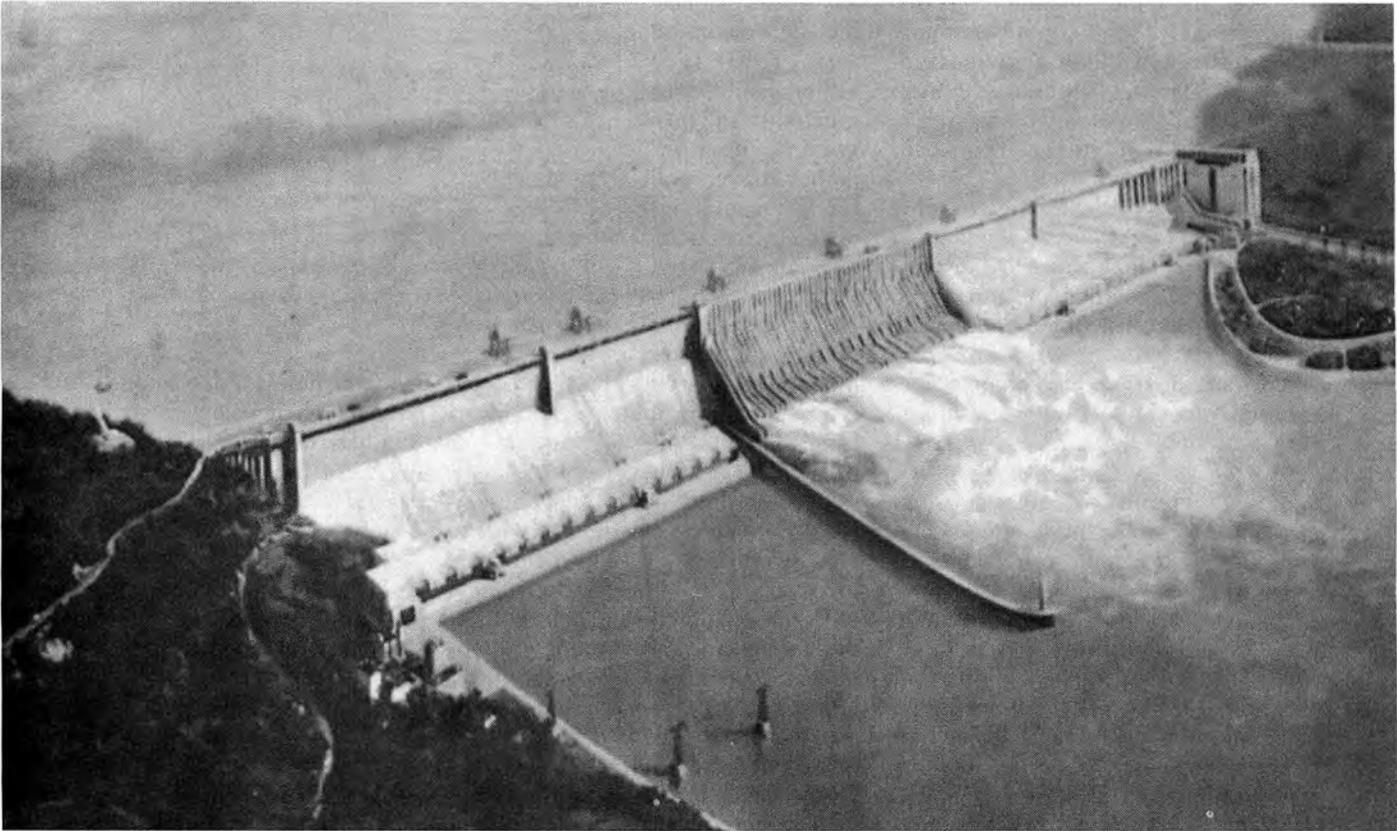


Three Gorges Dam

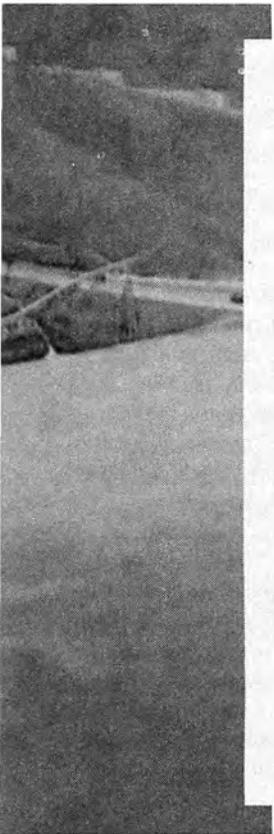


Yangtze Three Gorges Project Development Corporation

The TVA on The Yangtze River

by William C. Jones and Marsha Freeman

China's Three Gorges Dam, modelled on the Tennessee Valley Authority, will greatly reduce the threat of flooding, and lead to a new era of economic development.



The one American achievement which has most appealed to Chinese observers as an American model for China to follow is the regional development program of the Tennessee Valley Authority. TVA makes sense in China. The use of public funds for big public works and water control, the government and the individual citizen cooperating in the application of modern technology to the ancient problems of the soil, the state helping the small man to help himself—this is the most clear-cut democratic ideal in Asia. In our relations with economically backward peoples, TVA is a primary asset. The fact that in our own more fully developed economy we have less urgent need, or think that we have less urgent need, for such programs of regional development, should not prevent our using the TVA idea in our foreign policy.

—John Fairbanks,
The United States and China, 1948

From its origins in the glacial marshlands of the 20,000-foot high Tibetan plateau, the mighty Yangtze River, or the Changjiang (Long River, as the Chinese call it), winds its way like a giant dragon nearly 6,300 km (3,900 miles) on its way to deposit its annual 960 billion cubic meters of water into the East China Sea. It is the third longest in the world after the Amazon and the Nile, and the third largest in terms of annual runoff after the Amazon and the Congo Rivers. On its journey eastward, the Yangtze passes through an area inhabited by more than 400 million people, approximately one third of the country's population.

Known since ancient times as the "Golden Waterway," the Yangtze has served as a main transmission belt for products and people, with 3,600 rivers open for navigation in its main-stream and its branches for 44,000 miles. In the late 1980s, the volume of goods transported on the Yangtze represented 80 percent of all goods transported in China. The fertile Yangtze basin, including the great delta region formed by the sediment from the Yangtze River, produces 40 percent of China's grain, 33 percent of its cotton, 48 percent of its fresh-water fish, and 40 percent of the total industrial output of the country.

In this drawing of the completed Three Gorges Dam, the spillway to release water and control flooding is in the center, with electric generating plants on either side. On the right is a shiplift for comparatively small vessels, and on far right is the five-step shiplock, which will allow ocean-going vessels to travel up the Yangtze to the western reaches of Chongqing.

Along the banks of the Yangtze are situated some of China's major industrial cities, Chongqing, Wuhan, Nanjing, and Shanghai. Cascading down from the high mountains southwest of Chongqing, the waters of the glacial snowmelt flow swiftly through the 200-kilometer long stretch of majestic gorges, beginning at Fengjie, east of Chongqing, and gathering strength from the hundreds of tributaries that rush down from the mountains to meet the Yangtze as it makes its way through the narrow limestone canyons to the fertile Jingjiang plain below, and on to the broad Yangtze delta, the famed "Land of Fish and Rice." The river has a drainage area of 1.8 million square kilometers (km), accounting for 18.8 percent of China's territory.

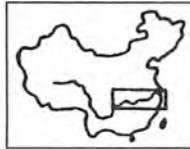
But the mighty river has also been the cause of great destruction and loss of life, that devastate the valley. From time immemorial, flooding has been a problem. During the spring and summer, flood waters rush down from the mountains in the west, through the gorges, overrunning the fields and plains and towns on the middle and lower reaches, and wreaking havoc in the lives of the millions of people inhabiting the region. Chinese scientists have determined that the bulk of the floodwaters accumulates in the upper reaches of the Yangtze. Historical data show that upstream flood flow usually accounts for 60 to 80 percent of the total volume of the river upstream of Yichang, and between 55 to 76 percent from Chenglingji and Wuhan. So, controlling the flow of the Yangtze in the gorges would significantly reduce the danger of flooding in the lower plains region.

During the 2,200 years, from the beginning of the Han Dynasty to the end of the Qing Dynasty in 1911, there have been 214 floods, an average of one every 10 years. In this century, there have been five severe floods. Combined flooding on the Yangtze and the Han rivers in 1911, is said to have claimed hundreds of thousands of lives. The great flood in 1931, took the lives of 145,000 people, inundated an area the size of New York State, submerged more than 3 million hectares of farmland, and destroyed 108 million houses. In the flood of 1935, 142,000 people were killed.

The 1954 flood inundated 48 million hectares of farmland, affected 18 million people, and claimed 30,000 lives. An additional 18.88 million people suffered from flood damage, and the operation of the vital Beijing-Guangzhou railway was suspended for more than 100 days.

THE YANGTZE RIVER AND THE THREE GORGES PROJECT

As the Yangtze River flows from west to east, it passes through the beautiful 200-km Three Gorges, and empties into the East China Sea, near Shanghai. The reservoir that will be created behind the Three Gorges Dam will stretch from Chongqing to the dam, near Sandouping, in Xiling Gorge, a distance about the length of the Grand Canyon. The inset shows the location of this section of the Yangtze in China.



Yangtze Three Gorges Project Development Corporation



Although other sites, farther east, had been considered for the Three Gorges Dam in the past, the current site near the city of Sandouping was considered to have the most stable foundation. The Gezhouba Dam, 40 kilometers downstream from the dam site, was completed in 1981.

Most recently, a major flood in 1996 was followed by an even greater one in 1998, which led to 3,656 fatalities, and affected the lives of 290 million people. In that flood, there were more than 5 million houses destroyed and 21.8 million hectares of farmland submerged. The total economic cost of the 1998 flood for China was \$30 billion. Ironically, the continual development of the Yangtze Basin is increasing the economic cost of such flooding.

The 1954 flood, which occurred at a time when the area was still considerably underdeveloped, would today, with the present agricultural and industrial capabilities, cause 10 times the amount of damage.

Taming The Dragon River

The flooding problem has generally been dealt with by constructing levees in the Jingjiang plain area. Since the 1950s, more than 30,000 km of dikes and levees have been reinforced or raised. As sedimentation lifts the river bottom, however, the dikes are continually in danger of being over-run, for the water level during flood season rises 6 to 17 meters higher than that of the plain region along both banks.

In the middle reaches of the Yangtze, the Jingjiang Flood Diversion Project and the Dujiatai Flood Diversion Project were completed in the 1950s. But since that time, most of the flood diversion areas have been economically developed and are now densely populated, so that diverting a flood, even temporarily, would displace people, and result in heavy economic losses. It is estimated that if there were a 1954-level flood today, inundating the flood-diversion areas, it would affect 933,000 hectares of farmland, and millions of people

would have to be relocated for several months. After completion of the Three Gorges Dam, the need for flood diversion will be greatly reduced, and some of the diversion areas may no longer be needed.

Dongting Lake, lying just to the south of the Yangtze as it makes its way up from the southwest towards Wuhan, and connecting to it by the Jingjiang River, has also been used as a reservoir to "capture" the rising waters of the Yangtze during flood season. Because of silting, however, the level of Dongting Lake has been rising, while the total area of the lake has shrunk from 6,000 km² in 1825, to 2,700 km² in 1983. This has greatly reduced the flood-diversion capability of the Jingjiang River. If it keeps diminishing at the present rate, Dongting Lake would vanish in the near future. The Three Gorges Dam will control both the water and sediment reaching Dongting Lake and help retard the process of siltation.

