Urban Waste Revolution:

Turning China’s Sludge & Garbage Mountains into Low-Carbon Solutions

September 20, 2018
Fighting Climate Change: Story of China’s Low-carbon Cities

Meian Chen, Ph.D.
innovative Green Development Program (iGDP)

Wilson Center| Washington, D.C. | September 20, 2018
About iGDP

• An independent Chinese think tank working on:
  ○ Green and Low-Carbon Development Planning
  ○ Green Economy
  ○ International Cooperation on Climate Change

• The implementation organization of the Green Low-Carbon Development Think Tank Partnership (GDTP):
  ○ A network of 45 local research institutions that have been providing technical support for subnational green low-carbon development

• Please visit us at new.igdp.cn.
Story of a low-carbon city: Shenzhen

1980s
Story of a low-carbon city: Shenzhen

Source: china.org.cn
Story of a low-carbon city: Shenzhen
Why Cities?

GDP
- 75%

Energy Consumption
- 80%

Source: Belfer Center for Science and International Affairs
Overview of China’s Low-carbon Cities

87 low-carbon pilots

- 6 provinces
- 81 cities

31% population

47% GDP

14.5% Land area
Low-carbon Pilot Cities Requirements

- Low - carbon plan
- Carbon peaking target
- target responsibility system
- low-carbon industrial structure
- GHG inventory
7 Priority Areas

Shenzhen

Area (10000 hectares) 19.96
Resident population (10000) 1137.89
GDP (hundred million yuan) 17502.99
Peaking year 2022

- Shenzhen Implementation Plan on the Construction of Green and Low Carbon Transportation City (2013-2020)
- Shenzhen Five-Year Implementation Plan on World-class Public Transportation City
- Shenzhen Transportation Plan on Walking and Bicycling
- Shenzhen Special Plan on Green Road
- Shenzhen Action Plan on Green Low-carbon Harbor Construction 2015-2020
- Shenzhen 13th Five-Year Plan on Comprehensive Transportation

Source: http://www.cepm.igdp.cn/
How to Measure Progress?

China Low-Carbon and Green for Cities Index (LOGIC)

7 Index Categories

- Energy & Power
- Economic Dimension
- Industry
- Environment & Land Use
- Transportation
- Policy Dimension
- Buildings

National low carbon pilot cities
Non-pilot cities
5-10 million Population
1-5 million
>10 million Population
Measuring Progress

7 Categories / Sub-Categories

- Economy: 20%
- Energy & Carbon: 50%
  - Energy & Power
  - Industry
  - Building
  - Transportation
- Environment & Land Use: 20%
- Policy & Outreach: 10%

23 Indicators

\[ \sum = 100\% \]
Pilot Cities Have Higher Average Scores.....

Average Index Score

- Pilot Cities: 47.0
- Non-Pilot Cities: 42.9

Source: http://logic.igdp.cn/
….. And Are Improving Faster

Source: http://logic.igdp.cn/
2015 Pilot City Breakdown

- **Average Score**
- **Gap from Benchmark**

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
<th>Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment &amp; Land Use</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Energy &amp; Power</td>
<td>9.6</td>
<td>8.4</td>
</tr>
<tr>
<td>Industry</td>
<td>7.4</td>
<td>10.6</td>
</tr>
<tr>
<td>Economic Dimension</td>
<td>5.9</td>
<td>14.1</td>
</tr>
<tr>
<td>Building</td>
<td>4.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Policy Dimension</td>
<td>5.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Transportation</td>
<td>2.5</td>
<td>3.5</td>
</tr>
</tbody>
</table>
Change by Average Index Scores

- 6 out of 7 rising
- Environment & Land Use dropped
- Economic category had fastest growth
Challenges and Opportunities

- Gaps remain between current performance and benchmarks
- Non-CO2 emissions overlooked
Challenges and Opportunities

- Chinese Cities have considerable room to improve
  - Environment and land use
Challenges and Opportunities

- Less attention has been paid to non-CO2 emissions
Thank You for Your Attention!

