Spectrally Enhanced Lighting: Los Angeles Public Library Case Study

Spectrally enhanced lighting (SEL) is a lighting design technique that saves energy by changing the color of light to be closer to daylight. Buildings that are retrofitted with SEL can reduce their energy costs by 25–50%.

DOE research studies show that by simply shifting the color in fluorescent lamps from the warmer yellow end of the color spectrum to the cooler blue end of the spectrum, we can see things more clearly and spaces appear brighter. Therefore, when we change the color of light to be more like daylight, lighting levels can be reduced to save energy while still achieving the same visual acuity. In T8s with electronically ballasted fluorescent lighting systems, this translates to a 20 percent energy savings, and in T12s with magnetically ballasted systems, SEL can achieve a 50 percent savings.

"We have received nothing but thanks from staff and patrons for improving lighting in the open book stacks as well as in the accounting and administrative areas. We are very excited about the elevation in visibility and energy efficiency that this outstanding upgrade has brought to our historic facility."

David Luther, Business Manager
Los Angeles Central Library

The Central Branch of the 71-branch Los Angeles Public Library system is a 538,000-square-foot, eight-floor building in the heart of downtown Los Angeles. The library shone new light on its spectacular collection of rare books and photographs, fine and vintage paintings, sculptures, and architectural elements when it retrofitted its lighting system with a promising new technology called spectrally enhanced lighting. Since the upgrade, color rendering and reading ability have improved, while energy costs have dropped significantly.

The flagship Central Branch of the Los Angeles Public Library has been a high-profile part of downtown Los Angeles since its original construction in 1926. To improve service for the Central Branch's 2 million annual visitors, the library system undertook an extensive lighting upgrade in spring 2006. The purpose was twofold: modernize the outdated lighting system to improve reading ability and color rendering while reducing energy consumption and lighting costs. The library system chose SEL technology for the retrofit and selected facility management company Johnson Controls, Inc., to oversee the project with support from California-based lighting company EnerTech Systems, Inc.

The Upgrade

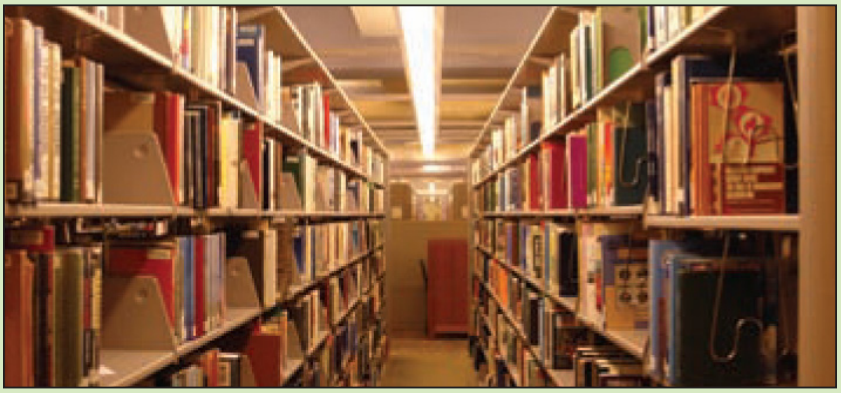
Much of the library's previous lighting consisted of outdated 3-foot, T12 warm-white fluorescent lamps driven by magnetic ballasts, as well as inefficient incandescents. Beginning in April 2006, 8,900 fixtures throughout the library's book rack, rare book, and office areas were upgraded to a significantly more energy-efficient system comprised of 3-foot, 25-watt and 4-foot, 32-watt Advantage ALTO® T8 fluorescent lamps from Philips Lighting Company driven by 6,500 Optanium® Low Ballast Factor electronic ballasts from Rosemont, Illinois-based Advance. At a temperature of 5000K, the lamps elevated the library's lighting system from its previous CRI of 53 to a more appealing index of 85. Additional energy was saved by changing out roughly 400 exit signs to highly efficient LED technology.

