

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 can find the latest on outdoor lighting, lighting industry news, new outdoor lighting industry standards, new technology lighting installations 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.

LED Outdoor Lighting Now Available From Georgia Power

Georgia Power's Lighting Services has been evaluating light-emitting diode (LED) lighting technology and testing LED lighting products since the fall of 2008. By December 2011, the company had installed over 100 test and demonstration LED outdoor lighting fixtures at company facilities and more than 500 LED outdoor lighting fixtures for customers at their request on a case-by-case basis.

At that point Lighting Services determined that the technology was ready to be offered to customers as part of Georgia Power's outdoor lighting product offering. Our experience had shown that the technology was developing rapidly and that many excellent products were available which met our stringent product selection criteria. The LED lighting fixtures that had been installed to date performed very well, provided excellent lighting quality, met or exceeded both Georgia Power's and customer's expectations, and offered benefits that would be appealing to additional customers.

LED Outdoor Lighting Benefits:

- Enhanced Lighting Quality
- Improved Lighting Uniformity
- Energy Efficient
- Long Fixture Life
- Reduced Maintenance Requirements
- Light Trespass Minimized/Eliminated
- Instant-on/No Warm-up
- Environmentally Friendly

LED outdoor lighting technology and products continue to improve, new products are being developed, and costs are decreasing as manufacturing processes improve and volumes increase. While not all outdoor lighting applications currently have LED products that we feel are acceptable, we continue to test and evaluate new products and we will approve additional products for use that meet our quality and performance criteria.

For additional information on LED outdoor lighting contact Georgia Power's Lighting Services at **1.888.768.8458** or online at **outdoorlighting.georgiapower.com**.



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The Future of Lighting in the United States

In January 2012 the U.S. Department of Energy (DOE) released a report on lighting energy consumption and predictions for the future of lighting in the U.S. Major points of these two publications, *2010 U.S. Lighting Market Characterization* and *Energy Savings Potential of Solid-State Lighting* are summarized below:

- In 2001, lighting accounted for approximately 765 terawatt-hours (TWh) of electricity consumption, equal to 22 percent of total U.S. electricity consumption
- In 2010, lighting accounted for approximately 700 TWh of electricity consumption, or 19 percent of total U.S. electricity consumption
- In 2001 there were approximately 6,977 million permanent lamps in the U.S.
- In 2010 there were approximately 8,203 million permanent lamps in the U.S.
- Lighting energy consumption decreased by 65 TWh while the number of lamps increased by more than 1 billion (a 15 percent increase)
- If lighting energy consumption had not been affected by new, efficient products, consumption in 2010 should have been around 880 TWh
- The decrease in lighting energy consumption is attributed to increasingly more energy efficient lighting products, government and industry outreach and education encouraging new products, and industry innovations that enabled implementation of new and efficient products that transformed the nation's energy consumption habits
- LEDs are currently dominating product development in the lighting industry but still only represent 5-10 percent of luminaire sales and 1 percent of the installed base of lamps in the U.S.
- The future appears to belong to this light source, with the potential to reduce U.S. lighting consumption by nearly 50 percent and reduce carbon emissions by 1.8 billion metric tons
- LED will achieve a market share, expressed as demand for lumen-hours, of 10 percent by 2015
- The smallest gain will be in the commercial building sector (5 percent)
- The largest gain will be in the outdoor stationary sector (29 percent)
- LED share is expected to increase to 36 percent in 2020, 59 percent in 2025 and 74 percent in 2030, with the biggest long-term gains in outdoor and residential lighting
- Indoor luminaire average life is predicted to increase from 25,000 hours in 2010 to 44,000 hours by 2015 and to 48,000-50,000 from 2020 to 2030
- Outdoor luminaire average life, estimated at 50,000 hours in 2010 is expected to increase to 68,000 hours in 2015 and 73,000-75,000 hours from 2020 to 2030
- Initial cost is expected to decrease from about \$181 per kilolumen in 2010 to \$41.81 in 2015 and \$12.73 in 2030

These points are reminders that LED lighting is still a very young technology with great potential for improved lighting quality and energy efficiency.

OUTDOOR LIGHTING INDUSTRY NEWS

Municipal Solid-State Street Lighting Consortium

The U.S. Department of Energy sponsored Municipal Solid-State Street Lighting Consortium (MSSSLC) has released two new guidance tools for use by members and non-members who are planning to use LED roadway lighting.

