Millennium Villages

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

Rural Energy Systems Update Summary

(Potou Cluster, Senegal)

Report: Jose Barnuevo | Summary: Rahul Kitchlu

July 2009

Table of Contents

Table of Contents ii

Executive Summary 3

1. Schools 3
   1.1. Current Situation 3
   1.2. Future Growth and Challenges 4

2. Health Care Centres 4
   2.1. Current Situation 4
   2.2. Future Growth and Challenges 5

3. Public Buildings 5
   3.1. Current Situation 6
   3.2 Future Growth and Challenges 6

4. Agriculture 6
   4.1 Current Situation 7
   4.2 Future Growth and Challenges 7

5. Fisheries 7
   5.1 Current Situation 8
   5.2 Future Growth and Challenges 8

6 Mills 9
   6.1 Current Situation 9

7 Shops and Households 9
   7.1 Current Situation 10
   7.2 Future Growth and Challenges 10

8 Conclusion and Recommendations 10

Executive Summary

This report summarizes the findings of a survey conducted on the use of energy in different sector in the Millennium Villages Project (MVP) cluster of Potou (Senegal). The survey included energy use in schools, health care centers, public buildings, agriculture, fisheries as well as shops and businesses.

The surveys aimed at identifying the different energy systems employed in business establishments, public institutions, as well as other activities like agriculture and fishing. Once those systems were identified, the surveys were also designed to learn about the maintenance service, the energy costs, and the plans related to energy use projected by the owners.

The purpose of conducting those surveys was to establish what was in place before the MVP project begun (in 2006), what plans were made and which of those plans have been achieved (by 2009), paying attention to the maintenance and conservancy of these systems.

The survey concluded that there has been a noticeable progress made in the delivery of energy needs of important structures in the Potou cluster since the MVP project began, for example **6** schools, **12** heath care centers and **4** public have been electrified. Also **35** farms were using new energy sources, **10** isothermal boxes for preserving fish and **3** new mills have been installed.

The grid connections exist and are expanding in Leona and Potou since 2007 and have seen **343** household connections since then. The grid has arrived in Thiowor as of January 2009 and as of today **98** household connections have been made out of **197** requests. Almost **95%** of the shops in the semi-urban areas have been grid electrified.

Moreover, other non electric energy solutions were also in place as part of the MVP program, for example ten isothermal boxes for preserving fisheries.

Despite the progress, many challenges remain related to acquisition and maintenance costs. To be truly effective this program must scale in the depth and breadth of its reach in the Potou cluster.

1. Schools

In 2006, at the beginning of the Project, there were 42 schools in the cluster, and none of them was electrified. The main reason is the long distance between these buildings and the existent Grid, which makes the costs unaffordable for the community. In 2007, the MVP plans were to electrify 4 schools with a non-conventional and renewable energy source. Two options were considered: PV solar systems and generators. The objective was to provide energy to at least two classes. The energy system chosen was the PV solar system (figure 2). Lighting can be provided by efficient bulbs that don't consume too much energy.

1.1. Current Situation

Today, 6 schools in the area have electricity (figure 1). Of which, 4 schools are solar powered (using MVP installed systems) and the other 2 schools are grid powered (SENELEC) in Leona and Potou.

Location	Energy system	Electrified Classes/Total classes	Maximum Power subscribed (kW)
Leona	Grid	1/8	0.957
Potou	Grid	1/7	Unknown
Batlamine	PV solar system	3/3	75 Wc
Gabar	PV solar system	2/6	75 Wc
Thiowor	PV solar system	2/6	75 Wc
Sague Sathiel	PV solar system	2/4	75 Wc

Figure 1: List of electrified schools in Potou cluster

The power is being used for lighting mostly and has certainly improved teaching standards. So far, these solutions have had a low maintenance costs and the users are generally very satisfied. Usage of alternates such as, LPG canisters, flashlight batteries and candles has dropped significantly.

1.2. Future Growth and Challenges

A big challenge today is the electrification of remaining 30+ schools in the cluster. Also, electrification of the remaining rooms in the school that have been electrified (toilets, classrooms, lodgings) could be undertaken. There are open questions regarding usage of existing solar power systems once the grid hook-up happens. One option is to move the systems to other schools. Finally, maintenance of solar systems, training of locals to maintain systems and the cost associated with this are a big challenge for the future success of the project.

Figure 2: Pictures of electrified schools

2. Health Care Centres

In 2006, at the beginning of the Project, there were 19 health centers (1 Post and 18 Cases) in the cluster, and only five of them were electrified with a PV solar system (figure 4). All but Leona had a PV solar system installed by Agence Française de Développement du Sénégal (AFDS).

