Renewable Energy Workshops in Burma

Chris Greacen

Burma is primed for renewable energy—all it needs is a little education and financial support.

Due to years of isolation from the international community, rural Burma has been cut off from the renewable energy revolution that has been sweeping the rest of the Third World. A series of renewable energy installation workshops over the last few years has started to change that.

With generous funding of £5,000 from the Ashden Trust, two hands-on renewable energy workshops were conducted in June 2002. One was for thirteen participants in Myitkyina, Kachin State in northern Burma, and another for fifteen participants in Toungoo in central Burma. The workshops emphasized both theory and practice of solar-electric system installation and maintenance.

In the course of the workshops, participants installed three, 55 watt solar-electric systems. Two were in rural NGO training centres—the Metta Training Centre in Alam, 17 miles (27 km) north of Myitkyina, and the Shalom Centre, 15 miles (24 km) north of Myitkyina. The third system was installed at the Thaw Thi Kho Clinic in Toungoo.

Workshop participants ready to install a 55 watt (peak) solar PV system at the Metta Centre in Alam, Myitkyina.

System Design Principles

In designing the systems and specifying equipment for the installations, I emphasized locally available equipment, high quality, and expandability.

Local equipment procurement makes the systems easier to repair and replace. It also reduces expenses and uncertainties associated with customs and immigration. I used solar modules and charge controllers purchased from a dealer in Yangon, Burma's capital, instead of bringing them in from my home base in Thailand. All other materials (wire, 12 volt lighting ballasts and bulbs, inverter, and connectors) were available in regional towns, as well as Yangon. I purchased many of these materials in Yangon because prices were lower and availability more certain. Heavy or fragile items, such as batteries and fluorescent light tubes, were purchased in regional towns.

Author Chris Greacen (center) and PV vendors in Yangon test PV panel output.

I used high quality solar modules and controllers, and searched out materials (wire, solder, crimp connectors) to make high quality connections. Besides improving the reliability and expected life of the system, emphasizing quality has an educational objective. After completing the installation, workshop participants know what a quality installation should look like, and how to do one. Poorly installed solar-electric systems are alarmingly common in developing countries (maybe not yet in Burma, but possibly in the future). These generally function, albeit poorly, for a while, but they waste precious electricity made by the expensive solar panels. When the systems stop functioning properly, they give renewable energy a bad name.

Related to system quality is the issue of battery depth of discharge. In many solar-electric systems, the batteries suffer early death because users chronically overdischarge them. To avoid this common problem, I used charge controllers with a low voltage disconnect (LVD) function that disconnects 12 volt loads before battery voltage falls to dangerously low levels. Using the LVD function required the use of 12 volt lights.

Finally, I wanted the systems to be expandable. Racks were made large enough to accept a second module. Charge controllers were sized to accept additional lights and solar-electric modules for future expansion.

Low tech supports high tech—building a PV mounting rack with hand tools.

Component Specification & Transport

I chose Siemens SM55 modules for the systems. These have 36 single-crystal cells in series. Unfortunately, the solar-electric company in Yangon offered a considerably better price for Siemens SM50-H modules, which have only 33 single-crystal cells. Most of Burma is quite warm during much of the year, and I have seen 33 cell modules in tropical developing countries fail miserably at charging 12 volt batteries because of the modules' temperature-induced voltage drop. Do these 33-cell modules really work when it is sunny and the ambient air temperature is 30°C (86°F)? I suspect not, but would love to hear some reports from the field.

The design for each system was more or less the same: one 55 watt PV module, a charge controller (Siemens S12 or Steca Solsum 6.6), several 12 volt lights, a Burma-made "300 watt" inverter, and a 12 volt, 120 amp-hour "deep-cycle" battery.

Rev. Saboi Jum from the Shalom Centre helped me transport the solar-electric equipment by airplane (train would have taken several weeks) to Myitkyina. He happened to be on the same flight and was traveling with no checked baggage. Using his baggage allowance (and political clout) avoided significant overweight baggage charges. The flight to Myitkyina took all day, since the airplane was grounded for four hours in Mandalay due to inclement weather.

