06 LIGHTING

Overview

Lighting systems affect the physical and emotional well-being of a building's occupants, contribute powerfully to aesthetic design, produce a significant amount of heat and consume lots of electrical energy—up to 40% of a building's energy use. Widespread use of efficient lighting would reduce the nation's demand for electricity by more than 10%. This would save nearly $17 billion in rate payer bills and would significantly reduce pollution generated by power plants. A well-designed lighting plan optimizes energy use by balancing the three components of proper lighting—the source, the distribution and the controls.

Lighting systems consist of:

- Lamps
- Ballasts (for fluorescent lamps)
- Luminaires (complete lighting units)
- Lighting controls
- Daylighting (such as windows, skylights, or light shelves)

"People habitually switch lighting on more often than they switch lighting off."

Lamps are incandescent, fluorescent, high intensity discharge (HID) or low-pressure sodium (LPS). The amount of light radiated by a lamp is measured in lumens or the ratio of lumens per watt of electric input. Lamp selection is typically based on efficacy, color temperature, color rendering (the effect of a light source on the color appearance of an object), life and lumen maintenance, availability, switching, dimming capability and cost.

Lighting controls are used to increase efficiency in lighting systems through daylight harvesting, task tuning (tailoring the lumens needed for the task), lumen maintenance and occupancy sensing. Lighting control equipment includes photo cells, dimmers, occupancy sensors, switches or timers as well as whole building systems.

Benefits

A comprehensive lighting upgrade typically yields:

- Highly profitable energy savings on a low-risk investment
- Energy saving opportunities for subsequent building system upgrades
- Increased awareness of other energy-efficiency opportunities
- Improved productivity—up to 15% —achieved by enhancing visual comfort and reducing eye fatigue

Quick Fact

According to the Illuminating Engineering Society of North America, 100 watts is 10% light and 90% heat. A 100 watt incandescent bulb provides only 17 lumens per watt while a 32 watt T8 fluorescent tube provides around 80 lumens per watt.

Strategies

There are two primary sources of light: natural daylight and electric lighting. Maximizing the use of daylighting and using high-efficiency electric lighting—only "on" when required—yield significant savings on electricity costs.

Post-occupancy studies indicate a potential for a 50–80% decrease in lighting energy costs with daylighting. This decrease typically occurs during peak demand periods when electricity prices are highest. Less electric lighting means less heat produced by the lighting system, which further reduces energy consumption by reducing the load on the air-conditioning system.

LEED®-CI v2.0: Commercial Interiors

By implementing various energy efficient lighting strategies, your project may be eligible for the following:

Energy & Atmosphere

EA Credits 1.1–1.2: Optimize Energy Performance, Lighting Power & Controls

Indoor Environmental Quality

EQ Credit 6.1: Controllability of Systems, Lighting

EQ Credits 8.1–8.3: Daylight and Views

CASE STUDY

Port of Seattle Pier 69 Headquarters

In 2005, the Port of Seattle's headquarters at Pier 69 underwent an extensive lighting upgrade.

Electric lighting was changed from more expensive biax lamps to T5HO linear fluorescent lamps with double the life rating. Watts per lineal foot dropped from 40 to 30 while light levels nearly doubled. Metal halide luminaires consuming 460 Watts were changed to T5HO fluorescent luminaires using 120 Watts — light levels increased from 15–20 foot-candles to 35–45 foot-candles. The port received a $17,000 incentive through Seattle City Light and is saving an estimated 120,000 kW hours per year.

Money Back

Seattle City Light has a variety of incentive programs that can help pay for a portion of the up-front costs for lighting equipment efficiency upgrades. Reimbursements are offered on:

- *T-8 fluorescent fixtures with electronic ballasts*
- *Metal halide fixtures*
- *High-pressure sodium fixtures*
- *T-12 to T-8 fluorescent retrofits*
- *Incandescent to fluorescent retrofits*
- *Exit signs*
- *HVAC controls*
- *Central lighting controls*
- *Daylighting controls*
- *Occupancy sensors*

Call (206) 684-3800 or visit ***seattle.gov/light/conserve/business***

Checklist

- ☐ **Use lighting controls** as a management system to increase occupant comfort and save the maximum amount of energy—up to 50% or more.
  - Whole building integrated lighting strategies must be simple enough to be understood and used by the tenant and the facilities management team.
  - Timers, dimmers, and occupancy or daylighting sensors are the most common strategies.
  - Consider occupancy sensors at a minimum in restrooms, storage and copy rooms, private offices, and meeting rooms.
- ☐ **Consider task-lighting** which directs the light where it is most needed.
- ☐ **Design for the "best practice" amount of lighting needed for the task.** Compare the light output of multiple light sources (windows, skylights, task lights, overhead electric lighting) to the amount of light needed.
- ☐ **Design or retrofit with the most energy efficient lamp technology.** The T5 lamp has become the standard for new construction and can commonly be used as a replacement for 40-watt T12 lamps.
- ☐ **Employ daylighting where possible.** The effectiveness of daylighting depends primarily on floor to ceiling height, window configuration, and depth from exterior window wall to the core. At best, daylight from windows provides light a distance of about two times the window head height.
- ☐ **Utilize the Lighting Design Lab.** Tour the lab to learn about and see the latest technology, attend a workshop or schedule a free lighting consultation. To test how a proposed lighting fixture installation will appear, set up a free mock-up. Review their commercial lighting guides and other great online resources.
- ☐ **Install skylights on the top floor** to significantly increase the daylighting penetration into the space.
- ☐ **Provide open office plans** and specify interior partitions with lower heights to allow better daylight access to all.
- ☐ **Consider clear glazing in interior walls** to provide daylight and views.
- ☐ **Select light-colored interior finishes** for walls, ceilings, and flooring. Light colors bounce and reflect daylight.
- ☐ **Use the actual reflectance of interior finishes**—versus rules of thumb—when calculating how many fixtures are needed.

Resources

www.seattle.gov/light Search for financial incentives.

www.daylightinglab.com Find daylighting consultants and modeling assistance.

www.lightingdesignlab.com Find education and consultant resources.

www.betterbricks.com Search "lighting efficiency" for articles and case studies.

www.newbuildings.org/lighting Review studies and reports on lighting efficiency.

www.energystar.gov Search under "Building and Plants" for guides and resources to energy efficient buildings.