Resource oriented sanitation in rural China

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03/11/2014
Outlines

• 0. USTB-CSES
• 1. Chinese policy for rural development
• 2. China rural sanitation
• 3. Resource oriented sanitation – case study
  – Rebuilding the toilet in rural China
  – Rainwater harvesting
  – Biogas linked eco-agriculture model
  – Decentralized Wastewater Treatment System (DEWATS)
• 4. Institutional arrangements
• 5. Outlook - international cooperation
Contribution to the capacity building and networking of Chinese and international Young Professionals in the area of environmental sanitation through „learning by doing“ in international teamwork, together with experienced multidisciplinary Senior Experts from the integrated fields of (1) sustainable sanitation, and (2) biogas & waste-to-energy.
## Comparison between rural and urban area in China

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>666 million</td>
<td>674 million</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>49.68%</td>
<td>50.32%</td>
<td></td>
</tr>
</tbody>
</table>

The rural and urban disposable income in the past decade

<table>
<thead>
<tr>
<th>Year</th>
<th>Urban (CNY)</th>
<th>Rural (CNY)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>24565</td>
<td>7717</td>
<td>3.10:1</td>
</tr>
<tr>
<td>2011</td>
<td>21810</td>
<td>6977</td>
<td>3.13:1</td>
</tr>
<tr>
<td>2010</td>
<td>19109</td>
<td>5919</td>
<td>3.23:1</td>
</tr>
<tr>
<td>2009</td>
<td>17175</td>
<td>5153</td>
<td>3.33:1</td>
</tr>
<tr>
<td>2008</td>
<td>15781</td>
<td>4761</td>
<td>3.31:1</td>
</tr>
<tr>
<td>2007</td>
<td>13786</td>
<td>4140</td>
<td>3.33:1</td>
</tr>
<tr>
<td>2006</td>
<td>11760</td>
<td>3587</td>
<td>3.28:1</td>
</tr>
<tr>
<td>2005</td>
<td>10493</td>
<td>3255</td>
<td>3.22:1</td>
</tr>
<tr>
<td>2004</td>
<td>9422</td>
<td>2936</td>
<td>3.21:1</td>
</tr>
<tr>
<td>2003</td>
<td>8472</td>
<td>2622</td>
<td>3.23:1</td>
</tr>
</tbody>
</table>

• 1978, Household production responsibility system (HPRS)
• 2005, the Communist Party of China (CPC) pointed out that an important historical mission in China’s modernization drive is to build a new socialist countryside.
• "Three rural” issues: agriculture, farmers and countryside
• Rural policy today in China
  – “Give more”
  – “Take less”
  – ”Liberalization”
Policy challenges for rural development

- **Land use**: Progress is needed to implement laws on farmland rights which could facilitate the realization of important economic potential for rural areas. Moreover, recent policy improvements on land expropriation have to be fully embodied into law.

- **Service delivery**: A more coherent and better funded strategy for rural services should aim to bridge rural-urban and rural-rural divides.

- **Economic diversification**: Changes on both the demand and supply side require looking beyond agriculture for the future of rural China. Emerging sectors which hold great promises include rural tourism, renewable energy production and high-value added typical food, agricultural and forest products.

- **Environmental protection**: Sustainable development and economic diversification depend on a sound environmental policy. It is crucial to address the challenges rural China is facing in terms of the protection of natural amenities and better management of biodiversity protection.
China under MDGs

• As roughly estimated, there is approximately **9 billion tons of domestic wastewater discharged every year in rural China**.

• In China alone, the population in rural China that suffers from contaminated water sources reaches **90.84 million in 2005**.

• The government has set ambitious targets in this regard, aiming for **95 % of the rural population to have access to improved water supplies, 70 % to have piped water supplies, and 65 % to have sanitary latrines by 2010**.
# China rural sanitation

**Targets/Achievements of Improved Rural Water Supply and Sanitation of the 7th to 12th Five Year Plans and MDG**

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Targets of Improved Water Supply Service Coverage</td>
<td>80 %</td>
<td>85 %</td>
<td>90 %</td>
<td>95 %</td>
<td>-</td>
<td>95 %</td>
<td>100 %</td>
</tr>
<tr>
<td>2</td>
<td>Achievements of Improved Water Supply Service Coverage</td>
<td>76 %</td>
<td>87 %</td>
<td>92 %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Achievements/Tar\ets of Piped Water Supply Service Coverage</td>
<td>31 %</td>
<td>44 %</td>
<td>55 %</td>
<td>60 %</td>
<td>63 %</td>
<td>70 %</td>
<td>80 %</td>
</tr>
<tr>
<td>4</td>
<td>Targets of Sanitary Latrines Coverage</td>
<td>40 %</td>
<td>55 %</td>
<td>65 %</td>
<td>-</td>
<td>65 %</td>
<td>-</td>
<td>75 %</td>
</tr>
<tr>
<td>5</td>
<td>Achievements of Sanitary Latrine Coverage</td>
<td>-</td>
<td>49 %</td>
<td>-</td>
<td>-</td>
<td>67.43%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Chinese sanitation

