



# Improving Performance of Wastewater Sector via Private Sector Participation

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## ABSTRACT

It has been heavily argued municipal wastewater infrastructures in China are currently facing great challenges of low efficiency and poor performance while thousands of wastewater treatment plants were constructed during the past decade. In addition to raise funds needed for expanding the coverage of infrastructure, it is also believed that the participation of private sectors could help improve the management as well as the performance of facilities. Eight years later since Chinese Government called for the marketization reform of public sectors (including water, wastewater, transportation, etc.) and introducing private sectors to invest, operate and manage wastewater infrastructures, emphases of the reform have shifted from raising funds to both funds and efficiency/performance improvement. This paper reviews the development of private sector participation in China's water sector to date, and analyzes in details the innovative PPP development in Hunan Province, which has successfully raised fund needed, expanded wastewater infrastructure coverage, and improved integration of wastewater governance. It illustrates that the improvement of wastewater sector performance could come along the private sector involvement in some conditions.

*Keywords:* Performance; Wastewater infrastructure; Private sector participation; China

## 1. INTRODUCTION

The well development of water infrastructures (such as water supply plants, sewers, wastewater treatment plants and etc.) has been regarded as an important characteristic of urbanization. While China has been experiencing its double-digit annual economic growth and rapid urbanization during the past three decades, it has wreaked havoc with severe environmental pollutions and ecological degradation partly due to the heavily lagged development of environmental infrastructure

such as wastewater treatment plants (WWTPs). To solve this problem, Chinese Government started to accelerate the construction of wastewater infrastructures via increasing financial investment, rising water prices, opening the market and involving private sectors over the past decade. Especially, the nationwide Cap Program for chemical oxygen demand (COD) discharge reduction in the 11<sup>th</sup> Five Year Plan (FYP, 2006-2010) has triggered a surge of WWTPs constructions in China, a total of 2160 new WWTPs, three time as many as the total WWTPs constructed before 2005, have been constructed and run into operation during this five-year period. By

the end of 2010, about 93 percent of cities and 63 percent of counties have been served with WWTPs with a total designed daily treatment capacity of 125 million m<sup>3</sup>, and about 75 percent of urban domestic wastewater was treated; however, at least 10 percent of existing operated WWTPs were operated with a lower load below 60 percent of their designed capacity (Ministry of Housing and Urban-Rural Development, 2010a).

In the wake of the expanded coverage of wastewater infrastructure in cities and counties, the emphasis of water pollution control shifted from the insufficient infrastructure to weak management of wastewater infrastructure. Although it has been argued that the ownership (public or private) of infrastructure is not directly related to the management (e.g. operation efficiency) of water infrastructures (Vining and Boardman, 1992; Spiller and Savedoff, 1997; Birchall, 2002; Afonso et al., 2005; Anwandter and Ozuna, 2002; Hart, 2003), it is still believed that the participation of private sectors in water sectors could help improve the management as well as the performance of facilities (World Bank, 2004; Zhong, 2007).

Since the turn of the century, Chinese Government has facilitated the full development of marketization reform and involved private sectors in public sectors (including water supply, wastewater, solid waste, gas, and public transportations) to address the funding shortfall. After a reform of ten years, more than 40 percent of total investments in WWTPs have been successfully raised from private sectors and hundreds of WWTP projects have involved private sectors via different public-private-partnership (PPP) arrangements, such as Build-Operate-Transfer (BOT), Transfer-Operate-Transfer (TOT), management contract, joint venture, and etc. (Zhong, 2010). In addition, both the Central Government and local governments in China have turned on efficiency issue of wastewater in-

frastructure after prioritizing the financial and investment issue over the past decade.

This paper attempts to map the development of private sector participation in China's water sector, and discusses the improvement of wastewater sector governance through involving the private sectors and how to achieve it via an in-depth case study in Hunan Province.

## 2. LEGAL AND REGULATORY FRAMEWORK FOR PPP IN CHINA'S WATER SECTOR

In contrast to water PPP pioneers such as the United Kingdom and Philippines, which enacted specific laws before entering into PPP arrangements, PPPs in China's water sectors and other public sectors were conducted under various policy papers covering five main aspects (such as market opening, concessionary management, financial and investment mechanism, water tariff, and regulation), but without specific enabling legislation.

