SSL Postings
U.S. DEPARTMENT OF ENERGY

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Updated Recommendations for Testing and Reporting LED Luminaire Reliability

Long lifetime ranks high on solid-state lighting's list of potential advantages. But accurately predicting that lifetime is no easy matter, because—unlike most other lighting technologies—SSL has many different components, each one of which can cause system failure. You may recall that in 2011, an industry working group under the auspices of DOE and the Next Generation Lighting Industry Alliance (NGLIA) published the seminal report *LED Luminaire Lifetime: Recommendations for Testing and Reporting.* A revised version of that report, the latest in a series on LED product performance and reliability, has just been published by the NGLIA's LED System Reliability Consortium (LSRC), which is a spinoff of the earlier working group. Based on the considerable progress made since 2011 in the understanding of SSL failure mechanisms, the new report summarizes what's been learned to date, suggests directions for further work, and updates the previous recommendations for describing the life and reliability of LED luminaires.

The LSRC draws on the electronics and testing expertise of RTI International, whose ongoing work on accelerated lifetime testing is focused on developing a model for predicting the lifetime of integrated SSL luminaires and led to the publication of the 2013 report *Hammer Testing Findings for Solid-State Lighting Luminaires*. The findings of that report not only reinforce the belief that the other luminaire components are far more likely to fail than the LEDs, but suggest that certain stress factors such as heat and humidity could accelerate those failures. Accelerated testing, once established, could greatly reduce the time and expense presently needed to evaluate product lifetime. It's not that the luminaires would be likely to encounter high heat and humidity during real-life usage, but rather that such conditions speed up the failure rates of the various components, and that a way may be found to accurately project actual lifetime based on those speeded-up failure rates.

Because the importance of some lighting parameters is dependent on the particular application, the LSRC recommends that LED lighting products be classified into three reliability categories—lamp-replacement grade, standard grade, and specification grade—that cut across all market segments and apply to a range of parameters, from color stability to light output. The idea here is to keep costs down by enabling manufacturers to tailor stringency to actual needs, rather

than force them to take an over-engineered and over-tested one-size-fits-all approach.

Color shift has been added to the LSRC's new recommendations as a consideration in defining lifetime—but only for those applications where color stability is important. The color of general-illumination lighting products doesn't shift steadily but runs in all directions, which means that the best one can do is describe the magnitude of the shift over a given interval. There may be several different mechanisms that come into play—involving changes in the phosphors, changes in the LEDs themselves, and mechanical changes. But right now it's not clear what those changes are, so there's a need to unravel the underlying mechanisms to get a better handle on them. For those applications where color stability is an important consideration, it may be advisable for the customer and manufacturer to negotiate with one another; some manufacturers even claim to have proprietary means of predicting the color stability of their own products.

The new recommendations are an important step toward consistent, industrywide understanding of this complex topic. Gaining a better understanding of SSL reliability will help increase consumer confidence—which, in turn, will accelerate adoption of this energy-saving technology.

The new recommendations can be found online.

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