PROJECT INFORMATION DOCUMENT (PID)
APPRAISAL STAGE

Report No.: AB4459

Project Name	Vishnugad Pipalkoti Hydro Electric Project
Region	SOUTH ASIA
Sector	Power (50%); Renewable energy (50%)
Project ID	P096124
Borrower(s)	THDC India Limited
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Environment Category	[X] A [ ] B [ ] C [ ] FI [ ] TBD (to be determined)
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1. Country and Sector Background

1. The limited access to electricity and the poor quality of power supply in India have long constrained the country's human and economic development. While there has been some recent progress in addressing these chronic problems, some 44% of the population of India is still without access to electricity; the gap between the demand and supply of electricity remains persistent; and irregular, unreliable and inadequate power supply continues to constrain the growth of the economy. In the estimate of the Ministry of Power, the country will need to add some 150,000 MW of generation capacity over the next decade—a doubling of India's current installed capacity—to meet the forecasted demand for electricity.

2. In recent decades, India has built mainly new thermal plants, with the result that the share of hydropower in the total installed capacity has been reduced to about 24%, which is suboptimal from a system management perspective. The government's plans to meet India's need for electricity give prominence to tapping the country's undeveloped hydropower potential, which is estimated at about 120,000 MW. This will eventually bring hydro's share in the total generation mix to 40%. The government plans to develop one-third of this total hydro potential (about 30,000 MW) over the coming decade.

3. The advantages of hydropower that prompted GOI's decision are well known: (i) low-cost generation from a renewable source; (ii) an important contribution to the low-carbon growth agenda; and (iii) the power system management benefits of hydropower plants through their ability to start up and shut down quickly (as opposed to thermal and nuclear plants). At the same time, these attractive qualities are diminished by a legacy, in India as in other countries, of large cost- and time-overruns and inadequately addressed environmental and social impacts. Moreover, the practice of recent years of allocating projects in the same river basin to several different developers has added another dimension of complexity to the general environment. Coordination among developers, which is vital to ensure the optimal functioning of cascaded hydropower systems that have inherently shared costs and benefits, is currently weak.

4. In recent years, important legislative and policy reforms have been enacted in India with respect to the power sector in general and hydropower in particular. While the ground-breaking Electricity Act (2003) seeks to improve the efficiency and accountability of the sector, the National Electricity Policy (2005; NEP) and the Integrated Energy Policy (2006; IEP) are intended to facilitate the goals established in the Act by detailing policy on specific issues. There have been noteworthy recent revisions to the national Hydropower Policy, including a recommended increase of 1% of the current 12% "free power" royalty paid by operating projects to home states, to be earmarked for local area development; and clarification of the percentage of output from merchant power plants that is not subject to economic regulation.

5. Although the Central government plays an important role in the hydropower sector through national policy and planning, and through its ownership of the several Central power sector companies that are significant producers of hydroelectric power, the Indian Constitution gives the states primary rights over the waterways that pass through their territories. The acceleration of hydropower development has posed a particular challenge for the states, which generally have more limited financial and technical capacity than the Central government. As a result they have found themselves in uncharted territory with respect to the need to develop specific mechanisms to implement broad policy guidelines (such as for benefits-sharing), and to oversee the activities of numerous public and private developers of several river basins. Some of the most acute gaps have been in the states' ability to coordinate project design, development and operation from a river basin perspective and to fully assess and manage the possible cumulative impacts of such widespread hydropower development.

6. The challenge is particularly acute for Uttarakhand, a young state created in 2000 from the hill regions of Uttar Pradesh that is in the process of forming the institutions needed to manage the complex hydropower development program. The Alaknanda River, one of the major tributaries of the Ganges, is one of the key rivers earmarked for hydropower development in the state. Some 20 hydropower projects are slated for development on the Alaknanda River and its tributaries, including the proposed Vishnugad Pipalkoti Hydro Electric Project (VPHEP).

