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**WATER RESOURCES IN THE NORTHEAST:
DEVELOPMENT OPTIONS IN A COOPERATIVE
FRAMEWORK**

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Abbreviations

ASEAN	Association of Southeast Asian Nations
MoDONER	Ministry of Development of North Eastern Region
NEEPCO	North Eastern Electric Power Corporation
NEWRA	North Eastern Water Resources Authority
NHPC	National Hydroelectric Power Corporation

1. Introduction

India's Northeast has all the attributes of a national powerhouse and reservoir that could transform the region, ameliorate poverty, and generate national wealth. The gifts of water and biodiversity offer tremendous potential that requires vision, will, and careful planning if they are to be converted into bountiful, renewable resources for sustainable development. However, unregulated waters currently vent their fury in destructive annual floods, while much biodiversity is being stolen or lost.

This tremendous opportunity also brings great challenges, as small, segmented political entities and infant economies lack the ability to harness what are essentially cross-boundary and transboundary market opportunities or to harvest economies of scale. Physical and geopolitical realities also dictate that cooperation is essential in dealing with shared resources such as interstate and international rivers, and to catalyze and synergize the interdependence of hill and plain, ocean and hinterland. Many local solutions in the Northeast lie in subregional development, just as many national solutions lie in wider regional cooperation, such as within the eastern quadrant of the South Asian Association for Regional Cooperation.

Time too is a resource. Awakening peoples, newly aware of their identity and conscious of bordering some of the fastest growing economies in the world, are impatient for progress and change. Nation building, a delicate task at any time, becomes doubly difficult when burdened by centuries of isolation and benign neglect. To reconcile the rival pulls of integration and differentiation within a democratic framework is no easy task and has not surprisingly resulted in frustration, alienation, withdrawal, and insurgency. Development requires peace, but there can be no peace without development. There are significant opportunity costs of delay.

2. Setting the scene

Northeast India was at one time a great crossroads linking the Indian subcontinent with East, Southeast, and Inner Asia along the southern Silk Route. Commerce, culture, and faith traveled that route; Mongoloid migrant streams, for example, moved into this sequestered and sparsely populated but richly endowed region from central China and Southeast Asia to mingle with indigenes and others pushing westward from the Indian heartland and, later, Nepal.

Tea plantations were established and oil was discovered in Assam in the late 19th century, and by the early 20th century the province was among the more prosperous and globalized parts of India. Steamships moved along the bustling Brahmaputra and Barak waterways to Calcutta (Kolkata) carrying Assam tea to London auctions. Coal was mined and Digboi still boasts the oldest producing oil well and refinery in the world. The British drew an Inner Line along the foothills skirting the Brahmaputra and Barak valleys to protect them from the marauding tribesmen who would periodically descend from the surrounding mountain and jungle fastnesses. The outer limit of the hill country marked the political frontier whereas the Inner Line marked the administrative boundary. The lands in between, sweeping up in steep and serried ranges all around, were "excluded areas", directly ruled by the governor of Assam, whose authority extended to the two princely states of Manipur and Tripura.

The Northeast was a major staging area for the Allied armies and air force for the Burma and China campaigns during World War II. The advance by the Indian National Army (supported by the Japanese) was halted at Kohima and on the outskirts of the Imphal valley. All this

constituted a massive intrusion that shattered the timeless existence and simple outlook of the myriads of small tribal communities. Independence followed suddenly in 1947. Many of those making up this extraordinary mosaic of ethnic, linguistic, and cultural diversity were uneasy to find themselves members of a new nation state.

Partition and a time of trouble across the international boundaries in Bangladesh (then East Pakistan), Tibet (then independent), and Myanmar (then Burma) traumatized the region further, severing the traditional social and economic connections of the native peoples. Lands were sundered, lives and livelihoods were disrupted, and regional arteries of communication, whether by river, sea, road, or rail, were cut. The only remaining link to India was the circuitous Siliguri corridor, a narrow wedge of territory between Nepal and Bangladesh. The ensuing market disruption damaged local economies and heightened the Northeast's geopolitical and cultural isolation.

Sikkim (a former protectorate state, fully acceded to India in 1975) was formally added to the Northeast recently as the eighth member of the North Eastern Council. But it is separated from the original so-called Seven Sisters by the Darjeeling-Gurkha Hills and the Jalpaiguri Division of West Bengal, which lie north and west of the Siliguri neck. Logically North Bengal is geopolitically part of the Northeast and was recently invited to join it for planning and developmental purposes without injury to its parental West Bengal connection. Politics intervened: West Bengal feared that this might be but the first step towards North Bengal's separation from the state.

The Northeast is a transition zone. At the confluence of the Indo-Malayan and Palearctic biogeographical realms, it is home to a wide range of endemic and exotic species and unique gene pools, a treasure house of biodiversity. It includes the highest rainfall region in the world and exhibits very dynamic tectonics, factors that account for the huge sediment load carried down the Brahmaputra-Barak system, a product of mass wasting and erosion, aggravated by the extensive practice of *jhum* or slash-and-burn farming in the hills. This is a form of agroforestry that is becoming increasingly unsustainable; the pressure of population and development has reduced the *jhum* rotation from 10–12 years to less than half that cycle, resulting in forest regression, landslides, and further erosion.

The narrow Brahmaputra and Barak valleys apart, the landscape is characterized by almost perpendicular gradients, with rivers descending through steep, narrow valleys before they debouch into the plains where they deposit their silt load and flow through vast braided channels. The jacketing of rivers within embankments to contain the annual floods has further raised riverbeds, leading to a vicious cycle of cause and consequence. The Barak is a wholly Indian river and becomes the Meghna in Bangladesh. The Brahmaputra, however, rises in Tibet and cuts through the Himalaya to drain Bhutan and the Northeast before entering Bangladesh as the Jamuna and then joining the Ganges lower down to form the Padma. This in turn meets the Meghna to form an enormous deltaic fan culminating in the densely tangled Sundarbans mangrove swamp.

The rivers have changed course over the millennia. The Teesta once flowed down from Sikkim to join the Ganges but now falls into the Brahmaputra. The major rivers have created innumerable oxbow lakes and feed *beels* (seasonally flooded wetlands) that constitute rich spawning and fishing grounds and once made for extended seasonal inland navigation. The Brahmaputra and Barak account for almost 30 percent of India's total annual runoff, a discharge hugely surplus to the requirements of the regional ecology, population, and arable land, much

of which is underlain by rich groundwater aquifers. Additionally, the Northeast has a hydroelectric potential of around 36,000 megawatts at 60 percent load factor. This constitutes some 44 percent of the country's total hydroelectric potential and translates into something like 80,000 megawatts of high-value peaking power.

There could be a huge accretion to annual income from the 12 percent royalty earned by host states and the increased employment and production that plentiful energy would stimulate. This could help deliver the region from fiscal constraints and greatly assist its development; in this regard, the example of Bhutan is instructive.

