SSL Postings

Among solid-state lighting's assorted advantages, longevity is the one that gets touted most often, after energy efficiency. Many LED lighting products on the market are claimed by their manufacturers to last for 50,000 hours, and some are said to last even longer than that. In certain applications, long lifetime can result in significant maintenance savings, affecting the payback and consequently, the buyer's decision. But in fact the long lifetimes of SSL products, as well as the tendency for LEDs to fade over time rather than suddenly burn out, make it difficult to define, measure, and report just what those lifetimes really are.

That's why a group under the auspices of the U.S. Department of Energy (DOE) and the Next Generation Lighting Industry Alliance (NGLIA) has been working hard on the topic for the last few years, with the twin goals of supporting the [Lighting Facts](#)® program and helping the standards bodies develop appropriate standards. Composed of NGLIA members as well as other experts in reliability, lighting, and LED technology, this working group published a set of recommendations for reporting and demonstrating LED luminaire lifetime last year and has just come out with a [revised and updated version](#), which was discussed at DOE's sixth annual SSL Market Introduction Workshop in Seattle last week and was mentioned in the last *Posting*.

Central to both versions of the recommendations is the realization that any meaningful determination of the lifetime of an LED luminaire has to go beyond the LEDs and take into consideration all of the other components that come into play. As the new set of

recommendations memorably puts it, incorporating even the best LEDs into a product that's poorly engineered can turn a potential Methuselah into the embodiment of "live fast and die young."

That's because a chain is only as strong as its weakest link, which means that even if the LEDs are capable of lasting for 100,000 hours, that longevity is largely wasted if the driver or the optics or any of the other key components fails at a much earlier point – or causes the LEDs to fail early – thus marking the end of the luminaire's useful life. This hasn't stopped many manufacturers from using the lumen depreciation of the LED package as a proxy for lifetime – a misleading practice that doesn't serve the best interests of the consumer or ultimately, the industry. The more we've learned about LED luminaires, the clearer it's become that their lifetimes can be shorter than what would be projected based solely on the light depreciation of the LEDs – although generally still longer than many traditional lighting solutions.

The working group recommends that the standard way to define the lifetime of an LED luminaire or lamp be only in terms of its lumen output – specifically, the point in time (usually rendered as "L_{70}/B_{50}") when half of the product population has fallen below 70 percent of the initial light output for any reason. The key here is the phrase "for any reason," because it means that the definition goes beyond gradual lumen depreciation of the LEDs to include *any other mechanism* that lowers the light output – whether catastrophically or below a specified threshold.

But using standard tests to demonstrate L_{70}/B_{50} for SSL luminaires is both complicated and time-consuming. Recognizing that some manufacturers may not have the ability or the time to do it, the working group recommends that lifetime be an optional metric on the Lighting Facts label, rather than a required one. However, if lifetime is not specified on the Lighting Facts label, the working group recommends that at least one of three other related options, but none called "lifetime," be included instead: lumen depreciation,

a warranty, or a lifetime estimate based on accelerated testing of components.

Although excessive color shift is not part of the standard lifetime definition recommended by the working group, there are some applications where such a shift is unacceptable. That's why the new recommendations suggest that manufacturers be allowed to include optional information on color shift, as well as other optional information that's tailored to the needs of specific applications.

The process of developing these recommendations may well prove as valuable as the recommendations themselves. That's because it's brought people from different segments of the lighting industry together to share and interact, which has resulted in a great deal of learning on all sides. The topic is not an easy one, and we still have a ways to go, but we're much closer to a common understanding and characterization of product lifetime and reliability than we were a year ago.

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