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Hydropower Development in Northeast India: Issues and Concerns

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ABSTRACT

Northeast India is endowed with a hydropower potential of 66,000 megawatts, which represents about 40% of the national potential. While looking at the benefits of huge hydropower potential of the region, many serious issues are overlooked and not projected in proper way. Geographical disadvantage, threat to ecosystem, impact on river morphology, socio economic challenges and downstream impacts are the major challenges in hydropower development in the region. In this review paper, an attempt is made to address all those issues with some effective development and management options for sustainable hydropower development in the geographically, ecologically and socially ultra-sensitive region of Northeast India. Small projects instead of large dams, structural modification, change in location and combination of both (scaling down and change in location) are effective options to minimize the negative impacts as well as to safeguard the environment and society. Intensive and comprehensive Environmental and Social Impact Assessment study prior to dam construction is necessary. Local people as well as downstream people should be given due importance in the whole process of EIA and benefit sharing.

Key words : *Hydropower, Big dam, Northeast India, EIA*

Introduction

Hydropower energy

Hydropower is one of the oldest and largest sources of renewable energy which supports the development of other renewables (WCD, 2000). Although hydropower requires relatively high initial investment, but has the advantage of very low operation costs and a long lifespan. Hydropower has a low carbon footprint & the highest energy payback ratio. Projected as a clean energy, hydropower is affordable power for today and tomorrow and key tool for sustainable development (WEC, 2001, IHA, 2003; Yuksel, 2010).

Northeast India and hydropower initiatives

Blessed by unique topography and abundant surface water resources, the Northeast India, comprised of states of Arunachal Pradesh, Assam, Nagaland, Manipur, Mizoram, Tripura, Meghalaya and Sikkim, is endowed with a hydropower potential of 66,000 megawatts (MW), which represents about 40% of the national potential (World Bank, 2007). Hydro initiative apparently looks promising when seen from the huge power generation and revenue earning point of view. In spite of colossal water resources, average per capita income in the Brahmaputra floodplains is 30 percent lower than the national average in India. Huge hydropower potential of Northeast India can fulfill the energy need of the whole country and thereby boost the economy of the entire region. Other potential benefits would have been reduced flooding in floodplains of Assam if storage facilities were part of the hydropower projects in the Arunachal Pradesh, eligibility of small hydro schemes for carbon trading benefits and substantial employment generated from the significant investment for the priority projects. But while looking at the benefits of hydropower potential many serious environmental and socio-economic issues are overlooked and not projected in proper way. Large hydropower dams represent a whole complex of social, economic and ecological processes and when the project site is in a tectonically, ecologically and socially ultra-sensitive region of Eastern Himalayas, the issues pertaining to hydropower development are much more complex and challengeable. In this review paper, an attempt is made to address all those issues with effective development and management options for sustainable hydropower development in the region.

Challenges of hydropower development in Northeast India

Geographical disadvantage and tectonic issue

Geographical disadvantage is the main and unavoidable challenge in hydropower development in northeastern region of India. About 168 hydropower projects having a power potential of nearly 63,628 MW was identified in the Brahmaputra River basin (CEA, 2001). Feasibility of so many dams in the region is a big question due to tectonic instability, ecosystem fragility and cumulative impacts. The northeastern part of Indian subcontinent is one of the seismically most active regions of the world. Bureau of Indian Standard (BIS) in 2002 gave the status of Zone-V, the highest zone of seismic vulnerability to the entire north-eastern part of India. Adequate knowledge and expertise to deal with large dams in the seismically active region is doubtful. Dam break due to seismicity is not impossible and if this happens during already flooded season, the disaster will be tremendous.

Fragile and pristine ecosystem

The consensus among river ecologists is that dams are the single greatest cause of the decline of river ecosystems. The NE region is at the confluence of the Indo-Malayan, Indo-Chinese and Indian biogeographical realms, and therefore unique in providing a profusion of habitats, which features diverse biota with a high level of endemism. The region is a part of the Indo Burma 'Hotspot' and contains more than one-third of the country's total biodiversity.

