A Study of the India-Bhutan Energy Cooperation Agreements

AND THE IMPLEMENTATION OF HYDROPOWER PROJECTS IN BHUTAN

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A Study of the India-Bhutan Energy Cooperation Agreements and the Implementation of Hydropower Projects in Bhutan

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Srinivas Krishnaswamy
CEO, Vasudha Foundation

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Contents

LIST OF TABLES

LIST OF FIGURES

List of Acronyms

ADB	Asian Development Bank
BCCI	Bhutan Chamber of Commerce & Industry
BEA	Bhutan Electricity Authority
BHEL	Bharat Heavy Electrical Limited
BHUCORE	Bhutan Consultancy & Research
BPCL	Bhutan Power Corporation Limited
BRICS	Brazil, Russia, India, China, South Africa
CAG	Comptroller and Auditor General of India
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CEIA	Cumulative Environmental Impact Assessments
CER	Certified Emission Reduction
CHPA	Chhukha Hydel Power Authority
CSMRS	Central Soil & Materials Research Station
CWC	Central Water Commission of India
CWPRS	Central Water & Power Research Station
DGPC	Druk Green Power Corporation
DoE	Department of Energy
DPR	Detailed Project Report
EIA	Environment Impact Assessment
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GLOF	Glacial Lake Outburst Flood
GNH	Gross National Happiness
GoI	Government of India
GRF	Government Reserve Forests
GSI	Geographical Survey of India
HCC	Hindustan Construction Company
HEP	Hydroelectric Project
HRT	Head Race Tunnel
HV	High Voltage
IBSA	India, Bhutan, South Africa
IG	Inter Governmental
IUCN	International Union for Conservation of Nature
JV	Joint Venture
KHPC	Kurichhu Hydro Power Corporation Limited
L & T	Larsen and Toubro
LV	Low Voltage

MEA	Ministry of Economic Affairs
MHPA	Mangdechhu Hydro Power Authority
MV	Medium Voltage
MW	Mega Watts
NEC	National Environment Commission
NHPC	National Hydro Power Corporation of India
NLDC	National Load Dispatch Center
NSB	National Statistical Bureau of Bhutan
PAP	Project Affected People
PDD	Project Design Document
PHPA	Punatsangchhu Hydroelectric Project Authority
PPP	Public Private Partnership
R & R	Resettlement and Rehabilitation
RAA	Royal Audit Authority of Bhutan
RGoB	Royal Government of Bhutan
RMA	Royal Monetary Authority
RoR	Run of the River
RS	Reservoir Scheme
RWSS	Rural Water Supply Scheme
SANDRP	South Asia Network on Dams, Rivers & People
SIA	Social Impact Assessment
SJVN	Satluj Jal Vidyut Nigam Limited
THDC	Tehri Hydro Development Corporation Limited
THPA	Tala Hydroelectric Project Authority
ToR	Terms of Reference
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WAPCOS	Water and Power Consultancy Services

Executive Summary

This report generates a preliminary analysis of the energy cooperation between India and Bhutan, the modalities and conditionalities of the agreements signed by them, and the implementation of hydropower projects in Bhutan. The study selected six projects as case studies for detailed analysis - Chhukha, Kurichhu, Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu Hydroelectric Projects (HEP).

Since commissioning the first hydropower plant in 1988, Bhutan has largely expanded its economy by exploiting natural resources for the generation of hydropower. The country's relation with India has provided it with the necessary technical and financial assistance and India's huge power deficit has created the market for Bhutan's surplus power. While the country claims a hydropower potential of about 30,000 MW, the installed generation capacity reached 1,608 MW in 2015 with the completion of the sixth project.

Hydropower projects in Bhutan have largely been implemented though bilateral agreements with India. In July 2006, the two countries signed a framework agreement on hydropower development and trade and undertook to develop 10,000 MW of hydropower from 10 large projects.

The hydropower sector has undoubtedly benefitted Bhutan's economy through substantial contributions to the national revenue and by providing the much-needed boost to kick-start the industry and service sector. However, the sector is currently facing a multitude of problems, particularly of economic and environmental nature.

The hydropower projects implemented with assistance from India are implemented jointly through project authorities with representatives from both governments. Analysis of projects reveals that the control of management in project authorities is skewed in the favour of India. Indian citizens occupy a disproportionate percentage of decision-making roles within project authorities. Furthermore, the planning, designing and management of projects, implemented under the India-Bhutan energy cooperation agreement, and all major construction and supply contracts are handled by Indian agencies.

There is minimal access to essentially basic information relating to the agreements and hydropower projects implemented with assistance from India while projects implemented with assistance from the Asian Development Bank (ADB) and other governments have proactively disclosed basic information.

The hydropower sector's financial performance has seen deterioration, indicating that its commercial profitability cannot be taken for granted. The net profit per unit of electricity sold has fallen sharply since 2007. Simultaneously, the sector's contribution to the national budget has reduced and Bhutan's external debt has increased. Of Bhutan's total outstanding external debt of Rs. 11,621 Cr, the standalone debt of the hydropower sector alone is nearly 60 per cent. The model of financing hydropower projects under the India-Bhutan energy cooperation agreements has witnessed a trend of reversing the grant-loan ratio, which will not only increase Bhutan's debt, but also increase cost per unit of electricity exported to India. The grant components for the projects financed by India have been reduced from 70 per cent to 30 per cent and the loans have risen from 30 per cent to 70 per cent.

The study also finds that escalation of costs is higher in projects implemented with assistance from India in relation to projects implemented with assistance from ADB or other governments. The escalation of cost is the most alarming for the Punatsangchhu I HEP where the project cost has increased from the originally estimated cost of Rs. 3,400 Cr in 2008 to a whopping Rs. 9,700 Cr in 2015.

Preliminary information indicates that the environment is taking a backseat in the development of hydropower. This study finds that both governments approve hydropower projects before assessing them for environmental impacts and this has contributed to adverse environmental consequences. Findings of this study also indicate that impacts of hydropower projects are not sufficiently assessed, thereby impeding mitigation plans. The Chhukha and Tala hydropower projects have rendered a stretch of 35 km on River Wangchhu nearly dry with limited or no flow of water. The impacts from projects include loss of forest lands; disturbance to wildlife habitat; noise pollution due to blasting and tunneling activities; impacts on fish breeding and migration; extreme dust pollution leading to respiratory disorders, lower crop productivity and pollution of water sources; damage to open water bodies such as streams and ponds causing severe stress on water resources in the region. Also, even though projects have been planned and constructed in close-quarters and many a times on the same river course, basin wide studies to assess cumulative impacts of projects have not been conducted.

While local people lost wetlands and dry lands to hydropower projects, they have not been given employment, either during the construction phase or during operation. The study also notes that consent of land owners was not sought prior to acquisition of their lands and the affected people were not informed of the potential adverse impacts of large hydropower projects during consultative meetings.

Key Findings of the Study

Implications of Modality of Agreements

- Lack of access to essentially basic information relating to agreements
- Minimal disclosure on hydropower projects implemented with assistance from India
- Control of management in project authorities is skewed in favour of India
- All major contracts for work are awarded to Indian agencies
- Concerns over quality of work of consultants and contractors
- Lack of opportunities for the private sector in Bhutan

Implications to Economy

- Hydropower sector's financial performance has fallen; net profit per unit of electricity sold and the sector's contribution to national budget has reduced
- Bhutan's external debt is witnessing a steady rise
- Enormous increase in project costs severely questions financial viability of electricity
- Funds for hydropower projects from India are disbursed directly to project authorities in Bhutan bypassing the national budget

Implications to Ecology

- Planning of hydropower projects does adequately not factor environment impacts
- EIA reports are not made public
- Impacts from projects include loss of forest lands and disturbance to wildlife habitat, noise pollution and damage to buildings due to blasting and tunneling activities, damage to open water bodies such as streams and ponds and severe stress on water resources in the region
- Downstream impacts in Assam have not been assessed
- Adverse impacts on fish breeding and migration
- Inadequate environmental flows in rivers
- Basin wide studies to assess cumulative impacts of projects have not been conducted
- Severe geological risks of earthquakes and Glacial Lake Outburst Floods *(GLOF)*

Implications to Communities

- SIA reports are not made public; EIA reports were not provided to affected communities
- The six case study hydropower projects have acquired dry lands, wetlands and orchards
- No consent was sought from people for acquisition of their lands
- Potential adverse impacts of large hydropower projects on the natural environment and people were not discussed during consultative meetings with community
- Dust pollution from construction of hydropower projects has caused respiratory illnesses
- No formal procedures for addressing grievances
- Projects have not generated employment for local communities
- Families losing land are provided 10,000 units of free electricity per annum per acre lost
- Projects have constructed basic infrastructure such as roads, health facilities and schools

1.1 Introduction

Bhutan's relation with India dates back to the period of the British rule in India and it was in this period that trade between the two countries was first recorded. Historical relations however date back to the 747 A.D., when the Indian saint Padmasambhava introduced Buddhism in Bhutan.[1]

Following India's independence in 1947, the two countries solidified their informal relations with the Treaty of Friendship and Cooperation in 1949, which provided for perpetual peace and friendship, free trade and commerce, and equal justice to citizens of both countries. This treaty enabled deep political connections between the two countries and is the foundation of subsequent economic cooperation arrangements. The friendship was re-affirmed in 2007 when the two countries signed an updated treaty[2] to reflect the present-day nature of the relationship.

The presence of Chinese troops near Bhutan's border, the annexation of Tibet by the People's Republic of China and Chinese claims over Bhutanese territory, compelled Bhutan in the 1950s to re-evaluate its traditional policy of isolation. Consequently, Bhutan was more inclined to develop relations with India and the process of socio-economic development in Bhutan began with Indian assistance. Simultaneously, border tensions between India and China which escalated into military conflict in 1962, also necessitated India to play a role in establishing stability in the Himalayan region and in ensuring that Bhutan not remain a weak buffer state.[3]

The two countries strengthened their relations in the 1950's under the leadership of the third king of Bhutan, His Majesty Jigme Dorji Wangchuck and the then Indian Prime Minister, Jawaharlal Nehru. Formal bilateral relations between Bhutan and India were established in January 1968 with the appointment of a resident representative of the Government of India (GoI) in Bhutan's capital city of Thimphu. India sponsored[4] Bhutan's application for UN membership in 1971 and thereafter Bhutan began to gradually diversify its relations with the international community.

The changing global paradigm of the 21st century has compelled the forging of new alliances that yearn to become mutually beneficial partnerships. The concentration of global powers, volatility of the economic markets sparked by recessions, increasing challenges in meeting needs from developing countries and the waning of older alliances prompted the resurgence of the South-South cooperation with initiatives such as the IBSA and BRICS.

There are many claims and speculations regarding the emerging South-South Cooperation; that the dual identity of donor and recipient will enable countries to understand the drawbacks of traditional development models, the possibility of new alternative models that are locally and contextually relevant, development that is demand driven and based on successful local experiences and aid that is free of policy conditionalities. The alliances between southern developing countries will positively promote economic cooperation, increase local capacities and generate knowledge, strengthen voices of developing countries in the global platform and add to their bargaining power in multilateral negotiations. However, unless the countries stand firm to fight poverty that is exacerbated by the models of economic development currently at play in developing countries, ensure distributional justice in terms of resource and opportunity, and move towards envisioning a balance

1 Indo – Bhutanese Relations: A Historical Perspective. 2009. Dr. Lopamudra Bandyopadhyay. Global India Foundation.
2 India – Bhutan Friendship Treaty of 2007. www.carnegieendowment.org/newsletters/SAP/pdf/march07/india_bhutan_treaty.pdf
3 Security of Bhutan: Walking Between the Giants. Dorji Penjore. The Centre for Bhutan Studies.
4 India and Her Neighbours. N. Jayapala. 2000. Atlantic Publishers and Distributors.

in global powers, the new alliances and platforms will mirror existing platforms which have failed to deliver equitable development of populations. The progress of platforms such as IBSA and BRICS in the coming decade will eventually determine success or failure of the models.

Regional cooperation between countries has existed long before multi-lateral platforms and can possibly offer a nuanced understanding and knowledge of existing partnerships. This study aimed to generate a socio-political analysis of the regional cooperation between India and Bhutan. Learning from such a study can not only strengthen the relation between the two countries but also facilitate a better understanding of mutually beneficial cooperation between countries

Bhutan is India's oldest, and remains as the largest, recipient of development assistance. India is also Bhutan's leading trade partner. The India-Bhutan relation is also perhaps the only bilateral engagement in South Asia that has stood the test of time and therefore beckons deeper and critical inquiry. The modalities and conditionalities of the 'friendship' need deeper scrutiny to understand how the arrangement benefits both countries and how the profits, benefits, and impacts are shared between them.

1.2 Methodology of Study

This study endeavored to analyze the India-Bhutan energy cooperation agreements and the resultant hydropower projects implemented in Bhutan. *[*Please note: hydropower is used interchangeably with hydroelectric in this report.*]* For the purpose of this study, six projects were selected as case studies for detailed analysis. These projects are Chhukha Hydroelectric Project, Kurichhu Hydroelectric Project, Tala Hydroelectric Project, Punatsangchhu I Hydroelectric Project, Punatsangchhu II Hydroelectric Project and Mangdechhu Hydroelectric Project.

The analysis was made possible through desk research of secondary data and information; semi-structured interviews with government functionaries, project authorities, sector experts, journalists, and concerned individuals; and focus group discussions *(*FGD*)* with people in project affected areas.

Focus groups discussions were conducted between 19 and 24 July 2015 and between 7 and 17 September 2015 with communities affected by five out of the six case study projects. Focus group discussions were not conducted with communities impacted by the Chhukha project as the project was implemented nearly three decades ago.

Case Study
(Selection of 6 hydro-electric projects as case studies for detailed analysis)

Desk Research
(Gathering the secondary data regarding the India- Bhutan Cooperation Agreements and other HEP related information)

Semi – structured Interviews*
(Conducting interviews with individuals from government departments and other organizations to carry out a stakeholder assessment of their perceptions regarding the nature of development projects and their impact on the communities involved, on the environment etc.)

Focus Group Discussions
(Conducting discussions with Project Affected Population (PAP) to understand ground realities and community participation in any decision making process)

Tala
People from affected villages of Tabji, Rinchhentse, Dangreyboog, Gengu, Khamaedthapang, Nimgang, Tashilakha, Bongo and Tsimalakha

Punatsangchhu I & Punatsangchhu II
People from affected villages in Chiwogs of GasetshoGom, GasetshoWom, Thedtsho, Daga (Dagar), Athang and Ruepisa in Wangdue Phodrang district

Mangdechhu
People from affected villages of Kuengarabten,Eusa, Taktse, Samcholing-Khatoe, Samcholing Lkhatay and Khamay

Kurichhu
People from affected villages within Saling, Drepong and Mongar Gewogs in Mongar district

Office of the National Council Members

***Interviews with**

- National Council of Bhutan
- Punatsangchhu II Hydroelectric Project Authority
- Department of Hydropower and Power Systems
- Bhutan Power Corporation Limited
- National Load Dispatch Centre
- Druk Green Power Corporation
- Mangdechhu Hydroelectric Project Authority
- National Environment Commission
- Department of Forest & Park Services
- Department of Disaster Management
- Bhutan Chamber of Commerce and Industry
- The Bhutanese (newspaper)
- Royal Society for Protection of Nature
- WWF Living Himalayas Initiative

2.1 Basic Profile of Bhutan

The Kingdom of Bhutan is traditionally referred as Drukyul, or the Land of the Thunder Dragon. Bhutan rests in the southern slopes of the eastern Himalayas, landlocked amidst the Tibet Autonomous Region (China) to the north and the Indian territories of Arunachal Pradesh to the east, Assam and West Bengal to the south, and Sikkim to the west. Huge variations in altitude are characteristic of this country that is dominantly a spread of steep mountains sandwiched between rich rivers, narrow gorges, deep valleys and few plains. The altitudes of the mountains within Bhutan range from just 100 meters to nearly 7500 meters.

In 2008, following a decade of planning, Bhutan transitioned[5] peacefully from absolute monarchy to constitutional monarchy. King Jigme Khesar Namgyel Wangchuck, eldest son of King Jigme Singye Wangchuck who abdicated the throne in favor of his son in 2006, transferred administrative powers to the Council of Cabinet Ministers and allowed for impeachment of the King by a two-thirds majority of the National Assembly. Under the present system[6], the King is the head of the state, the National Council with 25 elected members is the Upper House and the National Assembly with 47 elected lawmakers from political parties is the Lower House. The executive power is vested with Council of Ministers, headed by the Prime Minister, and legislative powers are vested with the two houses. The capital city of Thimphu on the banks of the River Wangchhu houses the State Secretariat of the Royal Government of Bhutan (RGoB).

Bhutan comprises of twenty dzongkhags[7] (or districts) that are further divided into dungkhags (or sub-districts), Gewogs (or a block of villages) and thromdes (or municipality). The twenty dzongkhags comprise 205 Gewogs. Only some of the larger dzongkhags are sub-divided into dungkhags. Therefore, some Gewogsin the country are subordinate to dungkhags while others are directly subordinate to dzongkhags. Gewogs are administratively subdivided into chiwogs which comprise a small number of villages. However, the thromde is now recognised as the tertiary administrative unit and as the most basic level of local government. These changes in the administrative divisions within Bhutan are part of the country's push towards decentralisation and devolution of power and authority.

The population of Bhutan[8] in 2014 was 7, 57,042. According to the 2012 data from the National Statistics Bureau of Bhutan (NSB), the literacy level is at 63 per cent, average life expectancy is 67 years and the population living below poverty rate is 12 per cent. The Ngalops and Sharchops constitute 50 per cent, Lhotshampas constitute 35 per cent and indigenous tribes constitute 15 per cent. Dzongkha is the official language and Sharchhopkha, Lhotshamkha (Nepali), Dzala, Limbu, Kheng, Rai and other dialects are spoken in the different regions. Television and the internet were introduced to the Bhutanese people as late as 1999. As of 2013, about 37 per cent of the population lived in urban centers[9].

