



# Challenges and good practices of decentralized domestic wastewater treatment in China

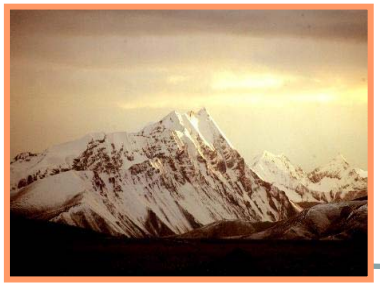
**Dr. Meixue Chen**

**Rural Wastewater Management Division, Department of Rural Infrastructure Construction， Ministry of Housing and Urban-Rural Development**

**Sep. 27, 2016**

# Rural areas

North east



North of China

North west

Middle south

West south

South of China

# Wastewater in different regions

## Domestic water use (L/P.day)

| Types of village | Northeast | North south | North | West north | West south | South |
|---|---|---|---|---|---|---|
| Good economic，bath ,flush toilet ,wash mashine | 80-135 | 90～200 | 100~145 | 75～140 | 80-160 | 100～180 |
| Good economic, bath and kitchen | 40-90 | 80～100 | 40~80 | 50～90 | 60-120 | 60～120 |
| Normal economic ,simple toilet | 40-70 | 60～90 | 30~50 | 30～60 | 40-80 | 50～80 |
| No flush toilet | 20-40 | 40～70 | 20~40 | 20～35 | 20-50 | 40～60 |

## Characters of wastewater (mg/L)

| | pH | SS | COD | $BOD_5$ | $NH_4^+$-N | TP |
|---|---|---|---|---|---|---|
| West south | 6.5~8.5 | 100-300 | 100-400 | 50-300 | 3-50 | 1.0-6.0 |
| Northeast | 6.5-8.0 | 150-200 | 200-450 | 200-300 | 20-90 | 2.0-6.5 |
| North south | 6.5~8.5 | 100~200 | 70～300 | 150~450 | 20~50 | 1.5~6.0 |
| North | 6.5~8.0 | 100~200 | 200~450 | 200~300 | 20~90 | 2.0~6.5 |
| West north | 6.5～8.0 | 150～200 | 150～400 | 100～150 | 20～50 | 2.0～6.0 |
| South | 6.5~8.5 | 100~200 | 100~300 | 60~150 | 20~80 | 2.0~7.0 |

# Technical guide for rural domestic wastewater treatment in different regions

**Northeast:** septic tanks, anaerobic biofilter, bio-contact oxidation tank, land treatment, constructed wetlands, lagoon

**North China :** septic tanks, sewage digesters, aeration tank, sequencing batch bio-reactor, oxidation ditch, biological contact oxidation , constructed wetlands, land treatment

