



Decentralized Approaches to Rural Wastewater Treatment in China

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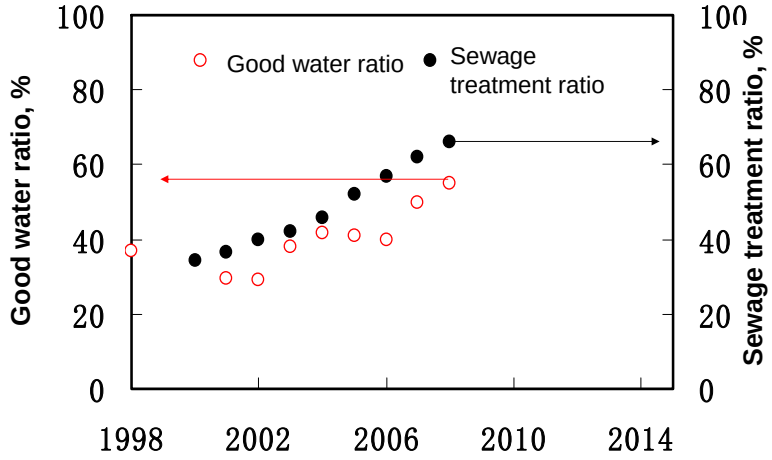
January 27, 2010

Water Pollution Situations

Good water ratio：percentage of sections meet Class I-III standards



Construction of MWTPs contributes to the improvement of water quality. But it is not enough.

Background

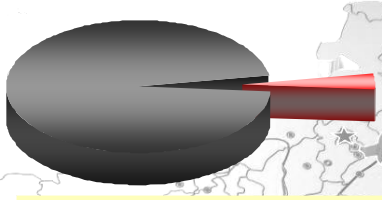
- Town number: 19,234
- Village number: 0.57 million
- Population in T&V area: 910 million (70%).
- Poor infrastructure conditions : Just from 2009, the centre Government built subsidy for sewage treatment in rural area, but it is not enough.
- Weak economy: low GDP in comparison with cities.

Rural wastewater



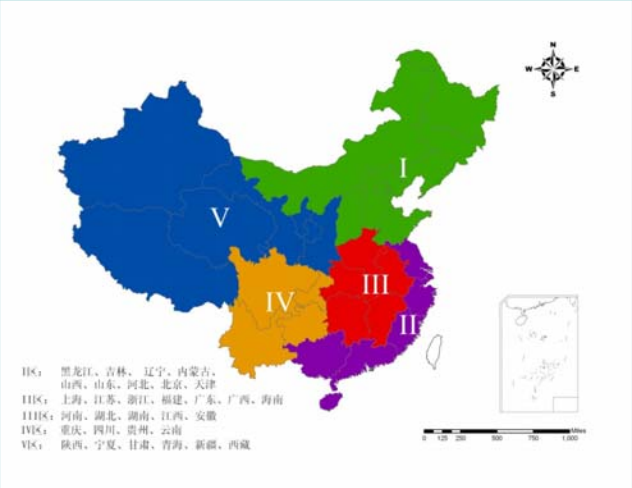






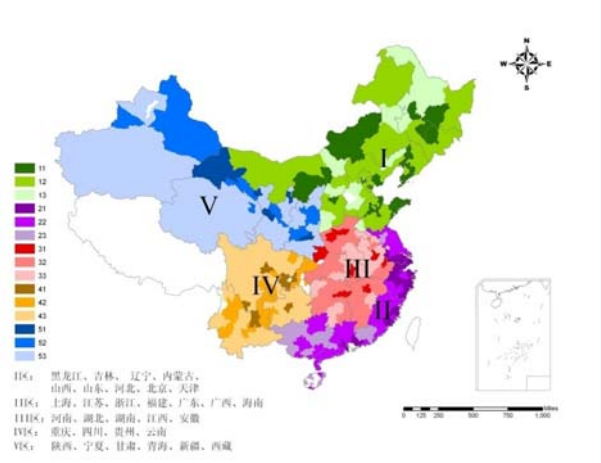
- Only 3% of villages and 12% of towns have wastewater treatment
- Most parts of feces are applied as fertilizer

Five zones



Main index: geographical & climate condition
Auxiliary index: level of economical development