Sun Yat-sen's Vision

The idea of building a dam in the gorges has a long history. In 1919, in an article titled "Industrial Plan," Sun Yat-sen, the founding father of modern China, saw the tremendous economic benefits of building a dam on the Yangtze as a part of his economic development plan for China. Dr. Sun was particularly interested in using the vast hydropower resources of the river to produce the electricity needed to build factories for making artificial fertilizer, the only means he could envision for China to make the leap in agricultural productivity needed to feed its growing population.

He also saw the area of the gorges as the most suitable spot for building a dam to generate that electricity. Dr. Sun further elaborated on this idea in 1924, in a lecture he gave on his "Third Principle of the People, Peoples' Livelihood":

Consider the tremendous water power in the Kui Gorges of the upper Yangtze. Some who have studied the stretch of river between Ichang [Yichang] and Wanshien [Wanxian] estimate that the water power there could generate over thirty million electrical horsepower. Such an immense power is much greater than that produced at present in any country. It would not only supply all the railways, electric lines, and factories in the country with power, but it could be used to manufacture staple fertilizers.

Consider again the Yellow River which at Lungmen Waterfalls could also generate many million electrical horse power. You see how great are China's natural resources! If the water power in the Yangtze and Yellow rivers could be utilized by the newest methods to generate electric power, about one hundred million horse power might be obtained. Since one horse power is equivalent to the power of eight strong men, one hundred million horse power would be equivalent to eight hundred million man power. A man works eight hours a day, according to the law in most countries; a longer working-day is injurious to the worker's health and lessens production. . . . Man power can be used only eight hours a day, but mechanical horse power can be used all twenty-four hours. This means that one horse-power for a day and night accomplishes as much work as twenty-four men. If we could make use of the Yangtze and the Yellow river water power to generate a hundred million horse power, or twenty-four hundred million man power, and let this great electrical energy work for us, China would produce a great deal, and would certainly turn her poverty into riches.

In 1932, seven years after Dr. Sun's death, the Construction Committee of the Kuomintang, a party founded by Dr. Sun, which took power in 1927, organized a prospecting team to survey the hydroelectric power generation of the upper reaches of the Yangtze River. The team examined several alternative plans and recommended dams at one of two possible sites, at Huangling-miao and at Gezhouba. The project was to include a 12.8-meter-high water-head dam with an installed generating capacity of 300 megawatts (MW), and equipped with shiplocks. The Hydroelectric Generating Plan the Committee published the next year was, however, simply filed away for reference.

Why a Chinese TVA?

In 1933, when President Franklin Roosevelt signed the legislation that created the Ten-

nessee Valley Authority, fewer than 3 percent of the households in the Tennessee Valley had electricity. Malaria afflicted up to 30 percent of the population in some areas, and the average expenditure per child for education was about one third of that of the United States as a whole. The average farmer's income in the valley was \$639, compared to the national average of \$1,835. Conditions were little different than those in Third World nations around the globe.

The seven-state Tennessee Valley was at the mercy of the ravages of nature. The periodic flooding of the Tennessee River prevented the development of cities along the river's banks, leaving small and isolated towns. Unchecked fires burned 10 percent of the woodlands every year, and because of soil depletion, 4.5 million acres were on the decline, and 300,000 acres were nearly destroyed.

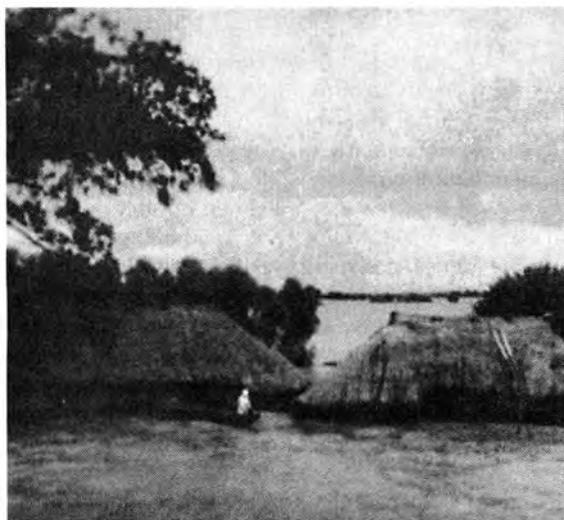
The TVA changed the valley dramatically. In the eight years after the establishment of the TVA, the number of households with electricity went from 6,000 to almost half a million. In its first 20 years, the TVA built 20 dams, requiring the use of 113 million cubic yards of concrete, rock, and earth—more construction materials than were used to build the seven great pyramids of Egypt. Nearly 200,000 men and women were employed by the TVA during its two-decade period of dam construction. At that time, the TVA was the largest construction project in the world.

In order to build the intricate systems of dams and reservoirs to tame the Tennessee River, 15,000 families had to be moved from the areas that were to be flooded. More than 19,000 graves were moved, along with 170 schoolhouses, and 180 churches. Entire towns and villages were relocated, or physically reorganized, to make way for the lakes that were created behind the dams.

Unique to the TVA system, was the concept of *multipurpose* dams. Previous dams had been constructed primarily for flood control, but the planners of the TVA designed a system for flood control, power generation, improved navigation, irrigation, and recreation. Writing about these early years, Gordon Clapp, a general manager of the TVA, said that this was

a policy deprecated by many prominent engineers of that day. In recruiting engineers to bring to life this idea—multipurpose dams—those who believed in the feasibility of this approach were sought and found.

The managers of the TVA knew that the introduction of electricity would be the single most important factor in improving the standard of living of the people in the valley. With electricity came the possibility of



China Pictorial Publications and Beijing National Library, *A Glimpse of Old China* (Beijing: Beijing Dongfang Mingzhu Cultural Co., Ltd., 1995)

The Yangtze River valley has been plagued with periodic floods since the beginning of recorded history of the region. Hundreds of thousands of people have died, millions of homes have been lost, and millions of hectares of farmland have been submerged. Shown here are homes wiped out in the middle reaches of the Yangtze, in the great flood of 1935.



Dr. Sun yat-Sen (1867-1925), the father of modern China, was one of the first to recommend the construction of a dam on the Yangtze River for electric power generation. Here, Dr. Sun at the Tientsin railway station in 1924.

eliminating much of the back-breaking work in farming, which, before the TVA, was conducted essentially at the same level of technology as in the 19th century. Once electricity and fertilizer factories were available, agricultural productivity in the valley tripled.

As increased productivity created an excess of manpower on the farms, cheap electricity made it possible for new and modern factories to spring up, and between 1933 and 1950, nearly half a million jobs in industry were created in the Tennessee Valley. For those free marketeers who would complain that this was all developed "at the taxpayers expense," it is worth noting that the annual income taxes now paid into the Federal treasury from the TVA are almost six times the government's yearly investment in the TVA.

The TVA established its own Health and Safety Department, to rid the valley of its endemic diseases. Libraries were established at every dam construction site, which connected otherwise isolated communities to the rest of the world. Model farms were established, where farmers were taught modern farming methods, and, in return for free fertilizer from the TVA, they then welcomed in their neighbors to teach others what they had learned.

It was this approach, not only to build dams, but to transform a population, that made the TVA the model for develop-

ment in nations around the world. This was the system that Chinese government officials and engineers saw when they, along with thousands of other foreign visitors, came to the Tennessee Valley before the end of World War II.

In 1944, the TVA's first director, David Lilienthal wrote his book *TVA: Democracy on the March*. In the preface, Lilienthal stated:

There is almost nothing, however fantastic, that (given competent organization) a team of engineers, scientists, and administrators cannot do today. Impossible things can be done, are being done, in this mid-twentieth century.

Although the resources of the TVA, particularly abundant electric power, were crucial for the war mobilization that was still under way when he wrote the book, Lilienthal said:

History may well record, however, that it is the TVA as an idea that represents its greatest significance; that it is in its high symbolic value "in a thousand valleys" beyond the seas that TVA has rendered its greatest service in safeguarding and nurturing freedom in the world.

By 1953, more than 39 million people had visited the TVA, from nearly every nation in the world, and David Lilienthal's book had been translated into 14 languages.

Before World War II, Lilienthal had developed a close relationship with China's ambassador to the United States, Hu Shih. Engineers from the National Resources Commission of China visited the TVA, and during the war, an electrical engineer from the TVA was an advisor to the Chinese War Production Board. In July 1944, the Chinese Resources Commission met in Knoxville, Tennessee, the home of the TVA.

Lilienthal reported in his diary that in 1939, Ambassador Hu suggested that the TVA should help rebuild China after the war. During the war, the two met, often in Lilienthal's home, to plan the multi-purpose dam development of the Yangtze River.

On Feb. 6, 1945, Lilienthal met with Donald Nelson, whom he describes as President Roosevelt's personal representative to China. Nelson said he was having Lilienthal's recently published book translated into Chinese. (In fact, in less than a year, 50,000 copies were circulating there). At their meeting, Nelson and Lilienthal discussed the Yangtze Three Gorges Project, which was being referred to as the "Chinese TVA," and Nelson said that the President wanted Lilienthal to be one of seven industrial leaders to go to China, to help work out the nation's postwar industrialization plan.

Lilienthal begged off the trip, but two months later, Nelson sent his assistant, Edwin Locke, to confer with Lilienthal about the next steps on the Yangtze project. After the death of President Roosevelt in 1945, the comprehensive plans of the President to use "American methods" to rebuild the postwar world, were shelved. Nonetheless, the idea of the "TVA on the Yangtze River" had been firmly planted.

After decades of study and investigation, in 1992, the Chinese government decided to start construction of its TVA on the Yangtze River. Although since that decision, U.S. government policy has virtually prohibited U.S. organizations and companies from participating in the project, in September 1996, the leadership of the TVA, and of the state of Tennessee,

organized a joint conference in Beijing on “Economic Opportunities Through Water and Energy,” to provide American input into China’s great projects. The conference was organized by people who understand the history and purpose of the TVA: Tennessee Governor Don Sundquist, the chairman of the TVA, and then-U.S. Ambassador to China, James Sasser, who is a former Senator from Tennessee.

Representatives from dozens of U.S. companies were invited by TVA to attend, including water and energy experts, and a representative of a U.S. nuclear company. China’s plans for water and power development were presented, and in side meetings, TVA engineers discussed the plans with China’s engineers. During the conference, TVA Chairman Craven Crowell announced that the TVA and the Minister of Water Resources of China had signed a Memorandum of Understanding (MOU) for the TVA to review the master plan for the development of the Han River, and an MOU was also signed with the Chinese Hydro and Power Corporation for assistance in developing the Li River Basin.

In an interview with one of the authors (Freeman) in 1998, during that summer’s devastating floods in China, David Hall, the head of the TVA’s work in China, explained that to control flooding in China, projects have to be planned on the tributary rivers, like the Han and the Li, not just on the Yangtze.

Asked what the “TVA model” is that the Chinese expect to learn from the U.S., Mr. Hall described it as

an integrated regional resource development approach. It entails developing a river system by looking at all the possible uses of the water, and making sure that you optimize the competing uses of water, such as navigation, flood

control, in their case, water supply for irrigation and flood protection. . . . [Y]ou optimize the way the water is utilized, which effects where dams are placed, how many dams, the size of the dams, navigation locks, and all of the facilities that will be built.

