Economic and Financial Analysis of Decentralized Water Recycling Systems in Beijing

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Water scarcity problems in Beijing

- The Beijing municipal government issued a series of regulations on building wastewater recycling systems
- In 1987, the first regulation, called <Temporary water reclamation and reuse regulation> was enacted
- It states that all institutes, schools and hotels of which a construction area larger than 30,000 m2 must have their own water recycling system
- In 2000, a more complete regulation on constructing water recycling system in Beijing was generated
- Following that, the standards for recycling water quality and the standards for recycling systems were fixed. This includes wastewater source standards, water quality standards, and wastewater reclamation technique standards

Effect: decentralized WWT systems

- Because of these policies, around 1000 decentralized wastewater recycling systems have been constructed and are operational in Beijing
- The number of decentralized systems in Beijing is still increasing and will continue to rise in future
- The Beijing municipal government expects that the reused water production of all systems could reach 1million m3 in the year of 2008 and will reach 1 billion m3 in 2010 (Beijing Daily, 2007)
- Except for WWT systems for the industrial sector, many decentralized waste water recycling systems obtain subsidies from the Beijing municipal government

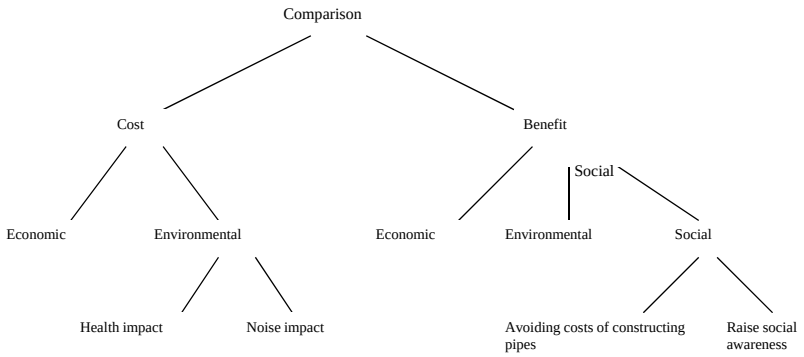
However, actual reused water production is less than expected

- The production of both decentralized and centralized water recycling systems is often less than their designed capacity
- Another important reason can be that some decentralized systems stopped their operations because of financial problems
- These problems are high operational cost, limited financial resources and poor management
- Financial losses affect the performance of the decentralized systems in Beijing negatively so that the actual production of the decentralized system is decreasing

Approach of decentralized WWT

- Economic, financial, environmental and social analysis of the project for the government
- Financial appraisal for the investor
- This is in line with the approach taken in the shared framework for the subject group (presentation on Monday and Tuesday morning)

