



PORTABLE

RESIDENTIAL

OFFICE

RETAIL

ARCHITECTURAL

OUTDOOR



# LED Lighting Revolution LED City



Greg Merritt

ASERTTI Meeting – February 5, 2008



# Cree Profile – [www.cree.com](http://www.cree.com)

- **Founded in 1987, public since 1993**
- **Introduced 1<sup>st</sup> Blue LED in 1989**
- **Headquarters:**
  - Durham, NC, USA – all chip manuf.
- **Global Locations:**
  - Santa Barbara, CA, USA
  - London, UK
  - Vienna, Austria
  - Huizhou, China
  - Tokyo, Japan
  - Hong Kong
  - Taipei, Taiwan
  - Seoul, Korea
  - Penang, Malaysia
- **~ 2,600 Employees**



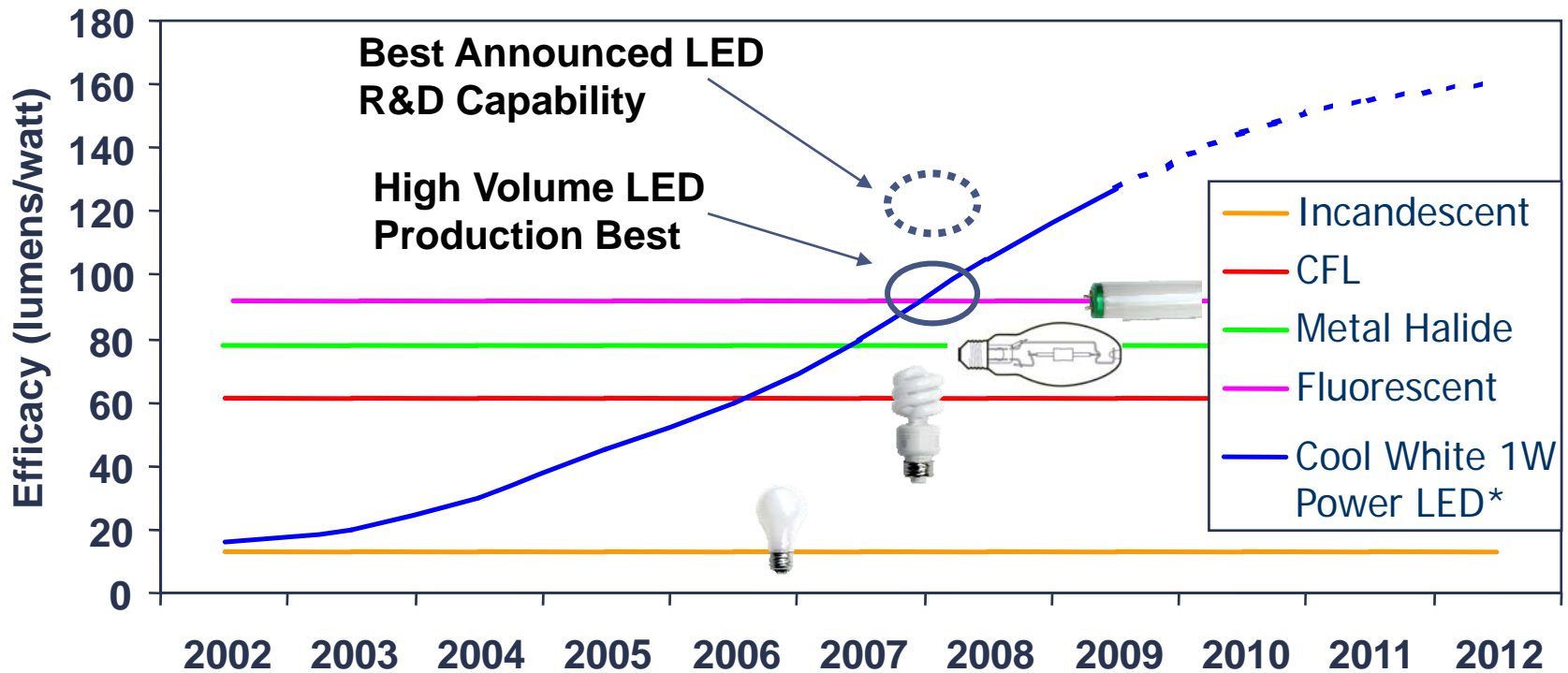
# Lighting and Energy

- **22% of US electricity usage is for lighting**
  - 30% of electricity in buildings
- **Widespread LED deployment by 2025 can:**
  - Save \$115B in electricity
  - Eliminate 258 Million metric tons of greenhouse gases
  - Eliminate the need for 133 coal-fired 1000 MW power plants
- **Incandescent light bulbs use 92% of electricity to generate heat – only 8% for light**

