

THE

By CHRISTOPHER "COLE" HONS

green Revolution



David Lettero researched methods for reducing his ecological footprint while living in a 144-square-foot yurt sitting on University property.

A growing number of University researchers are vigorously seeking alternative energy technologies

On a 28-degree morning last February, Penn State graduate student David Lettero left his door wide open to give local journalists a tour of his yurt—a squat, round 144-square-foot pine structure that sits on eight secluded acres of University property. For two years it served as Lettero’s home—and his research project.

While working toward his master’s degree in adult education, Lettero was also striving to reduce his ecological footprint—the amount of acreage required to produce the resources and assimilate the wastes that are used to live.

“The average American’s footprint is 24 acres,” he explained. “The fair Earth share, factoring in all 6.5 billion people, is 4.5 acres.” With a three-kilowatt windmill, an array of solar cells and a year-round greenhouse at his disposal, Lettero was able to produce 80 percent of his own food, vastly reducing his burden on the planet.

During his stint in the yurt, Lettero was also the site manager of Penn State’s Center for Sustainability—a College of Engineering unit founded in 1995 to integrate interdisciplinary education, research and outreach on sustainability issues.

A team assembled through the center—led by Dr. David Riley, associate professor of architectural engineering—was accepted this year into the prestigious international Solar Decathlon, in which 20 universities compete to design an ultra-efficient solar home.

All the finished homes will be displayed on the National Mall in Washington, D.C., in fall 2007

for final judging. The Penn State building, named the MorningStar, will eventually occupy a space near the yurt, where it will serve as a tool for further research and educational outreach.

Getting Organized

These are just two examples of how Penn State is addressing some of the country's greatest challenges. With the United States growing increasingly dependent on unstable foreign powers for energy, and the link between fossil fuel use and global warming asserting itself as undeniable fact, the nation, and planet, stand poised on a shaky precipice.

In response, a growing number of Penn State faculty and staff have been working to restore ecological balance, and security, through the pursuit of green technologies. In fact, the University is striving to become a leader in this area as one of a small number of higher education institutions nationwide that is collaborating with the U.S. Department of Agriculture on energy alternatives.

There has been so much activity at the University that Associate Professor of Agricultural and Biological Engineering Dr. Tom Richard saw a need for a higher level of coordination.

Richard began to compile a list of the many Penn State researchers working on different bioenergy projects and initiated fund-raising efforts. In July, he became director of a new Biomass Energy Center, a multidisciplinary, University-wide effort, housed in the College of Agricultural Sciences' Environment and Natural Resources Institute and supported by the Penn State Institutes of the Environment.

The goal of the center is to encourage and support the wide-ranging expertise of Penn State faculty in developing green, economically viable energy alternatives from living materials.

From agricultural research on alternative fuel crops like switchgrass, to basic science and engineering projects involving anaerobic digestion and methane, to investigations by forestry and combustion specialists into wood waste gasification, Penn State is



Cole Hons

Dr. Greg Roth describes the wide variety of crops that Penn State is investigating for use as clean renewable energy alternatives.



Courtesy of the Center for Sustainability

A Penn State team is designing an ultra-efficient solar home—called the MorningStar—for the prestigious international Solar Decathlon competition.

already deeply involved in the area of biomass energy development. By bringing all these projects under one umbrella, Richard feels the University has the potential to play a leading role in alternative energy development for the country.

“By building on the synergies between innovation and implementation, Penn State can make dramatic contributions toward a sustainable energy future,” Richard said.

Biobased Energy

Take, for example, the work of Glen Cauffman, Penn State's manager of farms and facilities. Cauffman has overseen a conversion to biodiesel and biohydraulic fluids in Penn State machinery that began with the College of Agricultural Sciences' equipment in 2002—a major step forward in environmental stewardship.

“Hydraulic-line breaks are the most common types of oil releases across Pennsylvania,” explained Lysa Holland, environmental compliance engineer in the University's Environmental Health and Safety Office. “If not attended to, these releases can cause contamination of soil, groundwater and surface water.” With biobased hydraulic fluid, these risks are negated, as are the steep costs of cleaning up spills.

Cauffman is most recently collaborating with Dr.

Did You Know?

Penn State is on the U.S. Environmental Protection Agency's top 10 list of college and university Green Power Partners, having purchased 17,600 megawatt-hours of green (wind) power.

André Boehman, associate professor of fuel science, and the Case New Holland machinery company to research biodiesel at a higher level. Two new farm tractors are being tested with 100 percent biodiesel, up from a 20 percent mixture.

Cauffman is also working with Drs. Joe Perez and Wally Lloyd—researchers in the Department of Chemical Engineering in the College of Engineering who are developing their own brand of biodiesel. Perez and Lloyd, with students, are collecting leftover fryer grease from local restaurants that Cauffman will eventually use to fuel Penn State machinery.

From the Department of Environmental Engineering, Dr. Jack Matson and doctoral student Dheeban Kannan are also experimenting with biofuel production. “We wanted to eliminate the two nongreen materials that are currently used to produce biodiesel: sodium hydroxide and methanol,” explained Matson. They were granted a provisional patent for their Green Biodiesel in June.

In a world of ever-climbing oil prices, biomass energy alternatives are finally becoming financially viable, said Cauffman. “We now are buying biodiesel at the same price as petroleum diesel,” he reported.

Cauffman also noted that the state’s struggling communities could look into alternative energy as an economic development tool. For example, as a net exporter of soybeans, he said, Pennsylvania stands poised to become a major producer of biodiesel. Dr. Greg Roth, professor of agronomy, added: “We are developing an experience base with canola, mustards and other oilseed crops, in addition to management recommendations, which will be very useful if commercial scale production begins,” putting Penn State in an ideal position to contribute its expertise in this area.

The Tipping Point

For many at the University, green technology research is nothing new. Agricultural engineer Jim Garthe began working in 1993 to convert nonrecyclable agricultural waste



Cole Hons

Penn State’s Plastofuel team has devised a method for converting nonrecyclable plastics to clean-burning fuel.

plastic into a clean burning energy source.

Just over a decade later, with funding from the Pennsylvania Department of Agriculture and the American Plastics Council, Garthe’s team completed construction of a machine that converts 500 pounds of plastic per hour into fuel pellets. These pellets burn cleanly—well below EPA toxic emissions standards.

Garthe will be taking the machine, housed in a mobile trailer, on the road for a demo tour. He hopes to see the technology

commercialized, and then expanded beyond agricultural use, so that all nonrecyclable waste plastics can eventually be used for energy.

Such promotion is also the goal at the Westmoreland County Cooperative Extension Office, led by Gary Sheppard, where a hybrid solar and wind power generating system educates the community about renewable power sources and renewable energy credits—financial incentives for individuals and businesses to invest in renewable energy development. This concept is gaining ground in Pennsylvania since the January 2005 passage of the Renewable Standards Portfolio Act. The act requires that, by 2020, 18 percent of all electricity sold in Pennsylvania must come from a defined renewable source.

Many more efforts are emerging across the University—from experiments with corn waste to generate electricity, to cutting-edge research on hydrogen power. In coming years, these projects will take on increased importance.

As Andy Lau, associate professor of engineering and participant in the Solar Decathlon, noted, “The risk of global climate change from using fossil fuels mandates that we take responsibility now and begin to develop and deploy renewable energy alternatives.” ■

Witnessing Changes Firsthand

Penn State’s Center for Sustainability and the Office of Physical Plant offer a free Green Bus Tour, which explores environmental projects at the University Park campus. For more information, contact Laura Silver at las361@psu.edu or 814-865-2224.