

April 2009

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### Recommended Citation

Chandrasekhar, K. L. and Kothari, D. P. (2009) "Three Gorges Dam - Stochastic Perspective for the Project Planning Issues," *Management Dynamics*: Vol. 9: No. 1, Article 8.

DOI: <https://doi.org/10.57198/2583-4932.1175>

Available at: <https://managementdynamics.researchcommons.org/journal/vol9/iss1/8>

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# THREE GORGES DAM – STOCHASTIC PERSPECTIVE FOR THE PROJECT PLANNING ISSUES

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## *Abstract*

*Yangtze River in China has been playing havoc, for centuries, causing devastation and destruction to lives and property due to the monsoon floods. To arrest this and to improve the living conditions for millions of Chinese, the Government has taken a bold initiative to 'tame' this mighty river with the construction of a 600 feet high dam, spanning over a mile and half, and extending the Dam to a distance of 350 miles upstream to tap 18200MW of Hydro Electric Power. The sheer size of the Dam and the complexity in this Project execution has never been witnessed in the annals of Water Conservancy project anywhere in the World. The unpredictable fall out on account of human relocation from the dam site, and the after effect of floods in the upper reaches of this mighty river enables us to have a stochastic evaluation of the planning process of this Project. This paper examines the complex issues of ecology and mass scale human relocation, and how the Chinese authorities have overcome the stiff opposition from Environmental critics and human rights activists from both within and outside China with a target date for completion of this mega project in 2009. Also the authors feel that India too can emulate China in circumventing World opposition on these issues by opponents for its own mega Hydel- projects.*

## **INTRODUCTION**

The Yangtze River in China with its 4000 miles route from the glacial mountains of northern Tibet, meandering through the mountains of south western China, passing through a 125 miles stretch of spectacular, deep canyons at a

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place called 'Sanxia' ( meaning Three Gorges ), and then widens across Southern China to the East China sea at Shanghai. The three Gorges are: Qutang gorge, Wu Xia gorge ( meaning Witch's gorge ), and Xiling gorge ( this gorge water level has already been raised due to Gezhouba dam, down the present Three gorges Project (TGP) site).

The Yangtze basin has been supporting over 400 millions of people, and is responsible for producing 40% of grain for the Nation, of which chiefly it is rice. On the down side of the qualities of Yangtze lies, its devastating statistics, which are very gory. During this century alone, Yangtze's floods fury have claimed over 300,000 human lives in five flooding seasons besides leaving millions of people homeless.

It was Dr. Sun Yet Sun, who proposed the Three Gorges Dam Project (hereafter referred to as TGP) in the year 1919, followed in the year 1958 by the Chinese paramount leader Mao Ze Dong, who had envisioned the prospect of harnessing this mighty river for the Country's progress and sought Soviet's help to build the TGP. Under Chairman Mao's tenure, TGP got the needed encouragement with the opening up the Yangtze Valley Planning Office, and their primary task was to build a pilot Hydro electric Project on the main channel of Yangtze, 40 Kms downstream at Gezhouba, by raising a 45meter high dam. Thereafter hundreds of study reports were prepared by the Central Chinese authorities to execute the TGP but without any success, either due to stiff opposition within China or very strong international criticism and condemnation for the Project. In 1970, Deng Xiao Ping, the successor to Chairman Mao, brought the required impetus by getting assessed the feasibility of construction of TGP.

Despite this, controversies kept brewing up for the TGP, both within and outside China. And it was not until the quelling of Tiananmen Square demonstrations of June 04, 1989, that Li Peng, who was then the Premier of China gave a concrete shape by giving the 'go ahead ' of the TGP, after subduing all the opponents for the TGP in China. It is widely believed amongst intelligentsia in China, that most of the opponents for the TGP were made the "escape goats" of Tiananmen Demonstrations! The final approval for TGP came from the Chinese National Peoples Congress ( NPC ) on April 03, 1992.

The TGP is expected to be completed in three phases. Phase I from 1993

to 1997 to create diversion of the Yangtze River, Phase II from 1998 to 2003 to fill up the reservoir and to operate first 14 Hydro electric turbines for generation of power and Phase III from 2004 to 2009, completing installation of balance 12 turbines to augment the power to its peak optimum capacity of 18200 MW. By the end of Phase III in this year, 2009, the World is expected to witness a spectacular dam of 600 feet high, one and half mile wide, and 350 miles extent Hydro Electric Dam, which has become the World's largest Water Conservancy Project, never seen in the annals of world's history so far.



