

Quarterly Report (Q2 2014)

The Earth Institute at Columbia University

**Micro-Solar Utilities for Small-Scale Irrigation in Senegal
(Cooperative Agreement No. AID-OAA-A-13-00063)**

April 30, 2014



Main Activities and Accomplishments:

This quarter was dominated by the finalization of the site selection, introduction of the project into the beneficiary community, pump testing of existing gasoline-powered pumps, and the procurement of the AC pump controller and PV panels. The following is a list of the most important activities from Q2 2014:

- **Site visit to Potou, Senegal (February 2014):** Brett Gleitsmann spent 10 days in Senegal, both in Dakar and at the project site in Potou, Senegal. The following was accomplished:
 - Met with the community leaders and representatives of the beneficiary community to formally introduce the project and to outline the conditions of the partnership (see below, *Community Meeting*);
 - Obtained community approval for the location of the PV array ([google map link](#));
 - Finalized design parameters for PV array (8kW) and AC pumps (750W);
 - Attended DC solar pump training course by Lorentz (German DC solar pump manufacturer) and facilitated by Soleil-Eau-Vie and attended by solar technicians and suppliers from across Senegal;
 - Visited pump and PV panel suppliers in Dakar to get quotes, determine what is locally available and begin procurement process;
- **Community Meeting (February 2014):** The field technician, Mahécor Diouf, and Brett Gleitsmann met with the village chief to formally introduce the project into the community and to outline the scope of the project and expectations on behalf of all parties. The main points of discussion were:
 - **Project scope:** this installation in Gabar is one of three pilots in the MV project zone that will take place in 2014/2015. We chose Gabar due to its groundwater accessibility and high population density. Should the project be successful it will expand to reach other neighboring communities. The PV array of 8kW will be installed in a central location to provide power for pumping to a maximum of 10-12 producers. Power will only be available when the sun is shining as the systems will not have batteries. And so beneficiaries are encouraged to keep their existing gasoline pumps and to use them as a backup power source. All electricity will be sold on a pre-paid basis at a fixed tariff that will be transparent to all.
 - **Site for PV array:** a technically-sound, centrally-located site for the 8kW solar array was chosen in collaboration with the community.
 - **Ownership:** a contract will be put in place with input and signatories from the community, the project and the local government, to ensure that the infrastructure (PV panels, wiring, etc.) will belong to the local government (CR Léona). This will help to ensure equitable use of the infrastructure after the project involvement disappears in 2015.
 - **Eligibility:** initially, only producers who have gasoline pumps and who are located within 300 meters of the PV array will be eligible to participate (see farms highlighted in orange in the map below). If the number of potential beneficiaries exceeds 10 then we will prioritize those who have drip systems and then we will prioritize those that are closest to the PV array.



- **Cost sharing:** the community is ready to provide the labor for digging trenches for wiring and for installing the solar array. It was also agreed that the beneficiary farmers would be required to pay a small fee to participate. The amount of the fee will be finalized once the infrastructure is in place but an amount of 10,000 CFA (20 USD) was discussed.
 - **Security:** this is recognized as an important issue and the community will be responsible for protecting the infrastructure.
 - **Revenue:** revenue from electricity sales will enter a jointly held bank account with multiple signatories and funds can be used to pay for maintenance, security and other approved activities. Details will be ironed out in the coming months.
- **Pump Tests**

Our field technician, Mahécor Diouf, conducted a series of pump tests on four existing gasoline-powered pumps in the project zone (see results below). Testing was done primarily to establish a baseline level of fuel consumption for the existing systems. The pumps were tested for one-hour intervals to determine consumption rates and efficiency. We found that the pumps are producing roughly 13m³ of irrigation water per liter of gasoline at a total dynamic head of approximately 6 meters.



Pump	Gasoline Consumption (L/hr)	Flow Rate (m ³ /hr)	Flow per Liter of Gasoline (m ³ /L)	Total Dynamic Head (m)
Yamaha YP20	0.9	10.8	12.3	6
Yamaha YP30G	0.8	11.1	13.8	6
ASIA DP80	0.9	10.5	12.3	6
ASIA HT175	0.8	10.6	12.8	6

- **Procurement (January-March 2014):**
 - **AC pump controller:** We continued to work with Sakthi Electrical Controls on the AC pump controller. The Indian-based company is still making technical modifications to their existing controllers to enable it to operate with multiple pumps. Their original controllers were designed to operate with only one pump and this added capability has proven more challenging than they anticipated. The final production unit is expected by the end of April 2014. Once the unit is fully tested by the manufacturer, it will be sent to Columbia University for further testing with the rest of our smart-meter and payment system components before being sent to the field for the pilot.

- **Solar PV panels:** We continued to work with Soleil-Eau-Vie SARL and the Columbia University procurement team to finalize the procurement and installation of 8kW of PV solar panels. Installation is expected to happen in mid-May.
- **Sub-award with Millennium Promise:** A budget modification to include an \$81,766 sub-award to Millennium Promise was approved by USAID. The sub-award will allow us to pay local MVP field staff and hire local consultants which have been challenges to us since project inception. The legal teams for The Earth Institute and Millennium Promise continue to discuss the payment terms but a finalized sub-award is expected by late April 2014.
- **Smart-meter software testing (March 2014):** The senior programmer, Denis Papathanasiou, began working with existing Trinity smart-meters to make sure that they will be compatible with the AC pump controller and the Android-based payment system.

Challenges:

We are about 2.5 months behind schedule in developing the solar AC pump controller. The cause of the delay is that the controller manufacturer continues to struggle to get the controller to work with multiple pumps, and many of the other activities are dependent on having the controller in the lab for testing, programming, etc. We had expected to receive a functional controller in New York by January 2014 so that we could have it tested and integrated with our Android-based payment system here in our lab before installing the first unit in the field by April. The manufacturer continues to make changes to the production unit to enable it to work with multiple pumps but we expect it to be completed and sent to New York by mid-May. Once it arrives in our lab, we will need 2-4 weeks (depending on how well it functions) to integrate it with the rest of the pumping system. And so we expect to be ready to send the entire unit to Senegal for installation of the pilot by mid- to late-June. The PV panels have also taken longer than planned to procure, but due to the delays with the controller, we anticipate that the panels will be installed well before the controller is ready for field installation.