3. Physical and socioeconomic background

The eight northeastern states occupy an area of 262,179 square kilometers and have a combined population of just over 39 million (2001 census) and a density of 1,498 persons per square kilometer. Assam is the largest unit and forms the physical backbone of the region, connecting the other states and joining them with the Siliguri corridor. It is also the most populous state (26.6 million). The major plains areas lie in the Brahmaputra and Barak valleys in Assam, the Imphal valley in Manipur, and the piedmont strip skirting the entire length of western Tripura. Over 64 percent of the land area is forested, ranging from over 80 percent in Mizoram and Arunachal Pradesh to 35–45 percent in Assam and Sikkim. Jhumming (shifting cultivation) is widely practiced in the hills and a steadily shrinking jhum cycle has resulted in degradation, a growing area of abandoned jhum fields, and soil erosion. Urbanization is well below the national average, except in Mizoram. The regional per capita income in 2001 at Rs. 6,625 was uniformly below the national average (Rs. 10,254),¹ with 34.3 percent of the population living below the poverty line compared to the national average of 26.1 percent (1999–2000).² This is an index of prevailing poverty amidst potential plenty.³

Irrigated cropping is practiced in about 30 percent of the plains areas, though the Angami Nagas have beautifully terraced fields, as do the Apa Tanis in Arunachal's tiny Ziro valley. The Brahmaputra and Barak valleys in Assam have an abundance of water, but recurring floods and limited agrarian reforms have made for agricultural instability. Irrigation is limited and groundwater development is low. Shortage of funds is not the problem as the region suffers from an adverse credit:deposit ratio.

Assam has a gross irrigation potential of 2.7 million hectares, which constitutes 68.5 percent of its cropped area. With the efforts made under a variety of rural infrastructure, accelerated irrigation, and tubewell programs in recent years, and total funding from the Non-Lapsable Central Pool of Resources, the gross irrigation potential created comes to 1.07 million hectares, covering only 27 percent of the gross cropped area. Even more disappointing has been a decreasing trend in the utilization of created potential through government schemes, partly on account of the levy of an irrigation service charge to finance the operation and maintenance of

¹ Note that the per capita income in Arunachal Pradesh, Mizoram, and Nagaland used to be higher than the national average till 1996–97. Net domestic product and per capita income in these states have reduced significantly after the closure of commercial logging operations and forest-depleting industries.

² Conversion: 1 US dollar = 44 Indian rupees (February 2006).

³ Among the northeastern states, Assam and Tripura have very low per capita income (around 65 percent of national average). The other states are relatively better off (at about 80–85 percent of national average per capita income). Poverty incidence in Mizoram and Nagaland is below the national average.

schemes that is recoverable from beneficiary committees. While this may have acted as a disincentive, the nonenergization of pumps in lift schemes has been another negative factor.

Electricity generation and consumption are both low in the Northeast despite its rich hydro and fossil fuel resources. Per capita consumption of electricity in India in 2000 was 364 kilowatt-hours, of which 92 kilowatt-hours was used in the agricultural sector, mostly for pumping water. The corresponding figures for Assam were 101 kilowatt-hours and 2 kilowatt-hours respectively. The position was not much better elsewhere in the region: only 3.37 percent of the groundwater resources of the Brahmaputra valley have been tapped thus far and no more than 3.97 percent in the Barak valley.

Assam and Meghalaya are the only two northeastern states that have electricity boards, the power sector in the others being departmentally managed. The two boards made losses of Rs. 3,700 million and Rs. 380 million with substantial subsidy outgoes in 2001–2002, the agricultural subsidy in Assam being Rs. 160 million in that year. Overall, the power sector in the Northeast is underdeveloped and poorly run despite its tremendous potential. However, reforms are on the way. Central power corporations have entered the field and the Government of India's 50,000-megawatt hydro initiative announced in May 2003 promises to give a tremendous boost not merely to the power sector but to the entire northeastern economy. But there is an important caveat. Unless a holistic approach is adopted, with hydropower seen as just one element in the optimization of total multipurpose water use, imbalanced development could result, to the lasting detriment of the region and its people.

4. The flood factor

Floods play havoc. More than Rs. 5,000 million has been spent in the Northeast since 1980 on flood management works to protect a little over 2 million hectares. Yet floods remain an annual visitation, causing death and destruction, disrupting lives, livestock, homes, crops, and infrastructure, and contaminating drinking water. Over 90 percent of the cultivable area in Assam is flood prone. There are several flood peaks and the long residence time of the spillage tends to encourage high-risk kharif II (monsoon) agriculture. Low investment in turn entails low returns. Delayed sowing of the winter crop can also depress yields. Though there has been some increase in grain production, the Northeast still has a net grain deficit and also imports fish, despite its extensive water bodies. With 80 percent of its population dependent on farming, Assam's depressed agriculture retards its economy. Forty percent of its landless rural labor is impoverished and subject to food insecurity and malnutrition.

The flood toll is rising. The floods of 2004 affected 10,425 villages in Assam, affecting a population of almost 5 million. Parliament was told that over 250 lives were lost and the damage to crops, houses, and public utilities was estimated at Rs. 19,150 million. This is at best a partial count and excludes many unreported as well as private losses.

The Brahmaputra Board was established in 1980 with a number of responsibilities related to the development and management of the Brahmaputra and Barak basins, commencing with a series of surveys and investigations that would form a basis for planning. This process resulted in the preparation of master plans for flood moderation, control of bank erosion, and drainage decongestion, together with multipurpose storages with flood cushioning, hydropower, irrigation, navigation, fishery, and other benefits. Detailed project reports were to be prepared as a prelude to their construction after due approval by the central government in consultation with the concerned states. Three master plans were completed by 2000: the first for the main

stem of the Brahmaputra, the second for the Barak and eight of its major tributaries, and the third covering 41 tributaries of the Brahmaputra, Majuli Island, and eight Tripura rivers. As many as 34 drainage improvement schemes were also investigated.

Two mega projects on the Dihang (also called the Siang), the main stem of the Brahmaputra, and the Subansiri were identified. The Siang project, with a planned 20,000-megawatt installed capacity, envisaged estimated storage of 3.55 million hectare-meters live (4.70 million hectare-meters gross) behind a 294-meter-high rockfill dam, submerging 490 square kilometers, including three towns and 91 villages, and displacing 35,000 people. The Subansiri project was of 4,800-megawatt installed capacity, with storage of 1 million hectare-meters live (1.34 million hectare-meters gross) behind a 257-meter-high rockfill structure, with a water spread of 193 square kilometers submerging 13 villages and one town, displacing 7,500 people. Taken together, both dams were calculated to reduce the Brahmaputra flood peaks significantly, the former by 1 to 2 meters in the lower reaches of the river, thus saving large areas from inundation and reducing spill retention time. Additionally, the Subansiri project was expected to moderate erosion of the culturally important Majuli Island.

Additional benefits included improved navigation, rich reservoir fisheries, and considerable augmentation of lean season flows, which could possibly be diverted to the Ganges in West Bengal through a major link canal traversing Bangladesh from a barrage at Jogighopa. Indeed, the Brahmaputra-Ganges link canal was formally proposed to Bangladesh in 1978-1982 as the favored Indian option for augmenting Ganges flows below Farakka as part of a sharing agreement for the river. Bangladesh opposed the link canal idea on a number of grounds and instead argued in favor of seven high dams in Nepal as a means of augmenting the lean season flows of the Ganges.

As a result India withdrew the link canal proposal, which was formally buried when Arunachal Pradesh also objected to the proposed Dihang and Subansiri dams on the grounds of environmental loss, population displacement, and the submergence of important townships. Arunachal could have absorbed the forecasted loss of 540 square kilometers of forest, constituting little more than 1 percent of its total forests. However, although it was argued that displacement per unit of storage or energy output was extremely low by any comparison, the displacement of 42,500 persons, accounting for as much as 6 to 7 percent of the state's total population, and the drowning of some of the smaller tribes' traditional homelands as well as prestigious urban settlements, involved cultural, social, and political costs that could not be brushed aside.