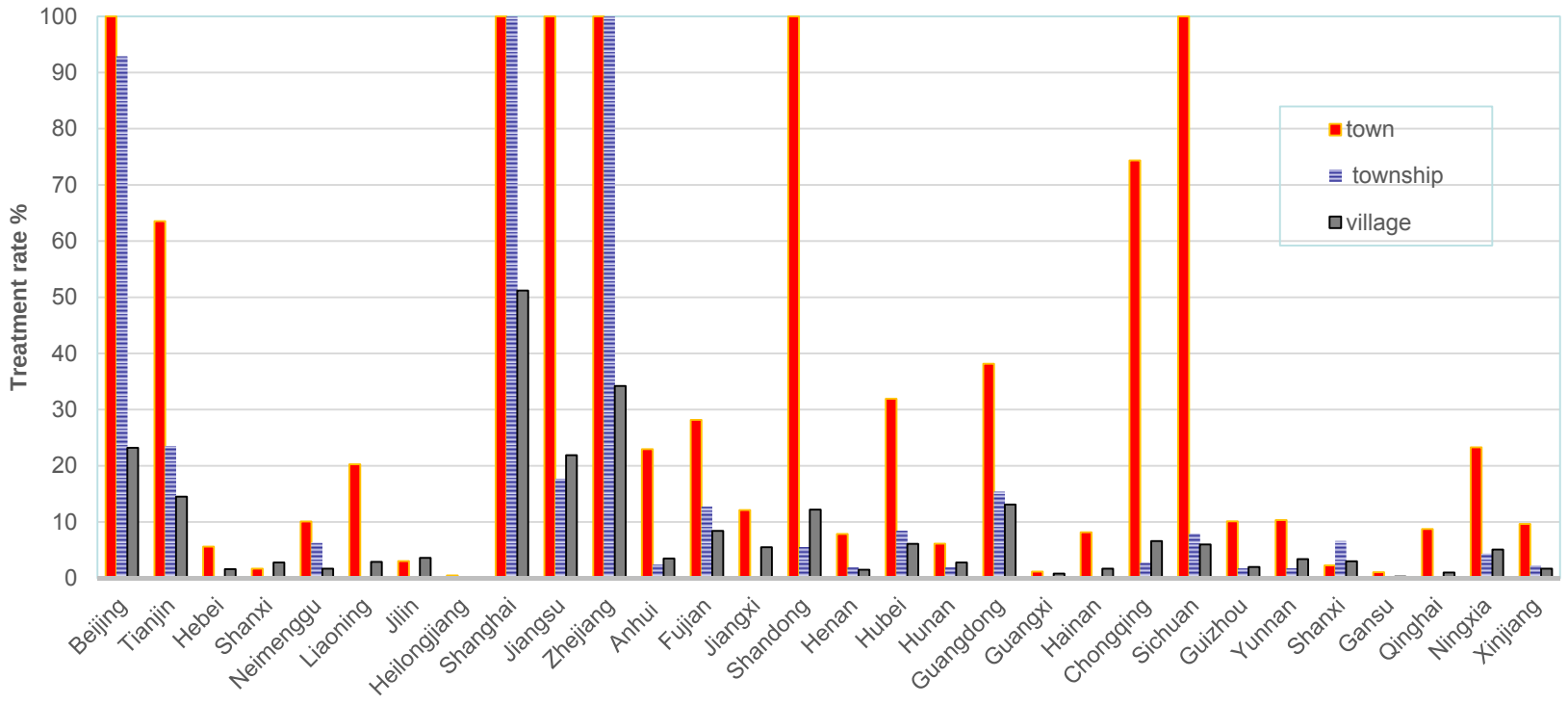
**Northwest :**septic tank, anaerobic digesters, anaerobic biofilter, constructed wetlands, land treatment

**Southwest:** septic tanks, wetland, land treatment, anaerobic technology, bio-contact oxidation tank, oxidation ditch, anaerobic biofilter

**Middle south**: septic tanks bio-contact oxidation, oxidation ditch, constructed wetland, lagoon, floating islands could be applied for sewage treatment.

