Brainstorm: Lighting

What do you think is the chief factor preventing the mainstream adoption of solid-state lighting?

Mark McClear, Cree, www.cree.com [1] - LED lighting technology has been gaining acceptance rapidly over the past few years, but one of the greatest barriers to wide adoption continues to be educating the potential users about the availability and capabilities of this technology. Information from just six months ago is usually out-of-date. Helping potential customers recognize the benefits and economic viability of LED technology is critical for market acceleration. LED companies continue to produce products that exceed the predicted performance of the technology, and several forward-thinking lighting companies have responded by fielding high-quality, LED-based luminaires that deliver tangible advantages versus fixtures using traditional bulb technologies. In the early stages, LEDs were limited to specialty, niche, and color-changing applications. Now performance advancements have allowed for small arrays of high-power LEDs that can match the light output of most traditional light sources while delivering higher efficacy. Greater adoption of solid-state lighting has driven the development of new standards, and the first wave of critical standards in light measurement, LED lifetime, and color, have been enacted by the IESNA and ANSI. The U.S. Department of Energy's SSL ENERGY STAR® criteria recognizes the coming adoption of solid-state lighting as well with the development of standards for complete luminaire products.

Ken Marasco, Analog Devices, www.analog.com [2] - Power consumption has become the most important design challenge for battery-operated portable devices. As power hungry microprocessors double in speed every two years, battery improvements aren't keeping pace with the innovation that's taking place at the device level. Smart phones, portable media players, digital still cameras, scan guns, point-of-sale terminals, and personal navigation systems not only need power to run complex application-specific software, they need power for white light emitting diodes (WLEDs) to illuminate the display. To a large degree, the use of WLEDs has been held back because of their power consumption.
As displays increase in size and more WLEDs are required, new design strategies are needed to reduce their power consumption and squeak more minutes out of a single battery charge. For example, WLEDs can be configured in series or parallel circuit configurations depending on the type of display. A lighting management system (LMS) can be used to improve system efficiency by off-loading ambient light sensing and keypad monitoring tasks from the microprocessor. LMS with intelligent lighting control allows the device to autonomously sense ambient light levels and adjust backlight brightness for optimum viewing and power savings. The LMS's integrated architecture saves energy by eliminating the required CPU processing for monitoring ambient light and keypad scanning, thus reducing current drain on the battery and increasing available processor bandwidth for other tasks. Depending on the usage model, a 20 percent to 50 percent increase in operating time can be achieved. Locating the LMS alongside the LCD display allows designers of portable devices with flip or slider covers to streamline the number of required control lines, which reduces the energy required to drive the additional lines and lowers the cost of the flex cable. In tomorrow's portable devices, every section of the power system must be optimized for efficiency.

Bill Abbott, Endicott Research Group, Inc. www.ergpower.com [3] - Cost is a key factor, as is performance. And, key to achieving the performance that will get the cost/performance ratio to where SSL is truly cost-effective is an understanding of all the parts in the value chain that have to work together, including LED, driver and luminaire manufacturers. No one has all the answers, but all parties concerned should be aware that LED drivers need to do more than just "light the lamp". Even a cursory look at the LM80 test procedure for Energy Star qualification will show you how important constant drive current with low ripple and input current regulation are, as well as active thermal management, power factor correction, Triac-based dimming, color temperature regulation and ambient light control. And, misconceptions such as LEDs generate no heat which,

believe it or not, is still on some manufacturers web sites, need to be cleared up. LED and driver manufacturers need to work together with luminaire OEMS to make sure all components work together harmoniously and efficiently.

Irene Signorino, Microsemi Corporation, www.microsemi.com [4] - Energy savings, creative color management and a green approach are all keywords used to promote LED as a source of light for general illumination. The LED manufacturing industry has consistently been improving the performance of the LEDs by driving progress in the manufacturing and packaging processes. But the technological advances achieved on the LEDs will be voided unless the whole lighting fixture (including LED drivers, heat sync, optics etc) is specifically designed and optimized for this very different light source.
Optimized LED drivers designed and specified over realistic operating ranges significantly contribute to the overall performance of the fixture. It is to be understood and accepted that the cost effectiveness of such specialized LED drivers might not yet be comparable to existing power supplies developed for other light sources. If the industry doesn't recognize and properly address such specific needs the payback models – one of the most used vehicles to sell this new technology – will become completely unreliable. This will also create a group of very disappointed early adopters who will resist flickering, cold un-tunable light, suboptimal energy savings as well as premature fixture failures and will in turn slow down or completely hinder the long-term growth of the market.

