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Solar electricity: hands-on experience in Zaire

Solar electricity from photovoltaic systems can bring health, education, entertainment and economic development to settlements which will never be served by a grid. And unlike the grid-based systems of the developed world which rely on fossil or nuclear conventional fuels, these solar electric systems have minimal environmental impact. JEAN-PAUL LOUINEAU of IT Power describes the world's largest rural health care project to utilise photvoltaics.

Zaire (formerly the Belgian Congo) was the location for a health care project which began in 1983, funded by the European Development Fund. Involving some 850 solar systems, this project involved a wide range of technical and management expertise to ensure its success. The French company Solar Force won the 1983 tender for equipment and supplied 2,460 France Photon (now Photowatt International) monocrystalline modules, as well as refrigeration and lighting systems. The batteries provided the storage capacity necessary for 24 hour operation.In 1984, IT Power was awarded a contract for technical assistance. This included not only testing the systems, but also system installation, maintenance, and the training of users for the Zairean Ministry of Health.

Of the twelve regions that comprise Zaire, five have benefited from the project. Bas-Zaire, the region closest to the capital city of Kinshasa was chosen as the pilot region. A team of engineers from the Ministry of Health installed the first 170 systems in selected rural health centres.

As a result of this pilot project, it was decided to contract NGOs and private firms to carry out the remaining installations in the other four regions: Shaba, Kivu, Kasai and Equator.

Surgical operation with a photovoltaic lighting system at the Kingoyi hospital in the region of Bas-Zaire, Zaire, August 1991

Responsibility for the region of Equator was given by tender to the dynamic NGO, CDI Bwamanda, and the three other regions to the firm FNMA. The installation programme began in March 1988 and ended in September 1990.

The many positive results achieved by this project are principally due to the strict respect paid to the installation standards written in the technical specifications, and to the permanent on site presence of an engineer trained during the pilot region installations. The devotion of the technicians involved also played a major role in ensuring the success of the project.

Each region's installation programme lasted 6 to 8 months, usually under difficult conditions. The experience gained through this project led to the production of several handbooks on the installation and maintenance of photovoltaic refrigerators written by IT Power and disseminated by the World Health Organisation.

Production of solar refrigerators

With technical support, the Zairean company FNMA, manufacturer of domestic refrigerators, designed a solar refrigerator destined for use in the project.

This solar refrigerator, one of the most efficient in the world with regards to its energy consumption, meets WHO's standards. The cooling circuit is comprised of standard components, replaceable (in case of break-down), by a refrigerator repairman. Other international aid organisations such as USAID have also bought the FNMA solar refrigerators for vaccine storage. Today, the company has produced some 500 units of which 200 have been exported.

Indispensable Preventive Maintenance

After having financed material and installation, the European Development Fund also financed a three year maintenance program for all the installed systems. A call for tenders for triennial maintenance contracts was issued. Each regional maintenance base was composed of (at least): the engineer- technician who had supervised installations in that region; a local bureau and workshop; a 4 wheel drive vehicle; and a stock of spare parts for solar systems.

The engineer for each region was responsible for quarterly preventive maintenance and training of the system users. Monitoring of the systems was done through control sheets on which all technical information was noted as well as any repairs. Particular attention was paid during installation to training the medical staff who would use the systems, as they were also responsible for its regular maintenance. A user's manual was written and distributed to provide help in the absence of the engineer.

Delivery with the help of a solar electric lighting system at the health centre of Kansenia in the Shaba region, Zaire, February '91

Cleaning of a photovoltaic panel during a maintenance tour at the health centre for Sundi Lutete, region of Bas-Zaire, July 1991

Measurement of the state of charge of batteries at the community battery photovoltaic charger system of Nselo, region of Bas-Zaire, August 1991.

Sale of solar electricity!

A photovoltaic system can produce services, kilowatt hours and financial return. Since July 1990, several pilot systems for the commercialisation of solar energy have operated in Zaire in the rural health zone of Nselo. IT Power provided the technical assistance for this project which was financed by the WHO Expanded Programme of Immunisation.

The marketing of solar electricity !

A rural health centre equipped with a solar refrigerator and a lighting system becomes an attraction for the community. The personnel benefit from the availability of the scarce electricity and the quality of the

health services is strongly enhanced. Such a health centre is often the first example of rural "pre- electrification" to which surrounding populations are attracted. One method of redistributing the initial cost of solar energy and recuperating the ongoing costs of the EPI programme is to generate surplus solar energy in a health centre by installing a more powerful generator than normally required to operate the refrigerator. This surplus of energy can then be "sold" to the community. Such was the theory behind the EPI project so that the revenue generated from surplus energy would contribute to a hospital or health centre's ability to autofinance itself.

The sale of excess energy can be carried out in many ways. Some examples include the recharging of 12V batteries, rental and recharging of 1.2V nickel cadmium batteries, recharging of portable lamps with built in batteries or by charging admission to community television broadcasts or videos.

After a study examining the local market and evaluating the potential clientele, a lead-acid 360 Wp battery charger capable of charging one 12V battery per day; a charger of nickel cadmium batteries (60 peak watt, 200 nickel cadmium batteries) and a TV with a video player (240 peak watt) were installed at the Nselo Hospital.

A small cement block building was built to house the three systems and the panels were installed on the roof. The television screen was positioned in a window facing outwards on the rear wall of the building with the audience of up to 100 seated in an outside area made of local materials. Similarly, at a health centre 25 kms from Nselo, a 12V battery charger was installed.

The community television and video programme function well. The best receipts for an evening are usually generated by films like "Rambo" and football games of the Zairean national team, the Leopards. Apart from the revenue that the community television brings in, the TV/video is an excellent means of communication for the delivery of primary health care information through documentaries.

The organisation of activities (management of services and prices) at these two centres was left entirely in the hands of the hospital administration committee. The medical personnel were among the first to benefit from the services offered as the prices of different services were fixed below the market price and did not follow the inflation rate.

An evaluation of the project will be done in few months by WHO experts. We already know that battery chargers bring in the most revenue in a local economy, because they respond to immediate needs of the population. They are also simple, reliable and present a return on investment in 2-3 years and a life well past 10 years.

Zaire project on hold

In October of 1991, events in Zaire were rapidly unfolding to reveal a picture of political turmoil and unrest. Non-Zaireans were advised by their respective governments to leave the country. This led to the suspension of the project by the EC.

After a review of the situation in early January this year, the EC, following in the footsteps of France, Belgium and the United States, decided to continue postponement of co-operation and development projects within the Republic of Zaire for six more months due to continuing political unrest. For IT Power, this means the possible end of an interesting and innovative PV project ongoing since 1985. For the project itself, with the loss of supporting monies, technical assistance and Zairean political infrastructure, it means yet another setback in the struggle to ameliorate rural Zaire's living conditions.

About the author

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