

## What is a compact fluorescent lamp?

A compact fluorescent lamp (commonly known as a CFL) is a more energy-efficient alternative to a standard incandescent light bulb. CFLs (also called PL twin-tube, CFL twist tube, or BIAx lamps) can be used in table lamps, ceiling fixtures, wall fixtures and outdoor porch lights and lamp posts. The lamp life is about 10 times longer than a standard light bulb and uses less energy to operate.

CFLs have a different base (depending on wattage) to reduce the likelihood of using the incorrect ballast.

## Why choose compact fluorescent lamps (CFLs)?

CFL technology has several advantages over incandescent lighting technology: it is four times more efficient and lasts up to 10 times longer; it uses about 75% less energy; and produces 90% less heat while delivering more light. In addition, it provides a flicker-free start, soft-white light, is environmentally friendly, and comes in a variety of styles.

Although CFLs may be more expensive to purchase initially, you save money in the long run because CFLs use less energy and last longer. Energy-efficient CFLs can be used almost anywhere incandescent bulbs are used: in recessed fixtures, table lamps, ceiling fixtures, porch lights, vanity bars and more.

Just like incandescent bulbs, CFLs come in different color “temperatures” (i.e., soft white, bright white). If you want a light most like an incandescent, choose a CFL with a temperature around 2700K. For brighter task lighting, choose a higher temperature, around 3500K. The higher the color temperature, the bluer the light will appear.

## Why should people use CFLs?

Switching from standard light bulbs to CFLs is an easy, affordable change every American can make right now to reduce energy use at home and reduce greenhouse gas emissions that contribute to global climate change.

Did you know that lighting accounts for close to 20 percent of the average home’s electric bill? If every home in America replaced just one incandescent light bulb with an ENERGY STAR qualified CFL, it would save enough energy to light more than 3 million homes and prevent greenhouse gas emissions equivalent to those of more than 800,000 cars annually.

## I want to replace my 60-watt incandescent light bulb. How do I select the best CFL?

Finding an ENERGY STAR qualified CFL that will put out the same amount of light as your current incandescent bulb is easy. Manufacturers include product equivalency information on the packaging to help consumers choose a bulb that produces enough light. For example, if you are looking for an ENERGY STAR qualified light bulb to replace your 60-watt incandescent, look for words like “Soft White 60”, or “60 Watt Replacement” on the packaging.

You can also refer to the chart below to as a guide for selecting the right bulb. A watt is actually a measure of power consumption. When purchasing a light bulb, what you are really after is light output, which is measured in lumens. When you purchase a 60-watt incandescent bulb, you are getting about 800 lumens. By selecting a 13-watt ENERGY STAR qualified CFL instead, you can still get 800 lumens, but it requires much less power.

Energy Use Incandescent (Watts)	Minimum Light Output (Lumens)	Energy Use ENERGY STAR CFL (Watts)	Light Output (Lumens)
25	250	4 - 9	200 - 250
40	450	9 - 13	400 - 450
60	800	13 - 15	700 - 800
75	1100	18 - 25	1000 - 1100
100	1600	23 - 30	1500 - 1600
125	2000	28 - 40	1900 - 2000
150	2600	30 - 52	2500 - 2600

Be sure to look for the ENERGY STAR on the product packaging. ENERGY STAR qualified CFLs must pass product quality and performance tests to earn the ENERGY STAR, so these CFLs are a notch above the others.

Also, make sure you choose the right light for the fixture you're using. For example, use a reflector CFL for recessed cans, or a globe CFL for vanity bars. If you have a fixture on a dimmer switch, or a fixture with a 3-way switch, it's important to read the packaging, because you must choose a CFL that states it is right for these applications to get the best performance. Normally, CFLs are not appropriate for motion sensing fixtures, since these fixtures come on infrequently and are on for short periods of time.

**Will ENERGY STAR qualified CFLs fit into my existing fixtures?**

ENERGY STAR qualified CFLs can replace incandescent bulbs in almost any fixture. They come in a wide variety of sizes and shapes including globe lamps for your bathroom vanity, chandelier bulbs, lamps for recessed down lights (now commonly found in kitchens, hallways, and more). The spiral CFL even comes in standard and mini sizes.

There are three factors to pay attention to for certain fixtures: if you have an entirely enclosed fixture, a fixture on a dimmer switch, or a 3-way fixture, you must check the packaging to ensure the CFL is specifically made for those types of fixtures.

**Does ENERGY STAR recommend installing CFLs in the bathroom?**

Because bathrooms are considered a "high use" area of the home, ENERGY STAR qualified CFLs are a good choice. However, high humidity can shorten the life of CFLs. To avoid moisture problems, control humidity in your bathroom by running your ventilating fan during and for 15 minutes after showers and baths.



