

## LED Evaluation and Selection

### **LEDS FOR THE RIGHT APPLICATIONS: SPECIFYING THE LED OR THE LED SYSTEM?**

#### **How are LEDs chosen and with so many LED models from various manufacturers, what criteria are most important in choosing the right one?**

The race is on among LED manufacturers to produce the biggest, baddest LED. This competition fuels rapid research and development and helps to advance solid-state lighting technology. While these dynamics create exciting opportunities, it is important to remember that the LED itself is but one component in a complete integrated solid-state lighting system. As a designer, specifier, engineer or end user, it is important to understand that it is the complete LED system that is specified, not simply the LED.

Color Kinetics continuously assesses new and emerging generations of LEDs with an eye toward new product designs in numerous applications. LEDs are not chosen on any one measure, but as a result of many factors to meet the needs of the application. Color Kinetics evaluates LEDs from manufacturers based on technical performance including electrical, thermal, efficiency and optical characteristics. Overall levels of quality, binning and consistency are extremely important in this process. Color Kinetics also carefully examines assembly, design for manufacturability and cost considerations, as well as the ability of the manufacturer to deliver the requisite quantities and logistics support. The careful review of all of these criteria determines which LED Color Kinetics chooses to incorporate in each LED-based lighting system.

Performance and application of the complete integrated LED-based lighting system are the most relevant aspects of LED selection. This article further explores topical issues in LEDs for illumination.

#### **LED Performance Measured in Watts or Lumens?**

One trend in the LED space is the emergence of high power packages measured in Watts. Wattage defines the electrical energy consumption of an LED, but it is only one characteristic of an LED. Specifying an LED based on Watts would be analogous to choosing a car solely based on the engine's RPM. Or a computer based solely on the microprocessor's speed. Or a TV remote control based solely on how many buttons it has. These issues are irrelevant to the real tasks at hand: driving from one place to another, getting work done and changing channels. When it comes to lighting, the notion of wattage is similarly misleading.

Higher wattage devices today are primarily the result of using larger die within a specialized package. While the overall lumen output may increase with higher power, LED efficiency may go down. High wattage equates to high electrical power consumption, which requires additional energy usage and heat generation. This result is less available light and higher power consumption. Ultimately, additional heat may worsen color shift issues and result in significant binning issues: differences in color between high wattage packages.

Alternatively, if a number of smaller, more efficient LEDs are used, the system may have improved thermal performance. Using a larger number of LEDs also offers the benefit of more consistent binning which translates into better and more consistent color both within and between fixtures. Additionally, the use of more efficient devices translates into lower currents, which use smaller and less expensive power electronics to drive them.

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### **Performance of the LED v. Performance of the LED System. Is the Whole the Sum of the Parts?**

A curious development is the notion that the power consumption of a LED-based system is the sum of the power for the LEDs. This is rarely the case. A LED system with 18 1Watt LEDs will draw more than 18Watts, as there is overhead for drive electronics, voltage drops, resistance heating etc. Even more curious is the assumption that the lumen output is the sum of its parts. A LED system with 18 1Watt emitters each producing 30 lumens will not result in a system that produces 540 lumens as losses occur in lenses, optics, fixture reflections and more. The only way to provide accurate measurement of power and light output from a LED-based system is to measure both metrics *after* the system is integrated. All Color Kinetics technical specifications, including photometric and electrical data, are measured on actual LED *system* performance.

The bottom line in evaluating LEDs and LED lighting systems is delivering high-quality, high-performance, efficient lighting solutions. LED evaluation and selection must be made within the context of the LED system design and the intended application. It should deliver the *amount* of light required to *where* that light is needed with a minimal amount of additional requirements such as effective heat dissipation, robust power delivery and stringent binning criteria. Color Kinetics provides a complete LED solution through careful consideration of all the important factors.