# LOW HEAD MICRO HYDRO POWER SYSTEMS FOR APPLICATION IN POOR VILLAGES IN THE AMAZON REGION OF BRAZIL

PROJECT'S AIM: IMPROVE THE LIVING CONDITIONS OF THE VILLAGE POPULATION THROUGH ACCESS TO MODERN ENERGY

**Location:**
Santarém, Brazil

**Technology:**
Hydro power for low head

Micro Power Systems

**Costs:**
WISIONS financial support: € 60,000

**$CO_2$ Reduction:**
14,000 Kg CO2/ year

**Partners Involved:**
Amazon Institute for the Sustainable Management of Natural Resources (IARA)

**Duration:**
04/2009 – 05/2010

**Webpage:**
www.drfn.org.na

Picture: IARA

In many villages, situated in the remote areas of the Amazon region in Brazil, people have few or no access to modern energy services. Electricity can often only be generated by expensive and polluting diesel engine generators, which deliver energy usually a few hours a day. To improve the energy situation in poor villages and therewith the living conditions, two low head hydro power systems were installed in two chosen villages within the Reserva Extrativista - RESEX Tapajós-Arapiuns. The villages Prainha and Carão have been chosen by the executing organisation IARA. Low water levels are typical in the flat regions of the Amazon valley. The water wheels used have been especially adapted to these conditions.

They offer clean energy for 24 hours day, which is used by the villagers for multiple applications in the households and the processing of agricultural products and timber.

Besides the water wheels a drinking water system and a timber processing unit in each village have been installed and five manioc processing units electrified. Not all manioc processing units could be electrified by the hydro power system, only the once located in the range of 200m of grid. Although the project faced several problems during the implementation phase, in the end both hydro power systems have been installed successfully and are running. Today a local association responsible for the operation and the maintenance owns the systems.

## TECHNOLOGY, OPERATIONS AND MAINTENANCE

Two low head hydro power systems of 8 and 12kW have been installed. The hydro power systems have mainly been built out of local materials, besides the generator, the two wheels and other mechanical parts. Therefore the local people will be able to repair most parts of the systems when problems occur in the future. The wheels have been made of steel with diameters of 1,60 and 2m and 2m width. To pond the water, a dam has been built (2m high, 2m wide, filled with soil) in both locations out of two rows of hard wood planks that are rammed deep into the earth. The local hard wood was part of the counterpart contribution of the villagers. Once the wheels are turning, they drive generators

that produce electricity at 220V which than is transformed to 7500V to reduce losses at the transmission of the energy by one wire to the village. At the village the energy is transformed to normal tension of 110/220 V for the local grid which connects the houses and the newly build drinking water systems, the timber processing units and the five manioc processing units. In each village 3-5 people have been chosen by the communities and been trained to run and maintain the power units and drinking water systems, so that the communities are able to handle the systems on there own.

## FINANCIAL ISSUES AND MANAGEMENT

The costs of the project have been higher than expected, as external experts had to be consulted, the exchange rate had fallen and the project realisation had taken longer than expected. So the initial investment calculations have been risen from €105,500 to €150,500. The population has to pay monthly fees for the supply of services: R$20 for electricity (9€), R$5 (2.2€) for the water supply and R$10 (4.5€) for each day of use of the timber processing unit. These payments should cover the costs for management, operation and maintenance of the systems. If the investment costs would have to be paid back through the villager's payments, contributions would have to be much higher, which might not be affordable for all.

After the termination of the project the hydro power systems are managed by 2– 3 persons in every village who have been trained in a management training concerning costs, calculation of costs, accountability, planning of resources and budget and strategies of maintenance. The management skills have been one of the most crucial parts of the project.

## ENVIRONMENTAL ISSUES

The wheels have low environmental impact because it is not necessary to build big dams. The amount of $CO_2$ emissions reduced by the project is 14,000kg per year as the formerly used diesel generators worked only 3 hours a day. But the water wheels produce energy 24 hours a day, so the equivalent to the energy production nowadays, would be 38,000kg $CO_2$ per year. Less pollution is also related to the compensation of the diesel generators.

## SOCIAL ISSUES

The electrification of the manioc processing units has facilitated the agricultural processing especially for women, who are mainly affected.

## RESULTS & IMPACT

As a result of the project 23 families in Prainha 23 (ca. 130 persons) a 14 families in Carão (ca. 75 persons) gained access to modern energy services, 24 hours a day, and clean water access. These developments are major improvements of the living conditions for the two rural communities.

## REPLICABILITY

The replication of the project in the Amazon valley region is in general possible, because the region is rich in water with low levels. Many rural villages have a demand for access to electricity and clean water. Furthermore, the applied technology is relatively simple. But the transportation of the heavy wheels to the sites and the financing of such projects as well as sometimes low motivation of the local communities could constrain further replications.

## LESSONS LEARNED

The project encountered several difficulties, resulted in a delay and higher project cost (heavy weight of the material; transportation problems; unavailability of building material; technical problems as well as low local knowledge and motivation).

A major obstacle for the implementation was the low motivation among the local people for long, rather complicated and complex projects. So social acceptance and motivation is crucial for future project planning. Furthermore it is essential to use skilled labour force in critical construction phase. The upfront calculations of the construction should be conservative to avoid possible undersizing of the material.

Source: Final Report submitted to WISIONS by Amazon Institute for the Sustainable Management of Natural Resources (IARA)

Picture: IARA