Im Fokus

China's Water Market – Opportunities for Foreign Investors

Der chinesische Wassermarkt – Eine Chance für ausländische Investoren

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Abstract

China has undergone a remarkable transformation process and rapid economic development. However, the resources that such growth demands have raised deep concerns about the long-term sustainability and hidden costs of China's development. Many of these concerns are associated with the state of China's water resources. As demand for water has increased, so too have problems with water shortages, pollution, falling groundwater tables, and flood/drought damages. To tackle these challenges, the Chinese government increasingly encourages foreign companies to engage in the country's water market. Market research studies claim that this market holds promising business opportunities for both domestic and foreign companies. This article analyses this statement from a foreign investor's perspective. It evaluates key factors influencing the reform policy of the Chinese government and introduces the main policy and investment implications. It shows that in spite of the remaining market barriers, the Chinese water market indeed holds business opportunities. In fact, a key role in solving China's water crisis should be played by international companies and governments.

Keywords: China, water market, private-sector participation (PSP) projects, build-operate-transfer (BOT) projects, transfer-operate-transfer (TOT) projects

Introduction

Worldwide, the hidden costs of China's rapid transformation have raised deep concerns. In recent years the cases of water shortages, pollution, and flood/drought damages have severely increased in number. These developments are the result of both a large population and a rapidly developing economy. No doubt, in recent years the Chinese authorities have been able to significantly improve the country's water and wastewater infrastructure. Nevertheless, water shortages remain a serious problem. In 2004 China's per capita water resources equalled

1,856 cbm. This is a decline of nearly 15 percent compared to the year 2000 (Bfai 2006a:11). The World Bank estimates the overall annual cost of water scarcity to be approximately 147 billion CNY (World Bank 2007:xvi). This is equivalent to one percent of China's GDP.

The Chinese government is trying to counter this misbalance and is insistently pursuing an environmentally sustainable development policy. Its countermeasures include management-model reforms, private-sector participation (PSP) projects, and support for the development of new technologies. According to the 11th Five-Year Plan, more than 140 billion CNY will be spent on environmental projects and campaigns before 2010.

The reforms have unleashed a wave of optimism. A significant amount of new water infrastructure is to be built, and the operation and maintenance of all existing and newly built municipal water and wastewater treatment plants have been or will be transferred to authorised enterprises. Both domestic and international enterprises can profit from this trend. The overall market size and future market potential provide strong arguments for the participation of foreign investors. This article provides an overview of the factors influencing the investment conditions and analyses the market opportunities for foreign investors.

Factors Influencing the Reform Policy

Environmental Determinants

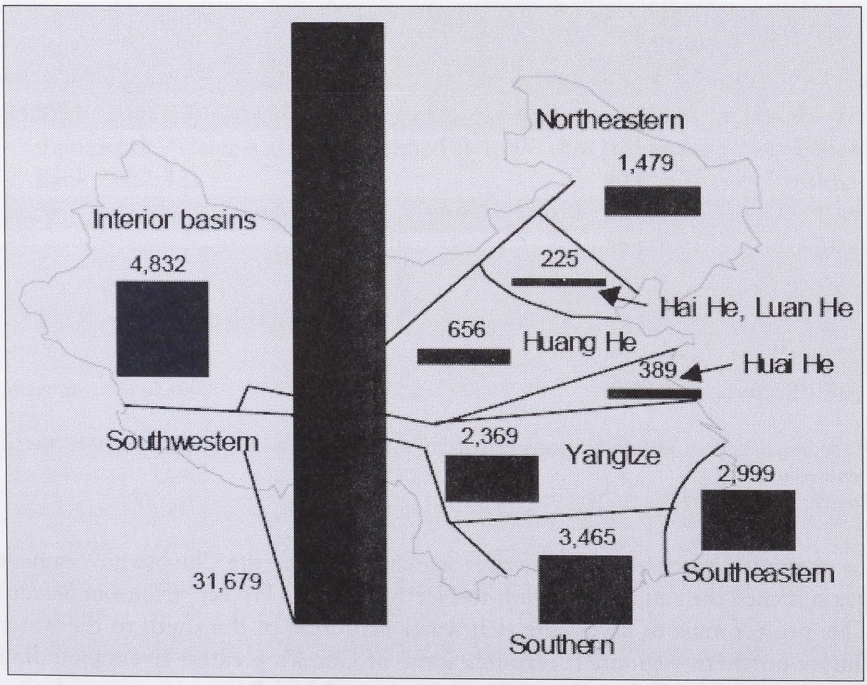
At first sight China does not seem to be a water-scarce country per se. The Food and Agricultural Organization (FAO) of the United Nations (UN) estimates China's total naturally available water flows (surface and underground sources) to be 2,812 billion cbm per annum (FAO 2007). This ranks China sixth in the world behind Brazil, Russia, Canada, Indonesia, and the USA.