Damming of rivers blocks or delays upstream migration leading to the decline and even the extinction of species as longitudinal movements along the stream continuum is necessary for many aquatic species (Kinsolving and Bain, 1993; Larinier, 2001). There are several cases of loss of species diversity in river basins due to hydropower projects. Drastic declines in the molluscs of the Murray-Darling River in Australia and disappearance of approximately 35 species from the Lower Nile can be attributed to damming of those rivers (McAllister *et al.*, 2001). The Yangtze River Dolphin is another species under threat due to damming of the Yangtze River. There are as many as 4,327 wetlands in the eight states of Northeast and most of them are in the floodplains of the rivers. The wetlands are vulnerable to downstream impacts like floods and sedimentation from hydropower projects.

Socio economic challenges

The Northeastern region of India is the abode of approximately 225 tribes in India, out of 450 in the country. Each tribe follows distinct social, cultural, and religious practices and confined in specific regions (Ali and Das, 2003).

The Adis which are divided into different groups, such as *Padam, Minyong, Shimong, Pangis, Pasi, Asing, Bori, Bokar, Karko, Ramo, Milan, Tagin, Gallong, Tangam* and *Pailiba* are concentrated in the Siang frontier division. Similarly the main concentrated areas of the *Khamti* are sixteen villages of Lohit district of Arunachal Pradesh. The *Singhpo*, a minor tribe in Northeast India, are found in Tirap district and some parts of the adjoining Lohit district of Arunachal Pradesh. Culture and livelihoods of those communities are intrinsically linked to pristine forests and rivers. River-people relationship and forest-people relationships are targets of ongoing and coming hydro projects. Displacement due to dam construction and flood hazard will disrupt community networks. Indigenous tribal communities are in fear of losing territorial identity and dignity of life due to both displacement and challenge of transition to alternative livelihood.

Impact on river morphology

A comparative study of monthly flow characteristics between natural rivers and reservoir regulated rivers revealed that dams alter monthly flow characteristics with variable extent of modification (Lajoie *et al.,* 2007). Installation of more than 80,000 dams in America has segmented the streams and fragmented their watersheds (Graf, 2001). Extensive construction of dams has greatly dampened the seasonal and inter-annual streamflow variability of rivers, thereby altering natural dynamics in ecologically important flows on continental to global scales (Poff *et al.,* 2007).

Damming of rivers causes trapping of sediments in reservoirs and water released from a dam will tend to recapture its sediment load by eroding downstream bed and banks. Erosion may also increase beyond the mouth of the river, as observed, for example, downstream of the Akosombo dam in Ghana. Modified outflow and sediment flux of the Brahmaputra River and its tributaries due to damping of peak flows, river channel fragmentation and reservoir siltation resulting from dam initiatives, has serious negative implications on flood plains, coastal ecosystem and global geochemical cycles.

Downstream impacts

Hydroelectric power projects in the upper or middle course of a river influence on river hydrologic behaviour as well as channel efficiency at downstream (Dynesius and Nilsson, 1994; Baxter, 1997; Batalla *et al*., 2004). Significant effects of dam constrctionon downstream floodplain environments in tropical Africa and in Nigeria is already highlighted (Adams *et al*., 1986).

People of Assam are already suffering a lot from floods due to existing small hydro projects like Ranganadi, Kurichu, Kapili, Umtru and Karbilongpi. As reported in EIA report of the Lower Subansiri Hydro Electric (LSHE) project, there will be discharge of only 6 cusec for 20 hours and 2,560 cusec for 4 hours in operation time. The river will be almost dry for 20 hours and again there will be high flood for 4 hours.Such fluctuation will bring misery to people of downstream including those who earn their livelihood by cultivating in 'char' areas and/or by fishing. Rivers with highly altered and regulated flows lose their ability to support natural processes. Impoundment makes a river unproductive because most of the sediment entering a reservoir is stored behind dams, also resulting in sediment-starved conditions in the downstream (Graf, 2002). Dammed rivers are in fact described by many as 'dead rivers'.