5 Democracy in Bhutan - An Analysis of Constitutional Change in a Buddhist Monarchy. Marian Gallenkamp. 2010. Institute of Peace and Conflict Studies.
6 Polity IV Country Report 2010: Bhutan. Political Instability Task Force. Central Intelligence Agency.
7 National Portal of Bhutan. www.bhutan.gov.bt/government/dzongkhags.php
8 Bhutan at a Glance. October 2015. National Statistics Bureau. Royal Government of Bhutan.
9 World Development Indicators. The World Bank. www.data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS

Figure 1 Farming as a Primary Source of Income in Bhutan

The country continues to be a traditional Buddhist society, deeply engrained in Bhutanese culture, and the protection of cultural and natural heritage is a high national priority. Although modernization is slowly making its way, generating modern urban settlements, most of the people in Bhutan still live in small remote villages. The predominant way of life is small family farms and the primary occupation of the Bhutanese people is farming.

Bhutan has four major river systems[10] of Amochhu (or Torsa), Wangchhu (or Raidak), Punatsangchhu (or Sunkosh) and Manas (or Drangmechhu). Tributaries of River Wangchhu include Pachhu, Tachhu, Hachhu, Thimchhu and Wongchhu; tributaries of River Punatsangchhu include Mochhu, Phochhu, Tangchhu, Harachhu, Dagachhu, Basochhu and Dangchhu; and tributaries of River Manas include Mangdechhu, Kurichhu, Chamkarchhu, Drangmechhu, and Kholongchhu.

10 Bhutan Biodiversity Action Plan. February 2009. National Biodiversity Centre. Ministry of Agriculture. Royal Government of Bhutan.

Figure 2 River Pachu

The geographical and climatic variation in Bhutan has contributed to an equally startling bio-diverse ecosystem. Bhutan has about 5400 species of plants, over 700 species of birds[11] and its forests are home to healthy populations of species such as the royal Bengal Tiger, snow leopard, clouded leopard, one-horned rhino, golden langur, grey langur, hispid hare, sloth bear, goral, serow, Himalayan black bear, red panda, Himalayan musk deer, blue sheep, marmot, Tibetan wolf and antelope.

The fragile mountain ecosystem is however under constant risk of hazards[12] like earth quakes, flash floods, landslides and Glacial Lake Outburst Floods (GLOF). Such impending dangers obligate the conservation of forests to minimise siltation, check landslides and reduce risks of flooding and earth quake. According to the National Statistics Bureau of Bhutan, the environmental challenges facing the country include unsustainable agriculture, deforestation, overgrazing, infrastructure development and mining, increasing solid waste, and stress on water resources.

2.2 Economic Growth

The Kingdom of Bhutan cautiously opened its borders to outsiders in the 1970s and joined the United Nations[13] in 1971. The official Bhutanese currency, the *ngultrum* (BTN), was introduced in 1974. The ngultrum was pegged to the Indian rupee and its fluctuation vis-à-vis major international currencies are a reflection of developments in India. Till the 1960s, economic aid from India was the only source of revenue to the government. However, with admittance to the United Nations, Bhutan began to receive development assistance from multilateral and other bilateral donors.

11 International Encyclopaedia of Himalayas (5 Vols. Set). Ramesh Chandra Bisht. 2008. Mittal Publication.
12 Country Environment Note: Bhutan. 2014. Asian Development Bank. www.adb.org/sites/default/files/linked-documents/cps-bhu-2014-2018-ena.pdf
13 Permanent mission of the Kingdom of Bhutan to the United Nations in New York. United Nations. www.un.int/bhutan/

The rugged terrain, compounded by the lack of access to sea, does not provide economic advantage to Bhutan. Its geographic placement makes navigation, communication, construction of infrastructure, development, and establishment of industries rather difficult and expensive. Starting with the commissioning of the first hydropower plant in 1988, Bhutan has largely expanded its economy by exploiting natural resources for the generation of hydropower. It is one of the world's smallest economies[14], with a GDP representing less than 0.01 per cent of the world economy. Bhutan grew rapidly with the commissioning of the fifth hydropower project in 2005. The economy grew[15] by 8 per cent in 2005, by 14 per cent in 2006 and it was the second fastest growing economy in the world in 2007 with an annual growth rate of 22.4 per cent. The GDP reached an all time high of 1.82 USD billion in 2011 but remained the same in 2014[16]. With the completion of Dagachhu hydropower project in 2015, the World Bank projects Bhutan's economy to grow at 7.9 per cent[17].

Bhutan's economy is based on agriculture, forestry, tourism and sale of electricity. Fifty six percent of the population depend on agriculture, 22 per cent depend on industry and 22 per cent on services. In 2014, agriculture contributed to 14.4 per cent of the GDP, industry contributed 41.6 per cent and services contributed 44 per cent[18].

Agrarian practices consist largely of subsistence farming and animal husbandry. Agricultural produce includes rice, chillies, dairy *(*some yak, mostly cow*)* products, buckwheat, barley, root crops, apples, citrus and maize. The primary sources of water for irrigation are streams and rain. Though agriculture has been the mainstay of Bhutan's economy and a majority of its population depends on farming, only 2.9 per cent of the country is under agriculture. And of the total land area of 38,394 sq. km., irrigated land comprises 319 sq.km. or just 0.8 per cent making wetlands exceptionally valuable. Over the years, the average landholding of Bhutanese farmers has reduced, impacting the sector's contribution to national GDP[19].

The industrial sector is at a nascent stage, and though most production comes from cottage industry[20], larger industries are being encouraged by the Royal Government of Bhutan. Small cottage industries manufacturing food products, handicrafts and handloom are found in several regions. The manufacturing sector in Bhutan includes ferrous silica, cement, wood products, alcoholic beverages, calcium carbide, construction material and agricultural products. Much of the material for everyday consumption is imported from other countries. The country has an installed generation capacity of 1,608 MW and claims a hydropower potential of about 30,000 MW[21], out of which 24,000 MW is economically viable potential. Though Bhutan has a coal reserve of 1.3 million tonnes, it mines less than 1,000 tonnes a year[22]. There has been recent growth in the technology sector, in areas such as green tech, consumer internet and e-commerce. Also, software imported from India is packaged in Bhutan and exported to Hong Kong and Singapore.

Bhutan's major imports[23] are petroleum products, mineral products, base metals, machinery and electrical appliances, automobiles and spares, wood, plastic, rubber, spices, and processed food. Eighty percent of all imports are from India and the remaining is sourced from South Korea, Thailand, Singapore, Japan, China and Nepal. Bhutan's main export partner is India which accounts for

14 The World Factbook. Central Intelligence Agency. www.cia.gov/library/publications/the-world-factbook/geos/bt.html
15 Bhutan Millennium Development Goals - Needs Assessment and Costing Report (2006-2015). November 2007. Planning Commission. Royal Government of Bhutan.
16 An investment guide to Bhutan Opportunities and Conditions 2013. United Nations Conference on Trade and Development (UNCTAD).
17 Global Economic Prospects: Having Fiscal Space and Using It. January 2015. World Bank.
18 Bhutan Country Strategy Paper 2007 – 2013. European External Action Service.
19 Bhutan's Experiments with Happiness. Nitya Jacob. 31 October 2013. Down to Earth.
20 Cottage & Small Industry of Bhutan – Overview. 2011. Ministry of Economic Affairs. www.moea.gov.bt/documents/files/pub0nu5370zv.pdf
21 Sustainable Hydropower Development Policy. 2008. Royal Government of Bhutan.
22 Bhutan's Experiments with Happiness. Nitya Jacob. 31 October 2013. Down to Earth.
23 Bhutan Trade at a Glance. World Integrated Trade Solution. World Bank. www.wits.worldbank.org/CountrySnapshot/en/BTN

around 90 per cent of the total. Export of electricity to India constitutes around 50 per cent and other exports include metals, minerals, chemical products, timber, raw silk, fruit products and rubber products. Other exports partners include Hong Kong, Bangladesh, Japan, Nepal and Singapore. According to data from the Royal Monetary Authority of Bhutan, exports increased from Rs. 29,932 million in 2013 to Rs. 32,880 million in 2014 while imports in Bhutan increased from Rs. 51,970 million in 2013 to Rs. 55,307 million in 2014[24].

2.3 Relations with India

India first provided development assistance to Bhutan in 1949[25], the year of its own independence. Efforts towards planned development in Bhutan began in the early 1960s and the First Five Year Plan of Bhutan was launched in 1961. As the principal donor for socio-economic development in Bhutan, India extends financial assistance to Bhutan's Five Year Plans. Development projects, such as infrastructure, road construction or hydropower plants, also rely heavily on technical expertise and contract labour from India.

Table 1 India's Contribution to Bhutan's Five Year Plans

Year	Total Allocations (in Rs. Cr)	India's Contribution	Percentage of India's Contribution (in per cent)
1961 (1st Plan)	10.72	10.72	100
1966 (2nd Plan)	20.22	20.22	100
1971 (3rd Plan)	47.52	42.66	90
1976 (4th Plan)	110.62	85.30	77
1981 (5th Plan)	444.05	134.00	30.2
1987 (6th Plan)	950.00	400.00	42.1
1992 (7th Plan)	2350.00	750.00	31.9
1977 (8th Plan)	4000.00	1050.00	26
2002 (9th Plan)	8900.00	2610.14	29.33
2008 (10th Plan)	14900.00	3400.00	23
2013 (11th Plan)	21300.00	4500.00	21

Source: India-Bhutan Relations. No. 29|R N|Ref.|2014, Lok Sabha Secretariat

Between 2000 and 2013, Bhutan received 49 per cent of the grants and loans committed to foreign countries from the Indian budget, making it the largest recipient of Indian development assistance. India's contribution of Rs. 4,500 Cr to Bhutan's 11th Five Year Plan (2013-2018) accounts for 68 per cent of India's total external assistance[26].

India's assistance towards mega projects, including hydropower, is additional to its contribution to the Five Year Plans. India also provides petrol and cooking gas to Bhutan at the same subsidized rates at which it provides to its own population. The Agreement on Trade and Commerce signed by the two countries allows Bhutanese imports and exports from third-country markets to transit India without tariffs. India is not only Bhutan's main development partner but also its principal trade partner as 80 percent of all imports come from India and 90 per cent of exports go to India.

24 Monetary Policy Statement. May 2015. Royal Monetary Authority of Bhutan.
25 The emerging foreign assistance policies of India and China: India as a development partner. Eswaran Sridhara.March 2014. Institute for the Advanced Study of India, University of Pennsylvania.
26 Economic Cooperation with Bhutan. Embassy of India, Thimphu, Bhutan. http://www.indianembassythimphu.bt/pages.php?id=33

"The Kingdom's relationships with India will remain of primary importance. The contribution made by India to the Kingdom's development can be expected to lessen in the years ahead, with the India-Bhutan relationship maturing into one that gives increasing importance to trade and economic transactions within the framework of new bilateral and sub-regional agreements. The export of hydropower and other goods to India will mean that our economy will continue to be inextricably entwined with that of our neighbor and, by extension, to the global economy."

Bhutan 2020: A Vision for Peace, Prosperity & Happiness. 1999. Gross National Happiness Commission, Royal Government of Bhutan.

2.4 Framework of Environmental Legislations

Efforts to protect the biodiversity and forestlands are a constitutional mandate in Bhutan. The 2008 Constitution[27] stipulates that a minimum of 60 per cent of the total land in Bhutan remain forested. According to the 2010 assessment of land cover conducted by the Department of Forest and Park Services, the forest cover is about 72 per cent[28] and nearly 80 per cent of bushes and sparse vegetation are included. Furthermore, about 50 per cent of the land is already designated as protected areas. With his famous declaration, that "Gross National Happiness is more important than Gross National Product", the fourth King of Bhutan, Jigme Singye Wangchuck, introduced the distinctive concept of GNH to the people of Bhutan and the world. The four pillars of GNH focus on sustainable development, good governance, preservation and promotion of cultural values and conservation of the natural environment. The framework of GNH is also enshrined in the 2008 Constitution and guides Bhutan's development and policy formation.

Bhutan's efforts to design legislations and implement policies to preserve its vast and diverse natural resources are relatively recent. The main legislations[29] concerning the protection of environment are Forest and Nature Conservation Act 1995, Environmental Assessment Act 2000, National Environment Protection Act 2007, Waste Prevention and Management Act 2009 and Water Act 2011. Hydropower development is governed by the Sustainable Hydropower Development Policy of 2008. The National Environment Protection Act is the umbrella legislation that "defines roles and responsibilities of key agencies in environment management and sets out requirements for the protection of the physical and ecological environment". The Environmental Assessment Act stipulates the requirements for conducting environmental assessments and obtaining environmental clearances. The Forest and Nature Conservation Act lays down guidelines for extracting forest resources and protecting Bhutan's wildlife.

The National Environment Commission (NEC) is an autonomous regulatory authority. It is the highest decision-making body on matters concerning environmental management. The NEC also works to include environmental protection clauses in various policies & Acts. The Prime Minister chairs the Commission, which has nine members, special advisors and a secretariat. The NEC secretariat is responsible for implementing policies and regulations formulated by the commission.

All development activities in Bhutan are subject to environmental assessment. All projects require an Initial Environmental Assessment (IEA) while some projects such as farm roads do not require Environment Impact Assessment (EIA) and Social Impact Assessment (SIA). IEAs have set guidelines and EIAs are conducted on the basis of project specific ToR that are provided by the NEC. The Commission has guidelines for specific industries and sectors, including hydropower.

27 The Constitution of the Kingdom of Bhutan. Royal Government of Bhutan. www.bhutanaudit.gov.bt/About%20Us/Mandates/Constitution%20of%20Bhutan%202008.pdf

28 Has Bhutan gone greener?June 2, 2015. Kuensel.http://www.kuenselonline.com/has-bhutan-gone-greener/

29 Review and compendium of environmental policies and laws in Bhutan - Input to the Asian Judges Network on Environment. Antonia Gawel and Irum Ahsan. 2014. Asian Development Bank.

The legislations implemented so far outline procedures to ensure the sustainable management of forests, waterways, wildlife and plants but do not cover the whole range of issues, particularly in regard to large-scale hydropower projects. The NEC is making earnest efforts to improve legislative framework for environmental protection but lags behind in effective enforcement of set standards[30]. Bhutan is at an important crossroad in this regard and the strength and quality of the legislations it implements will determine the impact of large-scale projects on the country's environment, wildlife, culture, and people.

"Throughout the centuries the Bhutanese have treasured their natural environment and have looked upon it as the source of all life. This traditional reverence for nature has delivered us into the twentieth century with our environment still richly intact. We wish to continue living in harmony with nature and to pass on this heritage to our future generations".

- His Majesty the Fourth King of Bhutan Jigme Singye Wangchuck

30 Kingdom of Bhutan: Capacity Building of the National Environment Commission in Climate Change. December 2009. Asian Development Bank.

3.1 Hydropower Development

The Royal Government's decision to exploit the country's water resources for production of electricity and simultaneously boost the service industry has changed the economic scenario for Bhutan. An estimate by Asian Development Bank (ADB), in 2012, shows that tourism and hydropower have helped Bhutan's economy grow at 8.2 per cent between 2008 and 2012. The rapid altitudinal variations with swift flowing rivers make Bhutan a natural haven for hydro power production. The country's relation with India has provided the necessary political will and India's huge power deficit has created the market for Bhutan's power. Hydropower has become the backbone of the Bhutanese economy. The production of electricity is also expected to boost industrial activity within the country.

The models of hydropower plants employed in Bhutan so far are run-of-the-river (RoR) and reservoir scheme (RS). The RS hydropower projects typically have large reservoirs to store water, and electricity is produced by releasing water from the reservoir to a turbine, which activates a generator. RS projects provide a continuous supply of electricity (base load) as well as the ability to start-up at short notice for peak load. RoR projects divert water from the river course to pass through a channel or a tunnel, at about the same rate of the river flow, to spin the turbine. These projects store smaller amounts of water. RoR plants provide for base load and allow for some daily fluctuations in demand by regulating water flow. RoR projects are known to be small in size, generating 30 MW, or less, of electricity.

India has been a key contributor to the development of the power sector in Bhutan and exclusively benefits from Bhutan's surplus power. The commissioning of the Chhukha Hydro-electric Project (HEP) in 1988 facilitated the development of several industries including chemical carbides, wood processing, cement, ferrous alloys.

The development of hydro projects in Bhutan is largely based on bilateral agreements with India, deriving its framework from the India-Bhutan Friendship Agreement[31] of 1949. The Jaldhaka Agreement signed in 1961 was the first bilateral agreement between India and Bhutan, which enabled the construction of a barrage in Bhutanese territory for a 27 MW power plant in West Bengal. In the 1970s, power import connections were established at 3 places in southwest Bhutan to electrify Bhutanese villages and towns bordering India. The agreement for implementing the 336 MW Chhukha run-of-the-river HEP was signed in 1974[32] and the plant was fully commissioned in 1988. The agreements for implementing the 60 MW Kurichhu reservoir HEP and the 1020 MW Tala run-of-the-river HEP were signed in February 1994 and March 1996.

Other international development partners[33] of Bhutan include Austria, Japan, Netherlands, Norway and the Asian Development Bank (ADB). The Basochhu I and II power projects were implemented in 2001 and 2005 with assistance from the Austrian government[34] and the Dagachhu power project[35], completed in 2015 with assistance from ADB, Austria and Japan, was the first Public Private Partnership (PPP) project implemented in Bhutan.

31 Indo-Bhutanese Relations: A Historical Perspective. Dr. Lopamudra Bandyopadhyay. 2009. Global India Foundation

32 Agreement between the government of India and the Royal Government of Bhutan regarding the Chukha hydro-electric project. March 23, 1974. www.mea.gov.in/bilateral-documents.htm?dtl/6349/Agreement

33 Three Decades of Development Partnership - Royal Government of Bhutan and Asian Development Bank. 2014. Asian Development Bank.

