With the Northeast identified as India’s ‘future powerhouse’ and at least 168 large hydroelectric projects set to majorly alter the riverscape, large dams are emerging as a major issue of conflict in the region. Although the current scale of dam-related developments far outstrips anything which took place in the past, the region has been no stranger to dam-related conflicts. For example, the Kaptai dam, built in the Chittagong Hill Tracts of East Pakistan (now Bangladesh) in the 1960s, submerged the traditional homelands of the Hajong and Chakma indigenous communities, and forced them to migrate into parts of Northeast India. Over the years, this has led to serious conflicts between the refugees and local communities in Arunachal Pradesh. In the 1970s, the Gumti dam in Tripura submerged large tracts of arable land in the Raima Valley and displaced the local tribal population, leading to unrest. Projects such as the Loktak hydroelectric project commissioned in the 1980s have impacted the wetland ecology of the Loktak lake in Manipur, seriously affecting the habitat of the endangered Sangai (the brow-antlered deer) and the livelihoods of local people. The impending loss of home, land and livelihood has led to many years of opposition to the Pagladiya project in Assam and the Tipaimukh project in Manipur on the Barak river. More recent times have seen major conflicts emerge in Assam and Arunachal Pradesh over the individual and cumulative impacts of over 100 dams planned in upstream Arunachal. Dam-induced floods from projects such as the 405 MW Ranganadi hydroelectric project in Arunachal and the intense people’s opposition to the under-construction 2,000 MW Lower Subansiri hydroelectric project on the Assam – Arunachal Pradesh border have been major triggers for what has now emerged as a major political debate on the downstream impacts of dams in the region. Meanwhile, in the uplands of Sikkim and Arunachal, minority indigenous communities such as the Lepchas and Idu Mishmis have expressed concern about the impacts of multiple mega projects in their homelands. The large dams’ juggernaut promises to be the biggest ‘development’ intervention in this ecologically and geologically fragile, seismically active and culturally sensitive region in the coming days.

THE REGION
Northeast India, consisting of the eight states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim, is known for its biological and cultural diversity and the unique Brahmaputra and Barak river systems. While the eight states are indeed collectively referred together as the ‘Northeast’, there is substantial diversity within the region even as far as political and socio-economic issues are concerned, both historically and in contemporary times.

The region is rich in biodiversity and is home to important populations of wildlife species such as the rhino, elephant, tiger, wild water buffalo, pygmy hog and gangetic river dolphin. Three out of 34 biodiversity hotspots identified globally – Himalaya, Indo-Burma, and Western Ghats and Sri Lanka – cover parts of India. The Northeast is traversed by the first two and in 8% of the country’s geographical area it also houses 21% of Important Bird Areas within India, identified as per international criteria. It is an area which is still poorly documented and in recent years biologists have discovered new species and extended known ranges of existing ones in the region. This is not just restricted to smaller life forms, but also large mammals such as primates, discovery of which is rare these days, an indication of how unexplored the region is. The Northeast also has a high level of endemism (plant and animal species found nowhere else).

The Brahmaputra is one of the world’s largest rivers, with a drainage basin of 580,000 sq km, 33% of which is in India. Originating...
in the great glacier mass of Chema-Yung-Dung in the Kailas range of southern Tibet at an elevation of 5,300 m, it traverses 1,625 km through Chinese territory and 918 km in India, before a final stretch of 337 km through Bangladesh, emptying into the Bay of Bengal through a joint channel with the Ganga. A unique river, it drains such diverse environments as the cold dry plateau of Tibet, the rain-drenched Himalayan slopes, the landlocked alluvial plains of Assam and the vast deltaic lowlands of Bangladesh. An extremely dominant monsoon interacting with a unique physiographic setting, fragile geological base and active seismo-tectonic instability, together with anthropogenic factors, have moulded the Brahmaputra into one of the world’s most intriguing and gigantic river systems. The dramatic reduction in the slope of the Brahmaputra as it cascades through one of the world’s deepest gorges in the Himalayas before flowing into the Assam plains explains the sudden dissipation of the enormous energy locked in it and the resultant unloading of large amounts of sediments in the valley downstream. The river carries the second largest sediment yield in the world, while it ranks fourth in terms of water discharge.

In the course of its 2,880 km journey to the Bay of Bengal, the Brahmaputra receives as many as 22 major tributaries in Tibet, 33 in India and three in Bangladesh. Many of the north bank tributaries are of Himalayan origin, fed by glaciers in their upper reaches, e.g. the Subansiri, the Jia Bharali (Kameng), and the Manas. The Dibang and the Lohit are two large tributaries emerging from the extreme eastern flank of the Himalayas, while the Jiadhal, the Ranganadi, the Puthimari, and the Pagladiya are some of the major tributaries with sources in the sub-Himalayas, the latter two in Bhutan. The river system is intricately linked with the floodplain ecology of wetlands (beels) and grasslands in the Brahmaputra valley. For example, these linkages are evident in the world-renowned ecosystems such as the Kaziranga National Park in Assam. Due to the colliding Eurasian (Chinese) and Indian tectonic plates, the Brahmaputra valley and its adjoining hill ranges are seismically very unstable and the region has seen some major earthquakes (see box on Dams & Environmental Risks).

The other major river basin in Northeast India is the Barak. This river has its source in Manipur and the upper Barak catchment area extends over almost the entire north, northwestern, western and southwestern portion of the state. The middle course of the river lies in the plains of Cachar in southern Assam, while the lower, deltaic course is in Bangladesh. Both the Brahmaputra and the Barak river systems are also the lifeline for livelihoods such as fishing and agriculture of local communities in their respective floodplains.

The region is home to a diversity of indigenous communities, with a substantial portion of the population dependent on natural resource-based livelihoods. This diversity of communities comes with unique socio-cultural, agro-ecological and land-holding systems (such as different forms of community control over forests in various parts of the region). By the late 19th century, tea and other business had brought massive demographic and economic change to undivided Assam. But the experience was varied across the region. For example, the area that would later become Arunachal Pradesh was relatively isolated from such changes. In 1875, the British established the ‘inner line’ - a demarcation between the Assamese plains and the mountains through which nobody could pass without a permit. This restriction and the geography of the region kept Arunachal Pradesh isolated from upheavals, such as conversion of massive stretches of land into privately owned tea gardens, seen in Assam.

The region, today, is marked by socio-political complexities, which include struggles for political autonomy and associated armed conflicts. The Indian constitution has attempted to deal with the northeast’s unique nature by establishing a system of administration that differs from the rest of the country. The Sixth Schedule and other constitutional provisions relevant to the Northeast offer different degrees of autonomy and self-management (including natural resource management) to indigenous communities. Despite this, there seems to be little opportunity for them for participation in decisions related to large developmental projects. Faced with a multitude of challenges, the region is currently charting a course for ‘development’, and multiple large hydel projects for power export are a part of the government’s official development plan.
**NORTHEAST POWER SURGE**

In 2001, the Central Electricity Authority (CEA) did a preliminary ranking study of the hydroelectric potential of various river basins in the country. The Brahmaputra basin was given the highest ‘marks’ and 168 projects with a total installed capacity of 63,328 MW were identified. The tag of being the country’s ‘future powerhouse’ has been proactively used for the region since the Northeast Business Summit in Mumbai in July 2002. The 50,000 MW Hydro Initiative launched by the Ministry of Power in 2003 also has a major focus on the Northeast. The ‘Pasighat Proclamation on Power’ adopted in January 2007 at the North East Council’s Sectoral Summit on the Power Sector identifies the region’s hydropower potential as one of the priority areas to contribute to the country’s energy security.

The push for large hydropower projects in the Northeast was primarily a process driven by the Central Government till the gradual liberalisation of hydropower policies allowed states to invite private players. While Sikkim kick-started this process in the Northeast in 2001-2, the process gathered momentum across the region in 2005. Although states such as Arunachal Pradesh and Sikkim are at the forefront in the initiative to sign multiple Memoranda of Understanding/Agreement (MoUs/MoAs) with power developers, other states such as Meghalaya, Manipur, Mizoram and Nagaland have seen some action too. Assam and Tripura are smaller players in hydropower because of their topography. In May 2008, the then Union Minister of State for Power, Jairam Ramesh, raised concern about the ‘MoU virus’ which was affecting states like Arunachal Pradesh and Sikkim. He was referring to the very rapid pace at which agreements (MoUs/MoAs) were being signed by these State Governments with hydropower companies, particularly in the private sector. Till October 2010, the government of Arunachal Pradesh has already allotted 132 projects to companies in the private and public sector for a total installed capacity of 40,140.5 MW, with around 120 of these projects having an involvement of private players. Each of these agreements have been accompanied by huge monetary advances taken from project developers at the time of inking the deal, before any public consultations, preparation of Detailed Project Reports and receipt of mandatary clearances!

This kind of process of signing MoUs, where monetary advances are paid upfront, greatly compromises the manner in which subsequent clearances take place as such projects are considered as a *fait accompli* by both the developer and the state government. Moreover, it leaves no room for an assessment of options for development planning in areas where these projects are coming up. The Comptroller and Auditor General (CAG) of India, the supreme audit institution in the country, has, in a performance audit for 2008 – 9 for the state of Sikkim, highlighted serious concerns about the manner in which projects have been handed out to some private hydropower players. While the Meghalaya Legislative Assembly has seen a debate and enquiry on the manner in which projects had been allotted to hydropower projects in the state, the Assam Legislative Assembly has debated the implications of the dams’ juggernaut in upstream Arunachal Pradesh. In Arunachal Pradesh too, local affected communities, civil society groups, the media and opposition political parties have repeatedly raised serious concerns about the process of rapidly allotting projects to power developers without any public consultation.