7. Following an increasing awareness, in government and in the public at large, of the extent of the challenge of coordinated development and of the need for a more informed understanding of the likely cumulative and induced impacts of large-scale hydro development, the Government of India commissioned two studies to assess these cumulative impacts on the Bhagirathi and Alaknanda basins. The initial findings of these assessments became available in April 2011 and the Government of India is in the process of considering revisions to the environmental

regulations pertaining to hydropower development, including the likely enforcement of a higher minimum flow regime and additional measures for mitigating impacts on wildlife in the area.

2. **Objectives**

8. The primary development objective of the proposed project is to increase the supply of energy to India's national grid through the addition of renewable, low-carbon energy from the Vishnugad Pipalkoti Hydro Electric Project. A secondary development objective is to support capacity-building at THDC India Limited with respect to the preparation and implementation of economically, environmentally and socially sustainable hydropower projects.

2. Rationale for Bank Involvement

9. To supplement the available public finance and help meet the significant capital requirements of the planned hydropower generation capacity expansion, the Government of India and individual state governments have encouraged private sector investment in the hydropower sector. While private companies have shown a strong initial interest in the hydropower sector, their experience to date of developing and operating hydropower plants in India is limited and mixed, and the public sector will continue to play the dominant role in the expansion of hydropower generating capacity. The Government of India has approached the World Bank to help bridge the funding gap for certain select public sector companies.

10. The Project also responds to the Ministry of Power's desire to build the capacity of the public sector hydro companies, to bring them to the level of top-performing public companies in the power sector like POWERGRID and National Thermal Power Corporation. MOP requested Bank support for helping THDC India Ltd. (THDC) develop into a leading public hydropower company by translating its corporate policies and practice into sustainable systems and procedures and enhancing its institutional capacity for improved design and implementation of environmental and social programs.

11. The proposed Project thus contributes to several higher level objectives, namely: (i) contribution to India's economic and human development through augmentation of the country's power infrastructure; (ii) demonstration of a model of large-scale infrastructure project development that incorporates recent improvements in sustainable development and helps move the industry standard towards internationally recognized good practices; (iii) strengthening the capacity of a major hydropower generation company; and (iv) supporting India's low carbon growth strategy

3. Description

12. The Vishnugad Pipalkoti Hydro Electric Project (VPHEP) has been designed as a 444 (4 x 111) MW, run-of-river water diversion scheme on the Alaknanda River in Uttarakhand. The Project is being developed by THDC India Limited, a joint venture of the Government of India and the Government of Uttar Pradesh. The Project has been designed to generate approximately 1,800 GWh (Gigawatt-hours, or million kilowatt-hours) in a statistically average year.

13. The major civil works required by VPHEP include a 65-meter diversion barrage, a 13.4-km headrace tunnel which will carry water to the underground powerhouse, and a 3-km tail race tunnel which will return the water to the river. The diversion barrage will help create a small pondage to store some 4.9 hours of average flow to allow the Project to meet its generation obligations during peak demand times. This will submerge only a small amount of unused government land, as the Project is located in a deep, narrow and uninhabited gorge. No fields, houses or other infrastructure will be affected by the pondage. All water diverted from the river will be returned to the river approximately 18 km below the point of diversion.

14. A number of technical, environmental and social studies and impact analyses have been conducted to assess and help mitigate potential direct and indirect impacts from the Project. Located in the rugged reaches of the Middle Himalayas, the Project area covers steep, sparsely vegetated slopes. The project lies in the vicinity, but outside, two protected areas. The eastern boundary of the Kedarnath Wildlife Sanctuary, which was established primarily as a sanctuary for the Himalayan Musk Deer, falls in the valley adjacent to the Alaknanda River Valley. The distance from this boundary to the nearest surface project infrastructure, the diversion dam, is approximately 5.2 kilometers "as the crow flies"; the terrestrial distance is somewhat greater as a result of the steep valleys that are characteristic of this region. It is expected that the impact on wildlife from the sanctuary will be negligible, as movement of wildlife from the adjacent valley to the Alaknanda Valley is limited by the sheer walls of the valleys. Mitigation measures for impacts on wildlife have been incorporated in the EMP and will be revised as needed on the basis of monitoring.