In the mid-1990s, the Government promulgated two policy papers with the intention of attracting private sector involvement to urban infrastructures (thermal power, hydropower, highways, water supply, etc.) via the BOT approach, which provided the initial legal basis for private sector involvement and foreign investment in China's urban infrastructure. The National Development and Reform Commission (NDRC) subsequently approved three BOT infrastructure projects in 1996, including Chengdu No. 6 Water Supply BOT Plant B, Guangxi Laibin Power BOT Plant and Changsha Wangcheng Power BOT Plant (failed). These earlier experiences of BOT projects brought into needed capital and investment, but it also illustrated many problems. The issue of the fixed investment return to investors was one of these problems. To correct foreign investment projects with fixed investment returns, the General Office of the

State Council issued a circular in 2002 to call for modifying relevant contract terms, repurchasing foreign investors' shares, translating foreign equity into foreign loans, and/or terminating contracts.

In the December 2002, the Government initiated marketization reforms for the water supply, wastewater and other public sectors by opening public utilities to both foreign and domestic investors. A subsequent policy paper in 2004 specified procedures for involving the private sector in public utilities through awarding concession rights (in this policy, 'concession management' refers to all forms of private sector participation), which is followed by at least 36 different local policy papers (including 8 local ordinances, 23 local administrative measures, and 5 local regulations) to elaborate the implementation of concession management at local level till 2009. In the early years of marketization the emphasis was mainly on market opening and financing issues. In 2005, emphasis shifted towards regulatory arrangements.

In addition to the market opening policies, the Government has also promulgated a variety of policy papers to advance reforms in financial and investment mechanism as well as

water pricing, which have facilitated private sector involvement in the water supply and wastewater sectors.

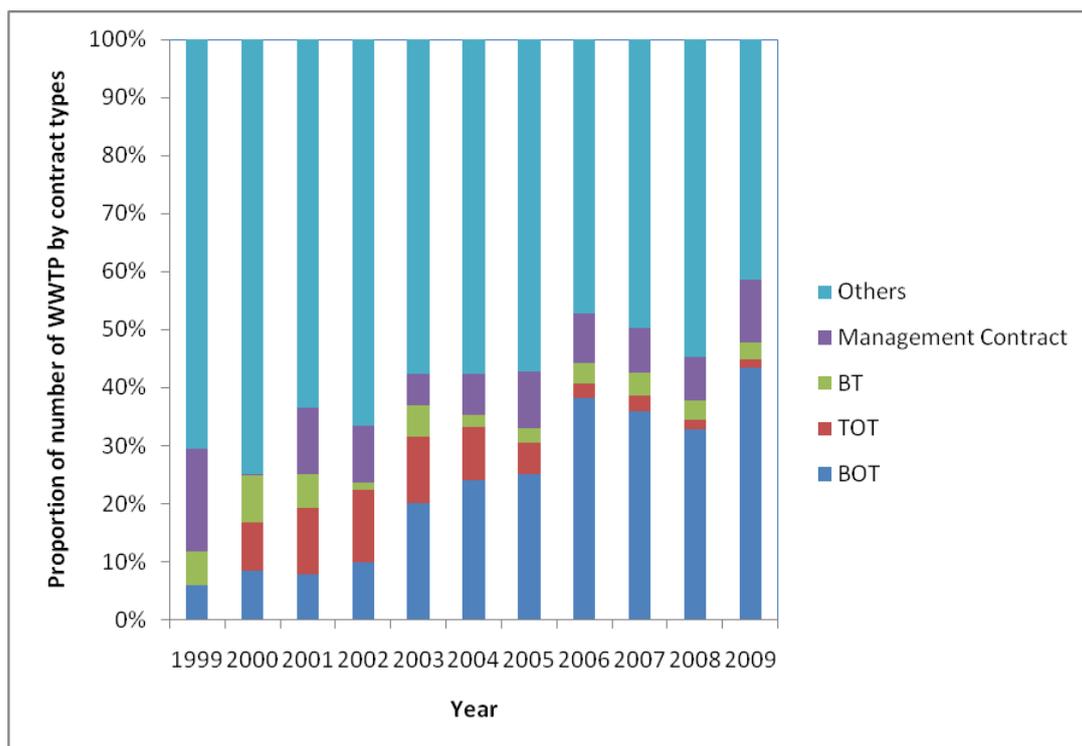
Since the initial application of BOT approaches in the water sectors in the 1990s and the full development of marketization reform in the public sector since 2002, China has applied various PPP arrangements in hundreds of wastewater projects, such as commercialization of public utilities, management contracts, greenfield (BOT-type contracts), and full sale (or full divesture). Table 1 summarizes the various forms of private sector participation and their characteristics.

