



Empowering Women with Solar Irrigation:

The Solar Market Garden Enhances Food Security in Benin, West Africa

Validation Overview, Pilot Report & Dissemination Detail

I. INTRODUCTION

Today, 1.6 billion people in the world live “off the grid” with no access to electricity. They turn to dangerous, unreliable, and, over time, expensive choices of kerosene lamps and diesel generators for light and power. In their 21st century fight with energy poverty, they should look to the sun. With the help of the Solar Electric Light Fund (SELF), they can.

In the Kalalé District of Benin, Africa, w/it ! fi" th
Sahel region: unpaved roads and no secondary school, hospital, or reliable electricity sources. Its agriculture is based on rain-fed crops such as cotton, maize, and, to a lesser extent, root crops. Vegetable and fruit production is very limited and malnutrition is prevalent.



In partnership with the Association pour le Developpement Economique Social et Culturel de Kalalé (ADESCA) and under evaluation by Stanford University, SELF designed its Whole Village program. The local community made clear that an agricultural component needed to be the introductory element and the World Bank’s Global Development Marketplace awarded a grant to the project. The Solar Market Garden mE O " ion. The 2007 – 2009 Pilot Phase involved

n’s cooperatives in two pilot villages, Bessassi and Dunkassa, to install Solar
on three half-hectare plots. The success experienced to date has
ating the SMGs in additional villages can begin, as can extending electricity
ges.

_____ : The Solar Electric Light Fund (SELF) is a nonprofit organization founded in 1990 that designs and implements sustainable rural solar electrification projects. Its clean energy solutions in 20 c - alr e mM

enhanced the health, education, developing world.

II. VALIDATION PHASE OVERVIEW

Based on the 2007-2009 Pilot Phase results, summarized below and detailed in the next section of this report, the second, Validation Phase of the project was initiated in 2010. It involved securing financing for a larger set of SMGs in eight more villages in Kalalé, with installation scheduled for 2011-2012. Such funding was received from the Nordic Environment Finance Corporation, the U.S. Africa Development Foundation, ExxonMobil Corporation, and other private donors, and planning has begun for the installations.

The project's evaluation partner, Stanford University's Program on Food Security and the Environment, completed an assessment and concluded that the SMG: "significantly augments both household income and nutritional intake," and added:

"Scaling this technology will undoubtedly face challenges, but successful widespread adoption could be an important source of poverty alleviation and food security in the marginal environments common to sub-Saharan Africa."

III. PILOT PHASE – PROJECT REPORT, 2007 - 2009

The Need for the Project

1.6 billion people in the world live “off the grid” with no access to electricity. Most derive their livelihood from subsistence farming yet their poverty is defined in large measure by poor nutrition and related health problems. Productive agriculture requires water delivered reliably to the fields – a serious challenge in areas with lengthy dry seasons, such as the Sahel. Irrigation solutions need energy to pump water, but rural villagers and farmers are rarely connected to the power grid. Diesel generators cannot alleviate this





The Project's Roots

In 2006, SELF Executive Director Robert Freling was contacted by [Dr. Mamoudou Setamou](#), a native of Kalalé who had received a Ph.D. in agricultural entomology from the University of Hanover in Germany. Dr. Setamou, now a Professor at Texas A&M University, had just returned from a home visit to Benin, where he had participated in a meeting of Kalalé's district council to explore alternative options for electrifying Kalalé's villages since the national grid was not likely to reach this remote part of Benin anytime soon. Intuiting that solar represented a way forward for his people, Mamoudou turned to SELF for help. Over the next few months, a plan was assembled, through the good offices of the local group ADESCA, to generate solar electricity for a wide range of end-uses—including schools, health clinics, water pumping systems, street lighting, and wireless Internet access—in each of the 44 villages that comprise Kalalé District. In terms of priority, however, an on-the-ground needs assessment revealed that the first concern among the local communities was food security: to find a way to overcome the endemic lack of water and agricultural produce that condemns the people of Kalalé to an endless cycle of poverty and poor health, especially during the 6-month dry season.

Project Impact – Stanford's Assessment

SELF has partnered with Stanford University's Program on Food Security and the Environment (<http://foodsecurity.stanford.edu/>) to monitor and evaluate the economic, agricultural, environmental, health, and organizational impacts of this project. The two v Food 0

control villages was just under \$1 (PPP, 1993 US dollars), over \$0.60 of which is spent on food, confirming that Kalalé's population is among the poorest on the planet. Furthermore, while virtually all of the households in Kalalé are engaged in agricultural and/or livestock production as a primary activity, most are net consumers of food, particularly of non-staples (proteins, vegetables, and fats). These households either rely on sales of cotton (grown across northern Benin) or draw down assets (usually livestock) to supplement poor production. Against this food- and nutrition-insecure backdrop, the SMG's impact has been striking:

Solar Market Garden and Assessment Facts

Three 0.5-hectare systems were installed in two "treatment" villages with pre-existing local women's cooperatives (two surface pumping systems, one groundwater pumping system).

The 30-35 women per group each farm their own 120m² plot; the remaining plots are farmed collectively to fund group purchases and expenses.

