Brainstorm: Solid State Lighting

Edited by Jason Lomberg

What application area will benefit most from the integration of solid state lighting?

Mark Emuss, DALI Lighting Limited, www.dalilite.com **[1]**

In-building applications such as hotels and public buildings where lighting is required for long continuous periods and where maintenance is difficult due to factors such as high ceilings or round-the-clock high levels of foot traffic will benefit most from solid state lighting.

Expected life in the region of 50,000 hours compared to around 2,000 hours for halogen means that the period between costly and disruptive maintenance is significantly extended.

In applications where multiple lights are in continuous use, the energy savings of approximately 80% that are achievable with solid state replacements for halogen lighting quickly repay the initial capital outlay and give buildings operators important running cost savings.

Some of the latest solid-state replacements for ‘sockets’ such as MR16 and GU10 – popular in buildings applications - overcome the deficiencies of early LED lamps by being carefully thermally managed to promote longer life and reliability, and utilise design techniques to enable them to replicate the colour temperature and beam spread of the halogen fittings they are replacing.

With rising energy costs and the need to save power from an environmental standpoint, solid state lighting for buildings offers a great way to address the challenges whilst also providing a low maintenance, long-life solution that meets the ‘fit and forget’ needs of this type of application.

 **Michael Kretzmer, ERG Lighting,** www.erglighting.com **[2]**

Street lighting and area lighting (such as parking lot, garage, and walkway illumination) will undoubtedly reap the benefits from the integration of solid state lighting. These applications have several successful, well-documented pilot projects in the field and have been creating a lot of industry buzz.

Street lighting and area lighting have enormous installation bases and present the opportunity for very large energy and cost savings. These potential savings are a direct result of the advantages inherent to solid state lighting sources: namely high efficiency and reliability. The fact that street and area lights are powered for long periods of time, consume a fair amount of energy, are often in harsh physical environments, are not easily accessible and therefore carry potentially high maintenance costs, makes them perfect applications for solid state lighting.

Although LEDs remain a costly alternative to conventional light sources, the prices have been dropping steadily for the past two years. The promise of long-term financial savings, coupled with some of the funding that is available for converting to energy-saving technologies, suggests that the next few years will see a huge number of conversions to solid state lighting, particularly in the applications of street and area lighting.

 **Joseph Velas, JKL Components,** www.jkllamps.com **[3]**

Hazardous area lighting and emergency lighting in developing countries will benefit most from the integration of solid state lighting.

Thinking of solid state lighting, the benefits that are most obvious to most of us include; Reducing Energy Consumption, Cleaner Environment and Overall cost savings that is realized from Energy and Maintenance cost. However, the issues that

have the most significant impact on human lives are often overlooked.

Worldwide, less than 10 percent of people have the option to use modern technology and rely on hazardous substances such as kerosene for illumination.

One quarter of the world population lives without electricity
• 1.6 million people (that's about equivalent to the population of the State of Idaho), die every year due to dangerous kerosene lamps. In some cases, one overturned kerosene lamps causes an entire village to burn down. In addition to saving lives, the access to safe light will remove barriers in relation to education and health services.

• The environmental effect of 1.6 billion people using kerosene fuel and candles contributes to global carbon emissions at a rate of 100-150 million tons per year. The development of long-lasting energy efficient solid state lighting will significantly impact these safety issue immediately while benefiting the environment in the long-term.

Advances in Hazardous location lighting
Proper and safe lighting is key in many industries. In mining alone, the operational safety benefits of LED lighting are great but also increase safety substantially due to light duration, quality and reduced need for maintenance. LEDs also eliminate the extension cords that are worn by miners to connect the battery pack to the miners cap lamp. Accidents caused by the cords alone are responsible for several incidents each year.

In addition to areas associated with risk, solid-state lighting provides added safety in areas we might not realize are so hazardous. The filaments and surfaces of many traditional lighting fixtures can reach 600-1500 ºC. If these break or explode, this heat can cause an immediate fire in areas where flammable liquids and materials are stored, in places as common as garages, basements and storage rooms.

With benefits extending across finance, safety and the environment, a wide range of organizations and corporations are looking to solid-state lighting solutions to benefit their clients and service partners.

Laurent Jenk, ON Semiconductor, www.onsemi.com **[4]**

Roland Haitz (a now-retired scientist at Agilent Technologies) said one day "Edison

was only the 38th inventor of a filament based lamp…but Edison was the 1st to deliver the entire lighting system."

As one talks about integration in Solid State Lighting, it is useful to remind that Solid State Lighting requires a complete system solution:

• LED Source: compact effective light source available in a broad range of colors and output power

• Power Conversion Electronics: Electronics to convert high voltage AC, low voltage AC, DC voltage from a battery, or solar cell, into DC voltage for the LED

• Control & Drive Electronics: Electronics to regulate and control the LED

• Thermal Management: To achieve long operating lifetime of the LED, control of the junction temperature is critical

• Optics: Focusing the light to where it needs to be requires lenses or light guides

Integration in Solid State Lighting involves the electronics (power conversion and control & drive). Therefore, the applications that will benefit from integration of the electronics will be those where the space and volume reserved for the electronics is the tightest, i.e. these applications are mostly LED light bulbs. This includes the replacement of conventional light incandescent and halogen light bulbs (for example, A-19 or MR-16 or GU-10 or PAR-30) in a retrofit system.

Multiple options can be considered for the integration of the power conversion and control & drive electronics:

- New topology. For example, a non-isolated topology can eliminate the use of the bulky transformer used to perform galvanic isolation between the primary AC line and the secondary DC voltage. But, in such a topology, the isolation must be ensured by a robust and safe mechanical design.

- Combination of the power conversion function together with the control & drive function. For example, primary side regulation enables to control the LED current from the primary side and to eliminate all the components on the secondary side.

Links:
[1] http://www.dalilite.com
[2] http://www.erglighting.com
[3] http://www.jkllamps.com

[4] http://www.onsemi.com