Another major dam the Brahmaputra Board proposed was on the Barak river at Tipaimukh in Manipur near the trijunction of that state with Mizoram (which would also face submergence and some marginal displacement) and Assam. This also ran into strong Manipuri opposition on grounds of displacement of vulnerable tribes (Hmars and Zeliangrongs), damage to plantations, and biodiversity and cultural loss. It also entailed submergence of the main national highway from Silchar to Imphal at three points, resulting in long detours and higher fuel costs on any new road alignment. The Tipaimukh dam, with an installed capacity of 1,500 megawatts, was to provide a valuable flood cushion and, additionally, considerable irrigation for Cachar in Assam from a diversion barrage to be constructed 100 kilometers downstream, at Fulertal.

As in the case of the Dihang and Subansiri projects, Tipaimukh was also projected as capable of benefiting Bangladesh through flood moderation, irrigation, development of fisheries, and improved navigation. However, all three projects were put on the back burner and a weakened

Brahmaputra Board gradually ran aground. Tipaimukh was then handed over to the North Eastern Electric Power Corporation (NEEPCO) in 1999. A year later, the reconceptualized Dihang and Subansiri projects were reformulated as cascades with the consent of the Arunachal Pradesh and Assam governments. Each cascade was to comprise three (or four) run-of-the-river projects with limited storage. These were handed over to the National Hydroelectric Power Corporation (NHPC), another central public service utility.

The Dihang and Subansiri cascades, and other projects being investigated under the 50,000-megawatt hydro initiative launched in 2003, have been conceived primarily as power projects. Relegating flood and irrigation storage, however, does raise some concerns. Notwithstanding the importance of hydropower, national and regional interest both dictate the need for an optimized mix of benefits. Flood moderation is imperative for Assam and in the absence of viable detention reservoirs, there is a danger of preempting the future and losing good or even ideal dam sites without exploring other avenues for satisfying the affected communities. Therefore efforts must be made to win their consent for long-term interstate or international cooperation in the interest of larger gains based on mutually beneficial interdependencies and tradeoffs.

Assam is the Northeast's largest state and principal dynamo and physical backbone. A weakened Assam cannot therefore make for a strong and stable Northeast. Such an approach should not be seen as applying the brakes on NHPC or NEEPCO but as giving pause to all concerned to see if it is possible to come up with more inclusive outcomes. Larger storages would enhance power generation while flood cushioning could mitigate floods and reduce displacement and distress in the lower catchment. The critical issues are therefore of meeting the challenges of displacement, resettlement and rehabilitation, and environmental loss.

5. Lessons from Dihang, Subansiri, and Tipaimukh

The Government of India has laid down a simplified three-stage financial and environmental clearance procedure for hydro projects undertaken by central public sector units. Stage I is limited to preparation of prefeasibility reports. Stage II clearance permits activities relating to further investigations necessary for the preparation of detailed project reports. Investment sanction follows in stage III after due consideration by the Public Investment Bureau and Cabinet Committee on Economic Affairs. The guidelines have been further simplified under the Electricity Act (2003), with states being permitted to license central public service utilities and private promoters more or less automatically for schemes entailing investments of up to Rs. 10,000 million.

Under this rubric, surveys and investigations are in progress to rework the Dihang (Siang) project by NHPC. Envisaged is a cascade consisting of lower Siang (1,600 megawatts, stage II works in progress), middle Siang (1,000 megawatts, detailed project report submitted), and upper Siang (11,000 megawatts, stage I works in progress).

As far as the Subansiri cascade is concerned, the Ministry of Environment and Forests accorded conditional forest clearance for the 2,000-megawatt lower Subansiri project, enabling NHPC to divert just under 4,000 hectares of forestland (3,183 hectares of this in Arunachal Pradesh and 816 hectares in Assam), subject to the outcome of a writ of 1995 pending before the Supreme Court. Middle Subansiri (1,600 megawatts) and upper Subansiri (2,000 megawatts) have not progressed to stage II works as neither dam site has been cleared. And thereby hangs a tangled tale.

The lower Subansiri project just above Gerukhamukh (reworked by NHPC as part of a three-dam cascade) is likely to displace 24 families from two villages and submerge 3,436 hectares of land, including 42 hectares of the Tale valley wildlife sanctuary, which the Supreme Court was approached to condone. The Court took into account the views of the five-member Central Empowered Committee, which advises it on forest-related issues, and handed down its verdict on 19 April 2004.

Under its order:

- The 42-hectare Tale valley area shall legally remain part of the sanctuary.
- The reserve forest area forming part of the lower Subansiri catchment, including that portion coming under submergence, is also to be declared a national park or sanctuary, the exact area being left for determination by the state government in consultation with the Ministry of Environment and Forests in association with reputed forestry and wildlife experts.
- The sanctuary will be placed under the control of the chief wildlife warden of Arunachal Pradesh.
- NHPC will provide funds for the relocation and resettlement of those residing in the sanctuary area in sites earmarked for the purpose by the state government.
- NHPC shall fund the cost of a 10-year management plan for the national sanctuary to be prepared by the state government, including both its recurring and nonrecurring expenditure.
- NHPC shall ensure that there is no siltation of the river during the construction phase of the project and that the diversion and spill channels will be maintained as fish ladders.
- Excavated material shall not be dumped in the river or any part of the surrounding forests, nor any fuelwood be cut from the forest.
- NHPC will provide complete funds for reforestation with indigenous species of degraded sites within the national park or sanctuary.
- There shall be no construction of (any) dam upstream of the Subansiri River in future.

Noting the fact that “the Parties are agreed” that the project proposed by NHPC may be permitted subject to these conditions, the Court disposed of interim applications 966 (filed by Dr. Lalit Mohan Nath of New Delhi) and 1012.

The matter does not rest there. In view of forest submergence, NHPC has had to deposit almost Rs. 3,740 million for compensatory afforestation on the basis of an award made by the Compensatory Afforestation Fund Management and Planning Authority set up under an earlier Supreme Court directive in another case in order to streamline existing procedures. This is over and above prior payment of Rs. 790 million to the Arunachal Pradesh and Assam governments for compensatory afforestation, as well as a sum of Rs. 87.1 million for catchment area treatment.

It is estimated that 14 or more villages falling in the expanded protected sanctuary area ordained by the Court will need to be relocated, displacing anything up to 5,000 persons. The additional resettlement and rehabilitation responsibilities that have been assigned to NHPC could add up to a considerable and as yet indeterminate liability to which must be added the

open-ended cost of managing the new sanctuary area for 10 years. All these costs will necessarily have to be charged to the cost of power generation.

The lower Subansiri project order could well affect all other hydroelectric projects in the country. All in all, the situation is complex and confused, with several bodies representing divergent interests likely to pull in different directions. The matter does call for review and it is possible that the government may find it necessary to approach the Supreme Court again for clarification and relief.

The Ministry of Water Resources is insistent that projects in the Northeast and others under the 50,000-megawatt hydro initiative must be developed as integrated multipurpose schemes incorporating an adequate flood cushion if they are to receive Technical Advisory Committee endorsement. This has more or less put the Dihang projects on hold.

The Tipaimukh project is also not quite out of the woods. This planned 162.5-meter-high rockfill dam with an installed capacity of 1,500 megawatts is being undertaken by NEEPCO, but the irrigation component has been excluded for the moment. The project received stage I forest and environment clearance in May 2002 and a revised detailed project report was approved by the Central Electricity Authority at a cost of Rs. 51,630 million (at 2002 prices) in July 2003. It received a letter of comfort for funding from the Power Finance Corporation in July 2004, following which the corporation has sought Rs. 1,570 million to carry forward stage II activities.

