

Photovoltaics as a Cottage Industry

By Richard Komp

One of the more exciting new developments in photovoltaics is the widespread introduction of this technology to 3rd World areas. Back in the 1981, I wrote an article called “Photovoltaics as a Cottage Industry” where I had worked out the calculations of what it would cost to set up a tiny PV factory in a 3rd World country and what the cash flow would be when one started with finished PV cells and only assembled the modules, or when one even made the PV cells as well.

Work in Nicaragua

At the time, nothing came of this idea, but 9 years ago, I was contacted by Susan Kinne, an electrical engineer working at the Universidad Nacional de Ingeniería (UNI) in Nicaragua. She had an old copy of my book **Practical Photovoltaics** where she read about this idea and asked me if it was possible to actually manufacture PV modules in Nicaragua. I wrote back and said yes, and later that year she came up to the US and attended a photovoltaics workshop where we all made small solar battery chargers. We stayed in touch and the following January I went down to Nicaragua to work with her and the small club called the Grupo Fenix that her students had started at the UNI.

One of the result of this collaboration is a pair of small workshops which make, sell and install PV modules of up to 75 watts. One of these is in Managua and has become an independent renewable energy business called Suni Solar *Below is a photo of the new Suni solar headquarters in Managua.*



The second cottage factory was started as a result of Fenix’s work with landmine victims in northern Nicaragua. As part of this work (sponsored by a Canadian governmental CIDA grant) was rehabilitating the landmine victims and teaching them a new profession. They learned how

to solder the PV cells together and assemble 25 to 60 watt PV modules that they installed on health clinics and other community buildings in 48 villages as part of the grant project. The small factory, called Fenix Norte, is also making small solar battery chargers and other PV modules to run portable radios and electric fences for the local farmers. *The photo below shows Mauro, one of the landmine victims installing a 25 watt Fenix PV module on the roof of a community center.*



The two workshop groups soon figured out that it wasn't worth their while to make large power modules, since the big PV cells are more difficult to acquire and handle, and the price per watt of the big power modules is barely above the cost of the components. However, the smaller 25 to 35 watt modules in big demand for the small PV systems used by 3rd World peasants are sold by the major manufacturers at a much higher price per watt. These can be profitably made from the broken pieces of solar cells that Fenix people buy by the pound and trim to uniform size sets for their modules. In general, the cottage PV manufacturers now confine themselves to making modules no larger than 50 watts, and normally do these larger sizes as custom modules for 1st World NGOs (non-governmental organizations) that specifically want to use modules manufactured in the 3rd World country where they will be installed.

Work in Haiti

As knowledge of this work by the Grupo Fenix started spreading in the international aid community, we started getting asked by other NGOs to help them copy this work in other poor countries. The first of these was Haiti, where I went, accompanied by two Fenix members to teach a group of peasants organized by the Peasants' Movement of Paypay (MPP) on the basics of solar energy, solar microdrip irrigation and how to start their own PV factory. On the first

month-long trip, Rodolfo, an electrical engineer, Marco Antonio, one of the landmine victims, and I taught the hands-on course in Spanish with one of the MPP members translating our lectures into Creole. Before we left, they group had made four 35 watt PV modules and were starting production on small 14 watt ones for lighting individual peasants' homes. *The photo below shows the MPP peasants' group cutting the broken PV cells to assemble a 35 Watt PV module under Marco Antonio's supervision. Since the classroom is off-the-grid, the cell cutter is solar powered and operates off of a 6 volt battery to give the proper cutting speed.*



Other members of the Grupo Fenix have made two follow-up visits since then to check out the PV module assembly work as well as to install two more solar powered microdrip irrigation systems. There are now three peasants' groups in Haiti making the small PV modules, and the problem I now have is finding enough bargain PV cells to handle the increasing demand for these cells. The peasants' groups are now also making their own little $\frac{1}{2}$ watt light emitting diode (LED) lights to serve as reading lamps for the children to study at night. These lamps use plastic coke bottle caps as housings and only have 4 to 8 white and yellow LEDs mixed together to give a warm white color (and cut the cost since the white LEDs cost \$1 each and the yellow ones are only 35 cents apiece).

Work in Mali

Our latest work in setting up photovoltaics as a cottage industry was in Mali, West Africa. This past March, Carolina Barreto from the Grupo Fenix and I went to Mali for two months to work with Ji Duma, a native NGO that has been working there for the past 20 years with the villagers to install wells and give the peasants a safe supply of water. The group wanted to add solar water pumps to some of the wells to irrigate gardens in this very dry part of the world, but wanted to make their own PV modules to power small diaphragm pumps. They also had promised to furnish electric power to the new school and the village office in Banko, one of the villages that just received a new well. The first Malian workshop was to teach the Ji Duma members how to assemble their own modules for this work. *Below is a photo of Carolina Barreto giving a lecture in on how PV cells work, and how they will be cut for the 35 and 50 watt modules we assembled. Mary Graham, the person who organized the Mali project and raised the funds, is to the left of Carolina in the photo.*



Carolina is fluent in French (the Official Mali language) but the lecture was also translated into Bambara for the students. The group started working with single crystal Astropower PV cells, but since these are no longer available, they then learned how to make 30 and 60 watt modules using the ribbon-grown Evergreen Solar cells, which are much more fragile but able to be cut with care and are available in quantity.

The group then went to the remote village of Banko to install the PV systems on the school and on a rack near the new Ji Duma well. We installed the locally purchased batteries and the charge control in the village office and ran an underground cable between the two buildings. *The photo below shows Carolina and local Malians installing the new PV modules on the school. A friend of Mary Graham is documenting the work with a video camera.*



In addition to the photovoltaic work, we also had workshops where we built solar box cookers. These workshops were organized by the woman who runs the prison rehabilitation program for young women and we had four of these women working with us to build three solar cookers out of cardboard boxes, aluminum foil and other inexpensive materials. When these were finished and working, we built three bigger permanent wooden box cookers using packing crate wood and aluminum printing plates from the local newspaper. Deforestation is a major problem in that part of Africa and most of the trees are used directly for cooking or the making of charcoal to sell to poor people in the cities for cooking fuel. Efficient cook stoves have been introduced in some areas, but the introduction of solar cookers will be a much bigger help. However, it is **very** difficult to introduce this cooking method to 3rd World villages and future follow-up work by the Grupo Fenix in Mali will have to take place to have any hope of success.

Future cottage industry PV work

I have been contacted by a number of people and organizations who wish to emulate the success of Fenix in setting up small cottage industry factories in developing countries so I expect that I will be busy for years to come. Other groups are setting up these factories on their own so it would appear that photovoltaics as a cottage industry is an idea that is spreading worldwide. There is even talk of making the PV cells themselves in these small cottage factories.