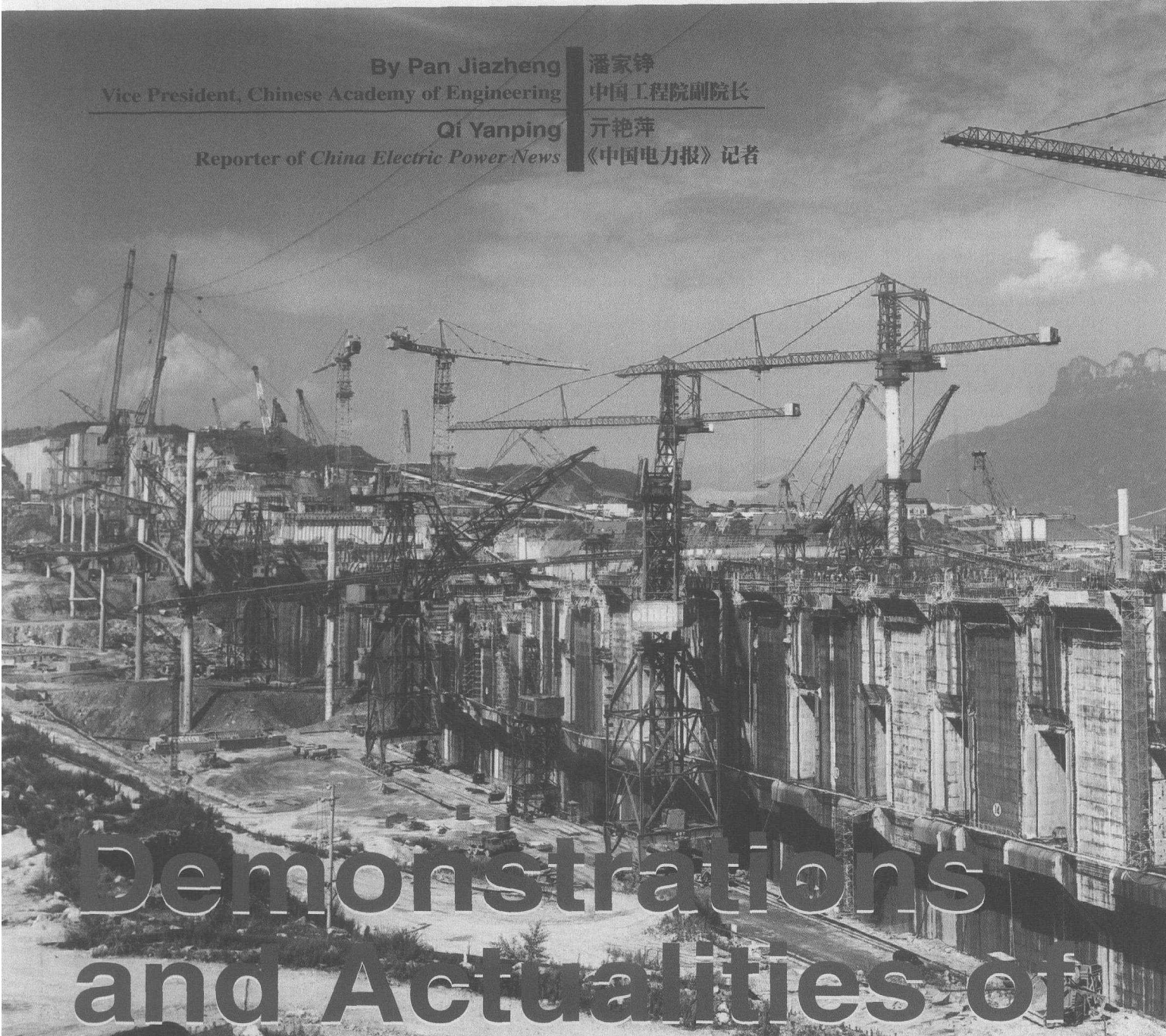


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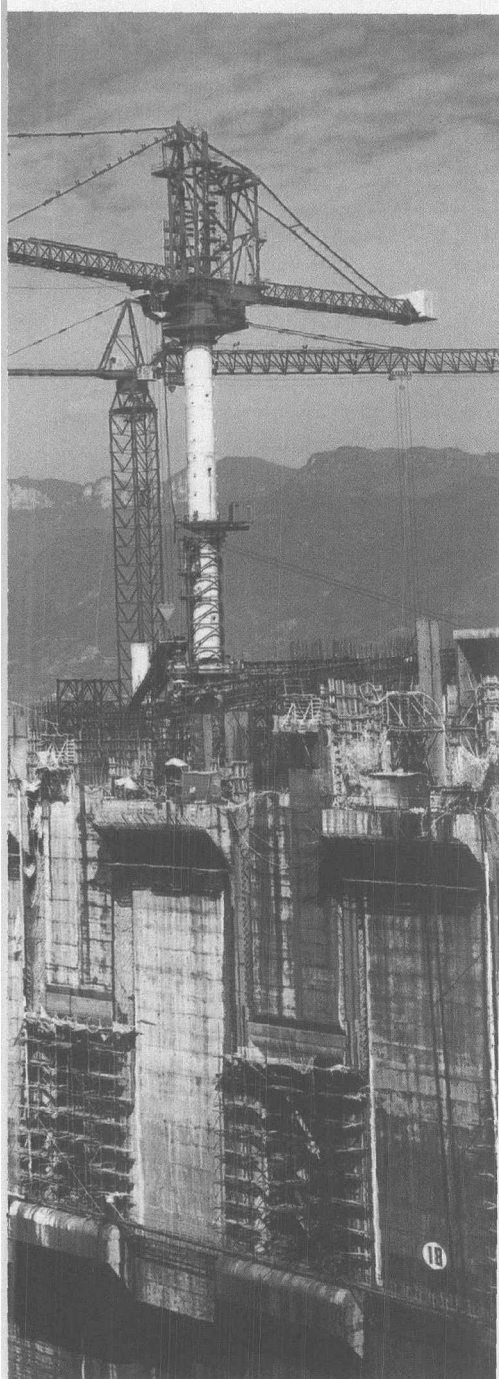
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Demonstrations and Actualities of Three Gorges Project

三峡工程的论证与现实



[Abstract]

This paper is a record of an interview discussion. It explains the demonstration process of the Three Gorges project in aspects of flood control and navigation, investment, settlement, sediment, ecological environment, geological disasters, science and technology and democratic way of demonstration work. It shows clearly that the demonstrational conclusion is fully in conformity with the actual situation.

[Keywords]

hydropower station; Three Gorges project; demonstration of project

[摘要]

本文为记者访谈录。文章从防洪和通航、投资、移民、泥沙、生态环境、地质灾害、科学与技术及民主的论证工作方式等七个方面阐述三峡工程论证过程，并指出论证结论完全符合客观实际。

[关键词]

水电站；三峡工程；工程论证

A short time ago Qi Yanping, a reporter of China Electric Power News interviewed Pan Jiazheng, vice-president of the Chinese Academy of Sciences, academician of the Chinese Academy of Engineering, Chairman of the Technical Panel of China Yangtze Three Gorges Project Corporation on different expertise during the Three Gorges project demonstrations and the project's actualities.

Flood prevention and navigation

Qi: The first aim to build the Three Gorges dam is to control high water, in other words, to ensure to have no worries about a biggest flood in a hundred years in the middle and lower reaches of the Yangtze River. Up to this

day the questions as to the actual benefits of control flood are still debating endlessly.

Pan: The major benefits of the Three Gorges Project lie in flood control, electricity generation and navigation. Queries center mainly upon flood control among them. A number of experts held that the project's flood control storage is limited in number and the conditions of flood disasters in the Yangtze River Valley are very complicated, therefore, the Three Gorges reservoir would have no means of effective resolving the problem of the Yangtze River's flood disasters. Some of them believed it to exacerbate flood disasters in Sichuan Province.

Thirty-day flood volume of the Yangtze River can be recorded at over 100 billion m^3 . The Three Gorges flood control capacity is 22.15 billion m^3 .