According to the Ministry of Housing and Urban-Rural Development (formerly the Ministry of Construction), private sectors have become increasingly important in China's wastewater sector over the past decade. By the end of 2009, over 45 percent of total WWTPs in operation were managed by various PPP contracts (including BOT, TOT, BT, and management contract, see Figure 1), among which BOT dominated in the PPP arrangements absolutely and the non-investment intensity PPP contract (e.g. management contract) is getting of more importance.

**Table 1** Different Forms of PPP Arrangements in China's Wastewater Sector

Form of PPP arrangement	Asset ownership	Capital investment	Operation & maintenance	Contract period
Commercialization of governmental utilities/enterprises	Public	Public	Public	Indefinite
Management contract	Public	Public	Private	3-5 years
Greenfield (BOT-type)	Private/public	Private	Private	20-30 years
Full Sale or divesture	Private	Private	Private	Indefinite

**Notes:** Commercialization is the transformation of a public agency/utility into an independent corporation. Management contract (or operations and maintenance contract) refers to a contractual arrangement in which a private operator manages and maintains the services in a given period but does not have investment obligations. Greenfield contract (such as BOT, TOT, BOOT, and etc.) means the government commits new investment projects to a private company; within the contract duration, the private operator manages the infrastructure and the government purchases the services by a contracted prices. Full sale or divesture is the sale of public assets to the private sector (adapted from Zhong et al., 2008).



**Figure 1** Change of Proportion of WWTPs by Contract Types (1999-2009)

**Note:** Others include the projects without PPP arrangement and some unclassified PPP projects (Ministry of Housing and Urban-Rural Development, 2010b).

### 3. CASE STUDY: PPPS DEVELOPMENT IN HUNAN'S WASTEWATER SECTOR

The reported growing involvement of the private sectors has led to radical changes in China's wastewater management, not only by bringing into fund needed to construct and operate WWTPs, but also by shortening the construction period, reducing the cost, and playing a positive role in advancing the new institutional arrangement and improving the regulatory and managerial capacity of governments. This section is reported on fieldwork on an in-depth case study with the PPP development in Hunan Province to analyze in detail the new institutions established to improve the wastewater sector management via the private sector involvement in Hunan Province. During the fieldwork in Hunan, we carried out face-to-face interviews with the manager of water companies and telephone in-

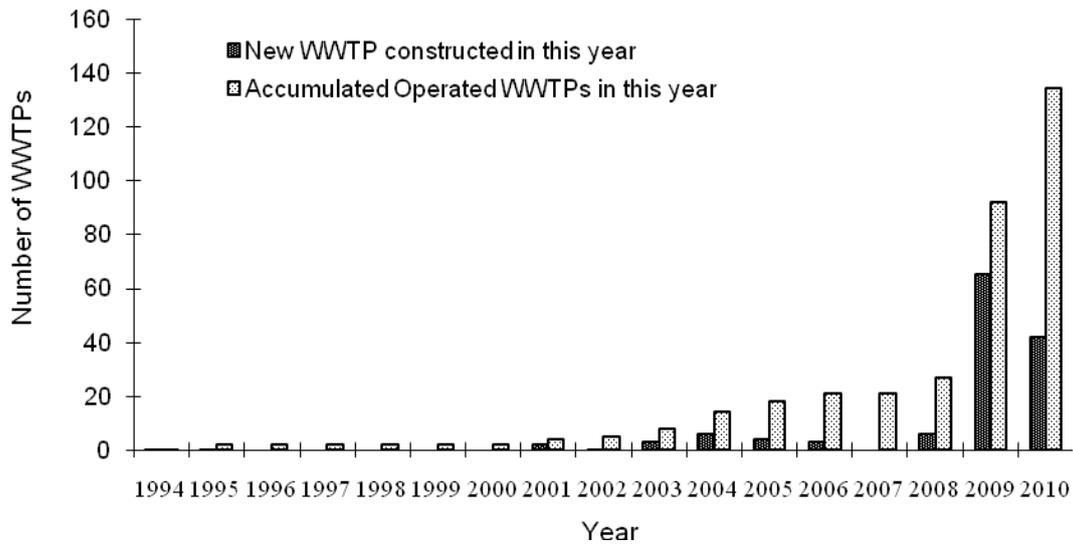
terviews with relevant local officials. Hunan Province is the first province to establish PPP arrangement between the private sector and the provincial-level government while the others just set up the cooperation at municipal and lower levels, and has successfully illustrated its development of wastewater infrastructure and institutional transformation that come along private sector involvement, making it rather a best practice than representative case.

