CONCESSION APPROACH IN RURAL ELECTRIFICATION BECOMES POPULAR IN MOROCCO EXPERIENCES AND ACHIEVEMENTS AFTER IMPLEMENTATION OF THE 16,000 SOLAR HOME SYSTEM PROJECT OF PERG-KFW

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ABSTRACT: Supported by the German KfW Development the Moroccan electricity utility ONE is implementing a project on the electrification of 16,000 rural households by means of Solar Home Systems. This first large-scale project with SHS in Morocco is based on a concession approach. Being chosen as the lead consultant for project preparation, management and monitoring as well as quality control PROJEKT-CONSULT GmbH assisted in designing the fee-for-service model for wide-scale rural electrification. A service company is in charge not only of installation services, but also of identification of clients, collection of monthly fees as well as maintenance services for a period of 10 years. Challenges in this approach lie in the organizational service structure which has to be built up in large and decentralized rural zones: the company structure has to keep pace with a growing number of clients. Moreover the capacity of the technical and commercial staff has constantly to be built up in order to meet the increasing maintenance requirements of the customers. While these starter problems are being solved, the approach has already proven his capability to lead SHS large-scale projects to success and has convinced the national utility ONE to tender a large number of additional concessions using the same set-up.

Keywords: Rural electrification, solar home systems, concession

1 INTRODUCTION

In the framework of the Moroccan Rural Electrification Program (PERG) the national electricity utility ONE is implementing a project on the electrification of 16,000 rural households by means of Solar Home Systems (SHS) in four provinces. This project is supported by a 5 m€ grant from the German KfW Development Bank. Installations in the first large-scale project with Solar Home Systems in Morocco based on a concession approach have come to an end by January 2006 while the service duration is 10 years for each system.

The fee-for-service approach (FFS) modified as a concession with regards to the special conditions in Morocco created a favorable environment for the Service Company and good conditions for a long-term sustainable service of the systems.

2 CONCEPTUAL APPROACH

2.1 Fee-For-Service approach implemented

After having evaluated different implementation schemes as direct sale or lending of SHS, a concession approach with a fee-for-service model was chosen as an appropriate method for rural electrification at a wide scale: A service company shall not only act as a system integrator and carry out installation services, but also be in charge of identification of clients, collection of initial payment and periodic fees as well as maintenance services for a period of 10 years. Customers stay clients of the national utility which is the owner of the systems during the 10 years operation period. A simplified set-up of the project is shown in figure 1.

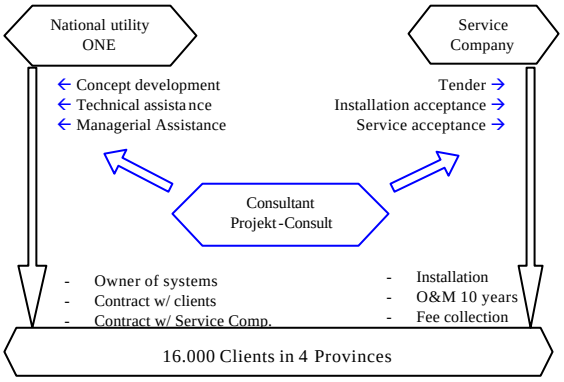

***Figure 1** Simplified project set-up*

The actual project design shows some differences to the "classical" fee-for-service approach although the latter has been taken as a reference: a service company (system integrator) is contracted by ONE to carry out installations in a fixed period of time and all required service works for the 10 following years. ONE defined in their invitations to bid the province and the respective number of systems to be installed based on the clientele potential. This allocation of a certain number of installations in a predefined region is similar to a

concession. It was then up to the Service Company to find sufficient clients in order to respect the given installation frequency.
In the current project the service mandate comprises at least one maintenance visit per year at each household and the obligation to pass by the client within 48 hours after the client's notification of a defect or breakdown. However, in contrast to a classical fee-for-service approach the service company is not owner of the system. Moreover, concerning ownership (and warranties) the system is divided into two parts:

a) From the date of completed installation the so-called production part of the installed system (module, regulator, battery etc.) is immediately passed into the ownership of ONE.

b) The rest of the equipment (lamps, installation material etc.) is owned by the client.

While the service company is contracted by ONE and paid according to the fulfillment of his obligations (installation and maintenance), the client is contractually bound to ONE as well. He is liable to pay his monthly fees for a period of 7 years. If ever a monthly payment is delayed more than 3 months or in case of unwillingness to pay, the client is threatened with disassembling of his system. After the payment period the client will become owner of the while system.