2.1. Current Situation

Today, 12 health care centers have electricity (figure 3). Of which, 6 centers are solar powered (using new MVP installed systems) and 4 centers are using AFDS systems that are outdated and malfunctioning in many cases. Also, 2 centers are grid powered (SENELEC) in Leona and Potou. The power is used for lighting for treatment during night and operating other medical equipment. So far, the system has seen very low

maintenance costs and the users generally very satisfied. Also, the usage of alternates such as, LPG canisters, flashlight batteries and candles has dropped.

Location	Energy system	Type	Maximum Power subscribed
Leona	Grid	Post	5.742kW
Potou	Grid	Post	5.742kW + 0.957kW
Sague Sathiel	MVP solar system	Post	225Wc + 300Wc + 300Wc
Syer Peulh	MVP solar system	Post	225Wc + 300Wc + 300Wc
Ndialakhar Samb	MVP solar system	Post	225Wc + 300Wc + 300Wc
Batlamine	MVP solar system	Case	225Wc
Ndemba	MVP solar system	Case	225Wc
Ouassam Assal	MVP solar system	Case	225Wc
Gabar	AFDS solar system	Case	300Wc
Keur Koura Dieri	AFDS solar system	Case	300Wc
Maka Tare	AFDS solar system	Case	300Wc
Santhiou Diatji	AFDS solar system	Case	300Wc

Figure 3: List of electrified heath centers in Potou cluster

2.2. Future Growth and Challenges

A big challenge today is the electrification of remaining 7+ health centers in the cluster. Also, electrification of more medical equipment such as refrigerators, as well as emergency backup generators should be undertaken. There are open questions regarding usage of existing solar power systems once the grid hook-up happens. One option is to move the systems to other centers. Finally, maintenance of solar systems, training of locals to maintain systems and the cost associated with this are a big challenge for the future success of the project.

Figure 4: Pictures of electrified health centers

3. Public Buildings

There are many public buildings in the Cluster. A few of them are electrified but most of them are not. A major reason to electrify these buildings in villages is their importance as Community Centers. The MVP plans in 2007 related to public buildings (besides schools and clinics) were to provide a PV solar system (figure 6) and a generator to the Fishing Post in Niayam for the use of microcomputers, light points and fans and to build two Multimedia Centers (CMC).

3.1. Current Situation

The Fishing Post has been connected to solar power (using new MVP installed systems) taking the total number of public buildings electrified to 4 (figure 5). The power is so far being used for lighting and other equipment such as computers will be based on generators (not yet installed). So far, the systems have seen low maintenance costs and the users generally very satisfied. Also, the usage of alternates such as LPG canisters, flashlight batteries and candles has dropped.

Building	Location	Energy system	Maximum Power subscribed
Rural Council	Leona	Grid	0.957kW
Stock-farmers house	Leona	-	-
Familial house	Potou	Grid	0.957kW
Fishing Post	Niayam	MVP solar system	150Wc
CMC	Leona	Will be grid	-
CMC	Potou	Not built yet	-

Figure 5: List of electrified public buildings in Potou cluster

3.2 Future Growth and Challenges

The electrification of remaining two community centers remains a priority. Also, electrification of other equipment such as computers, printers, UHF radios, and warning lights should be undertaken. There are open questions regarding usage of existing solar power systems once the grid hook-up happens. One option is to move the systems to other centers or schools. Finally, maintenance of solar systems, training of locals to maintain systems and the cost associated with this are a challenge for the future success of the project.

Figure 6: Pictures of electrified community centers

4. Agriculture

Agriculture is the most important economic sector in the cluster, even though in the last years, the rainfall has decreased, and the salinity of the soils have grown, which means that the soils have lost fertility. In 2007, the MVP plans were to provide 35 surface motor pumps (figure 7) to the farmers in the area of Niayes. The motor pumps would be given to the farmers association in Potou, and then they would distribute them to the farmers with financial means.

4.1 Current Situation

Thus far, 35 Motor Pumps for irrigation have been distributed of which 8 are already being used. The pumps selected were 2kW YAMAHA YP20G motors that can work on the water level in the area (4-10 meters). Pumps are being used to elevate water and distribute it using drip irrigation method however; the delivery of some of the drip irrigation kits is still pending.

The pumps have had an immediate impact on the agricultural practices. For instance, pumps can irrigate an average rate of 0.22 ha/hr while consuming 11.47 mm/day of water. The Average fuel consumption is 1.69 l/h. Compared to manual labor where the average rate of irrigation is 0.011 ha/hr while consuming 11.72 mm/day of water. The manual labor has no fuel costs but is in fact riskier and in many cases costlier than using the pumps. The overall agriculture practice has improved through faster, cheaper and less risky irrigation for the farmers compared to manual labor. Also, so far, the systems have low maintenance costs and the users generally very satisfied.