Coverage rate of sanitary toilet of different provinces (%)
Chinese sanitation

Accessing rate of clean drinking water of different provinces (%)
Chinese sanitation

Harmless treating rate of different provinces (%)

03/11/2014
Chinese sanitation

Average water resources of different provinces (m3/person)
Chinese sanitation

Average investment on sanitary facilities of different provinces (CNY/person)
Chinese sanitation

Comprehensive assessment on sanitary system of different provinces
## Sanitation scenario

### Regional districts and their characteristics of developing ecosan in China

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of district</th>
<th>Provinces included</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>East and coast region</td>
<td>Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Shandong, Guangdong, Fujian, Hainan</td>
<td>Natural condition: Generally, four distinct seasons, abundant precipitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Fast economic growth, high investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Good toilet, drinking water, good rural sanitary condition</td>
</tr>
<tr>
<td>2</td>
<td>Middle plain region</td>
<td>Hebei, Henan, Hubei, Hunan, Anhui, Jiangxi</td>
<td>Natural condition: Four distinct seasons, abundant precipitation, fertile soil,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Medium economic growth, medium investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Normal sanitary toilet, basic clean drinking water</td>
</tr>
<tr>
<td>3</td>
<td>Northeast cold region</td>
<td>Heilongjiang, Jilin, Liaoning</td>
<td>Natural condition: Cold winter, long freeze-up period</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Medium economic growth, medium investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Normal sanitary toilet, basic clean drinking water</td>
</tr>
<tr>
<td>4</td>
<td>Midwest semi-arid region</td>
<td>Inner Mongolia, Shaanxi, Shanxi, Ningxia, Gansu</td>
<td>Natural condition: Arid, water depletion, soil depletion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Slow economic growth, short investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Shortage of sanitary toilet and clean drinking water</td>
</tr>
<tr>
<td>5</td>
<td>Southwest hot and humid region</td>
<td>Sichuan, Chongqing, Guizhou, Guangxi, Yunnan</td>
<td>Natural condition: Humid, hot, abundant water resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Slow economic growth, short investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Shortage of sanitary toilet, easy pathophoresis</td>
</tr>
<tr>
<td>6</td>
<td>West minority concentrated region</td>
<td>Xinjiang, Qinghai, Tibet</td>
<td>Natural condition: Typical plateau, desert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society and economic development level: Slow economic growth, short investment of environmental protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sanitary system: Shortage of sanitary toilet, basic clean drinking water</td>
</tr>
</tbody>
</table>
Sanitation scenario

Population distribution of different sanitary systems in China (unit: in 10000)

<table>
<thead>
<tr>
<th>District</th>
<th>Without sanitary facilities</th>
<th>With sanitary facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Among</td>
<td>Enough investment</td>
</tr>
<tr>
<td>1</td>
<td>697</td>
<td>642</td>
</tr>
<tr>
<td>2</td>
<td>958</td>
<td>285</td>
</tr>
<tr>
<td>3</td>
<td>119</td>
<td>78</td>
</tr>
<tr>
<td>4</td>
<td>1410</td>
<td>19</td>
</tr>
<tr>
<td>5</td>
<td>1871</td>
<td>84</td>
</tr>
<tr>
<td>6</td>
<td>735</td>
<td>0</td>
</tr>
<tr>
<td>Sum</td>
<td>5790</td>
<td>1108</td>
</tr>
</tbody>
</table>

Note: “Short investment” means that toilet modification per capita is less than 100 CNY/year
Sanitation scenario

Distribution of the population (unit: in 10000) with urgent ecosan demands of different districts

- District 1: 55
- District 2: 673
- District 3: 41
- District 4: 1391
- District 5: 1787
- District 6: 735
## Sanitation scenario

