

Konarka's CEO Rick Hess says interest in alternative energy will remain strong for several years.

By Lee Copeland

# Solar Converts

A fitting tribute to the sun god Surya, Konarka converts light to energy.

**THIN-FILM SOLAR. SOUNDS** simple, yet it's anything but.

Boston-area startup Konarka Technologies develops a plastic material that absorbs either natural or artificial light to generate electric power. The technology stems from nanosized photovoltaic (PV) cells coated with a light-sensitive polymer. What makes Konarka's approach to solar technology unique is that it can literally be printed on thin film, making it cheaper and more flexible, allowing the company to place its solar film in the most unusual of places.

Take an umbrella shade as one outrageous example. A typical 11-foot wooden umbrella pole would splinter under the weight of a 25-pound solar panel and would probably look ridiculous to boot. But with a thin-film panel, wrapping an umbrella in sun-absorbing solar technology isn't far-fetched. It's actually a centerpiece of Konarka's strategy to focus on developing the intellectual property and technology, and

work with partners to develop products.

Konarka technology is behind SkyShades' outdoor umbrellas. The thin-film solar coats the shade and provides electric power through the umbrella stand. "It solves the problem of how to power your laptop," explains Rick Hess, Konarka's CEO. "You can sit outside your favorite coffee shop with a wireless connection, but not run out of power."

The lightweight properties of thin-film solar — as opposed to its heavier cousin, crystalline silicon solar — make it attractive for a number of interesting applications. Konarka also partners with Noon Solar, which offers a collection of handbags and briefcases with enough solar-powered juice to keep an MP3 player or cellular phone recharged without plugging a cord into the wall.

Historically, solar panels have been made of silicon or glass, which required a stronger and heavier grid system to support the panel's weight. Konarka developed a thin-film technology that is similar to the ink used to print labels or airline tickets. By printing that ink onto a piece of plastic, Konarka avoids the weight constraints that hinder other forms of solar technology from being used in other form factors.

## Running on Empty

After the oil crisis of the 1970s, research, development and production of solar technologies took off. Yet when oil prices declined, so did interest in solar alternatives. Obviously, escalating oil prices have rekindled interest, as have concerns about global climate change and investigating alternative fuel sources. But in the past several months, the precipitous decline in oil prices, combined with global economic woes, has created additional challenges for alternative energy startups.

Still, Hess isn't deterred. "It's a different time today than it was in the 1970s when interest peaked and dropped for the moment. We don't think interest will go away," he says. "Energy independence and clean energy production is top of mind. The issue now is how do we generate energy and protect the environment?"

Yet, the recent economic downturn has put a damper on the market outlook. NanoMarkets of Glen Allen, Va., estimates that the percentage of *inorganic* thin-film PV as a proportion of all solar is about 25 percent. By 2012, NanoMarkets projects organic PV — including dye cells — will generate about \$400 million in revenue, but only if building products, such as rooftop panels, become mainstream.

"The economic climate is making it difficult to find funding for these technologies, but when people are making bets, it's in thin-film solar," says Lawrence Gasman, principal analyst at NanoMarkets. Gasman says paneling buildings with PV solar is the next hurdle Konarka needs to tackle.

"The real challenge with thin-film solar panels is making it more affordable," Gasman says. "In theory, PV solar should be more inexpensive per square foot, which means it can be embedded into new form factors. But Konarka needs to improve the efficiency of its product to compete against inorganic thin-film, especially amorphous silicon, and make it a stronger commercial option in the rooftop building market."

Konarka is working on improving efficiency, Hess says. Its outside funding tops \$150 million, including an investment by Chevron and a recent infusion from French gas and electric utility Total S.A., which also produces petrochemicals.

Konarka also received \$5 million in funding from the state of Massachusetts last month to support job creation and renewable energy. The state's "competitive advantages will continue to be in the technology and innovation sector," says Greg Bialecki, Massachusetts' secretary of Housing and Economic Development. The company received the state funds because it invested in a New Bedford, Mass., manufacturing facility, says

## NO SHAKING REQUIRED

Contrary to legend and modern music lyrics, Polaroid instant film does not require shaking to dry, and this action may actually damage the images.

BRIAN SMITH; ORANGE SUNSET; HEMERA TECHNOLOGIES/JUPITER IMAGES

Bialecki, which happens to be the same plant that produced the last film components for the now-defunct Polaroid instant-camera business (see sidebar).

### Shake It Like a Polaroid Picture

"You actually don't need to shake it," states Larry Weldon, vice president of manufacturing for Konarka. Weldon should know. He spent 19 years at Polaroid as their vice president of manufacturing and operations before the instant-camera maker decided to shut down global operations last year.

"We got a lot of complaints about shaking the picture," Weldon recalls. The original Polaroid instant photo was covered by a contact sheet, requiring the photographer to wait 60 seconds before peeling it off, he explains. The photo would be a little wet, and to accelerate drying, people would shake it. After Polaroid launched its One-Step instant camera in 1977, shaking wasn't necessary — and it could actually damage the picture — but the shaking continued, he says.