We welcome your suggestions and comments.

Please contact us at: igdpooffice@igdp.cn or visit us at http://new.igdp.cn/
Mitigation Actions in Waste Sector in China
A Case Study of China MSW NAMA Project

Liu Xiao
2018-9-20
Content

1. Brief summary of MSW management in China
2. Why NAMA in waste sector?
3. How to achieve NAMA in waste sector
4. About China MSW NAMA project
Brief summary of MSW management in China
Recyclables have been removed before transported.
By 2015, MSW environment sound treatment rate is 90.2%, while for city area achieve 94.1%.
Mitigation Actions in Waste Sector in China
--A Case Study of China MSW NAMA Project
MSW Transformation in China
During the 12th FYP (2011-2015)

Built 70 out of 100 planned restaurant waste treatment plants

More than 70% using anaerobic digestion.
MSW Transformation in China

Since the 13th FYP (2016-now)

46 waste segregation demonstration cities

Segregation from source: Restaurant Park Market

Recyclables management: Data from both recycle system and waste system

Organic waste treatment

Strong initiatives on integrated management and low carbon development in MSW sector!
Why NAMA in Waste Sector?
First defined in COP13 in 2007 as “nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner” (1/CP.13:1.b.ii)
China NAMA Goal

2020

- CO₂ reduction 40-45%
- non-fossil 15%
- forest 1.3 billion m³

2030

- Peaking around
- CO₂ reduction 60-65%
- Non-fossil 20%
- forest 4.5 billion m³
Climate Change Emissions from the Waste Sector

- Global statistic from IPCC:

  - 1.5 billion tons of GHG emission from waste sector 2010, 3-5% of total GHG emissions

- 97% from methane emission (50% solid waste, 50% waste water)

Source: Intergovernmental Panel on Climate Change
来源：政府间气候变化专门委员会
Climate Emissions from Different Sectors in China

Source: The first two year update of climate change in People’s Republic of China 2016

- Industry, 12.3%
- Agriculture, 7.9%
- Energy activities, 78.5%
- Waste treatment, 1.3%

158 million CO$_2$eq

- Incineration 14 million
- Waste water 91 million
- Landfill 54 million
GHG Emission Reductions from MSW Sector

GHG emissions from the waste sector
3-5%

GHG emissions reduction from the waste sector
24%
In Germany

High Concentration
Easy management

Lower cost for
GHG reduction

Mature mitigation
technology

Significant
Co-benefit
How to achieve NAMA in Waste Sector?
How to Reduce GHG Emissions in the MSW Sector

Prevention
  >
  Reuse
  >
  Recycling
  >
  Energy recovery
  >
  Disposal
How to Reduce GHG Emissions in the MSW Sector

Estimation by average MSW treatment situation using UNFCCC methodology
How to Reduce the GHG Emissions in MSW Sector

**Mix collection and treatment**

65% sanitation landfill, 35% incineration

Organic waste + Methane capture

Optimization of current facility

Organic waste treatment
How to Reduce GHG Emissions in the MSW Sector

Optimization of current facilities

Landfill

- Improve the efficiency
  - Improve collection
    - FID detector
    - IR Camera
  - Reduce leakage
    - CHP
    - Purification
- Reduce the GHG
  - Improve utilization
  - Semi-aerobic landfill
    - Active ventilation
    - Passive ventilation
How to Reduce GHG Emissions in the MSW Sector

Optimization of current facility

- Incineration
  - Improve the efficiency
    - Waste heat utilization
    - Gas–gas heating
    - Heat recycling
  - Reduce the GHG
    - Storage Pit
    - Leachate treatment
Mitigation Actions in Waste Sector in China
A Case Study of China MSW NAMA Project

