

## Healthcare Lighting

### LEDs are a Welcome Remedy in Healthcare Facilities

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The healthcare industry represents tremendous opportunities for reducing energy costs and implementing sustainable construction, especially since healthcare ranks as the country's second most energy-intensive industry and hospitals are the sector's largest energy consumer and producer of greenhouse gases (GHG).

The industry's reliance on non-renewable energy sources contributes to the emission of GHG, alleged to be driving climate change and impacting public health from air pollution. But there are many tactics that can be implemented by the more than 8,000 hospitals and 8,000 Diagnostic Imaging Centers nationwide to reverse this trend, one being the use of LED luminaires in MRI suites.

And while high-quality healthcare must be the driving factor in hospitals' new construction or renovations, it is possible, by identifying sustainable design and products early in the process, to achieve sustainable objectives without sacrificing services, care, or budget.

## Reducing Maintenance and Operational Expenses

Recently, the Department of Energy (DOE) announced that it wants the nation's hospitals to improve energy efficiency by 20% at existing facilities and make new hospitals 30% more efficient than expected. To that end, the DOE began an initiative, EnergySmart Hospitals, to promote

improved energy conservation and resources management at the 8,000 U.S. hospitals. LEDs are a solution to meet these mandates.

In 2007, hospitals spent more than \$5 billion on energy costs with more than 2.5 times the energy intensity and carbon dioxide emissions of commercial buildings. Of these energy costs, approximately 15% was spent directly on lighting. With dramatically fluctuating oil prices, already cash-strapped hospitals are seeing double-digit increases in energy costs. According to the Environmental Protection Agency (EPA), the healthcare industry could save more than 30% of the \$5 billion it spends on energy, without sacrificing the quality of care, by becoming more efficient. The EPA calculates that every dollar a hospital saves on energy is equivalent to \$20 in new revenues and \$10 for medical offices. That means that "an energy-efficiency project that saves \$20,000 is equivalent to generating \$400,000 in new revenues per year over the lifetime of the equipment. Furthermore, reducing energy costs by 5%, at for-profit hospitals, medical offices, and nursing homes is like increasing earnings-per-share by one penny."

### Lighting and MRI Suites

LEDs used in radiology address a number of important issues: reducing accidents in the MRI suite, decreasing maintenance and operational costs, and sustainability. Since more than ten million MRI scans are performed each year in the United States, there is plenty of opportunity to confront these challenges.

Typically, LEDs were considered only for aesthetic uses. But engineering and technological advances have improved LED luminaires' output and it is possible to use high-efficiency LED lighting for commercial applications. Additionally, with their compact size, LEDs can be used in places unreachable with conventional lighting and arranged in a number of different array configurations.

Because LEDs don't have filaments to react with an MRI's magnetic field, the typical premature lamp failure is eliminated. In other words, for the complete life of the magnet, maintenance crews will never enter the suite to change a light bulb. Not surprisingly, many healthcare facilities are replacing entire light systems [with LEDs] because they can't handle the frequency at which traditional bulbs have to be replaced. The long life and reliability of LED light sources diminish maintenance costs and help increase profits through reduced labor and re-lamping expenses. It costs up to \$20/minute when an MRI suite isn't operating.

## LED Technology

LEDs have been around for a long time. They are small, semiconductors that can be used to produce millions of different colors and brightness levels, but use significantly less energy than traditional lighting methods. LEDs create light differently from conventional forms. Other lighting technologies such as halogen and incandescent sources heat up a fragile filament until it radiates light, wasting large amounts of electrical energy through infrared radiation. Conversely, LEDs convert an electrical current directly into light, eliminating that waste of energy. Additionally, LEDs do not burn out like a standard lamp, so individual diodes do not need to be replaced. Instead, diodes gradually produce lower output levels over a long time.

*Durability:* LEDs are solid-state devices containing no moving parts, no filaments, and no fragile glass to break, eliminating the risk of damage during transportation, installation or operation, even in the toughest environments. And, unlike conventional light sources, LEDs are not subject to sudden failure or burnout.

