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Dams and Development: the Kaptai Hydro Electricity Project Revisited

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Abstract

There are myths surrounding hydropower dams as environment-friendly, clean, cheap and greenhouse gas free. As a result, there has been massive construction of hydropower dams worldwide (around 45,000)[2]*, the notably among them is the Three Gorges Dam over the Yangtze river in China with a capacity to generate 22,500 MW of electricity in operation since 2012*[3]*. On the hind side, the adverse effects of dams are always overshadowed. Hydropower needs a regular supply of water from a permanent reservoir created by inundating an area. Such an inundation causes involuntary displacement of people with poor or no compensation, no resettlement and mostly with no measures for livelihood reconstruction. Moreover, the trade-offs, the cost-benefit analysis of hydropower projects never done properly and mostly exaggerated. The socio-environmental costs always exceed the cost of generating electricity through hydropower. Due to poor output from hydro projects and mounting socio-environmental costs, around 450 old dams in the US have been decommissioned so far. Around the world, some 5,000 large dams are now more than 50 years old, and many more reaching their half century is increasing. They are to be decommissioned and the cost of removal of dams sometimes exceeds the cost of construction because of difficult silt management and augmentation of the river. Against the backdrop of massive dam construction worldwide, this article intends to deal with issues related to contribution of hydropower dams to development and how development is affected by the dams. It reviews proliferation of*

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2 The World Commission on Dams, 2000, *Dams and Development: A New Framework for decision-Making*, The Report of the World Commission on Dams, An Overview, Earthscan Publications Ltd, London, UK., www.dams.org.

3 Kazi, R.K., 2013, *Political Structure and Anti-damProtest Movements: Comparing Cases of India and China*, M Sc thesis submitted at Uppsala University, Sweden.

hydropower dams worldwide and their impacts on the people, society and the environment. It examines the adverse effects of dams, inundation, displacement of people, sufferings of the project affected persons, resettlement and compensation. The paper unearths the myths surrounding the hydropower as environment-friendly, cheap, clean and greenhouse free. It makes an effort to prove that hydroelectricity emits greenhouse gases, runs the risk of failure in case of earthquakes and flooding and very expensive when the socio-environmental costs are accounted for.

Keywords: Dam Decommissioning, Hydropower; Indigenous Peoples, Involuntary Displacement, Involuntary Resettlement, Methane Emission, Project Affected Persons, Renewable Energy.

Introduction

Dams have been built for thousands of years to manage flood waters, to harness water as hydropower, to supply water to drink or for industry, or to irrigate fields. As populations increased and national economies grew, more dams are being commissioned. America's pioneering giant, multipurpose dams in the 20th century received instant attention throughout the world. The result was a dam-building boom of epic proportions on virtually every major river of the planet. Beside generation of hydro-electricity, large dams have been providing irrigation for increased food production; power for industrial factories; drinking water supply; sanitation services; illumination for large metropolis; and betterment of people's life and society. US President Herbert Hoover (after whom, Hoover Dam was commissioned in 1936) proclaimed that "every drop of water that runs to the sea without yielding its full commercial returns to the nation is an economic waste"[4]. This view was also shared by many other world leaders. The Indian Prime Minister Nehru compared dam project to "the new temple of resurgent India" and Egyptian President Nasser compared Aswan Dam to a pyramid.[5] Although, Egypt's Aswan High Dam was described as a "modern engineering wonder fulfilling a vital need of the country's increasing population", it was perceived by others, the environmentalists and sociologists as a "disaster reflecting a

4 See, Sajjadur Rasheed, K.B., 2011, *Water Resources Management with examples from Bangladesh*, AHDPH, Dhaka, p.62. In a separate chapter on "Water Development" , the author gave the definition of hydropower, described multiple benefits and multipurpose use of dams, raised issues related to social and environmental effects of large dams and brought to the fore the dams debate.

5 *Op. cit.*, p62.

classic case of ecological ignorance and shortsightedness".[6] However, completion of the 2080 MW Hoover Dam on the Colorado river in 1935 was a significant moment in the history of dam building in the US.

