New energy technologies promise brighter future

Eurekalert!

TAMPA, Fla. (Nov. 19, 2012) – In three studies published in the current issue of Technology and Innovation – Proceedings of the National Academy of Inventors, innovators unveil creative technologies that could change our sources of energy, change our use of energy, and change our lives.

Untapped energy in the oceans

The kinetic energy in the Florida Current and in Florida's ocean waves can be captured and used, said Howard P. Hanson of the Southeast National Marine Renewable Energy Center at Florida Atlantic University.

"Capturing the kinetic energy of the Florida Current will require both materials advances and new designs for marine current turbines and their efficient deployment," said Hanson. "The hydrokinetic energy of tidal and open-currents, as well as ocean waves, and the thermal potential of the oceanic stratification, can be recovered using ocean thermal conversion technology."

Hanson calls this concept "marine renewable energy," or MRE, and noted in his article that the U.S. Department of Energy has formed three national MRE centers to investigate the resource potential in the oceans and to advance the technology for recovering MRE.

Nanoscale "rectennas" can convert waste thermal energy to electricity

"Converting waste heat to electrical energy can be a reality by using a rectenna, a combination of high frequency antenna and a tunnel diode," wrote three clean energy engineers from the University of South Florida's Clean Energy Resource Center.

According to article co-author Yogi Goswami, thermal radiation, or the infrared (IR) portion of the electromagnetic spectrum, is often an overlooked source of renewable energy and more than half of the power provided by the sun – both directed and re-radiated – lies in the infrared part of the spectrum.

"If the IR radiation potential of the earth could be harvested with 75 percent efficiency, it would generate more energy per unit area than a fixed orientation solar cell located in a prime solar location," said study co-author Subramanian Krishnan.

Rectenna components (antenna and rectifier) used to recapture wasted IR radiation is developed from the decades old concept of using the wave nature of light rather than its thermal effect. Recent advances in nanotechnology have made possible the harvesting of solar energy by rectenna more viable, they said. Recent research has shown that rectenna can be developed at IR frequencies with existing technology and used for IR energy conversion.

For co-author Elias Stefanokos, the approach of using a rectenna in combination with a plasmonic blackbody emitter would improve efficiency of all systems.

"This research will significantly increase the efficiency of photovoltaic cells, at little added cost, by integrating the plasmonic emitter with the cell," said Stefanokos.

Their paper presents the current state-of-the-art in the field of rectenna-based conversion with a focus on its critical components.

Nanotechnology solutions for greenhouse light

"Farmers are at the mercy of weather that can cause damage to their crops," wrote a team of physicists from the University of South Florida. "Consequently, greenhouse farming and urban agriculture are being looked at as a more efficient and cost effective way to grow produce."

Sarath Witanachchi, Marek Merlak and Prasanna Mahawela, of the USF Department of Physics, presented the specifics for a new nanophosphor-based electroluminesence lighting device that caters to the exact wavelengths of light required for photosynthesis in indoor, hydroponic agriculture. The new, nanotechnology-based grow light also has the potential to reduce energy costs significantly."

"Conventional technologies used in today's agriculture are inefficient and lead to natural resource waste and degrade the environment," said Witanachchi. "Urban agriculture will become the choice in the future. Nanophosphors required to fabricate the active layer of the electroluminescence device are grown by a microwave plasma process, which was developed at the University of South Florida. This process enables the growth of crystalline nanophosphors directly on a substrate as a uniform coating without further processing steps."

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News Release by Florida Science Communications, www.sciencescribe.net

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