### **Can ENERGY STAR qualified CFLs be used with dimmer switches?**

Yes, certain ENERGY STAR qualified CFLs are made to work on dimmers. Be sure to check the fine print on the back of the packaging for the proper applications. Dimming an ENERGY STAR qualified CFL that is not designed to work on a dimmer switch can shorten its life significantly.

To find a list of retailers that carry dimmable CFLs, visit [aps.com](http://aps.com) and click on “CFL light bulb” link. Click on the Store Locator link for a list of stores and which types of CFLs they carry. Your local hardware store may not stock a wide variety of dimmable CFLs, so if you are looking for a specific wattage or bulb type, you may also want to try to purchase it online.

### **What is ENERGY STAR®?**

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE) helping us all save money and protect the environment through energy efficient products and practices. Qualifying for the ENERGY STAR is open to all and any manufacturers that wish to comply with ENERGY STAR's strict code of requirements.

Many of today's household items are ENERGY STAR qualified: TVs, refrigerators, freezers, computer monitors and power supplies, VCRs, DVD players, CFLs, light fixtures, ceiling fans, AC units and many, many more. For more information, go to [www.energystar.gov](http://www.energystar.gov)

### **Is it important to buy an ENERGY STAR qualified CFL?**

ENERGY STAR qualified CFLs are different from other CFLs on the market because they have been tested to meet stringent performance criteria established by the EPA and DOE. The criteria ensures that all CFLs earning the ENERGY STAR meet minimum lifetime and efficacy requirements, and are within maximum allowed product start and warm-up times. Manufacturers are also required to label the product if the light output is different than that of a soft white incandescent. If you choose a CFL that is not ENERGY STAR qualified, you might not get the performance you were looking for.

### **Where can I buy ENERGY STAR qualified CFLs?**

Look for ENERGY STAR qualified lighting products at your local home improvement centers/hardware stores, and at local independent and regional retailers. Some grocery stores also sell CFLs. To find a store near you, visit [www.aps.com](http://www.aps.com) and click on “CFL Light Bulbs” to take you to a store locator.

### **How does a product earn the ENERGY STAR?**

ENERGY STAR manufacturer partners must certify that their product meets the strict energy efficiency guidelines set by the EPA and DOE. When they do, they may place the label on their product. As technology advances and more energy-efficient products make it to the marketplace, ENERGY STAR reviews the guidelines for each product category and strengthens them as necessary to ensure that, generally, only the top 25% of products in each category can earn the label.



**How long is the warranty for ENERGY STAR qualified CFLs?**

The warranty must be at least two years for residential applications, but some manufacturers offer longer warranties. Since ENERGY STAR qualified CFLs can also be used in commercial applications like hotels, restaurants, or office buildings (where the lights are on for longer periods of time), ENERGY STAR requires manufacturers to offer at least a one-year warranty for commercial applications.

**Who makes ENERGY STAR qualified CFLs?**

The same manufacturers that you already know make ENERGY STAR qualified bulbs -- GE, Panasonic, Osram Sylvania, Philips, and Westinghouse. Other manufacturers you may not know yet - Feit, MaxLite, Technical Consumer Products, U Lighting America, Greenlite, Globe Electric, Lights of America and many more. Check out [www.energystar.gov](http://www.energystar.gov).

**How much do ENERGY STAR qualified CFLs cost?**

CFL prices range from \$2 for a standard twist to \$15 for specialty bulbs, but save you about \$30 or more per bulb in energy savings over their lifetime, more than offsetting their initial cost. To save the most money, use CFLs in the fixtures you use the most, whether indoors or outdoors. The typical high-use areas of the home are the living room lamps, kitchen ceiling light, bathroom vanity and outdoor porch light. To find a store near you, visit [www.aps.com](http://www.aps.com) and click on CFL light bulbs to take you to a store locator.

**If a light fixture is rated for a maximum 75 watts with an incandescent bulb, does that mean I am limited to a CFL with the equivalent light output of a 75-watt incandescent? Or, can I use a CFL that is the equivalent to a 100-watt incandescent as long as it uses less than 75 watts of power?**

The watt rating on the fixture is a description of how much electricity the internal wiring of the fixture can accept safely. A watt is a measure of power consumption. Since the light fixture can accept up to 75 watts of power, you can use any light bulb with a rated wattage of 75 or less. While you can use a 75-watt equivalent CFL, if you want more light in this fixture, then yes, you can use a CFL that produces as much light as a 100-watt incandescent. Most 100-watt equivalent CFLs will use between 23 and 30 watts of power. This is much less than the 75-watt rating of the fixture. That's the great thing about ENERGY STAR qualified CFLs – you get more light for less power!

**I've noticed some CFLs need a few minutes to warm up, or reach full brightness. Is there a way to determine which warm up fastest?**

By choosing an ENERGY STAR qualified CFL, you are assured that it will turn on in less than a second, and reach at least 80% of brightness within 3 minutes. If the CFL doesn't have the ENERGY STAR, both start time and warm up time could be much longer.

