

# 2016 DOE Solid-State Lighting R&D Workshop Agenda

February 2–4, 2016 • Raleigh, NC

TUESDAY, FEBRUARY 2, 2016

7:00 a.m. *Registration Opens and Continental Breakfast*

## PLENARY SESSIONS

8:00 a.m. **WELCOME AND INTRODUCTION**

JAMES BRODRICK, U.S. DEPARTMENT OF ENERGY

There is widespread agreement today that we are in the midst of a sea change in lighting, one that will reshape the lighting industry as we know it. Rapid advances in SSL technology make it easy to forget that this technology is still at a relatively early stage of development, and much of its potential remains untapped. So what will it take to unlock the full potential of SSL? This workshop will share the latest on SSL R&D advances, examine market forces that are shaping SSL technology, and explore how the technology is defining new market opportunities.

8:30 a.m. **A NEW LIGHTING PARADIGM**

JEFF QUINLAN, ACUITY BRANDS

The lighting industry looks vastly different today compared to a decade ago, as new companies emerge and familiar companies reinvent themselves. This talk will share Acuity's vision for SSL technology, future connected lighting systems, the lighting market, and R&D directions needed to achieve this vision of the future.

9:15 a.m. **BRINGING OLED LIGHTING TO MARKET**

DAVID DEJOY, OLEDWORKS

Learn how an innovative OLED startup in Rochester, NY, is leveraging technologies from research labs at Kodak and Philips to establish OLED panel manufacturing in the U.S. and Europe, applying new approaches to scale up production capacity using limited capital resources. What remaining challenges stand in the way of bringing OLED lighting panels and products to market? How can the OLED industry collaborate on the path forward and contribute to U.S. competitiveness in a global lighting market?

10:00 a.m. *Refreshment Break*

10:30 a.m. **THE INFLUENCE OF SSL ON LIGHTING DESIGN CONCEPTS FOR RESTAURANTS**

ERIC KERLEY, JACK IN THE BOX  
KEVIN REILLY, PEAK LIGHTING & ENERGY

Jack in the Box's early installations of LED lighting systems for their restaurant properties helped to lay the groundwork for the brand's current strategy for implementing energy-efficient lighting solutions in restaurants system-wide. The unique properties of LED lighting have changed how they approach exterior lighting design. Learn more about Jack in the Box's vision for transforming restaurant lighting, and how that impacts energy use, the environment, and the bottom line.

11:15 a.m. **THE IMPACT OF RISING CHINA LED INDUSTRY ON GLOBAL LED MANUFACTURING AND SSL ADOPTION**

DECAI SUN, LUMINUS DEVICES, SUBSIDIARY OF SANAN OPTOELECTRONICS CORPORATION

Insights from Sanan Optoelectronics about the trends and development of the SSL industry in China and the impact of competitive Asian manufacturers on the global SSL industry, including a perspective on how Luminus Devices fits within Sanan's global reach.

*Noon Lunch*

1:00 p.m. **PANEL | DIRECTIONS IN CONNECTED LIGHTING**

MODERATOR: MONICA HANSEN, LED LIGHTING ADVISORS

SANDHI BHIDE, INTEL

EVAN PETRIDIS, ENLIGHTED

HIMAMSHU PRASAD, GE LIGHTING

The convergence of lighting controls and the IoT provides a connected lighting platform that will change the way we interact and think about light. Connectivity is harnessing various technologies such as sensors and data analytics with SSL to create a platform that creates new performance capabilities and benefits. The connected lighting vision will be presented from various viewpoints from smart luminaires to connected buildings and smart cities, and the panel discussion will center on R&D needs to achieve that vision.

*2:30 p.m. Refreshment Break*

3:00 p.m. **PANEL | THE RIGHT LIGHT FOR THE APPLICATION**

MODERATOR: MORGAN PATTISON, SSLS, INC.

JOE CASPAR, EPHESUS LIGHTING

MATTHEW LEGLER, U.S. NAVY

MARC LUENNEMANN, OSRAM OLED

JERRY RYU, OSRAM SYLVANIA

Different lighting applications require different performance, cost, and features, and SSL technology can be engineered to provide these specific attributes. This panel will review SSL products that were designed for some specific, challenging lighting applications.

4:30 p.m. **WORKSHOP MISSION**

MORGAN PATTISON, SSLS, INC.

