

LIGHTING R&D WORKSHOP

Co-sponsored by the Illuminating Engineering Society

MONDAY FEBRUARY 1

11:00 a.m.– 12:30 p.m. ET	Welcome Keynote Chuck Swoboda, Innovator, former Chief Executive Officer at Cree Lighting Keynote Star Davis, Design Consultant
1:00 p.m.– 2:30 p.m. ET	What Is Ideal Light? LED technology enables almost unlimited freedom for achieving desired lighting conditions. However, we still rely on form factors, layouts, and lighting objectives determined by previous technologies. In this panel, we will consider ideal lighting conditions and hypothetical lighting integration schemes based on LED technology to achieve them. The speakers will consider the performance of the light source technology, desired optical delivery, optimum spectrum, and effective controls technology. <i>Moderator: Morgan Pattison, SSLS, Inc.</i> Jennifer Scheib, University of Colorado Boulder Ron Gibbons, Virginia Tech Transportation Institute Tero Mäkinen, LEDiL Ian Ashdown, SunTracker Technologies
3:00 p.m.– 4:30 p.m. ET	“Ask Me” Session: Connecting the Dots Between Light & Health Research and Practice This session will focus on a better understanding of light and health terminology that often gets mentioned by researchers but is not always clear to the broader lighting industry. Registered attendees will have an opportunity to submit questions in advance. What is circadian disruption? Why are current metrics focused on melatonin suppression? What does circadian phase shift mean and how is it relevant to lighting practice? Tune in for answers to these questions and more. <i>Moderator: Kelly Gordon, Pacific Northwest National Laboratory</i> Erin Flynn-Evans, NASA Andrew Phillips, Monash University Céline Vetter, University of Colorado Boulder Jamie Zeitzer, Stanford University

4:30 p.m.– 5:30 p.m. ET	Networking Sessions Select a topic from the list below for informal discussion in small groups. Grab a coffee/beer/soda and meet some new colleagues in two 30-minute sessions. • General networking – just like the buffet line • Young professionals and seasoned pros – expanding your contacts • Lighting academics and manufacturers – connecting the dots • Lighting designers and manufacturers – sharing stories • Physiological responses to light – trading notes • LED materials and device science – solving problems • OLEDs – moving the technology • Deploying new technologies – overcoming barriers • New lighting tech – sharing ideas
----------------------------	--

TUESDAY FEBRUARY 2

11:00 a.m.– 12:30 p.m. ET	Realizing the Potential of GUV: Perspectives from SSL Technology Development Among emerging applications of solid-state lighting, germicidal ultraviolet (GUV) radiation already has attracted substantial scientific and market interest, as it may offer significant health safety benefits. With the potential to deactivate surface, waterborne, and airborne pathogens, these applications are accompanied by concerns over a lack of product measurement standards to inform UV output, efficiency, safety, and other aspects of product performance. Such challenges resemble those that the DOE and IES have previously addressed in other SSL technologies and markets. In this panel, we will discuss approaches our organizations have used and ideas for opportunities to support GUV technology development going forward. <i>Moderators/Speakers: Brian Walker, U.S. Department of Energy, and Alex Baker, Illuminating Engineering Society</i> Kyung Lee, Guidehouse David Sliney, Independent Consultant Cameron Miller, National Institute of Standards and Technology Ruth Taylor, Pacific Northwest National Laboratory
1:00 p.m.– 2:30 p.m. ET	Value Metrics: Quantifying Lighting Benefits As research reveals more about the range of possible benefits of light in the built environment—and lighting technology evolves to achieve those benefits—lighting metrics need to become more multifaceted to include the value propositions for different applications. Given that we know more about how lighting affects human non-visual and visual responses, and that there are a multitude of action spectra for plants and animals, how can that knowledge be directed toward outcomes that positively impact people and our environment? What metrics are needed to define beneficial outcomes—such as less sleep disturbance for nursing home residents—indicated in recent research? Evidence-based metrics are needed to support positive outcomes, like pedestrian safety, and minimize negative outcomes, like sky glow. This session will consider how to better define and parameterize benefits from advanced lighting systems, using healthcare, outdoor lighting, and horticultural lighting as examples. <i>Moderator: Brian Liebel, Illuminating Engineering Society</i> Michael Myer, Pacific Northwest National Laboratory Shadab Rahman, Harvard Medical School Leora Radetsky, DesignLights Consortium Rajaram Bhagavathula, Virginia Tech Transportation Institute

