

RISK ASSESSMENT AND RISK MANAGEMENT PLAN

Risk Description	Risk Assessment	Mitigation Measures or Risk Management Plan
Construction and completion	Medium	<p>The completion risk of any hydropower projects falls mainly on geological conditions and their relevant time and cost overruns. Many geological investigations and drilling studies undertaken for more than 3.5 years during project preparation found 80% of the rock tested to be in good order. The detailed project report prepared by a qualified engineering firm and the PPTA conducted due diligence studies including extensive field and laboratory investigations, such as hydrological, geological, geotechnical and geophysical, sedimentation, mechanical, and electrical requirements. Uncertainties of geological conditions remain as residual risks of construction delays and cost overruns, which could be affected by price increases in labor and materials. To address these risks, contingencies total \$32 million or 22% of the base cost. Contractual mitigations are included in engineering, procurement, and construction contracts with liquidity damage clauses on a milestone basis. DGPC has adequate experience in procuring and managing contractors for construction of hydropower projects, demonstrated with Dagachhu hydropower plant implementation. Experienced staff of Dagachhu will support project construction. Project site accessibility is very good, i.e., along the main east–west national highway close to access roads and transmission connections.</p>
Operations	Low	<p>The plant’s run-of-river hydropower operations are straightforward. DGPC has operated five run-of-river hydropower plants (HPPs) with capacity of 60 MW, 64 MW, 126 MW, 336 MW, and 1,020 MW. THyE will be staffed with experienced staff from DGPC and its subsidiaries—management and staff with adequate experience in operating HPPs. DGPC plans to select a reputed private joint venture partner with extensive experience in similar project development. The project’s powerhouse will release water discharge to the Mangdechhu HPP reservoir (720 MW, run-of-river), expected to be available in 2017. The reservoir, under construction, is large enough to absorb the project’s water release (confirmed by the Mangdechhu HPP’s dam safety assessment under the PPTA due diligence studies). Project operation can begin regardless of completion of Mangdechhu HPP construction, as the existing Mangdechhu’s diversion tunnel could easily absorb the project’s water discharge.</p>
Offtake	Low	<p>A long-term 25-year PPA was agreed with PTC, the leading power trading company in India. DGPC has already exported almost 75% of its generation through other PPAs with PTC. The project’s PPA is a take-or-pay contract in fixed volume terms for 80% of salable power; the volume will be less than 1% of the entire PTC trading power, which PTC can easily absorb. Given the prolonged power shortage in India, all of the project’s power will be readily absorbed. If PTC fails to pay as per the PPA, the right for third party sale will be triggered, but PTC’s financial position is adequate as reflected in its credit rating, i.e., A1+ (low credit risk) from an Indian credit-rating agency. The offtaker’s credit risk is further mitigated by adequate payment security mechanisms in the PPA. While 20% of salable power will be on a merchant basis (the PPA has no sales or purchase obligations), this will serve as a cushion for unforeseeable delays or reductions in the project’s generation. Given the present and future power demand–supply gap in India, the merchant power sales of this small amount can easily be absorbed in spot trading. The recent average spot prices for power trading in India are higher than the project’s PPA tariff. The sensitivity of the revenues from power sales</p>