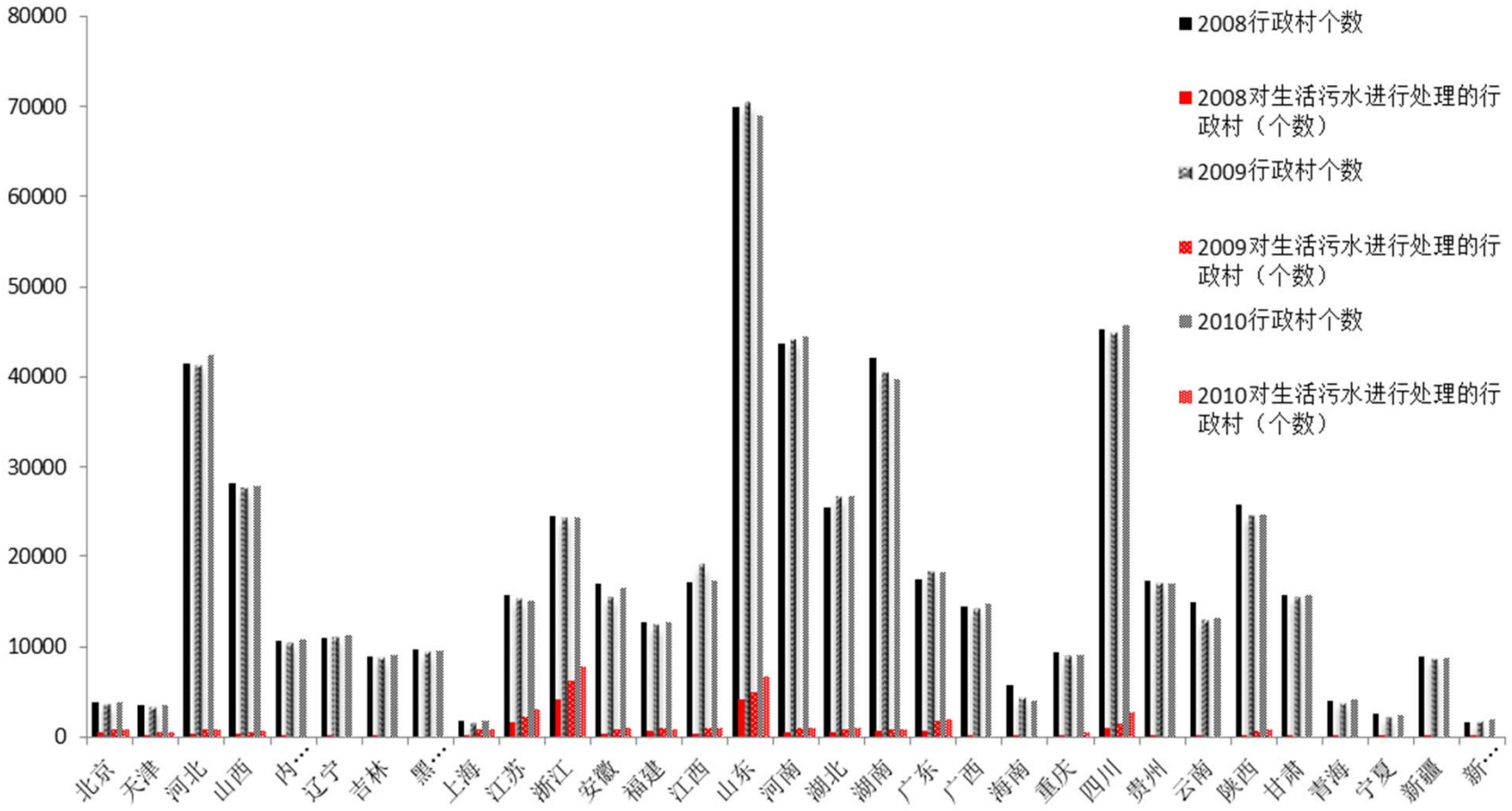
**southeast:** septic tank, anaerobic biofilter, anaerobic digesters; biological contact oxidation tank, oxidation ditch, constructed wetlands, ecological filter.

