Global Sustainable Electricity Partnership

PROJECT BHUTAN - CHENDEBJI MICRO HYDRO POWER PROJECT

LOCATION	Bhutan, Chendebji village in Trongsa Province (150km east of Bhutan's capital of Thimphu)
TIMELINE	From November 2001 (2.5 year for studies and tender) to August 2005 (1 year for construction).
CATEGORY	GRANT/CSR
TECHNICAL PARAMETERS	Construction of 70kW run-of-river micro hydro power plant and transmission/distribution line for rural electrification of 50 households
OBJECTIVES	• Promote rural electrification, where the electrification rate remains low; • Improve living conditions by reducing indoor smoke from firewood and kerosene use, providing lighting to allow studies and cottage industry activities, such as weaving, after sunset; • Provide access to improved education through new electric learning devices, including computers; • Demonstrate the "Clean Development Mechanism (CDM)" on the model of a micro hydropower as the worldwide leading case;
PARTNERS & BENEFECIAIRIES	• Government of Bhutan, Ministry of Trade and Industry/the Department of Energy, the Ministry of Finance and National Environment Commission; • Bhutan Power Corporation (public utility); • Bhutan's residents in Chendebji village, a dispensary and a school.
OPERATOR	Operated by Bhutan Power Corporation and total transfer of the project to the Ministry of Trade and Industry/the Department of Energy in 2005.
FINANCE	Total Cost: Approx. USD 600,000 (including construction cost of USD534,307 and CDM registration related cost). Funds: GSEP grant (e7 fund)
HUMAN CAPACITY BUILDING & TRAINING	Holding 1 day workshop on July 2004 and 2days workshop on August 2005 Total 55 participants were trained. The Planning of this project, Civil and Electric work design, Environment Impact Assessment, Clean Development Mechanism and Information and Communication Technology and O&M etc.
ENVIRONMENT	GHG emission reduced: 500tCO2/year Environmental Impact is minimal by adopting run-of-river hydro type.
DEVELOPMENT OUTCOMES	Total wattage provided by electrification: 70kW Expected annual output (kWh) = Capacity (kW) x Annual Continuous Generating Duration (hrs) x Capacity Factor (%) = 70 x 8,760 x 0.95= 582,540 kWh

SUSTAINABILITY

SUSTAINABILTY FOOTPRINT

- **Projected Direct Sustainability Impacts**

- Number of household connections	50 connections (completed soon after COD)
- Total wattage provided by electrification	70 kW
- GHG emission reduced/avoided	500 t CO_2 / year
- Number of public buildings connected	5
- Total capital invested (e7 and external)	Approx. US$ 600,000
- Number of HCB training days provided	1 and 2 (July 2004 and August 2005 workshops)
- Number of participants who received e7 HCB	30 and 25 (July 2004 and August 2005 workshops)

- **Projected Indirect Sustainability Impacts (qualitative description)**

- Facilitated health care	Provision of electricity to the local dispensary for refrigeration of medicine, notably vaccines. Provision of electricity for lighting to reduce lung disease caused by soot from kerosene lamps.
- Facilitated education	Provision of electricity for lighting in houses to allow students and adults to read in the evenings. Provision of electricity for computers to allow teachers and students to make outside contact through the internet.
- Facilitated water access/sanitation	Provision of a source of hot water for welfare of villagers
- Facilitated local entrepreneurial activity	Provision of electricity for lighting to allow economic activities inside houses after dark
- Facilitate income generation	Provision of electricity to make house industries possible: weaving, handcrafts and small industry (lumbering, macadam production)

The two years monitoring had improved the sustainability of the project; After the start of operation on August 2005, Some runner blades of the turbine were damaged and electric supply was stopped but they were repaired.

REPLICATION

- Choose the local construction company
- Use of standard equipment and no superfluous;
- High hydro power availability;
- Presence of trained and qualified engineers;

KEY SUCCESS FACTORS

- Good collaboration with government authorities;
- Choose the renewable power source;
- Production of environmental and feasibility studies;
- Collaboration of the village residents, facilitate the improvement of their health care and education;

STATUS

Commissioned in 2005 and assets transferred in the same year to Bhutan Power Authority
In operation. For more information: www.globalelectricity.org