Model Specification for LED Roadway Luminaires

The DOE Municipal Solid-State Street Lighting Consortium's Model Specification for LED Roadway Luminaires enables cities, utilities, and other local agencies that are evaluating or implementing LED street lighting projects to assemble effective bid documents.

The Model Specification template contains two guidelines: System Specification (Appendix A – Application Efficacy) and Material Specification (Appendix B – Luminaire Efficacy).

- Appendix A allows municipalities to maximize application efficiency and incorporates site characteristics such as pole spacing, mounting height, number of drive lanes, input power, and required light levels and uniformity.
- Appendix B allows utilities to emphasize luminaire efficiency and does not consider site characteristics.

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The flexible format of the Model Specification allows users to modify default values to fit their local design criteria, which typically varies from city to city, and even from application to application within a given city.

The Model Specification is available at <http://www1.eere.energy.gov/buildings/ssl/specification.html>

MSSLC Retrofit Financial Analysis Tool

The Retrofit Financial Analysis Tool, developed by the DOE Municipal Solid-State Street Lighting Consortium in collaboration with the Clinton Climate Initiative, provides municipalities, utilities, finance and budget offices, energy efficiency organizations, and others a method of analyzing the cost and return-on-investment from switching to LED street lighting.

The Financial Analysis Tool can be used to compute annualized energy and energy-cost savings, maintenance savings, greenhouse gas reductions, net present value, and simple payback. This information can be helpful when putting together construction and grant applications, as well as for preparing budgets and comparing incumbent lighting system costs to new system costs.

The Financial Analysis Tool is available at <http://www1.eere.energy.gov/buildings/ssl/financial-tool.html>

Lighting and Crime

A September 22, 2011 article in the Oakland, CA Bay City Citizen had the following headline – “*Dimmer Lights Curb Waste and Glare – but Breed Crime, Some Say*”. The article reported that Oakland, along with many other cities in California, imposed restrictions on its 37,000 streetlights following the enactment in 2002 by the California Legislature of new energy-efficiency lighting standards.

These standards required the city to begin using energy-efficient bulbs, “cap” new lamp-posts to prevent light from flooding into the sky, and maintain lower levels of light to prevent waste and glare, among other measures.

The article reports that Oakland residents are fighting for an exemption to the standards in East and West Oakland where homicide and other crime has spiked 25% over the comparable period last year. They feel that the “star-friendly” lighting policy has contributed to the city’s crime problem.

It also reports that research has long shown a correlation between street lighting and crime and quotes Brandon Walsh, a criminology professor at Northeastern University,

who said streetlights acted as natural surveillance and could reduce crime by 20% as well as give residents a sense of pride and ownership over their neighborhood.

While the article repeatedly mentions the resident’s desire for better street lighting, it also points out that there is an economic incentive for cities to keep lighting levels low, as many cities have identified outdoor lighting as a drain on their budgets. It notes that Santa Rosa has saved about \$400,000 per year since it began removing some streetlights and putting timers on others. Also noted is that Oakland is facing a \$76 million budget deficit next year and that public works officials say that the city can’t afford to go brighter.

News articles have appeared recently reporting on similar issues in other U.S. cities, including Detroit, MI and Highland Park, MI, while the cities of Los Angeles and Seattle both report high levels of support from police, public safety officials, and residents for the improved lighting provided by the new LED street lights being installed in those cities.

Outdoor Lighting

New standards have been approved and released by two major lighting industry organizations – the Illuminating Engineering Society (IES) and the National Electrical Manufacturers Association (NEMA) – as part of their ongoing efforts to provide standards and guidance to the lighting industry.

IES’s Technical Procedures Committee approved and released technical memorandum **TM-21-11 “Projecting Long-Term Lumen Maintenance of LED Light Sources”**.

- TM-21-11 provides a method for determining when the useful life of an LED is reached, a point when the light emitted from an LED depreciates to a level where it is no longer considered adequate for a specific application.
- TM-21-11 is intended to work with data collected in LM-80, an approved method for measuring the lumen maintenance of LED packages, arrays, and modules at various operating temperatures.
- It is important to note that TM-21-11 is limited to determining a light sources expected lumen depreciation over time and does not contain procedures for determining reliability of other LED luminaire components such as drivers or complete luminaires.