Despite the concern raised by a central minister about the ‘MoU virus’, the Central Government has proactively granted various clearances to these projects ignoring important concerns. At least two dozen large hydroelectric projects have got final environmental clearance in the Northeast. Other than seven large hydroelectric projects in Arunachal Pradesh which have already received final environmental

**FACTS ON NORTHEAST HYDRO**

- **Assessed hydroelectric power potential of the Northeast:** 63, 257 MW
  - This is 43% of the total assessed hydropower potential of the country.
  - State-level figures may vary depending on updation by State Governments. E.g. Arunachal Pradesh now estimates a potential of 57,000 MW. Revised figures for the full Northeast region would be closer to 170 hydropower projects for a total capacity of 70,000 MW.

- **Large hydropower projects (above 25 MW) already in operation in Northeast:**
  - Sikkim: Rangit III, Teesta V
  - Assam: Kopili, Khangdong, Lower Borpani (Korbi Langpi)
  - Manipur: Loktak
  - Meghalaya: Umiam Umtru IV, Kyrdamkulai, Umiam Stage I
  - Arunachal Pradesh: Ranganodi Stage I
  - Nagaland: Doyang
  - 11 projects with total installed capacity of 1,686 MW

- **Large hydropower under construction in Northeast:**
  - Sikkim: Chujachen, Teesta III, Teesta VI, Rangit IV, Jorenthang Loop
  - Arunachal Pradesh: Kameng, Lower Subansiri, Pare
  - Meghalaya: Myndtu, New Umtru
  - 10 projects with total installed capacity of 4,891 MW. Many projects across the region are at various stages of clearance and be shortly under construction.
  - **Arunachal Pradesh – Biggest hydropower player in region:**
    - 132 hydropower projects with total installed capacity of 40,140.5 MW already allotted by State Government to private and public sector players as of October 2010
    - 92 of these are large hydropower projects (above 25 MW)
    - 38 of these are above 100 MW
    - 50 projects granted Scoping or pre-construction environmental clearances (first stage) by Environment Ministry from September 2006 – October 2010
    - 7 hydro projects have received final environmental clearance till October 2010

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1 Central Electricity Authority data from report of Inter-Ministerial Group on NE Hydro, February 2010. Slight variation with CEA 2001 data.
2 Arunachal Pradesh state government and Ministry of Environment & Forests data.
clearance, at least 50 have received first stage environmental clearance for carrying out pre-construction activities. While pre-construction clearances do not necessarily translate into final clearances, existing experience shows that the Ministry of Environment and Forests (MoEF) grants final environmental clearance to over 95% of all projects which it appraises for their environmental and social impacts.

The government and the proponents of large dams in the region paint a win-win picture: exploiting the country’s largest perennial water system to produce plentiful power for the nation; economic benefits for Northeastern state governments through export of power to other parts of the country; employment generation; comparatively little direct displacement of local communities as compared to elsewhere in the country; the promise of the dams and private capital changing the perceived ‘lack of development’ scenario of the region forever.

THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FARCE

Considering the unique features of the region and the scale of intervention planned, it is critical that the social and environmental impacts are carefully assessed before deciding whether these projects are truly feasible. Large hydroelectric projects need to pass through mandatory environmental clearance procedures, administered by the MoEF, to evaluate their viability on environmental and social grounds. Based on their specific location, they could also require other clearances such as ‘forest clearance’ from MoEF and approval from the Standing Committee of the National Board for Wildlife (NBWL) for locations inside or within 10 km radius of wildlife protected areas (PAs). A key feature of the environmental clearance process is the Environmental Impact Assessment (EIA) report, which is a critical document aiding the decision-making. It is important to note that this is the only study under current clearance mechanisms to include a mandatory component on social impact assessment.

The EIA report of the 1750 MW Demwe Lower project was completely silent on the downstream impacts of the project on critically endangered grassland birds such as the Bengal Florican in the Lohit river basin.

RUN-OF-THE-RIVER (ROR) HYDRO

The Bureau of Indian Standards Code IS: 4410 defines a Run-of-the-River Power Station as:

A power station utilizing the run of the river flows for generation of power with sufficient pondage for supplying water for meeting diurnal or weekly fluctuations of demand. In such stations, the normal course of the river is not materially altered.

IS: 4410 defines a Storage Dam as:

This dam impounds water in periods of surplus supply for use in periods of deficient supply. These periods may be seasonal, annual or longer.

The term ‘run-of-the-river’ hydro is a cause of major confusion in the public at large and definitions of the term around the world may vary from the above definition. According to some, a project is RoR only if inflow equals outflow on a real-time basis, i.e. if there is no storage or flow modification at all. Others (like the BIS definition above), use the term to refer to projects with relatively smaller storages and lesser flow modification. But contrary to the popular image created by dam proponents that the river is flowing unhindered and unaltered, the ground reality may be quite different.

Most of the so called ‘run-of-the-river’ hydroelectric projects being developed in the Himalayan region involve large dams which divert the river’s waters through long tunnels, before the water is dropped back into the river at a downstream location after passing through a powerhouse. These projects are promoted as being ‘environmentally benign’ as they involve smaller submergences and lesser regulation of water as compared to conventional storage dams. This perception conveniently ignores the impact of several features intrinsic to this design. For example, long stretches of the river will be bypassed between the dam and powerhouse, with up to 85 - 90 % of the river flow in the winter (lean season) diverted through the tunnels. In the 510 MW Teesta V project in Sikkim the ‘head race tunnel’ taking the water from the dam to the powerhouse is 18.5 km long and bypasses a 23 km length of the river. Not only will this destroy riverine ecology, but a cascade of projects will mean most of the river would essentially end up flowing through tunnels. The Affected Citizens of Teesta have aptly described this as: “Our sacred Teesta is being converted into an underground river.”

These projects also involve extensive tunneling in a geologically fragile landscape, the environmental and social impacts of which are grossly underestimated. Impacts observed include cracks in houses above long tunnel alignments, drying up of water resources and major landslides. The list of project-affected-persons is clearly much longer than what is calculated at the planning stage which only looks at those whose lands are to be directly acquired for various project components. The tunneling also generates a huge quantity of muck and rock debris, the disposal of which is huge challenge. Power companies in Sikkim have earned themselves the name uttani musa (mountain mouse in the Nepali language) for digging the insides of the Sikkim mountains.

The indiscriminate dumping of such massive quantities of excavated muck in steep Himalayan valleys with little available flat land has been another cause of serious impacts and environmental violations in projects. This is a fact corroborated by the Comptroller and Auditor General (CAG) of India in a 2009 report on Sikkim.

Another type of RoR project being built is that which has a ‘dam-toe’ powerhouse located immediately downstream of the dam. Examples of such projects are the 2,700 MW Lower Siang, the 1,750 MW Demwe Lower (Lohit) and the 2,000 MW Lower Subansiri located in the Arunachal foothills just before these rivers enter the plains. However, the impact of these mega RoR projects is certainly not small. The reservoir of the 2,000 MW Lower Subansiri project will submerge a 47 km length of the Subansiri river while the 2,700 MW Lower Siang project will submerge a 77.5 km length of the Siang river (total 100 km length of various rivers to be submerged in this project). The above-mentioned projects will also cause drastic daily fluctuation in river flows downstream (see section ‘We all live downstream’) due to power generation patterns, particularly in winter. Dam proponents argue that these projects are benign since the total flow in the river downstream over any 10 – day period in the year will be the same as in the pre-dam condition. But they fail to acknowledge that the massively altered daily flow patterns will have serious social and environmental impacts in the Brahmaputra floodplains.

There are other issues related to siting of such projects and their impacts in the ecologically and geologically fragile, seismically active
Restructured Rivers: Hydropower in the Era of Competitive Markets,

PAGES 4-5

and culturally sensitive Northeast. For example the Expert Committee of IIT Guwahati, Dibrugarh University and Gauhati University which studied the downstream impacts of the 2,000 MW Lower Subansiri project has stated in its final recommendations of June 2009 that such a mega dam is inappropriate in such a geologically and seismologically sensitive location.

Hydropower proponents are currently running a misleading campaign which claims that the RoR projects being built in states such as Arunachal Pradesh do not even include construction of dams! It needs to be clarified here that the bulk of the projects involve not just dams, but large dams1, as defined by India’s Central Water Commission, the International Commission on Large Dams (ICOLD) and the World Commission on Dams. Irrespective of the nature of project, dams fragment rivers, breaking the organic linkages between the upstream and downstream, between the river and its floodplain.

It is clearly misleading to universally label RoR projects as ‘socially and environmentally benign’ projects. Whether of RoR or storage type, both the individual and cumulative impacts of hydropower projects in any river basin need to be comprehensively scrutinised and understood. This, together with free, prior and informed public consent, should be the basis of decision-making on these projects.


2 Daily  

3 ICOLD defines large dams as: ‘those having a height of 15 meters from the foundation or, if the height is between 5 to 15 meters, having a reservoir capacity of more than 3 million cubic meters’.