4.2 Future Growth and Challenges

This project needs to be scaled out to be successful - there are many farmers who do not have pumps. Also, there needs to be a study conducted of the difference in crop production between farms that use a motor pump to those that do not. Other ways of improving irrigation related energy needs could be joining multiple fields to use a bigger irrigation motor and perhaps building better access to fuel in the local area.

Figure 7: Pictures of motorized drip irrigation

5. Fisheries

The fishing catch must be conserved till it is sold and any degradation in the quality of the fish reduces the price the fishermen will receive for it. Most of the local catch is sold to urban markets in Dakar, Louga, etc., a big reason why an energy source is necessary to conserve the fresh fish. In 2007, the solutions provided by the MVP staff included immediate installation of two PV solar systems that enable a small scale ice production. In the medium-term, it was suggested that an ice fabric be installed which can be used for preserving fish.

5.1 Current Situation

As of today, no PV systems or ice fabrics have been installed. Nevertheless, the MVP has provided the fish-mongers with ten isothermal cases (figure 8) that can be filled with ice to keep the captures fresh for at least 4-5 days. The isothermal boxes are intermediate, non energy solution. Ice is a critical factor for these boxes which is bought through delivery trucks. Capacity of each box is 600l. So far, the solution has yielded a low maintenance costs (cleaning only) and the users generally satisfied but seek a more reliable solution. Also, the boxes are getting old and the price of Ice varies from season to season. It can range from 1000-2000 CFA / bag of 25 kg Ice.

Figure 8: Pictures of fishermen and the isothermal boxes

5.2 Future Growth and Challenges

The Isothermal boxes could be replaced in the near term with newer boxes. However, an ideal solution would be to install two PV solar systems that enable a small scale local ice production (figure 9). In the mid-term, installation of an ice fabric is needed. Once this fabric is put in place, the PV solar systems could be used to provide energy to other buildings, like clinics or schools.

Figure 9: Picture of a solar powered refrigerated box that can be used for fish preservation

6 Mills

6.1 Current Situation

Also, so far, there have been 3 new grinding mills and 2 multipurpose platforms installed (figure 10). These mills are managed by women's councils and are used only a couple hours a day for grain milling. Energy source is a diesel based generator. These mills free up time for local women and generate additional income for them. The cost of fuel however, is a concern, as are the very high maintenance costs of these machines.

Figure 10: Picture of local businesses and the new grid connections

7 Shops and Households

Société Nationale d'Electricité du Sénégal (SENELEC) has been working hard to provide grid based delivery systems to rural areas. The grid exists in Leona and Potou since 2007 and has just arrived in Thiowor in 2009. SENELEC's priority is to connect every household following which it will start to connect the shops, the school and the mosques.

Figure 10: Picture of local businesses and the new grid connections

7.1 Current Situation

Most semi-urban shops and businesses in Leona and Potou have grid power or other power sources such as flashlights, LPG, PV solar systems, etc. Energy is used for lighting, refrigerators, audiovisuals, fans and work equipment. It creates better employment opportunities for the locals but has high operating cost with associated with it. Grid power is preferred but is expensive at 20,000 CFA per connection thus making acquisition costs prohibitive.

7.2 Future Growth and Challenges

Grid access seems to a priority for the local government and thus far over 343 households have been connected to the grid in Leona and Potou. Thiowor area has seen 198 requests for hook-up and of which 97 have already been made. This will be followed by the schools, hospitals, and local businesses; however, the progress is slow. In the short term, energy efficient off-grid solutions should be identified. However, acquisition costs and maintenance costs remain an issue. Solution should not only be affordable initially, but should be able to generate income to offset some of the operating costs.

Figure 10: Picture of local businesses and the new grid connections

8 Conclusion and Recommendations

The importance of energy supply and energy access to achieve the objectives of the Millennium Development Goals (MDG) led the Millennium Villages Project (MVP) to include an “energy component” in every project launched. The survey conducted of the Potou Cluster in Senegal proves that the efforts to meet the energy needs of the rural community have been generally successful.

The project has thus far installed energy supplies to 6 out of the 42 schools in the area, to 12 of the 19 health care centers, 4 out of the 5 community centers and has provided 35 different farmers with motors to draw water for irrigation. The grid has been in existence in Leona and Potou since 2007 and has seen 343 household connections. In Thiowor, 198 households have requested connection to the grid and of now 97 connections have already been made taking the total number of households connected to 440.

The MVP project has also provided 10 isothermal boxes for the fishermen to preserve their catch and has provided 3 news grain mills that are being used by women’s councils for additional income.