

# **Economic Comparison Analysis for Application of Ecological Sanitation and Traditional Sanitation System in Towns of Northern China: Case Study**

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# 1. Introduction (1)

**Principal questions of promoting traditional sanitation system and drainage mode are as follows:**

**(1) Constructing flush sanitary installation, network of drains and sewage treatment plant cost large funds.**

**(2) The current situation of water resources shortage is more and more serious, one person uses about 15,000 clean water to flush dejecta and urine according to statistics. It is a severe waste of water resources.**

**(3) Adopting traditional sanitation system and drainage mode, the nutrient of human excrement would be wasted. Apart from causing resource losses, it is the source of pollution which brings about the great degeneration of land lacking manure.**



# 1. Introduction (2)

**Ecosan system is a new program which can replace traditional sanitation system completely. It can separate the source pollutants, save water, reduce diffusion of pollutants as well as reclaim useful nutrient for agriculture from dejecta and urine. Its key features are as follows:**

**(1) The natural and energy-saving composting method should be used to deal with human excrement and other organic refuse;**

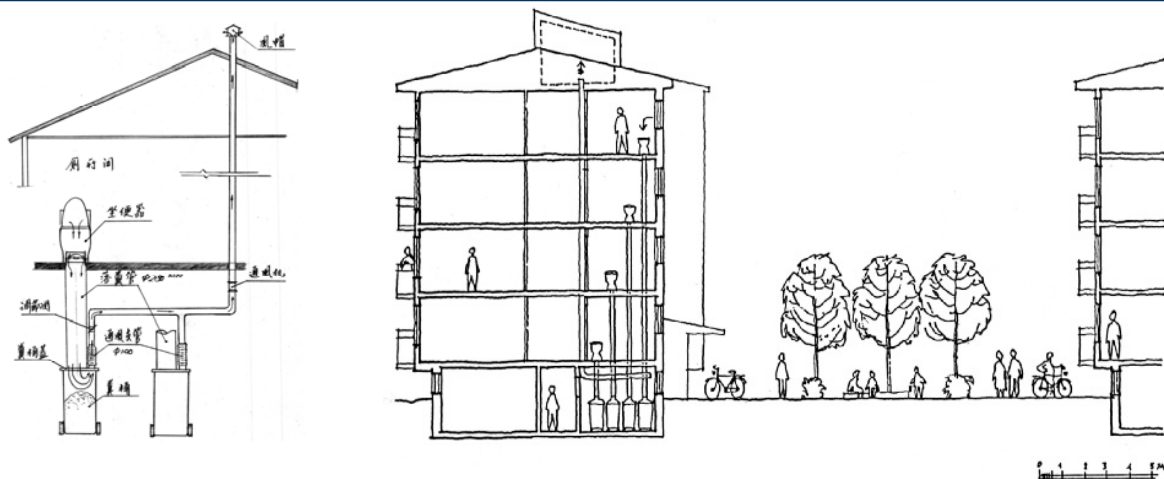
**(2) The nutritive material in human excrement and other organic refuse should be reclaimed and recycled to form a close cycle system;**

**(3) To use water efficiently, safely and properly. The sewage drained out should be treated and then reclaimed to guarantee safe usage or sent back to recharge groundwater in order to form a close cycle system.**



# 1. Introduction (3)

## Hao Zhaokui Ecodistrict



Eco-town Project, Inner Mongolia, China

# 1. Introduction (4)

**Town ecosan system, especially town sewage source separating system, has just begun. Proper application of the technique and available investment and construction method, as well as effect is subject of public concern.**

**Ecosan system project is similar to other investment projects. It will bring direct influence not only to the investors, but also the economic development of the whole society, nation and area. Therefore, it is necessary to assess the economical efficiency of the project for the project feasibility.**

**Combining the investment condition of ecosan system of Hao Zhaokui ecodistrict and typical traditional sanitation system to carry out cost-benefit analysis on the ecosan system and typical traditional sanitation system, and to compare the economical efficiencies of these two systems.**