# Domestic wastewater treatment rate in 2011year



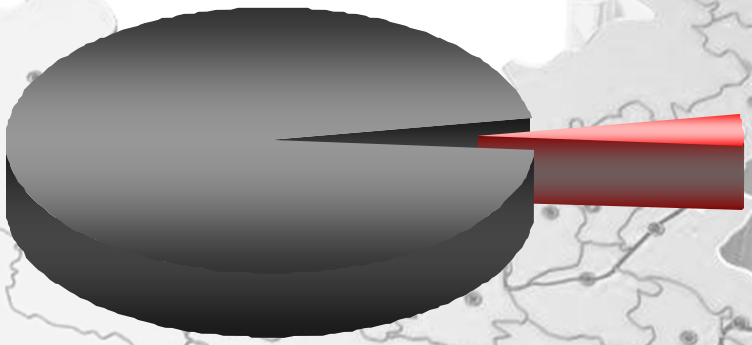

**Up to the and of 2010, 22.9% of domestic wastewater from towns and villages**

# Construction of villages




**From 2008 to 2010**

# Rural wastewater



**(13% spray drain, and wastewater treatment)**

# Pollution loads

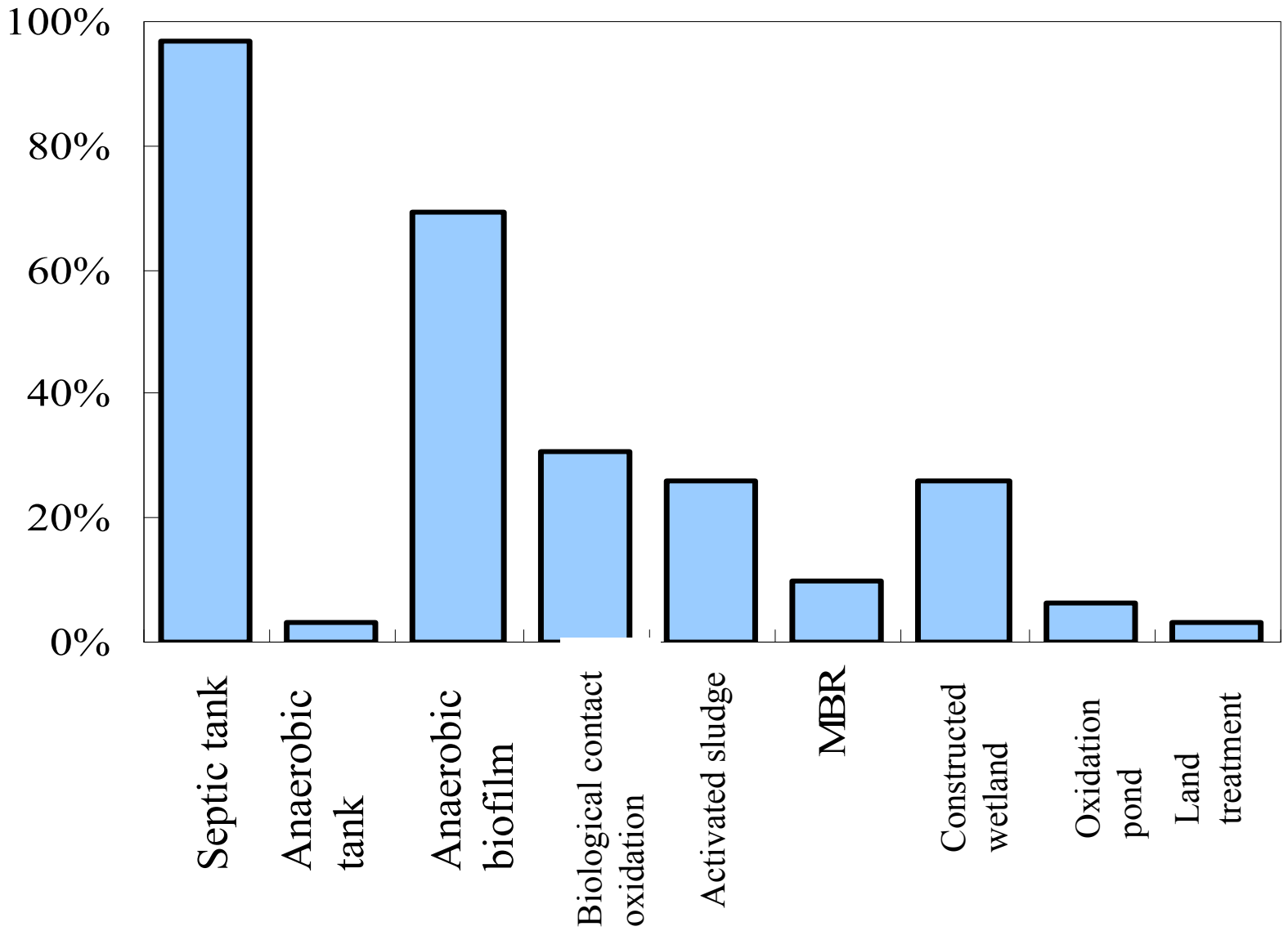
| | town | village | T&V | city |
|---|---|---|---|---|
| SV($10^8 m^3/a$) | 3.6 | 5.6 | 9.2 | 33.0 |
| COD($10^6 t/a$) | 2.6 | 5.4 | 8.0 | 8.6 |
| N($10^6 t/a$) | 0.5 | 1.1 | 1.6 | 0.97 |
| P($10^6 t/a$) | 0.04 | 0.07 | 0.11 | |

