

Solar Electricity for the Developing World



Guidelines for Getting Involved

Courtesy Walt Ratterman

Courtesy Laurie Stone

Above: The author (fifth from left) worked with villagers from tribal lands in Pakistan to install this PV array, which powers a water pumping system.
Right: A Ecuadorean woman assembles a PV module rack.

by Walt Ratterman

If you want to travel to exotic places and install solar-electric systems in the developing world, you're not alone. Those of us in this field get requests almost daily from people who want to get involved. But what does it take to truly help people in less-developed countries begin to use solar electricity in an effective and lasting way? The simple answer is that training *yourself* is as important as training others.



Right: Small rooftop PV systems at this Buddhist monastery in Arunachal Pradesh provide electricity for lighting.

Below: Community members from a village in northern Thailand learn how to use a digital multimeter to test a PV module's output.



Courtesy Walt Ratterman



Courtesy Andrew Pascale

Local Choice

Working on renewable energy projects in the developing world can mean installing interesting systems, traveling to new and exciting places, and sharing your knowledge. But this work is really about helping people improve their lives in a way that *they* choose.

For example, one organization I'm involved with does a lot of work with the Shuar people in Ecuador. Before we start a project, we travel to the village and teach the local residents the basics of efficient energy use and management, and develop an energy budget for their community. Recently we worked in two similar Shuar communities, both of which were far from the utility grid. One community decided they

did not want to put individual solar-electric systems on their houses, but instead chose to develop a centralized installation on a clinic to power an emergency radio system, community center, and a public battery charging system. The other village chose to electrify their individual homes, and decided to raise additional funds so they could also provide electricity for their school.

To do this kind of work successfully, you should first understand that you're not helping people who are in any way *less* than or *behind* us. In fact, in most ways that are important to individual survival, people in these cultures are often light years ahead of us. The abilities of these groups to

Thai medics configure small-scale solar-electric systems for their clinics.

PV Differences

Here in the United States, solar-electric (photovoltaic; PV) systems typically consist of modules on our roofs, connected to the utility grid to generate some portion of our household electricity. But in many parts of the developing world, solar energy is the *only* source of electricity for a home or a village, because no grid exists.

In the States, average-sized residential solar-electric systems are between 3 and 5 kilowatts (KW). In the developing world, systems of that size could run an entire *village* or a large community health center. Average home systems in the developing world are 50 to 75 *watts* (W), and "large" systems may be 120 W—a fraction of the size of a typical residential system in the United States.



Courtesy Walt Ratterman



Courtesy Walt Patterman (2)

The Solar Electric Light Fund sponsored PV systems in Rwanda to provide much-needed electricity for community hospitals.

build large structures with simple hand tools, and to be able to identify and treat most illnesses with plants that grow in the jungle is amazing. Approach these projects realizing that in all likelihood, you will learn far more about yourself than the people you are helping will learn about renewable energy.

Quality Control

Bringing renewable energy systems to developing areas cannot be done in a hurry—at least not correctly. Since the technologies are new to those you are working with, you'll need to impart your knowledge to them in a way that will enable them to troubleshoot and

maintain their systems. It is easy to go to a village with a couple of horse-loads of equipment, install a few systems, and leave. But the systems won't last.

In my travels, I have come across numerous systems that were installed by placing a module on a roof, nailing a charge controller to a wall, and stringing some wire along the beams—with no attention paid to the climate, the durability of the installation, or local training to properly use and maintain the system. I am usually informed that the system worked for anywhere between two and six months before it failed.

When it comes to installing systems in the developing world, we hear a lot of comments like, "Well, at least we don't have to pay attention to the code when we are overseas..." In most respects, we need to pay *more* attention to the issues raised in the *National Electrical Code* or other standards, because they are developed to produce safe and reliable



The author teaches PV basics to Burmese refugees in Thailand with the Border Green Energy Team.



Left: A Cuban video center.

Volunteers and villagers work side by side to install a PV system that will provide electricity for refugee camps.



Courtesy Danny Lenain; left: Courtesy Cubasolar

systems. These should actually become minimum standards in developing-world PV applications, and not something we can conveniently avoid.

For example, in many installations I've seen, the installer did not pay any attention to the use of weather-tight junction boxes for wiring terminations, or use strain-relief connectors on cables going into enclosures. Most of the wiring failures we see occur at terminations. Adhering to first-rate wiring practices goes a long way to making the system last.

Training is Crucial

Lots of well-intentioned people want to go overseas and "install systems for folks." In many ways, that is the worst favor we could do. Are you going to leave your cell phone number for them to call when a wire comes loose? So besides providing training in the basic concepts of solar electricity, we train people to install systems properly. That way, they know how to work on them after we've left.