#### 3.1 Development of Wastewater Infrastructures in Hunan Province

Hunan Province, located to the south of the middle reaches of the Yangtze River and south of Lake Dongting (the second largest freshwater lake of China), is a conventional heavy metal manufactures base in China. It is one of the developing provinces, with a GDP per capita of 20,226RMB (ca. 2,961US\$) in 2010

(ranked the 20<sup>th</sup> of 31 provinces), as well as a province with serious water pollution. Like many other provinces and cities in China, Hunan Province has experienced rapid growth in economic development with an average double-digit GDP growth rate during the past decade. However, it has experienced a much

lagged development in wastewater infrastructures before 2007 (ref. Figure 2) and only 21 WWTPs were operated with a total treatment capacity of 1.37 million m<sup>3</sup> per day in 2007 while over 2 billion m<sup>3</sup> wastewater was produced annually.

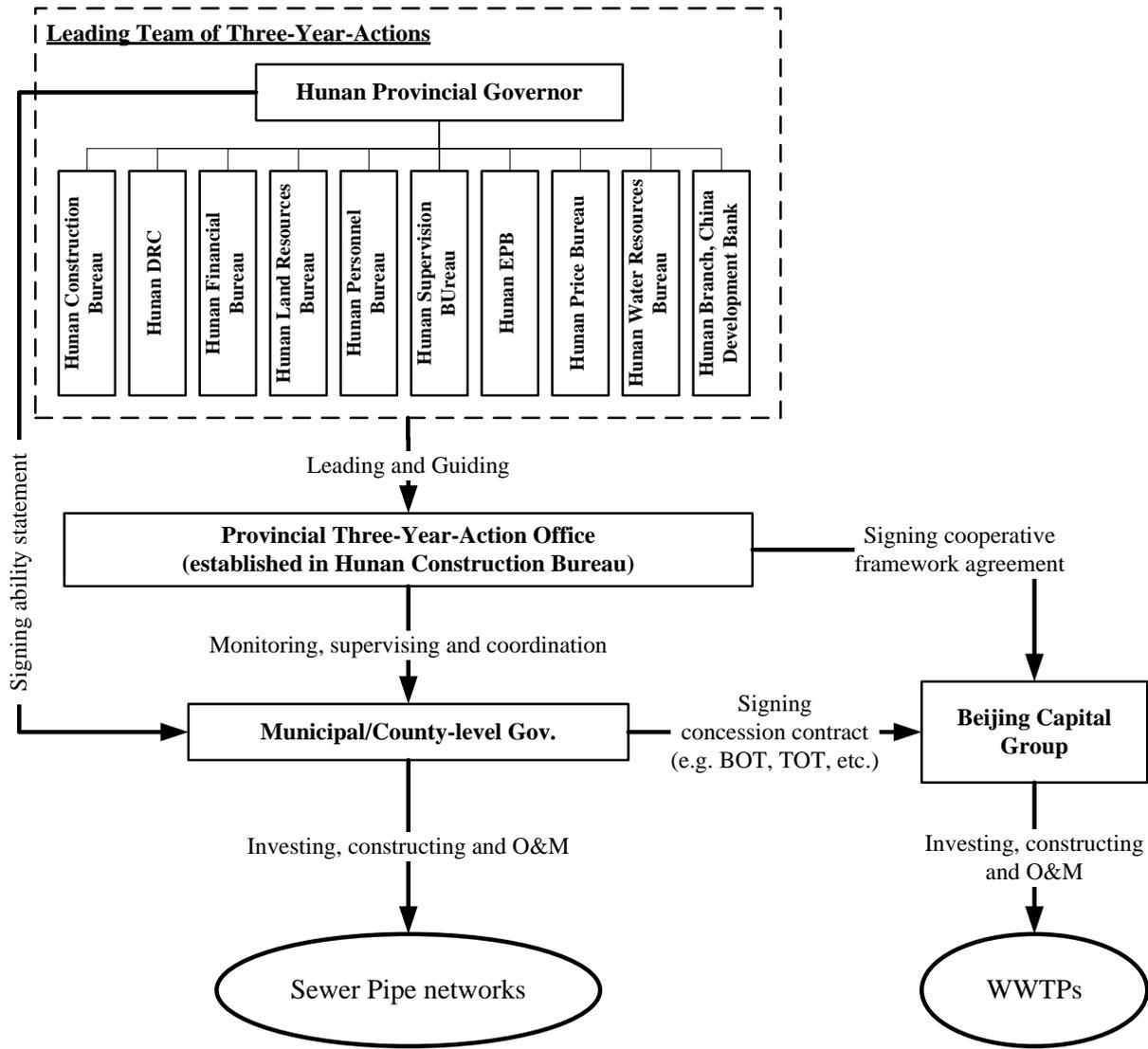


**Figure 2** Developments of WWTPs in Hunan Province (1994-2010) (Hunan Statistics Yearbook, 1995-2010)

Learning from the interviews with Hunan Construction Bureau, the explanation to the lagged development of wastewater infrastructures was partly due to the huge fund shortfall of municipal governments, partly due to the unclear responsibilities between the government and companies, and partly due to the lack of coordination ability of some municipalities or counties. In order to solve these problems, Hunan Provincial Government set up a Three-Year Target of wastewater infrastructure constructions – including 113 new WWTPs and 5,500 kilometer sewer pipelines – with a total cost estimate of 15 billion RMB in the period of 2008-2010 (Hunan Provincial Government, 2008). All mayors and county head within Hunan Province have been requested to sign a liability statement to achieve the mandatory target of wastewater infrastructure construction.

