



# Energy Facts

## Energy Efficient Lighting

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With the steady rise in energy prices, many people are making a conscious effort to reduce their energy consumption. One of the easiest ways to lower energy consumption is to use energy efficient lighting. Energy efficient lamps and fixtures can be installed in all buildings including homes and businesses as well as outdoors. The initial cost of installing the energy efficient lighting may be a bit unsettling at first. But with some simple calculations, it's easy to see that switching to more efficient lighting will save money and you may be able to see your return much sooner than you think.

### Getting started

Before changing lamps and fixtures to energy efficient ones, it is important to evaluate your current lighting system. Changing to the wrong type of fixture could give too much or too little light or give a room poor color rendition. These factors are especially important in retail stores and office buildings. Another important consideration is the type of lamp or light fixture for the application. Some lamps like fluorescent operate poorly in cold or moist areas. Before purchasing a fixture or lamp, read the installation instructions and make sure it suits your needs.

### T-8 Fluorescent lighting

T-8 fluorescent lighting is a relatively new technology. At first glance it looks like any standard fluorescent fixture. Closer inspection shows an electronic ballast powering smaller diameter lamps that makes the fixture up to 75% more efficient. Two options exist for those who want to switch to T-8 lighting. If a fluorescent fixture exists, it can be retrofitted inexpensively with a T-8 ballast and lamps. New T-8 fixtures are available and can be purchased in different styles to meet most lighting requirements.

### Compact Fluorescent Lamps (CFL)

Compact fluorescent lamps (CFL) are the easiest and, in many cases, the least expensive way to switch an existing lighting design to energy efficient lighting. CFLs combine a fluorescent lamp and ballast into a lamp roughly the same size as a standard incandescent lamp. Most of these lamps have bases that screw into a standard light socket and this eliminates the need to change wiring or to hire an electrician. These lamps are sold with an equivalent incandescent wattage. An example would be a 15-watt CFL that gives off an equivalent amount of light to a 75-watt incandescent lamp. Another advantage of the CFL is its longer lamp life. An incandescent lamp will last from 750 to 2,000 hours of operation while a CFL will last 10,000 to 20,000 hours.

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## Important fluorescent lighting notes (tubular and CFL types):

- Fluorescent fixtures including CFLs are not dimmable unless they are purchased specifically for that purpose.
- Fixtures need to be enclosed when used in agricultural buildings.
- They lose efficiency in cold temperatures (for low temperature operation, use jacketed lamps or an enclosed fixture and use low temperature ballasts).
- Lamp life is shortened by frequently turning it off and on.

## High Intensity Discharge (HID) Lighting

In the right applications, high-intensity discharge (HID) lamps have overwhelming advantages over incandescent lamps. A measure of the output of a lamp is the number of lumens. Efficiency is given in lumens produced per watt consumed. While incandescent lamps have an efficiency of more than 12 lumens per watt, HID lamps can produce up to 198 lumens per watt.

HID fixtures come in four basic types.

- high-pressure sodium
- low-pressure sodium
- mercury vapor
- metal halide

Choosing which HID fixture is best to use depends on your intended application.

For use as a security light only, low-pressure sodium is the most efficient and has the longest life, but colors will not appear normal. For good color and high efficiency, use metal halide. The initial purchase price is significantly higher than that of the low-pressure sodium.

Mercury vapor lamps and fixtures are inexpensive, but their efficiency is the lowest of the HID sources. High pressure sodium has high efficiency, but it produces an excess of orange light. It is important to remember that HID fixtures are designed to work with specific lamps. Using the wrong lamp could cause damage to the lamp and fixture.

## HID notes

- They work well in all temperatures.
- They have a slow warm-up and restrike time. When turned off, they don't come back on for one to five minutes depending upon the type.
- Consider putting an incandescent fixture with a photocell to provide light in the event that there is a power interruption followed by a slow restrike time.
- Choose a lamp according to color requirements

## Initial Investment vs. Annual Savings

One of the main arguments against retrofitting to energy efficient lighting is the cost of switching lamps and fixtures. For example, a compact fluorescent lamp can be 24 times more expensive than a standard incandescent lamp. While it is initially more expensive to switch, a simple calculation will show the total cost of operation over the life of both lamps and show the total amount saved.

