14 Recharging batteries: Zimbabwe

General information

- **Implementing institution**
  Energy Technology Institute (ETI) of the Scientific and Industrial Research and Development Centre (SIRDC)

- **Head**
  C.J. Chetsanga, Director General, SIRDC; Professor M. Elmissiry, Director, ETI

- **Details of institution**
  Address: P.O. Box 6640, Harare, Zimbabwe
  Tel.: (+263) 4 860320/9
  Fax: (+263) 4 860340/50
  E-mail: melmissiry@sirdc.ac.zw
  Web site: www.sirdc.ac.zw/eti.html

- **Implementation period**
  18 months (January 1999 to June 2000).

- **Costs**
  US$21,456: US$12,874 (60 per cent) from the Netherlands Embassy and the balance from SIRDC. The local community prepared the site and operates the station. The site was donated by the Ministry of Health.

Summary

The Mhondoro solar photovoltaic (PV) battery charging station is the first of its kind in Zimbabwe. The Mhondoro project, which was implemented by the Energy Technology Institute (ETI) of the Scientific and Industrial Research and Development Centre (SIRDC), is based on the simple concept of reducing the initial costs of small-scale solar systems for home use. These costs have been significant, especially for those who stand to benefit most from solar-generated power.

A solar home lighting system (SHS) consists of four main components: a solar panel, a battery, a charge controller, and solar lights. The solar panel accounts for about 50 per cent of the cost of the SHS and, at about Z$100,000 for a 50-watt panel, is beyond the reach of most people in rural areas. A solar battery charging station sidesteps this problem by using only a few centrally located solar panels to charge a larger number of batteries for home lighting. The individual SHS user does not have to pay for the solar panel, cutting the initial cost of an SHS by nearly 50 per cent. Users of the scheme pay a fee, which entitles them to have their batteries recharged at the central station. The money raised from fees is used to run and maintain the station.

In the Mhondoro project, a 1-kilowatt central battery charging station with 12 solar panels of 83 watts each was installed at a medical clinic that serves 23 villages located some 100 kilometres southwest of Harare. Project participants paid for a battery, a charge controller, solar lights and wiring for their own household systems. The charging station provides power for the clinic and for batteries used by up to 50 households, including those participating in the project and other local people who pay a small fee to charge batteries at the station.

Participation has been the watchword since the outset of the project. The project organizers realized that by involving people from the local community, they would feel that the project was really theirs, thereby ensuring its sustainability.

First, the Department of Energy (DOE) in the Ministry of Mines and Energy helped ETI to select Mhondoro as the project site. Then meetings were held to introduce the project to local people, gauge their responses and discuss their expectations. During implementation, local labourers and artisans worked to design and build the station. This made it a community-owned asset and not something mysterious and threatening that had been introduced by outsiders.

Local people are also responsible for the day-to-day running of the station, security and fee collection. Participants' willingness to pay for solar lighting in their homes is a significant departure from the long-established mindset of projects of this kind as being wholly donor-funded and donor-driven. In fact, the project has disproved the popular notion that rural communities are merely

the passive recipients of donor assistance by demonstrating how people are willing to pay for what they need if they are well informed, involved and able to make their own decisions about what is best for them.

Background and justification

The Musinami Clinic serves about 250 households in 23 villages in the Mhondoro communal lands of Zimbabwe. The clinic is not connected to the national electricity grid so night-time emergencies or births had to be attended to by candle light or kerosene lamps, neither of which provides particularly efficient or reliable lighting. In addition, most of the households in the 23 villages were without modern lighting. Local people first became aware of the potential for PV home lighting when a Global Environmental Facility (GEF) project installed demonstration PV lighting systems in a few homes between 1993 and 1998. This earlier project encouraged people in the Musinami Clinic community to accept and use clean energy sources, including photovoltaics.