Myitkyina Workshop

The Kachin Baptist Convention (KBC) Development Department Office hosted the training at their main office in Myitkyina. Because foreigners are only allowed to stay in certain registered hotels located in urban or semi-urban areas, having the workshop in Myitkyina was logistically convenient. More important, KBC has considerable experience in hosting workshops of this nature. The KBC provided facilities for the workshop, workshop materials, lodging and meals for workshop participants, local transportation, and the services of Nang Doi, an excellent English-Kachin translator. The KBC contacted participants for this year's workshop, including community leaders, farmers, and technicians.

Six of the twelve workshop participants had attended the workshop that I taught in February 2001. Five of the six had worked on renewable energy projects of one kind or another since that workshop. I was very impressed by these activities, especially given the fact that they had very little to work with. Several had also built and used solar ovens in their communities.

La Wuam had built a hydraulic ram pump (but had problems with the flapper valve, just as we had in the workshop). Tu Ja had tried to build a windmill using a bicycle dynamo (and remains very interested in this project). Zau Sam had built many bamboo waterwheels for his educational work with children.

Htoi San had begun work on a second village microhydro, but stopped for lack of funds. He also had installed the solar-electric system at the Kachin Theological College. For his microhydro project, he was doing surprisingly advanced work. He was using an induction motor as a generator (he had seen this done in China at the border near his village), and had experimentally determined appropriate amounts of capacitance to provide excitation current. He was very interested to see a book on this subject that I had brought, by coincidence.

Most workshop days were a mixture of theory (taught in the classroom) and practice (in the field). Considerable attention was paid to developing a theoretical understanding of basic electricity concepts—current, voltage, resistance, power, and Ohm's law.

Mounting the PV array at the Metta Centre in Alam, Myitkyina.

The control board built by workshop participants at the Thaw Thi Kho clinic in Toungoo (see schematic).

We then built on these concepts to develop an appreciation for the need for low resistance wiring and electrical connections for low voltage electricity applications. We also covered basic system design principles, and learned what features of solar-electric system components are most important for long-term system sustainability. Finally, we covered maintenance and operations procedures.

Metta Centre Installation

In the field, each solar-electric installation took about one and a half days to complete. We started with the installation at the Metta Centre. The Metta Development Foundation is one of the few local NGOs that exist in Burma. It works to assist Burmese communities to recover from the impact of decades of civil conflict. Two of the renewable energy workshop participants were from Metta.

The centre trains farmer-teachers in multi-month training courses on integrated farming methods. The farmer-teachers return to their villages to set up field schools. The Metta Centre itself is a working example of the successful application of these natural farming methods. Starting with land that had been abandoned as unproductive and barren, Metta has adapted natural farming methods to produce impressive crop yields.

The Metta Centre is many miles away from grid electricity. The solar-electric installation will be used to power lights for evening meetings and to power two computers used to write reports. A microhydro system using a 1 KW, AC Chinese turbine was installed last year. Stream flow is insufficient to provide adequate electricity year-round, so the system only functions during the wet season.

