# Which bulbs will light the way?

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Wednesday, February 20, 2008

With the tide of legal reform in California and the nation turning against the familiar incandescent lightbulb, will criminals soon be the only ones with good lighting in their homes?

Not if lighting designers, manufacturers and consumers have anything to say about it. Technology improvements, driven by a spate of regulations legislating more energy-efficient lighting, are providing a range of choice both in bulbs and in dimmer and occupancy-sensor systems. Traditional lighting manufacturers like GE, Sylvania and Philips are responding, and new manufacturers are coming into the market. This is good news for consumers looking for an alternative to the standard Edison bulb introduced in the 1880s and largely unchanged since.

Energy-efficient fluorescents also have evolved. They're no longer found only as tubes reminiscent of "Star Wars" lightsabers; you now can find the white twisty lamps - compact fluorescent lights, or CFLs - throughout Bay Area stores. And their prices are finally creeping down.

What brought about the change? A movement to bring the state - and the nation - toward greater energy conservation and independence. Title 24 of California's Building Energy Efficiency Standards, most recently updated in 2005, stipulates that all lighting in new residential construction be either high efficiency or controlled by an occupant sensor or dimmer. (Existing homeowners are exempt from these restrictions.) In October, Gov. Arnold Schwarzenegger signed AB1109, a lighting-efficiency bill sponsored by Jared Huffman, D-San Rafael. The law requires an increase in energy efficiency and a reduction of the pollution associated with lighting technology. The law also will likely speed up adoption of efficiency requirements in California and could even layer on new standards.

On a national level, Congress last year wrestled to the ground a comprehensive energy bill that President Bush signed into law on Dec. 19. Simply put, HR6, the Energy Independence and Security Act of 2007, "requires a reduction in the wattage of incandescent bulbs without a reduction in light emitted," said Gary Flam, who heads the Lighting Program at the California Energy Commission. Starting in 2012, a 100-watt bulb will have to become a 72-watt bulb. Similar reductions in wattage will roll out for other bulbs through 2014, as manufacturers upgrade the efficiency of incandescents. In the meantime, GE has announced its intention to introduce a high-efficiency incandescent lamp, or bulb, ahead of schedule by 2010.

And the United States is not alone: Other countries, like New Zealand and Australia, have imposed even stricter regulations, with plans to phase out incandescents altogether.

Of course, changes in lighting standards and regulations are not lost on designers. At the San Francisco Design Center's Winter Market show in January, Susan Oster of LIT Inc., a professional lighting designer, summed up the challenge: "The trick is to choose more effective lighting. It's about the quality of the light not the quantity."

With lighting in the spotlight, here's a rundown on your energy-efficiency choices.

## Fluorescents

Fluorescent lights were the earliest and most widely implemented energy-efficient choice on the market. That might be part of their problem.

Randall Whitehead, author, designer and lecturer on residential lighting, said: "The fluorescents we grew up with were not great. They had harsh colors, they hummed and buzzed and weren't dimmable."

Those early fluorescents, still in wide use today, used magnetic ballasts, the auxiliary device that regulates the flow of electrical current through the tubes. But electronic ballasts have replaced magnetic for many of the tubular lights, meaning they illuminate immediately and no longer hum.

"In the old days, those lamps cycled on and off 60 times per second, which was discernable to some people," Whitehead said. "Now the tubes cycle at 10,000 times per second, which is imperceptible to the human eye."

Standard fluorescent lamps use 25 to 35 percent of the energy used by incandescent lamps to provide the same amount of illumination, according to the U.S. Department of Energy. They also last about 10 times longer.

## Compact fluorescent

The newest fluorescent choice is the compact fluorescent light, or CFL. Much like standard fluorescent lamps, the gas in a CFL's tube glows with ultraviolet light when electricity from the ballast flows through it. This in turn excites a white phosphor coating on the inside of the tube, which emits visible light throughout the surface of the tube.

According to the Department of Energy, CFLs can replace incandescents that are roughly three or four times their wattage, saving as much as 75 percent of the initial lighting energy. Although CFLs can cost as much as 10 times more than comparable incandescent bulbs, they last up to 15 times as long.

Another major complaint about CFLs is their relatively cold color temperature, which is measured in the kelvin temperature scale. Counterintuitively, higher kelvin temperatures (3,600-

5,500 K) are considered "cool" blue-green colors, preferred for visual tasks because they produce higher contrasts. Lower color temperatures (2,700-3,000 K) are considered "warm" yellow-red colors, more flattering to skin tones and clothing.

Early CFLs were bulky, couldn't be dimmed without a special adapter and used magnetic ballasts. Plus, the seasick green of the first CFLs was enough to send some early adopters back to the warm but energy-sucking incandescent.

But it's time to take a second look. Warmer colors characterize the newest choices on the market, which use electronic ballasts for immediate illumination and no-flicker, dimmable bulbs.

City Lights Lighting Showroom, a store in San Francisco, sells a variety of CFLs from GE and Westinghouse. It also carries a line of CFLs from Technical Consumer Products about which lighting designer Whitehead raves.