However, China has to deal with a much larger population. On a per capita basis, China's annual naturally available water flow of 2,206 cbm per capita (2004) is one of the lowest in the world. In fact, it is only one-third of the average for developing countries (7,762 cbm per capita) and one-fourth of the world average (8,549 cbm per capita) (FAO 2007). This comparison shows that the state of China's water resources is alarming.

China also has to cope with difficult geographical conditions. While the demand for water is increasing throughout the country, the northern territories

have much less available water than the south. The area north of the Yangzi River accounts for 70 percent of the arable land, 46 percent of the population, and some of the largest industrial centres. However, this area can access only 20 percent of China's total water resources (2005). In contrast, the area south of the Yangzi River, bearing 30 percent of China's arable land and 54 percent of the population, has access to 80 percent of the national water reserves (Bfai 2006a:13). Furthermore, the average rainfall in the south-east (1,800 mm) is nine times higher than in the north-western interior basins (200 mm) (Economy 2004:68).

Figure 1 *Water Resources Availability per Capita (cbm per Year)*



Source: Varis & Vakkilainen 2005:18.

The problems are most acute in the North China Plain (NCP) – a region covering Hai River/Luan River, Huang River, and Huai River. The annual per capita water resources in this area stand at 462 cbm. This is one-fifth of the national average and far below the critical value defined by the UN (Bfai 2006a:14). What's more, water shortages in the north have led to the overuse of ground water, which has caused ecological problems such as the destruction of wetlands and the drying up of rivers. Experts estimate that from 1998 to 2006 the groundwater tables in Beijing dropped by 100 to 300 metres (Shalizi 2006:10). It's obvious that the state of China's water resources is worsening year by year.

Table 1 *Water Resources Availability per Capita*

	Gross water availability* (BCM)	Population (billion)			Water availability per capita (cbm)		
		1980	1993	2003	1980	1993	2003
TOTAL	2,812.00	0.99	1.19	1.29	2,840.40	2,363.03	2,179.84
Surface	2,712.00						
Aquifer	829.00						
NORTH	405.00	0.42	0.48	0.54	964.29	843.75	750.00
Surface	334.00						
Aquifer	168.00						
SOUTH	2,406.00	0.58	0.66	0.75	4,148.28	3,645.45	3,208.00
Surface	2,376.00						
Aquifer	659.00						

** The sum of surface and aquifer water exceeds the total water resources by the amount of overlap between them.*
Source: NBS 1981, 1994, 2004.

To overcome northern China's water scarcity problem, the Chinese government has launched the ambitious "South-to-North Diversion Project" (*Nanshui Beidao*). This project aims to divert the rich water resources of the south to the water-thirsty northern regions. It reroutes some of China's greatest rivers including the Yangzi River, Yellow River, Huai River, and Hai River. After completion, the eastern, middle, and western routes are to divert up to 50 billion cbm annually (USDC 2005:19). But even if the Chinese government succeeds with this ambitious plan, the country will continue to face severe water challenges

in the short and medium term. Some authors, such as Zmarak Shalizi from the Development Research Group of the World Bank, even argue that China will soon become the most water-stressed country in East and Southeast Asia (see Shalizi 2006).

However, the definition used to describe "water stress" is not being used consistently. The definitions are either based on the "overall water use model" by the International Water Management Institute (IWMI) or on the "per capita water use model" that is applied by the UN, the World Bank, and the World Resources Institute (WRI):

- The IWMI uses a four-part scale to classify countries in terms of their overall water use: A) Low exploitation: <20%; B) Comfortable range: 20-59%; C) Environmentally overexploited: 60-100%; D) Mining: >100% (World Bank 2002:87).
- The UN, the World Bank and the WRI define "water stress" on a per capita basis as annual water availability of 2,000 cbm per person or less. In this framework, "water scarcity" is defined as 1,000 cbm per person or less (World Bank 2002:43).

