# SMALL WIND POWER GENERATION SYSTEMS TO PROVIDE CLEAN ENERGY IN POOR RURAL AREAS - A PERUVIAN EXAMPLE

PROJECT AIM: TO SHOW THAT SMALL WIND POWER GENERATION SYSTEMS ARE A SUITABLE TECHNOLOGY FOR RURAL ELECTRIFICATION IN PERU

**Location:**
El Alumbre, Peru

**Technology:**
Wind Power

**Costs:**
Total:€63,700

WISIONS financial support: €24,500

**$CO_2$ Reduction:**
38,32 Kg CO2/ year

**Partners Involved:**
Intermediate Technology Development Group (ITDG)

**Duration:**
2007 – 2009

**Webpage:**
http://www.itdg.org.pe

Picture: ITGD

The project was designed to electrify an entire rural community including a school and a medical centre in a village in Peru, a country where wind power has not yet received much attention The selection of the village El Alumbre was based on the favourable wind potential and the willingness of the authorities and the population to contribute to the project. The project, which was carried out by the ITDG, started with a detailed socio-economic survey to establish the levels of demand for energy within the community and the current spend on energy by the population. Another important step for the success of the project was the training of users and technicians. The trained local technician has the responsibility of managing the system and collecting the payments for the electricity. Based on the results of the survey, it was decided to install 22 wind power generation systems in 2007 – this included the provision of electricity for the school – and then to install an additional 13 wind power systems in 2008, which resulted in the medical centre also gaining access to electricity. The entire project to implement the wind power systems was based on the active and effective participation of the whole community in every aspect. The District Municipality took over the legal ownership of the electrical systems once the project was finished. To ensure the future sustainability of the project, a local management model that takes into account the social relationships has been incorporated

## TECHNOLOGY, OPERATIONS AND MAINTENANCE

The wind power systems used in El Alumbre are small installations each providing electricity for one unit i.e. household, school or medical centre. The small 100W wind power generators are 10m tall and the 500W ones are 12m tall. Both systems consist of different components that ensure their operation; in the project a 100W/500W micro wind power generator, a 35 Amp wind power controller, a 130 AH battery, a 12 VDC/220 VAC inverter and a control panel were used for the construction. The system works independently, so the user does not have to operate or regulate the power generator. The structure of the windmills was specially designed so that the technicians could easily climb to the top. Most of the components were purchased in Lima because the costs there were lower compared to regional prices due to the larger market in the capital. Users and potential local technicians/administrators were trained to operate and maintain the system. The community and local authorities then chose one of the potential technicians to be responsible for managing the system as a one-person micro

enterprise.

## FINANCIAL ISSUES AND MANAGEMENT

The estimated cost for the individual wind turbines was as high as US$600/EUR€400 (for the 100W turbines) and US$ 1800/€1200 (for the two 500W turbines at the school and the medical centre). The families now spend less on average on energy than they did prior to the project. They used to spend more than US$5/€4 a month for energy from kerosene or candles etc.; now, each family pays US$3/€2 a month for a better quality service and for greater periods of light. With a family income of between US$28/€18 and US$148/€100 per month, this represents a significant saving. Since the end of the project implementation period, the District Municipality has legally owned the system and the trained technician has been in charge of the technical and administrative operations. Together with the Community Electrification Committee, the users and the Control Unit, the technician and the District Municipality also belong to the group of five stakeholders. This local management model ensures the sustainability of the project, as it takes into account the social relationships that exist within the community.

## ENVIRONMENTAL ISSUES

The use of the wind power generating systems has replaced the former use of conventional energy such as kerosene, candles and batteries. In order to save energy, efficient light bulbs have been installed in most houses and in the school. The total volume of power used in the village now amounts to 2737 kW/year, which is a reduction of 38.32 kg CO2/year. The consumption is 43% less than estimated upfront, as the families consume less electricity than the predicted amount of 400W/day/family. In future, the energy consumption is expected to increase - but only to a limited extent.

## SOCIAL ISSUES

As a result of the access to electricity, several small businesses such as two radio broadcasting stations, a sweater-making business and a cheese factory have been established. Furthermore, access to electricity has enabled the local population to use modern information and communication technologies. As an example, the percentage of the local population using mobile phones has increased from 5% to 95%, due to the access to electricity.

## RESULTS & IMPACT

In total, 35 small wind generators were installed. Now the family homes are provided with electricity for lighting, radios, TVs, DVDs and for charging batteries and, in addition, school children are able to study and do their homework at night. In the school the energy is also used to operate 4 computers and in the health care centre to operate a refrigerator to store vaccines. There is no doubt that the project has helped the families to improve their standard of living in many ways. So far the project has gained attention from the national media as well as from local and provincial authorities and university students. The local authorities have already expressed their interest in further projects.

## REPLICABILITY

Wind power is not very widespread in Peru; the project was the first to electrify a whole community with the use of wind power and so the success of the project can serve as an example for further wind energy projects. The critical points to be aware of when considering replication are the funding and the purchase of technical equipment, which is not available in rural areas and which has to be transported from bigger cities to the construction site.

## LESSONS LEARNED

Instead of small wind power systems for each house it would be better to install centralised generation for small housing complexes within the community and connect those with micro grids. That way more powerful equipment could be installed. Furthermore, the implementation should take place during the summer to avoid delays due to winter rainfall, and future projects should plan an additional budget to purchase basic equipment for the electrified public buildings so that the energy available can be used to benefit the community immediately.

Source: Final Report submitted to WISIONS by ITDG Peru


Picture: ITDG