HYDROPOWER DEVELOPMENT IN MEKONG RIVER BASIN

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Given a substantial importance of international river basins for providing almost 60% of global freshwater, accommodating around 42% of the world population, spanning 151 countries, producing roughly 54% of the global river discharge, development on international river basins is perceived as an important issue in bilateral or multilateral relationship of reparian states as developments by one reparian may affect the opportunities of developments by other ones. Hydropower development continues to be a "difficult-to-address" challenge for the regional cooperation and situation with the Mekong River and 6 riparian countries including China, Myanmar, Thailand, Lao DPR, Cambodia and Vietnam proves that. Focusing on the hydropower development problems in Mekong River Basin, regulation mechanisms for harmonization of using energy resources, analysis of confrontation between hydropower supporters and opposers, this research answers two significant questions: how hydropower influences on regional cooperation in the Mekong River Basin and why the reparian states can't find compromise on using hydropower potential of the Mekong River. Politization of "water question" actualized problems not only regional but global security too. Only the establishment of an effective mechanism for managing the water resources of the Mekong River, which all reparian countries would support, could solve the complex hydropower development problems, but this is hampered by objective international contradictions between states, behind which national interests are hidden.

Keywords: Mekong River Basin, hydropower development, regional cooperation and non-traditional security, reparian states, confrontation

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Mekong River Basin (MRB) spans over a 795,000 km^2 area along more than 4,800 km (the river's length varies in documents) within 6 countries including China, Myanmar, Lao DPR, Thailand, Cambodia and Vietnam and home to around 70 million people from 100 different ethnic groups.

In accordance with the Trans-boundary Freshwater Dispute Database, water-related events at international rivers follow one of three dimensions: confliction, neutrality or cooperativeness. It is found that cooperation is overwhelmingly pervasive in the Mekong River Basin.

There are lots of researches dedicated to key problems in the Mekong Basin, hydropower aspects, dam-building, hydropolitics.

Specifically, the main literature can be divided into four groups. First, hydropower development has been taking place in an increasing speed in the entire basin [26]. Dam-building by one reparian may affect the opportunities and benefits offered by the shared water resources to others.

Second, construction of hydropower dams for electricity generation is beneficial to energy security and economic development [17; 5], but unbeneficial to food security, ecological security, human security and water security [20].

Third, the net economic benefits of planned hydropower projects on the Mekong River system including the mainstream and its tributaries are negative in comparison with the social and environmental impacts [1]. It is unfortunate that scientifically-sound evidences of repercussions and strong criticism by other downstream countries including contestations of the hydropower dam-affected population [8] have not been capable of getting some upstream countries change their minds with their hydropower development schemes, even when physically daming and diverting the flows are explicily impacting their own residents in terms of food security and livelihood opportunities.

Fourth, there are several studies on hydropolitics on the Mekong River Basin [23].

The purpose of the article is to analyse why hydropower development is a "difficult-to-address" challenge in the regional cooperation. There are two key questions of the research: firstly, how

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hydropower impacts on regional cooperation in Mekong River Basin; secondly, why the reparian states can't negotiate on using hydropower potential of the Mekong River.

The study is based on (a) specialized literature review on hydropower and political aspects of regional cooperation in Mekong River Basin, (b) data analysis from Asian Development Bank, WLE database, Mekong River Commission (MRC) and others, as well as (c) studies programs materials and reports (Danish Hydraulic Institute, International Finance Corporation, International Centre for Invironmental Management, etc.).

DEVELOPMENT IN MEKONG RIVER BASIN

The estimated hydropower potential of the Lower Mekong River (LMR) is 30,000 MW, of which less than 10% has been developed, all of it on Mekong tributaries [16, p. 19]. This includes 13,000 MW on the Mekong's mainstream and the remaining on the tributaries, of which 13,000 MW are in Lao DPR, 2,200 MW in Cambodia and 2,000 MW in Vietnam [11, p. 224]. The Upper Mekong River (UMR) has a little lower hydropower potentials at 28,930 MW [15, p. 58]. Despite a hydropower boom in the world in the 1970's, the Mekong River remained nearly untapped.

The physical construction of hydropower dams in the mainstream of Mekong River is generally later than other international rivers. Actually, the history of hydropower development in the UMB was very early, dating back 1950's when Hydro China Kunming Engineering Corporation (HCKEC) began site investigations. From the initial surveys to physical construction took several decades due to political and economic stability in the basin.

After a series of investigation, China considered Langcang River (upper section originating from and running through China) as one of ten key energy development bases in 1979. The first hydropower dam in the UMB, Manwan, was built in 1986. More than 30 years later, the mainstream hydropower projects total 26 including 7 completed, 6 under construction, 11 proposed and 2 cancelled. China also completed 52 dams on the tributaries. Other 6 and 4 dams are being built and planned. The total installed capacity of all dams in various stages of development is 31,696 MW.

