LED Lighting Retrofits

Key considerations for interior LED lighting upgrades.
BY ADAM FRANKLIN

The lighting industry is in the midst of a major technology revolution. LEDs, or solid state light emitting diode lighting technology, have emerged as a viable alternative to most conventional light sources. While it may not be the right choice for every lighting application, manufacturers are making significant advancements when it comes to the performance and quality of LED lighting products.

To ensure that all of the highly touted benefits of the technology are realized, proper product selection is critical. In the world of LED lighting, advertising claims are often misleading and selecting the right product out of the countless offerings can be a daunting task. Key considerations follow.

Luminous Efficacy and Visible Light

There are currently no local regulatory standards for determining how efficiently different LED products produce visible light, also known as luminous efficacy. One company advertises that its 13 watt lamp is equivalent to a 60 watt incandescent lamp, while another company insist their 9 watt lamp is an equivalent. With more than a 30 per cent difference in energy usage it is no wonder why there is so much confusion when it comes to product selection.

Luminous efficacy is one of the primary performance criteria to consider when evaluating LED products because the higher the luminous efficacy (lumens per watt) the greater the energy saving potential. When selecting the right LED product, we try and find the right balance of product performance and cost.

Light Quality and Colour

The quality of light produced by LED products is also important, particularly for indoor lighting applications. The colour rendering index (CRI) of a light source indicates the product's ability to accurately reproduce an object's colour and is measured out of a scale of 100. The CRI segments the colour spectrum into 14 different sections and takes the average colour saturation values of each to produce the CRI value. Although some LED lamps or luminaires have a high CRI (80 – 90+), they may actually be deficient in select regions of the colour spectrum. This is because CRI values for LEDs are only based on the average value of 8 of the 14 standard colour samples.

One of the more important colour samples we consider when selecting LED products for indoor applications is R9, which consists of saturated red tones. This is because it impacts the appearance of skin tones and any predominantly red object. The California Energy Commission (CEC) has recently released a set of voluntary standards for LED lamp certification and quality that requires products to have a CRI greater than 90 and a R9 value greater than 50.

Consistency and Stability

Other important selection criteria include the correlated colour temperature (CCT) consistency and stability of different LED products. CCT is a method of characterizing the overall colour tone of a light source. The CCT of lower quality LED products can shift over time, which will reduce uniformity of light output and may cause the light to appear more purple than white. In some cases two identical products from the same manufacturer can produce distinctively different colours of light.

Life Expectancy

One of the driving factors for building owners and managers to switch to LED is the long life expectancy of the technology and the resulting decrease in maintenance costs. As with any type of product, LED lamps and luminaires can also vary greatly in terms of performance and quality.

Life expectancy of LED lamps and luminaires are easy to find in the products specifications but are not measured the same way as traditional light sources. The previous method of measuring life expectancy was to determine the duration of time until 50 per cent of the test samples fail. The probability of a LED chip or array failing, however, is quite low.

Instead, the light output of a white LED chip will gradually decrease over time and, at certain point, will no longer meet what is considered its acceptable light output. When the lumen output decreases to 70 per cent of its initial value (also referred to as the L70 rating of the LED system), the general industry consensus is that the LED chip, lamp, or luminaire should be replaced. To get the best performance out of LEDs, confirm that all life expectancy and performance claims are based on IES LM-80 and TM-21 industry standards.

Thermal Management

The primary cause of premature LED lamp and luminaire failure is not the individual LEDs, but rather the driver of the LED chips. And the main factor causing failure is heat. While LEDs do not radiate heat, they do produce heat that is conducted throughout the system, which can damage the electronic components. As such, proper thermal management is critical in ensuring long life of the LED array and the driver. Confirm that the manufacturer has properly engineered the LED product and work with a lighting consultant to avoid installing products in applications where heat can become an issue.

Thermal management is a factor in many retrofit applications, including downlight upgrades. Performance testing for LED lamps and downlight conversion modules is typically conducted at 25°C. However, when installed in a fully enclosed recessed housing, the operating temperature can quickly surpass 25°C. Operating a LED system above the manufacturers recommended temperature can result in reduced light output, shorter life expectancy, and can even void the manufacturer's warranties.

In the quest for high quality, energy efficient LED lighting, the quality of the product and the characteristics of the light are critical elements in determining success. Consider these factors and select the right technology for your next lighting upgrade project. **CB**

Adam Franklin, EIT, is a LEED green associate at Prism Engineering Ltd., an energy management consulting firm in Vancouver.