**LED Lighting is the highest-impact option to reduce our electricity consumption**

# LED Technology Is Accelerating

## Light Source Efficacy Trends

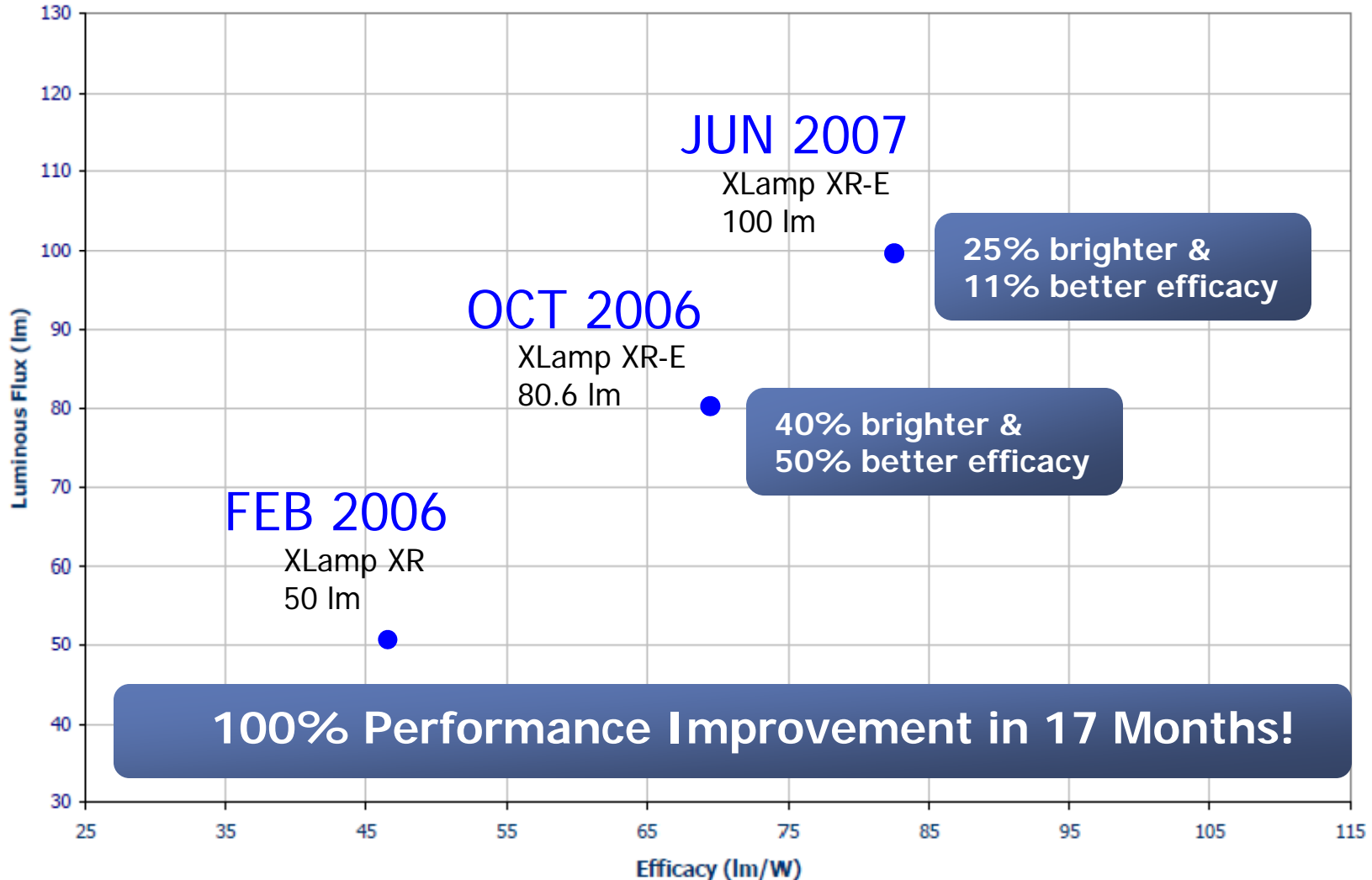


LEDs become most efficient lighting technology!