By mid-twentieth century, at least 45,000 large dams have been built as a response to meet energy or water need. Today, nearly half of the world's rivers have at least one large dam. In fact, dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable. In too many cases, an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment. Lack of equity in the distribution of benefits has called into question the value of many dams in meeting water and energy development needs when compared with the alternatives. Large dams have fragmented and transformed the world's rivers, while global estimates suggest 40-80 million people have been displaced by reservoirs.[7]

According to the International Commission on Large Dams (ICOLD), a large dam is 15 m (49.2 ft) or more high from the foundation. If dams are between 5-15 m high and have a reservoir volume of more than 3 million cubic meter of water, they are also classified as large dams.[8] Using this definition, there are more than 45,000 large dams around the world. Considering the world population of dams, China topped the list having 22,000 (45%); followed by USA with 6,575 (14%); India 4,291 (9%); Japan 2,675 (6%); and Spain 1,196 (3%). The top five dam-building countries account for more than three-quarters of all large dams worldwide. Dams generally serve the purpose of retaining water aiming at a) power generation; b) flood control; c) irrigation; d) supply water for drink/industry;

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[6] See, Hussein M. Fahim, 1981, *Dams, People and Development: The Aswan High Dam Case,*Pergamon Press, New York.

[7] See, Tortajada, Cecilia, *et.al.*, 2012, *Impacts of Large Dams: A Global Assessment*, Springer, Heidelberg; and Nusser, Marcus, ed., 2014, *Large Dams in Asia, Contested Environments between Technological Hydroscapes and Social Resistance*, Springer, Dordrecht Heidelberg New York London.

[8] Definition of large dam is given in The World Commission on Dams, 2000, *Dams and Development: A New Framework for decision-Making*, The Report of the World Commission on Dams, An Overview, Earthscan Publications Ltd, London, UK., P.4. Visit, www.dams.org.

and e) riverine communication. Dams help regional development, job creation and so on.[9]

World Commission on Dams (WCD) in its report *Dams and Development: A New Framework for Decision-Making* (November 2000) has elaborated adverse impacts of large dams on the environment and ecosystems.[10] Large dams have led to the loss of forests and wildlife habitat, the loss of species population and degradation of upstream catchment areas due to inundation of the reservoir area; the loss of aquatic biodiversity of upstream and downstream fisheries, and of the services of downstream floodplains, wetlands, and riverine, estuarine and adjacent marine ecosystems; and cumulative impacts on water quality, natural flooding and species composition where a number of dams are sited on the same river. Reservoirs were found to emit greenhouse gases due to the rotting of vegetation and carbon inflows from the catchment.

Impacts of large dams on ecosystems, biodiversity and downstream livelihoods are more negative than positive. They have caused significant and irreversible loss of species and ecosystems. Other effects are a) loss of forests and wildlife habitats; b) loss of aquatic biodiversity of upstream and downstream fisheries; c) adverse impacts on water quality, natural flooding and species composition; d) displacement of people. Some 40-80 million people have been physically displaced so far worldwide due to construction of hydro-projects. There are tragic stories of forcible eviction from historic homelands and concentration in crowded resettlement camps.[11]

Indigenous Peoples and Dams

Large dams have had serious impacts on the lives, livelihoods, cultures and spiritual existence of indigenous and tribal peoples. Special needs and vulnerabilities of indigenous and tribal peoples were not addressed. For indigenous peoples and ethnic minorities, dam-induced displacement can trigger a spiral of events and spreads beyond the submerged area. A case in

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[9] For a discourse on dams, dikes and development, see, Duivendijk, Hans van *et.al.*eds, 2002, *Dams and Dikes in Development*, Proceedings of the Symposium at the Occasion of the World Water Day, 22 March, 2001, A.A. Balkema Publishers, Lisse, Abington, Exton (PA), Tokyo.

