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FEBRUARY 2009

# Rocky Mountain Monthly

IESNA ROCKY MOUNTAIN SECTION

WWW.IESRMS.ORG

## LED TECHNOLOGY

The emergence of efficient, high brightness LEDs has generated a tremendous amount of excitement in recent years. Ruggedness, reliability, color changing capability, optical control, and long life are among the unique qualities that this potentially revolutionary technology offers.

However, there are a number of issues that currently limit the degree to which it can be

practically applied. Join us as we take an in-depth look at LED performance and discuss the inherent challenges relative to broad-scale application.

Join us for this exciting update on LED technology, while being able to get hands on demonstrations of the latest products using LED technology, all available from various manufacturers before the meeting!



**We will have a wide variety of LED fixtures and products from several manufacturers available for demonstration before the meeting .**

**COME EARLY TO CHECK THEM OUT!**

Register for this meeting right now!



Click here to be automatically directed to the registration website.

## LED TECHNOLOGY MEETING DETAILS

**Date:** Tuesday, February 10, 2009

*(deadline for RSVP is Monday, February 9)*

**Location:** Original Brooklyn's  
2644 West Colfax, Denver

**Time:** 5:30pm

**Cost:** \$20 Members  
\$30 Non-Members  
FREE Students

*Students attend free thanks to...*



**DIRECTIONS?**  
**CLICK HERE**



Wisdom,

Wonders,

and

Wit

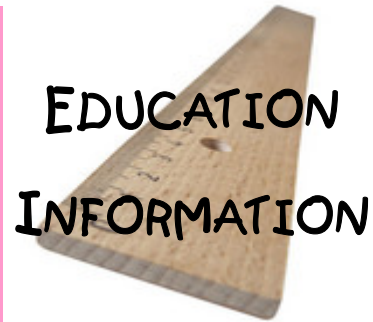
# Birth of the LED

The first known report of a light-emitting solid-state diode was made in 1907 by the British experimenter H. J. Round of Macaroni Labs when he noticed electroluminescence produced from a crystal of silicon carbide while using a cat's-whisker detector. Russian Oleg Vladimirovich Losev independently created the first LED in the mid 1920s; his research, though distributed in Russian, German and British scientific journals, was ignored, and no practical use was made of the discovery for several decades. Rubin Braunstein of the Radio Corporation of America reported on infrared emission from gallium arsenide (GaAs) and other semiconductor alloys in 1955. Braunstein observed infrared emission generated by simple diode structures using alloys at room temperature and at 77 kelvin.

In 1961, experimenters Bob Biard and Gary Pittman working at Texas Instruments, found that gallium arsenide gave off infrared radiation when electric current was applied. Biard and Pittman were able to establish the priority of their work and received the patent for the infrared light-emitting diode.

The first practical visible-spectrum (red) LED was developed in 1962 by Nick Holonyak Jr., while working at General Electric Company. He later moved to the University of Illinois at Urbana-Champaign. Holonyak is seen as the "father of the light-emitting diode". M. George Craford, a former graduate student of Holonyak's, invented the first yellow LED and 10x brighter red and red-orange LEDs in 1972. Up to 1968 visible and infrared LEDs were extremely costly, on the order of US \$200 per unit, and so had little practical application. The Monsanto Corporation was the first organization to mass-produce visible LEDs, using gallium arsenide phosphide in 1968 to produce red LEDs suitable for indicators.

The development of LED technology has caused their efficiency and light output to increase exponentially, with a doubling occurring about every 36 months since the 1960s, in a similar way to Moore's law. The advances are generally attributed to the parallel development of other semiconductor technologies and advances in optics and material science. This trend is normally called Haitz's Law after Dr. Roland Haitz.



