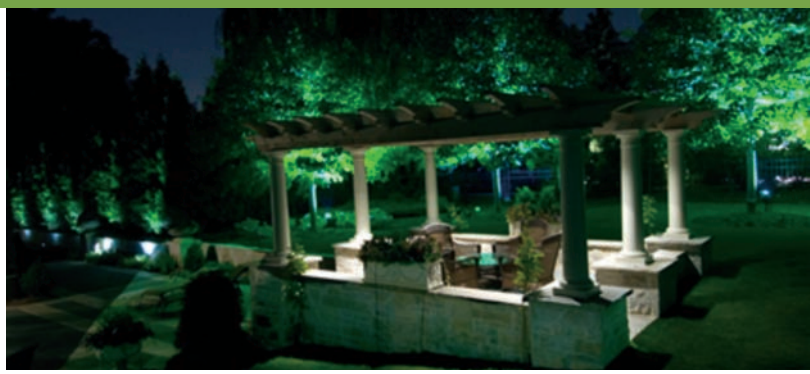
FEATURE I
Dean MacMorris, *Nightlight*



Watch out . . . There are Pitfalls to the New LED Lighting

Ever since George W. Bush signed the Energy Policy Act of 2005, emphasis has been placed on the efficiency of lighting. The many benefits of Light Emitting Diode (LED) lighting have come to our attention. While there are many benefits to LED, it also has many pitfalls that could get you into trouble. I will describe LED lighting so you can understand why it has become so popular and why there is so much confusion. It's true that LED technology is more costly on the front end. However, I will show that when it's done properly, it can save considerable money long-term.

Most of us are familiar with the common types of lighting, such as the regular incandescent, fluorescent, and High Intensity Discharge (HID) like metal halide, mercury vapor, and high-pressure sodium lamps. The Energy Policy Act of 2005, requires most of these common types of lighting to be replaced eventually with the more efficient LED.

Although people are fighting against this as we speak, it's common knowledge that the regular light bulb is slated for extinction. We already know there has been a push to replace it with the compact fluorescent or CFL. Even though lawmakers want all of us to use CFLs, rather than regular incandescent bulbs, many people still prefer the bulbs we have used for years. Issues include the color of CFL lights, how slowly they come on, and that they are not dimmable. The argument for CFLs is their efficiency. That's also why LED is becoming much more popular. LEDs are far more efficient than CFLs. They are also dimmable and instant on.

Because many are unfamiliar with LED technology, it's easy to jump on the bandwagon without really knowing which LED fixture or lamp is the right choice. Many of the major manufacturers have been working very hard to develop a new technology that is state-of-the-art, efficient, with acceptable colors, as well as cost-effective. To some extent, there has been a rush to be the market leader with little focus on the consumer. Since most consumers are uninformed about LED lighting, they could unknowingly choose a technology with a short lifespan. Whether it's interior lighting or site and landscape lighting, it's wise to consult with a lighting professional before buying LED. You want to be sure you're making the right decision the first time, due to the initial cost.

Rather than heating up wires or exciting a gas, an LED emits light by electronic excitation with very little heat generation. Diodes are electrical valves that allow electrical current to flow in only one direction, just as a one-way valve might in a water pipe. When the valve is "ON," electrons move from a region of high electronic density to a region of low electronic density. This movement of electrons is accompanied by the emission of light. The more electrons that pass across the boundary between layers, known as a junction, the brighter the light.

To make the semiconductor wafers, gallium, arsenic, and/or phosphor are first mixed together in a chamber and forced into a solution. To keep them from escaping into the pressurized gas in the chamber, they are often covered with a layer of liquid boron oxide. Next, a rod is dipped into the