[10] See, The World Commission on Dams, 2000, *Dams and Development: A New Framework for decision-Making*, *Op.Cit.*

[11] See, Isaacman, Allen F. and Isaacman Barbara S., 2013, *Dams, Displacement, and the Delusion of Development, CahoraBassa and Its Legacies in Mozambique, 1965-2007*, (New African Histories), Ohio University Press, Athens, Ohio.

point is the situation of 100,000 Chakma people displaced by Kaptai hydropower dam in the Chittagong Hill Tracts, Bangladesh. The Chakmas have never gained citizenship for themselves or for their children in India. Conflict triggered by land shortage due to Kaptai inundation resulted in protracted guerrilla warfare claiming around 10,000 since commissioning of the dam in 1962[12]. The indigenous peoples in central India have been waging a prolonged agitation over a series of irrigation and hydro-projects (30 major, 135 medium and 3000 minor) over the *Narmada River*that have displaced huge population and caused siltation and invited floods and landslides.[13]

The World Commission on Dams revealed that indigenous and tribal peoples have suffered disproportionately from the negative impacts of large dams, while often being excluded in sharing the benefits. Many international lending agencies have developed project guidelines on Indigenous peoples addressing issues like displacement of population, resettlement, livelihood security and restoration of cultural heritage. The "World Bank's Resettlement Policy" mentioned that the Bank would only support operations that involve the displacement of indigenous communities or other low income ethnic communities, if it could ascertain that a) the resettlement component will result in direct benefits to the affected community relative to their prior situation; b) customary rights of the affected communities will be fully recognized and fairly compensated; c) compensation options will include land-based settlement; and d) the affected people have given their informed consent to the resettlement and compensation measures.

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[12] See, Haque, M., 1997, *Ethnic Insurgency and National Integration: A Study of Selected Ethnic Problems in South Asia*, Lancer Books, India, pp.79-80; and Haque, M, 2008, *Trekking the Tracts: Livelihood Security of the Indigenous Peoples in the Chittagong Hill Tracts*, BARCIK, Dhaka, p.29.

[13] For a description on the Narmada Valley hydro-projects, see, Bahadur, Jagdish, 1998, *Tehri Hydro-Electric Project, Narmada Valley Project, Environmental Hotspots*,VigyanPrasar, New Delhi, India, Prologue. *Also see*, Baviskar, Amita, 1995, *In the Belly of the River, Tribal Conflicts over Development in the Narmada Valley*, Oxford University Press, New Delhi, India; Roy, Arundhati, 1999, *The Greater Common Good*, India Book Distributers (Bombay) Ltd.; Leslie, Jacques, 2005, *Deep Water: The Epic Struggle Over Dams, Displaced People, and the Environment*, Farrar, Straus and Girowx, New York; and Khagram, Sanjeev, 2004, *Dams and Development: Transnational Struggles for Water and Power*, Cornell University press, Ithaca and London.

Upstream and Downstream Livelihoods

A dam adversely affects not only upstream but also downstream population. On the upstream, due to creation of water reservoir by inundation, people are displaced requiring resettlement and compensation; forest and aquatic biodiversity depleted; wildlife affected; fish habitat lost; archaeological sites submerged and so on. Downstream people are no less affected. The once flowing river gets dried, river transportation disrupted, indigenous variety of fishes disappeared, riverbanks occupied by agricultural practices and the whole downstream population live under the shadow of a dam failure due to breach.

Downstream impacts can extend for many hundreds of kilometers and well beyond the boundary of the river channel. People are impacted generally after completion and functioning of the project. In general, downstream riverine communities have less social, economic and political power to seek mitigation. At many places, the changed hydrological regime of rivers has adversely affected floodplains that supported local livelihoods through flood recession agriculture, fishing herding and gathering floodplain forest products. The disruption of downstream economies can create uncertainty in livelihoods leading to migration to towns and embrace impoverishment.

Downstream impacts are disruption of water and sediment flow; reduction of biodiversity, suffering of communities increase due to poor water quality; lowering of crop production and decrease fisheries. Dam blocks fish migration; disrupts water and sediment flow; and aging structures pose safety hazards. Reservoir displaces communities; floods and fragments ecosystems; increases waterborne diseases; and triggers earthquakes. Due to rotting vegetation, greenhouse gases are released contributing to global warming, more than that generated from thermal power plant.