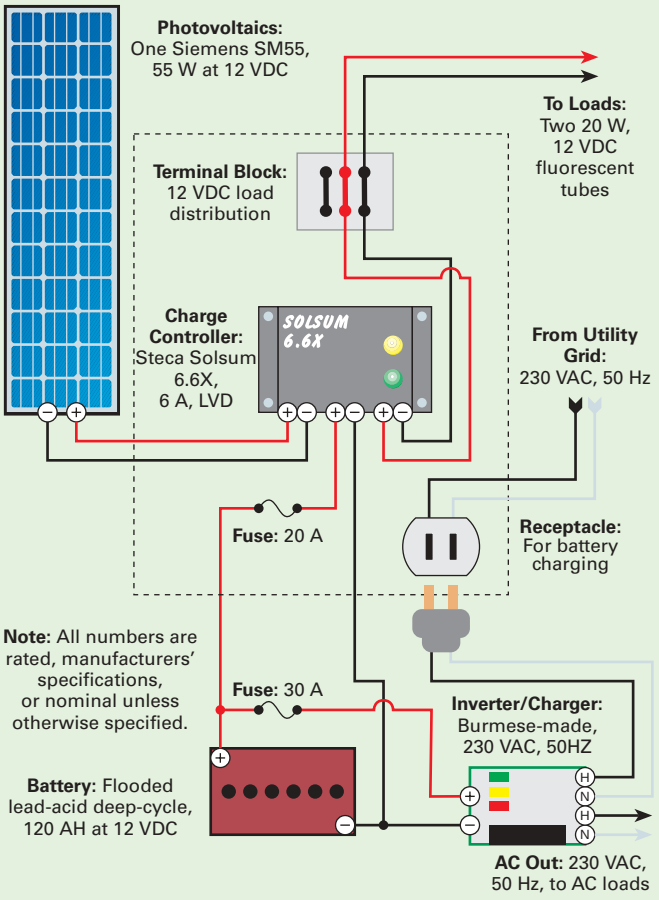
The center also has a diesel generator that is used only occasionally because of the high cost of diesel fuel. For lighting, lamps and candles are used most of the time. The solar-electric system at Metta included a battery charger to take advantage of electricity from both the diesel and microhydro when they are operating. The microhydro and diesel are not run at the same time; a transfer switch is used to run one or the other.

For the solar-electric installations, participants broke into three teams. One team was assigned the task of mounting the solar module. The second team was in charge of wiring for the 12 volt lights. The third team wired the battery, fused disconnect, and charge controller. The system will be maintained by two Metta Centre workers who attended the five-day installation workshop.

Shalom Centre Installation

Our second installation was at the Shalom Centre, about 9 miles (15 km) north of Myitkyina. The Shalom Center provides a forum for a variety of peace and reconciliation

Thaw Thi Kho Clinic System



Soldering with DC straight off the battery.

activities following the cease-fire between the Kachin Independence Organization (KIO) and the Burmese military. It is also involved in efforts to find sustainable development opportunities for the Kachin people to replace the current reliance on resource extraction—teak logging, gold mining, and jade mining.

We installed a solar-electric system at the night watchman's house at the Shalom Centre. Though the center has a diesel generator, it is seldom used because of the high cost of fuel and generator maintenance. The solar-electric system will provide reliable and affordable lighting for evening meetings at the Shalom Centre.

The center is located far from grid electricity. Using a transfer switch connected to the centre's generator, electricity from the solar-electric system will power lights in a key meeting room at times when a few lights are needed, but turning on the generator would be overkill. The system also powers a 12 volt fluorescent light for the watchman's house. One of the renewable energy course participants is responsible for maintenance at the Shalom Centre, and will look after the operation of the system.

With the successful completion of both installations behind us, we held a review and question and answer session. It covered participants' interest in less expensive renewable energy technologies—hydraulic ram pumps, hydroelectricity, biogas, and simple wind turbines. In the closing ceremony, I donated the tools that we had used in the installation, as well as several books and *Home Power* compact discs on renewable energy to KBC.

Thaw Thi Kho Clinic Workshop

Following the closing ceremony at Myitkyina, I returned to Yangon and traveled by bus with translator Pienne Pien to the town of Toungoo. Even though only 60 miles (100 km) north of Yangon, the bus ride takes 8 to 10 hours because of poor roads. I taught the three-day, solar-electric installation workshop to sixteen participants. As in Myitkyina, each day was a mixture of theory and practice.