### 3.2 New Institutional Arrangements in Hunan’s Wastewater Sector

To achieve the mandatory target of wastewater infrastructure construction, Hunan Provincial Government has promulgated a series of policy papers to facilitate and guarantee the infrastructures construction timely, including management of projects preparation, requirements of project proposal, guidance of technological selection of WWTPs, project verification, governmental subsidies, regulation of WWTP operation, wastewater treatment charge, and etc. Moreover, Hunan Provincial Government has carried out various institutional changes below in wastewater sector and Figure 3 summarizes the main stakeholders involved in:



**Figure 3** Main stakeholders involved in Hunan’s wastewater sector

- *Establishing an ad hoc management leading team for the three-year-actions*

An ad hoc management team led by Mr. Xu, Vice Governor of Hunan Province and made of directors from all relevant governmental agencies (including Hunan Construction Department, Hunan Development and Reform Commission, Hunan Supervision Department, Hunan Finance Department, Hunan Personnel Department, Hunan Land Resources Department, Hunan Environmental Protection Bureau, Hunan Price Bureau, Hunan Water Resources Department, and Hunan Branch of China Development Bank) was established to

facilitate the enforcement of wastewater infrastructure development plan (No.51 Policy Paper of Hunan Provincial Government, 2008; No.5 Policy Paper of Hunan Urban Construction, 2008). This leading team is responsible for developing an integrative wastewater infrastructure development planning, choosing the provincial partner (e.g. Beijing Capital Group), supervising and monitoring the project implementation at municipal and lower levels, and coordinating between various levels government and various governmental departments, as well as between the private sector and local governments.

- *Signing provincial-level cooperation framework agreement with private sector*

In contrast to the regular PPP arrangements which regularly happen between the private sector and municipal or county-level government, Hunan Province signed a strategic cooperation framework agreement with Beijing Capital Group on 21st December 2007 to give it priority to cooperate with municipal or county-level governments via various PPP contracts such as BOT, TOT, etc.

According to this agreement, Beijing Capital would provide a total investment of 5 billion RMB to help Hunan Province construct new WWTPs via BOT or TOT approaches.