The DOE SSL R&D Workshop provides an opportunity for stakeholders to provide input to the DOE program. This talk will recap the DOE R&D planning process, share highlights from a series of roundtables and meetings held in Fall 2015, and set the stage for in-depth discussions in the track sessions to come.

*5:00 p.m. Adjourn*

**OPTIONAL TOUR OF SSL LIGHTING INSTALLATIONS (DETAILS TO COME)**

## WEDNESDAY, FEBRUARY 3, 2016

7:30 a.m. *Continental Breakfast*

### PLENARY SESSIONS

8:00 a.m. **DOE SSL R&D PROGRAM DIRECTION**

JAMES BRODRICK, U.S. DEPARTMENT OF ENERGY  
JEFF TSAO, SANDIA NATIONAL LABORATORIES

An overview of the DOE SSL R&D program direction and areas of focus, including recognition of the contributions of visionary Roland Haitz over the last 15 years, and a look ahead to what's coming in the next decade.

8:30 a.m. **PANEL | LIGHTING AND HUMAN FACTORS**

MODERATOR: JEFF TSAO, SANDIA NATIONAL LABORATORIES  
JOHN HANIFIN, THOMAS JEFFERSON UNIVERSITY  
YOSHI OHNO, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
JENNIFER VEITCH, NATIONAL RESEARCH COUNCIL OF CANADA

The spectral content in light has physiological and biological impacts, which can be both beneficial and detrimental to human health and productivity. LED lighting can provide tailored spectral content that has the potential to improve our health and productivity, but more research is needed to quantify and verify these claims. This panel will discuss the impact of SSL on human color perception, physiological responses, and the impact of blue light on health.

10:00 a.m. *Refreshment Break*

### TRACK SESSIONS

10:30 a.m. **LED TRACK I: DROOP**

Droop is the single biggest factor than can change the cost structure of LED lighting. Several pathways for eliminating the impact of current density droop will be discussed, as well as how the green gap is tied to droop.

MODERATOR: MONICA HANSEN,  
LED LIGHTING ADVISORS  
PARIJAT DEB, LUMILEDS  
BERTHOLD HAHN, OSRAM  
SIDDARTH RAJAN, OHIO STATE UNIVERSITY  
JAMES RARING, SORAA LASER DIODE

**OLED TRACK I: MANUFACTURING CHALLENGES**

This panel will identify remaining challenges regarding the fabrication of OLED lighting panels, with the focus upon cost reduction and the production of flexible devices.

MODERATOR: NORMAN BARDSLEY,  
BARDSLEY CONSULTING  
JOHN HAMER, OLEDWORKS  
JUERGEN KREIS, AIXTRON  
CHRISTIAN MAY, FRAUNHOFER INSTITUTE

Noon *Lunch*

1:00 p.m.

**LED TRACK II: LED PACKAGE AND POWER SUPPLY**

Beyond the LED chip itself there are important areas for improvement in the package and system. This panel will explore R&D in down converters, encapsulants, and novel, more robust, power supply components.

MODERATOR: MORGAN PATTISON, SSLS, INC.  
JON OWENS, COLUMBIA UNIVERSITY  
SPEAKERS TBA

**OLED TRACK II: OLED MATERIALS**

A look at open science questions related to improving the stability and efficiency of blue emitters, simplifying devices with single emitters, and the status of solution processable materials for OLED lighting.

MODERATOR: LISA PATTISON, SSLS, INC.  
JIAN LI, ARIZONA STATE UNIVERSITY  
MATHIAS MYDLAK, CYNORA  
MARK THOMPSON, UNIVERSITY OF SOUTHERN CALIFORNIA

2:30 p.m.

*Refreshment Break*

3:00 p.m.

**PANEL | QUANTIFYING SYSTEM RELIABILITY**

MODERATOR: MONICA HANSEN, LED LIGHTING ADVISORS  
LYNN DAVIS, RTI INTERNATIONAL  
WARREN WEEKS, HUBBELL LIGHTING  
SPEAKERS TBA

Quantifying SSL system reliability is a challenge for luminaire manufacturers due to the various components that can fail in a variety of fixture designs targeting application specific performance and cost thresholds. The lack of accurate reliability models for LED color shift or SSL drivers creates a critical uncertainty in the true lifetime of luminaires. OLED reliability is critical for market adoption in general lighting, and early reliability results toward a more robust model will be shared. This panel will discuss the key failures and what barriers must be overcome to certify 10-year fixture warranties with less risk to the manufacturer and impact to the end user.

