Energy-Efficient Hospital Lighting Strategies Pay Off Quickly

The lighting demands of hospitals are complex due to their round-the-clock nature and the effects of lighting on patients and staff. Lighting, however, abounds with opportunities for energy savings. This fact sheet was developed by the U.S. Department of Energy's Hospital Energy Alliance to assist hospital facilities managers and operators in using effective, energy-efficient technologies and practices to reduce lighting-related energy costs while maintaining and enhancing the hospital environment.

Lighting is a significant component of hospital energy use, representing more than 10 percent of energy consumption. Further, lighting boosts the demand for cooling because every watt of electricity used for lighting generates heat. Energy-efficient lighting strategies, whether used in new construction or in retrofits of existing facilities, yield major savings and have a short payback period.

Lamp Technologies with Quick Payoffs

Commercially available, cost-effective lighting technologies offer the best opportunities to achieve high energy savings and reduce hospital operations and maintenance costs. Hospitals can benefit from:

- Installing light-emitting diodes (LEDs) in exit signs.
  - Lowers energy use—LED exit signs use only 44 kWh of energy per year.
  - Uses less than a third of the energy consumed by fluorescents (140 kWh) and seven times less than incandescents (350 kWh).
  - Requires less maintenance—The lifespan of LEDs is 50,000 hours, or around six years, when operated 24/7. This compares with a lifespan of about a year for fluorescent lamps and less than a year for incandescent lamps.[1] Reducing replacements cuts maintenance costs.
  - Increases safety—LEDs allow for signs with higher lumen output and greater contrast against backgrounds than conventional exit signs.
- Eliminating incandescent lamps.
  - Replacing incandescent lamps with fluorescent lamps (other than in exit signs).
  - Federal efficiency standards will ban the manufacture of incandescent lamps starting in 2012.
- Replacing older T12 or T8 technologies with Super T8 lamps and high-efficiency electronic ballasts.
  - Super T8 lamps reduce energy usage by 20 to 30 percent.[2]
  - Compared with magnetic ballasts, electronic ballasts save energy and reduce flicker and noise.

Retrofit Exit Signs with LEDs[3]

For a typical 600-bed hospital with 300 exit signs, replacing traditional 36 W signs with 5 W LED signs results in an **annual savings of about $14,755**.

Project Total Cost: $17,100, ($57 per sign)

Payback: 1.15 years

1. http://www.energystar.gov/ia/partners/promotions/change_light/downloads/Fact%20Sheet_Lighting%20Technologies.pdf.
2. Efficiency Vermont, www.efficiencyvermont.com, 2006.
3. ENERGY STAR® 2007.

T12 vs. T8 vs. Super T8[4]

	T12	T8	Super T8
Watts	40	32	32
Mean Lumens	2,623	2,520	2,990
Mean LPW	65.5	78.8	93.4
Lumen Maintenance	78%	90%	95%
CRI	62	75	85

LPW: lumens per watt
CRI: color rendering index

Lighting Controls

Both low-tech and high-tech solutions for controlling lighting can prove to be effective. Many hospitals have adopted a lighting awareness campaign to train staff to turn off lights when rooms are not in use. Beyond that, high-performance lighting systems significantly reduce energy usage by ensuring electric lighting is used only when necessary, in the amount necessary. The following options can save energy without affecting patient care or facility functionality:

- Incorporating daylighting controls in patient rooms and public spaces with large window areas.
- Integrating controls that enable continuous dimming (100 to 5 percent lamp power).
- Installing occupancy sensors in spaces that are frequently unoccupied, such as restrooms, stairwells, service areas, and mechanical plants.
- Using sensors that include dimming and stepping options for spaces that utilize daylighting.
- Incorporating exterior motion sensors, which save energy and can enhance security.

Daylighting

Daylighting involves architectural designs intended to take advantage of natural light. Public spaces and patient rooms that incorporate natural light offer many benefits.