Overall, he said, “that model can be applied in China.” The joint work, Mr. Hall reported, also benefits the TVA itself. It

helps us from the standpoint that we’re not developing any new rivers. It’s important for us to maintain our skills in that area, because things happen on our river all the time. We look at modifying the way we operate reservoirs and continue to optimize that. It can always be better. So this type of work helps our water management people to keep their skills sharp.

Conveying the philosophy of the Roosevelt era, and the purpose of the TVA, Mr. Hall concluded:

It is very gratifying to be in China, and meet so many people who know TVA quite well, and see that they hold TVA in high regard, especially in the area of river basin development and hydroelectric power. We appreciate the fact that we’re held in high regard, so where we have the resources to help them, we’re happy to do that.

Roosevelt’s Postwar Reconstruction Program

After World War II, President Franklin Roosevelt envisioned using the economic power of the United States, exhibited so mightily during the course of the war mobilization, to create a new international system in the postwar world. Roosevelt was particularly determined to end the reign of the British Empire—indeed, of all empires—and to create a rebirth of the nation-state, especially in those areas of the underdeveloped world, in Asia and Africa, where the fight to overthrow the Nazi and Japanese yoke had been so intimately linked to the fight for independence and national sovereignty.

This was the one major factor that separated the postwar conceptions of the two wartime allies, the United States and Great Britain, for Winston Churchill was still intent on rebuilding a British Empire that lay in shambles. Nation-state building was also the postwar policy that Roosevelt intended towards our other wartime ally, China. Roosevelt was intent on preserving the territorial integrity of China, primarily by preventing a bloody civil war between the Nationalists and the Communists, and



Tennessee Valley Authority

President Franklin Delano Roosevelt’s plan for the reconstruction of China after World War II centered on the building of Great Projects, modelled on those he had initiated in the United States. Here, the President signs the legislation creating the Tennessee Valley Authority, on May 18, 1933.



Bureau of Reclamation, Department of the Interior

John Lucien Savage, one of the great dam builders of the Bureau of Reclamation in the United States, led an extensive study of the Three Gorges Dam in the 1940s, as part of President Franklin Roosevelt's postwar reconstruction program for China.

secondly, by instituting a major reconstruction program for war-torn China.

One aspect of that reconstruction program, which harkened back to the earlier development program of Sun Yat-sen, was a major program of dam construction on China's key rivers, the Yellow River and the Yangtze, which would help alleviate the serious flooding problems and allow the use of hydroelectric power to raise the standard of living of the impoverished Chinese peasantry.

In 1944, Nationalist leader Chiang Kai-shek, anxious to consolidate his sagging support and, under pressure from the United States to institute a program of political and economic reform, began to revive Sun Yat-sen's development program. Talks were initiated with the United States regarding the construction of a hydroelectric dam on the Yangtze. Earlier that year, American economist G.R. Paschal, an adviser to the China Wartime Production bureau, had suggested building a hydropower plant in the Three Gorges area with an installed capacity of 10,500 MW. He also resurrected Dr. Sun Yat-sen's idea of using the power generated to produce electricity in order to build a fertilizer plant with U.S. investment, machinery, and equipment, to be repaid to the United States with fertilizer, over a 15-year period. During the war, American farms were not getting enough fertilizer and were therefore decreasing in fertility from year to year.

In May 1944, John Lucien Savage, a leading dam-builder, who worked on most of the TVA dams as well as the great Boulder (Hoover) Dam in Nevada and Arizona, was invited to China by the Nanjing Government Resources Commission, to investigate possible sites for the construction of a dam on the Yangtze River.

Savage recommended a number of possible sites farther downstream from the present Three Gorges damsite, at various locations between Shipai and Nanjingyuan Pass, which is the entrance-way to Xiling Gorge, the longest of the three gorges. Savage presented a detailed engineering study to the Nationalist government. In the introduction to the report, Savage wrote:

It gives me one of the greatest pleasures in my forty years of engineering experience to submit this preliminary report on the Yangtze Gorge project. The study of this project has been extremely interesting because of the unprecedented magnitude of the works to be constructed and also because of China's great need for the benefits that will accrue from the project.

The Yangtze Gorge Project is a "CLASSIC." It will be of utmost importance to China. It will bring great industrial developments in Central and Western China. It will bring widespread employment. It will bring high standards of living. It will change China from a weak to a strong nation. The Yangtze Gorge Project should be constructed for the benefit of China and the world at large.

Savage proposed a dam which was 200 meters wide and 225 meters high, with an installed generating capacity of 10,560 MW. He recommended that hundreds of Chinese engineers and technicians be brought to the United States, to be trained by the only organization at the time which could accomplish such a massive task: the Tennessee Valley Authority (see box, p. 31). A contract was signed with the U.S. Bureau of Reclamation and the Resources Commission, and, in June 1944, the Bureau officially began work on the design of the Three Gorges Dam.

Enthusiasm for the project ran high in China, as well as in the United States. A 1946 China edition of *Stars and Stripes*, a U.S. military newspaper said, in part:

Drawing on the idealism and practical experience of the TVA and the Reclamation Bureau projects . . . the Chinese are projecting a public works improvement surpassing anything ever built.

An article in the *Engineering News-Record*, Feb. 28, 1946, reported, "China plans an unprecedented dam for power, irrigation, and navigation on the Yangtze river." Under a contract negotiated between the Bureau of Reclamation and the Natural Resources Commission, planning was being done for the great dam. John Savage was a consulting engineer on the project, for both the U.S. and Chinese governments. The *Engineering News-Record* reported that the estimated cost of the project, which would create a 250-mile long reservoir, and enough water to irrigate 10 million acres of land, would be \$1 billion. The generators would produce more than 10 GW of electricity, the article stated, which is three times the combined capacity of Grand Coulee, Shasta, and Boulder Dams, in the United States.

And yet, the initial implementation of the project fell far short of what Savage had envisioned. Some 54 Chinese technical personnel were sent to the United States to participate in the project, but after only a small amount of exploration, survey, economic study, and design work had been carried out, the Nationalist government, in the midst of a raging civil war in China, decided to terminate work on the project, in May 1947.

Optimism, however, remained. An August 1950 publication by the TVA, which was a digest of information concerning issues of interest to the Authority, has an entry titled, "China's TVA—The Proposed YVA on the Yangtze." The report

stated that although China was then in a "period of major transition," the program to tame and develop the Yangtze, remains a much publicized possibility for the future." The Yangtze, it reported, has been called, "transportation lifeline, bottomless irrigation well, and pitiless master of life and property." Referring to statements by David Lilienthal, the TVA publication continued:

The terms "gigantic" or "colossal" are not inappropriate to apply to the ambitious plans for the proposed Yangtze development. TVA is dwarfed in comparison. Within a 300-mile radius of the main dam site, more people than live in the entire United States would be affected. The river would be held in rein the year around, permitting ocean-

going ships to sail to Chungking, 650 miles from the coast. Hundreds of miles of canals would be excavated. Ten million acres could reap irrigation benefits.

Regarding the influence of the TVA on the project, the report stated that a large number of engineers with the National Resources Commission of China, as well as the leaders of that, and other organizations in China, had visited the Tennessee Valley and conferred with TVA officials and engineers.

The death of Roosevelt and the defeat of the Nationalist Kuomintang by the Communists put an end to these projects, for the time being. But the project itself was soon to be revived, under the new Communist regime which took power in 1949. The new Chinese leader, Mao Tse-tung, himself

Training Chinese Dam Specialists in America

John Lucien Savage, a world-famous dam-builder, who worked on most of the TVA dams as well as on the great Boulder Dam, was invited to China to investigate possible sites for the Yangtze project. In his preliminary report, he wrote:¹

The program of employment and training of Chinese engineers, scientists, and artisans, proposed by the [Chinese] National Resources Commission and cooperating Ministries, is believed to be essential and of utmost importance. The basic purpose of such a program should be to give practical experience on actual necessary work and to train specialists in the many important classifications of technical, scientific, and skilled work. . . .

What arrangements should be made for specialized training of Chinese personnel in China, India, America, and other countries, for the investigation, design, and construction of large multipurpose water projects?

An arrangement should be made with the Irrigation Branch of the Public Works Department of Punjab, India, through A.N. Khosla, Chief Engineer and Secretary, for training of Chinese technical personnel . . . providing a large construction program is to be started before conclusion of the war in China.

Similar arrangements should be made with the Bureau of Reclamation and Tennessee Valley Authority in America. These latter arrangements should include cooperative assistance by these two organizations on the investigations, designs, and construction of specific projects that are to be authorized for construction, following the conclusion of the war

The tentative estimate includes the training in America of professional personnel, such as engineers, geologists, chemists, and physicists; also of artisans such as construction superintendents, foremen in all classifications, electricians, machinists, mechanics, welders, etc. It is assumed that such training programs will be started at an early date and that they may

continue for perhaps two years in America. They will, of course, be continued simultaneously in China, so far as possible, and will be carried out principally in China after actual development work starts.

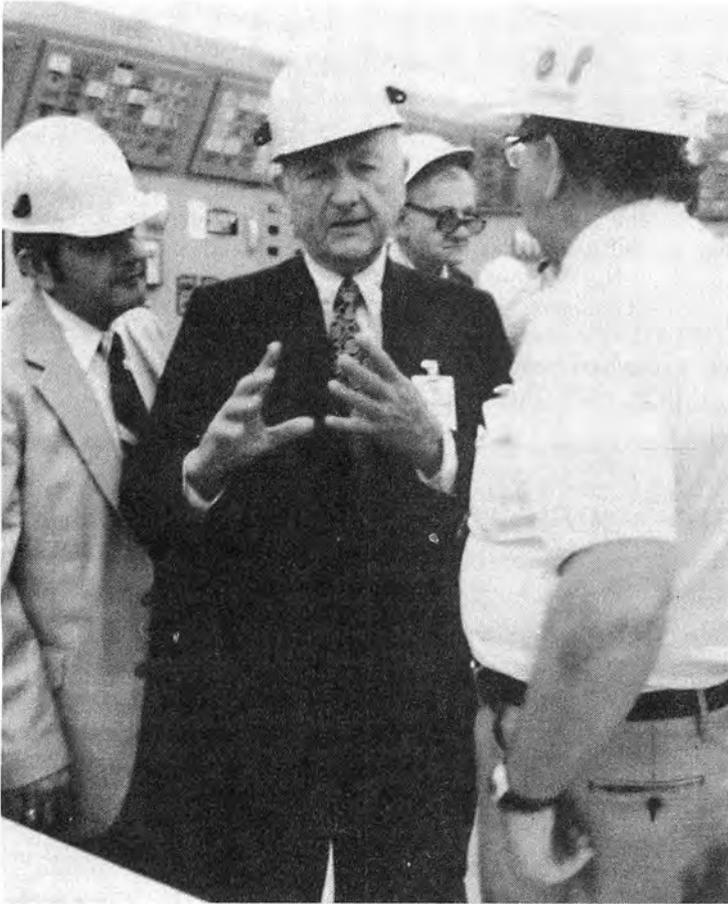
For preparing the final detail designs and specifications for the project, Savage states that 500 Chinese specialists will work in America, along with 500 specialists from the Bureau and the TVA. He outlined the following technical personnel requirements after the conclusion of the war in China:

TECHNICAL REQUIREMENTS FOR THE THREE GORGES PROJECT

| Classification | Chinese | Foreign |
|-------------------------------------|--------------|------------|
| Consulting engineers | 2 | 3 |
| Consulting geologists | 2 | 3 |
| Civil engineers | 800 | 40 |
| Electrical engineers | 160 | 8 |
| Mechanical engineers | 140 | 7 |
| Geologists | 25 | 2 |
| Chemists | 20 | 2 |
| Physicists | 6 | 1 |
| Construction superintendents | 20 | 9 |
| Construction foremen | 200 | 25 |
| Electricians | 425 | 25 |
| Machinists | 425 | 25 |
| Mechanics | 750 | 50 |
| Welders | 425 | 25 |
| Carpenters | 3,000 | 175 |
| Machine operators | 1,000 | 50 |
| Miscellaneous | 2,000 | 100 |
| TOTALS | 9,400 | 550 |

Notes

1. J.L. Savage, Consulting Engineer, "Preliminary Report, Yangtze Gorge Project," October 1944.



Robert Kollac, Harper & Row

"There is almost nothing, however fantastic, that (given competent organization) a team of engineers, scientists, and administrators cannot do today. Impossible things can be done, are being done. . . ." This was the spirit of the TVA's first director, David Lilienthal whose book, TVA: Democracy on the March, was translated into 14 languages, including Chinese. Here, Lilienthal (center) in 1980 at a nuclear plant.

became a major proponent for building a great dam on the Yangtze River.

