

# Edging Closer

**Konarka Aims to Create Low-Cost Solar Energy through Window Film**

by Drew Vass

**“When we coat and print our material, there are several different materials—PET’s (Polyethylene terephthalate) or polyesters—but they are some of the very same materials used for window film.”**

**—Dan Williams, vice president of product development for Konarka Technologies Inc.**

In January of 2008, a three-word combination that had never been seen before suddenly appeared. Photovoltaic (PV) window film—the words surfaced in a press release issued by Konarka Technologies Inc., developer of Power Plastic®, a polymer-based organic photovoltaic (OPV) technology. In the release, the company announced its intent to incorporate this material into a semi-transparent window film. According to company officials, the technology would be aimed at homes of every economic level, in an effort to bring low-cost energy to every region of the world. To date, no aftermarket window film product has appeared, but the company has begun to move toward the manufacture of windows, most notably through a recently-announced relationship with Arch Aluminum and Glass Co. in Tamarac, Fla. (see June 2009 *USGlass*, page 24). The two companies are teaming up to develop a PV architectural glass product. While Konarka’s Power Plastic will appear in a resulting interlayer, Dan Williams, vice president of product development for Konarka, assures that an aftermarket film is still on the company’s to-do list.

“We do [intend to develop a window film product], because we still have a lot of customers in the decorative window category who are interested in similar things, like roll shades, blinds and the such,” Williams explains. “We have several developments in that category. So I do still see us introducing something in the add-on category.”

The product isn’t a far cry away, as Konarka’s manufacturing process bears a strong resemblance to that of various types of window film already in production. In a roll-to-roll process, polymers are applied, followed by conductive layers—much the same way coaters and laminators create solar control or other film products.

“What we use in our manufacturing process is very much akin to those found in the printing and coating industries,” Williams says. “In a roll-to-roll

process, you're literally putting the material down, drying it, putting another layer down and drying it—just the way ink is applied to paper or plastics.”

The process is so similar to that of the printing industry, in fact, that the company has been able to employ the same technologies. In Boston, Konarka acquired an old Polaroid facility previously used for producing photographic films. Williams says the process and equipment was perfect for its new PV products. And reusing equipment once used in other industries can only add to the company's green persona.

## Dependent Personality

One key difference in Power Plastic and the average window film product is that Power Plastic is unable to stand on its own. That is, the conductive materials used to produce this product are subject to oxidation and, for this reason, it must be married to a protective layer. Williams says glass is a natural fit for this purpose, thus the Arch collaboration. Glass provides a complete and (essentially) permanent barrier for the product. Film, on the other hand, does not provide as permanent of protection, according to Williams.

“If you have it as a film on the glass, you might not be looking at something that has as long of a life as something you apply as an interlayer,” he says. “Glass does not allow any infiltration of oxygen or moisture to the cell. Right now we're looking at three to five years [in terms] of capabilities for standard polyethylene terephthalate (PET) films that are [cur-

rently] out there to prevent any kind of penetration of moisture through the plastic and eventually to the cell.”

But before that final sigh of disappointment, consider how close the product comes to a finished PV window film. Very close, according to Williams.

“We're applying it to polyester film now,” he exclaims. “When we coat and print our material, there's several different materials—PET's or polyesters—but that is one of the very same materials used for window film. And when we run our materials through the manufacturing process, there's a laminating process where the front and the back of that polyester, now coated and printed with our materials, is packaged.”

So while the window film industry will have to continue its holding pattern in anticipation of entering the PV arena, it appears the fenestration industry will get its dose of Power Plastic first through glass.

“We are teaming up to develop a product, over the next year or so, that will change the world of building integrated PV (BIPV),” says Max Perilstein, vice president of marketing for Arch Aluminum and Glass Co. “The key is, you will be able to see through our BIPV unit.”

## It's Clear to See

PV technologies have long been integrated into various building-related solutions, such as the panels that have adorned roofs starting as far back as the 70s. But, considering one of glass's

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## A Moving Source of Energy

In example of Williams' personal “empowerment” concept, Konarka's vice president of business development, Dr. Terri Jordan, sported a fabric laptop brief at the recent American Institute of Architects convention (see *June 2009 USGlass*, page 64).