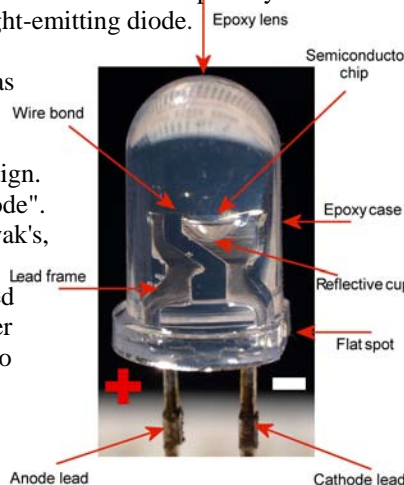
## Advanced Energy Design Guides Free Download

The *Advanced Energy Design Guide* series provides a sensible approach to easily achieve advanced levels of energy savings without having to resort to detailed calculations or analysis. The four-color guides offer contractors and designers the tools, including recommendations for practical products and off-the-shelf technology, needed for achieving a 30% energy savings compared to buildings that meet the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999. The energy savings target of 30% is the first step in the process toward achieving a net-zero energy building, which is defined as a building that, on an annual basis, draws from outside resources equal or less energy than it provides using on-site renewable energy sources.

These guides have been developed through the collaboration of ASHRAE, the American Institute of Architects (AIA), the Illuminating Engineering Society of North America (IESNA), and the U.S. Green Building Council (USGBC), with support from the Department of Energy (DOE), to help meet all of an owner's energy performance requirements. In an effort to promote building energy efficiency, ASHRAE and its partners have made these guides available for download (PDF) at no charge.

[Click here to begin your free download](#)

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## By The Numbers...

1.5  
MILLION

number of jobs California's energy-efficiency policies created from 1977 to 2007, while eliminating fewer than 25,000, according to a study by the Center for Energy, Resources, and Economic Sustainability at the University of California Berkeley

# BIG BROTHER IS WATCHING YOU!!!

Have any of you noticed we haven't been giving out our meeting raffle tickets? Well, we've been keeping attendance this year.

We are going to give a **COOL PRIZE** to the person that shows up to the most meetings this year! Last year, **Hal Congdon from Performance Lighting Products** won an **\$100** for attending the most meetings!

See, you knew you were coming for something other than learning!



## ENERGY

ESTES PARK | FORT COLLINS | LONGMONT | LOVELAND

If you're planning a new lighting design, **energy efficiency starts now.**

Platte River Power Authority provides assistance to help maximize your building's efficiency and minimize future energy costs.

Our cash incentives will help pay the initial costs of making your project energy efficient.

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Adam Perry, LIGHTENUP Manager



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## Illumination Awards

The IES Illumination Awards program is open for submissions **Friday, January 16th, 2009.**

**New in 2009!**

- Online submission
- 300 word count narrative
- Online judging
- \$100 submission fee

This is the first year for all entries to be submitted through the IES website. Please follow the link <http://www.ies.org/programs/ia.cfm> to watch a short tutorial about how to complete a submission. You will also find the current procedures and rules document, a program timeline, and an example score sheet for your reference. Questions? Contact Phyllis Werts, Illumination Awards Administrator at [pwerts@ies.org](mailto:pwerts@ies.org) or 212-248-5000 x 125

Thank you, and we look forward to receiving your submissions!

WELCOME

NEW SECTION

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### LED Expo

Original Brooklyn's

February 10

Join us as we invite manufacturers to bring you the latest products and technologies in the LED industry along with demonstrations and discussions on the industry.

### 2009

## Upcoming Section Events

### IIDA & the IES Illumination Awards

Original Brooklyn's

May 12

This May we explore the restructuring of the IIDA. Awards veteran chairman Leo Mendoza discusses the changes and improvements to the program, along with a "How To" for new project submissions.

### Daylighting Design Expo

Original Brooklyn's

March 10

As the world turns to energy savings, we invite exhibitors to share new innovations in daylighting products along with a discussion on designing with daylight.

### Denver After Dark

Union Station

April 18

This April we return as one of the highlights of the Doors Open Denver event; an exclusive look at lighting downtown from a unique perspective.