15. The project dam site touches on the boundary of the transition zone of the Nanda Devi Biosphere Reserve, a UNESCO World Natural Heritage Site. The core zone of NDBR has an area of 712 sq. km and includes two national parks. The buffer zone has an area of 5,148 sq. km. and surrounds the core zone. The buffer zone, in turn, is surrounded by the transition zone with an area of 584 sq. km. The core zone is at a distance of 36 km from the VPHEP dam site. Impacts on NDBR are expected to be insignificant. The only impacts on the transition zone are likely to occur during the construction of the dam, when the noise level in the area is likely to increase. However, as noted in the EA, this impact will be intermittent, temporary and localized

16. As a run-of-river project located where the Alaknanda River runs through a deep gorge, VPHEP has comparatively limited land needs impacting private landowners. Of the total 141.53 hectares of land being acquired under the Project, only 22 percent is privately-owned land; the rest is government land. Even this quantum of private land acquisition exceeds the Project's actual requirement because the developer, THDC, responded to the demand of a local community – the village Haat which is closest to the proposed powerhouse – that additional land be acquired from the village and all those residents wishing to relocate be helped to do so in view of the expected impact of construction on the village. THDC agreed to the village's demand for the voluntary resettlement of 242 families and worked out a generous compensation package on par with those 23 families who were losing their homes involuntarily. Eleven families from the hamlet of Hatsari chose not to relocate so THDC shifted the location of the switchyard to already-acquired government forest land, and also realigned an access road so as to minimize the impact on these families.

17. Although the Project will cause a certain amount of disruption to the lives of some people living in the area, it will also bring positive benefits to the local population. In an innovative mechanism for sharing the benefits of development with the local communities, THDC has decided to devote 1 percent of the construction cost of the VPHEP (approximately Rs 310 million) to building small infrastructure and other development works in the 19 project-affected villages, including drinking water facilities; link roads; mobile health units; distribution of fruit bearing tree saplings; and scholarships for meritorious students. Moreover, once the Project is operational, the Project will provide 12 percent of power generated free of cost to the host state of Uttarakhand. The Project will also supply 100 units (kilowatt-hours) of free electricity each month to every project-affected household for 10 years after commencing generation.

18. Bank-financed support to the Project will comprise two components: (i) construction of the 444 MW Vishnugad Pipalkoti Hydro Electric Project; and (ii) technical assistance for institutional strengthening and capacity-building to assist the Borrower, THDC India Ltd., in addressing the needs of its major expansion program, including assistance in adopting recognized good practices in hydropower development and operations, and improving the corporate capacity for project preparation and operation.

4. Financing

Source:	($m.)
Borrower	274
International Bank for Reconstruction and Development	648
Total	922

5. Implementation

19. THDC will be responsible for project implementation, with support in some areas (e.g. catchment area treatment, land acquisition and compensation, participation in grievance redress mechanism, etc.) by the relevant agencies of the Government of Uttarakhand (GoU) in keeping with their statutory authority. Detailed discussions regarding the implementation and monitoring arrangements have been held with both THDC and GoU.

6. Sustainability

20. The sustainability of the investment and technical support is expected to be high, given the likelihood of continued demand for reliable power supply in the northern region of India. The power generated by VPHEP will be fully dispatched, because of its competitive price and the inherent flexibility offered by a hydropower station to meet fluctuations in demand. THDC has developed good expertise during the operation of the Tehri Dam Stage 1 project, and has been running the plant profitably for more than two years.

21. A challenge for THDC will be to ensure that it has the necessary manpower and skills to implement and operate VPHEP while it is simultaneously undergoing rapid transition and growth, and developing several other projects it has in its pipeline. Under the project's significant institutional building component, the World Bank project is helping the company

identify skill-gaps in this context and work out suitable capacity-building measures.