In contrast to the upper mainstream, no physical hydropower dams have been constructed on the lower mainstream despite many hydroelectric infrastructures in different stages of development in its tributary system at the turn of the 20th century. It is true to perceive that the Lower Mekong River nearly remained undammed before 2000's. However, this general perception of a pristine Mekong has been rapidly changing as water infrastructure projects have materialized throughout the basin in recent years [26, p. 4030].

This change is mainly attributed to hunger for electricity to serve industrialization, population growth and modernization including electrification in the LMB. Between 2010 and 2035, the demand of electricity is projected to double, concentrated heavily in Vietnam and Thailand [3], motivating the LMB countries to plan and construct hydropower infrastructures of different installed capacity on both the mainstream and its tributary system.

There were approximately 17 hydropower projects in operation in the LMB with a capacity of less than 1,400 MW in 2001, additional 40 hydropower projects were built to provide a generation capacity of 6,442 MW during the period from 2002 to 2015 [19, p. 13]. As evaluated by Mekong River Commission (MRC), Mekong has become one of the most active regions for hydropower development in the world [18, p. 21]. The number of hydropower projects in the MRB totals 468, including 329 commissioned, 41 under construction, 79 planned and 44 proposed.

CONFLICTS OF NATIONAL INTERESTS RELATED TO HYDROPOWER DEVELOPMENT

Water resources provided by the Mekong River are normally described as common pool resources. Construction of hydropower dams on the MRC created a dilemma about using the common pool resources. The naturally-inequitable distribution of water resources and advantageous upstream position give some countries favorable conditions to turn water into electricity at the expense of the downstream countries in terms of food, water and environmental security.

A common priority set by China, Lao DPR and Cambodia is to exploit hydropower potentials of Mekong riverine system in maximum for economic gains. Thailand not only needs to buy much hydropower from neighbors in support of their growing economy but also thirsts for diverting water flows from the Mekong River to smaller rivers like Mun-Chi River and Loei River for irrigating much drier Northeast region of this country in an attempt of forming here an extensive irrigated agriculture for many decades.

Thailand's water diversion plan worries Cambodia and Vietnam, two downstream countries for exacerbating water shortages in the dry season, particularly in drought years. Vietnam is the most

vulnerable to disastrous impacts caused by dam-building and water-diverting but they have been actively harnessing hydropower potentials on the key tributaries of Mekong River since 1990's. Their dam-building have already negatively impacted downstream regions in Cambodia. In turn, Cambodia-proposed mainstream dams add more troubles to food security, water security and environmental security for Vietnam.

A current problem challenged the basin is that most Mekong countries lack highly developed governance mechanisms for dealing with or fully grasping the interaction of conflicting priorities [23, p. 14].

All the mainstream dams commissioned or being constructed by China and Lao DPR are either mega-large or large dams, ranging from 5,850 MW (Nuozhadu in China) to 256 MW (Don Sahong in Lao PDR). Nevertheless, decisions to build the dams are all unilateral based on the dam-building states' calculation of national interests with little attention for deteriorative impacts possibly endured by others. These include a desire for revenue and the political and other benefits of rewarding power stakeholders [23, p. 15].

Even though the MRC's procedures of prior notification, consultation and agreement have been in place since 2003, there has been no consensus from LMB countries for construction of any hydropower dams on the lower mainstream segment, let alone those on the Lancang River. Deep concerns by the riparian governments about potential severe repercussions of two Lao DPR-proposed mainstream dams raised in the consultation process were absolutely neglected by the host country. Daovong Phonekeo, Director General of Laos' Department of Energy Policy and Planning, told Voice of America: "For the development of the Mekong River, we do not need consensus!"*

It was said amid the backdrop that the three National Mekong Offices of Cambodia, Vietnam and Thailand opposed to Lao DPR's plan to build the second mainstream dam, Don Sahong, in January 2015. Instead, they continue to insist that they only need to notify other reparian countries about their plan to build the dam. Reportedly, the construction of Don Sahong commenced before this country conducted the MRC-required consultation process. This is a typical example for "action out of self-interest" in the basin.

Relations between China as the furthest upstream state and Vietnam as the downstream state are inherently complicated due to ideological difference during the Indochina War and Vietnamese occupation of Cambodia, Chinese attack of Vietnamese border and territorial disputes in South China Sea.