4 ICOLD does not have any standard guidelines for RoR projects. In practice this means they are not usually included in the commitments that signatories to the Hydropower Directives have undertaken to implement.

What about the quality of these EIA reports for dams in Northeast India? Let us, for example, look at certain biodiversity aspects of the EIA reports. Dr. Anwaruddin Choudhury, renowned naturalist from Northeast India, has examined EIA reports of at least five large hydroelectric projects — Kameng, Lower Subansiri, Middle Siang, Tipaimukh, and Dibang — and finds them all poor on wildlife aspects.

A common feature of his introductory comments on these reports has been: “contains innumerable (instances of) incorrect data, unverified and superfluous statements, and above all reveals the casual approach,” referring to the power companies and EIA consultants. Dr. Choudhury says: “It is shocking that mega hydel projects in the northeast are being granted clearances based on such reports. How can we decide the fate of some of the country’s most important wildlife habitats based on sub-standard impact assessment studies?”

Here are a few examples from these reports: the EIA for the 1,000 MW Siyom project lists 5 bird species in an area which has over 300 and even in this short list has one which is non-existent; the EIA for the 600 MW Kameng project reclassifies carnivores such as the red panda, pangolins and porcupines as herbivores; the EIA for the 2,000 MW Lower Subansiri lists 55 species of fish in a river which has at least 156 and reports an area called the ‘Arctic’ in the Eastern Himalayas.

But these days citizens’ groups are getting cynical and increasingly reluctant to send their comments on poor EIA reports to the government. That is because necessary additional and credible studies are rarely asked for by authorities. On the contrary, the reports are sanitised by developers based on the comments received, to weed out problematic portions, and the projects conveniently granted clearance.

In some cases additional rapid EIAs have been asked for, which prove to be entirely inadequate. In the Lower Subansiri project on the Assam-Arunachal Pradesh border, the Zoological Survey of India (ZSI) spent six days doing an additional study and then made surprising statements such as: “...The long and vast water body thus created by the reservoir will be happy haunt for aquatic creatures.” It is well known that native aquatic species, whose habitats are fast-flowing rivers, do not find the still waters of a reservoir a ‘happy haunt! While reservoirs may benefit exotic species that are introduced for fisheries, such introduction has very often proved to be detrimental to the native species. It is a matter of serious concern that reputed government institutions such as ZSI have given such poor reports. While biodiversity was used as an indicator in the above examples, the reports have been found to be poor in many social and environmental aspects in general. In some cases the MoEF has indeed asked for additional detailed studies when EIAs were found to be poor, but often they have been post-clearance studies! There is little logic in first clearing the way for destruction of wildlife habitats and then doing a detailed assessment as a formality after project work and environmental destruction is well under way.

Another trend has been to grant clearances to projects that destroy sensitive wildlife habitat based on poor assessments, and then claim to compensate the losses by asking for other areas to be protected. While appropriate compensatory mechanisms may be relevant in some cases, they cannot substitute a sound decision-making process based on comprehensive environmental and social impact assessment. The main problem in current environmental decision-making processes is that virtually every project is treated as a fait accompli by both the Expert Committees appraising these projects and the regulatory authorities concerned. This subverts the possibility of a proper environmental decision-making process.
The ground situation indicates that displacement, particularly of livelihoods by hydroelectric projects in the Northeast, is that there is relatively ‘small ecological and social costs which are unacceptable.”

Can we determine the long-term viability of projects in this region? Without the availability of comprehensive information, how can we determine the long-term viability of projects in this region? The situation is likely to be grimmer in light of emerging threats from climate change (see separate section). Without the availability of comprehensive information, how can we determine the long-term viability of projects in this region?

Let us take the example of earthquakes. Currently the focus is only on whether the dam will withstand the earthquake. Occasionally, the issue of whether the water reservoir itself can induce seismic activity is discussed. While these are both very important aspects, they are not the only earthquake associated risks as far as dams are concerned. Researchers in the Northeast have been highlighting overall impacts of earthquakes on river systems, which can increase risks to and from existing large dams. Dam engineers are quick to point out that a particular dam may survive a major earthquake, but even assuming that the actual structure stands intact, as several basic parameters vis-à-vis the regime of rivers, and the morphology and behaviour of channels, may change. The last two major earthquakes in the region (1897 and 1950) caused landslides on the hill slopes and led to the blockage of river courses, flash floods due to sudden bursting of these temporary dams, raising of riverbeds due to heavy siltation, fissuring and sand venting, subsidence or elevation of existing river and lake bottoms and margins, and the creation of new water bodies and waterfalls due to faulting.

Analysis of the available scientific data clearly indicates that the neo-tectonism of the Brahmaputra valley and its surrounding highlands in the eastern Himalayas has pronounced effects on the flooding, sediment transport and depositional characteristics of the river and its tributaries, which in turn has a bearing on the long-term viability of dams. The earthquake of 1950, for example, raised the bed level of the Brahmaputra at Dibrugarh by at least three metres (10 feet) leading to increased flood and erosion hazard potential in the river. Brahmaputra expert, Dr. Dulal Goswami, says: “A single earthquake event could cause sedimentation equivalent to several decades of normal sedimentation during the high flow period.” This could certainly render many of the proposed dams economically unviable as dam life is intricately connected with rates of sedimentation. However, this is yet to be studied as part of risk assessment.

Another important environmental risk was discussed for the first time by the EAC on River Valley and Hydroelectric projects in July 2009 with respect to the 3,000 MW Dibang Multipurpose project. In its meeting the committee noted: “After critically examining all the issues the committee noted that the Dibang high dam is located in high seismic zone V and the area receives very high rainfall during monsoon. The dam impounds huge reservoir stretch (43.0 km). A situation may arise when high rainfall together with a major earthquake may occur. The steep slopes charged with rain water and triggered with earthquake are very vulnerable and may lead to large scale landslide. A major landslide may occur into the reservoir which may lead to creation of water waves in the reservoir….overtopping causing serious safety problems may happen.”

This is a very crucial risk to the downstream areas even if the dam stands intact. In October 1963, the Vaiont dam in Italy, one of the world’s tallest, set off earthquakes as soon as its reservoir began to fill. One tremor set off landslides that plunged into the reservoir, creating a huge wave that overtopped the dam by 110 metres. About two minutes later, the town of Longarone was leveled and almost all of its 2,000 inhabitants killed. However, except for the one discussion in July 2009, the EAC has been silent on the need for such risk assessment studies while evaluating umpteen projects in the Northeastern region for environment-related clearances.

Dr. Dulal Goswami, environment scientist and renowned expert on the Brahmaputra river basin says: “The geophysical nature of the Brahmaputra river basin is fragile and dynamic. The scientific knowledge base on the river system is currently very poor, for example on aspects such as sedimentation and hydrology which are linked to the economic life of the project. This needs to be strengthened urgently, more so in light of emerging threats from climate change (see separate section). Without the availability of comprehensive information, how can we determine the long-term viability of projects in this region? The wisdom of such public policy has to be questioned. Economic viability apart, the mega-projects planned come with tremendous ecological and social costs which are unacceptable.”

**UNDERESTIMATING SOCIAL IMPACTS**

One of the major arguments put forward in New Delhi to ‘sell’ large hydroelectric projects in the Northeast, is that there is relatively ‘small displacement’ by submergence as compared to that in other parts of the country and therefore these projects are benign. But a careful perusal of the ground situation indicates that displacement, particularly of livelihoods and rights is grossly underestimated. Aizing Pertin of the Siang Peoples Forum in Arunachal Pradesh says “Since our state is hilly, there is very little land where permanent cultivation is possible. Virtually all our available arable lands will be submerged by the 2700 MW Lower Siang project in the affected area in the Siang Valley. The magnitude of impact has to be understood keeping this context in mind. It is misleading to argue that the land being lost is a small percentage of the total area of the district or state and wrongly assume that the project is benign.”

The impacts of dams on resources under common use (e.g. pasture lands), vital to livelihoods of local communities, is also a major missing link in impact assessment of projects. Shifting agriculture (jhum) is a dominant traditional land use in the hills of Northeast India and plays a critical role in the livelihoods of people, maintaining agricultural biodiversity and providing food security. Increasing pressures on land have resulted in the shortening of jhum cycles (the length of the fallow period between two cropping phases), thus impacting the ecological viability of this farming system. The submergence of land by hydel projects will further shorten the jhum cycle and enhance the pressure on the surrounding areas, thus affecting the environment and the livelihoods of jhum-dependent communities over a much larger landscape. In addition to the submergence, land use restrictions will apply in the catchment area of the reservoir as per mandatory norms to...
reduce siltation and to increase the life of the reservoir. Further, compensatory mechanisms required as per forest laws to offset the loss of forests due to the project, also lead to protection of other areas, affecting community access to land and resources. Take, for example, the conversion of Unclassified State Forests in Arunachal Pradesh, which allow more access and control by local communities, into Protected Forests, with greater state control. The impacts on rights of local communities in such cases also need to be examined in terms of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

Clearly the impact on local communities is well beyond just the submergence area. However, in the existing planning and decision-making process, the social and environmental impacts over the larger landscape due to various aspects described above are not assessed. This is therefore not reflected in the decision-making on the overall viability of the project.