\* US Department of Energy Projections, March 2007

# Leading the Industry in Performance

## Cool White XLamp LED Performance @ 350 mA



# Where is LED Lighting Today?

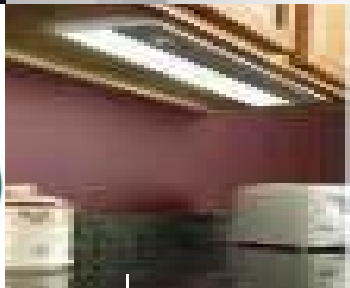
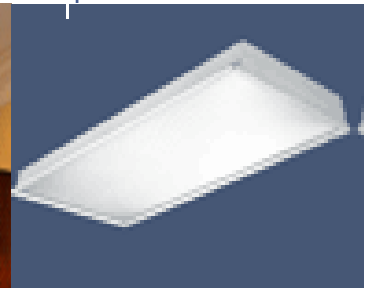
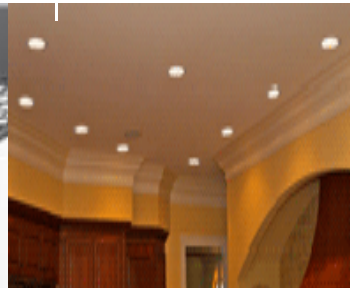
Portable