Fifteen sub-zones



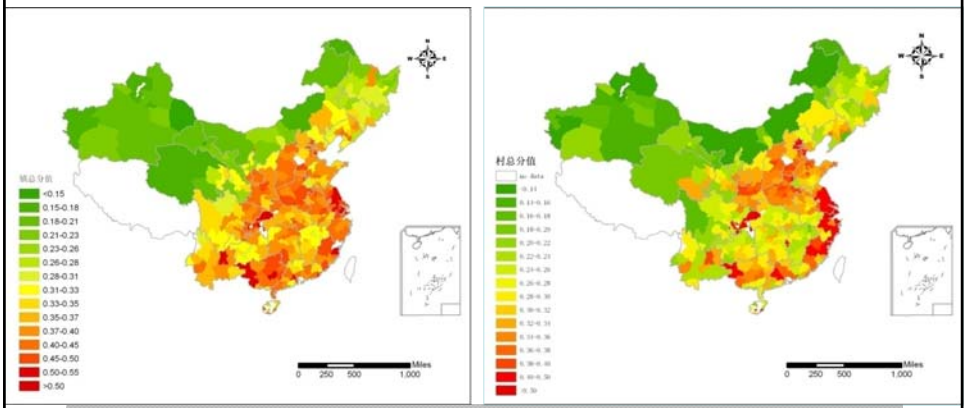
Based on social-economic development level and living standards

Pollution loads

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

SV: sewage volume

Town & village sewage treatment priority



- Spatial difference is apparent. But difference is indistinctive in the priority regions between towns and villages;
- High in large area in Northern China, middle and downstream region of Yellow River.

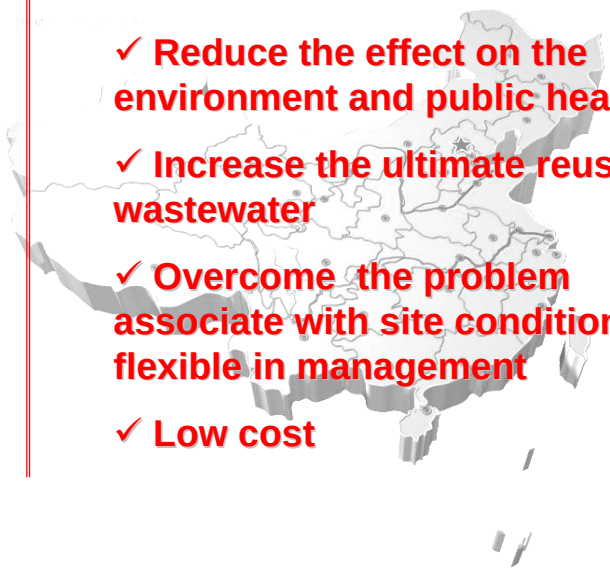
Decentralized technologies for rural wastewater treatment

Decentralized technologies





- ✓ Reduce the effect on the environment and public health
- ✓ Increase the ultimate reuse of wastewater
- ✓ Overcome the problem associate with site conditions and flexible in management
- ✓ Low cost



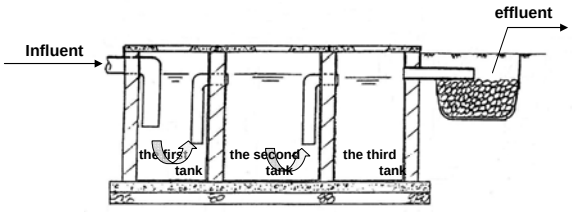
Types of decentralized wastewater systems

- **Primary treatment**
  - Septic tank
- **Secondary treatment----Biological technologies**
  - Biofilm (生物膜)
  - Anaerobic digesters(厌氧处理)
  - Activated sludge(活性污泥)
- **Eco-technologies**
  - Constructed wetlands (人工湿地)
  - Leach trenches(土地渗滤)
- **Community Systems**

