



Project Readiness Financing Report

PUBLIC

Project Number: 56335-001
November 2023

Kingdom of Bhutan: Green Power Project Readiness Enhancement

This document is being disclosed to the public in accordance with ADB's Access to Information Policy.

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 31 October 2023)

Currency unit	=	ngultrum (Nu)
Nu1.00 (₹1.00)	=	\$0.01201
\$1.00	=	Nu83.2586 (₹83.2586)

ABBREVIATIONS

ADB	–	Asian Development Bank
CO ₂	–	carbon dioxide
COVID-19	–	coronavirus disease
DGPC	–	Druk Green Power Corporation Limited
GWh	–	gigawatt-hour
kWh	–	kilowatt-hour
MW	–	megawatt
PPP	–	public–private partnership
PRF	–	project readiness financing
TA	–	technical assistance

NOTE

In this report, “\$” refers to United States dollars and “₹” refers to Indian rupees.

Vice-President	Shixin Chen, Office of the Vice-President (South, Central and West Asia)
Director General	Kenichi Yokoyama, South Asia Department (SARD)
Deputy Director General	Cindy Malvicini, SARD
Directors	Sujata Gupta, Energy Sector Office (SG-ENE), Sectors Group (SG) Shamit Chakravarti, Bhutan Resident Mission (BHRM), SARD
Project team leader	Kaoru Ogino, Principal Energy Specialist, SG-ENE, SG
Project team members	Andrew Bennett, Senior Counsel, Office of the General Counsel Esnerjames Fernandez, Associate Regional Cooperation Officer, Regional Cooperation and Integration Unit, South Asia Department Nargis Halimova, Social Development Specialist, Office of Safeguards (OSFG) Sajid Khan; Senior Financial Management Specialist; Public Financial Management Division; Procurement, Portfolio, and Financial Management Department (PPFD) Grace C. Macalisang, Operations Assistant, SG-ENE, SG Kirsteen Anne Mack, Procurement Specialist, Procurement Division 1, PPF Emma Marsden, Senior Environment Specialist, OSFG Kyla Matias; Associate Climate Change Officer; Climate Change Resilience, and Environment Cluster; Climate Change and Sustainable Development Department Louise McSorley, Social Development Specialist, Human and Social Development Sector Office, Sectors Group Noel Peters, Principal Investment Specialist (Climate Finance), Office of the Director General, Private Sector Operations Department Sonam Zam, Project Officer (Procurement and Implementation), BHRM, SARD
Peer reviewer	David Morgado, Senior Energy Specialist, SG-ENE

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CONTENTS

	Page
PROJECT AT A GLANCE	
I. PROJECT READINESS FINANCING	1
A. Rationale	1
B. Outputs and Activities	3
C. Ensuing Projects	4
D. Cost Estimates and Financing Arrangements	4
E. Implementation Arrangements	5
II. DUE DILIGENCE	5
III. THE PRESIDENT'S DECISION	6