Architectural

Parking/Street

Down Lights

Commercial



Specialty

Task

Landscape

Residential

Established

This Year

Future

# A Long History of Success for Solid State



**Vacuum Tubes**



**Transistors**



**VHS**



**DVD**



**CRT TV**



**Flat Panel TV and Displays**



**Film**



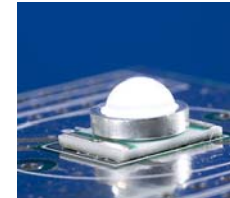
**Flash Memory**



**Light Bulbs/  
Fluorescent Tubes**



**Solid State Lighting**

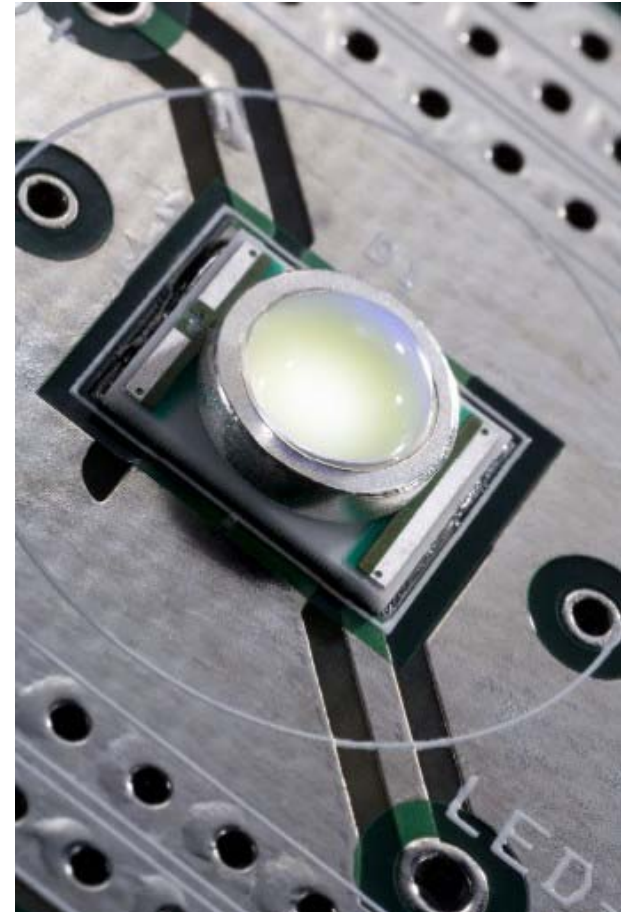


# LED General Lighting – Why Now?

- **Technology has advanced dramatically to deliver value to new and emerging applications**
  - Reliability and lifetime are advantages for LEDs
  - Lumens/watt has improved significantly
  - White light quality & stability
- **Economics are starting to make sense**
  - LED light delivers Total-Cost-of-Ownership savings through:
    - Maintenance avoidance
    - Energy savings
- **Regulatory & Green impact**
  - CA Title 24; EnergyStar
  - Energy Independence and Security Act of 2007

# Basic Advantages of LED Light

- Are very **energy efficient** → ~100 LPW (still improving...)
- Are **directional** → No wasted light, any pattern possible
- Have very **long lifetime** → >50,000 hours to 70% LM
- Are inherently **rugged** → No filament to break
- **Start instantly** → nanoseconds vs. > 10 min (HID)
- Are **environmentally sound** → no Hg, Pb, heavy metals
- Are **infinitely dimmable, controllable** → New lighting features, power savings
- Love cold temperatures → **No cold starting issues**



LEDs can *technically* replace ANY incumbent lighting technology.  
“When” will LEDs replace all light bulbs, not “if”

# LED City Initiative

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**LED Lighting is  
Happening Now!**

- **Joint initiative with Cities around the world**
  - Broad commitment to LED lighting across the City infrastructure
- **Joint testing, deployment and promotion of LED lighting – “LED lighting at the table”**
- **Community of LED Cities to share results and best practices – accelerate the market**

# LED City Launch

- Joint launch with City of Raleigh, NC on February 12, 2007
- Launch Presentation at Alliance to Save Energy conference on February 14, 2007
- Over 70 feature articles, broadcast news
  - NY Times, Fortune, CNN Money, UPI, Business 2.0, Red Herring and more



- National/Global coverage



The New York Times

# Municipal Garage Project



- Commercially available LED lighting
- Delivered Same lights with new Cree LEDs = 80% energy savings – valid
- ~10% less photopic light – better quality

Early generation fixtures and white LEDs



LED Lights supplied by Lighting Science Group  
[www.lsgc.com](http://www.lsgc.com)



# Toronto Joins LED City Initiative



- **Announced July 11**
- **Multiple LED projects**
  - **Streetlights**
  - **Signs and displays**
  - **Parking garages**
- **Member of William J. Clinton Foundation's Climate Initiative**



# Ann Arbor Joins LED City Initiative



- Announced October 16
- Converting 1000 downtown streetlights
- Payback is 4.4 years
- \$100k/yr. electricity savings



**...meet the challenge**

**GREEN ENERGY ANN ARBOR**

[www.a2gov.org/energy](http://www.a2gov.org/energy)

ENERGY - ANN ARBOR  
PUTTING IT TOGETHER

CITY OF ANN ARBOR  
MICHIGAN

The banner features a stylized logo on the left consisting of three interlocking loops. On the right, there is a circular seal for the City of Ann Arbor, Michigan. The background is a gradient of yellow and orange.

# Austin, TX Joins

- Announced Jan. 30
- Installed parking deck lighting
- Austin Energy: LED lighting rebates in-place



# LED City Web Site – [www.ledcity.org](http://www.ledcity.org)

The screenshot shows the LED City website interface. At the top left is the LED City logo. At the top right is a banner that says "JOIN THE LED CITY COMMUNITY". Below the logo is a navigation menu with links: HOME, ABOUT THE PROGRAM, ABOUT LEDS, PRESS ROOM, PARTICIPATING, APPLICATIONS, and CONTACT. The main content area features a large image of a parking garage with a "PARKING GARAGE" section header. The text describes the challenges of lighting parking garages and lists three reasons why LED lighting is an excellent application. A "VIEW EXAMPLES" button is located below the text. To the right of the text is a "NEXT SECTION" link with a circular arrow icon and a photograph of a parking garage. At the bottom of the main content area is a circular navigation graphic with labels for "WALLEY", "DOWNTOWN", "PARKING GARAGE", and "MAIN STREET". Below the main content area are three columns: "RECENT PRESS" with two articles, "LED CITY™: TO IMPROVE QUALITY OF LIFE" with a list of benefits and a paragraph, and "FEATURED" with the Cree LED Light logo and a quote.

