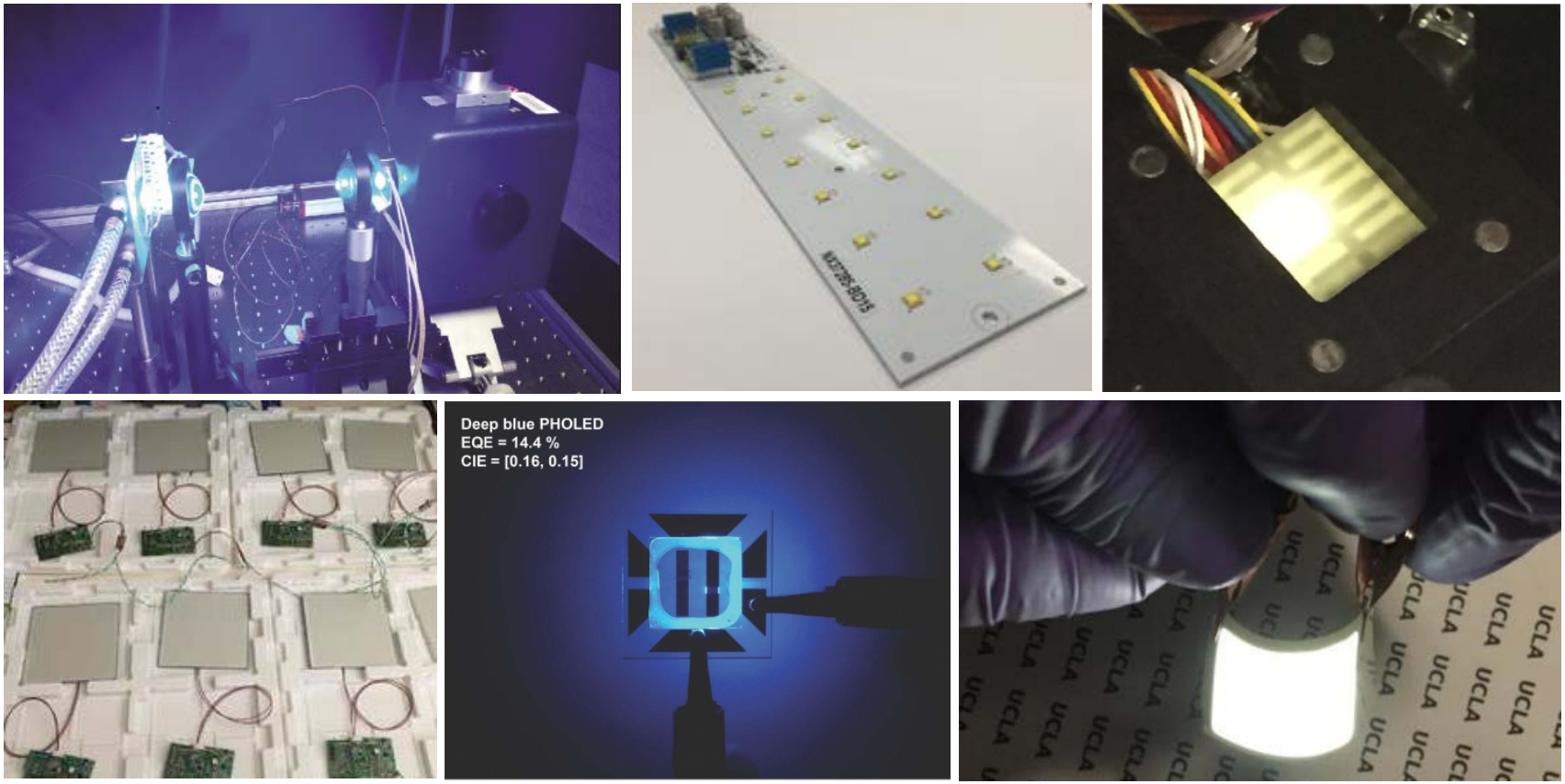
DOE SOLID-STATE LIGHTING PROGRAM

2017 Building Technologies Office Peer Review



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

James R. Brodrick, Ph.D.
james.brodrick@ee.doe.gov
Lighting Program Manager

DOE Solid-State Lighting Program Mission and Goal

MISSION

Through engagement with the lighting community, the DOE SSL Program mission is to **further scientific understanding** on optimizing light spectrum and intensity for numerous applications/tasks **using semiconductor technologies** to **save energy** while also **enhancing human perception, wellbeing, and commerce**.

