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Distribution & sharing of benefits

Andhikhola Hydroelectric and Rural Electrification Project, Nepal

The Andhikhola Hydroelectric Project, Nepal, boasts a number of innovative and very unusual design features in the energy distribution system and tariff structure, enabling very low income subsistence farmers in rural Nepal to enjoy the benefits of electricity.

Overview

The Andhikhola Hydroelectric and Rural Electrification Project (AHREP) is a 5.1MW run of river scheme situated in the mid-hills near Galyang Bazaar, 280km south-west of Kathmandu, Nepal.

A 6m high by 60m long concrete gravity diversion weir on the Andhikhola River north of Galylang diverts flow through the intake structure on the left bank. From here, water passes through a 1.3km long horizontal tunnel prior to the headrace tunnel and into a 234 metre vertical drop shaft to an underground powerhouse containing three 1.7MW Pelton turbines and generators. The scheme supplies approximately 27GWh of electricity into the Nepalese electricity grid annually.

Scheme Specifications

Dam Name

Scheme operator
Butwal Power Company Ltd

Size of scheme (MW)
5.1

Country
Nepal

Catchment area

River
Andhikhola River

Effective reservoir capacity
Run of River

Construction years

Reservoir size

1982-91 Run of River

External Recognition

The Andhikhola Hydroelectric Scheme has received significant recognition from external sources, including:

- 2005 “Blue Planet Prize” awarded by the International Hydropower Association
- The scheme featured in the book “New designs for rural electrification – private sector experiences in Nepal”, published in 1994 by the National Rural Electrification Association, USA (a pioneer organisation on rural electrification in the US).

Details

The AHREP, through the sale of bulk electricity to the Nepal Electricity Authority, supplies power to some 100,000 people.

80% of electricity users in the region are subsistence farmers, and an underlying philosophy of the AHREP is to benefit low-income families in one of the poorest regions in the world. In contrast to most hydroelectric schemes, which provide power to urban communities that are often remote from the project site, the aim of AHREP was to make electricity available to rural communities close to the project site. Within the project area, over 17,000 consumers of electricity across 22 villages benefit from the scheme, with this number growing by 10% annually.

The success of the project in servicing low-income rural communities is due to unconventional methods of distribution and an unusual approach to tariffs. This approach reduced the cost per household (1990’s prices) of electricity installation to around USD$120, (c.f. USD$600 for similar projects elsewhere) and the cost of distribution lines to $USD3700/km (c.f. USD$5-15000). The innovations that made the distribution of power to these communities economical include:

- *Intermediate 1kV distribution voltage*

Although the adoption of a 1kV distribution voltage resulted in no significant cost savings within the pilot area of the scheme, it has been found very economical in supplying areas where the population is less dense. This is largely because a single porter can carry transformers to areas that are not serviced by roads, significantly reducing access costs.

- *Innovative power transmission poles*

The pre-cast concrete poles typically used to suspend transmission lines along road sides in Nepal are unsuitable for villages not serviced by roads. Through the AHREP project, lightweight poles consisting of tapered telescopic sections were developed. These are carried by porters to areas not serviced by roads and are assembled on site.

- *Use of insulated cables*

The introduction of insulated cables enabled distribution lines to be suspended from wooden poles, live trees and buildings, further reducing the cost of transmission.

- *Low cost wiring*

The cost of wiring houses using conventional methods (1990's prices) was approximately USD$20-30, which is prohibitively expensive for most families within the project area. The development of easy to install wiring harnesses brought this cost down to around USD$5 per household.

- *Tariff structure*

The use of energy meters would push the cost of electricity installation beyond the means of most families in the project area, and meter reading and administrative costs would have further increased the cost of electricity. Instead, a power-based tariff has been applied, with low cost current cutouts installed at each household. Families subscribe to 25-400W usage at a fixed tariff. Larger consumers of electricity are equipped with two tier meters. Usage above the subscribed demand is charged at a significantly higher rate, which aids in reducing peak demand.

- *Low wattage electric cookers*

The introduction of low wattage electric cookers for off-peak cooking was not popular within the AHREP area due to the abundance of fuel wood, although the use of electric rice cookers in increasing. In higher income areas of Nepal, electric cooking is more popular, particularly where fuel wood supplies are depleted.

Other aspects

Local Capacity Building
Throughout the construction of the project, the Butwal Power Company adopted a policy of employing local people where possible, including technicians, engineers and local workshops. Hundreds of Nepalese gained experience and skills during the construction period, and many continue to be employed on the operation and maintenance of the scheme. Some of the senior technicians, engineers and managers within Nepal's leading hydropower companies started their careers on the Andhikhola project. In addition, civil companies such as Himal Hydro and General Construction Company Ltd and Nepal Hydro and Electric Ltd have formed as a result of the project and are now leading civil hydropower contractors involved in electro-mechanical and hydro-mechanical manufacture and installation.

Multiple Use Benefits
In addition to hydropower benefits, the AHREP provides water for gravity irrigation of 280ha of land. The 800 subsistence households within the irrigation area had been prone to famine prior to the development of the scheme and were able to grow only a single crop annually. The development of a community organization to build, operate and manage the irrigation scheme has resulted in the cultivation of crops during the drier months, with three harvests now possible annually. The outcome is a reduction in famine, with the sale of excess crops providing additional household income.

Further information

http://www.bpc.com.np/

http://www.ippan.org.np/hydropower_in_nepal.htm

http://www.himalhydro.com.np/hh-ahrep.html

http://southasianmedia.net/cnn.cfm?id=262167&category=Development&Country=NEPAL

http://www.hydropower.org/blue_planet_prize/andhikhola_hydel.html