Research determines financial viabililty of solar power plants

August 22 2013

Concentrated solar power technology is an emerging, environmentally friendly way to produce electricity.

However, the high upfront capital costs of solar power plants, an uncertain production schedule, and the inherent weather-related variability of solar power production raise an important question: is the technology worth it?

A team of Rutgers–Camden researchers has developed a mathematical model for the solar power plant—including weather, solar, and storage interactions—that enables production prediction by hour, allowing the plant owners to demonstrate financial viability of the technology.

"If you want to build a solar plant, you need to finance it. To finance it, one of the requirements is to rigorously demonstrate detailed plant operations that generate profits," says Alok Baveja, a professor of management at the Rutgers School of Business–Camden.

The research project began as a special study project for Lockheed Martin engineer Alan Taber in the fall of 2008 while he was working toward earning his master of business administration at Rutgers–Camden.

Taber, a Cinnaminson resident who completed his MBA at Rutgers–Camden in 2009, is a senior project specialist who works in Lockheed Martin's Aegis Chief Engineering Department. The global

security company's engineers have designed world-class utility-scale concentrated solar power plants that can be connected to a power grid.

To obtain financing for a new plant, plant production guarantees must be established.

"The task was to model how the plant would produce power and if we could reasonably operate it in a way that would enable the plant to repay its investors," Taber explains.

Taber worked with Baveja and Andrei Nikiforov, an assistant professor of finance at the Rutgers School of Business–Camden, to develop a mathematical model that predicts an hourly production schedule over an entire year for a solar plant. The model therefore estimates minimum and maximum annual revenue from the plant.

"We wanted to find the best possible solution to the question and this model is one than can be extended to other renewable energy technology," Nikiforov says.

Taber, Baveja, and Nikiforov published their research in an article titled "An Optimization Mathematical Model for Concentrated Solar Power Financing Decisions at Lockheed Martin."

The article appeared in the journal *Interfaces* in late 2012. Interfaces is published by the Institute for Operations Research and the Management Sciences (INFORMS).

"It makes sense for Rutgers–Camden to continue to work on projects that can make a difference with technology leaders like Lockheed Martin," Baveja says. "Our students, including MBA students like Alan, greatly benefit from research opportunities like this one."

Taber earned his bachelor's degree from Stanford University and his master's degree from Stevens Institute of Technology.

Baveja is a resident of Macungie, Pa. whose expertise is in the use of innovative analytics modeling for managing operations in the public and private sectors. His research has appeared in several prominent operations and management journals. He received his bachelor's degree from the Indian Institute of Technology in New Delhi, India, and his doctoral degree from the State University of New York at Buffalo.

Nikiforov, of Cherry Hill, studies how financial markets respond to liquidity shocks and how liquidity can be transferred across different markets. He also looks into the effect of earnings seasons on the prices of stocks and bonds. He received his bachelor's and master's degrees from Perm State University in Russia and his MBA and doctoral degrees from the University of Missouri.

Provided by Rutgers University