Key Indicators of Dams

From an environmental point of view, there are good dams and bad dams. The amount of possible environmental damage from a proposed project is largely determined by the dam sites. "World Bank Guidelines on Large Dams" suggested 13 quantitative easily calculated indicators useful for hydro project site selection from environmental standpoint[14]. These

[14] For key indicators of likely environmental impacts, see, The World Bank, 2003, *Good Dams and Bad Dams: Environmental Criteria for Site Selection of*

indicators have high predictive value for likely adverse environmental and social impacts. Indicators are as follows:

a. Reservoir Surface Area: Size of the area flooded by the reservoir is an important variable to evaluate environmental and social impacts. A large reservoir area implies the loss of much natural habitat and wildlife and displacement of people. Large reservoirs are typically in the lowlands and usually occupy larger rivers with more fish and other aquatic species at risk. A very useful measure of environmental costs relative to economic benefits is the ratio of inundated hectare per megawatt (ha/MW) of electricity. The global average of all large hydroelectric dams constructed to date is about 60 ha/MW. It would be environmentally highly desirable for this average to be much reduced in future hydro projects. For Kaptai (Bangladesh), the lone hydro-project, this ratio is 235ha/MW, meaning 650 sqkms of land inundated to generate 230 MW of electricity, to be considered as bad dam.

b. Water Retention time in Reservoir: Mean water retention time during normal operation (the shorter, the better) is very useful in estimating the extent to which reservoirs will have long-term water quality problems. This figure (number of days) is calculated as a function of reservoir volume (cubic meters) and mean river flow (cubic litres/second). For Kaptai (Bangladesh), the reservoir volume is 5,00,000 cubic meters and water is retained round the year at 76 ft MSL (min) on 1 June and 109 ft MSL (Max) on 1 November. The longer time of water retention would affect more the quality of water.

c. Flooding of Biomass: For good reservoir water quality, dams should minimize flooding of forests (which have biomass content). Flooding native forests also threatens biodiversity and releases greenhouse gases. Biomass flooded is calculated in tons per hectare based on the percent cover of different vegetation types in the reservoir area. Kaptai inundated a large tract of forest area in the south-eastern hills of Bangladesh.

d. Length of River Occupied: Dam sites should minimize the length (km) of upstream river occupied by the reservoir (measured during high flow period) in order to conserve aquatic and riparian biodiversity. Ideally, hilly rivers with gorges would allow less area of the river for creation of

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Hydroelectric Projects, Latin America and Caribbean Region Sustainable Development Working Paper 16, pp.9-14.

the reservoir. For Kaptai, Bangladesh, a large area (80,000 acre of shallow land) of upstream river Karnaphuli has been occupied turning it into a bad dam.

e. Length of River Left Dry: The length of the dried up river bed below the dam should be minimized. It would have less adverse effects on fisheries, aquatic life, ecosystems, human water supply and agriculture downstream. This measures the kilometers of river left dry.

f. Number of Downriver Tributaries: The more tributaries downriver of the dam site, the better in terms of maintaining accessible habitat for migratory fish, the natural flooding regime for riverine ecosystems and nutrient needed for rich biodiversity of estuaries.

g. Reservoir Life: Useful reservoir life is the expected number of years required to fill up the reservoir's dead storage to that extent that any further sedimentation would reduce the live storage and curtail power generation. Dead storage comprises all reservoir water beneath the level of the intakes for the dam's turbines.

h. Persons Requiring Resettlement: Dam sites should generally seek to minimize the number of individuals or households requiring resettlement from land affected by the reservoir and complimentary civil work. It is especially important to minimize the number of people seeking resettlement and quantified as people displaced/MW. For example, the ratio is as low as 0/MW (Pehuenche, Chile); 1/MW (Fortuna, Panama); AND 2/MW (Arun II, Nepal). These are good dams as per the definition. On the other hand, there are dams with high ratio as 71/MW (Three Georges, China); 214/MW (Victoria, Sri Lanka); 1000/MW (Kedung Ombo, Indonesia). These are bad dams. For Kaptai (Bangladesh) this ratio is 435/MW, meaning 100,000 people displaced to produce only 230 MW of electricity, which may also be considered as a bad dam.

i. Loss of Natural Habitat: Hectares of critical natural habitats that would be lost due to inundation and other project components need to be examined. World Bank's Natural Habitat Policy for hydro-electricity projects ensured no significant loss or degradation of critical natural habitats.

j. Loss of Fish Species Diversity: Fish species diversity in the dam, reservoir and downstream zone need to be looked into. Generally, lowland rivers in warm (tropical or sub-tropical) climate have a high diversity of native fish and other aquatic organisms, while small rivers in cold (tropical highland or temperate) climate have relatively low diversity. Large, lowland rivers are also more likely to have significant seasonal fish migrations, which are blocked by many dams.

k. Loss of Cultural property: An indication of the cultural significance of the area to be inundated is the number of cultural objects (archaeological, historical, paleontological, or religious) or sites to be affected. Such cultural property at the project site to be salvaged.