This example compares the operating cost of a 25-watt compact fluorescent lamp and a 100-watt incandescent lamp both operating 2,500 hours a year and both having the same light output. The energy cost used is \$.10 per kilowatt hour.

### Compact Fluorescent Lamp

$$\frac{2,500 \text{ hrs} \times 25\text{W}}{1,000} \times \$0.10 = \$6.25 \text{ Per year}$$

### Incandescent Lamp

$$\frac{2,500 \text{ hrs} \times 100\text{W}}{1,000} \times \$0.10 = \$25.00 \text{ Per year}$$

**Energy Savings per year: \$18.75**

In this scenario, the cost of the CFL would be paid for in the first year. Another aspect to consider is the number of lamps used during this period of time. In the previous example, the CFL lamp life was 6,000 hours and the incandescent lamp life was 750 hours. Within the 2,500 hour period of time, the incandescent lamp would have been changed at least three times, while at the same time, the CFL would have only reached half of its life expectancy. While there is an energy savings in this instance, keep in mind that energy efficient lighting only saves money while energy is used. In the case of a closet, storage room, or other

such area where lights are used only occasionally, it is more cost effective to use incandescent lighting.

## Other Methods

The use of occupancy sensors is another good way to conserve electricity. An occupancy sensor detects movement of heat within an area (such as a person walking into a room) and turns the lights on. When a person leaves the room, a timer counts for a set number of minutes and turns the light off. This is ideal for rooms where the lights are frequently left on. There is also switch that allows the light to be manually turned on and off. These sensors come in a number of styles including a ceiling mounted unit, a unit that mounts in place of a standard light switch, and a unit made to be mounted outdoors.

Dark colors in a room will absorb light and will require more light fixtures to maintain the desired lighting level. The use of light colors on wall and ceiling surfaces greatly reduces the number of light fixtures needed and cuts energy consumption.

Lighting dimmers should be used only in areas where lighting levels need to be changed. Dimmer switches are solid-state electronic devices that consume energy even when they are at full intensity. An alternative to using dimmers is to use multiple fixtures on multiple switches. Turning the switch on or off can change lighting levels.

## Energy Star

It is a good idea to make sure your energy efficient lamps and fixtures meet or exceed Energy Star require-

ments. Energy Star is a cooperative effort among the Environmental Protection Agency, the Department of Energy, and industry that sets standards for energy efficiency. In lighting these standards include lamp life and light output.

An important safety note: make sure that devices you use are listed by testing labs like UL, ETL, or CSA. Testing laboratories set reliability and safety standards that must be met before their symbol (UL, ETL, CSA) can be displayed on the product.

## Safety notes

- Be sure to check with local code authorities before attempting to install wiring and electrical devices.
- Make sure all wiring is installed in accordance with the National Electrical Code®.
- Read and understand manufacturer installation instructions before installing wiring and fixtures.
- When changes in wiring are required, it is recommended that a licensed electrician make them.

MSUE gratefully acknowledges the expertise and experience of the author of this fact sheet on energy efficient lighting systems.

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## Glossary

*Compact Fluorescent Lamp (CFL)* - newer, highly efficient lamps that screw into existing light bulb sockets (in most cases) and resemble traditional bulbs in appearance rather than the tubular style of regular fluorescent lamps.

*Fluorescent lamp* - a tubular electric lamp having a coating of fluorescent material on its inner surface and containing vapor whose bombardment by electrons from the cathode provides ultraviolet light that causes the material to emit visible light.

*High Intensity Discharge lighting (HID)* - formerly outdoor or special use lights that now are being produced for indoor use; HID greatly increases the amount of light produced.

*Incandescent lamp* - an electric lamp in which a filament gives off light when heated to incandescence by an electric current (incandescence means white, glowing, or luminous with intense heat).

*Lamp* - "light bulb"

*Lumen* - a unit of luminous flux equal to the light emitted in a unit solid angle by a uniform point source of one candle intensity.

*Restrike Time* - the time it takes for a lamp to reach full brightness when the lamp is first turned on; or if the lamp is burning, the time it takes for the lamp to restrike when power is switched off and then back on.

### Energy Team Acknowledgments

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