SV: sewage volume

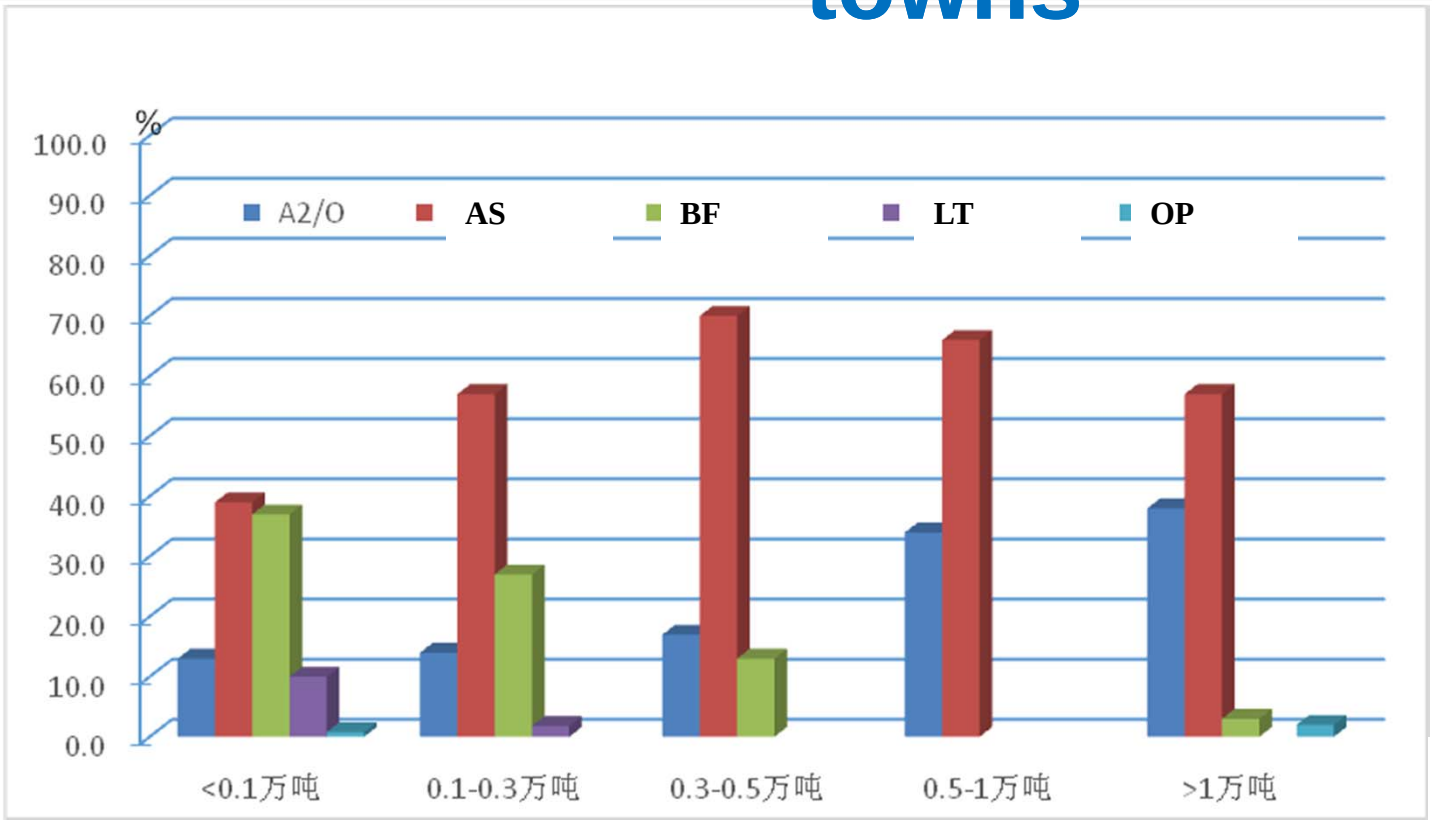
# Types of decentralized wastewater systems

- **Primary treatment**
  - Septic tank
- **Secondary treatment----Biological technologies**
  - Biofilm
  - Anaerobic digesters
- **Eco-technologies**
  - Constructed wetlands
  - Leach trenches
- **Community Systems**

# Technologies for decentralize wastewater treatment in villages



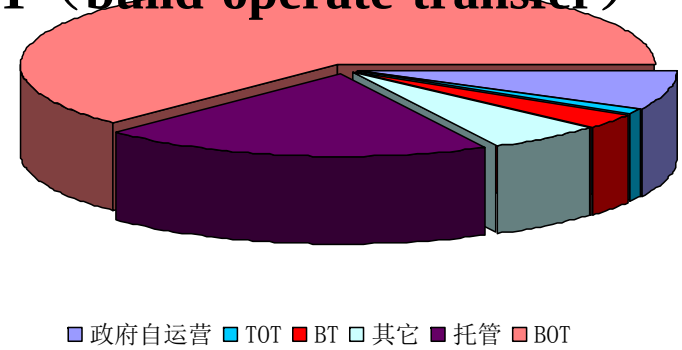
# Wastewater treatment technologies in towns