Dam Failure

Hundreds of dam failures have occurred throughout U.S. history. These failures have caused immense property and environmental damages and have taken thousands of lives. As the nation's dams age and population increases, the potential for deadly dam failures grows.No one knows precisely how many dam failures have occurred in the U.S., but they have been documented in every state. From Jan. 1, 2005 through June 2013, state dam safety programs reported 173 dam failures and 587 "incidents"-episodes that, without intervention, would likely have resulted in dam failure.

In 1975 the failure of the Banqiao Reservoir Dam and other dams in Henan Province, China caused more casualties than any other dam failure in history. The disaster killed an estimated 171,000 people and 11 million people lost their homes. In 2012 a dam in northern state of Rio de Janeiro, Brazil failed forcing thousands of people from homes.

Overtopping of a dam, is often a precursor of dam failure. National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for approximately 34% of all U.S. dam failures. Foundation defects, including settlement and slope instability, cause about 30% of all dam failures. Another 20% of U.S. dam failures have been caused by piping (internal erosion caused by seepage). Seepage often occurs around hydraulic structures, such as pipes and spillways; through animal burrows; around roots of woody vegetation; and through cracks in dams, dam appurtenances, and dam foundations.[15] There is a growing trend among the hydropower engineers for undertaking measures on dam safety.[16]

[15] Visit Association of State Dam Safety Officials (info@damsafety.org); and Wikipedia on "Dam Failure". The ASDSO (Association of State Dam Safety Officials) Dam Failures & Incidents Committee (DFIC) in the US has a mission

Myths about Dams

There are myths surrounding a hydro dam. It is said that hydropower is the cheapest, clean and environment-friendly. The argument regarding hydropower is cheap is a myth. It is cheap to produce hydroelectricity, once the dams are built. But dams are hugely expensive to build and their costs are usually far higher than estimated. The WCD found that on average dams end up costing 56 percent more to build than predicted. Climate change is expected to increase the frequency and severity of droughts, reducing hydropower production. When these factors are considered, hydropower is frequently a very costly form of power generation. There is another argument that hydropower is the cleanest. Hydropower dams cannot be considered a clean source of electricity because of their serious social and environmental impacts. In addition, reservoirs emit Methane gas (CH_4) gas- a potential GHG due to rotting of flooded vegetation, aquatic plants and organic matter flowing in from upstream. Emissions of carbon dioxide and methane are particularly high from reservoirs in the lowland tropics. In some cases, reservoirs may have a greater impact on global warming than similar-sized thermal power stations.

It is said that dams control flooding. Dams can stop regular annual floods but often fail to hold back large floods. Dams provide a false sense of security. When a large flood occurs, damages are devastating. Between 1960 and 1985, the US government spent $38 billion on flood control, mostly on dams. It is further said that dams reduce hunger through agricultural practices. The benefits of large dam-and-canal irrigation schemes have been overstated. These schemes are invariably mismanaged and waste huge amounts of water. They frequently destroy huge tracts of formerly fertile lands through salinization and water logging. The construction of reservoirs and canals itself consumes large amounts of fertile land. Irrigation schemes are typically used to produce crops for agribusiness and export rather than for local consumption, as only large producers can afford to pay for the water.

It is said that hydropower is a green energy. Recent scientific data disclosed that methane emissions from big hydroelectric dams in the tropics outweigh the benefits that this form of renewable energy provides.

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to assist the states to improve the practice of investigating/learning from dam failures and incidents.

[16] See Bradlow, Daniel, D., 2002, *Regulatory Frameworks for Dam Safety: A Comparative Study* (Law, Justice and Development Series).

Researchers at Brazil's National Institute for Space Research calculated that the world's largest dams emitted 104 million tons of methane annually and were responsible for 4 percent of the human contribution of GHGs to climatechange[17].

