

# Lighting Systems Can Boost Productivity and Cut Costs

## TECHNICAL DATA SHEET

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A poorly designed or outdated lighting system can negatively affect a business's bottom line. Productivity can suffer, energy costs can rise unnecessarily, and customers may buy fewer products in a retail store. What is poor lighting? Areas that are underlit, overlit, or have problems such as glare, reflections, and poor color rendition.

Well-designed lighting systems help workers and students see their daily tasks without physical strain or discomfort. They are visually pleasing and convey a positive image to customers and clients. No matter the building type or use, it is possible to design energy efficient lighting systems that maximize worker productivity, enhance sales areas, and save money.

### GOOD LIGHTING DESIGN BENEFITS

- Energy and cost savings
- Realistic payback periods
- More productive workers
- Happier customers

Businesses should seek certified lighting experts when planning a new building, retrofitting an existing space, or redesigning a lighting system. Organizations such as the National Council on Qualifications for the Lighting Professions (NCQLP) and Association of Energy Engineers (AEE) certify lighting professionals who know how to translate designs into cost effective systems.

### LIGHTING 101

Light levels are measured in units called footcandles (fc), a unit of illuminance equal to one lumen per square foot. The Illuminating Engineering Society of North America (IESNA) has developed lighting standards and practices that are followed by reputable lighting designers and contractors. IESNA specifies footcandle levels for most lighting situations, from offices to manufacturing facilities to retail businesses. For example, IESNA recommends 30 to 50 fc of light for typical computer use. However, most offices are illuminated to 100 fc or more, which wastes energy.

### LIGHTING COMPONENTS AND SYSTEMS

Lighting systems come in all shapes and sizes, but they include three basic components: lamps/ballasts, fixtures, and control systems. Each component provides energy saving potential, as does the entire system. Lamp types include incandescent, compact and linear fluorescent, metal halide, and high pressure sodium models. All but incandescent models require ballasts to operate. Fixtures house the lamps and ballasts. Controls include occupancy and light sensors as well as timers. Controls can typically cost \$1 per square foot, but they are worth the cost. Without controls, an energy efficient system will not deliver the promised energy savings.

### BASIC LIGHTING USES: GENERAL, AMBIENT, AND TASK

Today's businesses are retrofitting existing lamps and ballasts with energy efficient options. However, they often fail to look at the bigger picture: Is the existing system actually providing the correct light levels? Today's lighting designers recognize that systems should meet general illumination needs as well as task-specific requirements.

General lighting provides consistent illumination throughout a space. For example, open office spaces are often lit by arranging fluorescent fixtures in a grid pattern for a "one size fits all" effect. General lighting systems should not require additional light fixtures, such as desk lamps. However, to meet task-specific lighting needs, these systems often provide much more light than needed in circulation areas, office spaces, and meeting rooms. This excess lighting wastes energy and costs money.

Ambient lighting provides general illumination too, but it is used as one part of a two-part system: ambient lighting paired with task lighting. Ambient light can be provided by direct or indirect fixtures that distribute most light output upward, usually to the ceiling and/or walls, where it is reflected back down to the workspace. This lighting strategy provides indirect light and allows fixtures to be spaced further apart. It also reduces shadows and creates a sense of openness in the building space.

Task lighting fixtures distribute light directly at task areas and provide customized light levels based on specific needs. Task lighting fixtures include desk lamps, products mounted under shelves or cabinets, or those attached to office partitions. The task/ambient lighting system offers greater flexibility and saves

The capital costs of a newly installed lighting system in offices can range from \$2.50/square foot to \$6.00/square foot.

more energy than general lighting systems. This combination system can be configured to meet multiple lighting needs in one office, from circulation areas to meeting rooms, office spaces, work surfaces and lab areas. For example, a general lighting system might require a ceiling-mounted three lamp T8 fluorescent fixture (approximately 87 watts) to provide enough light at a work surface to perform office tasks. A 13-watt compact fluorescent task lamp can provide the same light levels at the work surface—a savings of 74 watts of electricity.

One additional lighting type, daylighting, takes advantage of natural light to offset the need for electric lights during much of the day. In most cases, new construction or renovation is the time to add daylighting features. For more information about daylighting, visit [www.daylighting.org](http://www.daylighting.org).

Two other elements affect light quality and distribution: color rendering and correlated color temperature. Lamps differ in their ability to render color correctly. The color rendering index (CRI) indicates how “natural” an object’s colors will appear when illuminated. For example, incandescent and T8 fluorescent lamps produce light that offers the best color quality, while color rendition is low with light from standard high pressure sodium lamps.

A second index, the correlated color temperature (CCT), describes the color appearance of light in terms of warmth or coolness. CCT is measured in degrees Kelvin and lamps with a CCT rating below 3200 K are considered “warm” light sources, while those with a CCT above 4000 K are considered “cool.” Warmer lamp colors are best in hospitality spaces and cooler colors are best when strong, direct task light is needed.

Lighting professionals are now designing energy efficient task/ambient lighting systems that ensure CRI and CCT levels match a business’s lighting needs. This strategy provides layers of lighting, with light output that more directly targets specific needs.

### LIGHTING CHALLENGES AND SOLUTIONS

Additional factors contribute to poor lighting. Glare is a common source of visual discomfort. It can come from overhead lights, windows, or reflections in a computer monitor. Fixtures that distribute light to walls and ceilings can control glare, as can adjustable blinds/shades and the use of daylight when possible.

Veiling reflections occur when light strikes a task and produces shiny reflections that cause eyestrain and impaired productivity. To correct this problem, light should be masked or redirected. For example, place a lamp to one side or the other, not directly over the task.

Brightness differences can cause eyestrain or distraction. A room’s surfaces — walls, ceilings, and furnishings — should have light colored matte (not glossy) finishes. Lighter-colored rooms reflect light, provide better daylight distribution, and are visually more comfortable. A lighter-colored room also uses 70 percent less energy to achieve brightness when compared with darker rooms.

### LIGHTING CHECKLIST

- Find a certified lighting designer or contractor that meets IESNA standards when assessing a business’s lighting needs. Lighting experts should use photometric data to ensure that adequate footcandle levels are met for key business tasks.
- Choose energy efficient components and systems.
- Use the control systems—they work.
- In new facilities or renovations, incorporate daylighting into the design.