What remains at issue is the question of who should properly bear the Rs. 2,800 million cost for raising and maintaining four battalions of any central force to provide security against the depredations of various insurgent groups; Rs. 2,880 million for the degree of flood cushioning that the Ministry of Water Resources is seeking; and Rs. 1,050 million for the realignment of the National Highway from Silchar to Imphal and the construction of three new bridges along it over the Irang, Makhru, and upper Barak rivers, to replace sections that will be submerged. NEEPCO, a power company, feels that it should be relieved of some or all of these burdens, as it must operate on commercial principles.

Social and political activists are concerned about protecting livelihoods and the natural environment, which tend to have sacred and cultural dimensions for small tribal communities whose territorial identity may be threatened. Consultation is therefore important and public hearings must be given due importance and not conducted pro forma. Indeed, at a mandatory public hearing in regard to the 110-megawatt Dikrong project in Arunachal Pradesh, objections were raised as the environmental impact assessment study was not made available in the local language to the 29 families potentially affected by the project (Down to Earth 2005). Another point made was that "we don't want to supply power to entire India [sic] at our cost". Such considerations cannot be brushed aside and must be addressed.

6. Peace for development and problems of transition

Unrest and insurgency in the Northeast are no more than the growing pains of variegated insular and traditional societies undergoing a process of modernization and change. Development and demography have exerted further pressure on community resources and appear to threaten identities. The transition from subsistence to a market economy is in its own way as traumatic for some as is that from free peoplehood in village republics to becoming equal partners in a huge nation state in the making. Yet there can be no going back.

If peace is necessary for development, there is unlikely to be peace without development. Investment in the one is therefore investment in the other. Yet, keeping the peace (and the maintenance of law and order) being a fundamental attribute of governance, the state must properly take responsibility for project security, as in Tipaimukh.

Traditional, self-sufficient livelihoods such as jhumming may no longer be viable or sustainable nor meet the aspirations of youth who seek new opportunities in keeping with what they see in the wider world around them. Enclave development, as in the tea estates or gardens of old, is no more acceptable. Partnerships have to be struck and interdependencies forged. So the communities around the Dikrong project or anywhere else have to be made to feel partners in a larger enterprise that benefits them as much as others in terms of electricity supply, flood moderation, irrigation, navigation, or employment.

Complete information and transparency are of course necessary. Compensation and the resettlement and rehabilitation of those displaced must also be done with great care and compassion. But the approach to these must change from statutory condescension to empathy and building partnerships. The prevalent dichotomy between those living in remote catchments who bear the costs of submergence, displacement, and environmental loss, and others who benefit from irrigation, flood control, enhanced power supply, employment, and income generation in command areas below major dams, can and must be modified.

Dams are almost invariably located in areas of hilly or mountainous terrain that are intrinsically disadvantaged compared to the plains below. Yet no country can let populated areas languish because they suffer a locational handicap. India is committed to the Millennium Development Goals, which reinforce solemn national commitments to poverty alleviation and the fulfilment of a raft of basic minimum needs such as primary education and health, potable water, and electricity for all by 2012. Socioeconomic indices tend to be low in hill and border regions and the Northeast figures are no exception.

7. Area development for poverty alleviation

Large infrastructure projects like dams can stimulate overall development and poverty alleviation and must therefore be seen as area development programs. Further, though some displacement is likely, resettlement and rehabilitation should be regarded as a development opportunity to assure a better quality of life and, indeed, as part of poverty alleviation. Likewise, though there will be some environmental loss, mandatory catchment area treatment, compensatory afforestation, prophylactic health measures, and the construction of better homes can improve the physical and living environment. The opening up of roads and communications as a concomitant of dam building can create market and employment opportunities and facilitate more productive and ecologically friendly land use patterns. Connectivity will reduce pressure to engage in subsistence jhum farming by enabling grain to be imported from the plains and will encourage better land use and crop planning under plantation crops, horticulture, herbiculture, and floriculture, and permit ecotourism. On balance, therefore, dam building could result in a net environmental gain and higher living standards.

The notion that land for land is the best or even the only legitimate form of resettlement and rehabilitation is misconceived and has on more than one occasion proved to be a false promise. It has eliminated freedom of choice by barring cash compensation (under suitable supervision, where necessary, to ensure that the money is not idly squandered or appropriated by vested

interests). Since diversion of degraded forestland for resettlement and rehabilitation is prohibited, the land-for-land compulsion has meant searching for land in distant locations at the cost of alienating displaced families from their cultural roots and kinship groups on the one hand and creating tensions between the new settlers and host populations on the other.

Far more sensible and practical to undertake resettlement and rehabilitation in situ, through training and employment in the new opportunities created by area development even during the gestation period. Hitherto, poverty alleviation, hill development, and resettlement and rehabilitation have been assumed to be unconnected activities whereas they obviously go hand in hand and could be mutually reinforcing. Only submerged habitations would need to be relocated at higher contours above the new reservoirs and it should not be too difficult to acquire land for that purpose.

Three things can be done to promote a sense of partnership between the people and dam projects. First, the lands acquired from individuals or communities for the project, its appurtenant infrastructure and related colonies and works, could be treated as equity and therefore liable to lifetime returns in the form of dividends and a place on the board of management. Second, although the host state is entitled to a royalty of 12 percent of the electricity generated, project-affected families get no direct share of this bounty. The Volta River Authority in Ghana has successfully experimented with paying a small percentage of project revenues to a community development fund for project-affected families and villages. This suggests a payback mechanism that could be utilized and managed in a variety of ways.

Third, 1 to 3 percent (say) of the total cost of the project could be set aside for area development of the immediate project-affected area and the larger project-influenced upper catchment region around it. An upper catchment authority with local, state, project, and national representation could be established to oversee and manage an area development program. This could start with a socioeconomic and land use survey of the upper catchment to establish benchmarks. Thereafter, there should be a commitment on the part of the project, duly underwritten by the concerned state(s), to meet given basic minimum needs, with suitable vocational and other training and land use planning, to bring the region on par with the state or national level within 6–10 years, which would be the average gestation period of medium to large water resource projects. This would automatically address many of the problems associated with in situ resettlement and rehabilitation to a considerable extent and bind the people to the project. Stakeholders do not necessarily exist; they often have to be created.

Where would the funds come from? As it is, 5 to 12 percent of any large water resource project typically goes for resettlement and rehabilitation. Add to this the funds designated for a whole range of poverty alleviation programs and allocated or unutilized balances in the Non-Lapsable Central Pool of Resources for the Northeast, which had Rs. 6,120 million unspent as of June 2004 out of the Rs. 22,870 million released since 1998, excluding Sikkim. Of this, Rs. 590 million were unspent by Arunachal Pradesh and Rs. 1,660 million by Assam. Much of these funds are earmarked under different headings but area development could usefully be introduced as a new head of expenditure.

Why should Arunachal Pradesh or Manipur undertake water resource projects to moderate floods in Assam and feed power far in excess of their own requirements into the northeast or national grid? The answer is that falling water not used in any one year entails an annual income loss that poor states can ill afford to throw away. How that income is distributed is of course an important and even sensitive issue. But that is something for which equitable

solutions can be found. Bhutan affords a prime example of how water resource development can be used to generate income to enable a nation or region to make considerable socioeconomic advances on a number of fronts.

That apart, the northeastern states are clearly interdependent. The region's major lines of communication and arterial road, rail, air, inland water, power transmission, oil, and fibre optic links traverse the Barak and Assam valleys to connect with the Indian heartland. Assam's economic and political health must therefore concern the dormitory states around it. These peripheral areas do have international linkages that must be exploited. But while this is important, it is no substitute for a lively and productive Assam connection.

