

LEVITON

It's essential to ensure that lighting control systems are correctly programmed and commissioned and the operating staff understand how the systems work.

MULTIPLE CHOICES

A wide range of lighting control options means systems can meet the varying needs of specific buildings

The Energy Star program says that 30 percent of the energy consumed by buildings is being used inefficiently or unnecessarily. And with lighting accounting for a large chunk of the energy used in commercial and institutional buildings, the lighting system represents a big opportunity to use energy more efficiently.

One of the most important and least appreciated ways to reduce lighting energy use is using lighting controls. As well, lighting controls can improve lighting quality and occupant comfort and security.

Why aren't lighting controls more widely used? Reasons range from misperceptions about potential savings and return on investment to a lack of familiarity with the range of technology choices and the capabilities available today.

"Lighting controls are important because they can eliminate 60 percent or more of the wasted lighting energy in buildings while enhancing occupant comfort and productivity," says Michael Jouaneh, marketing manager for Lutron. "They provide flexible control over the lighting in a space and support energy savings by reducing the amount of power or amount of time a lighting system is in use."

Cost reductions are only one reason that wider use of lighting controls makes sense. "Projections show that demand for electrical energy will double by the year 2030, but according to a 2007 study by the Intergovernmental Panel on Climate Change, we need to cut our carbon dioxide emissions in half to avoid a climate change," says Kelly Edison, director of product management for Lifespace at Schneider Electric. "Creative, effective ways to manage our energy consumption are critical in keeping up with demand, while avoiding skyrocketing emissions."

Energy Savings

Lighting alone uses 38 percent of the electricity in commercial buildings, more than any other building system, says Jouaneh. "Controlling and managing lighting is an important factor in managing a building's energy costs," he says.

There are really only a few key methods for reducing the amount of energy used in lighting: providing the right amount of light, increasing the efficiency of the light source and turning on lights only when they are needed.

As technology has improved, the third method has become more viable for more applications. "It can dramatically

cut energy consumption, as nothing uses less energy than a light that is turned off," says Lesley Matt, marketing communications manager for Technical Consumer Products. "A good lighting controls system will effectively keep unused lights off for as long as possible, and therefore maximize savings. It also will be transparent to occupants, by never leaving them 'in the dark,' and by giving them the ability to control their own lighting environment."

What's more, changes in energy codes have reduced lighting power densities — measured in watts per square foot — to "about as low as achievable," says Dorene Maniccia, director of policy and industry affairs at WattStopper.

"As a consequence, to continue further optimizing building performance, attention must move beyond lighting to lighting controls as a way to do this," Maniccia says. "Lighting controls can help move a building's energy performance from a 'watts per square foot' mentality to a 'net zero' mentality."

Maniccia says one of the most powerful best practices involves moving beyond a basic code compliance strategy of automatic on/off.

"By adding manual controls, usually at a fairly modest incremental cost, FMs can

enable more advanced control strategies for much more significant energy savings," she says. Advanced control strategies include manual-off and automatic-on to 50 percent.

Of course, it's also important to evaluate lighting fixtures and light sources when developing a controls strategy. Lighting products like lamps and ballasts have become increasingly efficient, with a wide, growing range of options to enable lighting systems to be tailored to the specific needs of individual spaces.

"Oftentimes, there is an opportunity to provide more consistent, high-quality and efficient lighting sources that will deliver a quick return on investment," says Bill Morreal, vice president of Schneider Electric's Juno Lighting Group. "For example, luminaires that use LED technology consume minimal electrical energy versus typical lighting sources and achieve a service life of more than 50,000 hours. This also reduces overall maintenance costs."

Control Strategies

At the core of any lighting controls strategy is the delivery of the right amount and quality of light at the right time to a given space or facility. Implementing such lighting control strategies as daylight harvesting, occupancy- and vacancy-sensing and schedule-based controls can help building owners realize savings of between 35 and 55 percent of the energy

used for lighting, while enhancing occupant comfort and productivity.

"The answer to the question, 'How can we save more?' is not only to make your lighting system more energy efficient, but also more energy intelligent," says Randy Dollar, vice president of systems market development for Universal Lighting Technologies. "You want a dynamic system that changes with its environment so that you're not wasting energy by providing more artificial lighting than is necessary."