Randall Restle, Newark, www.newark.com [5] - With the higher initial cost, need for heat removal in a small fixture, and relatively limited range of applications, it may seem that the transition from incandescent to solid-state lighting has slowed. However, we must consider that the few advantages of conventional incandescent lighting will be far outweighed by the long term benefits

of solid-state lighting. Lower energy consumption is perhaps the most sought after benefit. Whereas a 60W incandescent bulb produces around 900 lumens, a single 1W white power LED may produce up to 100 lumens, suggesting a total power saving of over 80% for a fitting of equivalent light output.
Another environmental advantage is the lower cost of disposal, at end of life, compared to fluorescent tubes. Further benefits of LEDs include predicted lifetimes up to 50,000 hours depending on operating conditions. Their small size will enable many new form factors, and also allows easier installation in space-constrained applications, such as on board buses or trains or in electronic signs. Furthermore, as a low-voltage DC light source, LEDs can also meet high safety standards by separating users from direct contact with AC mains electricity.
With ongoing, rapid developments in LED chip design, package performance, control electronics and module integration, solid-state lighting is now able to provide an exciting and hugely beneficial alternative to traditional approaches in numerous lighting markets. As the initial cost comes down, its technology continually improves and the call for higher environmental standards increases, solid-state light will continue to thrive.

Dan Jacobs, OPTEK Technology - www.optekinc.com [6] - While there are many solid state lighting opportunities in niche applications where maintenance is a key factor in operating costs, particularly with high power consumption areas such as hotel lobbies and casinos, the mainstream adoption of solid state lighting hinges on initial cost. In an effort to reduce cost for increased adoption, LED quality and reliability (the primary advantages solid state lighting promises) are often sacrificed, resulting in only minimal performance improvement over traditional technologies, such as fluorescent lighting.
Along with cost, education is a limiting factor to the mainstream adoption of solid-state lighting, as many people oversimplify the transition from traditional to solid state lighting sources. For instance, customers often want an “instant retrofit” kit for an existing lighting solution, yet in order to take advantage of LEDs’ full capabilities and benefits, it’s best to redesign the entire lighting system to make sure its properly driven and thermally managed.
As LED costs inevitably decrease, more people become educated about the long term payoff of using LEDs, and “green” corporate incentives or federal initiatives accelerate, there will be an increasing adoption rate of solid state lighting on a mainstream level. We see a lot of interest in discrete lighting moving to LEDs, primarily in publicly funded lighting applications being driven by cost sensitivity and the need for more energy efficiency. While the timeframe of adoption depends upon the market segment, we expect commercial buildings to soon follow outdoor and

architectural applications, and residential lighting to be the last to convert.

Doug Bailey, Power Integrations, www.powerint.com [7] - “Outdoor lighting currently consumes approximately 4.4% of all the electricity produced in the U.S.” That is the claim made in the introduction to a new bill before the U.S. House of Representatives which aims to reduce energy consumption of street lights by phasing out more traditional technologies, such as High Pressure Sodium (HPS) light bulbs. LED lamps deliver 80 lumens per watt when driven by a high-efficiency resonant power supply, versus just 58 lumens per watt for HPS lamps. LEDs also deliver better directional control and color quality than HPS lights, an important consideration in shopping and residential areas.
LED lighting fixtures are more costly to buy than incandescent and fluorescent alternatives, which constrains adoption in applications that favor low initial expense. The business case for LED street lights is based on simple efficiency and maintenance mathematics – over the long term, the light output is achieved at lower cost in electricity and the longevity of the solid-state bulbs reduces the number of service calls to replace bulbs. Following positive trials in the U.S. and worldwide, many cities are now introducing policies to replace traditional street lights with LED products. The largest and highest profile project is happening in Los Angeles where, over a five-year period, the city’s Bureau of Street Lighting will replace 140,000 existing street light fixtures with LED units. Not only will this improve LA's lighting quality and reduce its electricity use, but it will also help the city save money, as LED fixtures last two to three times longer than traditional products, delivering significant maintenance cost savings.
With these benefits, we can expect to see an explosive growth in LED street lighting and almost complete adoption in a very short time. Our PI Expert? design software now supports the HiperPLC? (integrated PFC and LLC controller) device, which enables designers to quickly develop power supplies suitable for LED lighting from 75 W to 600 W with better than 90% efficiency.
No Interference with Slim Notebook Adapter Design

Dr. Bernhard Stapp, OSRAM Opto Semiconductors, www.osram-os.com [8] - LEDs are the future of energy efficient lighting. Mainstream adoption of solid state lighting is dependent on various factors related to the ongoing development of LEDs and the integration of LEDs into a system. Regulation will also play a key role in the pace of widespread adoption. OSRAM is continually expanding its portfolio of products and

implementing solutions that improve the quality of light and deliver better color temperature, color rendering and uniformity, These efforts will increase the pace of adoption. For example, as the efficacy (lm/W value) of warm white LEDs increases, we will witness more rapid adoption of LEDs in a variety of applications where customers prefer warm white over cool white lighting. By offering LEDs that are Energy Star compliant, we will help customers meet the Energy Star standards for more efficient light sources.

Working together with the community of lighting planners and architects is key to the continued adoption of LED technology. This is not your daddy's light bulb, and there's a strong need to educate and partner with the lighting community to ensure there's a common understanding of what is required to build an LED solution-- from drivers and optics to components for thermal management. Regulation will help bring LED products to market and provide the parameter of technical identification that customers will come to understand and that will form the new language of Solid State Lighting. And last, but certainly not least, as the adoption of LEDs increases, the cost will continue to come down, opening up the markets and more rapidly expanding the adoption of LEDs for SSL.

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