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LED there be light

Fluorescents aren't the only alternative -- light-emitting diodes offer an energy-efficient and non-polluting way to illuminate our lives

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As California lawmakers push to stop the sale of incandescent lightbulbs in the foreseeable future, now might be the time to start looking for new ways to light up the home.

We know about fluorescents -- both the good and the bad. But there is another technology to consider for reducing energy consumption that could end up becoming the residential lighting of choice: LEDs.

Solid-state lighting -- commonly known as light-emitting diodes, or LEDs, for short -- was born of the semiconductor industry. On a very basic level, LEDs are about color and light transmitted to our eyes via a variety of inorganic semiconductor materials. Many LED fixtures and light bulbs come equipped with special metal heat sinks to absorb and dissipate heat -- which means energy goes into the light itself and is not lost as heat -- especially if the fixture is designed to be on for hours at a time. Some LED manufacturers say their lights will stay bright for as long as 50,000 hours. That means they will last 17 years if the lights are turned on for eight hours a day.

For the most part, when talking about LEDs and general lighting, we don't think of one LED alone. LEDs are typically clustered into straight lines, geometric shapes or irregular forms.

The average person might not fully comprehend the engineering that goes into LED design for something even as small as a decorative tea light that sells for \$2.75. But it's simple enough to see the practical applications already in place. Traffic lights, green and red exit signs in public buildings, automobile indicator lights, emergency strip lights in airplanes, compact flashlights and lanterns, garden pathway lights, bicycle lights, adhesive minilights for brightening drawers and closets, clocks, cell phones, coffeemakers and many of the new small appliances incorporate LED lights in some fashion.

Now, however, LEDs are starting to become available in a "white" light, the kind normally used at home. Randall Whitehead, a residential lighting designer for nearly 30 years, recently switched all the lighting in his San Francisco flat to LEDs and fluorescents, using lights both warm and cool in color.

There is an incredible range of colors to work with when using LEDs. Some LEDs are bright and bluish -- fine for a flashlight but not so pleasing in a home setting. Whitehead advises: "Use the warm whites to achieve a flattering glow, the cool whites when you want a space to have the quality of sunlight."

He uses fluorescents mostly for decorative and general ambient illumination and LED fixtures in the kitchen as down and task lights and also to accent artwork and plants.

Whitehead says it's possible to have good looks and savings, too. After he installed the more energy-efficient lighting, he says, the kilowatt portion of his Pacific Gas and Electric Co. bill dropped by about 60 percent.

There are good-quality LED products for residential use for both inside and outside, but selections are still few and prices are still high.

Permlight, a Southern California company in Tustin (Orange County), recently introduced a series of LED recessed cans for ceilings that are energy efficient and can be dimmed. Depending on size and style, prices for these specialized LEDs range from \$95 to \$150 each.

An average consumer should expect to pay \$100 for a single in-ground fixture to light up the garden path or \$30 a linear foot for rope light that tucks under stair treads. (These amounts would have to be multiplied depending on the lighting requirements of the space or area to be lit.)

Commercial, residential

A single LED diode is about the size of a small pea. Lighting designers who employ LEDs in their work most often use the kind in the shape of a domed cylinder that's sliced off at the bottom with two protruding wires. These LEDs provide a sharp, focused light.

Lighting designers were the first to use LEDs, mostly in commercial settings. LEDs seem to inspire innovation and creativity because of their versatility and compact size.

They are energy efficient because it takes less LED wattage than incandescent wattage to create an equal "punch." Also, unlike fluorescents, which contain mercury, LEDs can be dumped with the household trash.

As a result, LEDs mean big savings for businesses and for public places such as symphony halls, large municipal buildings and casinos. Casinos, in fact, were among the first of the big-time LED users -- mostly for exterior signage and for slot machine digital displays. Think Fremont Street in Las Vegas, where a 400-foot LED canopy and computer-generated light show draws crowds nightly.

The number of LEDs required for commercial settings, however, is sky high. The new Seven World

Trade Center in New York City, for example, uses 250,000 LEDs, .125 watt each.