Sensitive IR camera for methane leakage detection

The picture below, around 100L biogas/h

We tried in 2 landfills, around 10 leakages per 10,000m²

Source: CERT & Tsing-Tech
How to Reduce GHG Emissions in the MSW Sector

Organic waste treatment

Green waste

On site treatment and utilization

Composting facility

Compost product

City park or landscape

Recycling & Business Loop
How to Reduce GHG Emissions in the MSW Sector

Organic waste treatment

Restaurant waste

Waste oil → Biodiesel

Slurry → Biogas

Solid residue → Disposal

Recycling & Business Loop
About China MSW NAMA project
China Integrated Waste Management NAMA At a Glance

Duration:
• September 2017 – August 2022

Budget:
• 8,000,000 €

Political Partner:
• Ministry of Housing and Urban-Rural Development (MoHURD)

Implementation Partner:
• China Association of Urban Environmental Sanitation (CAUES)

Client:
• NAMA Facility
Mitigation Actions in Waste Sector in China
A Case Study of China MSW NAMA Project

- Advanced technology and management system
- National/regional policy and standard
- 5 Pilot cities demonstration
- MSW sector transformation
Mitigation Actions in Waste Sector in China
A Case Study of China MSW NAMA Project

Output:

- Baseline and GHG mitigation evaluation for demonstration city
- Best practices on MSW management focused on mitigation effects
- 220,000 t/y GHG reduction for each demonstration
- Suggest sustainable business model for low-carbon development in MSW sector
- 3 national policies or standards
- Training for the stakeholders
Thank you for your attention!

LIU Xiao
PhD / Associate Researcher
Tsinghua University Science Park
MSW management and low carbon development, technology innovation
Liuxiao_thu@163.com
China's wastewater and sludge treatment and low carbon development

Jinghao LIU

China Urban Construction Design & Research Institute Co., Ltd
Environmental Sanitation Engineering Technology Research Center, MoHURD

2018–09–20
1. Facts and Figures
2. Policies, Standards and Plans
3. Technology and Cases
4. Low Carbon Development
1. Facts and Figures
General information

Urban population of 653 cities: ~0.48 billion
Urban population of 1483 counties: ~0.150 billion

China Urban Construction Statistics is released by MoHURD as two classes.
➢ 653 cities, include 293 prefecture-level cites and 360 country-level cities;
➢ 1483 counties.

½ of Total Population of China Mainland
~0.63 billion
about ½ of 1.38 billion

One prefecture-level city governs some country-level cities and some counties.

