

# HIGH-PERFORMANCE lighting upgrades



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# Bright Lights, BIG SAVINGS

A lighting upgrade not only lightens energy bills, but also brightens first costs with rebates, tax breaks, and more

By John Gregerson, Contributing Editor

**T**here is no greater energy glutton in commercial construction than lighting. Nothing, not even heating or cooling, comes close.

For much the same reason, lighting is commercial construction's single greatest source of energy savings, assuming that owners exercise their options.

There is no reason not to, now that new generations of lamps and ballasts can cut lighting costs by 30 to 60 percent, all but ensuring prompt payback. In fact, lighting upgrades have been dubbed the low-hanging fruit of energy-conservation programs since they can be performed with relative ease and require little, if any, maintenance once the upgrades are completed.

Owing to growing concern about the nation's strained infrastructure and about the deleterious effects of carbon emissions, owners also can reap substantial rewards in the forms of rebates and tax breaks from states, regional utilities, and the federal government.

Qualifying for incentives requires effort, if for no other reason than the programs can weave unwieldy webs of regulations and protocols. Further, they may require significant upgrades in hardware and software, either in service of concepts, such as daylight harvesting, or to reduce energy consumption during periods of peak demand.

Nevertheless, the potential savings are too great to ignore. Payback often arrives within a year or two, and the rest, as the saying goes, is gravy.

## State Programs

Despite the number of states with incentive programs, surveys suggest that the majority of owners don't know the programs exist. Fact is, some 80 percent of states offer lighting-related rebates, according to the DOE.

A useful guide to state- and utility-sponsored incentives is [www.Business.gov](http://www.Business.gov), which provides a state-by-state list of programs, including those that finance upgrades with

grants or loans. Another site, [www.energytaxincentives.org](http://www.energytaxincentives.org), places particular emphasis on programs available in conservation-oriented states, such as California, Connecticut, and Wisconsin.

Rather than rebates, some programs provide supplemental funding for lighting upgrades. Waltham, MA-based utility National Grid, which services the New England region, funds up to 70 percent of smaller lighting projects, with owners repaying the balance over a period of 12 to 24 months.

Uncle Sam, by comparison, offers tax reductions for upgrades, assuming they conform to provisions listed in the Energy Policy Act of 2005 (EPAAct). One provision, the Commercial Buildings Deduction (CBD), allows deductions of \$1.80 per square foot for offices, schools, warehouses, retail establishments, and government buildings that reduce annual energy and power consumption by 50 percent, in accordance with the *ASHRAE 90.1 2001* standard.

According to DOE spokesperson Christina Kielich, owners can earn a partial deduction of \$0.30 per square foot for lighting systems that not only employ dual switching – the ability to switch off half of the lights and maintain fairly uniform light distribution – but also reduce lighting power by at least 25 percent from values specified in the ASHRAE standard.

As power reductions climb from 25 percent to 40 percent, deductions increase proportionally, up to \$0.60 for a 40-per-



**To receive federal tax deductions, upgrade projects must follow specific inspection and testing procedures developed by the National Renewable Energy Laboratory ([www.nrel.gov/docs/fy07osti/40467.pdf](http://www.nrel.gov/docs/fy07osti/40467.pdf)).**

cent reduction incorporating dual switching.

Installations must be certified in accordance with the following provisions:

- Certifications must be performed by “qualified individuals,” meaning licensed engineers or contractors who aren’t professionally associated with the project or taxpayer.
- Calculations must be performed with DOE-approved software. A list, including names and versions, is available at [www1.eere.energy.gov/buildings/qualified\\_software.html](http://www1.eere.energy.gov/buildings/qualified_software.html). The IRS deduction for energy-efficient commercial buildings is described at [www.irs.gov/irb/2006-26\\_IRB/ar11.html](http://www.irs.gov/irb/2006-26_IRB/ar11.html).
- Certifications must include a field inspection after the

forms to targeted reductions, payback schedules, and incentives.

4. Hire a licensed electrical contractor to install the new system.

As an agent of National Grid, Rise performs energy audits free of charge, though owners typically can find similar assistance from a number of sources, including system vendors, consultants and engineers. Vendors, in particular, perform free audits and financial planning, as do utilities, energy commissions and their agents.

Some consultants are one-stop shops. In addition to designing the project and calculating its costs and payback schedule, Rise performs the upgrade once plans are in place, according to Cowger.



COURTESY OF CE

### Financing Options

No- or low-cost audits notwithstanding, current economic conditions may not be conducive to undertaking significant lighting upgrades unless they are funded in whole or part by sources such as National Grid. Traditional lending sources may provide financing, but often don’t cover associated labor costs.