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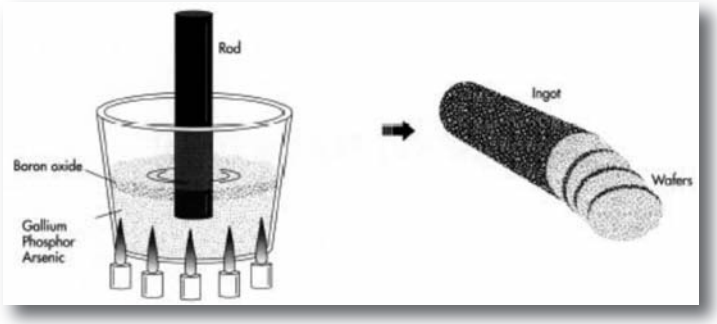

solution and pulled out slowly. The solution cools and crystallizes on the end of the rod as it is lifted out of the chamber, forming a long, cylindrical crystal ingot. The ingot is then sliced into wafers. Each of the semiconductor materials (called substrates) and impurities result in various colors of light from the LED.

During the process of growing the LEDs, the diodes are tested for many factors. The two main factors are the color of light that the diode emits (in degrees Kelvin), and the intensity of the diode (or lumens-per-watt output). The growing process has been difficult to control; therefore, the diodes must be graded for quality in these two categories. This is called binning or batching. The greater percentage of diodes are of low quality; and therefore, are sold rather cheaply. On the other hand, the higher-quality diodes command a considerably higher price. This is why there are so many different lamps to choose from at varying prices and levels of quality. The lower quality diodes, although less expensive, do not offer the intensity most consumers are looking for, which leads to disappointment and frustration.

When most people think of LED lighting, the first thought that comes to mind is that the light is too blue. Some people think they are eerie looking. When Christmas lights first came out in LED several years ago, they were all blue in color. This was because cooler colors are the most cost-effective to produce, and they happen to have the highest lumen-to-watt output. The warmer yellow light has less lumen output. At the time, the blue option was the only one available. Manufacturers could not produce a bright enough warm diode. Since then, the technology has changed so warm, cool, and cooler options are available cost-effectively. The color of light is measured in degrees Kelvin. See the chart at right:

The technology is changing quickly. Manufacturers are limiting their inventory of fixtures and lamps, not wanting to manufacture and inventory product that may become obsolete before it's sold. This is a major reason why LED remains much more costly than the more common forms of lighting. This will continue to be the case until there is an industry standard and larger quantities are produced. With all of the focus on LED lighting by many different manufacturers, the technology is improving greatly and the prices are falling. In the past a viable LED replacement lamp(s) was not available. In the last few months, cost effective options have been made available for retrofitting many of the common incandescent and HID fixtures.

LEDs run on direct current (DC), as opposed to alternating current (AC), the standard in office buildings and homes. This requires the diodes to have a "driver," which converts the power from AC to DC. The advantage is the lamps themselves use approximately half of the energy. Unfortunately, the driver generates heat in the conversion process, and this heat is detrimental to the diodes themselves. This and the limited space an existing lamp occupies cause a restriction on how big or powerful a driver can be before it generates enough heat to damage the diodes. This is the reason many LED lamps perform at a lower level than their incandescent rivals even though they are sometimes as much as ten times more expensive. It isn't cost effective to replace an entire existing fixture to convert to LED. Technology is quickly moving in the direction of producing lamps

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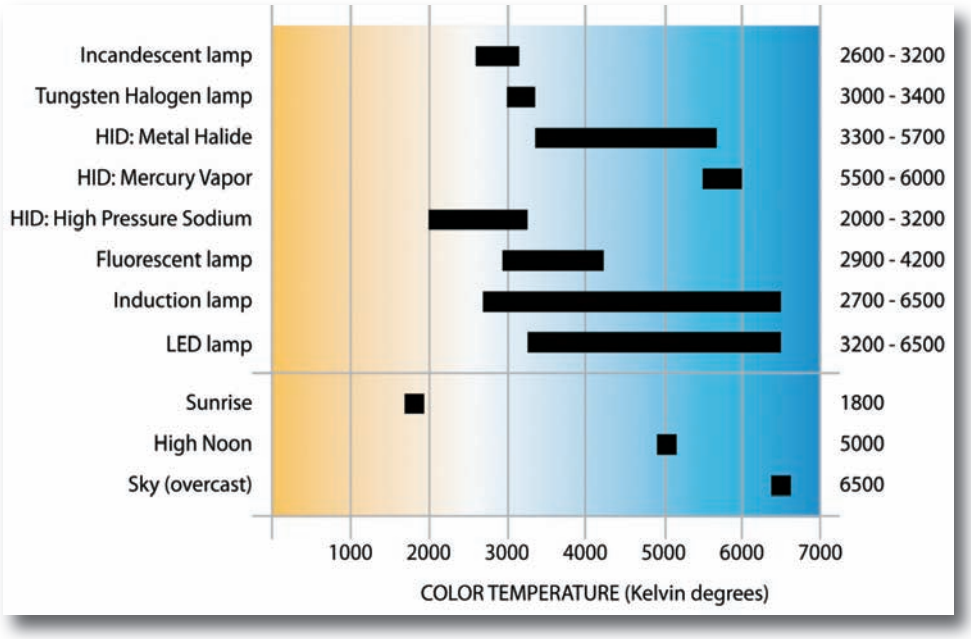


