



Bringing Power to Bhutan's Villages and Beyond

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BHUTAN GREEN POWER DEVELOPMENT PROJECT
 Approved: October 2008
 Closed: April 2014

PROJECT RESULTS

- MORE THAN 9,000 RURAL POOR HOUSEHOLDS AND FACILITIES**
will gain access to electricity through extensions of the electrical grid
- REDUCED RELIANCE ON FIREWOOD AND KEROSENE**
brings cleaner indoor air, benefiting women and children especially
- BURNING LESS WOOD**
means less carbon dioxide and other pollutants released into the atmosphere
- EXPORTING CLEAN ENERGY TO INDIA**
replaces power generated by fossil fuels, reducing CO₂ emissions by 500,000 tons a year

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Rinchen Norbu, a resident of the small southwestern Bhutan village of Balaygang, remembers in the past trying to keep his three daughters healthy in a home full of soot and smoke.

"Before we had electricity, we used a kerosene lamp for light and charcoal for cooking," recalls the 39-year-old farmer. "That produced a lot of smoke."

In recent years, the situation has changed dramatically in his remote village. Electricity has been brought into the area, despite steep mountainsides and rugged terrain. Today, his children study with electric lighting and his wife prepares meals using an electric rice cooker and other appliances.

The small village also used to be barely accessible, especially during the rainy season when muddy roads were completely washed out. Rinchen and other farmers would battle the water-logged roads for 2 days trying to bring their goods to the market in the capital city, Thimphu.

With an improved road into the village, they can now bring rice and vegetables they grow on their land to the market faster, in about seven hours, regardless of the weather conditions.

People in the village of Balaygang benefited from a rural electrification program that was part of the ADB-supported Green Power Development Project. The project's rural component connected more than 8,500 rural households to hydroelectricity, and 119 remote public facilities (schools, health clinics, and other community facilities) to solar electricity. Access roads to the project site, which also run through the village, were improved during plant construction.

In addition to rural electrification in Bhutan, the project built the 126-megawatt Dagachhu Hydropower Plant, which will begin operating in June 2014. The electricity generated will be exported to India through an existing cross-border grid.

The project aims to sustain the country's economic growth by both promoting cross-border power trade and increasing domestic access to electricity.

Abundant hydropower resources

Bhutan has an abundant supply of hydropower. It is the only South Asian country with surplus energy available for export. Yet, three in five homes in the country's rural areas were without electricity before the project began in 2008. The Government of Bhutan is developing the potential of its vast energy reserve while providing electricity to many remote areas.

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Bhutan's potential hydropower output is estimated at 30,000 megawatts, but only 5% is being used. After meeting domestic demand, about 70% of the 1,500 megawatts of hydropower being generated is exported to neighboring India to help drive that country's booming economy.

The export of energy is one of the main drivers of Bhutan's \$1.5 billion economy. The power to be exported to India from the Dagachhu plant over 25 years is expected to generate more than \$250 million in taxes, dividends, and royalties. Hydropower export will be the largest source of income for the government to fund its public services and social programs. The revenues will also help keep the price of electricity low for poor rural users.

The government aims to develop and export 10,000 megawatts of hydropower to India by 2020. Several more hydropower projects are in the pipeline.

"Hydropower will allow us to develop and strengthen our economy," said Bhutan Prime Minister Tshering Tobgay.

In 2013, 95% of the population was connected to electricity, compared with 60% in 2008 before the Green Power Development Project started.

Powered by the private sector

Hydropower plants in Bhutan have been developed in partnership with Austria and India. The Dagachhu Hydropower Plant was developed by a joint venture between the Bhutan public utility, Druk Green Power, and an Indian private company, Tata Power.

"The hydropower plant is Bhutan's first public-private partnership in infrastructure," said Kaoru Ogino, a principal energy specialist in ADB, who noted that most projects of this type are undertaken by governments. "The project is a model for future private participation in the energy sector, particularly in hydropower."

