

Warren J. Baker Endowment for Excellence in Project-Based Learning Robert D. Koob Endowment for Student Success

FINAL REPORT

I. Project Title

Comparative Analysis of Photovoltaic Systems across multiple environments

II. Student(s), Department(s), and Major(s)

(1) Wesly McGuire, Construction Management

(2) Adam Poffenbarger, Construction Management

III. Faculty Advisor and Department

Thomas M. Korman, Ph.D., P.E.

IV. Cooperating Industry, Agency, Non-Profit, or University Organization(s)

National Electrical Contractors Association (NECA) (<http://www.necanet.org/>)

ELECTRI-International (<http://www.electri.org/>)

Reach Beyond (<http://www.electri.org/>)

SunPower (<http://us.sunpower.com/>)

Spring Electric - San Jose, CA (<http://www.sprigelectric.com/>)

V. Executive Summary

The Cal Poly National Electrical Contractors Association (NECA) Student Chapter through participating in the NECA ELECTRI-International Student Passport Initiative fabricated and installed a photovoltaic system in Wayusentza, Ecuador (a medium jungle community of 220 people). Following the installation, the NECA student chapter monitored the operation of the system and performed a comparative study of the systems across the various ranges of geography, humidity, elevation and ecological conditions.

VI. Major Accomplishments

(1) Fabrication and testing of a photovoltaic system in the Cal Poly Campus Simpson Strong Tie (SST) Building. The Cal Poly NECA student used the project as mechanisms to recruit new students to the student chapter and increase awareness of the benefits of alternative energy solutions.

- (2) Transporting, installing, and commissioning of the pre-fabricated photovoltaic system. The system was packaged and shipped to Ecuador. The team then traveled to Ecuador and installed and commissioned the system.
- (3) Monitoring and documentation. Following the installation of the system, data was recorded and used as a comparison to contrast its performance against similar systems installed in various climate regions.

VII. Expenditure of Funds

The total cost of the project exceeded 15,000. The \$5,000 granted from the Baker Endowment was used for travel purposes to install the systems in Ecuador. Additional funding was secured from the NECA Passport Initiative Program. The photovoltaic panels were donated by Sunpower and the remainder of the components required for the installation was donated from Sprig Electric of San Jose, CA.

VIII. Impacts to Student's Learning

Student learning was enhanced by the ability for students gain hands-on experience managing the project from conception through commissioning and operation. The installation benefited the learning efforts at Cal Poly as the installation by serving as a living laboratory for current and future students as they collect data for comparative studies across multiple environments and providing students with a global green perspective.

PROFESSORS AND STUDENTS HELP BRING WATER TO AN ECUADORIAN VILLAGE IN THE

AMAZING AMAZON



Solar-powered energy has made it all the way to the Amazon jungle, thanks in part to construction management Professors Thomas Korman and Lonny Simonian.

Those two, along with students Adam Poffenbarger and Wesley McGuire, traveled to Ecuador in November 2014 to help deliver clean spring water to about 200 indigenous people in the Amazon Basin — a project, noted Korman, that would “benefit so many who have so little.”

The trip, partially funded by a \$5,000 grant from the Cal Poly Baker Foundation to the student chapter of the National Electrical Contractors Association (NECA) and support from industry, was made in partnership with the nonprofit agency Reach Beyond.

The more than 3,500-mile journey to their final Ecuadorian destination was an arduous one. “We flew into Quito, took land transportation to Shell, then flew into the Amazon rain forest in a small Cessna,” Simonian said.

The Cal Poly team was discouraged from bringing in food or any Western cultural bias. “They wanted us to interact with the community,” Simonian said. “We did bring sleeping bags and tents with nets to keep the mosquitoes out.”

The Cal Poly contingent was greeted warmly upon their arrival. “The people were expecting us,” Simonian said. “They have a close relationship with Reach Beyond. The organization’s intention is to work collectively with the indigenous people to better their lives.”

Cal Poly students Adam Poffenbarger (top, left) and Wesley McGuire install the water-pumping system on a home.

Professor Lonny Simonian (bottom left) assists McGuire with the installation.

Children of the village rejoice in their easily accessible water (right).

Korman, Simonian, Poffenbarger and McGuire went there to help install a system to pump water from a spring to a village about 5,000 meters away.

The project had begun before they arrived. “Some trenches had been dug, and construction at the spring had started,” Simonian recalled. “A lot of excavation work had been completed, and some pipes had been installed in the trench.

“Cal Poly assisted Reach Beyond in providing quality control and material inspection and helped get material to the site.”

The students experienced a whole new level of Learn by Doing. “They carried machetes and cleared underbrush. They worked in a large, open-walled structure, assembling small components, prefabricating pipes, valves and fittings,” Simonian said.

The students worked alongside the indigenous people, who took the lead on the project. “The people of the village are the ones who do all of the work, solve all of the problems,” Poffenbarger said. “They are the ones who have to own it; they make it happen.”

Before the project was completed, the villagers hand-carried their drinking water in buckets from the spring to their village. They bathed in the river. “The photovoltaic (PV) and water distribution







The villagers and Cal Poly visitors collaborate on installing a photovoltaic system (left).

system pumps drinking water and water for them to wash in," Simonian said.

That isn't the end of the story. The Cal Poly student NECA chapter was recently awarded \$20,000 from ELECTRI International, the research foundation for NECA. Students Parker Haerr and David Mulder will accompany Simonian on a return trip this fall to work on additional projects.

The Ecuadorian government has also pledged financial support. "The \$20,000 ELECTRI grant will be leveraged to almost \$200,000 in effective cost benefits," Simonian said. "With the new grant money and additional support, we will be working on eight projects that will help several hundred people.

"Plus we will install 16 PV panels at Beyond Reach headquarters, allowing it to become carbon neutral," Simonian continued.

The Cal Poly group learned a great deal on that first trip. Planning becomes paramount. "The village is located 60 kilometers from the nearest road. It is so isolated, the biggest task is logistics," Simonian said. "What do you need? When do you need it? How are you going to get it there?"

"It's one thing when you can transport materials on a plane, but the Cessna has a very small capacity," Simonian continued. "The PV panels were too big and had to be transported up-river in canoes. There were obstacles, but it is part of daily life. You have to look at the entire work sequence and stage everything exactly right."

Simonian found the trip "enriching" and looks forward to returning. "I enjoyed observing and participating in the people's daily activities. It was great to be part of a team helping a community of people install a system that will dramatically improve their lives."