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Exploring the Hydropower Potential in India's Northeast

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ABSTRACT The Northeastern states of India have massive potential for harnessing hydroelectricity. While the government has rightly recognised this capacity as crucial to boosting the growth of the region, the pace of development has remained slow, and marred by many problems. This brief builds on the "43rd Report on Hydro Power" presented in Parliament in January 2019 by the Standing Committee on Energy, to assess the prospects of the hydropower sector in the Northeast. The brief outlines the challenges faced by the sector and offers suggestions to address them.

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INTRODUCTION

India's Northeastern states, with their mountainous topography and perennial streams, have the largest hydropower potential in all of India. Together, Sikkim, Arunachal Pradesh, Assam, Meghalaya, Manipur, Mizoram, Nagaland and Tripura account for almost 40 percent[1] of the total hydropower potential of the country.

Since the 1990s, the Government of India (GoI) has shown interest in exploring this potential as an energy source that is cleaner and more sustainable than traditional ones. Following the Northeast Business Summit in Mumbai in July 2002,[2] the Northeast has frequently been called the "Future Powerhouse" of India.[3] In 2001, the Central Electricity Authority (CEA) conducted a preliminary study of the hydroelectric potential of various river basins in India, ranking the Brahmaputra basin the highest. In 2003, the Ministry of Power launched a hydro initiative of 50,000 MW, with a major focus on the Northeast. In January 2007, the "Pasighat Proclamation on Power" was adopted at the Northeast Council's Sectoral Summit on the Power Sector, identifying the region's "hydropower potential" as a priority area with regard to India's energy security.[4]

In 2001–02, Sikkim became the first state in the region to kickstart the hydroelectricity boom, followed by Arunachal Pradesh. Both states signed a number of Memoranda of Understanding/Agreement (MoU/MoA) with power developers. Meghalaya, Manipur, Mizoram and Nagaland soon followed. The government of Arunachal Pradesh had already allotted 132 projects to companies in the private and public sector, of which 120 involved private players. Together, these projects accounted for a total installed capacity of 40,140.5 MW.[5] At the time of signing the deals, project developers also offered substantial monetary advances to the states.[6] Despite such progress, however, the development of hydroelectric power has been slow. At present, India has a total potential of 145,320 MW hydropower, excluding pumped storage scheme, but only 45,399.22 MW of this has been utilised.[7] In 2019, there were only 18 projects above the capacity of 25 MW under construction across Northeast. Of these, 10 are suffering from time overrun due to various challenges.[8]

On 4 January 2019, the Standing Committee on Energy (SCE) presented the "43rd Report on Hydropower" in the Lok Sabha, which discusses the potential and significance of hydropower in India, as well as the challenges faced by the sector which have resulted in the slow pace of development. Based on the report, in March 2019, India declared large hydropower projects (installed capacity more than 25 MW) as sources of "renewable energy," with special focus on exploiting the full potential of hydropower in the previously underexplored regions of India, specifically the Northeast.[9]

In the context of the recommendations made in the report, this brief examines their feasibility, viability and sustainability for India's Northeastern states. It first discusses the challenges that have caused time overrun and the palpably slow development of the hydropower projects, then assesses the SCE's report and its suggestions in light of these. Finally, the brief highlights some gaps in the

report and makes recommendations to address them.

HYDROELECTRICITY PROJECTS IN THE NORTHEAST

Time Overrun Causes Listed in the SCE's Report

There are various reasons behind the time overrun of the hydropower projects in the Northeastern states of India (See Figure 1). The SCE's report takes cognisance of some of these and offers suggestions to combat them.

Fund Constraints

According to the SCE's 2019 report,[10] the average cost for new power plants is around INR 8 crore/MW for coal-based ones and INR 10 crore/MW for hydroelectric ones. Thus, from an initial-cost perspective, hydropower projects are less lucrative for developers. A typical hydro station is financed based on the debt–equity ratio of 70:30. 'The 30 percent equity is managed by developers, either from their own resources or from public–private placements. The remaining 70 percent can be obtained from various sources such as scheduled commercial banks, financial institutions or bonds. The SCE's report claims that for projects developed by Public Sector Undertakings/Central Public Sector Undertakings (PSUs/ CPSUs), the availability of domestic loan is not an issue.[11] "However, lenders carry out their own exercise of due diligence before deciding to finance any project. In some cases, after releasing part of the loan, the lenders may stop disbursing further loan due to reasons such as inability of promoters to deploy requisite equity, unsatisfactory physical progress of the project, time & cost overruns etc."[12]

