

## Developing the Capacities of Rural Women to Operate Decentralized Solar Electrification

Communities in remote, rural areas traditionally lack access to conventional power sources. As these communities have to rely on kerosene or firewood for basic energy needs, pressure on the local environment have increased dramatically having a negative impact on the global environment. It is estimated that one rural family in Africa typically burns 60 liters of kerosene a year, releasing one ton of CO<sub>2</sub> in less than ten years.

Solar energy provides an alternative energy solution while simultaneously spurring progress in human development including poverty reduction, gender equality, education and health. However, there is a need to enhance the capacities of local communities to build, install, maintain and repair solar technologies and local women could play a significant role in addressing this issues.



For this reason, in 2008 the GEF Small Grants Program (SGP) decided to enter into a partnership agreement with Barefoot College and support “Women Solar Engineer” pilot projects across Africa’s and Asia’s poorest countries. In this collaborative effort, the GEF SGP provides communities with technical support and funding for the solar panel kits. The Barefoot College, a pioneer in demystifying complex technological processes for illiterate students, offers a six-month training to the women beneficiaries of the GEF SGP on their campus in Tilonia, India.

The goal of this “Women Solar Engineer” initiative is to build local capacity and electrify poor, “off-the-grid” communities with clean, low-cost solar energy. As such, the project is uniquely positioned to address multiple development goals at once:

- relieves environmental stress by providing an alternative energy source
- bridges the gender gap by empowering poor, illiterate women
- promotes sustainable development outcomes through community ownership and
- enables improvements in health, education, living standards and quality of life

The GEF SGP also provides support in awareness raising, monitoring and evaluation, promotion of the project at the community level, and by mobilizing other partners to support the projects in its different country programmes. Its National Coordinators and National Steering Committees play a fundamental role in each of the country programmes where the partnership operates.

*To date, SGP has supported 15 projects with USD\$689,167 dollars in 12 countries, leading to the implementation of solar projects by 35 women trained by the Barefoot College as solar engineers.*

## SOLAR ELECTRIFICATION TRAINING AND IMPLEMENTATION ON THE GROUND



SGP and the Barefoot College “Women Solar Engineers” partnership is rooted in the belief that it is fundamental to empower communities to develop their own sustainable energy solutions.

Once the project has been approved by the SGP National Steering Committee and the funds and technical support from the GEF SGP are available, each community forms a village solar committee, trained to manage and supervise the community’s solar energy project. This includes providing facilities for a Rural Electronic Workshop (REW), negotiating budgeting and fee collection, and selecting suitable candidates for the women solar engineer training in India.

After learning how to install, maintain and repair solar energy kits, the women solar engineers return to their communities to electrify households in their villages. In return for their installation, maintenance and repair services, the women engineers receive a monthly salary from the village solar committee.

The partnership is currently implementing projects in the following countries:

- Benin
- Bhutan
- Burkina Faso
- Cameroon
- Chad
- Ethiopia
- Ghana
- Kenya
- Mozambique
- Niger
- Rwanda
- Uganda

## RESULTS

*Through the projects the women managed to provide electricity to over approximately 2,245 households, bringing light to more than 14,549 beneficiaries in 32 villages.*

In addition, communities have seized the opportunity to provide electricity to numerous public facilities, including schools, hospitals, food processing plants, local administration offices, religious buildings and community centers. Most fundamentally, the projects have managed to reduce CO<sub>2</sub> emissions, ease pressure on deforestation and decrease air pollution from burning firewood and kerosene.

### Environmental Benefits

To assess the results of the initiative, the GEF SGP conducted a first round of surveys to solicit feedback from the national coordinators in the twelve participating countries, and realized that even at this early stage communities already realized considerable reduction in air pollution, fire and health hazards. Those communities relying heavily on fire wood experienced significant reductions in deforestation and land degradation. The partnership also provides support for local communities to contribute towards the green economy by creating green jobs and access to renewable energy.

Mozambique estimates that with the help of solar energy, annual kerosene consumption fell by 27,375 liters and annual fire wood consumption fell by 91,250 metric tons. This resulted in an overall decrease of reduction of 82,125 Kg in of CO<sub>2</sub> emissions per year. In Ghana, the rising price of kerosene puts pressure on household budgets, rural migration and has led to large-scale deforestation and soil erosion as communities resort to firewood to meet their energy needs. But thanks to solar electrification, communities in Ghana and Benin managed to replace 95% and 50% respectively of kerosene lamps with solar powered lighting; those in Niger and Benin succeeded in eliminating kerosene lamps completely. In Ethiopia, Cameroon, and Chad, solar electrification had a substantial impact on easing pressure on deforestation as they were able to reduce consumption of both firewood and kerosene.

## Socio-Economic Impact

Participating communities are remote, rural towns who have no prospect of being included in the traditional power grid. Therefore, the socio-economic impacts are considerable. Communities registered significant cost savings over expenditures for kerosene and batteries in nearly all communities including Chad, Bhutan, Niger, Ghana and Mozambique.

