Potentials, Challenges & Strategies for China’s Eco-San Development

王如松 Rusong Wang
Research Center for Eco-Environmental Science, Chinese Academy of Sciences
Outline:
Challenge to national sanitation and health from swift development
1. Basic concept of ecological sanitation and its relationship with policies
2. Developing potential of China’s eco-san construction
3. Benefit analysis of China’s eco-san development
4. System bottleneck of China’s eco-san development
5. Strategy study on China’s eco-san development
1. Challenge to national sanitation and health from swift development

2005 Statics from the Ministry of Construction:

1. Water quality of 27% of 410 surface waters of China’s seven major watersheds is proved poor.
2. Average rate of water quality up to standards of 222 surface waters in 113 key cities of environment protection is 72%.
3. 42% of cities all over the country are lack of sewage treatment plant.
4. The handling capacity of household refuse increases 20%, while sanitization rate drops from 61% to 53%.
Ecological sanitation is just an effective approach to deal with urban and rural environment problems, public sanitation problems and people’s health consequence. By respecting ecological integrality and through sanitization and recycle of household organic waste, ecological sanitation can improve people’s living quality and health and protect drinking water and biotic resources, and this is what its essence lies in.
Sanitation provides protection for the metabolism environment of life, while ecological sanitation is the shorten form for the sanitation system with proper ecological relationships.

Narrow sense on the term of ecological sanitation refers to the treatment, management and recycling system of domestic waste.

Broad sense on the term of ecological sanitation refers to the ecological metabolism system which is composed of the main body of human and his working and living environment (including the sources for supplying food, water, energy and other materials; collecting pit for absorbing or assimilating smell, excreta, mosquito and flies, pathogen and any other pollutants, as well as rooms for containing, releasing and maintaining such activities, such as living rooms, kitchens, bathing rooms and toilets).
Ecology has three implications:

- relationship
- knowledge
- culture
Relationship: link between biology and environment

- The interrelation and interaction between biology and environment, living individual and integrity is ubiquitous in biological realm and human society during every period.

- The term of ecology in most people’s mind generally refers to the various necessary conditions that the survival, development, propagation and evolution rely on and the interrelation and interaction between the main body and the object.
Knowledge: bridge between science and society

1. A subject of world ideology, methodology or natural philosophy on how human knows about and transforms environment.

2. A subject of system science relating to the relationship between biology (human included) and environment.

3. A subject of engineering technology that human rebuilds and simulates environment.

4. A subject of nature aesthetics that human cultivates his temperament, enjoys his views, releases pressure and appreciates natures.
Culture: condensation of time and space

It refers to some kind of culture venation, texture, organization or order (including recognition, system, substantial and mental culture) as a result of the interaction between people and environment in the succession of time and space. With a good sense, ecology is always used to denote an ideal culture state of the relationship between human and environment in the shorten form of harmonious ecological relations. And as to phrases such as “eco-city”, “eco-tourism”, “eco-construction” and “eco-san” have been widely accepted and adopted.
Ecological sanitation is a human society-economy-natural complex ecosystem
Ecological sanitation is a revolution in the field of manufacture, living and ecological relationships.

2. Basic concept of ecological sanitation and its relationship with policies

Ecological sanitation is a revolution in the field of manufacture, living and ecological relationships.

- traditional recycling economy of China
- living style of urbanization and industrialization
- modern recycling society
2. Basic concept of ecological sanitation and its relationship with policies

Ecological sanitation is the basic goal of the construction of recycling economy, harmonious society and ecological safety.

- **Ecological sanitation and recycling economy**
  Recycling of water and nutrients resources

- **Ecological sanitation and harmonious society**
  Ensure the substantial requirement of the poor

- **Ecological sanitation and ecological safety**
  Control ecological accidents due to the weak sanitation.
Ecological evolution of human settlement

- Purification (clean, quiet, healthy, safe)
- Intensification (powerful, healthy, harmonious, sustainable)
- Greening (sight, industry, behavior, mechanism)
- Activation (unimpeded water, mild wind, fertile soil, flourishing beings)
- Beautification (culture vein, texture, construction, soul)
- Culture (system, recognition, substantiality, mentality)

Industrialization

Ecological Sanitation

- fossil energy
- chemical products
- surface hardening
- nutrient overload of water bodies
- air acidification
- Biological degeneration

Eco-San
### 3. Developing potential of China’s eco-san construction

<table>
<thead>
<tr>
<th>Target area</th>
<th>Sub target area</th>
<th>Index</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanitation</td>
<td>toilet sanitation</td>
<td>coverage of sanitation facility in rural area</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>healthy drinking</td>
<td>accumulative benefit factor of water reform in rural area</td>
<td>%</td>
</tr>
<tr>
<td>Resource level</td>
<td>water resource</td>
<td>average person possession of water resource</td>
<td>m³/ per person</td>
</tr>
<tr>
<td>Economy investment</td>
<td>sanitation investment</td>
<td>average person (without sanitation utility) investment in toilet and water reform</td>
<td>yuan/per person</td>
</tr>
</tbody>
</table>

