Three Gorges Dam Project: An Introduction

Pranav Acharya

Project background

International advocates of hydropower have long argued that hydroelectric dams are a perfect example of 'renewable' or sustainable development, largely because of the use of water as their fuel and the fact that dams employ technologies that are non-greenhouse gas emitting (Sullivan 1999). In China, the government has adopted the hydropower development policy, in part, to stem the country's enormous dependence on coal and to avoid substantial increase in oil imports. The Three Gorges Dam Project (TGDP) is one of the several hydroelectric projects under construction that are touted as long term solutions to China's increasing energy and agricultural needs.

The concept of building a much controversial and optimistic dam across the world's third longest river, Yangtze (6300 km) in China's Hubei Province had its beginnings in the early 1900s, when the Chinese Supreme leader Sun Yat Sen suggested to build a dam at the Three Gorges in 1919. The advertised objectives of TGDP, apart from electricity production, is providing long-term solutions to the perennial problem of flooding on the Yangtze valley, which has caused the loss of thousands of lives and property over the past century and to improve navigation conditions in Yangtze river. For example, the major floods in the river in 1931 and 1954 caused 140,000 and 30,000 deaths, respectively, and disrupted the entire economy of the region for some time (ibid.:302-303).

The construction of the dam began in 1994, after the TGDP was voted on and passed by the National People's Congress in April 1992. The government has planned the construction work in three phases, starting from 1993 with expected completion in 2009.

After the completion, Three Gorges will be the world's largest dam ever built and the project will have three major components: a dam, a hydropower station and navigation facilities. The 181m high and 1.9 km long dam will create a reservoir of 1084 km^2, with an average width of 1.1 km expanding over 600 km. The reservoir will contain 39.3 billion cubic meter water and will be able to generate 18.2 million KW power. The official estimation of the project cost is about US$ 24.65 billion, which is debatable because the unofficial estimates claim that total costs will rise over US$ 75.0 billion.[1]

Proposed alternatives

From the 1950s, some alternatives to TGDP were considered, when the Chinese Government formally adopted the concept for flood control. Construction of smaller dams across the river, as an alternative of such large dam was discussed in the 1950s, arguing that China could not afford such a large scale and costly project. A small attempt was also taken to build smaller dams on Gezhouba, but was stopped because of technical problems and cost overruns. In 1980s also, alternatives of damming upstream and tributaries and lowering the dam height were proposed to mitigate the effects of inundation and resettlement to some extent. Finally, after the study on 15 alternative sites, the dam site for TGDP was finally determined at Sandouping because of its stable geologic condition and other favorable factors.[2]

However, the tragedy with the alternatives was that they were never taken seriously nor considered officially. Instead of looking for viable alternatives, concerns were raised addressing technical, social and environmental issues of TGDP.

Baseline studies before the project

The preliminary studies of TGDP started in 1950, when the Chinese Academy of Science began to study some of the environmental issues associated with the project. Preliminary findings were included in The Report on the Key Points of the Yangtze Valley Planning and in The Report on the Key Points of the Preliminary Design of the Three Gorges Project. The environmental issues began to take on high concern after the establishment of Yangtze Valley Water Resources Protection Bureau in 1976, which came up with an Environmental Impact Statement (EIS) of the TGDP in the 1980s. In addition, in 1984, the State Science and Technology Commission formally commissioned a study called The Studies on the Environmental Impact of the Three Gorges Project and Its Countermeasures, as one of the major components of the project's scientific research program. The environmental studies continued until 1991 through different agencies and the EIS was finished in December 1991, and then pre-examined by the Ministry of Water Resources in January 1991 and finally approved by National Environmental Protection Agency in February 1992.

In summary, the principal findings of the feasibility and environmental studies of TGDP concluded that the project objectives of flood control, hydroelectric power and navigation were significant benefits compared to some adverse environmental and social impacts.

Anticipated benefits

Hydroelectric power, flood control, navigation and tourism are the major sectors in which TGDP will benefit China. When completed, the dam will provide 85 billion kilowatt hours of electricity, approximately 10% of the country's total capacity as of 1993, thereby eliminating the annual burning of 40-50 million tons of coal in steam power plants (Sullivan 1999:303). This will help significantly in reducing the emission of green house gases like sulpher dioxide (SO_2) and carbon dioxide (CO_2), thus nullifying some effects of global warming.