Additionally, many lighting manufacturers offer "instant on" CFLs. Some spiral and mini-spiral products incorporate "instant-on" technology in their products and display this feature prominently on the product packaging. Some covered or reflector CFLs actually do take longer to warm-up, but the tradeoff is that they last longer than regular CFLs. ENERGY STAR qualified CFL products that are covered (like incandescent shaped, reflectors, globes, candles) have a



higher operating temperature so they require a compound called amalgam to perform properly. This compound actually increases the bulb life and the light output! The one tradeoff is that these CFLs cannot offer “instant full brightness” The CFL will turn on, but may take up to three minutes to reach full light output.

### **What is the difference between a watt and a lumen?**

A watt is the measure of power consumption, and is the common way incandescent light bulbs are identified -- for example 60-watt, 75-watt and 100-watt. When purchasing a light bulb, however, what you really should look for is lumens, which is the measure of light output. When you purchase a 60-watt incandescent bulb, you are getting about 800 lumens. By selecting a 13-watt ENERGY STAR qualified CFL instead, you can still get 800 lumens, but it requires much less power.

### **What is CRI?**

CRI stands for Color Rendering Index and is measured on a scale of 1 to 100. The higher the CRI, the better the ability of the light source to render colors accurately. In other words, colors will look more “true” and natural. Look for a CFL with a CRI between 97 and 100 for best results. A lower CRI can result in some distortion of the actual color.

### **What is Correlated Color Temperature (CCT) and Kelvin?**

Kelvin temperature (K) is often referred to as Correlated Color Temperature. It describes the actual appearance of the light itself. Higher temperatures represent a “cooler” appearance while lower temperatures represent a “warmer” appearance.

- 2700K - 3000K = Warm White (closest to an incandescent)
- 3500K - Neutral
- 4100K - Cool White
- 5000K - 6000K = Daylight

### **Some ENERGY STAR qualified CFLs have a bluish white hue (“cool”) and others seem almost yellow (“warm”) in comparison. How can I find consistent colors in lighting?**

Just like incandescent bulbs are labeled soft white, cool white, bright white, etc., you will find ENERGY STAR qualified CFLs labeled soft white, cool white, or daylight (similar to bright white). When selecting a new CFL, it is a good idea to use the same color type as the incandescent you are replacing.

Another way to choose the right “color” for a CFL is to look for the Kelvin temperature (K) on the packaging. A lower number (between 2700K and 3000K) means the light will be warmer (most like an incandescent), while higher numbers (between 3,500K and 5,000K) mean it will be cooler light (brighter, like in offices). The majority of CFLs offer temperatures in the 2700K–3000K range. If you’re replacing several bulbs in one room (for example, multiple recessed can lights in a kitchen) choose CFLs with the same temperature for a consistent light throughout the room.



### **I have heard that electromagnetic fields can be problematic in a home using CFLs?**

An electromagnetic field, or EMF, is all proportional to the current or voltage present in the home. Because CFLs actually use less energy, they do not generate as much EMF as an incandescent bulb. The “killer” fields that people normally refer to are usually associated with HIGH VOLTAGE transmission lines, which CFLs actually help to reduce. The ENERGY STAR specifications address interference in their qualifications.

### **How can more components in a CFL be more energy efficient than the fewer components of an incandescent light bulb?**

The number of components in any light product has no real bearing on efficiency. If that were the case, then an incandescent bulb would be the most efficient light source ever, seeing that it has very few components.

The pure fact is that CFL technology, while having a numerical increase in components compared to its incandescent counterpart, just flat out uses less wattage to get 'almost equal, equal and sometimes more' light or lumens per watt per unit. A simpler comparison would be to use a 'miles per gallon' theory in thinking. Look at the change in the automobile over the last century. An older car with fewer components and older technology has a low to moderate miles per gallon efficiency (depending on the year and the price of gas that is!). Now look at today's new hybrid cars that more than likely have a lot more components than its predecessor, yet is more efficient (more MPG).

CFL/incandescent comparisons should be thought of in the same way. CFLs may need a little more energy for the initial start up, but that is because the ballast and cathodes need a 'kick start.' However, the electronic ballast monitors the wattage and keeps the CFL at a steady state while using only a fourth of the wattage that is needed compared to an incandescent.

For example: A 60 W incandescent gives 900 Lumens while using 60 watts. This equals 15 Lumens per watt (LPW). However, a 60 watt equivalent CFL, also with 900 lumens, uses only 15 watts which equals 60 LPW. You're getting more light per watt, or using the car analogy, better MPG!

### **I have heard that if you put a CFL in the socket of a garage door opener unit that it will make the unit's warranty 'null & void'.**

Garage door openers are usually not supplied with any bulb when purchased. The light only comes on when the door is opened or closed as a security measure. So there are two answers to this question: 1) no, using a CFL does not void the warranty and 2) because the light comes on rarely and does not stay on very long, there will be almost no energy savings between a CFL and an incandescent. It's best to choose high-use fixtures that are on for longer periods of time for CFLs.

