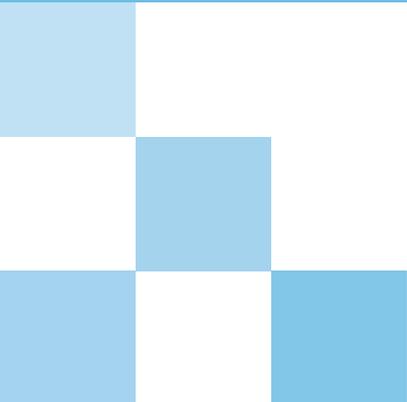


# GREEN POWER FOR BHUTAN CLEAN ENERGY CROSSES BORDERS TO REACH POOR HOUSEHOLDS



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Note:

In this publication, "\$" refers to US dollars.

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**GREEN POWER FOR BHUTAN**  
CLEAN ENERGY CROSSES BORDERS  
TO REACH POOR HOUSEHOLDS





# Foreword

Bhutan's commitment to environmental sustainability and the welfare of its people is known worldwide. In support of that commitment and for Bhutan's economic development, the Asian Development Bank (ADB) has pledged to help the country better manage its clean energy and water resources, particularly where they intersect in Bhutan's hydropower sector.

Energy has been a key focus sector for ADB's operations in Bhutan for as long as we have been working in the country. Energy drives economic growth, and powers human development. When energy is drawn from sustainable renewable sources, a country can rightly say that it is on the low-carbon path.

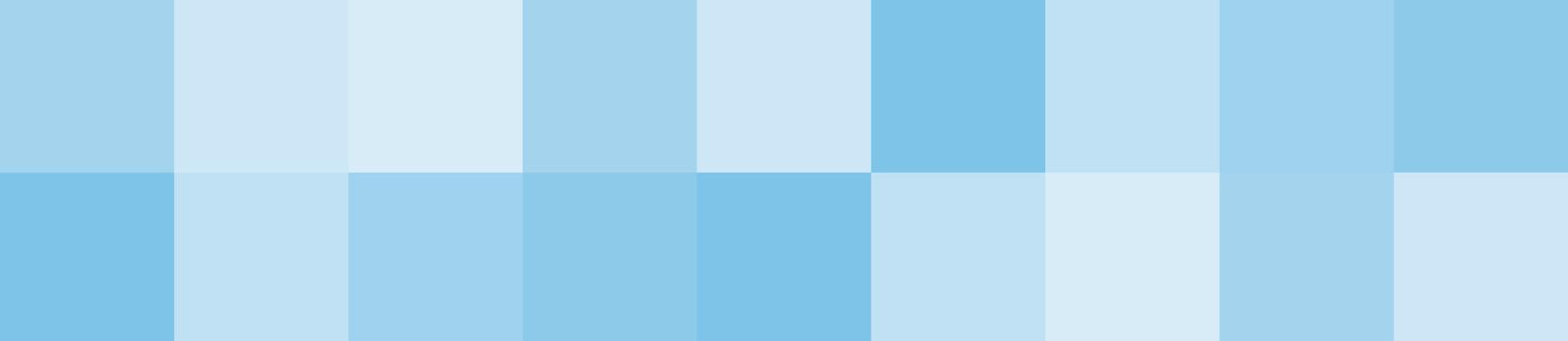
The Dagachhu plant, as Bhutan's first public-private partnership for hydropower development, marks a new

phase for development in Bhutan, and illustrates how cross-border power trade is a win-win solution for all countries involved. This showcase, prepared as a joint effort by the South Asia Department's Energy Division and the Regional and Sustainable Development Department's Sustainable Infrastructure Division, reviews the key features of the project.

ADB hopes that the success of Bhutan inspires other countries to explore ways to develop their renewable energy resources and promote cross-border power trade for the greater benefit of all.