The analytical framework
For the economic analysis

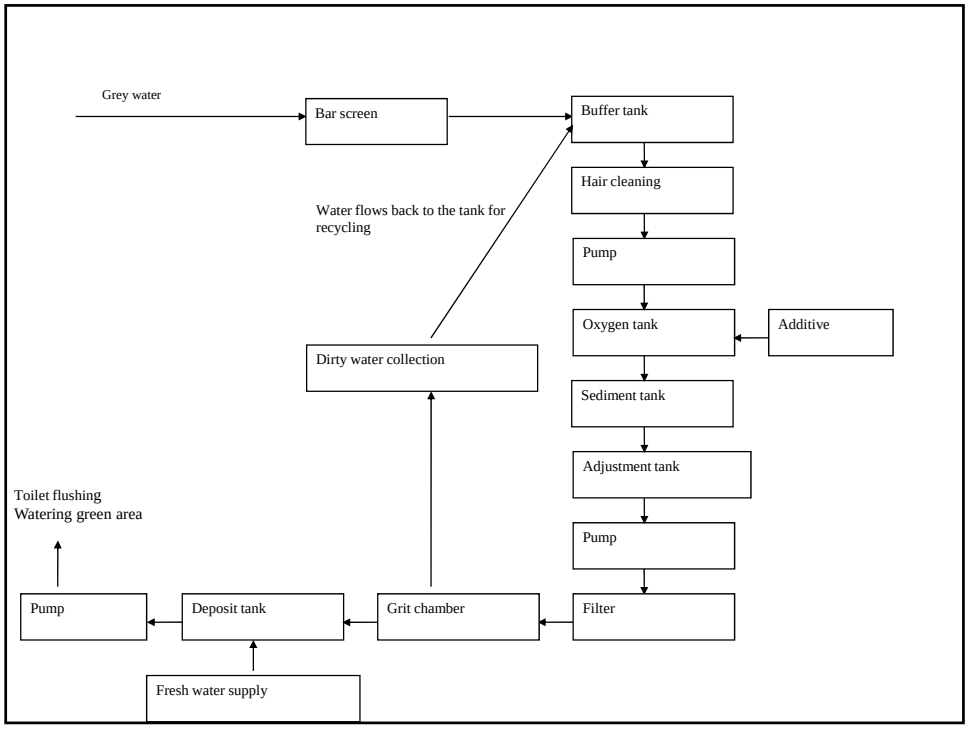


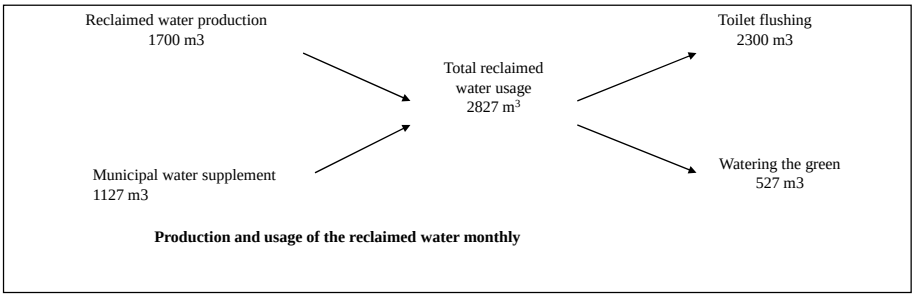
Description of the investigated Qing project

- The project is located in a residential area in the Beijing city center, built in 2003. It is small scale: only around 2583 persons are serviced by the project and two workers are in charge of the project. Its initial construction investment is completely funded by the government so the project manager is only concerned about the O&M expenditures
- The reclamation plant is the main part of the project, constructed underground and besides a parking place. The depth of the plant is 8 m and its total surface is 218 m2
- Like other systems the Qing project uses a simple treatment technique
- Besides the water reclamation plant, there are double collection pipes in the system. Wastewater is collected separately: the grey water including shower and sanitation wastewater, and the black water covering other wastewater. The grey water is recycled and reused, and the black water is transferred to the municipal sewage system
- Reclaimed water is reused to flush toilet and to water the green area

Reclaimed water is reused:

- The produced reused water can not satisfy the water requirement, so part of the “reused water” is supplemented by municipal fresh water
- In fact almost half of the reused water is supplemented by municipal water
- The produced reused water can not even satisfy the toilet flushing requirements
- To simplify the calculations, we assume that the Qing project produces all the required reused water, which amounts to 1700m3 per month

