MOROCCO, SOLAR POWER

Case Study (solar power)

Project Summary:

Since the early 1990s, the Moroccan government has sought to provide electricity to all of its citizens. The national grid is centralized, which makes it difficult and expensive to connect rural households to the system. This circumstance has led the government of Morocco to pursue alternative methods of electrical service delivery, particularly for rural areas. This case study will describe Morocco’s use of a public-private partnership to achieve its rural electrification objectives.

Morocco’s Office National de l’Electricité (ONE) is the state-run operator in Morocco’s electricity supply sector and the government entity that oversees the rural electrification project. In June 2002, ONE entered into a public-private partnership with a private company to electrify rural households by using solar energy to produce electricity. The technology selected presents various social, economic and environmental benefits while encouraging the rural population to remain on their land, rather than move to the small towns or large cities that are connected to the grid.

The private operator is responsible for the installation and maintenance of solar equipment as well as the collection of users’ fees in twenty-four of Morocco’s 62 prefectures and provinces. However, the solar customers actually become clients of the ONE once they sign the utility contract.

In order to ensure the viability and sustainability of the project, the government and the operator agreed to a fee-for-service business model. The customers pay an initial connection fee and a monthly service fee determined by the type of service that they receive. ONE provides an equipment subsidy that enables the partnership to offer electrical service at affordable rates, by offsetting the high installation and maintenance costs associated with solar home systems. Due to this subsidy, the partnership is able to offer rural customers comparable rates to what Moroccan households that are connected to the grid pay for service.

Customers are able to pay their bills at local offices of the private operator or to its representatives who attend the weekly markets in the provinces. While rural households have
other alternatives for electrification, the private operator’s accessibility to the rural population and dedication to customer support have helped to increase the number of solar clientele in Morocco.

**Project Objectives:**

Based on the 2004 census, the population of Morocco is 29.7 million, of whom 45 percent live in rural areas. In 2004, 16.4 percent of the rural inhabitants were living on less than $2 per day, and many of these rural residents lacked access to modern services that can be found in the urban areas. In part this is because the Moroccan power system is centralized to support the needs of urban centers and industrial sites. While the government recognizes that access to reliable energy can enhance both human and economic development, incorporating rural households into the grid is too costly a venture. Demand is unevenly distributed throughout the country and the distance between homes and from homes to the grid makes it difficult to incorporate them into the centralized system.

Using solar power to provide rural homes with electricity is a more viable option for Moroccans. The primary objective of the solar project is to provide photovoltaic kits to over 58,000 households in rural Morocco to enable them to meet their basic energy needs. In turn, rural electrification will provide local development benefits in terms of health, education, economic development and also reduce macroeconomic strains on the economy through processes such as rural-urban migration. Additionally, the project is expected to create jobs in sales, installation and after-sales services in the rural areas where employment is scarce.

**Project Description:**

1. **Partners**

The private operator is a Renewable Energy Service Company (RESCO) comprised of a French oil company, a French electricity company and one of their joint subsidiaries which provides design, production, installation and operation of photovoltaic solar power systems. The private operator, selected through a competitive tendering process, is in charge of implementing the solar program, managing the technical and financial aspects of the program, performing maintenance on the installed systems, replacing equipment and collecting users’ fees in twenty-four Moroccan provinces.
The Office National de l’Electricité manages the overall coherency of the rural electrification project. Prior to implementation, the ONE defined the specifications of the project and selected the solar systems’ operator. Currently, the ONE ensures that the solar power operator maintains its commitments to the project and measures the satisfaction of the operator’s customers. The agency also provides subsidy funding, which enables the operator to provide the service at a rate that is more affordable for rural Moroccan residents. The subsidy is made possible through grants and loans from bilateral aid agencies. It is through this mixture of the free market and government and foreign intervention that Morocco is hoping to bridge the energy gap with the wealthier countries of the North.

2. Implementation Environment - Legislative and Administrative

In 1995, the Rural Electrification Pilot Program (PPER) was launched in Morocco under a Franco-Moroccan memorandum of understanding and a four-party agreement made by the Moroccan General Directorate of Local Communities (DGCL), the Moroccan Energy Ministry, the French Ministry of Foreign Affairs (MAE) and the French Agency for the Environment and Energy Management (ADEME). This program led to the installation of 2,000 photovoltaic systems, funded in part by the users, as well as several group systems such as small hydraulic or diesel power plants linked to micro-networks. Utility companies were also set up in the villages to maintain and oversee the facilities. Customers of these micro-network systems were guaranteed electrical service in return for their payments.

