

OSRAM SYLVANIA



Lighting Upgrades: Big Gains, No Pain

FAST PAYBACK may be possible thanks to gains in lighting technologies

Just how big is the lighting retrofit opportunity for commercial and institutional buildings? Data from the Department of Energy (DOE) paints a startling picture. Of the 2.7 million commercial buildings constructed before 1980, only 455,000 made lighting upgrades between 1980 and 2003. Those numbers — drawn from DOE's 2003 Commercial Buildings Energy Consumption Survey, the most recent data available — suggest that more than 2 million of those older facilities have been using essentially the same lighting systems for the past three decades, says the National Lighting Bureau, which ana-

lyzed the DOE numbers. These buildings consume nearly 900 billion kilowatt-hours of electricity, at an annual cost of more than \$115 billion.

"It's true that a very high percent of existing buildings have lighting systems that are more than 20 years old," says Keith Ward, president of Luminus Devices. "Today's lighting technologies have evolved an incredible amount in the past five years or so, enough

to make an enormous impact on an existing facility."

Lighting, on the average, can account for a third of a building's energy use and potentially more if the facility has exceptionally outdated, inefficient lighting. Making even a few changes to an outdated lighting system, whether it is through lamp or fixture replacement, adding controls or adjusting lighting color and intensity, can bring numer-

In addition to saving energy, lighting technologies offer the opportunity to improve the quality of illumination, increasing occupant satisfaction with better color rendering, more even lighting or more appropriate light levels.

LIGHTING UPGRADES = TAX SAVINGS

Upgrading to the latest lighting technologies not only reduces a facility's energy consumption and creates savings in utility and maintenance costs; making these changes also can cut taxes through a deduction offered by the Energy Policy Act (EPA) of 2005.

"Now is an excellent time to make conversions because of the financial incentives," says Susan Anderson, manager of energy relations at Osram Sylvania.

The Energy Efficient Commercial Building Tax Deduction, backed by the National Electrical Manufacturers Association (NEMA), establishes a deduction for expenses incurred for energy-efficient building expenditures made by a building owner. The provision is effective for property placed in service between Jan. 1, 2006 and Dec. 31, 2013.

Improvements must beat ASHRAE/IESNA 90.1-2001 by 50 percent. The deduction is limited to up to \$1.80 per square foot of the property, with allowances for partial deductions for improvements in interior lighting, HVAC, and building envelope systems. All three systems must qualify for a building owner to get the maximum deduction. If just one system, such as lighting, qualifies, then the deduction is up to \$0.60 per square foot.

Lighting deductions are based on reductions in power density (watts per square foot), and the upgrade must involve capital expenditures that are depreciated. Changing only the lamps does not count, and exterior lighting is not included.

To learn more about the Energy Efficient Commercial Building Tax Deduction, visit www.efficientbuildings.org.

ous benefits, lighting industry experts say. In fact, more widespread lighting upgrades in the United States could avoid some \$50 billion of needless energy expense each year, according to DOE estimates.

"With 75 percent of all commercial buildings using outdated technology, the potential for energy efficiency and cost savings with lighting upgrades can be significant," says Silvie Casanova, senior manager of lighting communications at Philips Lighting North America. "Upgrades typically can save between 40 and 60 percent on energy costs, leading to a fast ROI just by switching to the technologies available today. In fact, if we switched all the lighting in the world's non-residential buildings to energy-efficient solutions, we would save \$80 billion on electricity costs and avoid emitting 330 million tons of carbon dioxide into the atmosphere. That's equivalent to the output of 312 power plants."

It's clear that facility managers can make a difference locally and globally by making lighting upgrades in their buildings — some of which are simple, yet still often overlooked. The common denominator is that all yield energy and

cost savings, boosting efficiency and improving the bottom line — crucial concerns for any facility manager.

"Operating costs, which include electricity costs and maintenance costs, are a major expense for any facility, and facility managers are responsible for managing these costs," says Susan Anderson, manager of energy relations for Osram Sylvania. "Converting from less-energy-efficient, old-technology lighting systems to new, more efficient technologies is a proven way to cut operating costs."

According to Greg Bennorth, director of system projects, Universal Lighting Technologies, lighting upgrades can provide substantial energy savings while improving the overall lighting quality for a building's space by delivering higher lighting levels, more evenly distributed light and improved color rendering. Better light, studies show, can improve occupant productivity. "It's a win-win opportunity for facility managers and occupants," he says.

New Technologies, New Opportunities

The lighting industry is continuously improving and developing new prod-

ucts geared toward reducing energy use while meeting the illumination requirements for a given space.