You can add toymakers to the list of early users. Lighting expert Kevin "Fuzzy" Furry, owner of LED Effects in Rancho Cordova (Sacramento County), was playing "seriously" with LEDs beginning in 1986. He and a colleague would challenge each other to use LEDs in bigger and more innovative ways. Some of the early startups: wands that wrote in the air, a robot car with "feelings" (bright lights for angry, soft lights for happy) and toy rockets that could be tracked by LED streaks of light in the night sky.

"You name it, we did it," Furry says.

From these evolved a company of 36 employees. Furry now directs LED installations around the world. He was part of the team for the new Chanel tower in Tokyo's Ginza district, where more than 700,000 LEDs were embedded into the facade of the building to produce a constantly changing billboard.

Arts, artifacts at home

Even the Vatican has an LED connection. When "The Legacy of the Popes" exhibition toured the United States and Canada from 2003 to 2006, Lightswitch in Orlando selected LEDs to illuminate treasured robes worn by early popes.

Kelly Roberson, who works out of the Lightswitch office in Sausalito, explains: "LEDs emit negligible ultraviolet light." That property means that art and artifacts are better protected from damaging rays.

Some homeowners are homing in on this quality. Why not give Grandma's quilt hanging on the bedroom wall a better chance for survival by spotlighting it with LEDs? Homeowners might even consider using LEDs to create special moods and effects.

Roberson and other designers know how to use the many colors of LEDs much as an artist does from a palette. In time, it is expected that we'll be able to select the color of the lighting in our homes in the same way we select paint for our walls: mix and match. Better yet, this kind of color can be made to change with the flip of a switch -- or, more likely, a computer key. You might choose a light of vanilla cream for your room in the morning and peach sorbet at night.

LEDs also hold up well outside. According to Roberson, they can withstand anything Mother Nature throws at them: wind, rain, even earthquakes. Try getting that kind performance out of your typical incandescent bulb.

Because there are a lot of gimmicky LEDs on the market nowadays -- mostly from China -- consumers are accustomed to paying just \$15 for a strand of colored LED Christmas lights probably

not manufactured to high standards.

If you decide to buy an LED product, whether it's an inexpensive LED lamp for your desk or a high-end recessed ceiling fixture, be sure to check the label for color temperature. Look for lighting for the home in the warm range of 2,700 to 3,500 degrees Kelvin.

Title 24

There is a dark shadow, however, for California designers and installers: LEDs, for the most part, do not yet comply with Title 24, the state laws regulating energy consumption. For new construction and residential remodels that require building permits, such as kitchens and bathrooms, and certain other locations, the wattage consumption must be kept in accordance with required mandates. Standards do not yet exist to prove that LED lights are efficient.

Engineer Kevin Gauna of the California Lighting Technology Center at UC Davis is among the researchers perfecting uniform ways for manufacturers to test the true efficiency of their LEDs. He expects these testing procedures to become part of the state's Title 24 revision package in 2008.

"It's kind of a lawless frontier out there right now," Gauna says, "but soon the Wild West will be tamed, after we have all the laws in writing."

With the LED technology "exploding," Gauna anticipates that in three or four years LEDs will be as common in the home as dimmer switches.

Designer Whitehead predicts: "These are the lightbulbs your children will inherit."

LED facts

Lasts thousands of hours

Creates a full spectrum of color

Works with PCs to produce special effects

Emits minuscule amounts -- if any -- of ultraviolet light

Don't really burn out; they mostly just fade away

Requires a good heat sink (to absorb or dissipate heat)

Not considered hazardous waste (unlike fluorescent bulbs, which contain mercury)

For more information

www.ledeffects.com

www.lightswitch.net

www.permlight.com

www.randallwhitehead.com

www.rpi.edu (Rensselaer Polytechnic Institute)

Tips

Best when used as focused, not general, light

Use less wattage for "punch" accenting

Should be kept in the range of 2,700-3,500 degrees Kelvin

Good for garden path and stairway lighting

Good for out-of-the way places such as under cabinets and in toe kicks, coves and niches

May reflect little white dots on shiny surfaces

Can be dimmed with special controls

Don't come in an inexpensive screw-in white bulb -- yet

May meet Title 24 requirements for kitchens and baths in 2008

Should be tested before you buy big

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