Possibility of the Zero Growth of Water Requirement in China

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Water is a basic natural and a strategic economic resource playing a key role in China's sustainable development. With a rapid socio-economic development and population increase, a growing water demand leads to its over-exploitation, which in turn results in an obvious contradiction between water supply and demand. That contradiction may be solved in three different ways: first, through areal reallocation of water resources against uneven water resources distribution such as an inter-basin water transfer; second, through reasonable water resources management; third, through the use of water saving technologies (Guo, 2001). China, as a country tackling extremely imbalanced temporal and spatial distribution of water, has already carried out numerous hydraulic projects, including the South-to-North Water Diversion Project *etc*. However, in conditions of limited availability of water resources, an integrated management of its supply and demand is the only way to ensure sustainable socio-economic development and realize the zero growth of water requirement.

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1. Main problems in exploitation and utilization of water resources

At present China focuses on the water management mechanism rather than on further, more intense water exploitation to meet its growing demand. However, despite a noticeable progress, China still falls behind developed countries in good practices of water resources management.

1.1 Inefficiency and unreasonable structure of water use

A difference in water productivity refers mainly to the efficiency and structure of water utilization. For example, Israel assigns water rights according to the output of unit water (Qian *et al*., 2009). The country's population increased by more than 11 times from 0.65 million in 1948 to 7.31 million in 2008 and the GDP per capita from about $300 to over $27,000 (approximately 91 times), but the per person fresh water consumption remains at the same level of about 280 m^3. Currently, its water consumption per 10,000 yuan output value is roughly 45 m^3, the average grain yield per unit irrigation water reaches 2.5~3.0 kg, while the coefficient of effective utilization of irrigation water is 0.7~0.8 and the rate of water resources recovery comes up to 75%. As for China, from 1980 to 2008, its population grown from 0.987 to 1.328 billion (1.35 times) and the per capita GDP from about 463 yuan to 22.7 thousand yuan (49 times). At the same time, the per capita water consumption reached 445 m^3, the water consumption per 10,000 yuan GDP fell from 3501 m^3 to 193 m^3. Now, the average grain yield per unit irrigation water in China is only 1 kg, the coefficient of effective utilization of irrigation water is only about 0.45 and the reuse rate of the industrial water is approximately 60~65%.

Moreover, the exploitation rate in most river basins of North China has already surpassed the international warning line of 40%, while the groundwater over-extraction and related ecological and environmental problems have posed a serious threat to the sustainable development of those areas. The industrial structure matching with water and land is closely related to the reasonable utilization of water resources, but the industrial modernization of China proceeds relatively slow and the regional disparity can be seen very clearly. The proportion of three industries in China in 2008 was 11.3%:48.6%:40.1%, compared to around 1~2%:20~30%:79~68% in developed countries.

1.2 Low water-saving consciousness and technique backwardness

The public understanding of water issues and water-saving technologies in China needs significant enhancement. At present, traditional flooding irrigation, whose water loss in the process of evaporation, channeling water and leakage in the fields is very high, still remains the most popular technique in many regions. The acreage of water-saving irrigated land occupies only 35% of the total in China, while in developed countries it exceeds 80%. In addition, its utilization degree of rainwater, seawater and brackish water as well as of different kinds of unconventional water resources is low, and the introduction of technologies of cleaner production and efficient water utilization is slow. Therefore, there is still a huge water-saving potential in China.

1.3 Misunderstandings in the exploitation and utilization of water resources

Nowadays, attention is paid to the development of water sources rather than water-saving technologies. There are three important misconceptions: first, population growth and economic development have to be accompanied by the proportional growth of water resources supply; second, water saving, pollution prevention and disposal are irrelevant; and third, in regions short of water resources and with fragile ecological environment the only way to satisfy water demand is the inter-basin water transfer, while the full use of the local water resources is neglected (Liu *et al*., 1996; Qian *et al*., 2009).

