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New solar technology could break photovoltaic limits

MU engineer part of team making solar panels more effective in collecting energy

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COLUMBIA, Mo. - Photovoltaic (PV) efficiency is a significant problem for today's commercial solar panels, which can collect only a theoretical maximum of about 30 percent of available light. Now, a team that includes a University of Missouri engineer is developing a flexible solar film that can theoretically capture more than 90 percent of available light. Prototypes could be produced within the next five years.

Patrick Pinhero, an associate professor in the MU Chemical Engineering Department, is developing a flexible solar sheet that captures more than 90 percent of available light. Today's solar panels only collect 20 percent of available light.

Patrick Pinhero, an associate professor in the MU Chemical Engineering Department, says energy generated using traditional photovoltaic methods of solar collection is inefficient and neglects much of the available solar electromagnetic (sunlight) spectrum. The device the team is developing — essentially a thin, moldable sheet of small antennas called nantenna — is designed to harvest industrial waste heat and convert it into usable electricity. Their ambition is to extend this concept to direct solar facing nantenna devices capable of collecting energy broadly from the near infrared to the optical regions of the solar spectrum.

Working with colleagues at Idaho National Laboratory, and Garret Moddel, an electrical engineering professor at the University of Colorado, Pinhero and the team are now developing a way to extract electricity from the collected heat and sunlight using special high-speed electrical circuitry. This team also includes Dennis Slafer of MicroContinuum, Inc., in Cambridge, Mass., which is developing a manufacturing process that can inexpensively produce high volumes of the novel energy-harvesting film.

"Our overall goal is to collect and utilize as much solar energy as is theoretically possible and bring it to the commercial market in an inexpensive package that is accessible to everyone," Pinhero said. "If successful, this product will put us orders of magnitudes ahead of the current solar energy technologies we have available to us today."

The team, which is seeking funding from the U.S. Department of Energy and private investors, also envisions an energy-harvesting device for existing industrial infrastructure, including solar farms and factories that generate waste heat.

Within five years, the research team believes they will have a product that complements conventional PV solar panels by capturing currently unused infrared energy. Because it's a flexible film, Pinhero believes it could be incorporated into building materials and infrastructure.

The team envisions several commercial product spin-offs based on the core technology. These include improved contraband-identifying products for airports and the military, optical computing, and infrared line-of-sight telecommunications.

A study on the design and manufacturing process was published in the *Journal of Solar Energy Engineering*.

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