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The quarterly newsletter of the Schatz Energy Research Center

HUMBOLDT
STATE UNIVERSITY

A Ground-Breaking Ceremony for Blue Lake Rancheria's Low-Carbon Community Microgrid *Jim Zoellick*

It was a beautiful day for a celebration. Keynote speakers included Congressman Jared Huffman and Energy Commissioner Karen Douglas. Entering the Blue Lake Rancheria (BLR) property the morning of August 24, I saw a huge banner announcing the Rancheria as one of 16 designated White House *Climate Action Champions*. Further onto the property were additional banners with words like "sustainable" and "clean energy." And then I came to the banner that explained what the hoopla was all about: "Celebrating clean energy and climate action. Announcing a new project: low-carbon community microgrid."

The event was a ground-breaking ceremony for the Blue Lake Rancheria Low-Carbon Community Microgrid Project. A partnership between the Schatz Energy Research Center, BLR, [Siemens](#), Pacific Gas and Electric Company (PG&E) and others, the project is funded in part by a \$5 million grant from the California Energy Commission's Electric Program Investment Charge program. The multi-year project includes planning and design in year one, system installation in year two, and operation and performance analysis in year three.

According to the US Department of Energy Microgrid Exchange Group, "A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode." The Rancheria's microgrid will feature a 400 kW-AC solar electric array (the largest in Humboldt County), 1 MWh of battery storage, a 175 kW fuel cell system powered by a woody biomass gasifier, and interruptible loads, all of which will be controlled by a Siemens microgrid controller.

The microgrid will provide numerous benefits to the Rancheria and the local community. First, the Rancheria is a nationally recognized American Red Cross critical support facility, and in the event of a natural disaster on the North Coast, such as a large earthquake or tsunami,



Left: Jana Ganion, Blue Lake Rancheria Energy Director, addresses the crowd. Right: Tribal leaders and project partners participate in the ground-breaking ceremony. *(continued on page 4)*

A Message from the Director

Hello from Washington, DC, where I just attended the *White House Forum on Catalyzing Markets for Off-Grid Clean Energy Access*. The session involved a lively round table forum with participation from government, industry, investors, foundations, and development agencies. It also included a technology showcase attended by high-level administration officials. It is exciting to see off-grid energy access receive this attention. The fact that the event was held is a testament to the growing recognition of the linkage between energy access and poverty alleviation and to the recent growth of the off-grid solar sector.



I am now headed to Dubai for the *4th International Off-Grid Lighting Conference and Exhibition*, which will be attended by over 450 delegates from around the world. SERC will be well represented at the conference, with three current staff members and three SERC alumni joining me at the event. Our collective work will be featured at the conference, including presentations on quality assurance for off-grid solar, the market implications of key technology advances in the sector, and the role of super-efficient DC appliances in enabling cost reductions for off-grid products. It will be a busy week.

Back at SERC, we have been busy on a number of fronts, including the kickoff of our micro-grid collaboration, the Waste-to-Wisdom biomass project, and a host of clean transportation efforts. Over the past few months, we also added six new team members, including Pramod Singh, Steve Harrison, Jake Rada, Julie Groff, Lukas Kennedy, and Jeff Mosbacher. I am very pleased to be able to welcome them to SERC.

Right: Christie Goldfuss, Managing Director of the White House Council on Environmental Quality, and Dr. John Holdren, Director of the White House Office of Science and Technology



technology showcase during the *White House Forum on Catalyzing Markets for Off-Grid Clean Energy Access* in Washington, DC. **Far right:** Round Table Discussion in the Eisenhower Executive Office Building at the *White House Forum on Catalyzing Markets for Off-Grid Clean Energy Access* in Washington, DC.

Driving the World's First Mass-Produced Fuel Cell Vehicle Greg Chapman

There's a new hydrogen vehicle in town: a 2016 Hyundai Tucson Fuel Cell vehicle. SERC used this state-of-the-art vehicle, on a three-month loan from the Hyundai America Technical Center Station, as an education, outreach, demonstration, and testing tool for zero emission vehicle (ZEV) planning projects in the North State region of California.