ANNEXES

<http://www.adb.org/Documents/LinkedDocs/?id=56335-001-PRF>

1. Legal Agreements

PROJECT AT A GLANCE

Project Data			
Project number	56335-001	Project name	Green Power Project Readiness Enhancement
Country or borrower	Bhutan	Executing and implementing agency	Druk Green Power Corporation Limited
Sector office	Energy	Geographical location	Bhutan
Sector	Energy	Subsector	Large hydropower generation
Country economic indicators	http://www.adb.org/Documents/LinkedDocs/?id=56335-001-CEI	Portfolio at a Glance	http://www.adb.org/Documents/LinkedDocs/?id=56335-001-PortAtaGlance
Lending modality	Project Readiness Financing	Sustainable Development Goals	SDGs 7.2, 9.1, 13.1,17.3
Operational Priorities			
OP No.	OP Priority	Expected Value	Methods/Comments
OP 3.1.5	Low-carbon solutions promoted or implemented (number)	2	The PRF will prepare the design of two ensuing hydropower projects.
OP 3.2.5	New and existing infrastructure assets made climate and disaster resilient (number)	2	The PRF will design climate-adaptive hydropower projects.
OP 6.2.1	Service delivery standards adopted and/or supported in implementation by government and/or private entities (number)	1	The PRF will deliver an international best standard to integrate detailed engineering design with effective safeguard measures for project implementation.
Financing			
ADB Financing		Amount (\$ million)	
Regular ordinary capital resources loan		0.00	
Concessional ordinary capital resources loan		5.00	
Special Funds resources (ADF grant)		0.00	
Cofinancing		Amount (\$ million)	
		0.00	
Counterpart		Amount (\$ million)	
DGPC		0.15	
Total		5.15	
ADB Climate Financing			
ADB			
Adaptation		0.00	
Mitigation		0.00	
Cofinancing			
Adaptation		0.00	
Mitigation		0.00	
Total		0.00	
Climate Change			
Absolute GHG emissions (tCO ₂ e per year)			0
Relative GHG emissions (tCO ₂ e per year)			0
Climate Change Risk on the Project without Adaptation Measures:			Low
Private Sector Development			

Private capital mobilized (\$):		
Safeguards		
Category:	Environment:	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> FI
	Involuntary resettlement:	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> FI
	Indigenous peoples:	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> FI
Gender Equality		
Category:	<input type="checkbox"/> GEN (gender equity theme)	<input type="checkbox"/> EGM (effective gender mainstreaming)
	<input type="checkbox"/> SGE (some gender elements)	<input type="checkbox"/> NGE (no gender elements)
Poverty Targeting		
Category:	<input checked="" type="checkbox"/> General intervention	<input type="checkbox"/> Individual or household (TI-H)
	<input type="checkbox"/> Geographic (TI-G)	

Source: Asian Development Bank
This document must only be generated in eOps.

Generated Date:

I. PROJECT READINESS FINANCING

A. Rationale

1. **Scope.** The project readiness financing (PRF) is proposed to complete detailed engineering studies, environmental and social impact assessments, and bid document preparation for two hydropower projects: (i) the Bunakha hydropower project (180 megawatt [MW]), and (ii) the Nyera Amari hydropower project (404 MW). In 2019, these projects were included in Bhutan's power system master plan for 2040.¹ The PRF's scope is also aligned with the Asian Development Bank (ADB) country partnership strategy for Bhutan, 2019–2023.²

2. **Sector and macroeconomic issues.** Bhutan has significant potential hydropower reserves estimated at 23,760 MW, of which only 9.8% have been tapped, resulting in an installed generation capacity of 2,334 MW. This electricity is utilized for domestic consumption while the surplus is exported to India largely during the wet season from June to September.³ The revenue earning from power exports sustains the Bhutanese economy. Hydropower exports account for about 50% of total exports and contribute 30%–40% of the government's annual revenue. These revenues are the primary source of government spending on socioeconomic development for social services such as health care, education, and rural development. Thus, Bhutan has been incentivized to promote hydropower development as the key driver for inclusive economic growth. However, hydropower exports have experienced a decline since 2020 because of rising domestic electricity demand.⁴ Increased domestic consumption has led to a reduction in export and total revenues. The domestic demand growth will continue, primarily driven by industrial customers.⁵

3. **Demand growth.** Despite being a power surplus country on an annual basis, Bhutan faces a significant seasonal shift in its power situation. During the dry winter season (December–March), hydropower generation drops drastically to less than 20% of the installed capacity because of reduced river inflows. Since all hydropower plants in Bhutan use run-of-river generation, their water storage capacity is insufficient to meet seasonal fluctuations. This position has been exacerbated by the recent surge in demand, which has intensified cyclical power shortages. In the most recent winter period (December 2022–March 2023), Bhutan experienced its most severe power shortage. Domestic peak demand surged to 629 MW while the firm power capacity decreased to only 415 MW during the period.⁶ In the upcoming winter season (2023–

¹ Government of Bhutan, Ministry of Energy and Natural Resources. 2019. [Power System Master Plan 2040](#). Thimphu. The ministry also identified these projects for investment during the 13th five-year plan period (2024–2029).