A New Era of Development

When the People's Republic of China was formed in 1949, flooding was one of the first problems the ruling Communist party had to confront. Earlier that year, another serious flood on the Yangtze had occurred, and many of the dikes on the middle and lower reaches of the river had burst, causing untold disaster. In February 1950, the Yangtze River Water Conservancy Commission was established in Wuhan. This organization, renamed the Yangtze Valley Planning Office in 1956, worked directly under the Ministry of Water Resources, and began to sort out the hydrological data which had been collected by the previous government, regarding the comprehensive utilization plan of the valley, including the plans for the Three Gorges Project.

In early 1952, the Government Administration Council issued the decision to build a flood diversion project in the

Jingjiang area. In the latter half of the year, the Yangtze River Water Conservancy Commission began to study plans to strengthen the embankments, to create retention basins on the plains and in the lake regions, and to construct dams in upstream mountain valleys for flood regulation. The commission concluded that even with these control measures, there would still be a serious threat to the middle and lower reaches of the Yangtze River, if there were serious rainstorms in the Three Gorges area, like those that occurred in Hubei province in July 1935. After hearing these reports, Chairman Mao Zedong said:

If after so much effort has been put into the construction of reservoirs on tributaries, flooding still cannot be controlled, then why not put a check to it at the Three Gorges?

From May to August 1954, a series of heavy rainstorms again struck the Yangtze Valley, culminating in the largest flood of this century in the middle and lower reaches of the Yangtze. Although the strengthening of the embankments, and the completion of the flood diversion project along the Jingjiang, saved the embankments, the cities of Wuhan and Nanjing, and other areas downstream, were subjected to severe destruction. It became clear that much more had to be done to control the flood danger, including the construction of one or more dams upstream. Planning for such a project was begun immediately, and Premier Zhou Enlai, who was to spearhead the effort, wrote to Soviet Premier Bulganin requesting that experts be sent from the Soviet Union to provide assistance. The Soviet experts began arriving in June 1955, and began a program of systematic surveying, design, and study of the Three Gorges.

In 1955, the Yangtze River Water Conservancy Commission began drawing up a comprehensive utilization plan for the valley, and conducting a large-scale work of surveys, planning, design, scientific research and economic investigations. The Soviet experts favored a location farther up the Yangtze, which, combined with a project on the Jialing River and several other sites, could effectively solve the flooding problem downstream. The Chinese, however, thought that a dam at the site favored by the Soviet advisors would create an excessively large reservoir, and they were still looking more favorably to the Three Gorges area as the damsite. At the end of 1955, after listening to the various viewpoints on the subject, Premier Zhou took the first step to define the Three Gorges Dam as the principal part of the project for the whole Yangtze River basin.

A year later, based on the preliminary results of the planning activities, Lin Yishan of the Yangtze Valley Planning Office published a paper on the subject, in which he expounded the principles of "multiple-use" in the Three Gorges Project. In January 1958, during a Communist Party Central Committee meeting in Nanning, Chairman Mao, Premier Zhou, and other leading party officials, listened to the various views on the subject, including the arguments of Lin Yishan for a dam at a Three Gorges site. Chairman Mao then

appointed Premier Zhou to take personal charge of the planning of the Yangtze River Basin and the Three Gorges Project.

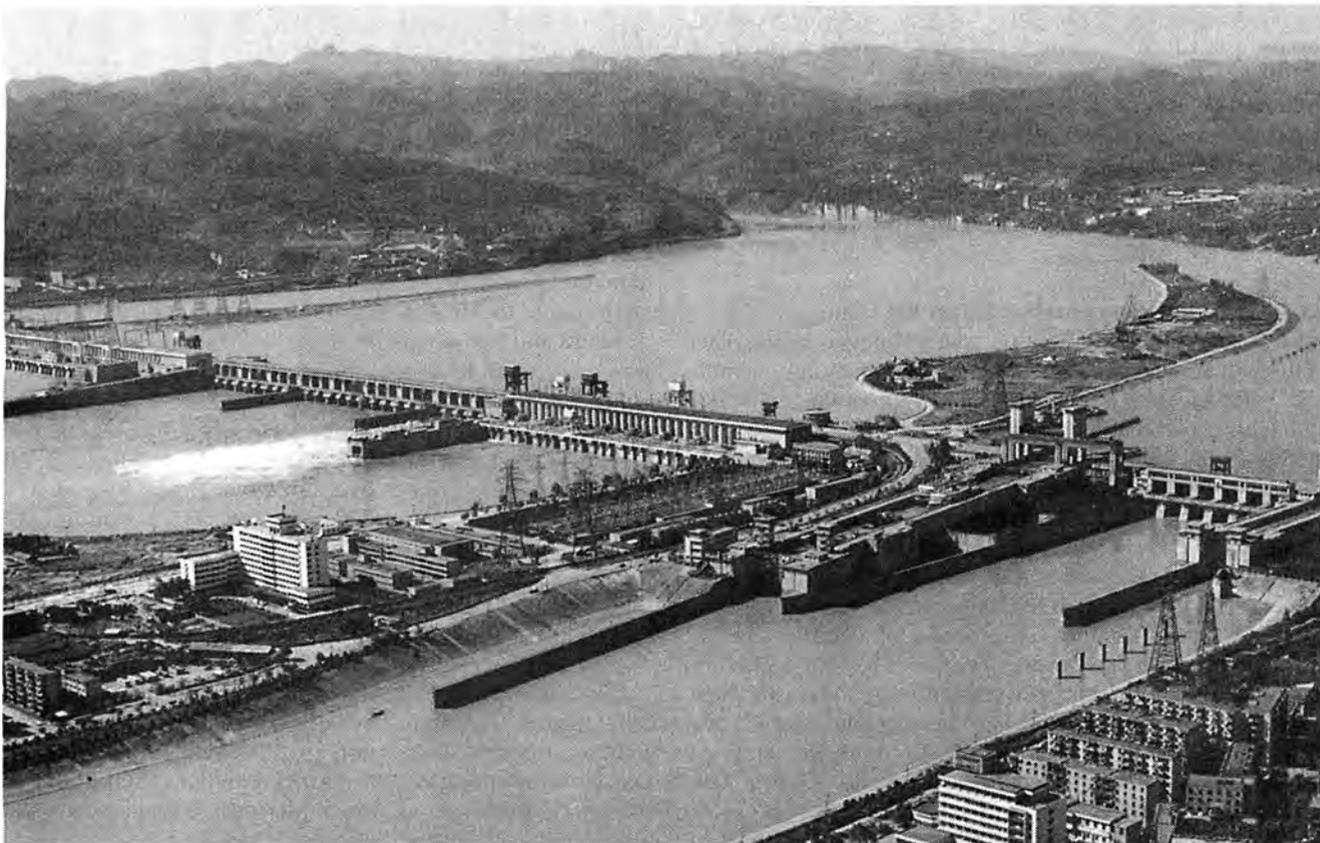
In March 1958, at a Central Committee meeting in Chengdu, the capital of Sichuan province, the decision was taken to begin preliminary design work on the Three Gorges project. In June of that year, the first Three Gorges Scientific Conference was convened in Wuhan, to formulate the major research plans. The enormous size of the project meant that some of its technical aspects would place it on the very frontiers of dam-building technology, and would establish world precedents. These aspects included deep-water weir construction; damming under high-flow conditions; super high voltage electrical transmission and transformation; large turbo-generator and ancillary equipment manufacturing; giant machinery for high-speed building and for elevating ships; automation in electrical systems and installations; new building materials; reservoir regulation; and prevention of reservoir sedimentation.

More than 200 working groups and almost 10,000 scientific personnel took part in this nationwide effort. During the first year alone, more than 700 research reports and papers were published, which partially resolved a number of the major technical issues of the project, and provided scientific evidence for the preliminary technical design. Two areas along the Gorges were chosen for a closer examination of the bedrock. One was the stretch of the river, indicated by the U.S. Bureau of Reclamation's John L. Savage, from the entrance of the Xiling Gorge at Nanjingyuan Pass to Shipai.

The bedrock there was limestone. The other area examined was in the Meirentuo section, along the upper portion of Xiling Gorge, from Meirentuo to Nantuo, a stretch of the river about 25 km long. The bedrock there is crystalline igneous rock. In both areas, a total of nearly 200,000 meters of small-diameter rock cores were drilled. More than 150,000 meters of this total was obtained from the igneous rock area, and about 76,000 meters was from Sandouping in the Meirentuo section. After comparisons were made, the Meirentuo area was chosen as more suitable.

On the basis of the reports from the expert committees, the Yangtze Valley Planning Office issued the draft "Report on the Main Points of the Preliminary Design." In May 1958, the Planning Office invited 188 people, from 66 working groups involved in the design work, to discuss the report, in order to decide on the height and location of a dam. After 10 days of discussion, it was unanimously decided that the location at Sandouping possessed "unequivocal superiority."

During the following years, more investigations were carried out, although with the increased international tensions stemming from the escalating Vietnam War, and the onset of the disastrous Cultural Revolution in 1966, a decision on dam construction awaited better times. At the end of 1969, provincial leaders in Hubei Province, where the dam was to be located, again called for beginning construction on the Three Gorges Dam. The Chinese leadership struck a compromise, by deciding on first building the auxiliary dam further down-



Yangtze Three Gorges Project Development Corporation

A full view of Gezhouba Dam, which is 40 km downstream from the Three Gorges site. The decision to build this auxiliary dam first, was taken in 1970 by the Central Committee, and the dam began producing electricity in 1981.

stream at Gezhouba.

The Gezhouba Dam, about 40 kilometers downstream from the proposed Three Gorges site, was originally conceived as an auxiliary to the major dam at Sandouping, and was to be constructed only after the main dam was built. The auxiliary dam was needed, because the construction of the major dam at Sandouping would have the immediate effect of lowering the water level through the portion of the canyon downstream from it, thus seriously impeding navigation there, especially during the dry season. The building of a second dam downstream would help maintain the water level in this difficult canyon area. Although there were still those in the Chinese leadership who opposed the construction of the Gezhouba (and even of the Three Gorges Dam itself), Central Committee decided on December 25, 1970, to build the Gezhouba Dam.

Located about 3 kilometers downstream from the Nanjingyuan Pass, at the entrance to the Three Gorges, the Gezhouba construction provided valuable experience in dam-building to Chinese engineers and workers, preparing them for the major undertaking at Three Gorges. Gezhouba Dam began producing electricity in 1981, and was completed in 1988. It is 70 meters high and 2,606.5 meters long, and now produces an annual output of electricity of 15.7 billion kwh.