Table 2 Contamination of Important Rivers

	Length (km)	2002		2003		2004	
		Sufficient (%)	Insufficient (%)	Sufficient (%)	Insufficient (%)	Sufficient (%)	Insufficient (%)
North							
Songhua River	2,300	27.8	72.2	7.7	92.3	21.9	78.1
Liao River	1,390	17.9	82.1	29.7	70.3	32.4	67.6
Hai River	1,090	14.4	85.6	21.5	78.5	25.4	74.6
Huai River	1,000	16.1	83.9	18.6	81.4	19.8	80.2
Yellow River	5,460	22.7	77.3	22.7	77.3	36.4	63.6
South							
Yangzi River	6,300	51.5	48.5	71.8	28.2	72.1	27.9
Zhu River	2,210	73.5	26.5	81.8	18.2	78.8	21.2

The classification is based on the Chinese categories in five quality classes for the drinking water quality: classes I to III are sufficient for the supply of drinking water. Classes IV and V are regarded as insufficient.
Source: SEPA 2005.

Using the per capita definition (UN, World Bank, WRI), China as a whole will be classified as water stressed by 2010 at the current rate of population growth. Taking the IWMI's classification, China currently uses 44 percent of its water and is still within the "comfortable" water-use margin. However, its use of water is estimated to exceed 60 percent by 2020, putting it in the "environmentally overexploited" category (Shalizi 2006:5). Thus, by either definition, China will face a potentially serious water management problem in the coming decades.

However, it is not only the availability of China's water resources that gives reason to worry. China's development is leaving evident ecological footprints and causing new environmental challenges. Water pollution is a particular cause of serious concern. The Ministry of Construction (MoC) has stated that 90 percent of the national water resources are polluted. More than 75 percent of the lakes don't meet the standards for drinking water. More than 70 percent of the water in five of the seven major river systems – the Huai River, the Songhua River, the Hai River, the Yellow River, and the Liao River – have been graded level IV or worse (Bfai 2006a:15).

Social Determinants

The Chinese government is aware of the volatile situation and is increasing pressure on local governments to take action against water pollution. One can illustrate this development by looking at the chemical accident in the upper regions of the Songhua River in November 2005. The water contamination caused a temporary shutdown of the entire drinking water supply for the area of Harbin, populated by more than nine million people. The accident even affected the supply of drinking water in neighbouring Russia. Due to shortcomings in prevention measures and communications hurdles, local government officials and the head of the State Environmental Planning Association (SEPA) had to resign. This incident served as an impetus for the development of China's water protection system.

Table 3 Cases of Water Contamination from 2000 to 2004

	2000	2001	2002	2003	2004
Registered cases	1,138	1,096	1,097	1,042	753

Source: NBS 2005.

One must not neglect the important role of the Chinese population in the water market reform process. Their living standard and state of health are directly influenced by the quality and accessibility of China's water resources. In 2006 more than 75 percent of the water in rivers flowing through China's urban areas was not suitable for drinking or fishing. Only six of China's 27 largest cities fulfil the state standards (Shalizi 2006:12). Many stretches of urban rivers and some large freshwater lakes are polluted to such an extent that they cannot be used for irrigation.

Table 4 Water Prices per cbm in Beijing, Shanghai and Guangzhou

	Beijing	Shanghai	Guangzhou
Households			
Tap water	2.80	1.03	1.32
Sewage water	0.90	0.90	0.70
Industry and Trade			
Tap water	4.10	1.30	1.83
Sewage water	1.50	1.20	0.70
Local authorities			
Tap water	3.90	1.30	1.61
Sewage water	1.50	1.10	0.70
Service sector			
Tap water	4.60	1.50	2.71
Sewage water	1.50	1.20	0.70

Source: Bfai 2006a:22.

The poor quality of the water resources has a significant health impact. This holds particularly true for rural areas, where about 300 million people lack access to piped water. A World Bank study (World Bank 2007) attributes a considerable number of deaths among children under five to cases of diarrhoea caused by the absence of a safe water supply. In response, Chinese authorities have begun to address these issues from the national level down to the village and farm levels.

The impact of social needs on China's water resource policies is also reflected in the development of China's water prices. Despite widespread increases in prices in recent years, China's water prices are still far below the international average. Beijing serves as a good example. Its quotas of 3.7 CNY per cbm

water and sewage water are among the highest in the country (Bfai 2006a:22). Nevertheless, they account for as little as one percent of the overall consumption. The benchmark of the World Bank for developing countries is five percent. This comparison shows that current water prices do not reflect China's water scarcity in any way.

