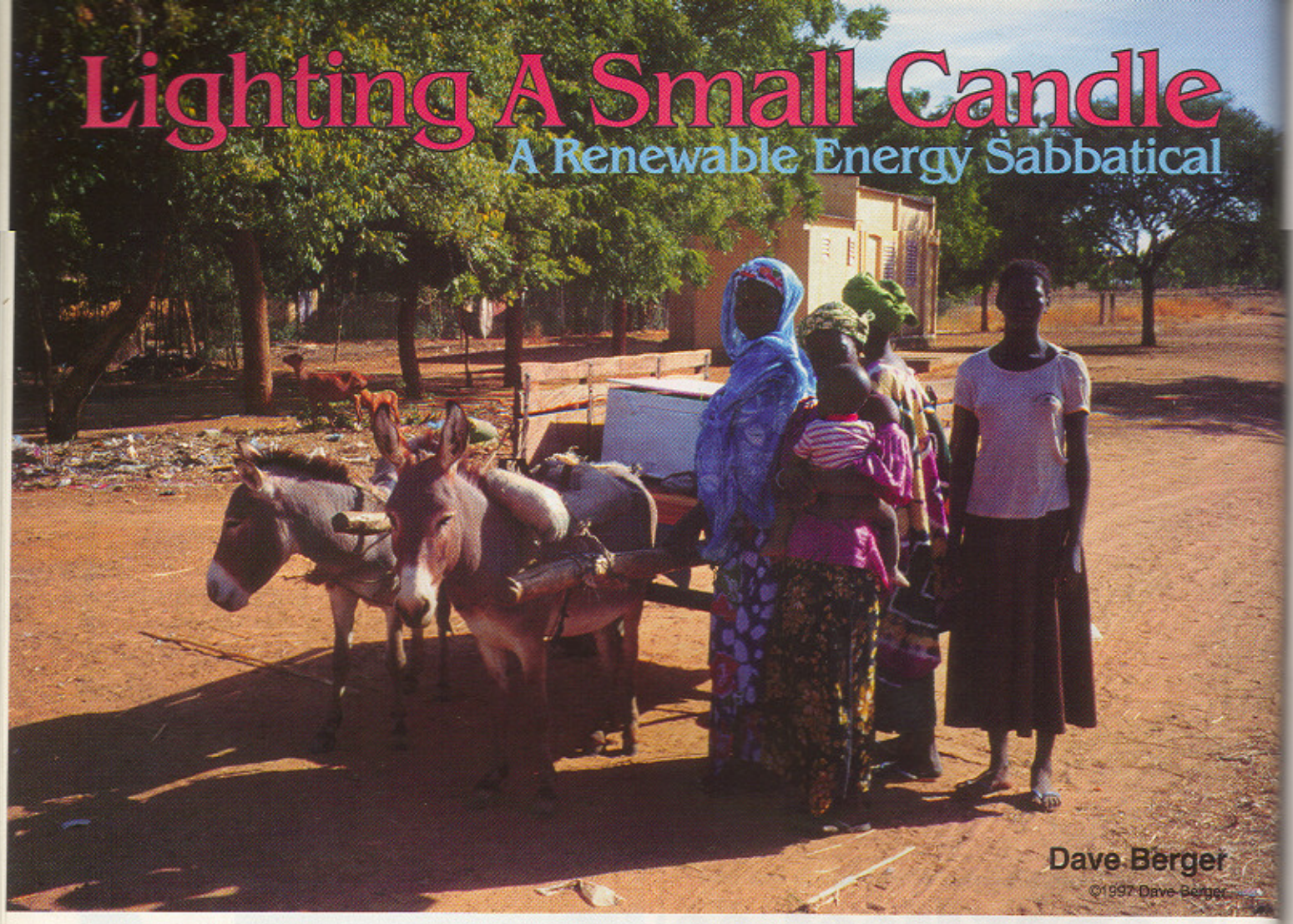
Lighting A Small Candle

A Renewable Energy Sabbatical



Above: Representatives from a womens' collective take a solar cooker home in a donkey cart.

Several years ago I heard a very dedicated United Nations worker speak about environmental and health issues. She said she had spent many years complaining about the problems in the world. One day she realized her energy would be better spent trying to work for an improved world rather than sitting in the dark and "bitching." So she decided to join the United Nations and "light one small candle in the dark" rather than sit and complain.

