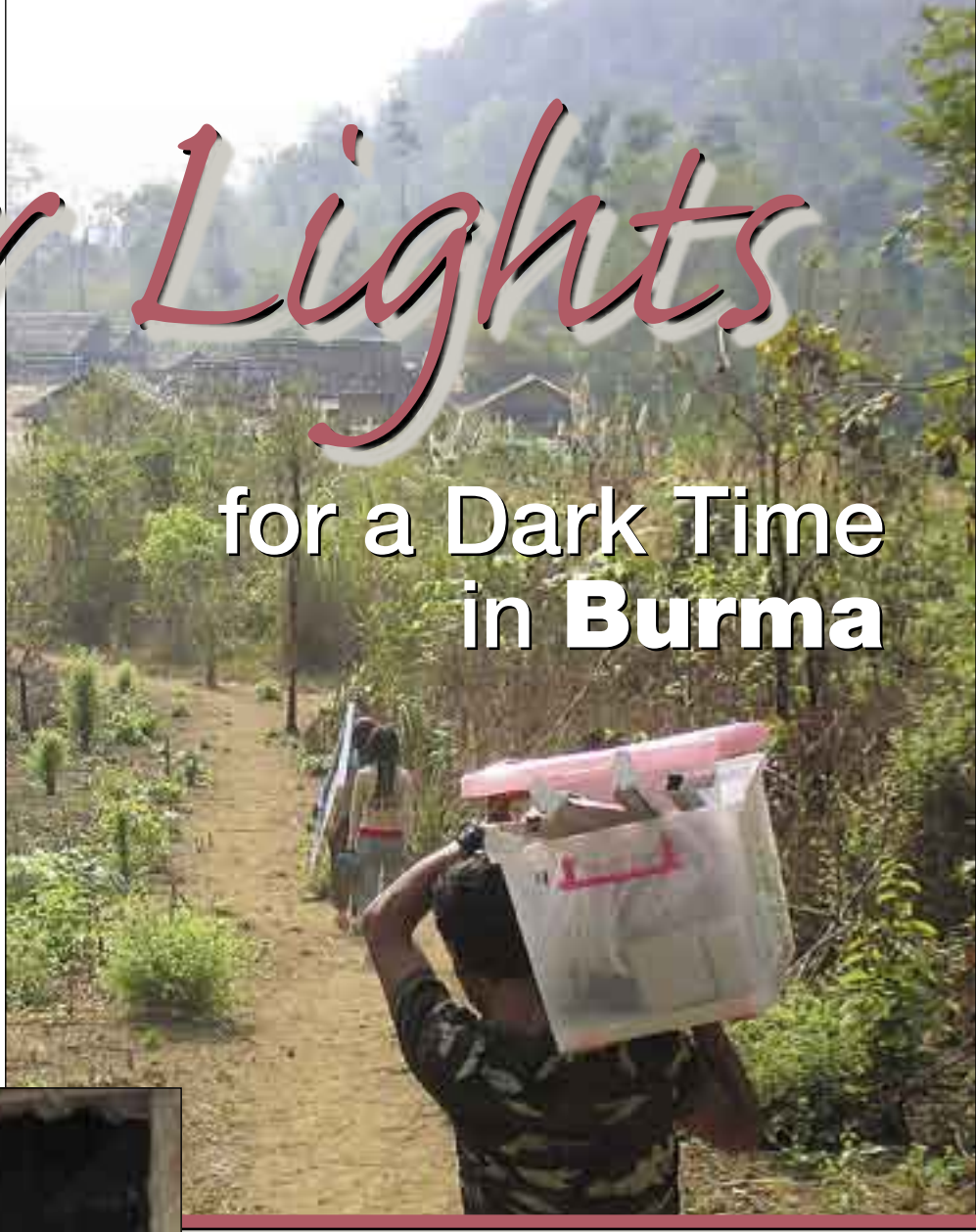
Solar Lights for a Dark Time in Burma

Chris Greacen
& Walt Ratterman



Transporting solar-electric system components to a jungle village clinic in rural Burma.

A patient receives treatment under solar-powered lighting.

"It is difficult," said Eh Kalu Shwe Oo, "to perform amputations by flashlight." Eh Kalu is director of the Karen Health and Welfare Department (KHWD), and oversees 36 medical clinics located in the Karen State in eastern Burma (also known as Myanmar).