ADB provided \$119 million in loans to help build the Dagachhu Hydropower Plant, which does not include a large water storage reservoir. The run-of-river-type plant, which generates electricity through power created by rushing water, will have less environmental impact than traditional plants because the project did not build a major reservoir; there is also no need to relocate people.

Reducing greenhouse gas emissions

While the project has protected the surrounding environment, it is also making an impact on a global scale. In February 2010, the Dagachhu plant was registered as the world's first cross-border project to receive carbon credits under the Clean Development Mechanism.

The Clean Development Mechanism, allows greenhouse gas emission reduction projects in developing countries to earn carbon credits which can be traded and sold, and used by industrialized countries to meet part of their reduction targets under the Kyoto Protocol. This creates a financial incentive to build clean energy projects.

The power to be produced by the Dagachhu plant will be used in India, where it will replace power generated by fossil fuels. The use of Bhutan's clean power supply will avoid about 500,000 tons of carbon dioxide emissions every year, or 15 million tons over 30 years.

"When we sell power to India, we are replacing fossil-fuelbased power generation, so globally we are contributing to a clean environment," said Thinley Dorji, chief executive officer of the Dagachhu Hydro Power Corporation, the company that will operate the plant.

The project has become a model for other countries on how to trade renewable energy, such as wind, solar, and geothermal, across borders.

The environmental benefits of the project have received international recognition. On 25 July 2013, the Development Impact Honors Program of the United States Department of the Treasury awarded the project for its excellence. The honor is given to outstanding projects that "reflect the vital on-the-ground work that strengthen communities and regions around the

world."

Busy days at the community store

In Balaygang Village, near the Dagachhu Hydropower Plant Project, 51-year-old Sangay Dema runs a small general store selling noodles, canned goods, and cold drinks. These days, business in her wooden, corrugated-iron-roofed shop is better than it has ever been, thanks to passing trade from truck drivers and the many workers at the plant.

She says her fellow villagers also drop by more often than they used to because they too are earning more from selling food to workers; leasing rooms in their homes; or from construction, driving, and other jobs at the plant.

In Bhutan, about 12% of the population lives below the national poverty line of about \$27 per month. Sangay has been able to earn more than that in a single day since work began on the plant in 2008.

Her grandchildren will have more opportunities opened to them than she had. Sangay did not go to school, and learned to read and write in a monastery. But she is happy that increased sales means she now has a little extra money to expand the range of products in her store and to spend on small luxuries like a refrigerator and a television. She can also afford to visit her children in Thimphu more often.

"Life is better now," she says.

Lighting up the countryside

Part of the revenue from power export to India will be used to bring affordable electricity to people in remote and poor areas of the country.

Electricity has been provided under the project to more than 9,000 households and public institutions, including schools, clinics, and community facilities in remote rural areas.

Bringing electricity to these areas has reduced the need to destroy the forests that supplied firewood for cooking and home heating. It has also diminished the threat to health of women and children in particular, by reducing their exposure to smoke generated from using kerosene and firewood in the home.

Through the efforts of this project, and others, Bhutan is expected to achieve 100% rural electrification by 2015, ahead of the original government target of 2020.

In the remote district of Dagana Dzongkhag in southern Bhutan, there has been increased employment, resulting from the construction of power lines and new roads built in remote communities.

This has included extending and improving the bumpy path from the hydropower plant through Balaygang village, and up to the main road that connects to the Bhutan capital and beyond.

"Before this project, this was one of the remotest districts in Bhutan," says Thinley Dorji, who lives at the plant with his wife, son, and two nephews. "Now that is changing because of the project."

"We used to have lots of respiratory problems in the rural areas because the kitchen is entirely dependent on fuel wood," says Sonam Tschering, the secretary of the Ministry of Economic Affairs. "Many people suffered from pulmonary diseases. Providing rural electrification not only has given people a clean source of light, it has also improved their health."

Not only that, he adds, "You talk about schools, about hospitals. These were all supported through the revenue generated by hydropower."

This article was originally published in [Together We Deliver](#), a publication highlighting successful ADB projects across Asia and the Pacific that demonstrated development impacts, best practice, and innovation.

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