To spur activity, some states and utilities provide financing for projects under highly favorable rates, with owners repaying loans with money saved on their utility payments. Some such arrangements even cover soft costs, such as maintenance agreements and software. Many also qualify owners for rebates, assuming the projects conform to specified performance standards.

The California Energy Commission (CEC), for instance, approved a loan request by Alameda County to upgrade lighting systems at 50 county facilities

– a \$1.7 million undertaking anticipated to save the county \$360,000 annually while reducing electricity consumption by 2.9 million kWh per year.

To set project parameters, Pacific Gas & Electric performed initial audits for the program over a period of a year, according to CEC.

The loan, which will fund replacement of T12 and older T8 fluorescent lamps with high color-rendering index (CRI) T8 lamps, was obtained from CEC’s Energy Efficiency Financing program, which offers loans of up to \$3 million to state schools, hospitals, and local governments. Rates are as low as 3 percent for projects targeting energy conservation.

CEC is funding the entire Alameda County project, which is expected to earn \$250,000 in utility rebates. The calculated payback is four years, within the five-year window mandated by CEC.

CEC is expanding the program, which primarily targets public facilities, as a result of funding it has received from the federal economic stimulus bill. Yes, even in cash-strapped California, the lights are on and the state is ready to do business. ■

**A lighting upgrade at the Kendall-Jackson Winery replaced a metal halide system with a combination of T5 and T8 fluorescent lamps, saving more than \$100,000 annually on energy and maintenance costs.**

project is completed and operational. Specific inspection and testing procedures developed by the National Renewable Energy Laboratory are available at [www.nrel.gov/docs/fy07osti/40467.pdf](http://www.nrel.gov/docs/fy07osti/40467.pdf).

- Certifiers must provide the owner with a list of the building’s energy-efficient features and projected annual energy costs.

For additional information on CBD, including guidance from the Internal Revenue Service, Kielich advises visiting [www.energystar.gov](http://www.energystar.gov).

### Getting Started

Owners often know they are burning their footcandles at both ends, even if they’re uncertain how. Todd Cowger, a marketer for Cranston, RI-based Rise Engineering, which contracts with National Grid to help owners qualify for utility-funded upgrades, advises facility managers to perform the following steps:

1. Conduct an energy audit of the facility.
2. Examine utility bills to verify current energy spending.
3. Consult with vendors to develop a program that con-

# Savings are Food for Thought

Extended lamp replacement cycle is an additional cost benefit when considering LEDs

Switching to 7-watt LED lamps in 150 of its restaurants nationwide, Red Robin replaced 12,000 incandescent and halogen lights, starting at the end of 2008, in order to achieve its energy-management goals.

In addition to saving energy, the restaurant chain also wanted to preserve the ambiance of its interiors and maintain the level of comfort that its customers have come to expect. The 7-watt LED PAR lamps from GE helped do just that, as well as save several hundred thousand dollars annually in lighting costs over the life of the lamps.

Used in general downlighting applications – entrance and lobby

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The new lamps are used in downlighting applications, including entrance and lobby areas, lighting over dining room tables, and perimeter lighting.

## LIGHTING UPGRADE SUMMARY

<b>Owner &amp; Building Type</b>	Red Robin restaurants.
<b>Project Scope</b>	Replacement of approximately 12,000 incandescents and halogens with 7-watt LED flood and spotlights in 150 restaurants.
<b>Project Schedule</b>	Four months (November/December 2008, February/March 2009).
<b>Energy Savings</b>	The 7-watt LEDs (200 lumens) reduce energy by as much as 70 percent over 30-watt incandescent R20 reflectors (200 lumens). Annual dollar savings per LED operated at 4,500 hours is \$10.
<b>Rated Lamp Life</b>	The 7-watt LED lamps have a 20,000-hour rated life to 70 percent of initial light output.
<b>Payback</b>	Less than 2 years.

areas, lighting over dining room tables, and perimeter lighting – that require high-quality light, the switch to LEDs is one that Red Robin is proud of.

“Switching to LED lamps in our company-owned Red Robin restaurants offers immediate energy-cost advantages, given the number of locations involved in our energy-reduction efforts,” says John Rogers, vice president of capital purchasing for Red Robin. “We expect a very attractive return on investment with reductions in energy consumption and maintenance requirements.”

These long-lasting LEDs also work well in restaurant environments due to their extended lamp life. Many fixtures can be challenging to reach, and extending replacement cycles as much as possible across a span of chain restaurants is appealing to owners. ■

# Outdoor Lighting Shaves Peak Demand

LED retrofit cuts wattage by 81 percent

After starting with the normal energy-saving activities (automated lighting controls, reprogramming HVAC systems, replacing incandescents with fluorescents, decommissioning obsolete servers, etc.), RCI was ready for something more. Its 21,000-square-foot facility, which runs 24/7 and houses a data center, call center operations, and office support operations, had achieved moderate reductions in energy usage with its initiatives, but the organization was looking to gain even more savings.