GOAL

By 2025, develop advanced SSL technologies that — compared to conventional lighting technologies — are much more **energy efficient**, **longer lasting, and cost competitive**, by targeting a product system efficiency of 50 percent with appropriate application spectrum.

Legislative Authority

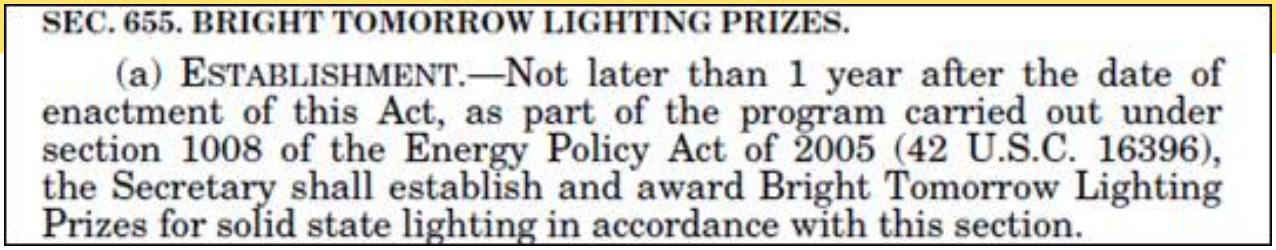
DOMENICI-BARTON ENERGY POLICY ACT OF 2005, SECTION 912

"**The Secretary shall carry out a Next Generation Lighting Initiative** in accordance with this section to support research, development, demonstration, and commercial application activities related to advanced solid-state lighting technologies based on white light emitting diodes."

Legislative Authority

ENERGY INDEPENDENCE AND SECURITY ACT OF 2007, SECTION 321

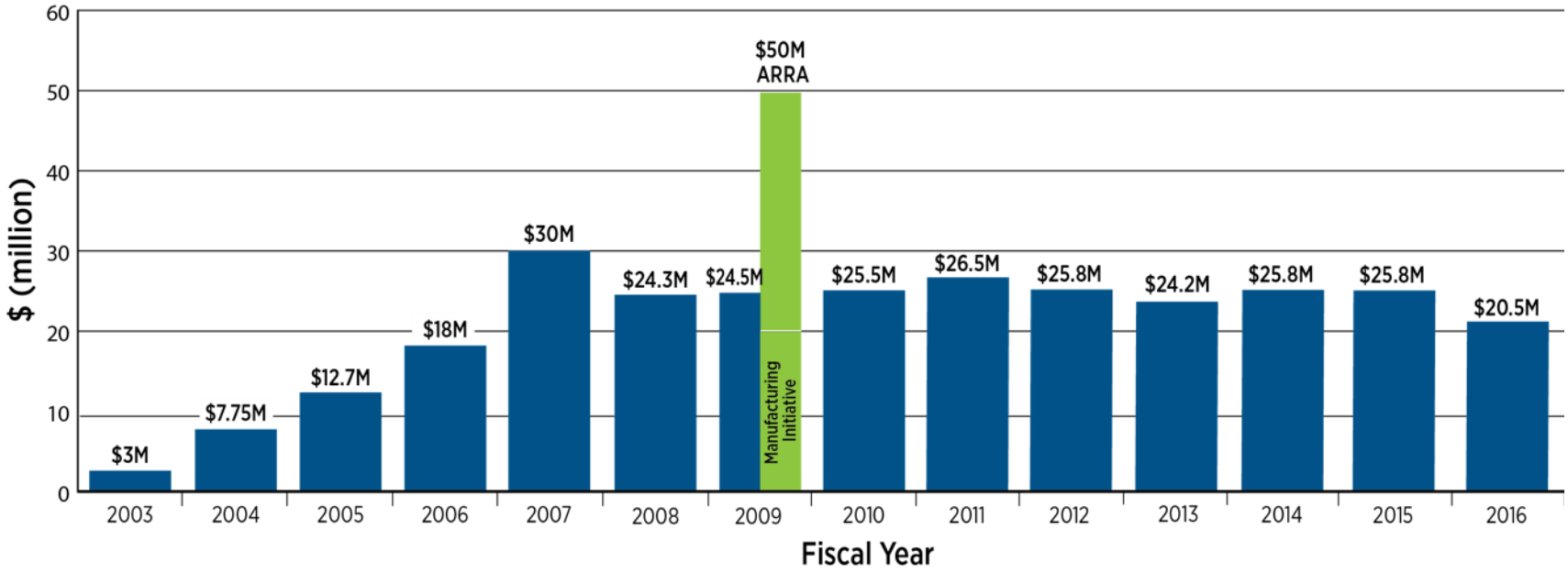
(g) Research and Development Program.— (1) In General.— The Secretary may carry out a lighting technology research and development program—(A) to support the research, development, demonstration, and commercial application of lamps and related technologies sold, offered for sale, or otherwise made available in the United States…