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Transmission	Low	<p>was tested and the result showed that THyE would keep the breakeven point even if it encountered 15% revenue reduction from the base-case revenues for 25 years. This scenario is considered unlikely.</p> <p>The 132 kV transmission line works are contracted with BPC for the project's full annual operations in 2020. The nearest substation under construction is on track to be available in 2017 as part of the ongoing Mangdechhu HPP. Once the project's transmission line (18.6 km) is connected to the substation, the project's power can alternatively be exported through existing grid connections to India. The project's power will be mostly evacuated to India through the Mangdechhu–Goling–Jigmeling–Alipurdwar transmission line corridor (400 kV) under construction for Mangdechhu operations scheduled in 2017.</p>
Hydrological	Low	<p>The hydrological risk primarily comprises drought risks, which can significantly affect hydropower generation. The project's design energy is based on 22-year hydrological data; the risk of any deviation is considered minimal. The financial analysis is based on the design energy of 90% dependability (P-90 generation and plant availability of 95%), which is quite conservative. This means that more water is likely to be available for 90% of the operating time than designed on the hydrological data. The assessment of potential future hydrological impacts, using various climate models found the project to be hydrologically sound. It projects that annual water flow in the Nikachhu watershed would increase by an average by 1%–3% for non-monsoon months and 5%–8% for monsoon months to 2041–2060.</p>
Other climate change (disaster)	Low	<p>The climate change modeling analysis was extended to risks other than potential hydrological issues, including risks of possible floods, earthquakes, landslides, and glacial lake outbursts. The engineering design and environmental management plan are adaptive to extremely severe conditions created by such events. The analysis concludes that overall climate change is unlikely to impose negative effects on the project and its operation. Details of the assessment are in the climate change impact assessment. Effective adaptation measures will be adopted for the project's structures, facilities, and adjoining areas to address such potential disasters as floods, landslides, and earthquakes. The dam safety design was reviewed and continues to be monitored by DGPC's dam safety committee and a panel of experts. The project will include an early warning system and awareness programs for public safety in spite of no human settlement along the river downstream to the confluence with the main river of the Mangdechhu.</p>
Funding and debt repayment	Low	<p>The cofinancing loan from Indian commercial banks has been approved in principal. The cofinancing framework was agreed and its signing is a disbursement condition of ADB financing. To cover its own equity requirement, DGPC has generated adequate net profits (more than \$85 million in 2013), and sufficient cash and cash equivalents (around \$50 million). DGPC's current and projected financial position is sufficient to meet its capital contribution requirements for the project. DGPC and the government ensure adequate own funding for the project in the loan and financing agreements. Given the financial analysis and debt sustainability assessment, THyE, DGPC, and the government demonstrate self-sustaining viability to fully meet debt services.</p>
Currency	Medium	<p>Since the project is earned in Indian rupees from power exports, foreign debt from the OCR loan will have a currency exchange rate fluctuation</p>

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Safeguards	Low	<p>risk if the Indian rupee depreciates. The Indian commercial bank cofinancing in local terms will reduce the overall debt service risk. The PPA stipulates that tariff adjustments in dollar terms may be introduced sometime in the future if both parties agree. Given the currency risk assessment, THyE will fully meet the debt service requirements even under an extreme scenario of continued annual 7% depreciation of Indian rupees over the debt repayment period. To mitigate the residual risks arising from the foreign debt services, THyE will adopt a foreign exchange fluctuation reserve fund. THyE and DGPC will also explore periodic currency hedging contracts once this becomes a feasible option in the financial market as covenanted.</p> <p>All safeguard documents are in accordance with ADB's Safeguard Policy Statement (2009). The compensation relating to resettlement will be fully paid in a satisfactory manner to the affected people. The current mitigation measures in the environmental management plan are appropriate and adequate to contain environmental impacts during project construction and operation, and environmental monitoring will be carried out during the project. To ensure minimum ecological flows, particularly in the lean seasons, the recommended level of 10% will continue to be monitored and finalized during implementation to ensure the habitat requirements combined with integrated water resources management, including relevant plant operations in the river basin. The ADB financing and loan agreements will ensure compliance with safeguard measures and implementation requirements, and an attached TA will support the safeguard activities. Extensive consultations and mitigation plans are provided. The grievance redress committee was formed and an independent panel of experts is to be established to monitor and audit implementation of safeguard activities.</p>
Financial management	Low	<p>DGPC has adopted comprehensive corporate policies and manuals covering accounting and financial management, inventory and procurement management, internal audit, human resources, and safeguards, along with enterprise resource planning systems. The external independent auditor reported that DGPC and its subsidiaries have adequate internal control systems, suitable budgetary systems, adequate competitive bidding, and sufficient organizational system control to carry out their operations in an orderly and efficient manner. THyE will follow the same policies and practices.</p>
Procurement	Low	<p>Increased transparency, efficiency, and competition are assured due to ADB requirements for major construction works. ADB, DGPC, and THyE will conduct regular site inspections and reviews of the quality and timeliness of progress on contracts where applicable.</p>
Corruption	Low	<p>Increased transparency and accountability are assured due to ADB requirements and regular stakeholder consultations. ADB loan agreements ensure that ADB's Anticorruption Policy and its specific measures are conformed with. ADB will ensure full disclosure of project-related information on the website, and monitoring of the statement of expenditure by ADB.</p>
Overall	Low	

ADB = Asian Development Bank, BPC = Bhutan Power Corporation, DGPC = Druk Green Power Corporation, kV = kilovolt, MW = megawatt, OCR = ordinary capital resources, PPA = power purchase agreement, PPTA = project preparatory technical assistance, PTC = Power Trading Corporation of India, TA = technical assistance, THyE = Tangsibji Hydro Energy.

Source: Asian Development Bank.