1:00 p.m.– 2:30 p.m. ET, continued	Advances in LED Materials and Devices LED emitter materials and devices are the critical enablers of energy savings with SSL. Continuing innovation in efficiency across wavelength ranges and operating conditions will continue to expand the toolbox to create lighting products for buildings with improved energy savings, performance metrics, and functionality. This expert panel will discuss some of the latest innovations and new directions in LED materials and devices across the wavelength spectrum. <i>Moderator: Monica Hansen, LED Lighting Advisors</i> Rob Armitage, Lumileds Kirstin Alberi, NREL Michael Kneissl, Technische Universität Berlin Siddarth Rajan, The Ohio State University
1:00 p.m.– 2:30 p.m. ET, continued	Advances in OLED Materials Advancements in OLED materials are being made to improve their performance and manufacturability. Stable, efficient blue emitter systems are needed to achieve the efficiency targets of OLED devices. Emitters, hosts, and transport layers each play a role in the device, and these materials must work synergistically to achieve peak performance. This session will discuss advancements and recent successes in the search for stable, efficient TADF, hyperfluorescence, and blue phosphor materials. <i>Moderator: Lisa Pattison, SSLS, Inc.</i> Marina Kondakova, OLEDWorks Mark Thompson, University of Southern California Jun Yeob Lee, Sungkyunkwan University Russ Holmes, University of Minnesota Chris Giebink, Penn State University
3:00 p.m.– 4:30 p.m. ET	Lighting Innovators This session will offer a preview of the Poster Session, showcasing select projects with potentially game-changing results. DOE will also recognize the winners of the 2021 Student Poster Competition, who will present their work and be available for questions in the Poster Session.
4:30 p.m.– 6:00 p.m. ET	Poster Session The Poster Session provides an opportunity for one-on-one discussions with solid-state lighting’s leading scientists. Preview the posters in advance, and drop into the poster rooms during this session to chat with research team representatives.

11:00 a.m.– 12:30 p.m. ET	Lighting & Displays Cross-Cutting R&D Advancements in lighting and display technology have come from the same building blocks: LED and OLED device innovations, and developments in phosphor and quantum dot materials. The growing interest in mini- and micro-LEDs for displays has intensified research into LED mechanisms and fabrication techniques for a much smaller size scale and opens up opportunities to design SSL fixtures with flexible light distributions and color tuning, while allowing for new forms of building integration. In addition, new functionality such as animation and wayfinding can be integrated into buildings with mini- and micro-LED technology. Both communities are eager to develop more efficient, stable blue OLEDs and to reduce the amount of trapped light. The demand for higher color gamut has motivated developments for phosphors and quantum dots which can be leveraged in new lighting applications. This panel will review the strong technology overlaps that allow for synergistic R&D opportunities between the two applications. <i>Moderator: Monica Hansen, LED Lighting Advisors</i> Mike Hack, Universal Display Corporation Rajiv Pathak, Lumileds John Whiteman, Plessey Semiconductors Jim Murphy, GE Research Ray Ma, Nanosys
1:00 p.m.– 2:30 p.m. ET	Glare and Diffuse Lighting The small size and high brightness of LED emitters means that in most applications they must be hidden from view and surrounded by bulky optical systems that diffuse the light. The availability of affordable, efficient diffuse light sources could enable a wide variety of new form factors for SSL luminaires. Recent progress in the understanding of the human impact of glare will be summarized, and examples of the technologies that may enable the production of lightweight, conformable, glare-free diffuse light sources will be analyzed. <i>Moderator: Norman Bardsley, Bardsley Consulting</i> Nathaniel Jones, Arup Dan Schwade, Acuity Brands Sergey Vasylyev, Lucent Optics Eric Haugaard, Cree Lighting
3:00 p.m.– 4:30 p.m. ET	Incorporating New Tools to Advance Lighting Products and Practice in 2021 We often hear of the promises offered by new tools for lighting research, design, and manufacturing, and perhaps we hear some of the results, yet we rarely hear what it really takes to incorporate new tools into research and practice. What are the current limitations of these new tools? Are these new tools delivering value today? How the lighting community can benefit from incorporating these new tools? This session will bring together the expertise of academic researchers and entrepreneurs to consider these questions while exploring opportunities for virtual reality, eye-tracking, and additive manufacturing and more. <i>Moderator: Andrea Wilkerson, Pacific Northwest National Laboratory</i> Steve Fotios, University of Sheffield Siobhan Rockcastle, University of Oregon Gary Trott, Acuity Brands Steven Rosen, Available Light