Conclusions

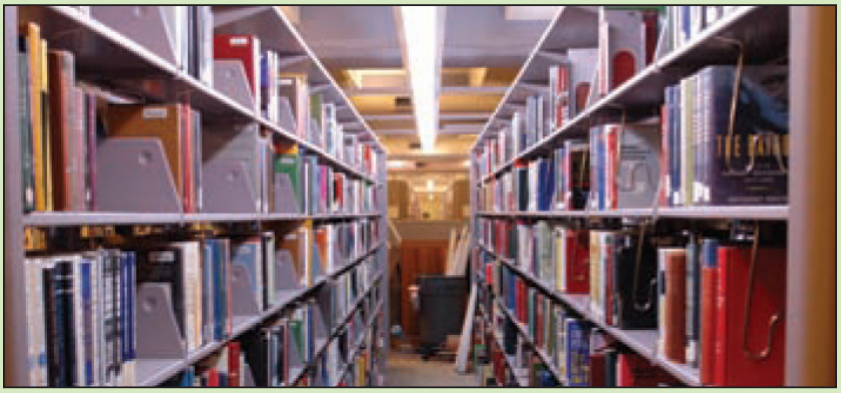
By retrofitting its lighting system with highly efficient SEL technology, the Los Angeles Public Library system reduced lighting energy consumption at its main branch by nearly 40 percent and now enjoys savings of $100,000 each year. The change allows the library system to better serve its millions of patrons through lighting that gives better coloring to its stunning paintings, more illumination to its architecture, and improved ability to read the books resting on its 89 miles of shelves.

Results

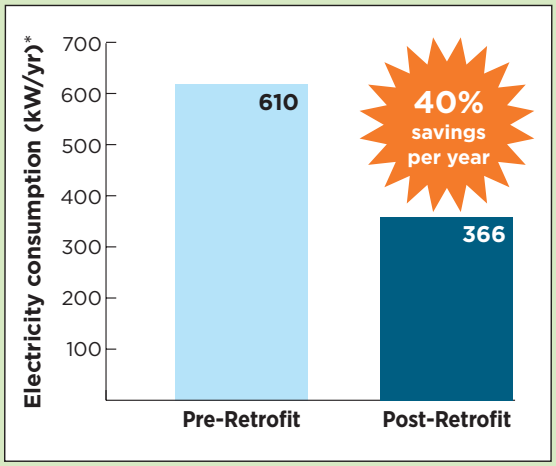
Pre-Retrofit



Post-Retrofit



Specifications



	Pre-Retrofit	Post-Retrofit
Lamp	T12 fluorescent & incandescent	Philips 32 W Advantage ALTO® T8
CCT (Kelvin)	2700*	5000
CRI	53	85
Lamp color	527*	850

**Note: Figures are approximate.*

LIGHTING TERMS

The Los Angeles Public Library system selected 5000K, 85 CRI T8 lamps—also known as 850 lamps—for its retrofits.

Correlated color temperature (CCT)—A measure of the color appearance of a white light source. It is measured on the Kelvin absolute temperature scale and commonly ranges from 2700K (warm white) to 8000K (sky white).

Color rendering index (CRI)—A measure of how a light source renders the colors of objects. CRI is given as a number from 0 to 100, with 80 being the minimum CRI recommended for interior lighting.

Electronic ballast and ballast factor (BF)—To improve energy efficiency, SEL technology usually includes Premium electronic ballasts designed to work with the new T8 or T5HO fluorescent lamps. Ballast factor (BF) is the factor applied to the rated lumens of the lamps and is a function of the lamp/ballast combination employed. When dimming ballasts are used, the dimmed BF should be used in all calculations.

T8—A type of fluorescent lamp. The "T" means it is tubular in shape and the "8" means the diameter is eight-eighths of an inch, or 1 inch. A T12 lamp is twelve-eighths of an inch, or 1.5 inches thick. T8 lamps have a better CRI and are more efficient than T12 lamps.

850—A number that combines the CCT and CRI into one number. The "8" in 850 references a CRI in the 80s and the "50" refers to a CCT of 5000K. A 741 lamp would have a CRI in the 70s and a CCT of 4100K.

For More Information

For more information about spectrally enhanced lighting, or to download complete technical reports about its feasibility and economics, visit www.eere.energy.gov/buildings/spectrally_enhanced.html.

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