**LED CITY**

JOIN THE LED CITY COMMUNITY

HOME ABOUT THE PROGRAM ABOUT LEDS PRESS ROOM PARTICIPATING APPLICATIONS CONTACT

## PARKING GARAGE

Next Section

Parking garages can represent a challenging environment for lighting solutions. The lighting must economically accommodate vehicular and pedestrian traffic, must endure harsh environments and must address public safety considerations. Parking garage lighting is an excellent application for LED lighting for several reasons.

- Most parking garage lights burn 24 hours-a-day – during peak electrical rates.
- The vibration from vehicle traffic creates a harsh environment for traditional light sources.
- Public safety concerns favor white light and a high color rendering index (CRI), and "burned out" bulbs can create safety hazards

VIEW EXAMPLES

WALLEY DOWNTOWN  
PARKING GARAGE MAIN STREET

### RECENT PRESS

**Raleigh, North Carolina, the First "LED City"**

Raleigh Recognizes Greater than 40 Percent Energy Savings as Municipal Garage Switches to LED Lighting.

Read More >

**Survey Shows Public Feels Safer in City Spaces Lit by LEDs**

LED City Initiative Yields Benefits Beyond Energy Efficiency

Read More >

### LED CITY™: TO IMPROVE QUALITY OF LIFE

The LED City is an expanding community of government and industry parties working to evaluate, deploy and promote LED lighting technology across the full range of municipal infrastructure to

- Save energy
- Protect the environment
- Reduce maintenance costs
- Provide better light quality for improved visibility and safety

According to the U.S. Department of Energy, 22 percent of electricity used in the U.S. powers lighting. In a world with soaring energy prices based on the availability and control of fossil fuels, and with growing concern about sustainability of the environment, a revolution in lighting is long overdue.

Light emitting diodes, called LEDs, are revolutionizing lighting. Switching to LED-based lighting can save 40 to 70 percent of the electricity a city uses for certain lighting applications such as parking garage, parking lot, outdoor public area, street and portable lighting.

In addition to helping protect the environment by reducing electricity

### FEATURED

**CREE** LED Light

**Light. Power. Communications.**  
Essential to modern life.  
Dramatically transformed by science and innovation.  
Cree. Improving the quality of life ahead.

# LED City – Interest

- **Numerous inquiries from:**
  - other cities
  - Other organizations (State Gov't, US Gov't, Universities, Corporations)
- Organizations are focused on “Green” initiatives and solutions
- Connection between LED lighting manufacturers and interested parties

# Benefits for Participating Cities

- **Community of LED Cities**
  - Shared results
  - Shared investigation
  - Shared initiatives (incentives, tariffs, regulations)
- **Introduction to leading-edge LED lighting manufacturers**
  - Influence product development
  - Lead deployments and projects
- **Promotional Vehicle**
  - LED leadership
  - Environmental leadership
  - Responsible government

# Torraca, Italy



*Courtesy of Elettronica Gelbison, SRL*

**1<sup>st</sup> Total LED City Conversion!**

# LED Workplace



LED  
Workplaces

Q & A

Press Room

## LED Lighting in Today's Workplace

LED lighting is ready for office buildings, factories, schools, hospitals – almost every place that people work.

Learn how Cree is converting all of its indoor and outdoor lighting to LEDs. Also see examples of how other workplaces are joining the LED Lighting Revolution.



View **CREE's** Campus Plan

View **OTHER** Workplaces

**CREE**  
LED Light

**LED CITY**

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# Manufacturing Facility – 1.3 Year Payback



LED Down Lights

LED Outdoor  
Lighting





# BEFORE

Incandescent 65W BR30 - Total Power = 5,135W





**AFTER**

LR6 - Total Power = 948W





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OUTDOOR

**LED lighting: Energy efficient & planet friendly.**

**Cree. Leading the LED lighting revolution.**

Join Cree's LED lighting revolution. We invite you to see how our high-performance, high-efficiency LEDs are lighting up the world.

**CREE**   
LED Light