

Chris:
I wanted to reach out and thank you for the new LED lights at our condo property! The work was done quickly and professionally; the new lighting has been well received by our owners and residents.

Also, please use me as a reference for other Atlanta properties considering the LED solution.

Peter L. Piecuch
Risk Manager – Insurance Counsel
Global Building Solutions, LLC – Charleston, SC

Hi Joe!
I checked the center last night and, WOW, what a difference! I am very pleased with the results. I have notified Kroger corporate, suggesting that they make a trip to the center to check the results for themselves.

Thanks for your patience and help on this project.

Patricia Conley
Property Asset Manager
Schottenstein Realty Company

Our customers are very pleased with their new Georgia Power LED lighting.

Shannon Crossing Shopping Center – Union City, GA

OHNO America, Inc. – Dalton, GA

Jonathan,
Thank you so much for introducing OHNO America, Inc. to your new LED lighting. The employees have complimented us on the lighting of the parking lot and the difference it has made in our facility. We look forward to many years with the new lighting.
Best Regards,
OHNO America, Inc.

Lighting Controls – Intelligent Lighting Systems

Controls for outdoor lighting have been available for years in the form of photocells, timers, etc., to turn high-intensity discharge (HID) outdoor lights on at dusk and off at dawn or at other predetermined intervals. Further control options are limited by the nature of HID and component technology. Dimming is possible but requires the use of electronic ballasts in place of magnetic ballasts, and dimming may shorten bulb life. Quick on and off cycling of lights is not possible due to the need for HID lights to cool down before restarting (restrike). This is the reason that it took so long for the stadium lights to come back on after a temporary power outage at a recent Super Bowl game.

While digital solid-state (LED) lighting offers a number of well publicized advantages such as improved light quality, white light, energy efficiency and long life, other less well known capabilities have the potential to increase savings in energy efficiency and provide for wireless network adaptive control and monitoring of outdoor lighting systems. LEDs provide instant off and on functioning and, since LED outdoor fixtures use solid-state electronic drivers, they have the capability to be dimmed after business hours to save energy while still providing safe levels of illumination. In addition to providing energy savings, dimming can extend the useful life of the LED fixture.

Other options for lighting control include occupancy sensors to quickly switch lighting from dim to full brightness when pedestrians or vehicles are present or as traffic volumes change, as well as increasing, decreasing or eliminating lighting for specific events such as holiday displays, fireworks, sports events, etc.

Remote monitoring of LED outdoor lighting fixtures provides 24/7/365 ability to assess lighting performance, identify potential equipment problems and proactively initiate maintenance and

See **Lighting Controls,** *page 5*

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Municipal Solid-State Street Lighting Consortium Update

The U.S. Department of Energy-sponsored Municipal Solid-State Street Lighting Consortium (MSSLC) continued its activities in 2013 to advance the adoption of LED outdoor lighting technology by municipalities, cities, power providers and others who invest in street and area lighting. Its goal is to build a repository of valuable field experience and data that will significantly accelerate the learning curve for buying and implementing high-quality, energy-efficient LED lighting.

The MSSLC, established in 2010, has over 360 primary members in the U.S. plus advisory members and guests in North America and other regions of the world.

Activities to date in 2013 include webinars on Selection of LED Street Light Luminaires; Member Case Studies – LED Street Lighting Programs in Algona, IA, Boston, MA and Los Angeles, CA; and a two-part webinar on Adaptive Street Lighting Controls. In April, the MSSLC released its new Model Specification for Adaptive Control and Remote Monitoring of LED Roadway Luminaires, V1.0. It also launched an effort to develop an inventory of the nation's street and highway lighting systems by collecting a large sample of information from municipalities, utilities and other operators.

The Light Post, a newsletter for members, is published monthly, and the consortium held its annual meeting in conjunction with the IES Street and Area Lighting Conference September 11 in Phoenix.

Similar activities are planned for 2014. For additional information on the MSSLC, refer to volumes 8, 9 and 10 of Georgia Power's *Bright Ideas* newsletter or visit the MSSLC website at www1.eere.energy.gov/buildings/ssl/consortium.html.

Georgia Power supports the vision and mission of the MSSLC and is a primary member of the consortium. In addition, three representatives of Georgia Power's Lighting Services business unit are actively involved with the consortium as a member of the executive board and as chairmen of the education and Communications committees.

You've heard the claims of long life for LED lights – here are several examples of what this means based on four different daily hours of operation scenarios for an LED fixture with a rated life of 50,000 hours.

Hours of Operation	Life
24 hours per day	5.7 years
18 hours per day	7.6 years
12 hours per day	11.4 years
8 hours per day	17.1 years

Lighting Controls

continued from page 4

repair operations. This capability assures that lights are always operating when and where needed, eliminates the need for visual monitoring and manual requests for service, and allows for efficient scheduling and repair of lighting malfunctions.