SEC. 655. BRIGHT TOMORROW LIGHTING PRIZES.

(a) ESTABLISHMENT.—Not later than 1 year after the date of enactment of this Act, as part of the program carried out under section 1008 of the Energy Policy Act of 2005 (42 U.S.C. 16396), the Secretary shall establish and award Bright Tomorrow Lighting Prizes for solid state lighting in accordance with this section.

Congressional Appropriations



U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Strategic Approach

Key DOE Roles

CONVENE

DOE roundtables and workshops bring innovators together to identify priority challenges

PLAN

Based on those priorities DOE sets technology milestones and creates an annual SSL R&D Plan

CO-FUND

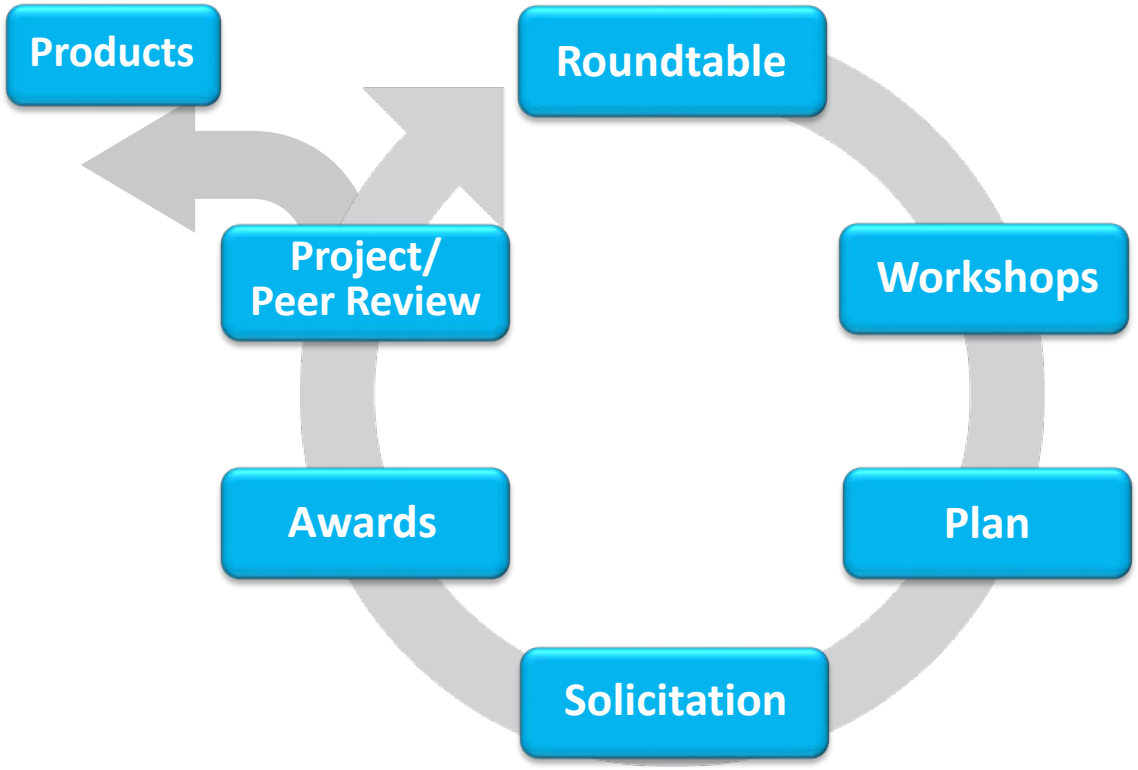
DOE funds competitively awarded and cost-shared projects aligned with the plan