Can the reservoir play a role under the circumstances? Let's take the Yangtze River's flood disasters in 1998 as a checking object. High water occurred in the whole basin of the Yangtze River. There were eight flood peaks altogether. The water level at Shashi reached the biggest historical value of 45.22 m. Originally, the central government has decided to diverge flood with Jingjiang flood diversion area. Afterwards, several forceful measures were taken, such as flood detention by means of upper reservoirs, thus avoiding flood diversion. Although the storage capacity of the reservoirs which could be employed was extremely limited in quantity then, it has played a significant role for staggering flood peaks. There will be a reservoir capacity of 22.15 billion m³ available for storage regulation after the Three Gorges reservoir is built. With the help of it the water stage can be lowered by 1.5~1.6 m, so it is beyond all doubt to turn danger into safety.

Though the flood lasted longer and flood volume was large in 1998, the peak flood flow was not high at all. The largest peak discharge numbered only 63,300 m³/s at Yichang, commensurate to seven-year flood crest. It could not be counted as a secular flood. Floods in a century and even in a millennium occurred in the past. Flood discharges might reach 80,000, 100,000 and 110,000 m³/s. The Three Gorges reservoir should cope with this kind of devastating disasters first before considering how to regulate storage capacity for lower flood. A comprehensive flood control system is necessary to the Yangtze River. Now, various new issues should be investigated and studied, for example, improvement of Dongting Lake, coordination of different flood prevention measures and so on.

Qi: The other benefit of the Three Gorges project is presented on navigation. The design transit time of the Three Gorges lock is two hours and forty minutes. It is too long, isn't it?

Pan: But we should note that the navigation time could be shortened by six to eight hours on the deep-draft course of 600 km directly to Chongqing after passing through the lock. In addition, passenger liners pass over the dam with barge lift, which spends only forty-five minutes. It is more important that the Three Gorges project will promote the modernization

of navigation.

Investment

Qi: Up to now, the amount of capital invested into the Three Gorges project reached nearly 200 billion yuan. However, 30 billion odd yuan in an initially proposed motion still met with oppositions from some experts. What was the reason for it? Did they deem that our national strength would be hard to afford so large expenses or the investment in the Three Gorges project was difficult to be estimated?

Pan: Some people believed such an expense would be beyond the national strength. To start the project would lead to soaring prices and economic bust. According to some reckonings, the funds injected into the project would be 500 billion yuan, even a "bottomless pit". In addition, some specialists feared that the developments in hydropower industry and other economic sectors would be affected, if the project were constructed.

Facts during the ten-year construction proved that all the abovementioned problems didn't exist. The Three Gorges project didn't caused serious consequences, on the contrary enlarged domestic demands and promoted economic development. Simultaneously, it furnished employment opportunities in quantities. It is in the cards that the dynamic investment is controlled within 180 billion yuan. The project not only can repay capital with interest as planned, but also has an enormous competitive power and a staying strength for future development. In addition, it is to point out that for a time past the hydropower construction was progressing at an unprecedented great pace all over the country. Depending on the Three Gorges and Gezhouba hydropower stations, we are marching towards Jinsha River as still more abundant hydropower resources.

Settlement

Qi: In building of a reservoir, settlement is always a difficult point. No doubt it was a central issue in the demonstration on the project. How did the settlement work of the Three Gorges project advance actually?

Pan: As seen by the demonstration data, there was a population of 0.726 million in the reservoir area. Taking various factors of population growth in account, 1.13 million people are to be moved and migrated up to 2008. This is a crux to success or failure, whether the settlement issue could be well dealt with.

In order to perfectly work it, a way of working was adopted that experts were integrated with local governments to do the demonstration work. On the principle of "developmental settlement" various measures were put forward, the resources in the reservoir area were investigated, a settlement planning was drawn out and sufficient funds were placed in the plan so as to ensure "smooth and steady emigration and gradual acquiring wealth of migrants".

It is mentioned that inhabitants in cities and towns constitute more than half of population to be emigrated. If only city and town enterprises can be well moved and established, the residents are easily to be settled. A key point is how to settle agricultural population.

At present, the settlement task in the reservoir area under 135 m of water stage was fulfilled; 722,000 people were moved, of which over 100,000 emigrated, and 34.7 billion yuan was paid out for it. Migratory enterprises carried out readjustment of structure and upgrading and updating of products. Futureless enterprises were handled through bankruptcy or closed down. Functions and conditions of migrated cities and towns were much better than before. The per capita farmland of rural migrants came up to the stipulated standard. The compensation of settlement was handed to the migrants completely. Conditions in the settlement areas met requirements of their production and livelihood and obviously improved as compared with the original ones.

