SunEnergy Power Corporation
Sustainable Social Entrepreneurship™

Solar Electric Light Fund

Solar Electric Light Fund and
SunEnergy Power International
Supporting Partners in Health

Rwanda
Health Center Electrification
Solar / Diesel Hybrid
Training and Implementation

Training locations
Eastern and Southeastern Rwanda

Village Locations
Kirehe, Mulindi
Mulindi, Rusmo,
And Nyarubuye

Project dates
Phase 1: Jun 2006
Phase 2: Jan/Feb 2007

Areas Covered
5 Health Centers
Catchment of 400,000 People

Capacity of installed PV Systems
3360 to 4320 Wp

Equipment for each Pumping System
Solar Array
9000 Watt Inverters
Battery Banks
AC and DC Wiring

Rwanda is moving quickly to get past the unbelievable hurdles to survival placed on it by the Genocide in the spring of 1994. Kigali, its capital, is one of the cleanest cities I have been in, and its government officials are quite helpful.

The Genocide saw to it that nearly the entire infrastructure was destroyed. At this time there is electrical service to only about 5% or 6% of the population, and most of that is around the capital, centrally located in the small country.

Rwanda – Land of 1000 Hills

Partners In Health, a medical team headed by the legendary Dr. Paul Farmer, who started his work in Haiti, has accepted the responsibility for the regional hospitals and health centers in the southeastern part of the country. A large part of the work in these areas includes dealing with AIDS and Tuberculosis diagnosis and treatment, in addition to the high quality of personal care given at the PIH facilities. To do this work effectively, the health centers require reliable electricity for the laboratories, and central data retrieval and reporting systems. This is simply not available from the grid in most of the country.

SEPI Health Center Solar Hybrid Project SELF
Rwanda
Implementation and Training
Jan / Feb 2007

This project sought to provide these 5 PIH health centers with Solar / Diesel hybrid electric systems, designed to provide reliable electricity for this important medical work.

Kirehe, the largest of the centers, is growing rapidly, and currently serves a patient catchment area of 300,000 people.

Mulindi – Phase One Site

Phase One: Initial Project Training and Implementation

SELF visited Rwanda to make a design assessment in late 2005 / early 2006. Based on this assessment, they ordered all of the equipment for one site – Mulindi – and we arrived in Rwanda in June of 2006 to meet the equipment arrival from the States.

First a one-week training course was given to representatives of PIH, as well as local solar company installers, and instructors and students from the Kigali Institute of Science and Technology (KIST).

Following the training class, we proceeded for a more in-depth hands-on training at the first site of Mulindi, where the system was built by the trainees, under our supervision. This installation took about two weeks, and included the construction of the solar panel support structure, as well as architectural and structural modifications to the existing buildings to house the equipment.

Along with the installation of the system equipment, the project included adopting energy efficiency measures throughout the facility. Wiring for the new labs and internet equipment was included as part of this project.

System Description

All of the five health centers had been previously provided with 11KW, three phase, diesel powered generators. These generators are stand-by generators, and therefore not designed to be run continuously. Although the initial cost of the generator is low, compared to solar equipment, the amortized fuel costs are extremely high, not to mention the maintenance costs of the generator and the difficulty and cost of getting the fuel to the remote sites.

Erecting Pole Mounted Panels

Our proposal was to incorporate solar electricity into the power system, utilizing the generator for supplemental battery charging. This would drastically reduce the amount of fuel required for the system, while providing more reliable and higher quality power as well.

The 20-year amortized costs of this system (using NREL's software program HOMER as a resource) are many times lower than the amortized costs of using the diesel alone. And, this is considering that the owner pays 100% for the solar equipment. In this case, the generous donors of SELF made it possible for the equipment to be provided to the project, freeing up more funds for Partners In Health for treating patients.

Phase Two: Continued Training and Implementation

Between July of 2006 and the end of the year, daily voltage logs and generator action reports were kept at Mulindi and sent back to SELF's Project Director – Jeff Lahl, who studied the information and determined if any changes needed to be made to the design. Fortunately, the system was working as expected, and SELF proceeded to purchase and ship the equipment for the remaining 4 systems.

The equipment arrived in Kigali in January of 2007. A few days after its arrival, we landed in Kigali to start Phase Two of the project – for the continued training, and implementation work at the remaining four sites, in an ambitious six-week time frame.

The first several days were spent getting all of the equipment from Kigali to a PIH warehouse in Rwinkwavu, and staging the equipment for delivery to the four sites, which range from 1 to 2.5 hours away. We then had to make the normal logistic arrangements such as transportation, trucking, a place to live and train, etc….

Having gotten these details out of the way rather quickly, our team started at the first health center, Kirehe. Kirehe has the largest catchment area of any of the other sites, and is seeing far more patients, and they were therefore quite anxious to have us start the work there.

Loading up equipment for Kirehe

Our crew was mostly made up of the team we had trained before, plus a few guys we picked up along the way. They were all very hard working and eager to learn every stage of the work.