22. The threat to the Project's sustainability that could be posed by the failure of its state utility customers to pay their bills in full and on time has been largely mitigated by the securitization mechanism introduced by GOI which has substantially tightened payment discipline in the power sector.

7. Lessons Learned from Past Operations in the Country/Sector

23. The Project design reflects the experiences and important lessons learned from hydropower projects worldwide as well as in India. These lessons have in common the objectives of avoiding costly delays in project preparation and implementation, and of ensuring the long-term sustainability of the projects.

Procurement strategy: On the basis of its experience in constructing the Tehri Dam, which required the management of dozens of contracts and imposed an enormous contract management burden on the company, THDC was originally inclined to implement VPHEP on the basis of a single Engineering, Procurement, Construction (EPC, "turnkey") contract. Upon consideration of the poor international experience with the application of this model to hydropower projects, and the unwillingness of reputable contractors to assume joint and several liability for all project components under a single joint-venture, it was decided to construct the project on the basis of two EPC contracts, one for civil works and hydro-mechanical equipment, and one for electro-mechanical equipment, with suitable arrangements for the interface between the two contractors and for the allocation of risks. This procurement packaging has made it possible to reduce the number of packages to the minimum practicable level while encouraging international competition.

Pre-qualification of bidders: In the past the Bank tended to enter projects when the PQ process was well underway or completed, and the application of the rigorous Bank procedures sometimes resulted in the need to eliminate contractors who had been pre-qualified. An early involvement allowed the Bank and THDC to work together to ensure that rigorous financial and technical pre-qualification criteria were employed. This has proven to be particularly important in mitigating the risk of an applicant claiming the experience of parent or subsidiary companies for complex works that the applicant does not in fact possess.

Risk allocation: Suboptimal allocation of risks between owners and contractors has been at the core of contract disputes that have plagued hydropower projects in the past, leading to significant cost- and time overruns. For VPHEP, a detailed Risk Register has been prepared that defines various risks, identifies measures to be taken in case the risk materializes, and allocates the risk to the parties to the contract, allowing them to make better estimates of potential costs they could face, and to take account of the above in insurance cover. An essential component in the risk allocation has been the preparation of a Geo-technical Baseline Report (GBR), the first of its kind for a hydropower project in India, which provides to the bidders a baseline for the expected geological conditions.

Contract management: Good contract management is key to managing project implementation and avoiding disputes with contractors that can be timely and costly. Using loan proceeds, THDC will engage a Design Review Consultant (DRC) who will be responsible for the detailed hydraulic and geo-technical design; for reviewing the detailed designs and drawings submitted by the two EPC contractors; and for advising/assisting THDC to carry out its Project management functions and to help to resolve any differences between the Owner and the Contractors that may arise during implementation of the Project (without resorting to the Dispute Review Board). The Bank is also helping build THDC's capacity on this front through special training and experience sharing sessions.

Sediment handling: The high sediment load of the Himalayan rivers is one of the most intractable operational problems of hydropower plants operating on these rivers. The sediment erodes the turbine runners, eventually making power generation impossible. A sediment handling optimization study was carried out to optimize the techno-economic configuration of the sediment handling arrangements and has been included as part of the bid documents for the civil works and hydro-mechanical equipment works contract.

Tunneling technology: At 13.4 km, the head race tunnel of VPHEP is one of the single largest components of project cost. Consequently, the actual tunneling rates achieved during project construction will be a significant determinant of actual project cost**s**. The Project cost approved by the GOI has been based on the use of the conventional drill and blast method (DBM), which in the Himalayas has been preferred over the alternative technology based on the use of a tunnel-boring machine (TBM). TBM technology offers the possibility of a much faster and more predictable tunneling rate than DBM, but is most effective in relatively uniform geological conditions, which are not typical of Himalayan geology. However, detailed evaluation of the geology over the length of the headrace tunnel has indicated that geological conditions are favorable for a TBM drive. For this reason, and because TBM significantly reduces the footprint of the project (as fewer access facilities are required) and reduces the social impact of the construction (blasting and vibrations are greatly reduced), THDC have decided to mandate that most of the length of the HRT will be driven by a TBM. Detailed contingencies measures have been laid out in case difficulties are encountered with deploying the TBM.