After determining that demand costs (what the organization was paying for exceeding peak electrical loads) were a good opportunity to save, the HID lighting in the parking lot was replaced with LED units that were originally designed for street

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Only minor modifications were necessary to adapt the new LED units to existing posts and circuits.

## LIGHTING UPGRADE SUMMARY

<b>Owner &amp; Building Type</b>	Outdoor parking lot for Group RCI office/data center.
<b>Project Scope</b>	In the parking lot, 48 metal halide units rated at 1,000 watts were replaced by 96 LED units rated at 180 watts. For exterior wall wash, four 1,000-watt metal halide units were replaced by four 100-watt LED units.
<b>Energy Savings</b>	Wattage has dropped from 52,000 watts to 9,616 watts, resulting in approximately \$2,000 savings per electric bill.
<b>Project Schedule</b>	Installation required three weeks in 2008.
<b>Rated Lamp Life</b>	5 to 7 years.
<b>Payback</b>	18 months.

lighting. Wattage in the parking lot went from 1,000 watts per fixture down to 180 watts per fixture; two LED fixtures were installed for every one HID fixture, and only minor modifications were necessary to adapt the new units to the lighting posts and circuits.

Energy and cost savings were immediate. The first electrical bill RCI received after the retrofit demonstrated a noticeable reduction on electrical usage and demand costs (a \$2,000 savings). "We really knew we had made a significant difference when the utility service arrived at our facility on the third month to examine our electrical meters for tampering or malfunction," says Charles Phipps, director of facility and security operations for RCI.

The ROI for the project is approximately 18 months. Because this retrofit was so successful, RCI has now taken LEDs to its exterior entrance and sidewalk lighting as well. ■

# Northeastern University Shines with Lighting Upgrade

A campus-wide lighting upgrade helped reduce energy use and maintenance while demonstrating leadership in sustainable practices

As a leader in interdisciplinary research, urban engagement, and the integration of classroom learning with real-world experience, Northeastern University in Boston also commits itself to being a leader in the use of sustainable products and practices within the educational and institutional sectors. When the lamps throughout the 67-acre, 60-building campus were nearing the end of their life-cycle, Northeastern conducted a thorough analysis of its lighting options and initiated an extensive, campus-wide lighting upgrade.

The project was officially launched in November 2008 and completed in February 2009, and involved the upgrade from the school's previous system of 30-watt fluorescent lamps to more efficient 25-watt fluorescent lamps from Philips Lighting Company.

"Just as we have always done in the past," says Joe Rarahan, Northeastern University's energy manager, "our team fully investigated the market options and selected



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**Upgrading to 70,000 efficient, low-mercury lamps will save Northeastern University 1.4 million kilowatt-hours annually and reduce its carbon emissions by 686 tons each year.**

the lamps that would deliver the most energy efficiency and sustainability possible without sacrificing lighting performance or quality."

For the upgrade, Northeastern University chose Philips' 25-watt, 4-foot linear fluorescent lamps for classrooms and laboratory spaces; U-Bent fluorescent lamps for hallways, offices, and older dormitories; and 25-watt PL-L compact fluorescent bulbs for offices, laboratories, newly renovated dormitories, and public spaces, such as the health clinic. Both the 25-watt linear and U-Bent fluorescent lamps incorporate Philips' ALTO® or ALTO II™ low-mercury technology, and the long lifespan of the 70,000 lamps relieved concerns about excessive maintenance requirements.

An outside contractor conducted the lighting upgrade overnight and during the school's 2008 Thanksgiving and Christmas breaks to minimize disruptions to campus operations. The upgrade is projected to save Northeastern at least \$200,000 per year in energy costs. ■

## LIGHTING UPGRADE SUMMARY

<b>Owner &amp; Building Type</b>	Higher-education campus lighting analysis and upgrade for Northeastern University in Boston.
<b>Project Scope</b>	Upgrade of 30-watt fluorescent lamps to more efficient 25-watt fluorescent lamps throughout the campus' 60 buildings and 5 million feet of floorspace.
<b>Project Schedule</b>	The upgrade project was launched in November 2008 and completed in February 2009.
<b>Cost and Energy Savings</b>	Northeastern will save at least \$200,000 annually in energy costs, totaling approximately \$1.2 million over the anticipated 6-year life of the lamps. Additionally, the lamps will save about 1.4 million kilowatt-hours annually.
<b>Payback</b>	Less than 2 years.
<b>Environmental Benefits</b>	The lighting upgrade will reduce Northeastern's carbon emissions by approximately 686 tons per year.
<b>Other Benefits</b>	Long-life models minimize maintenance costs and concerns, and continued leadership in the green area is supported by use of the lowest mercury option available.