The strategies of developing ecosan of different districts

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of district</th>
<th>Development strategies</th>
</tr>
</thead>
</table>
| 1   | East and coast region                | 1. Improve the comfort and appearance of sanitary facilities  
2. Mobilize a batch of manufacture, technology consult service and ecological logistic in light of sanitary facilities  
3. Systemic integration of planting and processing industry with ecological sanitation |
| 2   | Middle plain region                  | 1. Gradually improve the sanitary level and solve the drinking water issue and toilet issue in rural area  
2. Prioritize nutrient recovery and food increasing of ecological sanitation, study the relevance and coupling between dwelling ecosan and agricultural recycling economy |
| 3   | Northeast cold region                | 1. Develop ecosan technology which can bear cold winter, e.g. urine storage technology and subsurface constructed wetland  
2. Strengthen utilization of nutrient from ecosan system in planting |
| 4   | Midwest semi-arid region             | 1. Popularize the ecological dry toilet in suitable township and rural areas  
2. Strengthen the awareness of sanitation and health among rural residents, arouse the initial fund and labor input from residents for ecosan construction by means of dissemination and education |
| 5   | Southwest hot and humid region       | 1. Prioritize household biogas technology by means of government loan, popularize the “pig-biogas-fruit” model, perfect the service system of biogas technology  
2. Popularize the ecological dry toilet in suitable township and rural areas  
3. Strengthen the education of rural residents in views of epidemic disease control and ecosan know-how |
| 6   | West minority concentrated region    | 1. In light of the decentralized feature of concentrated region, prioritize decentralized ecosan technology  
2. R&D, demonstrate, promote ecosan system aiming at minority people |
Sanitation actions

• In 1986, the China National Economic Committee issued the “Circular on Improving Rural Energy Development”, which was the first policy paper on renewable energy development that promulgated the importance of bioenergy.

• Since the “Rural Ecological Enrichment Project” was proposed by the Ministry of Agriculture, biogas construction projects have been implemented all over the country at the beginning of this century.

• In 2009, the central government listed “Rebuilding sanitary toilet in rural areas” as one of six national important public health services programs. In the same year, the subsidy fund was allocated at a number of 1.5665 billion RMB to support 4.1137 million households to rebuild harmless sanitary toilet nationwide.
Sanitation actions

• In 1994, the Chinese government launched the nationwide “Health Education Actions for 900 Million Rural Population” to disseminate basic health education to rural populations. The actions called for promotion of healthy living, hygienic life style and clean living ambience, through mass media and inter-personal communication to minimize the main public health problems encountered among rural populations. Positive impacts have been achieved related to eradication of bad habits and un-hygienic lifestyle of rural population. The rural population is now more aware of personal hygiene and the needs of self health care.
Sanitation actions

• In 2007, SEPA released Opinions on Strengthening Rural Environmental Protection Work, which explicitly specified to strengthen pollution control of wastewater in rural areas.

• MOA set a target of reducing emission level of agricultural pollutants by 50% during 11th Five-Year Plan. Until end of 2012, it is expected that treatment ratio of rural domestic wastewater will increase by 10% compared with 2010. During 12th Five-Year Plan, Ministry of Housing and Urban-Rural Development (MOHURD) will conduct to draw up technical guideline on rural domestic wastewater treatment. Demonstration project for wastewater treatment and reclamation in rural areas of China will be constructed. At the end of 2010, MOHURD firstly released the Guideline on Rural Domestic Wastewater Treatment (draft version).
Resource oriented sanitation – case study
Rebuilding sanitary toilet program in rural China
Rebuilding toilet in rural area

- Six technology proposals are recommended:
  - Three-septic-tank type
  - Double-vault funnel type
  - Biogas-linked toilet
  - Urine-faces division toilet
  - Double-vault composting toilet
  - Integrated flushing toilet
Three-septic-tank type
Biogas-linked toilet
Double-vault funnel type
Urine-faces division toilet
Double-vault composting toilet
Integrated flushing toilet
School sanitation

• Rural school water and sanitation facilities need extensive improvement.
## Cost of sanitation facilities

Specific Investment Costs of Different Water Supply Systems and Sanitary Latrines

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Unit Investment Cost, US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Piped Water Supply System</td>
<td>&gt; US$ 30</td>
</tr>
<tr>
<td>2</td>
<td>Deep Well with Hand Pump</td>
<td>US$ 5-10</td>
</tr>
<tr>
<td>3</td>
<td>Rain Water Collection System</td>
<td>US$ 50-80</td>
</tr>
<tr>
<td>4</td>
<td>Household Sanitary Latrine</td>
<td>US$ 90-120</td>
</tr>
<tr>
<td>5</td>
<td>Public or School Sanitary Latrine</td>
<td>US$ 500-850</td>
</tr>
</tbody>
</table>
## Biogas subsidy

