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Greener lighting

for today and tomorrow

Municipalities across North America spend a large amount of money to light the streets and recreational spaces in the communities. In recent years, efforts have been made to find alternative sources of lighting that will work as well or better than traditional light bulbs and are more energy efficient.

Advances have been made and are continuing, and the new products are not only more energy efficient, they last longer as well, reducing maintenance costs. This article identifies a couple of lighting solutions.

compiled by *Summit* staff

UNTIL THERE IS sufficient verification that light emitting diode (LED) technology is every-thing they hoped it would be, most US state and local governments are taking a wait-and-see approach to LED products as a source for lighting streets. While LED street lighting tests in locations such as Ann Arbor, Michigan and Anchorage, Alaska are encouraging, the present high purchase price and short track record for LED street lighting are still seen as obstacles by many.

For communities using high-density discharge (HID) light sources such as high-pressure sodium lamps, one solution that provides significant savings on energy, maintenance and replacement costs is to install advanced RGB fluorescent street lighting units. These lights provide improved light quality at lower overall cost (initial and maintained).

Larry Leetzow, president, Magnaray® International, Sarasota, FL, a manufacturer (www.magnaray.com) and marketer of advanced fluorescent lighting systems says the immediate solution available is RGB fluorescent light, which offers visual quality and efficiency at a much lower cost than HID-type lamps, plus very substantial savings on energy and maintenance.

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According to Magnary, twin T5 RGB fluorescent lamps now have a life rating of up to 48,000 hours with 90 percent lumen maintenance, and a lamp unit replacement cost of less than $12. Fluorescent electronic ballasts with a life of 100,000 hours (supposedly the same as LED systems of higher cost) are in the $25-$30 range.

As well the quality of light produced by the RGB fluorescent lamps is far more balanced and normal than the yellow light frequencies produced by a low pressure or high pressure sodium systems and they produce less glare. Magnaray's RGB system has been in use as part of the Austin, Texas street and parking evaluation for over 4 years, and has proven to be superior in light color, distribution, uniformity, and overall "see-ability." And as a bonus, these lamps can be refitted with the potentially even more efficient and economical LED lamps – once communities feel that the technology is proven.

Advances have been made in the ongoing research to perfect the LED product. According to a January 13, 2009, news report published in *Digital Communities,* "Researchers at Rensselaer Polytechnic Institute [in the USA] have developed and demonstrated a new type of LED with significantly improved lighting performance and energy efficiency.

According to the report from Rensselaer (www.rpi.edu), *Transcending the Replacement Paradigm of Solid-State Lighting*, by Jong Kyu Kim and E. Fred Schubert, "Deployed on a large scale, LEDs have the potential to tremendously reduce pollution, save energy, save financial resources, and add new and unprecedented functionalities to photonic devices," leading to environmental, energy, and cost benefits as well as innovations in healthcare, transportation systems, digital displays, and computer networking.

Schubert is Wellfleet Senior Constellation Professor of Future Chips at Rensselaer, and head of the university's National Science Foundation-funded Smart Lighting Engineering Research Center. Jong Kyu Kim is a research assistant professor of electrical, computer, and systems engineering at Rensselaer. The institute was founded in 1824 and is the USA's oldest technological university.

Along with Schubert, co-authors on the paper include Rensselaer physics, Future Chips, and electrical engineering graduate students Jiuru Xu, Martin F. Schubert, and Ahmed N. Noemaun; Rensselaer Future Chips research assistant Di Zhu; along with Samsung Electro-Mechanics researchers Min Ho Kim, Hun Jae Chung, Sukho Yoon, Cheolsoo Sone, and Yongjo Park. Results of the study can be found online at *Applied Physics Letters*.

The new polarization-matched LED, developed in collaboration with Samsung Electro-Mechanics, exhibits an 18 percent increase in light output and a 22 percent increase in wall-plug efficiency, which essentially measures the amount of electricity the LED converts into light.

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The new device achieves a notable reduction in "efficiency droop," a well-known phenomenon that provokes LEDs to be most efficient when receiving low-density currents of electricity, but then to lose efficiency as higher density currents of

electricity are fed into the device. The cause of this droop is not yet fully understood, but studies have shown that electron leakage is likely a large part of the problem.

… Focusing on the active area of LEDs where light is generated, project leader Fred Schubert's team discovered the region contained materials with mismatched polarization, which probably causes the electron leakage, and consequent loss of efficiency. The newly designed LED is closer to operating efficiently at high current densities.

Schubert expects that a new wave of lighting devices based on LEDs and solid-state lighting will supplant the common light bulb in coming years. If all of the world's light bulbs were replaced with LEDs for a period of 10 years, Schubert and Kim estimate the following benefits would be realized:

- Total energy consumption would be reduced by 1,929.84 joules.
- Electrical energy consumption would be reduced by terawatt hours.
- Financial savings would be $1.83 trillion.
- Carbon dioxide emissions would be reduced by 10.68 gigatons.
- Crude oil consumption would be reduced by 962 million barrels.
- The number of required global power plants would be reduced by 280.

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For more information visit: http://www.rpi.edu/futurechips/index.htm and smartlighting.rpi.edu.