Need for adequate resettlement planning, consultation and monitoring. One of the most sensitive aspects of hydropower development is the social impact of the development. While the negative impacts of VPHEP are comparatively low (as there is only small pondage and the project's land acquisition needs are not great), there will be a small amount of involuntary displacement and the project impacts during construction will be experienced over a wide area. In order to augment its capacity for managing social impacts, THDC has engaged two social workers who are posted at site, and has hired a reputed NGO whose staff speak the local language, Garhwali, to facilitate the implementation of the Resettlement Action Plan.

Need for effective, ongoing communications with stakeholders: Experience has shown that development projects in general, infrastructure projects in particular, and hydropower projects perhaps most of all require early and continuous communication between the

implementing authorities and all other stakeholders. In this way the benefits of the Project can be widely understood and both real and perceived concerns of stakeholders can be taken into account. This in turn contributes to better design and sequencing of the Project, larger stakeholder support for it, and smoother implementation. THDC and the Bank have taken cognizance of this factor, and have worked together to ensure that effective and credible two-way channels of communications are set up between the VPHEP authorities and stakeholders, especially focusing on project-affected people. Two Project Information Centers (PICs) were set up during the project preparation period to increase the outflow of project-related information outflow and to gather feedback and concerns from project-affected people. Regular interactions with local communities, held with the help of two social workers and a reputed NGO hired to act as an interface with villagers, have informed the design and implementation of project activities concerning local communities. All information documents and reports have been placed in the public domain, via the Project Information Centers *(see details below)* and on THDC's corporate website, http://www.thdc.gov.in.

8. Safeguard Policies (including public consultation)

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[X]	[ ]
Pest Management (OP 4.09)	[ ]	[X]
Physical Cultural Resources (OP/BP 4.11)	[X]	[ ]
Involuntary Resettlement (OP/BP 4.12)	[X]	[ ]
Indigenous Peoples (OP/BP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[X]	[ ]
Safety of Dams (OP/BP 4.37)	[X]	[ ]
Projects in Disputed Areas (OP/BP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP 7.50)	[X]	[ ]

24. **Social Safeguards:** A Social Impact Assessment (SIA) for the Project area was completed in April 2008. It included consultations with stakeholders, information on socio-economic and cultural features of the population, and baseline data on land acquisition impacts. This information, together with wide-ranging consultations with communities in the project area regarding their concerns, have informed the measures to ensure that negative impacts are mitigated and that people receive benefits from the Project.

25. THDC has drawn up a Resettlement and Rehabilitation Policy that goes beyond the provisions recommended by the National Policy on Resettlement & Rehabilitation (2007) in providing compensation and resettlement assistance to project-affected people. The policy was shared with the project-affected communities in its draft form and their concerns addressed in its finalization and in the formulation of the Resettlement Action Plan that will guide its

* *By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas*

implementation.

26. Apart from compensation and resettlement assistance, the THDC Policy also recognizes the impacts on the villagers of the acquisition of public land of one form or another that most villagers traditionally use for grazing their animals or for gathering fuel and fodder. In addition to the 31.6 ha of private land that will be acquired by the project, 109.9 ha of government land (including forest/grazing land and 10.3 ha of *van panchayat* land) will be acquired. As villagers use these common lands for collecting fodder or firewood, THDC's R&R Policy seeks to provide compensation to these affected people. These households will each be provided with compensation equivalent to 100 days of minimum agricultural wages for a five-year period, which would serve as a supplementary income stream until the re-plantation of fodder and trees on vacant government forest and *van panchayat* land can mature.