"TCP makes really beautiful screw-in bulbs that are dimmable without a special adapter," Whitehead said. The smooth appearance of the TCP bulb and its 2,700-degree color temperature mimics the look and light of an incandescent, making it more suitable for use in formal fixtures.

Although CFLs typically are more expensive than incandescents, they sometimes cost the same, thanks to special bulk-purchase programs by PG&E and retailers like Wal-Mart and Safeway.

Vladimir Vlasov, who works at City Lights, said CFLs are most efficient when they remain turned on for longer stretches. "When they are powered on there is a surge within the ballast, so it's better to leave it on for longer. If you're leaving the room for five minutes, just leave the light on" to maximize the life of the bulb.

Disposal of CFLs is another concern because the bulbs contain mercury, which is classified as hazardous waste. Unfortunately, said Flam, the onus is still on the consumer to dispose of mercury-containing lamps; responsibility has not yet shifted to retailers or manufacturers, although a few retailers will accept them for recycling. City Lights has next to the cash register a large cardboard box full of fluorescent tubes and CFLs dropped off by customers for recycling. Ikea also accepts CFLs for recycling.

As Flam points out, "Mercury is bad, but there's no benign generation of electricity. Regardless of what light you use, some sort of pollutant is put into the environment." He expects the disposal process for CFLs to become more efficient as they edge out incandescent bulbs for common usage.

## Halogen

Halogens are actually a type of incandescent lighting, but they have slightly higher energy efficiency than standard incandescents. Halogen lamps have a gas filling and an inner coating; together, the filling and coating recycle heat to keep the filament hot with less electricity.

"A halogen lamp will last 2,000 hours compared to 750 for a standard incandescent," Whitehead says. They also use about 20 percent less energy, according to the California Energy Commission.

Lighting designers prize halogen for its bright white light, which renders objects very close to their true color. But because it is a direct rather than a diffuse light, halogen is best suited for spotlight applications, such as under-cabinet or display-case lighting. Halogens also burn hotter than other lights, so they should be kept at least 6 inches away from flammable materials.

Said Whitehead: "The best halogen bulbs for the general public are what are known as 'double envelope' halogen lamps. The lamp has two layers of glass, which not only makes it easy to handle, but it can replace standard household bulbs that hum when dimmed. These special halogens are totally silent when dimmed."

## Light-emitting diode

LED lighting has been around since the 1960s, used in indicator lights for cars, clock radios and traffic lights. Only very recently have LEDs aimed at residential usage come to the mass market. However, LED lighting stands to gain quick popularity because of its versatility and efficiency.

A LED doesn't use a filament or a glass bulb - it's a semiconductor diode that converts electricity to light. The bulbs use 85 percent less energy than conventional incandescent bulbs and less than half the energy of CFLs. They last as long as 50,000 hours, according to LED lighting manufacturer LLF Inc. Because they have no filament, there is nothing in the bulb to "burn out" and there's very little heat produced.

With a LED, according to Whitehead, "98 percent of the power goes to light production. Without all that incremental heat being thrown off, air conditioner usage can be reduced in warmer climates." (It stands to reason that heating costs would rise in colder climates where incandescents are switched out for LEDs.)

Whitehead prizes LED lighting because it emits no ultraviolet light. "So for sensitive items, like art or textiles, LED lighting won't erode the object," Whitehead said. "I expect that museums all over the world will soon be switching to LED lighting to preserve their works."

The small size and inherent directionality of LEDs make them a good option for recessed downlights, under-cabinet lighting and task lighting. Because an individual LED chip emits light in a specific wavelength, buyers can experiment with colors in a way that is impossible with other types of lighting.

In her Design Center presentation, Oster noted: "There are 6 million color possibilities with LED light fixtures. It can be like painting light with a paintbrush."

The drawbacks are a lack of widespread availability and relatively high cost. "People are asking for them but we don't have much LED lighting yet," said Vlasov at City Lights. "There just isn't that much out there, but we're hoping by summer to have more choices."

Also of note is the difficulty in proving compliance with Title 24's residential construction efficacy requirements. According to Flam: "There is no state standard for determining the efficacy of LED lighting, although with the update of the Building Energy Efficiency code planned for 2008, a more uniform testing protocol will be established." In the meantime, it's up to manufacturers to seek objective testing and certify the lamps as to their energy efficiency.

If you opt for LEDs, Whitehead recommends "retrim kits," which screw into an existing 6-inch recessed housing and sell for about $100 from LLF and Permlight. Oster favors the $10 MR-16 (mirror reflective bulb) from GE.

## Dimmers and sensors

Part of California's Title 24 regulations call for dimmers and occupancy-sensor systems in new homes.

Megan Donovan, local sales representative for Lutron Electronics Co., which specializes in home-lighting control systems, said, "The lower a light is dimmed, the more time it spends off and the less energy it uses. For example, dimming an incandescent lamp just 10 percent saves 10 percent of the electricity and doubles the lamp's life."

Lutron lighting systems aimed at the professional market start at $1,800 and can go into the tens of thousands of dollars, depending on the extent of the installation. However, Donovan said: "Our AuroRa lighting system is a simple, low-cost alternative which includes three or five dimmers and two light switches, along with a tabletop control panel and a handheld remote control."