Weldon was hired by Konarka last year, just as he and all of his colleagues were facing not only the closure of their plant but also the end of an era.

"Everyone knew where the end of the road was," Weldon recalls. "We were very up front months before the termination dates and trained our employees in writing résumés and interviewing. They were in the mode of being out there peddling their résumés and looking for alternative employment, and so was I."

Opened in 1993, the Polaroid coating facility in New Bedford employed at its peak roughly 300 people who handled the chemical-coating process required to produce the photographic components of the Polaroid instant photo: the negative and sheet-roll film. A variety of people worked there — chemical engineers, assembly workers, mechanics, electricians and plumbers.

New Bedford has been hard hit over the years. Many of its clothing mills have shut down, its once dominant fishing industry is waning and an unemployment rate of nearly 12 percent reflects the challenges the area faces.

The decline of the instant-camera market brought bankruptcy to Polaroid, and the iconic American brand shutdown U.S. operations almost two years ago. "In 2007, the New Bedford facility stopped producing Polaroid products and shut down," Weldon says. But by November of that year, Konarka had stepped in and purchased all the machinery and equipment at the New Bedford plant, which was ideal for producing its plastic material.

Instead of polishing up his résumé, Weldon reopened the New Bedford facility under Konarka's banner in January 2008 and has spent the past year retrofitting the plant to produce the company's thin-film solar material.

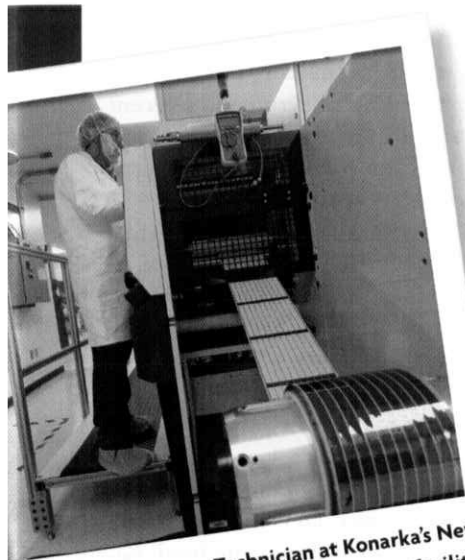
"When Rick Hess brought me on board, I made some phone calls to key former Polaroid employees, who we had just laid off," Weldon says. He eventually hired 13 of those former Polaroid workers. By the end of 2009, the 250,000-square-foot facility will need about 30 full-time employees.

"Finding that facility was a bit happenstance," Hess recalls. "It was a bit early for us to move into a facility of that size, but the opportunity presented itself to purchase a printing facility with a lot of capacity and with people with the right skill set to run it."

Hess says the most important thing is to build a team of people to take your idea forward. "No one person has all the capacity to bring a big idea to fruition," says Hess. "It's like basketball — you need to have all the positions covered to win."

Hess has gathered an impressive team backed with brainpower, experience and the ability to execute. But he also got a head start by teaming with co-founders Howard Berke and Alan J. Heeger. Heeger was one of three recipients of the 2000 Nobel Prize in Chemistry for his pioneering research in the area of semiconducting and metallic polymers.

Another co-founder, distinguished materials scientist Sukant Tripathy, died tragically a few months before the company was formed in 2000. He hasn't been forgotten. Konarka was named after the 13th-century Sun Temple near the Orissan coast in Konark, India. The temple is dedicated to the sun god Surya and was one of Tripathy's favorite places. [BT]



Technician at Konarka's New Bedford, Mass., facility.

## ABSORB AND CONVERT

By buying Polaroid's facility, Konarka jump-started its manufacturing capabilities and also landed a highly trained workforce. Larry Weldon, Konarka's vice president of manufacturing, rehired people such as Bob Pusateri, a chemical engineer who spent 30 years at Polaroid, and machine operator Mike Page, a 12-year Polaroid veteran.

When they worked for Polaroid, Weldon's team focused on improving the visual attributes of a photograph. Today, they ensure that the chemical reaction occurs to absorb light and successfully convert it to electricity.

"We're taking a web of material, coating it and printing fluids on that web of material, then drying it," Weldon explains. "It needs to be done in a very clean environment and with high quality, and we produce it on a roll just like at Polaroid."

The technical challenges aren't that different, but the philosophy and mind-set are. "You hear a lot about reinvention," he says with pride, "but Konarka is an example of a company that's not only reinventing a technology but also retraining existing workers in a new market."

The thin-film solar material Konarka manufactures is 60 inches wide, and a roll runs anywhere from 1,000 to 10,000 feet in length. The film weighs about 1 to 2 ounces per square foot.

And the size of the New Bedford plant should help Konarka shorten its time to market. "They jumped on an excellent opportunity to test the product, and if they get it running, they'll have the capacity to address a larger market," NanoMarket's Lawrence Gasman adds.