"Halogen lamps can be used to replace incandescent general service and parabolic aluminum reflector (PAR) lamps to provide energy savings, and in many cases, longer lamp life," says Anderson. "Compact fluorescent lighting (CFL) also can replace incandescent to deliver similar benefits. New, lower-wattage, pulse-start metal halide systems with electronic ballasts are another option that delivers energy savings and longer lamp life. Solid-state (LED) lighting also is a viable option for replacing incandescent, HID, halogen and CFLs in a variety of indoor and outdoor applications."

To understand the kind of savings new technologies yield, consider that a 65-watt incandescent bulb produces roughly the same amount of light as a 15-watt CFL or an 11-watt LED, assuming that each is using the same fixture, says Jeff Spencer, director of project management — commercial at Juno Lighting Group. He also says that newer technologies do more than slash energy consumption and utility budgets. Modern lighting systems also can reduce maintenance costs by delivering longer lamp life and easier replacement methods.

There are other benefits. "With all the dust, dirt and light depreciation in older buildings, new energy efficient lighting also can improve the appearance," says Spencer. "It makes a space look the way it is supposed to look. You get clean new lamps with an upgrade, and all of a sudden it looks new again."

Improvements in the energy performance of lighting technology has led the federal government to take action to drive the market to more efficient products. In 2000, DOE issued regulations requiring the phase out of magnetic T12 fluorescent ballasts for 4-foot linear lamps and 2-foot U-lamps with medium bi-pin bases, 8-foot linear lamps with single-pin bases, and 8-foot linear lamps with RDC bases. The Energy Policy Act of 2005 — widely known as EPA — went further, requiring the phase out of ballasts for T12 energy saving lamps. As of last month, regulations bar the manufacture of T12

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magnetic ballasts for use in both new fixtures and replacement applications.

What's more, by July 2012, new federal energy standards will eliminate the manufacture or import of many popular T12 lamps as well as a few T8 lamps.

Taken together, these regulations are pushing facility managers to abandon T12 systems in favor of more efficient T8 or T5 technology — options that have long made economic sense.

Replacing magnetic ballasts with electronic ballasts brings significant energy savings and environmental benefits, says Jeanette Strainic, manager of strategic initiatives and events at GE Lighting. "With new high-efficiency electronic ballasts, total system wattage can be reduced more than 40 percent relative to the use of older T12 fluorescent systems."

But replacing existing ballasts with electronic ones is only one option. Facility managers with facilities using T12 lamps and magnetic ballasts have other energy-efficient upgrade choices. For example, fixtures can be retrofitted to T8 lamps and electronic ballasts.

With dimmable ballasts and a wide range of lighting control options — from occupancy sensors to daylight harvesting — facility managers can customize lighting to meet the specific needs of a given space.

Another route is to completely replace existing fixtures with either efficient T8 or T5 units with electronic ballasts or an entirely different technology.

As Casanova says, "Many facility managers look at lighting upgrades as just changing lamps or upgrading the ballast from magnetic to electronic." But there are other considerations. When selecting from the wide array of new technologies, factors to consider across a number of products include:

- Efficiency improvements (lumens per watt)
- Efficiency standards
- Environmentally conscious products
- Long-life products

For example, if a facility manager is considering an LED product based on the fact that it delivers high efficiency and long life, it is also important to consider the kind of fixture it requires for successful operation. LED fixtures may

need to be replaced entirely when it's time to change the lamps. Ones with replaceable light engines extend the life of the fixture.

"It's bad for the environment if you have to throw away all of the fixtures in a building every five years," Spencer says. "It's only a matter of time before the replaceable light engine feature of some LED fixtures becomes a requirement rather than a nice option."

Lighting Controls

Bear in mind that lighting upgrades go beyond lamps, ballasts and fixtures. To further increase efficiency and savings, controllable lighting is not just something that's "good to have." It's a necessity for creating a truly efficient lighting system. However, as important as lighting controls are for energy savings, most facility professionals still have not implemented a facilitywide controls system in their buildings.

"With only 1 percent of buildings using controls, this is often one of the most overlooked, yet most effective, technologies in saving energy through lighting," Casanova says.

Upgrading to lighting controls can save as much as 50 percent of the energy used in a commercial building, says Bob Freshman, marketing manager for Leviton Lighting Management Systems. "This can amount to a very significant saving on energy costs," he says. "And the dollars saved only will increase as the cost of energy rises."

In fact, statistics from the National

than a thoughtfully specified and commissioned lighting control system," says Michael Jouaneh, marketing manager for Lutron Electronics Co.

A range of lighting control strategies are available to help facility managers be efficient. These include the following:

Astronomical time clock scheduling. This automatically dims or turns lights off at certain times of the day. Few buildings operate on 24-hour schedules, and many are empty during the overnight and weekend hours. These time clocks can be used to provide

automatically turn off lighting when occupants leave a space. The average savings tally up to about 35 percent, according to Freshman. Occupancy sensors are best suited for private offices, conference rooms, restrooms and classroom spaces.