4:30 p.m.– 6:00 p.m. ET	Topic Tables This is your opportunity to provide input to DOE and IES! Registered attendees will select a single topic from the list below, for small-group discussion. Each group will examine why this topic is important and what the technical challenges are. Some “questions to consider” will be provided for each topic to help spur the discussion. The inputs from each group will be used to guide planning for future DOE and IES research activities. • Opportunities for workforce development • New lighting metrics • GUV – R&D and deployment challenges • Displays – reducing energy consumption with new technology • Horticultural lighting • Animal responses to light • LED materials and devices • Phosphors and quantum dots • Directions in secondary optics • Realizing advanced luminaires • Lighting manufacturing and sustainability • Lighting application efficiency • Basic understanding and translational research on human physiological impacts of light • OLED materials and devices • OLED panels and manufacturing • Power and functional electronics, sensors, and controls • Using data from connected lighting • Grid-interactive buildings
----------------------------	---

THURSDAY FEBRUARY 4

11:00 a.m.– 12:30 p.m. ET	Data’s Role in the Future of Building Design and Operation There is a growing use of software in the building industry that incorporates complex data and parametric design options, enabling users to calculate hundreds of design variables while incorporating the latest codes, standards, and research consensus. There is considerable opportunity to also incorporate data from current building systems to optimize performance and to provide a critical feedback loop to inform the design process for new building systems, changing the way decisions are made. These ideas and more will be explored in this session full of passionate experts in building systems and lighting. <i>Moderator: Michael Poplawski, Pacific Northwest National Laboratory</i> Leland Curtis, SmithGroup Star Davis, Design Consultant Cindy Zhu, Prescriptive Data
1:00 p.m.– 2:30 p.m. ET	The LED Lighting Supply Chain: Economics, Innovations, and Sustainability The maturation of LEDs and LED lighting products has led to changes in manufacturing approaches and the supply chain makeup over the past decade. This panel will explore the evolution of the supply chain and how technology, markets, and macroeconomic events have shaped it. The status of the global supply chain will be presented with an eye toward leveraging innovative manufacturing design approaches and adapting to new manufacturing practices to further the supply chain progression. Additionally, sustainable manufacturing approaches will be discussed, highlighting areas for integration of sustainable materials into lighting products and the deconstruction of decommissioned lighting products to properly recycle the embedded materials. <i>Moderator: Morgan Pattison, SSLS, Inc.</i> Valerie Nubbe, Guidehouse Monica Hansen, LED Lighting Advisors John Trublowski, Eaton Aaron Smith, Finelite

1:00 p.m.– 2:30 p.m. ET, continued	OLED Manufacturing Challenges Although ultra-thin layers of organic materials are efficient emitters of light, further research is needed to design structures that can be manufactured at affordable cost to protect the fragile organic materials and extract the light. Recent progress in fabricating light extraction films, conformable substrates, and encapsulation layers will be reviewed. Opportunities for cost reduction will be summarized, with an assessment of the potential benefits from printing techniques and roll-to-roll manufacturing. Analysis of the market demands for diffuse lighting will be used to discuss the integration of OLED panels and drivers into luminaires. <i>Moderator: Norman Bardsley, Bardsley Consulting</i> Jeff Spindler, OLEDWorks Christian May, Fraunhofer Steve Forrest, University of Michigan
3:00 p.m.– 4:30 p.m. ET	Lighting the Future How will lighting meet the moment? Future lighting systems have the potential to be more energy efficient, flexible, and controllable, improve our well-being and productivity, streamline maintenance, reduce negative environmental impacts, and more when they are not tethered to the limitations of previous lighting technologies. Panelists will discuss their visions for the future of lighting technology and application. <i>Moderator: Morgan Pattison, SSLS, Inc.</i> Naomi Miller, Pacific Northwest National Laboratory Tom Phoenix, CPL Brad Koerner, Cima Brian Walker, U.S. Department of Energy