When the local crew finishes installing a system and has their celebration the night before we leave, we spend some time sabotaging the installation. We remove wires, switch connections, and even short out wiring. In the morning, when we are asked to fix the systems, we instead watch as the newly trained installers do the troubleshooting.

A PV installation in the mountains of Peru.



Courtesy Laurie Stone

Misconceptions About RE Work in the Developing World

"Our job is to help them..."

This is a two-way street—we need to be open to learning as much (or more) than we are able to teach.

"The people we are teaching are primitive."

The people in these situations are highly skilled with their hands and with their concepts of what it takes to make things work. We just need to teach them about the technology.

"The problems related to developing-world projects are mainly technical."

The technical issues were resolved long ago. Aside from funding, the important work is matching appropriate systems to a community's needs and providing the community with training for the ongoing maintenance of the systems.

"Now that I have taken a class in renewable energy, I can try out the real work in a remote community."

Until you've worked on many installations with success, consider yourself an apprentice.

"The work is simple."

Although the technical work is not difficult, planning and

executing a project is complex. Load analysis, design, and community expectations all come into play.

"The work is quick."

Projects typically take several times longer than in the States, mainly because of the degree of training that we must do.

"Once the system is complete, we are finished."

We need to be sure that procedures have been established to address problems and maintenance. Nothing works forever, and community members need to be able to service their systems once we depart.

"We only need to visit the project once—to do the work."

Generally, it is best if we can make one or more preliminary visits to the community to assess the site, examine the loads, and gauge local interest and ability.

"This will be a good way to make a living."

This is a work of love and commitment, most often done by volunteers. Though there are career possibilities, they are not common, and generally not entry-level.



Courtesy Walt Ratterman

Refugees at a camp on the Thailand–Burmese border install an inverter and charge controller.

Managing Loads

Beyond maintaining the systems, perhaps our biggest job is to help system users understand load management—how much energy they have at their disposal over a given time period. If you tell folks that the batteries are designed to support their electrical load for three days, what are they supposed to do when there are four days of clouds? Or even when there is only one day of clouds? Finding approaches to get these ideas across in a way that makes sense to people who have never lived with electricity, and in a way that they can relate to and remember, is crucial.

When we install systems in the developing world, we go through a lot of examples showing how the battery never gets recharged unless system users keep the loads off. We teach them that for every day that is cloudy, they must leave the system off (or nearly off) for a day.

Fostering Ownership

While the trainings cover how solar-electric systems work, they also need to include fiscal management strategies—how much money the community needs to allocate for maintenance and battery replacement. This training ultimately involves community development and community resource management. For RE systems to last in the developing world, their users need to be well equipped—both with technical skills and the financial means—to maintain them.

Systems are expensive, and most families living far from the grid are poor and can't afford to purchase a system outright. Do we offer them a gift? Do we offer them credit? How do we set up a system so that community members can put money into a fund each month to pay for replacement batteries when they eventually fail?

The answers to these questions are different for each community. We have to be ready to work with the people, understand their needs and their culture, and be able to recommend solutions that work within that framework.

Where to Begin

Besides learning how to effectively communicate and work with cultures that may be vastly different than your

own, mastering the technical work first is essential. Many organizations, such as Solar Energy International (SEI) and the Midwest Renewable Energy Association, offer extended workshops in renewable energy systems. See Laurie Stone's article on RE education options in *HP116* for more good places to start.

After the coursework, getting practical, hands-on experience is critical. For instance, to be able to show someone else how best to connect wires to a charge controller, you need to have figured out all of the *wrong* ways to do it already. You can only get this experience by working with similar systems here in the States, or as a helper overseas.

Once the technology is under your belt and you have taken a good dose of humility, finding a place to learn the people side of things might be more of a challenge. A good first step is to find a nongovernmental organization (NGO) based in the country where you want to work, especially one that is doing RE work already. The best way to locate these NGOs is by searching the Internet for them, as well as networking with people you meet in RE workshops and events. SEI's INVEST (International Volunteers in Environmentally Sustainable Technologies) program helps pair SEI alumni who want to volunteer in the developing world with organizations there.

Mutual Gain

Although getting started is not easy, working with renewable energy in the developing world is exciting and well worth the rewards. If you have the desire to become involved, keep pushing for answers. The right opportunity will surely present itself. The need remains huge, with more than 1.5 billion people who live with absolutely no electricity. Bringing electricity to these people can make dramatic changes in their lives, allowing them to educate themselves, start businesses, and improve their standard of living.

Working to give people in the developing world access to electricity is always a two-way street. The people we help have so much to gain by improving their access to education, health care, additional work opportunities, and much more. But *we* gain as much or more from the experience.

Access

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