"Besides traditional uses, occupancy sensors also can be integrated into stairwell luminaires for additional savings," says Dorene Maniccia, director of policy and industry affairs for Watt Stopper. "And they can be used to signal other building management systems."

Care should be used in setting time delays on fluorescent systems, so that no more than six starts per day occur even when using "program start ballasts" or maintenance replacement cost could decrease overall savings.

Digitally addressable dimming ballasts. This technology is fully controllable, and scalable for applications ranging from small, standalone spaces to multiple rooms and areas, to whole floors, entire buildings or even expansive campuses. It allows light fixtures to directly network with time clocks and occupancy sensors, as well as daylight sensors, wall controls, handheld remote lighting controls, window shades and building management systems.

"Digital lighting controls are one of the most recent and robust technologies available today," Maniccia says. "Advanced lighting control systems emerging in the market are smarter, easier to connect than traditional wiring, offer self-commissioning, report on usage and save more energy. These systems take advantage of the benefits of digital control and plug-and-play cabling to provide these benefits."

Tuning. Lighting energy use can be reduced by 20 percent or more through tuning, which sets the appropriate light level for each space. Existing buildings are usually significantly over-illuminated. Light levels are set for the worst-case scenario, which is typically much higher than desired. For this reason, a facility manager can "tune" a new lighting system that is controllable via dimming ballasts to the right light level for each space. For instance, some areas may require 40 foot-candles or light on the work surface while others need only 20. This strategy can save

NEMA'S enLIGHTen AMERICA PROGRAM PROVIDES UPGRADE BLUEPRINT

The National Electrical Manufacturers Association (NEMA) has teamed up with lighting members of the electrical industry to offer a web-based initiative aimed at saving energy and reducing costs in the 5 million existing commercial, industrial and institutional buildings in the United States.

Through its enLIGHTen America campaign, launched in 2008, NEMA provides facilities professionals with a practical blueprint for upgrading lighting products in un-renovated buildings.

The enLIGHTen America campaign offers tools to help facility managers make educated decisions about their lighting systems. Such tools include:

- Energy-saving solutions through energy-efficient lighting products
- Case studies
- Information on tax incentives
- Fluorescent lamp recycling information
- Cost calculators
- Audit and retrofit checklists

To use these tools or to get additional information on lighting upgrades, visit www.nemasavesenergy.org.

Electrical Manufacturers Association (NEMA), through its enLIGHTen America (www.nemasavesenergy.org) campaign, estimate the use of lighting controls can reduce energy costs by an additional 15 to 80 percent, depending on the facility, over and above savings from other lighting upgrades alone. Some estimates assume that with no lighting controls in place, the energy savings from a lighting system upgrade should be a minimum of 30 percent, but if control options are part of a system, it could easily reach 50 percent.

"Numerous strategies must be combined to deliver a high-performance building, but none is more powerful

a building with a "lighting sweep" at night, switching lights off or dimming them at certain times to save energy and prevent light pollution.

According to Jouaneh, astronomical time clocks are preferable to standard time-of-day time clocks because they automatically adjust lighting based on such events as sunrise or sunset. Scheduling can reduce lighting costs by 10 to 35 percent.

Bi-level switching. These systems, which provide two levels of "on" in addition to "off," can provide up to 18 to 20 percent savings. There have been cases where savings are even greater.

Occupancy sensing. These sensors

a significant amount of energy while making occupants more comfortable and productive.

"Even when you employ tuning, many occupants prefer lower light levels to minimize glare on computer screens," Jouaneh explains.

Daylight harvesting. This option automatically dims electric lights when enough daylight is present and typically can save an additional 10 to 16 percent in lighting electricity costs in buildings with many windows or skylights.

Personal controls. Personal lighting controls allow users to control general lighting directly over their workstations. Studies suggest that the ability to vary lighting to levels appropriate to the job at hand can improve productivity and reduce eyestrain and glare. This is in addition to saving energy — about 10 percent more than a standard lighting upgrade alone.

Wireless controls. Wireless options save on the costs of installing new

lighting energy consumption in the range of 77 to 83 percent. What's more, the payback was only 1.5 years instead of the three years predicted prior to installation. Toronto Hydro recently replaced most all HID exterior luminaires with controlled, fluorescent weatherproof luminaires, to save nearly 77 percent in lighting energy costs for parking lots, parking garages, parking decks, security, docks, etc.

Benefits of lighting controls go beyond electricity savings. One such benefit can be a reduction in cooling load.

"Because lights emit heat, lighting controls and upgrades can reduce HVAC demand," Jouaneh says. "As a rule of thumb, for every 3-watt reduction in lighting power, there is a 1-watt reduction in cooling load."

What's more, savings from lighting controls require little, if any, participation from building occupants once they are set to run.

day, as long as inside lighting. Exterior lighting makes a building secure. It makes people secure."