Effective development and Management options

Mainly due to seismic and ecological threats, large hydropower projects are not acceptable in Northeast India. There are examples of dams which were never built for a variety of reasons. Auburn Dam of 210 m high was a proposed on the North Fork of the American River in the United States and construction work commenced in 1968. But following a nearby earthquake and the discovery of a seismic fault that underlay the dam site, work on the project was halted. Finally, an end was put to the project due to limited flood-control capability, geologic instability, and potential harm on recreational and ecological values.

Structural modification in terms of scaling down of generation capacity and/or dam height is an effective development option to minimize negative impacts and safeguard livelihood and environment. Clyde Dam, New Zealand's third largest hydroelectric dam, was constructed between 1982 and 1993. During construction, the adjacent rock was discovered to be micro-fractured, because of an earthquake fault running underneath the dam site. The dam was redesigned, losing a sluice channel and cutting its generation capacity from 612 MW to 432 MW.

Change of location is another alternative if the proposed site is highly objectionable in terms of seismic or environmental or social issue and there is availability of suitable site. Combining change of location and structural modification is one of the best options.

Most dams in the northeastern region are criticized because of the poor Environmental and Social Impact Assessment (ESIA) studies done and also because downstream impacts are not adequately taken into account. ESIA studies should give equal weightage to social and environmental aspects along with the economic and financial aspects. The public hearing must be made into an effective exercise. A well enforced licensing system to hydropower projects, practiced in Switzerland and USA, can be a good mechanism to ensure implementation of mitigation measures to safeguard environment (Colliar, 2004).

Development of small/mini/micro/pico hydel projects in a more targeted manner should be planned and possibility of people's ownership may be explored. Small hydropower plants (SHP) are a key policy issue in the development of rural areas. Multi-purpose SHP designs will promote the efficient use of water resources for agricultural land, thus meeting requirements for the rapid development of agriculture (Tasdemiroglu, 1993).

Affected communities should be provided with improved living and public health conditions, with an equitable distribution of benefits of the project, through revenue sharing. Provision of community infrastructure like water and electricity and above all a comprehensive risk compensation plan with consent and acceptance of the community, and sustainable long-term solutions to protect the livelihoods and social cohesion of the community should be ensured. Greater risk of downstream communities must be recognized and accounted for in working out compensation package for vulnerable and affected people. To ensure compensation of any loss suffered by the downstream people during and after construction of any large or medium sized dam over any river in the country, 'Big Dam Liability Bill' in line with the Nuclear Liability Billmay be demanded.

Conclusion

India needs power and Northeast India has enormous potential. But assault on nature by jeopardizing the environment and livelihood of river-dependent communities by hydropower projects is not acceptable. Proper appreciation of the trade-offs between economic benefits and environmental costs must emerge. Both environmental extremism and bureaucratic rigidity must be avoided.

Large hydropower projects are not encouraged in the Northeast India mainly due to unavoidable tectonic threat associated with serious ecological, socioeconomic and downstream impacts. Some rivers may be designated as "free flowing river" and "no-go" areas for hydropower schemes

Planning of small/mini/micro/pico hydel projects in a more targeted manner and people's ownership should be explored.

Ongoing mega projects in the region should be assessed for their stability to withstand in earthquake of magnitude 8 or more (in Richter scale). In case of potential threat and significant anomalies in construction, those projects should be structurally modified, if closing of the project is not possible at all.

Any hydropower project should be selected and implemented after River Basin Assessment and an Intensive and Comprehensive Environmental and Social Impact Assessment study with active participation of both local and downstream people.

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