### **How is an ENERGY STAR qualified CFL different from the fluorescent light bulbs I grew up with?**

Early models of the fluorescent light bulb were made with magnetic ballasts, which were the cause of slow start up, flickering, buzzing, and an unattractive light. They were also expensive – often up to \$20 per bulb! Modern CFLs use electronic ballasts, which eliminate the problems of earlier fluorescent lights. Even better, modern CFLs – while still traditionally more expensive than incandescent bulbs – cost significantly less. Often utilities (like APS) provide their customers discounts on their CFL bulb purchases.



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### Why are incandescent bulbs so inefficient?

Incandescent light bulbs work by heating a tungsten filament, or wire, until it glows. This is what produces the light you see. Unfortunately, 90% of the energy used to generate that light is wasted as heat, making incandescent bulbs a very inefficient way to light your home. ENERGY STAR qualified CFLs, on the other hand, create a chemical reaction among gasses located inside the glass tube, causing phosphors to illuminate. This is a much more efficient way of producing light, and means CFLs produce far less heat.

### Why does a CFL fail?

CFLs can fail for a number of reasons. If a CFL is at the end of its rate life, it will stop performing due to mercury (Hg) depletion. CFLs need a very small amount of mercury to perform efficiently. When the CFL is switched on, the Hg heats up and vaporizes. Once the CFL is turned off, a very, very small amount of Hg imbeds itself into the glass. Over a period of time, the depletion of Hg is enough so that the CFL no longer works.

Using a CFL improperly can cause it to fail prematurely. Always look for ENERGY STAR CFLs. These are tested in all three positions of application: downward, horizontally and vertically. Some CFLs are also third party tested for better high altitude performance and also for heat in an enclosed fixture.

If you are placing CFLs in an enclosed fixture, please look for wording on the packaging that states 'can be used in an enclosed fixture.'

### What are EPA and DOE doing about CFLs that fail? Is the government following up with these companies?

ENERGY STAR CFLs must last a minimum of 6,000 hours. (On January 1, 2008, the minimum will go up to 8,000 hours.) At an average usage of 3 hours per day, the CFL should last about five and a half years. Many qualified CFLs exceed 6,000 hours, and manufacturers may assert higher hours on the packaging. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a 2-year limited warranty (covering manufacturer defects) for residential applications.

The ENERGY STAR program takes product failures seriously by monitoring all CFL early failures. If you have a CFL that fails within two years, you may contact ENERGY STAR and include the manufacturer's name and product model number. You can also visit the manufacturer's web site to find customer service contact information and inquire directly with them about a refund or replacement.

### How is the hour rating of a CFL determined?

Lamp manufacturers test large groups of lamps to estimate the average burn time that can be expected. In the lighting industry, hour ratings are referred to as Average Rated Life. Some lamps will last longer and some will not last as long as the Average Rated Life but this provides the best estimate. Rated lamp life is then determined when half of the number of tested lamps have failed. This makes no difference if the test sample is 100 or 10,000 units.



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**What is the difference between the coil design and the CFLs that resemble a traditional light bulb?**

There are a handful of differences between coil (sometimes called spiral or twist) CFLs and CFLs that resemble a traditional light bulb (A-line). The first difference is the amount of light each will produce. Most times, a CFL that looks like an incandescent light bulb is really the "coil" shaped CFL with a plastic or glass cover. This cover will slightly reduce the amount of light that is produced. If you compared a 14W bare spiral CFL and a 14W A-line CFL, the bare product will provide more light for the same wattage. Also, bare CFLs usually have longer lifetimes than covered products.

Second, most bare spiral CFLs perform like incandescent light bulbs - they turn on instantly and provide full brightness. Covered CFLs may take slightly longer to reach full brightness.

The last difference is the price - covered CFLs generally cost slightly more than bare spiral because of the additional materials required to manufacture the products. But if you want a CFL that is more aesthetically pleasing, the A-line is a good choice.

**How do you measure the length of a lamp?**

The length of a lamp can also be referred to as the Maximum Overall Length, or M.O.L. Most lamps are measured from end to end including the base. Linear fluorescents are an exception; they include the actual socket in their M.O.L.

**Why does a CFL turn black?**

Over the life of an incandescent bulb, the filament begins to deteriorate and the particles will settle on the inside of the glass. In return, the bulb will take on a grayish appearance and a slight decrease in light output may occur.

In CFLs, only the ends will blacken as the bulb is burned. Each time the lamp is turned on and off, the emissions material settles on the inside of the glass. Extreme darkening generally indicates the bulb is about to burn out.