Sediment

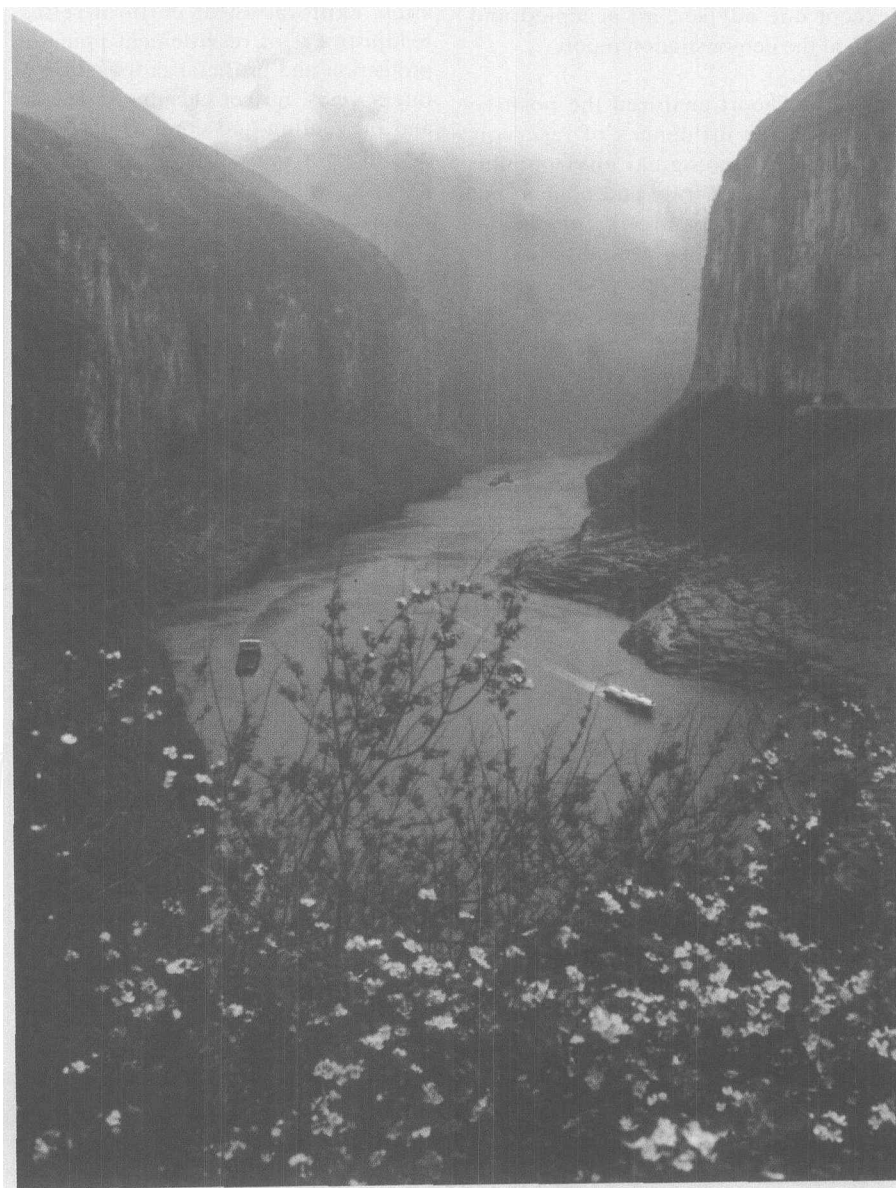
Qi: The sediment deposition of the Yangtze Three Gorges project is a major issue followed with public interest all along. However, there were two viewpoints that are different at all on it. The one is that the Three Gorges reservoir is of a river channel type. The

channel is very narrow. This reservoir can impound clear water and drain muddy water. The other is that the reservoir with a flood control storage of 21.0 billion m^3 would be fully silted up within less than a hundred years under such an annual sediment yield of 0.5 ~ 0.6 billion t.