Beneficiaries in Ghana have been able to register savings of 76% in solar energy expenditures over kerosene, while beneficiaries in Benin registered savings of up to 57%. These cost savings may reduce rural migration which is partly driven by increasing energy costs. Similarly, solar energy resulted in considerable time savings, freeing women from having to devote many hours on hauling wood, kerosene or batteries from distant locations. Mozambique and Ghana report to have saved roughly 109,500 hours and 61,320 hours per year, which can now be spent on more productive activities.

However, the most profound impact of solar electrification has been on community-wide economic activity. Solar lighting has enabled the extension and improvement on the continuity of economic activities after dark. This has had particularly positive implications for women who are now able to expand income generating activities into the night. In the case of Ghana, for example, solar energy has been providing lighting for two food processing plants where women produce shea butter at night. In Niger, women engaged in increased honey production; in Rwanda, women increased craft-making; and in Ethiopia women got to increase production of handcrafts and 'tela,' a locally brewed beverage. Benin reported a 10% increase in income by "women traders" within the first year of receiving solar electrification. . In Cameroon, exposure of cocoa farmers surged due to growing attention of visitors to their village.

In the long term, the Women Solar Engineer partnership may also realize a reduction in unemployment. Indeed, some countries including Benin, Ethiopia, Uganda, and Ghana reported that Barefoot alumni have been or will start training other community members.

Another dramatic improvement has been in information and communication technologies, since the households received at least one electric plug through the project. All communities noted a substantial increase in mobile phone usage as solar energy users were now able to charge their cell phones on a regular basis. In addition, radios and TVs facilitated more efficient information gathering and educational activities. In Ethiopia, children can now enjoy "school mini-media" thanks to solar energy. Preliminary evidence also suggests that the placement of solar energy powered ICTs lighting in public places and institutions has may contributed favorably to social cohesion and community building.

## Education & Health



Despite the short time the projects have been in operation, evidence suggests a few critical improvements. Most notably, every single respondent emphasized the overwhelming benefit of solar energy on children's education, especially the opportunity to study after dark. The extended hours allow for higher flexibility in managing domestic duties, work and studying.

Several communities including those in Bhutan and Ghana installed solar energy kits in school buildings. Several communities have also implemented adult literacy programs, along with community television and radios airing audio-visual education programs.

In addition to education, communities have noticed considerable improvement in health. Beneficiaries, from all countries experienced reduced exposure to toxic fumes and fire hazards from kerosene, firewood or diesel.



Ghana even achieved a decrease in whooping cough. Communities in Ethiopia and other countries installed solar energy in health facilities. There is also evidence that lighting has improved safety and basic hygiene.

## Gender

All participating communities noted the powerful effect of the GEF SGP-Barefoot College partnership on the social status of the illiterate women trainees. Women trainees felt empowered to acquire complex technical skills, and return as qualified solar engineers to serve their communities. Pursuing the training in India in a multi-cultural setting also broadened their horizon. Most of the Women Solar Engineers managed to translate their new livelihood activity into better living standards.

Overall, participating communities note how the image of women and girls has been boosted. In Chad, for example, women and girls are very “excited” and “attracted” by the solar energy program. It has given women a place in the community and allowed them to take on community leadership roles. Most communities emphasized the key role of the GEF SGP to help communities give a stronger role for women on the project. For example, SGP encouraged a greater proportion of women on the solar energy management committee and chair.

## Replication and Up-Scaling

As the widespread benefits of the pilot projects become evident, several communities, government agencies and non-profit organizations have shown interest in replicating the project in other villages. Currently, Bhutan, Niger and Ghana are exploring models for scaling up the solar energy project. This involves solving a number of challenges that communities have encountered in the pilot projects: (a) refining procurement, timely delivery and transport of solar equipment; (b) scaling and refreshing training skills for engineers and (c) expanding funding and partnerships.

In particular, Bhutan’s government has offered strong support to extend solar electrification to off-the grid communities and the Bhutan Foundation already provided funding to electrify five more villages. The government in Ghana is also studying models for scaling up, planning to expand the project to fifty communities and foresees locally training fifty rural youth and unemployed young mothers.

## Conclusions and Lessons Learned

Results clearly show the positive effects of the GEF SGP-Barefoot College partnership on the environment and quality of life of the communities. Other key benefits are:



- reduced pollution, deforestation and CO2 emissions
- empowerment of illiterate, rural women
- improved health due to the reduction of toxic fumes
- more time spent on educational activities
- increased economic activities that can be pursued after dark
- higher usage of information and communication technologies

*The GEF SGP welcomes the opportunity to partner with other organizations to deliver similar community based projects following the example of the experience with Barefoot College.*

**250 children in Ghana and 100 primary school children in Niger are now able to study in the evening.**

**Benin and Ethiopia noted that the impact is particularly important for girls who can now better manage domestic duties and school.**