34 Project profile of Basochhu Hydropower Plant. Druk Green Power Corporation. www.drukgreen.bt/index.php/bhp-menu/about-bhp

35 Project profile of Basochhu Hydropower Plant. Druk Green Power Corporation. www.drukgreen.bt/index.php/subsidiary-companies/dhpc-dagacchu-hydro-power-corporation/289-background-of-the-project

Three models of developing projects have emerged in the hydropower development sector in Bhutan[36] – Inter-governmental (IG), Joint Venture (JV), and Public Private Partnerships (PPP). In the IG model, the project is implemented by an independent project authority comprising of actors from both governments. Within two years of completing and commissioning a project, the project authority is dissolved and the project is amalgamated into the Druk Green Power Corporation (DGPC). The project cost is met with a grant and loan from the Government of India.

The JV model involves the incorporation of project specific Joint Venture companies, with DGPC as one of the JV partners. The JV is the project authority. This model is achieved through the project finance mode where each JV partner brings in 50 per cent of the funds. Even though the Sustainable Hydropower Policy of 2008 requires that the Government of Bhutan own a minimum of 51 per cent of the company, the JV has a built-in debt equity ratio of 70:30. The equity is split between JV partners and debt is raised from the open market and banks. In IG projects, only surplus electricity is sold to India, whereas in JV projects the financial model does not allow for sale of just surplus electricity. For PPP projects, the investment is tied to market availability.

The three projects implemented with assistance from India-Chhukha, Kurichhu and Tala HEPs, were implemented in the IG model. The project costs for these projects were met with a 60 per cent grant and 40 per cent loan from the Government of India (GoI). Basochhu I and II HEPs were implemented as Joint Ventures and the Dagachhu HEP was implemented as a PPP. The Bhutanese government and people are most comfortable with the IG model, as in this model, commissioned projects are owned by the Government of Bhutan.

Table 2 List of Commissioned Hydropower Projects in Bhutan

S. No.	Project	Capacity (MW)	Year (full commissioning)	India-Bhutan Agreement	Project Model	ProjectCost (in Rs. Cr)	Funding Agency
1.	Chhukha	336	1988	Yes; 1974	IG	246	GoI
2.	Kurichhu	60	2002	Yes; 1994	IG	564	GoI
3.	Basochhu I	24	2001	No	JV	144	Austria
4.	Basochhu II	40	2005	No	JV	182	Austria
5.	Tala	1020	2007	Yes; 1996	IG	4,126	GoI
6	Dagachhu I	126	2015	No	PPP	1,296	ADB, Austria, Japan Special Fund & NPPF

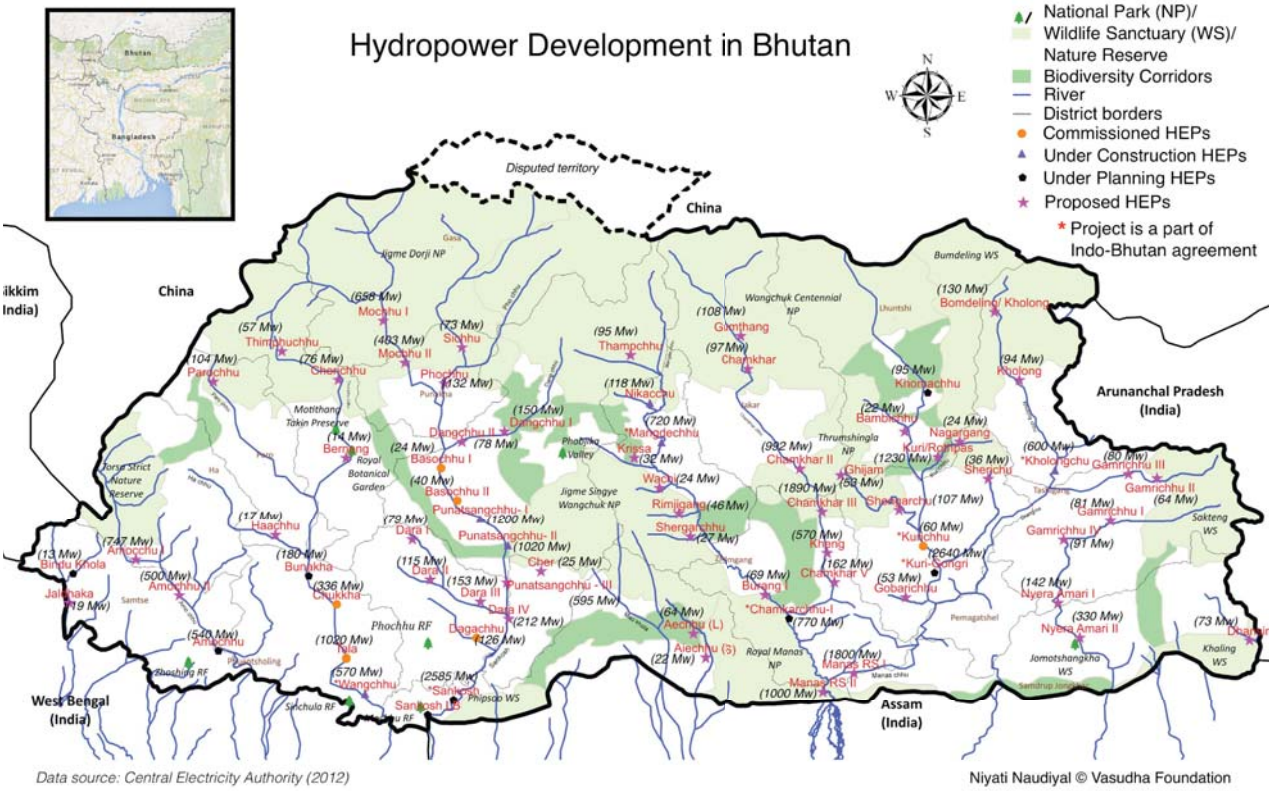
Source: Compiled by Vasudha Foundation

Out of the 30,000 MW potential capacity of electricity generation, Bhutan has so far harnessed less than 6 per cent with the completion of 6 hydropower projects. Bhutan requires about 300 MW of the 1,608 MW it currently generates. The huge surplus in electricity, particularly in the wet season, is exported to India. In the winter dry season, hydroelectric generation plummets to a point at which Bhutan imports electricity from India. Based on an assessment conducted by the Central Water Commission of India (CWC) and Central Electricity Authority of India (CEA), the 2004 Updated Bhutan Power System Master Plan[37] identified 76 economically viable locations for hydropower projects. If this plan were to be fully implemented, there would be one or more hydropower projects on every one of Bhutan's rivers and tributaries. Refer Annexure 1 for list of projects under construction and planned by 2020 and Annexure 2 for list of projects planned by 2030.

36 Hydropower Development Policy and Programmes. November 2015. National Council of Bhutan. www.nationalcouncil.bt/assets/uploads/files/Hydro%20Report%20as%20on%20Nov%2026%202015-%20Final%20for%20deliberation%202.pdf

37 Water Resources Management Plan and Update of the Power System Master Plan. April 2004. Department of Energy. Royal Government of Bhutan.

Figure 3 Bhutan Hydropower Plants Map



In July 2006, India and Bhutan signed a framework agreement[38] on hydropower development and trade to facilitate development of hydropower projects and transmission systems and trade in electricity, through both public and private sector engagements. Under this Umbrella Agreement, India promised to provide technical and financial support and agreed to import a minimum of 5000 MW of hydropower by 2020. The agreement was revised in 2009 to expand the generation capacity to 10,000 MW[39]. An empowered group with representatives from both governments was set up to facilitate identification of projects, preparation of Detailed Project Reports (DPR) and selection of agencies for speedy implementation of projects.

The 10 projects identified under the 2006 Umbrella Agreement are Punatsangchhu I, Punatsangchhu II, Mangdechhu, Bunakha, Sunkosh RS & Sunkosh LB, Chamkarchhu, Kuri-gongri, Kholongchhu, Wangchhu and Amochhu. Six of these projects are planned in the IG model and four are planned as JVs. Bunakha is a JV between DGPC and THDC India Limited (formerly Tehri Hydro Development Corporation Limited), Chamkarchhu I is a JV between DGPC and National Hydro Power Corporation of India (NHPC), Kholongchhu and Wangchhu are JVs between DGPC and Satluj Jal Vidyut Nigam Limited (SJVN). Six of the projects are run-of-the-river (RoR) hydropower plants and four are large reservoir (RS) based projects. Construction work for Punatsangchhu I, Punatsangchhu II and Mangdechhu is ongoing. The other projects are in various stages of planning.

38 Protocol to the 2006 Agreement between the Government of India and the Royal Government of Bhutan concerning cooperation in the field of hydroelectric power https://www.internationalrivers.org/files/attached-files/india_bhutan_hydropower_protocol_march_2009.pdf

39 India-Bhutan Power Cooperation: Between Policy Overtures and Local Debates. Medha Bisht. 2011. Institute for Defence Studies and Analyses.

Table 3 List of Projects Planned Under the 2006 Umbrella Agreement

S. No.	Project	Capacity (MW)	Type of Project	Status	Year of Agreement	Model	Project Cost (in Rs. Cr)
1.	Punatsangchhu	1200	RoR	Under construction	2007	IG	9,396
2.	Mangdechhu	720	RoR	Under construction	2010	IG	4,500
3.	Punatsangchhu II	1020	RoR	Under construction	2010	IG	7,435
4.	Bunakha	180	RS	Under planning	2014	JV	2,950
5.	SunkoshRS	2560	RS	Under planning	NA	IG	9,700
	Sunkosh LB	35	RoR	Under planning	NA	IG	NA
6.	Chamkarchhu I	770	RoR	Under planning	2014	JV	NA
7.	Kuri – Gongri	2640	RS	Under planning	NA	IG	20,000
8.	Kholongchhu	600	RoR	Under planning	2014	JV	4,076
9.	Wangchhu	570	RoR	Under planning	2014	JV	6,452
10.	Amochhu	540	RS	Under planning	NA	IG	NA

Source: Compiled by Vasudha Foundation

In 2014, media reports indicated that the Indian government had not resolved[40] to finance the 2,640 MW Kuri-Gongri, the 2,560 MW Sunkosh and the 540 MW Amochhu projects. Coincidentally, all of them are reservoir projects and planned under the 2020 vision. India has not officially confirmed that it is backing out of the three projects. However, if India does pull back from these projects, the huge amounts of money spent by the Bhutanese government to develop Detailed Project Reports for the projects could go to vain. The progress made in the 10 projects has been slow[41] and it is speculated that Bhutan will only achieve 3,000 MW by 2020.

Even though Bhutan's Sustainable Hydropower Policy 2008 allows private sector companies to participate in projects lesser than 25 MW, the government has not allowed the private sector to independently take on hydropower projects. Bhutan also initially expressed discomfort with the Indian government's proposal to shift from the earlier inter-governmental (IG) model of financing HEPs to the joint venture (JV) model. The 2006 Umbrella Agreement signed between the two countries however stipulates greater participation from the private sector in both implementing and financing projects.

3.2 Energy Overview

Bhutan is the only country in South Asia with surplus power generation capacity and a power sector that contributes significantly to its national economy[42]. Electricity generation gained momentum in Bhutan with the commissioning of the country's first hydropower project, the 366 MW Chhukha HEP, in 1988. During the sixth Five Year Plan (1987-1992)[43], a significant portion of the national budget was apportioned towards power projects. In that period, the Bhutanese government installed seven mini-hydropower plants, twelve micro-hydropower plants and eight diesel generation sets. Domestic consumption was lesser than 16 MW with industry as the primary consumer. With the commissioning of the Kurichhu and Basochhu I projects, electrification rose to 20 per cent in 2003 and Bhutan swiftly achieved 97 per cent grid-based electrification[44] in 2014.

40 Status of hydropower dams in Bhutan. April 2015. International Rivers.
41 Bhutan: Economy, Corruption and other Issues. Dr. S. Chandrasekharan. 10 March 2015. South Asia Analysis Group. www.southasiaanalysis.org/node/1733
42 Bhutan: Energy Sector – Evaluation Study. August 2010. Asian Development Bank.
43 Sixth Five Year Plan of Bhutan. www.gnhc.gov.bt/wp-content/uploads/2011/04/06fyp.pdf
44 Bhutan: Country Snapshots. March 2014. World Bank.

Peak domestic consumption of electricity is approximately 300 MW at present and 99 per cent of this requirement is met from hydropower[45]. The government has succeeded in extending grids even to remote hilltops and in places where this has not been achieved, solar off-grid and decentralized diesel generation supplement the main grid. Power cuts, blackouts and load shedding are not common. However, metering and billing continues to be human resource intensive owing to the distance between houses and villages.

In 2002, Bhutan deregulated its energy sector, which was until then overseen by the Ministry of Trade and Industry, and created the Department of Energy (DoE), Bhutan Electricity Authority (BEA) and Bhutan Power Corporation Limited (BPCL). The three bodies function under the ambit of the Ministry of Economic Affairs (MoEA). While the Department formulates energy policies and conducts planning and coordination, the Authority is the main regulatory agency of the energy sector and BPCL is in-charge of distribution and transmission of electricity. PTC India Limited (formerly Power Trading Corporation of India) facilitates export of power to India.

In 2008, the Government of Bhutan incorporated the Druk Green Power Company (DGPC) as a holding company to "promote, develop and manage renewable energy projects, particularly hydropower, in an efficient, responsible and sustainable manner, and to maximize wealth and revenue of the nation". The government handed over the Chhukha Hydro Power Corporation, Basochhu Hydro Power Corporation, and Kurichhu Hydro Power Corporation to DGPC. Both BPCL and DGPC are owned by the government-owned Druk Holding and Investments, which exercises oversight in the investment and development of power companies.

While Bhutan's annual electricity generation is much more than its needs, it faces shortages during winter[46]. This is because river flows go down in this season, impacting generation. In the months of October to March, Bhutan imports electricity from India. The peak demand from southern Bhutan is in summer months and the peak demand from northern Bhutan is in winter months. The average consumption peak is from November to February and the generation peak is from June to September. On an average[47], an urban household today consumes 200 units of electricity in summer months and 800 units in winter and a rural household consumes 50 units in summer and 180 units in winter months.

The royalty collected from export of electricity subsidizes domestic electricity. The cost of electricity for urban consumers, domestic consumers and commercial consumers is the same as long as the demand is lesser than 300 units. The current policy[48] in Bhutan mandates that the first 100 units to rural consumers be provided free of cost. Urban consumers[49] are charged Rs. 1.28 per unit for consumption of less than 100 units. Rural and urban consumers are charged Rs. 2.45 per unit for consumption of units between 101 and 300 and Rs. 3.23 per unit for consumption of more than 300 units. Low voltage (LV) commercial consumers who consume more than 300 units per month are charged Rs. 3.68 per unit. Medium voltage (MV) commercial consumers who consume between 3 and 10 MW per month are charged Rs. 2.35 per unit. High voltage (HV) commercial consumers who consume more than 10 MW of electricity per month are charged Rs. 1.96 per unit.

45 Green power for Bhutan clean energy crosses borders to reach poor households. 2014. Asian Development Bank.
46 Sector Assessment: Energy. 2012-13. Asian Development Bank.
47 Data provided to the researcher by Bhutan power corporation limited (BPCL), Bhutan.
48 Revised domestic power rates announced. 14 October 2013. Kuensel. www.kuenselonline.com/archive/revised-domestic-power-rates-announced/
49 Data provided to the researcher by National Load Despatch Centre (NDLC), Bhutan.

Table 4 NLDC's Record of Electricity Generated on 23 July 2015

Power Plant	Electricity Generation
Chhukha HEP	366.3 MW
Kurichhu HEP	66 MW
Basochhu I HEP	36.6 MW
Basochhu II HEP	22.1 MW
Tala HEP	1115.1 MW
Dagachhu HEP	90 MW

Source: Compiled by Vasudha Foundation on the basis of data provided by NDLC

In 2014, Bhutan consumed 2004 million units – 1495 by HV industries, 90 by MV industries, 67 by LV consumers, 127 by urban domestic and 84 by rural domestic. The peak consumption in 2014 was 333 MW on 25 December, when generation was 280 MW. According to data from the National Load Dispatch Centre (NLDC), as on 23 July 2015, actual generation was 1682.5 MW and actual export was 1448.63 MW.

4.1 Introduction to Case Study Projects

The study selected the six hydroelectric projects of Chhukha, Kurichhu, Tala, Punatsangchhu I, Punatsangchhu II, and Mangdechhu as case studies for detailed analysis. Chhukha, Kurichhu and Tala HEPs have been completed with assistance from India while Punatsangchhu I, Mangdechhu and Punatsangchhu II HEPs are projects under construction with assistance from India.

4.2 Chhukha HEP

STATUS: COMMISSIONED IN 1988

The 336 MW run-of-the-river (RoR) Chhukha HEP, built on River Wangchhu in Chhukha district, is the oldest hydropower plant[50] in Bhutan. The agreement for the development of the 336 MW Chhukha run-of-the-river HEP was signed in 1974, with an energy buy back arrangement for 99 years. The Chhukha Hydel Project Authority (CHPA) was formed in 1975[51] and entrusted with the responsibility of constructing and commissioning of the project. The National Hydro Power Corporation (NHPC), Geological Survey of India (GSI) and Central Water and Power Commission of India (CWPC) provided their expertise to the project. Bharat Heavy Electrical Limited (BHEL) supplied the electro-mechanical machinery and the civil works contracts were awarded to three Indian companies – Patel Engineering, National Projects Construction Corporation Limited (NPCC) and Aban.

The GoI funded this project with a 60 per cent grant and a 40 per cent loan at the interest rate of 5 per cent payable over a period of 15 years after commissioning. The project was completed at a cost of Rs. 246 Cr[52], increased from the originally sanctioned cost of Rs. 83 Cr. The entire loan has been repaid by the RGoB as of December 2007.
The Chhukha Hydro Power Corporation Limited (CHPC) was formed in July 1991 under the 1989 Company's Act of Bhutan to operate and maintain the hydroelectric power plant and the transmission system and to export surplus power to India after meeting domestic requirement. With the formation of the Druk Green Power Corporation (DGPC) in 2008, CHPC became an operational unit of DGPC.

