Is use of LEDs within our reach?

LEDs are currently more expensive, price per lumen, on an initial capital cost basis, than more conventional lighting technologies. The additional expense partially stems from the relatively low lumen output and the drive circuitry and power supplies needed. However, when considering the total cost of ownership (including energy and maintenance costs), LEDs far surpass incandescent or halogen sources and begin to threaten compact fluorescent lamps. In December 2007, scientists at Glasgow University claimed to have found a way to make Light Emitting Diodes brighter and use less power than energy efficient light bulbs currently on the market by imprinting holes into billions of LEDs in a new and cost effective method using a process known as Nan imprint lithography.

LED performance largely depends on the ambient temperature of the operating environment. Over-driving the LED in high ambient temperatures may result in overheating of the LED package, eventually leading to device failure. Adequate heat-sinking is required to maintain long life. This is especially important when considering automotive, medical, and military applications where the device must operate over a large range of temperatures, and is required to have a low failure rate.

LEDs must be supplied with the correct current. This can involve series resistors or current-regulated power supplies.

The spectrum of some white LEDs differs significantly from a black body radiator, such as the sun or an incandescent light. The spike at 460 nm and dip at 500 nm can cause the color of objects to be perceived differently under LED illumination than sunlight or incandescent sources, due to metamerism. Color rendering properties of common fluorescent lamps are often inferior to what is now available in state-of-art white LEDs.

LEDs do not approximate a “point source” of light, so cannot be used in applications needing a highly collimated beam. LEDs are not capable of providing divergence below a few degrees. This is contrasted with commercial ruby lasers with divergences of 0.2 degrees or less. This can be corrected by using lenses and other optical devices.

There is increasing concern that blue LEDs and white LEDs are now capable of exceeding safe limits of the so-called blue-light hazard as defined in eye safety specifications such as ANSI/IESNA RP-27.1-05: Recommended Practice for Photo biological Safety for Lamp and Lamp Systems.