Dam-caused impacts on nutrient sediment-loaded flows affecting the productivity of Mekong Delta, a "rice-bowl" of Vietnam, and fishery, including wild capture and aquaculture strains Sino-Vietnam relations. Around 18 million of Vietnamese in the Mekong Delta are vulnerable to food insecurity and loss of livelihoods as consequences of dam-building not only in the upper but also lower segment of the mainstream.

Lao DPR's intransigent attitude towards their hydropower development plan on the Mekong mainstream is much likely to undermine the traditionally important political relationship between Vietnam and Lao DPR [7; 23]. The MRC regulates that reparian countries should notify other countries about their dam-building plans on key tributaries. Before that, downstream countries did not know anything about dam-building upstream of all tributaries.

Until a terrible flooding in north-eastern province of Ratanakiri in Cambodia, locating downstream of Se San River, a main tributary of Mekong River, in 2000, Cambodian was fully aware that Vietnam had been constructing 720 MW Yaly Falls Dam upstream since 1996. Many surveys to the flood-affected region reported a strong contestation from local residents with Vietnamese authority for dam-building [8]. Christopher O'Hara & Niels Selling were pessimistic when Lao DPR set to start the construction of the 1260 MW-Xayaburi Hydroelectric Plant, that dams in the Mekong River clearly illustrate the future of conflicts that where natural resources will be more and more heavily contested and climate change, economic growth, and national interests intermingle in a potentially hazardous mix.

The downstream countries' reactions are merely vocal and no armed conflicts or severe political tensions caused by the building of large or mega-large dams have been occurred. The Mekong states continue to cooperate together for sharing benefits in power trade and power infrastructure development through the regional cooperation mechanisms, particularly in power trade [24]. Through the allocation of a huge amount of funding in forms of concessional loans, grants and aids to a wide range of projects in water management, energy, transportation etc., China desires to strengthen economic ties with the reparian states, expand its influence and build up China's image of "peaceful rising" in their eyes.

* Hutt D. China flexes its control on the Mekong. January 11, 2018 - http://www.atimes.com/article/china-flexes-control-mekong

CONFRONTATION BETWEEN HYDROPOWER SUPPORTERS AND OPPOSERS

There is a "seemly endless" confrontation between "hydropower supporters" and "hydropower opposers" in the MRB. Supporters argue that economic development in the war-torn and poverty-characterized basin necessitates stable "clean" hydro-electricity supply exploited from untapped Mekong River. Electricity consumption has increased significantly over the last decades in the basin, particularly by China, Thailand and Vietnam. In the UMB, the Chinese mainstream dams alone, taken together, produce some 15,000 MW of electrical power, enough to power a city of between 1 to 2 million people [5]. In the LMB, if built, the 11 mainstream dams would generate roughly 15,000 MW of power, projected to account for 8% of regional demand by 2025. Gross incomes from hydroelectric generation vary from documents to documents. Gross income from hydropower generation might total $3,7 billion/year [22, p. 179].

The updated net present values (NPV) of 11 dams scenario in the MRC's assessment of basin-wide development scenarios - Basin Development Plan, Phase 2 (BDP 2), conducted in 2011, far outweigh negative impacts at $33,4 mln.

Economic benefits as demonstrated by the pro-hydropower group are short-termed and incomparable with environmental and social impacts. Construction of dams on the Mekong River's mainstream will unavoidably reduce fish biodiversity and productivity [6, pp. 9-10].

By 2030, if 11 dams are built in the LMB, an annual loss of 550,000 to 880,000 tons of fish is to be expected compared to the situation in 2000, and a specific loss of around 330,000 tons is forecasted compare to the situation in 2030 without mainstream dams [4, p. 93].

Hydropower dams built from Chiang Saen (Thailand) to Kratie (Cambodia) in the LMB convert 55% of Mekong River into reservoirs, affecting the natural habitats of fish species. At least 41 mainstream species out of 262 species in the ecological zone upstream of Vientiane are threatened by a severe alteration of their habitat [4, p. 94].

For a long period, a focus of scientific communities and media is directed to mainstream dams on the MRB but as demonstrated by [12, p. 5610], construction of all planned tributary dams, nearly all within Lao PDR national borders, would have graver impacts on fish biodiversity basin-wide and on the Cambodian and Vietnamese floodplain's fish productivity, than the combined impact of the six upper main-stream dams on the lower Mekong River, including Xayaburi.

To be specific [12, p. 5610], found that individually, the dams with the largest impact on fish biomass are Lower Se San 2 (LSS2, 9.3% drop in fish biomass basin-wide), Se Kong 3d (2.3%), Se Kong 3u (0.9%), and Se Kong 4 (0.75%).