- Daylighting, in combination with energy-efficient lighting, can lessen lighting power density in office areas from 2.2 W per square foot to 0.88 W per square foot, without a reduction in measured light levels.[5]
- Daylight produces less heat per unit of illumination than most electric lights, reducing cooling loads when properly controlled.
- Decreased demand for electric lighting, particularly during peak periods (i.e., daytime and summer), yields additional energy cost savings.
- A well-configured patient room can result in cost reductions of about $30 annually per patient bed, with patient comfort level unaffected.[6]
- Reduced dependence on electric lighting enables limited electricity to be diverted to vital equipment and service areas during power outages.
- Exposure to natural lighting has been shown to provide non-energy benefits, such as a 12 percent increase in patient

4. Efficiency Vermont, www.efficiencyvermont.com, 2006.
5. University of Oregon Daylighting Lab Study for Hospitals.
6. Ibid.

recovery time,[7] 2.5 percent lower staff absenteeism,[8] increased productivity and job satisfaction, and heightened psychological well-being.

Lighting Best Practices

Today's lighting best practices and technologies can dramatically improve the energy performance of new and retrofitted hospitals. These are highlighted below.

- Specify and provide multiple levels of light—both general ambient and task lighting—in patient and exam rooms. In patient rooms, bright lights can be turned on during examinations but remain off the rest of the time. "Downtime" lighting permits patients to rest while lowering energy usage.
- Consolidate lamp inventories by eliminating unnecessary bulb types (different bulbs with the same purpose).
- Maximize matte or diffuse light-colored surfaces to encourage effective glare-free daylighting.
- Adopt a lighting strategy for a facility that can be integrated into future designs. A strategy should standardize technologies, apply control measures consistently (e.g., dimming, occupancy sensors, daylighting), and ensure a consistent look and feel throughout the hospital.

When employed as part of a facility-wide energy management program, a lighting strategy can help hospitals proactively manage energy use. Information generated through the program can help hospitals to redirect energy savings to patient care. This information also provides predictive maintenance indicators, helping the hospital to reduce equipment downtime.

Today's lighting best practices and technologies can dramatically improve the energy performance of new and retrofitted hospitals.

Case Study

St. Mary's Hospital

Leonardtown, Maryland • 2004

St. Mary's Hospital is a full-service, 103-bed facility that provides state-of-the-art emergency care as well as acute inpatient and outpatient care. In an effort to cut down on energy use and costs, the hospital evaluated its lighting. After a facility audit determined outdated T12 fluorescent lamps and T8s with magnetic ballasts were draining energy, the hospital replaced them with more efficient lighting options.

Details

- Fixtures with T12 fluorescent lamps with magnetic ballasts were upgraded to 28 W T8 fluorescents with electronic ballasts.
- Where T8 fluorescents already were in place, magnetic ballasts were replaced with electronic ballasts.

Results

- Project payback was 4.35 years.
- After the payback period, the hospital's $20,759 annual energy savings was added to its operating budget.
- Maintenance costs were reduced due to longer lamp life.
- Old lamps and ballasts containing PCBs were sent to an EPA-licensed recycling center.

7. St. Joseph's Hospital Daylighting Study (http://archone.tamu.edu/faculty/lbeltran/Pubs/Choi_Beltran_AsiaPacific_2004.pdf).
8. Kaplan McLaughlin Diaz (KMD) Study.