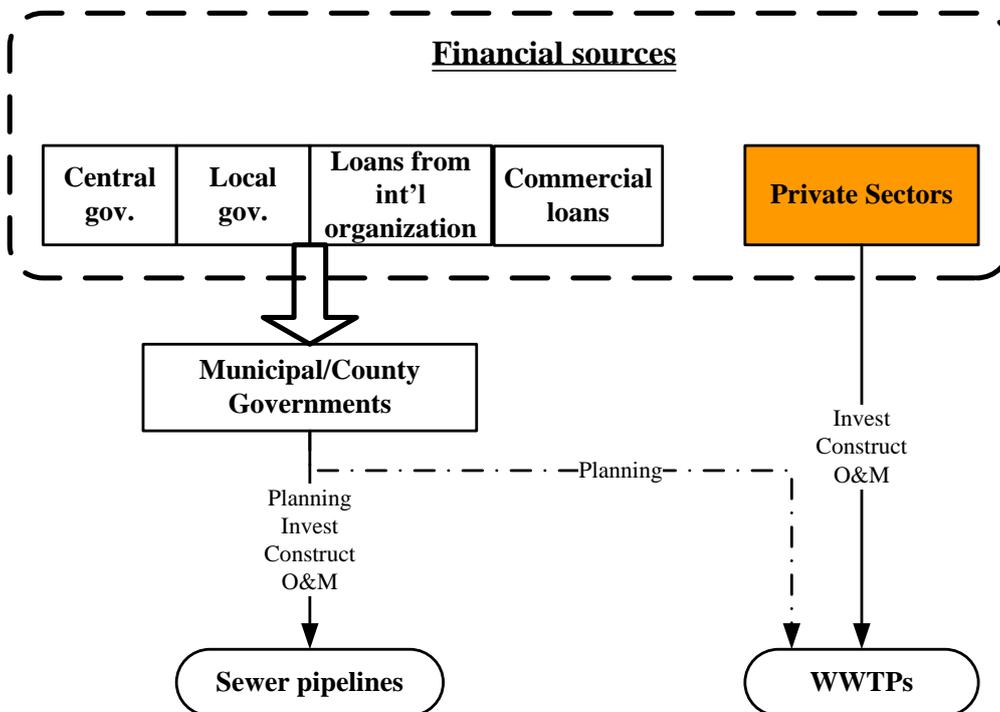
- *Clear responsibility allocation between local governments and the private sector*

In order to well introduce the market mechanism into the wastewater sector, Hunan Pro-

vincial Government set up a clear responsibility allocation between the local governments and the private sector (e.g. Beijing Capital Group) – the municipal and/or county-level governments are responsible for the construction of sewer system while all new WWTPs projects constructed by private sector.

- *New financial mechanism in Hunan's wastewater sector*

Hunan Provincial Governments established a complicated financial framework (as shown in Figure 4), including expanding financial channels (such as subsidies from the Central Government, local public finance, concessionary loans from development institutes, loans of commercial banks, private sectors, and etc.), making the best of governmental investment for expanding sewer pipelines, and fully involving private funding to invest, construct, and operation WWTPs.



**Figure 4** Financial Framework of Hunan Wastewater Sector Development

### 3.3 Improved Wastewater Performance In Hunan Province

After three years practices of establishing provincial PPP arrangement, Hunan Province has made a great progress in expanding the coverage of wastewater infrastructure and achieving its mandatory target of wastewater infrastructure construction. As shown in Figure 2, a total of 134 WWTPs with a total daily treatment capacity of 5.38 million m<sup>3</sup> have been constructed and operated in 2010, bringing about a total COD reduction potential of 400,000 ton (6.4 times as many as the number of WWTPs and 4 times as many as the COD reduction potential in 2007; Wang, 2011). In the meanwhile, Hunan Province has improved performance of wastewater sector via the involvement of private sectors, in particular in the areas below:

- *Improved integration of wastewater sector management*

Learning from the interviews on fieldwork, both the manager of water companies and the representative from the Three-Year-Action Office (Hunan Construction Bureau) emphasized the importance of improved integration of wastewater sector management via developing a basin-wide (or province-wide) planning for wastewater infrastructures from a systematic perspective. In addition, the local governments, which were pressured by their commercial contract with private sectors for WWTP construction, recognized the importance of sewer construction and laid pipelines right on schedule, improving the integration of wastewater infrastructure construction and management.