When it became clear that the clinic desperately needed electric power but could not be connected to the national grid for many years to come, solar PV power was identified as the best option. Some of the more prosperous subsistence farmers in the area were also interested in having solar electricity for their homes, but the initial costs of an SHS were too high for them. The concept of a cost-cutting central battery charging station was therefore greeted with enthusiasm.

The energy policy of the Government of Zimbabwe is based on the idea of equal access to energy as a vital tool for development across the country. Lack of access to electrical energy in rural areas deprives communities not only of modern lighting but also of radio and television, which are essential ways of disseminating information on general development concerns. Among other issues, schoolteachers and students without electricity have to study by poor lighting. Women who spend a great deal of time working in the home, particularly during the evenings, were also among the most enthusiastic participants in the project.

Description

The central battery charging station provides power to trickle-charge batteries from stand-alone solar panels. Villagers bring their batteries to the station for recharging to a specified voltage (which is monitored by the charge controller). Batteries can be recharged as often as required, but they are designed to provide sufficient power to power two lights, a television and radio for five days under normal use. A household discharge controller indicates when the battery is running low. At the station, which provides both fast and slow charging facilities, batteries are plugged into a control panel that can be used to charge a

maximum of 12 batteries at any one time.

The first step in the project involved making sure that it would conform to the policy guidelines of the Government. Consultations were held with the DOE, which expressed enthusiasm for the proposal and put SIRDC in touch with possible funding agencies. DOE suggested Musinami Clinic as a potential client because it was aware of the needs of the area. After a series of meetings with the community served by the clinic, work started on the central charging station, which was designed on the basis of the expected energy consumption and took into account views expressed by local people.

Total energy requirements were calculated by estimating the power consumption of 50 houses using two lights and a radio for two to three hours a day as well as the clinic using three lights for 14 hours a day. The total came to 4,312 watts a day, which meant generating 5,079 watts a day to allow for 85 per cent system efficiency.

Given that this area of Zimbabwe can expect seven hours of solar radiation a day, a total of twelve 83-watt/12-volt panels was necessary to meet the energy needs of the 50 households plus the clinic. A 100-amp battery, large enough to supply the estimated energy needs of a household for five days, was also selected. Appropriate charge controllers (for use at the station) and discharge controllers (for use in the households) were chosen as was cable of the correct thickness and length.

The main aim of the project was to use Musinami Clinic and the surrounding Mhondoro district community as a model to determine how willingly people in rural Zimbabwe would accept the concept of central battery charging stations. The results were good. Subscribers demonstrated a willingness to pay for services that had previously been provided by donors.

On average, five batteries a day were recharged at the station during its first year of operation. This shows that there is a need—and a market—for battery charging services. In fact, it is estimated that about 10 to 15 per cent of rural households in Zimbabwe already use motor-vehicle batteries to power radios and rudimentary lighting systems. Medical staff at the clinic also report improved health service delivery, especially at night, since electric lighting has become available.

In July 2001, the charging station was officially handed over to the local community during a special ceremony.

Patenting and commercialization

The installation in Musinami Clinic was the first of its kind in Zimbabwe. As yet, however, it is not ready for commercialization, but it could be once a few more similar systems have been installed and put into operation in other parts of the country. The government body responsible for commercialization, the Industrial

Development Cooperation, has shown interest in the project and has visited the site, but it has not yet devised any plans for its commercialization.

Partnerships

This project highlights the importance of collaboration and partnership. DOE and SIRDC collaborated from the start; small-scale industries were involved in manufacturing components for the station; the Netherlands Embassy in Harare contributed 60 per cent of total project costs; a World Bank consultant, working with DOE, carried out the initial assessment of the project proposal and approved its implementation; and SIRDC worked closely with the local community throughout project implementation.

Replicability

Solar battery charging centres could be built and put into operation in any developing country that faces the same energy challenges as Zimbabwe. Colombia, Morocco, Peru, South Africa and Thailand all have experience in pursuing such projects and have promoted them with different levels of commitment.