The tasks were broken into three main areas: Work associated with the solar array; work in the equipment room (to include the inverters, charge controllers, batteries, and generator); and the AC distribution, wiring and re-wiring work. Having four hospitals to complete, allowed us to give everyone a chance at working on all of the three areas.

Solar Array Work

Installing Rack for Panels

On these four sites, our solar panels were mounted on large, 6" steel poles, sunk a couple of meters into the ground, and set in concrete. Large racks top the poles, which hold up to 12 – 120-Watt peak solar panels. These were quite high in the air, so part of our "tool set" we had to haul around included huge (really heavy) hard wood scaffold platforms we had built just for this purpose.

The solar array crew completes all of the wiring on the poles to the combiner boxes, and then the wiring between poles. Finally, they were responsible for all of the wiring from the combiner boxes to the inside of the equipment room, taking the wiring underground, and through a junction box on the side of the equipment room.

Equipment Room Work

The primary work for the equipment room crew was to install the Outback Inverters, along with the mounting equipment, AC box, and DC box. Each site received 3 – 3000 Watt Inverters along with all of the required control equipment. The crew also installed the charge controllers and meters.

The batteries were mounted in the equipment room on large heavy steel racks, fabricated by the welding shop at PIH.

Once the inverters and controllers were mounted, and the batteries wired into the system, it was time to connect the generator to the system. In most cases, what used to be the outgoing feeder from the generator to the hospital loads was now connected to the output of the Outback Inverters. A line was run then from the generator to the inverters to provide the AC Input to the system.

Inverters and Battery Rack

AC Wiring Work

The AC wiring work was actually quite extensive in most locations. Each facility was quite different, and been managing along on their own with whatever they could cobble together for electricity supply. The generators are a relatively new addition to the centers (since PIH took over only a year ago). They were, in most cases wired to the new buildings that were erected for HIV / AIDS research, and that wiring was in good shape. However, the other buildings on the sites usually more than a half dozen buildings) were quite a different story. In some cases they had been wired with several small PV systems, and in other cases, quite "innovative" extensions of existing small power

supplies. Needless to say, this task involved a search and recover method of design and installation. Fortunately, our crew was quite up to this type of work, and did amazingly well at getting everything powered up.

Training Element of the Project

Our "idea" was that we would work during the day, and have a couple hours of lecture / training class at night. We had rented a house with a large living room, bought a white board and markers, and had a computer equipped with powerpoint for this task. (The schedule for the night classes was chosen by the crew…..) Well…..good intentions ….. Our daily schedule usually meant everyone was up by 5 a.m. at the latest to support a departure not later than 6:30. (This can be a task with 12 people and two bathrooms…) Our first project was close (within an hour) and we generally returned home by dark, and had our training classes. However, as the weeks marched on, and our sites moved farther away, we were getting home way after dark, and after eating and showering, there was just neither time nor energy for productive classes.

Night Trainings

We did, however, have some 1-hour classes during this work time, when we needed to work out a particular solution to a problem, or to design the AC wiring in a particularly difficult site. But generally, the consensus was that we would try to have a training at the end.

After the first 10 days into the project, it looked like we would probably be there weeks beyond our scheduled completion date, and that would leave no room for training. But as the crew got more and more comfortable with what they were doing, and saw ways on their own to make their movements more and more productive, we ended up finishing the work several days ahead of time, and the crew rightly insisted that we take that time for all-day trainings. (The last day's training was done on the shore of a beautiful lake, where breaks were taken in a boat touring up and down the coastline….)

More Training

This actually worked out perfectly, because we were able to go through the design of the systems we had just installed. The crew was able to see why the wire was sized as it was, and why we had the numbers of panels and batteries that we did. They went through many design examples on their own. They were also able to figure out all of the programming steps that were used to set up the Outback Mate system and be able to do the programming themselves.

Still more Training

Following the class training, we went back to all of the sites and conducted staff trainings. This was so that all of the users of the system at the health centers would understand that they are not working with grid electricity. It was also to explain to the operators what their responsibilities were relative to regular monitoring and maintenance. As a result of the class trainings, these staff trainings were conducted entirely by members of the team.

What's Next?

SELF has made arrangement to provide similar trainings and installations at another group of hospitals and health centers in western and northwestern Rwanda. This work is scheduled to take place in May, June, and July of this year.

Keep your eyes out for the report on this follow-on project – hopefully by late July.

This project was conceived of, financed, and designed by Solar Electric Light Fund. All of us at SunEnergy Power International are proud to be part of the team.

Report by: Walt Ratterman

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More Pictures Follow……..

Young Helpers

Kirehe at Sunset

Maurice and Fabrice wiring the Inverters

Jerome Wiring a Combiner Box

Installing the Rack on the Pole

Conducting Staff Trainings

Musafiri and Gats wiring the AC Side

A Well Trained Rwandan Solar Installation Team!!