



# SERC

## ENERGY NEWS

**Spring 2007**  
Volume 2, Number 1

### Features

Hydrogen Fueling Station  
Update

Biomass Feasibility Study

H<sub>2</sub> Safety Training for UTC  
Power and CT Transit

SERC Helps Turn Schools  
Green

Yurok Energy Project  
Update

### In Every Issue

A Message From  
the Director

Looking Back

The quarterly newsletter of the  
Schatz Energy Research Center

**HUMBOLDT**  
STATE UNIVERSITY

## Hydrogen Fueling Station Update Richard Engel

As reported in our last issue, SERC will soon receive a hydrogen-powered Toyota Prius for use at Humboldt State University (HSU). SERC engineers have recently completed design of an on-campus hydrogen fueling station to be located just a block away from SERC. Equipment is beginning to arrive and construction is scheduled to get underway shortly. The station will generate hydrogen on-site, compress it, store it, and dispense it to vehicles. Vehicle delivery and fueling station completion are both expected to take place by mid-July.

SERC's partners on the project include HSU, Chevron Technology Ventures, the California Hydrogen Highway Network, the California Department of Transportation, and the North Coast Air Quality Management District. While the costs of the vehicle and fueling station hardware have been met, SERC continues to seek additional partners to help fund the project's design and installation costs.



Artist's rendition of the station with hydrogen-powered Toyota Prius. *Drawing by Matthew Marshall.*

# A Message from the Director

Peter Lehman

What a difference a year makes. SERC colleague Arne Jacobson and I traveled to Washington, D.C. in January to speak to our lawmakers, discuss ongoing work at the Center, and offer our support and guidance on climate change legislation. For the last few years, there has been general pessimism in the Congress that anything would be accomplished with regard to climate change. This time, Arne and I found energy and optimism. We met with staffers for Senators Feinstein and Boxer, including the chief consul of the Committee on Environment and Public Works, the Senate Committee that will be taking up climate change legislation. We were also fortunate to meet with Congressman Mike Thompson and his staff. Everyone was encouraged that times have changed and real movement toward effective legislation is finally happening. Whether it will be Senator Feinstein's incremental bill or Senator Boxer's more radical one, we wish the Congress luck in finally tackling our most pressing global issue.



Back at home, as Richard Engel reports, work is kicking into high gear on the hydrogen fueling station we are designing and building on the HSU campus. Thanks to Matthew Marshall, we have a beautiful conceptual picture of the station which graces our cover. Richard also reports on our work for the Alliance to Save Energy (ASE). We're helping develop high school and middle school student energy audit curricula and correlate them with state standards (part of ASE's "Green School's" program). Richard (he's a busy man) has also become the advisor for ASE's Green Campus program here at HSU. Jim Zoellick (SERC's "Dr. Safety") reports on a trip he and I made recently to Hartford CT to do hydrogen awareness and safety training for CT Transit and UTC Power. CT Transit will soon operate the first hydrogen fuel cell bus in New England. We trained bus mechanics and emergency first responders. Finally, we mention the work SERC is doing to help the Environmental Resources Engineering capstone design class in their Yurok energy resources study.

One of the most heartening developments is the possibility of collaborating with the Schatz Tree Farm. As Ranjit Deshmukh reports, we've had a series of meetings with Tree Farm leaders to explore working together to develop energy generation from woody biomass through gasification technology. Mr. Schatz would be proud to see the two organizations he founded finding common ground in their research work.