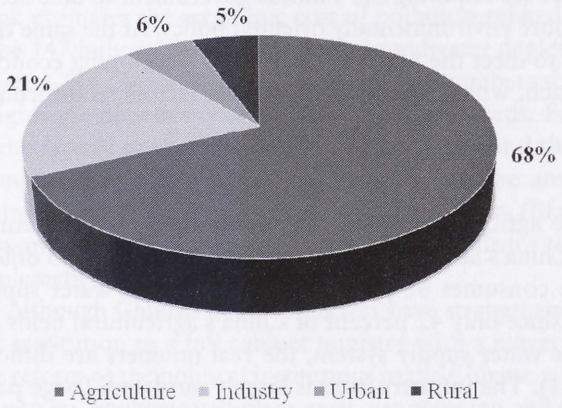
However, Chinese authorities have strong reasons for this restrained pricing policy. Raising water prices would have adverse effects on farmers' already low incomes and would dilute the competitive advantages of China's manufacturing industry. This could create social instability and directly counter important policy goals. Still, one must not neglect the current efforts to counter the overuse of water. For example, the central government is increasingly pushing regional and local authorities to implement demand-oriented pricing models. Some analysts argue that the Chinese customer's perception of higher water prices changes in favour of investors (see USDC 2005). However, it is unlikely that Chinese water prices will increase to the world's average in the short or medium run.

Another problem lies within the nature of the Chinese water-pricing system, which mostly uses regional market-segmentation models to define maximum price levels. This works well in the case of regional disparities. However, the Chinese market is affected not only by regional disparities but also by high income disparities within regions. In 2005 the Gini coefficient exceeded 0.4, which is the international benchmark for alarm (*People's Daily* 2005). Since water has to be affordable for both low- and high-income people, regional pricing models have to be aligned to the groups with the lowest income. This correlation leads to inefficient pricing structures and leaves only a small profit margin for investors. Policies such as increasing block prices, which charge marginal costs for marginal water use, are rare (Fang 2004:34). However, the share of private consumption makes up only 11 percent of China's overall water demand.

Rural

Rural residential demand for water is approximately 5.4 percent (see Figure 2). In these areas access to the water supply system is highly insufficient. It is estimated that 360 million peasants do not have piped water. This is largely caused by a comparably low investment inflow in rural areas. Hence, a major program to install tap water systems for rural villages has been underway for many years. As this program progresses, more households will have regular access to tap water (USDA 2000:26).

Figure 2 China's Water Demand



Source: NBS 2003.

Urban

Urban water demand is stable and currently accounts for six percent of national demand (see Figure 2). According to figures from the MoC, 89 percent of the urban population is connected to the public water supply system (MoC, cited by Bfai 2006a:36). In the last two decades China has entered a major phase of urbanisation. The number of residents in China's cities has more than doubled from 191 million to approximately 459 million (Shalizi 2006:14). Therefore, urban water use has increased significantly compared to all other sectors. However, the per capita water use in urban areas differs throughout the country. In some areas, such as Beijing-Tianjin, water use is rising dramatically: the annual domestic demand in Beijing raised from 552 million cbm in 1993 to 829 million cbm in 2000. This is despite the fact that residents in Tianjin still use only 135 litres of water per day (USDA 2000:26).

Given the scale and social impact of these problems, it is reasonable to assume that sustainable progress will be a difficult and lengthy path. Considering the length of time it took to create these problems, sustainable solutions cannot be implemented in the short run.

Economic Determinants

Social and ecological issues are requiring the Chinese government to take action quickly in developing a more environmentally oriented policy. At the same time, Chinese authorities have to meet the needs of the rapidly developing economy. A balanced policy approach, which equally considers all factors, is difficult to implement.

Agriculture

Even though the Chinese agricultural sector only accounts for 15 percent of China's GDP, it is by far China's largest consumer of water. According to official SEPA figures, agriculture consumes 68 percent of China's total water supply (see Figure 2). However, since only 42 percent of China's agricultural fields are connected to the Chinese water supply system, the real numbers are difficult to ascertain (Bfai 2006b:1). The infrastructure is largely outdated. Large parts of the rural infrastructure were built during the period of collective agriculture (1950s to late 1970s). Due to poor quality and age, these pipelines lose much water through leakage. In the past, investments were generally geared towards new projects rather than the maintenance of older ones (Lohmar et al. 2003:3). The need for change is reflected in the high expenses for public wastewater canalisation: from 2001 to 2005 more than 150 billion CNY were invested in such projects.