Note: The data of Hongkong, Macao and Taiwan are not included in this PPT. Urban population in the slide include Urban Temporary Population.
In 2016, 653 cities,
- 2039 WWTP, 3 plant/city,
- 149 million t/d, 73,000 (t/d)/plant
- 480 million people, 735,000 people/city
- 48 billion m$^3$ wastewater, 100 m$^3$/cap·a
In 2016, 1483 counties,
- 1513 WWTP, 1 plant/county,
- 30 million t/d, 20,000 (t/d)/plant
- 150 million people, 100,000 people/city
- 9.3 billion m$^3$ wastewater, 60 m$^3$/cap·a
## Wastewater and Sludge Facts (2014 – 2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>Region Name</th>
<th>Annual Quantity of Wastewater Discharged (10^9 m^3/a)</th>
<th>Length of Drainage Pipelines (km)</th>
<th>Number of Wastewater Treatment Plant (unit)</th>
<th>Secondary and Tertiary Treatment Capacity (10^6 m^3/day)</th>
<th>Secondary and Tertiary Treatment Quantity of Wastewater Treated (10^9 m^3/a)</th>
<th>Dry Sludge Produced (10^6 t/a)</th>
<th>Dry Sludge Treated (10^6 t/a)</th>
<th>Treatment Capacity (10^6 m^3/day)</th>
<th>Wastewater Treated (10^9 m^3/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>城市 City</td>
<td>44.53</td>
<td>511,179</td>
<td>1807</td>
<td>1513</td>
<td>130.9</td>
<td>38.27</td>
<td>32.51</td>
<td>7.12</td>
<td>40.16</td>
</tr>
<tr>
<td>2014</td>
<td>县 County</td>
<td>9.05</td>
<td>160,267</td>
<td>1555</td>
<td>1163</td>
<td>28.8</td>
<td>7.25</td>
<td>5.73</td>
<td>1.02</td>
<td>0.17</td>
</tr>
<tr>
<td>2014</td>
<td>合计 Total</td>
<td>53.58</td>
<td>671,445</td>
<td>3362</td>
<td>2676</td>
<td>159.7</td>
<td>45.53</td>
<td>38.24</td>
<td>8.13</td>
<td>47.59</td>
</tr>
<tr>
<td>2015</td>
<td>城市 City</td>
<td>46.66</td>
<td>539,567</td>
<td>1944</td>
<td>1666</td>
<td>140.4</td>
<td>41.05</td>
<td>36.65</td>
<td>7.46</td>
<td>42.88</td>
</tr>
<tr>
<td>2015</td>
<td>县 County</td>
<td>9.27</td>
<td>167,917</td>
<td>1599</td>
<td>1196</td>
<td>30.0</td>
<td>7.73</td>
<td>6.27</td>
<td>1.15</td>
<td>7.90</td>
</tr>
<tr>
<td>2015</td>
<td>合计 Total</td>
<td>55.93</td>
<td>707,484</td>
<td>3543</td>
<td>2862</td>
<td>170.4</td>
<td>48.78</td>
<td>42.92</td>
<td>8.61</td>
<td>50.78</td>
</tr>
<tr>
<td>2016</td>
<td>城市 City</td>
<td>48.03</td>
<td>576,617</td>
<td>2039</td>
<td>1757</td>
<td>149.1</td>
<td>43.13</td>
<td>37.44</td>
<td>8.00</td>
<td>44.88</td>
</tr>
<tr>
<td>2016</td>
<td>县 County</td>
<td>9.27</td>
<td>171,865</td>
<td>1513</td>
<td>1177</td>
<td>30.4</td>
<td>7.96</td>
<td>6.65</td>
<td>1.34</td>
<td>8.10</td>
</tr>
<tr>
<td>2016</td>
<td>合计 Total</td>
<td>57.30</td>
<td>748,482</td>
<td>3552</td>
<td>2934</td>
<td>179.5</td>
<td>51.09</td>
<td>44.09</td>
<td>9.34</td>
<td>52.98</td>
</tr>
</tbody>
</table>
## Key Index Analysis

### In 2016, 653 cities
- 2039 WWTP, 3 Plants/City,
- 149 million t/d, **228,000 (t/d)/city**
- 480 million people, **735,000 people/city**
- 48 billion m³ wastewater, **100 t/cap·a**
  - **72 gallon/cap·d**
- 90% wastewater was treated

### In 2016, 1483 counties
- 1513 WWTP, 1 plant/county,
- 30 million t/d, **20,000 (t/d)/county**
- 150 million people, **100,000 people/county**
- 9.3 billion m³ wastewater, **60 t/cap·a**
  - **43 gallon/cap·d**

#### In 2016, 1483 counties
- 85% wastewater was treated
- **8.0 billion m³ wastewater**
- **1.3 million ton dry sludge, 0.18 tDS/10³tWW**
  - **Dry Sludge: 40 ton/city**
  - **Wet Sludge (W%=80%): 200 ton/city**