This issue of the SERC newsletter marks a milestone--our first year of publication. We are also working to refurbish our web

# Biomass Feasibility Study

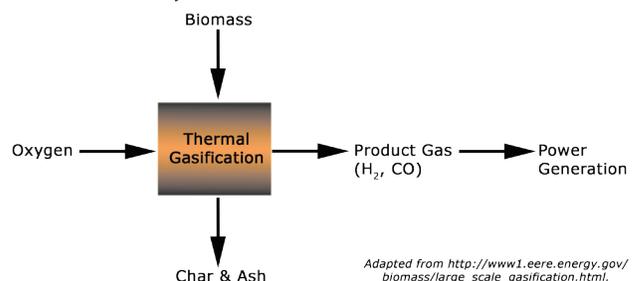
Ranjit Deshmukh

Biomass has a tremendous potential for providing renewable energy if it is harvested in an environmentally sustainable manner. The forestlands of Humboldt County have considerable biomass that is scheduled for removal due to fuel reduction and fire prevention activities. The Schatz Energy Research Center (SERC), with potential collaboration with the Schatz Tree Farm and the Department of Forestry at Humboldt State University, is looking at possible ways to convert this forest biomass into useful energy. As a Schatz Energy Fellow and SERC team member, I am involved in studying the thermal gasification process and researching its feasibility in successfully harnessing energy from the forest biomass.

To reduce the risk of wildfires, the Forest Service treats parts of the forestlands for fuel reduction, which involves burning biomass in concentrated piles. This results in degradation of air quality as well as the environment due to the concentrated burning. The biomass piles left to dry out by the roadsides often suffer from backlogs due to the limited burn windows, posing a serious fire hazard. This biomass, which is typically brush and small diameter wood, has little economic value. Removing this biomass from the forest and transporting it to the two biomass power plants in Humboldt County is generally not economically feasible, since the transportation costs and energy often outweigh the revenues and energy production gained from the biomass.

Thermal gasification of biomass could offer the benefits of distributed energy generation and controlled particulate emissions, while converting biomass into useful energy. The incomplete combustion of biomass results in the production of combustible gases consisting mainly of carbon monoxide and hydrogen. These product gases, after being cleaned and filtered, can be used in a variety of applications ranging from internal combustion based electric generators to combustion for thermal applications. Small-scale gasifiers (devices that convert solid fuels into gaseous fuels) could possibly be transported to the fuel reduction sites to generate electricity in closed reactors to feed into the grid. Gasifiers could also provide heat and/or electricity to non-electrified communities, schools and other institutions.

SERC is committed to researching clean and renewable energy technologies for our local region and is excited to bring biomass into our sphere of knowledge. We'll keep you informed of the results of this study in a future edition of our newsletter.



Adapted from [http://www1.eere.energy.gov/biomass/large\\_scale\\_gasification.html](http://www1.eere.energy.gov/biomass/large_scale_gasification.html).

site and should have a new site up in a couple of months. We'd welcome your feedback on all of our outreach efforts.

## H<sub>2</sub> Safety Training for UTC Power & CT Transit Jim Zoellick

SERC recently added UTC Power to their list of clients for whom they have provided hydrogen safety and awareness training. That list also includes Chevron, AC Transit, SunLine Transit, and the State University of New York at Buffalo.

UTC Power, a Connecticut-based company, has led an industry team to build New England's first fuel cell bus, which will be operated by CTTRANSIT. The bus will debut in Hartford in April. A \$2.9 million Federal Transit Administration grant is paying for the bus and associated infrastructure development. The bus features a UTC Power PureMotion™ 120 kW fuel cell power system, a VanHool chassis, and a hybrid all-electric drive system integrated into the bus by ISE Research Corporation. The bus will be fueled at a new hydrogen fueling station at UTC Power, and will be housed and maintained at CT Transit's central bus terminal.

SERC's hydrogen safety and awareness training was delivered to mechanics at CT Transit who will be performing routine maintenance on the bus. The day before SERC arrived, CT Transit received the fuel cell power system and installed it in the bus with the help of UTC Power engineers. The fuel cell power module is essentially a plug-and-play system that was installed in a matter of hours. SERC also provided a hydrogen safety and awareness training to local first responders. The awareness training set a context for hydrogen as a transportation fuel and provided an overview of hydrogen technology. The safety training covered basic hydrogen safety concepts, presented details about the facilities and equipment associated with the project, and highlighted facility safety features and emergency response procedures.

