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Fee-for-service companies for rural electrification with photovoltaic systems: The case of Zambia

Xavier Lemaire

Centre for Management under Regulation, Warwick Business School, University of Warwick, CV4 7AL Coventry, UK

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ABSTRACT

In developing countries, photovoltaic systems often remain unaffordable for inhabitants of rural areas. Therefore, special financing mechanisms need to be implemented to support their dissemination. For instance, fee-for-service schemes enable users to spread the up-front costs of photovoltaic systems over a long period, and provide a solution to the problem of their long-term maintenance.

The paper surveys Energy Service Companies (ESCOs) that have been established in the Eastern Province of Zambia. Three small enterprises have been selected in 1999 and each manage 100–150 solar home systems. Regular contacts with technicians facilitate their follow-up and provide feedback from customers. Systems are now running efficiently and customers seem satisfied with the quality of the service provided. However, solar systems tend to be overused and batteries to be constantly discharged as the electricity loads increases. Furthermore, these small enterprises still face financial uncertainties due to a high inflation rate in Zambia and the difficulty to increase regularly monthly fees. Even with an initial subsidy from the funding agency, only the wealthiest customers of the area, with regular incomes, can be targeted. And like all rural electrification programs, a long-term involvement of the state is still needed to cover part of the capital costs and expand the scheme to new customers.

However, even with its current limitations, this case shows that a well-articulated public–private partnership can deliver a cost-effective energy service in rural areas. With a more flexible offer of photovoltaic systems and the addition of other energy services, small energy companies seem to be able to usefully complement the role of conventional utilities.

Introduction

Photovoltaic systems present a number of advantages for rural electrification in developing countries. First, investments in generating energy with solar systems are adjustable precisely to the demand. Second, they can reach end-users directly in remote locations, where electricity can be delivered without waiting for a connection to the grid. Third, the demand for electricity is, for many users in rural areas, quite low.

Combined with the abundance of sunshine in tropical areas—5–6 kWh/m^2/day in Zambia against for instance 2–3 kWh/m^2/day in a country like Germany—this makes photovoltaic systems an efficient and cost-effective way of delivering energy to meet basic needs, when compared to the poor quality of light provided by "traditional" sources (i.e. candles or paraffin lamps) or to the high operating costs of conventional electricity sources, like running a diesel generator in remote areas. Even in areas near the grid, solar systems could, for some categories of users, be better adapted to their low consumption of electricity. Furthermore, the reliability of solar energy systems—once the basic maintenance is done—is far higher than that of a diesel generator due to the lack of dependence on the supply of mechanical parts.

Small utilities with photovoltaic systems?

Despite the advantages of solar photovoltaics, the initial investment for these systems remains unaffordable for the majority of end-users living in the rural areas of developing countries. Like grid connection, giving access to solar electricity relies on subsidies. And as with conventional electricity, a commercial and technical network is also needed to keep the systems running.

As conventional utilities do not have the knowledge of solar systems (or, most of the time, any interest in this kind of system), it seems sensible to create specific small utilities specialised in the installation and maintenance of photovoltaic systems. Often, these small companies benefit from a long-term concession and they can obtain a loan from the government to buy the systems.

Energy Service Companies (ESCOs) are, in the context of developed countries, concerned with maximising efficient end-use of energy for their customers. In the case of a developing country, Energy Service Companies also may include small enterprises that provide solar electricity to their customers. Unlike conventional installers, these

E-mail address: Xavier.Lemaire@wbs.ac.uk.

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enterprises are not paid for the installation of a product—the initial fee covers just a small part of the cost of installation—but for the delivery of an energy service for which the ESCOs are paid, as long as electricity is provided to the customers.

In this scheme, ESCOs are given incentives to ensure the continued operation of the systems, as the customers pay only for the time that the service is provided. ESCOs are in fact not far from conventional utilities that would charge a low cost of connection to the grid and receive a monthly payment from their customers for the delivery of electricity.

The relevance of the case of Zambia

Several countries in the world have recently implemented or are in the process of implementing off-grid fee-for-service concessions, generally promoting a mix of solar and diesel systems. These include several African countries, namely South Africa, Namibia, Sénégal and Morocco (De Gouvello and Maigne, 2002).

Zambia appears to be one of the countries with the longest experience in Africa, as companies have been operating relatively smoothly for several years now. Otherwise, another country with a long experience in rural electricity supply concessions is Argentina, with solar systems managed by private concessionaires, notably in the remote province of Jujuy since 1999 (Alazraki and Haselip, 2007). The first place where ESCOs were introduced seems to be in the Pacific region, where small cooperatives were launched in the 1980s (Ross, 2001, p. 6). This last experience inspired the Zambian scheme.

Many countries have adopted or would like to adopt the fee-for-service scheme in some parts of their rural electrification program (EDRC, 2003; Krause and Nordstrom, 2004). As it is currently limited in scope with only a few hundred systems installed, the experience of photovoltaic companies in Zambia can be considered as a kind of ideal case of the fee-for-service scheme, as there has been limited political interference or delays in the process, compared to larger projects. It is also well-documented, with several reports and surveys enabling us to retrace all the stages of the project and its impact.