### 2008 Golf Tournament

Raccoon Creek Golf Club

June 13

Our annual golf tournament returns again at the Raccoon Creek Golf Club! More games, fun, and prizes are scheduled for this year's tournament!



# Smarter LED's Eliminate "Droop"

© January 15, 2009, *Applied Physics Letters*

In the U.S. and elsewhere, lighting accounts for as much as a third of electricity usage. Thus, when it comes to fossil fuels conservation, there is a large impetus to adopt more efficient lighting solutions. Right now the most efficient lighting solution is LED lighting, which if widely adopted could save 10 percent of the power used in the U.S. Unfortunately, LED lighting is also by far the most expensive form of lighting. To spur research in to lower LED lighting costs, the U.S. Department of Energy (DOE) has offered a \$20M USD "L Prize" for the first team to meet a rigorous set of standards.

A new breakthrough by researchers with Rensselaer Polytechnic Institute's National Science Foundation-funded Smart Lighting Engineering Research Center and Samsung Electro-Mechanics may bring LED lighting closer to affordability and help the researchers creep closer to the DOE-funded jackpot.

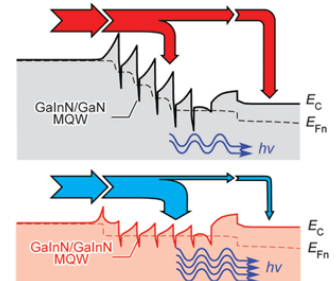
The new type of LED is said to be "polarization matched", but what's most important is its improved metrics. The light offers 18 percent increase in light output and a 22 percent increase in wall-plug efficiency, which essentially measures the amount of electricity the LED converts into light.

The new kind of LED greatly diminishes a common problem with LEDs called "efficiency droop". This phenomenon involves LEDs being most efficient when operating on low current densities, and seeing their efficiency greatly droop at higher current densities. While all the factors have yet to be determined, electron leakage is one source of droop. The end result of droop is that LEDs are forced to operate at lower current densities, which feature much lower brightness and efficiency in achieving light output. Project leader E. Fred Schubert, Wellfleet Senior

Constellation Professor of Future Chips at Rensselaer states, "This droop is under the spotlight since today's high-brightness LEDs are operated at current densities far beyond where efficiency peaks. This challenge has been a stumbling block, because reducing the current densities to values where LEDs are more efficient is unacceptable. Our new LED, however, which has a radically re-designed active region, namely a polarization-matched active region, tackles this issue and brings LEDs closer to being able to operate efficiently at high current densities." His team discovered that a cause of electron leakage was mismatched polarization. The used a quantum-barrier design to help to greatly reduce the mismatch. The conventional Gallium Indium Nitride/Gallium Nitride (GaInN/GaN) layer of the LED active region was replaced with Gallium Indium Nitride/ Gallium Indium Nitride (GaInN/GaInN).

The decrease in polarization mismatch, in turn decreased electron leakage, in turn lessening droop and delivering superior brightness and efficiency. The gains present in lab testing were similar to theoretical models, created in computer simulations. Professor Schubert says he expects discoveries like this one to propel solid state lighting into the mainstream, which he says will amount to vast environmental, energy, and cost benefits as well as innovations in healthcare, transportation systems, digital displays, and computer networking.

LED lighting has already found its way into many vehicles. The list of models sporting LED headlights continues to grow, as the technology prepares to exit the high-end market and move into the mainstream auto market. The new research is reported in this week's *Applied Physics Letters*.



The top figure showcases "LED droop", which decreases efficiency and brightness. Research has come up with a new LED, whose output profile is shown below. (Source: RPI/Samsung)

## REPRESENTATIVES... MANUFACTURERS...

Did you remember to reserve your tabletop space for the LED Technology section meeting?



Send an e-mail to [info@iesrms.org](mailto:info@iesrms.org), and an IES Board Member will be in touch with you quickly to get your space reserved!

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