SERC
ENERGY NEWS

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Features

In Every Issue

The quarterly newsletter of the Schatz Energy Research Center

HUMBOLDT STATE UNIVERSITY

Graduate Studies in Energy, Environment, and Society

Arne Jacobson

We are pleased to launch a new and exciting graduate program at Humboldt State University. This semester we welcomed the first class of students in the interdisciplinary "Energy, Environment, and Society" (EES) program. Students in EES earn a Master of Science (M.S.) degree in Environmental Systems with an emphasis in Energy, Environment, and Society. We begin this fall semester with a solid group of 10 graduate students, and we expect that the program will grow quickly from this initial base. You can check out the program at www.humboldt.edu/~ere_dept/grad/cat/eesgradhome.php.

While the energy-environment-society nexus has long provided important areas for study, the threat of global climate change has created increasing demand for professionals, researchers, and academics with the expertise to play a role in mitigating this problem. The passage last year of the landmark California Global Warming Solutions Act of 2006 and the associated job creation that it has already sparked highlights this trend. The EES program is designed to prepare students for careers in this expanding area of work.

EES graduate student Stephen Kullmann works on a renewable energy feasibility study for the Yurok Tribe. *Photo by Stephen Kullmann.*

Energy and the Environment at Humboldt State University

The EES program is the newest component of HSU's longstanding tradition of innovative, environmentally oriented academic programs. For example, the Environmental Resources Engineering program has a rigorous and respected renewable energy and energy efficiency curriculum that dates back to the 1970s. In addition, the university is well known for its excellence in natural resource sciences and environmental economics. The university also has strong programs in areas such as political science and international development. EES builds on this existing foundation, and its students have access to a diversity of relevant course offerings.

RESU members Andrea Allen *(foreground)* and Juliette Bohn *(background)* work on RESU's solar monitoring station atop the HSU library. *Photo by Kellie Brown.*

Energy, Environment, and Society Faculty

The EES faculty is a multi-disciplinary group that includes members from all three colleges at HSU. The core members of the group include Arne Jacobson, Peter Lehman, and Charles Chamberlin (Environmental Resources Engineering), Sarah Goldthwait (Oceanography), Steve Hackett (Economics),

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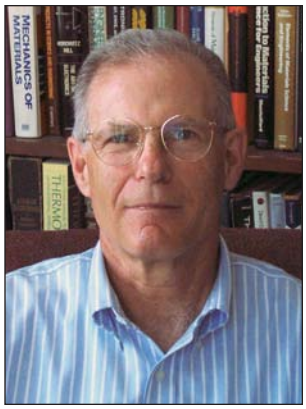
A Message from the Director

Peter Lehman



The big news at the Schatz lab is that after 15 years at our present location in the Humboldt State University Annex, we've begun the process of building a new facility on the HSU campus. Though our present home has served us well, we are severely space limited and this poor old building, built as a hospital in the 1940s, has seen better days.

Our new Center will be located on a picturesque, hillside site only a few hundred yards from our present location. The new building will be about 50% larger than our current space and will provide us with room to accommodate more graduate students and a more complete lab and shop. In keeping with our values, the new building will be energy and resource conserving and blend in with its beautiful North Coast environment. We'll keep you informed as we progress toward a completed design.

Our cover story this issue announces an exciting new graduate program spearheaded by SERC co-director, Arne Jacobson. The Energy, Environment, and Society masters program will provide students with the multi-faceted education they'll need to tackle the daunting problems of climate change. Graduate student Ranjit Deshmukh describes his trip to Ankur Energy Technologies, an Indian company that builds a gasifier we'll be installing and testing. Regular contributor Richard Engel describes our project with the US Forest Service to investigate using biomass to heat a nearby ranger station and Jim Zoellick reports on the grid-connected PV class he's been teaching for several years. Though he teaches it three times a year, Jim's class always fills up with local citizens eager to install a solar system. I hope you enjoy reading about our activities.

What we did on our summer vacation: Schatzers Peter Lehman and Jim Zoellick on the summit of Glacier Peak in Washington state. Mt. Baker and the North Cascades are in the distance. *Photo by Peter Kuhnlein.*

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and Llyn Smith (Anthropology). In addition, a number of affiliated faculty members from departments ranging from Political Science to Forestry and Watershed Management will play supporting roles.