The clinics, scattered over 600 miles (965 km) of roadless jungle, have a roster of approximately 75 KHWD surgeons, medics, and nurses. They serve an estimated 200,000 "internally displaced people" inside Burma whose villages and fields have been destroyed in the course of the ongoing civil war. Malaria, parasites, and a variety of medical conditions (diarrhea, pneumonia, blindness) stemming from malnutrition are endemic. Land mines and mortar fire maim thousands.

Twenty-eight of these clinics now have electricity for the first time, thanks to solar-electric systems. The systems provide electric lighting for nighttime medical procedures, radio communications, and basic low-power medical equipment. The clinics were chosen because they were in areas considered "stable." That is, they were less likely to be destroyed by the army of the State Peace and Development Council, widely believed to be one of the most brutal dictatorships on the planet.

Trainings

A collaborative of various organizations (see Access) spearheaded workshops at the clinics, with support from a variety of organizations. Our first training, in August 2003, involved hands-on instruction for fourteen participants, and solar-electric systems for two medical clinics. After the first training, Mr. Eh Kalu from KHWD, who coordinated the pilot project and organized the training, said, "Our dream ten years ago was to have some kind of lighting for these clinics. And when we did the two clinics, I could only hope that we would be able to do so many more." In subsequent trainings in 2004, 2005, and 2006, we built another twenty-six systems and trained more than seventy additional participants.

The trainings have two goals. The first goal is the provision of rugged, reliable solar-electric systems to clinics able to use them. The second goal is basic training of clinic medics in photovoltaic design, system construction, operation, and maintenance. Since the participants are responsible for installing their systems at their respective

Installing a PV module at a village clinic.

The remote clinics are the only source of postnatal care for tens of thousands of families.

Workshop participants take measurements on a PV module.

A nurse prescribes medicine for a patient.

A medic proudly displays the finished controller–switch box.

Clinic PV System Costs

System Equipment	Cost (US$)
Mitsubishi MF130EA2LF PV module, 130 W	$496.34
3K battery, 125 AH, 12 V	76.82
Leonics SB1210 charge controller	52.68
LED light, 1 W, 12 V	18.00
Receptacle, heavy duty, 12 V	16.00
Wire	14.54
Misc. hardware & electrical	13.08
2 Fluorescent lights w/ fixtures, 12 V, 18 W	10.26
Junction box for controller	9.32
Battery box	5.13
Distilled water	5.13
Aluminum angle stock for rack	4.66
Total Equipment Costs	$721.96

clinics, they must understand how to connect, re-connect, and troubleshoot the equipment.

The trainings combine classroom teaching and hands-on building of the systems—with an emphasis on hands-on training. We cover the basics of electricity and the specifics of photovoltaic systems. In the hands-on portion of the classes, participants build the systems from scratch. Each system is assembled and disassembled by each participant to be sure everyone knows how to put them together when they return to their remote clinics.

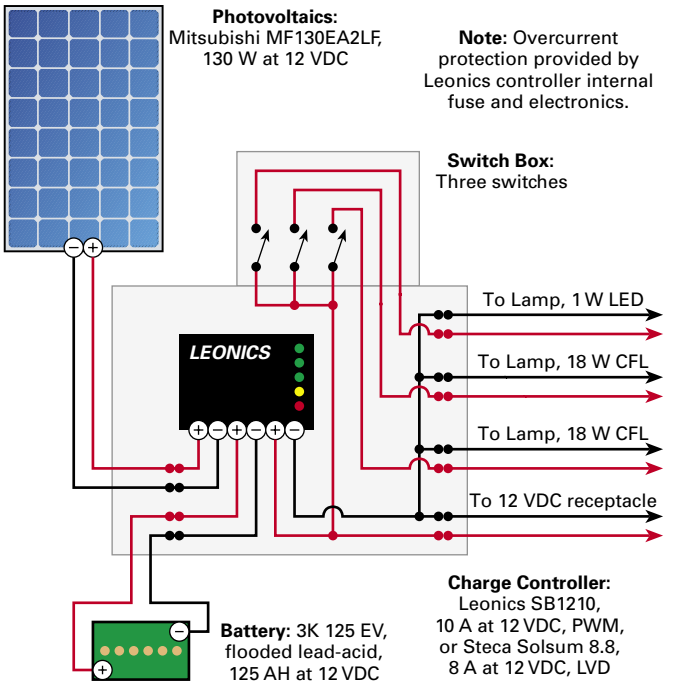
Systems

Simplicity, robustness, and plug-and-play features are key design attributes of the systems. Each system powers two 18-watt fluorescent lights and a 1-watt LED light. The low power, efficient LED is particularly nice for clinics because it can be left on all night. It provides enough light for medics to make their rounds without bumping into patients, while consuming just a smidgeon of energy—about 10 watt-hours per night.