States such as Arunachal Pradesh are home to small populations of culturally sensitive indigenous communities. Therefore, direct and indirect displacement is high if looked at in the perspective of local population (as opposed to the population of the country). Dr. Mite Lingi, Chairman of the Idu Indigenous Peoples Forum, says “The ‘small displacement’ argument to sell these projects as being benign needs to be confronted. The entire population of the Idu Mishmi tribe is around 9500 and at least 17 large hydel projects have been planned in our home, the Dibang Valley in Arunachal. As per this faulty argument, little social impact will be indicated even if our entire population were supposedly displaced!” The land in the state has also been customarily delineated between different indigenous communities and clans. Therefore, contrary to popular belief, there isn’t plenty of land for resettling people in the state, just because the population density is less.

Further, the concerns being expressed in states like Arunachal Pradesh and Sikkim are not restricted to the issue of displacement. The over-900-day satyagraha in Sikkim by affected indigenous communities from 2007-9 focused on the impacts of hydel projects on Dzongu, the holy land and reserve of the Lepcha tribe. The protests have also received the support of the Buddhist monk community in Sikkim, as a sacred landscape stands to be desecrated. Sociologist Vibha Arora says: “Such protests are not merely on grounds of displacement but that the region’s cultural and ethnic traditions are rooted in the river Teesta and its environs.” A major concern in the Northeast is the influx of large labour populations from outside the region. Dr. Lingi adds, “We have been given constitutional and legal protection, particularly with respect to our land rights and restricted entry of outsiders. These projects are going to require both skilled and unskilled labour which Arunachal Pradesh cannot provide. 17 large projects in the Dibang Valley will bring in outside labour, upwards of 150,000 people, for long periods, as these are long gestation projects. We are concerned about the demographic changes and other socio-cultural impacts associated with this, as the Idu Mishmis are only 9500 in number. The development policies are in glaring contradiction to the constitutional and legal protection we have been given.”
Despite major movements emerging in the region raising serious concerns about the impacts of dams, it will be misleading to argue that there is universal opposition to hydropower projects across the Northeast. In states such as Sikkim, Arunachal Pradesh and Manipur, there are also those amongst local communities who are defending the projects. Monetary gains from sale of land, small contracts during construction and a promise of quicker development of basic infrastructure like roads and bridges is cited as a major motivation. Responding to these arguments, journalist-activist Raju Mimi, from Dibang Valley, Arunachal Pradesh says: “We certainly want a bridge across the Lohit river at Dholla ghat. But the government cannot thrust on us some of the world’s largest hydropower projects, such as 3,000 MW Dibang and 4,000 MW Etalin, by promising that we will get a bridge in return! What kind of governance is this? We should get the bridge irrespective of whether these hydropower projects come up or not.”

While dam related opposition has primarily been seen in states such as Assam, Arunachal Pradesh, Sikkim and Manipur in recent times, the state of Mizoram saw a major rally against dams in the Sinlung hills in September 2010. Perhaps the first of its kind in the state, the rally was organised by the Sinlung Indigenous Peoples Human Rights Organisation (SIPHRO) and Sinlung Peoples Collective in Aizawl, the capital of Mizoram. Their memorandum to the Chief Minister, also signed by a wide array of civil society groups in the state who participated in the rally, argues that dams are being pushed for the benefit of a minority of influential individuals in the state who seek to corner the financial gains from compensation and contracts. They cite the examples of the Serhui B and Turial hydropower projects wherein they claim that has already happened. Opposing the plans to extensively dam all big and small rivers in the Singlung hills, they state that the land, rivers and forests are the backbone of the existence and survival of the Hmar and other indigenous people of the region. A crucial argument they make is that their very citizenship and democratic survival of the Hmar and other indigenous people of the region. A crucial argument they make is that their very citizenship and democratic survival is inextricably linked to its river systems.

WE ALL LIVE DOWNSTREAM

An issue of heated current debate in the Northeast is the downstream impacts of dams, often a lacuna in the broader popular discourse on the impacts of dams in the country, which is primarily influenced by upstream submergence and displacement. When large dams block the flow of a river, they also trap sediments and nutrients vital for fertilising downstream plains. They alter the natural flow regimes which drive the ecological processes in the downstream areas. Quite literally they disrupt the connections between the upstream and the downstream, between a river and its floodplain.

A major catalyst to trigger the larger debate on downstream impacts of dams in Assam, has been the repeated incidents of dam-induced floods across the state from upstream projects (e.g. 405 MW Ranganadi in Arunachal Pradesh) in recent years. Downstream impact concerns raised in the Northeast include: loss of fisheries; changes in beel (wetland) ecology in the flood plains; impacts on agriculture on the chapories (riverine islands and tracts); impacts on various other livelihoods due to blockage of rivers by dams (e.g. driftwood collection, sand and gravel mining); increased flood vulnerability due to massive boulder extraction from river beds for dam construction and sudden water releases from reservoirs in the monsoons; dam safety and associated risks in this geologically fragile and seismically active region. The Brahmaputra valley, a thickly populated narrow strip of land with hills surrounding it, has awoken to the fact that it is going to be increasingly vulnerable to risks from existing and proposed large dams upstream. This realization has been significant for a civilisation whose cultural identity – customs, food habits, music, religious beliefs – is inextricably linked to its river systems.

One of the key issues which have come up is the drastic daily variation in river flows which will take place after these dams are commissioned, particularly in winter. For example, the average winter (lean season) flow in the Subansiri river in its natural state is approximately 400 cubic metres per second (cumecs). Both the ecology of the downstream areas and people’s use of the riverine tracts in winter is adapted to this ‘lean’ but relatively uniform flow of water on any particular day (even though there is a gradual variation through the season). Chapories, for example, which are exposed and drier in winter are used for both agriculture and cattle grazing purposes, by local communities, and simultaneously by wildlife. After the commissioning of the 2,000 MW Lower Subansiri project, flows in the Subansiri river in winter will fluctuate drastically on a daily basis from 6 cumecs for around 20 hours (when water is being stored behind the dam) to 2560 cumecs for around 4 hours when the water is released for power generation at the time of peak power demand in the evening hours. Thus the river will be starved for 20 hours and then flooded for 4 hours with flows fluctuating between 2 percent and 600 percent of normal flows on a daily basis.

The flow during peak load water releases in the Subansiri river in winter will be equivalent to average monsoon flows and will cause a
setting up of an interdisciplinary expert committee to study the movements and the All Assam Students Union (AASU) led to the Assam-Arunachal Pradesh border. Downstream agitations by local society groups (e.g. mass movements and major students unions) on the downstream concerns vis-à-vis the spate of mega dams planned in Arunachal Pradesh. A major focus of conflict has been the 2,000 MW Lower Subansiri project, under construction on the Lohit river in February 2010. This clearly indicates that the actual ‘impact prediction’ has been asked to be restricted to an even shorter distance downstream-only between the dam and powerhouse! There is only one aspect which is mandatory to be studied beyond 10 km downstream in all cases; this is the ‘dam-break analysis’ which predicts the effects of flooding downstream, in case the dam actually breaks. But dam-break is not the only downstream risk a dam poses, as indicated earlier. Unfortunately, most detailed downstream studies are only prescribed as post-clearance studies as has been done in the environmental clearance granted to the 1,500 MW Tipaimukh Multipurpose project in October 2008 and to the 1,750 MW Demwe Lower project on the Lohit river in February 2010. This clearly indicates that the projects are being treated as a fait accompli and the clearance processes as a formality. It was only recently that the MoEF for the first time prescribed partial downstream impact studies for a few projects before grant of clearance (e.g. 3,000 MW Dibang Multipurpose project and 2,700 Lower Siang). But the ToRs in these cases, too, do not ask for comprehensive downstream studies, which should have been the case.

Assam has seen serious concern raised by a wide sector of civil society groups (e.g. mass movements and major students unions) on the downstream concerns vis-à-vis the spate of mega dams planned in Arunachal Pradesh. A major focus of conflict has been the 2,000 MW Lower Subansiri project, under construction on the Assam-Arunachal Pradesh border. Downstream agitations by local movements and the All Assam Students Union (AASU) led to the setting up of an interdisciplinary expert committee to study the downstream impacts of the project. Interim recommendations were made by this committee in February 2009 to stop work pending completion of the report. But they were ignored by the power company and both the State and Central governments. In their final report submitted in June 2010 this committee has recommended that: “…The selected site for the mega dam of the present dimension was not appropriate in such a geologically and seismologically sensitive location… Therefore, it is recommended not to construct the mega dam in the present site…”

Following a major debate in the Assam Legislative Assembly in July 2009, a House Committee was set-up to look at the impacts of dams on downstream Assam. The committee, in its July 2010 report, has categorically endorsed the Expert Committee recommendations raising concerns about the Lower Subansiri project. On August 12th, the Rajya Sabha (Upper House of Parliament) saw a lively discussion on the issue in response to a calling attention motion by a Member of Parliament from Assam, Birendra Prasad Baishya. On September 10th, the Union Environment Minister, Jairam Ramesh, held a public consultation on the issue in Guwahati as a follow-up to a meeting, with a delegation led by the Krishak Mukti Sangram Samiti, a major peasants’ movement in Assam in August 2010. Along with the Brahmaputra valley in Assam, downstream impact debates have also raged in Manipur and in southern Assam, in the Barak Valley, downstream of the proposed 1500 MW Tipaimukh dam. A long battle fought by those affected by the Mapithel dam in Manipur in the Thoubal river basin has forced the state government to conduct a review of the impacts of the project, including in the downstream areas.

