

Energy

Spray-Painted Solar Cells

John Anthony (chemistry) sees the future of solar energy as a can of spray paint. It's a far cry from the solar panels you see on houses today. Instead, these new solar cells are tiny, organic semiconducting crystals developed by Anthony that convert sunlight into electricity. "These plastic solar cells are going to be flexible, portable and disposable," he says.

Anthony, with scientists at Cornell and Northwestern, is working on three different solar energy projects funded by the Army, the Navy, and the Defense Advanced Research Projects Agency. (Rodney Andrews, Center for Applied Energy Research, is working with Anthony on one of these projects.) These solar cells can be spray painted onto any surface, a concept that particularly intrigues the U.S. military. The cells could be spray painted onto the sides of a tent, a panel on the back of a soldier's uniform, or an inflatable structure.

"Special forces soldiers carry about 14 pounds of batteries. Since they don't have the capability of recharging them in the field, they have to carry replacements," Anthony explains. "We're trying to replace that 14 pounds with a couple little cans of spray paint. These guys bed down during the day and operate at night. They could spray out their solar cell during the day, plug their batteries into it, go to sleep, and when they wake up could pick up their charged batteries; then they'd be off and running.

"The Department of Defense has immediate and specific needs, but in a broader sense we're making materials that could eventually be put into everybody's house and everybody's car," he adds.



CAER Turns 30

In October, the University of Kentucky's Center for Applied Energy (CAER) will turn 30. The center was established during the 1970s' energy crisis, and since then has gained an international reputation for cutting-edge energy research that has led to important commercial applications. CAER was an early leader in synthetic fuels and is known for its work on coal combustion to produce electricity (which accounts for 85 percent of coal use), control of air emissions from coal-fired power plants, technology to process minerals, advanced carbon-fiber composites for environmental cleanup, and the reuse of coal combustion by-products. Energy companies from around the world use CAER's catalyst testing facilities, and hundreds of clients each year benefit from CAER's problem-focused services.

Packaging Green Energy: The Fine Coal/Sawdust Briquette

Can the unlikely marriage of two common waste products in Kentucky lead to a new, viable commercial product? A team of UK researchers thinks so. Darrell Taulbee, B.K. Parekh (Center for Applied Energy Research), and Rick Honaker (mining engineering) are creating a premium fuel by taking fine coal and sawdust—and packaging them as a briquette.

These briquettes offer an alternative to the huge quantities of fossil energy, primarily natural gas and coal, which are currently used in ethanol and biodiesel production. They could also be used to produce green power at utility plants.

In the process of mining, 15 to 20 percent of the coal generated is "fine coal"—tiny particles with the consistency of flour. Typically this fine-coal material is disposed of in sludge-like ponds called slurry impoundments. "We used to throw away 20 percent of the fine coal we produced, but now we're down in the 5 to 10 percent range," explains Parekh. This 'cleaner' number is due in part to a separation process he developed called the Ken-Flote column, which allows

coal-preparation plants to clean and recover these tiny coal particles.

And what about the sawdust connection? Five years ago our state produced three-quarters of a million tons of sawdust in Eastern Kentucky alone. Sawdust hills have typically been left behind from timber operations. So the UK team decided to link up the leftovers from coal plants and lumber mills.

The researchers' scenario involved taking the fine coal directly from the column flotation unit, dewatering it, mixing it with the sawdust, adding a binder, and pressing it into a briquette. The binder is the "glue" that holds the sawdust and fine coal together.

"The most impressive result of the project so far is the production of a high-energy fuel with a heating value exceeding 13,000 Btu per pound from 90 percent fine coal and 10 percent wood waste," Honaker explains. "We've had several meetings with potential investors and utility companies who are interested in briquettes because of their need to respond to CO₂ emission concerns."