AS: Activated Sludge
BF: Biological Filter
LT: Land Treatment
OP: Oxidation Pond

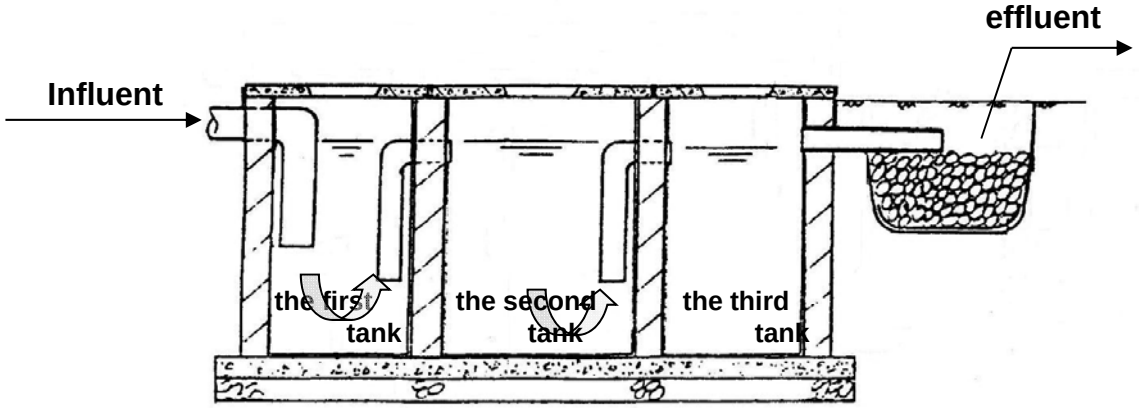
## Funding

**BOT（build-operate-transfer）**



# Case study: Septic tank

- Inexpensive
- Simple to maintain




- Sludge may cause an odor problem
- Not effective in removing nitrate and phosphorus and pathogenic organics
- Potential pollution source of groundwater