**Can I turn my CFL on and off frequently? I've been told I have to turn it on and leave it on all day.**

Turning a CFL on and off frequently can shorten its life. To take full advantage of the energy savings and long life of ENERGY STAR qualified CFLs, it is best to use them in light fixtures you use the most and leave on for at least 15 minutes at a time. Good locations include outdoor light fixtures, indoor fixtures in the living room, family room, kitchen, bedroom, recreation room, etc. This is not to say you should leave your lights on all day if you use ENERGY STAR qualified CFLs. It is still a good habit to turn the lights off when you leave the room for an extended period of time.

**Can CFLs be used horizontally? I heard they could only be used vertically. Is this true and why?**

ENERGY STAR qualified CFLs generally can be used both horizontally and vertically. The operating position of a CFL can affect how well the mercury inside the lamp performs, which can affect the product's lumen output. However, while the exact light output may differ slightly



between the lumen rating stated on the packaging and the light output based on the installed position, the difference generally is so small that it would be unnoticeable.

ENERGY STAR qualified CFLs are tested in both the base-down and base-up positions, which are the two most extreme positions within the range of possible installation options. If a manufacturer wants to market an ENERGY STAR qualified CFL for use in one particular position only, they must state this explicitly on the packaging. For example, if installing a CFL horizontally or base-down would cause a noticeable change in the lumen output or performance, the packaging would be required to state, "For use in base-up position only."

Another option is to replace the entire fixture with one of the many ENERGY STAR qualified light fixtures which incorporate bulbs specifically designed for the fixture.

### **Can CFLs be used in recessed cans, outdoor lights or track lighting?**

Yes! Always read the packaging of the CFL to be sure of its proper application, but there are a wide variety of ENERGY STAR qualified CFLs that are designed for use in most fixtures in your home or business. Product types include:

**Incandescent shape (or A-shaped) and globes** – both are good in fixtures where the bulb is exposed, or in fixtures with clamp lamp shades.

**Reflectors** – intended for non-dimmable track lighting and recessed cans, and some weather protected outdoor spot lights.

**Candle shapes** – for use in some porch lights, in wall sconces and in some chandeliers.

**Spirals and mini-spirals** – the most versatile, which are getting smaller and smaller in size and can be used in almost any fixture, especially table and floor lamps with harped shades.

Some CFLs are qualified to be used in 3-way and dimmable fixtures (like chandeliers, recessed lights or track lighting).

### **I have heard that CFLs can overheat and smoke - should I be worried? Why would this happen? Are these bulbs a fire hazard?**

Unfortunately, there have been some instances of CFLs smoking or smoldering. While this usually occurs when the product is defective or installed improperly, it is nonetheless a concern to consumers and the government. Currently, the Department of Energy (DOE) is working with the lighting industry to address this phenomenon. Meanwhile, all CFLs are currently designed to meet UL 935, which requires the CFL materials to be self-extinguishing. So in the case of defective products, although the base or glass tubing may darken, and it may be possible for the product to smoke, it will NOT catch on fire. As with most light bulbs, CFL manufacturers recommend that you install and remove the CFLs by grasping the plastic portions of the base only. If the CFL is screwed into a light socket by twisting the tube rather than the plastic base, it can cause the vacuum seal or glass tubing in the CFL to break. Once certain parts are exposed to oxygen, they are more liable to become defective and/or overheat.



If you have a product that does begin to smoke or smolder, immediately shut off the power to the CFL and, once it has cooled, remove it from the light socket. Then visit the manufacturer's web site to find customer service contact information to inform them of the early failure. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a 2-year limited warranty (covering manufacturer defects) for residential applications. In some cases, the manufacturer may request the failed product to be shipped to them so they can determine why the smoking happened, so make sure to keep the product until you speak to the manufacturer. The manufacturer will most likely provide a replacement product or a refund.

### **Should I throw away my "regular" (incandescent) light bulbs and replace them with CFLs?**

Replacing incandescent light bulbs with ENERGY STAR qualified CFLs right away, rather than waiting until they burn out, is beneficial because you can begin to start saving energy and money right away, as well as reduce greenhouse gas emissions. Instead of throwing away the incandescent bulb, you can always save it for areas where CFLs aren't suitable (like in a closet where the light would only be on for a few minutes at a time). CFLs provide the most savings in applications where the light is on for at least two hours a day.

### **What's the difference between "long life" incandescent light bulbs and ENERGY STAR qualified CFL?**

While a "long life" bulb does last longer than a standard incandescent bulb, it still uses a lot of energy and it still doesn't last as long as a CFL. For example, a long life 60-watt incandescent bulb usually lasts for 2,000 hours, but an equivalent 13-watt ENERGY STAR qualified CFL will last 6,000 hours or more, and use 75% less energy. ENERGY STAR qualified CFLs help you save money in energy and household costs and you won't have to buy and change bulbs as often.

### **My CFL burned out before the packaging stated it should. What can I do to get my money back? I don't have the original packaging or receipt.**

If your ENERGY STAR qualified CFL product burns out before it should, look at the CFL base to find the manufacturer's name. Visit the manufacturer's web site to find the customer service contact information to inquire about a refund or replacement. Manufacturers producing ENERGY STAR qualified CFLs are required to offer at least a 2-year limited warranty (covering manufacturer defects) for residential applications. In the future, save your receipts to document the date of purchase and purchase price.