Pan: The sediment discharge of the Yangtze River through the Three Gorges is 0.53 billion m^3 per year. Not a few people worried about this. They considered the reservoir to be silted up fast, so that it would lose its function. In addition, they held that a silt deposition in reservoir tail must raise the flood stage at Chongqing, thus making an impact on harbour and navigation. Some people put forward even a pessimistic argument that the Yangtze River would turn into another "Yellow River" as a result of continuous increase of its silt content.

In the light of complexity and importance of sediment problem, this issue, as an independent topic, was demonstrated. The expert group embraced nearly all the standard experts in sediment work. A lot of well-known research institutes, colleges and universities also went in for argumentation activities. Based on a great quantity of previous works many experiments, calculations and analyses were additionally conducted. The final conclusions were accepted by all the experts. Because the Three Gorges reservoir is of a channel type and adopts an operation mode of impounding clear water and draining muddy water, its usable storage will still hold at 85% ~ 92% for a long period of time after about 80-year operation and silt stabilization. It is the usable storage to take effect really.

Over ten years passed after the demonstration the all-round and further work on sediment investigation, experiment and analyses was always underway. More problems were buttoned down: (1) There is no possibility that the Yangtze River becomes another "Yellow River"; (2) Soil-and-water conservation measures are being taken at the upper reaches of the Yangtze River; (3) A rolled development of Jinsha River was started, so that sediment load will be reduced significantly; (4) The project is built strictly in accordance with the principle of construction at one stroke and impoundment at stages. So, there is still room for verification, analysis and adjustment, (5)



The final appearance of the Three Gorges — Qutang Gorge

Huge sum of funds is injected into comprehensive monitoring and analyzing sediment regimen before and after impoundment. Taking it all in all, nothing happened to have to change the main conclusions.

In order to deal with the silt deposition in the reservoir tail the measures of optimized dispatching, engineering and improvement of port and city area should be adopted.

Ecological environment

Qi: How did the expert group con-

sider the inundation of ancient relics and the protection of rare animals and plants after impoundment?

Pan: The reservoir which is built up will have widespread and far-reaching influences on ecological environment (including both positive and negative). Many of foreign and home figures take an opposite attitude to the Three Gorges project.

By virtue of extensive coverage of ecological environment involved, the demonstration group consisted of as many as fifty-five members. Most of them came from academies of sciences and departments of ecological environ-

ment protection. The group investigated and discussed all the related issues within three years. At last the experts, except one adviser, all accepted and signed the demonstration report.

The report analyzed the positive and negative influences of reservoir building on ecological environment exhaustively and truly and pointed out that the negatives are mainly in the reservoir area. They are classified as three types: (1) irreversible influences, e.g. inundation of farmland, ancient and cultural relics and changing of landscapes; (2) worse influences but can be alleviated with the help of effective measures, e.g. problems emerging from the resettlement, affects on rare species, waterlogging disasters to reservoir tail, as well as landslides and induced earthquakes, etc.; (3) light influences, losses of which can be reduced with the help of sufficient measures, e.g. influences on local weather, hydrologic factors, terrestrial animals and plants and water pollution.

The report showed clearly that the environmental carrying capacity to the settlement in the reservoir area is a constraint factor in a variety of influences. However, the ecological environment wasn't a factor to restrict the decision-making for the Three Gorges project.

In practice the experts' opinions gained respect. Authorities concerned

paid full attention to the ecological and environmental protection, for example, removing and rebuilding of historical sites, exploration of cultural relics, readjustment of resettlement planning protection and artificial propagation of rare species, further cleaning reservoirs and preventing and controlling pollution of river sources, removing ancient trees and so on.

Geological calamities

Qi: Is it possible that the Three Gorges project induces earthquake?

Pan: Some people had suspicions about geological conditions of the dam area and the reservoir area and believed that there were significant defects or latent danger.

The construction over ten years proved that the conclusion of surveys lasted for many years is correct. The dam base is fresh and sound granite. The engineering geology is in a favourable condition. The basic earthquake intensity is low. Therefore, it is an excellent location of dam. Nobody raised any objection to the above-mentioned conclusions.