While media reports seem to indicate that the Union Environment Minister has communicated to the Prime Minister the concerns raised in the September 10th public consultation in Guwahati, we need to wait and watch whether the Centre responds adequately to the serious concerns raised in the downstream areas of proposed projects. However, the experience of decision-making until now makes one thing amply clear: the Central Government has been in denial of a basic fact of nature - that a river flows downstream. This is evident from the Terms of Reference (ToR) for Environment Impact Assessment (EIA) studies granted by the MoEF for at least 50 large hydroelectric projects in Arunachal Pradesh from September 2006 to August 2010. In most cases the ‘baseline data’ is restricted to only 10 km. downstream of the project and the actual ‘impact prediction’ has been asked to be restricted to an even shorter distance downstream-only between the dam and powerhouse! There is only one aspect which is mandatory to be studied beyond 10 km downstream in all cases; this is the ‘dam-break analysis’ which predicts the effects of flooding downstream, in case the dam actually breaks. But dam-break is not the only downstream risk a dam poses, as indicated earlier. Unfortunately, most detailed downstream studies are only prescribed as post-clearance studies as has been done in the environmental clearance granted to the 1,500 MW Tipaimukh Multipurpose project in October 2008 and to the 1,750 MW Demwe Lower project on the Lohit river in February 2010. This clearly indicates that the projects are being treated as a fait accompli and the clearance processes as a formality. It was only recently that the MoEF for the first time prescribed partial downstream impact studies for a few projects before grant of clearance (e.g. 3,000 MW Dibang Multipurpose project and 2,700 Lower Siang). But the ToRs in these cases, too, do not ask for comprehensive downstream studies, which should have been the case.
A perception carefully built and nurtured by the proponents of big dams is that dams control or help moderate floods. In theory, it sounds possible. However, in practice, that perception won't stand up to scrutiny if actual experience with dams is objectively assessed.

People of Assam have been raising concerns about dam-induced floods in downstream areas due to hydropower projects like Ranganadi, Umtru, Karbi-Langpi, Kapili, and Kurichu. While the technocracy keeps disputing the on-ground experience of people, it might help here to recount some of the instances of dam-induced floods across the country.

In August 2006, Surat city on Tapi River in South Gujarat experienced the worst floods in its history due to a sudden release of 7 to 10 lakh cusecs (cubic feet per second) of water from the upstream Ukai dam. At least 150 people were killed, 80% of the city was under water, and over 20 lakh people were trapped inside the flooded city without drinking water, milk, electricity or communication for four days and nights. This disaster could have been avoided if the Ukai dam had adhered to the dam operating rules properly, keeping in mind upstream and downstream rains and short-term forecasts, as well as the capacity of the downstream river channel and the timing of the high tides.

The Ukai Dam story was repeated in many river basins across India in 2006, including the Mahi, Sabarmati, Chambal, Narmada, Krishna, Godavari and Mahanadi basins. A sudden high release of water from dams (many of them having high pre-monsoon storages) was the prime reason for flood damages in these basins. Each dam has specific operation rules. For example, lowering pre-monsoon water storages to reduce downstream flood risk in monsoons, is often a mandatory requirement. Many instances of dam-induced floods are due to mismanagement of dams by faulty operations, while lack of proper operation rules is also a reason in other cases. An overall lack of transparency and accountability in dam operation in the country is an important contributing factor to such disasters.

The floods of 2006 were in no way unique. Similar instances include: Mahanadi floods in Orissa in September 2008 due to faulty operation of the Hirakud dam, floods in the Damodar basin in 2009, floods in Punjab in 1988 (and also in 2010) due to sudden releases from the Bhakra and Pong dams, floods in the Krishna basin in late September-early October in 2009 due to faulty operation of the Upper Krishna, Tungabhadra, Srisailam and Nagarjunasagar dams, floods in the Bhagirathi and Ganga river basin due to faulty operation of the Tehri Dam in Sept 2010. Over the years, India has experienced escalating flood damages despite the fact that the total area supposedly protected by flood-control engineering projects has grown.

It is often claimed by the government that India’s 5,000 plus large dams bring flood control benefits, yet all too often the results have been increased flood damages, usually because of mismanagement. The National Commission on Floods, set up by the Central Government, noted in 1980: “Most of the reservoirs completed in the country do not have any specific operation schedules for moderation of floods.” In the Ganga basin, the Kansabati dam is supposed to reserve more than a quarter of its reservoir for flood storage, yet the report says, “The Kansabati reservoir has no operation rules drawn up so far; nor have the moderation benefits been evaluated.” A working group report of the Planning Commission for the 11th Five year Plan and the Maharashtra government report after the 2006 floods corroborate such observations. Some changes brought about in the functioning of the Ukai dam after the 2006 disaster also indirectly admits that the dam was mismanaged in 2006. However, no accountability has been fixed on dam operators in any of these instances.

The Way Forward: A comprehensive flood-management program should revolve around improving and disseminating flood-forecasting, flood-coping mechanisms and flood-preparedness. Some key areas that must be addressed include sustaining and improving the natural systems’ ability to absorb floodwater; improving dam management (in existing projects), and instituting clearly defined and transparent operating rules that are stringently enforced; improving the maintenance of existing flood-control infrastructure rather than spending money on new dams and embankments; undertaking a credible performance appraisal of existing infrastructure in a participatory way, removing dams and embankments that are found to be ineffective; and producing transparent disaster management plans to be implemented in a participatory way. Most importantly, India needs to assess the potential impacts of climate change on rainfall and on the performance of flood-control infrastructure, to begin planning for the crucial adaptation to changing climate.

In the Northeast, even as per official plans, most projects do not have an explicit flood moderation component, thus there being no question of these being able to effectively moderate floods. Out of the 130 plus hydropower agreements signed in 2008, 22 agreements have been signed with China. While these projects need to be reviewed, it is essential that the present assessment of the project, the way it is going, is periodically reviewed. It is imperative to recognize the fact that the projects need to be managed to ensure they do not cause any damage to the people and the environment, and to ensure that the projects do not in any way cause any harm to the people and the environment.

As a result, the present development paradigm that envisages a massive expansion in large dams in the northeast, is full of risk. In the sections ahead we discuss how the myth of green hydropower is being mitigated.

The scientific evidence that the Himalayan region is being impacted by climate change is growing, with serious ramifications for Himalayan river basins and the Indian subcontinent. Studies show that hydrological characteristics such as discharge pattern, sediment load, snowmelt run off and intensity and frequency of flooding in Himalayan Rivers are changing due to climate change. The Brahmaputra river basin is particularly sensitive to climate change impacts, implying changes in volume of water, sediment and biogeochemical processes.

One reason cited by promoters of hydropower development in developing countries is that energy from hydropower is ‘clean’ because, unlike thermal energy, its production does not generate green house gases (GHG). Therefore it is suggested that by investing in hydro, developing countries like China and India that emit large amounts of GHGs can reduce or slow the growth of their carbon emissions and contribute to mitigating climate change. However, recent research has generated enough information to question this assumption.

Since dams are designed around known characteristics of rivers and local geology, it is natural that changes in the hydrological regime triggered by climate change will affect the existence, operation and management of these projects considerably. However this aspect is usually ignored by agencies executing projects, making it difficult for disaster management agencies as well as communities to anticipate and prepare for possible hazards like flash floods. Experts acknowledge that the present knowledge base about hydrology, climate, ecology and geography of the Himalayan region is inadequate to support large-scale interventions on the Himalayan rivers. Climate change introduces an additional layer of uncertainty to this evolving knowledge base.

As a result, the present development paradigm that envisages a massive expansion in large dams in the northeast, is full of risk. In the sections ahead we discuss how the myth of green hydropower is being mitigated.
**HYDROPOWER GENERATION AGGRAVATES GLOBAL WARMING AND CLIMATE CHANGE**

Scientific evidence of greenhouse gas emissions (like methane, carbon dioxide, and nitrous oxide) from the reservoirs of hydroelectric projects has been emerging since the 1990s. However, the climate-benign nature of hydropower was strongly questioned for the first time by the World Commission on Dams (WCD). It was known by the year 2000 that globally 70 million tonnes of methane and a billion tonnes of carbon dioxide were emitted annually from reservoir surfaces. A recent study carried out by Brazil's National Institute for Space Research estimates that the large dams of the world emit 104 million tonnes of methane annually from reservoir surfaces, turbines, spillways, and downstream river courses. Greenhouse gases like methane and carbon dioxide are produced in reservoirs due to rotting organic matter (vegetation) and carbon inflows from the catchment. Large dams of the world contribute about four percent of the total warming impact of human activities and they could actually be the single largest source of anthropogenic methane emissions, accounting for about a quarter of the total methane emissions from the earth's surface. Tropical shallow reservoirs where the natural carbon cycle is most productive are the highest emitters of methane, while deep water reservoirs exhibit lower emissions. Dams in Brazil and India are responsible for a fifth of these countries' total global warming impact, although these sources of emissions are not considered in the national greenhouse inventories.