In 1992, the Seventh National People's Congress made the final decision to construct the larger Three Gorges Dam at Zhongbao Islet near the village of Sandouping. This is the area which divides the eastern and western parts of the Xiling Gorge, the first of the Three Gorges, heading upstream; the dam is situated some 5,000 km from its source and 1,300 km from its mouth near Shanghai. The Chinese assumed that experts in America, with whom they had worked for decades, would continue to provide advice for this great project. But while the Chinese were embarking on the construction of dams on the Yangtze, their colleagues in the United States were being told that the days of big water projects were over.

Environmentalists Target Big Dams

By the end of the 1960s, a paradigm shift was taking place in the United States and the industrialized nations, exemplified by the creation of the anti-growth Club of Rome in 1969, which proposed that man-altered nature was a crime against Mother Earth, and that great projects, such as dams and water development, were "bad for the environment." As the largest nation in the world, in terms of population, China came under attack for having "too many people," and whose continued growth would only further threaten the "environment." The Three Gorges Dam, as the largest economic development project in China, became a prime target for attack.

The Chinese had been aware since the 1950s, that such a dramatic change in the Yangtze River would alter the environment. Forty years ago, the Yangtze Valley Planning Office (which later became the Yangtze Water Resources Commission, under the Ministry of Water Resources), carried out a series of surveys concerning the natural and social impacts of the project, and issued *The Report on the Key Points of the Yangtze Valley Comprehensive Utilization Planning*, and also *The Report on the Key Points of the Preliminary Design of the Three Gorges Project*.

In 1976, the Yangtze Valley Water Resources Protection

Bureau was established by the Ministry of Water Resources, in order to carry out environmental impact studies of the Three Gorges Project. Working with more than 40 universities and research institutes in China, a special team was created in 1979. This group submitted an impact statement for a design of the dam which, at that time, was for a 200-meter Normal Pool Level.

By 1979, with the re-establishment of U.S. relations with the People's Republic of China, the Chinese government again expressed interest in re-establishing a working relationship with American dam builders. In the United States, however, the pro-growth outlook of the Roosevelt era had been replaced by the zero-growth insanity of the Carter Administration. The support for "great projects," which had been the hallmark of FDR's postwar reconstruction program, had been replaced by the call for "appropriate technologies." The commitment to progress had been gradually eroded by the new philosophy of "small is beautiful," put forward by E.F. Schumacher. In place of the commitment of the nation to economic and population growth, the world suddenly became "overpopulated," and disaster scenarios were spun out in the publications of Worldwatch Institute, the World Resources Institute, and other zero-growth organizations. In that atmosphere, any agreement on U.S.-China cooperation was ultimately doomed to failure.

In March 1980, the United States and China signed a "Protocol on Cooperation in Hydroelectric Power and Related Water Resource Management," which brought the Bureau of Reclamation, the Army Corps of Engineers, and the TVA again into work on the Three Gorges Project. However, the radical environmentalist bent of the Carter Administration prevented any major U.S. involvement in Three Gorges Project.

Under the Protocol, a one-year period of training was provided to 11 Chinese engineers, and a 30-day program was provided for a group of 10 engineers—a far cry from what dam-builder John Savage had proposed in the 1940s. The Carter team that was sent to China in April 1980, to investigate the Three Gorges, included the new Carter-appointed chairman of the TVA, S. David Freeman, a radical environmentalist and "conservation" proponent, whose claim to fame was his attempt to restore the use of wood-burning stoves, which had gone out of vogue in the Tennessee Valley with the introduction of electricity in the 1930s. Needless to say, the Freeman crew came back from China, recommending against the Three Gorges Project. In an article in *Engineering News-Record*, April 3, 1980, Freeman boasted, "I think our delegation succeeded in killing a 700-ft. high dam on the Yangzi River that a bunch of engineers there had been in love with for the past 20 years." Freeman neglected to note that among that "bunch" were some of the U.S. Bureau of Reclamation's and TVA's finest engineers.

The defeat of Jimmy Carter in the Presidential elections of 1980 helped to blunt the edge of the environmentalist attacks, but the sabotage of U.S. participation in the project did not cease. In the spring of 1981, a 10-man delegation from the Bureau of Reclamation, now under new management, was again in China studying the Three Gorges Project.

On his visit to China in 1984, President Reagan was asked by the Chinese leadership to increase U.S. involvement in this important project. Reagan, whose outlook, although conser-



AP Photo/Scott Stewart

On his visit to China in 1984, President Reagan reopened U.S. involvement in the Three Gorges Dam project. Here, President Reagan and his wife with Chinese leader Deng Xiaoping.

vative, was more characteristic of the Roosevelt era, responded forthrightly. He sent his former National Security Advisor, William Clark, to Beijing, as head of a group of people from the Bureau of Reclamation and private industry, with a wide-ranging proposal for collaboration on the Three Gorges Project, proposing, in fact, a U.S.-China consortium to build the dam. The proposal would have made of the Three Gorges Project a giant joint venture. The Chinese were not so eager to pursue this "joint venture" route in such a strategically important undertaking. Interest in the project from the Reagan Administration quickly cooled, and the joint venture bid was quietly tabled.

Nevertheless, the Reagan visit resulted in the 1984 signing of a five-year agreement between the U.S. Bureau of Reclamation and the Chinese Ministry of Water Resources and Electric Power, to provide technical assistance in the final planning and design phases, and in the construction of the Three Gorges Project. A second agreement was signed in 1992, to provide technical assistance on data management, computer software, drill-hole survey technology, and dam safety monitoring. By that time, however, the environmentalist movement had geared up its campaign to sabotage all U.S. involvement in the Three Gorges Project.

In 1985, the Environmental Policy Institute, the Worldwatch Institute, and other environmentalist groups initiated a major campaign to stymie continued U.S. cooperation with the Three Gorges Project. Hearings were held on Capitol Hill in July 1985 by the Subcommittee on Water and Power

Resources of the House Committee on Interior and Insular Affairs, on the topic "Irrigation in Drought and Famine-affected Countries," chaired by Democrat George Miller from California, a darling of the environmentalist lobby. The purpose of the hearings was clearly aimed at discouraging major water control and other infrastructure projects, which were absolutely critical for "jump-starting" developing sector countries. The call was out for a "small is beautiful" format for development—that is, no development at all.

Much of the material for the hearings had been provided by the Worldwatch Institute, whose founder was zero-growth guru, Lester Brown. In recent years, Worldwatch has published multiple tracts touting the old Malthusian argument that raising the standard of living of China and other developing countries, would require a substantial increase in their food consumption, and could increase the risk of famines!

Some of the popularity of this discredited doctrine, which totally ignores the element of productivity rises resulting from technological advances in agriculture, was caused by the fact that such zero-growth programs do not require much investment. The World Bank, the prime funder in the postwar world for many infrastructural projects in the developing sector, had 100 experts participating in the Feasibility Study of the Three Gorges Project in the mid-1980s. But after the project finally got under way, the Bank invested no funds. Instead, it became a promoter of "appropriate [that is, labor-intensive] technologies" for developing sector countries. The World Bank's claim was that large projects were not "economical," according to its cost-benefit analysis.

(The Chinese have well understood the "cost-benefit" of projects such as the Three Gorges Dam. The obvious direct economic benefit of the dam will be the avoidance of billions of dollars in damage to farms and property during floods, not to mention the enormous loss of life, and other losses, caused by the bursting of dikes, the threat to the city of Wuhan, the suspension of operation of the railway, and so on. In writing about the project, the Chinese point out that the dam can also prevent flood damage to the ecology and environment, the occurrence of which may contribute to famine, the spread of infectious diseases, large numbers of refugees, and further environmental problems. But in the end, as the Chinese point out, "All of the significant benefits are uncountable, and can hardly be measured in economic indexes.")

The environmentalists—in reality, white-collar Nazis—



AP Photo/Xinhua, Liu Shaoshan

Sen. Frank Murkowski, who visited China in 1997, opposed the Clinton Administration's refusal to support the Three Gorges Dam project. The Senator stressed the environmental benefits of the dam; electricity from the Three Gorges project equals that produced by 36 coal-burning power plants, he said. Here, the Senator meets with Chinese President Jiang Zemin

cloaked their attacks on the dam in fictitious arguments about how "small projects" benefit people more than larger enterprises, and were more "appropriate" to develop countries than those bigger infrastructural projects. Because the entire history of the United States, especially the development of the Tennessee Valley Authority in the 1930s under Roosevelt, belied these arguments, these zero-growthers were also forced to alter the historical record. In 1985, William U. Chandler, another associate of the Worldwatch Institute, published a book titled *The Myth of the TVA*, in which he attempted to discredit the role the TVA played in raising the standard of living for millions of people.

Greenies Attack Great Projects

Although the prime focus of the 1985 hearings of the Subcommittee on Water and Power Resources of the House Committee on Interior and Insular Affairs, was on Africa, the environmentalists focussed on the Three Gorges Project. They demanded that the Bureau of Reclamation submit an environmental impact statement on all its foreign engagements, under the newly legislated domestic requirements of the National Environmental Policy Act (NEPA), which was an environmentalist straitjacket that had been placed on U.S. industry during the Carter Administration.

By 1986, Rep. George Miller and his environmentalist friends in Congress had introduced legislation that would mandate the Bureau of Reclamation to "give priority to solutions to water resources problems which emphasize small-scale, affordable,

resource-conserving, low-risk projects." One of the key figures who helped shepherd this particular item through committee was Miller's staff director, Dan Beard.

When the Clinton Administration was elected to office in 1992, the year the Chinese Government actually decided to proceed with the Three Gorges Project, President Clinton had, in a "pre-nuptial agreement" with Al Gore, relegated to his Vice President key areas of responsibility, first and foremost over the environmental agenda. Many Gore appointees were immediately placed in responsible positions in the Bureau of Reclamation, and the Department of Interior.

A year later, seven environmentalist groups filed a law suit against the U.S. Bureau of Reclamation and the

Army Corps of Engineers, charging that the assistance they were rendering the Three Gorges Project would flood the habitats of a dozen "endangered species." The Bureau, a branch of the Interior Department, whose head now was the notorious environmentalist Bruce Babbitt, withdrew from the project that same year. Serving as the commissioner of the Bureau of Reclamation at this time was none other than the same Dan Beard, who had helped author the new "small is beautiful" policy during his work for the Water Resources subcommittee in 1986. True to form, Beard issued the new—and now politically correct—response of the Bureau to the Three Gorges Project: "Reclamation's current priorities," Beard said, "are water-resource management and environmental restoration, not large dam projects."

According to a *Wall Street Journal* article, April 18, 1994, on cost-benefit analysis, Dan Beard, was planning a trip to China that May to explain to the Chinese the position of the Bureau. "Large dams are tremendously expensive," Beard would later tell his Chinese hosts. "They always cost more than you thought and tie up huge sums of capital for many years." The trend is toward smaller dams and environmentally friendly flood control, he said. "There's no more visible symbol in the world of what we are trying to move away from than the Three Gorges Dam," Beard told the *Journal*.

At the same time, the Clinton Administration, was intent upon establishing a good working relationship with China—but not at the cost of alienating Al Gore's environmentalists.