“Here we have a panel that generates electricity, which trickles into a battery,” Jordan explains. “It powers a cell phone or iPod charger very effectively.” And the feature doesn't work like your 1980s solar calculator, which only ran in the brightest of light. “It works in low-light conditions, both indoors and outdoors. It essentially works in any area and in any condition to ensure you never lose your power.”



**Dan Williams, vice president of product development for Konarka Technologies Inc., holds a “personal” view for energy production. He equates the future of photovoltaics to the history of telecommunications, suggesting that, one day, power sources will travel with the individual rather than being location-based, as phone lines once were.**

Photo courtesy of George Disario.

greatest qualities—daylighting—any PV film integrated into fenestration would need to stick with the program.

“The polymer, when you apply it, prior to applying one of the conductive layers that is silver ink, is by nature somewhat transparent,” Williams explains of Power Plastic’s elements. “I mean, if you hold just the film with a semi-conductive material on it up to the light, it’s fairly transparent. When we added the silver semi-conductive layer, it was no longer transparent.” This represented the first challenge in fulfilling Perilstein’s aforementioned promise. But minus the view and daylighting features, why not stick with a solid wall adorned with PV siding, for instance? Williams says—point taken.

“As we’ve looked at ways to modify and move the product in some new directions, one of our inventions was to try and regain the transparent feature, because we had heard from many, many people that using it as a fenestration product would be something ideal,” he explains.

In order to accomplish this goal, the company discovered a way to apply its silver semi-conductive layer in a grid pattern. When applied in various densities, the result is a translucent effect that does not reduce efficiency. In addition, Konarka engineers determined a way to make the product bi-facial—that is, able to absorb light from both sides. As a result, the company’s fenestration version will both absorb natural sunlight entering from outside of a building’s envelope, as well as recycle light being generated through artificial means from the interior.

## A Solar Robin Hood

One of Konarka’s original intentions with Power Plastic, mentioned alongside the possibilities of window film, was to bring energy-producing technologies to all areas of the world, regardless of economic status.

“Bringing off-grid power to the developing world to help alleviate poverty is still a big mission statement that originated with one of our



Photo courtesy of George Disario.

**One of Konarka’s challenges in entering the fenestration industry was restoring transparency to its Power Plastic® product. Here Dr. Terri Jordan, Konarka’s vice president of business development, holds the end result.**

founders,” Williams says.

Williams points out a fairly obscure but critical purpose for these technologies. “The two most urgent things that one requires, whether you’re in an emerging world or whether you’re in a first world that’s been hit by disaster, are light and modes of communication,” he explains. “So those two fronts are very rich for our efforts.”

But the way in which Williams sees these critical technologies being implemented takes a twist you might not expect—one that veers far from the window film perspective. Konarka may be focusing on building integrated BIPV as of late, but Williams sees Power Plastic going in an even more revolutionary direction.

## Take it Personal

“This technology, because of its nature, would allow many people to become what I term as ‘energy independent’—as individuals,” he says. And this is not Williams’ first time around bringing the personal approach to existing technologies. “A lot of my career was spent with Motorola, designing cell phones, and the mission there was moving people away from phoning places and towards phoning people, which really changed not only the course of

communication, but also how people viewed communication,” he explains. The concept has certainly taken hold. A large number of Americans have ditched their landlines and opted to carry their only number on them at all times. “The very same premise holds true for energy,” Williams says. “The thought and the future of having technology that allows people to have energy wherever they are, and not where energy is, is a profound revolution in the way we think about power and power distribution. It’s not about large, grid-tied systems. You wouldn’t have to worry about where the power is. It’s with you.”

As for a PV window film, it may not appear on Konarka’s roster just yet, but Williams says the same materials used for an interlayer solution and those that would be used for an add-on film are virtually the same. In one case, the glass serves as a protective barrier. For a stand-alone product, window film could provide the same. With a little tweaking. ■

## the author



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