SSL Postings
U.S. DEPARTMENT OF ENERGY

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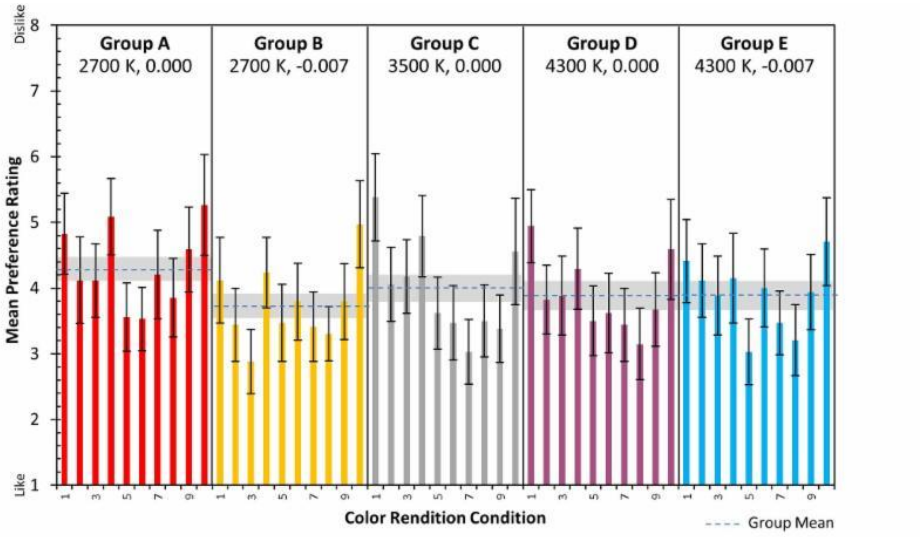
Upcoming Webinar on TM-30 and What We've Learned in the Past Two Years

IES TM-30-15, a system of measures and graphics that can be used together to effectively evaluate and communicate a light source's color rendition properties, has been around for two years now, and in that time researchers have been helping to lay the foundation for its widespread use in the lighting industry. On Tuesday, September 12, DOE will host a webinar that will explore the new research — some of it conducted by DOE — and how it can help in applying TM-30. Presenter Michael Royer of Pacific Northwest National Laboratory, who chaired the IES task force that developed TM-30, will review studies relating TM-30 values to human evaluations, and the specification criteria that can be derived from the results. He'll also discuss the future of TM-30 and color-rendition measures. The webinar will be held from 1:00 – 2:00 p.m. EDT, and will include a 45-minute presentation followed by a 15-minute live Q&A session.

We'd also appreciate any voluntary feedback on how TM-30 is being used by specifiers, manufacturers, utility programs, and other segments of the lighting industry. So if you have a story to tell, a product to share, or even a question you hope to have answered in the webinar, feel free to send it to doe.ssl.updates@ee.doe.gov.



TM-30 was developed because of the well-recognized limitations of the International Commission on Illumination's (CIE) General Color Rendering Index (R_a or, colloquially, "CRI"), which has been in use since 1965. Although there have been many past efforts to develop complementary or alternative ways to evaluate color rendition, none was widely adopted. The advent of SSL — which offers tremendous scope for spectral engineering and optimization — increases the need for such a method.

CRI indicates average color fidelity — the average similarity of the appearance of test colors compared to how they appear under reference illuminants. But changes in average fidelity scores can result from different patterns of distortion, and average color fidelity measures don't indicate what combination of hue, chroma, and lightness shifts lower the score. TM-30, on the other hand, indicates not only average color fidelity, but also gamut area, hue-specific chroma shift, and hue-specific hue shift — and includes a color vector graphic.

By using more accurate models of color vision and object colors, as well as providing a more comprehensive characterization of color rendition, TM-30 can provide a better prediction of how colors in a space will appear. However, it's still necessary to investigate what types of color rendition patterns lead to different perceptions of a space. The objective characterizations in TM-30 are intended to be used in varying combinations based on the needs of the application.

The DOE SSL Program's color research focuses on deepening the fundamental understanding of human perceptions of different patterns of object color appearance — or shifts in color compared to defined reference conditions — using new tools for characterizing color rendition, such as those in TM-30. We design, conduct, and analyze human-subject experiments to accomplish this, and we prioritize disseminating our results to manufacturers and standards organizations to stimulate the advancement of SSL technology and the development of improved metrics for characterizing color rendition. This work is intended to encourage the development, manufacturing, and use of products with novel spectral power distributions, including color-mixed LED systems (which have higher maximum efficacy potential than current broadband phosphor-based LED systems), narrow-emission phosphor LED, quantum dots, laser diodes, OLEDs, and other new technologies. It also provides guidance and targets for engineering SSL products so that they're chosen for their color quality rather than just their energy efficiency, thereby ensuring maximum energy savings by avoiding commoditization, homogenization, and stereotyping.

DOE has completed two such experiments so far. The first one investigated perceptions of the full range of practical color rendition conditions at one chromaticity. It found, among other things, that preference is not strongly related to average color fidelity, and there's a negative correlation with CRI (R_a); that preference is most strongly related to red chroma; that TM-30 measures can be combined to build strong predictive models of preference; and that two sources with the same chromaticity, average color fidelity, and average gamut area can be perceived substantially differently.

Our second experiment investigated the interaction of chromaticity and color rendition on perceptions of a generic environment. It found, among other things, that preference is related to red chroma shift at all chromaticities; that the best overall preference model includes average fidelity, gamut area, and red chroma shift; and that there's no difference in ratings based on CCT alone, but there's an interactive effect of CCT and D_{uv}.

Among the other things we've learned so far are that gamut shape (the illustration and quantification of color shifts at different hues) is a very important concept in understanding perception and should be characterized by color-rendition measures, that specification criteria can be set with two or three measures from TM-30 — and that it can be hard to break a longstanding habit such as relying on CRI, even when the science is there.

Two additional DOE experiments are in the works: further exploration of chromaticity effects, which will help refine our understanding of how CCT and D_{uv} interact with color rendition; and an investigation of illuminance effects, which will examine how various color rendition conditions are perceived at different illuminance levels.

I hope you'll join us for the webinar. For more information or to register, visit the DOE website. I also invite you to check out our FAQs on TM-30 and our other online resources on color rendition.

Best regards,
Jim Brodrick

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