These projects, funded by the California Energy Commission, include planning for hydrogen fueling infrastructure, working with local municipalities and key stakeholder groups to facilitate deployment of hydrogen fueling infrastructure and fuel cell vehicles, and conducting public education and outreach activities to promote these efforts.

The vehicle made its North Coast debut last month at the ZEV Ride and Drive Event at the Arcata Community Center. Along with our long-running Toyota Fuel Cell Hybrid vehicle, it was used as a shuttle for people attending Arcata's 42nd Annual North Country Fair.

In addition to outreach events, SERC engineers also collected and analyzed driving and fueling data from the HSU Hydrogen Fueling Station to determine the vehicle's performance under the driving conditions characteristic to our unique geographic and climatic region here in Humboldt County.

SERC research engineer Jerome Carman poses in front of the Hyundai Tucson Fuel Cell vehicle.



Accelerating the Adoption of Low-Carbon Transportation Fuels

Jerome Carman

The transportation sector accounts for 37% of all tracked greenhouse gas emissions in California, making this a key focus sector in statewide efforts to reduce greenhouse gas emissions. The California Energy Commission has aggressively funded the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) through which SERC has received funding for numerous planning and implementation projects over the last four years.

SERC is continuing this important work through three more planning and implementation projects funded through ARFVTP in partnership with the Redwood Coast Energy Authority and the Siskiyou County Economic Development Council:



- The North Coast Plug-In Electric Vehicle Readiness Plan Implementation Project, which covers Del-Norte, Humboldt, and Trinity Counties. This project will address permitting and code barriers to the installation of electric vehicle charging stations (EVCSs), conduct micro-siting efforts to identify viable locations for EVCSs, and engage in education and outreach efforts.
- The Plug-in Electric Vehicle Readiness Glenn-Colusa Planning & Upstate Implementation Project, which covers Colusa, Glenn, Siskiyou, Shasta, and Tehama Counties. For this project we will develop a readiness plan for Glenn and Colusa Counties, address permitting and code barriers to the installation of EVCSs, conduct micro-siting efforts to identify viable locations for EVCSs, and engage in education and outreach efforts.
- The North Coast and Upstate Fuel Cell Readiness Planning Project, which covers Colusa, Del Norte, Glenn, Humboldt, Lake, Mendocino, Siskiyou, Shasta, Tehama, and Trinity Counties. This project will develop a readiness plan for the ten county region to prepare for the accelerated deployment of hydrogen fuel cell vehicles.

These projects build upon and expand the geographic reach of past efforts.

Project Updates

BRDI Waste to Wisdom: Summer 2015 Testing
Yaad Rana

Late last spring, the BRDI team began acquiring testing apparatus and field equipment needed for torrefaction, drying, and briquetting of biomass at a test site located on Green Diamond property at Big Lagoon. The area, a demolished mill site, consisted of dilapidated cement, old iron railings, and overgrown shrubs. Drawings had already been prepared for electrical lines, equipment placement, and emergency evacuation locations for the test site, so site set up proceeded quickly.

The torrier was a pilot unit custom-built by Norris Thermal Technologies (NTT) and hauled on a trailer over 2000 miles from Indiana. This was the largest piece of equipment on site and was the main focus for our summer testing of feedstocks at various temperatures and dwell times. NTT also provided a drying unit, which was purchased by BRDI for future biochar field-testing. This is the same type of drying unit used in many industries, including food and agriculture. BRDI's application of the dryer was unique in that it used waste heat from the torrier to dry the feedstocks to varying degrees of moisture content. The team found that moisture content in the woodchips, hard to control due to the combination of summer rains, early fog, and blazing midday heat, had a significant impact on torrefaction. Moisture content in samples

From right to left: The torrefier trailer, the biomass drying unit, and the homemade chip screener used to sift feedstocks to acceptable chip sizes.



The summer testing team from left to right: Yaad Rana, Andy Eggink, David Carter, Greg Pfothenauer, Kyle Palmer, Anna Partridge, and Marc Marshall.

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Project Updates (continued from page 3)

also affected the briquetting of the woodchips. Dry feedstocks of small particle sizes were observed to form dense briquettes of uniform size. Briquettes made of larger wet chips tended to crumble easily, and if the moisture content was high, the bricks expanded and deformed. In addition, because water is incompressible, too much moisture could damage the process mold and hydraulic pistons used to densify the woodchips into briquettes.