This talk truly inspired me and the complaining part struck home. When I proposed my sabbatical project for the 1995–1996 academic year I emphasized lighting a candle in the dark by focusing on implementation of renewable energy projects. My employer, Portland Community College, has always had a wonderful track record in supporting student and community projects. They accepted my proposal. I was released from my normal teaching duties for one year with partial salary.

Solar Energy International

Perhaps the best thing to come of the year long adventure, was the thoughtful, caring people I met and the friends I made. The Solar Energy International teaching staff gave me and a small group of students unsurpassed classes in photovoltaics, wind, micro-hydro, and solar cooking.

With the help of SEI staff we 1) selected a solar box cooker design for a project in Mali, West Africa, 2) received a grant from the Northwest Environment and Self Reliance Trust for educating future SEI students in renewable energy, and 3) developed a list of materials to take to Mali.

The cooker design was a simple rectangular box. The materials taken included an electrical meter, a camera, a compass, a site level, a measuring tape, rubber gloves, a solar powered battery charger with batteries for a flashlight and short wave radio, a "Leatherman"

tool, and oven thermometers. I brought a completed solar cooker prototype without glass, a sketch pad, and wapi pasteurization indicators for solar cookers.

Strawbale Research Facility

At PCC I worked with an extraordinary group of students and volunteers on the "Strawbale Project." We designed and constructed a 10 by 12 foot exterior shed with a passive solar south facing window, concrete slab foundation, insulated metal roof, and strategically placed moisture monitors in the bales. We are upgrading the facility to include photovoltaic (PV) power for lighting, monitoring, humidification and water pumping, a propane heating system, a solar hot water system, and a computerized data acquisition system. One purpose of the project is to provide a demonstration of renewable energy. We are also testing the viability of strawbale construction in the moist Pacific Northwest.

Above: Strawbale test structure at Portland Community College.

Mali Solar Cooker Project

The solar cooker project was the heart of my year long experience. It was managed by myself and another Oregonian, Lassine Niare, a native Malian who is fluent in Bambara, the prevalent language, and French. Lassine is committed to helping his country.

The objective of the project was to plant a small educational seed for solar cooking. The goals were to reduce CO_2 emissions (rough estimates were for reductions of 6.1 tons of CO_2 per cooker per year), diminish on-going deforestation, reduce desertification potential (Mali is virtually the doorstep of the Sahara), protect wildlife habitat and local vegetation, provide a smoke free environment, and save people the money usually spent on fuel.

The philosophy we applied was 1) use local materials to insure sustainability, 2) have a local person at all times to deal with cultural implementation issues, 3) train locals to build cookers, 4) hold cooker training classes for recipients, 5) distribute cookers to various individuals, groups, and locations to spread the seeds of

Left: The President of Mali (in purple), Lassine Niare (second from right) with tribal elders and a solar box cooker.

Above: Solar cooker training in Banamba, Mali.

knowledge, 6) develop a follow-up evaluation mechanism, 7) test samples of cookers for quality before distribution, and 8) provide a completed prototype.

We chose a simple flat box cooker design to accommodate Mali's 12°N equatorial latitude. We decided to use wood for the box to insure sustainability, two pieces of glass to insure a warmer cook and allow the cooker to continue to function if one was broken, a black metal base plate for better heat conduction, cardboard insulation, aluminum foil interior lining, and an aluminum-covered wood reflector. The exterior of the box was 30 by 75 by 85 cm. The size of the typical Mali cooking pot was considered.

Implementation

We arrived in Bamako, the capitol city, and contacted the materials manufacturers, our lead carpenter, Binafu, and his crew. Binafu's crew built all the cookers that we distributed in Bamako and prepared all the kits disbursed in rural areas. Our costs for 98 cookers averaged about $78 each including parts and labor. During the three months that we were there we employed approximately 50 locals for fabrication and disbursement. Countless other local jobs were assisted by the manufacture of the materials we used. We had positively contributed to a local economy of one of the poorest countries in the world. Almost everyone we worked with had large families, was extremely cooperative, and truly welcomed the work. We chose to train only carpenters in cooker fabrication because they owned tools, and their skills assured quality work and timeliness.