### **Does temperature or humidity affect the life of a CFL? For example, would a CFL work in extremely cold temperatures, or extremely wet climates?**

Extreme temperatures can affect CFLs. Some CFLs can be used outside in temperatures down to minus 10 degrees Fahrenheit and up to 120 degrees Fahrenheit. However, very cold temperatures may cause CFLs to take longer to reach full brightness. There are some ENERGY STAR qualified CFLs that are weatherproof and can be used outside where exposed to rain, so check for "weatherproof" models before installing it in your outdoor spot light.



## How much energy does it take to turn a CFL on compared to leaving it on for a long time?

Even when turned on and off frequently, a CFL uses less energy than its incandescent equivalent. While there is a brief surge in energy use when a CFL is turned on, with today's starting technology, that surge usually lasts about a tenth of a second and consumes about as much energy as five seconds of normal operation.

However, turning a CFL on and off more frequently will also shorten its life. Because of this, and because CFLs are more expensive than incandescents, we generally recommend that consumers use CFLs in applications where they are on for at least fifteen minutes. This is where CFLs have the biggest impact and make the most sense economically.

## Why do my fluorescent lights flicker?

Flickering can be caused by any of the following conditions:

- **The environment is too cold.** Most ballasts are not designed for temperatures less than 50 degrees. Drafts and moving cold air may cause flickering too. Special low-temperature ballasts are available.
- **The lamp is not properly installed in the socket.** Try removing it and reinstalling it to ensure it is firmly in place.
- **The lamp is at the end of its life and needs to be replaced.**
- **The lamp and the ballast wattage requirements are not properly matched to each other.**

## What causes a fluorescent light fixture to hum?

All fluorescent lights require a ballast to function. Both magnetic and electronic fluorescent ballasts give off a slight humming noise; *harmonics* is the technical term. By design, an electronic ballast has reduced harmonics and therefore the hum is less noticeable than when using a magnetic ballast. If the hum is louder than usual the ballast may need to be replaced. CFL manufacturers stopped using magnetic ballasts in April 2006.

## Can I use a CFL with a timer?

While CFLs can be used with mechanical timers, digital timers may cause interference with the electronic ballast, and can adversely affect product performance. Typically, CFLs used on digital timers will fail far before their rated lifetime. Remember, ENERGY STAR qualified CFLs are required to state any incompatibility with controls on the packaging, so be sure to read and follow the manufacturer recommendations.

## Can I use a CFL on a dimming switch/circuit?

Using a regular CFL on a dimming switch or circuit will cause performance issues and shorten its rated life. If you are planning to use CFLs on dimming switches or circuits, please look for a CFL product that has the word 'Dimmable' on its packaging. The reason these CFLs perform better is that the ballast can handle the reduction in power to the unit. The dimmable CFL will not flicker, hum or have a huge shift in color.



**What is the difference between medium and mogul base lamps?**

Medium base or “standard” base is the most frequent choice in everyday household applications; a standard household bulb is a medium base. Many industrial applications require a mogul base lamp which is larger in size than the medium base.

**I was told that I could not use CFLs in my home because I have “60-degree wiring,” as opposed to new homes that have 90-degree wiring. Is that true?**

No. In this instance, using CFLs in your house would actually be preferable to using incandescent bulbs. “60-degree C” refers to the temperature (in Celsius) up to which the insulation around your household wiring will protect the wire safely. If the temperature exceeds that, the insulation becomes brittle and there is a danger of electrical shorts and fire. Around light fixtures, this can be an issue since incandescent light bulbs generate a lot of heat. It’s also an issue if a circuit in your house is overloaded, since drawing an excess of electricity will cause the wire itself to heat up. Since CFLs are cooler than ordinary light bulbs, and draw less electrical current, they are perfectly fine to use with older 60-degree C wiring.

**Warning!** If the wiring has already been exposed to excessive temperatures or electrical currents, the insulation is already damaged! While CFLs do nothing to harm the wire if it is still intact, they cannot undo damage that has already occurred. If the insulation around your wiring has already failed, it should be replaced, no matter what type of bulb you are using.

**What is the difference between 120 volt and 130 volt?**

Line voltage in the United States is 120 volts. However, lamps are often manufactured at 130 volts to increase lamp life and to offer protection against power surges. You may use a 130-volt lamp in a 120-volt socket without issue, but you will sacrifice some light output.

Rule of thumb: a 130-volt lamp may last up to twice as long but can be up to 15% dimmer than a 120-volt lamp.

**What is power factor?**

Power factor of an AC electric power system is defined as the ratio of the real power to the apparent power, and is a number between 0 and 1. Real power is the capacity of the circuit for performing work in a particular time. Apparent power is the product of the current and voltage of the circuit.