A company in the San Francisco Bay area evaluated its outdoor lighting system after an employee was mugged in the facility's brightly lit parking lot, which used low-pressure-sodium lighting. After the mugging, the company hired a security guard to escort employees, many of whom kept non-traditional working hours, to and from their cars.

"It turned out that while the lot and surrounding walkways had bright lighting, the orange color of the lighting created reduced visibility," Leetzow said. "By changing the system to a white fluorescent system, the lot was better illuminated, saved \$4,000 each year on energy and maintenance, and cut their security bill by \$58,000 because they no longer needed a full-time security guard. High color rendering, good glare control and uniformity of lighting are non-negotiable."

As Bennorth says, lighting issues also come into play in parking garages. Typically these areas are lighted 24/7, but in theory, this isn't always necessary.

"Converting this lighting to a controllable, energy efficient source — such as high-efficiency fluorescent lighting — will save energy when the lights are on and also allow savings when the lighting can be reduced or shut off, based on a schedule, occupancy sensors or available daylight," he says.

When weighing lighting improvements, facility managers should consider options beyond lamp and ballast upgrades

line-voltage wiring, as well as reducing the impact on the building occupants. According to Freshman, ROI can be achieved on many projects within one year. Products include occupancy sensors, line-voltage controls, photocells for daylight harvesting and relay control systems for scheduling.

Taking advantage of wireless controls for renovations can reduce cost as much as 50 percent compared to wired systems, Freshman says.

One organization, BC Hydro, a Canadian electric utility in British Columbia, had a chance to realize energy savings when it moved to four floors in a new office building. The company installed a product that integrates network controls, occupancy sensors, personal dimming and daylight dimming.

BC Hydro reported reductions in

"Lighting control products operate automatically and do not need any action from the building occupants," Freshman says. "This means savings generally are not affected by building use. They happen automatically."

Exterior and Other Lighting

Outdoor lighting, which includes parking garage lighting, is one of the most overlooked areas during a lighting upgrade, experts say. It's a significant missed opportunity, because it can provide energy savings and operating cost reductions.

"Many people don't believe exterior lights are as important to the budget as those on the inside," says Larry Leetzow, president of Magnaray International Division. "But they also forget that outside lighting is on at least 12 hours a

Making the Change

No two facilities — and in some cases, no two areas within a single facility — have the same lighting needs. A lighting system strategy that works in one building's conference room might be a complete failure in another facility's similar space.

"You really do need to arrive at a solution based upon your facility's needs," says Maniccia.

That's where a lighting audit comes into play. An audit can help facility professionals assess the many options available to them and determine their lighting needs in different locations within the facility. An audit also will identify total lighting energy expenditures within a facility and help determine where facility managers can real-

ize the most significant savings.

"A high-bay location vs. a conference room vs. a foyer vs. a large employee task environment require different energy-efficient lighting solutions," Strainic says. "They also can use different controllable lighting options. An audit allows facility professionals to tailor each location's lighting needs, and in turn, realize greater savings with lighting that is more beneficial to that application."

Lighting experts recommend, at minimum, designing new or major renovations based on the latest version of the ANSI/ASHRAE/IES 90.1 standard for building energy efficiency. The current version is 90.1-2007, but 90.1-2010 will be published this year and will provide even greater energy savings. Another option is the new ANSI/ASHRAE/USGBC/IES 189.1-2009, Standard for the Design of High-Performance Green Buildings, Except Low-Rise Residential Buildings.

"Facility professionals also must remember to comply with the state and local building energy codes, although, in most cases, compliance with the 90.1 or 189.1 standards will exceed the state and local codes," Anderson says.

Emerging federal regulations also will come into play. DOE recently announced new efficiency standards for fluorescent, incandescent and halogen lamps, with an effective starting date of July 14, 2012.

"The result will be that nearly two-thirds of the SKUs sold in the market today will be eliminated because of these changes," Strainic says, adding that these changes likely will prompt upgrades in some facilities.

As with any technology, expect energy-efficient lighting to continue to evolve as manufacturers develop new ways to help facility managers reduce energy consumption, save money, simplify maintenance and operations, and even improve occupant productivity.

"Keep watching," Ward says. "The electrical and lighting industries are going through a most exciting time as manufacturers continue to drive new technologies into this market. These technologies will give end users more control over their work environment and allow for both creative and functional lighting systems that optimize business

operations and worker performance."

Simply put, the facilities industry needs to take a holistic approach with lighting system upgrades, from the luminaire to the controls.

"You need to look beyond the upfront costs and do modeling on the life-cycle cost and payback to calculate your long-term savings," Casanova says. "It might cost a little bit more in the upfront costs, but the payback is relatively quick and far exceeds the investment. And remember that lighting upgrades are not just financial decisions. Quality of light is important because improved quality leads to enhanced productivity and better safety." ■