- *Raised fund needed*

Funding shortfall is one of the biggest obstacles for wastewater infrastructure develop-

ment in Hunan Province, which has low governmental revenue. In the period of 2008-2010, a total of 16.59 billion RMB was raised and invested to construct 119 new WWTPs and to lay 5,139 kilometer sewer pipelines. Among which 3.3 billion RMB was raised from private sectors. Up to date, over 40 water companies have been involved in 85 wastewater projects via BOT, BT or TOT approaches through Hunan Province, which provide about 67 percent of the total treatment capacities of WWTPs in Hunan Province.

- *Mobilized stakeholders and resources*

During the past three years, not only the private sectors but also other stakeholders including local governments and banks (both development and commercial banks) have been fully active in constructing wastewater infrastructures in Hunan Province. For instance, given a packaged program with hundreds of wastewater projects, Beijing Capital Group was much easier to mobilize funding from bank loans and/or financial market. In the meanwhile, Beijing Capital Group has successfully cut down the cost both in construction and in operation via large scale purchases and mobilizing internal personnel and other resources.

- *Incentives and effective reward mechanism*

To facilitate the construction of WWTPs and sewer pipelines, Hunan Provincial Government has established special rewards (progress rewards and pollutant reduction rewards) to encourage the local governments, water companies and other organizations which have played an important positive contribution in wastewater infrastructure construction or reducing pollutant loads. By the end of 2010, a total of 373 million RMB were awarded to 11 provincial governmental agencies and 21 local

municipal and county governments (among which 18 local governments have involved in private sectors to invest, construct and operate WWTP projects), 68 advanced groups (including 58 governmental agencies at different levels, 3 design institutes, 3 water companies, 1 engineering construction company, 1 consulting and supervision company, and 2 medias) and 277 advanced individuals (Wang, 2011).

## CONCLUSIONS

The experience of Hunan Province is a good practice in accelerating the wastewater infrastructures construction by involving private sector participation and improving the performance of wastewater sector via institutional changes, including establishment of a provincial-level PPP construction, clearly definition of the responsibilities between government and private sector (e.g. the governments are mainly responsible for financing sewer pipelines while the private sectors mainly invest in WWTPs), establishment of an ad hoc provincial management team and strengthened coordination ability at a higher level, and development and implementation of an integrated provincial planning of wastewater infrastructure construction. However, as Zhong and others stated (Zhong et al., 2008), it is still premature to conclude whether the private sector involvement will successfully overcome the major problems (such as capital shortage, inefficient operation, and service quality) in China's water sector since most of dominant PPP contracts (such as BOT and/or TOT contracts) are still at the early stage of implementation. However, at the same time, PPP contracts have become dominant in China's wastewater sector while the focus of involving private sectors in wastewater sector has shifted from single raising fund to both raising fund and efficiency improvement. From the nationwide trends of PPP develop-

ment in wastewater sector and the in-depth analysis of Hunan practices, we can draw some lessons for how to successfully involve the private sector into the provision of wastewater treatment services.

Firstly, a clear definition of responsibilities between government and private sector is significant. Governments have to take responsibilities of financing and investing in sewer pipelines which are with a highly sunk-cost while establishing a more openly WWTP market. Secondly, an integrated basin wide planning of wastewater infrastructure is crucial with or without involving private sectors since the nature of water pollution problem is a basin wide problem. Thirdly, a powerful coordination system, as the ad hoc provincial management team in Hunan Province, is significant for a success in private sector participation because the involvement of private sector into wastewater sector is a complicated reform process, covering various sub-reforms such as water tariff, tax, subsidies, land resources, regulation and etc. However, the ad hoc team will be dismissed after all planned WWTPs were constructed and run into operation, probably causing new coordinative problem in subsequent stage of WWTP operation and management. Fourthly, the selection of concessionaire is also an important factor since a right concessionaire could not only bring in capital needed and professional experiences, but also leverage more resources (including financial, technological, personnel, and etc.) to improve the local capacity of water governance. Fifthly, Hunan Province create a first successful provincial-level PPP construction; it, however, couldn't be duplicated in other provinces simply the governmental awareness is different. Finally, but not the least, the selection of the PPP form has a close relation with the level of local water tariff (Zhong et al., 2006). Greenfield projects (such as BOT and TOT) would produce a high pressure on the tariff since they highly rely on

the investment from private sectors. In order to alleviate the tariff pressure resulted from the private sector participation, as well as to enhance the competition degree, the non-investment type of PPP, such as management contract, should be paid close attention, in particular in the underdeveloped areas where the public have a lower paying capacity.

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