Industry

Using 21 percent of national water resources, the industrial sector is the second-largest water consumer (see Figure 2). The dynamic growth of China's industrial sector has had an enormous effect on the development of the overall water demand. Between 1980 and 2002 industrial water use grew from 46 to 114 billion cbm annually, an increase of 250 percent (Shalizi 2006:14). However, the water demand conditions in the industrial sector are difficult to determine – especially for sewage water treatment. Large companies or conglomerates are allowed to acquire quotas for extracting ground- and surface water as self-suppliers. The MoC estimates that 30 to 40 percent of the companies in urban areas hold such quotas (Bfai 2006a:35). In these cases the relevant pipelines are privately owned by the companies, which are also responsible for the maintenance. The condition of these pipelines is difficult to determine.

The demand for water by China's companies is pressing. The great increase of their water use clearly harms China's macroeconomic development. The World Bank estimates the economic cost of pollution-related sources of water scarcity to be 147 billion CNY. The cost of groundwater depletion comes at a further 92 billion CNY (World Bank 2007:81). These numbers show that China is walking a tightrope between economic and ecologic needs. Foreign experts argue that in the face of the rapidly developing economy and the growing water demand, monitoring and treatment of wastewater will be among the main challenges facing Chinese authorities in the upcoming years (Bfai 2006a:36). However, a vast and complex bureaucracy makes it difficult for the relevant institutions to implement the necessary changes.

Although Chinese decision makers have strengthened the SEPA by upgrading the institution to a full cabinet ministry with a bigger budget and more people, the reform of the political institutions in the Chinese water market still has a long way to go. Sophisticated plans exist, yet planning and decision-making processes often contradict one another. The lack of a unified water administration and management body poses a serious problem in addressing the contemporary water challenges (Bfai 2006a:25).

Policy and Investment Implications

Public Investments

Many of the problems described above are well known to Chinese authorities, who have initiated a wide range of programs to cope with them. The status of the implementation of these programs is summarised in the *Water Resources Report* published by the Ministry of Water Resources (MWR) (MWR 2005). Many of the associated actions focus on the state of the water recovery, storage, and delivery infrastructure.

Investments generally concentrate on the rural water sector. Following the implementation of the Water Law (1988), investments in rural water infrastructure increased from 4.9 billion CNY (1990) to 12 billion CNY (1995). This trend was mostly triggered by the need to restore and maintain water infrastructure and by a renewed national commitment to all infrastructure investments (Lohmar et al. 2003:9). It has continued up to the present.

China is also shifting its investment priorities from new projects to the renovation and maintenance of existing systems. This explains the increasing

Figure 3 China's Water Management Administration

National Level	**The State Council** The State Council oversees all national ministries. It initiates laws and policies to be carried out by the various ministries. **Ministry of Water Resources (MWR)** The MWR has implemented most components of water policy since the enactment of the 1988 Water Law. It is responsible for planning, constructing, and managing all water-related projects. **State Environmental Protection Administration (SEPA)** The SEPA is charged with enforcing environmental laws and the maintenance of water resources. The SEPA has local-level offices similar to the MWR. **Ministry of Geology and Mining (MGM)** The MGM is charged with managing ground-water resources, primarily monitoring ground-water levels and understanding ground-water flows. The MGM also has local-level offices. **State Price Bureau (SPB)** The SPB administers the pricing of state-owned resources such as water. The national bureau sets guidelines for provincial-level bureaus to use in setting prices. **Ministry of Agriculture (MOA)** The MOA is charged with developing and implementing policies to guide water use once it is delivered to the field and has local-level offices as well.
Subnational Level	**Water Resources Bureaus and Offices (WRB)** WRBs are at all levels of the formal administrative bureaucracy. They carry out plans initiated from levels above them and administer systems that are within their administrative district. **Urban Construction Commissions (UCC)** The UCCs are in charge of accessing and delivering water to urban users. The UCCs issue well-drilling and ground-water withdrawal permits collect urban water fees. **Village Water Officers (VWO)** VWOs primarily inform farmers when the irrigation deliveries arrive, manage allocations among the village households and collect water fees. This does not apply to all villages.
Cross-Administrative Institutions	**National River Basin Commissions (NRBC)** An NRBC exists for each of China's major river basins. The NRBCs are charged with implementing policies that cross provincial boundaries. **Irrigation Districts (ID)** Publicly run IDs manage delivery of irrigation water for all surface systems and some ground-water systems. IDs report directly to the WRB. Large IDs may report to the provincial WRB.