Here's a look at how some of the most popular lighting control applications can help achieve this:

- **High-end trim/tuning.** Sets target light level based on occupant requirements in the space and can save lighting energy without occupants noticing any difference. "The ability to tune task lighting for occupants improves productivity as well," says Bob Freshman, marketing manager at Leviton.

- **Scheduling.** Turns off or dims lights automatically at certain times of day or based on sunrise or sunset. "Scheduling is part of a building management system," says Susan Isehour Anderson, manager of energy relations at Osram Sylvania. "If a building has a predictable pattern of use, then a scheduling system can be used to control the building systems based on that occupancy."

- **Occupancy/vacancy sensing.** Turns off lights when occupants vacate the space. "Facility managers should leverage their use of occupancy sensors so that the sensors control not only the general lighting but also the task lighting and other plug loads, such as a computer monitor," Jouaneh says. "Plus, the same occupancy sensor controlling the lighting also may be connected to the HVAC system so that not only will the lighting be turned off automatically when the space is empty, but so will the plug loads and air conditioning."

- **Multilevel lighting/dimming.** Provides users with one or more light levels beyond full on and full off. "Dimmable lighting has become commonplace in lighting control strategies," Freshman says. "A good example of successful use is that you can dim the lights by 15 percent without making it discernible to occupants and have it deliver a 15 percent reduction in energy use."

- **Daylight harvesting.** Adjusts light levels automatically, based on the

amount of daylight in the space. "It's another control strategy that maximizes energy savings while providing other benefits," says Edison. "This solution measures light levels to take advantage of natural sunlight from windows or skylights, while providing the convenience and comfort of automated lighting."

- **Demand response/load shedding.** Reduces lighting load during peak electricity pricing times. "What's more, you can sign agreements with some utilities or energy aggregators that will pay you simply for the capability to shed load in your building when you receive a demand response signal," Jouaneh says. "And lighting load is the easiest load to shed without causing disruption or discomfort to the occupants."

Other control options can include plug-load control, which turns off task lighting and other plug loads automatically when they are not needed; personal light control, which allows users to select correct light levels for a desired task; and controllable window shades that allow users to control daylight for reduced solar heat gain and glare.

Designing for Maximum Efficiency

Several important factors shape lighting control strategies.

First it's important to remember that lighting controls should fit within a facility manager's overall energy management strategy. For existing spaces, a lighting/energy audit can be a good way to look at space utilization and energy consumption.

"An audit can provide a baseline and identify opportunities to improve the lighting design with controls," says Joseph Gullo, GE Lighting global product manager, lighting controls. "Occupant needs and application requirements need to be considered for both new and retrofit applications. While the function of a controls strategy may be complex, the user interaction should be seamless and simple."

When the lighting control system is being designed, lighting experts agree it's essential to consider the space and application where the controls will be used. The fact that a room has windows to provide daylight or has a low occupancy rate can affect the type of controls used in the space. Further, identifying the purpose of the space, whether it is a



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In conference rooms, effective lighting controls are essential to the functionality of the space.



If a building has a predictable pattern of use, a scheduling system can control the lighting based on the time of day.

classroom, laboratory or executive office, also can affect how lighting controls are employed.

Another consideration is energy code compliance. The country's top energy codes, including ASHRAE 90.1, IECC and Title 24, all reflect the importance of using lighting controls to conserve energy. Different codes, however, have different provisions. Some might demand mandatory occupancy sensors in certain types of space, while others might require daylighting controls in specific areas. Still others might demand a certain type of facility address light level reductions.

But one thing is certain: All have mandatory lighting control requirements that designers and engineers must meet for new construction or major renovation projects.

"The prominence of energy efficiency requirements in today's building codes has changed the order and extent to which controls are taken into consideration," Anderson says. "They impact the orientation and design of the building from the beginning, impacting the conceptual design phase. Building controls

systems are important because they have matured enough that they can impact building design on the front end, as opposed to adding controls at the end."

