

ENERGY SERIES: What about Fluorescent Lighting?

Robert "Bobby" Grisso, Extension Engineer, Biological Systems Engineering
Martha A. Walker, Ph.D, Community Viability Specialist, Central District

How Much Can I Save by Switching to Compact Fluorescent Lamps?

While compact fluorescent lamps (CFLs) are initially more expensive, you should see a quick return on your investment when you replace your most frequently used incandescent light bulbs with CFLs. A 26- or 28-watt compact fluorescent lamp (CFL) can replace a 100-watt incandescent bulb, and it will last about 8,000 hours (compared an incandescent bulb, which usually lasts about 1,000 hours). Purchasing the 26- or 28-watt fluorescent bulb saves over 70 watts worth of energy. On average, each bulb can save more than \$30 in electricity costs over its lifetime and prevent more than 450 pounds of greenhouse-gas emissions.

Currently, a CFL costs more than a comparable incandescent bulb. However, you save the initial cost of the bulb many times over—and a CFL used an average of four hours a day will probably not need to be changed for at least four or five years.

For the biggest energy savings, replace incandescent or halogen bulbs with CFLs in the rooms where you spend the most time such as your family and living rooms and kitchen. It is estimated that if every household in the U.S. changed just one light bulb with an ENERGY STAR[®] rated CFL, the nation would save enough energy annually to light more than 2.5 million homes and prevent greenhouse gases equivalent to the emissions of nearly 800,000 cars.

How Do “Regular” Light Bulbs Work?

Incandescent bulbs or “regular” bulbs consist of finely coiled wire filaments in a glass bulb filled with an inert gas. The wire’s resistance to the flow of electricity causes it to become hot enough to glow. About 90% of the energy used by an incandescent bulb becomes heat and 10% becomes light.

How Do Fluorescent Lights Work?

A fluorescent bulb has a phosphor coating on its inner surface that converts ultraviolet energy into light. Over time, molecular vibrations inside the tube cause the phosphor coating to vibrate off. When the phosphor is used up, the tube won’t light.

Why Do Fluorescent Bulbs Use Less Energy?

More of the energy of a fluorescent bulb is converted into light and less into heat. By producing less heat (about 70% less heat for an ENERGY STAR[®] qualified CFL), fluorescent bulbs also save on air conditioning costs. You save twice!

What is Ballast?

Ballast is the part of a fluorescent bulb that excites the phosphor molecules. Depending on the bulb, it can either be attached—as in CFLs—or be part of the fixture as with fluorescent tubes. Ballasts can be magnetic or electronic and often last much longer than the bulbs themselves. Electronic “instant start” ballasts are often used for the 4-foot overhead fluorescent lighting fixtures frequently found in garages, shops, kitchens, and bathrooms. For other uses,

however, the instant start feature may be detrimental, because the bulb usually doesn't last as long. If you're interested in longer bulb life, look for CFLs that *don't* mention "instant-start" on the package.

How Do I Know How Much Light I'll get if the Wattage is Different?

Look at lumens. Lumens measure light output whereas watts measure energy use. For example, one 100-watt incandescent bulb on the market provides 1,710 lumens and uses 100 watts of energy. Its efficiency (or efficacy) is 17 lumens per watt (LPW), calculated by dividing 1710 by 100. A compact fluorescent bulb provides similar light output, an average of 1750 lumens, and uses 28 watts. Therefore, its efficiency is around 63 LPW (1750 divided by 28). The higher the LPW, the more light you receive for the energy used. Federal law, since 1995, requires both lumens and wattage be printed on bulb packages.

Is it True That Fluorescent Lighting is Harsher than Incandescent?

Not necessarily. Two factors, color rendering index and color correlated temperature, affect a light's harshness.

What is the Color Rendering Index (CRI)?

CRI measures the perceived color of objects under artificial light. It is measured on a scale of 0 to 100. The higher the number, the more natural and vibrant an object will appear; incandescent bulbs usually have 95+ values. Old-style fluorescents had values of 62 at best, which is why people complained in the past that fluorescents gave false colors. A CFL with a CRI of 80 or above is acceptable for everyday residential use; many fluorescent bulbs meet this requirement.

What is Color Correlated Temperature (CCT)?

CCT measures the appearance of the light itself—how "warm" or "cool" it seems. Oddly, the lower the CCT value is, the warmer the light; CCT values below 3100 K indicate a warm white light. Standard incandescent bulbs have a CCT of 2800. Many fluorescents have a CCT of 3000 and provide the same warm, white light that an incandescent bulb produces.

What about Halogen Bulbs?

Tungsten-halogen bulbs are another form of incandescent lighting. Halogen bulbs are slightly more energy efficient than standard incandescent bulbs, but are not as energy efficient as fluorescents. They are often used for merchandising because of their high CRI, which produces a crisp intense light. However, halogen bulbs burn at 700–1,100 degrees Fahrenheit, hot enough to fry an egg in three minutes, while CFLs generate little heat. Halogen torchieres have caused hundreds of fires resulting in serious or critical injury, and many college campuses have banned them.

What Should I Look For When Purchasing Bulbs?

Compare brands for price, lumens, wattage, hours of life, CRI, and CCT. (CRI will be a 2-digit number, and CCT will be a 4-digit number. Sometimes the CCT will be incorporated into the product number with the last two zeroes dropped off.) Check the CFL's packaging for any restrictions on use—for example, some should not be used in enclosed fixtures. Many are made for specific fixtures such as recessed cans, dimmer switches or outdoor fixtures.

Should I Turn Off the Fluorescent Lights When I Leave the Room?

Yes. Contrary to popular belief, turning off fluorescent lights saves energy. Frequent

switching does shorten bulb life, but electric bill savings will more than compensate.

Can I Use Dimmers with Fluorescent Lights?

Yes, provided you pick fluorescent bulbs that are dimmable. Manufacturers are beginning to produce dimmable fluorescents that will work in standard incandescent fixtures. Read package directions carefully—if incorrect bulbs are installed, it can cause fires.

Do CFLs Contain Mercury?

CFLs contain very small amounts of mercury sealed within the glass tubing—approximately 4 to 5 milligrams. Mercury is what enables the CFL to be an efficient light source. There is currently no substitute for it, but manufacturers have been trying to reduce the amount used. No mercury is released when the bulbs are in use and they pose no danger if used properly, although care should be taken when handling because the tubing is glass. Keep in mind that coal-fired power plants

emit mercury. By using CFLs, and thus reducing the amount of energy used, you are reducing the amount of power-generated mercury emissions. Also, mercury in the CFLs can be recaptured through recycling.

How Do I Dispose of CFLs?

Don't throw CFLs away with the household trash if there are better disposal options. Check <http://www.earth911.org>, which locates disposal options by zip code, call the U.S. Environmental Recycling Hotline at 1-877-327-8491, or contact your local waste-management agency for guidelines in your community. Additional information is available at: <http://www.lamprecycle.org>.

If no other disposal options are available except the trash can, place used CFLs in a plastic bag and seal it. Never send a CFL or other mercury-containing product to an incinerator.

Developed as part of the NASULGC/DOE Building Science Community of Practice.

DISCLAIMER – This piece is intended to give the reader only general factual information current at the time of publication. This piece is not a substitute for professional advice and should not be used for guidance or decisions related to a specific design or construction project. This piece is not intended to reflect the opinion of any of the entities, agencies or organizations identified in the materials and, if any opinions appear, are those of the individual author and should not be relied upon in any event.