



# SERC

## ENERGY NEWS

### A New Home for the Schatz Lab

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Schatz Lab

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A rendering of the new SERC building.

After nearly 20 years of being housed in the old and tired University Annex building, SERC is getting a new home. A contract has now been signed for construction of the new facility. Groundwork will begin in January 2009, full-scale construction will kick off in March, and completion is slated for June 2010.

The 6,000 square foot-plus building will house an exterior laboratory, two indoor labs, a machine shop, a conference and demonstration room, and offices for staff and graduate students. The new research center will be situated atop a picturesque hill on the Humboldt State University campus. It is located on the west side of Cluster Court, just across the street from HSU's new Behavioral and Social Sciences Building.

The design for the building was completed by Design Department, an Oregon architectural firm. The contractor will be Humboldt County based Beacom Construction.

Adhering to the sustainability principles of both HSU and SERC, the new building will meet LEED (Leadership in Energy and Environmental Design) Gold equivalent standards.

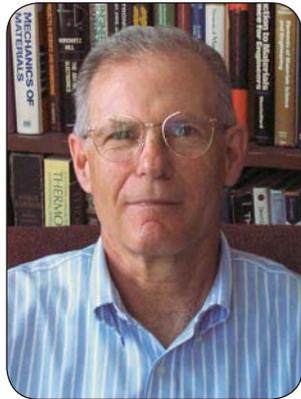
Funding for the \$3.0M project comes from the estate of the late Dr. Louis W. Schatz, SERC's long-time benefactor.

The quarterly newsletter of the  
Schatz Energy Research Center

**HUMBOLDT**  
STATE UNIVERSITY

## A Message from the Director Peter Lehman

It was a great thrill for us at SERC to finally have a signed contract in place for the construction of our new lab/office building. After years of planning, we now have a design we can dream about and a date we can look forward to for completion of our new home. I walked up to the site the other day. The building corners are marked and I was able to imagine what it will be like to walk into a modern, energy-efficient facility right in the middle of the HSU campus. Our cover story shows the building rendering so you can dream along with us. We'll keep you informed with updates in each forthcoming issue.



We are also very encouraged by the energy related appointments in the Obama administration. With Nobel laureate Steven Chu leading the Department of Energy and John Holdren as the President-elect's science advisor, our country will have two experienced energy experts in the government to help shape a new energy policy. It augurs well for a shift in course so that we begin taking climate change seriously and developing renewable energy. It's an exciting time to be doing energy work.

In other news at SERC, Greg Chapman reports on progress with our gasifier experiment. After much installation and construction work, fuel preparation, and debugging, we are now running smoothly. It feels good to be opening up this new line of renewable energy work at the lab. Also in this issue, Jim Zoellick reports on our work in helping AC Transit plan and site their new hydrogen station in the Bay Area. Jim also reports on the latest news from our HyTEC project. Finally, Richard Engel describes working with UC Berkeley to introduce hydrogen and fuel cell topics into the undergraduate engineering curriculum.

Yesterday was the longest night of the year. As the light returns to our northern hemisphere, best wishes to you and yours for a festive holiday season and a healthy and happy new year.

## SERC Supports AC Transit in Implementing Hydrogen and Fuel Cell Technology

Jim Zoellick

The Alameda-Contra Costa Transit District, or AC Transit, has been working to introduce hydrogen fuel cell technology into their transit bus system since 1999. Today they have one of the most comprehensive hydrogen fuel cell demonstration programs in the world. This includes three fuel cell buses operating in regular passenger service that have logged over 125,000 miles while serving more than 300,000 passengers. Their program also includes a fleet of fuel cell passenger vehicles, on-site hydrogen production and fueling, on-site fuel cell vehicle maintenance, extensive evaluation, outreach and education, and safety training.

In support of their hydrogen fuel cell program, SERC has provided consulting services to AC Transit since 2004. We have conducted hydrogen trainings for bus drivers, mechanics, board members (or "policy makers"), and other staff; we have conducted emergency responder trainings for fire departments throughout their service territory; and we have conducted town hall meetings and assisted them with various public outreach activities.

Recently we have begun a new round of work to support AC Transit in building a new hydrogen fueling station at their Emeryville transit facility. We are consulting with them on their facility design and safety analyses and are providing public outreach and first responder training services. Their new hydrogen fueling station in Emeryville will include a publicly accessible fueling station and will serve up to 15 passenger vehicles and 6 buses per day. As much as 420 kilograms of hydrogen per day will be produced from reformed natural gas, as well as electrolytically using solar electricity.

SERC is pleased to be helping AC Transit do this important work to advance hydrogen and fuel cell technology.



A rendering of AC Transit's hydrogen fueling station in Emeryville, CA.