#### In 2016, 1483 counties
- **8.0 billion m³ wastewater**
- **1.3 million ton dry sludge, 0.16 tDS/10³tWW**
  - **Dry Sludge: 3 ton/county**
  - **Wet Sludge (W%=80%): 15 ton/county**
2. Policies, Standards and Plans
<table>
<thead>
<tr>
<th>Year</th>
<th>Titles</th>
</tr>
</thead>
</table>
| 2009 | 城镇污水处理厂污泥处理处置及污染防治技术政策（试行）  
*Technical policy for sludge disposal and pollution control in municipal wastewater treatment plant (Trial)* |
| 2010 | 城镇污水处理厂污泥处理处置及污染防治最佳可行性技术指南（试行）  
*Technical guide for sludge disposal and BAT pollution control in municipal WWTP(Trial)* |
| 2010 | 关于加强污水处理厂污泥污染防治工作的通知  
*Government Doc.: Notice on strengthening prevention and control of sludge pollution in WWTP* |
| 2011 | 城市污水处理厂污泥处理处置技术指南（试行）  
*Technical guide for sludge treatment and disposal of municipal WWTP(Trial)* |
| 2015 | 水污染防治行动计划  
*Water pollution control strategy* |
| 2016 | “十三五”全国城镇污水处理及再生利用设施建设规划 (2016-2020)  
*National Plan for municipal wastewater treatment and recycling facilities in 13th Five-Year* |
| 2017 | 城市排水工程规划规范(新修订)  
*Planning specification for Urban drainage works (Updated 2017)* |
| 2018 | 城镇污水处理厂污染物排放标准(新修订)  
*Standard for the discharge of pollutants in municipal wastewater treatment plant (Updated2018)* |
## MoHURD (CJJ 131-2009)

**Technical specification for sludge treatment of municipal wastewater treatment plant**

### Contents

| 1 | General Provisions .............................................. 1 |
| 2 | Terms ............................................................ 2 |
| 3 | Process Design .................................................. 4 |
| 3.1 | General Requirements ........................................... 4 |
| 3.2 | Process Analysis ................................................ 4 |
| 3.3 | Design Requirements ............................................ 5 |
| 4 | Composting ....................................................... 7 |
| 4.1 | General Requirements ........................................... 7 |
| 4.2 | Static Solids Bed Composting .................................. 8 |
| 4.3 | Agitated Solids Bed Composting ............................... 11 |
| 4.4 | In-vessel Composting ............................................ 11 |
| 5 | Lime Stabilization ............................................... 13 |
| 5.1 | General Requirements ........................................... 13 |
| 5.2 | Technical Parameters ........................................... 13 |
| 6 | Heat Drying ....................................................... 14 |
| 6.1 | General Requirements ........................................... 14 |
| 6.2 | Direct Heat Drying ............................................... 15 |
| 6.3 | Indirect Heat Drying ............................................. 15 |
| 6.4 | Direct-indirect Heat Drying .................................... 16 |
| 7 | Incineration ...................................................... 17 |
| 7.1 | General Requirements ........................................... 17 |
| 7.2 | Multiple-Hearth Incineration ................................... 17 |
| 7.3 | Fluidized Bed Incineration ..................................... 17 |
| 8 | Construction and Acceptance ................................... 19 |

### 目次

<table>
<thead>
<tr>
<th>章节</th>
<th>内容</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Provisions</td>
</tr>
<tr>
<td>2</td>
<td>Terms</td>
</tr>
<tr>
<td>3</td>
<td>Process Design</td>
</tr>
<tr>
<td>3.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>3.2</td>
<td>Process Analysis</td>
</tr>
<tr>
<td>3.3</td>
<td>Design Requirements</td>
</tr>
<tr>
<td>4</td>
<td>Composting</td>
</tr>
<tr>
<td>4.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>4.2</td>
<td>Static Solids Bed Composting</td>
</tr>
<tr>
<td>4.3</td>
<td>Agitated Solids Bed Composting</td>
</tr>
<tr>
<td>4.4</td>
<td>In-vessel Composting</td>
</tr>
<tr>
<td>5</td>
<td>Lime Stabilization</td>
</tr>
<tr>
<td>5.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>5.2</td>
<td>Technical Parameters</td>
</tr>
<tr>
<td>6</td>
<td>Heat Drying</td>
</tr>
<tr>
<td>6.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>6.2</td>
<td>Direct Heat Drying</td>
</tr>
<tr>
<td>6.3</td>
<td>Indirect Heat Drying</td>
</tr>
<tr>
<td>6.4</td>
<td>Direct-indirect Heat Drying</td>
</tr>
<tr>
<td>7</td>
<td>Incineration</td>
</tr>
<tr>
<td>7.1</td>
<td>General Requirements</td>
</tr>
<tr>
<td>7.2</td>
<td>Multiple-Hearth Incineration</td>
</tr>
<tr>
<td>7.3</td>
<td>Fluidized Bed Incineration</td>
</tr>
<tr>
<td>8</td>
<td>Construction and Acceptance</td>
</tr>
</tbody>
</table>
Technical Guide for sludge treatment and disposal of municipal wastewater treatment plant (Trial)

