ADB ASIAN DEVELOPMENT BANK

# Bhutan: Preparing Renewable Energy for Climate Resilience

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| Project Name | Preparing Renewable Energy for Climate Resilience |
| Project Number | 54142-002 |
| Country | Bhutan |
| Project Status | Approved |
| Project Type / Modality of Assistance | Technical Assistance |
| Source of Funding / Amount | TA 6598-BHU: Preparing Renewable Energy for Climate Resilience<br>Technical Assistance Special Fund — US$ 500,000.00<br>Climate Change Fund — US$ 250,000.00 |
| Strategic Agendas | Environmentally sustainable growth<br>Inclusive economic growth |
| Drivers of Change | Knowledge solutions |
| Sector / Subsector | Energy - Renewable energy generation - solar - Renewable energy generation - wind |
| Gender Equity and Mainstreaming | Effective gender mainstreaming |
| Description | The proposed project will prepare the Bhutan Renewable Energy for Climate Resilience Project with following outputs: (i) construction of two solar PV power plants located in central-west Bhutan with a total capacity of 48 megawatt peak (MWp), (ii) construction of one wind power plant located in western Bhutan with a total capacity of 23 MW, and (iii) respective transmission lines for grid connection. This will be the first step to diversify the generation portfolio of Bhutan's hydropower dominated energy sector.<br>In addition the proposed project will strengthen the EA's institutional capacity on solar and wind power project design, financial evaluation, implementation, operation, renewables grid integration, and environment safeguard monitoring. The proposed project will support an awareness campaign on benefits on efficient and safe electricity use conducted with project affected people with special focus on women participation. It will also promote renewable energy by incorporating and implementing a training program into the schools' science, technology, engineering, and mathematics (STEM) curriculum with special attention to training female students. The following areas will be explored during the project preparation: (i) women's employment during project construction and operation, (ii) supporting students with a special focus on females from educational institutions in STEM curriculum by organizing extracurricular learning and/or special lecture in whole project cycle of the proposed project to foster understanding of non-hydro renewables, and (iii) gender inclusive local community participation to foster understanding of the project by organizing study tours to the project sites. |