According to the Inter Governmental Panel on Climate Change (IPCC) these revelations have challenged the conventional wisdom that hydropower produces only positive atmospheric effects (e.g., reductions in emissions of carbon dioxide and nitrous oxides), when compared with conventional power generation sources. Taking cognizance of the GHG emissions from hydropower projects, the executive board of the United Nations Framework Convention for Climate Change (UNFCCC) has excluded large hydro projects with significant water storage from its Clean Development Mechanism (CDM) programme. That means hydroelectric projects with big storage dams are not considered as climate-friendly and therefore are not accepted as desired alternatives for climate change mitigation or adaptation. The IPCC has recommended estimation of methane emissions from large dams and evaluation of the net effect on the carbon budget in the regions affected by large dams. A recent study by Swiss scientists, released in October 2010, reveals that substantial amounts of the greenhouse gas methane are released not only from large tropical reservoirs but also from run-of-the-river (RoR) reservoirs, especially in the summer, when water temperatures are higher. This finding disputes the existing belief that RoR projects with smaller reservoirs, particularly in temperate regions, are a climate-neutral way of generating electricity.
basin. But the MoEF has continued granting clearance to one project after another without seriously examining the issue in a holistic manner as per its own mandated condition. After completion of the study in 2008, however, the MoEF had declared certain areas in North Sikkim in the Teesta river basin as ‘no-go’ areas for dams. But this condition too has been recommended for dilution by the EAC in early 2010, threatening to open up the last free-flowing stretches of the Teesta in Sikkim for more dams.

In fact, the National Environmental Appellate Authority (NEAA)\(^1\), a special environmental court, in an April 2007 order has also observed that it feels the need for “advance cumulative study of series of different dams coming on any river so as to assess the optimum capacity of the water resource giving due consideration to the requirement of the Human beings, Cattle, Ecology/ Environment etc.” However, this order has been repeatedly violated by the MoEF. Even though river basin-level studies have been prescribed for some river basins such as the Bichom and Lohit in Arunachal Pradesh, these have been de-linked from clearances to be granted to individual projects. Therefore, project clearance can continue business as usual, without completion of cumulative studies, making it a cosmetic exercise.

Contrary to the scientific evidence, project proponents have been rhetorically promoting hydropower as clean and green to outweigh its other known detrimental impacts. It is important to analyse the facts emerging from recent scientific research to counter this misinformation.

**ARE HYDRO-PROJECTS SUSTAINABLE UNDER CLIMATE CHANGE?**

Climate change is likely to cause such changes in local and regional weather and climate patterns that would jeopardise dam operations and trigger more complex and intensive impacts downstream. It has been projected that Himalayan river basins like that of the Brahmaputra river may experience increased summer flows and more flooding for a few decades initially, due to rapid melting of Himalayan and Trans-Himalayan snow and glaciers. In the long run however, they will face scarcity of water as a result of progressive reduction of flow as the river-feeding glaciers recede and disappear from the headstreams.\(^9\) In fact, the Upper Brahmaputra river basin has already lost roughly 20% of its water reserves bound in glaciers during the thirty years between 1970 and 2000, which is equivalent to the loss of 175 cubic km of glacier mass in that period and about 7 cubic km of glacier mass loss per year.\(^10\) While such melting of glaciers leads to increased dry season run-off in the short term, in the long-term there could be a decline of dry season river run-off from glaciers, turning perennial rivers like the Brahmaputra into seasonal river systems.\(^11\) Although there will be an initial increase in flow in the Brahmaputra basin due to accelerated glacial melt till about the fourth decade of this century and increase in mean rainfall over the upstream of Brahmaputra basin by about 25 per cent, the overall summer and late spring discharges are eventually expected to be reduced consistently and considerably, at least by 19.6% on an average during the years 2046 to 2065\(^12\).

The planning of hydropower projects that are now operational or in different stages of implementation in the Northeast, have not incorporated any considerations for possible impacts of climate change on the rivers and the dams, either when the projects were being designed or when the EIA reports were being prepared. In the case of many of these dams, the meteorological and hydrological time series data of rainfall, extreme rainfall, water level and discharge used to design dams, is not adequate to be able to provide a reliable description of trends and periodicity of rainfall and river run-off. These trends become more uncertain in a changing climate scenario, resulting in large fluctuations in the normal inflows to the dams. Such a situation usually disrupts normal operations of the dams affecting power generation. IPCC predicts that extreme rainfall i.e. episodes of very high and/or very low rainfall are likely to increase in the Asian region in the coming decades\(^4\). In such a situation the dams will either underperform due to lack of adequate flow or will exacerbate flooding hazards triggered by excess flow. Therefore, to adapt climatically, such dams would need to be redesigned with inputs from high resolution regional climate models to generate reliable future climate scenarios for specific geographical areas of concern. This is not easy as of now, given the difficulty in developing reliable climate simulations at small spatial scales.

In December 2008, the Standing Committee of the National Board for Wildlife (NBWL) has relaxed a condition restricting the construction of dams in the upstream areas of the Subansiri river, imposed earlier while granting clearance in May 2003 to the 2,000 MW Lower Subansiri hydroelectric project coming up on the Arunachal Pradesh-Assam border. This relaxation has happened without consultations in Assam, located downstream,
and ignoring a demand by some members of the committee to first get an understanding of the cumulative impacts of 22 large hydel projects which can potentially come up in the Subansiri river basin, once the restriction has been lifted. The Inter-Ministerial Group set-up to give recommendations for accelerating hydropower development in the Northeast has, in its 2010 report, specifically recommended that MoEF not hold up environmental clearances pending completion of cumulative impact assessment studies, thus rendering the entire exercise futile.

While the EAC in its September 2010 meeting has finally expressed an opinion that a cumulative downstream impact assessment does indeed require to be carried out in Assam to study the impacts of multiple projects in the Brahmaputra river basin, it is silent on the need to halt environmental clearances of individual projects until such a study is completed.

Due to impact of climate change, water stress will be felt more in winter, in general, which will be aggravated in weak monsoon years, thus significantly affecting agriculture, the principal livelihood of the people, and the overall economy of states like Assam, West Bengal, Sikkim and Arunachal Pradesh, the main Brahmaputra basin states in India. Further, changing temperatures and evaporation rates would alter soil moisture conditions and the amount of run-off from the catchments into reservoirs. Given this scenario, it will become increasingly uncertain whether the required inflow of some rivers could be sustained to produce power efficiently, especially in the lean season in the future. This also brings into question the wisdom of investing thousands of crores of public money in such ventures, when there is so much uncertainty over the hydrological changes in the rivers in the region under a changing climate. A recent study of hydro-electric power generation conducted in the Zambezi Basin in Africa, taken in conjunction with projections of future run-off, indicates that hydropower generation would be negatively affected by climate change.

**ARE DAMS’ SAFEGUARDS AGAINST CLIMATIC UNCERTAINTY?**

An argument made by promoters of large dams is that if precipitation and river flows are likely to become uncertain and vary widely due to climate change, then it is important to create large storage dams in upstream areas to make water supplies more certain. The faulty logic behind this argument is that more storage is necessary to hold additional water volume if river flow increases and also to hold the occasional peak flows, which can then be used to augment winter flow from the reservoirs. That this is an unsound argument is seen clearly when one considers the technical limitations and the very high financial stakes involved with building large storage dams in the Greater Himalayan region. Erratic increase in river flows will make it difficult to operate the dams under specific designed conditions and put the rivers at high risk of flash floods due to Glacial Lake Outburst Flooding (GLOFs) and cloud bursts. On the other hand, big storage dams also become economically unviable if constructed only to store occasional high flows when average river run-off reduces because of retreat of glaciers and uncertain precipitation.

Adopting standards for evaluating the sustainability of hydropower projects under different climate change scenarios is prescribed as an important criterion for decision making in hydropower governance, which should be applied strictly to hydropower projects in the Himalayan region.

**HYDRO-PROJECTS MORE HAZARDOUS DUE TO CLIMATE CHANGE**

The frequency of heavy precipitation events has increased over most land areas, consistent with warming and observed increases of atmospheric water vapour. Intense rainfall events will become even more frequent in the future. Dams are often seen to trigger flash floods in downstream areas. The potential of such dam-induced flash floods will increase due to climate change in the Northeastern region because of the projected intense as well as erratic rainfall and run-off in rivers. Since most of the hydropower plants in the region are run-

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**PEOPLE, DEVELOPMENT AND POWER**

In the current situation it seems difficult to bring accountability back to the governance process on these mega-hydel projects in the Northeast, without addressing the arguments on development and power being used to ride roughshod over some of the country’s most important ecological landscapes, and the livelihood rights of the people of the region.