Figure 1: Location of Three Gorges Dam

## BONE OF CONTENTION FOR THE OPPOSITION OF THE TGP

The Core issue for opposition to the TGP critics, both within and outside the Peoples Republic of China is the '*belief that the TGP would be nothing less than a social and environmental disaster*'. This concern by ecologists gives us an opportunity to stochastically analyze this issue, from the following four aspects which are also the impediments for the Planning phase of the TGP:

1. Resettlement and relocation of residents in the TGP site area
2. Environmental impact.
3. Efficacy of the Flood control by the TGP
4. The myth of the TGP alleviating the Energy crisis in China

## RESETTLEMENT / RELOCATION ISSUE

According to critics, the TGP was likely to dislodge over 1.3 million of both rural and urban population who are living in the valley area of the Dam's site, from their habitats to accommodate the Normal Pool Level (NPL) height of 175 meters for the dam to store the world's largest water conservancy system for 39.3 billion cubic meters of water. By 2009, over a period of 17 years of TGP construction, 42.7% of rural population and 57.3% of Urbanites from the TGP valley area would have been relocated nearer to and distant parts from the dam site. Compared to other Hydro-electric Projects of the World, TGP has special demographic, social, economic, and political characteristics that differentiate its resettlement policies and approaches (China Three Gorges Project report, 2002).

The critics have been arguing that shortage of enough cultivable land in the new locations will make the rural population more impoverished and the 'well settled' urbanites with their established Industries, will be gravely affected due to lack of infrastructure and other 'marketing facilities' in their new locations.

The critics main arguments for this highly unpredictable issue has been founded on the experiences of two previous 'dams habitat's relocation'. The first being during Yvpo resettlement experience where in the relocated people have been treated like refugees in their own country. The refugee camps where people were relocated into are the already overpopulated cities and towns (Fang et al., 1988). The second one refers to Danjiangkou dam example when 38000 people relocated have put the native population to great discomfort.

Finding a viable cultivable land, in a China, which is very densely populated, adds a great challenge to the Government, and in any Dam construction related relocation affects the society in three ways, viz: economic disaster, human trauma, and social catastrophe (Jhaveri, 1988).

In the case of TGP, a fourth challenge has been loosing of over 10,000 years old historical monuments, apart from the scenic canyons getting submerged in the Gorges dam, which assumes a great Historical significance.

The stochastic reasoning by the opponents is proved wrong with the ground reality. The Wan Zhou city in Chongqing municipality is a testimony of the Chinese authorities resolve and efforts made to rehabilitate majority of these relocated population on account of TGP. The Impoverishment Risks and Reconstruction

model mooted by the World Bank in such large scale displacement and rehabilitation of human population have been amply taken into account by the concerned Counties / towns affected due to TGP.

The survey of the affected region, by going through the research literatures in China and by talking to academicians and affected population in these Counties, suggest that most of the counties / town governments have done their best within the available resources at their disposal to alleviate the problems of the relocated / rehabilitated population. New Schools and Health clinics have cropped up in these locations, apart from a mushroom of schools for the education of Children of the relocated population.

Initially the Chinese authorities planned to relocate most of the rural population of the TGP site in the upper reaches of the valley by reclaiming the land, to make it cultivable. But the floods of Yangtze in 1998, the authorities learnt that reclaiming the land in upper reaches of Yangtze, meant 'deforestation' of the heights surrounding the valley, that causes more deluge due to landslides during monsoon season. Appreciating the gravity of the situation, the Chinese cautiously moved only part of rural population to the upper reaches, encouraging them to do a forestation, while majority of them have been moved to distant places of the Valley area making sure that agriculture / farming becomes their main stay for livelihood. Also the authorities closed down small enterprises, which hitherto polluted the river, in the valley region, discharging effluent into the Yangtze River.



Figure 2: The Three Gorges Dam into its 'finesse'

As for the urban relocation, the TGP authorities ensured that the counties as such with all their industries are moved to distant locations of the TGP valley, taking along with them their old identities of urban living with an avowed policy of making them stable first, and grow richer gradually. At the same time, the resettlement / relocation policy is made to apply adapting to the geographic location of the land and Natural resources available at the new locations for both rural and urban populations.