Source: Hutterer 2007:16.

popularity of Transfer-Operate-Transfer (TOT) projects in which the private investor is responsible for the maintenance and repair of existing water systems. Nevertheless, the Chinese agricultural irrigation systems are still in bad shape. The MWR says that much effort is needed in the repair and replacement of the rural water system. The ministry estimates that 40 percent of the systems are not fully usable anymore. Approximately 80 percent of the pumping stations are outdated and restoration is badly needed. The MWR report also states that, whenever possible, maintenance and repair of these systems should be covered by local products (MWR by USDC 2005:19).

In recent years the Chinese government has invested heavily in the construction of water supply and treatment systems. Nevertheless, in both fields the demand for sophisticated solutions is still great. The investments of the central government are geared predominantly towards water supply, while local governments focus on water treatment and disposal (Table 5).

Table 5 Central Government Expenditures for Urban Projects

	2002 (in billion CNY)	Change 2001/02 (in %)	2003 (in billion CNY)	Change 2002/03 (in %)	2004 (in billion CNY)	Change 2003/04 (in %)
Water supply	17.1	0.8	18.2	6.4	22.5	23.6
Sewage water	27.5	22.5	37.5	36.4	35.2	-6.1
Water treatment	14.4	23.8	19.9	38.2	17.5	-12.1
Flood control	135.1	91.6	124.5	-7.8	100.3	-19.4

Source: Ministry of Construction 2004.

The government has announced plans to further increase public investments in water supply and water treatment projects. According to the 11th Five-Year Plan, the Chinese government will invest approximately 300 billion CNY in water supply and water treatment, including the maintenance of the irrigation system. The central government's share of the investment is 20 to 30 percent. The rest will be covered by local governments and communes. Experts from the German Ministry of Foreign Trade expect double-digit growth rates (Bfai 2006a:27).

Foreign Participation

Following the worldwide trend, the Chinese government is opening its water supply and water sewage sector to private investments. In May 2004 China officially opened the water distribution sector to privately owned companies. This change was implemented by the Administration of Chartered Public Utilities (*Shizheng Gongyong Shiye Texu Jingying Guanli Banfa*).

Furthermore, in July 2004 the National Development and Reform Commission (NDRC) and the Ministry of Commerce (MofCom) approved the construction and operation of urban distribution systems for water delivery and wastewater disposal. This liberalisation was carried out for twenty provinces in central and western China. Contracts were only given to companies or consortiums in which the majority share was held by the Chinese business partner. However, past cases show that exceptions are possible. Two French companies, Suez and Véolia Water (previously Vivendi Water), and a U.K. company, Thames Water, are the best-known foreign companies that have profited from this market development.

In principle, there are three ways for foreign companies to enter China's water market:

1) The first PSP project in greater China was signed in 1985 in Macau. It was a concession contract. A concession contract transfers the responsibility for operations, management, and new capital investments to the company, while the government retains ownership of the assets. The company is responsible for the entire system. However, concession contracts have been slow to catch on the mainland, where tariffs are much lower.
2) In mainland China, the first PSPs in the water sector were standard Build-Operate-Transfer (BOT) projects. In a BOT project the company finances, constructs, and operates new facilities for bulk supply. However, it does not play a role in distribution or retail. Up to now, foreign investors in the Chinese water market have favoured BOT projects over alternative investment models. The first large-scale BOT projects in Shanghai and Chengdu were fully owned by foreign-owned companies.
3) The wholly privately owned BOT model is increasingly being challenged by a distinctive new model, the Joint Venture (JV) model. A JV can be defined as the sale of a minority stake in the utility assets under a public-private JV ownership structure. The contract lifespan can be between 15 and 50 years. During this contract period, the private company may be given full

management and operational control. This may also be shared with the local government depending on the terms of the contract and the equity contributions of the parties. At the end of the contract period, the assets are transferred back to the local government at a nominal price. This model is usually favoured by municipalities because it offers a short-term injection of cash from the sale of assets but still allows them to retain control over the management of the business.