Student Involvement in Research and Projects

Students in the EES program have opportunities to involve themselves in a number of research programs and hands-on energy projects. Some of these opportunities are through faculty and groups with which the EES program is affiliated, including the Schatz Energy Research Center (SERC), the Renewable Energy Student Union (RESU), and the Campus Center for Appropriate Technology (CCAT). Others are student led initiatives.

This semester, our students are working to install a renewable energy system at the Smith River Alliance's environmental education center on the scenic Smith River. They are also working to develop a low cost method to evaluate Humboldt County's wind energy resource. On the international front, EES students are involved in projects ranging from an effort to use biogas digesters to reduce greenhouse gas emissions associated with pig farming in Mexico to an initiative to evaluate the potential to use white light emitting diode (LED) technology as a substitute for kerosene lighting in Kenya. To see these and other examples of the exciting projects that EES students are doing, visit the program website at www.humboldt.edu/~ere_dept/grad/cat/subcat/eesprojects.php.

Who Should Apply to the EES program?

EES is an excellent program for students with backgrounds in science and engineering, economics, business, and the social sciences. Details of who should apply and how can be found at the program's website. Prospective students interested in international or US based work related to energy and the environment can apply for scholarships such as the prestigious Schatz Energy Fellowship.

Our interdisciplinary curriculum combines hands-on learning opportunities with rigorous courses in areas including energy technology and policy, engineering, climate science, and international development. We welcome applications from students who are interested to make a difference in these important fields of study.

SERC & U.S.F.S. Team Up On Biomass Energy

Richard Engel

The U.S. Forest Service recently asked SERC to look into the feasibility of using woody biomass as a fuel to replace propane and electricity for space and water heating at the Orleans Ranger District Office in Six Rivers National Forest. Large amounts of woody debris are generated by Six Rivers' forest thinning operations aimed at reducing wildfire risk. The Forest Service is interested in ways of disposing of this debris other than open pile burning, which is

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Learning About Biomass Thermal Gasifiers in India

Ranjit Deshmukh

India's economy is growing at a tremendous rate, but corresponding rise in energy demand has left the country in a severe power crisis. Blackouts and brownouts are common, with rural areas experiencing the bulk of it. Decentralized village electrification projects offer the possibility of predictable electricity supply for rural areas as well as a source of community income by feeding electricity to the grid. The Indian government currently offers up to 50% in capital subsidies for electrification projects using biomass thermal gasification. For those of you new to this technology, gasification is the incomplete combustion of biomass that results in the production of combustible gases that can be cleaned, filtered and fed into an engine running a generator to make electricity.

This summer, I had the opportunity to visit one of India's leading gasifier manufacturers, Ankur Scientific Energy Technologies. Established in 1986 by Dr. B.C. Jain, Ankur has supplied over 50 percent of India's gasifiers to date. I attended a four-day training on their GAS-11 system, a biomass gasifier coupled with a gas engine and electric generator. The gasifier used in this system is an air-fed downdraft gasifier with a thermal output of 20kW. The overall system provides an electrical output of up to 11kW.

Biomass is becoming an increasingly important source of renewable energy. In light of this, SERC plans to acquire the GAS-11 system and test it with the woody biomass available in Humboldt County, as well as with other feedstock such as bagasse, the waste plant fiber from the sugar industry. The staff at Ankur was extremely helpful in providing all the information about installing, operating, and testing the system. This information will prove invaluable to SERC as we take our first step in researching and testing biomass energy systems. We'll keep you apprised of our research findings in future newsletter articles.

Schatz Energy Fellow Ranjit Deshmukh fires up the GAS-11 gasifier during a four-day training at Ankur Scientific Energy Technologies in India. *Photo by Ranjit Deshmukh.*

Spreading the Word About Grid-Connected Solar Electricity

Jim Zoellick

When people ask me, "Does solar work in foggy Humboldt County?" I answer with a resounding "Yes," adding that the large number of solar electric systems gracing our local rooftops is a good indication that solar works here. In fact, although coastal Humboldt County only receives about two-thirds as much solar energy as the rest of California, we have installed about three times more solar electric systems than the rest of the state on a per capita basis.