An AuroRa package costs about $800 and can be installed by a do-it-yourselfer. A trip to a hardware store will also turn up do-it-yourself dimmer plates for less than $6.

It's important to use dimmable bulbs in these systems. "If you use non-dimmable bulbs in a fixture that you have on a dimmer, you can actually burn out the dimmer switch," said Vlasov of City Lights. He added that replacing the dimmer switch will probably cost more than replacing the bulb.

## Other options

"I'm a big advocate of natural light," said Whitehead. "I look at all the different ways I can get natural light into a home when I'm working. Mother Nature gives us free illumination, why not use it?"

One of Whitehead's favorite tricks is to replace solid-core doors inside the home with frosted glass doors to pull daylight farther into the interior. He also recommends placing mirrors on the wall opposite windows to bounce more natural light into the space, or using glass bricks as semi-transparent room dividers.

Exterior solar lighting, usually used to illuminate a garden path or porch, is another energy-efficient option. Although even the Solar Garden Store acknowledges on its Web site that solar lighting cannot replace conventional fixtures at this time, there's good reason to think that Title 24 requirements and consumer demand will push solar lighting as it has the rest of the market - toward better, cheaper and more aesthetically pleasing alternatives to the old incandescent bulb.

## Lighten up

## Incandescent bulb

**Pros:** Traditional lightbulb introduced by Thomas Alva Edison in the 1880s is probably in your home right now, providing diffuse, warm light.

**Cons:** Inefficient. Under fire because of state and federal regulations that stipulate more efficient lighting.

**Worth noting:** Roughly 80 percent of the electricity used by an incandescent bulb goes to produce heat rather than light.

**Price:** $1 or less per bulb.

## CFL

**Pros:** Compact fluorescent light, the newest fluorescent choice, uses as much as 75 percent less energy than an incandescent bulb and lasts as much as 15 times as long. Some are dimmable and don't hum, buzz or flicker.

**Cons:** Can have a greenish, bluish cast to the light. Fluorescent lights contain mercury, a hazardous waste, which California bans from landfills, meaning you can't just toss them into the trash or recycling bin.

**Worth noting:** Lighting designer Randall Whitehead recommends the CFL line from Technical Consumer Products, which he says mimics the warmer hue of an incandescent.

**Price:** TCP bulbs cost $3.80-$13.

## Halogen

**Pros:** A type of incandescent bulb that uses about 20 percent less energy - and lasts roughly three times as long - as a traditional incandescent. Clean, bright white light.

**Cons:** Extremely hot compared with a traditional incandescent and must be kept at least 6 inches from flammable materials.

**Worth noting:** Direct, rather than diffuse light, which makes halogen lights better suited to task lighting.

**Prices:** A 75-watt "double envelope" bulb made by Westinghouse costs about $10.

## LEDs

**Pros:** Energy-efficient light-emitting diodes last as long as 50,000 hours. (That's 17 years if the lights are turned on for eight hours a day.) They come in an incredible variety of colors.

**Cons:** Lack of availability and relatively high cost.

**Worth noting:** Have been used for years in home appliances, traffic lights, etc. They emit negligible ultraviolet light and provide sharp, focused light.

**Price:** GE MR-16 (mirror reflective) is $10.

## Dimmers

**Pros:** Prolong the life of a bulb and are required in new home construction in California under Title 24.

**Cons:** None.

**Worth noting:** Lighting experts advise using bulbs that can be dimmed (look at the bulb packaging) with dimmable fixtures.

**Price:** Do-it-yourself dimmer plates can be found for less than $6.

## Have you made the switch?

Have you replaced incandescent bulbs with energy-efficient CFLs, halogens or other bulbs in your home or office? Are you happy with the switch? Do your CFLs hum or flicker? Which bulbs offer the best light? Any tips you can offer someone else making the switch? Let us hear from you. E-mail *home@sfchronicle.com*.

## Resources

**Susan Oster,** LIT Inc., (760) 777-0926, *www.litwell.com*

**Randall Whitehead,** Randall Whitehead Lighting Solutions, (415) 626 1277, *www.randallwhitehead.com*

**California Energy Commission,** *www.energy.ca.gov*

**U.S. Department of Energy,** Energy Efficiency and Renewable Energy, *www.eere.energy.gov*

**City Lights Lighting Showroom,** (415) 863-2020, *www.citylightssf.com*

**Technical Consumer Products,** *www.tcpi.com*.

**Permlight,** *www.permlight.com*.

**LLF Inc.,** *www.llfinc.com*

**Lutron Electronics,** *www.lutron.com*

**The Solar Garden Store,** *www.solargardenstore.com*.

**For recycling** locations for fluorescent tubes and bulbs: *www.earth911.org*, *www.sfenvironment.org*, *www.lamprecycle.org*.

*E-mail comments to home@sfchronicle.com*.

http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/02/20/HOVOUV7BH.DTL

This article appeared on page **G - 1** of the San Francisco Chronicle