



# Urban Innovations and Best Practices

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## SUSTAINABLE URBAN DEVELOPMENT IN THE PEOPLE'S REPUBLIC OF CHINA\*

# Municipal Solid Waste Treatment: Case Study of Public–Private Partnerships (PPPs) in Wenzhou

### Urbanization in the People's Republic of China

Urbanization in the People's Republic of China (PRC) has been on an extensive and accelerated path. In 2008, more than 600 million people were residing in 655 cities, pushing the urbanization level to 45.7%. Based on current trends, the urban population in the PRC is projected to cross the 1 billion mark in 2030 and eight megacities—each with a population of over 10 million—would be existing in the country by 2025 (Woetzel et al. 2008).

However, the rapid rate and sheer scale of urbanization is associated with increasingly pressing social, economic, and environmental problems. Clearly, new models of sustainable urban development are needed to cater to this phenomenal urban growth for the coming decades.

### PPPs in the PRC's Municipal Solid Waste Treatment Sector

The amount of municipal solid waste (MSW) generated in the PRC has grown tremendously as a result of population growth, urbanization, and industrial development. The PRC now produces more waste than the United States. In 2004, cities in the PRC produced 190 million tons of MSW (World Bank 2005), which includes residential, institutional, commercial, street cleaning, and non-treated waste from industries. On a per capita basis of 0.98 tons per capita per year, however, it is still below that of developed countries (Zhang et al. 2010). While the safe disposal rate of MSW has increased significantly since the 1980s, it has largely remained below 55% since 2002, in part due to the rapid increase in waste generation (Chen et al. 2010).

Of the MSW collected, about 90% is disposed by landfill (both sanitary and uncontrolled) and to a much lesser extent by incineration and composting. Up to 30% of MSW is, however,

**Although the proportion of municipal solid waste (MSW) incinerated in the PRC is still relatively low, such MSW-to-energy plants are growing.**

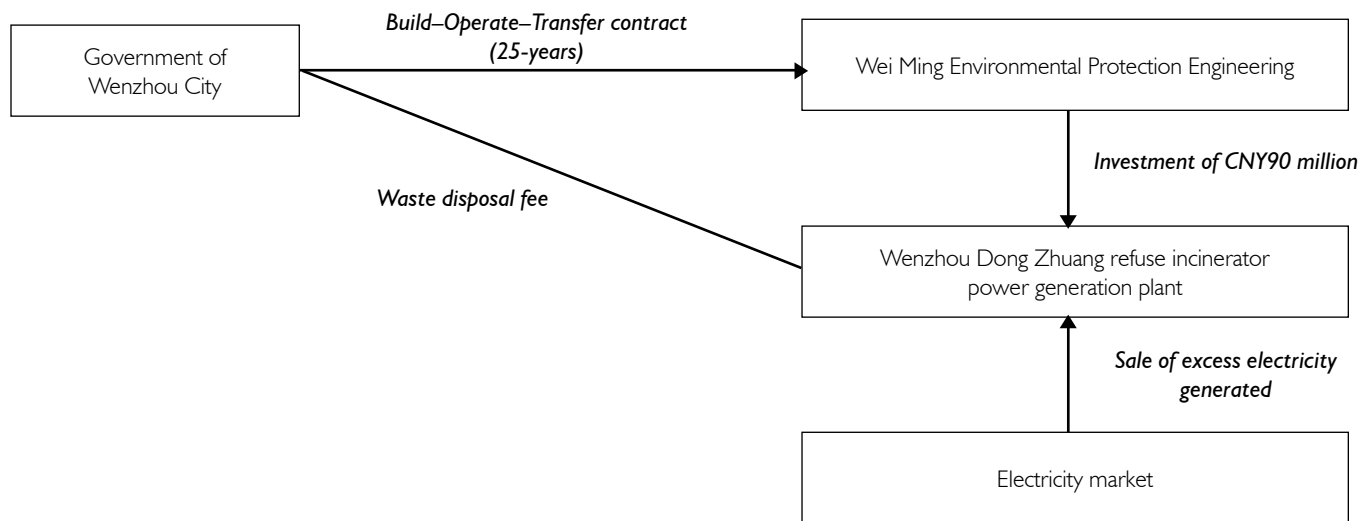
uncollected (Zhang et al. 2010). Another worrying occurrence is the number of “brownfield” sites contaminated by inadequate disposal practices. A World Bank (2005) report estimates that there are at least 5,000 such sites in the cities of the PRC. Although the composition of MSW varies greatly between cities, the waste stream is generally dominated by waste with high organic and moisture content, as kitchen waste can make up 60% of the waste. Source separation at the household level is not commonly practiced, while recycling and recovery are largely conducted by the informal sector. The waste disposal fee levies are generally based on a relatively low flat rate and are usually below cost recovery levels.

More than CNY5 billion is spent annually by the Government of the PRC on MSW collection, treatment, and disposal, but funding is unevenly distributed among the cities. Another primary source of financing is private sector participation. Public–private partnership (PPP) can take a number of forms, including household and commercial collection, operation of transfer stations, compaction and transport to treatment and disposal facilities, material separation and recycling, and treatment and disposal through build–operate–transfer (BOT) or design–build–finance–operate (DBFO) contracts (World Bank 2005). In practice, however, collection and treatment is still largely undertaken by

\* This is one of a series of case studies in sustainable urban development in the PRC.



**Figure 1: Build–Operate–Transfer Structure and Financial Flows for Wenzhou Dong Zhuang MSW-to-Energy Plant**



local governments, while private sector participation is primarily in landfill and incineration plant projects. The private sector has become the major investor in incineration projects largely through BOT contracts (Chen et al. 2010).