Contents

1 General Provision ......................................................... 1
2 Sources and Properties of Sludge ........................................ 2
3 Technical Route and Process Analysis ............................. 4
   3.1 Present and Trend ................................................ 4
   3.2 General Requirements ........................................... 5
   3.3 Scheme Selection and Assessment .............................. 7
4 Technologies for Sludge Treatment ............................... 13
   4.1 Thickening and Dewatering ...................................... 15
   4.2 Anaerobic Digestion ................................................. 15
   4.3 Aerobic Fermentation .............................................. 23
   4.4 Heat Drying ......................................................... 30
   4.5 Lime Stabilization ................................................ 35
   4.6 Other Technologies ................................................ 37
5 Sludge disposal methods and related technologies .......... 39
   5.1 Sludge Land Utilization ........................................... 39
   5.2 Sludge Incineration ................................................ 44
   5.3 Building Materials Utilization ................................. 58
   5.4 Sludge Landfill ..................................................... 60
6 Emergency Handling and Risk Management ................... 63
   6.1 Emergency Handling of Sludge .................................. 63
   6.2 Risk Analysis and Management of Sludge disposal ......... 65
The Appendix .............................................................. 68

中华人民共和国住房和城乡建设部
中华人民共和国国家发展和改革委员会
二〇一一年三月
### Main Objectives and Tasks in 13th Five Year

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2015</th>
<th>2020</th>
<th>Add in 13th Five-Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wastewater Treatment Rate (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>91.9</td>
<td>95</td>
<td>3.1</td>
</tr>
<tr>
<td>County</td>
<td>85</td>
<td>≥85</td>
<td>/</td>
</tr>
<tr>
<td>Town</td>
<td>/</td>
<td>70</td>
<td>/</td>
</tr>
<tr>
<td><strong>Sludge Harmless disposal rate (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>53</td>
<td>75</td>
<td>22</td>
</tr>
<tr>
<td>County</td>
<td>24.3</td>
<td>~60</td>
<td>35.7</td>
</tr>
<tr>
<td>Key Town</td>
<td>/</td>
<td>+5%</td>
<td>5</td>
</tr>
<tr>
<td>Length of drainage pipelines (10⁴km)</td>
<td>29.65</td>
<td>42.24</td>
<td>12.59</td>
</tr>
<tr>
<td>Wastewater treatment capacity (10⁴m³/day)</td>
<td>21744</td>
<td>26766</td>
<td>5022</td>
</tr>
<tr>
<td>Innocent treatment capacity of sludge (10⁴t/d)</td>
<td>3.74*</td>
<td>9.75</td>
<td>6.01</td>
</tr>
<tr>
<td>Regenerated water production capacity (10⁴m³/d)</td>
<td>2653*</td>
<td>4158*</td>
<td>1505*</td>
</tr>
</tbody>
</table>

Note: Data with * do not contain township data.
3. Technology and Cases
Typical equipment of sludge drying technology

