

---

# Contents

Acronyms and Abbreviations	v
Preface	vii
Executive Summary	ix
I Introduction	1
II Overview of Indian Power Sector	3
III Plans for Future Power Development	5
IV Hydropower Development in India	8
V Strategies for Accelerated Hydropower Development	12
VI Private Sector Participation	17
VII The Small Hydro Segment	20
VIII Energy Security Issues and Regional Cooperation in Hydropower Development	24
IX Conclusions	27
Appendixes	29
A – Breakdown of Installed Generation Capacity in Utilities	29
B – List of Low Tariff Schemes under 50,000 MW Hydroelectric Initiatives	30
C – Requirements for Obtaining Clearances and Approvals	32
D – Regulatory and Tariff-related Issues in Hydropower Generation	40
E – Draft Guidelines for Allocation of Hydrosites to Private Developers	43
F – Hydropower Development in Uttaranchal	49
G – Hydropower Development in Himachal Pradesh	55
H – Hydropower Development in Sikkim	61
I – Hydropower Development in North-Eastern Region	65
References	70



---

# Acronyms and Abbreviations

CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CAT	catchment area treatment
CCEA	Cabinet Committee on Economic Affairs
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CPIB	Committee of Public Investment Board
CPSU	central power sector unit
CNG	compressed natural gas
CWC	Central Water Commission
DPR	detailed project report
EA	Electricity Act 2003
EIA	environmental impact assessment
EMP	environmental management plan
EPS	Electric Power Survey
FI	financial institution
GDP	gross domestic product
HP	Himachal Pradesh
HPERC	Himachal Pradesh Electricity Regulatory Commission
HPSEB	Himachal Pradesh State Electricity Board
IPP	independent power producer
JPVL	Jaiprakash Power Venture Limited
LADA	local area development authority
LNG	liquefied natural gas
MNES	Ministry of Non-Conventional Energy Resources
MOEF	Ministry of Environment and Forests
MOF	Ministry of Finance
MOP	Ministry of Power
MORD	Ministry of Rural Development
MOU	memorandum of understanding
NEA	Nepal Electricity Authority
NEEPCO	North-Eastern Electric Power Corporation
NHDC	Narmada Hydro Development Corporation
NHPC	National Hydroelectric Power Corporation
NTPC	National Thermal Power Corporation
NPV	net present value
PNRR 2003	National Policy on Resettlement and Rehabilitation, 2003
NEP	National Electricity Plan 2005
NER	North-Eastern Region
PAF	Project-affected family
PFC	Power Finance Corporation

PIB	Public Investment Board
PFR	prefeasibility report
PGCIL	Power Grid Corporation of India Limited
RFP	request for proposal
R&R	resettlement and rehabilitation
SEB	state electricity board
SHP	small hydro project
SEIAA	state/union territory environmental impact assessment authority
SEAC	state/union territory level expert appraisal committee
SERC	state electricity regulatory commission
SJVNL	Satluj Jal Vidyut Nigam Limited
SPCB	state pollution control board
SPDCL	Sikkim Power Development Corporation Limited
THDC	Tehri Hydro Development Corporation
TEC	techno-economic clearance
THPA	Tala Hydro-electric Project Authority
TOR	terms of reference
UERC	Uttaranchal Electricity Regulatory Commission
UPCL	Uttaranchal Power Corporation Ltd.
UTPCC	Union Territory Pollution Control Board

#### WEIGHTS and MEASURES

BU (billion unit)	Unit of energy, equal to $1 \times 10^9$
kWh (kilowatt-hour)	Unit of energy, equal to 1 unit
MW (megawatt)	Unit of power, equal to $1 \times 10^6$
GW (gigawatt)	Unit of power, equal to 1 billion ( $10^9$ ) watts
MT (metric ton)	Unit of weight, equal to 1,000 kg or 2,204.6 pounds

#### CONVERSION

Rs1 million	Equal to $Rs1 \times 10^6$
Rs1 billion	Equal to $Rs1 \times 10^9$
Rs1 lakh	Equal to $Rs1 \times 10^5$
Rs1 crore	Equal to $Rs1 \times 10^7$

---

# Preface

This report is intended to be a reference document for various parties involved in hydropower development in India. It provides an assessment of the hydropower development potential in India. Although the report is somewhat technical in nature, it should be of interest to the Government, nongovernment organizations, and civil society in general. The report would serve its purpose if it helps to reinforce public awareness and concern to make the Indian energy sector more diverse and sustainable.

