

The Framework on Eco-efficient Water Infrastructure

Development in China

Summary

China is a nation of water shortage. The per capita water resources amount is 2185 cubic meters, which is less than a third of the global average. The spatial distribution of the water resources is uneven, that doesn't keep up with the distribution of land and mineral resources and the layout of productivity. The North (north of the Yangtze River) makes up 63.5% of the territory, where the population makes up about 46% of the total population of China and the cultivated land makes up 60% of the total cultivated land and the GDP makes up 44% of the total GDP. But the volume of water resources makes up only 19% of the total volume. The Water Resources faces four issues. Firstly, the frequent disaster of floods and water-logging threatens the social and economic development. Secondly, water resources shortage becomes the main factor restricting the economic and social development. Thirdly, water and soil loss and ecological deterioration has not been put under control effectively. Fourthly, water bodies are polluted severely.

As a national important infrastructure, the water infrastructure has been paying great attention to in China. So far, China has gained the world accredited magnificent achievements in the water infrastructure development and the system of flood control, water supply, irrigation, hydropower generation has been formed. At present, flood control works, taking reservoirs and dikes as its principal body, undertake the task protecting the 0.62 million square kilometers of land area, 0.500 billion populations, 0.64 billion mu (one mu equals about 666.67 square meters) of cultivated land, 469 cities and a large number of infrastructures such as railroads, transportation, oil fields

and so on. GDP in flood control protected areas accounts for 62% of the total of China. Irrigated area added by reservoirs nearly reached 0.600 billion mu. The volume of diversion reached 173.6 billion cubic meters per year. And the capacity of hydroelectric power amounted to 0.145 billion kilowatts.

Since entering the new century, China water has entered the transformation period of development. This period has six following features: (1) integrated management taking a basin as a unit, (2) placing equal stress on water development and protection, (3) eco friendly water infrastructure planning and construction system, (4) fully play the role of water infrastructure in the ecological environment construction, (5) paying attention to livelihood, and (6) Establishment and implementation of the ecology compensation mechanism and system.

According to the last relevant plans of water infrastructure development of China, the dikes of the main trunk stream and the important tributaries of the great rivers will reach the standards prescribed in the relevant plans, and the system of flood control and disaster mitigation will come into being, which will be suitable for the requirement of comparatively well-off society. The annual water supply capacity will be increased by about 80 billion cubic meters, and the problem of the drink water security in countryside will be resolved on the whole, and the water supply system suitable for urbanization development will come into being. The national total irrigation water will keep balance or decrease. The national average industrial water reuse rate will reach 90%. Value-added of industry per ten thousand RMB Yuan will come down to 58 cubic meters. Water-saving irrigation area will be newly added by 13.33 million hectares. The effective irrigation area will be newly added by 1.3333 million hectares. The ongoing, supporting, and water-saving reform construction of the large and medium irrigation districts will be basically completed. Capacity of the rainfall collection and usage project will be newly added by 0.6 billion cubic meters, which will provide the supplementary irrigation condition for 1.0667 million hectares of basic farmland. Water-saving forage land will be newly added by 0.6667

million hectares. 26.67 million hectare of natural grassland ecology will be protected and restored. Installation capacity of rural hydropower will be added by 35 million kw. Continue the construction of the rural electrification counties with hydroelectric power. The attainment rate of water quality will be 80% in the entire country for the water function zones of the important rivers and lakes. The attainment rate of the water quality will be 98% for the urban important water supply water sources. Treatment rate of domestic sewage will be 80%. Area of water and soil conservation will be added by 0.5 million hectares. The modern national water information network will be basically completed to push on the progress of the water modernization.

In the last decades, in order to echo the challenges from the water problems in the process of economic and social development, China has adopted active actions and effective measures and gained many achievements and experiences for references.