A point that needs to be borne in mind is that China is still a developing economy rising from the staunch communism, and the scale of rehabilitation / reconstruction cannot be compared to that of developed countries in the world, when such an event occurs.

## ENVIRONMENTAL ISSUES

The chief arguments of those opposed to the TGP were ( Margaret & Graine, 1990 ):

- Over 75 million people who are living all along the Yangtze River, will lose their livelihood due to the damage that will be caused by the TGP to the ecosystem.
- Due to the Dam's built up, the land use pattern will change
- There may be endangerment to Asian Waterfowl, Siberian cranes both of which have the habitat in the lakes and wetlands downstream Yangtze.
- Already declining estuarine and marine fisheries due to Yangtze's pollution, will suffer further due to TGP construction
- The TGP will cause costal flooding of hundreds of kilometers of best farm land causing erosions.
- The Shanghai municipality which is faced with the problem of saline water supply during dry seasons will suffer further due to decrease of water flow, when the TGP is operating fully.
- Wild life in Yangtze, such as Chinese sturgeon, River Dolphin, and alligators would become extinct when TGP commences operation.
- Due to water impoundment at the Dam site, the river would flood up streams and valleys.

However the ground realities on majority of the above issues were found to be contrary to the opponents arguments and were aptly snubbed by both Chinese authorities as well as by quite a few European countries which actively participated in bidding for the Dam construction project of TGP. Chiefly amongst the supporting Countries is Japan which claimed that the TGP project benefits far outweighs the environmental degradation, chiefly because, the project gives three major benefits to China as a whole, viz., Flood control, emission reduction, and increased navigation. These three are apart from the chief benefit of increased Power production to the Country.

Added to this support by the European countries, the Chinese authorities moved most of the ancient artifacts and structures from the water filled dam site, to higher grounds to retain their original identity, except for location change. The TGP authorities have identified forty four relics that would be affected due to the rise in dam water level during construction. One of them is Baiheiliang sculpture and epigraphy at Fuling. These have been copied and transferred to another place along with Zhang Fei temple, Shibaozhai and Qu Yuan Temple. Based on Survey, even the ancient tombs at the submerged area have been unearthed and transferred. Further search has been going on to find remains of the thousands of these archaeological sites in the area.

Also the proponents for the TGP argue that the natural habitats in the land area that has been flooded due to the Dam construction are principally rocky cliffs that are too precipitous to farm. In order to conserve the declining Chinese sturgeon population, an artificial stocking program has been initiated since 1981 closure of Gezhoubu dam, with 10,000 sturgeon fingerlings released into the river annually from hatchery at Yitchang. Also it has been found that no significant impact is expected for other fish species in the TGP area. (Zhou, 1985).

Small dams plus dikes along the river built to prevent flooding of agricultural land isolate many of the lakes downstream of Yangtze, and as such TGP will not affect them, as opposed to the concerns expressed by critics, who have been arguing that the more forceful Yangtze due to TGP dam will wash off these dikes.

One of the chief concerns of the critics have been for the silt / sediments deposits to the Yangzi lakes due to the TGP, which according to them will cause the lakes to rise to breach the dikes and result in flooding more often. However the LANDSAT imagery shows that much lower silt content in the lake waters



than in the nearby Yangtze (Yang et al., 1983), which dispel the critic's contention.

### **EFFICACY OF FLOOD CONTROL BY TGP**

The critics argue that a mighty water conservancy project such as TGP, will make the sediment / silt filtered to the bottom of the Dam, thus making the water lighter. This when released through the sluice gates, will make the flow much faster than the 'free flow river water'. The speed of water will have a great impact on thousands of levees / dikes all along its path down stream, and will breach them causing more extensive flooding all along the river path downstream. This argument no doubt is a most unpredictable outcome of floods on which humans have no control over nature.

However the statistics of Yangtze shows, that TGP was not there, 23400 cubic feet/ Second of water flowed during the flood season of 1981, but when on completion of TGP, the usual discharge rate is expected to be only at the rate of 1.6 cubic feet / second, and during flood season going upto 10 cubic feet / second. The only substantial water flow during the flooding season is from catchments areas of down stream of Yangtze, and this too is seen not affecting very badly the basin of Yangtze's path.(Eckholm,1986).