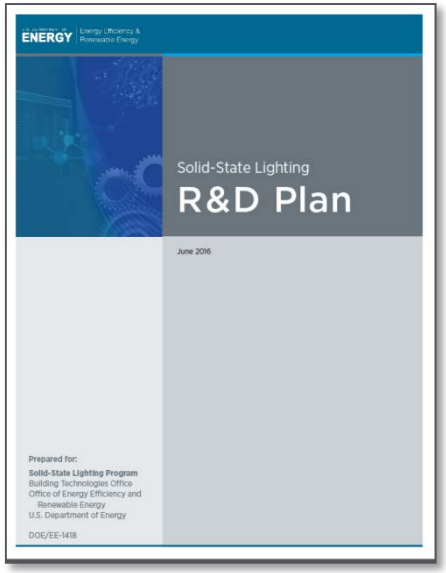
ELEVATE

DOE ensures open information flow and provides analyses that spur technology advances and inform future R&D priorities

DOE R&D Plan Process

SSL community input from roundtables and workshops shape R&D priorities and DOE solicitations





DOE targets push industry to levels of efficacy and performance that might not otherwise be achieved

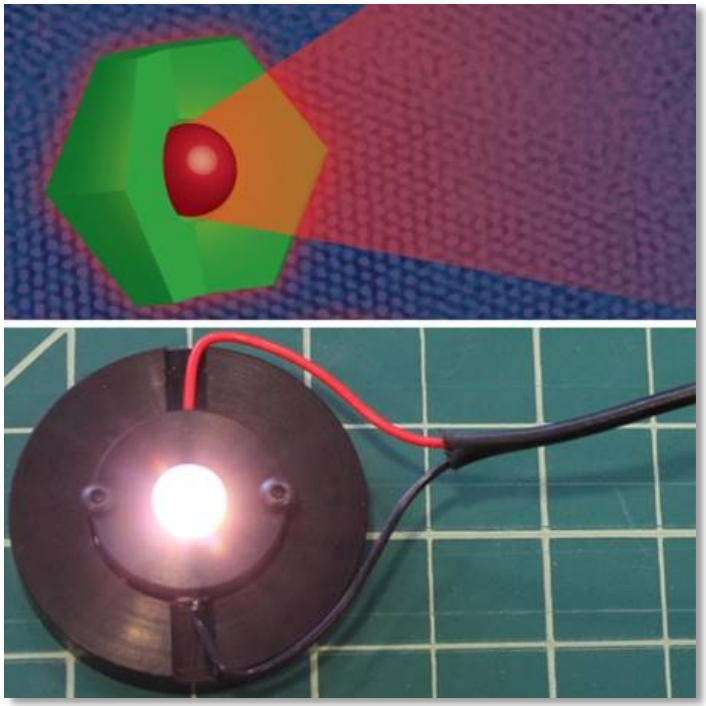
Analysis of emerging products prompts improvements, informs R&D priorities

https://energy.gov/eere/ssl/research-development

Expert Information Exchange

R&D Challenges for LEDs

- Emitter materials
- Down converters
- Emitter architectures for system efficiency
- Encapsulation
- Package/module integration into luminaires
- Novel luminaire systems
- Manufacturing test and inspection equipment
- Package manufacturing