We disbursed our cookers with numerous collectives, government organizations, and agencies to spread as many seeds as possible for solar cooking.

Our three major disbursement sites were Banamba, Bamako, Yanfolila, and the Peace Corps. Banamba was the ideal development site. We had support from two environmental managers with the Bureau of Water and Forestry. They connected us with the local radio station which was PV powered by a grant from Plan International, a USA development organization. Even Banamba's water supply and grocery store were PV

Dave's Sabbatical Schedule

Activity	Location	Time Frame	Status
Training	Solar Energy International, Carbondale, Colorado	June–October 1995	Complete
Construction of Straw Research Facility	Portland Community College, Portland, Oregon	June–October 1995	Phase I complete Phase II upgrade in progress
Implementation of Solar Cooker Project	Bamako, Banamba, and Yanfolila, Mali, West Africa	November 1995 –April 1996	Fabrication and distribution completed Evaluation in progress
Assisted on Solar Electricity Project of Masai Organization	Terrat, Tanzania, West Africa	May–August 1996	Project is ongoing

Cooker Distribution

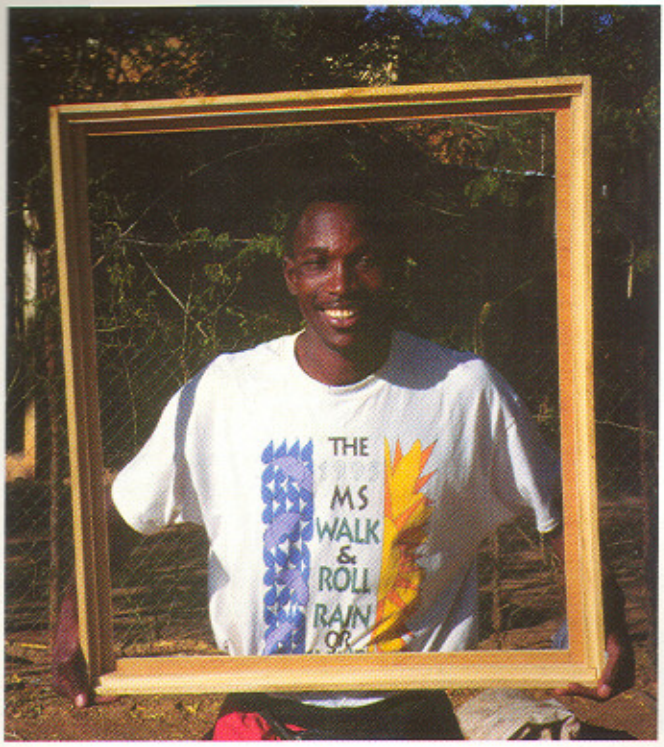
No.	Location	Recipients / Purpose
1	Bamaco	Prototype made in Portland, used only as a model for local carpenters.
15	USA Peace Corps	Used by USA Peace Corps volunteers to introduce solar cooking in rural villages.
8	Bamako	Placed with individual families and a women's co-op that may be easily monitored and has shown interest in the project.
1	Kaye	Placed with an individual interested in environmental protection.
5	NGO's	Given to non-governmental organizations having interest in energy and environmental issues, and access to areas of northern Mali plagued by desertification.
27	Yanfolila	Placed with individual families, the hospital, the school, a group fighting deforestation, and women's collective. The local branch of the National Bureau of Forests & Water, (Mali's EPA) placed 10 cookers in rural locations via 4-wheel drive. The local circle for county government placed 9 in rural locations.
21	Banamba	Given to women's collectives, solar energy advocates, and environmentalists. Placed with the assistance of the local branch of the National Bureau of Forests & Water and the local solar-powered radio station.
20	Bureau of Forests & Water, and National Dept. of Energy	Placed for nationwide distribution to spread the solar-cooking concept in order to prevent desertification and make popular the use of the sun for cooking.

powered. Banamba was no stranger to development projects, already familiar with renewables, and very receptive. At the radio station we placed four short ads in the local tribal language, and received a 30 minute interview for Lassine in Bambara, a national language. This and support from the local government and community elders resulted in solar cooking training sessions for about 500 people. We cooked rice, beans, potatoes, sauce, meat, and garlic. At the doorstep of the great Sahara, our cookers reached 265° F in the low January sun. It was a clear day and our cookers registered 150° F even at sunset. We trained two engineers as cooking trainers. One, Mamadou, said that he would cook every day during the ten month cooking season and save 2 to 3 cubic meters of wood a month valued at $17. A substantial savings considering that his salary is $140 per month. It was here that I experienced one of the most wonderful moments of the project as three women from a local women's collective took two cookers off into the sunset in a donkey cart.