![Distribution map of toilet sanitation circumstance (unit: %)](image1)

![Distribution map of drinking water sanitation circumstance (unit: %)](image2)
3. Developing potential of China’s eco-san construction

- Distribution map of excreta sanitization circumstance (unit: %)
- Distribution map of water resource circumstance (unit: m³ per person)
- Distribution map of the investment in Sanitation utility (unit: yuan per person)
- Overall evaluation map of ecological sanitation circumstance
3. Developing potential of China’s eco-san construction

Zoning of China’s eco-san development
- compact districts in the east and coastal towns
- plain terrain in the middle
- cold region in the northeast
- semiarid region in the middle of west
- tepid and wet region in the southwest
- ethnic enclaves in the west

zoning map of China’s eco-san development
### 3. Developing potential of China’s eco-san construction

Illumination for the zoning of China’s eco-san development

<table>
<thead>
<tr>
<th>Zoning No.</th>
<th>Zoning Name</th>
<th>Provinces and municipalities covered</th>
<th>Features of every zoning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zoning 1</strong></td>
<td>compact districts in the east and coastal towns</td>
<td>Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Shandong, Guangdong, Fujian and Hainan</td>
<td>apparent seasons and abundant precipitation rain fall</td>
</tr>
<tr>
<td><strong>Zoning 2</strong></td>
<td>plain terrain in the middle</td>
<td>Hebei, Henan, Hubei, Hunan, Anhui and Jiangxi</td>
<td>apparent seasons and abundant precipitation rain fall and fertile soil</td>
</tr>
<tr>
<td><strong>Zoning 3</strong></td>
<td>cold region in the northeast</td>
<td>Heilongjiang, Jilin and Liaoning</td>
<td>old winter and long ice period</td>
</tr>
<tr>
<td><strong>Zoning 4</strong></td>
<td>semiarid region in the middle of west</td>
<td>Inner Mongolia, Shanxi, Shaanxi, Ningxia and Gansu</td>
<td>arid, insufficient water and barren soil</td>
</tr>
<tr>
<td><strong>Zoning 5</strong></td>
<td>tepid and wet region in the southwest</td>
<td>Sichuan, Chongqing, Guizhou, Guangxi and Yunnan</td>
<td>tepid and wet, abundant water resource</td>
</tr>
<tr>
<td><strong>Zoning 6</strong></td>
<td>ethnic enclaves in the west</td>
<td>Xinjiang, Tibet and Qinghai</td>
<td>typical tableland and desert</td>
</tr>
</tbody>
</table>
3. Developing potential of China’s eco-san construction

Sanitation systems in the rural area of our country can be classified into 4 categories in general:

(1) sanitation facilities installed and without serious derived environmental problems
(2) sanitation facilities installed but with some serious derived environmental problems
(3) no sanitation facilities installed but with conditions for sanitation construction
(4) no sanitation facilities installed and without conditions for corresponding sanitation facilities construction within a short time

Population distribution of each sanitation system:

<table>
<thead>
<tr>
<th>Zoning</th>
<th>Population without sanitation facilities (ten thousand persons)</th>
<th>Population with sanitation facilities (ten thousand persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Among which: Adequate investment</td>
<td>Inadequate investment</td>
</tr>
<tr>
<td>Zoning 1</td>
<td>697</td>
<td>642</td>
</tr>
<tr>
<td>Zoning 2</td>
<td>958</td>
<td>285</td>
</tr>
<tr>
<td>Zoning 3</td>
<td>119</td>
<td>78</td>
</tr>
<tr>
<td>Zoning 4</td>
<td>1410</td>
<td>19</td>
</tr>
<tr>
<td>Zoning 5</td>
<td>1871</td>
<td>84</td>
</tr>
<tr>
<td>Zoning 6</td>
<td>735</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>5790</td>
<td>1108</td>
</tr>
</tbody>
</table>
3. Developing potential of China’s eco-san construction

(1) sanitation facilities installed and without serious derived environmental problems
(2) sanitation facilities installed but with some serious derived environmental problems
(3) no sanitation facilities installed but with conditions for sanitation construction
(4) no sanitation facilities installed and without conditions for corresponding sanitation facilities construction within a short time

key points of eco-san development in the rural area of China

(4) Sanitation system

(4) Sanitation system is mainly centered in:

Zoning 4: semiarid region in the middle of west
Zoning 5: tepid and wet region in the southwest
4. Benefit analysis of China’s eco-san development

- **Drive a number of emerging eco-san industries**
  - materials circulation, property management, organic fertilizer, urban farming and forestry, technology consultation and service

- **Provide a great deal of employment opportunities**
  - Eco-san communities in urban and rural area can settle employment difficulty of 1% to 2% people.