*Longer life span:* An LED lasts vastly longer than an incandescent source; even after 50,000 hours, an LED is still producing a significant

percent of its original output. The following calculations help conceptualize how many years 50,000 hours are when a fixture is illuminated for varying lengths of time eventually at 70% at original brightness: 24 hours a day = 5.7 years; 18 hours a day = 7.6 years; 12 hours a day = 11.4 years; and 8 hours a day = 17 years.

### LEDs vs. Incandescents in MRI Suites

How does this LED lifespan compare with traditional light sources? Incandescent bulbs have a lifespan of only 700 to 3,000 hours due to the high magnetic field of an MRI. Because incandescent bulbs convert electrical energy to heat energy, temperatures increase in MRI suites, which then have to be cooled. The air conditioner then cycles more often to compensate for the heat thrown off by the bulbs, which results in the use of more energy.

LED luminaires also consume less energy than incandescent while emitting the same amount of light. For example, the luminaires don't consume 75 watts of energy to make 75 watts of light energy; only 42 watts of energy are consumed to produce the equivalent of 75 watts of light. And, the next generation will have a 150-watt equivalency while using only 67 watts.

LED lights are MRI-safe because they do not use filaments that can react with magnetic fields, nor do they emit radio frequencies. Lighting in MRI suites is challenging because of the short life of incandescent bulbs. Fluorescent lights can't be used either, because they generate noise artifacts on patient scans. Some imaging facilities experience weekly light outages, which shut down the MRI suite for maintenance. Additionally, by not having a filament, LED lighting eliminates the potential for an image-degrading artifact that can appear when an incandescent bulb's filament is cracked.

## Looking Ahead

Nearly \$200 billion of healthcare construction is expected by the year 2015, with dramatic and innovative advances in sustainable products. Unfortunately, of the more than 3,600 current LEED-registered projects in the United States, only about 2% (74) are healthcare buildings, according to the U.S. Green Building Council. There are many reasons why hospitals are so energy-intensive, such as operating 24/7, as well as the stringent medical standards and ventilation requirements. However, through discussions that include engineers, designers, hospital management, and facility executives, innovative, cost-effective energy solutions can be incorporated and implemented.

In a world with soaring energy prices based on the availability and control of fossil fuels, and with growing concern about sustainability of the environment, a revolution in lighting is long overdue. LEDs are that revolution.

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Sidebar (Photos are of this)

### LEDs in Action

University of California San Diego

Sandy Arbuckle, AIA, associate principal, Childs Mascari Warner Architects

After several years of planning and construction, UC San Diego Medical Center-Hillcrest opened a modern, new MRI suite. This is the hospital's latest step to ensuring that UC San Diego patients have access to cutting-edge technologies that improve patient care and diagnosis.

Patients and visitors enter a calming atmosphere, decorated with warmly colored photographs of the Slot Canyons of the American Southwest. These delicately sculptured canyons have vertical walls hundreds of feet deep and only a few feet wide. Yet, when sunlight pours into these sandstone creations, it elicits an inviting feeling. This MRI suite provides solutions to common patient complaints of anxiety, claustrophobia, and noise, as well as creating an environment that will attract and help retain quality staff. The design concept addresses the patients' feeling of confinement during the scan, turning it into a more relaxed experience, accomplished through abstraction of the natural phenomenon of slot canyons.

The suite's design carries the patient through a succession of warm, intimate spaces culminating in the Scan Room. The Scan Room is a quiet place of wonder. The curved, wood-veneer ceiling intrigues the patient, while backlit alabaster panels extend the limits of the walls, opening up the space in a horizontal direction. Sound-absorbing material associated with the ceiling system and walls mitigates the noises produced by the magnets. By using references to nature, such as slot canyons, in the design, the architects hoped to reduce the number of patient scan aborts due to claustrophobia and anxiety, and to have the patient come away with a positive experience from their MRI.

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