Case study: Septic tank

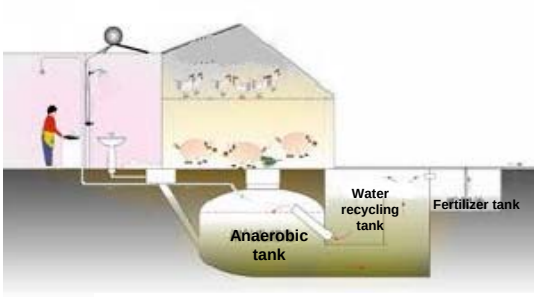
•Inexpensive

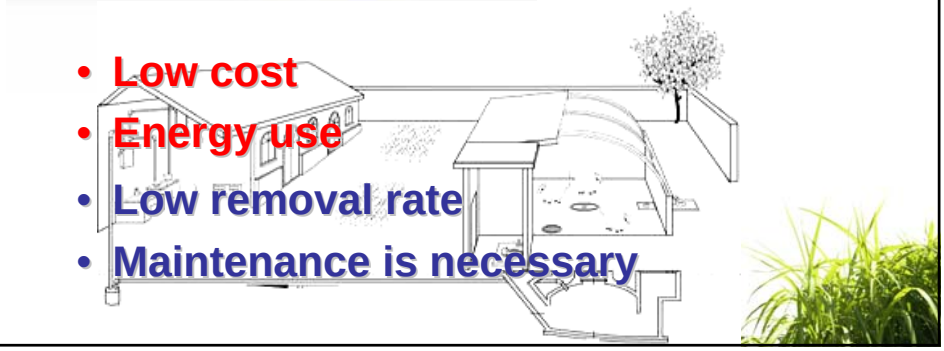
•Simple to maintain



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

Case study: Anaerobic Treatment





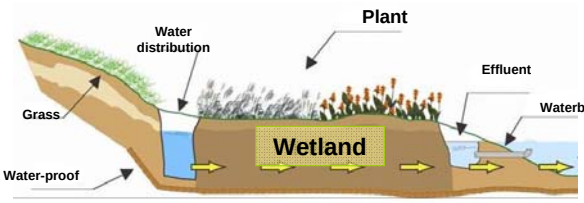
- Low cost
- Energy use
- Low removal rate
- Maintenance is necessary

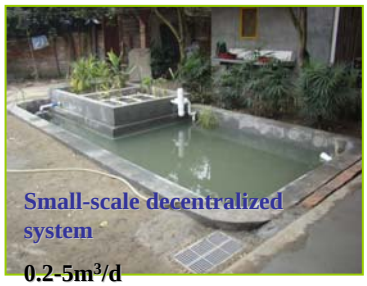
Case study: Activated sludge

1m³,2m³,5m³,10m³,15m³/day

- Flexible for decentralize wastewater treatment
- Automatic control
- Expensive for single family
- management is relative complex

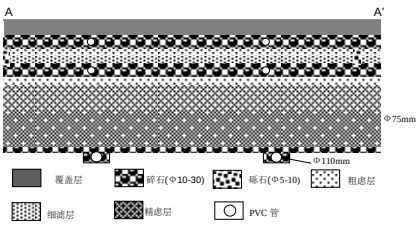
Case study: Constructed wetland





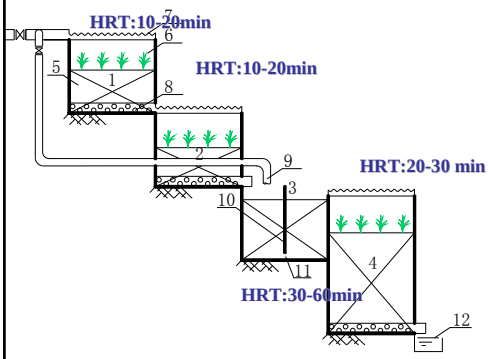
- constructed cost
- flexible land use
- Low removal rate
- Management

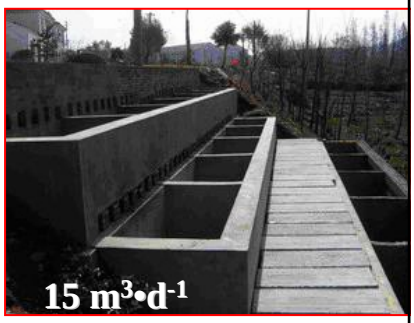
Case study: Leach Trenches



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

Case study: anaerobic tank+ ladder eco-filter



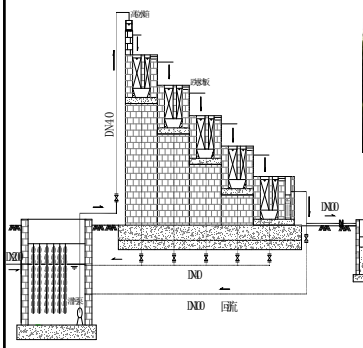


- Energy save
- Ammonium and phosphorus removal
- Odor

Unit：mg/L

item	COD	BOD_5	NH_4^+-N	TN	TP	SS
Influent	400	150	25	40	4	200
Effluent	60	20	8	20	1	20