# Controlling Costs with Lighting Controls

Daylight harvesting and smart use of lighting controls helped the Energy Foundation meld its mission with its practices

When the Energy Foundation moved to The Bently Reserve Building in 2007, it had a unique opportunity to showcase energy-efficient lighting; the building was already LEED Certified for Core & Shell, and it had been outfitted with the Lutron Quantum® total light management system.

With the large windows, the design team wanted to harvest daylight while managing glare on monitors and meeting building code requirements for task and ambient light. To achieve this, the design team used Lutron's EcoSystem® Solution, a modular lighting control system that connects seamlessly with the Quantum system.

"One of the nicest things about the workspace is the light here," says John Wilson, the foundation's buildings program director. "We get a tremendous amount of daylight, and that could be a problem if the accompanying overhead and task lighting weren't handled properly – but a great deal of thought has gone into the light design. And,

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**To plan the lighting upgrade, every light source in the Energy Foundation's office space was mapped out on a spreadsheet and on a color-coded floorplan, and a "light control intent" for the entire space was created.**

because people can easily control their own lighting, they are very satisfied with their individual spaces."

To achieve this level of control, every light source was mapped out on a spreadsheet and on a color-coded floorplan, and a "light control intent" for the entire space was created. The goal: reduce overall lighting energy use by 45 percent. An optimal light level was set for individual spaces. For example, walkway lighting was set at a maximum of 50 percent, and private office lighting ranged from 10 percent (for offices with windows) to 90 percent (for interior offices far from windows).

Additionally, occupancy/vacancy sensors are used in conference rooms, the system automatically shuts off the lights at the end of the day, and wall controls make it possible for people to turn the lights on manually. ■

## LIGHTING UPGRADE SUMMARY

<b>Owner &amp; Building Type</b>	The Energy Foundation offices in the Bently Reserve Building in San Francisco.
<b>Project Scope</b>	Renovate the 17,600-square-foot space on the fifth floor of the Bently Reserve Building using daylighting and lighting controls, transforming the space into a showcase for energy-efficient lighting.
<b>Energy Savings</b>	Energy for lighting was reduced by 66 percent.
<b>Other Benefits</b>	Individuals at the Energy Foundation are more satisfied with their individual spaces because they can easily control their own lighting.

# Illuminating Upgrade at the L.A. Public Library

A utility rebate increased the financial incentive for the historic building's upgrade



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Two simple objectives were established for the lighting upgrade at the Central Branch of the Los Angeles Public Library: improve color rendering and reduce energy demand and cost.

The building, which is listed on the National Register of Historic Places, offered neither to patrons with its former lighting, much of which consisted of 3-foot, warm-white T12 fluorescents driven by magnetic ballasts.

Staff and patrons are pleased with the improved lighting in the open book stacks.

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Completed in 1926 with an art deco design by Bertram Goodhue, the library is a signature building in downtown Los Angeles.

Some 8,900 fixtures throughout the library's book rack, rare book, and office areas were outfitted with 3-foot, 25-watt T8 fluorescents and 4-foot, 32-watt T8s from Philips Lighting. The new lamps are driven by electronic ballasts from Advance.

At a temperature rating of 5,000 Kelvin, the high-lumen, long-life lamps raised the color-rendering index (CRI) from 53 to 85, significantly enhancing the reading experience in the library. In addition, 400 exit signs in the building were changed out with new LED units for more energy savings.

The upgrade reduces the library's energy demand by 244 kW and saves an estimated \$100,000 annually – nearly 40 percent. The upgrade also received a rebate from the Los Angeles Department of Water & Power.

Johnson Controls Inc. specified and oversaw the upgrade. Dann Vail, Energy Solutions Developer for Johnson Controls, says that "the contrast, definition, usable light levels, and visual acuity within the library were significantly enhanced. Staff members have confirmed that the new lighting has greatly improved their ability to see colors, wording, and book codes, while patrons have shared extremely positive comments about the new ease of sight within the building." ■

## LIGHTING UPGRADE SUMMARY

<b>Owner &amp; Building Type</b>	City of Los Angeles, Los Angeles Public Library, Central Branch.
<b>Project Scope</b>	Replacement of T12 fluorescent lamps and magnetic ballasts with T8 lamps and electronic ballasts.
<b>Energy Savings</b>	Annual electrical demand was reduced by 244 kW, saving approximately \$100,000.
<b>Other Benefits</b>	CRI increased from 53 to 85, significantly increasing the library's reader friendliness.



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