² ADB. 2019. [Country Partnership Strategy: Bhutan, 2019–2023—Fostering Diversification and Reducing Disparities](#). Manila. The PRF scope is aligned with the strategy's priority for developing hydropower generation capacity to increase cross-border trade under pillar 2: improved connectivity for better access to information and markets.

³ The wet season can be called as rainy season or monsoon season.

⁴ From January 2023 to April 2023, Bhutan's domestic consumption rose by 46% compared with the same period in 2022, from 1,047 gigawatt-hours (GWh) to 1,526 GWh. During the same period, Bhutan's power exports fell by 78% to 65 GWh (5% of total generation during the period) from 543 GWh (36% of total generation) compared with 2022.

⁵ The demand growth is driven by power-intensive industrial customers (e.g., ferro-silicon, steel, cement, agro-base industries, and bitcoin mining operations), which accounted for about 75% of the total domestic load in 2022. Bhutan's industrial customers pay a higher electricity tariff than their cost of supply through high-voltage systems. This suggests that industrial customers are cross-subsidizing residential and commercial customers. However, the overall tariff rate is still attractive to power-intensive industries. Bhutan's average electricity tariff is low, at about Nu2.66 per kilowatt-hour (kWh) or \$0.032/kWh.

⁶ During the 2022–2023 winter period, the peak power deficits were attributed mainly to industrial customers. The peak demand of 629 MW was from bitcoin mining operations (40%), other industries (35%), and commercial and residential customers (25%). The power deficits were filled by power imports, and the extra import costs were charged to industrial customers as the power deficits were closely aligned with their large consumption (as a result, their

2024), the demand–supply gap is predicted to widen further because of increasing domestic demand.⁷ To compensate for these power shortages, Bhutan has resorted to importing power from India. However, the quantity of imports and their purchase prices have shown a significant upward trend since 2016.⁸ This situation has implications for Bhutan’s trade imbalance and Indian rupee reserve constraint.⁹

4. **Sector strategies.** In response to the winter power shortage issue, Druk Green Power Corporation (DGPC), the government-owned power generation company, plans to expand solar power generation as an alternative power source. Solar power facilities offer the advantage of rapid capacity addition because of shorter installation periods than hydropower plants. However, it is challenging to find suitable sites for large-scale solar power generation because of limited suitable accessible land in the country’s mountainous terrain. Consequently, the potential feasible solar power capacity is not sufficient to cover the current domestic power deficits. Therefore, DGPC maintains its development strategy of promoting hydropower development for both domestic consumption and power exports while diversifying its power generation types, including reservoir, pumped storage, and small hydropower plants in addition to utility-scale solar and rooftop solar types. The Bunakha project is designed as a reservoir type, primarily to address power deficits during the dry season and promote complementary operation with forthcoming solar projects.¹⁰ It can also export excess power to India during the wet season, effectively functioning as a large battery storage system to stabilize intermittent generation from solar and wind power in India. The Nyera Amari project is a run-of-river type, but it remains crucial for DGPC to continue increasing its generation capacity for power exports. This is because hydropower exports remain the primary exchequer for sustaining the government and the economy. This significance was reaffirmed during the coronavirus disease (COVID-19) pandemic as hydropower exports provided a resilient source of income for the country.

5. **Climate impacts.** Bhutan’s hydropower has gained recognition as a significant contributor to climate mitigation, particularly when it is exported and consumed in India. This is because India’s grid systems rely heavily on coal-fired power plants, contributing to high levels of carbon dioxide (CO₂) emissions. This also implies that Bhutan’s power imports from India carry a CO₂-polluting footprint. In this context, Bhutan’s hydropower development has the potential to contribute significantly to subregional climate change mitigation. However, hydropower projects face various complexities related to climate change adaptation, safeguard impacts, benefit and risk sharing coordination, and lack of financing for high-cost and long-gestation projects. Hydropower generation may be influenced by several climate-related factors, including changes in water availability; glacier retreat, leading to reduced snowmelt; and increased frequency and intensity of extreme weather events. Climate change can also lead to sedimentation and erosion, which can affect the efficiency of hydropower plants. Therefore, it will be crucial to prioritize

average tariff was increased from Nu2.66/kWh to Nu3.22/kWh during the 2022–2023 winter period). Under a power deficit situation, power supply is prioritized for residential customers, followed by commercial customers, then industrial customers.

