

SOLAR ENERGY SYSTEM FOR REFRIGERATION AND WATER DISTILLATION AT KAMUSUCHIWO, HIGH GUAJIRA, COLOMBIA

PROJECT'S AIM: TO SUPPORT THE IMPLEMENTATION OF A PHOTOVOLTAIC ELECTRICITY GENERATION SYSTEM TO POWER A REFRIGERATION AND SOLAR WATER TREATMENT PLANT

Location:

Department of High Guajira,
Colombia

Technology:

Solar photovoltaic
Solar refrigeration

Costs:

Total: € 82,000
WISIONS financial support: € 50,000

Partners Involved:

Solaris Energía Alternativa S.A.S
www.solarisea.net

Duration:

02/2013 – 09/2014



Picture: Solaris

Fishing is one of the main economic activities of the Wayuu communities living on the shores of the Caribbean in northern Colombia. Refrigeration of the fish they consume and sell is a key energy need for these communities. A second energy-related need concerns access to drinking water. As part of this project, a solar PV-powered water distillation and refrigeration plant was built in the Kamusuchiwo community in the Department of Guajira. A user-friendly management and accounting system ensures the sustainable use of the plant by the community.

TECHNOLOGY, OPERATIONS & MAINTENANCE

A well, situated approximately 10 metres from the sea, pumps seawater to an elevated tank inside the solar plant. The tank is located further inland, beside 12 mechanical distillers, which perform the evaporation and condensation processes, and a storage tank for clean water. The plant's roof houses six photovoltaic panels,

which power the hydraulic system and the automation of the plant. The panels also power two 160-litre freezers that provide ice for the refrigeration of fish and for cooling drinking water.

The effective distillation surface area is 24m² and the system currently produces 20 to 30 litres of water per day. Laboratory tests have confirmed that the water meets drinking water standards. Most of the water produced is sold as ice at the cost of \$200 Colombian pesos per litre, which is an affordable price in the context of the poverty and unemployment that characterises the Kamusuchiwo community.

The performance of the plant continues to be optimised and, although adding more distillers is not affordable for the community at the moment, there are plans to upgrade the system in the future.

DELIVERY MODEL & FINANCIAL MANAGEMENT

The idea for the project originated from the leaders of the community and the project itself was based on a thorough baseline study, which included interviews, polls and meetings with the Kamusuchiwo community. This allowed for the identification of the social players who needed to be involved to ensure long-term impact.

The maintenance of the system (replacement of parts and repairs) is supported by funds from selling ice to members of the community. The responsibility for the management and accounting of the system was initially assigned to a group of seven community members. This group was trained in the daily collection of water from the system and the sale of ice, as well as in the maintenance and cleaning of the various parts (defrosting of freezers and cleaning of PV panels) and the monitoring of the plant, using maintenance check-lists and

manuals that were developed as part of the project.

Over the course of the project, one out of the group of seven trainees emerged as the member with the strongest commitment. Therefore, the community assigned the full responsibility for administering the plant to this individual. His salary is funded from the revenue from the sale of ice and he coordinates a rota of community members who help with the cleaning and maintenance. Maintenance costs are currently met from the ice revenue and plans are in place to use the remaining revenue to upgrade the plant, adding lights, batteries and other components to the system.

ENVIRONMENTAL ISSUES

While the initial aim of the project was to provide both drinking water and ice for cooling, over the course of the project the community expressed a preference for ice. The drinking water needs of the community continue to be fulfilled with deliveries via tanker trucks from a nearby industrial port. However, the use of fuel for the transport of ice has been supplanted as ice can now be produced locally. The community was consulted regarding an expansion of the plant to provide more drinking water via a micro-credit system, but that option has not, for the time being, been adopted.

SOCIAL ISSUES

One major achievement of this project is the strong level of trust and communication achieved by the coordinating partner with the community members. Organisations working with the indigenous Wayuu communities are used to encountering a sense of disenfranchisement and distrust of outsiders. The strong communication (using translators), frequent community consultations, workshops and follow-up visits succeeded in creating a sense of ownership and responsibility amongst the community. The community perceives the benefits that the plant brings and stresses to its leaders that it should be kept in working order.

RESULTS & IMPACT

The main impact of the project is the reduction in the cost of ice. Prior to the installation of the solar plant, fishermen and women bought ice in Uribia at the cost of \$500 Colombian pesos. They now pay \$300 pesos less and save time and travel costs. Moreover, the availability of ice for cooling drinks is perceived as an improvement in their quality of life.

Another major result has been the establishment of a management and accounting system that ensures the long-term use of the technology and which sets a strong basis for future community-based projects in Kamusuchiwo. The project coordinators have gathered invaluable experience in running projects in the impoverished communities of the region.

REPLICABILITY

The project demonstrated a very reliable and low-cost set of solar technologies, capable of delivering drinking water where there is none and requiring minimum maintenance and technical skills.

The lessons from the project have been disseminated nationally and internationally and there is interest in its replication in similar environments, particularly in the region of Guajira. The Colombian government has recently embarked on a project to provide drinking water to the northern coast of Colombia, mostly through the drilling of underground wells. However, certain government stakeholders are also interested in sustainable options and in exploiting the vast renewable energy potential of the region.

LESSONS LEARNED

The building of trust via strong communication with the community was key to the success of this project. All the project steps were carried out hand-in-hand with the inhabitants of Kamusuchiwo. Examples include the initial workshops to introduce the technology in a hands-on way and the choice of site for the construction of the plant, which was agreed with community representatives

and the community's spiritual leader.

Valuable technical lessons were also learnt. The extreme desert climate and proximity to the sea posed challenges in the design and construction phases: strong winds, corrosion, intense solar radiation and torrential rain. These factors were taken into account in the choice of materials and will continue to influence the maintenance of the system in the long term.

The project team evaluated the best materials to use from different perspectives: local availability, affordability and performance. In particular, for the stills, different types of basins, insulating materials and two types of glass were researched. Locally-sourced materials where possible (e.g. sawdust instead of polystyrene for the distiller insulation) were particularly important to ensure easy maintenance by the local population in the long term.

Over the course of the project, it was observed that strong winds can limit the efficiency of the system by entering the distillers. Moreover, low overnight desert temperatures result in the distillers losing the heat accumulated during the day. These lessons are of use for future improvements to the Kamusuchiwo plant, as well as for other plants in similar extreme environments.

Source: Final Report submitted to WISIONS by Solaris in May 2015