Yanfolila was a site which provided good local support from government agencies and individuals. After placing our first six cookers we were forced to leave because I needed treatment for dysentery. We were not able to return for a month. But when we returned, two cookers were in use in the street cooking cassava and tea and preparing the traditional feast that marks the end of fasting during Ramadan. Two of the six is a small sample and may not seem very successful. However, based on information I later read in a report by Mark Hankins of Energy Alternatives Africa, Ltd. and based on small samples of cookers, it may actually be a high success rate. In fact, much of the literature and information supplied by solar cooking enthusiasts doesn't supply any follow-up evaluation information at all. This is a major flaw because simply placing cookers doesn't mean they are being used. Lassine and I developed follow-up surveys that address cooker use and design and he is back in Mali gathering these surveys.

Another noteworthy event happened in Yanfolila. My fiance, Julie Larson came for a visit and led a solar baking session, during which she baked bread in the oven with several women. It appears that the local women were more motivated or comfortable with a woman trainer.

Bamako was our headquarters and the nation's capitol. It has terrible air pollution from autos, dust, wood smoke, and fossil fuel burning. Plastic garbage is everywhere and smelly open sewers line the streets. Yet, it is a place of hope, a country that threw out its dictator six years ago. It has a democratic government that allows political freedom and is building new roads



Above: Lassine with cooker frame.

and attempting to clean the streets despite the county's widespread systemic poverty. Bamako served as an excellent home base to us because 1) it is a manufacturing center, 2) imported glass and aluminum foil are readily available, 3) Lassine's father, Baba Niare, is the traditional chief of this city and he has numerous connections and over 600 years of family lineage, 4) there are over 600 non government organizations in Bamako, and 5) it was wonderful to come home to Lassine's house and play with the children there. We made contact with numerous organizations and skilled laborers, held training sessions, established our infrastructure, and even got some local media coverage.

In an attempt to insure follow-up and training we gave approximately 15 box cookers and one specially made large cooker for a women's collective bakery to the Peace Corps. We trained a Peace Corps manager/trainer in the use and fabrication of the cookers. Their volunteers were very receptive and wanted more cookers than we could provide. It seems many of their volunteers have undirected projects without funds or even no projects, and were happy to work with the solar cookers. As the Peace Corps already had some success with charcoal cookers in Mali we were hopeful that they would be a good vehicle for the spread of solar cookers.

Problems

There are some problems we encountered. Families in Mali are extremely large, up to 20 people, requiring huge cooking pots. Glass was hard to find and unavailable in some rural areas. The roads are very rough making it difficult to transport without breaking. In some areas termites threatened the wooden boxes. Cooking time is much longer with the sun than with wood. The standard cooking pot is very dense and heavy as it had been designed to cook on an open fire. We gave cookers to smaller families of ten or less. We recommended that available lightweight aluminum pots be painted black on the exterior to be used in the cookers. We suggested that the cookers be stored off the ground for termite protection.

To address concerns about the glass we experimented with a parabolic design. Logi, the local satellite dish fabricator, had the skills to produce the frames by pounding out a rectangular shaped metal bar with sand inside of it. Perhaps a second phase would have Logi create a sustainable business by making copies of the German SK12 parabolic stand and importing the polished aluminum reflective material needed. The parabolic needs no glass and can boil 3 liters of water in 30 minutes. Reducing the cooking time would create a greater incentive for the locals, especially women who already work up to 20 hours a day.

Other Renewable Needs

You name it, Mali could use it. Coming out of a repressive political era isn't easy. PV could be used for lights, water supplies, radios, and small battery charging systems. More hand pumped well systems could be developed. Locals use wood to heat water for showers. We tested a simple 20 liter black plastic can, filling it with water and setting it out in the daytime sun. The solar heated water had to be cooled in order to provide evening "bucket" showers for 4 to 5 people!

