

U.S. DEPARTMENT OF ENERGY

December 3, 2015

The Best Is Yet to Come

Although they say the song *The Best Is Yet to Come* was originally written for Tony Bennett (much to the chagrin of Frank Sinatra fans), to my ears it sounds as if it had been penned expressly for SSL. That's because, despite the rapid progress solid-state lighting has already made, we've only scratched the surface of what it can do — a point that was driven home time and again at DOE's 10th annual <u>Solid-State Lighting Technology Development Workshop</u>, which brought more than 230 lighting stakeholders together in Portland, OR, two weeks ago.

What SSL can do goes way beyond the traditional definition of lighting, to encompass everything from improving health and productivity to communicating with other electronic devices to dictating the growth and quality of plants.

That last aspect was the focus of the Portland workshop's keynote address, given by Tessa Pocock of Rensselaer Polytechnic Institute's Smart Lighting Engineering Research Center. Noting that multistory "vertical farms" are springing up in Asia like mushrooms, she reviewed some very interesting research on tailoring a plant's aesthetic, commercial, nutritional, and even pharmacological qualities by adjusting various characteristics of the light it receives. One of her conclusions, which raised some eyebrows in the audience, was that providing plants only with the red and blue light we've been reading so much about is far from optimal, because a broad spectrum is important for photosynthesis. Observing that we humans are practically blind compared with plants, which have a dozen different kinds of photoreceptors, Tessa raised the intriguing possibility of creating a dynamic feedback loop in which plants communicate their needs to the lighting system, which reacts accordingly.

But despite the fact that we're less sensitive to light than plants are, it still affects us in profound ways. George Brainard of Thomas Jefferson University's Sidney Kimmel Medical College took a close look at the science underlying this, showing how light is able to alter our mood, alertness, and sleep cycle by stimulating photoreceptors in the eye that control the release of hormones. He also spoke of his work with NASA in using LED lighting to regulate the sleep cycles of the Space Station astronauts. But while George is admittedly excited by the spectral tuning possibilities offered by SSL, he cautioned manufacturers to make sure their claims are supported by scientific evidence.

Stephan Völker of Germany's Technische Universität sounded a similar warning as he reviewed the results of the humancentric use of lighting in settings such as offices, retirement homes, and hospitals. He also cautioned that while light can have health benefits, it's a double-edged sword, because anything that can heal also has the potential to harm — which is why guidance in the proper usage of light is so important.

Michael Royer of Pacific Northwest National Laboratory discussed the recently released IES TM-30-15, which details new metrics and tools for evaluating the color rendering characteristics of light sources. Michael, a member of DOE's SSL team and chair of the IES task group that developed TM-30, explained that TM-30 provides an improved color fidelity metric, based on a much more comprehensive set of 99 color samples compared to the eight on which CRI is based. He also discussed the color gamut metric introduced in TM-30, which addresses the relative color saturation provided by a light source, and gave a vivid on-stage demonstration to show how differences in color saturation affect the appearance of objects.

Although there's widespread agreement that SSL will eventually become the dominant technology for most lighting applications, it has a long way to go before that actually happens. Mary Yamada of Navigant discussed a recent DOE study, *Adoption of Light-Emitting Diodes in Common Lighting Applications*, which illustrates this. She noted that while there's been a lot of progress in the past five years, the actual market share for LED lighting is still quite small — about 3% of all indoor installations, and 10% of all outdoor installations. Mary pointed out that whereas most of the SSL energy savings are coming from A-type and directional products, the biggest potential savings are with linear fixtures (currently 1%) and low-bay/high-bay (currently 2%), which collectively represent 60% of the potential savings.

A panel on how changing technology and business practices will affect the lighting industry offered a wide range of perspectives and sparked a thought-provoking discussion. Four manufacturers were asked to describe the innovative features of their products, and how these features might change the way we design and construct buildings. Gary Trott of Cree talked about his company's CCT-adjustable CR Series troffer, which offers a SmartCast™ feature that automatically groups fixtures across a network. Yan Rodriguez of Acuity Brands discussed boosting efficiency and reducing installation costs by centralizing power with the use of DC microgrids. Chris Bailey of Hubbell Lighting described ArcheType X™, an outdoorapplication optical platform his company created that allows the optics to be adjusted to provide the desired intensity distribution. Lori Brock of OSRAM SYLVANIA explained how her company's OmniPoint™ downlight lets users easily adjust the beam angle, direction, distribution, and intensity using an iPad application.

On the non-manufacturer side, Ed Clark of ZGF Architects talked about how new

product capabilities will affect architectural design, and emphasized the importance of generational consistency — i.e., that individual products and components can be replaced without having to replace the whole luminaire or system. Dave Bisbee of Sacramento Municipal Utility District looked at how new product designs might impact utility programs, and discussed his work collaborating with DOE in using humancentric LED lighting in hospital and nursing home settings. Rob Fallow of Fortis Construction reminded manufacturers about the constraints of a typical construction schedule and the importance of procurement intervals, and emphasized the need for contractors to be educated on new lighting products and their installation. Chip Israel of Lighting Design Alliance stressed the quality of the lighting space and observed that he hasn't seen any client demand for color tuning just yet.

There were lots of other informative talks and panels at the Portland workshop, which, as always, featured spirited back-and-forth interchange with the audience during Q&A sessions, as well as countless discussions that were held "offline." Presentations are posted on the <u>DOE website</u>, and highlights will be posted soon. Meanwhile, mark your calendars for February 2–4, 2016, which is when DOE holds its 13th annual <u>SSL R&D Workshop</u> in Raleigh, NC (full details to come).

As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.