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## Science

### SWITCHING ON A NEW KIND OF EFFICIENT, CHEAP LIGHTS

BY JEFF NESMITH
Cox News Service

WASHINGTON — Updated versions of the little red and green indicator lights on tape recorders and VCRs are about to become a shining example of how the world can save energy and reduce pollution. Recent scientific breakthroughs are bringing a new generation of light-emitting diodes that can produce bright white light to the market.

Many believe that in only a decade or two, LEDs will replace conventional lighting the way Thomas Edison's electric light bulb swept aside the gaslights of the late 19th century.

"It's getting there," said Fred Schubert, a Rensselaer Polytechnic Institute physicist who recently co-authored in the journal Science a review of recent developments in the technology.

While incandescent bulbs produce light by heating a filament until it glows, and fluorescent tubes light up when electricity excites the gases they contain, LEDs produce light more directly.

An electric current passed through a specially designed semiconductor chip is converted directly to light, without wasting energy in the heat familiar to anyone who touches a lighted bulb.

For decades, LEDs produced only weak light. But "now it's getting stronger and stronger," Schubert said. "One could say that the technology is moving up the intensity chain."

Although the cost of manufacturing LEDs, also known as solid state lighting, is still several times higher than conventional incandescent and fluorescent lights, it is falling rapidly. And LEDs have several advantages over their older rivals:

— They are efficient. In terms of the amount of light they produce from a given amount of electricity, LEDs have passed incandescent light bulbs and are challenging fluorescent lights.

Schubert and Jong Kyu Kim, also of Rensselaer, estimated that LEDs could cut the amount of electricity used for lighting in America in half. That would eliminate the need for about 29 large power plants and reduce "greenhouse gas" emissions by 30 to 40 tons of carbon a year, according to a 2001 study by scientists at Sandia National Laboratories.

— They are durable. Unlike glass bulbs and tubes, solid-state lighting is built around rugged superconductors and wafers, making them cheap to handle, pack and ship, and giving them exceptionally long life.

— They produce what researchers call "high spectral quality," meaning white LEDs are more pleasing to the eye than fluorescent tubes.

Despite these advantages, the federal government has shown only limited enthusiasm for LED technology. The Bush administration asked Congress for $5 million in research funding in fiscal 2004 and $10.2 million this year.

In their Science article, Schubert and Jong describe applications that take advantage of the fact that solid-state light can be "tuned" to achieve specific purposes.

For example, adjusting the blue wavelengths that sleep researchers believe regulate human sleep cycles may one day reduce dependence on sleep-inducing pharmaceuticals.

Wavelengths the human eye cannot discern could be mixed into automobile lights so that cars could communicate with each other and "read" emergency actions such as sudden braking.

"Smart" traffic lights could detect the approach of a car and regulate reds and greens to make traffic flow more smoothly.

One application that could rapidly improve the lives of more than a billion people is off to a slow but determined start, even though U.S. agencies like the Energy Department and the U.S. Agency for

International Development have declined to provide supporting funds.
An $25 LED lamp with a built-in solar panel about the size of a paperback book could provide focused "task lighting" for reading or sewing, said Evan Mills, a researcher at the Energy Department's Lawrence Berkeley National Laboratory in California.
A day outdoors — even a rainy day — will let the solar panel recharge the lamp's two AA batteries so that it can be operated several hours at night.
He said a new company, Ignite Innovations, is developing a plant in India to manufacture the lights and will team with nonprofits to provide the lamps.
But the lamp will not depend on a charity-based system to spread throughout the world, Mills believes.
More than 500 million households around the world lack electricity, so the market potential for LED lighting is enormous. Developing nations may also save money in building out power networks.
Each lamp pays for itself in savings on kerosene or other fuels within a year, he said by telephone.
"After that, it is an annuity," he said. "People will have money in their pockets for luxuries like food."

(Story can end here. Optional add follows.)

Although the first practical demonstration of LED light was made by a scientist at General Electric in 1962, it has only been in the past few years that Schubert and others have devised workable white lights.
The first concrete step toward that goal came in the 1990s, when a Japanese researcher found a combination of semiconductor materials that glowed with a pure blue light. Blue, mixed with other colors, can create white light.
Yet early efforts to take advantage of that breakthrough were frustrating, according to Arpad Bergh, president of the Washington-based Optoelectronics Industry Development Association.
For example, mixing some blue and yellow wavelengths produced a light that looked white, but objects viewed under the light did not have their true color. Red appeared to be black.
During the past two or three years, laboratories raced to find the combination of semiconductors that would generate white light with color integrity. At the same time, the governments of Japan, Taiwan, South Korea and several European countries began setting up government-industry consortia in hopes of grabbing market share when the technology arrived.

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