Questions in dispute centered mainly on the stability of reservoir shore and reservoir induced earthquake. Most of the reservoir shore has a bank slope of base rock. The shore with poor

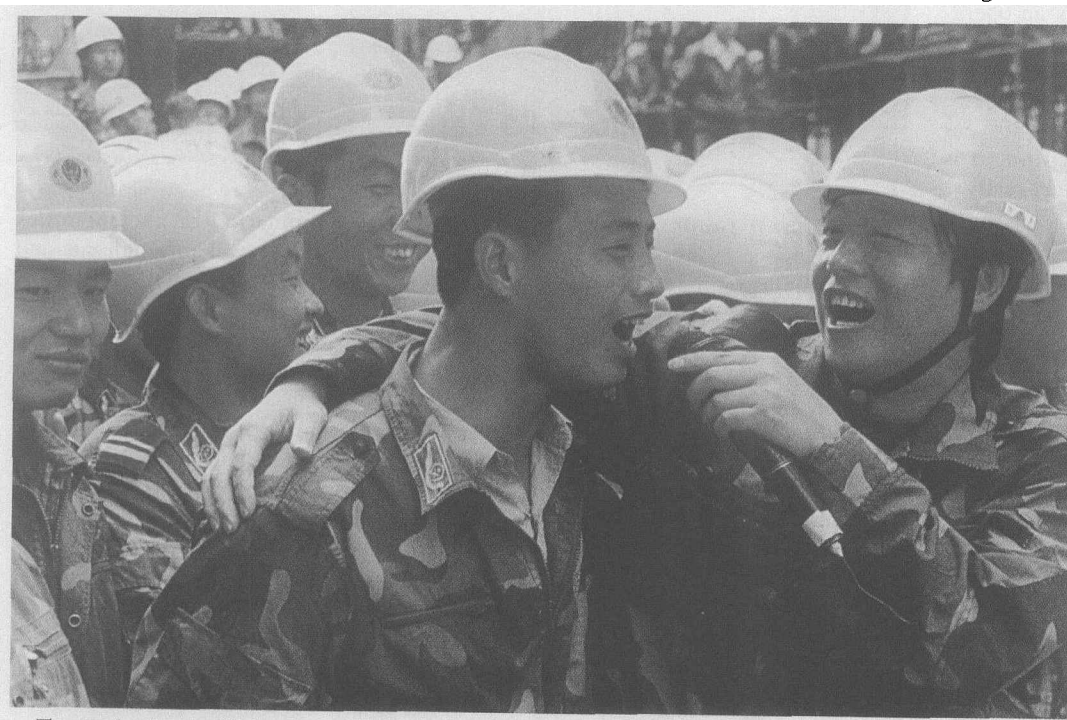
stability accounts only for 1.2% of the total length. Unstable phenomena have often cropped up there before building the reservoir and the river course was blocked at times. Larger slip masses were all surveyed, computed, monitored or strengthened. After the reservoir's impoundment, its water depth increases, water surface is broadened, however, the earth-rock of slip masses is limited in quantity. Therefore, such the landslides will not affect the effective storage and navigation channel, as well as dam safety. Up to now, there were no changes whatever in this conclusion. At present, main problems are to avoid removing towns and villages, enterprises and residents to the bank slopes with poor stability. Some departments didn't devote attention to opinions from geologists, thus being bound to repeatedly remove and rebuild. This is a lesson which is necessary to be drawn.

As regards the induced earthquakes and their scales, it depends on earthquake background in the reservoir area. The reservoir is seated in the district with a better stability of regional geology. There is no enormous seismogenic fault in the reservoir area. Two seismic belts pass through the reservoir section at distances of 30 km and 100 km from the dam site. Earthquakes occur most probably there. By a high estimate the maximum intensity of reservoir-triggering earthquake is a magnitude 5.5 on the Richter scale.

Suppose that an earthquake at a magnitude 6 arises along the Jiuwanxi fault which is closest to the dam site, its intensity to give an impact to the dam site would not yet be over 6. This is far lower than the design earthquake-proof intensity. The experts in geology agreed to the above-mentioned conclusion unanimously and re-mained so to date.

Science and technology

Qi: Can China take a heavy task to construct such a giant Three Gorges project



The armed policemen of hydropower taking part in the construction of Three Gorges project are singing on the site

by its science and technology?

