PICO HYDRO DEVELOPMENT TO PROVIDE ELECTRIC LIGHT TO THE RURAL POOR IN REMOTE AND INACCESSIBLE AREAS OF SRI LANKA

PROJECT'S AIM: TO PROVIDE RELIABLE AND RENEWABLE ELECTRICITY TO 75 REMOTE OFF-GRID HOUSEHOLDS, USING 35 PICO HYDRO UNITS

Location:
Sri Lanka
Technology:
Pico hydro power

Energy-related need:
Electricity

Costs:
Total: € 74,538
WISIONS financial support: € 44,000

CO2 Reduction:
71.6 tCO_2/year

Partners Involved:
Practical Action Sri Lanka
(www.janathakshan.net)

Duration:
October 2010 – April 2012

Picture: WISIONS

In many remote villages in the hilly region of Sri Lanka, people have little or no access to electricity. Consequently, they use kerosene for lighting their homes, which is unhealthy and causes pollution. To improve the energy situation for poor rural communities Practical Action Sri Lanka (now "Janathakshan"), in close cooperation with the beneficiaries of the project and local decision makers, installed 35 pico hydro systems to provide electricity to 136 households. The project was implemented in multiple stages and a proven technical design was used, but various methods had to be devised to make the project socially acceptable in the different local contexts.

In all cases the pico hydro unit was jointly funded by WISIONS and the provincial authorities. The beneficiaries provided labour, electricity poles, materials for the necessary civil works and also carried out the domestic wiring. While the units were being installed, relevant government officers, potential donors, financing institutions and universities were made aware of the process. They were informed about what support was needed and how they could become involved to make pico hydro technology a standard option for sustainable energy generation. As a result of these awareness-raising activities, pico hydro technology became recognized by the government as a method of providing electricity to off-grid households. Provincial authorities have also included the technology and the process used for this project as an exemplary method to follow in their energy delivery plans for rural off-grid communities.

TECHNOLOGY, OPERATIONS AND MAINTENANCE

A pico hydro unit is defined as a system of up to 5 kW. The unit uses basic hydro power technology, which has been around since the 19th century. The pico hydro units were designed by Practical Action engineers and manufactured under their supervision. Depending on the site requirement, either a metal casing design or a concrete casing design was chosen for the turbine.

During the project period six people were trained to manufacture the turbines. For repairs, which are infrequent, an electrician living within 4 km of the location was trained. To maintain the unit on a day to day basis two or three (female) village members were trained. The design of the system is intentionally very simple so that all components can be bought in a local hardware shop. Every unit is connected to a safety and voltage control system to protect the household members and the equipment in the event of electrical malfunction.

FINANCIAL ISSUES AND MANAGEMENT

A unit of 1 kW costs about LKR 276 000 (€1600), which includes installation and training. On average, households had to bear about LKR 10 to 15 000 (€60-90) of

the total cost. The rest of the cost was covered by the project's financial supporters. To achieve long-term sustainability there was no need to introduce a tariff system (payment related to electricity use) as the incentives to keep the system intact are good: clean electricity is highly valued by the villagers and, in addition, they save the cost of kerosene. Instead of a tariff system, usage fees are linked to the number of bulbs and plug points per household (usually 3-5 bulbs and 1 plug point). In locations where only 2-4 households were clustered there was not even the need for a revolving fund; in locations with 10-20 households a monthly fee of LKR 40-80 (€ 0.25-0.50) per household is collected to fund repairs and maintenance.

ENVIRONMENTAL ISSUES

Traditionally, rural off-grid households in Sri Lanka use kerosene lamps to light their houses. During the project kerosene lamps were replaced by efficient luminaires (LEDs and CFLs) powered by pico hydro systems. This intervention enabled annual savings of 71.6 tonnes of CO_2 emissions. The level of domestic emissions will have further decreased, although this was not scientifically measured. For example, energy for transporting kerosene to the village is no longer used. The project also performed well with regards to other local environmental aspects. In implementing the project, there was very minimal or no damage made to the surrounding environment, as setting up the pico hydro unit did not require large scale water diversion or large civil works.

SOCIAL ISSUES

In some villages on tea plantations households didn't work together but rather acted in their own self-interest, making it difficult to implement a community-based project. Nevertheless, the desire for clean electricity prevailed and the implementation of the project improved the social cohesion of these villages as between 3 and 4 households had to work together to install the unit.

In most of the project sites it was the women who were trained in the day to day maintenance, as they show greater interest in clean energy. Several women mentioned that better lighting conditions enable the children to study longer and, consequently, to have better educational prospects. Additionally, women now have more time to work at home and their sense of security around the house has improved. In economic terms, the clean energy also makes sense for the beneficiaries: by replacing kerosene lamps each household saves about LKR 500 (€3) per month, which is equal to a day's wage.

RESULTS & IMPACT

In total, 136 households were electrified by 35 pico hydro units with a combined capacity of 25.7 kW. As a minimum, each house can now light 3-5 12W CFL bulbs, use a radio or TV and charge a cell phone. Two households are using the electricity directly for productive purposes (a wood cutting machine and a hair dressing salon). Probably the most important result of the project is the political recognition of pico hydro as a competitive technology for electrification in remote areas. Provincial authorities now promote this technology and subsidize the connection to a pico hydro unit by up to LKR 30 000 (€180) per household.

REPLICABILITY

The technology has huge replication potential in Sri Lanka and around the world. The great advantage of this pico hydro design is its simplicity: all the parts needed for manufacture are locally available. For replication in other countries, a few components may need adapting to guarantee the local availability of spare parts.

In the Sri Lankan context of rising electricity prices due to the high price of fossil fuels and lower subsidies for electricity consumption, this low-tech unit is already competitive in relation to grid electricity. Richer households and commercial electricity consumers could use pico hydro systems to lower their electricity bills.

LESSONS LEARNED

One drawback was seen in villages in tea plantations with very low electricity requirements. It was difficult to motivate the families to work together as a community, e.g. to construct the weir or clear the pipeline path. Several reasons for this were identified. Families had to work in the tea plantations and it was difficult for them to get time off to undertake this work and, generally, there is not a strong sense of village community among families working on tea plantations as they are used to being controlled by the rules of the plantation management.

Another experience worth noting is the use – or not – of the electricity for productive purposes. The productive use of electricity is dependent on how much power is available. Most of the remote families are farmers and their power requirements are in the fields for activities such as hulling, grinding or pumping. The pico hydro units do not generate enough power to run these types of machines, which have a power demand of 2-4 KW. However, in future, the pico hydro units may serve to power small electric tools for productive applications.

Finally, the project illustrated that when a project is developed with the objective of influencing decision makers, sufficient time should be allocated at the outset and strong evidence for continuity is required at ground level.

Source: Final Report submitted to WISIONS by Practical Action Sri Lanka

Picture: WISIONS.

More SEPS supported project examples to be found on www.wisions.net