This can turn into a vicious cycle, especially when the project is affected and delayed by the other factors. Previous studies have found that, "In a large numbers of instances over the Hindu Kush Himalayan stretch, the viability of these projects has been in question and private players are exiting the business due to their inability to break even within their planned period."[13] Recommendation No. 6 of the SCE report urges approaching bankers for long-term loans (tenure > 20 years), grants or assistance at cheaper rates for hydropower projects from international agencies, along with power finance corporations and rural electrification corporations. However, this strategy might not work as well as projected, since the domestic organisations lending money might not be in a position to recover their investments, and foreign institutions might not be interested to invest in further projects. The report claims that investors would be more interested if the clearance process is sped up; however, this can create several problems elsewhere.

Table 1: Reasons for Time Overrun of Hydroelectricity Projects

States	Project (IC) Executing Agency	Reasons for Time Overrun
CENTRAL SECTOR		
Arunachal Pradesh	Pare (2x55 = 110 MW) NEEPCO	Law-and-order problem
		Poor geology
		Poor approach roads
		Flash flood during June and September 2015; dam area inundated with water
		Concreting of dam affected for four months
		Funds constraints with contractor
Central	Kameng (4x150 = 600 MW) NEEPCO	Change in dam parameters
		Slow progress in dam and HRT due to bad geology, heavy
		Seepage and inadequate machinery
		Flash flood in October 2008 and September 2012
		Ingress of water in HRT
		Poor approach roads
		Contractual issues
		Shortage of aggregate
		Clearance for quarry from state government
		Slow progress of works
		Funds constraints with contractor
Arunachal Pradesh/ Assam	Subansiri Lower (8x250 = 2000 MW) NHPC	Delay in transfer of forest land
		Disruption of works by locals in Arunachal Pradesh
		Slope failure in powerhouse in January 2008
		Damage to bridge on Ranganadi River
		Change in design of surge shafts to surge tunnels
		Stoppage of works due to agitation launched by the anti-dam
		activists in Assam against construction of projects
		Work stopped since 16 December 2011; issue of D/S impact studies
		Case in NGT
PRIVATE SECTOR		
Sikkim	Teesta Stage VI (4x125 = 500 MW) Lanco Energy Pvt. Ltd.	Poor geology
		Land acquisition
		Contractual issues
		Funds constraints with developer
	Rangit-IV HE Project (3X40 = 120 MW) JPCL	Slow progress of HRT and Surge Shaft works due to poor geology
		Works hampered due to earthquake in September 2011
		Financial constraints with developer
	Bhasmey (2x25.5 =51 MW) Gati Infrastructure	Forest clearance
		Financial constraints with developer

	Rongnichu (2x48 =96 MW) Madhya Bharat Pvt. Ltd.	Land acquisition
		Poor geology
Arunachal Pradesh	Gongri 2x72= 144 MW Dirang Energy (P)Ltd	Works awarded on 22 November 2011; however, consent to establish
		from State Pollution Control Board issued on 19 May 2014
		Financial constraints with the developer
Sikkim	Rangit-II 2x33= 66 MW Sikkim Hydro Power Ltd.	Slow progress of works
		Financial constraints with the developer
	Panan 4x75= 300 MW Himagiri Hydro Energy Pvt. Ltd.	Clearance from NWLB received in December 2015
		Clearance from NGT

Source: Created by the author, with data from the 43rd Report on Hydropower, 2019.[14]

Lack of Clearance

The SCE's report states that delays in environmental and forest clearances have been cited as one of the major reasons for apprehensions and entry barriers. At present, three types of clearances are mandatory from three different wings of Ministry of Environment and Forest (MoEF), i.e. environmental clearance from the Expert Appraisal Committee (EAC), forest clearance from the Forest Advisory Committee (FAC), and wildlife clearance from the National Board of Wildlife (NBWL). Developers as well as the Ministry of Power describe this process as cumbersome and time-consuming. However, five of the 10 projects that were previously delayed, had already started construction with partial clearance. This resulted in increased delay and costs, as the construction then had to be stalled while the developers waited for the remaining clearances.[15]