- (1) To echo the challenge of rapid development of urbanization, integrated management of water resources and the construction of urban flood control projects and water supply infrastructure have been strengthened to ensure the security of urban flood control and water supply. Furthermore, some sustaining protection and restoration measures have been adopted in the improvement of urban water environment.
- (2) In order to promote the economic development of the country backward areas, west development strategy and rural water facility construction development plan had been worked out. A large number of projects of rural drinking water, water transfer in a basin, environmental hygiene, water and soil conservation, ecological restoration, etc. had been constructed. And the international cooperation had been strengthened.
- (3) In order to ensure the grain safety, the construction of farmland water conservancy infrastructure and the water source projects had been strengthened in the areas deficient of water.
- (4) In order to resolve the problem of electric energy consumption, the construction and international cooperation of the rural electrification counties with hydroelectric power and small hydropower displacing fossil fuel had been strengthened that had improved the ecological

environmental in mountain areas in the same time. (5) In the aspect of efficient water management, the strategy and plan of the sustainable comprehensive use of water resources had been worked out, including perfecting the water management system, the construction of efficient water use and water saving society, water resources protection, integrated water resources management and allocation, rational development and utilization of water resources in the west region of China. Furthermore, the international cooperation and public participation in this field had been strengthened. (6) In the aspect of water and soil conservation, law and regulations of water and soil conservation had been perfected. Plans of water and soil conservation and ecological restoration had been worked out. The key control areas, key areas of prevention and control, main monitoring area had been put forward. The small watershed comprehensive management experiences had been expended ceaselessly. The international cooperation and standardization management in the water and soil conservation had been strengthened. (7) In the respect of ecological conservation, water resources protection plan had been worked out on the basis of the water function zoning. The monitoring of water quantity and water quality had been strengthened. Water resources bulletin system had been established for the main regions. The protection target of water source region and important wetland had been cleared and defined. The engineering construction of water resources protection and pollution control had been strengthened. (8) To echo the challenges of flood control, drought fighting, and mitigating disasters, a series of laws and regulations had been worked out and the unified leadership for the flood control, drought fighting and mitigating disasters had been strengthened on the basis of laws and regulations. A bathes of key projects of flood control and drought fighting had been constructed. The capacity construction and scientific research of flood control and drought fighting had been strengthened. In the same time, the natural laws had been observed more and the man-water harmonization had been paid more attention to in the water management.

Though the philosophy of the water resources management had changed greatly,

the eco-efficient water infrastructure planning and designing lacks for the scientific and systemic theory and methodology. In order to change this situation, the concerning organization has carried out the corresponding researches and has brought forward an indicator system for the assessment of eco-friendly and economic efficient water infrastructure development. This assessment indicator system aims at the water infrastructures such as flood control projects, agricultural water conservancy project, hydropower projects, waterway projects, irrigation projects, and water supply and drainage projects, polder projects and so on. The assessment indicators are classified into 5 categories such as hydrology and water resources, water environment, river morphology, biology and habitats and social economy. In the same time, combining the China water ecological regionalization characteristics, the corresponding methods have been put forward to determine the thresholds for the indicators. On the basis of the indicator system mentioned above, a standard system had further been put forward for the eco-efficient water infrastructure development. In the standard system, according to the correlative degree to ecological environment, the technical standards of water infrastructure development for ecological protection are divided into two categories, i.e. the corresponding standards involving eco-environment protection requirements for main work and professional standards for eco-environment protection. A series of technical criteria for the eco-environment protection of water infrastructure have been put forward according to the planning stage and design and operation stage of water infrastructure. These assessment system, standard system and technical criterion proposals will have the important direction significance for the eco-efficient water infrastructure development of China in the future.

At present, China places more emphasis on the integration of the conception of eco-efficient water infrastructure in the social and economic development. According to the actual characteristics of the seven basins of Yangtze River, Yellow River, Huaihe River, Haihe River, Pearl River, Songhua River and Liaohe River, and Taihu Lake and four regions of Coastal East China, Central China, Western China, Northeast

China, according to the conception of sustainable development of water resources management and the eco-efficient requirement, the development emphases of water infrastructure development for the different basins and different regions has been put forward and the general development strategy has been put forward too to harmonize the water infrastructure development and ecological protection.

The China future action plans in the eco-efficient water infrastructure development include 1) development strategy to keep carrying forward the sustainable comprehensive utilization of water resources, 2) to enlarge the degree of water resources protection to realize the sustainable utilization of the water resources, 3) to strengthen the construction of infrastructure of public service such as flood control and water supply, 4) to strengthen the water and soil conservation, ecological restoration and environmental protection further, 5) to establish the system of integrated management and operation of water infrastructure to ensure sustainable development, 6) to increase the science and technology investment to promote the technological efforts in supporting the sustainable development of eco-efficient water infrastructure, 7) to strengthen the sustainable development capacity construction and the safety system construction, and 8) to strengthen the international exchange and cooperation of the eco-efficient water infrastructure construction.