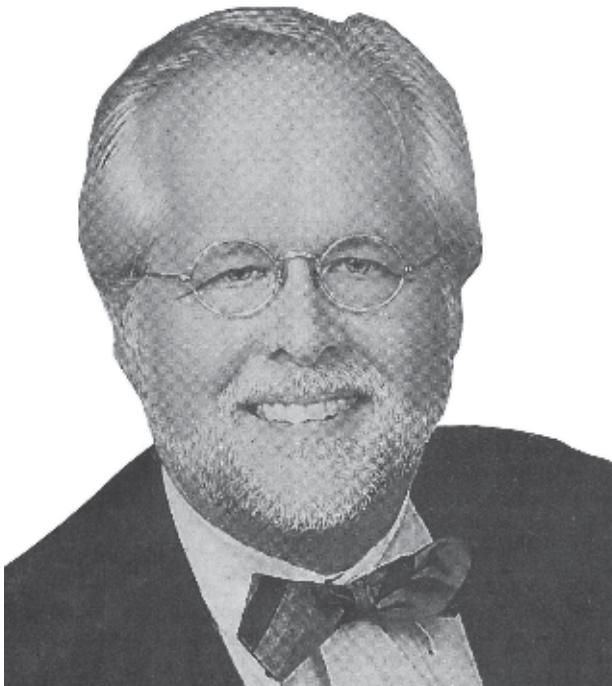
Additionally, lighting controls can help a building achieve LEED certification. For example, both electric and daylight control (e.g., window shades) can contribute to up to 40 out of 100 possible points in LEED NC 2009.

"That's significant," Jouaneh says. "Forty points is the minimum required for certification."

Lighting Quality and Occupant Satisfaction

While energy savings is a key and most-desired benefit of lighting controls, industry experts say that the quest for reduced power need not detract from the comfort, convenience and security of a building. A well-constructed lighting control strategy creates a safer, more productive environment no matter what the building's (and occupants') needs might be.

"Different tasks and individuals have different lighting needs," says Sally Lee,



"You need to sit down and figure out what lighting is costing you. We reduced energy consumption by 40%, and much of it was updating our lighting."

Curt Mann, Chief Sustainability Officer, HealthAmerica Realty Group

With tight budgets and growing interest in sustainability, don't ignore the quickest way to reduce your electric bill in your office, factory or warehouse. Lighting can be 40% of your cost, so an investment in new lamps, fixtures, ballasts, and controls pays you back quickly. It's one of the best financial decisions you can make. Contact the lighting industry experts for more information today.

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general illuminations applications marketing manager at Osram Sylvania. "Controls allow occupants to select the right amount of light for their space based on visual acuity, personal preference, time of day and even the type of tasks they must complete."

Controls strategies also may be used to create a certain visual effect, Gullo points out.

"Architectural lighting and optimization of lighting color temperatures are two examples where controls play an important role," he says, adding that adjusting light levels to maximize occupant comfort also can lead to enhanced productivity.

And, when controls are implemented correctly, the quality of lighting will be maintained, or in some cases, even improved, Dollar says.

"Occupants may be unaware that any energy management efforts are being implemented because a well-designed system will maintain appropriate light levels in occupied areas at relevant times," he says. "Even a demand response event

can be employed in a manner that is very subtle, yet provides the needed power reduction."

Controlling the Outdoor Environment

Lighting controls aren't just limited to the indoor environment. Outdoor lighting schemes also can benefit from the use of a targeted lighting control strategy.

"Safety and security, along with energy and maintenance savings, would be main factors as to why lighting controls are important for outdoor applications," says Larry Leetzow, president of Magnaray International Division. "None of us wants to go into a completely unlit area. The element of surprise with an 'instant-on' lighting system capability, using twin T5 fluorescents, induction or LED lamps can be a distinct advantage."

Leetzow notes that the IES is examining the feasibility of "Adaptive Lighting Recommendations," where dimming of exterior systems can both save energy dollars and promote safety in parking lots, parking garages, security areas, and even

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street and roadway lighting systems.

"Some of the most notable technological advances in controls are happening right now in outdoor lighting," says Maniccia, who cites fixture-integrated controls for high/low control of outdoor and parking garage lighting.

"These innovations can offer huge energy savings because outdoor lighting no longer needs to be maintained at full output all night long," she says. "This actually is being evaluated for inclusion in some energy codes in the near future, such as California Title 24. Dynamic control like this is evolving due to adoption of LED lighting systems and their inherent controllability."

According to Teresa Bair, technical marketing manager at EYE Lighting, the emergence of solid-state lighting has further bolstered outdoor controls technologies. For example, instant-start LED technology with no re-strike or warm-up times will encourage the use of controls in the outdoor space more than ever before, according to Bair.