NEMA’s Lighting Systems Division Committee 136 for Roadway and Area Lighting published ten standards in 2011 covering all types of street and area lighting. The ANSI C136 documents published are as follows.

- **C136.10-2010** *Locking-type Photocontrol Devices and Mating Receptacles – Physical and Electrical Interchangeability and Testing*

- **C136.11-2011** *Multiple and Parallel Wired Sockets*
- **C136.15-2011** *Luminaire Field Identification*
- **C136.17-2005(R2010)** *Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity Discharge Lamps – Mechanical Interchangeability of Refractors*
- **C136.19-2011** *High-Pressure Sodium (HPS) and Retrofit HPS Lamps for Mercury Ballasts – Guide for Selection*
- **C136.28-2006(R2011)** *Glass Lenses Used in Luminaires*
- **C136.31-2010** *Luminaire Vibration*
- **C136.36A-2010** *Aluminum Lighting Poles*
- **C137.37** *Solid State Light Sources Used in Roadway and Area Lighting*
- **C136.40-2011** *Solar Lighting Systems*

It should be noted that C136.37 is its first solid state lighting product standard and it addresses the form, fit, and function of SSL lighting assemblies used outdoors.

NEMA also published ANSI ANSLG C78.377 *Specifications for the Chromaticity of Solid State Lighting Products* in May 2012. This standard covers SSL applications for indoor lighting applications only and deals with tints or shades of white light and chromaticity standards, definitions, and specifications of the color rendering index.

The Model Lighting Ordinance (MLO)

In June 2011, after being in development for almost seven years, the Illuminating Engineering Society (IES) and the International Dark-Sky Association (IDA) approved and published their Model Lighting Ordinance (MLO).

IES and IDA collaborated on the development of this model ordinance to provide communities with a way to limit light pollution, maintain good lighting practices, and replace many poorly written local ordinances. The organizations hope that this document will encourage broad adoption of comprehensive outdoor lighting ordinances without the need to devote extensive staff

time and resources to their development.

The MLO includes the use of five lighting zones – LZ0 to LZ4 – to classify land use with appropriate lighting levels for each, and limits the amount of light used for each property. It also uses IES’s new TM-15-11 “BUG” (Backlight, Uplight and Glare) classification of outdoor lighting fixtures to ensure that only well shielded fixtures are used to reduce glare, light trespass, and skyglow. No uplight for area and street lighting is allowed in any zone.

The MLO will be revised on a regular basis to include new information, feedback from municipalities using it, and changes to

IES standards. The MLO with User’s Guide is available as a free download from both the IES and IDA websites.

Upcoming Lighting Industry Events

August 2-3, 2012
MSSLC LED Street Lighting Workshop
Boston, MA

September 9-12, 2012
IES Street and Area Lighting Conference
Miami, FL

New Metrics Proposed for Evaluating Color Rendering Ability

The Color Rendering Index (CRI) is a quantitative measure of the ability of a light source to replicate colors of various objects, materials, and skin tones in comparison with a reference light source of the same color temperature. CRI is stated as a number between 0 and 100. As a general rule, light sources with high (80-100) CRI's tend to make people and things look better than light sources with lower CRI's.

CRI was developed over 40 years ago by the International Commission on Illumination (CIE) to address fluorescent lighting technology and to compare fluorescent and HID lamps. It has been a durable metric for evaluating color rendering ability for these lighting technologies.

With the advent of LED lighting technology, research has shown that CRI does not always correlate well with subjective color rendering in practice for white LEDs because of the unique spectrum of light created by the technology.

The CIE Technical Report 177:2007, *Color Rendering of White LED Light Sources* states, "The conclusion of the Technical Committee is that the CIE CRI is generally not applicable to predict the color rendering rank order of a set of light sources when white LED light sources are involved in this set." This recommendation was based on a

survey of numerous academic studies ranking the appearance of illuminated scenes using white LED lamps (both phosphor-coated white LEDs and red-green-blue LED clusters) with different CRI's. These studies showed that there was little correlation between rankings and the calculated CRI values where many LED products had CRI's in the 20s, yet appeared to render colors well.

Researchers are currently working on alternatives to CRI for use with LED lighting technology. The Color Quality Scale (CQS) was developed by The National Institute of Standards and Technology (NIST) so that its scores agree well with perceived color rendering and to fix the problems of CRI for solid-state lighting sources. NIST has proposed CQS as a new standard to the CIE, which currently maintains CRI as a standard. CIE formed a technical committee in 2006 to develop a new standard and the

committee is currently focusing on two proposals, including CQS, but has not yet reached a decision. The U.S Department of Energy endorsed CQS in 2010.