Significant lessons were learned from the PPER program. It demonstrated that rural customers could become accustomed to making payments with the help of an appropriate organizational structure, and that solar power was an appropriate means of rural electrification in Morocco. The key issue raised by PPER concerned the long-term maintenance of the facilities, but by the end of 1995 the Moroccan government overwhelmingly supported moving from pilot programs to larger-scale operations satisfying a real market need.

In 1996, the ONE launched a program known as the Global Rural Electrification Program (PERG) to supply electricity throughout the country by 2007. With the village connection rate at only eighteen percent in 1995, the program’s goal entailed providing energy to approximately twelve million people, representing 80 percent of the rural population, by 2007. In cooperation with local authorities, the ONE studied various electrification configurations in an effort to minimize the capital costs for customers. The ONE decided to provide electricity to ninety-one percent of the villages by connecting them to the national power system, and to the other nine
percent by means of a decentralized system of electrification based on mini-networks driven by wind and hydroelectric power or individual photovoltaic systems.

The large scale solar project required investments beyond the capabilities of the ONE. The ONE decided to form public-private partnerships with private operators who would contribute to the operating costs, manage electricity services (supply, installation and maintenance of the photovoltaic kits) and be in charge of fee recovery. Given the limited resources of the population involved, the Moroccan government supplied financial support to make the program viable for the operators and affordable for consumers. The government also established a legal framework to define the local operator’s mission: whenever it costs more than 27,000 Dirhams ($3,250 USD) to connect a household up to a grid, the house would be electrified using a photovoltaic kit.

3. Financial Agreement

The total investment budget of this solar electrification project is $35.5 million. An equipment grant from ONE covers sixty-six percent of the costs. The equipment grant was largely financed through a $6.5 million grant from the German Bank KfW, a $6.5 million soft loan from the French Development Agency (AFD) and a $1.5 million grant from the French Fund for the World Environment (FFEM) which was used in the start-up phase to provide technical assistance for the project.

The private operator contributes twenty-four percent of the project’s cost. $1.5 million came from self-financing, while $2.5 million was borrowed in the form of loans. The company’s shareholders provided $4.5 million in additional financing. Monthly fees collected by the private company enable it to cover the amortization of its initial investment, replace equipment and cover running costs.

Customers provide ten percent of the initial financing through connection fees. However, this cost to consumers is drastically reduced because of the government grant. Rural solar customers receive a forty percent subsidy which makes the cost close to what city dwellers pay for the electricity they receive from the grid. These fees are affordable for a rural household that normally spends fifteen to twenty percent of its income on energy.

Following a call for tenders in 2002, a private company was selected to install 16,000 solar home systems in Moroccan households. In early 2004, the ONE issued another international tender for rural solar electrification and the same company’s bid won the new contract to electrify 37,000 more households. Under terms of the contract, the company agreed to install all of the photovoltaic systems by the end of 2007.

Morocco’s decentralized rural electrification program is based on a sale of service model to ensure the long-term success of the photovoltaic systems. When a rural household decides to install a solar home system, they sign a contract with the ONE and the private operator. This private company buys and installs the equipment within fifteen days of the signing of the contract. Installation is performed by trained, local technicians.

Once it is installed and working, the solar equipment’s ownership transfers to the ONE. The consumer is considered to be a customer of the ONE, even though the operator is responsible for managing the technical and financial aspects of the program. The operator is compensated for these services through the monthly fee that it collects from the consumers. The monthly fee provides users with annual routine system maintenance and breakdown service within forty-eight hour after a maintenance call is placed. The equipment is dismantled if the customer fails to pay the monthly fee for three consecutive months. The operator also guarantees the solar equipment for ten years after purchase, so the company is also responsible for equipment replacement (including light bulbs). Replacement costs are built into the initial connection fees. The state is able to collect revenue from the project through taxes. A twenty percent value added tax (VAT) is placed on service charges, income taxes are collected on salaries and benefit taxes are collected from private companies.
5. Implementation Metrics

For the first phase of the project, 16,000 customers in four provinces had a choice between three types of service. Each client received a solar panel, one battery of 150 amp-hours, one PWM regulator and one 12 volt outlet with two sockets, but those who were willing/able to pay for higher capacity systems were able to install more lamps (overhead lights). The battery can store enough power to last up to five days, allowing the equipment to run year round, even when the weather was not favorable.

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<thead>
<tr>
<th>Capacity</th>
<th>Lamps</th>
<th>Connection Fee</th>
<th>Monthly Service Fee</th>
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<tbody>
<tr>
<td>50 Wp (Watt peak)</td>
<td>4</td>
<td>$80</td>
<td>$7.50</td>
</tr>
<tr>
<td>75 Wp</td>
<td>6</td>
<td>$200</td>
<td>$10.00</td>
</tr>
<tr>
<td>100 Wp</td>
<td>8</td>
<td>$350</td>
<td>$15.00</td>
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During the second phase of the project, 37,000 customers throughout twenty provinces chose between two types of service. Once again the solar panel, battery, regulator and 12 volt outlet were standard equipment, but the higher capacity system could now handle the voltage demands of a refrigerator.