"Typically, reducing light levels is not

thought of as a way to increase safety, but anytime you change light levels, it draws attention to the location," she says. "Increasing light levels when activity is detected can provide a safer illuminated environment. LEDs are a controllable light source, and including control features into the driver creates a world of new opportunities to solve old technology challenges. Increased and unique uses for controls in outdoor applications will

change total-cost-of-ownership calculations and result in less frequent maintenance and lower energy consumption."

New and Improved Technologies

The majority of lighting experts say wireless controls are among the most notable technological advances in lighting management systems in both indoor and outdoor applications. Most wireless

NEMA ENLIGHTENS AMERICA

This summer marks the third anniversary of the electrical industry's ongoing effort to diligently spread the word that lighting upgrades can save money and energy.

The nation's leading lighting manufacturers, through the National Electrical Manufacturers Association (NEMA), support the enLIGHTen America Campaign. The campaign is designed to inform those involved with building management and operations that lighting upgrades are not only a great source of money and energy savings, but also provide a great return on investment and increase overall asset value.

Since 2008, enLIGHTen America has provided information and tools about lighting renovation, and the campaign continues to break new ground in its efforts to educate America about the importance of lighting upgrades. For more information, visit www.nemasavesenergy.org.

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"Wireless technologies continue to advance, making retrofit applications easier and less expensive to install. In the lighting controls world, it is not any different," Edison says. "New wireless products are being released that address typical lighting control strategies, as well as provide the ability to easily integrate to third party systems."

A big advantage to integrating wireless controls is the reduced labor costs to install and minimum disruption to workspaces during installation.

"Overall, installed costs for wireless systems can be 50 percent less than a wired system," Freshman says. "Plus these systems offer the same level of energy savings. Payback times for wireless lighting controls can be less than one year."

For exterior lighting systems, smart, wireless photocells can be used to control parking lots, parking garages, auto dealerships and many other applications.

"Systems that can control up to 100,000 luminaires, such as those used by highway departments, are now available at a reasonable cost, with great reliability," Leetzow says. "These controls can be designed for optimum energy savings, while providing system versatility to use at a given moment for a given site need or condition."

The ability to control a lighting system remotely is another technology that has made great strides in the past several years and allows facility managers to monitor lighting systems from any location, as long as they have Internet or intranet access.

"The ability to control smaller and more finite elements of lighting from a remote location has also changed the way

people think about facility management," Matt says. "Lighting changes (whether to schedules, or simply a one-time temporary need), maintenance requirements, and other tasks can suddenly be managed away from a given facility, potentially in a central location."

Occupancy sensor technologies have improved, as well. Multitechnology sensors that use both passive infrared and ultrasonic sensing have solved numerous issues with occupancy sensing.

"The days of lights turning on or off improperly should not be an issue," Freshman says. "Not only does occupant satisfaction improve, but energy efficiency improves as well because of this."

Lighting Controls Integration

Today, lighting controls are being integrated with the fixtures to provide more granular control throughout the building. Prices have dropped on dimming ballasts for fluorescent light fixtures, while controllable systems now exist for compact fluorescent lighting, as well as linear fluorescent lamps.

"Controllable systems are being developed for HID and solid-state lighting, as well," Lee says. "Not only have some products been optimized to perform with controls, the products themselves are already optimized for high efficiency. This allows for additional savings."

More manufacturers are also coming out with high/low ballasts, so multi-level control will no longer require much additional or costly wiring. What's more, electronic ballasts for HID lighting have become more dependable and enhance the viability of high/low control for these lighting types.

Solid-state lighting also has created new opportunities to resolve old technology challenges, according to Bair. Control options offered in some solid-state lighting luminaires include self-regulating current control, which increases the current to compensate for lumen depreciation.

"The result is extended luminaire usage and life, additional energy savings and reduced maintenance costs," she says. "Auto shut-off options ensure luminaire light levels never will be less than 70 percent of the initial lumen output and act as an indicator for end of life."

Reaping Return on Investment

The fact that controllable lighting systems have flourished and are required by the new codes has forced these systems to the front of the design decisions. But to be effective, controls also have to be considered once the building opens.

