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Tuesday, November 14, 2006

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Micro hydro power plants and other alternative energies: contributions of practical action – ITDG to rural development

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Practical Action – ITDG began its activities in Latin America in 1985. Over the years it has developed a number of appropriate renewable energy technologies for our region, the most outstanding being the Pelton type hydraulic turbines, axial turbines with fixed blades, river turbines, as well as permanent magnet generators and the use of engines as generators. Employing these technologies, about 50 micro hydroelectric power plants have been set up, with an accumulated plant capacity of more than 1.5 MW for the benefit of over 3 thousand families. Combined financing schemes and innovating management models for these schemes have also been tested.

Early in the XXI century, the eradication of poverty and inequality is still a challenge for international development. Although there is no single factor that causes poverty, the characteristics of which are numerous, the lack of access to technology is a distinctive aspect of extreme poverty.

About two million people in the world have no access to modern and efficient power supply systems (ITDG, 2002).

According to data obtained from the Ministry of Energy and Mines (2005), 23.7% of the population in Peru, i.e. nearly 6.5 million people, had no access to an electricity service at the end of 2004. The majority of these people live in rural areas, where the situation is even more critical: more than 67% of the rural population in Peru have no access to electricity.

In addition to aggravating the poverty situation in rural areas, this tends to act as a barrier, preventing families from overcoming their poverty condition.

The natural strategy for increasing the access to electricity in rural areas is to extend the electricity grid of the national interface system. However, due to the extensive and complicated geographical conditions in Peru and the widespread nature of its small towns, the expansion of the electricity grid would reach a limited number of people in our country.

Under the circumstances, other technologies based on the development of renewable local resources could give isolated communities the opportunity to gain access to infrastructure and decentralised, sustainable and locally managed energy services.

Approach

Practical Action – ITDG considers technology to be a vital factor for contributing to people's livelihoods.

Its definition of technology includes physical infrastructure, machinery and equipment, as well as related know-how, skills and the capacity to organise and use each and every one.

Practical Action – ITDG has acquired know-how and experience through practical projects with local partners, trying to maximize the impact on relieving poverty, keeping people informed and influencing them on the different national and international practices and policies that affect the lives of poverty-stricken people (ITDG, 2002).

In this respect, the work carried out by Practical Action – ITDG to provide energy to rural populations has been based on the development and promotion of renewable sources of energy as a decentralized, sustainable and low-cost alternative for the local supply of basic services.

To this end, Practical Action – ITDG has focused its work on overcoming the main barriers that prevent the expansion of renewable energies as a viable alternative for rural areas, namely: the lack of appropriate technologies, the absence of adequate financial mechanisms, the incipient development of local skills and the lack of proven decentralized models for the management of basic services.

Technological developments

Practical Action – ITDG has developed a number of appropriate technologies to suit the conditions of our region, placing special emphasis on low production costs and equipment that is easy to operate and maintain.

These technologies have been transferred to small workshops and manufacturers so that they can become suppliers of local markets.

The following are the most outstanding of the main technologies developed:

Technologies related to the development of hydroelectric power:

- ⚡ Hydraulic turbines: Pelton type turbines for 0.5 to 1000 kW and axial turbines with fixed blades for 5 to 250 kW. With the different models designed, advantage can be taken of the entire range of hydraulic resources that can possibly be used for generating electricity: from small volume and large head to large volume and small waterfall combinations.
- ⚡ Induction generators: whereby engines can be used as generators, reducing costs by up to 60% for less than 12 kW of power, including electronic load regulators and other accessories.
- ⚡ River turbines: 500 W turbines for domestic use in lower jungle communities settled on the shores of large rivers. This axial free-flow turbine takes advantage of the energy of these watercourses to generate electricity.
- ⚡ Low-cost civil Works: the technologies developed help reduce the costs of manpower and materials compared to conventional technologies. For example, lining Canals with the curved template method, fuse-type run-of-river intakes, desilters, load chambers, power house components and accessories, among others.

Technologies related to other renewable sources of energy:

- ⚡ Micro aerogenerator with 100 w of power: for domestic use and battery charging services in isolated areas. The designed model known as IT-PE-100 operates in low to moderate wind conditions, which are the most frequent in our territory. The blades of this highly reliable small wind turbine are made of Light material like resin or fibreglass and it includes a permanent magnet power generator specially designed to suit its requirements.

- ⚡ Small-scale production of bio-diesel: based on oils from native or introduced plant species as a possible solution to the lack of access to energy in isolated communities; and based on used oils, for use as a diesel additive to reduce contaminating gas emissions and as an alternative to the final disposal of used oils in urban areas.
- ⚡ Taking advantage of agricultural waste to generate power: trying out the use of rice husks as a source of fuel for manufacturing bricks in small non-industrial brick factories.

Innovating financial mechanisms

Practical Action – ITDG, supported by the Inter-American Development Bank, implemented a revolving fund between 1992 and 2005, for the implementation of micro hydroelectric power plants in Peru.

Through this mechanism, which was unique in Latin America, loans worth more than US\$ 940 thousand were granted and complementary investments of nearly US\$ 3 million were made by government, private and cooperation agencies.

With more than 30 micro hydroelectric power schemes implemented, the plant capacity exceeds 1.5 MW for the benefit of 3 thousand rural families or about 15 thousand rural dwellers.

Furthermore, the operation of micro hydroelectric schemes has resulted in the creation of 200 small businesses and a 33% rise in the income of local families, thanks to these new businesses as well as the improvement of previously existing businesses.

Based on the experience accumulated by Practical Action – ITDG as a result of the revolving fund supported by the IDB, a new phase is being implemented, referred to as the Renewable Energies Promotion Fund (FOPER), promoting a combined financing scheme that includes lost fund donations, loans, local and regional government investments through participatory budget processes, and the contributions of users of the schemes.

Local capacity-building

This work, carried out by the Renewable Energies Demonstration and Training Centre (CEDECAP) located in Cajamarca, is aimed at overcoming one of the main barriers that prevent isolated populations from gaining access to energy services: the limited local capacity to operate, maintain and manage small power plants.

So far, more than 200 managers of isolated schemes have been trained in both technical and management aspects, proving that it is possible to create a local capacity to manage schemes of this kind.

The CEDECAP, which has been supported by the Engineering Without Boundaries Association of Cataluña since 2005, conducts training courses, workshops and seminars, mainly for users, students, technicians, professionals, experts, manufacturers and policy-makers related to renewable energies and appropriate technologies.

The main subjects covered in the training activities are energy and rural development, technical resource evaluation aspects, the design, construction and implementation of small isolated power schemes based on renewable energies, and management models for decentralized services. Also considered are aspects concerning productive uses of energy and information and communication technologies for rural areas.

Management models for decentralized basic services

As an alternative to the management models for schemes with less than 500 kW of power managed by the municipality or the community, Practical Action

– ITDG has successfully tested an innovating model designed to ensure an efficient and sustainable management of small rural electricity schemes, based on the understanding that an electricity scheme is the group of elements related to the generation, distribution, operation, maintenance, management and use of electricity in small rural areas.

This scheme was designed based on research work carried out with the World Bank's Energy Sector Management Assistance Programme (ESMAP). Once the ownership of the power generating scheme is determined, the operation, maintenance and administration are awarded to a local micro company on concession.

This concession is awarded via a medium or long-term contract, with clear and specific terms of reference and respecting the legal framework currently in force. The local company is privately owned and formed by members of the community.

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