The Lighting Research Center (LRC) at Rensselaer Polytechnic Institute developed the Gamut Area Index (GAI) as a supplement to the CRI for use in color critical applications such as retail installations. The details of the Gamut Area Index were published in 2010 by the Alliance for Solid-State Illumination Systems and Technologies (ASSIST), a lighting organization established by the LRC.

While changes to the method used to determine the color rendering ability of lighting products are needed to accommodate LED technology, to date the lighting standards organizations in the lighting industry have not adopted either of the proposed replacements/supplements to CRI.



The eight color samples used in calculating the Color Rendering Index (CRI)

A perfect score of 100 represents no color differences in any of the eight samples under the test source and reference illuminant.



The 15 color samples used by the Color Quality Scale (CQS)

This proposed metric is believed to offer a superior indication of what humans perceive as superior color rendering compared to CRI specifications

Source for the above samples: lumenistics.com/what-is-color-rendering-index-cri/

Coming Soon to a Street Near You . . . "Smart Street Lighting"

While the change from high-intensity discharge (HID) lighting to light-emitting diode (LED) technology taking place in the outdoor lighting industry has been well publicized, there is another new technology that is less well known. The digital electronics systems used in LED lighting, and in some electronic ballasts for HID lighting, offer the ability to remotely control and monitor outdoor lighting.

This technology can:

- Provide two-way communication between lights and a control center
- Identify potential light problems
- Quickly identify and repair faulty lights
- Enhance customer service and public safety
- Reduce maintenance costs
- Adjust lighting levels and on/off times to traffic conditions, weather, season, etc.

A number of outdoor lighting and controls manufacturers now offer these systems, and controls and monitoring technology continues to evolve. The Municipal Solid-State Street Lighting Consortium is developing of a model specification for Remote Monitoring and Adaptive Control for LED street lighting.

Lexus of South Atlanta - Union City, GA

Following a change of ownership and management at the dealership, a decision was made to implement a “green” initiative at the facility. Being “green” included changing the existing outdoor lighting to a more environmentally friendly and cost effective lighting system.

The existing high intensity discharge (HID) outdoor lighting system at the dealership consisted of 138 1000-watt metal halide galleria fixtures mounted on 54 poles. The poles were a mix of mounting heights – 30’, 35’, and 39’ and light placement was a mix of single fixture, 2 fixtures, and 4 fixtures per pole.

Dealership management began meeting with Georgia Power’s Lighting Services in the summer of 2011 to develop a plan to replace the existing metal halide outdoor lighting with Light-Emitting Diode (LED) lighting. A new lighting layout and photometric analysis were developed to optimize the outdoor lighting levels for the facility and to use the existing poles and pole locations. Removal of the HID lighting and installation of the LED lighting fixtures was completed in December 2011.

The new LED lighting installation utilized a total of 82 General Electric Evolve

Area Lights on 55 poles. LED fixtures have a Correlated Color Temperature (CCT) of 4000K and a Color Rendering Index (CRI) of 70. One new pole location was added to illuminate an area of the property that had not been illuminated with the old system. The other 54 pole locations were retained from the old lighting system and approximately half of the existing concrete poles were replaced with shorter fiberglass poles. LED fixture mounting is mainly 1 or 2 fixtures per pole plus 3 poles with 4 fixtures per pole.



1000W metal halide; 19.8 average foot candles



202W LED; 7.9 average foot candles

Results/Benefits:

- Old HID System:
138 1000-watt metal halide fixtures = 138,000 watts
- New LED system:
67 202-watt fixtures = 13,534 watts
15 270-watt fixtures = 4,050 watts
 Total = 17,584 watts
- Substantial reduction in energy usage related to outdoor lighting
- LED lighting is directional – all light is directed toward the area to be illuminated
- Minimized/eliminated light trespass
- Greatly improved lighting uniformity (eliminated dark spots and hot spots)
- Vehicle display and vehicle color representation greatly enhanced
- Long fixture life and reduced maintenance requirements
- Environmentally friendly (no hazardous materials to recycle, and reduced energy usage lowers greenhouse gas emissions)
- Instant-on/no warm-up time
- Supports the National Automobile Dealer Association’s (NADA) Energy Stewardship program