The belief that each of these mega-power projects is crucial for India’s energy security is a major reason for subversion of environmental and social issues. This myth needs to be busted. Girish Sant of Prayas Energy Group, a leading organisation working on public interest power sector issues, says: “Development needs increased energy services. But demand forecasts that planners make are usually an overestimate and there is a bias towards centralised large projects to meet this highly inflated demand. This is not the ‘least-cost’ way of getting the required

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**Downstream groups in Assam team up with their counterparts in Arunachal Pradesh to oppose a public hearing being held for the 3,000 MW Dibang Multipurpose project.**

**A protest rally against multiple dams planned in the Sinlung hills of Mizoram was held in the state capital, Aizawl, on Sep 28, 2010.**
services. With increasing conflicts over the siting of new power projects, we urgently need an alternative approach towards power sector planning – such as Integrated Resource Planning (IRP). Such an approach can have substantial environmental and social benefits as energy services can be delivered with a sizeable reduction in the number of new power plants required by the country. IRP considers a mix of supply side and demand side solutions while giving equal importance to both. It includes a combination of cleaner centralised energies, decentralised renewable energies and efficiency improvements, which will together provide energy services at least cost. Several such alternative studies done across the country indicate that requirement of additional capacity for power generation can be reduced by as much as 50% of that reported in the official conventional plan.” Such information could prove critical in the discourse on dams in the Northeast, where state governments like Sikkim, Arunachal Pradesh and Manipur keep the newly-formed dam, it leads to an avalanche of water gushing down the hills and creating havoc as flash floods in downstream areas. Landslide dam outburst floods (LODF), as this type of flooding is called, have been responsible for several large floods affecting northeast India. The ‘Yigong flash floods’ triggered by the collapse of a landslide-induced dam on the Yigongzangbu river - a large tributary of the Yarlung Zangbo (Tsangpo) - on June 10, 2000, caused havoc in the river Siang in the bordering areas of Arunachal and China with estimated property losses of not less than a billion rupees, 30 deaths, more than 100 people missing, and more than 50,000 rendered homeless in five districts of Arunachal Pradesh. If there happens to
found to be in a state of general retreat since the year 1850\textsuperscript{9}, consistent with the general warming trend of the earth since the industrial-era began.

Several rivers in Northeast India, including the Brahmaputra (Yarlung Zangbo), and its tributaries like the Subansiri (Loro Chu), the Manas, and the Jia Bharali (Kameng), are fed by meltwater from snow and glaciers in the Tibetan and Himalayan region. 12.5 percent of the Brahmaputra is glacial meltwater\textsuperscript{10}. Glaciers in the Bhutan Himalayas are now retreating at an average rate of 30-40 m per year\textsuperscript{11}. In the past 40 years or more, glacial area in the entire Tibetan Plateau has shrunk by more than 6,606 sq km, with the retreat being higher since the mid-1980s\textsuperscript{12}.

The temperature of the Qinghai-Tibet Plateau is expected to rise by 2.5°C by the year 2050, resulting in thinning of glaciers and increased meltwater initially, but culminating in large-scale shrinkage of glaciers, and the MOEF has had to call for suspension of work. Similarly, over Northeast India, annual mean maximum temperatures are rising at a rate of 0.11°C per decade, while the annual mean temperatures are also increasing at a rate of 0.04°C per decade\textsuperscript{13}.

The Affected Citizens of Teesta stage a protest in New Delhi in December 2007 during their marathon satyagraha against the dams juggernaut in Sikkim.


\textsuperscript{7} YOU Qinglong et al. (2007). pp. 419.

\textsuperscript{8} Cryosphere refers collectively to all the areas on the Earth’s surface where water exists in the solid form either as ice or as snow. Examples are glaciers, snow cover on mountains, ice floating on sea, ice caps, ice sheets and frozen ground (both seasonal and permanent).


\textsuperscript{11} WWF brochure on glacier melt entitled ‘Going, going, gone!’ Climate change and global glacier decline. http://assets.panda.org/downloads/glacierspaper.pdf as on 06.05.2010


ENVIRONMENTAL VIOLATIONS

Hydropower projects are granted environmental, forest and wildlife clearances with several conditions imposed on them to supposedly reduce the environmental and social impacts of these projects. However, a look at some of the mega-hydropower projects either under construction or recently completed in the Northeast, shows a rather poor scenario vis-à-vis compliance.

The 510 MW Teesta V hydroelectric project in Sikkim, commissioned in 2008, has often been touted as being an environmentally benign RoR project (see box on RoR projects). However, the project was embroiled in an enviro-legal battle due to indiscriminate dumping of muck and debris in the Teesta river in violation of environmental laws. In an affidavit submitted to the Supreme Court appointed Central Empowered Committee in 2007, the Sikkim Chief Secretary admitted that the power company has “grossly violated the terms, conditions and guidelines” imposed by the MoEF and has deliberately dumped excavated material generated from extensive tunneling work “into the river Teesta obstructing its free flow causing thereby huge damage to the forest and environment.” The Comptroller and Auditor General (CAG) of India in a 2008-9 report on Sikkim note about the same project: “Spoils were thrown along the river banks raising the river bed of the Teesta leading to change in the flood behaviour of the river, acceleration of toe erosion and degradation of the overall geo-environmental setting of the area.”

The under-construction 600 MW Kameng hydroelectric project has made changes in the locations of the Bichom and Tenga dams and the Kimi powerhouse after getting initial clearances1. No fresh environmental and forest clearances have been sought by the project, although it is mandatory as per law to do so.

Several violations of environment and forest laws, as well as Supreme Court orders, have repeatedly been reported in the past few years in the 2,000 MW Lower Subansiri hydroelectric project. For example, conditions imposed by the Supreme Court in April 2004 include:

“(ix) The NHPC will also ensure that there is no siltation down the Subansiri river during the construction phase...”

“(x) Under no circumstances, the excavated material will be dumped either in the river or any other part of the National Park/Sanctuary or the surrounding forests....”

In spite of these conditions, there has been indiscriminate dumping of muck and debris in the river, repeatedly recorded since 2004. This is a clear violation of Supreme Court orders, but work has been allowed to continue business-as-usual. More recently, in September 2010, Assam-based groups have written to the Environment Minister about other serious violations in the project. There have been major changes in the design of the project (e.g. change of underground powerhouse to surface powerhouse, reduction in depth of foundation from 17 metres to 9 metres), yet the project authority has not sought fresh environmental clearances as required by law. No action has been taken by MoEF as of the first week of November 2010 on this issue.

In the 1750 MW Demwe Lower project in Arunachal Pradesh, forest land has been illegally used for road construction and labour colonies before forest clearance has been obtained.

1 Kalpavriksh case study on ‘Compliance and monitoring of environmental clearance conditions of the Kameng hydroelectric project’, Arunachal Pradesh (2008). This has also been reported in the CAG report of 2009 on implementation of 10th Five Year Plan power projects in the Northeast and East by NEEPCO and NHPC.

Illegal dumping of muck and debris in the Teesta river during the construction of the now commissioned 510 MW Teesta V project in Sikkim.

be a man-made dam on the river further downstream of such a bursting natural dam, the severity of damage could be many times higher because of a dam break or the release of excess water from the dam (a standard practice when the storage capacity is exceeded due to excessive inflows). This would be true for both storage and run-of-the-river projects.

The massive floods in western Assam in 2004, that were caused by water released from the Kurichhu Hydropower Plant (60 MW) in Bhutan on the Kurichhu river, were in fact triggered by the bursting of a landslide dam formed on September 10, 2003, on the Tiatischu river, a north–easterly flowing tributary of the Kurichhu River (itself a tributary of the Manas river that flows through western Assam). Failure of the landslide dam on July 10, 2004, released a flood wave that had a peak discharge of 3500 cubic meter per second at the Kurichhu Hydropower Plant 35 km downstream2. Allowed to pass through the spillways of the dam, the flood waters reached the rivers Manas, Beki and Hakua and caused devastation in Barpeta district of Assam. Part of the flooding in the years 2007 and 2008 in western Assam were also attributed to releases from the Kurichhu dam.

Many of the rapidly retreating glaciers in the Himalayas have shrinking snouts, that leave glacial lakes behind, allowing water to accumulate rapidly as snow and ice melts faster. Sudden discharge of large volumes of water and debris from these lakes causes glacial lake outburst floods (GLOFs) in valleys downstream.

There are many glacial lakes in the Brahmaputra basin in Tibet and some of these have the potential to cause GLOFs and create flood havoc in downstream areas in Arunachal Pradesh and Assam. Some of the Himalayan tributaries of the Brahmaputra such as the Manas, the Sankosh originating in Bhutan and the Teesta passing through Sikkim also have potentially dangerous lakes in their catchments that could cause flood disaster in Assam, in the northern part of West Bengal, and in Sikkim respectively. Large dams are being implemented or planned on all these GLOF prone rivers by Governments of India and Bhutan. The Mangdechhu hydroelectric Project (720 MW) proposed to be constructed with help from India on the Mangdechhu, a tributary of the Manas river24, is prone to be affected by GLOFs since the headstream region of the river adjoins expanding glacial lakes. The three hydro projects planned on the Sankosh river (Punatsangchhu in Bhutan), viz. the Punatsangchhu hydroelectric Project Stage-I (1200 MW) and Stage-II (990 MW), and the Sankosh Multipurpose Storage Project (4060 MW), may be a cause of aggravated flood hazards in future (both in Bhutan and Assam), as the upper reaches of one of its tributaries, the Pho Chhu in Northeast Bhutan, is severely GLOF-affected.

ALTERNATIVES TO LARGE HYDROPOWER DAMS IN A CHANGING CLIMATE25

There are two options to reduce the risk caused by large hydropower dams in an era of climate change impacts. The first is not to go for any large dams in the Himalayan landscape and alternatively promote micro, mini and small hydropower on a case-to-case basis. Such projects would have minimum structural interventions on the river systems, be congenial for the environment,
The compelling argument being made is that the sudden rush of capital for multiple mega hydropower projects is another attempt to siphon off resources from the region which itself has a small power demand. There appears to be some truth in this.”