2.2 Quality assurance and environment

In order to assure the technical quality of the systems installed and the services to be rendered by the service company, a Consultant team[1] was put in charge to take care of correct implementation of the project. For reasons of a comprehensive quality control distinction was made between quality of technical aspects and quality of the service provided as client satisfaction is closely linked to system performance and to the after sales service provided.

In order to ensure the quality of the material installed a qualified testing laboratory has been contracted to test the 3 systems by components and as a whole. Furthermore the Consultant carried out factory visits at the different places of production of the installed components.

After installation the quality of (i) the technical installation and material and (ii) of the after sales service are being controlled. Preliminary acceptance inspections are carried out by the Consultant for a random sample of 10% of systems newly installed. After successful operation time of one year a second visit, the final acceptance inspection, is carried out for another random sample of 10% of systems installed. During the first year of service or even after the final acceptance inspection the consultant carries out a third inspection at the remote homes regarding the quality of the after sales service.

In addition to the quality control on the client's level, the service infrastructure of the service company is regularly controlled in the four provinces.

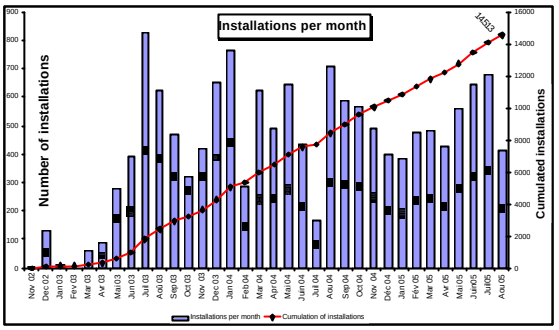

Figure 2 *Installations per month and cumulated installations*

3 RESULTS

3.1 Project implementation and progress

Installation started in larger numbers and took pace in summer 2003. Starter problems as bottlenecks in building up an organizational structure, finding first clients and procedures of payments and contractual issues had to be settled. The installation of 16.000 systems has been finished in early 2006 while the maintenance duration is 10 years for each system.

Figure 2 shows the frequency of installations. Differences are due to varying demand of the users (seasonal income, religious festivals etc.).

3.2 Project experiences

Since beginning of the implementation the building-up of an organizational service structure has been recognized as a general and continuous challenge. It is obvious that grid connection[2] in theses regions would be too expensive for good reasons: large distances, scattered homes and difficult accessibility. The continuous growing and spreading of the clientele (see figure 3) requires a steadily increasing infrastructure and personnel. Up to now 7 regional agencies have been established each of which manages about 10 mobile agencies on souks and weekly markets.

[1] The international consultant team comprises PROJEKT-CONSULT GMBH of Germany as lead consultant, the Swiss ENTEC AG and the Moroccan consultant RESING.

[2] Grid connection cost are about 2,700 € per household in these regions.

Figure 3 *Position of systems installed in the project region*

The clients have first been accumulated around local centers like souks or towns; their spreading started at these nodal points and then progressed to the outside. In the beginning the province Khouribga has experienced the fastest growing clientele, now the neighboring provinces Khénifra and Khémisset have still significant growing rates while in Settat the potential customers never were much interested. Demand for installations is much varying depending on seasonal income, weather conditions, field work and religious festivals. Awareness, information and retold experience are the most stimulating factors. On the other hand reasons for reluctance and retention are the promises of grid extension made by local governments; as a consequence people are still waiting for the grid (and already preparing their in-house installation) and are not interested in SHS.

Major issues experienced during project implementation are the following:

- In the beginning of implementation most of the activities were dedicated to installation and organisational structure, then the activities shifted more to service and maintenance. It turned out that the quality of the after installation service needs to be verified in a regular manner to assure that maintenance is carried out in the scheduled time frame and in a sufficient quality.
- Although payment rates are good in the present project a severe management is needed and close contact to the customers is required. In case of continuous non-payment (3 months) the client is threatened that his system will be dismantled.
- Even though the market value of solar equipment is rather high in Morocco only one case of theft had been observed during the present project lifetime. This might be due to the responsibility and valorisation which binds the customers to their system when they pay an important initial fee.
- A number of technical shortcomings in the installation works had to be solved especially in the beginning as the company had to contract and train a number of technicians. Also the growing personnel needs continuous supervision and coaching While in general, problems with installation have been lowered to an acceptable level, the consultant's acceptance inspections unearthed several deficiencies affecting the overall performance of the systems installed or causing administrative confusion.
- An upcoming challenge of the near future might be the large quantity of batteries to be replaced each in a remote place. The qualification of the personnel of the service company is a permanent challenge. The quality control needed to keep pace with the fast growing personal structure. Subcontractors do not have the same standards and need to be supervised. As the service company has other large projects in Morocco experienced personal is drawn off from this project to build up an organisational structure in other provinces. Installation quality never has to be accepted once it is found to be good but needs to be scrutinised in a regular manner.
- It has turned out during the preparation, implementation and control activities that the communication between the different project partners is a major task for proper project management. ONE as the power utility has a highly decentralized organisational structure on national, regional and local level. One has to imagine that only the signature of a service contract of a client includes numerous steps of actions and different responsibilities. To get other conventions than the already existing in the provinces the service company has to run through a long approval procedure within ONE. To follow the demand of the rural customers numerous installations took place before official approval of ONE; warranty problems may result of this because user contracts are only valid after approval of ONE.

4 CONCLUSIONS

The present FFS scheme adapted to the Moroccan institutional conditions intended to tackle durability of the systems and quality of the related services in the very beginning. After the installation period has been finished the following conclusions can be drawn:

- As the approach elaborated by PROJEKT-CONSULT GmbH jointly with the Moroccan utility ONE has taken into account the special institutional conditions in Morocco and made possible a successful implementation of this wide-scale project by a private service company. The approach turned out to be favorable for long-term O&M and regular and complete fee-collection.
- As a consequence ONE has awarded other concessions in the near past to a number of national and international service companies totalling a number of systems of more than 150,000.

- As a basic measure of quality assurance the technical quality has been strictly defined in the tender and assured by preliminary tests, nevertheless it has to be controlled in a regular manner: not only just after installation but even more important after a certain time of operation (one year or more).
- Even with good equipment the technical performance over the life time relies predominantly on a good service and maintenance on site. It turned out that these services have to be controlled in a regular manner in order to avoid that the remote clientele are not partly neglected. These services include both reachability of the service company and regular presence of technical personal on the sites for routine check, clean up and maintenance.
- The organizational structure of the service company needs to be steadily adapted to the customers' demand i.e. the clientele growing in terms of quantity and dispersion.
- After more than two years clients are generally satisfied with the system and the service after installation. This is underlined by the good payment behavior (about 95% of the monthly fees).

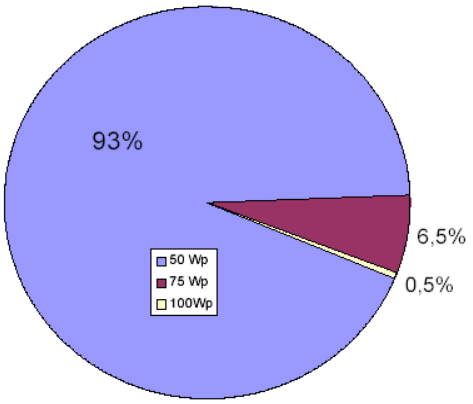

Figure 4 *Distribution of customers' demand of different systems*

- 93% of the clients made their choice for the 50 Wp system (see figure 4) which has for them a good cost performance ratio. They declared to be satisfied with the electricity available; the monthly fee is often equal or below the former expenses for batteries, candles etc.
- Only very few clients (<5%) expressed their wish to purchase a refrigerator; also a large proportion of about one fifth of the clientele can not afford at all. the fees for a large PV system required for such appliances.
- A strict position of the service company is necessary to prevent handicraft tempering and payment delays. Dismantling and contract cancellation are negligible up to now.
- Involvement of ONE is high so that the service company needs to go through several internal procedures to obtain new conventions or to claim payments.
- Return of capital investment (ROCE) only can be expected by the service company on a long-term basis. The first 3 years the ROCE will even be negative due to the cost-intensive start-up phase and the up-front expenses. After installation the ROCE is supposed to increase remarkably in the first years before constantly slowing down due to material renewal and maintenance work.
- The success of a concession is very much depending on the estimation of the number of potential clients which has been done before.
- As a general conclusion rural electrification in the project regions is considered particularly beneficial as a number of micro enterprises ("maisons de l'énergie") has been created and thus employment in the rural regions themselves. The socio-economic impact is considered by ONE as restraining from rural exodus. In addition traditional energy sources (candles, oil and gas lamps, batteries etc.) have been substituted to a certain extent and the rate of children going to school rose remarkably.