Initially, almost 90 per cent of the power from CHPC was exported to India. In the early 2000s, the rise in domestic demand brought down CHPC's export to India to about 81 per cent. However, with the commissioning of the Tala Hydroelectric Project in 2006, major share of domestic demand is met by Tala and CHPC became the bulk exporter. In 2013, the export tariff for electricity from CHPC was revised from Rs. 2 to Rs. 2.25 per unit. The project has been earning revenue for Bhutan through export of electricity to India and contributes significantly to the internal revenue generation of the RGoB. The CHPC currently employs 510 people.

50 Project Profile of Chhukha Hydroelectric Project. Druk Green Power Corporation.www.drukgreen.bt/index.php/chp-menu/about-chp
51 International Trade in Energy: The Chhukha Hydroelectric Project in Bhutan. November 1991. D.N.S. Dhakal and Glenn P. Jenkins.Harvard Institute for International Development.
52 Project profile of Chhukha Hydropower Project. Indian Embassy, Thimphu. www.indianembassythimphu.bt/pages.php?id=35

4.3 Kurichhu HEP

STATUS: COMMISSIONED IN 2002

Figure 4 Kurichhu Hydropower Dam Reservoir

The 60 MW reservoir-based Kurichhu HEP is built on River Kurichhu, a tributary of River Manas, in Mongar district. The Government of India and the Royal Government of Bhutan entered into an Agreement in 1994[53] to construct the project. The Government of India financed the project with a 60 per cent grant and a 40 per cent loan, repayable over a period of 12 years at an interest rate of 10.75 per cent. The project cost at the time of the agreement was Rs. 313 Cr[54] which escalated to Rs. 564 Cr by the time the project was completed. More than 60 per cent of the power produced is exported to India at the rate of Rs. 1.98 per unit. In 2008, the two governments agreed to peg Kurichhu's export tariff to Tala's export tariff, meaning that a revision in the power tariff of Tala will be automatically effective for power exported from Kurichhu.

The Kurichhu Project Authority was established to control and monitor the construction work and to arrange funds for the construction. WAPCOS India was appointed as the engineering design consultant. The Authority entered into an agreement with the National Hydroelectric Power Corporation Limited, (NHPC), who in turn entered into agreements with Asian Techs Limited, Hindustan Construction Company (HCC), Gammon India Limited and Bharat Heavy Electricals Limited (BHEL) for carrying out civil works and erection of electro-mechanical equipment.

The Kurichhu Hydro Power Corporation Limited (KHPC) formed to operate and maintain the hydro-electric power plant, the transmission system and to export surplus power to India was amalgam-

53 Project Profile of Kurichhu Hydroelectric Project. Druk Green Power Corporation. www.drukgreen.bt/index.php/khp-menu/about-khp

54 Project profile of Kurichhu Hydropower Project. Indian Embassy, Thimphu. www.indianembassythimphu.bt/pages.php?id=35

ated into the DGPC in 2008. The Kurichhu Hydropower Project currently employs 201 workers, who are predominantly Bhutanese citizens.

4.4 Tala HEP

STATUS: COMMISSIONED IN 2006

The 1020 MW run-of-the-river (RoR) Tala HEP is located downstream of Chhukha HEP on River Wangchhu in Chhukha district. The Agreement[55] for the implementation of the Tala HEP was signed by the two governments on 05 March 1996, following which an autonomous body named the Tala Hydroelectric Project Authority (THPA) was constituted for the construction, operation, and maintenance of the Project.

The original date of completion for the project was December 2004, however owing to delay in completing construction work, the first unit of the project was commissioned in July 2006 and the project was fully commissioned in March 2007. The Tala project was financed by India with a 60 per cent grant and 40 per cent loan at 9 per cent interest rate repayable in 12 years. The project cost as estimated in the DPR was Rs. 1,400 Cr and the project completed in 2007 at a cost of Rs. 4,126 Cr[56]. Export tariff for electricity from the Tala HEP is Rs. 1.80 per unit.

WAPCOS India was appointed as the engineering design consultant to conduct feasibility study and detailed project report. The contract for supplying main plant machinery and equipment was awarded to Bharat Heavy Electricals Limited. Civil works contracts were awarded to Hindustan Construction Company (HCC), Larsen and Toubro (L&T) and Jaiprakash Associates Limited.

A total of 855 acres of land was acquired for the project, of which 49.73 per cent (approximately 425 acres) was forested land, 47.93 per cent was agricultural land and the rest comprised of water bodies and waste lands. The Tala Hydropower Project currently employs 688 workers, who are predominantly Bhutanese citizens.

The project site lies in high landslide and flash floods prone area. In August 2000, heavy downpour of rain severely affected the project area, washed away work and camp sites and cut off roads, bridges and communication channels. Eight of the 1000-odd workers at the project site lost their lives to landslides and river currents. The Indian Air Force air dropped food and medicines to stranded workers.

The Tala hydropower project's application[57] for receiving Certified Emission Reduction (CER) credits from the UNFCCC is currently under validation. The California-based International Rivers and the New Delhi-based South Asia Network on Dams, Rivers & People (SANDARP) have argued[58] against the approval of CDM credits for the Tala HEP. They opine that the project was completed before the application was made to the UNFCCC indicating that the project did not "require" CDM credits. SANDARP's comments also exposed blatant lies made by the project authorities in its application to the UNFCCC. The project authority has claimed that there was no alternative to the Tala HEP in India or Bhutan; that there are no other hydropower projects in Bhutan even while Chhukha, Kurichhu and Basochhu HEPs were in operation; that India does not have hydropower projects of the size of the 1020 MW Tala HEP despite the 1350 MW Bhakhra project, the 1500 MW Nathpa Jhakhri project,

55 Project Profile of Tala Hydroelectric Project. Druk Green Power Corporation. www.drukgreen.bt/index.php/thp-menu/about-thp

56 Project profile of Tala Hydropower Project. Indian Embassy, Thimphu. www.indianembassythimphu.bt/pages.php?id=35

57 Project Design Document submitted by Tala Project Authority for CDM Credits to UNFCCC.

58 Comments on proposed CDM credits for Tala Hydroelectric project in Bhutan. January 2008. South Asia Network on Dams, Rivers and People.
Comments on CDM Project Design Document for Tala Dam, Bhutan. January 2008. International Rivers.

the 1450 MW Sardar Sarovar project, the 1000 MW Tehri project and the 1000 MW Koyna project currently operating in India. The application is still under review by the UNFCCC.

4.5 Punatsangchhu I HEP

STATUS: UNDER CONSTRUCTION

The 1200 MW run-of-the-river (RoR) Punatsangchhu I HEP, located on the River Punatsangchhu in the western district of Wangdue Phodrang, is the largest such project undertaken in Bhutan. The agreement between the Government of India and Royal government of Bhutan for implementation of the Punatsangchhu I HEP was signed on 28 July 2007. The project is being implemented by the Punatsangchhu I Hydroelectric Project Authority (PHPA I), constituted jointly by GoI and RGoB. Punatsangchhu I is being funded by the GoI[59] with a grant-loan ratio of 40:60, wherein the loan is given at an interest rate of 10 per cent per annum, repayable over a period of 12 years. The project cost has seen an enormous escalation from the original estimation of Rs. 3,815 Cr in 2006 to Rs. 9396 Cr in 2015. The project with a lifespan of 35 years will provide domestic electricity to Bhutan and export the surplus to India. Once commissioned, the project will pay an annual royalty of 12 per cent to RGoB for the first 12 years and 18 per cent for the next 22 years.

The project involves a 137 m high and 279 m wide concrete diversion dam across the River Punatsangchhu, an intake with desilting chamber, a water conductor system, an underground power house and transmission lines for evacuating power to India. Water diverted from the dam would be let through two diversion tunnels and the Head Race Tunnel (HRT) to an underground powerhouse. The Detailed Project Report (DPR) was carried out by the engineering design consultant, WAPCOS India, and the civil works contractors on the project are Larsen & Toubro (L&T), Gammon India and Hindustan Construction Company (HCC). The contract for supplying main plant machinery and equipment was awarded to Bharat Heavy Electricals Limited. The expertise of Indian bodies such as Geological Survey of India (GSI), Central Water Commission (CWC), Central Water & Power Research Station (CWPRS), Central Soil & Materials Research Station (CSMRS) and Survey of India (SoI) are provided to the project through WAPCOS.

The total land requirement for the project is 757 acres, out of which 673 acres are Government Reserve Forests (GRF) and 78 acres are private land from 116 landowners. The Project Design Document (PDD) submitted to UNFCCC for Clean Development Mechanism (CDM) credit however, mentions an additional acquisition of 1456.35 ha of forestland.

According to the project's PDD[60], the environmental concerns from the project include degradation of forests, disturbance to wildlife, increased erosion due to quarrying operations, increased incidence of water related diseases, generation of solid wastefrom labour camps, generation of muck from construction activity, dust pollution from construction activities, discharge of effluents with high suspended solid from tunnel and decreased environmental flow of the river.

The high altitudes and difficult terrain of the project's location can potentially expose it to geological risks of landslides and floods that might even impede the development and functioning of the project itself. The UNDP has in fact identified the Punatsangchhu valley as one of the two most Glacial Lake Outburst Flood (GLOF) vulnerable areas[61] in Bhutan. The Punatsangchhu HEPs face the highest risk of GLOF as 13 out of 25 potentially dangerous glacial lakes are located in the river basin.

59 Project profile of Punatsangchhu 1 Hydropower Project. Indian Embassy, Thimphu. www.indianembassythimphu.bt/pages.php?id=37

60 Project Design Document submitted by Punatsangchhu I Project Authority for CDM Credits to UNFCCC. July 2013.

61 Project Design Document submitted by Punatsangchhu I Project Authority for CDM Credits to UNFCCC. July 2013.

The project's commissioning has been delayed due to geological, climatic and technical challenges and date of commissioning has been delayed from 2015 to 2019. Following unprecedented floods in 2009 which delayed construction activities by a year, the project authority decided to relocate the dam upstream to another site on River Punatsangchhu. The rationale for the relocation was that it allowed the augmentation of the project's generation capacity from 1095 MW to 1200 MW. A recent joint report by the Comptroller and Auditor General of India (CAG) and the Royal Audit Authority of Bhutan (RAA) indicated major problems in the implementation of Punatsangchhu I HEP. According to the report, the Geological Survey of India (GSI) had indicated that there might be "geological surprises" in the new dam site, but the project was awarded to Larsen & Toubro (L&T) without further investigation. Construction of the dam began before GSI submitted its final investigation report, which indicated that the right bank contained clay and was not feasible for construction of dam. Subsequently, the right bank at the new dam site began sliding down during construction. Remedial measures have led to further delay and additional costs.

The Punatsangchhu I project has been approved by the UNFCCC for receiving Certified Emission Reduction (CER) credits.

4.6 Mangdechhu HEP

STATUS: UNDER CONSTRUCTION

Figure 5 Mangdechhu Hydropower Project Site

The 720 MW run-of-the-river (RoR) hydropower project is situated on the River Mangdechhu, a tributary of River Manas, in Trongsa district. The agreement between Government of India and Royal government of Bhutan for implementation of the Mangdechhu Hydroelectric Project was signed on 30 April 2010. The project is being implemented by the Mangdechhu Hydroelectric Project Author-

ity (MHPA), constituted jointly by the GoI and the RGoB. The scheduled date of commissioning the project is 2017.

The project was approved with an estimated cost of Rs. 3382 Cr but has seen an escalation bringing it up to Rs. 4500 Cr. The project is built with a grant-loan ratio of 30:70 at 10 per cent interest rate within a 12 year repayment period. The project with a lifespan of 35 years will provide domestic electricity to Bhutan and export the surplus to India. Once commissioned, the project will pay an annual royalty of 12 per cent to RGoB for the first 12 years and 18 per cent for the next 22 years.

The project involves the construction[62] of a 56 m high concrete dam, diversion tunnel, spillway, 2 intake tunnels, 2 de-silting chambers, a 13.5 km long headrace tunnel, underground power house and transmission lines for evacuating power to India. The National Hydro Power Corporation of India (NHPC) was roped in as the engineering design consultant; civil works contracts were awarded to Jaiprakash Associates and Gammon India. Bharat Heavy Electrical Limited (BHEL) was awarded the contract to provide electro-mechanical equipment for the project. The scope of the contract includes the manufacture, supply, erection and commissioning of four Pelton turbines and generators, control system and other auxiliary equipment.

The total land acquired for the project is 803 acres, out of which 733 acres are Government Reserve Forests, and 70 acres are private lands belonging to 49 households. Ten families lost both homestead and agricultural lands.

The Mangdechhu project has applied[63] with the UNFCCC for receiving Certified Emission Reduction (CER) credits and its application is currently under validation.

4.7 Punatsangchhu II HEP

STATUS: UNDER CONSTRUCTION

The 1020 MW Punatsangchhu II is a run-of-the-river (RoR) hydropower project situated on the right bank of River Punatsangchhu in the western district of Wangdue Phodrang. The Agreement between Government of India and Royal government of Bhutan for implementation of the Punatsangchhu II project was signed on 30 April 2010. The project is being implemented by the Punatsangchhu II Hydroelectric Project Authority (PHPA II), constituted jointly by the GoI and the RGoB. The project was scheduled to be completed in 2017; however owing to delays the date of completion has been pushed to 2018.

The Punatsangchhu II was sanctioned in 2010 with a project cost of Rs. 3,778 Cr. Unlike Punatsangchhu I, which received a 40 per cent grant and 60 per cent loan from the Government of India, Punatsangchhu II is built with a 30 per cent grant[64] and 70 per cent loan with an interest rate of 10 per cent and a 12 year repayment period. As of 2015, the project cost for Punatsangchhu II has escalated to Rs. 7,435 Cr. The project with a life span of 35 years will provide domestic electricity to Bhutan and export the surplus to India at tariff of Rs. 2.18 Nu per unit. Once commissioned; the project will pay an annual royalty of 12 per cent to RGoB for the first 12 years and 18 per cent for the next 22 years.

The project involves a 86 m high wide concrete diversion dam across the River Punatsangchhu, an intake with de-silting chamber, a water conductor system, an underground power house and transmission lines for evacuating power to India. WAPCOS Limited, the engineering design consultant

62 Project profile of Mangdechhu Hydropower Project. Mangdechhu Hydroelectric Project Authority. www.mhpa.gov.bt/
63 Project Design Document submitted by Mangdechhu Project Authority for CDM Credits to UNFCCC. May 2014.
64 Project profile of Punatsangchhu II Hydropower Project. Indian Embassy, http://www.indianembassythimphu.bt/pages.php?id=38

for the project, prepared the Detailed Project Report (DPR). The expertise of Indian bodies such as Geological Survey of India (GSI), Central Water Commission (CWC), Central Water & Power Research Station (CWPRS), Central Soil & Materials Research Station (CSMRS) and Survey of India (SoI) are provided to the project through WAPCOS. The contracts for carrying out main civil works for the project were awarded to Jaiprakash Associates and Gammon India. The contract for supplying main plant machinery and equipment was awarded to Bharat Heavy Electricals (BHEL).

A total of 556 acres of land was acquired for this project comprising 479 acres of Government Reserve Forests, 32 acres of private land, including 20 acres of wetlands, and 5 acres of institutional land. The 14 acres of private land were acquired from 19 landowners. Eighteen families lost both homestead and agricultural lands.

The environmental concerns and potential risks mentioned for Punatsangchhu I project are applicable for the Punatsangchhu II project as well, as the two projects are located on the same river. The Punatsangchhu II project has applied[65] for receiving Certified Emission Reduction (CER) credits and its application is currently under validation with the UNFCCC.

65 Project Design Document submitted by Punatsangchhu II Project Authority for CDM Credits to UNFCCC. May 2014.

Note: This section is a reflection of our analysis from the desk research and our meetings with various stakeholders, namely representatives from various departments and ministries of the Royal Government of Bhutan, Civil Society Groups and Think Tanks with specific focus on Environment and Development, journalists, and community members from various project locations. Amongst the representatives of the Government of Bhutan, include members of the National Council (Parliament).

The analysis in this section is thematically presented and includes views of multiple stakeholders. Therefore, it would be difficult to present the views of the various stakeholders separately. However, it must be noted here that, the analysis is primarily based on community views, and reflects the findings from the various focused group discussions.

For more details, please do refer back to the methodology section and also the section 5.5 for the focused group discussion schedule details.

5.1 Implications of Modality of Agreements

The governments of India and Bhutan have customarily reiterated that the key undertone to their relationship is mutual benefit. To ascertain that both countries and their citizens benefit equally within the framework of friendship established by both states, it is necessary to critically review the modalities of the friendship arrangement, which are translated into cooperation agreements, and the various implications of hydropower projects on the economy, environment, people, livelihoods and culture of Bhutan.

A step in that direction immediately reveals a conspicuous lack of access to essentially basic information relating to the agreements signed by the two countries and the hydropower projects executed under the agreements. The agreements for execution of particular projects are not public documents and there is minimal disclosure on hydropower projects implemented under the India-Bhutan energy cooperation agreement. The feasibility studies, Detailed Project Reports (DPR), EIA, SIA, Resettlement & Rehabilitation plans (R&R), compliance monitoring reports and other such documents are not made publicly available, obstructing genuine appraisal of already implemented projects. This continues to be the case for projects under construction and the many more in the pipeline, despite the fact that Bhutanese policies framed in the early 2000s require that documents such as EIA, SIA and R&R be in public domain.