Energy security is a major concern in many of our developing member countries. India is no different to this. In order to maintain the required power demand-supply balance and to meet its goal of Power For All by 2012, India needs to install an additional 100,000MW power generating capacity. This is a major challenge and we hope India's vast hydropower potential can contribute to this in an environmentally sustainable and socially responsible manner. In this report, an assessment has been made to understand the hydropower potential. A significant contribution from hydropower resources to meet the emerging needs of the power sector seems technically feasible and cost-effective.

The Energy Division of South Asia Regional Department prepared this report in collaboration with the Energy and Resources Institute, New Delhi, India. I wish to convey my sincere appreciation to the authors for bringing out this report at this juncture.



Kunio Senga  
Director General  
South Asia Regional Department  
Asian Development Bank



---

# Executive Summary

A fast growing power sector is crucial to sustain India's economic growth. India has an assessed hydropower potential to the tune of 84,000 MW at 60% load factor; out of this only about 20% has been developed so far. In the past various factors such as the dearth of adequately investigated projects, environmental concerns, resettlement and rehabilitation issues, land acquisition problems, regulatory issues, long clearance and approval procedures, power evacuation problems, the dearth of good contractors, and in some cases, inter-state issues and law and order problems have contributed to the slow pace of hydropower development. There have been large time and cost overruns in case of some projects due to geological surprises, resettlement and rehabilitation issues, etc. However, considering the large potential and the intrinsic characteristics of hydropower in promoting the country's energy security and flexibility in system operation, the Government is keen to accelerate hydropower development.

Most of the above concerns are being addressed through a number of legislative and policy initiatives at the central and state levels. As discussed in detail in the report, these include preparation of a shelf of well-investigated projects and streamlining of statutory clearances and approvals, establishment of independent regulatory commissions, provision for long-term financing for projects, increased flexibility in sale of power, etc. In May 2003, the Prime Minister of India launched a 50,000 megawatt (MW) hydro initiative. Under this scheme, detailed project reports (DPRs) are being prepared for 73 schemes, which have an indicative first year tariff below Rs2.50. This would provide a shelf of fairly well investigated low tariff projects to prospective developers. Risk perceptions in taking up the projects and the possibilities of time and cost overruns are also expected to get minimized. Of these schemes (total about 32,000 MW), 70 are located in the Brahmaputra, Indus and Ganga basins in the north and north-eastern part of the country.

The Government has formulated a number of measures to address the issues related to watershed management of upstream and downstream. For example, in case of multi-purpose schemes, Electricity Act 2003 requires that the state government and the generating company coordinate their activities with those other persons responsible for such scheme insofar as they are inter-related. Similarly, the techno-economic clearance and the Central Electric Authority would look into the optimal development of the river or its tributaries consistent with other requirements. The Ministry of Environment and Forestry clearance would look into the environmental impacts and social/community development aspects associated with the projects and the developers would be required to deposit adequate funds for compensatory afforestation, catchment area treatment plan, wildlife management plans, biodiversity conservation plans, etc.

Private sector participation has been low in the hydropower sector although the sector was opened up in 1991 since the investors looked at it as a higher risk proposition compared to thermal projects. The Government has initiated a number of policy measures to address such concerns. They include availability of fairly well investigated DPRs, formulation of transparent bidding procedures,

provision of open access and trading, notification of tariff determination processes, joint venture initiatives, etc. The small hydro segment also offers considerable scope for development both for grid and off-grid applications. About 80% of the estimated potential remains untapped. The Ministry of Non-conventional Energy Sources is presently providing support to the states for assessment of potential, preparation of DPRs and project implementation.

India needs to mobilize large finances for implementation of its power program. While the Government has substantially stepped up its budgetary allocations to the hydro sector, support from international agencies and the private sector is also needed. In case of such projects, the developers however seem to have a perception that the appraisal processes are often long and this in turn could cause delays in taking up the project for implementation and consequential time and cost overruns. Hence they hold the view that in case of projects that are in a fairly mature state for taking up for implementation, it may be prudent to borrow from the market (especially when such funding can be accessed). Nevertheless, the developers consider that working with international donor agencies would provide some rich experience and also improve their credit rating with other financiers.

India has been cooperating with Bhutan and Nepal in hydropower development for over a decade. There are prospects of further enhancement for the benefit of all the countries and in the larger interest of energy security in the region. Some prospects of hydropower cooperation with other neighboring countries are also indicated.