4:30 p.m.

**LEVERAGING DOE SSL R&D**

JOEL CHADDUCK, NATIONAL ENERGY TECHNOLOGY LABORATORY  
MARC LEDBETTER, PACIFIC NORTHWEST NATIONAL LABORATORY

The DOE SSL program supports the development of energy-saving SSL products directly through Core, Product Development, and Manufacturing R&D projects, funded via the FOA process. But where a broader approach is needed, the program supports other R&D efforts designed to accelerate technology and product advances in ways that benefit the lighting industry as a whole. The speakers in this session will review the typical FOA process as well as new R&D efforts within the DOE SSL program related to OLED testing, connected lighting systems, and more.

5:00–7:00

**RECEPTION/POSTER SESSION**

p.m.

Project posters will be presented by research team representatives, providing an opportunity for one-on-one discussions with SSL's leading scientists.

## THURSDAY, FEBRUARY 4, 2016

7:30 a.m. *Continental Breakfast*

### PLENARY SESSION

8:00 a.m. **INNOVATION IN LIGHTING APPLICATIONS**  
SPEAKER TBA

### TRACK SESSIONS

8:30 a.m. **LED TRACK III: NEW MANUFACTURING METHODS AND TOOLS**  
Improvements to manufacturing approaches and product design have enabled ongoing cost reductions while maintaining and even improving performance. This session will examine some new concepts in luminaire and component manufacturing.  
MODERATOR: MONICA HANSEN,  
LED LIGHTING ADVISORS  
CHRIS BOHLER, EATON'S COOPER LIGHTING  
GEORGE PAPASOULIOTIS, VEECO  
WOUTER SOER, LUMILEDS

**OLED TRACK III: LIGHT EXTRACTION AND INTEGRATED SUBSTRATES**  
This panel will explore progress and challenges in light extraction substrates, looking at manufacturable integrated substrate solutions along with newly conceived light extraction approaches.  
MODERATOR: LISA PATTISON, SSLS, INC.  
STEVE FORREST, UNIVERSITY OF MICHIGAN  
BARRY RAND, PRINCETON UNIVERSITY  
MARK TAYLOR, CORNING

10:00 a.m. *Refreshment Break*

10:30 a.m. **LED TRACK IV: NEW LIGHTING CONCEPTS**  
LED lighting products have been coming out with new features, form factors, and functionality. This panel will explore the status of some new products and concepts, and discuss future directions for product development.  
MODERATOR: MORGAN PATTISON, SSLS, INC.  
RON GIBBONS, VIRGINIA TECH  
TRANSPORTATION INSTITUTE  
ERIC HAUGAARD, CREE  
FRED MAXIK, MAXIK LABS  
STEVE PAOLINI, TELELUMEN

**OLED TRACK IV: DEVELOPING OLED LIGHTING PRODUCTS**  
The elements needed to convert OLED panels into attractive, affordable luminaires will be surveyed, including OLED-specific drivers, adaptable connectors, industry standards and form factors appropriate to each application.  
MODERATOR: NORMAN BARDSLEY,  
BARDSLEY CONSULTING  
MICHAEL HELANDER, OTI LUMIONICS  
MIKE LU, ACUITY BRANDS

12:00 p.m. *Lunch*

1:00 p.m. **LED TOPIC TABLE REPORTS & DISCUSSION**  
Each group will share a brief report of key points related to their topic, with an opportunity for further discussion with the larger group.

**OLED PRIORITIES AND MILESTONES**

3:00 p.m. *Refreshment Break*

## PLENARY SESSION

3:30 p.m. **PANEL | GLOBAL LIGHTING VISIONS**

Speakers from leading global companies will present their visions of the future of SSL technology—and discuss what’s necessary to enable these visions to be realized. Topics will include trends in price, value, and performance; government policies; R&D directions; access to SSL for all; deeper energy savings; connectivity; and industry consolidation.

MODERATOR: NORMAN BARDSLEY, BARDSLEY CONSULTING

LAWRENCE LIN, MLS

KLAUS VAMBERSZKY, ZUMTOBEL

SPEAKERS TBA

4:30 p.m. *Adjourn*