**Yongping Zhai**

*Director, Energy Division, South Asia Department  
Asian Development Bank*



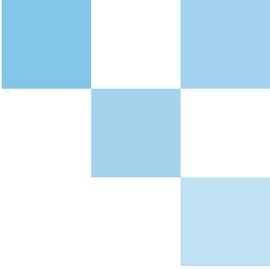
*Hydropower done right can be environmentally responsible and profitable. It can also promote inclusive growth. This project, combining clean energy development with rural electrification, shows how.*

# Project Background

The ongoing Bhutan Green Power Development Project of the Asian Development Bank (ADB) taps into Bhutan's enormous hydropower potential through a public-private partnership, the first of its kind in the country. The run-of-river 126 megawatt (MW) hydropower plant being built under the project will generate a new supply of clean energy, to be sold to neighboring India. The project will allow clean energy to be traded across borders, improving access to green power, supplying thousands of households with modern energy, and allowing Bhutan to profit further from its indigenous renewable energy resources.

Bhutan has vast hydropower resources. The present installed capacity of around 1,500 MW far exceeds the 300 MW domestic peak demand, and more potential exists beyond that. With this power surplus, Bhutan is South Asia's only energy exporter—energy exports form the backbone of the country's economy. Around 70% of the electricity generated in Bhutan is exported to India. The revenue earned by the government, in the form of taxes, dividends from the power utilities, and royalties, drives socioeconomic development, subsidizes costly rural electrification in mountainous Bhutan, and helps keep electricity prices affordable to rural users.





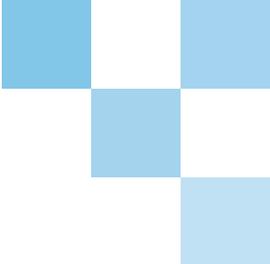
The main component of the Green Power Development Project is the 126 MW hydropower plant at the Dagachhu River. Of the investment cost of \$275 million, \$242 million is for the development of the hydropower plant and for the trade in power. The remaining \$33 million supports the rural electrification of communities around the hydropower plant, ensuring a better life for the people.

The Dagachhu plant is being built by Dagachhu Hydro Power through a joint-venture public-private partnership between the Bhutanese state-owned

Druk Green Power and Tata Power of India. The rural electrification component is served mainly by Bhutan Power, a public utility service company.

Clean energy for the poor is a win-win solution, according to ADB, and the way two countries are sharing hydropower resources to their mutual benefit, through the project, is an excellent example of regional integration. But beyond sustainability and energy access, the project has other noteworthy elements.





# Safeguards for Inclusive, Green Power

Large hydropower has drawn controversy in the past, mainly because of issues associated with the land rights of local communities, the rights of indigenous peoples, and the environmental impact of damming major rivers..

ADB's safeguard policy covers the environmental and social impact of all ADB-financed projects, including private sector operations, and all project components. These policies ensure that the impact of a given project is properly assessed, and that plans are developed and implemented to avoid, minimize, mitigate, or compensate for any adverse impact.

Due diligence for the Bhutan Green Power Project uncovered two potential problem areas: the effect of the dam's operations on the fish population, and the impact of the construction of support infrastructure on land rights.

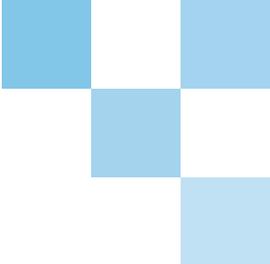
Both potential problems were properly addressed. The hydropower plant's "run-of-river" construction meant that large water storage would not be necessary. But as the fish population could still be affected, a fish ladder, to support fish migration along the Dagachhu River, was made part of the design.



The issue of land rights arose from the need to acquire properties for the construction of access roads. Twenty-five households in that agricultural area lost part of their land, but no houses or buildings had to be relocated. To replace the property they lost, the affected households received land of similar productivity from government plots. Cash compensation was negotiated with households that lost standing crops and fruit trees on affected land, and acceptable deals were reached.

Dagachhu Hydro Power is ready to deal with community grievances arising from the construction, and remains in close contact with the community.

All of these qualities have earned unexpected acclaim for the Green Power Development Project. In 2013, the project received Development Impact Honors from the US Treasury Department, which cited it for “Excellence in Use of Public–Private Partnerships and Innovative Solutions for Critical Energy Need” in the project’s design to meet the goals of economic growth, rural development, and environmental protection.



# Support for Rural Electrification

Despite a net power surplus and power exports, access to modern energy was limited in Bhutan because of the high cost of expanding the grid into Bhutan's mountainous terrain to reach remote communities. The people still burn fuelwood to heat their homes and cook their food. Collecting this fuel is a time-consuming task, for which the women of the household are primarily responsible. By supplanting fuelwood and kerosene use, electrification frees women of a major drain on their time, allows them to spend their day more productively, and boosts gender equity.

