ENERGY MANAGEMENT FREQUENTLY ASKED QUESTIONS (v10.09)

When should you turn your lights off when leaving a room?

The cost effectiveness of when to turn off lights depends on the type of lights and the price of electricity. The type of light is important for several reasons. All types of lights have a nominal or rated operating life, which is the total number of hours that they will provide a specified level or amount of light. However, the operating life of all types of light bulbs is affected by how many times they are turned on and off. The more often they are switched on and off, the lower their operating life. The exact number of hours that switching lights on and off reduces the total operating life depends on the type of light and how many times it is switched on and off.

Incandescent Lighting

Incandescent lights (or bulbs) should be turned off whenever they are not needed. Nearly all types of incandescent light bulbs are fairly inexpensive to produce and are relatively inefficient. Only about 10%–15% of the electricity that incandescent lights consume results in light—the rest is turned into heat. Turning the light(s) off will keep a room cooler, an extra benefit in the summer. Therefore, the value of the energy saved by not having the lights on will be far greater than the cost of having to replace the bulb.

Fluorescent Lighting

The cost effectiveness of turning fluorescent lights off to conserve energy is a bit more complicated. For most areas of the United States, a general rule-of-thumb for when to turn off a fluorescent light is if you leave a room for more than 15 minutes, it is probably more cost effective to turn the light off. Or in other words, if you leave the room for only up to 15 minutes, it will generally be more cost effective to leave the light(s) on. In areas where electric rates are high and/or during peak demand periods, this period may be as low as 5 minutes.

Fluorescent lights are more expensive to buy, and their operating life is more affected by the number of times they are switched on and off, relative to incandescent lights. Therefore, it is a cost trade-off between saving energy and money by turning a light off "frequently" and having to replace the bulbs "more" frequently. This is because the reduction in usable lamp life due to *frequent* on/off switching will probably be greater than the benefit of extending the useful life of the bulb from reduced use. By frequent we mean turning the light off and on many times during the day.

It is a popularly held belief that fluorescent lights use a "lot" of energy to get started, and thus it is better not to turn them off for "short" periods. There is an increase in power demand when a light is switched on, and the exact amount of this increase depends on the type of ballast and lamp. The ballast provides an initial high voltage for starting the lamp and regulates the lamp current during operation. There are three basic types of ballasts: magnetic (of which there are energy-efficient and not so energy-efficient types), cathode-disconnect, and electronic. All types can operate two or more lamps simultaneously. There are three main methods that are used in a lamp's ballast to start the lamp: preheat, rapid-start, and instant-start.

In any case, the relatively higher "inrush" current required lasts for half a cycle, or 1/120th of a second. The amount of electricity consumed to supply the inrush current is equal to a few seconds or less of normal light operation. Turning off fluorescent lights for more than 5 seconds will save more energy than will be consumed in turning them back on again. Therefore, the real issue is the value of the electricity saved by turning the light off relative to the cost of relamping a fixture. This in turn determines the shortest cost-effective period for turning off a fluorescent light.

The value of the energy saved by turning a fluorescent light (or array of lights) off depends on several factors. The price an electric utility charges its customers depends on the customer "classes," which are typically residential, commercial, and industrial. There can be different rate schedules within each class. Some utilities may charge different rates for electricity consumption during different times of the day. It generally costs more for utilities to generate power during certain periods of high demand or consumption, called peaks. Some utilities can charge commercial and industrial customers more per kilowatt-hour (kWh) during peak periods than for consumption off-peak. Some utilities may also charge a base rate for a certain level of consumption and higher rates for increasing blocks of consumption. Often a utility adds miscellaneous service charges, a base charge, and/or taxes per billing period that could be averaged per kWh consumed, if these are not already factored into the rate.

Why should people switch to CFLs?

Switching from traditional light bulbs (called incandescent) to CFLs is an effective, simple change everyone in America can make right now. Making this change will help to use less electricity at home and prevent greenhouse gas emissions that lead to global climate change. Lighting accounts for close to 20 percent of the average home's electric bill. ENERGY STAR qualified CFLs use up to 75 percent less energy (electricity) than incandescent light bulbs, last up to 10 times longer, cost little up front, and provide a quick return on investment.

If every home in America replaced just one incandescent ligh t bulb with an ENERGY STAR qualified CFL, in one year it would save enough energy to light more than 3 million homes. That would prevent the release of greenhouse gas emissions equal to that of about 800,000 cars (2008 Energy Star Government).