While remote monitoring and adaptive lighting functionality are very attractive features, there are still issues to be worked through before they become widely available for use. Standards for wireless networking and interconnection of outdoor lighting are still being developed. Wireless network security, equipment compatibility and costs, metering for accurate billing data, safety and liability issues, etc., are all being addressed and worked through by manufacturers and various lighting industry organizations.

The outdoor lighting experts at Georgia Power are deeply involved in the transition to Intelligent Lighting Systems and will have pilot projects underway in 2014 to test and assess products and performance before making these systems available to customers at a later date.

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Outdoor Lighting Standards, Regulations and Legislation

Lighting Standards

The National Electrical Manufacturers Association (NEMA) and the ANSI Accredited Standards Committee 136 for Roadway and Area Lighting recently published the following standards.

- **ANSI C136.20** American National Standards for Roadway and Area Lighting – Fiber-Reinforced Composite (FRC) Lighting Poles
- **ANSI C136.23-2012** American National Standard for Roadway and Area Lighting Equipment – Enclosed Architectural Luminaires
- **ANSI C136.25-2013** Roadway and Area Lighting Equipment – Ingress Protection (Resistance to Dust, Solid Objects and Moisture) for Luminaire Enclosures
- **ANSI C136.32** American National Standard for Roadway and Area Lighting – Enclosed Setback Luminaires and Directional Floodlights

The 136 Committee is investigating the following issues: luminaire voltage classification; updating the SSL standard; dimming and network protocols; and SSL cobra head retrofit mechanical and electrical interchangeability. It is also considering new projects for plasma lighting, remote monitoring, and meter-grade photocell billing.

Still under development by the IES Technical Procedures Committee is TM-28, Prediction of Lumen Maintenance of LED Lamps and Luminaires. This will be comparable to TM-21, Projecting Long-Term Lumen Maintenance of LED Light Sources, but at a fixture level, and it is intended to enable manufacturers to predict the lumen maintenance of complete lamps and luminaires.

Other LED-related standards in development by various organizations:

- **ANSI C82.XX1** LED Drivers Reliability
- **CIE TC1-69** Color Quality Scale
- **IES LM-79 (revision)** Approved Method for the Electrical and Photometric Testing of Solid-State Lighting Devices
- **IES LM-80 (revision)** Approved Method for Measuring Lumen Depreciation of LED Light Sources
- **IES LM-84** Method for Measuring Lumen Maintenance of LED Lamps, Light Engines and Luminaires
- **IES LM-85** Approved Method for the Measurements of High Power LEDs
- **IES LM-XX5** LED Reliability Tests
- **IES LM-XX6** AC LED Measurements
- **IES TM-26** Method for Estimating the Rated Life of an LED Product
- **UL 1598C (revision)** Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits

Federal Energy Standards

Energy standards for lighting in the U.S.are generally implemented under either a regulatory determination or a legislative act.

- Rulemaking by the Department of Energy (DOE)
  - Requires an evaluation of energy savings potential, cost-effectiveness and technical feasibility
  - Usually a two- to three-year process plus a 3 year compliance period
  - Negotiated Rulemaking established by the National Appliance Energy Conservation Act of 1987
- Congressional Legislation
  - Legislative language is typically negotiated among interested parties
  - Timing varies but typically is shorter than rulemaking

Most energy standards focus on an efficiency performance metric but some may ban a specific product.

Lighting energy standards have focused on components. This approach limits the ability to maximize system efficiency and does not relate to application requirements or address installed load or operating hours.

Energy standards often include multiple implementation tiers to promote efficiency improvements. California often sets the trend for many federal energy standards.

In 2010, the DOE determined that energy standards should be set for HID lamps.

- A rulemaking process is currently underway with emphasis on mercury vapor lamps and probe start MH lamps.
- A rule is likely to be issued in 2014 and compliance in 2017; mercury vapor lamps may be banned beginning in 2016.
- California established standards (Title 20) prior to the federal rule requiring higher ballast efficiency, controls or reduced lamp wattages.
- California Tier 2 standards, effective 1/1/2015, will require luminaires to use reduced wattage lamps and either controls or a higher ballast efficiency.

Metal Halide Luminaires

Existing standard established by the Energy Independence and Security Act of 2007.

- Established thresholds for ballast efficiency
- Covers 150 – 500 watt luminaires

An updated DOE rule for HID is in progress.

- May expand the wattage range and adjust ballast efficiency levels.
- Outdoor products are likely to face the most significant impact as proposed electronic ballasts very likely will not fit in current HID fixtures.
- Federal standard based on California Title 20 standard.
- Compliance options based on ballast efficiency, reduced wattages or controls.
- A session was held September 27, 2013, in Washington by DOE to address Energy Conservation Standards Notice of Proposed Rulemaking for Metal Halide Lamp Fixtures with manufacturer and utilities representatives in attendance.

LED Lighting

Currently there are no energy regulations for LED lighting. In the future, regulations could be put in place to cover such areas as testing, reporting and marketing claims, plus ongoing regulatory revisions.

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