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| Project Rationale and Linkage to Country/Regional Strategy | Bhutan is a landlocked and mountainous country in the Eastern Himalayan with elevations ranging from 160 meters to over 7,000 meters above sea level, abundant water resources and with a geographical area of 38,394 square kilometer (km2). Climate varies due to the country's topography and geographical location at the edge of the tropical circulation in the north and Asian monsoon circulation in the south. Summer monsoon typically lasts from June to late September and creates most of the annual rainfall in Bhutan.<br>Bhutan is one of the smallest in population and geographical area. Its annual average economic growth of 7.6% between 2007 and 2017 far exceeds the average global growth rate of 3.2%. This high growth has contributed effectively to reducing poverty. Poverty rate in Bhutan declined from 12% in 2012 to 8.2% in 2017. However, the COVID-19 pandemic is taking a high toll, decreasing projected growth rates to 2.4% and 1.7% in 2020 and 2021.<br>Bhutan's development has been heavily dependent on climate-sensitive sectors such as agriculture and hydropower, with hydropower making a major contribution to the growth. Hydropower contributes about 25% to total gross domestic product (GDP) annually, accounts for 32% of total exports, and generates about 25% of the government's total domestic revenue. The power generation sector almost exclusively relies on hydropower, with an installed capacity of 2,326 megawatt (MW), and power export to India is an important source of revenue.<br>More than 80% of annual precipitation in the central-eastern part of the Himalaya is delivered by the summer monsoon. Recent studies point to a decline in rainfall in the country's wettest regions and a weakening of the Indian Summer Monsoon over the subcontinent. While long-term future (projected) precipitation trends in the region, and in specific river basins, are subject to considerable uncertainty, several patterns have emerged. Based on the most recent climate modeling efforts (CIMP5), summer monsoon rainfall is likely to increase by mid to late 21st century in the central and eastern Himalayas, while winter precipitation is projected to decline. It is projected with high confidence that glaciers, snow-covered areas, snow and ice volumes will decrease within these regions over the coming decades in response to increased temperatures, and that snowline elevations will rise, affecting seasonal water storage and seasonal patterns of discharge, particularly in the high elevation sections of river basins. The loss of buffering capacity increases susceptibility to both extreme runoff due to increasingly frequent extreme rainfall events, and to prolonged low flows.<br>These and other impacts of climate change including seasonal reductions in flow, more unpredictable flow patterns and changes in rates of sediment transport can potentially decrease the reliability of hydropower generation, particularly for systems with limited storage or run-of-river facilities which are common in Bhutan. Climate change is also expected to contribute to increasingly frequent and severe extreme weather events, resulting in flooding due to extreme precipitation, droughts, and heatwaves; and to elevated risk of glacial lake outburst floods (GLOF) which are a major hazard in Bhutan.<br>Other renewable energy resources such as solar photovoltaic (PV) and wind can complement hydropower in forming a more diversified electricity generation portfolio, which is, in healthy mix, resilient to changes in seasonal weather patterns and weather extremes that can adversely affect power supply. In addition, Bhutan's run-of-the-river hydropower generation drastically drops during the winter dry season (December to March) due to low precipitation and snow melt, almost falling short to meet peak demand. The generating utility of Bhutan experienced poor hydrology in 2018 and for the first time since its formation in 2008, experienced net energy import from India in the dry season of February and March. In future, climate change could even amplify this effect. The use of renewable energy sources such as solar and wind in Bhutan have complementary annual generation profiles to hydropower, producing most power during the dry season from December to March. Estimates for the technical potential in the country range from 12,000 MW for solar PV and 760 MW for wind power.<br>The Alternative Renewable Energy Policy (AREP) prepared by the Royal Government of Bhutan in 2013 aims to diversify the energy mix by harnessing other domestic sources of clean renewable energy to ensure energy security, economic development, and protection of the environment and promote renewable energy technologies such as solar PV and wind power. This policy sets out a preliminary minimum target of 20 MW by 2025 through mix of renewable energy technologies.<br>Although Bhutan already has experience in construction of a small pilot scale wind power plant (2 x 300 kilowatt) and is planning to test small scale rooftop solar PV systems in a limited amount of households, the country has not tapped into its solar and wind resources at utility scale level and lacks capacity and experience in that field. The first deployment of non-hydro renewables at utility scale in Bhutan will be the first step to diversify the power generation portfolio, increase the resilience against severe weather events such as droughts, and complement the hydropower generation profile during the dry season. |
| Impact | |

| Project Outcome | |
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| Description of Outcome | |
| Progress Toward Outcome | |
| Implementation Progress | |
| Description of Project Outputs | |
| Status of Implementation Progress (Outputs, Activities, and Issues) | |
| Geographical Location | Nation-wide |

| Summary of Environmental and Social Aspects | |
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| Environmental Aspects | |
| Involuntary Resettlement | |
| Indigenous Peoples | |
| Stakeholder Communication, Participation, and Consultation | |
| During Project Design | |
| During Project Implementation | |

| Business Opportunities | |
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| Consulting Services | ADB will administer the TA, and will select, supervise, and evaluate consultants. ADB will oversight the TA implementation and communicate with consultants and concerned stakeholders. |
| Procurement | no procurement foreseen |

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| Responsible ADB Officer | Meindl, Christoph |
| Responsible ADB Department | South Asia Department |
| Responsible ADB Division | Energy Division, SARD |
| Executing Agencies | Asian Development Bank<br>6 ADB Avenue,<br>Mandaluyong City 1550, Philippines<br>Druk Holding and Investments Limited<br>Thori Lam Upper Motithang<br>Thimphu, Bhutan |

| Timetable | |
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| Concept Clearance | - |

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| Fact Finding | - |
| MRM | - |
| Approval | 18 Nov 2020 |
| Last Review Mission | - |
| Last PDS Update | 18 Nov 2020 |

## TA 6598-BHU

| Financing Plan/TA Utilization | | | | | | | Cumulative Disbursements | |
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| ADB | Cofinancing | Counterpart | | | | Total | Date | Amount |
| | | Gov | Beneficiaries | Project Sponsor | Others | | | |
| 750,000.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 750,000.00 | - | 0.00 |

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| Project Page | https://www.adb.org/projects/54142-002/main |
| Request for Information | http://www.adb.org/forms/request-information-form?subject=54142-002 |
| Date Generated | 20 November 2020 |