Alternatives to Hydropower

Viable alternatives to dams do exist, and are frequently more sustainable and cheaper. The most important alternative is to improve the efficiency of existing water supply and energy systems. This may involve reducing leaks in water pipes, retrofitting power plants and irrigation systems with modern equipment or reducing losses in power transmission lines. Another simple and economical option is to reduce the demand for water and energy. This can include recycling, shifting to less water-intensive crops and encouraging the use of more efficient electrical appliances. These options can diminish the need for new or existing sources of supply. When efforts to conserve resources and improve the efficiency of existing power plants are not enough to meet growing demand, renewable energy supply options should be considered. Renewable options include efficient and sustainable biomass, wind, solar, geothermal, and eventually ocean energy sources and fuel cells. Wind power is one of the fastest growing renewable energy options. The cost of wind power in good locations is now comparable to or cheaper than that ofconventional sources.

Some estimate that 10 percent of the world's electricity could be supplied by wind power by the year 2020. Solar energy technologies are coming down in price and have huge long-term potential. Small-scale decentralized options have the biggest potential for supplying water and power to rural communities. Rainwater harvesting and micro-hydro dams are easier to implement cost less and have lower environmental impacts than large-scale infrastructure. The construction of small damsto impounds rainwater in India's desert state of Rajasthan hasrecharged groundwater supplies and increased food securityand incomes for hundreds of thousands of farming families. In some places, rubber dams are being used to generate hydropower, relatively smaller in size, which are manageable during onrush of flood water.

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[17] See, *International Rivers* Features, "Drowned Tropical Forests Exacerbate Climate Change", 11 September 2014; also see, "Methane Blow-Holes, Sign of Runaway Climate Change?" 2 August 2014; "Is Renewable Energy Really Green",*FORBES*, 24 September 2014; and "How Hydropower Contributes to Climate Change", *Ecowatch,* 29 October 2014.

Dam Decommissioning

Dams do not live forever. A dead or dying dam may have silted up, stopped producing electricity, or become increasingly unsafe, at a point, it may be a candidate for removal. Not only for safety reason, but also for decimation of fisheries, activists demand removal of dams. Although, dams have been found unsafe or destructive of fish habitat in many parts of the world, few major dams have yet been removed. The engineering of dam removal is still young and untested, and the cost of dam-removal is still ignored when construction costsare estimated.

Momentum is gaining ground to remove age-old dams found to be ineffective or prohibitive to run economically and to restore the rivers they impounded. Around the world, some 5,000 large dams are now more than 50 years old, and many more reaching their half century is increasing. The average age of dams in the US is now around 40 years. Over 450 dams have been removed in the US alone, with some of the largest being hydro dams.[18] According to ICOLD's 1991 congress, "in the future, attention and activity (will) be more shifted from the design and construction of new dams to the restoration of the structural and operational safety of existing dams"[19]

Dam decommissioning has recently been forced into the agenda of an unwilling hydropower industry in the US. More than 500 of the 50-year license given by the US Federal Energy Regulatory Commission (FERC) to private hydro dam operators expire between 1989 and 2004. Sediment removal is a major consideration in dam removal. It was found that the cost of sediment removal in some cases was 181% of cost of building equivalent new hydroelectric power plants. Removal costs are typically 5 to 50% of construction costs. Let the river erode the accumulated sediments, works better. There is some evidence that hydro dam removals are getting costlier.[20]

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[18] Visit Association of State Dam Safety Officials (info@damsafety.org); and Wikipedia on "Dam Failure". The ASDSO (Association of State Dam Safety Officials) Dam Failures & Incidents Committee (DFIC) in the US has a mission to assist the states to improve the practice of investigating/learning from dam failures and incidents

[19] McCully, P., 1996, *Silenced Rivers: The Ecology and Politics of Large Dams,* Zed Books, London, cited by International Commission on Large Dams.