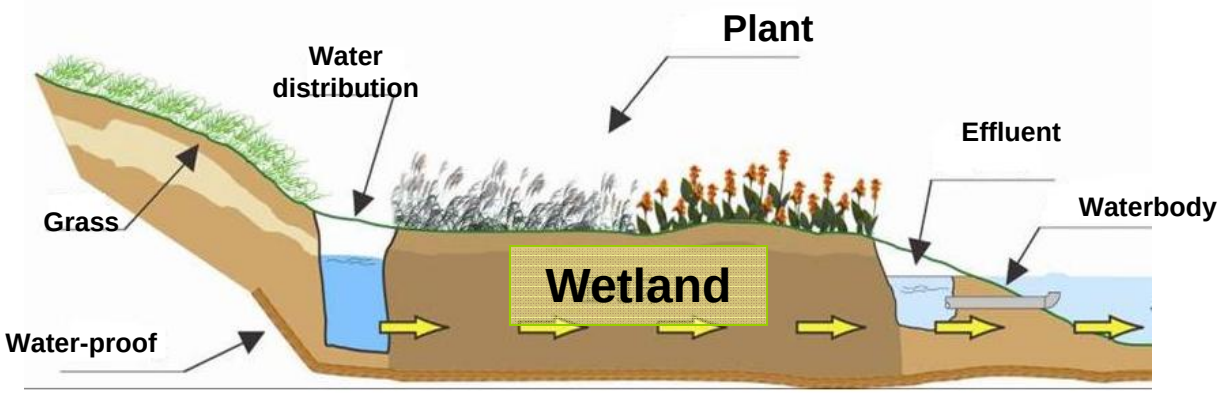
# Case study: Activated sludge

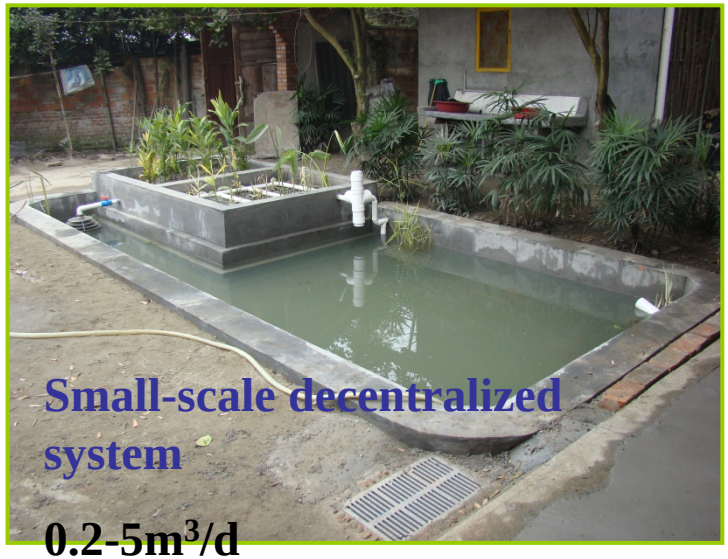

**1m³,2m³,5m³,10m³,15m³/day**

- **Flexible for decentralize wastewater treatment**
- **Automatic control**

- **Expensive for single family**
- **management is relative complex**

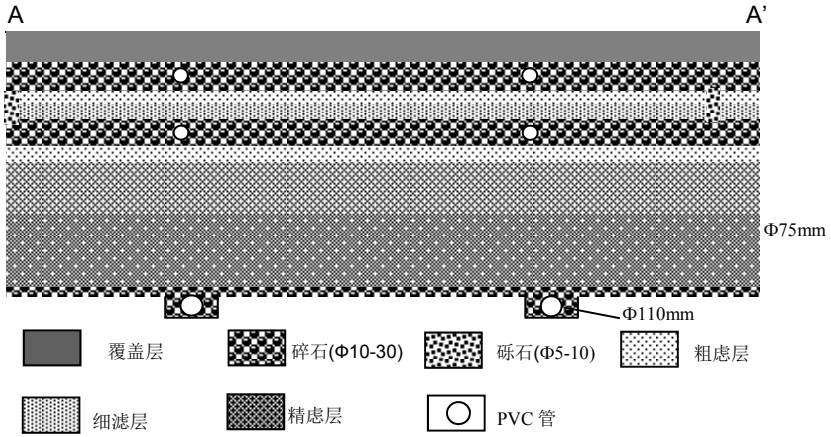
# Case study: Constructed wetland



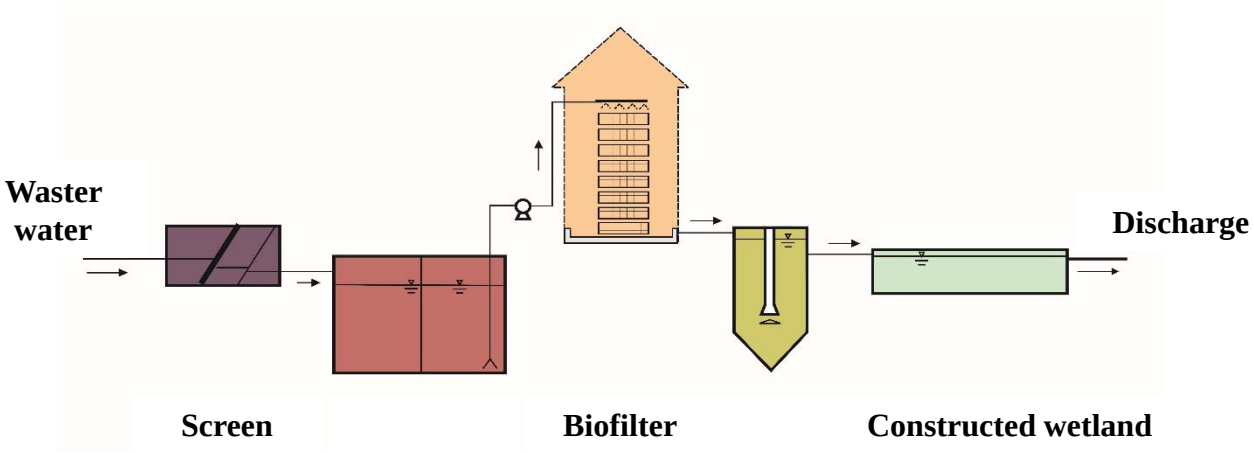

- constructed cost
- flexible land use
- Low removal rate
- Management

# Case study: Leach Trenches




- **Constucted and operation simple**
- **Low cost**
- **pollution of groundwater**
- **Poor quality of effluent**