Circuits containing purely resistive heating elements (filament lamps, strip heaters, cooking stoves, etc.) have a power factor of 1.0. Circuits containing inductive or capacitive elements (lamp ballasts, motors, etc.) often have a power factor below 1.0. For example, in electric lighting circuits, normal power factor ballasts (NPF) typically have a value of (0.4) - (0.6). Ballasts with a power factor greater than (0.9) are considered high power factor ballasts (HPF).

**What is an ENERGY STAR qualified fixture?**

ENERGY STAR qualified fixtures permanently replace standard incandescent fixtures and come with pin-based CFLs that are tested to last at least 10,000 hours (about 7 years, on average). Pin-based CFLs have a two-pronged base that “plugs in” to a fixture rather than a screw base. ENERGY STAR fixtures come in hundreds of attractive styles, including table, floor and desk

lamps, and in hard-wired styles for ceilings, walls, bathrooms, kitchens, dining rooms, and outdoors.

If you're remodeling and replacing fixtures in your home, we encourage you to look at all the attractive styles and fixture "families" that are available at home improvement stores and lighting showrooms. Just ask for ENERGY STAR qualified fixtures.

Replacement pin-based CFL bulbs can be found at most hardware or home improvement centers, at lighting showrooms, and on the Internet.

NOTE: Some ENERGY STAR qualified outdoor fixtures will accept an incandescent light bulb because the main energy savings is found through a motion sensor and/or a photocell that turns the light on only when someone is present, or on at night and off in the morning.

### **What's the difference between installing a permanent ENERGY STAR fixture and simply installing ENERGY STAR qualified CFLs in a standard fixture?**

Generally, the energy savings would be the same. However, ENERGY STAR qualified fixtures come with pin-based CFLs that are required to last at least 10,000 hours (about 7 years, on average) vs. ENERGY STAR qualified "screw base" CFLs that last at least 6,000 hours. So, you should save some money on bulbs with ENERGY STAR qualified fixtures.

In addition, installing ENERGY STAR qualified fixtures eliminates any guesswork about which type of CFL will work. ENERGY STAR fixtures are designed around the light source, including proper fit, color, wattage, and durability. For example, if a dimmable fixture is important, it would be safer to buy an ENERGY STAR qualified dimmable light fixture, so you know it works with CFLs.

Finally, an ENERGY STAR qualified fixture provides more permanent energy savings, since a CFL in these fixtures cannot be switched out with an incandescent lamp.

### **Do ENERGY STAR qualified light fixtures come with a warranty?**

Yes! ENERGY STAR partner manufacturers provide a 2-year warranty on their qualified lighting fixtures.

### **Do ENERGY STAR qualified ceiling fans come with a warranty?**

Yes! ENERGY STAR manufacturing partners provide a 30-year warranty on the ceiling fan motors, two years on qualified light kits, and at least one year for all other ceiling fan components.

### **How do I know what wattage to use in my fixture?**

When replacing a lamp, you must check the fixture for wattage and voltage requirements. With an incandescent light fixture, wattage becomes a preference depending on how much light is needed. With fluorescent or high intensity fixtures, the wattage is specific to the ballast built in the fixture.

CAUTION: Using the wrong lamp in a fixture could cause the bulb to burnout early and may create a fire or safety hazard.



**What is an ANSI code?**

An ANSI code is either an alpha or numeric designation that ensures certain specifications such as wattage voltage shape and base. ANSI stands for American National Standards Institute. This organization develops voluntary guidelines and product performance standards for the electrical industry and other industries. Bulbs and fixtures are often imprinted with the ANSI code.

**I see that some new CFLs are conforming to RoHS standards. What are the RoHS standards?**

RoHs stand for The Restriction of the use of Hazardous Substances in electrical and electronic equipment. It is a European standard that became effective on July 1, 2006. This standard bans the placing on the EU market of new electrical and electronic equipment containing more than agreed-upon levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants.

Manufacturers need to understand the requirements of the RoHS Directive to ensure that their products, and their components, comply.

Because many manufacturers ship product all over the world, some are conforming to this higher standard of monitoring for hazardous materials to comply with those regions and countries that require it and also to have a standardized, quality product worldwide.

**What precautions should I take when using CFLs in my home?**

Like any light bulb, CFLs are made of glass and can break if dropped or roughly handled. Be careful when removing the bulb from its packaging, installing it, or replacing it. Always screw and unscrew the lamp by its base (not the glass), and never forcefully twist the CFL into a light socket. Because CFLs contain a small amount of mercury, follow proper clean-up recommendations if a CFL breaks in your home. Used CFLs should be disposed of properly, not thrown in the trash.

**Do CFLs contain mercury?**

CFLs contain a very small amount of mercury sealed within the glass tubing – an average of 5 milligrams, which is roughly equivalent to the size of the period at the end of this sentence. No mercury is released into the air when the bulbs are intact or in use. By comparison, older thermometers contain about 500 milligrams of mercury. It would take 100 CFLs to equal that amount.