Los Alamos National Laboratory is advancing the use of quantum dots as LED narrow-band downconverters.

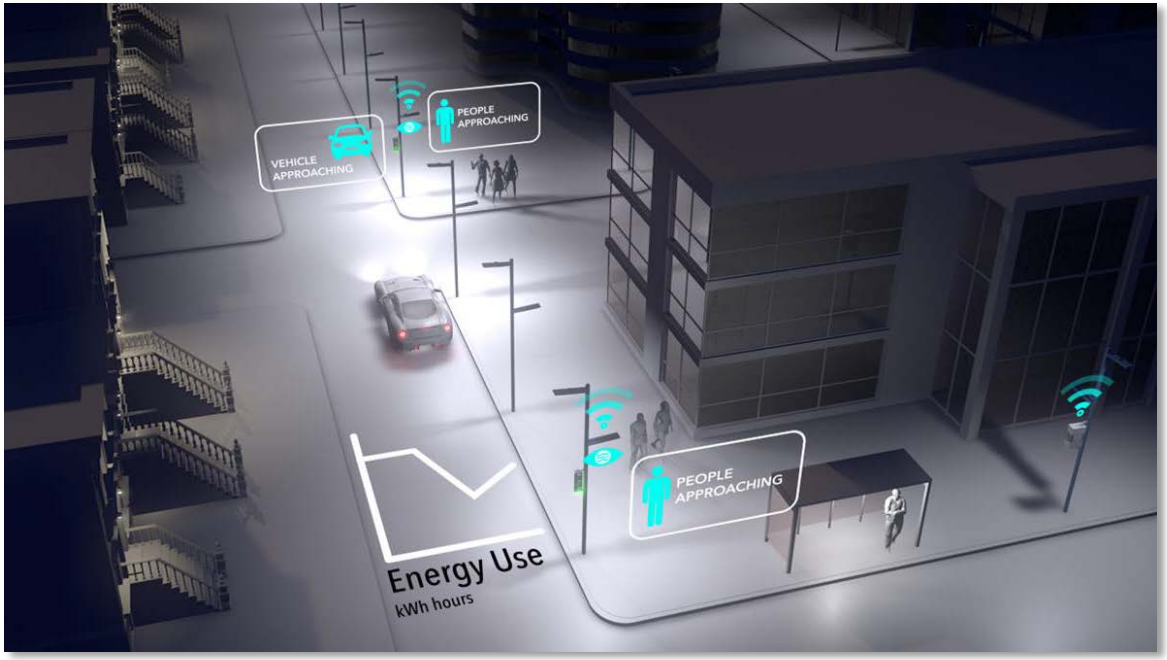
R&D Challenges for OLEDs

- Stable white devices
- Light extraction concepts
- Luminaire development
- Panel light extraction
- Panel manufacturing
- Roll-to-roll manufacturing
- Deposition equipment

Acuity develops OLED luminaire with panel-integrated drivers and advanced controls.

R&D Challenges for SSL in Total

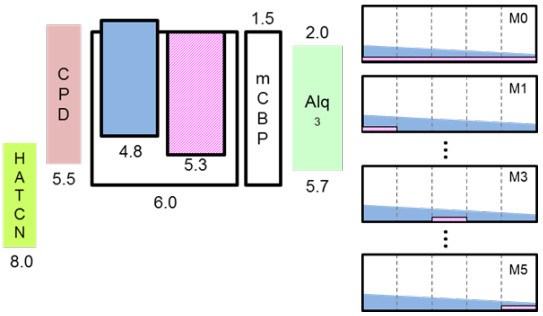
- Connected lighting
- Color rendition
- Form factors
- Glare
- Reliability
- Action spectrum
- Human-light interactions



Connected lighting systems hold the potential to deliver improved energy performance and lighting quality, along with a host of other benefits.