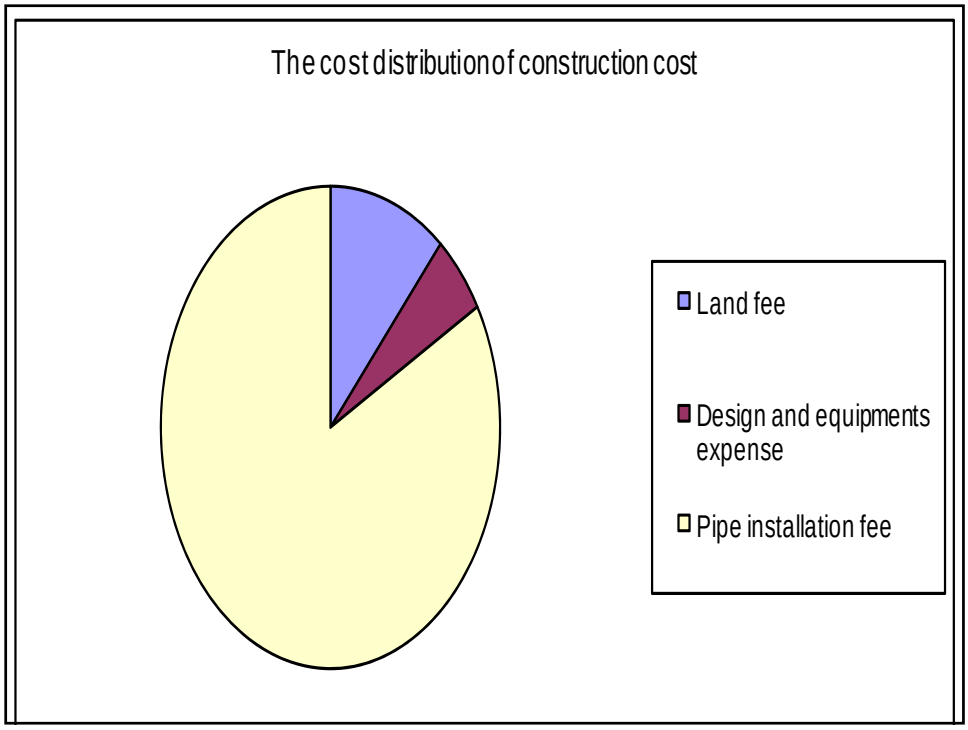


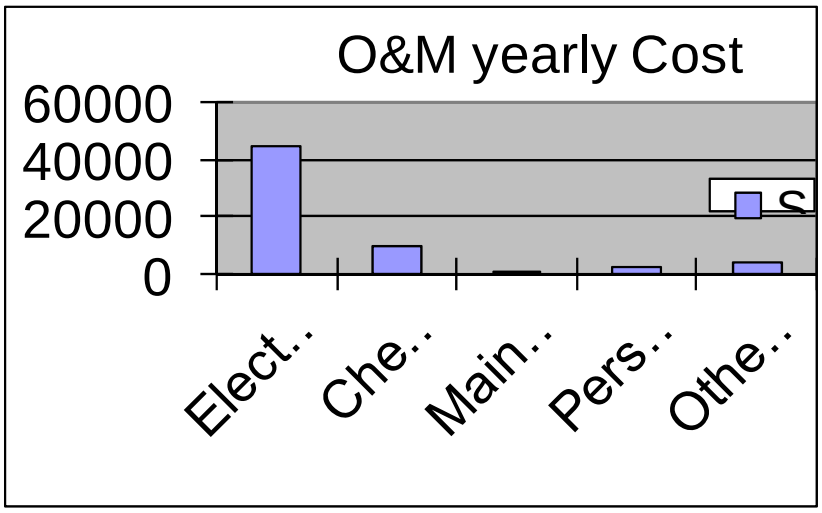


Production and usage of the reclaimed water monthly

Classification of the economic cost

Construction Cost	**Land, Building construction fee, Network installation: pipes fee and sewage facilities, Costs of equipment**
Operation & Maintenance Cost	**Electricity, Chemical Cost, Personnel cost: salary and training, Reparation, Network maintenance (such as leakage mitigation, pump maintenance, pipe cleaning)**





After economic cost (O&M), now effects on the environment: health & cost of additional noise etc.

Used the indirect valuation method to assess the health impact from a small wastewater recycling plant

Environmental cost:

1. Disability Adjusted Life Year (DALY) is taken as a measurement unit for the impact on human health
2. Negative noise effects are measured though Willingness to pay indicators
3. Pipe construction cost

Social and economic benefits

- Avoiding costs of constructing pipes
- Project raises social awareness concerning a new water culture
- Water saving
- Environmental benefits
- Revenues

Financial analysis

Cost = 2,776,000 yuan

Benefit = 101,000 yuan

The ratio of revenue and cost is only 0.04

The financial appraisal result reflects that the present value of the cost is almost 25 times more than the present value of revenue

It means that the project is financially non feasible

The project manager was losing money from the beginning of the functioning of the system

According to the project manager, the construction of decentralized system is not a good decision

The financial non feasibility may be explained by two points:

1. high operation cost and
2. a low price of reused water

Conclusions 1

- The economic analysis indicates that the decentralized water recycling system is economically feasible: saving pipe construction cost is the main reason for the economic feasibility
- Moreover, the economic analysis proves that the decentralized system is an environmental friendly system because the environmental benefits are larger than the environmental cost

Conclusions 2

- In the opinion of government, the decentralized systems have a positive influence, but from the viewpoint of project manager, the decentralized systems have serious financial performance problems: high O&M cost and a low price for reused water are the main reasons of the system's financial non feasibility
- Although the construction of decentralized systems could save water resources and save capital investments, the decentralized systems may not continue to operate in the long term if the financial problems are not solved
- Thus solving the financial problems of the decentralized systems should be a political agenda in the future!