Although inadequate MSW infrastructure investment has been identified as a bottleneck for MSW management, a World Bank (2005) report noted a general trend of foreign private operators disengaging from the MSW market in developing countries.

In the case of the PRC, only Onxy (a subsidiary of French company Veolia) has been able to grow its market share with projects in landfill and waste-to-energy facilities while competitors have largely scaled down their operations in the market (World Bank 2005).

### MSW-to-Energy Plant in Wenzhou

The refuse incinerator power generation plant in Wenzhou, Zhejiang Province is an example of PPP in the MSW sector in the PRC. Although the proportion of MSW incinerated in the PRC is still relatively low, such MSW-to-energy plants are a growing segment. In Zhejiang Province alone, more than 30 such plants exist in cities such as Wenzhou, Jiaxing, Shaoxing, Hangzhou, Ningbo, Jinhua, and Taizhou.

#### Structure of PPP

The city of Wenzhou generates about 400,000 tons in household waste each year, a figure that is growing at a rate of 8%–10%

annually. The household waste was disposed into two existing landfills that were nearing capacity while no other suitable sites had been identified for additional landfills.

In 2002, the local government decided to form a BOT partnership with a local private contractor, Wei Ming Environmental Protection Engineering, to build and operate a new MSW-to-energy incinerator plant. The company would invest a total of CNY90 million in phases to build the plant and would operate, manage, and maintain it for a period of 25 years (excluding a 2-year construction period) under the BOT agreement. At the end of the period, the plant would revert to government ownership without any additional compensation to the company. The BOT structure is shown in Figure 1. The plant has been operational since 2003.

The incinerator plant has a design capacity of 320 tons of MSW per day and electricity generation of up to 25 million kilowatts (kWh) annually. The first phase of the plant would be able to treat 160 tons per day. This would allow the plant to generate 9 million kWh a year, of which 7 million kWh would be available for sale. The plant would also receive a service fee from the Wenzhou city government for the disposal of MSW at a rate of CNY73.8 per ton. The BOT project is expected to break even after 12 years (Chang et al. 2003).

#### Incentive Structure

The implementation of MSW-to-energy plant in Wenzhou is closely aligned with the objectives of the PRC's Renewable Energy Law passed in 2005 and is supported by a host of incentives and



preferential policies. This includes the requirement that electricity network operators purchase electricity generated by qualified energy producers using renewable energy sources.

Moreover, the PRC's Regulation of the Price of Electricity from Renewable Energy and Fee Sharing raised the electricity tariff for electricity generated by MSW-to-energy facilities in Zhejiang Province from CNY0.54 per kWh to CNY0.66 per kWh. Waste-to-energy incineration facilities are also exempted from corporate income tax for the first 5 years of operation and are eligible for the immediate refund of value-added tax (Nie 2008).

### Considerations for PPP Projects

Since PPPs have been introduced in the PRC with the economic reforms in the late 1970s, such projects have faced a number of constraints that hinder more successful and widespread implementation. Some of the key issues are outlined below.

#### *Legal and regulatory risks*

The legal and regulatory infrastructure in the PRC for PPP activities presents a risk to private investors. For example, laws that govern PPP activities are not always consistent with one another or government policies may be revised with little consideration on the impact on private partners.

#### *Tariff pricing policies*

The slow pace of deregulation of tariffs for public services could impact project profitability for the private investor.

#### *Lack of transparency in bidding process*

Most PPP projects in the PRC remain hampered by a lack of transparency in the bidding and project supervision processes.

#### *SOE participation*

State-owned enterprises (SOEs) in the PRC have been involved in several PPP infrastructure projects, creating a category of public SOE partnerships. SOEs could increasingly crowd out local private sector firms as well as foreign participation.

#### *Access to capital*

While BOT projects and others of similar scale generally have a long-term horizon of up to a few decades, long-term financing options in the domestic financial markets in the PRC is limited.

### References

- Chang, M., M.A. Memon, and H. Imura. 2003. International Experience of Public–Private Partnerships for Urban Environmental Infrastructure and its Application to China. *International Review of Environmental Strategies*. 4(2). pp. 223–248.
- Chen, X., Y. Geng, and T. Fujita. 2010. An Overview of Municipal Solid Waste Management in China. *Waste Management*. 30: 716–724.
- Ke, Y., S. Wang, and A.P.C. Chan. n.d. *Public-Private Partnerships in China's Infrastructure Development: Lessons Learnt*.
- Liu, Z. and H. Yamamoto. 2009. Public–Private Partnerships (PPP) in China: Present Conditions, Trends and Future Challenges. *Interdisciplinary Information Sciences*. 15(2). pp. 223–230.
- Nie, Y. 2008. Development and Prospects of Municipal Solid Waste (MSW) Incineration in China. *Frontiers of Environmental Science and Engineering in the PRC*. 2(1). pp. 1–7.
- Woetzel, J., J. Devan, L. Jordan, S. Negri, and D. Farrel. 2008. *Preparing for China's Urban Billion*. McKinsey Global Institute. March.
- World Bank. 2005. Waste Management in China: Issues and Recommendations. *Urban Development Working Papers 9*. East Asia Infrastructure Department.
- Zhang, D.Q., S.K. Tan, and R.M. Gersberg. 2010. Municipal Solid Waste Management in China: Status, Problems and Challenges. *Journal of Environmental Management*. 91: 1,623–1,633.