It is projected that, normal pool level of dam with flood storage capacity of 22.1 billion m^3, will lessen the frequency of big downstream floods from once every 10 years to once every 100 years. This will help in saving the lives of 15 million people and protecting 1.6 million hectare of agricultural land from flood.[4]

The navigation capacities on the river will be improved and the economic benefits will include a decrease in shipping cost on the river by upwards of 40% and the ability of 10,000 ton ships to ply the smooth waters of the reservoir to inland cities, most notably Chongqing, Sichuan (Sullivan 1999:303).

In addition to these, the world largest man made dam structure, together with its landscape, will attract more tourists, which will ultimately uplift the economy of the area. This will also serve as a magnate for investment, especially in industry, in a region that has lagged behind the rest of the country.

Adverse consequences

Despite of its several positive impacts on Chinese economy, the TGDP has significant adverse impacts on the social and biophysical environments.

The costs of resettlement and environmental degradation will be enormous. Resettlement of 1.3 to 1.9 million people and the inundation of about 30,000 ha of river valley land in a rich orange growing region would cost more than one third of the total project cost. Resettlement will also create social disintegration and if it fails, many people will become reservoir refugees. In addition, the TGDP will, either completely or partially inundate two cities, 11 counties, 140 towns, 326 townships and 1,351 villages, which will create the huge problem of garbage, raising serious health concerns.[5] The reservoir will also submerge many archeological and cultural sites of national and global importance and valuable monuments of ancient history will be lost forever.

The dam will alter the natural environment, and the ecological effects will be devastating, across a region of about 58,000 km^2. Construction of the dam will affect the riverine ecosystem and the reservoir will create as many as 100 new islands causing significant habitat fragmentation, which will seriously affect many species of flora and fauna. Heavy logging and deforestation will further complicate the problem of habitat and biodiversity loss.[6]

In addition to these, the TGDP will affect endangered animal species, some of which are native to Yangtze basin. They include the giant panda, Chinese tiger, Chinese alligator, the Yangtze dolphin, the Chinese sturgeon and the Siberian crane.[7]

Finally, the TGDP will also cause the increase in local water pollution, increase in sedimentation deposition due to increased deforestation and soil erosion, and the potential hazards of earthquakes because of sudden storage of a heavy water load.

Ecological monitoring

Systematic tracing of environmental and ecological monitoring in the TGDP is required to mitigate the adverse ecological impacts. A properly implemented Mitigation Management and Monitoring Plan (MMMP), also known as an Environmental Management Plan (EMP), during construction and operation phase of the project is the backbone of ecological monitoring. The MMMP should formulate an authorized and comprehensive monitouring system for both biotic and abiotic components of ecology in the area before carrying out the field monitoring.

Long term ecological monitoring includes hydrological characteristics of the river (water flow, period, etc.), sedimentation in the reservoir (sediment load, deposition, etc.), water quality (dissolved oxygen), transparency, temperature, etc.), air quality (temperature, pollutants, etc.), aquatic biota (richness, migration patterns, adaptation, etc.), terrestrial flora and fauna (adaptation, effects of habitat fragmentation, isolation, etc.), and the related micro-ecosystems of tributaries and watershed.

The monitoring of these parameters is extremely important for implementing the proposed mitigation measures in a sustainable way. The ecological knowledge acquired through systematic monitoring will provide information for long term analysis and adaptive mitigation management approach.

Pranav Acharya *is a forestry and environmental professional and associated with Environmental Resources Group (ERG Nepal). The author has worked as an environmentalist for the Nepal Electricity Authority (NEA) and has conducted environmental impact studies and mitigation management assignments on several hydropower projects in Nepal. He left the NEA to pursue a Master of Environmental Management (MEM) degree at the National University of Singapore. The current study was done as an assignment to fulfill the requirements of the MEM course.* *The author acknowledges the Asian Development Bank Japan Scholarship Program for financial support to complete of his studies.*

Corresponding address: pranavacharya@gmail.com

End notes

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