8. Trusteeship areas

Water projects with a narrow, single focus tend to worsen interstate conflicts over water and give rise to more costs than benefits. Widen the field to include other water projects or other sectors and tradeoffs become possible, with gains for everybody. The carving out of the four new states of Arunachal Pradesh, Meghalaya, Nagaland, and Mizoram from Assam has left over border disputes, mostly in forestlands, over which there have long been rival claims. This stems from the transfer by the colonial rulers of certain forest tracts across the Inner Line to the plains districts of Assam for better management of newly created reserved forests. Thus there was an administrative boundary, a forest boundary, and a political boundary, making for a somewhat confusing situation. This perhaps did not really matter in most cases until district boundaries were redrawn as state boundaries at various times after independence. These boundary disputes have lingered and have periodically flared up as one side or other has sought to build a road, outpost, or settlement to buttress its territorial claim.

Political uncertainty and violent clashes have from time to time impaired development of these piedmont tracts to the detriment of their scattered inhabitants, thereby denying benefit to the rival claimants. Yet these flat lands are of potential value to the hill states for the development of railheads and airstrips, industrial parks, warehouses, cold storages, and distributive centers. Dimapur, in Nagaland, though not disputed, offers a good example of what such areas can mean to a hill state. Assam in turn is unable to develop any real revenue-earning activities in these strips, which have in some ways become a political headache.

Could these fringe areas be brought into the reckoning in coaxing agreements on the construction of water resource projects? This could happen were the Centre to negotiate a tripartite arrangement that converts part of these disputed areas into trusteeship zones for periods of 30 to 50 years for mutual benefit as entrepôts and growth centers. Water resource projects are vital for Assam, a lower riparian, as they promote flood moderation, improved navigation, and fisheries. They are equally important for hill states. Upper riparians seeking area development, income, and employment generation could gain value addition by processing a range of horticultural and plantation products and promoting other forms of industrial and service activity premised on the availability of large blocks of hydro energy and flat lands for developing the necessary infrastructure.

The Tipaimukh and Bhairabi dams in Manipur and Mizoram, for instance, could catalyze development by creating new inland waterways and market opportunities that would open up remote areas with rich potential. Suitable norms could be established for payment of royalties for the use of trusteeship lands and for sharing the capital appreciation in land values. This could ensure a situation from which all three partners gain considerable benefit. Project-affected

families not availing of in situ resettlement and rehabilitation could also opt for resettlement and employment in trusteeship area growth poles. The many thousands of northeastern students graduating from various central universities and professional institutions around the country would also have a strong incentive to return to their home state or to the region in general in order to participate in the transformation of their homelands. These young people presently constitute a major brain drain of some of the Northeast's finest human resources.

9. Good and bad water projects

Not all water resource projects are well conceived or well executed. Problems can emanate from faulty design parameters, inadequate consultation, poor environmental care, or as a result of political sensitivities. None of this need imply that they are bad projects per se but it indicates the need for review and reworking. The original Subansiri and Dihang projects, even if technically sound, possibly suffered from political overambition. They are now being recast but, as argued in an earlier section, need to be optimized to yield multipurpose benefit, especially flood moderation. The 105-megawatt Loktak power project in Manipur did not pay sufficient consideration to the unique lake ecosystem and livelihood factors, which call for remedial action. The ongoing Pagladiya project, which provides for a long embankment dam across the wayward Pagladiya River in Nalbari District in lower Assam, has run into difficulties as the recent creation of the Bodo Autonomous Council has placed the project-affected families and flood protection beneficiaries respectively in different political constituencies. In all such cases, renegotiation and technical corrections are probably feasible.

However, changing circumstances, as in the case of the Pagladiya dam, can also impact perceptions and cost-benefit calculations. A striking example of this is a small dam built across the Gumti River in Tripura at Dumbar 30 years ago. This has an upgraded installed capacity of 15 megawatts but has generated a diminishing output of firm power following siltation of the reservoir. Some 9,000 tribal project-affected families, many of them lacking title deeds, were displaced from the 45,000-hectare submergence area and resettled atop the adjacent hills, where they had to resort to jhum farming, with its propensity to enhance erosion.

This development aggravated existing tensions between the displaced Tripura tribal peoples and the Bengali beneficiaries. The demographic change in Tripura that has seen a tribal majority being reduced to a minority with Bengali immigration over past decades has been a prime cause of the multiple ongoing insurgencies in the state.

When the Gumti dam was constructed, Tripura needed the limited hydropower it generated. Since then, gas has been found in the state and a gas-fired thermal station of 84 megawatts has been commissioned and a second plant of 280 megawatts is under construction. In the circumstances, it is argued that rather than make the Gumti plant a 20-megawatt peaking station with some additional investment, as proposed, it might be better to decommission the dam and resettle the 30,000 or so landless tribal families in the state on the now rich silt-laden reservoir bed, with each family getting at least 1 hectare of prime agricultural land. (Subir Bhaumik, Presentation to World Commission on Dams, 2002).

Such a move would not merely make Tripura self-sufficient in grain but could heal the tribal-Bengali breach and bring the current National Liberation Front of Tripura and other insurgencies to an end. This would be a major gain and could send a message across the region that water resource development will not be pursued at the cost of legitimate human and tribal interests. Ethnic reconciliation and ecological restoration are major priorities.

10. Technological advances

Dam safety must remain a most important consideration in the highly seismic Northeast. Due care is being taken through dam break studies, instrumentation of project sites, appropriate designs, and disaster management protocols. Higher safety ratios may be adopted where necessary as a measure of abundant caution despite the higher investment involved.

The Indian Space Research Organization's advanced satellite and airborne system capabilities are now at the service of water resource planning. Satellite survey and mapping can facilitate 3-D terrain modeling, quick environmental assessments, and computer simulation and optimization studies with any number of variables. These are amazingly versatile tools for planning, designing, managing, and monitoring projects.

Flood response too can and must be improved through better communication between the northeastern states and between India and its neighbors. Flood forecasts, warnings, and alerts must be transmitted directly in real time to areas likely to be affected. The Northeast is prone to glacial lake and debris dam outbursts, which are not uncommon in Tibet and in the Himalaya and its outcrops to the south. India and China agreed some years ago to resume hydrological data exchanges relating to the main stem of the Brahmaputra. It would be advantageous if similar understandings were to be reached for the Subansiri, Lohit, Teesta, and other trans-Himalayan rivers.

The level of exchanges needs to be even greater between India and Bangladesh as virtually all of Bangladesh's rivers enter it from India. This is clearly a most significant area for Indo-Bangladesh cooperation. While information flows have improved, there is much more that can be done.

11. Regional cooperation

If the northeastern states are interdependent, so too are northeast India and its neighbors, especially Bangladesh. Friendship and cooperation with Bangladesh can repair the geopolitical wounds of partition, which cut the Northeast's arteries of communication, causing it huge socioeconomic and market disruption. In looking at the equation, it will not do to fix one's gaze on water alone. A holistic view is necessary and indicates large mutual gains from a variety of tradeoffs.