Further from the CTGP's archives search on the Yangtze River's flooding, they estimate that the build up of TGP will prevent the flood threat to Yangtze basin areas from the existing 10 years to 100 years span. This significantly means that people will, once in their life time only, may be able to see Yangtze flooding.

### **THE MYTH ABOUT TGP ALLEVIATING THE ENERGY PROBLEMS IN CHINA**

Critics have been of the view that, the projected power generation of mere one ninth of the Power needs of China is not worth a cause to bring upon so much of deluge, discomfiture, and hardships to millions of humans in the TGP area. However what these critics fail to see, is the prospect of saving millions of tons coal burning and pollution, for generating thermal power. As in 2005, China Year book, China's coal consumption been 76% of its coal production, compared to World as a whole consuming 26% of Global coal production. China has all along been utilizing its Coal energy to generate 70% of the power, and Hydro energy has only been 5%. Also due to good incentives given to coal power, till recent past, there has been more development of thermal power in China

compared to Hydro power. Thus TGP has come as happy news to the environmentalists to see a drastic cut in emission levels due to lessened use of Coal for power generation. With more and more dams in the offing in China, it will soon be making a greater impact of reduced coal power usage to produce Electric power for domestic consumption in China.

### **LEARNING EXPERIENCE FOR DEVELOPING COUNTRIES**

For developing countries, there is a lot to learn from China's bold venture to forge ahead with the TGP, despite relentless adverse criticism by the World body. China has kept its national interest in mind, rather than 'playing to the tune' of international critics and consultants. In the report published by the World Commission on Dams ( WCD, Nov 2000 ), it is amply clear that at times, the World body is critical about planning issues by countries, especially when they are the developing countries, such as India. In the instant case, one of the analysts of WCD report, audaciously terms the report as "biased" (Gopalakrishnan, 2000). In contrast, China vehemently opposed the WCD contention for Country's review by the World body, which is clear from the text of the report as below:

*"The Governments of India and China indicated that they were not prepared to participate in full case studies. Based on a meeting in Beijing in June 1999, China agreed to participate in a country – level review. After a change of institutional responsibilities within the Ministry of Water Resources in China, however, the government withdrew the agreement to participate actively in the country review. The WCD then undertook an external review of dams in China. The Government of India after meetings in New Delhi (June 1999), declined full participation; it subsequently agreed to-cooperate fully with a country review paper on dams in India (February 2000)."* [WCD, 2000]

Despite the clear-cut proof of success of large dams in the Indian context (such as Bhakra & Beas etc), which were made available to WCD Secretariat in time after a perusal of India Country Study draft report, consultants to WCD failed to project the above picture in a proper perspective. [WCD, 2000]

It is in this context, developing countries especially India should emulate the model adopted by China, in considering the "Non Dominant solution" benefits for the country at large and the neighboring society in dam sites in particular, in

preference to the most Dominant solution benefits. Needless to say, Dominant solution (best option in all criteria consideration) is very rare when such mega dams are planned, a point that World Body on Dams seems to have ignored, when dealing with developing countries.

## CONCLUSION

Whatever may be the grouse of the critics, both in and out of China, against the construction of the TGP, the opposition for the dam is purely hypothetical in negative thinking and stochastic. The Project construction so far has only yielded positive results to the Chinese and flooding has been arrested to a great deal in downstream areas of the river. The Chinese are all set to accomplish a 'New feat in the World' in the year 2009, by going to complete the '*seemingly impossible*' task. Over 20,000 humans working round the clock relentlessly, for the past 17 long years, and spending over US\$ 70 billion for the TGP. Further, this singular experience will be a 'morale booster' to the whole of Chinese Project Management team involved with this gigantic task. Already they are contemplating for seven major Hydro electric dam projects that are now various stages of project implementation in China. They all will cumulatively add up to 37000 MW of Hydro Electric Power to the Nation. The TGP project as a whole has become a role model for other countries to emulate for accomplishing a mammoth task in Hydropower Project construction. The daunting challenges that the Chinese experienced in this project can be a role model for India other developing countries in the world to learn lessons and follow.

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