27. **Environment safeguards:** A detailed environmental assessment (EA) was conducted to examine the following in detail (i) disturbance to the forest cover and impacts on terrestrial biodiversity in the project influence area, including supplemental study of the possible impact on the Kedarnath Wildlife Sanctuary; (ii) impacts on the potential water use downstream; (iii) possibility of induced erosion and landslides in the project area; (iv) possible impacts from the Project's associated facilities and their construction; (v) impacts on possible archaeological, cultural or religious properties; (vi) study of the aquatic diversity in the river; (vii) study of the river flow in the project stretch; (viii) analysis of alternatives and; (ix) safety assurance for the Project.

28. All these studies found the Project to have low-level local impacts that could be effectively managed by an efficiently-implemented and well-monitored environmental management plan (EMP).

29. As compensation for the acquisition of some 100 hectares of forest land, THDC will provide the state forest department with funds (Rs 67 million) for the afforestation of double that area of land. In addition, THDC will also bear the cost (around Rs 470 million) of treating and improving more than 70 sq km of the catchment area of the Alaknanda River. Although no significant direct impacts of the project on the protected areas are expected, the EIA assessed that wildlife movement for water could be affected as a result of vibration/disturbance during construction and operation. The EMP includes a wildlife monitoring plan as well as the provision of INR 24.35 million for wildlife management to NDBR and KWLS Forest Divisions of the State Forest Department under the Catchment Area Treatment (CAT) Plan. This CAT Plan will also be implemented by the Forest Department of Uttarakhand. Special sites have been identified for dumping construction debris so that it does not vitiate either the landscape or the river. Once filled, these sites will be re-developed and landscaped.

30. In keeping with the requirements of the World Bank's Operational Policy 7.50 that pertains to Projects on International Waterways, riparian notification was served to the upstream and downstream countries, China, Nepal and Bangladesh. In response to concerns over the Project impact expressed by the Government of Bangladesh, an expert hydrologist was commissioned to carry out an analysis of the project on water quantity and quality in Bangladesh. The analysis concluded that the Project would have no non-trivial impacts on Bangladesh.

31. **Disclosure:** The developer has engaged a range of stakeholders, especially the Project-affected communities and their representatives, in discussing different aspects of the Project over the last three years. The preparation of the environmental and the social assessments also relied heavily on consultations with the local people, ranging from informal household level interactions, through focus group discussions to larger public meetings. Some 109 formal consultation sessions; five project-wide public meetings (including two statutory public hearings that are part of the environmental clearance process); 11 meetings focused on environment issues and; innumerable informal meetings with Project-affected persons have been held during project preparation.

32. In order to allow stakeholders constant and easy access to information about the Project, two public information centers – one at the Project office in Pipalkoti and another in village Haat, the site of the proposed powerhouse – were set up during project preparation and functioned for three years from 2007. They were consolidated into one main PIC at Siyasain in December 2010 when THDC set up its permanent project office there.All major reports relevant to the Project, as well as details of consultations held can be found in the PIC at Siyasain and on THDC's corporate website, www.thdc.gov.in.

9. **List of Factual Technical Documents**
    a. **Studies that are part of the Tender Document:**
        i. Geological Baseline Report
        ii. Seismic Analysis of Dam & Foundation System
        iii. Sediment Handling Optimisation Studies
        iv. Risk Assessment & Risk Register
    b. **Studies which are not part of Tender Document:**
        i. Detailed Project Report
        ii. Hydraulic Model Studies
        iii. Transient Studies for Water Conductor System
        iv. Geotechnical Data Report
        v. Design Seismic Parameters for VPHEP
        vi. Stress-Strain Analysis of Major Underground Caverns i.e. Machine Hall-Transformer Hall Complex & De-Silting Chambers Complex
        vii. Assessment of Quality & Quantity of Construction Materials in Various Quarries.
        viii. Slope Stabilisation and Induced Effects of Blasting during Construction
        ix. Dam-Break Analysis
        x. Downstream Impact Analysis of Vishnugad Pipalkoti Hydro Electric Project (in connection with OP 7.50)
        xi. Comprehensive Environment Impact Assessment
        xii. Social Impact Assessment

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