<table>
<thead>
<tr>
<th></th>
<th>Eastern areas</th>
<th>Central areas</th>
<th>Western and northeastern areas</th>
<th>Special areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic biogas digester</td>
<td>1000 CNY/household</td>
<td>1200 CNY/household</td>
<td>1500 CNY/household</td>
<td>3000 CNY/household in Tibet, 2500 CNY/household in other Tibetan areas and three prefectures of south Xinjiang</td>
</tr>
<tr>
<td>Medium and large-scale biogas plant</td>
<td>25% of total investment (max. 1.5 million CNY)</td>
<td>35% of total investment (max. 2 million CNY)</td>
<td>45% of total investment (max. 2.5 million CNY)</td>
<td></td>
</tr>
<tr>
<td>Biogas service station</td>
<td>25,000 CNY</td>
<td>35,000 CNY</td>
<td>45,000 CNY</td>
<td></td>
</tr>
<tr>
<td>Centralized biogas supply plant</td>
<td>Subsidy would not be in excess of 120% domestic biogas digester in view of individual household. For straw feedstock, the subsidy could reach 150% of individual household</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Biogas linked eco-agriculture model

- Household 3-in-1
  - livestock-toilet-digester
- Northern model 4-in-1
  - livestock-toilet-digester-greenhouse
- Biogas Fruit model
  - livestock-digester-orchard
- Northwest model 5 Supports
  - livestock-toilet-digester-irrigation water tank-fruit/ fodder grass
- Southern model
  - livestock-digester-fishery-fodder grass
- Integrated farming model
  - livestock-digester-fruit-fodder grass
DEWATS

- DEWATS, short for Decentralized Wastewater Treatment System, was originated in China in 1988 as biogas septic tank.
- Starting in 1994, DEWATS have been further developed by contributing organizations from China, India and France under coordination of Bremen Overseas Research and Development Association (BORDA e.V.).
DEWATS

- DEWATS is based on four treatment systems:
  - sedimentation and primary treatment
  - secondary anaerobic treatment in fixed bed filters or baffled septic tanks
  - secondary and tertiary aerobic/anaerobic treatment in constructed wetlands (subsurface)
  - secondary and tertiary aerobic/anaerobic treatment in ponds
BORDA-DEWATS for Public Toilet of Zhizhong City, Sichuan Province, China
DEWATS

BORDA-DEWATS for toilets in No. 9 Primary School of Neijiang City, Sichuan Province, China
BORDA-DEWATS for hospital wastewater in Mianzhu City, Sichuan, China
The rural water supply and sanitation development works in China are the responsibility of the National Patriotic Health Campaign Committee (NPHCC).

Under the leadership of the central government, NPHCC organizes and collaborates with concerned departments at national, provincial, county and township levels for planning, implementation and management of rural water supply and sanitation works.

The NPHCC, as a coordinating committee for official resolutions, consists of senior representatives from nearly 30 ministries and commissions, such as Ministry of Health (MOH), Ministry of Construction (MOC), Ministry of Agriculture (MOA), Ministry of Water Resources (MOWR), State Environmental Protection Administration (SEPA), etc. at national level. The NPHCC was established in March 1953 with a Country Vice Premier as its Director, and Minister of Health as its Deputy Director.
Institutional arrangements

There is no single agency or ministry that has an overall mandate for rural water supply and sanitation (RWSS) in China. Overlaps of activities exist in institutions at national, provincial, county and village levels. The following depicts the institutions with their respective roles related to RWSS in China:

- National Development and Reform Commission (NDRC): responsible for approval of national implementation plans, preparation of five year national social development and economic construction plans, and identification and approval of foreign financed development projects;
- Ministry of Finance (MOF): responsible for all national budgeting and financial issues, and management of foreign loans;
- Ministry of Foreign Trade and Economic Cooperation (MOFTEC): responsible for management of the multi-lateral and bilateral funded projects;
- Ministry of Construction (MOC): responsible for management of urban and township infrastructures, and water supply projects;
- Ministry of Agriculture (MOA): responsible for development of agricultural sector, and rural water supply in agricultural areas, and support for construction of rural water supply systems and biogas latrines;
- Ministry of Water Resources (MOWR): responsible for development of water resources schemes, and management of rural water supply systems in water scarce villages;
- State Environment Protection Administration (SEPA): responsible for enhancement of protection of water sources and water quality;
- Ministry of Education (MOE): responsible for the construction and improvement of rural school latrines;
Institutional arrangements

- Ministry of Health (MOH): responsible for preparation of mid- and long-term plans, programs and standards/criteria, providing guidance for implementation, carrying out field monitoring, supervision, inspection and evaluation; conduct regular meetings related to rural water supply, sanitation and latrine improvement, and dissemination of lessons learned in connection with rural water supply and sanitary latrines.