## 2. Method (1)

### 2.1 Economic Evaluation Technique

- **Any economic activity in human society, including policy and development project, would affect the environment and natural resource allocation. Thereby, it is necessary to assess the magnitude of the effects and to decide whether to issue or carry out certain policy or not, as well as whether to develop or construct certain project or not. Cost-benefit analysis is the major technique to assess these effects.**
- **Cost-benefit analysis method proceeds assessment through the project's environmental effect and then brings the public's concern about environment into feasibility study of the project. Sometimes cost-benefit analysis can be called as cost effectiveness analysis, economic analysis, benefit-cost analysis national economy analysis or national economic evaluation, etc. Most government department and international body would adopt cost-benefit analysis as major method to evaluate projects.**



## 2. Method (2)

### 2.2 Evaluation Criteria of Cost Effectiveness

➤ **Economic Net Present Value-ENPV is the absolute index to reflect net contribution the project has made for the national economy.**

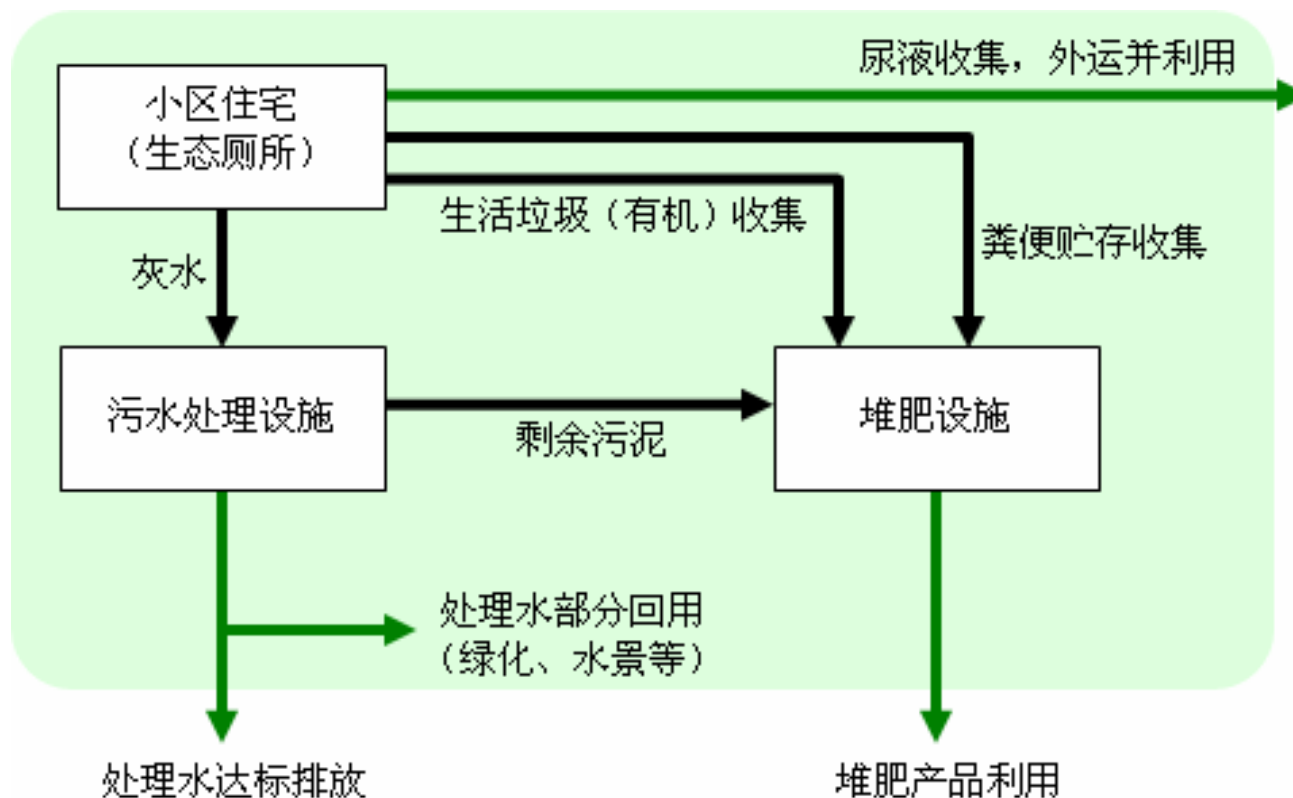
$$ENPV = \sum_{t=0}^n \frac{B_t - C_t}{(1 + i_s)^t}$$