Stanford also monitored two "control" villages for matched-pair comparisons.

Household surveys in treatment and control villages were conducted upon installation (November 2007) and after one year of garden operation (November 2008).



Assessment Results

Each SMG supplied an average of 1.9 tons of produce per month.

Other agricultural production was not displaced.

18% of the produce grown was kept for home consumption; the balance was sold at market and generated income.

Vegetable intake across all villages increased during the rainy season by approximately one serving per day (150 grams per person); by comparison, project beneficiaries gained the equivalent of 3-5 servings per day (500-750 grams per person), mostly during the dry season.

Project beneficiaries' daily standard of living increased by \$0.69 relative to non-beneficiaries.

Use of income earned "significantly" increased the purchase of staples, pulses, and protein during the dry season and oil during the rainy season.

Project Partners and Funders

three villages in Nigeria; four schools in South Africa; and three pilot drip-irrigation systems in Benin.

Personnel working on this project include:

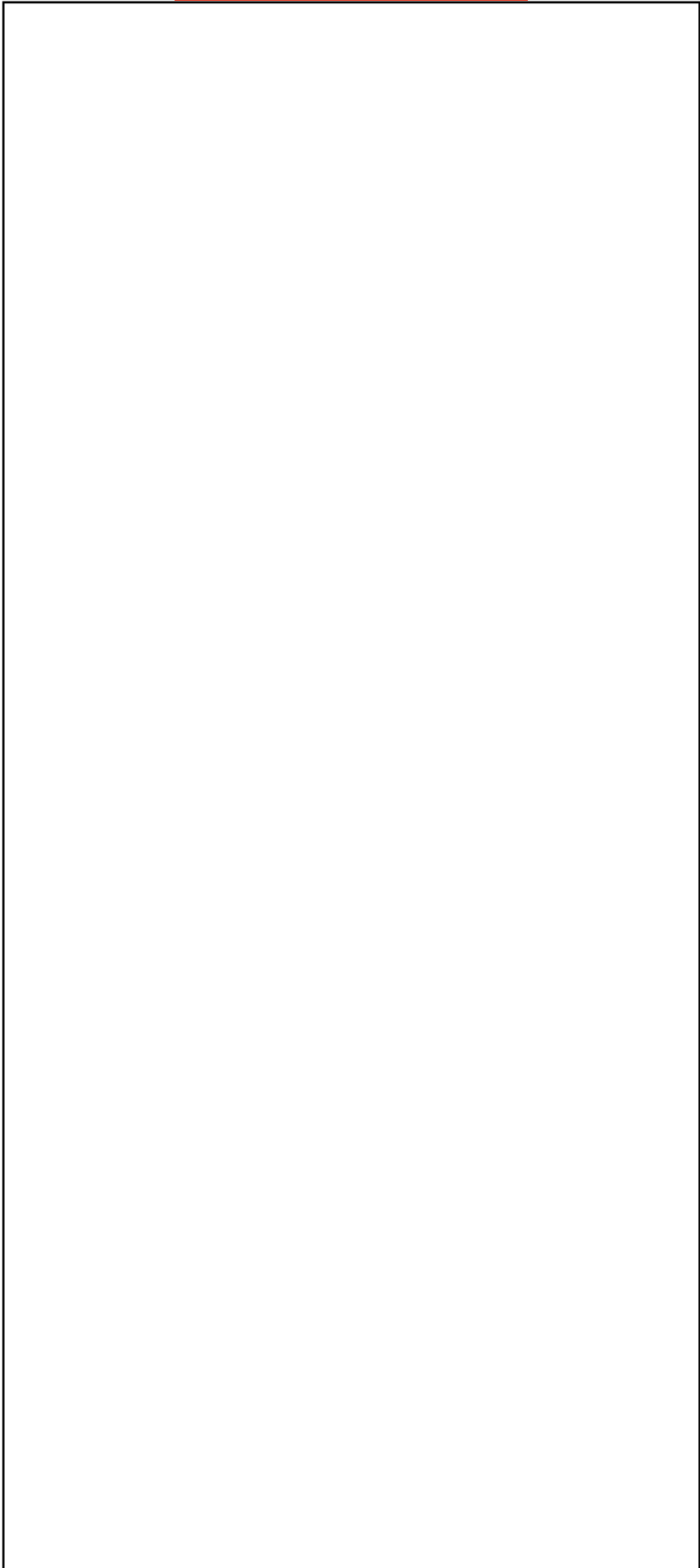
Robert Freling, SELF Executive Director since 1997. During his stewardship, SELF has completed solar energy projects in more than 15 countries. He is the recipient of the 2008 King Hussein Leadership Prize.

Jeff Lahl, Project Director, has 20 years' experience in solar technology, training and international development.

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IV. DISSEMINATION DETAIL

External Publications (partial listing)





Solar Electric Light Fund

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The digital divide captures many of the headlines, but the new century and millennium are riven by many other, equally serious inequities which, like the digital gap, are at their most extreme in developing nations. Among these are divides based on culture, economy, environment, gender, and – in a sense that goes beyond computers and the Internet – technology.