⁷ Since 2021, the bitcoin mining operations have contributed to increasing power deficits during the winter. However, excluding electricity consumption from such operations, the peak power deficits are projected to increase because of growth from other industries and commercial and residential customers.

⁸ The market prices of imported electricity have shown significant volatility, ranging from ₹2.3/kWh to ₹7.4/kWh (₹4.9/kWh on average), depending on the trading time and conditions. The average import price is higher than the average export price (at ₹3.1/kWh).

⁹ As a landlocked country, Bhutan is heavily dependent on imports of many products from India. In case Indian rupee reserves get low, the government has occasionally restricted imports of some products.

¹⁰ ADB. [Bhutan: Renewable Energy for Climate Resilience Project](#). In 2022, ADB financed Bhutan’s first utility-scale solar photovoltaic plant with a generation capacity of 17.38 MW, which is expected to support subsequent solar projects.

climate-adaptive design, minimize safeguard impacts and risks and life-cycle costs, and maximize operational efficiency when developing sustainable hydropower projects in Bhutan.

6. **ADB value addition.** In Bhutan, ADB financed the Dagachhu hydropower plant (126 MW) with the Austrian Export Credit Agency and a local financial institution.¹¹ This project marked a significant milestone as it was the first public–private partnership (PPP) in Bhutan’s infrastructure segment. Further, it achieved global recognition as the world’s first cross-border Clean Development Mechanism project. ADB has continued its support by financing the Nikachhu hydropower project (118 MW) through a syndication with Indian commercial banks.¹² For these two power export projects, ADB played a pivotal role in fostering innovation in project structuring through PPP, export credit, carbon finance, nonsovereign financing syndication, and cofinancing with both international and local financiers. ADB remains committed to supporting sustainable hydropower development in Bhutan by exploring diverse development types and financing mechanisms, and fostering collaboration with other development partners. While the previous two projects have experienced delays in implementation, the PRF’s detailed engineering studies are expected to significantly enhance the readiness for implementation.¹³ In these design studies, the focus is on maximizing hydropower generation during peak times and implementing cascaded operations to improve both operational and financial viability.¹⁴ For example, the Bunakha plant can be strategically operated with the existing two hydropower plants downstream, while the Nyera Amari project can optimize its operations with two plants situated upstream and downstream of the river. Additionally, both projects can explore power sale arrangements to meet peak demand. The Bunakha plant in western Bhutan will be the closest to the capital among the major hydropower plants. In contrast, the Nyera Amari plant will be situated in the eastern region, which is farther from the capital and has been historically less developed despite having a larger population and higher poverty incidence than other regions.¹⁵

B. Outputs and Activities

7. The PRF will support consulting services for detailed engineering design, environmental and social impact assessments, and bidding documents for the following outputs: (i) Bunakha hydropower project prepared, and (ii) Nyera Amari hydropower project prepared. The reservoir type Bunakha project will be the first of its kind in Bhutan. The Nyera Amari project is a run-of-the-river type designed for peak power generation with cascaded operations,¹⁶ and is expected to consist of two plants to be installed with capacities of 112 MW and 292 MW. Their feasibility studies were conducted earlier, and further updates and detailed analyses are required to ensure higher project readiness in preparation for financial arrangements. In addition to the PRF,

¹¹ ADB. 2008. [*Report and Recommendation of the President to the Board of Directors: Proposed Loans, Asian Development Fund Grant, Technical Assistance Grant, and Administration of Grant to the Kingdom of Bhutan for the Green Power Development Project*](#). Manila.

¹² ADB. 2014. [*Report and Recommendation of the President to the Board of Directors: Proposed Loans, Grant, and Technical Assistance Grant to the Kingdom of Bhutan and Tangsibji Hydro Energy Limited for the Second Green Power Development Project*](#). Manila.

