Questions about Compact Fluorescent Lighting? Get Your Answers Here!

Key Points

- You receive the same or more light output (lumens) with a 75% energy reduction and over six times the rated life with Compact Fluorescent Lights (CFLs) compared to incandescent bulbs.
- The cost of CFL operation easily lowers the purchase price premium.
- High vibration and high heat situations are not good applications for CFLs.

What Size of Compact Fluorescent Light (CFL) Should I Use to Replace an Incandescent Bulb?

The table below compares a standard 60-watt bulb with an *equivalent* CFL replacement bulb.

Type	Watts	Lumens	Color Temp.	CRI (Color Rendering Index)	Life (hrs)
Incandescent	60	830	2,800°K	100	1,500
CFL	13	900	2,700°K	84	10,000

The higher the lumen rating, the greater the light output. For more information on lumens, see the ENERGY STAR Web site. Notice that the CFL has the same or more light output (lumens) with a 75% energy reduction and over six times the rated life. The equivalent lumen output CFL wattage for incandescent replacement (roughly 25%) is shown in the following table.

CFL Replacement Wattages	
Incandescent	CFL
200	55
150	42
100	23-26
75	20
60	13-15
40	9-11

How Can I Justify Paying Five Times the Price for a CFL?

Actually, the cost of operation easily justifies the purchase price. For example, compare a 60-watt incandescent bulb that costs $0.50 each to a 13-watt CFL that costs $2.50 each in bulk. The electricity cost to operate those lights is calculated as follows:

Electricity cost = hours of operation x (wattage ÷ 1,000) x $/kWh

Assume that the lights operate 12 hours per day all year and that the cost of electricity is $0.085/kWh. See the equation below to determine the electricity costs.

Electricity cost (Incandescent) = 4,380 hrs x 0.06 kW x $0.085/kWh = $22.34

Electricity cost (CFL) = 4,380 hrs x 0.013 kW x $0.085/kWh = $4.84

The savings from changing to a CFL is about $17.50 annually, which more than recovers the difference in purchase price ($2.00). Because the CFL is rated to last approximately 10,000 hours, there is additional savings from not having to replace the incandescent bulb five times (an additional $2.50 saving).

Can CFLs Be Used in Ceiling Fans?

A ceiling fan application can exhibit several possible CFL failure modes: vibration, low voltage, overheating, frequent switching on/off, and the possibility of being wired to a dimmable switch.

You might think that CFLs would handle vibration well, due to the absence of a filament. However, GE Consumer & Industrial Lighting's FAQs Web page listed this response to the same question:

Source:
ENERGY STAR

> "Can I use a CFL in applications involving vibration such as a ceiling fan or garage door opener?
>
> Currently it is not recommended to use CFLs in vibrating environments. Vibration can cause the electronics in the CFL to fail."

However, GE recommends its FLE11 globe CFL for use in a ceiling fan. In addition, no such warnings were found from other lamp manufacturers such as Philips or Osram Sylvania. Furthermore, many new electronic ballasts now come with built-in filtering and protection circuits that are improvements over the less expensive designs.

Do CFLs Quickly Burn Out in Recessed Lights?

Some fluorescent ballasts are unreliable in ambient temperatures much over 120°F (50°C). This is sometimes a problem in enclosed or recessed ceiling fixtures if heat in the fixture builds up. The Rensselaer Polytechnic Institute Lighting Research Center publishes a newsletter, Lighting Answers. An article on high-wattage compact fluorescent lamps (HW-CFLs) showed the temperature increased from an average of about 25°C (77°F) to 40°C to 60°C (100°F to 140°F) in enclosed aluminum reflectors and prismatic refractors. The temperature rise in open reflectors/refractors was much smaller. These high-wattage CFLs were rated at 55 to 105 watts.