[20] United State Society on Dams (USSD) has established a "Committee on Dam Commissioning" to act as a forum where members and interested people can discuss issues related to decommissioning of dams and to prepare a "guidelines" for possible national use. Among the issues to be considered for dam decommissioning, they have suggested that beside economic,

Revisiting the Kaptai Dam, Bangladesh

Kaptai Hydro electricity project commissioned in 1962 with a capacity to generate 230 MW of electricity/day is the lone hydro project in Bangladesh. A dam of 666 meters long and 43 meters high with 16 spillways over the river Karnaphuli inundated an area of 650 sq km covering 54,000 acres of plough land (40% of cultivable land) of the Chittagong Hill Tracts. The objectives of the project were to generate electricity; to provide irrigation and drainage; to ensure riverine communication; to cultivate fisheries; to ensure flood control; and to transport harvested forest resources. Around 100,000 (mostly *Chakma)* people were displaced by the reservoir. They were resettled in the inferior and infertile land in the north with poor or no compensation package. Local communities, particularly the indigenous communities were not consulted.

Presently, the project is suffering from decreased electricity production; decreased fisheries yield; navigation disrupted for 5 months; siltation of the lake causing flooding; flash floods disaster; and decreased fringe land cultivation. The country presently generates 5735 MW (Day Peak); 6676 MW (Evening Peak) against a growing demand of 6270 MW/day. PDB's official website says that the country-wide load shedding was only 202 MW (with 66 MW in Dhaka) on 20 August 2014[21]. Based on 7% GDP, anticipated peak demand would be 10,283 MW in 2015; 17,304 MW in 2020; and 25,199 MW in 2025.[22] Even, Kaptai produces a full capacity of 230 MW/day it would hardly contribute 3% of the total generation of the country (20 August 2014). Question arises, how long we are to harness such a negligible quantity of hydro-electricity at what socio-economic and environmental costs?

Decommissioning of the Kaptai Dam?

If not today, may be not in too distant future, the policy makers of the country may decide to dismantle this age-old hydro dam (commissioned in 1962) having insignificant contribution to national economy in return of high socio-economic and environmental costs. This is the lone hydro project of the country, which saw exodus of 100,000 people and the displaced

environmental considerations are to be looked into. They have detailed out a "Dam Decommissioning Process". For details, visit www.ussdams.org.

[21] Ref: Bangladesh Power Development Board website (www.bpdb.gov.bd) as visited on 22 August 2014. Official site of BPDB is rather conservative in admitting on load shedding. Might be the issue of "system loss" due to unauthorized connections has not been accounted for.

[22] See,Bangladesh Power Development Board, *Power System Master Plan (PSMP)-2010.*www.bpdb.org

people, mostly local indigenous community, were never compensated or rehabilitated with proper livelihood. Their displacement ignited the two decade-oldinsurgency, which took many lives and warranted stationing of Bangladesh Army at a high cost as of today. Attempts to rehabilitate the homeless, river-erosion affected non-hill people from the plains turned abortive.

A large area of 650 sqkmscontinued to remain inundated taxing on the available 40% of the scarce cultivable land of the area-may not be acceptable for long. Furthermore, a huge shallow area in Baghaichhari in the north kept water logged in order to allow regular water supply to run the turbines round the year. Meanwhile, the Kaptai Lake continued to get silted over the years and during winter, water recedes to a point threatening the project to shut down. Fisheries yield falling down, navigation gets disrupted five months a year, fringe land cultivation becoming difficult due to arbitrary maintenance of the faulty "Rule Curve" by the project officials.

Conclusion

Dams continue to attract the policy planners in the government for harnessing potential hydro power in order to meet increasing demand for energy, as it is environment-friendly and the cheapest source of energy. Considering the environmental and social impacts, large dams should be avoided. The key indicators are to be strictly followed in order to get benefits out of a dam. In every development efforts there are some damages. We may go for dams causing minimum damage to the environment. Again, the question comes, how much damage is acceptable? How much damage can offset the benefits? It's true that all dams are not bad. There are good dams as well as bad dams. Prior to undertaking of hydro-projects, our planners are to seriously examine the site selection criteria for such projects.

As we frequently encounter adverse effects of dams due to displacement of people and related compensation and resettlement, question arises, is it worth to go for such a project considering unacceptably high environmental damages? Both borrowers and lenders are to re-examine this question in the coming days. Against the backdrop of unacceptably high socio-environmental costs due to construction of hydro projects worldwide, it is high time that we explore other sources of energy, especially renewable energy like, biogas plants, solar energy, wind and wave energy as well as promote fossil fuels, like natural gas, which is environmentally more benign than petroleum or coal.

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