Bhutan has so far not implemented hydropower projects independent of external assistance. So, the only comparison of projects is between those implemented with assistance from India and those implemented with assistance from others. There are three projects implemented or planned in Bhutan with assistance from sources other than India – Basochhu I & Basochhu II HEPs commissioned in 2001 & 2005 with assistance from Austria, Dagachhu HEP commissioned in 2015 with assistance from Austria, Japan and Asian Development Bank (ADB) and Nikachhu HEP which is to be commissioned in 2020 with assistance from the Asian Development Bank. A significant amount of information for two out of the three projects, the Dagachhu HEP and Nikachhu HEP, is publicly available. They include project administration memorandum[66], loan documents[67], resettlement

66 Project Administration Memorandum for Nikachhu Project.
www.adb.org/sites/default/files/project-document/153065/44444-013-pam.pdf
67 Proposed Loan for Additional Financing Kingdom of Bhutan: Green Power Development Project.
www.gtai.de/GTAI/Content/DE/Trade/Fachdaten/PRO/2013/10/Anlagen/PRO201310185011.pdf?v=1

plans[68], environment impact assessment[69], environmental safeguard compliance assessment[70], and environmental & social monitoring report[71].

However, similar information is not available for even a single project (whether completed, under construction or under planning), implemented with assistance from India. Not only are such documents not proactively placed in public domain by the Government of Bhutan and its Indian counterparts, various Bhutanese authorities approached by the authors of this report refused to provide them even while acknowledging that Bhutanese law mandates public disclosure of the same. Similarly, Right to Information applications[72] made to Indian authorities such as Ministry of Environment, Forests & Climate Change, Ministry of Power, Ministry of New & Renewable Energy, Central Electricity Authority and Ministry of External Affairs yielded no information.

Bhutan's diplomatic relations with India and the consequent implementation of hydropower projects are considered politically sensitive within the country and this excessive sensitivity could potentially prevent critical information regarding adverse impacts of projects from reaching its citizens. Juxtaposing this information black out with documented evidence of negative impacts of several projects on the local ecology suggests that the 'political sensitivity' is allowing for leeway to implement projects without adequate assessment of impacts and mitigation plans.

While the modalities of the agreements are not in public domain, Bhutanese citizens are starting to feel that the amount of control with each country in implementation of projects is skewed in favor of India. The Board of the Project Authorities comprises a Chairman, four Members nominated by the Royal Government of Bhutan and three Members nominated by the Government of India. The Project Management is headed by the Managing Director, supported by a Joint Managing Director, a Director (Technical) and a Director (Finance). The Managing Director is also the Ex-Officio Secretary to the Authority. In the case of the Punatsangchhu I Project Authority, as per the signed agreement, the Managing Director, Director Finance and Director Technical are Indian citizens while the Joint Managing Director is a Bhutanese citizen. Likewise, the Mangdechhu Project Authority[73] also has Indian citizens in the positions of Managing Director, Director Finance and Director Technical and a Bhutanese citizen as the Joint Managing Director. This supports the claim within Bhutan that hydropower projects implemented with assistance from India largely have Indians in decision-making positions.

Furthermore, the planning, designing and management of projects, implemented under the India-Bhutan energy cooperation agreement, and all major construction and supply contracts are handled by Indian agencies. Indian companies provide feasibility reports, Detailed Project Reports (DPR) and engineering design specifications. Similarly, Indian companies are contracted to carry out impact assessments and other relevant studies. In some cases, even after the implementation of the projects, major technical responsibilities are handled through a team of Indian engineers and experts.

68 Draft Resettlement Plan for Nikachhu Project.
www.adb.org/sites/default/files/project-document/81685/44444-013-rp-01.pdf

69 Environmental Impact Assessment for Dagachhu Project.
www.internationalrivers.org/files/attached-files/bhutan_dagachhu_eia.pdf
Environmental Impact Assessment for Nikachhu Project.
www.adb.org/sites/default/files/project-document/81680/44444-013-eia-01.pdf

70 Environmental safeguard compliance assessment for Dagachhu Project. www.adb.org/sites/default/files/linked-documents/37399-043-bhu-sd-02.pdf

71 Environmental & social monitoring reportfor Dagachhu Project.
www.adb.org/sites/default/files/project-document/148817/37399-043-esmr-01.pdf

72 Researchers of this study made applications under the Right to Information Act, 2015 to the above mentioned public authorities in India on 31 July 2015.

73 Personnel of the Mangdechhu Hydroelectric Project Authority
www.mhpa.gov.bt/management.php?mid=1

Table 5 Contracts Awarded for the Hydropower Projects Under Construction

Project	Engineering & Design Consultant - Main Plant	Civil Works Contracts (civil works are divided into portions)			E&M Works Contract	Engineering & Design Consultant - Transmission Line	Transmission Works Contracts
		C1	C2	C3			
Punatsangchhu I	WAPCOS (India)	Larsen & Toubro (India)	Gammon (India)	Hindustan Construction Company (India)	BHEL (India), Hyosun (South Korea) & Sudkabel (Germany)	Power Grid (India)	Jyoti Structures (India) & Gammon (India)
Punatsangchhu II	WAPCOS (India)	Jaiprakash Associates (India)	Gammon (India)	Jaiprakash Associates (India)	BHEL (India), Hyosun (South Korea) & L.S. Cables (South Korea)	Power Grid (India)	KEC International (India)
Mangdechhu	NHPC (India)	Jaiprakash Associates (India)	Gammon (India)	Jaiprakash Associates (India) &PES Engineering (India)	BHEL (India) & ALSTOM T&D (India)	WAPCOS (India) & CEA (India)	Kalpataru Power(India)

Source: Compiled by Vasudha Foundation based on information from official websites of Druk Green Power Corporation and Embassy of India in Thimphu

The quality of work of the consultants and contractors employed by the project authorities has also come into question. The South Asia Network on Dams, Rivers and People (SANDRP) contended that the Tala Project Authority "neither appraised the hydrological issues adequately, nor did they take adequate precaution to ensure minimum damages in seasons that are known to be high monsoon rains and flood seasons"[74]. Heavy rains and floods in August 2000 gravely affected the project area and resulted in the deaths of eight workers. SANDRP exposed false claims made by the Project Authority that construction work was paused during monsoons, as the effects of the August 2000 rains on the project and its workers demonstrate otherwise.

The project authority of the Punatsangchhu I HEP has alluded the slow pace of work and the inordinate delay in completing construction work to 'geological surprises' relating to the sinking right bank of the dam site. The dam was re-located by the project authority in 2009 to increase the generation capacity of the project from 1095 MW to 1200 MW. A joint audit[75] conducted by the Royal Audit Authority (RAA) of Bhutan and the Comptroller General Audit of India (CAG) shows that the Punatsangchhu Hydroelectric Project Authority (PHPA), the project's engineering design consultant WAPCOS and Central Water Commission of India (CWC) knew that there were geological weaknesses at the relocation site but still went ahead and approved the tendering of the dam on the same site. Geological Survey of India's (GSI) geo-technical appraisal report had identified weak geological features at the new dam site and pointed out that this may entail additional cost. The GSI appraisal report also said that additional investigations were required for the exact delineation of the weak geological features. However, instead of conducting further investigations as required by procedure, WAPCOS issued a clearance for the project dam bids to be opened on 16 February 2009. Civil contract for construction work was awarded to Larsen and Toubro on 27 March 2009. Subsequent investigations by GSI[76] showed adverse geological conditions in the right bank of the new dam

74 Comments about the proposed CDM credits for The Tala Hydroelectric project in Bhutan and Export of hydropower there from to India. 19 January 2008. South Asia Network on Dams, Rivers and People. www.sandrp.in/hydropower/SANDRP_Comments_Tala_Hydro_CDM_ValidationJan08.pdf

75 Losing the Dragon — India-Bhutan relations one year after Modi's historic visit. 17 October 2015. The Hindu. www.thehindu.com/opinion/op-ed/prime-minister-narendra-modis-historic-visit-to-bhutan/article7480714.ece

76 RAA Report Shows Nu 3.5 Bn Extra Cost And Time Delay For P-I Sinking Zone Could Have Been Avoided. 15 June 2015. The Bhutanese. www.web.archive.org/web/20150724124652/http://www.thebhutanese.bt/raa-report-shows-nu-3-5-bn-extra-cost-and-time-delay-for-p-i-sinking-zone-could-have-been-avoided/

location. The GSI report said that examination of cores of the bore hill drilled on the right bank revealed the presence of a number of shear, fracture, faults zones represented by nil to very poor core recovery with occasional clay gouge. It was concluded that the right bank is riddled with a number of shears and fractures. The Punatsangchhu I HEP now faces inordinate delay in completing work and enormous escalation in project cost.

Over the last 40 years, the private sector in Bhutan has advanced only marginally. The participation of Bhutanese private sector in hydropower development is primarily through small subcontracts in civil works such as supplying of boulders and sand. The private sector has not been given the opportunity to develop and this has created a situation where expertise, capacity and human resource within Bhutan are in short supply. The Bhutan Chamber of Commerce & Industry (BCCI) has asserted that the Bhutanese private sector has not reaped the benefits of hydropower development and has advocated for local companies to be given a greater role in hydropower development. A 2013 news article[77] reported that Ugen Tsechup Dorji, President of BCCI, "held a grudge against the monopoly of Indian companies and workers in the hydropower sector". The BCCI has argued that work that can be done by Bhutanese companies should be contracted to them with India transferring the knowhow.

It is often repeated that Bhutan does not have the local capacity to independently carry out work for the large-scale hydropower projects. But hydropower projects implemented in Bhutan with assistance from ADB and the Government of Austria have employed local Bhutanese agencies, companies and organizations to carry out different kinds of work. For instance, Bhutanese companies carried out civil construction work for the Basochhu HEP and Bhutan Consultancy & Research (BHUCORE) carried out the EIA studies for Nikachhu HEP and Dagachhu HEP. Having said this, the scale of the projects implemented under the India-Bhutan Cooperation Agreement is much larger than that of projects such as Basochhu, Dagachhu and Nikachhu. However, unless gradual participation of local companies and firms is encouraged, Bhutan will be unable to generate the technical know-how, financial and human resources required and will continue to wholly rely on assistance from India and elsewhere.

5.2 Implications to Economy

The hydropower sector has undoubtedly benefitted Bhutan's economy through substantial contributions to the national revenue and by providing the much-needed boost to kick-start the industry and service sector. The sector's financial performance has however seen deterioration in the previous decade, indicating that its commercial profitability cannot be taken for granted. Economic analysis has revealed that the net profit per unit of electricity sold has fallen sharply since 2007. Despite the increase in electricity generation capacity, the sector's contribution to the real GDP growth has seen a continual decline[78]; from 12.2 per cent in 2007 to (1.1) per cent in 2011 to 1.8 per cent in 2013 and (0.5) per cent in 2014.

Along with decreasing revenue, Bhutan's external debt has witnessed a steady rise, causing much concern within the country. According to the 2013-14 Annual Report of the Royal Monetary Authority (RMA), Bhutan's outstanding external debt has increased by 9.5 per cent to Rs. 11,621.5 Cr. The standalone debt of the hydropower sector alone was Rs. 6,787 Cr.

77 Bhutan's Experiments with Happiness. October 2013. Down to Earth. www.downtoearth.org.in/coverage/bhutans-experiments-with--happiness-42467

78 Annual Report of the Royal Monetary Authority. 2014-15. Royal Government of Bhutan. www.rma.org.bt/annualreporttp.jsp

Table 6 Economic Indicators for Bhutan

Economic Indicator	2010	2011	2012	2013	2014
GDP Growth Rate (in percentage)	11.7	7.9	5.1	2.1	5.4
RGoB's External Debt (InUSD Million)	1289.3	1333.7	1606.8	1759.0	1854.6
RGoB's Debt to India (In Rs. Crores)	3406.23	4555.09	6134.17	6787.02	8118.36

Source: 2014-15 *Annual Report of Royal Monetary Authority of Bhutan*

The RMA reported that as of June 2014[79], Indian rupee debt constituted 64 per cent of Bhutan's total debt and hydropower loans accounted for 83.4 per cent of the total rupee loan. Actual interest payments on rupee denominated hydropower debt amounted to Rs. 1.4 billion in 2014 and accrued interest on the three ongoing hydropower projects (Punatsangchhu I, Punatsangchhu II and Mangdechhu) amounted to almost Rs. 3.6 billion. In December 2014, Bhutan's total external debt was 112 per cent of the country's GDP[80]. According to World Economic Outlook online database of the International Monetary Fund (IMF), the percentage of governmental debt as a percentage of GDP increased to 117.7 per cent in 2015. This data shows that the hydropower sector has contributed to the steep rise in Bhutan's external debt. A report called, 'The New Debt Trap' by the Jubilee Debt Campaign, a UK-based company, has categorized Bhutan as a country with 'high risk of government debt crises'. The report lists Bhutan as one "among 14 other countries that are fast heading towards a debt crisis".

Bhutan's hydro-power projects have largely been perceived risk-free, and thus rapid hydro-power investment through heavy borrowing has not caused much concern until recently. Yet available information suggests that the sector's financial performance has been deteriorating... Should the hydropower sector's financial performance continue to deteriorate, Bhutan's solvency could be threatened. Although debt service costs are being borne by DGPC at present, after all, the hydropower debt is the government's liabilities. The source of the performance deterioration has to be identified, and, remedial actions taken soon to avoid debt service difficulties.

Naoko C. Kojo. Small Countries with Volatile Revenue: Botswana and Bhutan.
Economic Policy and Debt Department, World Bank

Bhutan's trade deficit, stemming from an imbalance in export and import, is seen as one of the key reasons for the macroeconomic instability in the country since 2009. Inflation began to rise markedly, initially driven by food price inflation imported from India. The inflation rate reached an all time high of 13.53 per cent in 2012 and stands at 5.15 per cent in the second quarter of 2015. Bhutan's exports of Rs. 3288 Cr compared to imports of Rs. 5530 Cr has created a trade deficit of Rs. 2242 Cr. Bhutan's balance of payment touched 21.5 per cent of its GDP in 2013. As a result, the country faced a severe rupee-crunch in 2012.

Despite the significant increase in electricity exports, the export growth has been unable to keep pace with growth in imports, particularly imports from India. While consumption-related imports have grown considerably over the last few years, a significant portion of imports are related to the construction of new hydropower projects and fuels. Much of the construction supplies for hydropower projects are purchased in India by Indian contractors and imported to Bhutan. Even when goods such as cement, transport trucks, food supply, vegetables and fruits are available in Bhutan, contractors of various projects have been found to import them from India.

79 Bhutan's debt increasing at 9.5 per cent, India largest creditor. 29 January 2015. Economic Times. www.articles.economictimes.indiatimes.com/2015-01-29/news/58586541_1_hydropower-rupee-loan-june-2014

80 Losing the Dragon - India-Bhutan relations one year after Modi's historic visit. 17 October 2015. The Hindu. www.thehindu.com/opinion/op-ed/prime-minister-narendra-modis-historic-visit-to-bhutan/article7480714.ece

The model of financing hydropower projects under the India-Bhutan energy cooperation agreements has witnessed a trend of reversing the grant-loan ratio. The Indian Government funded the Chhukha, Kurichhu and Tala HEPs with a grant-loan ratio of 60:40. For the Punatsangchhu I project, the grant component was reduced to 40 per cent and the loan component increased to 60 per cent. The grant component for the Punatsangchhu II and Mangdechhu HEPs were further reduced to 30 per cent thereby increasing the loan component to 70 per cent. Likewise, the rate of interest on the loans sanctioned by the Indian government to Bhutan has increased from just 5 per cent in the case of Chhukha HEP to 10.75 per cent for Kurichhu and 10 per cent for the Punatsangchhu HEPs and Mangdechhu HEP. The interest rate on loans provided by the Indian government is also higher than the interest rates on loans provided by the Austrian government and the Asian Development Bank (ADB). This reversal of grant-loan ratio will not only increase Bhutan's debt, but it will also translate into increased cost per unit of electricity exported to India.

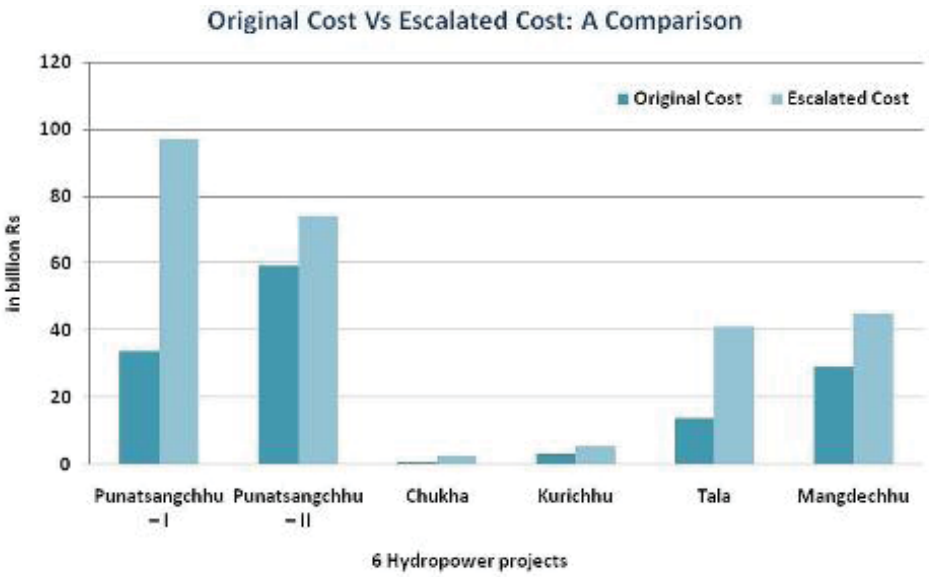
The Chhukha, Kurichhu and Tala HEPs had seen cost escalations during the construction phase and so are the three projects under construction experiencing escalations of cost. However, the magnitude of cost escalation is the most alarming for the Punatsangchhu I HEP where the project cost increased from the originally estimated cost of Rs. 3,400 Cr in 2008 to a whopping Rs. 9,700 Cr in 2015. In comparison, the projects funded by the Austrian government and the ADB have either kept to the original cost or seen much smaller escalations. This poses a serious challenge to the competence and proficiency of project authorities in managing projects implemented under the India-Bhutan energy cooperation agreements.