ESCOs in Zambia

Zambia is a landlocked country. Two thirds of the population lives in rural areas with a rate of rural electrification of 2% (against 35% in urban areas), and grid connection is unlikely to be extended out of the main towns for several decades. Population density is very low with an average of 13.1 persons per square kilometre (Haanyika, 2008). Therefore, it is a country where the dissemination of stand-alone systems or mini-grids using partly photovoltaic systems seems quite appropriate.

Energy Service Companies were launched in the Eastern Province of Zambia. The project was funded from 1999 until December 2005 by the Swedish International Development Agency (SIDA) with the technical assistance of the Stockholm Environment Institute (SEI) and the University of Zambia. The support was offered at the request of the Zambian government in 1996 (Mbumwae, 1998).

This area was chosen as it includes relatively wealthy communities of farmers. The selection of the enterprises to become ESCOs was made in 1999 (Arvidson, 2003, p. 100; Kalumiana, 2001). One of the criteria of selection was their implementation in the region. They do not benefit from a concession as such, but are the only ones to have access to a loan from the government, which is a barrier of entry to other potential competitors. ESCOs are small structures, typically with a director/project manager, two finance/administrative staff and two or three technicians. Solar service is only a subsidiary activity of these small businesses.

Three autonomous ESCOs have been created in the districts near the border with Mozambique and Malawi: one in Nyimba, operational in 2001 (called NESCO), one in Lundazi, operational in 2001 (called LESCO), and one in Chipata, operational in 2002 (called CHESCO). Initially, a fourth one located at Petauke (called PESCO) was also scheduled, but the company selected went out of business and solar home systems were reallocated to CHESCO and LESCO.

In the ESCO scheme, the Zambian government buys photovoltaic solar systems that are then lent to the Energy Service Companies, which have up to 20 years to reimburse the loan from the government (initially a donation from the Swedish International Development Agency—SIDA). The ESCOs install solar equipment in households and small shops and charge a fee. They then receive a monthly payment for the systems. A Battery Fund is created to replace the batteries regularly.

Successes and difficulties of Zambian ESCOs

The commercial relationship with customers

In 2006, 400 customers were paying a monthly fee to the ESCOs for solar photovoltaic electricity. In Chipata, they are mainly farmers (50%), civil servants who—for the most part—are also involved in farming activities (30%), and business people (20%). In Nyimba, they are mainly civil servants (55%), businesses (23%), farmers (13%) and institutions like schools (9%) (Zhou, 2007, p. 68–69). In Lundazi, they were civil servants and teachers (24%), small farmers and entrepreneurs (24%) and institutions (48%) [Mr Banda, LESCOs' Managing Director]. Now many of the small farmers and entrepreneurs have withdrawn from the service (Mfune and Boon, 2008, p. 183). The ESCOs scheme is mainly for government employees with regular income.

Each ESCO has a waiting list of several hundred customers applying for solar installations. Solar systems enable small businesses to extend their hours of work and therefore to improve their income generation. For households, solar systems improve the quality of life, by supplying basic needs like lighting, black and white TV and radio-cassette players. The impact of a basic service like lighting has been evaluated as quite positive, especially for pupils who can study during the night (Gustavsson, 2003; Gustavsson and Ellegard, 2004; Gustavsson, 2007a) or for small businesses (shops, restaurants, bars and mills) who can extend their opening hours.

There seem to be no acts of vandalism and very few solar panels are stolen, which may probably be related to a strong social control (the staff of each ESCO know their customers well) and the absence of a local black market for panels. Each client has to sign an agreement by which they take responsibility for the equipment, and can face severe costs if the system is stolen. In the case of NESCO, 10–15% of the clients are in arrears with paying their fee each month (Gustavsson and Ellegard, 2004). There is however a good payment record (95% of the clients eventually pay) due to the quality of the service provided by the ESCOs and immediate disconnection in case of non-payment. Only a limited number of solar systems have been repossessed after a default of payment, (Ellegard et al., 2004, p. 1255). Once again, this can be explained by the fact that ESCOs with a good knowledge of local applicants have been able to select the ones with regular sources of income.

In Nyimba, because of the connection to the grid of the centre of this town, a small percentage of clients (less than 10%) have surrendered their systems (CEEEZ, 2006, p. 14). In Lundazi, LESCO has been facing financial problems mainly linked to the non-payment of the monthly service fee by the Zambia National Service Camp, its main client with 64 systems (Swedpower, 2005, p. 16).

Technicians of ESCOs have to go every month to visit the customers and collect the fee (except in the case of prepaid systems). This means therefore that an inspection of the installations is conducted monthly. This also enables ESCOs to have regular feedback from their customers. Furthermore, in the case of malfunction, ESCO technicians have two working days to resolve the problem, once notified by the customer.