

FACT SHEET

LED (Light Emitting Diode) LIGHTING

LED lighting is a rapidly changing work in progress – everything you knew about LEDs last year is probably out of date today. The great potential of LEDs' efficiency and long life has caused manufacturers to devote considerable resources to improving manufacturing processes and costs, while new applications continue to appear.

HOW ARE LEDs DIFFERENT FROM OTHER LIGHTING, LIKE INCANDESCENT OR FLUORESCENT?

The advantages — and drawbacks — of LEDs stem primarily from the fact that they are completely unlike other forms of lighting. LEDs emit light in a specific direction, while an incandescent or fluorescent bulb emits light — and heat — in all directions. LED lighting uses both light and energy more efficiently.

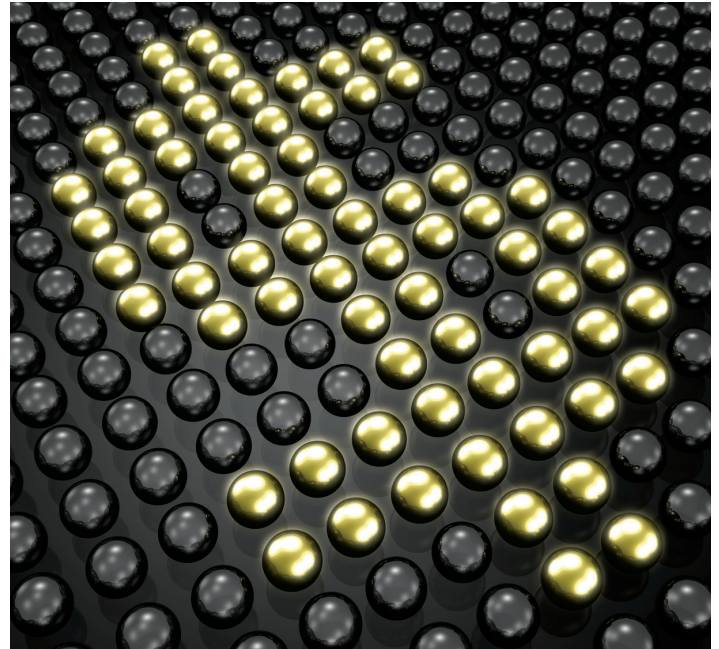
An incandescent light bulb produces light when electricity is passed through a metal filament until it becomes so hot that it glows. In a CFL (compact fluorescent light), an electric current is driven through a tube containing gases, producing ultraviolet light that is transformed into visible light by the fluorescent coating (phosphor) on the inside of the tube.

LEDs are made of very thin layers of semiconductor material. One layer will have an excess of electrons, while the next will have a deficit of electrons. This difference causes electrons to move from one layer to another, which generates light. The more electrons that pass across the boundary between layers, known as a junction, the brighter the light. Impurities within the semiconductor, which are introduced during the manufacturing process, are used to create the required electron density. Different semiconductor materials and different impurities result in different colors of light emitted by the LED.

One or more LED chips (about one square millimeter each) are mounted on a heat-conducting material called a heat sink and enclosed in a lens. The resulting device, typically around 7 to 9 millimeters per side, can be used separately or in arrays. A small amount of heat is released into the heat sink, but a well-designed LED is cool to the touch.

LEDs have several advantages over conventional light sources:

- **Directional light emission:** Because LEDs are mounted on a flat surface, they emit light hemispherically, rather than spherically, reducing wasted light and enabling light to be "aimed."
- **Near-monochromatic light:** An individual LED chip emits light in a specific wavelength (color), which makes them efficient for colored light applications.
- **Size:** LED lights can be very compact and low profile — an advantage where space is at a premium.
- **Breakage resistance:** LEDs use no breakable glass or filaments, so they are resistant to vibration and well suited to locations where breakage is an issue.
- **Cold temperature operation:** LED performance actually increases as operating temperatures drop.



- **Rapid cycling capability:** Traditional light sources will burn out sooner if switched on and off frequently, but LED life and lumen maintenance is unaffected by rapid cycling.
- **Controllability:** Some LEDs are compatible with electronic controls to change light levels and color characteristics.
- **No infrared (IR) or ultraviolet (UV) emissions:** Unlike other forms of lighting, LEDs intended for lighting do not emit IR or UV radiation.

LED USAGE

LED's monochromatic light makes them particularly efficient for colored light applications. In traffic lights, for example, LEDs have largely replaced the old incandescent plus colored filter systems. While a red filter on an incandescent lamp can block 90 percent of the visible light from the lamp, red LEDs provide the same amount of light for about one-tenth the power (12 watts compared to 120+ watts) and last many times longer.

LED lighting uses both light and energy more efficiently.