The thorniest water issue, that of sharing the lean season flows of the Ganges, was finally resolved in 1996 with the signing of the 30-year Treaty between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on Sharing of the Ganga/Ganges Waters at Farakka (the Ganges Treaty). This was accomplished as a result of several factors. The Indian prime minister decided that as the larger partner, India would not insist on instant or full reciprocity. The goodwill and trust engendered by an agreement would, he felt, yield its own dividends in time. Second, the issue of sharing of lean season flows, a wholly legitimate and immediate right, would be delinked from augmentation of flows, a future and possibly problematic option. Third, the normal formula of calculating river flows on the basis of 75 percent dependability was given up in favor of 50 percent or average dependability. This yielded a higher figure of base flows during the lean season at Farakka. Although clearly no more than a sleight of hand, the higher figures made it possible to change public perceptions by guaranteeing each side a magical minimum figure of 35,000 cubic feet per second (cusecs) in turn for six alternating 10-day periods during the critical 60 days of

minimum flows between March 21 and May 20. Thus Bangladesh was able to say that it had got higher minimum flows than those negotiated under the 1977 Ganges Water Agreement while India could tell West Bengal that it was assured of the minimum flows needed to flush Kolkata port and keep it in good health. The facts may have been otherwise, but face and honor were salvaged. Perceptions, and primeval emotions based on them, do matter.

Certain general principles of equity, fairness, no (significant) harm, optimum utilization, mutual accommodation, and good neighborliness were enunciated in the Ganges Treaty, which in many ways parallel the principles set out in the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (1997). Unfortunately, a fresh impasse has developed over the sharing of Teesta waters and there has been no progress on the sharing of the other 52 rivers. Some of this is based on differences over trade and transit, boundary accords, and so forth that have soured political relations.

Bangladesh is still unable to use its share of Ganges Treaty releases gainfully during the lean season in the affected southwest region as the outfall of the Gorai, the deltaic arm of the Ganges that flows through this area, has long silted and does not permit any inflow after a certain stage in the recession of the Ganges flood. A capital dredging Gorai cut to resuscitate the river, with Dutch assistance, was abandoned with a change of regime in 2000. India's offer to assist with Bangladesh's preferred option of a Ganges barrage at Pangsha (to force the Ganges to backflow across the Gorai hump by sustaining a higher pondage behind the barrage) remains dormant. The barrage project has however inched forward with the preparation of an inception report by the Bangladesh authorities.

Meanwhile, in the absence of a Teesta sharing accord, Bangladesh says that it is beginning to face desertification in its northwest region. It therefore seeks supplementation from the proposed Kosi high dam, which Nepal and India are jointly investigating. Meanwhile, both sides have completed barrages on the Teesta, though there are inadequate lean season flows to irrigate the full command in either country. Fresh discharge readings are being compiled to provide a scientific basis for water sharing. Until then, nongovernmental organizations meeting in Track II conclaves had some time back suggested that both sides jointly run the twin Teesta barrages in tandem as a single optimized system. But the political climate for this degree of cooperation is presently lacking.

A fresh issue has arisen over Tipaimukh, which Bangladeshi critics say will either dry up the Barak/Meghna (whereas storage releases through the turbines would actually augment lean season flows), or, contrarily, cause summer flooding in the Sylhet bowl. Here, too, there have been Track II suggestions that an agreement on Tipaimukh reservoir operations could obviate any flooding while irrigation from the stage II Fulertal barrage 100 kilometers downstream of Tipaimukh could irrigate large tracts of land in Bangladesh and also overcome the need for distress sharing of lean flows with regard to a number of small rivers flowing into Bangladesh further south from Tripura. Furthermore, the Tipaimukh flood cushion would also benefit Bangladesh. Indeed, Tipaimukh was the first flood moderation study suggested by Bangladesh when the Indo-Bangladesh Joint Rivers Commission was established in 1972.

Bilateral relations did not improve through 2004, with Bangladesh launching an international campaign against India's Interlinking of Rivers program to move water from surplus to deficit basins, which, it was claimed, would lead to the drying up of Bangladesh's rivers. Such an extreme outcome would, however, be most unlikely, given that the program envisages augmentation of lean flows by storing monsoon waters, and in any case seeks in the first

instance exclusively to investigate possibilities of transbasin transfers between India's peninsular rivers, obviating any international consequences. Moreover, the Indo-Bangladesh Ganges Treaty binds India to use its best endeavors to maintain existing flows and releases to Bangladesh and, indeed, to see if these supplies can be augmented in the future. Nevertheless, India certainly would have been wiser to keep Bangladesh, Nepal, and Bhutan formally informed at the very start of its studies for the Interlinking of Rivers program, thereby forestalling any misconceptions.

12. Interlinking of Rivers program

The Interlinking of Rivers concept, developed by the National Water Development Agency of the Central Water Commission over a period of two decades from 1982, contemplates 14 peninsular components and 16 Himalayan links. The latter part of the program envisages transfers from the Ganges in Nepal, but from only two major Brahmaputra tributaries in Bhutan, the Sun Kosh and Manas, while excluding all rivers further east - the Kameng, Subansiri, Dihang/Siang, Dibang, Lohit, and Noa Dihing. There is no clear explanation why this should be so. The latter rivers are, however, included in the energy-driven 50,000-megawatt hydro initiative, whereas the Interlinking of Rivers program aims to maximize water and flood storage behind multipurpose dams.

The Brahmaputra (excluding the Barak) carries about 28 percent of the country's total runoff. While the enormous energy resource of the basin is sought to be tapped, it would be remiss not to harness this huge water bounty optimally for current and future uses for the benefit of the entire region, not least Bangladesh. Urgent rethinking is required before possibly suboptimal projects are initiated and more favorable options preempted.

In fact, the Interlinking of Rivers program offers an opportunity to revisit the entire eastern Himalayan water dialogue with Nepal, Bhutan, and Bangladesh to review options and strategies and build synergy through regional cooperation. From India's point of view, it is technically feasible to transmit hydropower from the extremities of the Northeast to the Indian heartland through regional intergrid links traversing the Siliguri neck. But capital costs and power losses could be greatly reduced if transmission lines could run through Bangladesh, which would itself be a valuable power trading market for India. This could also result in the development of a more efficient regional energy market and an eastern Himalayan electricity grid based on hydropower from Nepal, Bhutan, and the Northeast, gas-based power from Bangladesh, and coal-based power from the Assam and eastern India coalfields in Jharkhand, West Bengal, and Orissa.

13. Ground realities

Multipurpose water resource projects in the eastern Himalaya would also provide for flood moderation and navigation to regional benefit and open up additional irrigation possibilities. Bangladesh is so placed that virtually all the high ground available for regulating its rivers, barring those in the Chittagong Hill Tracts, lie in India, where it would be not merely more feasible but far cheaper to build dams and diversion barrages such as at Jogighopa on the Brahmaputra and Fulertal on the Barak/Meghna in Cachar, Assam. Moreover, any regulatory structure in Bangladesh would have to contend with wide, braided rivers and probably require the construction of long and expensive guide walls. It would also have to be located some distance from the boundary so as to avoid backwater flows into India, as happened when the

Kaptai dam was constructed by Pakistan on the Karnafuli river in the Chittagong Hill Tracts in the early 1960s. In consequence, such structures would exclude substantial border tracts from the command of any irrigation program.

Likewise, flood embankments in Bangladesh need to be tied to similar Indian embankments upstream if rivers are to be jacketed. At the same time, embankments and spurs constructed on boundary rivers in one country in order to control erosion could have negative effects in the neighboring country. This has been happening regularly and has been the source of much bad blood among villagers along the Indo-Bangladesh and Indo-Nepal borders.

The consequences of random, go-it-alone solutions (often undertaken locally) have been so disruptive of boundary relations that it is surprising that more has not been done to survey and execute measures jointly on the basis of cross-border catchment area, subbasin, or basin plans. Some steps have certainly been taken in this direction, but the mechanisms need to be strengthened.