When U.S. companies expressed a keen interest in getting involved in the construction of the Three Gorges Dam, the Clinton Administration was still split on the issue. Should it allow the U.S. Export-Import Bank to give credit guarantees to companies interested in building the Three Gorges? Here, again, the Gore influence won out. "The Clinton Administration, with Al Gore at the head of their environmental parade, wasn't going to take on industry head-on," said Robert Oury, CEO of Rotec Industries, an engineering firm interested in participating in the Three Gorges Project. Instead, it created bureaucratic obstacles. "They put out enough rabbit trails that we just went around and around, and they wore us out."

In 1992, under pressure from the environmentalist lobby, Congress passed legislation which mandated an environmental review for all foreign projects in which the U.S. Export Import Bank was involved. The Three Gorges Project became a test case for this new policy. Because of the significance of the project for U.S.-China relations, Ex-Im asked the National Security Council to convene a panel to consider the merits of U.S. participation in the dam. In September 1995, the interagency National Security Council panel delivered its recommendation, signed by the then Deputy National Security Advisor Sandy Berger. The U.S. government, the panel advised, should not "align itself with a project that raises environmental and human rights concerns on the scale of the Three Gorges." But the memo, leaked to Congress, counselled the government to "refrain from publicly condemning the Three Gorges Project." Instead, it continued, "explanation of our policy should emphasize the U.S. government's commitment to strengthening commercial relations with China and to helping China meet its basic energy needs."

In May 1996, in reply to a request for credit guarantees and associated loans by Caterpillar and other major companies bidding for contracts at the dam, the Ex-Im Bank issued a ruling that it would not provide guarantees for the project. Ex-Im President Martin Kamarck, a close ally of Al Gore, told

reporters on the occasion of the Board's decorges,

The Board has concluded that Ex-Im Bank cannot issue a letter of interest for this project at this time. The information received, though voluminous, fails to establish the project's consistency with the bank's environmental guidelines.

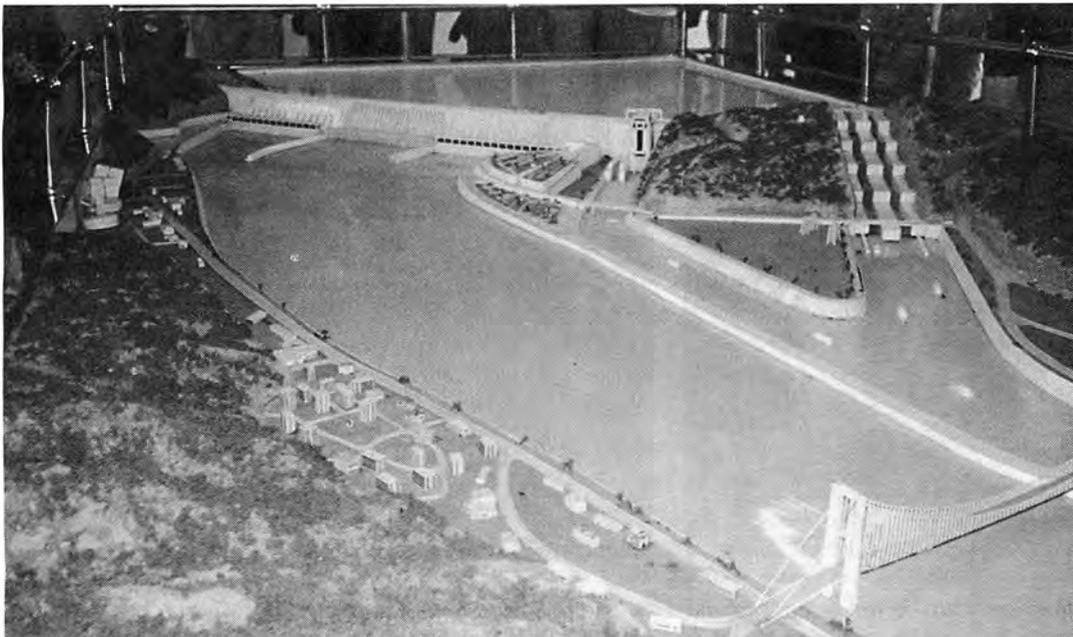
Kamarck then went on with his sop to the Chinese government:

If the China Yangtze Three Gorges Project Development Corporation, the sponsor of this project, provides Ex-Im Bank with additional information with respect to development and mitigation of the environmental issues involved in the project, the Board could reconsider support for the project.

As the project authorities had already provided "voluminous" environmental information, his final comments were really meant to allay any possible bitterness of the Chinese side regarding the decision. Kamarck was also quick to add that "no serious concerns were raised in this process about the creditworthiness of the project or the technical feasibility of the project."

There was a failed attempt by a handful of lawmakers, some representing districts of those companies interested in bidding on dam projects, to protest the Ex-Im Bank's decision. On May 30, the day the Ex-Im Bank made its ruling, Republican Rep. Don Manzullo, representing the 16th District in Illinois, issued a press release stating:

I am very disappointed that Ex-Im Bank has decided to postpone, in effect, deny, support for U.S. businesses and U.S. jobs. By denying support for U.S. exports to the Three Gorges Dam project, billions of dollars worth of



Marsha Freeman

A model of the current plan for the completed Three Gorges Dam, on display in the visitor's center at the construction site. The site has become one of the most important tourist attractions in China, for citizens and foreign visitors.



Marsha Freeman

Entrance to the Three Gorges, going upstream, at Xiling Gorge.

U.S.-made goods and services will be lost. That translates into revenues here. Every day that Ex-Im and the Administration drags its heels on this project, it means more lost sales and more lost wages.

The Three Gorges Dam is going to be built. We can't stop it. The strange twist on all of this is that it is a hydroelectric dam—one of the cleanest sources of energy on the planet. If the environmentalist lobby that opposes this project has a better idea of how China can solve its shortage of electricity, let them step forward with it.

Referring to the industrial companies in his district inter-

ested in supplying equipment for the Three Gorges Dam, Manzullo named Bergstrom Manufacturing in Rockford, Illinois, which makes heating, ventilating, and air conditioning components for Caterpillar. Based in Peoria, Illinois, Caterpillar is one of the handful of companies that is exporting equipment for the project, without guarantees from the Ex-Im Bank. Although we constantly hear about our trade deficit with China, Manzullo concluded, this policy will further block the export of goods to China.

During a trip to China in November 1997, Sen. Frank Murkowski, a Republican from Alaska, and chairman of the Senate Energy and Natural Resources Committee, scored the Administration's refusal to support the Three Gorges Dam project. Murkowski met with Chinese President Jiang Zemin and Vice Premier Zhu Rongji, and said he would pursue efforts to reverse the Ex-Im Bank's lending policies.

In an op-ed written a few months later, in August 1998, during severe flooding on the Yangtze River, Sen. Murkowski stated that while the environmentalists are worrying about the people who might be displaced by the dam, and the potential harm to endangered species, more than 3,000 people had already died in the ongoing flood. He pointed out that the Ex-Im Bank's policy actually hurts the environment, because if China did not build the dam, it would have to build an additional 36 coal-burning power plants. "Ex-Im's refusal to consider Three Gorges due to environmental concerns is ludicrous," Murkowski stated.

Although such protests did not alter the policy of the Gore faction in the Administration, the environmentalist obstruc-



Marsha Freeman

The steep hills that line the gorges are narrowly terraced and farmed, which has increased soil erosion and the amount of silt in the river.



Marsha Freeman

A bridge across a gorge. When the reservoir and dam are completed, the water level here will reach the bottom of the bridge.



Marsha Freeman



Marsha Freeman

An old town near the riverbank (right), now abandoned, as residents moved to new homes, higher up, in the resettlement program (left).

tions did not stop the project; the dam had become too important. The Three Gorges Project had already become a critical element in the overall development of China, elaborated under Premier Zhou Enlai and developed by Deng Xiaoping, as the “four modernizations,” in 1978, embracing industry and trade, education, military organization, and agriculture.

In 1999, the new dam also served as a major element in the new initiative by the Zhu Rongji government to “develop the Western regions.” For example, the dam will bring large, sea-going vessels to the interior port of Chongqing, a key gateway to the western regions of China.

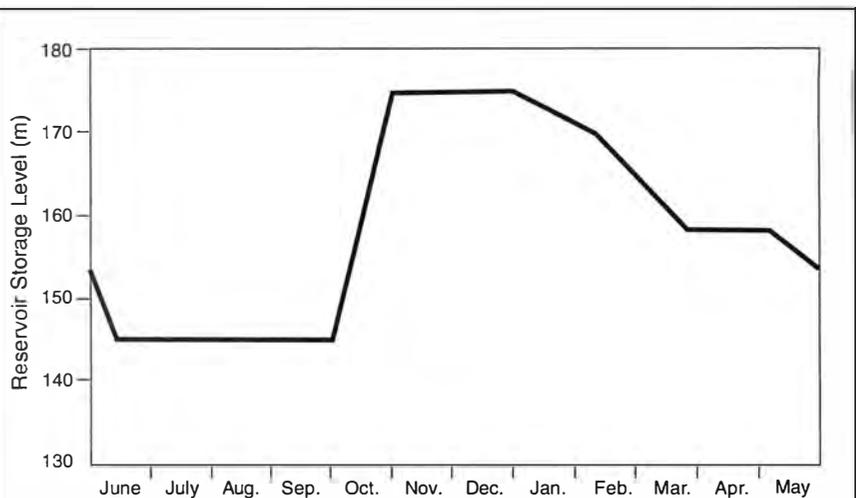
At the same time, the successful completion of the Three Gorges Project will also send an important signal to suffering nations in Africa, Asia, and Latin America that the era of “Great Projects” is not dead. The mealy-mouth double-talk about “appropriate technologies” and “sustainable development,” will recede into the shadow of the great dam, built to tame the mighty Yangtze, and will appropriately become, along with the Great Wall of ancient times, one of the few man-made objects distinguishable by the naked eye from space.

Building The Mighty Dam

The construction of the dam, begun in September 1994, will take 17 years from its inception, proceeding in three stages. When the dam is completed, it will have a height, or crest, of 185 meters, placing it somewhat higher than

the Golden Gate Bridge. In the early phase of operation, during the third phase of construction, the water level in the reservoir region will be 135 meters, and the final Normal Pool Level, or highest level, will be 175 meters.

Once the dam is completed, the raising and lowering of the water level in the reservoir behind the dam will provide the ability to control flooding (see figure, below). As the flood sea-



SCHEMATIC OF ANNUAL VARIATION IN RESERVOIR WATER LEVEL

Unlike many other flood-control dams, the water level in the reservoir behind the Three Gorges dam will vary throughout the year, lessening the accumulation of silt in the reservoir. The level in the reservoir will be at its lowest during the potential flood months of June through August, in order to prevent flooding. The water level will be increased between September and November to allow for the maximum production of electricity. Water will be released through the dam during the dry winter months to enable navigation downstream of the dam, and it will remain at that lowered level to catch the flood waters the next spring and summer.

Source: Yangtze Three Gorges Project Development Corporation

son approaches, from the end of May to the beginning of June, the water level in the reservoir region will be lowered to the flood control level of 145 meters, with the expectation that storage capacity will be needed during the flood season. After the passing of the potential flood peak, the water that has been stored, to a maximum of 175 meters, will be safely discharged, and the reservoir will again be lowered to 145 meters.

By October, the reservoir level will be gradually raised to 175 meters to allow the power station to meet the demand for electricity; regulating the water storage will be used to guarantee power output. Between January and May, the reservoir storage level will be lowered to increase the flow downstream during the dry winter season. At the beginning of the spring, the level will then be appropriately low, in preparation for the possible summer floods.