2. Realization of the zero growth of water requirement

Management of water demand is the systems engineering characterized by rational use of water resources based on the natural water cycle. It contains two aspects, namely the socio-economic and the environmental one. The goal is to comprehensively and systematically manage water demand combining society with nature and

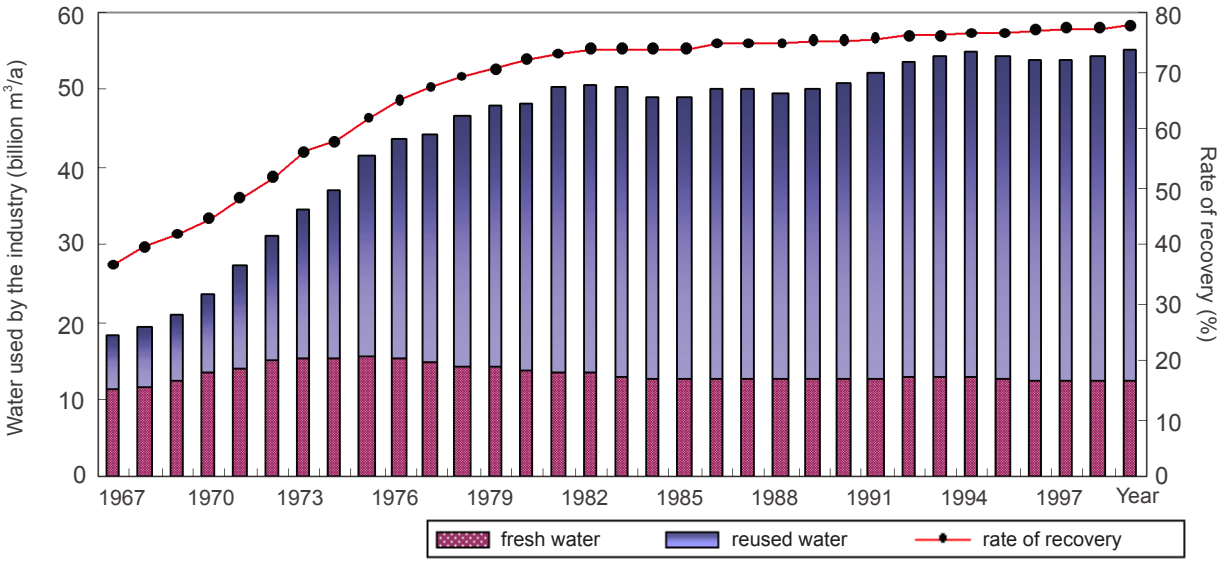

Figure.1 Changes of industrial water consumption in Japan.

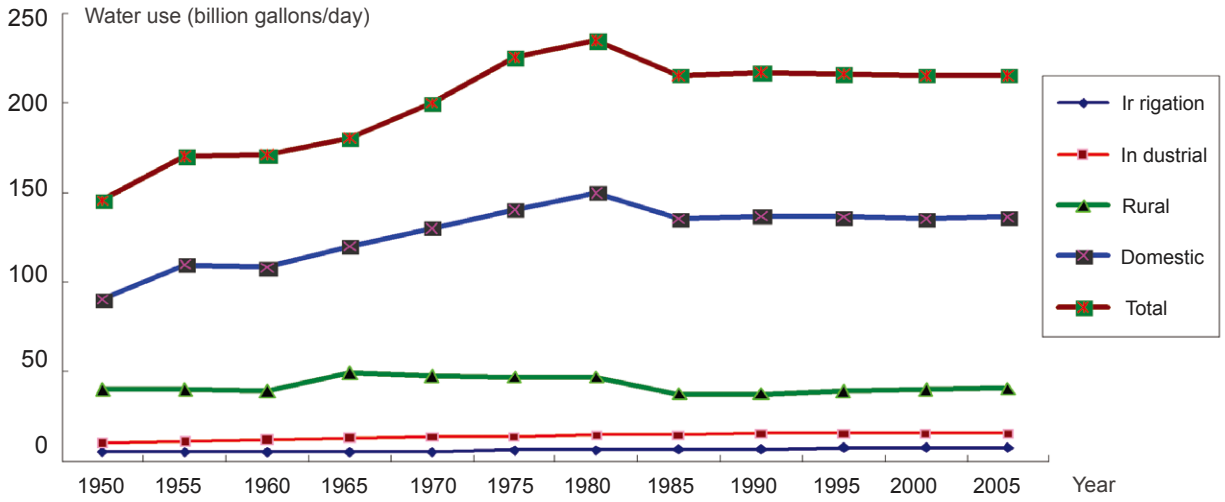

Figure. 2 Changes of water use for all kinds of industries in USA.

