Spray-On Solar-Power Cells Are True Breakthrough

Stefan Lovgren
for National Geographic News
January 14, 2005

Scientists have invented a plastic solar cell that can turn the sun's power into electrical energy, even on a cloudy day.

The plastic material uses nanotechnology and contains the first solar cells able to harness the sun's invisible, infrared rays. The breakthrough has led theorists to predict that plastic solar cells could one day become five times more efficient than current solar cell technology.

Like paint, the composite can be sprayed onto other materials and used as portable electricity. A sweater coated in the material could power a cell phone or other wireless devices. A hydrogen-powered car painted with the film could potentially convert enough energy into electricity to continually recharge the car's battery.

The researchers envision that one day "solar farms" consisting of the plastic material could be rolled across deserts to generate enough clean energy to supply the entire planet's power needs.

"The sun that reaches the Earth's surface delivers 10,000 times more energy than we consume," said Ted Sargent, an electrical and computer engineering professor at the University of Toronto. Sargent is one of the inventors of the new plastic material.

"If we could cover 0.1 percent of the Earth's surface with [very efficient] large-area solar cells," he said, "we could in principle replace all of our energy habits with a source of power which is clean and renewable."

Infrared Power

Plastic solar cells are not new. But existing materials are only able to harness the sun's visible light. While half of the sun's power lies in the visible spectrum, the other half lies in the infrared spectrum.

The new material is the first plastic composite that is able to harness the infrared portion.

"Everything that's warm gives off some heat. Even people and animals give off heat," Sargent said. "So there actually is some power remaining in the infrared [spectrum], even when it appears to us to be dark outside."

The researchers combined specially designed nano particles called quantum dots with a polymer to make the plastic that can detect energy in the infrared.

With further advances, the new plastic "could allow up to 30 percent of the sun's radiant energy to be harnessed, compared to 6 percent in today's best plastic solar cells," said Peter Peumans, a Stanford University electrical engineering professor, who studied the work.

Electrical Sweaters

The new material could make technology truly wireless.

"We have this expectation that we don't have to plug into a phone jack anymore to talk on the phone, but we're resigned to the fact that we have to plug into an electrical outlet to recharge the batteries," Sargent said. "That's only communications wireless, not power wireless."

He said the plastic coating could be woven into a shirt or sweater and used to charge an item like a cell phone.

"A sweater is already absorbing all sorts of light both in the infrared and the visible," said Sargent. "Instead of just turning that into heat, as it currently does, imagine if it were to turn that into electricity."

Other possibilities include energy-saving plastic sheeting that could be unfurled onto a rooftop to supply heating needs, or solar cell window coating that could let in enough infrared light to power home appliances.

Cost-Effectiveness

Ultimately, a large amount of the sun's energy could be harnessed through "solar farms" and used to power all our energy needs, the researchers predict.

"This could potentially displace other sources of electrical production that produce greenhouse gases, such as coal," Sargent said.

In Japan, the world's largest solar-power market, the government expects that 50 percent of residential power supply will come from solar power by 2030, up from a fraction of a percent today.

The biggest hurdle facing solar power is cost-effectiveness.

At a current cost of 25 to 50 cents per kilowatt-hour, solar power is significantly more expensive than conventional electrical power for residences. Average U.S. residential power prices are less than ten cents per kilowatt-hour, according to experts.

But that could change with the new material.

"Flexible, roller-processed solar cells have the potential to turn the sun's power into a clean, green, convenient source of energy," said John Wolfe, a nanotechnology venture capital investor at Lux Capital in New York City.