In an effort to promote solar energy, I've been teaching a class through HSU's Extended Education program since 2002 called "Understanding Grid-Connected Solar Electric Systems." It is offered three times per year and the class has filled up every time it's offered. In the last five years I've reached about 375 students. The purpose of the course is to empower people in the local community who are thinking about installing a solar electric system. I try to give them enough information so they can decide whether solar is right for them, and if they choose to proceed, they can make informed decisions about the size and features of their system.

The class is held over two evenings for three hours each and all day on Saturday. We start by assessing home energy use and the associated opportunities for increased energy efficiency and conservation. From both an economic and an environmental perspective, it always makes sense to first reduce your energy consumption. Then we talk about how solar electric systems work, what the major components are, how to choose and match system components, and how to determine if your prospective site receives adequate sunlight. In hands-on exercises, students measure solar panel output and utilize a surveying tool to assess the solar access for a given site. Additional exercises challenge students to size a solar electric array and to match solar panels to an inverter. Our Saturday class ends with a visit to a couple of local homes to view their solar electric systems in action.

The final evening of the class is held in a computer lab where every student has access to a computer and the Internet. We work on sizing a solar electric system and determining its economic payback, and students use web-based simulation tools as part of this exercise. Information is also provided on rebates, tax credits, net metering and PG&E rate options.

If you're considering solar for your home or business, come and join us and we'll give you the information you need to make an informed decision. Visit www.humboldt.edu/~extended/ to find out when the next class will be offered.

U.S.F.S. Biomass *(continued from page 2*

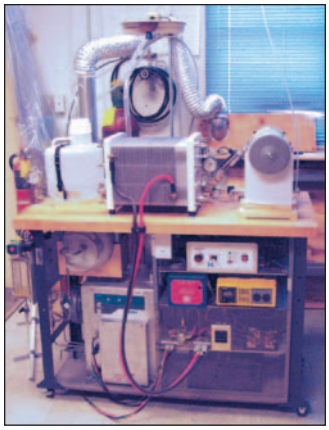
wasteful and can create air quality problems. SERC conducted an energy use audit at the facility and is now investigating commercially available equipment that could be used to heat the building with wood. We have interviewed several nationally recognized experts on commercial-scale biomass heating equipment. We also created a computer model of the building to estimate energy use and energy costs under different heating scenarios. In addition, the model will help us to recommend an appropriately sized replacement heating system for the building.

SERC will report its findings to the Forest Service by October. We are excited about this partnership, as we have long been interested in biomass energy – a natural option for making clean power here in Humboldt County, California's leading timber producing county.

SERC Engineer Richard Engel *(foreground)* collects propane usage data for the Orleans Ranger Station. *Photo by Ranjit Deshmukh.*

Looking Back

4 years ago SERC initiated a project with the University of Alaska at Fairbanks to develop a PEM fuel cell system to be used as an off-grid household-scale power system at a site in Alaska. In contrast to previous SERC fuel cell systems, this system's input fuel is methanol, from which hydrogen is derived using an on-site IdaTech FPM-20 reformer. This system design choice was made after considering the availability of different fuels in rural Alaska, their compatibility with hydrogen reformers, and their associated emissions. For more information visit www.schatzlab.org/methanolfc.html.



SERC Energy News is published quarterly by the Schatz Energy Research Center at Humboldt State University.

The mission of SERC is to promote the use of clean and renewable energy in our society. SERC meets its mission by performing research and developing new technology; designing, building, operating, and demonstrating clean and renewable energy systems; providing training for professionals; and educating the public about a sustainable energy future. SERC's affiliation with the Environmental Resources Engineering program at HSU provides a rare opportunity for undergraduate and graduate engineering students to acquire hands-on experience with cutting-edge energy technologies.

SERC is a member of the National Hydrogen Association, the International Association for Hydrogen Energy, the International Solar Energy Society, and the American Solar Energy Society.

SERC co-directors are Peter Lehman, Charles Chamberlin, and Arne Jacobson. Research and administrative staff include Andrea Allen, Greg Chapman, Ranjit Deshmukh, Richard Engel, Keith Glenn, Ray Glover, Peter Johnstone, Stephen Kullmann, Marc Marshall, Allison Oakland, Kyle Palmer, Mark Rocheleau, Scott Rommel, Michael Winkler, and Jim Zoellick.

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