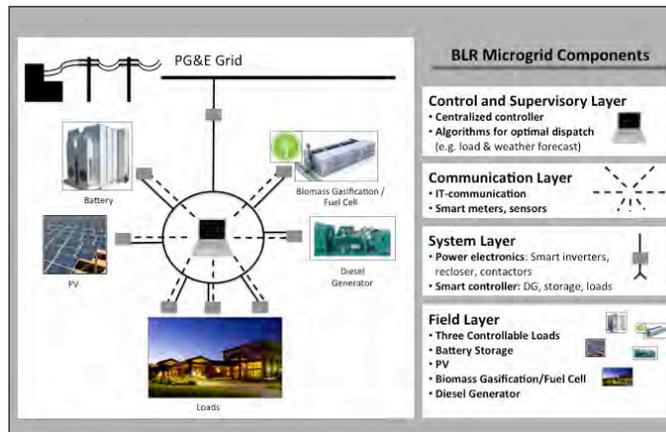
Overall, testing was successful and the BRDI team has a plethora of samples to analyze in the lab. An exciting year is expected, as analysis is performed in preparation for continued testing using full-scale equipment next summer.

Low-Carbon Community Microgrid (continued from page 1)

serves as an emergency evacuation site. The microgrid system will be capable of providing stand-alone power for emergency critical loads almost indefinitely. The microgrid system will also provide numerous non-emergency benefits. The solar electric array and biomass powered fuel cell generator will provide on-site renewable power that will lower the Tribe's greenhouse gas emissions and reduce their electric bills. In addition, the battery storage will be optimally managed by the microgrid controller to reduce power consumption during peak periods. This will serve to lower the Rancheria's electric bills, while also providing benefits to the local PG&E electric grid.

Microgrids are envisioned to be an integral part of the electric grid of the future. In this grid of the future, which PG&E refers to as the Grid of Things™, instead of relying solely on large central-station power plants, much of our electrical power will come from smaller renewable generators located near the facilities that need the power. In addition, there will be controllable loads, energy storage and plug-in electric vehicles; all of these

devices will be capable of interacting via smart controllers in order to optimize the performance of the overall system. The goal is to lower greenhouse gas emissions, lower prices, provide more secure and reliable power, and allow more local choice and control. The BLR's low-carbon microgrid project will move us one step closer to the Grid of Things™. Perhaps Jana Ganion, BLR Energy Director, explained it best when she said, "What it means to me personally is that I can look my son in the eye and when he asks me about climate change I can tell him, sweetheart, I'm working on it."



Microgrid topology. Adapted and used with permission from Siemens.

"This project shows the type of leadership and partnership that can advance California's climate and renewable energy goals, help transform our energy system and reduce greenhouse gas emissions."
Karen Douglas,
California Energy Commissioner

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.

SERC is a member of the California Hydrogen Business Council, the International Association for Hydrogen Energy, the International Solar Energy Society, and the American Solar Energy Society. SERC advisory board members are Rick Duke, Shannon Graham, Dan Kammen, David Katz, Jaimie Levin, David Rubin, Jeff Serfass, and Andrea Tuttle. SERC co-directors are Arne Jacobson, Peter Lehman, and Charles Chamberlin. Faculty research associates are Kevin Fingerman and David Vernon. Research and administrative staff include Nick Bryant, Jerome Carman, Dave Carter, Greg Chapman, Andy Eggink, Richa Goyal, Julie Groff, Allison Hansberry, Meg Harper, Andy Harris, Steve Harrison, Asif Hassan, Malini Kannan, Lukas Kennedy, Ga Rick Lee, Marc Marshall, Jason McMack, Jeff Mosbacher, Carolyn Ortenburger, Janoah Osborne, Kyle Palmer, Greg Pfothenauer, Tom Quetchenbach, Jake Rada, Kristen Radecky, Yaad Rana, Mark Rocheleau, Doug Saucedo, Colin Sheppard, Pramod Singh, Jayati Thakor, and Jim Zoellick. SERC docents and volunteers are Isabel Contreras, Julia Gomez, Christopher Long, Murielle Manka, and Lorenzo Pagano.

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