An important aspect of clearances is the issue of Environment Impact Assessment (EIA). The EIA conducted for several Northeastern hydropower projects has been found lacking. Dr. Anwaruddin Choudhury, renowned naturalist from Northeast India, examined the EIA reports of a few hydro projects and found them poor on some ecosystem aspects.[16] For the Tipaimukh project (a proposed 178-metre high dam on the Barak) the then Principal Chief Conservator of Forest S. Singsit noted that the preparation of the 2007 "Detailed Project Report" did not even involve the Forest Department. This is a critical oversight, since the reservoir created behind the dam will lead to the submergence of 219.5 sq. km of land that comes directly under the Forest Department.[17] Moreover, the EIAs often grossly neglect the ecosystem services provided by the rivers and rarely highlight the need to maintain ecosystem flows in the constrained rivers.

Recommendation No. 4 of the SCE report proposes the establishment of a special cell to address the hydropower projects.[18] While this is a definite step in the right direction, the authorities should not attempt to fast-track

the clearance process at the cost of national ecological resources. Recommendation No. 5 of the report suggests conducting basin-based studies before planning a project. If properly implemented, this can help make EIAs more holistic by identifying the ecological costs of a project, which will allow for informed decisions during clearance processes. However, the framework of this basin-based study requires further elaboration.

Geological Issues

India's Northeast is one of the six most seismically active regions in the world. From 1953 to 1992, the region experienced 21 earthquakes of more than 6.5 on the Richter Scale.[19] The proposal for large constructions in the region should consider such susceptibility to seismic activity. The project reports lack sufficient details and transparency in this aspect. While the seismic aspects of the construction area are evaluated by experts, and dams designed based on the seismic criteria for "maximum credible earthquake" and "design basic earthquake," the lack of proper historical cataloguing of earthquakes, poor knowledge of ground motion post-earthquake, and the variation of spectral acceleration can lead to incorrect assessments. Following the Bhuj earthquake in January 2001, structural engineering experts Sitharam and Govindarajau, speaking of the importance of seismic resistance in their 2004 paper, noted that "there is an imperative need to assess the design and construction practices" of dams in India.[20]

Geological issues, such as slope failure, are the second-largest cause of delay for ongoing projects (See Table 1). The SCE's report calls such issues "geological surprises."[21] However, geological problems like these are anything but a surprise in this region. After all, the Himalayas are a growing 'folded mountain' in an active tectonic zone, where slope failure is a frequently occurring event, especially when the fragile rock strata are disturbed by construction. There are several folds and fault zones in the Himalayas as well as the Northeastern hills, with discontinuities in the rock masses. Developers have faced "geological surprises" since the start of hydroelectric development in the region.

A paper published in 1993[22] details the issues that stall projects in the eastern part of the country, such as the existence of soft rocks behind faults, the highly weathered and decomposed rocks under hard gneissic rocks, and the existence of buried channels. The analysis used certain projects as case studies—Umiam and Umling Dam in Meghalaya, Manu Dam in Tripura, Kopili Dam in Assam, and Teesta-III in Sikkim—to examine how the issue of these "geological surprises" have been handled before.[23] Since these geological issues often cause leakage and seepage, they had to be addressed before the construction of the dams, which sometimes required changing the dam design. This caused significant delays in the construction process. As any project in these area has a high probability of facing such geological issues, prior arrangement of funds for mitigation and their inclusion in detailed project reports can avoid future stalling of construction due to lack of funds.