¹³ The previous projects were delayed mainly because of unforeseen geological constraints. The PRF’s studies will undertake more detailed engineering, including more thorough geological surveys and assessments.

¹⁴ Cascaded operations allow multiple plants in the same river to generate more power sequentially and progressively.

¹⁵ This approach will balance ADB development support geographically, following the Dagachhu hydropower plant in the western region and the Nikachhu hydropower plant in the central region.

¹⁶ Peak power generation plants are designed to meet short-term and high-demand periods (at night in the case of South Asia). These plants are typically smaller and have lower fixed costs than baseload plants. However, the size and cost of run-of-river plants can vary depending on factors like the river’s flow and the plant’s capacity. Therefore, the PRF studies will assess the detailed engineering design of the facility with thorough hydrological data analysis to determine the technical and financial advantages in terms of adjustable discharge, operational flexibility, cost, and generation output.

separate technical assistance (TA) will be prepared in 2024 to address other aspects, including the government's debt sustainability, macroeconomic impacts, Bhutan's overall power dispatch options and strategies for domestic electricity consumption and international power trade, commercial and contractual arrangements (e.g., power offtake arrangements), project financial viability assessments, cofinancing availability, and financial structuring. Financial structuring of the ensuing projects will be assessed following the findings of the TA.

C. Ensuing Projects

8. The PRF will support two ensuing projects: (i) the Bunakha, and (ii) the Nyera Amari. The project with the highest readiness is expected to be considered for approval in 2025.¹⁷ The proposed approval date of the other ensuing project will be subject to the feasibility study under the PRF and the forthcoming TA. The government has been advised that providing this PRF does not commit ADB to financing any ensuing project.

D. Cost Estimates and Financing Arrangements

9. The PRF is estimated to cost \$5.15 million (Table 1).

Table 1: Summary Cost Estimates

Item	Amount ^a (\$ million)
A. Base Cost^b	
1. Bunakha hydropower project prepared	1.78
2. Nyera Amari hydropower project prepared	2.72
Subtotal (A)	4.50
B. Contingencies	0.54
C. Interest During Implementation	0.11
Total (A+B+C)	5.15

^a Includes taxes and duties of \$0.15 million.

^b In mid-2023 prices as of 15 September 2023.

Source: Asian Development Bank.

10. The government has requested a concessional loan of \$5.00 million from ADB's ordinary capital resources to help finance project preparation and design activities. The loan will have a 32-year term, including a grace period of 8 years; an interest rate of 1.0% per year during the grace period and 1.5% per year thereafter (the interest and other charges during implementation to be capitalized in the loan), and such other terms and conditions set forth in the draft loan and project agreements. The government will make the loan available to DGPC under a subsidiary loan agreement on terms and conditions acceptable to ADB.

11. The summary financing plan is in Table 2. ADB will finance the expenditures in relation to consulting services, surveys, modeling, partial contingencies, and financial charges during implementation. DGPC will finance security arrangements, other management costs, counterpart staff, taxes and duties, and contingencies, if any, beyond the financing plan.

¹⁷ The project readiness can be assessed by due diligence studies in comprehensive terms including technical, financial, economic, social and environmental aspects.

Table 2: Summary Financing Plan

Source	Amount (\$ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (concessional loan)	5.00	97.1
Druk Green Power Corporation ^a	0.15	2.9
Total	5.15	100.0

^a Includes taxes and duties, and excludes in-kind contributions by Druk Green Power Corporation.
Source: Asian Development Bank.

E. Implementation Arrangements

12. The implementation arrangements are summarized in Table 3. DGPC will procure consulting services following the ADB Procurement Policy (2017, as amended from time to time) and the Procurement Regulations for ADB Borrowers (2017, as amended from time to time).