- NPHCC: responsible for formulation of national directives, policies and strategies for patriotic health and organization of their implementation, conduct nationwide hygiene and health education, mobilization of public participation related to health activities, and planning, organization and coordination of RWSS projects among central, provincial and local institutions and governments;

- Provincial and County Government: oversee the implementation of RWSS projects and ensure that the directives and plans laid down by central government and NPHCC are properly implemented;

- Local Patriotic Health Campaign Committee: responsible for organization and coordination of rural water supply systems, sanitation and latrine improvement under the leadership of NPHCC and local governments;

- Local Water Resources Bureau: responsible for organization and coordination of rural water supply systems implementation under the leadership of the local governments; and

- Township and Village Government: responsible for construction and O&M of rural water supply systems, sanitation and latrine improvement.
Foreign assistance

- Since 1981, aid from the World Bank, United Nations Children’s Fund, United Nations Development Programme, and other donors has accounted for about 5% of investments in rural water supply and sanitation.
• In response to the United Nations’ Declaration of “International Drinking Water Supply and Sanitation Decade” (1981 - 1990), the Government of China approved the National Patriotic Health Campaign Committee (NPHCC) to act as the State Action Committee and to take a lead in planning of its Declaration, through close coordination with all relevant institutions involved in rural water supply and sanitation works. Subsequently, a national office of NPHCC was set up under the Ministry of Health (MOH) to actually carry out the responsibilities of NPHCC in scaling up services for the poor rural residents in China.
External Support Agencies and Bilateral Agencies

• United Nations Development Program (UNDP): gratuitously provided fund for (i) preparation of the RWSS project financed by the World Bank in 1980s, (ii) provision of deep well supply with hand pump and sanitation & latrine improvements, and (iii) human resources training programs for implementing rural water supply, sanitation and latrine improvement in remote and poor areas.

• IDA/The World Bank (WB): provided loan under projects which have been implemented since 1980s.

• UNICEF: provided fund for demonstration pilot projects on rural water supply, sanitation & latrine improvement works.
External Support Agencies and Bilateral Agencies

• **WFP**: gratuitously provided 79,000 tons of wheat to assist the labor expense of workers for rural water supply projects in 10 counties of Liaoning and Shanxi Provinces.

• **WHO**: provided trainers and costs to conduct of training courses on water quality monitoring of rural water supply, sanitation management, and the roles of women in improvement of effectiveness of rural water supply and sanitation.

• **EEC**: provided fund for implementation of Sector Research and Institutional Improvement on China Rural Water Supply in Guizhou and Gansu Provinces.

• **Japanese Government**: provided fund in 1990 and in 1994 for construction of rural water supply in Guizhou and in Jilin Provinces.

• **Germany (GTZ/GIZ)**: provided fund to conduct training courses for staff who were working in the rural water supply sector in China.

• **UK (DFID)**: provided fund for construction of rural water supply, sanitation and latrine improvement works in Sichuan and Yunnan Provinces.
International cooperation

• Approved by the State Council the Biogas Research Institute of the Ministry of Agriculture (BIOMA) was established in 1979. The Biogas Research and Training Centre, Chengdu was founded in 1981 according to an agreement between the Chinese Government and UNDP and based at BIOMA. BRTC is the only international centre in China for research and training on biogas technology.
Conclusions - Lessons Learned

- Need for Strong Leaderships, Determination and Commitments
- Need for Simple and Clear Policies
- Need for Non-Complicated Institutional Arrangements for Leadership and Inter-Department Coordination
- Need for Community Participation.
- Cost Recovery: Willingness to Contribute Financially
- Need for Capacity Building
- Need for Technical Assistance from International Organizations.
- Need for Sharing of Knowledge and Understanding
- Need for Integration of Sanitation and Health Education with Water Supply
Thank You Very Much for Your Attention!

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