Dam builders believe that several technical measures like fish passage technologies may mitigate negative impacts caused hydropower dams on fish migration. When building the first mainstream dam on the LMR, Xayaburi Dam, a state-of-the art 500-meter long and 18-meter wide vertical-slot fish passage ladder is claimed to allow migrating fish to safely migrate up and down the river. The ladder has many slots featuring different water speed to help different types of fish to swim through.

Lao DPR continues to counting on the passage technology for combating with a strong criticism about blocked fish migration route when constructing Don Sahong dam. Although it is a relative small dam in comparison with other dams on the mainstream and tributaries but it is built at a very sensitive location (Sahong Channel) through which around eighty six percent of fish migrate twice a year to feed and spawn. Anuparp Wonglakorn, a Deputy-Managing Director of operation and maintenance from Xayaburi Power Co Ltd which is owner of Xayaburi Dam Project is very confident with the fish passage technology, saying «The fish passage is designed specifically for Mekong fish. And we're confident it will be effective» [21].

In contrast, fishery experts doubt that system of artificial streams and troughs are able to let fish migrate from one side to others. Fish passage is not a completely new concept as it has been set up in many transnational rivers around the world but Mekong migration fisheries are diverse in species, dimensions and migration habits. Mekong migratory fishes vary in sizes from few centimeters to a few meters, meaning that the fish passage is able to let some of species with the certain sizes swim through.

As doubted by [9, p. ES 4], it is likely that even the best available fish passage technologies may not be able to handle the massive volume of fish migrations, which during peak migration periods can reach up to 3 million fish per hour, and the diversity of migration strategies that characterize the hundreds of fish species in the basin. Ian Baird, a professor of geography at the University of Wisconsin in the U.S, expressed his concern about ineffectiveness of fish passage technology in Mekong River: "There's no telling if it will work. There's not one instance of a fish passage ever working in this region" [10].

Other reasons deepening the environmentalists' concerns include (i) there are currently no options

for facilitating the downstream drifting of larval and poor swimming juvenile stages over the extended distances (several km) experienced in most Mekong mainstream reservoirs and (ii) 'fish-friendly' turbines are not available [9, p. 77].

Dam builders normally highlighted job-creation for local people at dam-building regions as remarkable social benefits of hydropower projects. An amount of $7.9 bln in wages is expected to be generated from Lower Mekong mainstream dams as expected by the Strategic Environmental Impact Assessment conducted for all the proposed mainstream dams in LMB. But this study also indicated that "much of the labor (especially for skilled and semi-skilled jobs) is likely to be imported from surrounding countries other than the host countries (especially Viet Nam and China) [14, p. 53].

Environmental and social impacts far much outweigh economic benefits generated by hydropower projects. As calculated by [9], if 11 hydropower dams are built in the Mekong lower mainstream, annual fishery and farming losses would amount to over 15,8 trln VND ($760 mln) in Vietnam and loss due to adverse impacts on fisheries and farming could exceed 1.8 trln Cambodian Riel ($450 mln) in Cambodia.

Researchers from the Natural Resources and Environmental Management Research and Training Center (NREM) from Mae Fah Luang University, Thailand, have recently demonstrated that the net economic impact of planned hydropower projects on the Mekong River and its tributaries is negative (minus $7,300 mln) on conservative, updated data for project economics, fisheries and social & environmental mitigation costs. There is a big difference in terms of hydropower NPV as the authors considered three decisive factors of low capital investment data, high electricity price and the BDP2-used flawed electricity trading model. The NREM Update also recalculated negative impacts of hydropower dams on fishery capture based on a higher fish price and included two elements of reduced sediment and nutrients loading, completely-ignored in the BDP 2, into their analysis. Both NREM and MRC's BDP2 used the same rate of discount at 10%.

Hydroelectricity is a very promising source of stable incomes for developing countries like Lao, which are wishing to be excluded from the "low-income country" status and formulate the credibility of a "clean energy producer" for climate change mitigation.

Economic gains of hydropower generation are easily calculated in monetary terms with the gross income of electricity generation of around $3,7 bln each year to be contributed to some states' national budgets in support of poverty reduction-driven socio-economic development programs. However, these gains are definitely incomparable with accumulative and erratic impacts, causing non-traditional insecurities related to food, water, human and ecology in the entire basin, particularly on downstream reparian countries, if all the proposed hydropower projects go ahead without due care.

Environmentalists and development agencies alike commonly suffer from a certain myopia, whereby they tend to come at problems from only one angle and one objective and suggests that decisions about hydropower should always be framed as trade-offs among multiple objectives, for example trade-offs between fish biodiversity and energy.

At present, hydropower development continues to challenge the regional cooperation, thus requiring the MRC to evolve itself for providing long-term cooperation over shared water resources.

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