Table 7 Financial Details of Completed and Under Construction HEPs

Project Name	Capacity (MW)	Original Cost (Rs. Cr)	Escalated Cost	Escalation Percentage	Grant: Loan Ratio	Loan Interest (in percentage)	Repayment Period (yrs)
Projects financed by the Indian Government							
Chhukha	336	83	246	197	60:40	5	15
Kurichhu	60	313	564	79	60:40	10.75	12
Tala	1,020	1,400	4,126	193	60:40	9	12
Punatsangchhu I	1,200	3,400	9,700	170	40:60	10	12
Mangdechhu	720	2,896	4,500	29	30:70	10	12
Punatsangchhu II	1,020	3,778	7,435	97	30:70	10	12
Projects financed by Austrian Government and the ADB							
Basochhu I	24	145	144	None	-	6	15
Basochhu II	40	142	182	28	-	6	20
Dagachhu I	126	820	1,296	48	-	9	15

Source: Review of the Sustainable Hydropower Development Policy 2008. 27 May 2014. National Council of Bhutan.

Figure 6 Original Project Cost versus Escalated Cost



In July 2015,[81] a local daily TheBhutanese reported that Tata Power Trading Company (TPTC), which has a 15 year agreement with the Dagachhu HEP to sell its electricity in India, was facing problems selling electricity from the HEP at Nu. 2.90. The projected cost of generation at the Punatsangchhu I has already touched Rs. 4.00 per unit. The project's completion date has been pushed back to 2019, meaning the costs could go up further. The enormous increase in project costs severely questions the financial viability of electricity from this project. Also, the foregone profit owing to the delay in completing the Punatsangchhu I HEP is pegged at Rs. 39 billion. The Indian government has indicated acceptance of additional costs, but given that 60 per cent of the project cost is only a loan from India, it is Bhutan that will have to bear the brunt of the major share of the losses and repay a higher amount of interest on loans.

Another cause for concern is that the rupee denoted grants and loans for hydropower development from India are disbursed directly from the Indian Ministry of External Affairs to hydropower authorities in Bhutan bypassing the national budget, even though the financing agreements stipulate the Royal Government of Bhutan as the beneficiary. According to Naoko C. Kojo, "All government financial flows need to be integrated into the national budget process to ensure its integrity and protect its role as the mechanism for setting expenditure priorities and allocating public resources. Fiscal flows, regardless of the objectives and source of funding, should not be entrusted with an extra-budgetary authority, and all fiscal inflows and outflows should go through the budget."

5.3 Implications to Ecology

The directives for mega projects planned between India and Bhutan stem from the Ministry of Economic Affairs in Bhutan rather than through coordinated efforts between various ministries to ensure that planning factors implications on human and environment life apart from economic considerations.

For projects implemented under the India-Bhutan energy cooperation agreement, various regulatory bodies and departments such as National Environment Commission (NEC), Department of Forest and Park Services, Ministry of Labour and Human Resources, and Ministry of Works and

81 Tata Power faces low rates and red tape in selling 126 MW Dagachhu Power in India. 25 July 2015. The Bhutanese. http://4.bp.blogspot.com/-Hkf0Xi5Eiog/VfjBNT9zUDI/AAAAAAAAHWw/pMSjbnHjNhU/s1600/TheBhutanese.jpg

Human Settlement, which are empowered to screen and assess projects for environmental, social and cultural impacts, become involved only after the Government of Bhutan gives its go-ahead by signing an agreement with India to implement the project.

Available information indicates that pre-feasibility studies are carried out before the two governments reach an understanding such as the 2006 Umbrella Agreement which includes plans for 10 mega hydropower projects. Then, on the basis of such agreements, feasibility studies and detailed project reports (DPR) are commissioned. Once the studies discern the project's technical and financial viability, the two governments sign an agreement for actual implementation of particular projects. It is only after signing of this agreement, that the project is screened for environmental and social impacts. This has reduced regulatory processes, impact analysis, and consents and clearances from ministries to become inconsequential proceedings.

Since most of the hydropower projects implemented in Bhutan are run-of-the-river (RoR) schemes, the amount of forest lands diverted to the projects is lesser in relation to reservoir based projects which submerge greater amounts of land. Of the six projects implemented till date, only the 60 MW Kurichhu HEP is a reservoir scheme. Having said this, four projects planned under the 2006 Umbrella Agreement– the 180 MW Bunakha HEP, 2560 MW Sunkosh HEP, 2640 MW Kuri-Gongri HEP and 540 MW Amochhu HEP, are large or mega reservoir-based hydropower projects. These four projects, especially Sunkosh and Kuri-Gongri, are exceptionally large projects and will require large extents of land.

The Department of Forest and Park Services requires projects to compensate every acre of forestland used with 2 acres of afforestation. The forest protection norms do not allow any activity in areas identified as core zones. An official within the department however implied that they apply subjective analysis based on ground realities before taking a decision on projects. For example, underground drilling was permitted in the buffer zone of a reserve park in the case of the Nikachhu HEP. The construction of transmission lines through reserve forests and protected areas has negatively impacted forest cover and water shed areas.

Environment Impact Assessment (EIA) was not conducted for the Chhukha, Kurichhu and Tala HEPs as work on the projects began prior to the passing of the Environmental Assessment Act of 2000. The Project Authorities for Punatsangchhu I, Punatsangchhu II and Mangdechhu HEPs conducted Environment Impact Assessments, which are however not publicly available. Given the lack of access to critical information, it is not possible to determine if hydropower projects have been following environmental norms and to what extent they are successful in doing so. But preliminary information indicates that the environment is taking a backseat in new developments.

EIA studies for projects implemented under the India-Bhutan Cooperation Agreement have been undertaken by Indian agencies such as WAPCOS India, Guwahati University and the Dehradun based Forestry Research Institute. The EIA reports completed by WAPCOS for projects in India have come under severe criticism[82] in the past. Indian organizations such as the South Asia Network on Dams, Rivers and People (SANDARP) have critiqued[83] WAPCOS for substandard work, manipulation of information and underassessment of impacts. Without actually reviewing the EIA reports for the projects under study in this report, one cannot discuss its quality and standard. However, given the

82 Hydropower in Bhutan - Time for a Rethink? August 2015. International Rivers. www.internationalrivers.org/blogs/328-5

83 Sach Khas Hydro project in Chenab Basin: Another example of WAPCOS's shoddy EIA. 19 August 2014. SANDRP. www.sandrp.wordpress.com/2014/08/19/sach-khas-hydro-project-in-chenab-basin-another-example-of-wapcoss-shoddy-eia/
Lohit Basin Study by WAPCOS: A mockery of e-flows and cumulative impacts. SANDRP. www.sandrp.in/rivers/Lohit_Basin_Study_by_WAPCOS_A_mockery_of_e-flows_and_cumulative_impacts.pdf
Comments on EIA of Bansujara Multipurpose project in Dhasan basin in MP - Another shoddy EIA by WAPCOS. November 2013. SANDRP. www.sandrp.in/Bansujara_Multipurpose_Nov_2013.pdf
Comments on WAPCOS study on effect of Hydro peaking of dams on DSNP, December 2011. SANDRP. www.sandrp.in/hydropower/Comments_on_WAPCOS_study_on_effect_of_Hydro_ peaking_of_dams_on_DSNP.pdf/at_download/file

tight veil around the reports, the track record of some of the agencies employed, and the increasing evidence of adverse environmental impacts from projects, there is a growing sense that the EIA report are poor and do not sufficiently assess impacts of projects.

Environmental impacts from hydropower projects include loss of forest lands; disturbance to wildlife habitat; heavy dust pollution from construction work and use of heavy vehicles to transport construction material and equipment noise pollution due to blasting and tunneling activities; damage to open water bodies such as streams and ponds; and severe stress on water resources in the region.

Dr. Lam Dorjee of the Centre for Environment and Development, Bhutan stated that, "From what we see, the environmental standards employed in the Punatsangchhu I project are pretty low. Mega projects in the least should attempt to not interfere with day to day life of the general public".

The Punatsangchhu projects are located close to the Dikchhu and Hararongchu (streams), which is home to a variety of endangered species of flora and fauna. The critically endangered White-bellied Heron *(Ardeainsignis)* is under threat of extinction in Bhutan due to the development of the Punatsangchhu HEPs, which are located in close proximity to their habitat. As per the 2007 International Union for Conservation of Nature (IUCN) Red List, there are only 200 of the critically endangered species in the world. The Royal Society for the Protection of Nature (RSPN) initiated captive breeding of the white bellied heron and with financial assistance from the PHPA, RSPN successfully hatched a chick. In 2013, International Rivers reported that illegal riverbed mining for the construction of the Punatsangchhu HEP has affected breeding of Ruddy Shelduck. Similar concerns about construction of Punatsangchhu HEPs affecting breeding and migration of the golden mahseer[84] and Deccan mahseer have been voiced. The Mangdechhu project area is home to a rich diversity of birds, butterflies and endangered species such as the golden langur[85] and Himalayan black bear.

The Rivers Manas and Punatsangchhu drain into the state of Assam in India and hydropower projects on both the rivers are expected to have adverse trans-border impacts in the downstream state. Several studies have predicted a possible threat[86] from the Mangdechhu HEP to the Manas National Park, a UNESCO world heritage site. A part of the national park lies on the Bhutan side of the border by the name of Royal Manas National Park and the other half, located in the downstream state of Assam (India), is known as the Manas National Park. This heritage site in Assam has witnessed major flooding[87] in the past resulting from the downstream impacts from the Kurichhu HEP.

Most fish species in Bhutan are the local migratory kind, which are severely impacted by concrete dams across rivers. The experience of the implemented hydropower projects reveals adverse impacts on fish migration and fish breeding. Experiments of building fish ladders at the dam site to enable fish to cross the concrete structures to the other side have not proved successful. The fish ladders constructed at the Kurichhu[88] and Dagachhu dams failed to transport fish across the dams. The height of the dam is too high for the fish to cross over using a manmade ladder. The designs for Punatsangchhu I, Mangdechhu and Punatsangchhu II do not even include fish ladders.

Affected communities in the case study areas reported that spring waters, which were traditionally

84 Damming Or Damming Rivers? 10 October 2011. Climate Himalaya. www.chimalaya.org/2011/10/10/damming-or-damming-rivers/

85 Objections and comments on CDM credits for Mangdechhu hydropower project in Bhutan and export of hydropower from it to India by Mangdechhu Hydroelectric Project Authority. 25 July 2015. International Rivers. www.internationalrivers.org/files/attached-files/mangdechhu_cdm_comments-714-updated.pdf

86 Potential impact of large river dams in Eastern Himalaya on World Heritage Sites in Assam: Expression of Concern. Aaranyak. www.ercindia.org/files/Aaranyak%20concern-dams%20&%20WHS%20in%20Assam.pdf

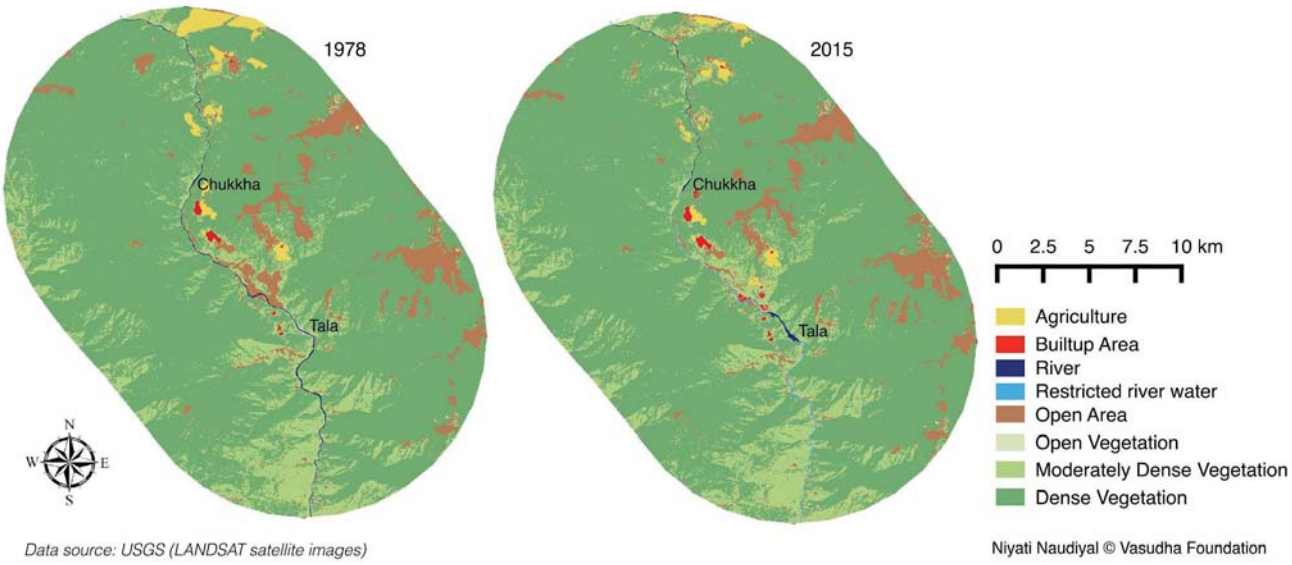
87 Manas could lose its World Heritage Site status again, thanks to dam. 27 October 2011. Asian Correspondent. www.write2kill.in/report/manas-could-lose-its-world-heritage-site-status-again-thanks-to-dams.html

88 Some thoughts on a visit to the fish-ladder at Kurichhu hydropower project, Bhutan. January 2014. SANDRP. www.sandrp.in/FishLadder_Kurichhu_Bhutan_Jan_2014.pdf

used for household and agricultural purposes, are gradually reducing while surface sources such as ponds are drying up at rates much faster than recharge of water sources is taking place.

Bhutan does not have specific norms and standards to maintain adequate environmental flow of rivers while implementing hydropower projects. Environmental flow is a system that manages the quantity, timing, and quality of water flowing below a dam, in order to sustain freshwater and estuarine ecosystems, and the human livelihoods that depend on them. Concurrently, there is a lack of local expertise to determine environmental flow, which has allowed projects with badly designed environmental flows to be implemented. The NEC is currently working to scientifically determine environmental flows for its rivers and hopes to have the results in 2017. Nonetheless, impacts of environmental flows in the already implemented projects are alarming.

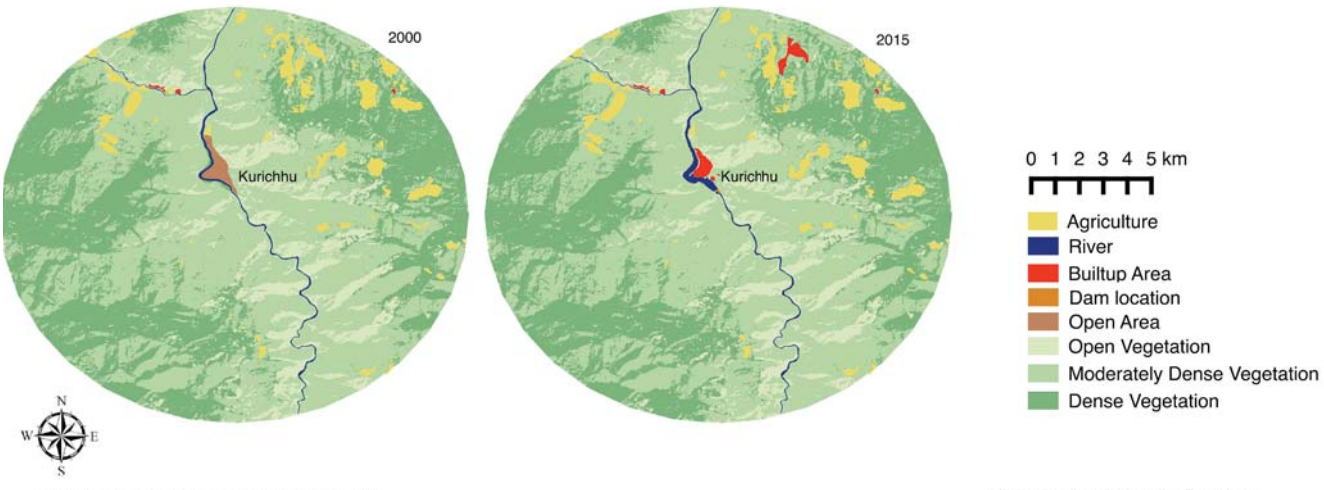
Figure 7 Landuse Change Map for Chhukha and Tala Hydropower Projects (1978 - 2015)



Data source: USGS (LANDSAT satellite images)

Niyati Naudiyal © Vasudha Foundation

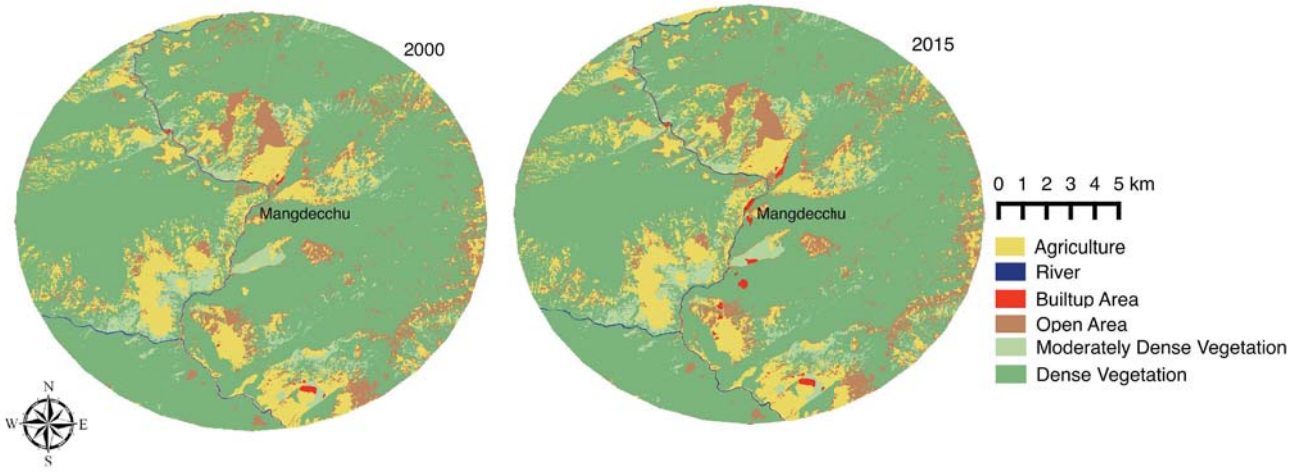
Figure 8 Landuse Change Map for Kurichhu Hydropower Project (2000-2015)