Land-Acquisition Issues

The SCE's 2019 report suggests a "regional government structure" to facilitate the land-

acquisition, resettlement and rehabilitation processes. However, India has a long history of improper identification of stakeholders (and the extent of their involvement) in large dam projects, even when local government is involved. Involuntary displacements and inadequate resettlement and rehabilitation of the people affected by large Multipurpose River Valley Projects (MRVP) are some of the biggest reasons behind anti-dam movements in India, which hinder the land-acquisition process.[24]

The "Rights and Risk" framework of WCD Report of 2000[25] prioritises five core values—equity, sustainability, efficiency, participatory decision making, and accountability—with importance given to stakeholder dialogue at all stages of development.[26] The GoI has passed several policies and acts to ensure transparent and fair compensation and rehabilitation for those displaced due to the development of any hydropower project, e.g. The National Rehabilitation and Resettlement Policy (2007), and the Right to Fair Compensation and Transparency in Land Acquisition and Rehabilitation and Resettlement Act (2013).[27] However, a huge gap remains between the on-paper provisions and the on-ground reality. Rehabilitation and resettlement plans are formulated and implemented by the state governments. Therefore, the proactive support and cooperation of the state and local authorities is necessary for their effective implementation. The non-availability of land records has been another major hurdle in land-acquisition. Rehabilitation and resettlement issues become further complicated due to the issue of multiple claimants.[28]

The identification of villages and individual households that are likely to be affected by a project must be the foremost consideration. In this context, many EIAs have been found lacking. For example, different versions of the EIA for Tipaimukh Project on Barrak mention different numbers of affected individuals and villages.[29] Such lapses fuel local agitations and anti-dam movements, which sometimes escalate into court cases, further delaying the projects. According to local protestors, the public hearings conducted are often designed to ensure that the affected stakeholders cannot be present to make their case.

For example, in the public hearing for Tipaimukh dam in Churachandrapur (Manipur) on November 2006, only those officially able to prove their displacement were allowed to participate. Those from displaced villages who did not have any official documents were denied entry. Moreover, even the ones were allowed inside had to deal with the delay tactics, i.e. being made to wait for the hearing for long hours, compelling many to return to their villages. The documents that listed the details of the dam were not translated into local dialects, and according to some affected villagers, the authorities were patently biased in their judgements.[30] The Adi and Galo tribes affected by the Siang project in Arunachal Pradesh have alleged that "their right to free, prior and informed consent (as enshrined by the UN Declaration on the Rights of Indigenous Peoples) is not only being ignored, but deliberately avoided."[31] Such incidents have made the locals increasingly sceptical of hydropower projects, exacerbating distrust and resistance and further delaying the projects.

The SCE's report rightly notes that the local district administration has a major role to play

in R&R and expects that "the District Administration, wherever, the hydro power projects/potential lies, will actively participate and do the needful to expedite the matter of land acquisition and R&R process related to hydro power projects to provide fair deal for the affected people as well as to fast track the hydro power projects. The Committee also recommend that the Central Government, the State Government(s) and the Developer of the Projects should coordinate and cooperate with the District Administration in this regard."[32] However, in its recommendations, the report fails to include a clear methodology of making the land transfer and rehabilitation process more transparent.

Issues Not Listed in the SCE's Report

There are a number of other issues that have hampered the economic profitability and sustainability of these hydropower projects but which were not mentioned in the 2019 report. While these issues are pervasive in the Northeastern states, they are not exclusive to the region. Due to this oversight, the SCE's report falls short of being comprehensive.

Sediment Management

The Brahmaputra and Meghna systems (the main river systems in the Northeast region), together with the Ganga system, are the largest carriers of sediment in the world.[33] Consequently, sediment segregation is required before the water can be used to produce electricity, even for run-of-the-river projects. The production of sediment in any river system significantly impacts any engineering obstruction created on the river. Sediment accumulation in the reservoirs of large hydroelectric projects can diminish their life expectancy. Unless properly managed, sediment load also reduces the cost- and carbon-efficiency of hydropower projects over time. Thus, construction of dams on the Northeastern rivers must be preceded by the creation of a proper database of the sediment load of those rivers. Further, when the project is planned, a management process must be put in place.

Transboundary River Management

A large number of the rivers that are utilised for hydropower flow through more than one country. The basin-based study mentioned in Recommendation No. 5 of the SCE's report must include this issue of hydropower projects being developed in transboundary river basins. For example, the Ganga–Brahmaputra–Meghna Basin is shared between India, China, Nepal, Bhutan and Bangladesh, with Bangladesh being the lower riparian to India. The Indus basin includes India, China and Pakistan, with Pakistan being lower riparian to India. Many of these rivers do not have any basin-based authority in place.