➤ **Economic Net Present Value is greater than or equal zero. The project is the optional one. When comparing two exclusive cases, the higher Economic Net Present Value takes priority.**



# 3. Result and Discussion (1)

## 3.1 Cost and benefit identification of ecosan system and traditional sanitation system



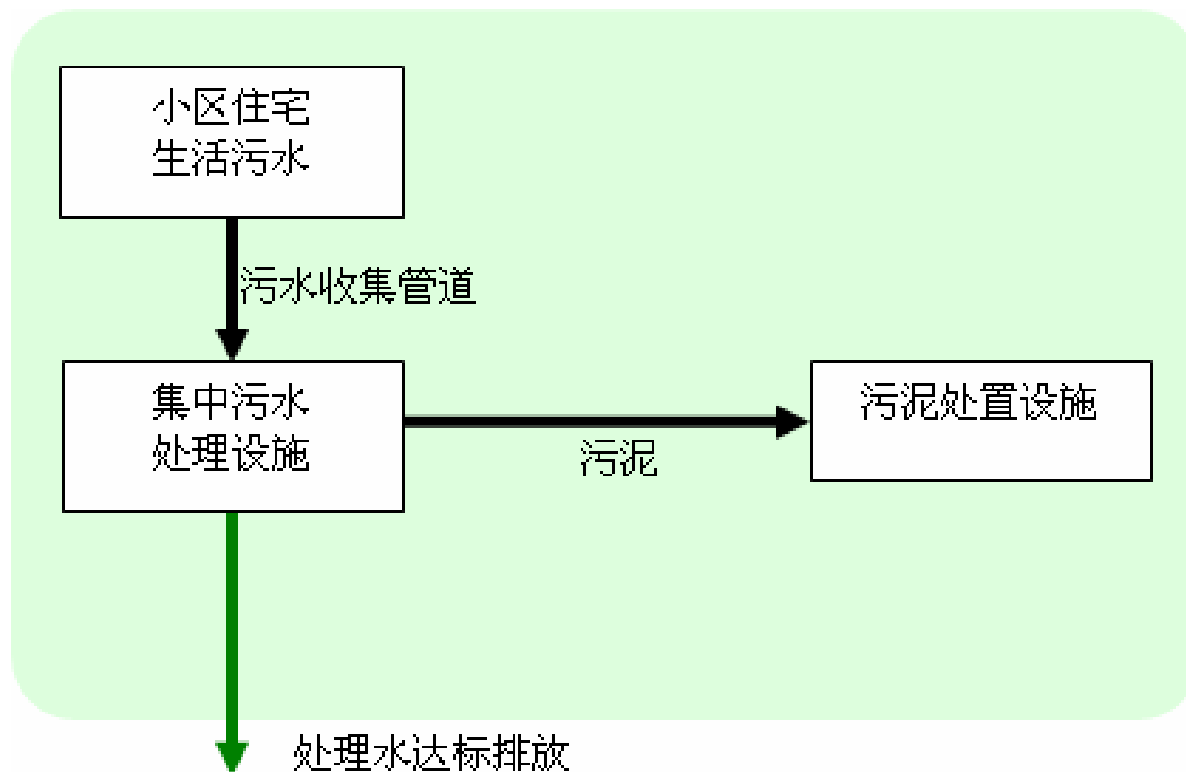
**Ecosan System Structure of Hao Zhaokui Ecodistrict**





## 3. Result and Discussion (2)

### 3.1 Cost and benefit identification of ecosan system and traditional sanitation system



**Traditional sanitation system structure (flush toilet is used inside the house)**



# 3. Result and Discussion (3)

## 3.1 Cost and benefit identification of ecosan system and traditional sanitation system

### Cost and benefit of Ecosan System in Hao Zhaokui Ecodistrict

效益流量	
直接效益	污水处理收费 (入住率 100%)
	年生产中水的效益 (入住率 100%)
	年堆肥产品及尿液效益 (入住率 100%)
	固定资产残值
间接效益	减少城市污水和垃圾处理建设费用
	减少给水设施基建费
	年垃圾、污泥减量化收益 (入住率 100%)
	年减少污水处理的费用 (入住率 100%)
	年节约给水水处理和供水费用 (入住率 100%)
	年节水新增工业产值 (入住率 100%)
	年减少水污染造成的环境退化成本 (入住率 100%)
年农业增产效益 (估计) (入住率 100%)	