# Case study: Cluster system



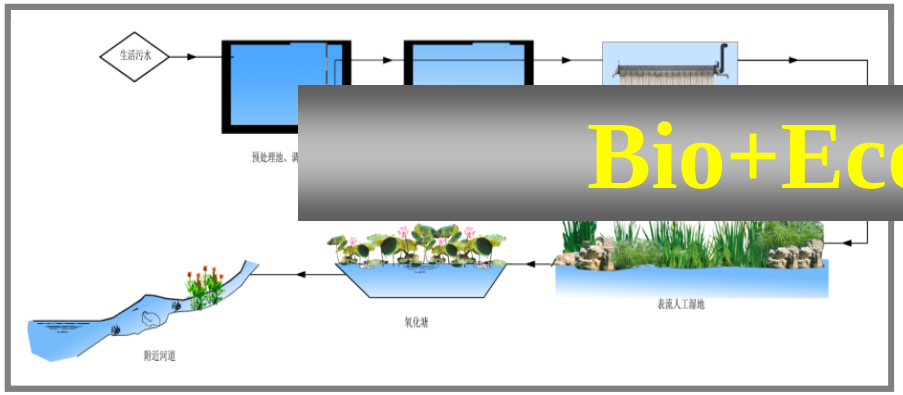

- **Cluster system**
- **High quality of effluent**

# Decentralized wastewater systems

## For COD removal

**Aeration process**

## For nitrogen removal




**Bio+Eco Treatment**

# Situation

- Lack of knowledge of decentralized systems
- Lack of long-term operation data
- **Management needed**
  - **systems are a cost-effective and long-term option for meeting public health and water quality goals**
  - **Who is responsible? Typically homeowner for onsite，Inadequate methods of needs assessment**

# Promotion Plan

## —Funding

- **PPP（Public-Private-Partnership）**

- **The main body of construction and operation management : Enterprises**
- **Local government is mainly to buy services included in the annual budget**

# Promotion Plan

## —Classification technical guidance

## Basic principle

- classification, in situ reduction
- The urban guiding the rural development
- Decentralized treatment
- Economic application, management is simple

# Actions

## 13th Five-Year Plan: Rural Residential Environment Improvement Actions

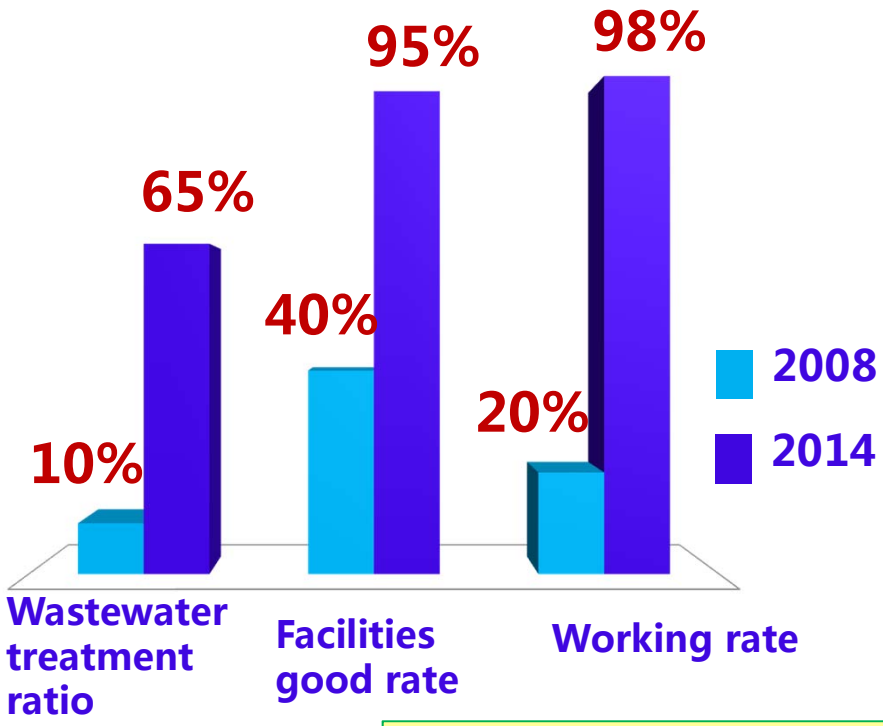
- Integration of urban and rural development
- The development of social undertakings in rural areas
- Urban public services extend to rural areas

# Actions

## Demonstration of one hundred counties

**Unified**

- **Planning**
- **Construction**
- **Management**
- **Operation**




**Changshu model**

| | | |
|---|---|---|
| **Regional integrated propulsion** | **Government purchase service** | **Unified operation of the company** |

# Thanks for your attention!