# University H<sub>2</sub> Curriculum Project Gets Underway

Richard Engel

In our last issue, we announced that SERC was selected for funding by the U.S. Department of Energy to develop hydrogen curriculum and teaching tools for use in California's public universities. We now have a contract in place with DOE, and on October 30 we held a kickoff meeting with our project partners at the University of California at Berkeley. We have named the three-year project "Hydrogen Energy in Engineering Education" (H<sub>2</sub>E<sup>3</sup>).

We have identified introductory engineering courses at UC Berkeley and Humboldt State University that already incorporate fuel cells. We consulted with instructors from these courses to get their input on how to enhance their curricula and incorporate our fuel cell learning hardware into their lesson plans. SERC engineers are also experimenting with improvements to our existing benchtop electrolyzer/fuel cell kits that will be used in the freshman engineering classes and have begun design of portable fuel cell test stations for use in advanced engineering labs. We are also scanning the market for commercially available fuel cell stacks we can use with the student test stations.

Stay tuned for announcement of a project website that will host curriculum modules to be made available for download. If you are an engineering instructor in the CSU or UC system interested in using fuel cells in your courses, please contact us to see how you can get involved in this exciting new project.

## Project Updates

**Biomass Gasification:** *The Gasifier has been Commissioned!*  
Greg Chapman

The gasifier system has successfully completed shakedown testing and is now ready for experimental testing. The gasifier burns wood chips in an air-deficient environment to produce a combustible gas made up of mainly hydrogen, carbon dioxide, carbon monoxide and nitrogen. The preliminary test results indicate that the production gas composition is very close to the expected values as provided by the manufacturer. Upcoming experiments will include a series of runs using wood chips of varying moisture contents. The production gas will be sampled and analyzed with a gas chromatograph throughout these runs in order to determine the effect of moisture content in the wood chips on the resulting gas composition.

The main gasifier unit and supporting subsystem were installed inside a well-ventilated metal building located at SERC. The gasifier unit is comprised of a hopper and reactor assembly, a gas scrubbing water system, two gas filters, a gas blower, a combustion air blower and a cone gas burner. Additional

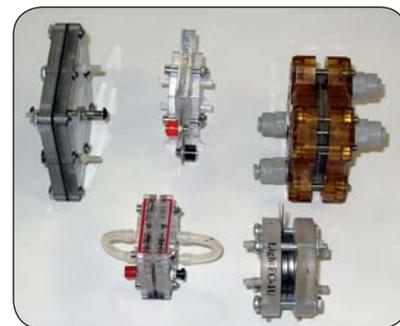
subsystems to support the research include an instrumentation system, a gas sampling system, and the building safety system.



SERC staff gathers for the much-anticipated initial system start-up. See additional start-up photos on the back page.

**HyTEC** Jim Zoellick

SERC has been working with the Lawrence Hall of Science (LHS) at UC Berkeley since 2004 on the Hydrogen Technology and Energy Curriculum (HyTEC) project. The curriculum introduces hydrogen and fuel cells into high school chemistry and science courses. To date we have completed a curriculum module consisting of six activities. The module has been field tested in numerous schools throughout the country. The curriculum module is built around a laboratory kit that allows small groups of students to work with a bench top electrolyzer and fuel cell. Students generate hydrogen via electrolysis, use the hydrogen to operate a fuel cell and power an electric motor, and then measure the efficiency of the fuel cell. In the process they learn about electrochemistry and how a fuel cell works.



SERC developed the bench top kit and is now working with

The commercial fuel cells tested for the HyTEC project.

LHS and Lab-Aids Inc. to commercialize the kit. In support of this effort, SERC recently tested various single-cell educational fuel cells to see how well they performed and how well they would fit into our laboratory kit. Later this year we hope to finalize the curriculum with LHS and support them in making the curriculum available nationwide to help educate our future scientists and engineers.



Above, SERC Co-Director Arne Jacobson and Graduate Student Research Assistant Ranjit Deshmukh cut the ribbon prior to system start-up. At left, Research Engineer Mark Rocheleau fires up the gasifier.



At left, Graduate Student Research Assistant Joe Purdon loads the hopper with fuel. Below, Senior Research Engineer Greg Chapman and Research Engineer Marc Marshall monitor the gasification system during initial start-up and operation.



## Looking Back

**7 years ago** UNPEPP interns working at Wolf Creek Outdoor School (WCOS) in Redwood National and State Parks designed a lighting system to illuminate walking paths and the amphitheater and a 2-kW grid-connected solar electric system to offset the increased electrical load. The Park installed the systems during 2002-2003 with assistance from Bonneville Power Administration, California Conservation Corps, SERC, and Humboldt State University Environmental Resources Engineering students. For more information visit [www.schatzlab.org/projects/community/unpepp\\_rnp](http://www.schatzlab.org/projects/community/unpepp_rnp).



**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, Richard Engel, Keith Glenn, Ray Glover, Meg Harper, Peter Johnstone, Patricia Lai, Marc Marshall, Allison Oakland, Joe Purdon, Kristen Radecky, Mark Rocheleau, Scott Rommel, Colin Sheppard, Michael Winkler, and Jim Zoellick.

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