The United Nations Development Programme (UNDP) has sponsored replication of the project in Rusitu Valley, Chimanimani district of Zimbabwe, as part of a larger project to develop a sustainable renewable energy village with funding from GEF.

The close involvement of DOE in the project represents a link with national projects and energy policy-makers, and the Government seems to be interested in spreading the SHS technology and management system to other parts of the country. DOE has applied to the United Nations Educational, Scientific and Cultural Organization (UNESCO) to help to fund these efforts.

Lessons learned

At the beginning of the project, there was a misconception that it was to be yet another donor-funded initiative that would provide recipients with a free service. As a result, the initial response was overwhelmingly positive.

When people realized that they would have to pay to help to defray the costs of the system, many decided not to participate. However, those who remained on board represented the most enthusiastic supporters of the project and were willing to pay and care for the station. The latter factor proved to be an essential element in the long-term sustainability of the project. Nevertheless, the dropout rate among participants shows that project organizers must spend time with their potential clients to make sure that they fully understand the terms of their commitment.

Much of the success of the project is the result of the community's sense of ownership, which was engendered from the outset. Indeed, vigorous community

participation in the inception and implementation of the project as well as its operation, maintenance and security have ensured its sustainability.

Subscription fees are collected during crop harvest seasons, when farmers have more available money. This meant that the project cycle had to be adapted to cropping seasons, but it has also led to a low payment default rate. In fact, only one of the 13 subscribers has defaulted. Subscribers paid an initial deposit before their houses were wired, and the balance was paid off within 12 months. Most of those who did pay on time were women, three of whom have little disposable income. The defaulter has a regular income, which implies that non-payment may depend more on attitude than on ability to pay.

Project completion was delayed and, to an extent, the quality of the work was reduced because there was a lack of technical expertise, components and materials at the site. In addition, work was slowed down during the rainy season when wet roads made it very difficult to continue. However, these drawbacks should be weighed against the business opportunities that the project created for the community.

Rural communities have clearly defined structures of local governance, and these must be respected and followed if projects are to proceed smoothly. For example, public information and consultation meetings had to be called through local leaders; otherwise nobody attended.

The project was greatly assisted by the fact that the earlier GEF project had made people aware of the central solar battery charging concept. It is always helpful to implement projects in areas that have some previous experience with the technology and ideas that are being promoted.

Government interest in a project is very useful to the future replication of similar projects in other areas. In this case, project organizers were encouraged that the local member of parliament from Mhondoro attended the ceremony when the station was handed over to the local community and that he saw the enthusiasm with which it was received.

Impact

To date, in addition to the clinic, 13 households have subscribed to the project's central charging station services. In other words, about 72 people now have electric lighting, radio and television in their homes. Another 250 households (or 1,500 people) served by the clinic are also benefiting. About five batteries a day are also being recharged by non-subscribers who live in the area and who pay a small fee for this service.

The project has encouraged the community to use the extra power available for commercial activities. For example, local people suggested that a water pump could be powered from the solar station.

Replacing fossil-fuel lighting with electricity is reducing carbon emissions into the atmosphere, which is of direct benefit to the environment.

The presence of the station and the need for community involvement in its management have encouraged people to take action for themselves. For example, a committee was set up to collect and manage the fees for battery charging.

The success of the project has had an impact on national policy-makers and on their approach to disseminating renewable energy in rural communities.

FUTURE PLANS

A project proposal has been submitted to UNESCO with a view to adapting and replicating the experience in Mhondoro in other parts of Zimbabwe.

In the meantime, ETI is developing integrated solar central charging stations that can charge home batteries, operate pumps for extracting underground water and provide telephone facilities and Internet/e-mail access to rural communities.

PUBLICATIONS

Reports on the Mhondoro solar battery charging station project were published in the SIRDC in-house magazine, *Technology Monitor,* in December 1999 (vol. 6, no. 4) and in September 2002 (vol. 9, no. 3).