Other partnership arrangements are also possible depending on local conditions. Still, foreign investors face difficult challenges and uncertainties in the Chinese water market. A recent research study (Hutterer 2007) identified the following four factors for foreign investors: (1) development of water prices, (2) choice of investment-return models, (3) transparency of competitive bidding procedure, and (4) offer of financing tools.

The return on investment (ROI) in the Chinese water market clearly depends on the water price level. The water supply and sewage fees are mainly fixed under government's guidance. The *Notice on Promotion of Water Price Reform, Enhancing Water Saving and Protecting Water Resources* identifies four elements of the water price: (1) water resource fee, (2) water supply price, (3) city water supply price, and (4) sewage treatment fee. However, the water prices differ from city to city (USDC 2005:14).

The water price is calculated using an index concerning investment gross costs, internal yield, local electricity prices, and residence consumption. It is confirmed through a price hearing held by the provincial or municipal price administration authorities. There is only a marginal market influence on the pricing. Whether waterworks and sewage treatment factories obtain their expected profits depends greatly on their operation and cost control level. With regard to water price adjustment, investors are always at a disadvantage. Generally speaking, governments do not promise increases in water prices.

Though the market tendency clearly shows the need for price increases, it is still hard to obtain governmental approval for price adjustments. Governments usually agree to reimburse investors when the water price cannot be adjusted due to government interference. Therefore, foreign managers generally regard the obstacle of administrative interference as a "no-protection risk" (Li 2007:252).

Contracts with a fixed investment return could serve as a tool to counteract these uncertainties. However, the state council passed three sentences against fixed-return projects between 1998 and 2002 (Bfai 2006b:1). It argued that a

fixed-return policy would contradict the principal of risk sharing and would violate relevant laws and regulations (Au & Liu 2007:2f.). However, today there are other means to reduce investment risks. Currently, one can define three investment-return models for BOT investment water projects:

- investment-return model of assuming sole responsibility for profits and loss,
- investment return with fixed-rate model, and
- investment return with flexible-rate model.

In the "investment return model of assuming sole responsibility for profits and loss", a company assumes responsibility for profits and losses and undertakes the operation result (Li 2007:254). In this case the government does not guarantee investment return rates. Instead, the company faces the most severe risks but also the largest possibility for profits.

In the "fixed rate model", the government undertakes investment-return payments according to a pre-negotiated return rate without regard to the actual operation status (Li 2007:255). For example, Beijing Holding invested 1.5 billion CNY for the operation rights to the Beijing Water Resource Ninth Waterworks Project. The agreed fixed investment return rate is 14 percent. Beijing Water Supply Co. is still in charge of the construction (October 2007), operation, and management of the waterworks, while Beijing Holding takes no responsibility for the operation result. Due to the comparatively large investment risks in BOT projects, the government has guaranteed the investment return rate at a slightly higher level than international loan interest rates or daily interest rates on short-term private loans.

The "flexible rate model" fixes the upper and lower limits of the investment return rate (Li 2007:255). The government subsidises the operator in case the operation income is lower than the investment return rate. Operation incomes beyond this return rate go to the government. In comparison with the other two models, the "flexible rate model" has intermediate risks and profit opportunities and is more reliable.

In China, PSP projects are carried out through public competitive bidding. China is still not a member of the international General Procurement Act (GPA). Even though the Chinese law has been partially harmonised with this agreement, there still remain hurdles and risks for foreign investors (Anke 2007:32).

China's bidding law states that the "content, term, market admittance condition, bidding process and method of the franchise project" have to be publicly announced. Thereafter, applications are publicly accepted "in stipulated time".

The law also states that "applicants shall be examined and seriously evaluated for their qualification by experts according to market admittance conditions, and the bidder to be granted with the franchise shall be chosen out of the best". However, the Government Procurement Law (GPL), for example, does not commit to giving national treatment to foreign suppliers. Consequently, the GPL provides that, except in limited circumstances, priority must be given to purchases of domestic goods, construction works, and services (Chou 2006:533ff.).

The Bidding Law of the PRC forbids further negotiation in any form after the completion of the bidding evaluation. Once the winning bidder is determined and announced, no further negotiation can be undertaken. However, the bidding process for BOT projects is quite different. The bidder needs to prepare plans for project financing, construction, operation, and maintenance. In bidding for a BOT water project, bidders' plans need to be evaluated jointly, and the final determination of the winner is made according to the integrated evaluation (Li 2007:262).