Data source: USGS (LANDSAT satellite images)

Niyati Naudiyal © Vasudha Foundation

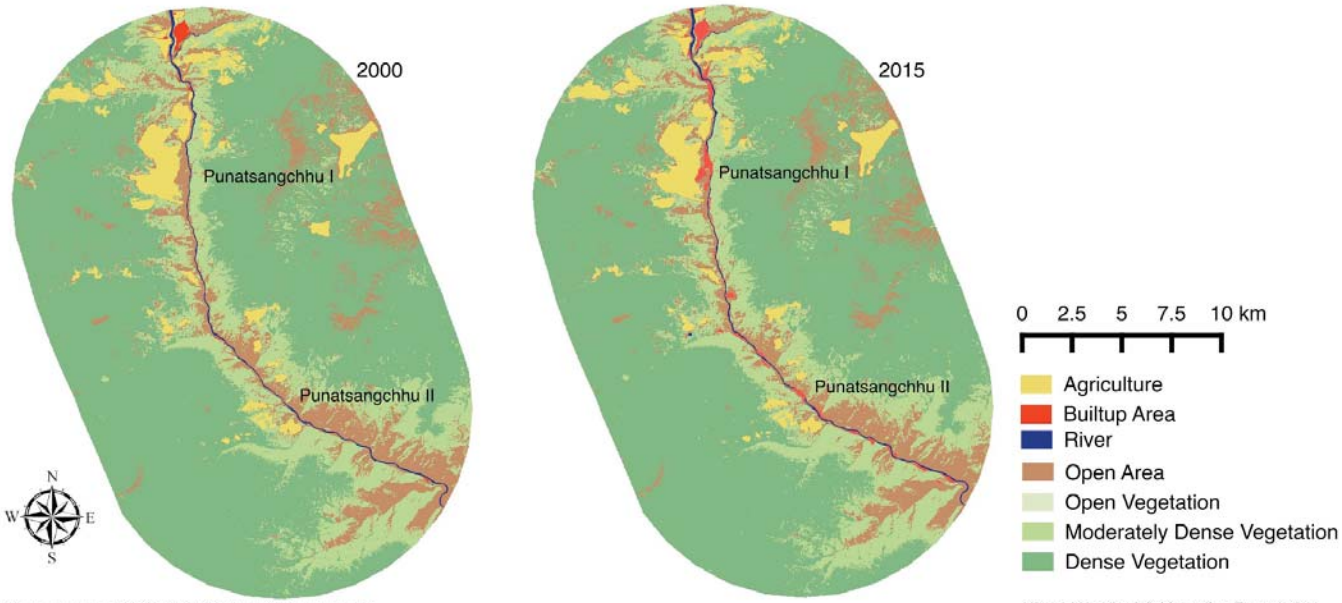
Figure 9 Landuse Change Map for Mangdechhu Hydropower Project (2000 - 2015)



Data source: USGS (LANDSAT satellite images)

Niyati Naudiyal © Vasudha Foundation

Figure 10 Landuse Change Map for Punatsangchhu I and II Hydropower Projects (2000-2015)



Data source: USGS (LANDSAT satellite images)

Niyati Naudiyal © Vasudha Foundation

This study conducted a land-use change mapping exercise for the six case study hydropower projects of Chhukha, Kurichhu, Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu. The mapping utilized post-monsoon satellite imageries since it is ideal for mapping water flow regimes. Images from two different time frames, before onset of project and after completion of the project, were analyzed for each of the case study projects to identify and map the impacts of the project on the surrounding ecology. A region of 10 km around each hydro power plant was delimited for the mapping. The main classification categories for the mapping include agriculture, open forests, moderate dense forests, dense forests, rivers, open area, and built-up areas.

The land-use change maps for Punatsangchhu I, Punatsangchhu II and Mangdechhu did not delineate significant information as construction work for these projects are ongoing and the projects have not been commissioned yet. The only major changes that can be observed include a significant addition of built-up area around the river course and at the HEP sites.

The most significant aspect observed in this exercise was the near total loss of water in the river course downstream of Chhukha and Tala HEPs. Run-of-the-river (RoR) hydropower schemes function by diverting a substantial portion of the river into tunnels, built through adjacent mountains, which flow at great speed for a significant distance and eventually hit turbines to generate energy. The headrace tunnel, located adjacent to the dam, is the intake channel and the tailrace tunnel, located downstream of the dam, flushes water back into the river.

In the case of the River Wangchhu, the land-use change map reveals that a 10 km stretch from the Chhukha headrace tunnel and another 25 km stretch from the Tala headrace tunnel are practically dry with very limited water flow. The fact that the Tala headrace tunnel is within a 2.4 km distance from the Chhukha tailrace tunnel additionally means that the two projects together affect an entire stretch of almost 35 km of the River Wangchhu. This can severely affect the riverine ecology of River Wangchhu and have irrevocable implications for ground water aquifers and ground water recharge in the region.

The Kurichhu HEP being a reservoir scheme, without diversion of river course through tunnels, does not have the same impact on River Kurichhu as Chhukha and Tala HEPs have on River Wangchhu. Impacts of the Punatsangchhu I, Punatsangchhu II and Mangdechhu HEPs on the river ecology will reveal itself only after the project begins to function.

In addition, there are no basin wide studies to assess the cumulative impacts of the hydropower projects in the same river basin, and to determine the need for environmental flows to ensure the ecological integrity of river basins. The environmental legislations in Bhutan mandates Cumulative Environmental Impact Assessments (CEIAs) for projects planned on the same river course and basin. However, so far Bhutan has not conducted even a single CEIA.

According to an August 2010 evaluation of the energy sector in Bhutan by the ADB, "the National Environment Commission (NEC), which has been tasked with the responsibility of monitoring and enforcing mitigating measures for the adverse environment impacts of large hydropower projects, lacks the institutional capacity to discharge its responsibilities effectively given the scale of proposed hydropower development in Bhutan."

The nascent Department of Disaster Management in Bhutan, setup in 2008, functions as the national coordination unit for disaster management work but holds little technical expertise of its own. The department works towards raising awareness on risks and preparedness, building local capacities to develop disaster management and contingency plans. The department has no specific focus on hydropower and there is no compulsion that project authorities of hydropower projects involve the Disaster Management Department for drawing up Disaster Management & Contingency plans.

The National Disaster Management Authority was set up in 2014 to approve disaster management plans of projects; however this Authority has not begun functioning to its full capacity. At present, there is very little coordination between the NEC, DGPC, Department of Hydrology, and Department of Disaster Management while planning and implementing hydropower projects.

Bhutan faces severe geological risks of earthquakes and Glacial Lake Outburst Floods (GLOF) due to its location in extremely challenging terrain in the mountainous Himalayan region. Unfavorable monsoon conditions also possess high risk of landslides that are amplified during project construction due to loose soil structure and high possibility of soil erosion. The Chhukha, Tala, Kurichhu, Punatsangchhu I and Punatsangchhu II HEPs are located in areas identified as high and very high seismic risk zones. The Punatsangchhu and Mangdechhu river basins possess highest risk of GLOF in Bhutan, as they hold huge ice reserves and massive and potentially dangerous glacial lakes. Of the 24 potentially dangerous glacial lakes, 13 are in the Punatsangchhu basin. The Kurichhu river basin is moderately exposed to GLOF.

5.4 Implications to Communities

Information regarding the social impacts of projects is nearly nonexistent for the two executed projects – Chhukha HEP and Kurichhu HEP. While this information is available for Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu, researchers of this study did not have access to the relevant documents. Therefore, rudimentary information such as the exact number and names of villages affected by each of the projects, the number of households affected, the number of household who lost wetlands and dry land, the number of households that lost homestead land continue to be missing links. Information relating to ground realities presented in this section is based on Focus Groups Discussions (FGD)[89] conducted in July and September 2015.

The schedules of their focus group discussions is as below:

Focus Group Discussions
(Conducting discussions with Project Affected Population (PAP) to understand ground realities and community participation in any decision making process)

Tala (19th and 20th July 2015)
People from affected villages of Tabji, Rinchhentse, Dangreyboog, Gengu, Khamaedthapang, Nimgang, Tashilakha, Bongo and Tsimalakha

Punatsangchhu I & Punatsangchhu II (20th and 21st July 2015)
People from affected villages in Chiwogs of Gasetsho Gom, Gasetsho Wom, Thedtsho, Daga (Dagar), Athang and Ruepisa in Wangdue Phodrang district

Mangdechhu (13th and 14th September 2015)
People from affected villages of Kuengarabten, Eusa, Taktse, Samcholing Khatoe, Samcholing Lkhatay and Khamay

Kurichhu (11th and 12th September 2015)
People from affected villages within Saling, Drepong and Mongar Gewogs in Mongar district

89 Refer methodology for more details on the focus group discussions conducted. Each focused group discussions had roughly 25 people specifically representing all the villages in each of the project locations, in addition to local government and elected representatives. Further, we also had meetings at various pit stops stuch as tonw centres, market places and community halls.

The main source of livelihood in all the six case study areas is agriculture, fruit orchards and livestock rearing. The six projects have acquired dry lands, wetlands and orchards. Community representatives from all the six case study areas stated that all villages are electrified and have piped drinking water supply through the Rural Water Supply Scheme (RWSS).

Table 8 Impacts of Punatsangchhu I, II & Mangdechhu on Land

Land Details	PHP I HEP	PHP II HEP	Mangdechhu HEP
Total land acquired	757 acres	556 acres	803 acres
Forest land acquired	673 acres	479 acres	733 acres
Private land acquired	78 acres	32 acres (20 acres wetland)	70 acres
Project Affected families (PAF) likely to lose cultivated land	116	19	49
PAF likely to lose both land and homestead	23	1	10

Source: Compiled by Vasudha Foundation

Community representatives stated that government authorities held a consultative meeting with the affected people to inform them of the upcoming hydropower project but did not seek their consent for acquisition of their lands or for implementing the project in their locality. In a meeting held in 1994 in Darla village (Chukha), the authorities shared information about the Tala HEP and the benefits of electrification and infrastructure it would bring to the region. Similarly, at the August 2013 meeting held by the district administration at the MHPA Colony, information regarding the Mangdechhu HEP and the benefits it would bring to the region were discussed.

The Environment Impact Assessment (EIA) report for the Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu HEPs were not made available to the affected communities by district and project authorities. More importantly, the people from the project-affected areas asserted that the district authorities did not seek their consent before acquiring their land for the hydropower projects. Also, the district and project authorities did not discuss the potential adverse impacts of the large hydropower projects on the natural environment and people during the consultative meetings.

Private Land for developmental projects including hydropower is acquired under the Land Act of 2007 by RGoB and leased to the projects' developers. As per the Act, when private land is acquired, landholders are given a choice between monetary compensation and replacement land in return for the land acquired from them. The norms specify that wherever possible replacement land be as close to the original land as possible and allows people to identify land for themselves and approach the local government for granting ownership rights. In the event that people are unable to identify replacement lands in their own village or neighbouring villages, the district authorities facilitate identification of land. Land replacement however is only granted if the landowner loses more than 10 decimals of land. For acquisition of land of less than 10 decimals, monetary compensation is the only option for those losing land. Given the scarcity of cultivable agricultural lands, wetlands in particular, all lands are compensated with dry land. Also, the replacement lands are predominantly on hilltops that are water scarce and unfertile, making new tilling of land strenuous and time-consuming. Many villagers narrated that their families had to work on the new barren lands for years before making them suitable for cultivation with healthy crop yields.

In the case of hydropower projects, land is required for a variety of reasons such as construction of dam, tunnel, reservoir, powerhouse, office buildings, housing colonies, transmission lines, transmission tower and roads.

Communities[90] reported issues in the disbursement of compensation owing to faults with land records and families lacking awareness of procedures to receive compensation. The Land Act also provides for monetary compensation to landowners for periods of crop loss. Communities affected by the Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu HEPs have received compensation for crop loss. In the case of Punatsangchhu I, land was acquired in 2008, compensation was provided in 2011 and replacement land was granted to the landowners in 2013. Families however reported that they received crop compensation only for a period of 2 years. Likewise land losers affected by projects currently under implementation stated that though their lands have been acquired, provision of land replacement took longer than the number of years for which they received crop compensation. For instance, villagers affected by the Mangdechhu HEP claimed that while they lost crop production for a period of five years, they were provided crop compensation for a period of only one year.

The acquisition of lands for hydropower projects has also impacted land holdings of people. Families with very small land holdings, of less than 10 decimals, have lost all the land they owned, as they are not eligible for receiving replacement land under the Land Act 2007.

People in Tala, Punatsangchhu I, Punatsangchhu II and Mangdechhu HEP areas reported increasing scarcity of water, drying up of source points, and drying up of streams. Some areas also reported the drying up of surface sources such as ponds in the recent past. Spring waters are the most important sources of water for domestic and irrigational use. Disruption of groundwater flows and springs are known to occur during construction of tunnels for run-of-the-river (RoR) hydropower projects. That spring waters are in fact drying up in Bhutan was acknowledged in the June 2012 Long Term Plan for Water Supply Infrastructures of the Ministry of Works & Human Settlement.

In 2013, a consultative meeting[91] was organized by the Dzongdag (Governor) of Trongsa District with representatives from affected villages and Mangdechhu Hydro Power Authority (MHPA) to discuss the use of water by MHPA. The people had given a written representation to the district authorities that expressed their refusal to share water with the project authorities, as "they did not have enough for themselves to irrigate the paddy fields". The letter also stated that MHPA had not honored its earlier commitments. On assurances from the district authorities and the MHPA, people agreed to share their water with MHPA. The MHPA promised to construct engineering structures to harness water from three sources into a channel; construct "open box drain channel" along the Trongsa-Gelephu highway as irrigation cum road drain channel and construct a water tank for drinking purpose. However, the incessant plying of heavy vehicles on the road has already damaged the newly built irrigation canal, which the authority has now promised to rebuild.

90 The sample size of the project affected communities varied across project sites. At some sites we were able to interview groups of peopleand in some cases, only the administrative head (known as the gup) at the village level was available for the interview representing the entire community. Refer methodologyfor more details on interviews and focus group discussions conducted.

91 The meeting was organised on 23 March 2013 at the Kuenga Rapten Dzong Compoud with the public of Drakteng Gewog for water abstraction by MHPA.

Figure 11 Plying of Heavy Vehicles at the Mangdechhu Project Site

Construction activities for Mangdechhu I have also disrupted the government's piped water supply from the springs to the villages. On MHPA's orders, Jaiprakash Associates, the civil contractor for the project, laid new pipes for water supply. People reported that the low quality PVC pipes, which were used for this purpose, routinely break at different points. Also, when the water supply is low, the project authorities and/ or contractors cut off supply of water to the village so that the colony gets water.

People from the Punatsangchhu I, Punatsangchhu II and Mangdechhu projects reported that blasting during construction activity has impacted concrete houses. Communities around the Mangdechhu project also revealed that blasting had affected the Trongsa Dzong, the Trongsa Museum and a guest house. MHPA has denied that the blasting was responsible for the impact on the public buildings.

The Wangdi phodrang - Tsirang highway has been damaged by use of heavy vehicles for Punatsangchhu project activity. The Trongsa-Gelephu highway has been rendered almost impossible to use owing to the plying of 12-18 wheeled trucks for construction work of Mangdechhu project. The people reported that immediately after complaints are made, the situation improves marginally only to revert to bad conditions in a short span. The people in these regions have been forced to use damaged roads for the last 5 years.

Dust pollution, as a result of increased vehicular traffic, blasting and construction activity, has given rise to respiratory disorders in children. Excavation activities during the construction of dam and tunnels generate huge quantities of muck and debris. Communities living around the Mangdechhu project has raised this issue through written and oral representations with the district and project authorities. MHPA promised to ensure regular sprinkling of water along the main roads and not just

within the project sites. People however reported that the sprinkling of water was neither sufficient nor consistent to curtail dust pollution.

MHPA's temporary labor colony is located in Samcholing Khamay village in Drakteng Gewog. Low quality PVC pipes used for carrying sewage have broken open several times in the past. Villagers reported that sewage water from the toilets in the colonies seep into water sources and pollute the water. Apart from polluting water sources and creating unhygienic environment, there has been a tremendous rise in mosquitoes in the area.

There are no formal procedures for addressing grievances arising from HEPs. People raise issues with the Gewog administration, who then raise it with the Managing Director (MD) or Joint Managing Director (JMD) of Project Authorities, who in turn raise the grievances with the concerned contractors. Experiences of communities who have raised their concerns with the PHPA and MHPA reveal that, while project authorities assure to intensify safeguard measures such as sprinkling of water to reduce dust pollution or ensure that water supply to villages is not cut off by contractors, the outcomes are not long lasting.

Bhutan does not have a policy to govern the resettlement and rehabilitation of communities affected by developmental projects. The Sustainable Hydropower Policy of 2008 mandates project authorities to set aside a minimum of 1 per cent of the project cost for resettlement & rehabilitation of affected families and for local development. As per the Act, the RGoB will implement the resettlement, rehabilitation and Local Development Plan in consultation with the Local Development Committee. A May 2014 Review of the Sustainable Hydropower Development Policy by the National Council of Bhutan alleged that the said funds have been used without proper guidelines and transparency.