## SERC Helps Turn Schools Green Richard Engel

Over the past two years, SERC has worked with the Washington, DC-based Alliance to Save Energy (ASE) on the creation of an energy efficiency curriculum intended for nationwide use in high schools. The curriculum, known as Student Energy Auditor Training (SEAT), teaches students about energy by having them perform an energy audit on their own campus. SERC staff have pilot-taught the three-day curriculum in a half dozen schools across northern California, receiving positive reviews from students and teachers. In several cases, schools have gone on to make energy-saving upgrades based on the students' recommendations.

However, the three-day format of the SEAT curriculum has gotten mixed reviews from school administrators, already hard-pressed to make sure students cover all their existing curricula. SERC and ASE have responded by producing a new, one-day version of the curriculum that is correlated to California's state educational content standards. This approach will help teachers to integrate SEAT into their existing lesson plans. ASE has also asked SERC

## Yurok Energy Project Update Richard Engel

SERC's ongoing effort to help the Yurok Tribe develop a Tribal energy program has recently been strengthened by a new collaboration with engineering students and faculty at Humboldt State University (HSU). The students, enrolled in Dr. Eileen Cashman and Dr. Arne Jacobson's capstone engineering design course for graduating seniors, are investigating options for hydropower development on the Yurok Reservation's many creeks. The class is learning how to operate within numerous technical, economic, environmental, and cultural constraints. The Tribe is eager to make greater use of on-Reservation energy resources but is also wary of potential impacts on fisheries or Yurok sacred and ceremonial sites.

The students will present their findings to SERC staff and the Yurok Tribal Council later this spring. SERC staff are excited about this opportunity to leverage the students' pro bono assistance on the project, while the students benefit from being involved in an exciting, real-world engineering project right here in Humboldt County.



Yurok Tribal Engineer (and former SERC employee) Dustin Jolley explains the Wautec community water system to HSU engineering students and faculty. *Photo by Richard Engel.*

to produce a new version of SEAT adapted for use in middle schools, also standards-aligned. ASE plans to launch the new, streamlined SEAT curricula in southern California this spring.

SERC has also expanded its partnership with ASE through involvement in the Green Campus program. This ASE-sponsored program works with university students, staff, administrators, and faculty to improve energy efficiency on U.S. college campuses. The students of Humboldt State University's Green Campus team recently recruited SERC's Richard Engel as their staff advisor. Richard accompanied the team to Berkeley for a



NON-PROFIT ORG.  
U.S. POSTAGE  
PAID  
PERMIT No. 78  
Arcata, CA 95521

**Humboldt State University**  
1 Harpst Street  
Arcata, CA 95521

Visit the online version of  
our newsletter and sign-up  
for email notifications at  
[www.schatzlab.org/newsletter](http://www.schatzlab.org/newsletter)

## Looking Back

**8 years ago** SERC built the first Stack-in-a-Box® portable fuel cell power supply system. The system was originally designed for use by a group of students at the Merit Academy in Santa Cruz, CA, to demonstrate the use of hydrogen and fuel cells to power everyday electric loads. SERC has since built four additional SIB® systems, three for customers, and one for our in-house education and outreach program. The portable nature of this complete fuel cell system affords a variety of audiences the unique opportunity to see, and sometimes operate, a working fuel cell. For more information visit [www.schatzlab.org/stackinabox.html](http://www.schatzlab.org/stackinabox.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 Dawne Abdul Al-Bari, Andrea Allen, Greg Chapman, Ranjit Deshmukh, Richard Engel, Ray Glover, Peter Johnstone, Marc Marshall, Allison Oakland, Mark Rocheleau, Scott Rommel, Michael Winkler, and Jim Zoellick.

Visit us at [www.schatzlab.org](http://www.schatzlab.org) E-mail: [serc@humboldt.edu](mailto:serc@humboldt.edu)