The Toungoo workshop participants were diverse. About half worked with the Thaw Thi Kho clinic in one way or another, and will need to understand the limitations of the system. These included nurses who will be operating the lighting system at night, a hospital

System Costs

Item	Each (Kyat)	Shalom Centre Qty.	Shalom Centre (Kyat)	Shalom Centre (US$)	Metta Centre Qty.	Metta Centre (Kyat)	Metta Centre (US$)	Thaw Thi Kho Clinic Qty.	Thaw Thi Kho Clinic (Kyat)	Thaw Thi Kho Clinic (US$)
Siemens SM55 PV module, 55 W	330,000	1	330,000	$386.42	1	330,000	$386.42	1	330,000	$386.42
Siemens SR12 charge controller, 12 A	83,000	1	83,000	97.19	1	83,000	97.19	0	0	0.00
Steca Solsum 6.6 charge controller, 6 A	56,000	0	0	0.00	0	0	0.00	1	56,000	65.57
Battery, 12 V, 120 AH	35,000	0	0	0.00	0	0	0.00	1	35,000	40.98
Battery, 12 V, 120 AH	34,000	1	34,000	39.81	1	34,000	39.81	0	0	0.00
Wire, connectors, transfer switch, etc.	15,500	1	15,500	18.15	1	15,500	18.15	1	15,500	18.15
Inverter, Burma-made, 300 W	11,500	1	11,500	13.47	1	11,500	13.47	1	11,500	13.47
Aluminum angle iron (rack materials)	11,000	1	11,000	12.88	1	11,000	12.88	1	11,000	12.88
Light fixture (20 W) & ballast (12 VDC)	1,800	2	3,600	4.22	2	3,600	4.22	1	1,800	2.11
Fluorescent tube, 20 W	1,500	2	3,000	3.51	2	3,000	3.51	2	3,000	3.51
	Totals		491,600	$575.64		491,600	$575.64		463,800	$543.09

technician who was responsible for the generator and electrical wiring, and hospital administrators and managers. The participants also included several pastors and deacons from churches in Toungoo and surrounding villages who were interested in applications of renewable energy for their rural parishes.

One participant, Hektor, was an accomplished marine electrical engineer who worked on merchant ships in Singapore. He was on leave and is looking forward to retirement in his hometown of Toungoo. Hektor's presence made it much more possible to squeeze a week's worth of curriculum into three days. Because of his language and technical abilities, he was able to communicate difficult concepts to other participants who were not well versed in English or electricity.

Thaw Thi Kho Clinic

The Thaw Thi Kho Clinic was started in the year 2000 and provides critical health services every year to more than 7,000 people who are unable to afford private health care or the government hospitals. The clinic is open 24 hours a day, 7 days a week, and accepts all patients, regardless of religion, ethnicity, or ability to pay. Most patients are Karen hill tribe villagers. Many patients come to the clinic at night because they have journeyed a long distance from their villages, or come after work in the fields.

Government electricity is available only eight hours a day, and may come in the morning, afternoon, or night. The solar-electric system we installed provides electricity for three multipurpose lights that illuminate two checkup rooms, the waiting room and reception area, the pharmacy, and an area used for giving injections. Nurses and doctors who worked the night shift at the hospital were especially excited because now they will no longer have to rely on candles. The grid provides electricity for sporadic battery charging.

Integrated Education

I ran the Toungoo workshop with morning theory sessions and afternoon installation practice sessions. This allowed me to have enough time for the installation, and to try to integrate theory and practice. As the first morning theory session began, one of the participants raised the question, "How many lights will the solar panel power?"

It's a good question, but one that is hard to answer. It depends, of course, on how big the lights are, how long and how frequently they are used, and how much sun there is. We used the question as a departure point to explore concepts of voltage, current, resistance, energy, Ohm's law, and system design practices, but with less depth than in Myitkyina.

For the installation, I had participants break into three teams according to their skills and interests. I played free agent, roving from team to team, observing and answering questions. One team's task was to install the solar array on the third-story roof and run the wire to the ground floor. Another team assembled and wired the controller, fuse, and terminal strips. The third team wired the 12 volt fluorescent light fixtures and switches.

Above: Installing the panel on the Thaw Thi Kho Clinic roof.
Below: The installation crew and clinic employees.