Case study: Anearobic+ drop aeration + constructed wetland



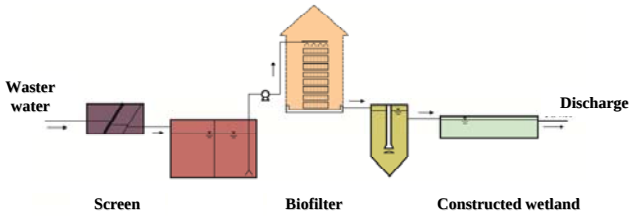
Anaerobic tank Oxic Constructed wetland

Case study: Bio- rotation + vegetable tank

3～10t/d，COD concentration is 100～100mg/L

- Suitable in south area
- Vegetable management complex

Case study: Cluster system



- Cluster system
- High quality of effluent

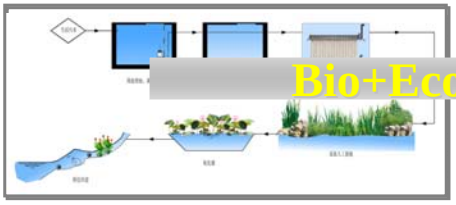
Decentralized wastewater systems

- For COD removal



Aeration process

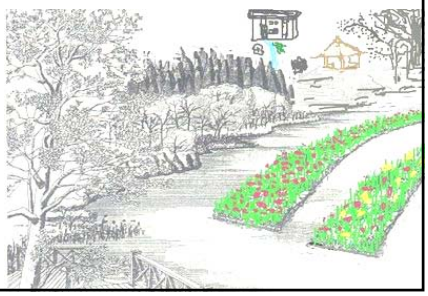
- For nitrogen removal



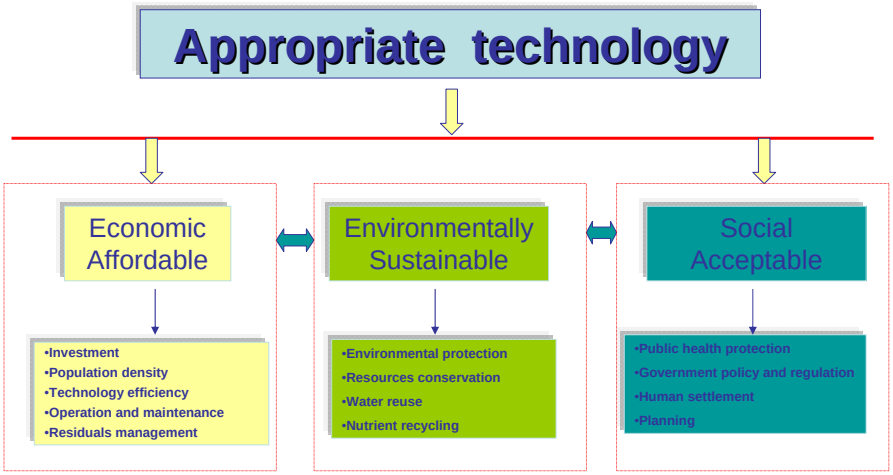
Bio+Eco Treatment

Difficulty for developing decentralized treatment in China

- Not enough budget
- Lack of long-term operation data
- Lack of suitable management system



Developing for decentralized system in China



May A. Massoud,2009

Developing for decentralized system in China

- To make policy
- To make specifications
- R&D of technologies
- Education and training

National planning

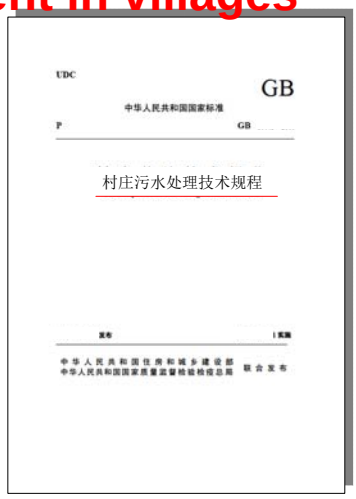
Establishing Research Center

- Established The Research Center for Rural Wastewater Treatment of Ministry of Housing and Urban-Rural Development，China in 2008.

Technical code and specification

Technical specification of wastewater treatment in villages

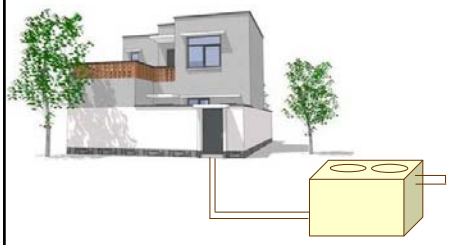
- Decentralized technologies
- Including:
- Biological treatment
- Ecological Treatment
- Combined system
- Cluster System



Demonstration Project

- **Cluster System for a village**

- **Decentralized system for single family**



Thanks for your attention!