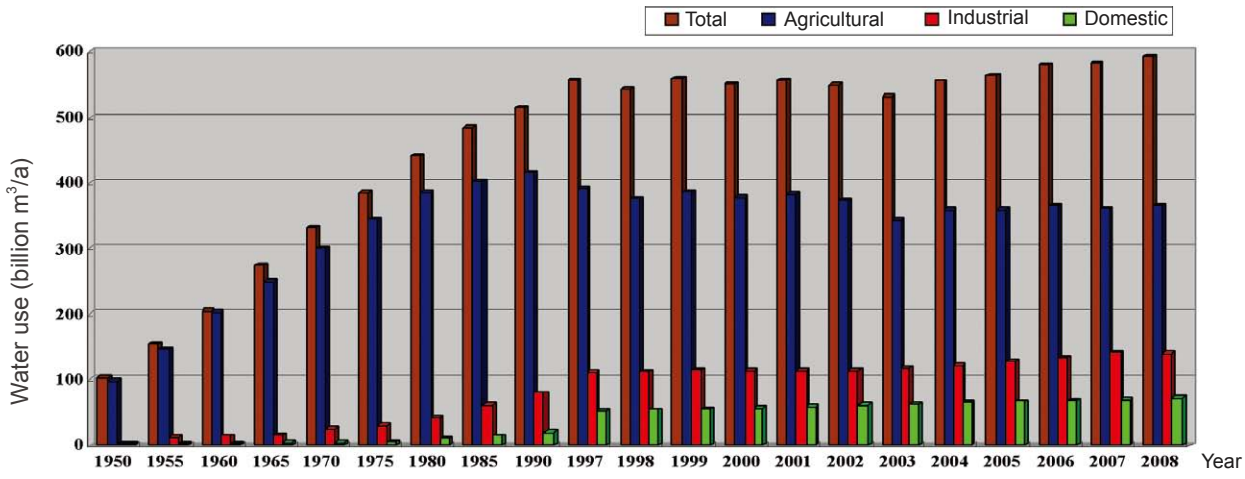

Figure.3 Changes of water use for all kinds of industries in China.

to control water used for the socio-economic needs within the carrying capacity of water resources in order to realize the requirement of the zero growth of water consumption.

In fact, some European countries (*e.g.* Sweden and Holland) have realized the zero growth requirement early in the 1970s, followed by Japan and the USA in the late 1970s and the early 1980s respectively (Figure 1 and 2). In China, the mean growth rate of water use reached the highest level of 5% before 1980 (Figure 3), dropped to below 1.5% in the 1980s and below 1% between the mid-1990s and 2006. That was due to the introduction of water-saving technologies, the increased water efficiency and the reform of the water utilization structure. Over the last 30 years of the policy of opening and reforms in China, the average annual growth rate of water was about 1% and the annual water consumption per capita was only 60% of the world's level, while the GDP growth all the time remained as high as 8~11%. Regarding the tendency of decrease of the industrial water demand per 10,000 yuan Yuan output, the steady reduction of the agricultural water use and a slight rise of the domestic water consumption, the water demand in China would slow down to reach the zero growth in step with the population until 2030.

3. Brief conclusions

In a word, the experiences of developed countries in the zero growth of water demand and the decrease in water consumption observed over the last three decades in China indicate that realization of that goal is not only possible but also indispensable for harmonious coexistence of human and nature. We believe that it is possible to realize the zero growth of water requirement in China if only water demand management is consequently implemented in the most strict way as the Chinese government has decided to implement the "strictest water resources management institution" with “three red lines” for controlling total water withdrawal, water use efficiency and pollution in the whole nation.

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