

Solar Energy for a Brighter Life

A Case Study of Rural Electrification through Solar Photovoltaic Technology in the Eastern Province, Zambia

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Abstract

Electricity is taken for granted in many parts of the world. In Sub-Saharan Africa, typically less than 5% of the rural population have access to this energy source. Even though electricity in itself does not lead to development, it can support a development process. Rural development and rural electrification often go hand-in-hand, but electrification is expensive, and power companies are often reluctant to venture into rural electrification. Small solar photovoltaic systems have become an alternative to extending the grid. Their power output is limited, but many energy services such as electric lighting, music, and information from radios can be obtained. One barrier to widespread use of solar technology is the cost.

During the 1990s several solar projects were implemented in many places in Africa where different delivery mechanisms were used to overcome the cost barrier. One such project was the PV-ESCO project in the Eastern Province of Zambia, implemented by the Department of Energy, Zambia. Solar services were offered to users on a fee-for-service basis, meaning that the clients pay for the service and an energy company owns and maintains the system.

The aim of this thesis is to study the introduction of solar electric technology in this area and how it affected people's lives and livelihoods. A combination of quantitative and qualitative methods has been used, including surveys, energy-use studies, and interviews. The results show that the most appreciated energy service is the improved lighting, which enables people to work, read, and write during the dark hours. Households constituted more than 90% of the users; shops, schools, and health clinics were also found. The households normally had at least one formal income, which is not typical for the area. With solar electric services the community institutions could improve the services offered. The solar systems were often used at above the intended capacity, leading to damage to the batteries. The fee-for-service model used in the project proved successful in enabling three companies to install, maintain, and repair solar systems, but less successful in creating a situation where the number of systems was increased.

Solar electric services can improve the living standards of people, and can also bring about improvements for social services such as schools. But successful operation of the technology will require support structures for training and loans. The conceptual framework applied in this thesis illustrates the complexity of the application of solar photovoltaic technology to rural electrification and development.

Keywords: Rural development, rural electrification, distributed generation, photovoltaic technology, solar home system, energy services, Zambia, Sub Saharan Africa