- **Improve the sanitation condition in rural areas, reduce disease prevalence**
  - 9,000,000 children and 19,000,000 women can enjoy clean and private sanitation utility.

- **Develop clean energy sources**
  - Promote ecological sanitation in the key areas could annually save 3,000 tons of core wood.
4. Benefit analysis of China’s eco-san development

- **Economic benefit**
  - Cost of capital construction and operation drops **50%**

- **Environment benefit**
  - Improve human settlement, enhance people’s living quality
  - Accelerate ecological recycling in agriculture: per hectare farmland could recycle 56 kilogram N, 7.2 kilogram P and 15.6 kilogram.  
  - Ensure (water, food ecological safety and health) in areas and districts
5. **System bottleneck of China’s eco-san development**

- lack of relative policies, practices and standards
- lack of production, construction and service systems
- lack of fund for research and development, operation and construction
- lack of technology and management talents
- lack of systems of research and promotion
- lack of publicity and education
From traditional ecological sanitation towards modern ecological sanitation

- Reduce
- Reuse
- Recycle
- Rethinking
- Reform
- Renovation
6. Strategy study on China’s eco-san development

Rethinking:

Traditional consumption pattern and waste treatment shall be replaced. Publicity and education with various channels and forms are needed. Promotion through newspaper, internet, TV and radio is feasible. The construction of demonstration project is also necessary, which can enhance people’s confidence in ecological sanitation and further their understanding of that system. In addition, governments of all levels, social organizations and scientific research colleges can launch training courses, cultivate teaching staff and set, implement and check plans to strengthen eco-san publicity and education.
6. Strategy study on China’s eco-san development

Reform:

In the course of ecological sanitation, every department of the government shall apply relevant policies and funds such as the state subsidy for agriculture, villages and farmers, support for the poor, public sanitation, environment protection, district ecology and construction of socialism new villages. Relative rules and regulations shall be instituted. Additionally, ecological sanitation index shall be brought into the system for assessing local government’s achievement and included in all levels of economy development layouts in order to strengthen eco-san management, supervision and service.
6. **Strategy study on China’s eco-san development**

- **Renovation:**

  The department for scientific research shall gradually do research on ecological sanitation; increase technology investment and achievements promotion; intensify research and development on city eco-san technology, facility industrialization and management; scale up ecological sanitation with advanced technology and sophisticated installation; during the technology research and development, accelerate the integration of orient culture and western technology, modern techniques and traditional customs, high technology and ordinary applicable technology.
6. Strategy study on China’s eco-san development

### Developing strategies for different zonings:

<table>
<thead>
<tr>
<th>Zoning No.</th>
<th>Zoning Name</th>
<th>Strategies</th>
</tr>
</thead>
</table>
| 1          | compact districts in the east and coastal towns | Improve the appearance of sanitation facilities in urban and rural areas and household utility (such as bathing facility and close-stool)  
                |                                                    | Drive manufacturing industry and technology consultation service of eco-san facility as well as ecological materials circulation.  
                |                                                    | To integrate eco-san system in urban & rural areas and plantation & processing of agriculture products  
                |                                                    | Gradually enhance sanitation level in urban and rural areas to solve the drinking water problem and toilet problem of villagers.  
                |                                                    | Emphasis on the eco-san technology of nutrients recycling and production increase, and do research on the interaction of ecological sanitation of human settlement and agricultural recycling economy. |
| 2          | plain terrain in the middle          | Development eco-san technology which is available in winter, such as the urine storage technology and subsurface Flow constructed wetland technology.  
                |                                                    | Enhance the comprehensive utilization of crops and the recycled nutrients from eco-san system. |
| 3          | cold region in the northeast         | Promote ecological dry toilets in suitable towns and villages  
                |                                                    | villagers’ health consciousness, encourage residents to devote a part of funds and labor force to eco-san construction.  
                |                                                    | Take advantage of the national debt projects to develop the household biogas technology, and carry out projects of human settlement and agriculture interaction such as “biogas-pigs-fruits”, perfect the technology service of biogas technology  
                |                                                    | Focus on the promotion of ecological dry toilets in proper areas  
                |                                                    | Strengthen education on epidemic control and sensitization of health knowledge. |
| 4          | semiarid region in the middle of west| According to the dispersion of the ethnic enclaves, focus on the development of dispersed eco-san technology  
                |                                                    | Develop, induce, demonstrate and promote eco-san system suitable for the ethnic culture. |
Thank you!