All these divides interlock with and reinforce each other. Finding ways to close and heal them is the urgent imperative of our time.

SELF, the Solar Electric Light Fund, takes its mandate from the words of Freeman Dyson, the Templeton Prize-winning physicist and SELF board member, who wrote in his recent book *The Sun, The Genome and The Internet* that "The new century will be a good time for new beginnings. Technology guided by ethics has the power to help billions of poor people all over the earth."

Narrowing the technology divide can also reduce other, interconnected divides. SELF works at the very base of the technology divide, the lack of electrical power.

Today, two billion human beings still live without electricity, primarily in developing nations' remote and rural reaches. For many of these people, connection to a utility grid is nowhere on the horizon. Their countries' economic struggles, high foreign debt, and public health burdens make grid extension, at as much as US\$20,000 a kilometer, far too expensive. The cost to the planet of bringing conventional, cchrstucar



SELF's projects have now reached 13 developing nations on four continents. Christopher Flavin, president of the Worldwatch Institute, recently remarked that "I know of few small non-profits with SELF's impact." Mikhail Gorbachev, presenting SELF with the 1998 Green Cross Millennium Award for International Environmental Leadership, praised the organization's "dedication, leadership, and vanguard efforts in creating a value shift for the new millennium." In 2002, SELF was selected from among nearly 500 nominees as one of 25 Laureates in Silicon Valley's Tech Museum of Innovation Awards.



Outside evaluators presented their findings about the project in the July 1997 newsletter of Energia, an international group that grew out of the 1995 Beijing Conference on Women, and which links individuals and groups concerned with energy, environment and women:

The VWU Solar Energy project is a remarkable project in many ways. In our view, it is exceptional that women have been trained in PV technology, and are successfully promoting, selling, installing, maintaining and using photovoltaic SHS [Solar Home Systems].

Not only is the project completely implemented by women, it is also implemented on a commercial basis with full cost recovery. Although initial funds were made available by American donors, the users pay back the costs of the systems over a period of four years, thereby renewing the fund and enabling more households to purchase a SHS...

It is interesting to take a closer look at the Vietnam solar energy project from a gender point of view, and use this example to discuss what 'women and energy' can mean.

When thinking of how to integrate women in an energy project, the first association that many people have is that more women should be involved in the project. The VWU project is a clear and successful example of such involvement by women. The women of the VWU are doing the marketing of the SHSs. They are evidently doing a good job; new households are constantly signing up for purchasing SHSs. Probably because the "saleswomen" of VWU know the energy needs of women best, they are very effective marketers.⁵

On the strength of its continuing achievements in solar electrification of rural Vietnam, the Vietnam Women's Union was presented with a 2002 Energy Globe Award, known as the "Sustainable Energy Oscar." The award was conferred by Mikhail Gorbachev on March 6, 2002 at a gala ceremony in Linz, Austria.⁶

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When apartheid collapsed in 1994, only 12 percent of rural black households had access to electricity. 0.0012 Tc 9 00034 Tw 25.69Td[(solat5(of rurun)-resw gcolectens wa, 1994, 6)-SELFs



The Kigoma region is famous as



Lamp production provides a new opportunity for women to earn a living, one in which their labour is highly valued. Non-farm labour among women was not significant in the area prior to the project. Now their employment prospects have increased.

Besides increasing the non-farm skills of rural women, the project has also allowed them to generate income, play a role in decentralised energy service delivery, improve their quality of life through better lighting, and raise their status in the household and community...

Women who are involved with lamp construction and, by extension, with addressing the overall energy needs of the region, are being heard more. Project participants and their associates now run meetings to discuss prospects and problems in microenterprise operations, regional sales and electrification issues.

The husbands of the project members offer assistance to the working team of women, especially in marketing and sales. Individually and collectively, the women are encouraged to bring their husbands to monthly meetings with the marketing manager in order to discuss potential business prospects. Such interactions have been found to build women's confidence, and interest in the project among the men. As a result, the project has been successful in removing some of the social and cultural discrimination experienced by women.

Regular participation in project activities requires women to spend time outside their homes, thereby overcoming a traditional social barrier. In addition, other family members are found to support the women by taking on household responsibilities in order to help them participate in training and production activities. With the electric lamps, housework can be done at night and women can restructure the time they spend on household activities... Such shifts in priorities of households in remote rural areas of the country are a sign of the social changes achieved by the project.¹¹

The observation regarding the supportiveness of men is especially encouraging, since both Bangladesh and Tanzania are nations where male privilege is pronounced. Further evidence of the viability of a women-led microenterprise in Tanzania comes from a study, *The Role of Women in Sustainable Energy Development*, from the U.S. National Renewable Energy Laboratory:

Although conflicts and differences of interests between women and men can and do exist, men often support the efforts of women to save time and improve their families welfare. Even in a country like Yemen, the openness of both women and men to women's role in renewable energy was evident in a baseline survey for a biogas project: It revealed that women were ready to acquire new skills and knowledge that would improve their lives and that of their families.