In the case of Northeastern states, the majority of the projects are being built on basins that are shared between India and Bangladesh. The projects developed by India (the upstream country) creates panic concerning water scarcity and ecological distress in the lower riparian Bangladesh, e.g. the hydroelectric projects on Teesta, some rivers in Tripura, or the proposed Tipaimukh dam. India and Bangladesh have established a "Joint River Commission" to address the common issues regarding water and river management. However, the major motivation is the quantitative sharing of available water volume.

India has proposed several large projects in the Northeast, which will occupy transboundary rivers between India and Bangladesh. These constructions can affect the ecology and economy of the downstream part of those rivers, i.e. Bangladesh. Without proper assessment and negotiation, these projects can create hydro-diplomatic problems for South Asia in future. The cross-border co-relation based on energy trade between some neighbours can result in further discords. In this context, basin-based authorities under the JRC can handle bilateral issues regarding India and Bangladesh. While doing so, the JRC must take a holistic approach, instead of considering rivers as mere 'water channels'.

THE RISKS OF HYDROELECTRICITY PROJECTS IN THE NORTHEAST

The building of dams in India has largely been a colonial legacy, with the technology of flood control, irrigation and power generation having come first from Europe, then North America.[34] Large dams were considered a symbol of triumph of human technology over nature, of harnessing the untameable. After Independence, India gave the green light to a number of multipurpose river-valley projects in the first two Five-Year Plans. Such reservoirs played a crucial role in making India self-sufficient in food production by supplying irrigation water. According to a 2000 report by WCD, approximately 35 percent of the water needed for irrigation in India is provided by large storage reservoirs or dams.[35]

However, while dams have been hailed as the "New Temples of Modern India" (a term coined by Jawahar Lal Nehru, India's first Prime Minister[36]), they have some far-reaching adverse consequences that have remained understudied and underestimated.[37] Dams are large structures that obstruct the flow of river water to create a reservoir. However, rivers are complex ecosystems created by the interaction of water, energy, biodiversity and sediment (WEBS).[38] River ecosystems have supported the development of human society and economy for centuries. For communities that live on banks and floodplains, especially tribal and indigenous ones, rivers form an integral part of cultural history and intangible heritage. The building of large dams disturbs this natural and social equilibrium.

A case in point is that of the Himalayan region, where the issue of large dams has become a critical one due to the region being a young folded mountain and one of the most seismically active regions of the world.[39] A number of large and active faults and thrust zones exist in and near the basin. As mentioned earlier, the region experienced 21 earthquakes of more than 6.5 on the Richter scale during the period of 1953 to 1992.[40] Before the construction of the Tehri Dam, the environmental impacts of large dams had not received significant attention. When the historical anti-Tehri campaign by the "Tehri Bandh Birodhi Sangharsh Samiti" demanded a wider review of economic and safety aspects of the dam, such issues were brought to mainstream consciousness. That campaign remains one of the most important contributions to the methodology of the Environmental Impact Assessment of large dams in Himalayas.[41]

While building large dams to harness hydroelectric power has certain benefits, the current paradigm, which neglects

environmental issues, can have disastrous consequences and is fast becoming outdated.

THE WAY AHEAD

In light of the worsening climate crisis that especially threatens developing countries like India, the country should move away from fossil fuels and towards eco-friendly sources of energy. However, it cannot roll out large hydroelectricity projects without first conducting proper impact assessment. In addition to traditional EIAs, detailed studies should be carried out regarding possible geological issues that might arise during the project. Further, rehabilitation and resettlement processes should be transparent, and the people most likely to be affected should be involved from the start to avoid future feuds. The 43rd Report on Hydropower urges the government to fast-track the clearance processes. However, while doing so, the GoI must be mindful of the possible, often irreversible, damages that can be caused to the ecosystem.

Despite their significance, the viability of hydropower projects has come under scrutiny in Northeast India. Private players seem uninterested in investing in the business due to difficulties they face in reaping economic returns within the expected timeframe.[42] To ensure project viability, all possible hidden costs—including those of losing ecosystem services—must be factored into the projected cost of a plant before national resources are allotted. The time overrun of the current hydropower projects in the Northeast is an important reminder of the importance of ecological and human issues, which must not be neglected in favour of quick benefits. ORF

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