SSL: Lighting's Future

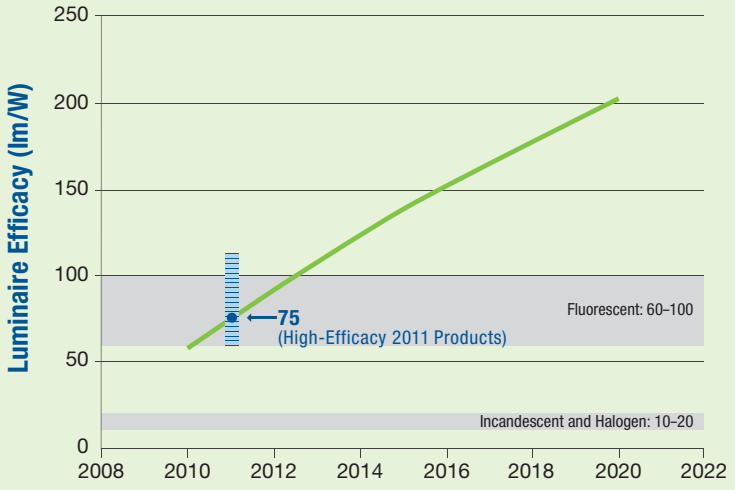
DOE and its partners are working to accelerate advances in solid-state lighting (SSL). SSL is an emerging LED technology that promises to fundamentally alter lighting. No other lighting technology offers as much potential to save energy and enhance building environments—important factors as our nation seeks solutions to challenges related to energy usage and climate change. DOE estimates that by 2030, SSL could reduce the annual U.S. electricity consumption by roughly 25 percent (compared with a scenario in which there is no SSL in the market). This represents enough energy to illuminate 95 million U.S. homes.

For commercialization of SSL products to be successful, purchasers must have confidence that products are well designed, accurately represented, and perform to their expectations. DOE-supported programs that address these concerns follow.

- Through the DOE-sponsored SSL Quality Advocates program, luminaire manufacturers voluntarily pledge to label their products with the Lighting Facts™ label. The label attests that industry-standard testing has been used to verify the performance of the products manufacturers make and distribute.
- The Next Generation Luminaires™ Solid-State Lighting Competition, sponsored by DOE, the Illuminating Engineering Society of North America, and the International Association of Lighting Designers, encourages technical innovation and promotes excellence in the design of energy-efficient LED luminaires for commercial lighting applications.
- GATEWAY Technology Demonstrations showcase high-performance LED products in a variety of commercial and residential applications, providing real-world experience and data on state-of-the-art SSL product performance and cost effectiveness. Demonstrations enable host sites to evaluate and refine lighting requirements before making large-scale purchasing decisions. Results are shared through the DOE SSL Web site, workshops, Webcasts, and other demonstration-related activities. Hospitals can apply to participate in demonstrations of exterior SSL technologies.
- The Commercially Available LED Product Evaluation and Reporting (CALiPER) program supports the testing of a wide array of SSL products available for general illumination. More than 250 products have been tested to date, with results that can be accessed for noncommercial, educational purposes through DOE's SSL Web site. DOE publishes detailed test reports, summary reports after each round of testing, and benchmarking reports that help users compare LED products with conventional lighting technologies.

These programs are just part of DOE's comprehensive strategy to accelerate the development and market introduction of SSL lighting technologies. For more information about SSL and these programs, visit www.ssl.energy.gov.

Solid-State Lighting Luminaire (Fixture) Performance Curve



The efficacy of LED light sources has already surpassed that of incandescent lighting and will continue to improve. By 2015, LED luminaires (fixtures) will be capable of luminaire efficacies exceeding 150 lm/W, more than twice that of a typical fluorescent fixture. Lowering the drive current applied to the LEDs can increase efficacy. The high-efficacy 2011 products shown on the graph achieve 75 lm/W using a standard drive current, but there are other high-efficacy products on the market that range from 60 lm/W to 110 lm/W, depending on the drive current.
Source: 2011 DOE SSL R&D Multi-Year Program Plan

Hospital Energy Alliance

HEA is a forum in which healthcare leaders work together with DOE, its national laboratories, and national building organizations to accelerate market adoption of advanced energy strategies and technologies.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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www.eere.energy.gov/informationcenter

Commercial Building Initiative

For more information, contact:
Kristen Taddonio
Building Technologies Program
Energy Efficiency and Renewable Energy
U.S. Department of Energy
kristen.taddonio@ee.doe.gov
commercialbuildings.energy.gov/hospital

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