An important element of protests in the region has been the strong involvement of youth from the Northeast. These young people certainly want development and economic progress, but they oppose the kind of development they feel will destroy their cultural and natural heritage. Tone Mickrow, a young leader from Arunachal Pradesh, is the General Secretary of the Idu Mishmi Cultural and Literary Society, the apex body of the Idu Mishmi community. He says, “Can the Dibang Valley absorb this kind of mega development? We need power, but these mega dams are not the development we want locally. We cannot allow such massive destruction of our rivers and submergence of our lands, which are intricately connected with our identity. Development activities need to keep in mind the absorption capacity of the region. We would rather go in for a few micro, mini and small hydropower projects after careful scrutiny and full public consent on a case-to-case basis. Such projects would be relatively benign – they will involve small dams on some of the tributaries, minor influx of outside labour and will be finished in short periods. This can help us set-up small-scale enterprises, for example horticulture-processing based, giving an impetus to the local economy and providing local employment.”

A banner of the Affected Citizens of Teesta (ACT) during its 900 day satyagraha in 2007-9 against the rush of dams in Sikkim read: “Meaningful development, not destructive development.” But will the political economy of large-dam building allow for processes to take the genuine consent of local communities and debate various options for local development? The current experience is discouraging. The Idu Mishmi community has blocked the public hearing for the 3,000 MW Dibang Multipurpose project no less than 10 times because they have no faith in this process, as a democratic space. Their concerns appear valid as the government has already accepted 150 crores rupees as an upfront premium from the project developers and the foundation stone for the project has been laid – before public consultation processes being complete and before mandatory clearances being granted. Despite widespread protests in downstream Assam, no downstream public consultation has been held to date while taking decisions on upstream projects.

Where do we go from here? There are several areas of action which need immediate attention, but the seriousness of the situation demands that there is a moratorium on dams in the region till fundamental issues are sorted out. These include:

- Ensuring transparency and accountability in decision-making and governance processes related to these dams at all levels – whether related to signing MoUs, conducting impact assessment studies or addressing trans-national issues in these river basins; building in mechanisms to get the free, prior and informed consent of local indigenous communities; learning lessons from old projects in the region such as Ranganadi, Gumti and Loktak; alternative power planning approaches at the national level; planning for genuine options-assessment and appropriate development in the ecologically and geologically fragile, seismically active, politically and culturally sensitive river basins of the Northeast.

- But progress on these fronts will not be possible without a widespread political debate on these issues within the region. As Akhil and enable communities to fulfil genuine power requirements. This could be accompanied by an earnest exploration of alternative sources of new and renewable energy such as solar, wind, geothermal and biomass. These aspects have never been seriously assessed in the Northeastern region.

The second option is to develop hydropower technologies that will not need construction of large dams and will absorb the climatic uncertainty and associated downstream impacts as well. However, given that no such technologies appear to be on the horizon, this option appears very remote in the immediate future.

No policy instrument in India addresses (even partially) the uncertainties of impacts of large dams under climate change. Conventional disaster risk reduction programmes in downstream areas are pitifully inadequate to offset the negative impacts of large dams. The true cost of mitigating the climate-change-induced risks of large dams will be several times higher compared to the investment in the hydro projects themselves. On the other hand, the success of making the projects ‘climate proof’ will be inversely proportional to the scale and intensity of dam building, given the emissions from large dam environs and the compounding uncertainty of risk due to dams.

Perhaps there is no middle path to walk here. It will not be possible to create a win-win situation in a business-as-usual scenario involving construction of more and more large hydropower projects in the Northeast. Large
CONTESTED WATERS
On August 12, 2010, an hour long debate took place in the Rajya Sabha on the downstream impacts of dams in the Northeast. The Environment Minister, Jairam Ramesh, admitted that environmental decision-making on dams in the region has indeed been insensitive until now and promised reform. But he also made a pitch for dams on the Siang1 in Arunachal Pradesh for strategic reasons, to supposedly strengthen India’s position in future negotiations with China on the Brahmaputra waters. While India and China have an Expert Level Mechanism (ELM) on transboundary rivers since 2007 to share river flow data and discuss issues, there is no specific treaty on the Brahmaputra waters. The argument being made by some is that if we build dams on the Siang we can establish our ‘user rights’ over the river. The water resources technocracy in the country has also argued that to safeguard against the impact of possible reduced flows, due to any proposed diversion of the Brahmaputra waters by the Chinese, we build large storage reservoirs in upper reaches of major rivers in the Brahmaputra river basin such as the Subansiri, the Siang and the Lohit to store monsoon waters.

Responding to the Environment Minister’s arguments, Itanagar-based civil society organisation, Arunachal Citizens Right (ACR), issued a public statement in August 2010. Citing ongoing protests against large dams by communities in the state, ACR argued that making these large dams a fait accompli is “an affront to the people of Arunachal Pradesh who remain pawns in the larger energy security policy of the Government and now in the geo-political relations between India and China, all without their consent.” Protesting being made “sacrificial lambs and guinea-pigs”, they argued that: “…India should immediately explore the possibility of a joint discussion with China on the issue of riparian rights and water sharing of rivers which flow through both the countries. On the issue of riparian rights the people of Arunachal Pradesh will definitely stand by Government of India’s position on downstream impacts of diversion of river water flow in the upstream of a river basin. But, that would mean that Government of India should also recognize the legitimate concerns over downstream impacts of dams invariably enhance people’s vulnerability and risk in a changing climate. Given the scientific evidences of large dams contributing to global warming as well as becoming potential sources of risk due to climate change, it has become imperative to do proper risk assessment in a holistic sense for each of the proposed or ongoing projects and for every river basin in which multiple projects are being planned. The prevailing development paradigm pegged on large interventions on natural systems generates considerable risk along with the resources such as hydropower it creates. The blue print for developing hydropower by building multiple large dams on the region’s rivers will increase the risks manifold and is certainly not the answer to provide climate security to the people of Northeast India.

1 Risk: A risk is the association of the probability of occurrence of a hazard or disaster with the (economic and financial) losses it would imply. Risk can be defined as RISK = HAZARD x VULNERABILITY/CAPACITY, where a ‘Hazard’ can be defined as a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation; a ‘Disaster’ is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope with the consequences using its own resources; ‘Vulnerability’ refers to a set of conditions and processes resulting from physical, social, economical and environmental factors, which increase the susceptibility of a community to the impact of hazards; ‘Capacity’ is a combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.

7 Bates et al. (2008) in end note 5
8 CDM: The Clean Development Mechanism (CDM) is a process that allows emission-reduction (or emission removal) projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one tonne of CO2. These CERs can be traded and sold, and used by industrialised countries to meet a part of their emission reduction targets under the Kyoto Protocol. The mechanism supposedly stimulates sustainable development and emission reduction targets, while giving industrialised countries some flexibility in how they meet their emission reduction limitaion targets.
safeguard the long-term social and environmental security of the river basin. We certainly need to raise serious concerns about the ongoing dam plans on the Brahmaputra by China and put forward a strong case based on the ecological, cultural and livelihood sustenance the river provides currently to lakhs of people downstream. Media reports in mid-November 2010 indicate that the Chinese government has started work on the 510 MW Zangmu project, supposedly a RoR project, on the river upstream. On November 18, 2010, the Chinese government has defended its decision to build a dam on the Brahmaputra and said that they have taken “full consideration of the impact on the downstream area.”

A mere statement of this nature is unacceptable and India needs to strongly demand an explanation from China on how downstream issues have been considered as claimed by them. As explained in other portions of this paper, so-called RoR projects could also have serious downstream impacts. For example, due to drastic alteration in natural flow patterns, even if total quantities of flow remain the same in the downstream over a period of time. We need to understand case-specific impacts of such projects (individually and cumulatively) on India and any complacency on part of our government by blindly accepting arguments that ‘RoR is environmentally benign’ would be dangerous. The Indian government could make a bold start by protecting the Indian portion of the Brahmaputra as a “cultural and ecological endowment of the people of the region and the country as a whole”, as demanded by one lakh signatories from the Northeast in a memorandum sent to the PM on November 2, 2010. This would also give us the moral right to stridently oppose Chinese dams on the Brahmaputra.

1 The Brahmaputra is called Siang in Arunachal Pradesh and Yarlung Tsango in Tibet. The first project being taken up in 2010. This would also give us the moral right to stridently oppose Chinese dams on the Brahmaputra.


GLOF: Glacial Lake Outburst Flooding, described later in section ‘Hydro-projects more hazardous due to climate change’, para 4.

Cloud Burst: A cloudburst is an extreme form of rainfall, sometimes mixed with hail and thunder, which descends from high clouds and fall at the rate of normally more than 100 mm per hour, causing accumulation of more than 2 cm of rainfall in few minutes often leading to disastrous flash floods.


For a more comprehensive look at alternative approaches to power planning see booklet on ‘Alternative Power Planning’ produced by Prayas Energy Group and Kalpavriksh at prayaspune.org/peg

Major quarrying operations in the riverine tracts of the Subansiri, downstream of the dam site of the 2,000 MW Lower Subansiri hydroelectric project. This has disrupted an important corridor for movement of elephants close to the Assam-Arunachal Pradesh border and led to increased human-elephant conflict in nearby areas.

Gogoi, of the Krishak Mukti Sangram Samiti, says: “Technical issues are important. But the dams’ debate in the region cannot be restricted to these issues alone. It is a matter of our rights over our natural resources. These resources are being handed over to power companies and our rivers transformed dramatically by political decisions taken in New Delhi and within the State Governments of the region. This requires a political response from people of the region and that will be our focus in the coming days.”
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