Bangladesh has expressed great interest in the projected Kosi high dam at Barakshetra that Nepal and India plan to build on the basis of a detailed project report that is being jointly prepared by the two sides. A large storage with an in-built flood cushion, a navigation link, and considerable hydro generation are envisaged. Bangladesh is interested in augmenting lean flows in the Ganges and inland navigation to Nepal and has said that it would be prepared to share costs in proportion to the benefits received.

Over a longer term, Bangladesh has considered diverting Brahmaputra flows into the Ganges within its own territory. This would entail building a huge barrage across the Brahmaputra, near Bahadurabad. This investment could be rendered unnecessary by construction of storages and a diversion structure on the Brahmaputra in India at Jogighopa, first proposed by India in 1978-1982 but too ambitious a project to survive the uncertain political climate prevailing between Bangladesh and India at that time. The Indian proposal for a large Brahmaputra-Ganges link canal was thereafter formally abandoned. But should India build multipurpose storages in Arunachal Pradesh and a barrage at Jogighopa, which offers a good site for the purpose, it could divert water northwest through Indian territory to feed the Teesta and Mahananda and lead further supplies south through canals linking up with the Karatoya, Atrai, and other streams and derelict flood channels coursing down northern Bangladesh. These would provide irrigation, navigation, and fishery benefits that Bangladesh could not achieve on its own. This would still leave large quantities of water that would flow down the Brahmaputra into Bangladesh. These could then be picked up further down for any subsequent Jamuna (Brahmaputra)-Ganges transfer.

An interesting proposal was put forward at an international conference in Dhaka in December 2004 on the possibility of just such a transfer. A foreign consultant with long experience of working in the Bangladesh water sector projected a Mawa-Paksi-Farakka complex of barrages to pond Brahmaputra waters behind a bridge cum barrage at Mawa on the Padma and pump some of this to a Paksi bridge cum barrage on the Ganges near Hardinge Bridge, with a further link from Paksi to the Farakka pond. This scheme would entail a two-stage 8-meter lift (less than for transfer by any all-India route) from the Mawa pond to the Paksi pond and from the latter to the Farakka pond (Brichieri-Colombi 2004). While this was only a preliminary study, it is indicative of the kind of creative thinking that needs to be brought to bear on the problem.

The benefits from cooperation on the Tipaimukh multipurpose project are clear and it is unfortunate that this has not yet been pursued after an initial show of interest. Among the problems confronting water sector cooperation is the guarding of information and data that it would benefit all to share. While India has failed to share its Interlinking of Waters program and 50,000-megawatt hydro initiative and other water sector plans and papers of regional interest with Nepal and Bangladesh, Dhaka has not shared its recently completed National Water Management Plan 2000–2025, nor Nepal its Water Resources Strategy 2002–2027 and proposed Power Sector Development Strategy 2001. These studies do not appear to be widely known in India. The result is that countries sharing common rivers seem to be planning water resource development in isolation without knowledge of (or even much concern for) what the others propose doing. A simple exchange of data – none of it really secret – would probably instantly reveal common interests, interdependencies, and regional solutions for national problems. A meeting of water resource sector officials and ministers to exchange notes on their own plans and projections would of itself go a long way to dispel many doubts and misperceptions and build the trust that is patently lacking at the moment.

14. New structures for the Northeast

In order to stimulate and speed up the process of regional planning and implementation in the Northeast, the Government of India has recently taken a number of steps. The Ministry of Development of North Eastern Region (MoDONER) has been established under a minister of cabinet rank who has now been made chairman of the reconstituted North Eastern Council, which has been designated the statutory planning body for the Northeast. The Planning Commission member looking after Northeast affairs has been made an ex officio member of the North Eastern Council together with two other nominated members to constitute an autonomous miniregional planning commission, integrally linking this new regional planning body and the national Planning Commission.

Further, it is proposed that the Brahmaputra Board be replaced by a North Eastern Water Resources Authority (NEWRA), linked to the North Eastern Council, with oversight over and powers to grant environmental and other clearances for all regional projects, enabling it to play an initiatory and coordinating role in issues concerning the water and power sector. Arunachal Pradesh, however, is not in favor of NEWRA and would prefer to deal bilaterally with Assam and private investors, though this may prove to be inimical to its own larger interest.

The North Eastern Council is being charged with the task of preparing a North Eastern Region 2020 Vision document. This will include a perspective water resource plan for the region and provide opportunity to iron out various differences in perception and priorities that obtain at present. Since the new North Eastern Council is expected to take a view on the region's externalities, it will hopefully join with NEWRA to take a fresh view on regional cooperation for harnessing the eastern Himalayan waters.

15. National power perspective

The Northeastern Region's water sector plan will need to fit in with wider long-term national perspectives. Among these are the Interlinking of Rivers program (which is currently undergoing review), the Central Electricity Authority's medium-term load forecast until the end of the 12th plan (2017), the 50,000-megawatt hydro initiative, and the Inland Waterways Authority of India's program to develop National Waterway 2 (from Dibrugarh to Dhubri) with

lower Brahmaputra links through Bangladesh to Kolkata and up the Barak to Silchar. The recommendations of the Flood Commission, which recently submitted its report to the government, and the national grid development program, are other elements that have a bearing on the Northeast.

The new Electricity Act (2003) provides an enabling framework to move forward with power development and reform. Installed capacity in the country was 112,058 megawatts in 2004 and an increase is required to 202,453 megawatts by 2012 and 273,734 megawatts by 2017, consisting of 94,104 megawatts hydro if the desired hydro-thermal mix of 40:60 is to be attained and peaking shortages are to be reduced if not contained. The 50,000-megawatt hydro initiative is intended to meet the additional hydro requirement and correct the presently imbalanced hydro-thermal mix.

According to basin-level ranking studies of hydro projects carried out by the Central Electricity Authority a few years ago, as much as 32,107 megawatts of the 50,000-megawatt hydro initiative is to come from the Northeast, including 25,690 megawatts from Arunachal Pradesh, 1,870 from Mizoram, 1,680 from Sikkim, 1,490 from Meghalaya, 970 from Nagaland, and 407 from Manipur (excluding Tipaimukh). NEWRA and the North Eastern Council would have a say in how the program moves.

16. The external dimension

Note should also be taken of three projects lying outside India but of great relevance to the Northeast. The first is the 1,200-megawatt Tamanthi hydro project on the Chindwin in Myanmar (opposite Phek District in Nagaland), which is being investigated by NHPC at the request of the Myanmar administration. This is part of a three-stage cascade of 3,000 megawatts. Should this be taken up, surplus power will be exported to Nagaland. Such a transmission line could mark the beginning of a power grid linking India with the rest of South Asia and the countries of the Association of Southeast Asian Nations (ASEAN).

The second is a Rail India Technical and Engineering Services (RITES) survey of a road link and inland waterway from southern Mizoram to Sitwe (Akyab) port in Myanmar down the Kaladan River. This could offer an intermodal road cum barge outlet to the sea for the Northeast.

The third project is more futuristic and grander - a 48,000–54,000-megawatt power project on the giant U-bend of the Brahmaputra as it swings north, then east, and finally south around Namche Barwa and Gyala Peri peaks to tumble some 2,400 meters from the Tibetan plateau to the Assam plain. This vast drop has long been an engineer's dream. Japan's Electric Power Development Corporation made a desktop study of a Tsangpo cascade in the 1980s for the Global Infrastructures Foundation of Japan (EPDC 1988). A proposal was mooted in the 1990s that instead of a structure to divert the Brahmaputra through a tunnel of 80 to 240 kilometers piercing the Himalaya it might be more ecologically friendly and cheaper to use an inflatable dam, a 10-meter-high nylon-reinforced rubber bladder filled with air or water and anchored to a steel baseplate. This would create a shallow pond to divert the river through the mountain (Cathcart 1999).