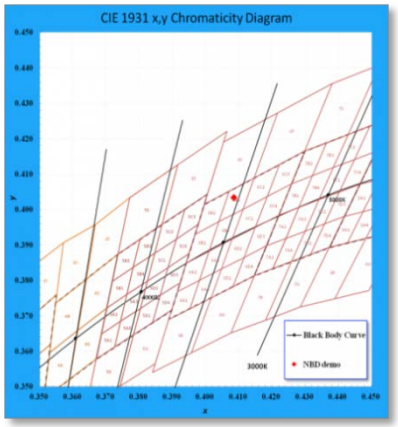
Broad Mix of R&D Partners

Invited Projects



Stable, High Efficiency White Electrophosphorescent Organic Light Emitting Devices by Reduced Molecular Dissociation
Stephen Forrest, University of Michigan

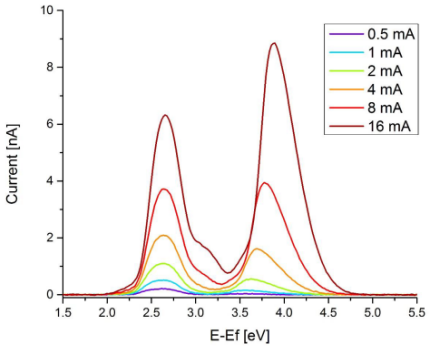
Materials and Designs for High-Efficacy LED Light Engines
James Ibbetson, Cree



Luminaires for Advanced Lighting in Education
Lynn Davis, RTI International

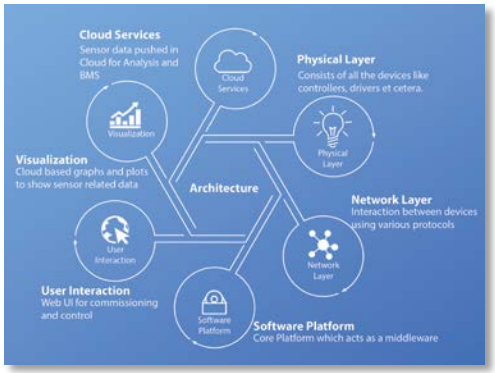
Invited Projects

Stable and Efficient White OLEDs Based on a Single Emissive Material
Jian Li, Arizona State University



Identification and Mitigation of Droop Mechanism in GaN-Based Light Emitting Diodes (LEDs)
James Speck, University of California, Santa Barbara

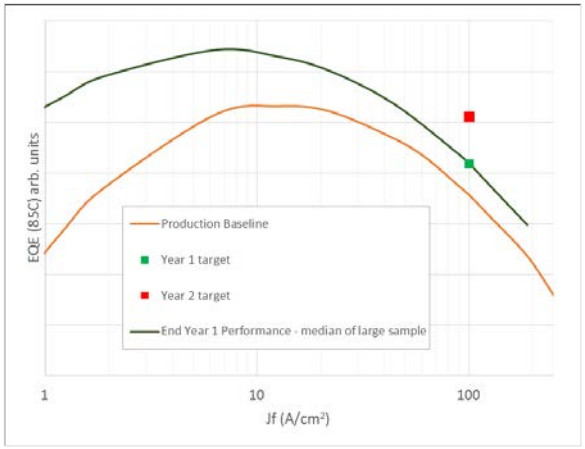
Innovative Office Lighting System with Integrated Spectrally Adaptive Control
Meg Smith, Philips Lighting North America