The first stage of construction, from 1992 to 1997, involved the building of two phase-one cofferdams to shut off the flow of the river from the construction site, and the re-routing of the river through an artificial diversion channel. Barges and other ships pass through the diversion channel, or if the river floods, through a temporary shiplock built for that purpose. Additional infrastructure, such as a new major highway road, the Three Gorges Project Expressway, was built to reach the otherwise inaccessible mountainous region, in order to transport the tons of materials excavated from the construction site. Along the Expressway there are 34 bridges and 5 double-lane tunnels, including a 3,610-meter single-line tunnel, which is the longest in China. In addition, a major suspension bridge, the Xiling Yangtze Bridge, was built over the Yangtze River downstream from the dam site.

During the first stage, the site for the permanent shiplocks was excavated, and the foundation laid for generation unit number 1 of the left-bank powerhouse. Construction also began on a vertical shiplift, a one-stage vertical hoisting system, which will accommodate those lighter, 3,000-ton passenger ships which may require a quicker route through the dam than the five-step shiplock, which is designed to accommodate larger vessels.

Now during phase two, from 1997 to 2003, the construction of the left bank dam section is under way; the left-bank powerhouse will be completed with the installation of some units, and construction of the spillway and continued construction of the permanent shiplock are taking place. The spillway dam, placed in the mid-section of the structure, is 483 meters long with 23 bottom outlets and 22 surface sluice gates. With a maximum discharge capacity of 102,500 cubic meters per second, the project is able to discharge the maximum level of water possible during floods.

In December 2002, before the flood season in the spring of 2003, the phase-three cofferdams in the diversion channel will be finished, and the reservoir water level will be raised to 135 meters. At this time, the permanent shiplock will be ready for use, and the diversion channel will no longer be needed for navigation. According to the scheme for the second stage, 17 million cubic meters of concrete will be poured, 180,000 metal structures will be installed, and approximately \$10 billion will be invested. The water level will be raised to the 135-meter level, creating the reservoir behind it, stretching 600 km back to the city of Chongqing. Construction will continue on building the right bank dam and the second power plant.

By the end of phase three, the water level behind the dam will be raised to its final 175-meter level. The reservoir formed in the upper river will be longer than the Grand Canyon, with an average width of about 1 kilometer, approximately twice the width of the present river. It will have a total storage capacity of 39.3 billion cubic meters including a flood regulation and storage capacity of 22.15 billion cubic meters. This will effectively increase the flood control standard of the hard-hit Jingjiang section of the river, between the gorges and the city of Wuhan, from the present standard of sustained 10-year floods to the standard of 100-year floods. Even if there were a flood of the size that occurs only once every 1,000



Yangtze Three Gorges Project Development Corporation

During the first stage of construction of the Three Gorges Dam, temporary cofferdams were built to close off the flow of the river. A diversion channel was built to allow the passage of ships while the dam is under construction. The final closure of the coffer dam in 1997 (shown here) was a cause for national celebration, and carried out with great ceremony. With the flow of the river diverted around the dam site, the job of excavating the soil and building a foundation for the dam began.



Marsha Freeman

◀ During phase 2, the five-step shiplock is under construction. When completed, ocean-going vessels will be able to traverse the Yangtze River year round. A shiplift will be used for small passenger vessels.

The temporary shiplock, shown below under construction, is being used by ships during the flood season, when it is not safe to go through the diversion channel. When the dam is completed, it will be replaced by a five-step permanent shiplock.

years, the vast plains on both sides of the section of the river below the dam, with the appropriate flood diversion and retention capacity, would now significantly limit the damage.

The reservoir will considerably improve navigation upstream on the river by raising the river's level between Chongqing, and the city of Yichang, which is just downstream from the dam. That stretch of the Yangtze through the Gorges, so well loved and oft written about in Chinese song and poetry, consists of 139 major treacherous shoals and fast-moving rapids, and 46 control sections, where only one-way traffic is possible. Downstream, in the Jingjiang section of the river, navigation is difficult when the river level is low because of the ubiquitous sandbars. The river is well-nigh impassable during a large part of the year; during the dangerous flood season in the spring and summer, and during the dry season in the winter.

In the days before motorized boats, and indeed, until only a few decades ago, when the river was low, the upstream trip demanded the services of dozens of trackers, who would, sometimes at the risk of their lives, use ropes to pull boats up the river, walking along narrow paths carved into the cliffs, or along the shoreline. Motorized propulsion has made the trip easier, but it still requires a knowledgeable captain, who knows the nooks and crannies of this dragon river, to take the passengers safely to their destination.

Even then, occasional avalanches take place, which pour massive rocks into the river, thus changing the contours of the river bottom, making the going treacherous even for old river hands. The raising of the water level in the massive reservoir region will slow the flow of the water and submerge the dangerous shoals. This will allow barges in the 10,000-ton class to sail upstream to the harbors of Chongqing. It is estimated that there will be a five-fold increase in the amount of ship-



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ping to Chongqing, and even ocean-going vessels will be able to reach it. This will increase the annual one-way passing capacity to Chongqing from the present 10 million tons, to 50 million tons, and transportation costs will be decreased by about 35 percent.

In addition, with the regulation of the reservoir, the minimum flow downstream of Yichang in the winter dry season will be increased from the present 3,000 cubic meters per second to more than 5,000 cubic meters/s, thus improving navigation also in the middle reaches of the Yangtze. Because it will be able, during low water conditions, to release water from the reservoir to the middle reaches of the Yangtze, the Three Gorges Project will also increase navigation along the



Wong How Man

For centuries, boats on the Yangtze River could safely negotiate the shoals in the gorges only with the help of trackers, who would pull the boat by ropes while passengers walked along the shore. Here, trackers at work in the early 20th century.



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The trackers used footpaths that they had carved in the steep sides of the mountains, during flood periods. Here, a view of the narrow footpaths used by trackers, carved into the mountain side.

mid-stream Jingjiang section of the river.

The creation of the reservoir upstream will also improve water conditions downstream, diluting sewage and improving water quality in that part of the river.

Vast Hydroelectric Power

The second major economic benefit from the dam will be the tremendous amount of hydroelectric power that will be drawn from the river. The Yangtze, with its elevation high in the west and low in the east—a total drop of 5,400 meters—contains the largest hydropower resources in China. For the cost-benefit analysts, who are convinced that China will never be able to pay for the Three Gorges Dam investment, and that the project will sap the capital available for growth, the Chinese point out that the project's power generation is what will allow all the capital investment in the project to be recovered.

The Three Gorges Hydropower Station is comprised of two power plants, situated on each side of the central spillway, with a total of 26 generating units. As a result of the U.S. decision in May 1996 to prevent the Export-Import Bank of the United States from guaranteeing loans for American companies interested in bidding on components for this vast hydropower project, eight of the turbines and alternators are being built by a consortium made up of GEC-Alsthom (Franco-British), and ABB Asea Brown Boveri of Switzerland. The contracts for another six, valued at \$320 million, went, in 1997, to Germany's Voith and Siemens AG, and to GE Canada. The only large U.S. industrial company involved in the Three Gorges Project is Caterpillar, Inc., which has supplied about \$30 million of earth-moving and other equipment. Rotec Industries Inc. has also sold about \$20 million of equipment to China.

Each generating unit has a capacity of 700 MW, the size of a baseload powerplant. The total capacity will be 18,200 million MW, with a planned annual power generation of 84.7 billion kilowatt-hours. It will be the single greatest power plant in the world, about 1.44 times bigger than the largest existing hydropower project built jointly by Brazil and Paraguay at Itaipu. The energy produced annually by the Three Gorges station would replace 40 to 50 million tons of coal, and relieve the corresponding stress on the nation's railway system, which transports the coal.

A Chinese poem about the Yangtze says that "the billowing Yangtze flows forward to the east entering the sea, while bringing away enormous coal and oil," because the water power has been wasted. Without tapping the vast hydroelectric resources of the river, the poem continues, "there are 50 million tons of coal, or 25 tons of raw oil, being poured into the sea in vain."



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Much of the industry that exists in the Three Gorges region today is old and labor intensive. Here, coal that is mined in the mountains is stored in these river-side bins for shipment. In the future, when this area is submerged and the dam's power plants are operating, China can reduce its reliance on coal burning, using the electricity produced by the dam. Note the new city at top.

The production of electricity from the Three Gorges Dam is particularly significant in light of China's recent drive to develop the western regions of the country. The city of Chongqing plays a very important role as one of the "gateways" to the Western regions. Much of the hydroelectric power from Three Gorges can help relieve some of the dependence on coal-burning plants, which has provided the bulk of China's energy production, but which leaves a perennial haze over Chongqing and other major Chinese cities. From the Three Gorges generators, there will be 15 transmission lines, with 500 kilovolt (kv) AC lines going west to Central China and Chongqing City, and 500 kv DC lines to East China.

At last, Sun Yat-sen's vision of plentiful electricity for the development of China's treasured valley will be a reality.

'Correcting' the Environment in China

In the aftermath of the refusal of U.S. government institutions to involve this nation in the Three Gorges Dam project, because it would supposedly "harm" the environment, Qin Zhongyi, vice president of the China Yangtze Three Gorges Development Project told *China Daily*, July 7, 1996, that unlike the American approach of "preserving" the environment, the Chinese approach is to "correct" the ecological problems in his country.

The Three Gorges Dam is necessary to save the lives of millions of people, as another "century flood," like that of 1870, is threatening the Yangtze, Qin said. "Erosion and silt buildup have swayed the natural balance of the river, and engineering is the only means available to restore the balance, aside from

resorting to God's mercy," he explained.

In fact, the 1998 flood—which killed more than 3,000 people, required the evacuation of 13.8 million people, destroyed millions of houses, and ruined 4.78 million hectares of crops—was less severe, in terms of the amount of river flow, than previous floods. But the build up of silt, largely the result of the erosion of land along the banks, had raised the height of the river and the flood diversion regions, leading to widespread flooding.

No one in any official capacity in China denies that the country has severe environmental problems. But in the south of China, the greatest threat to the environment is not "endangered species," but floods. And in the north, the greatest threat to the environment, and the economic growth of the people, is drought. The Three Gorges Dam project is the centerpiece of a vast plan designed to create a balance between areas of water abundance and water deficit, greatly improving the environment for hundreds of millions of people. The most important environmental benefit of the Yangtze dam project will be seen in the lives of the people.

A great deal has been made of the need to resettle as many as 1.2 million people from the lower slopes of the gorges, west of Sandouping, which will be inundated to create the great reservoir behind the dam. According to government figures, there are 846,200 people living there now who will have to be relocated. (The figure of 1.2 million, often quoted in the press, includes the natural population growth expected between the start of the project, and its completion in the year 2009.)

The opposition to resettlement, from "human rights" groups to environmentalist groups, has devoted thousands of pages of articles to the plight of the farmers in this region, and the failure of the government to adequately provide a new life for them. There have even been warnings that dissatisfied peasants may rise up in violent revolt against the authorities.

There is no question that the resettlement is an enormous job. The reservoir region behind the dam will inundate 17,160 hectares of farmland, and 3,867 hectares of riverside land will be flooded. It is estimated that 34.8 million square meters of rural and urban houses are below the inundation line. Also, land will be lost to the construction of roads, electricity transmission lines, communications lines, and other infrastructure.

According to one estimate, between 1949, when the People's Republic of China was founded, and the mid-1980s, more than 10 million residents have been affected by the building of reservoirs and other hydrological projects. The policy initially was to compensate them with a one-time payment to make up for the property they were to lose. But because there were not adequate opportunities for new work for those who were relocated, when that payment was

exhausted, the relocated individuals had to turn to the government for help.