Pan: The Three Gorges project is the today's world largest of water resources and hydropower works. It is confronted with a series of difficulties and challenges in the various aspects of design, construction, manufacture, and management, etc., for example, twin five-flight shiplock, river closure, second-stage cofferdam, third-stage RCC, over-heavy strength of concrete construction, mammoth metal structure, 700 MW hydrogenerator sets and others. Their technical difficulties in construction surpassed even the present world's level of science and technology partly. A number of foreigners didn't believe China could construct the Three Gorges project without supports from the Western countries. Some people among us had doubts whether China, as a developing country, could solve those problems based on its own technical and managerial strength. Results achieved for ten years answered this question. China will certainly complete the magnificent project on its own.

Democratic way of work during the demonstration

Qi: Some people questioned whether the work of demonstration was

done by way of democracy.

Pan: I have participated in the entire process of argumentation. "Leadership" never interposed in it, but urged us repeatedly to modestly listen to all opinions, create an unrestrained atmosphere, draw practical and realistic conclusions, and not to be limited in original results.

The whole work of demonstration was independently made by fourteen expert groups and presided over by headmen and advisers. Every leading group of demonstration performed only functions of organization, coordination and service. The conclusions from each expert group were reached by all its members. These experts were authoritative, serious and first scientists. They were responsible for signing and confirming the conclusions till end and enabling the conclusions to stand the historical test. The leading groups didn't and couldn't influence the experts to think things out for themselves.

Throughout the demonstration, various propositions have been fully elaborated. The experts might openly publish their own divergent opinions in newspapers, periodicals or other publications. News media were invited to attend comprehensive meetings. Any expert, who held opposite view of conclusions, might refuse to sign and raise

written objections. Taking the ecological environment for example, two advisers, four headmen and the majority of experts were all scientists in the field of ecological environment. They have thoroughly analyzed the project-caused influences on ecological environment and put forward a number of questions and suggestions. Even if that adviser, who has refused to sign, deemed in his written opinion that it were necessary to further investigate and prudently consider the project's starting without pointing out which influence was fatal.

On 6 ~ 14, 1990, the State Council has summoned a nine-day meeting to hear and discuss the report on the demonstration work. The meeting has reached the following conclusions: The demonstrational activities were carried out democratically and scientifically and the feasibility report of the project was stringent. It was agreed that the report was to be submitted to the Examination Commission for the Yangtze Three Gorges Project of the State Council for consideration and then to the National People's Congress for confirmation and vote.

Now, the Three Gorges dam stands majestically on the Yangtze River. The facts of the project construction have proved that the demonstration conclusions tally with the objective reality.

Erection of Three Gorges—Guangdong DC transmission line completed

On October 12, following the successful paying-off of the last one phase conductor across the Yangtze River—a natural moat, the erection of the DC transmission line from the Three Gorges to Guangdong, which is 940 km in total length, was completed.

The Three Gorges – Guangdong ± 500 kV DC transmission line started north from Jingzhou Converter Station in Hubei, via Hubei, Hunan, southward to Huizhou Converter Station in Guangdong, with a total length of 940 km and a total investment of 1.62 billion yuan (US\$ 0.195 billion). The project was started formally to construct on March 23, 2002, with a construction period of 567 days. The State Power Grid Corporation's affiliated Power Grid construction Branch Company was responsible for the project management.

The Three Gorges – Guangdong DC project is an important constituent of Three Gorges outgoing delivery project, being a major project of sending 10,000 MW power to Guangdong in the Tenth Five-year Plan period.

The project was pressed with time from survey, design to construction, while the line passed through plain river-flooded area, and crossed over the Yangtze River, Yuanshui River and Lishui River, the construction was quite difficult.

Presently the start-up and debugging timetable has been basically fixed:

Single pole debugging November 2003
Single pole commissioned February 2004
Double pole put into commercial operation June 2004

Changjiang Power Corporation and South China Power Grid Corporation have carried out negotiation. Both sides expressed that the power of the Three Gorges must be ensured to send to the South China Power Grid in February 2004 on time or ahead of time. It is expected that 7.84 TWh electricity will be sent to Guangdong in 2004. Peak period of sending power ranges from May to September. Currently the average on-grid electricity price is 0.25 yuan/kWh, the electricity price at the receiving end in Guangdong is 0.39 yuan/kWh (including tax).