The rural electrification component of the project will improve access to both on-grid and off-grid energy. On-grid access will increase as communities around the Dagachhu plant are connected, and these connections will spread outward as transmission systems improve. Eventually, more than 9,000 households and public facilities, such as schools, health clinics, and community buildings, will be supplied with electricity. This component also supports the distribution and installation of off-grid solar systems, in view of the priority Bhutan places on environmental sustainability, even as it contributes to meeting the government's development target of 100% household electrification.



# Use of the Clean Development Mechanism

Under the Clean Development Mechanism (CDM) as defined in the Kyoto Protocol, the Dagachhu plant is a showcase cross-border CDM project, the first such project under the CDM. Bhutan stands to benefit not only from the revenue from power trade but also from the sale of carbon credits as it is expected to reduce emissions of about 500,000 tons of carbon dioxide equivalent yearly on average.

The project helps to reduce greenhouse gas emissions by displacing fossil fuel-based power generation in India through hydropower sourced from Bhutan, thus

linking regional energy trade with greenhouse gas mitigation.

Bhutan is one of several Asian countries that generate power mostly from clean energy sources. Nepal and the Lao People's Democratic Republic are among the others. This project shows the benefits that such countries can derive from CDM by exporting clean electricity to their neighbors that use more carbon-intensive power. It is hoped that the project will spur further developments in cross-border energy trading that takes advantage of CDM.



# Promotion of Regional Trade in Energy

Bhutan has immense hydropower potential. The theoretical potential is up to 26,760 MW versus the present installed potential of 1,500 MW.

Although peak demand for electricity in Bhutan is now a low 300 MW, domestic demand is growing by around 17% yearly, and is expected to grow even faster as rural electrification proceeds and the country industrializes. Bhutan is seeking to tap more of its hydropower potential to keep up its export revenue. The government has set an ambitious target of developing 10,000 MW more of hydropower for domestic use and trade by 2020. Yet Bhutan is also strongly committed to environmental sustainability, and is known worldwide for putting its people and the environment first. Run-of-river hydropower plants, such as the Dagachhu plant, are an excellent

compromise between development needs and environmental protection.

However, the country does not have the domestic resources to finance hydropower projects of such a scale. The accelerated development of hydropower in Bhutan demands the strategic use of foreign public and private participation and their investments.

Cross-border regional trade in energy would galvanize private participation. ADB has long promoted greater regional integration, toward a seamlessly interconnected Asia, and has spoken strongly about the need for cross-border energy trade to solve the increasing energy insecurity in the region, where ever higher domestic demand for energy has bred a dependence on imported fossil fuels.

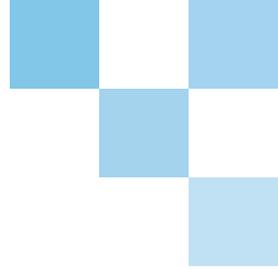
ADB's latest major publications on energy identify energy security as a region-wide challenge best addressed collectively by the countries in a region. Regional trade in energy has benefits that go beyond energy security. By creating larger energy markets, the region also attains economies of scale and therefore improved efficiency. ADB has pointed out that this kind of integration would not require new technology, and the investment would be no riskier than any typical investment in energy infrastructure.

Cross-border trade in energy has been proven to be feasible and successful. In the Greater Mekong Subregion of Southeast Asia, the Lao People's Democratic Republic and Myanmar are developing hydropower to provide clean, inexpensive energy to downstream markets, particularly Thailand. The Central Asian power grid is greatly interconnected and,

although aging, remains reliable. The very low incidence of energy poverty in these countries attests to the reach of the grid.

However, greater regional integration and cross-border energy trade is as much about political will as it is about infrastructure. Countries must commit to cooperate in energy markets and build the required infrastructure. The Dagachhu project showcases that cooperation in action.

ADB hopes Dagachhu's success sparks increased cross-border trade in energy. A follow-up project to export hydropower from Bhutan is in the works. ADB has also helped complete a transmission interconnection between Bangladesh and India, and intends to support a grid connection between Nepal and India.



## **About the Asian Development Bank**

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than \$2 a day, with 733 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.



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