

Students using solar power to create sustainable solutions for Haiti, Peru

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Students from Rensselaer Polytechnic Institute will return to Peru this summer, to continue their work on designing and creating a solar-powered milk pasteurization system for communities in the country's rural south. Credit: Rensselaer/Erin Lennox

Students at Rensselaer Polytechnic Institute are harnessing the strength of the sun to improve the situation of an impoverished Haitian school and jumpstart a new dairy industry in rural Peru.

As members of the campus group Engineers for a Sustainable World (ESW), the students are applying what they have learned in the classroom and laboratory to real-world problems with important repercussions for [developing nations](#). ESW projects have a strong sustainability focus and are carefully designed to serve as platforms that

encourage and enable long-term future growth for the host communities.

"What we learn in classes is great, but traveling to another country and applying what I've learned is an excellent challenge," said Alex Worcester, a sophomore electrical engineering major. "I love being able to take the project from start to finish, from sitting around the table talking about it, to designing the system, going there and installing it, and seeing how it helps people. This is what reminds me why I want to be an engineer."

Solar-Powered Laptops in Haiti

With fellow ESW members and Rensselaer classmates Andrew Chung, Casey McEvoy, Gloria Condon, and ESW faculty adviser Michael Jensen, Worcester visited Lascahobas, Haiti, in January. After about a year of planning, designing, building, and testing, the group installed 2.4 kilowatts of solar panels on the roof of a local school - enough to power 10 HP tablet laptop computers donated by Rensselaer, plus additional laptops the school and other nearby schools received from the One Laptop Per Child program.

The power system includes 32 large backup batteries that can store enough electricity to power all of the laptops for three days without sunlight. Worcester and Chung said the group designed the system to be as efficient and effective as possible, easy to repair, and require only minimal maintenance. The team removed the power converters on the computers, which allows the laptops to run on DC power straight from the solar panels. The project was a collaboration between Rensselaer, St. John's Episcopal Church in Troy, N.Y., and General Electric.

A high-tech solar power system may sound out of place in a community with no reliable access to electricity, no running water, and where no more than one student each year goes on to attend college. But ESW

members said it was the best solution they could devise to meet the needs that were clearly laid out by the rector of the school in Lascahobas.

"This isn't a hand-out, it's a hand-up," said Saadia Safir, a senior mechanical engineering major who worked on the project. "This is a sustainable project. We didn't just give them [solar panels](#) - we taught them how to run the system, upkeep it, and derive long-term value from the system. It's not only environmentally sustainable. It's also socially and financially sustainable."

Group members said they are looking into the possibility of returning to Lascahobas over the summer. Along with checking on the solar power system, Chung said they want to install additional software on the computers, deliver digital books, and investigate the possibility of developing a solar-powered fryer, as many traditional Haitian meals are fried in wood-fire fryers. Other longer-term goals would be developing water pumps and purifications systems.

"ESW allows us to apply the knowledge we learn as students to a cause that is both immediate and visible," said Jaron Koppers, a graduate student in the Department of Mechanical, Aerospace, and Nuclear Engineering, who worked on the Haiti project. "It's something that gives us an outlet to address a different community, a different group of people that we wouldn't normally get to interact with. There's a lot to be gained in terms of life experience, working in the field as an engineer, and being adaptable."



Students at Rensselaer Polytechnic Institute designed, built, and installed a 2.4-kilowatt solar power system on the roof of a school Lascahobas, Haiti. The system is robust enough to power 10 tablet laptop computers donated by Rensselaer, plus additional laptops the school and other nearby schools received from the One Laptop Per Child program. Credit: Rensselaer/Alex Worcester

ESW at Rensselaer

The Rensselaer chapter of ESW was launched in 2005. Barrett Rehr, current president of the Rensselaer group and a sophomore dual-majoring in mechanical engineering and Design, Innovation, and Society (DIS), said ESW membership at the Institute has grown from around 12 students in the 2008-09 school year to its current roster of 40 students. He said the group is actively seeking new members, and is always looking for new and interesting challenges to pursue. Several students are earning credit while working on ESW projects in the course Introduction to Engineering Design or as independent studies, something Rehr hopes to expand next year.

Safir said ESW is also seeking greater academic diversity, and is actively recruiting non-engineers. "It would be helpful to have more of an interdisciplinary team, because our projects are not just engineering,"

she said. "There are social aspects, there are business opportunities, and there's a lot more we will be able to do as a group with a wider range of expertise."

Michael Jensen, ESW faculty adviser and a professor in the Department of Mechanical, Aerospace, and Nuclear Engineering at Rensselaer, said ESW allows students a direct link to connect classroom lessons with real-world problems and solutions.

"I think working on ESW projects can give students the idea that they they're not required to go work for a for-profit company after graduation," he said. "There are other avenues to pursue if they want to do engineering and make a difference in people's lives, but also fulfill their altruistic tendencies to help those in need."

The national ESW organization named the Rensselaer student group a "chapter of the month" in December 2009.

Solar-Fueled Pasteurization in Peru

Several ESW members will return to Peru this summer, to continue their work on designing and creating a solar-powered milk pasteurization system for communities in the country's rural south.

The project kicked off in 2007 under the leadership of former Rensselaer Professor Lupita Montoya, and aims to help the Langui and Canas communities in southern Peru by developing affordable, solar-powered pasteurization equipment. Many families in the region have dairy cows and produce milk, yogurt, and cheeses on a small scale, but cannot obtain certification to market these products because they lack proper sanitation equipment. The new pasteurization systems will allow these families to meet governmental regulations so that they can begin to sell their dairy products and earn additional income. In addition to solar

power, ESW members are investigating how to create and use a "biodigester," which converts dung and other waste into biogas, as another means to power the pasteurization system.

The ESW team of John Cannarella, Ryan Lewis, Jared Stepanauskas, and Natalie Maslow, guided by Michael Jensen, has a working prototype of the system, which pushes milk through a tube that passes through a bath of boiling water. Heat from the boiling water transfers into the tube, sufficient enough to sanitize-but not spoil-the milk. ESW member and past president Erin Lennox, who earned her bachelor's degree in mechanical engineering from Rensselaer and is now pursuing a doctorate in ecological economics, said the group is partnering with the New York State Department of Agriculture and Markets to test the equipment and, ultimately, certify that the system meets U.S. pasteurization and sanitation guidelines. The team is also working with a pair of local artisan cheese makers from New York's Capital Region and Vermont to learn more about the process and business of cheese production.

Lennox, who visited Peru with other ESW members in the summer of 2009 to work on the system, said the next phase of the project includes testing the prototype on-site in Peru, in addition to making business connections to help ensure that the farmers have a profitable market in which to sell their newly pasteurized cheeses.

"The city of Cusco is about three hours away from Langui, and it attracts a lot of tourists and has a healthy eco-tourism industry. So we're hoping that the main consumers of these cheeses are tourists who are interested in purchasing fair trade and artisan products," Lennox said. The group will also try to help connect farmers with steady local customers such as restaurants and hotels, and start laying plans to create and construct a dairy cooperative that will serve as a local advocate and education center for Peruvian artisan cheese makers.

Lennox said the first ESW project she worked on as an undergraduate was designing water filters for rural communities in Mexico.

"I loved it, and since then I've only wanted to do engineering for the developing world," she said. "There are problems in the United States, but not to the levels that there are in other countries. We have poverty, but not extreme poverty with people living on \$1 or \$2 a day. It's in those situations where we can bring very real, very transformative improvements to the lives of many people."

Provided by Rensselaer Polytechnic Institute

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