费用流量	
固定资产投资	
年经营费	



# 3. Result and Discussion (4)

## 3.1 Cost and benefit identification of ecosan system and traditional sanitation system

### Cost and benefit of traditional sanitation system

效益流量	
直接效益	年污水处理收费（入住率 100%）
	固定资产残值
间接效益	年减少水污染造成的环境退化成本（入住率 100%）

费用流量	
固定资产投资	
年经营费	



# 3. Result and Discussion (5)

## 3.2 Comparison analysis on economical efficiency of ecosan system and traditional sanitation system

### 生态卫生系统和同等规模传统卫生系统经济效果比较

指标	生态卫生系统	传统卫生系统
经济净现值 ENPV (社会折现率=8%)	23427880.13 元	-1,449,793.74 元



## 3. Result and Discussion (6)

### 3.2 Comparison analysis on economical efficiency of ecosan system and traditional sanitation system

- If current sewage effluent fee increases from 0.8Yuan/m<sup>3</sup> to 1.8Yuan/m<sup>3</sup>, the ENPV would be 325,468.25 Yuan. It is more than zero, so the economy of traditional sanitation system is feasible.
- Meanwhile, the ENPV of ecosan system is 95,546,913.49 Yuan. It is more than the ENPV of traditional sanitation system greatly. It means that after increase of sewage effluent fee, the economical efficiency of ecosan system is better than that of traditional sanitation system.



# 3. Result and Discussion (7)

## 3.2 Comparison analysis on economical efficiency of ecosan system and traditional sanitation system

- **The social discount rate adopted by the organization and the nation is different overseas.**
- **It is 1.6%-3.2% in the USA. (It is applicable to the project calculation period of three to thirty years)**
- **It is 10%-12% by Asian Development Bank**
- **In China the social discount rate should not less than 8% for environmental protection project, but the specific figure has not been specified.**



## 4. Conclusion (1)

**(1) When the social discount rate is 8% as cost-benefit analysis method adopted, the ENPV of ecosan system is much more than that of traditional sanitation system. It means that when evaluated on the basis of the whole society, the economical efficiency of ecosan system is better than that of traditional sanitation system. At the same time, the ENPV of ecosan system is also much more than that of traditional sanitation system within the social discount rate specified by China.**



## 4. Conclusion (2)

**(2) The reclamation grade of the ecosan system is high. For example, the water saving rate can reach 40%, the dejecta can be used for agriculture after separation and treatment, and the buck can be reclaimed after treatment, etc. All of these make the direct benefit (take off residual value of fixed assets) of the ecosan system reach 133,698.1 Yuan/year, which is 1.96 times as much as traditional sanitation system. Quantized direct benefit direct benefit of the ecosan system can reach 14,178,159.91 Yuan/year, which is 35 times as much as traditional sanitation system. Hence, the economic benefit of the ecosan system is outstanding.**





## 4. Conclusion (3)

**(3) The large-scale application of the ecosan system in towns lacking of experience, meanwhile, associated equipment and product are insufficient. Therefore, current construction investment of ecosan system is relatively great. The investment scale of ecosan system in Hao Zhaokui ecodistrict is 2.17 times as large as traditional sanitation system. But in company with the construction of ecosan system and associated equipment and product going to scale and standardization, the construction cost of the ecosan system would be reduced.**



## 4. Conclusion (4)

**(4) Current benefit of the ecosan system is mostly represented by indirect benefit, so corresponding mechanism should be set up quickly in Dongsheng District where water resources are insufficient to promote the presence of direct benefit of ecosan system instead of indirect benefit. For example, to establish transaction of the right to discharge of sewage and transaction of water property rights, etc., at the same time, to increase the effluent fee.**



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# Thank you!

