



# Camp Hybrid System Project

## Installations, Trainings, and Equipment for Refugee Camps

### Training location

Mae La Ma Luang Refugee Camp, Thailand  
Mae La Oon Refugee Camp, Thailand

### Project dates

Jan. 8 through Jan. 27, 2007

### Technicians trained

5 ESP Students,  
4 Generator Operators,  
4 Computer Center Trainers

128 Participants received 1 Day Solar Training

### Instructors

Arie Jongejan  
Angie Beier  
E' Maw Lay  
ESP Students

### Project Funded by

UNHCR

### Implemented by

ZOA Refugee Care  
BGET

The Border Green Energy Team (BGET) worked in Mae Ra Ma Luang (MRML) refugee camp and Mae La Oon (MLO) Refugee Camp to install a solar PV / diesel hybrid system and to train local technicians in solar energy. The solar system and equipment will upgrade the power system for the computer training center. These were the fourth and fifth of seven refugee camps to be similarly outfitted.

The Border Green Energy Team (BGET) is working with ZOA and UNHCR to provide training, equipment and installation services to upgrade these systems to solar / diesel "Hybrid" power systems. Diesel is a non-renewable polluting fossil fuel, expensive and difficult to transport. The "Hybrid" system will increase the available power supply and allow computer training class hours to be expanded as well as offer an option to increase number of computers in each classroom without a corresponding power increase cost.

The fourth installation took place in MRML Refugee Camp and the fifth installation took place in MLO Refugee Camp, which are located about 3 hours south-west of Mae Sariang along the Burma border in Thailand. The Installation team consisted of three BGET staff members including Arie Jongejan, Angie Beier, and Saw E Maw Lay.

Saw E Maw Lay is our BGET intern technician and also a graduate of the Engineering Studies Program (ESP) at Mae La Refugee Camp. The install team also consisted of 5 ESP students from Mae La Refugee Camp including Naw May Htoo, Naw Priscilla, Saw Doh Htoo Win, Saw T'Nar Tu Saw, and Saw Kaw K' Lu Htoo. The team began the three week installations on Monday, January 8, 2007.



Saw E'Maw Lay leads the team



The team begins to assemble the PV structure

The solar system installations consist of installing 15 – 64W panels on a stainless steel PV rack, 12 – 12volt and 125ahr batteries, an Outback Inverter and an Outback Charge Controller.

The installation included the following tasks: choosing the site for the different components of the system, preparing the site, installing the PV rack and panels, wiring the panels together, running conduit and wire from the panels to the inverter room, building the battery house, filling batteries with acid, wiring batteries together, installing and wiring Outback equipment together, programming the system, and turning power on to the hybrid system. One additional component to the installation in MRML was the rewiring of the computer center. The rewiring of the center entailed making the wiring safer and out of the way of computer center participants, and also made it more aesthetically pleasing. The MLO installation included wiring the computer center for the first time as the center was recently moved to a new location. This entailed wiring two fluorescent lights, two fans, and three outlets for eight computers.



Naw Priscilla helps wire the combiner box together



Saw T'Nar Tu Saw and Saw Sundry wire the batteries together

There are three separate components to the training for this project.

The first component of training is hands-on, practical training as we work as a team to install the system. This includes on-site technical training as well as classroom training. The topics discussed with the students include solar fundamentals, how our system works, how energy flows, electricity, AC vs. DC electricity and how this applies to our MRML system, wiring series vs. parallel, wiring design for our system, system components, safety, and how to use the tools and equipment. BGET also discussed safety on the worksite, professionalism, organization, and cleanliness. The students of this hands-on training include five ESP students, the computer center trainers and generator caretakers at each of the two camps. Three laborers were also hired to assist the install team with land clearing.

The second component of training is to teach the generator caretakers and the computer technicians in system attendance, system maintenance, and their role in this system. The individuals are also present throughout the installation and at the one – two day solar training. These individuals are requested to keep a log of data on the system and provide this to ZOA and BGET on a monthly basis.

The third component of training is to provide a solar training for all interested members of the refugee camp. BGET held a one-day solar and renewable energy training at MRML on January, 19, 2007 and at MLO on January 26, 2007. There were 79 participants from the MRML community and 49 participants from the MLO community that attended these trainings. Below is the make-up of these participants:

<b>Mae Ra Ma Luang Refugee Camp Solar Training Participants</b>						
Age Group	Female	(in %)	Male	(in %)	Total	(in %)
15-20	4	36.4%	6	8.8%	10	12.7%
20-40	7	63.6%	48	70.6%	55	69.6%
40-60	0	0	13	19.1%	13	16.5%
>60	0	0	1	1.5%	1	1.2%
<b>Total</b>	11	100%	68	100%	79	100%

<b>Mae La Oon Refugee Camp Solar Training Participants</b>						
Age Group	Female	(in %)	Male	(in %)	Total	(in %)
15-20	0	0	0	0	0	0
20-40	2	50%	26	57.8%	28	57.1%
40-60	2	50%	19	42.2%	21	42.9%
>60	0	0	0	0	0	0
<b>Total</b>	4	100%	45	100%	49	100%

The topics discussed included sustainability of this system and the cooperation between BGET and ESP, the role and responsibility of the camp community, a tour of the system and a discussion of each of the parts of the system, system design, solar fundamentals, basic electricity, the flow of electricity, the role of the batteries and battery safety, installation of the system, maintenance of the system, and other ways to use renewable

energy in their Community. The MRML training was taught by the BGET Staff and ESP Intern. The MLO training was taught by the ESP intern and ESP students as BGET felt that these students were prepared to present the information they had learned throughout the previous three weeks to the MLO community.



The students pose in front of the completed Outback equipment



Arie trains the MRML community in solar energy

Training is a critical part of this project for the sustainability of this knowledge and the system. We will teach these engineering students about solar and renewable energy and provide them with the practical experience as part of the install team. Throughout seven camps, we will train approximately 30 ESP students on solar energy and the engineering aspects of installing this system. We will similarly train several members at each camp including computer center trainers and generator caretakers on these systems, the maintenance of the system, and solar energy. This will provide the camp members with the knowledge to care for the system after the BGET team leaves.

The BGET and ESP team completed these installations and trainings on Saturday, January 26, 2007.