The one-time compensation policy has been replaced with the policy of "population relocation for development," the goal of which is to raise the standard of living of the relocated population, by providing employment and better living conditions after the move. In a development-oriented policy, the resettlement should be integrated with the development of the economy, the exploitation of resources, and construction in the reservoir region to increase productive capability, improve the living standards of the relocated individuals, and raise the environmental quality.

Today, one sixth of the total population in the region from which people will be moved, roughly 3 million people, is below the poverty line. Because about one quarter of the land that is cultivated along the gorges exceeds a 25-degree slope (cultivation on which has now been forbidden), the soil is heavily eroded. According to a 1982 census, in Wan County, a district with 7.5 million people, there were only 13 secondary-school or university graduates per 10,000 population, whereas the national average is 44. The illiteracy rate of the population over the age of 12 was 31.9 percent.

Resettling—and Upgrading

Traversing the Yangtze River, it is plain what the government's plan for resettlement is. Above almost each settlement, or small town of old, and often dilapidated houses and small industries, entirely new cities are appearing, near the tops of the mountains. New roads, schools, health facilities, power lines, and housing are under construction. It is estimated that about 57 percent of the population in the inundation zone are urban dwellers, who could be resettled along with the relocation of the cities or towns.

Hillside slopes that are now farmed using the power of water buffalo and hand labor, and are fertilized with human and animal excrement, will be replaced with more modern farming methods and technology. But there will still be a gap between the amount of grain and basic foodstuffs that can be produced on the available land, and the number of farmers that will be displaced. The government planners expect now that 60 percent of the farmers will remain in farming, and the other 40 percent will be absorbed into secondary and tertiary industries. These industries will take advantage of the mineral resources, such as phosphorus, salt, and lime in the valley, which can serve as raw materials for chemicals, fertilizer, and building materials industries. This will require a dramatic upgrading of the education and skills of many of the valley's farmers.

In May 1999, the Chinese government made another important change in its relocation policy for the dam. China has decided to relocate 125,000 rural people living in Chongqing City, who will be affected by the rise in the level of the Yangtze River there after the reservoir is inundated, to 11 regions in the eastern coastal provinces over the next nine



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◀ Before construction could begin on the Three Gorges Dam, preliminary infrastructure, such as roads and bridges, had to be built. The Three Gorges Project expressway is the pathway to bring materials to, and take excavated materials from, the dam site. A training center was also built, to train the 40,000 workers on the dam project in dozens of new skills.

Xiling Yangtze Bridge (below), opened in 1996, is located 4.5 km downstream from the dam site, and is a main road across the river.



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years. Of the total, Shanghai, at the mouth of the Yangtze on the East China Sea, will take 5,500 people, all from one county in Chongqing, and the first group of 639 farmers and their families arrived there in mid-August. In total, *China Daily* reported on August 18, 2000, 227,000 people have been moved out of the Three Gorges Dam area so far. A given portion of the income from the hydroelectric production at the dam will be returned to the relocatees in other parts of the country, and the rest to the reservoir region for construction.

When the government announced this change in mid-1999, Prime Minister Zhu Rongji also voiced concern about the "misuse" of funds that have been given to local communities to build new housing and facilities for those who are relocated. Corruption by local officials has been given a public airing, with severe penalties imposed on those who are taking public money for personal gain.

Most of the Western press has stressed only the problems, and vastness of scale, of the resettlement program. But during an interview with Wan Jiazhu, Vice President of the China Three Gorges Project Corp., on August 11, 2000, reporter

Martia Sharp from *Star Weekly* in Germany remarked: "In Germany, moving even 100,000 people is impossible, whereas the TGP [Three Gorges Project] will move more than one million. May we say Chinese people have a sense of taking into account the interest of the whole?"

Wan Jiazhu replied, "That is right." When the dam was being planned, he said, "representatives of the upstream area [who will be moved] investigated the middle and downstream area. They understood that in the case of a large flood, people in the downstream plain area would have no way to escape [no hills to mount]. They thought it would be worth it to sacrifice some [of their] interests."

Asked whether the burden is "quite heavy" in being the Vice President of the Corporation, and a water resources expert, Wan Jiazhu replied,

We Chinese people have studied TGP for more than 70 years. Several generations of engineers expended the painstaking labor of their whole lifetime [on this project]. I have participated in the study of this project for more than 30 years; I am the third generation. I am inspired with enthusiasm, and feel my burden is very heavy, and I will do my best for the Three Gorges Project.

Real Environmental Concerns

In addition to making the most important environmental improvement—changing the lives of the people—the Three Gorges Dam is part of an overall policy to improve the environment of the Yangtze Valley, including the control of the approximately 500 million tons per year of silt that course down the river. Mountainside farming will be replaced with terraced fields to preserve the top soil. Reforesting the mountains to reduce the water runoff and erosion has been under way, and will accelerate.

The possibility of the collection of silt in the huge reservoir to be created by the dam has been a main objection by the dam's opponents. Problems of silt buildup at the Aswan Dam in Egypt, and others around the world, have added to this concern. According to the Chinese, extensive and detailed studies on sedimentation in the reservoir region began in the early 1950s, and concern has increased, as the existing reservoirs and water diversion areas have been filling with silt. The successful solution to the possibility of the silting of a dam's reservoir, achieved with the Yangtze Gezhouba Dam has provided 18 years of experience on how to solve such a problem.

Historical data suggest that the amount of silt content in the Yangtze River cannot be determined by examining only a few years' data, because the silt content can change dramatically, depending upon precipitation and its distribution in the region. The sediment load, for example, was 361 million tons in 1986, 320 million tons in 1992, and 210 million tons in 1994, with higher years in between. Based on more than 40 years of observations, sediment discharge averages about 526 million tons per year.

Unlike other dams, where the water storage for flood control is essentially static in non-flood years, and silt builds up year after year, the water in the Three Gorges Dam reservoir, which is not a lake but the widened river, will be raised and lowered throughout the year, to make room for flood waters

in the spring, and to increase the flow downstream during the dry winter period.

During flood periods, between June and September, when 84 percent of the sediment comes down from the upper reaches of the river, the dam will release water downstream so that the reservoir can remain able to store flood waters at a height of 145 meters. Sediments will be flushed out through the sluice gates with the water when the flow of the Yangtze is high. The remaining sediment will be kept in dead storage.

At the end of the flood period, when there is less sediment content in the water, the reservoir will be impounded for power generation, and for aiding navigation, at the 175 meter level. Toward spring, the water level in the reservoir will be lowered again to the flood control level, at which time the sediments deposited in storage will be flushed out with the increased water flow.

The operational mode is to "store clear water but release muddy water." In this mode, it is estimated that after about 100 years, when a balance is reached between deposition and flushing of sediment, 86 percent of the flood control capacity of the reservoir, and 92 percent of the active storage of silt, will be preserved.

David Hall, who directs the TVA's work in China, stated in an interview, that regarding silt,

there are ways to deal with it. We have silting in reservoirs across the United States in varying degrees. A lot of it depends upon the types of terrain that the river flows through. The more vegetation you have, the less erosion, and therefore the less silt coming into the reservoir. But at TVA we have a small reservoir that has silted up. It was not worth it to us to go to the expense of removing the silt and keeping the reservoir open.

In China, silting tends to be a larger problem; we're fortunate here, in that we have lush vegetation, and TVA has taken action to reforest lots of areas, and in the 1930s and '40s and '50s, we were helping to change farming techniques, and lots of things prevented soil erosion, which keep us from having our reservoirs silt up. In China, there is not a lot of vegetation, and there are still farming techniques that lead toward erosion. Silting is a problem any time you build a dam and slow the flow of the water. There are techniques for flushing the silt through the dam, and there are ways of designing the structure to minimize the silting. The Chinese say, "We understand silting and we have taken it into account using the best expertise from around the world."

Putting People First

Other "environmental" objections center on the impact this great water project will have on "endangered species," and other non-human forms of life. The Chinese have taken a clear stand on the issue, by putting people first. Until the 1960s, this was also the perspective of the builders of great projects in the United States, and around the world.

The Chinese describe the Yangtze River as "China's treasure house of freshwater aquatic resources." Although there are more than 1,000 aquatic species in the river, including 370 species of fish, what is important is that freshwater fish



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The White Emperor City, one of the cultural relics, will remain as an island when the surrounding area is flooded.

production in the river accounts for more than half of the nation's total, and is an important source of protein. These include, in particular, black carp, grass carp, silver carp, and bighead fish, described as the "Chinese Four Family Fish."

Changes in the flow of the river, the deposition of sediment, and other factors will influence the balance of fish species in the Yangtze. The experts expect that fish that move up to the higher reaches of the river to spawn and cannot navigate past the dam will decline, but that there will be an expansion of the habitats for the fish that favor living in still water, in the reservoir region. Also, some spawning fish will adapt, and not necessarily suffer a decline.

The construction of the great dam, and the reforming of the valley, on the model of the TVA, provides China with the opportunity, and the challenge, to move a large part of its population from the 19th century, into the 21st century.

Reporting on diversion of the Yangtze River, by completing the cofferdam, *The New York Times* wrote, on November 9, 1997:

Yet, like the Great Wall, the Three Gorges Dam may be as symbolic as it is practical. Although engineers on the site today described how the dam will control floods for centuries, these experts gushed even more about how the dam's tremendous scale—600 feet high and more than a mile wide—represents the nation's contemporary greatness. By insisting on an enormous size, rather than building several smaller and safer dams nearby as some engineers have proposed, the Communist Party leadership is building not just a dam but a political monument to itself. . . .

For years, opponents of the dam have thrown up "environmental" objections to the project, or questioned its "viability." But it is clear that much of the opposition, especially outside China, has been driven by opposition to the economic devel-

opment policies of the government, more than to the dam itself.

"It's because of politics, not technical problems, that they are against the dam," Three Gorges chief engineer, Gan Weiyi stated. He spent two years at Northwestern University researching the project before construction began. "I know it can be done," he said, "because I studied dams in America."

Preserving a Cultural Heritage

The Yangtze, together with the Yellow River, is one of the great sources of the origins of Chinese civilization. Some remains go back as far as 600,000 years ago, when so-

called Lantian man inhabited the area. Remains from 100,000 years ago, when a group of hunters inhabited Hubei province, have also been found. Early forms of agriculture date back to 6,000 B.C. Many new sites and cultural discoveries have been made in the archaeological work where the great dam is being built. As much of the area will soon be under water, it is of prime concern to save as many as possible of the cultural artifacts before the area is inundated.

There are an estimated 108 sites of important cultural and historical value in the area of the Three Gorges Project. Some of these sites are located above the 175-meter water mark of the new reservoir, and will not be touched. The famous White Emperor City (Baidicheng) that is now on dry ground, 180 meters above the river, will remain, and become an island, surrounded by rivers on three sides. But many are not above the water mark.

Some of the relics, including entire buildings, like the Zhangfei Temple at Yunyang, will be removed from their present site, to a higher location or to a museum. Some of the tablets found carved on stones in the river will have to be reproduced or protected. The key question at this point, is the amount of money that will be available for such preservation work from now until the area is inundated. Since this is such an important treasure, not only for China, but for the world, one would hope there would be more resources put into the preservation project from the international community. In a very real sense, it is a race against time to save those artifacts that can be saved.

The completion of the Three Gorges Dam, at the end of the first decade of this century, will open a new era in the economic development of China, and will provide an example to other developing countries of how Great Projects transform a nation. It will also stand as one of the greatest legacies of the TVA.

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