Mercury is an essential component of CFLs and is what allows the bulb to be an efficient light source. Many manufacturers have taken significant steps to reduce mercury used in their fluorescent lighting products. In fact, the average amount of mercury in a CFL is anticipated to drop by the end of 2007, thanks to technology advances and a commitment from the members of the National Electrical Manufacturers Association.

**What is mercury?**

Mercury is an element (Hg on the periodic table) found naturally in the environment. Mercury emissions in the air can come from both natural and man-made sources. Utility power plants (mainly coal-fired) are the largest man-made source, because mercury that naturally exists in

coal is released into the air when coal is burned to make electricity. Energy efficient CFLs present an opportunity to prevent mercury emissions from entering the environment because they help to reduce emissions from coal-fired power plants. Coal-fired power generation accounts for roughly 40 percent of the mercury emissions in the U.S.

The EPA is implementing policies to reduce airborne mercury emissions. Under regulations EPA issued in 2005, mercury emissions from coal-fired power plants will drop by nearly 70 percent by 2018.

For more information on all sources of mercury, visit <http://www.epa.gov/mercury>

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

Because CFLs contain a small amount of mercury, the EPA recommends that consumers take advantage of local recycling options for CFLs, where available. Consumers can contact their local municipal solid waste agency directly, or go to [www.lamprecycle.org](http://www.lamprecycle.org) and click on "State Lamp Recycling Regulations & Contacts" to identify local recycling options. If there are no recycling options near you and you must put CFLs in the garbage, put the CFL in two sealed plastic bags. CFLs should not be disposed of in an incinerator.

### **How should I clean up a broken CFL?**

When a CFL breaks, the greatest hazard is being cut by shards of broken glass. But because CFLs do contain a small amount of mercury, the EPA recommends the following clean-up and disposal guidelines:

1. Open a window.
2. Remove all materials you can without using a vacuum cleaner.
  - Wear disposable rubber gloves, if available (do not use your bare hands).
  - Carefully scoop up the fragments and powder with stiff paper or cardboard.
  - Wipe the area clean with a damp paper towel or disposable wet wipe.
  - Sticky tape (such as duct tape) can be used to pick up small pieces and powder.
3. Place the broken bulb and all cleanup materials in a plastic bag and seal it.
  - Take the waste to your local household waste disposal or recycling center. If your state permits you to put used or broken CFLs in the garbage, seal the CFL in two plastic bags and put into the outside trash.
  - Wash your hands after disposing of the bag.
4. The first time you vacuum the area where the bulb was broken, remove the vacuum bag once you have finished (or empty and wipe the canister) and put the bag and/or vacuum debris, as well as the cleaning materials, in two sealed plastic bags in the outdoor trash or protected outdoor location for normal disposal.

### **Where can I find more information online about recycling CFLs and linear fluorescents?**

[www.lamprecycle.org](http://www.lamprecycle.org)

[www.earth911.org](http://www.earth911.org)

**Does ENERGY STAR qualify LED lighting?**

Currently, ENERGY STAR qualified traffic signals and exit signs use light emitting diodes (LEDs). A draft specification for LEDs (otherwise known as Solid State Lighting (SSL) Luminaries) for consumer applications is currently under development.

**What is an LED?**

LED stands for "Light Emitting Diode." An LED consists of a chip of semi-conducting material impregnated, or doped, with impurities to create a p-n junction. Current flows easily from the p-side, or anode, to the n-side, or cathode, but not in the reverse direction. Charge-carriers - electrons and holes - flow into the junction from electrodes with different voltages. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon. The wavelength of the light emitted, and therefore its color, depends on the band gap energy of the materials forming the p-n junction.

**How far away are we from seeing LEDS being used for residential lighting?**

LEDs are very efficient sources of light. However, two of the main reasons that they are not yet ready for residential applications is lumen output and cost. Because LED lumen output is low, you need more LEDs to get a desired light level from the light source. The more LEDs used, the bigger the bulb and therefore the greater the cost. The additional expense partially stems from the relatively low lumen output and the drive circuitry and power supplies needed. Below is a comparison of a 60W incandescent, a 60W equivalent (13W) CFL and an equivalent LED light bulb. Cost wise, the incandescent is about 50 cents, a CFL is \$3-3.50 and the LED is in excess of \$50!

Measurement	60W Incandescent	13W CFL	60W Equivalent LED
Volts	124.5	124.5	124.5
Amps	0.505	0.112	0.030
Watts	62.87	13.94	3.74
Lumens	850	800	60
Lumens per Watt	14	57	16

Over the next few months APS will monitor the progress of LED lights and their potential to be promoted in the Residential Lighting Program. ENERGY STAR specifications are currently being worked on, and could be in place hopefully within the next 18 months to two years. Once cost has been lowered and lumen output increased, then the introduction of LEDs could be a real possibility.