Table 3: Implementation Arrangements for Project Readiness Financing

Aspects	Arrangements		
PRF implementation period	April 2024–May 2026		
Estimated PRF completion date	30 November 2025		
Management			
Executing agency	DGPC		
Consulting services	QCBS (Output 1)	87 person-months	\$1,930,000 ^a
	QCBS (Output 2)	143 person-months	\$2,960,000 ^a
Advance contracting and retroactive financing	Advance contracting will be used to commence consultant recruitment before approval and to accelerate consulting services. ADB allows retroactive financing for expenditures incurred before loan effectiveness, but not earlier than 12 months from the date of legal agreement, subject to a maximum amount equivalent to 20% of the loan amount		
Disbursement	Disbursements under PRF will follow ADB's <i>Loan Disbursement Handbook</i> (2022, as amended from time to time) and detailed arrangements agreed between the government and ADB.		

ADB = Asian Development Bank, DGPC = Druk Green Power Corporation, PRF = project readiness financing, QCBS = quality- and cost-based selection.

^a Includes contingencies of 8.7%.

Source: Asian Development Bank.

II. DUE DILIGENCE

13. **Technical.** The PRF will support DGPC in conducting detailed engineering designs to update each of the project feasibility study reports. It will be crucial to reflect the social and environmental resilience and the climate change proofing design.¹⁸ It will also be necessary to assess effective sediment flushing management, optimal cascaded operations, and least-cost transmission networks. The hydropower project sites have good physical accessibility, which can reduce the costs of associated facilities such as access roads. However, further engineering surveys and assessments will be carried out mainly to examine and assess more geological and hydrological data.

14. **Governance.** ADB has provided DGPC with TA for its institutional capacity development. DGPC follows the corporate governance code developed on globally accepted corporate governance standards.¹⁹ DGPC has experience of managing ADB-financed projects through its subsidiaries. Based on the recruitment of a consulting firm for the PRF with no pilot-testing

¹⁸ The Paris Agreement alignment will be assessed during the PRF implementation.

¹⁹ Based on the Organisation for Economic Co-operation and Development's corporate governance principles.

activities, the project procurement risk is classified *low*. The financial management assessment concluded that the overall pre-mitigation financial management risk of DGPC is *medium*.²⁰ The integrity due diligence assessment also indicated no significant risks. ADB's Anticorruption Policy (1998, as amended from time to time) and relevant guidelines and procedures were explained to and discussed with the government and DGPC.

15. **Safeguards.** Since the proposed activities consist of consulting services alone without any pilot testing approaches, the PRF has not been categorized following ADB's Safeguard Policy Statement (2009).²¹ The PRF aims to support the development of sustainable, and socially and environmentally responsible hydropower projects. The PRF will help DGPC (i) determine if the project design alternatives meet ADB's requirements, particularly with respect to dam safety and natural and critical habitats; (ii) update and prepare environmental and social impact assessments for each project following ADB's Safeguard Policy Statement (2009) and national laws; (iii) propose design alternatives for avoiding and/or minimizing potential adverse safeguard impacts to the extent possible; (iv) integrate safeguard measures into the engineering designs; and (v) ensure that all bidding documents and contracts include safeguard requirements.

III. THE PRESIDENT'S DECISION

16. The President, acting under the authority delegated by the Board, has approved the loan of \$5,000,000 to the Kingdom of Bhutan for the Green Power Project Readiness Enhancement, from the ordinary capital resources of the Asian Development Bank (ADB), in concessional terms, with an interest charge at the rate of 1.0% per year during the grace period and 1.5% per year thereafter; for a term of 32 years, including a grace period of 8 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements; and hereby reports this action to the Board.

²⁰ Since DGPC has implemented the ADB-funded projects through its subsidiaries, its staff may not be familiar with ADB's financial management requirements; hence, ADB will provide trainings to DGPC financial management staff.

²¹ The safeguard classifications for the ensuing projects are likely to be A for environment and involuntary resettlement and C for indigenous peoples, which will be confirmed during PRF implementation. In terms of involuntary resettlement impacts, it was preliminarily assessed that the Bunakha project will affect 27 households, including two to be physically relocated, and that the Nyera Amari project will affect 247 households with no physical relocation. The severity of the impact on these households will be further assessed. DGPC indicated that broad community support exists for each project based on public consultations conducted during 2012 for Bunakha and during 2015–2016 for Nyera Amari. Given the time that has passed since then, additional meaningful consultations will be undertaken.