Hydropower projects in Bhutan have not generated employment for the local communities. Completed projects such as the Chhukha, Kurichhu and Tala HEPs have 510, 201 and 688 employees at present. While nearly 95 per cent of the workforce comprises Bhutanese citizens, less than 5 per cent comprises of people affected by the projects. Where they are employed, it is for unskilled civil work. The construction phase of hydropower projects generates up to 10,000 jobs. The cases of the three HEPs under construction – Punatsangchhu I, Punatsangchhu II and Mangdechhu, reveal that workers employed for construction activities are predominantly brought in from India and lodged in local labor colonies. A few local individuals have benefitted from small sub-contracted businesses such as supply of material and civil work. According to a July 2015 release on India-Bhutan relations appearing on the website of Embassy of India in Bhutan, "there are about 60,000 Indian nationals living in Bhutan, employed mostly in the hydro-electric power and construction industry. In addition, between 8000 and 10,000 daily workers enter and exit Bhutan everyday in border towns." The rate of unemployment in Bhutan has increased from 2.10 per cent in 2013 to 2.90 per cent in 2014.

In many of the hydropower project areas, local people constructed housing on a large scale in the hope of renting them out to the project. However, once the contractors settled into the local area, they proceeded to construct houses of their own, rendering all the new houses constructed by the people vacant and useless. Poor assessment of social impacts and improper planning has led to the creation of ghost towns[92] in HEP areas. Gedu and Tsimalakha in the Tala and Chhukha HEP are two such ghost towns.

An important benefit from hydropower development to households losing land is the provision of 10,000 units of free electricity per annum per acre of land lost. According to the Sustainable

92 Ghost town is a town that comes up to cater to large influxes of people in the process of developing mega projects but is not used after the project is wrapped up.

Hydropower Policy of 2008, the household can choose to avail the free electricity or cash in lieu thereof at the export rate from the project.

The Project Authorities of all the six case study projects have constructed basic infrastructure such as roads, health facilities and schools or have advanced money to the district authorities for their construction.

The influx of labor into the region has also has enabled small local markets and businesses to sprout. For instance, the Kurichhu workers colony is a ready market for small supplies such as cheese, butter, eggs and vegetables. Most families grow vegetables in a small portion of their land and the variety of vegetables cultivated in the area has diversified. From cultivating only local species such as pumpkin, beans, spinach and radish, the local markets today display a larger variety including cauliflower and broccoli. The selling of supplies in the local markets has added supplementary income thereby improving the economic conditions of local families. Communities affected by the Punatsangchhu HEPs however, criticized the PHPA for not permitting them to sell their produce inside the colony premises. It is important however to note that this economic improvement is only marginal and has not gone on to improve further. A decade and a half after the completion of the Kurichhu HEP, the local communities are still selling vegetables in the local markets. Not even the younger generation of people in the region has been trained to take up skilled work in the project or elsewhere.

6.1 Conclusion and Recommendations

The Royal Government of Bhutan's decision to exploit the country's water resources for production of electricity and simultaneously boost the service industry has changed the economic scenario for Bhutan. Bhutan kick started economic development with the influx of Rs. 300 million generated from the Chhukha Hydro Electric Project that was commissioned in 1988. India, who has had bilateral relations with Bhutan since 1949 and an energy cooperation agreement since 2006, has been a key contributor to the development of Bhutan's hydropower sector. The Chhukha Hydro Electric Project was touted as an excellent example of bilateral cooperation between the two countries where both parties made economic gains. The hydropower sector grew and hauled the country's national economy up through the 2000s.

Hydropower projects implemented in Bhutan are largely an outcome of political processes founded on economic rationale with commitment from the heads of the two governments; the many particulars of which are veiled behind diplomatic relations and bilateral agreements. This study finds that the India-Bhutan energy cooperation agreements impede transparency and consequently restrains a critical analysis of the same. The guise of diplomatic sensitivity must not harbor critical information, managerial faults and corrupt practices. *This study recommends that the bilateral agreements become more accountable and ensure dissemination of basic information to the citizens of both countries.*

Analysis of implemented and under construction projects reveals that the control of management in project authorities is skewed in the favor of India. Indian citizens occupy a disproportionate percentage of decision-making roles within project authorities and all major contracts for work are awarded to Indian agencies. The study finds that at least some of the delays and cost over runs in the Punatsangchhu I project are due to erroneous decisions of the project authority and its Indian consultants. Nonetheless, it is Bhutan that will bear any losses resulting from the debacle. Therefore, *the two governments must review the agreements to ensure that Bhutan shares equal or greater responsibility in the project authorities constituted for the implementation of specific projects.*

A matter for concern is that Bhutan has not developed expertise and resources of its own to develop hydropower projects. One of the contributing factors to this is that the private sector in Bhutan has not been given equal opportunity to participate in the sector and the Indian private sector has reaped much of the benefits.

The hydropower sector has not contributed to building local economies as it has contributed to the national economy of Bhutan. This study finds that benefits to local communities are largely in the realm of social development in the form of additional schools, health facilities, roads and such. Local businesses have gained only marginally and are more an offshoot of hydropower projects rather than as planned benefits from development. With the exception of the 10,000 units of free electricity provided to affected families by the Government of Bhutan, the benefits to local communities are minimal. Very few of the local people are given employment during the construction phase of hydropower projects as Indian contractors bring in thousands of workers from India. *The sharing of benefits within the framework of the energy cooperation agreements is skewed in the favor of India. The Royal Government of Bhutan and Government of India must make earnest efforts to ensure that all benefits are shared between the two countries.*

The study finds that consent for acquiring lands from project-affected people was not sought, thereby violating the internationally recognized principle of Free, Prior and Informed Consent. The

people were also not consulted in drafting the resettlement and rehabilitation plans. The project-affected families were merely informed about the upcoming hydropower project, the resettlement and compensation plans drawn up for them and the probable benefits from the new economic activity. *The Royal Government of Bhutan must ensure that free, prior, and informed consent of people is sought before proceeding with acquisition of lands for developmental activity.*

Currently, the development of hydropower projects in Bhutan lies outside the realm of its Five Year plans and funds for hydropower projects from India are disbursed directly to project authorities in Bhutan bypassing the national budget. Financing of hydropower projects are not reported in annual budget documents. Neither are audits of hydropower projects a part of the Annual Audit Reports presented before the Parliament. Therefore, there are limited discussions on the matter within the parliament and the few discussions that take place are limited to tariff revision. *Bhutan must immediately make the necessary reforms to ensure that hydropower development is part of its national planning, budget and overall development. The Royal Audit Authority of Bhutan must also periodically audit the projects.*

Based on the year of commissioning of the already completed hydropower projects of Chhukha, Kurichhu, Basochhu, Tala and Dagachhu it is quite evident that they were spaced out in time. The Chhukhha HEP began in 1974 and completed in 1988, Kurichhu HEP began in 1995 and completed in 2002, Tala HEP began in 1996 and completed in 2007, Basochhu HEPs started in 1996 and completed in 2005, Dagachhu HEP started in 2009 and completed in 2015. However, the 2006 Umbrella Agreement identified 10 projects for completion before 2020 and as a consequence the Government of Bhutan has initiated a project almost every 2 years. The Punatsangchhu I HEP began in 2008, Punatsangchhu II HEP began in 2010, Mangdechhu HEP began in 2012 and Kholongchhu HEP began in 2015. During the same period, hydropower projects under construction have faced several challenges, delays in keeping up with schedule and massive cost escalations. The net profit per unit of electricity sold has fallen sharply since 2007, the sector's regular contribution to the national budget has declined, the project cost for Punatsangchhu I nearly tripled from Rs. 3400 Cr to Rs. 9700 Cr and Bhutan's national debt has risen to 118 per cent of the country's GDP. *The Royal Government of Bhutan must critically appraise the overall contribution of the hydropower sector to the economy, evaluate the progress of projects under construction, review existing loans from the sector and assess viability of electricity from projects such as Punatsangchhu I before proceeding to approve new projects.*

While Bhutan has significantly developed the hydropower sector, growth in other industries has been peripheral. The Eleventh Plan document of the Bhutan Government noted that, "lack of economic diversification has resulted in a situation of high growth rates driven by the hydropower sector without a commensurate increase in gainful employment for a rapidly growing and educated labor force, which poses significant macroeconomic challenges". *The Royal Government of Bhutan must plan for diversification of sectors and design fall back options.*

Unless a cost benefit analysis of the natural environment lost to hydropower development is carried out in the country, concluding that hydropower development has largely been beneficial to Bhutan is premature. Addressing environmental and social issues associated with large-scale hydropower development will be a major challenge for Bhutan in the coming years. Given the lack of access to critical information such as EIA reports, it is not possible to determine if projects have been following environmental norms and to what extent they are successful in doing so. Preliminary information indicates that the environment is taking a backseat in all the new development. Approval of hydropower projects from both governments before assessing projects for environmental impacts is an important factor contributing to adverse environmental consequences. *Overall assessment of projects must be made mandatory, and the assessment reports must be made public, before the two governments approve hydropower projects.*

Evidence gathered in this study indicates that the EIA reports for hydropower project do not sufficiently and correctly assess projects for impacts. This study finds that impacts from projects include loss of forest lands, disturbance to wildlife habitat, noise pollution due to blasting and tunneling activities, impacts on fish breeding and migration, extreme dust pollution leading to respiratory disorders, lower crop productivity and pollution of water sources, damage to open water bodies such as streams and ponds causing severe stress on water resources in the region. *The study recommends strengthening of environmental regulations and regulatory authorities such as the National Environment Commission for effective enforcement of environmental regulations. To ensure robust assessment of impacts and effective mitigation plans, the government of Bhutan must consider bringing in third party vetting of Detailed Projects Reports (DPR) and Environment Impact Assessment (EIA) reports prepared by consultants.*

The environmental flow maintained in rivers by project authorities is alarmingly inadequate. The Chhukha and Tala hydropower projects have rendered an entire stretch of 35 km on River Wangchhu nearly dry with limited or no flow of water. Hampering the natural flow of rivers to this extent could irrevocably damage the riverine ecosystems. Bhutan does not have a scientific system to determine environmental flows in hydropower projects. The November 2014 water regulation requires the EIA reports of projects to recommend the environmental flows and prescribes a default minimum of 30 per cent of lean season flow. The regulation however provides no guidance and criteria for working out environmental flows. Furthermore, it is worrying that basin wide studies have not been conducted to assess the cumulative impacts of projects. *The National Environment Commission of Bhutan needs to arrive at a scientific method for determining environmental flows in rivers for hydropower projects and alongside conduct cumulative assessment of projects before granting clearances to new projects.*

With the exception of hydropower project areas, Bhutan has protected its environment through stringent regulations and has an eco-system that is the envy of any country. Before embarking on any further development, the Royal Government of Bhutan must design proper systems to identify and account for loss of ecology, natural environment and local economy with regard to existing hydropower projects.

Policy Recommendations

The bilateral agreements between both the governments must become accountable and ensure dissemination of basic information to the citizens of both countries.

The Royal Government of Bhutan and Government of India must review the agreements to ensure that Bhutan shares equal or greater responsibility in project authorities constituted for implementation of specific projects.

The Royal Government of Bhutan must make efforts to develop local expertise so as to facilitate greater Bhutanese participation into the hydropower development process.

The Royal Government of Bhutan and Government of India must make earnest efforts to ensure that all benefits are shared between the two countries.

The Royal Government of Bhutan must ensure that free, prior, and informed consent of people is sought before proceeding with land acquisition for developmental activity.

The Royal Government of Bhutan must make the necessary reforms to ensure that hydropower development is part of national planning, budget and overall development. The Royal Audit Authority of Bhutan must periodically audit projects.

The Royal Government of Bhutan must critically appraise the overall contribution of the hydropower sector to the economy, evaluate the progress of projects under construction, review existing loans from the sector and assess viability of electricity from projects such as Punatsangchhu I before proceeding to approve new projects.

The Royal Government of Bhutan must plan for diversification of sectors and design fall back options.

Overall assessment of projects must be made mandatory, and the assessment reports must be made public, before the two governments approve hydropower projects.

The study recommends strengthening of environmental regulations and regulatory authorities such as the National Environment Commission for effective enforcement of environmental regulations. To ensure robust assessment of impacts and effective mitigation plans, the government of Bhutan must consider bringing in third party vetting of DPR and EIA reports prepared by consultants.

The National Environment Commission of Bhutan needs to arrive at a scientific method for determining environmental flows in rivers for hydropower projects and alongside conduct cumulative assessment of projects before granting clearances to new projects.

Annexures

ANNEXURE 1 - List of Hydropower Projects (Under Construction and those) Planned by 2020

S No	Project	River / River Basin	Capacity (MW)	Type of Project	Year of Commis-sioning	District	Project Status	India-Bhutan Agreement	Project Model	Implementing / Operating Agency	Project Cost (in Rs. Cr)	Funding Agency
1.	Punatsangchhu I	Sunkosh	1200	RoR	2015	Wangdue Phodrang	2020; Under construction	Yes; 2006	IG	PHPA I	9,396	GoI
2.	Mangdechhu	Manas	720	RoR	2017	Trongsa	2020; Under construction	Yes; 2007	IG	MHPA	4,500	GoI
3.	Punatsangchhu II	Sunkosh	1020	RoR	2017	Wangdue Phodrang	2020; Under construction	Yes; 2010	IG	PHPA II	7,435	GoI
4.	Nikachhu	Manas	120	RoR	2020	Trongsa	2020; Under planning	No	PPP	DGPC	1,596	ADB
5.	Bunakha	Wangchhu	180	RS	2020	Chhukha	2020; Under planning	Yes; 2014	JV	JV - THDC & DGPC	2,950	JV partners & others
6.	Sunkosh Reservoir	Sunkosh	2560	RS	2020	Dagana	2020; Under planning	Yes	IG	NA	9,700	GoI
7.	Chamkarchhu I	Manas	770	RoR	2018	Zhemgang	2030; Under planning	Yes; 2014	JV	JV - DGPC & NHPC	NA	JV partners & others
8.	Kuri - Gongri	Manas	2640	RS	2020	Mongar	2020; Under planning	Yes	IG	NA	20,000	GoI
9.	Kholongchhu	Manas	600	RoR	2020	Trashi Yangtse	2020; Under planning	Yes; 2014	JV	JV - DGPC & SJVN	4,076	JV partners & others
10.	Wangchhu	Wangchhu	570	RoR	2019	Chhukha	2020; Under planning	Yes; 2014	JV	JV - DGPC & SJVN	6,452	GoI
11.	Amochhu	Torsa	540	RS	2018	Samste	2020; Under planning	Yes	IG	NA	NA	NA
12.	Khomachhu	Manas	336	RoR	2017	Lhuentse	2030; Under planning	No	PPP	DGPC	3,073	NA
13.	Rotpashong (Kuri I)	Manas	1230	RoR	2019	Mongar	2030; Under planning	No	PPP	DGPC	10,943	NA
14	BinduKhola	Jaldhaka	13	RoR	2020	Samste	2020; Under planning	NA	NA	DGPC	NA	NA
15.	Sunkosh LB	Sunkosh	35	RoR	2020	Dagana	2020; Under planning	Yes	IG	NA	NA	NA

Source: Compiled by Vasudha Foundation

ANNEXURE 2 - List of Hydropower Projects Planned by 2030

S No	Project	Capacity (MW)	District	S No	Project	Capacity (MW)	District
1.	Dagachhu II	135	Dagana	30.	Punatsangchhu III	595	Tsirang
2.	Dangchhu I	150	Wangdue Phodrang	31.	Kholong	94	Trashi Yangtse
3.	Dangchhu II	78	Wangdue Phodrang	32.	Thampochhu	95	Wangdue Phodrang
4.	Amochhu I	747	Haa	33.	Thimphuchhu	57	Thimphu
5.	Amochhu II	500	Samste	34.	Cherichhu	76	Thimphu
6.	Chamkarchhu	97	Bumthang	35.	Krissa	32	Trongsa
7.	Chamkarchhu II	992	Bumthang	36.	Wachi	24	Trongsa
8.	Chamkarchhu III	1890	Zhemgang	37.	Rimjigang	46	Trongsa
9.	Chamkarchhu V	162	Zhemgang	38.	Shorgarchhu	27	Trongsa
10	NyeraAmari I	142	Trashigang	39.	Aiechhu (L)	64	Sarpang
11.	NyeraAmari II	330	Samdrup	40.	Aiechhu (S)	22	Sarpang
12.	Samchhu	71	Samste	41.	Gumthang	108	Bumthang
13.	Pachhu	77	Samste	42.	Shongarchhu	107	Mongar
14.	Pochhu	132	Punakha	43.	Ghijam/ Lirigang	53	Bumthang
15.	Mochhu I	658	Gasa	44.	Gobarichhu	53	Mongar
16.	Mochhu II	403	Punakha	45.	Burgang I	69	Zhemgang
17.	Kheng	570	Zhemgang	46.	Burgang II	70	Zhemgang
18.	Sichhu	73	Punakha	47.	Manas RS I	1800	Samdrup
19.	Jaladhaka	19	Samste	48.	Manas RS II	1000	Samdrup
20.	Cherchhu	45	Haa	49.	Bambichhu	22	Lhuentse
21.	Haachhu	17	Paro	50.	Dhansiri	73	Samdrup
22.	Dara I	79	Dagana	51.	Nagargang	24	Mongar
23.	Dara II	115	Dagana	52.	Bomdeling/ Kholong	130	Trashi Yangtse
24.	Dara III	153	Dagana	53.	Cher	25	Tsirang
25.	Dara IV	212	Tsirang	54.	Sherichhu	36	Mongar
26	Parochhu	104	Paro	55.	Gamrichhu I	64	Trashigang
27.	Bemeng	14	Thimphu	56.	Gamrichhu II	79	Trashigang
28.	Piping	55	Chhukhha	57.	Gamrichhu III	80	Trashigang
29.	Sama	16	Dagana	58.	Gamrichhu IV	91	Trashigang

Source: Compiled by Vasudha Foundation