The systems use 130-watt, 40-cell PV modules. Typical 12-volt modules have 36 cells. The higher-voltage modules allow us to use long (50 ft; 15 m) wires from the module to the controller. This increases design flexibility, allowing the installer to find a sunny area if the clinic roof is in the shade.

The PV wires are fitted with MC connectors to ensure that polarity isn't reversed, and for quick disassembly if the clinic comes under attack. The 125 amp-hour, deep-cycle battery is heavy (35 kg with acid; 24 kg dry), so we improve portability by supplying the acid separately, and having medics fill the batteries and do a forming charge on-site. Medics still complain about the weight—some have to carry the systems for as long as two weeks to reach their villages. In future systems, we will use two, 50 amp-hour, deep-cycle 12-volt batteries in parallel.

Clinic PV Lighting System



Tech Specs

System Overview

Type: Off-grid, battery based PV (28 systems total)

Location: Jungle clinics, Karen State, Burma

Solar resource: 3.5 average daily peak sun-hours

Production: 10 DC KWH per month

Photovoltaics

Array: One Mitsubishi PV-MF130EA2LF, 130 W STC, 19.2 Vmp, 12 VDC nominal

Array installation: Homemade aluminum angle mounts installed on south-facing wood rack, 17-degree tilt

Energy Storage

Battery bank: One 3K 125EV, 12 VDC nominal, 125 AH at 20-hour rate, flooded lead-acid

Balance of System

Charge controller: Leonics SB1210, 10 A, PWM, 12 VDC or Steca Solsum 8.8, 8 A, PWM, LVD, 12 VDC

System performance metering: Uses indicator lights built into charge controller. Each system also provided with a digital multimeter.

The system includes a DC receptacle (high-quality cigarette lighter) for DC loads such as battery charging for two-way radios. We are wary about using inverters in these systems, based on feedback from KHWD medics who said that the availability of AC might mean that the electricity would be consumed for nonmedical purposes (tape players, or perhaps television). However, in the latest round, we're adding the Xantrex XPower Plus 60/75-watt inverter as a plug-in option to the DC receptacle, and we will encourage users to use it only for essential loads.

The systems feature a rugged cabinet for the charge controller, switches, and strain-relief terminal strips. The cabinet is built from a large, industrial-strength plastic junction box with a clear cover. A three-gang switch box is bolted on top.

In designing the cabinet, we had several design criteria. First, if any wire is yanked inadvertently, we want to ensure that the charge controller is not damaged. In addition to strain relief where the cables enter the box, we designed the cabinet so that all wires passing into the box are connected to a terminal strip that isolates the charge controller from physical strain.

Second, we want the system to be relatively plug and play out in the field. By pre-wiring all of the light switches into the box, we reduced the number of electrical connections that recipients have to make when installing the system in a clinic. Similarly, through color-coding and MC connectors, we minimized the chances of reverse polarity.

Laying the Groundwork

We're pleased to report that most of the systems we've installed are still operating, even though several have had to be disassembled and moved from their clinics temporarily due to security concerns. In the future, we hope to provide larger systems for vaccine refrigeration.

On the Thai side of the border, we have built four microhydro projects, and we hope, someday, to expand this work into Burma. When peace returns to the area, we trust that having dozens of local, trained renewable energy technicians will help enable a transition toward widespread use of renewable energy in the area.

Access

Chris Greacen, Palang Thai, 289/770 Bangkok Garden Sathupradit 19, Bangkok, Thailand 10120 • Phone/Fax: 66-2-672-0364 • Mobile: 66-6-34-00-943 • chris@palangthai.org • www.palangthai.org/en/bget

Walt Ratterman, SunEnergy Power Corp., 1033 NW Bond St., Ste. 230, Bend, OR 97701 • 503-922-1548 • Fax: 503-922-1552 • wratterman@sunenergypower.com • www.sunenergypower.com

Border Green Energy Team, PO Box 66, Mae Sot, Thailand 63110 • 66-55-542-068

Green Empowerment, 140 SW Yamhill St., Portland, OR 97204 • 503-284-5774 • www.greenempowerment.org • Fundraising, coordination & technical support

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