Meanwhile, BOT project participants need to establish a risk-share mechanism through a series of contracts. The process is quite complicated. It is hard to ensure that all relevant matters are appropriately dealt with in the contract. In the bidding process for a BOT water project, it is impossible to eliminate detailed negotiation after the winning bidder is chosen due to the complexity of project arrangements.

BOT water projects are generally characterised by long-term repayment periods, long-term operations, and stable cash flows. The application of long-term debt favours the improvement of financing efficiency in order to lower project costs. In the global market, foreign companies generally receive 15- to 20-year loans according to the cash flow status in different operation periods. However, long-term financial debt instruments are not legally supported in China (Silk & Black 2000:3). Article 11 of the General Rules for Loans determines that in China loan terms are to be defined through negotiation between the debtor and creditor but mustn't exceed ten years. Therefore, many foreign investors have to extend their loan contract. Hence, the law also states that an extension of short-term loans must not be longer than the original loan term, extensions of mid-term loans not longer than half of the original loan term, and extensions of long-term loans not longer than three years (ibid.:2). Therefore, by Chinese law the maximum length of the loan term is 13 years. This obviously doesn't meet the financing demand of investors in BOT water projects.

Remaining Challenges

China is a large country with a complex economy and legal system. Generalisations and "one-size-fits-all" type recommendations are likely to be misleading. A guideline for the remaining challenges can be found in the *Water Resources Report* of the MWR (2005) and in the recent agreement (2008) between the German Technical and Scientific Association for Gas and Water (DVGW) and the China Urban Water Association (CUWA). According to these papers, the main challenges can be summarised as follows:

- China is in need of a more balanced water distribution system: Particularly in the northern regions, water use exceeds supply. There are ample signs of diminishing water resources such as falling water tables and receding surface-water supplies, all requiring solutions. These problems are most acute in the North China Plain.
- Divergent interests hinder efficient reforms: In order to manage national water supplies, China has charged several different agencies with duties that sometimes overlap. These institutional arrangements interfere with the rapid establishment of policies and slow down the reform process.
- China faces conflicts between agricultural and industrial users: The extensive water demand of the agricultural sector limits the amount available for other users. At the same time, industrial wastewater decreases the overall quality of water. The Chinese government is promoting unified water management institutions to settle this imbalance.
- Water prices have to be increased: In recent years, Chinese authorities have begun increasing water prices to encourage water saving. Nevertheless, prices still remain far below international standards – particularly in the agricultural sector. This may cause a free-rider problem and mute incentives to implement water-saving technologies.
- Water-saving irrigation practices and technology need to be extended: Most farmers are still not adopting water-saving practices. This might be caused by insufficient incentives. Furthermore, China's system tends to promote advanced technological solutions rather than simple techniques appropriate for farmers.
- China needs to reform its irrigation district management: Irrigation districts are establishing a variety of management reforms to provide better service and to promote water conservation. However, the effectiveness of these reforms

is still very limited and needs to be improved.

- Effective monitoring and screening models are needed: In order to enhance the implementation of China's environmental regulations, an effective monitoring and screening system has to be established. China has to find more efficient ways of detecting violations in order to enhance its reforms.

Conclusion

China's water crisis offers attractive business opportunities for foreign companies. Difficult geographical conditions and political shortcomings have in the past lead to serious problems such as water shortages, pollution, falling groundwater tables, or flood/drought damages. However, in recent years the Chinese government has gone to great efforts to tackle these challenges. Deregulation and an increasing internationalisation of the market have made room for new participation opportunities for both domestic and foreign companies. The recent decision to upgrade the State Environmental Planning Association (SEPA) to a full cabinet ministry shows that the Chinese government continues to attach great importance to environmentally sustainable development.

The China Urban Water Association (CUWA) has pointed out that foreign investments and foreign management know-how are driving forces in China's fight to solve its water problems (Zenz & Ma 2008:96). In this regard, international cooperation agreements play an important role. The recently signed agreement between the CUWA and the German Technical and Scientific Association for Gas and Water (DVGW) underlines the importance of cross-border projects and gives hope for ongoing positive developments.

We must realise that in a globalised world economy, China's water problems will affect all of us in the long run. Also, China as a developing country is not able to tackle these challenges by itself. International companies and governments must play a key role in solving China's water crisis. Such a key role also holds the possibility of business opportunities for foreign investors.

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