Masai Solar Electricity Project

The final phase of my sabbatical was with a Masai human rights organization, Olkonerei Integrated Pastoralist Survival Program (OIPSP). The Masai and their current day situation is akin to the Native Americans two hundred years ago. They are fighting to hold their lands while educating their people. But they are developing renewable energy in rural areas.

OIPSP's work for the Masai in rural areas provides legal and paralegal training on land use and human rights issues, implements solar electricity projects, maintains a veterinarian training center, develops small businesses and housing, provides education on environmental damage from multi-national mining projects and other exploitive endeavors, develops

international alliances in the theater of public opinion, and seeks funding for their cause and projects. In the past they have received assistance from Dutch, British, American, Irish, and Canadian organizations.

I assisted on PV project maintenance at their largest site in Terrat and Simangero, attempted to restore some very old 2 Volt 150 Ah utility cells (using EDTA with slight success), assisted in evaluating potential wind and water projects, attended meetings on human rights and solar planning, assisted in installing some new lights, wiring, PV, and radio phone equipment, trained technicians in using hydrometers and a sight level, and toured past projects including a defunct wind powered water pumping system, a defunct vaccine refrigerator, a large agribusiness, and a gem farm.

OIPSP has many small PV systems in place. Typical systems included 33 to 55 Watt panels, 80 to 150 AH Exide truck batteries, compact fluorescent lights, and Solatec charge controllers set for an LVD of 11.9 Volts.

Above: Eva, solar tech. of Masai, with three types of lanterns.

Problems that I observed with the PV projects were 1) undersized wiring was forcing consistent LVD during the cloudy season at their human rights center in Terrat, 2) the set LVD level protected the compact fluorescents but LVD was happening often indicating that battery life was in jeopardy, 3) the batteries were not high quality, deep cycle (no quality manufacturer existed locally) and would not last long presenting a disposal problem (no recycling center exists in Tanzania), 4) expensive hand-rotated PV trackers were being used with 2 panels instead of the 4 panels that would make the trackers cost effective, and 5) expensive PV powered lanterns were being tested with small capacity batteries that ran down as a result of people running lights too long.

Some of the future renewable energy needs for OIPSP include 1) upgrade some existing PV systems by increasing wiring sizes, test different charge controllers, obtain better batteries, and perhaps develop in-the-field acid neutralization techniques for battery fluid, 2) repair the wind powered water pumping system at Naberera, 3) replace or repair a small BP solar fridge at Moipo used for vaccines for polio, typhoid, tetanus, diphtheria, TB, and measles medicine, and 4) continue to train technicians in renewables. Fortunately, OCF, with the help of SEI, is funding two full scholarships for sessions on renewables for technicians Lukas Sanango and Eva Saineye.

Return to the Past

While in East Africa I returned to Shabwali Secondary School in Western Kenya where I was a volunteer teacher eight years ago. I wanted to follow up on a water supply/rainwater catchment system for the school that had still been in the planning stages when I left. I had designed it with headmaster George Mbele and the local Peace Corp volunteer with funding through a US AID grant. The system had been successfully implemented and built at triple the design capacity as a result of strong community participation.

You never know if projects you work on or things you try will be successful. Who knows whether the Mali solar cooker project will work at all? I am convinced that our efforts are worthwhile, even if it is to learn how not to do things in the future.

Epitaph

In the Dogon country of Northern Mali, I saw a small PV setup lighting a table in a school at night because a Dutch traveler carried it in on his back. Perhaps it won't be sustainable. At least people can read at night for a while since they must work all day. If they can get replacement batteries, they may read for a very long time. They now know about the concept of solar energy, which is good because they have an abundance of solar fuel.

Julie Larson came for a visit and found a 20 year old man chained to a post in his village on the Ivory Coast because of his mental illness and episodes of destructiveness. His family could not afford the medication that would relieve his symptoms. Julie is a social worker and arranged for assistance from a local doctor with the aid of a Peace Corp worker. She raised funds when she returned home by contacting fellow social workers to help provide his medication at cost of about $20 a month. Guess what? He is now on medication and unchained, his life sentence at the post has ended. That little "candle in the darkness" was truly lit.

In Closing

I want to thank everyone who educated, helped, funded, and befriended me through these projects. Special thanks go to Lloyd Marbet, a lifelong environmental and social justice advocate.

Access

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