"It is essential that building operators learn how to utilize the system to achieve the benefits the systems can provide," Lee says. "Commissioning is essential to assure optimum utilization of the system features and overall savings. Once commissioned, these systems need to be periodically surveyed to make sure they are still operating as designed and have not been overridden or modified. They should also be adjusted if building use changes. A good time to conduct these surveys would be when life safety checks are done. Operator training is available from equipment manufacturers. If your staffing changes, make sure the new employees are also trained."

With this in mind, it's always in the facility manager's best inter-



Using controls to take advantage of available daylight can reduce energy costs while improving lighting quality.

CONTROLS AUDIT: QUESTIONS TO ASK

When developing and implementing a lighting control strategy, here are some important questions to consider during the process:

- When is the space occupied?
- How will the space be used?
What tasks will be performed?
- What are the existing light levels in the space?
- What are the targeted light levels for the space?
- What is the layout of the space?
(Where are the windows? Are there any skylights? Where are they? Which direction does the space face? Where are the walls? Where are other obstructions in the space?)
- What are the peak demand charges from the utility?
- Does the utility offer a demand response program?

est to perform a careful analysis of the total investment cost when planning any new controls strategy.

"Sometimes it's easy to pencil out the product cost without also considering the cost of installation and commissioning and any ongoing maintenance costs," Maniccia says. "But all these costs actually help the FM arrive at what the actual payback will be."

For example, facility managers should analyze factors like the amount of set-up time required for a system and any specialized knowledge required for ongoing maintenance. A control system that provides automatic configuration might end up being more cost effective than one with extensive set-up requirements because less labor investment is needed.

Understanding what technologies are available is the key to making the best decisions on what strategies to implement. Working with professionals that have the background and experience in designing lighting controls systems will ensure a maximum benefit from the investment.

"Facilities managers should evaluate luminaires and controls objectively and not focus on one particular technology," Bair says. "Lighting designers should take an application-based approach and base decisions on ambient conditions, efficiency of the optics, control options, directionality of the light and the energy consumed."

Freshman agrees, adding that careful thought must reach beyond system specification in order to achieve the best return on investment.

"It's important not only to make correct decisions on the products used but also to have the system professionally programmed and commissioned to make sure it does what you expect," Freshman says. "The end result of any control strategy is to use the right technologies and products for each application to maximize savings and energy reduction and also to have occupant satisfaction. Bringing in professionals that have the background and experience designing lighting controls systems will ensure you get the maximum benefits from your investment." ■

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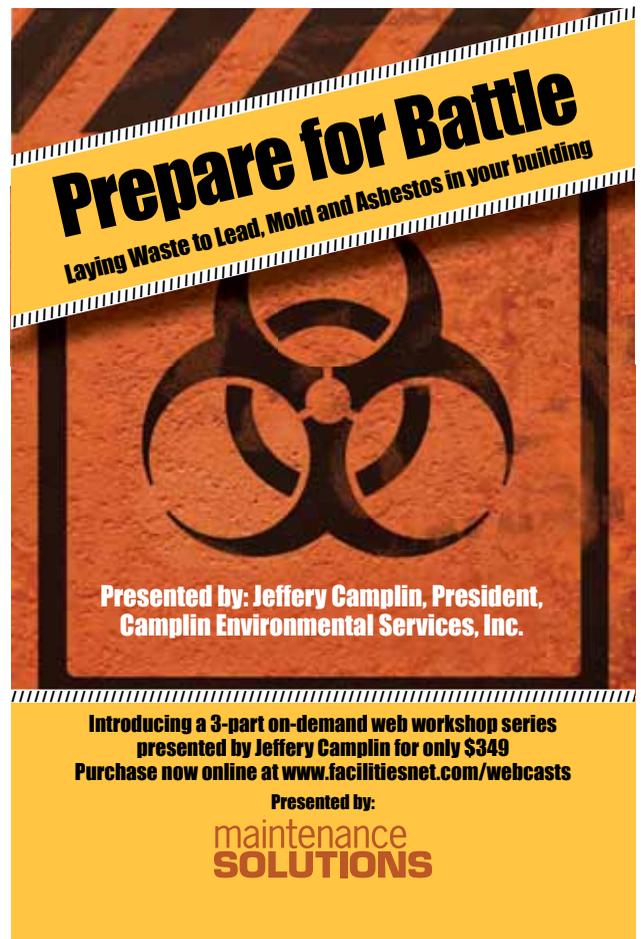
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