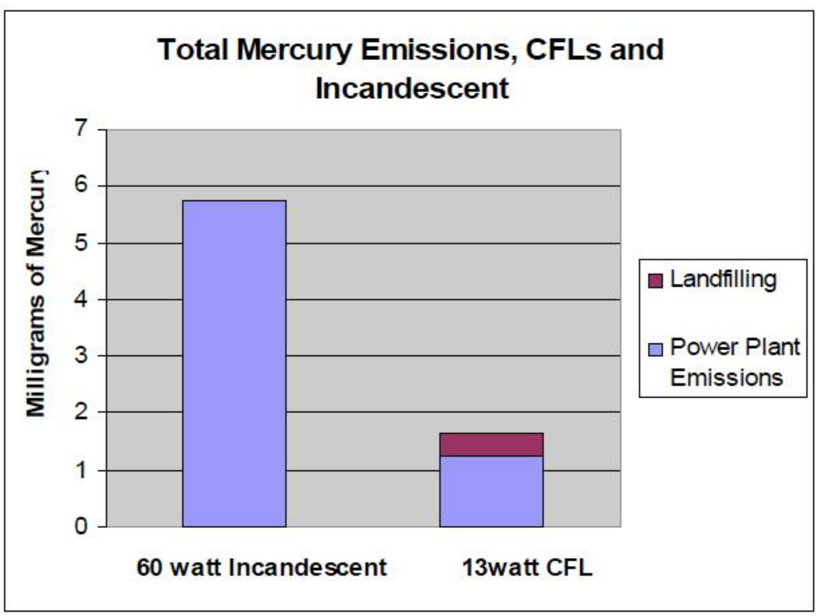
<u>I can't seem to get used to the light given off from CFLs. Is it as good as the light given off by incandescent light bulbs.</u>
In the May 2007 issue of *Popular Mechanics*, they tested seven popular compact fluorescent light bulbs (CFLs) <http://www.popularmechanics.com/home_jour nal/home_improvement/4215199.html?ser ies=15> and found that the brightness and overall light quality in all of them topped that emitted by traditional incandescent bulbs. , In other words, the new fluorescent bulbs aren't just better for both your wallet and the environment, they produce better light.

<u>I've heard that compact florescent lights aren't necessarily a better choice for the environment over incandescent light bulbs because they have mercury in them. Is that correct?</u>
The short answer to this question is: because they use less energy, they are better for the environment than the environmental effects of burning fossil fuels to create electricity.
A more detailed answer is: CFLs contain a very small amount of mercury sealed within the glass tubing – an average of 4 milligrams. By comparison, older thermometers contain about 500 milligrams of mercury – an amount equal to the mercury in 125 CFLs. Mercury is an essential part of CFLs; it allows the bulb to be an efficient light source. No mercury is released when the bulbs are intact (not broken) or in use.

Most makers of light bulbs have reduced mercury in their fluorescent lighting products. Thanks to technology advances and a commitment from members of the National Electrical Manufacturers Association, the average mercury content in CFLs has dropped at least 20 percent in the past year (from 2007 to 2008). Some manufacturers

EPA estimates the U.S. is responsible for the release of 104 metric tons of mercury emissions each year. Most of these emissions come from coal-fired electrical power. Mercury released into the air is the main way that mercury gets into water and bio-accumulates in fish. (Eating fish contaminated with mercury is the main way for humans to be exposed.)

Electricity use is the main source of mercury emissions in the U.S. CFLs use less electricity than incandescent lights, meaning CFLs reduce the amount of mercury into the environment. As shown in the table below, a 13-watt, 8,000-rated-hour-life CFL (60-watt equivalent; a common light bulb type) will save 376 kWh over its lifetime, thus avoiding 4.5 mg of mercury. If the bulb goes to a landfill, overall emissions savings would drop a little, to 4.0 mg. EPA recommends that CFLs are recycled where possible, to maximize mercury savings.



Because CFLs also help to reduce greenhouse gasses, other pollutants associated with electricity production, and landfill waste (because the bulbs last longer), they are clearly the environmental winner when compared to traditional incandescent light bulbs.

<u>Home much CO_2 can be saved by installing CFLs?</u>
Replacing the lights you use most often will get you maximum savings benefit, and replacing just a single bulb will keep half a ton of CO2 out of the atmosphere (Popular Mechanics 10/06).

What should I do with a CFL when it burns out?

EPA recommends that consumers take advantage of available local recycling options for compact fluorescent light bulbs. EPA is working with CFL manufacturers and major U.S. retailers to expand recycling and disposal options.

Are halogen bulbs better than CFLs and/or incandescents?

A halogen bulb is a long-lasting and far more energy-efficient form of the standard incandescent bulb—it can yield a 40 percent savings, by some accounts, depending on bulb type. Problem is, it runs a lot hotter—so hot, in fact, that lights using halogen bulbs are completely unacceptable for children's rooms, play areas or dorm rooms. Also off limits: old houses with creaky wiring. Such houses often experience a significant drop in the voltage supplying outlets. While a standard incandescent bulb actually lasts longer (but is dimmer) when voltage drops, a halogen bulb wears out more quickly because the lower voltage cannot sustain the chemical reaction that keeps its filament going.