In 2002, Pacific Northwest National Laboratories (PNNL) completed technical and market research on reflector CFLs (R-CFLs) in the 12 to 20-watt range and identified several challenges to the use of R-CFLs installed in insulated, ceiling-rated, airtight (ICAT) recessed can housings:

- "Delivered light output. Total light output for R-CFLs was often significantly less than their incandescent counterparts, and R-CFLs installed in high ambient temperature environments generally produced lower light levels, compared to CFLs installed in "open" fixtures at room temperature.
- Longevity. Operating life was often much shorter than the manufacturer rated life when installed in insulated ceiling environments. Operating temperature was often above manufacturer guidelines when operated in an ICAT can."

Note that the PNNL R-CFLs were not totally enclosed. The housings were open on one end but not vented, thus the categorization as *airtight* to prevent loss of conditioned air into unconditioned spaces above, such as attics.

In a follow-up press release, Philips Lighting Company R-CFLs Prove They Can Take the Heat, the Philips SLS/R40 20-watt and the EL/A BR30 16-watt Reflector Flood, which are part of the Philips® Marathon™ line, "met the DOE's stringent performance criteria for its R-CFL project, including ENERGY STAR certification and a minimum of 6,000 hours of elevated temperature life testing." Manufacturers now have specially designed recessed housings for fluorescent lighting.

Can I Use a CFL with a Dimmer Switch?

To use a dimmer switch with CFLs, you must buy a CFL specifically made to work with dimmer switches. These are different than normal CFLs.

Can I Use a CFL in Applications Where I Will Be Turning the Lights On/Off Frequently?

Like linear fluorescent lamps, CFLs require a very short time period before they achieve rated lumen output (brightness). The rated life of fluorescent lighting is typically tested using a cycle of 3-hours on and 15-minutes off. Turning fluorescent lights off sooner than 3-hours will shorten the rated life. Manufacturers generally recommend keeping a CFL on for at least a 15-minute period of time before turning it off.

What Should I Do if a CFL Breaks?

GE Lighting's FAQs address this issue as well:

> "Because there is such a small amount of mercury in CFLs, your greatest risk if a bulb breaks is being cut from glass shards. Research indicates that there is no immediate health risk to you or your family should a bulb break if it is

cleaned up properly. You can minimize any risks by following these proper clean-up and disposal guidelines:

- Sweep—not vacuum—all of the glass fragments and fine particles.
- Place broken pieces in a sealed plastic bag and wipe the area with a damp paper towel to pick up any stray shards of glass or fine particles. Put the used towel in the plastic bag as well.
- If weather permits, open windows to allow the room to ventilate."

A more detailed procedure on proper disposal approaches is available from an ENERGY STAR fact sheet on CFLs. LampRecycle.org has a directory of state regulations governing lamp disposal. The Web site www.earth911.org offers disposal options by using your zip code, or call 1-877-EARTH911 for local disposal options.

What Are the ENERGY STAR Requirements for CFLs?

The power factor (PF) of today's ENERGY STAR rated CFLs must be 0.50 or greater (average of ten samples). PF is a measure of how effectively a device converts input current and voltage into useful electric power. Many CFLs have a 0.6 PF rating. Look for the High Power Factor (HPF) designation in CFL nomenclature such as the CF15/DQ/27K/HPF bulbs from Genesis Lamp. ENERGY STAR rated CFL lumen maintenance must be greater than 90.0% of initial (100-hour) lumen output at 1,000 hours of rated life and greater than 80.0% of initial lumen output at 40% of rated life (for example, at 4,000 hours for a 10,000 hour CFL). The Color Rendering Index (CRI) must be greater than 80. This compares to lumen maintenance of a little over 90% at 40% of rated life and CRI in the mid-80s for fluorescent tube lamps.

Sources

CFL Reflector Products Technology Procurement. Pacific Northwest National Laboratories (PNNL). http://www.pnl.gov/rlamps (accessed May 15, 2007)

ENERGY STAR® Program Requirements for CFLs. 2008. U.S. Environmental Protection Agency. Version 4.0

Frequently Asked Questions - Compact Fluorescent (CFL). GE Consumer & Industrial Lighting. http://www.gelighting.com (accessed May 15, 2007)

Philips Lighting Company R-CFLs Prove They Can Take the Heat. July 29, 2004. Pacific Northwest National Laboratories (PNNL).