With their other unique characteristics — low profile, lower energy consumption, good performance in cold environments, and breakage resistance — LEDs are well suited to a variety of indoor and outdoor signage.

PUTTING LEDS TO WORK

One way businesses can take advantage of LEDs' efficiency is by replacing incandescent exit signs, which operate continuously, with LED exit signs. A relatively fast and inexpensive project, even a smaller buildings can realize solid energy savings. A typical exit sign's electricity consumption drops from about 40 watts (incandescent) to about 5 watts, saving 300 kWh per year, per sign.

| Exit Sign Energy Use by the Numbers | | | | |
|-------------------------------------|-------------------|--------------------|-------------------|--|
| Exit Sign Lighting Technology | Annual Energy Use | Annual Energy Cost | Lamp Service Life | Annual Carbon Dioxide (CO ₂) Pollution |
| LED | 44 kWh | \$3.50 | 10+ years | 72 pounds |
| Fluorescent/CFL | 140 kWh | \$11 | 10.8 months | 230 pounds |
| Incandescent | 350 kWh | \$28 | 2.8 months | 574 pounds |

Assumes 24-hour, 365-day-per-year operation at an average electricity cost of \$0.08 per kWh. Exit sign electricity consumption is assumed to be 40 watts for incandescent signs, 16 watts for fluorescent signs, and 5 watts for LED signs. Actual sign wattages may vary. Pounds of pollution are based on the national average emissions factor for electricity generation in the United States. 1.64 pounds CO₂ per kWh. Source: ENERGY STAR®.

LED exit signs also offer lower maintenance, and they are typically brighter — and easier to see in an emergency — than comparable incandescent or fluorescent lights. ComEd's *Smart Ideas for Your Business* program offers incentives of \$20 per exit sign to help offset the retrofit cost.

LEDs are also being used in outdoor channel signs to reduce energy and maintenance costs. Strings of LEDs can take the place of neon as well, and lighting manufacturers continue to create new ways to use LEDs in signage. ComEd's *Smart Ideas for Your Business* program offers incentives for replacing incandescent, neon and other low-efficiency signs with LED signs, ranging from \$6 to \$25 per sign.

PARKING LOTS AND OTHER OUTDOOR AREAS

Recent advances in LED technology have resulted in a new option for lighting outdoor areas, including streets, roadways, parking lots and pedestrian areas. LEDs offer several potential advantages over metal halide and high-pressure sodium lighting:

- Without glass or filaments, LED lights are less prone to breakage from vandalism or accidents.
- LEDs turn on instantly without run-up time or restrike delay.
- Their compact and low profile size means that even "large" LED fixtures producing thousands of lumens can be lower-profile than their HID counterparts.
- Their directional light emission reduces light trespass and "sky glow."
- Cold environments do not affect them.
- They contain no mercury, lead, or other known disposal hazards.

Retrofitting outdoor or parking garage HID fixtures with LEDs may qualify for incentives of \$15 to \$110 per fixture from *Smart Ideas for Your Business*.



LED REFRIGERATION CASE LIGHTING

Refrigerated display cases in grocery stores and convenience stores are typically lit by fluorescent systems. As temperatures drop, however, light output for fluorescent lamps can decrease by as much as 60 percent. LED lighting actually performs better in colder temperatures, and LED lighting uses half the energy of fluorescent systems while emitting less heat.

The low profile of LEDs again is an advantage in the close quarters of a refrigerated display case, and because the light from LEDs can be "aimed," they help make displays effective as well as efficient. Replacing fluorescent refrigerated case lighting with LED illumination can qualify for prescriptive incentives of \$20 per door.

SPECIFICATIONS FOR LED LIGHTS

ComEd's *Smart Ideas for Your Business* program has defined specifications that LED lights must meet to be eligible for incentives. These specifications are detailed on the application form.

- All new exit signs or retrofit exit signs must be UL924 listed, have a minimum lifetime of 10 years and have an input wattage ≤ 5 watts per face.
- LED recessed downlight luminaires up to 18 watts or screw-in base lamps must have a minimum efficacy of 35 lumens per watt and must meet ENERGY STAR® version 1.1 criteria.
- Other LED lamps and downlight luminaires over 18 watts must:
 - Be tested to IESNA LM-79-08 — an industry standardized test procedure that measures the performance qualities of LED luminaires and integral lamps — by a third-party DOE-accredited lab.
 - Carry a warranty on the light source and power supplies of three years or more.
 - Have a minimum efficacy of 35 lumens per watt.
 - Have a CRI of 75 or above.

FOR MORE INFORMATION

Contact the *Smart Ideas* team at (888) 806-2273, visit www.ComEd.com/BizIncentives, or send an e-mail to ComEdSmartIdeas@KEMA.com.