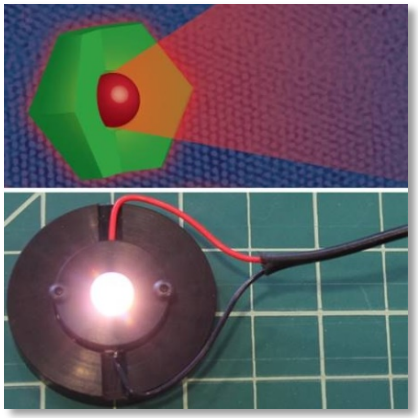
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Invited Projects

Improved InGaN LED System Efficacy and Cost via Droop Reduction
Isaac Wildeson, Lumileds



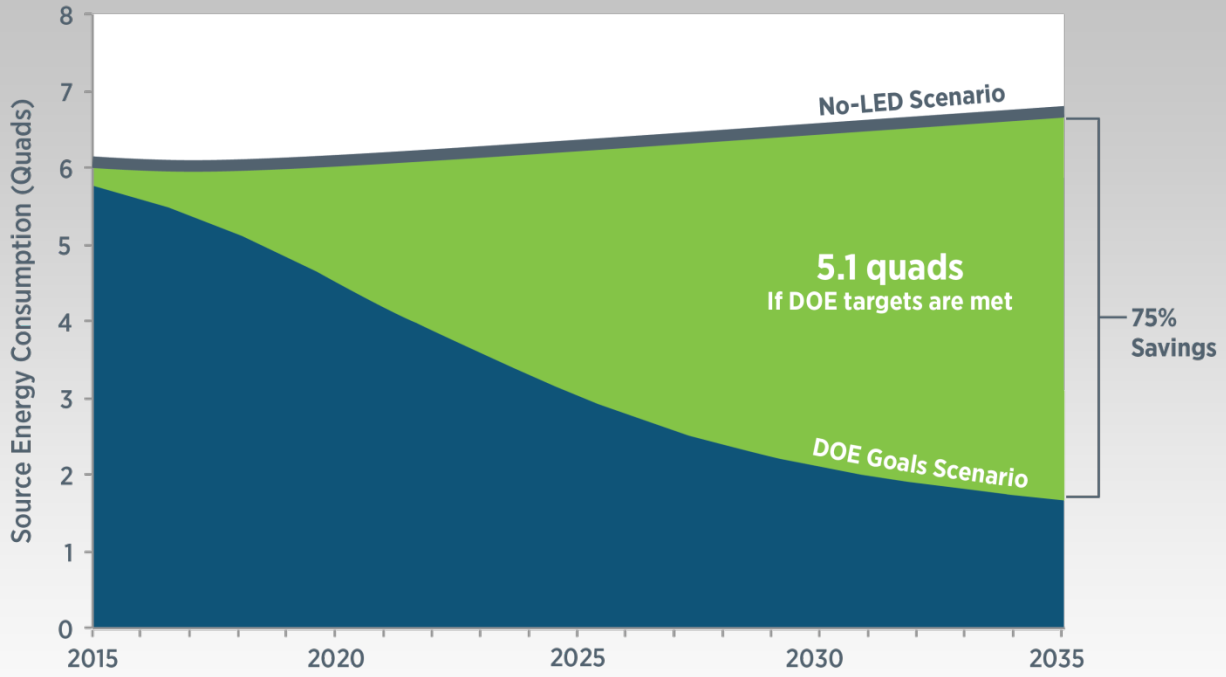
Next-Generation 'Giant' Quantum Dots: Performance-Engineered for Lighting
Jennifer Hollingsworth, Los Alamos National Laboratory



The Best Is Yet to Come

TURNING
DOWN
LIGHTING
ENERGY USE

U.S. energy savings attributable to LED lighting will reach 5.1 quads by 2035. Energy use for lighting in 2035 will be **75% lower** than it would have been if LEDs had not entered the market.



https://energy.gov/eere/ssl/ssl-forecast-report

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy