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Internet of Things

How can smarter technologies improve operations?

American Hospital Association

Lighting the way

LED continues to shine for design and efficiency

The unique environments found within hospitals pose special challenges to manufacturers of lighting systems. Not only does the lighting need to achieve a balance between aesthetics and technology, but also support the requirements of patients that may have limited mobility and vision. Patient rooms require specialized lighting and controls. Other spaces, such as operating rooms, include large equipment that can make it difficult to display light evenly and efficiently.

Light-emitting diode (LED) technology is helping hospital facilities managers to meet many of these challenges. LED benefits include energy savings, easy maintenance, controllability, visual acuity and integration with building automation systems.

Beyond illumination

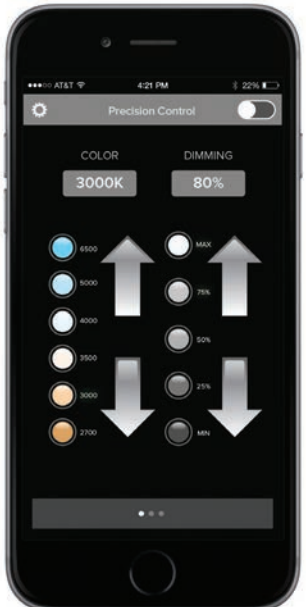
With today's focus on the patient experience, LED lighting has become the No. 1 choice for new construction and renovation, creating new opportunities for what light can do beyond illumination, according to John Casadonte, vertical marketing manager, lighting, Cree Inc., Durham, N.C. "LED lighting is easily adjustable and controllable for customizable spaces. Advanced lighting controls, for example, can adjust light output depending on the amount of natural light in the room. One of the latest breakthroughs is intelligent light used to personalize user experiences."

The latest LED products are dimmable and programmable, and enable users to vary the color and intensity of light to mimic daylight. LED luminaires, such as panels, downlights and replacement lamps, are available with color tuning modules that can shift white light from warm to cool, using remote controls or software. They also offer improvements in dimming performance.

"The new crop of LED luminaires replicates the smooth dimming performance of incandescent and halogen lights by decreasing in color temperature while light output is lowered. Light can be tuned to mimic the phases of natural daylight by shifting from 3000K (morning) to 4000K (midday) to 2700K (sunset) to support the body's circadian rhythm," says Amy Silver, corporate communications manager, MaxLite, West Caldwell, N.J.

In addition to superior efficiency, LEDs continue to up the efficacy of light output, says Jay Black, vice president, development and communications, Revolution Lighting Technologies, Stamford, Conn. "While incandescent and halogen lighting deliver 15 to 20 lumens per watt, LED can achieve values of 125 or more. In addition, LED lighting's longevity — capable of operating 100,000 hours, compared

Three in one // The ZERA bed light is an ultra-slim fixture at only 20 mm in height with three lighting scenarios: homogeneous general light (3000K), rectangular examination light (4000K) and glare-free reading light (2700K). **Waldmann Lighting**



App for that // FineTune's intuitive user interface is available as a smart app for iOS and Android that communicates via Bluetooth for convenient adjustments. **Finelite**

Just right // The Trilume PCX by Healthcare Lighting meets recommended light levels for patients and caregivers, with the added value of simply integrated networked controls. **Acuity Brands Lighting**

Better than before // Warm-on-Dim LED downlight retrofits offer incandescentlike dimming performance at 80 percent energy savings. **MaxLite**

Pure light // The MedMaster White and Disinfection LED luminaire provides both ambient light and disinfection in operating rooms, or disinfection only. **Kenall**

with 20,000 hours for fluorescent counterparts — generates reduced long-term maintenance costs."

LED technology also saves on space and maintenance, experts agree. "LED has particular advantages in the health care space. Smaller light engines equal smaller fixtures that fit in a limited plenum space. The extended life of LED products now surpasses fluorescent products, and fixtures may need little to no maintenance over the life of the installation. Less disruption to the space for maintenance means less chance of introducing contaminants to treatment areas," says Deb Zawodny, market development manager, health care, Lighting Division, Eaton, Peachtree City, Ga.

New color standards (TM-30) have created more awareness around how light should represent the true color of objects in the health care environment; this is an area in which LED performs well. "High Color Rendering Index (CRI) sources improve visual acuity and assist caregivers in performing patient exams, treatments and procedures. High CRI sources also highlight the comfort and visual appeal of an environment, which is a growing consideration for health care providers," says Cliff Yahnke, director of clinical affairs for Indigo-Clean, Kenall Manufacturing, Kenosha, Wis. Kenall has begun testing its products to the TM-30 standard and is updating its product literature where appropriate.

Waldmann Lighting Co., Wheeling, Ill., has developed the ZERA fixture, a luminaire with four separate or jointly switchable light scenarios. The ZERA's free-form optic produces a homogeneous, low-glare lighting. In addition, the fixture blends different Kelvin temperatures within one luminaire, each for the desired application. The warm lighting (3000K) ensures pleasant basic illumination, while neutral white (4000K) light provides suitable conditions for examinations and nursing activities. The 2700K lighting is calming while simultaneously providing optimal reading conditions.

LED features are a good match for a new certification program, the WELL Building Standard, which strives to positively impact human health through architectural and interior design, according to Black. "Artificial lighting that most accurately reflects natural light's full spectrum output is one crucial aspect. LED's capability to produce broad-spectrum light output, maximized through spectral adjustment of its diodes, is what makes it the optimal solution. Even at different color temperatures, LEDs are able to achieve a broad spectral output," he notes.

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Finelite Inc., Union City, Calif., has introduced FineTune LED Luminaires, which can be tuned to provide a wide range of white light, from warm light as experienced at sunrise and sunset to electric light similar to daylight. FineTune enables Correlated Color Temperature (CCT) tuning from 2700K to 6500K and dimming from 1 to 100 percent. Digital Multiplex controls support a user interface with preset CCT and dimming levels, simple up/down arrows for more granular control and a

Tied together // This connected lighting module allows fixtures to connect to multiple wireless systems and building control systems. **Osram Sylvania**

Brain power // SmartCast Power over Ethernet is an intuitively simple, scalable and open platform. **Cree**

Specially designed // Overhead graphic illumination provides radio frequency and electromagnetic interference-free LED back lighting for graphics and room illumination in magnetic resonance imaging applications. **C3 Lighting**

Hidden in plain sight // The eco-friendly Thin Panel features a flat-panel design, delivering one of the thinnest LED solutions available. **Revolution Lighting Technologies Inc.**

digital display of CCT as well as a smart app — available in iOS and Android — that communicates via Bluetooth.

Fixture design can help hospitals to prevent infections as well, according to Tony Sarti, health care sales manager, Kenall Manufacturing. "Kenall pays close attention to the design of its luminaires to prevent the spread and transmission of pathogens. Sealed luminaires prevent the ingress of dust, moisture and bacteria to stop the transmission of pathogens from plenum to patient. Antimicrobial paint finishes, coupled with easy-to-clean surfaces, also play a part in keeping bioburden levels to a minimum," he says.

Built for efficiency

LED technology is becoming ever more energy-efficient, as lighting engineers and designers develop fixtures or enhance current fixtures with higher efficiencies. While LEDs have improved in performance, the market has had time to evaluate and incorporate thermal management characteristics of LED technology.

"We also are seeing many new form factors within fixtures, breaking away from the traditional profile of fluorescent and halogen lamps. Fixture designers can develop optimal and application-specific profiles and pair them with LEDs, rather than (as in the past) engineer around a given lamp light source," says Nick LaRoche, product marketing manager, Waldmann Lighting Co.

LED lighting achieves 50 to 70 percent energy savings compared with fluorescents, and can reach 80 percent when coupled with smart controls, Casadonte adds. "With extended lifetimes virtually eliminating maintenance costs, the technology enables lifetime financial benefits and a strong return on investment."

LED costs are coming down, according to manufacturers that supply the nation's hospitals. "However, of greater importance, the lumens per watt, color binning and range/precision of color temperatures available are all increasing rapidly. This allows lighting manufacturers to design more capable fixtures with higher visual performance and greater energy efficiency," says Rick Farrell, president, C3 Lighting Solutions Inc., Santa Ana, Calif.

Advances in LED control systems are helping to bring down overall maintenance costs, experts agree. "Controls systems are advancing rapidly, and in three major ways," says Karyn Gayle, vice president, health care, Acuity Brands, Atlanta.

Distributed controls systems are easier to install and commission, whether through low-voltage wiring or wireless connectivity.

Controls are getting smarter; sensors and beacons can go beyond light level and occupancy sensing to enable facility space planning, indoor positioning for wayfinding or asset/inventory tracking. User interfaces also are evolving to ensure that patients, caregivers and staff can adjust lighting easily when needed.

Mike Lunn, product manager, lighting solution systems, Eaton, has seen significant advances in control systems for health care spaces. "The integration of sensor and communications technology directly into the light fixture reduces the cost of the overall system. By leveraging the large number of fixtures

already installed in hospitals, the same LED lighting system can enable continuously evolving solutions to solve the complex challenges that hospitals face," he notes.

The ability of LED lighting to connect and empower its users continues to grow with the integration of wireless technologies. "Lighting is no longer a stand-alone system, but rather the foundation for a smart building. Through sensors and controls, LED luminaires can communicate to buildings with information such as occupancy, temperature and presence of daylight, enabling facilities to reduce energy and maintenance costs while creating an infrastructure for intelligence," Silver explains.

Gayle sees the emergence of networked building control systems that natively conform to open building management protocols for lighting, HVAC or shade control without the use of costly translation devices. "Intelligent luminaires throughout the health care facility can communicate directly with other networked devices via wired and wireless protocols. This distributed control capability enables the overall system to be more responsive and adaptive to changes in the facility — whether at the room, floor, building or campus level," she says.

Cree Inc. recently introduced SmartCast Power over Ethernet (POE)-enabled luminaires, a scalable and open platform that supports the evolution of the intelligent building. POE uses standard Ethernet cables to carry both power and data, replacing more expensive AC wiring while networking the lights and a complement of sensors. Instead of wiring the light fixture into the building's AC electrical system, it's simply plugged into an Ethernet port and the network.

Osram Sylvania, Wilmington, Mass., recently unveiled the Connected Lighting Module, which can be inserted into any fixture with a driver capable of providing 12-volt auxiliary output for wireless control. It also allows fixtures to connect to multiple wireless systems and building control systems certified to the ZigBee Home Automation standard. In the past, original equipment manufacturers had to figure out how to install the wireless-enabling components. Now, they can use one device that works with a variety of leading wireless controls systems and offer a standard wireless controllable fixture, the company reports.

Functional benefits

As the cost of LED lighting continues to drop, the focus now is on the functional benefits that lighting can provide relative to circadian entrainment and improved visual acuity, experts say.

"I see increased demand for tunable white fixtures and the implementation of lighting systems that replicate dawn-to-dusk illumination," says Farrell. "These systems allow the patient to retain a more normal circadian rhythm, which has numerous advantages." HFM

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