Should I wait to replace my incandescent light bulbs with LEDs?

LED light bulbs will eventually probably be what we use to replace CFLs. CFLs are currently the best available household lighting technology to save money and energy and reduce our carbon footprint. LEDs will not be a commercially viable household lighting technology in the near future.

The current problems with using LEDs for normal light bulbs are manifold. For one, the light they produce is directional, meaning that they work great for things like flashlights where you want to point the light in one direction, but they don't work nearly as well for general room lighting. For another, individual LEDs generally aren't all that bright - individual ones don't produce a great deal of light, certainly not enough to light up a room. Another problem is that the process for making truly white LEDs pushes the very limits of technology.

In short, LED light bulbs are just barely at the edge of being commercially viable. One manufacturer that's producing direct replacement bulbs that replace normal 60-watt light bulbs is C. Crane, which is making what they call GeoBulbs. These bulbs cost an *astounding* $99.95 a pop, but they last for 30,000 hours and use only 7.5 watts of energy (less than the 13 watts or so an equivalent CFL would use, and far less than the 60 watts a comparable incandescent would use). Even better, they light up immediately like an incandescent and don't have disposal hazards (mercury) like CFLs do.

What are LEDs?

A Light Emitting Diode (LED) is a semiconductor device, which converts electricity into light. LED lighting has been around since the 1960s, but is just now beginning to appear in the residential market for space lighting. At first white LEDs were only possible by "rainbow" groups of three LEDs -- red, green, and blue -- by controlling the current to each to yield an overall white light.

This changed in 1993 when Nichia created a blue indium gallium chip with a phosphor coating that is used to create the wave shift necessary to emit white light from a single diode. This process is much less expensive for the amount of light generated.

Each diode is about 1/4 inch in diameter and uses about ten milliamps to operate at about a tenth of a watt. LEDs are small in size, but can be grouped together for higher intensity applications. LED fixtures require a driver that is analogous to the ballast in fluorescent fixtures. The drivers are typically built into the fixture (like fluorescent ballasts) or they are a plug transformer for portable (plug-in) fixtures. The plug-in transformers allow the fixture to run on standard 120-volt alternating current (AC), with a modest (about 15 to 20 percent) power loss.

What currently (current technology available) are the best household lighting applications for LEDs. LEDs are better at placing light in a single direction than incandescent or fluorescent bulbs. Because of their directional output, they have unique design features that can

be exploited by clever designs. LED strip lights can be installed under counters, in hallways, and in staircases; concentrated arrays can be used for room lighting. Waterproof, outdoor fixtures are also available. Some manufacturers consider applications such as gardens, walkways, and decorative fixtures outside garage doors to be the most cost-efficient.
LED lights are more rugged and damage-resistant than compact fluorescents and incandescent bulbs. LED lights don't flicker. They are very heat sensitive; excessive heat or inappropriate applications dramatically reduce both light output and lifetime. Uses include:

- Task and reading lamps
- Linear strip lighting (under kitchen cabinets)
- Recessed lighting/ceiling cans
- Porch/outdoor/landscaping lighting
- Art lighting
- Night lights
- Stair and walkway lighting
- Pendants and overhead
- Retrofit bulbs for lamps

<u>What are the advantages and disadvantages of LED's?</u>
LED lamps have many advantages over traditional lighting methods. These include:

- Low energy consumption – retrofit bulbs range from 0.83 to 7.3 Watts
- Long service life – LED bulbs can last up to 50,000 hours
- Durable – LED bulbs are resistant to thermal and vibrational shocks and turn on instantly from -40C° to 185 C°, making them ideal for applications subject to frequent on-off cycling, such as garages and asements
- Directional distribution of light – good for interior task lighting
- No infrared or ultraviolet radiation – excellent for outdoor use because UV light attracts bugs
- Safety and environmentally conscious – LEDs contain no mercury and remain cool to the touch
- Fully dimmable – LEDs do not change their color tint when dimmed unlike incandescent lamps that turn yellow
- No frequency interference – no ballast to interfere with radio and television signals
- Range of color – LEDs can be manufactured produce all colors of the spectrum without filters, they can also produce white light in a variety of color temperatures

There are some current disadvantages to LED lighting:

- LEDs are currently more expensive than more conventional lighting technologies, and may be hard to locate
- LEDs are very heat sensitive. Excessive heat or inappropriate applications dramatically reduce both light output and lifespan
- LEDs typically cast light in one direction at a narrow angle compared to incandescent or fluorescent lamps so lenses or reflectors are needed in fixtures to broaden the beam (if desired)

<u>What is an energy vampire or a phantom load?</u>
Many devices — including anything with a remote control or clock — continue to draw current when they're not in use. This graph shows how many watts of electricity common devices use when they're at work, standing idle or turned off. On average, idle machines use 11 percent of a home's electricity.