On the third day, we began with the hands-on activities in the morning session just in case we had any unexpected surprises that might slow down completion. We finished by lunch, and spent the remaining time discussing topics of interest to the participants: battery chemistry, care, and maintenance; microhydro-electricity; hydraulic ram pumps; and biogas digesters.

Chris and the Shalom Centre workshop installation team.

Lessons & Next Steps

In the course of conducting these workshops, I was particularly struck by two things. First, in rural Burma, solar electricity for medical clinics that serve marginalized (and often brutalized) minorities is an especially important application. A little electricity goes a long, long way in improving the working conditions of doctors and nurses, and provides convenience and comfort to scores of people when they are sick and vulnerable. For this reason, 2003 activities are focusing on training medics and providing PV systems for remote medical clinics—especially those hit hard by Burma's ongoing civil war.

Second, for all of PV's benefits (simplicity, reliability, and flexibility in providing essential electricity services), the reliance on high-tech imported equipment means it is very expensive for the average villager. Micro-credit programs are needed. But there is also a lot of merit in working to introduce simpler, low-tech renewable energy technologies based on local affordable materials. In 2003, our activities will include a 15-day, hands-on biogas digester workshop at the Metta Centre in Alam taught by Nepali biogas expert Govinda Devkota.

Grassroots Leadership Training Programme

Coordination and planning help for the Burma Sustainable Energy Project workshops was provided by Grassroots Leadership Training (GLT), a programme run by the Spirit in Education Movement (SEM). The GLT programme involves empowerment training and ongoing educational support for grassroots leaders of marginalized communities, such as the ethnic minorities and the rural poor in Siam and Southeast Asia. Every year since 1996, the GLT has worked with Metta, the Shalom Foundation, and KBC to provide three-month training courses for ethnic people in Burma.

The trainings reach across ethnic, religious, and demographic boundaries. They bring together participants from Karen, Kachin, Shan, Karenni, and Burman ethnic groups; Buddhists and Christians; and rural villagers and city dwellers. Participants engage in an in-depth critical look at the modernization process and consider development models that foster people's participation, environmental justice, and sustainability. Despite difficult circumstances in Burma, when they return to their country, the vast majority of participants develop projects that recognize and address the root causes of some of the issues they are facing.

Palang Thai & the Burma Sustainable Energy Project

The Burma Sustainable Energy Project is a project of Palang Thai, a Thailand-based, not-for-profit group dedicated to promoting clean and democratic energy in Southeast Asia. Our other projects include the Thai Net Metering Project, work on building remote grassroots micro-hydro projects, and public-interest analytical work on electricity sector restructuring in Thailand.

Filling the Gap

The renewable energy workshops in Burma fill a crucial gap by providing practical, experience-based knowledge about rural sustainable energy technologies and practices that have proven useful in other areas of the developing world. Ethnic minorities in rural Burma have been cut off from the rest of the world for several decades. They are hungry for information, particularly information that is useful in helping them meet basic needs and foster models of development that will not impair the environment.

Access

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Metta Development Foundation, PO Box 516, GPO Yangon, 510B, Lower Kyeemyindaing Rd., Kyeemyindaing Township, Yangon, Myanmar (Burma) • Phone/Fax: 95-1 22 87 80 • metta@mptmail.net.mm • www.metta-myanmar.org • Rural development; recipient of solar-electric system

The Shalom Centre, Myitkina, Myanmar (Burma) • Peace work; recipient of solar-electric system

Thaw Thi Kho Clinic, Toungoo, Myanmar (Burma) • Toungoo workshop host; recipient of solar-electric system

Grassroots Leadership Training (GLT), Spirit in Education Movement (SEM) • www.sulak-sivaraksa.org/project15.php • Burmese contacts; Toungoo translator

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SEI Invest, Solar Energy International, PO Box 715, Carbondale, CO 81623 • 970-963-8855 • Fax: 970-963-8866 • sei@solarenergy.org • www.solarenergy.org • Volunteer opportunities for SEI alumni