<table>
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<th>Monthly Service Fee</th>
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</thead>
<tbody>
<tr>
<td>75 Wp</td>
<td>4</td>
<td>$100</td>
<td>$7.50</td>
</tr>
<tr>
<td>200 Wp</td>
<td>4</td>
<td>$450</td>
<td>$18.00</td>
</tr>
</tbody>
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The fees are adapted to the budgets of the local households: approximately the same amount was being paid for candles, gas, batteries or battery recharging. However, families are less inclined to overly restrict their use of energy while using solar because the monthly fee is fixed, regardless of the amount used in 2005, the payment rate exceeded ninety-eight percent.

By July of 2005, more than 14,000 households in 400 villages had received solar home systems with an installation rate of 500-700 homes per month. The 16,000 customers of the first phase were connected before the end of 2005, one year in advance of the contract schedule. The second phase started in the second quarter of 2005. The installation of equipment for the remaining 37,000 customers is scheduled to take two years.
When the project started in 2002, the private operator’s first actions were to promote the new energy service, and to find and train local personnel. The business created jobs in rural areas where unemployment is high. As of 2005, the operator had eighty-three direct employees working in seven local agencies and one main office while also employing thirty-one subcontractors. The company invests heavily in staff development – all workers receive high-level in-house training in technical skills (equipment, installation, maintenance and management), quality control and customer relations.

At the company’s head office in Rabat, employees are recruited and trained, equipment supplies are received, logistical preparation is carried out and the operation and coordination of the local branches is centrally managed. The local branches are responsible for sales, installation, repair or maintenance and collecting monthly fees. Each local agency manages between 500 and 3,000 customers. The customers can contact the operator through telephone or by stopping at the local agency, but most company/customer interaction occurs at the weekly markets. To help access customers, each local branch has from one to three cars and one motorcycle at its disposal.

Commentary:

1. Methods for Overcoming Impediments

One of the main barriers to large-scale solar adoption in the rural areas was the economic factor. The average cost (including equipment, installment and maintenance) of a photovoltaic kit is twice the cost of connecting a household to a mini-grid supplied by a diesel generator system. Without the subsidy from the ONE, the solar project would not have been implemented at the scale desired by the Moroccan government. The subsidy also provided an incentive to households who were unsure about the performance quality of the solar home system. To help sustain the subsidy, Moroccan consumers already connected to the grid pay a tax of two percent of their monthly bill to help promote rural regions’ access to solar power.

The fact that solar powered households would be customers of the ONE and not the private operator created a challenge. This is because the private company bears the responsibility of recruiting clientele and providing customer service. A sub concession was developed to address the issue. In order to be as close as possible to its customers, the private company’s teams are present in each weekly souk (market) as the inhabitants of these regions regularly frequent them. This presence enables sales information to be given, contracts to be signed with new customers, monthly fees to be collected and any repair requests to be logged. By maintaining an
informative marketing and sales presence at souks, the operator has strengthened its contacts with existing and potential customers.

2. Key Points for Success or Failure

The various studies and pilot programs operated by ONE prior to implementation of the large-scale solar electrification project provided technical, social and economic data validation on concerns such as climatic conditions, needs of the rural population, purchasing power, and geographical distribution. This information assisted the Moroccan government in opting for the fee-for-service model, instead of the sale of equipment model that has been adopted in other countries implementing rural solar electrification projects. The fee-for-service business model helped to make the project viable and sustainable. The private company also used the previously-gathered information to develop its marketing campaigns. Knowing that a large part of the target market for solar energy is illiterate, they produced a promotional cassette that inserted publicity material between songs on local radio broadcasts.

Installation and maintenance of the solar equipment could have been a costly venture for the private partner its decision to train and hire local technicians helps enable the company to provide prompt and reliable services to its customers, at affordable rates. Additionally, having local offices and local representation at the weekly souks has helped the company develop a reputation for accessibility and trustworthiness throughout the communities. This attention to customer support has resulted in the low payment default rate.

Finally, cash flow is critical to the smooth running of the private partner’s operations; as a medium-sized enterprise, it does not have access to unlimited resources. In the electrification scheme in Morocco, the RESCO is obliged to advance the money for the equipment before being reimbursed through the subsidy from the ONE. Notable delays in payment for the installation of the equipment have led to major cash-flow problems. Fortunately, the project has the backing of the French oil and French electricity companies, which allowed the operator to survive the short-term cash-flow crisis. However, ensuring regular, timely payments of external subsidies by funding partners remains a challenge.