Whichever way one looks at it, the very large hydro potential available in the Northeast could make a great contribution to reducing greenhouse gas emissions and open up possibilities for carbon trading as a means of financing some of these projects. India's annual per capita consumption of electricity in 2001 was 474 kilowatt-hours, compared to 1,019 for China and

12,406 for the United States. At this level of electric consumption, India's carbon dioxide emissions rose from 0.5 metric tons per capita in 1980 to 1.1 metric tons in 1999 and accounted for a 4.6 percent share of world carbon dioxide emissions. India's share is likely to rise sharply if current development goals are fulfilled. On present calculations it will be burning nearly 450 million metric tons of coal and lignite for power generation by 2012. The need for using cleaner renewable sources of fuel is evident. The Northeast's contribution in this regard could be very significant.

17. Grid efficiency

A national power grid has come into being with the ability to exchange up to 30,000 megawatts across large distances. Private generation and distribution companies driven by market forces have also begun to compete for business under the watchful eye of central and state electricity regulators. These two developments have created a new scenario. The earlier state electricity board monopolies can no longer dictate prices and pay out large subsidies. Power trading is becoming highly competitive with availability-based tariffs that enable efficient, low-cost producers, wherever they be, to sell power to distant clients.

The Northeast therefore now has an emerging national and regional power market that it can exploit. Fortuitously, it experiences earlier snow and glacier melt (from March), premonsoon showers (from May), and actual onset of the monsoon (early June) than occurs in the west and north of India. In the circumstances, the Northeast can draw on secondary power resources to supply consumers in more westerly states and cater to base loads while coal-fired thermal stations elsewhere shut down through June and July for annual maintenance. Such a seasonal matching of generation could offer a considerable boon to the national economy, improve grid efficiency, and earn northeastern suppliers handsome dividends.

For the rest, hydropower is best used as peaking power, which commands a higher time-of-day tariff. The Northeast must learn to exploit its locational, seasonal, and renewable energy strengths. Availability of cheap power during the prolonged monsoon period also offers possibilities of attracting energy-intensive industries to the region. Further, the Brahmaputra and Barak and their major tributaries can emerge as efficient inland waterways with improved drafts from augmented lean season flows regulated by storage dams. Given a strong power base and good transportation facilities, the trusteeship zones ringing the Assam foothills could prove a great attraction if imaginatively developed and marketed.

18. Waterway restoration

Among Northeastern priorities should be the restoration of the great Brahmaputra, Meghna (Barak), and Ganges waterways. The role of the Inland Waterways Authority of India has been enlarged and it has been empowered to participate in joint venture equity. The authority has been accorded infrastructure status under the Income Tax Act, which makes it eligible for 100 percent tax exemption for five years and another 30 percent exemption for a further five years. It also makes it eligible for priority lending by financial institutions and for foreign direct investment up to 74 percent. A 30 percent vessel-building subsidy is now available, with higher depreciation for inland vessels and concessionary customs duties as well. Build-operate-transfer projects are being separately encouraged.

Asian Development Bank funding has been obtained and a Canadian consultant engaged to study the Patna-Haldia and Dhubri-Dibrugarh sections of National Waterways 1 and 2 respectively. Hydrographic surveys have been conducted and prefeasibility studies undertaken in regard to navigation on the River Tizu in Nagaland, the Gumti and Haora in Tripura, and on the Subansiri.

Only just under 800,000 metric tons of cargo were moved along the Brahmaputra during 2003–2004. However, the possibilities for inland water transport are considerable, especially during the wet months, with country craft using outboard motors operating on feeder routes. River tourism and boat cruises on the Brahmaputra are also slowly picking up.

The limited duration of Indo-Bangladesh inland waterway transport protocols has been an inhibiting factor in the development of intercountry and transit movements by water. This impediment is likely to be removed with the conclusion of a long-term trade and transit agreement between the two countries. The extension of route facilities to Ashuganj could facilitate intermodal movement from Kolkata to Agartala in Tripura. The establishment of night navigation will also reduce travel time and improve the economics of movement by water.

19. National and international comparisons

Comparisons of the Northeast's problems with those encountered in other parts of the country – such as in the Narmada valley, the Cauvery basin, or between Punjab and Haryana – do not hold good in all cases. The Northeast is essentially not short of water, though there are areas of dry season distress with regard to municipal water supplies whose problems need individual attention. The region is challenged by floods and erosion and can use its immense hydropower resources to finance development, generate employment, and improve the quality of life, as Bhutan has done.

One area where comparisons might be seemingly valid is in relation to resettlement and rehabilitation. The land-for-land formula applied in the case of Sardar Sarovar or the Tehri dam have largely brought grief and should not be replicated in the Northeast (or even elsewhere), least of all on the mistaken grounds of applying uniform policies all over the country. The Northeast must be treated *sui generis*. Even tribal comparisons can be misleading. The tribal majority states of the northeast hills cannot be treated on a par with such states as Jharkhand and Chhattisgarh, which have significant but proportionally smaller tribal populations. The constitutional protection of the Sixth Schedule and the family of Articles from 371-A to 371-I also distinguish this region from the rest of the country.

There is a problem of land rights in the region as lands are held by communities or tribal chiefs over large areas, except for Assam, and the states' powers of land acquisition are correspondingly limited. The matrilineal system followed by the Khasis in Meghalaya also entails some complications. Yet ingenious ways are being found around some of these traditions and customary rights. The concept of tribal interest has been advocated in Meghalaya to create a new type of public interest able to grapple with contemporary realities in the region.

Water conflicts within India are federal, interstate, or intrastate, but those with Bangladesh and Nepal are transboundary or international. In the resolution of interstate water conflicts, various interstate (water) tribunals have cited international water law and conventions such as the Helsinki Rules on the Uses of the Waters of International Rivers (1966) as guidelines. Having started its water resource development earlier than its neighbors India has come to accept

equitable apportionment as a principle and has not sought to take a rigid stance on prior appropriation, even while seeking, within reason, to protect existing uses. It is coming to recognize demand management, conservation, and recycling as means of coping with the needs of a rising population and economic growth, as water is ultimately a finite resource. Pollution control is also assuming increasing importance in managing what is a scarce economic resource as much as a social good.

20. Conclusions

The message for the Northeast is clear: cooperate or languish. To be satisfied with small gains when there are far larger rewards to be garnered would deny the local populace, the region as a whole, and the nation their dues. Sustainability need not be sacrificed and in many ways the human and natural environment could be enhanced through carefully planned, participative water resource development. Certain projects may never be built; but others could be viable, environmentally friendly, and a boon to local communities, neighboring states, and the wider Eastern regional quadrant at various levels.

Conceptually, it is necessary to think imaginatively and experiment boldly with new ideas. The Northeast is poised to take a great leap forward. Its water resources can provide the springboard to make the region a happening place and catapult its people towards a brighter future. However, this will require cooperation among the various political units and subunits that make up this composite region as well as a wider framework of regional cooperation in an eastern Himalayan growth quadrangle that is part of India's new Look East, Look North policy, opening up to ASEAN and China.

The basic infrastructure is falling into place in the Northeast and a number of still unfolding financial, policy, and structural reforms are creating an enabling environment for growth. Problems remain, including the need for improvement in certain external relationships that are under strain. Internally, there is still considerable political volatility, but peace requires development as much as development requires peace. The two go hand in hand. Taking all things together, the Northeast can look forward to better days.

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