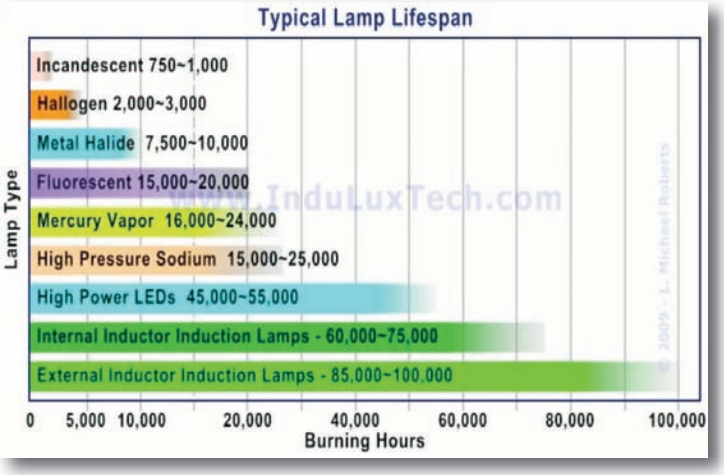
that are more powerful, and generate little enough heat, to offer a reasonable alternative.

The main reason LED lighting was developed in the first place is its energy efficiency. Today, many of the high quality lamps can reduce energy consumption by as much as eighty percent. Lamp life is approximately eight to ten years. Compare this to incandescent, fluorescent and HID, and you will quickly see why LED is growing in influence and popularity. There is so much attention being given to LED worldwide that quality, efficiency, and light color improvements are occurring on an almost weekly basis.

Fixtures that once cost several thousand dollars are now available for less than $500. As lamps and fixtures improve, the prices continue to drop. Within the next several years, we will probably see LED fall into line with existing, conventional fixture pricing. It is already possible to do an LED retrofit of conventional lighting that will provide a reasonable return on investment. While the initial investment is substantial, the energy savings and the lamp life soon pay off. With a nearly eighty percent reduction in energy usage for lighting, it is possible to do simple calculations on what the annual electrical savings will be. For example, a recent LED retrofit conversion of the site and landscape illumination at Butterfield Country Club will net approximately $3,400 in savings annually. This savings is for site and landscape lighting alone. To compare lumen-to-watt ratios and lamp lifespan, see chart below.

The LED phenomenon is the most significant change in the lighting industry since the invention of the original light bulb by Thomas Edison. LED will continue to evolve and become the replacement for the lighting we know today. LED is truly a "green," sustainable alternative for the future.

MAGCS member, Night Light, Inc., located in Lombard, Illinois, has already converted all of their incandescent and HID landscape illumination to LED. Mitch Beiser: mitch@nightlightinc.net, or www.nightlightinc.net. **-OC**



SOURCE	Lumen/Watt Ratios
Incandescent lamp	17 - 20
Tungsten Halogen lamp	17 - 20
HID: Metal Halide	65 - 115
HID: Mercury Vapor	50 - 60
HID: High Pressure Sodium	85 - 150
Fluorescent lamp	50 - 100
Induction lamp	60 - 90
LED lamp	30 - 100