FACILITY CARE®
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In The Right Light

The Eneref Institute reports on options for energy efficient lighting for healthcare facilities.

Healthcare lighting is more complex than other facility lighting in that the lighting must serve the work environment of the medical staff while providing a comfortable, unobtrusive environment for patients. For example, color rendering is crucial to enable doctors to distinguish color nuance, yet the same light must avoid glare discomfort for patients. Still, healthcare facilities should not sacrifice energy efficiency to achieve quality of light.

Fortunately, most professional lighting designers are well aware of these issues. Yet in a study last year by the Eneref Institute, over 60 percent of general commercial facilities retrofitted their existing lighting without the support of a lighting professional – thereby sacrificing efficiency and/or light quality.

In achieving the dual goals of energy efficiency and visual comfort, there are some tricks of the trade that lighting designers are privy to. An example of a lighting specification that is known by designers but may not be well-known by facility managers is the issue of reflectors. In a typical fluorescent fixture most facility managers will specify the right combination of fluorescent tube and ballast. But just as important are the design, shape and quality of the reflector. The reflector determines how effectively the fixtures controls, redirects and displays light.

A well-designed reflector or louver can easily add 25 percent efficiency to a fixture. And not doing so is a costly energy omission. In fact, an efficient reflector may be the least expensive way to add energy efficiency to your lighting system.

It's not important how much light is generated by the fixture, but rather how much light ends up on a desk or hospital operating table. And controlling and maximizing horizontal and vertical illumination is the job of the reflector. Many fixtures and lighting systems appear similar, but there can be enormous differences in lighting output and energy consumption, due to the wide differences in reflector design and material.

Capturing and Controlling the Light

The most efficient reflective material is both highly reflective and highly specular. Reflectivity is measured by the amount of light that bounces off of the surface of the reflector. Today light reflective materials are available with up to 98 percent reflectivity -meaning that only 2 percent of the light energy is lost in the surface of the reflector.

Whereas reflectivity describes the quantity of light reflected off the surface, "specularity" describes the amount of directional control of the light that is reflected off the surface. Predicting which way the light will bounce is what gives fixture designers the ability to control the light coming out of the fixture.

The best example of a specular sur-

A specialized stack fixture, used in the Univ. of Alberta's reading room retrofit project, takes advantage of reflective aluminum technology to drive light from a very high ceiling to the bottom of the bookshelves

face is a mirror. The reason you can clearly see your reflection in a mirror is because the light that hits the glass at one angle bounces off the mirror at the exact opposite angle - like an old-fashioned rubber SuperBall bouncing off a smooth driveway. Specular means that the bounce direction is predictable. The opposite of a specular surface would be a diffused surface, where the incoming light is reflected back in any range of directions. A diffused surface would be similar to bouncing the rubber SuperBall off of a gravel driveway – the ball could bounce in any direction.

What a specular material offers the fixture is the ability to point the light exactly where it's needed, so that no light energy is wasted on, say, the ceiling. And high reflectivity offers a light fixture the minimal amount of light lost when the light bounces off the surface of the reflector.

Very specular material is usually a shiny silver color. White, on the other hand, is a diffused surface. A typical white reflector offers no light control, so the light could end up where it's not needed. Lighting manufacturers bend reflectors to aim the light in a particular direction. But with a white-painted reflector, the reflected light direction simply cannot be controlled.

A common example of the benefit of specularity is illustrated by a storage room with an old-design lighting system where most of the light shines onto the highest shelves and the bottom shelf is too poorly lit to read the labels. The same warehouse with a specular reflector can point every drop of light to exactly where it's needed so that even the bottom shelves are bright.

Not all specular surfaces offer the same level of reflectivity, durability or color rendering. Some surfaces are simply anodized or even have thin films mounted to the surface. In fact, some reflectors discolour or tarnish over time, reducing both the quality and quantity of light – a potential hazard in healthcare facilities. Look for a warranty, independent of the fixture, on the material used to make up a reflector or louver.

The human eye can see color wavelengths from about 390 to 750 nm. When comparing two different fixtures side by side, a reflector that produces true colors will offer our eyes a light that is crisp and clear. Reading, for example, is simply easier.

Visual Comfort

Like many building improvements, a lighting retrofit is often not as simple as just picking the right reflector. Highly reflective material built into poorly designed light fixtures only serves to intensify their bad designs. Glare is the enemy of specular lighting material. Visually comfortable environments have no excessive glare.

On the other hand, a well-laid-out lighting system can take full advantage of a light fixture's intensity by creating contrast, focal distance and depth perception. Contrast creates natural visual cues and psychological boundaries within a space.

The low-cost solution to avoid glare is to simply employ a highly diffused white painted reflector. But that short-term remedy can easily sacrifice a quarter of the fixture's energy. The better solution is to choose a highly reflective semi-specular matte surface that still offers some specular properties, yet not so many as to create glare.

Energy Efficiency

The goal of any energy-efficient lighting system is, of course, to achieve the lowest watts per square foot. A well-designed system should not only reduce energy use, but increase lighting performance, offering better light with less energy. And using less energy to gain more light offers additional cost savings. Fewer fixtures within the same space mean fewer ballasts and tubes or bulbs to install and maintain.

When the reflector shape is complex, or when the lamp is deep within the surrounding reflector, the reflective materials performance is especially crucial. That's when the reflector material has the greatest consequence on efficiency of the fixture. Consider, for example, two fixtures; one made with a 98 percent reflective Miro-Silver and the other made with a 86 percent reflective standard white painted.

Bounce light off of a 98 percent reflective surface and 2 percent of the light is lost. But some reflectors are designed in a way that the light bounces around inside the fixture a few times before it exits the fixture. If three bounces are required before the light leaves the fixture, then the fixture loses 2 percent three times, so you end up getting 94.1 percent of the light energy you're paying for.

But with an 86 percent reflective surface, the amount of light diminishes quickly after three bounces: 86 percent after the first bounce, to 73.9 percent after the second bounce, and 63.6 percent after the third bounce. Therefore, you're getting only 63.6 percent of the light you're paying for, compared to 94.1 percent when using a 98 percent reflective surface.

In today's economy, facility managers are often forced to buy lighting on price alone. Yet when considering the lifetime cost of ownership, a closer investigation of the system may find that the short-term savings are lost within a matter of just months, if the reflective component is of poor design or quality. Given all the costs invested in getting a light fixture onto a ceiling a reflective material that can increase the energy efficiency by 25 percent is not only wise economics but should be done stat.

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This article is an excerpt of a larger Eneref Institute report which assesses the impediments to building zero net energy urban communities in the U.S.