- 转鼓式干燥机 (Drum Dryer)
- 带式干燥机 (Band Dryer)
- 浆叶式干燥机 (Paddle Dryer)
- 流化床干燥机 (Fluidized Bed Dryer)

Source: Shijun Hang, BMEDI
Typical equipment of sludge incineration technology

- 多膛炉 (Multiple Hearth Furnace)
- 回转窑 (Rotary Kiln)
- 流化床炉 (Fluidized Bed Furnace)

Source: Shijun Hang, BMEDI
Sludge Treatment Facility in Nanjing

- **Capacity:** 1400 t/d (W%=80%)
  - 处理总规模1400t/d（含水率80%）

- **Dehydration drying in low temperature**
  - 低温真空脱水干化

- **Design capacity of first-phase construction: 400t/d, 2 lines**
  - 一期规模400t/d，2条生产线

- **Design capacity of second-phase construction: 1000t/d, 2 lines**
  - 二期规模1000t/d，2条生产线
Sludge Treatment Facility in Tangjiatuo, Chongqing

- **Capacity:** 240 t/d (W%=75%)
  - 处理能力240吨/日（含水率75%）

- **Reduce moisture content to 10% with two-stage heating drying process and Anaerobic Digestion process**
  - 采用热干化两段式组合工艺，污泥的含水率降至10%；

- **In operation in 2009**
  - 2009年投入运营；
Sludge Drying & Incineration Project in Shidongkou, Shanghai

- Capacity is 150t/d (W%=80%)
  处理能力150吨/日（含水率80%）

- The Germany Andritz fluidized bed is used for drying sludge
  污泥干化采用德国Andritz流化床

- Chinese fluidized bed furnace is used for incineration
  采用国产流化床污泥焚烧炉

- In operation in 2004
  2004年投产运行
Sludge Drying and Incineration Project in Jiaxin City

- Capacity of first-phase project is 1300 t/d (w%=80%)
  - 一期处理能力为1300t/d
- 7 Chinese drum dryers
  - 7台国产超圆盘污泥干燥机
- 1x260 t/h sludge-fired CFB furnaces
  - 1台260t/h循环流化床污泥焚烧炉
- 3x220t/h coal-fired CFB furnaces
  - 3台220t/h循环流化床燃煤锅炉
- In operation in 2011
  - 2011年投产
Drying Sludge Project in Beijing Cement Plant

- **Capacity is 500 t/d (W%=80%)**
  处理规模500t/d（含水率80%）

- **Use cement kiln heat to dry sludge**
  采用水泥窑余热干化技术

- **5 turbine thin layer sludge drying device are used for drying process.**
  5套涡轮薄层污泥干化装置用于干燥工艺

- **In operation in 2009**
  2009年建成投产
4. Low Carbon Development
### China’s GHG Emissions Target by 2020

- **To lower carbon dioxide emissions per unit of GDP by 40% to 45% from the 2005 level**
  - 单位GDP二氧化碳排放量相对2005年降低40-45%
- **To increase the share of non-fossil fuels in primary energy consumption to about 15%**
  - 化石能源占总能源比重提升至15%左右
- **To increase the volume of forest stock by approximately 1.3 billion cubic meters over 2005 levels**
  - 森林蓄积量比2005年增加13亿立方米

### China’s Nationally Determined Contributions (NDC) Targets (around 2030)

- **To lower carbon dioxide emissions per unit of GDP by 60% to 65% from the 2005 level**
  - 单位国内生产总值二氧化碳排放比2005年下降60-65%
- **Increase the share of non-fossil fuels in the primary energy mix to around 20%**
  - 非化石能源占一次能源消费比重达到20%左右
- **To increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level.**
  - 森林蓄积量比2005年增加45亿立方米左右
- **To achieve the peaking of carbon dioxide emissions around 2030 and making best efforts to peak earlier**
  - 二氧化碳排放2030年左右达到峰值并争取尽早达峰
CDM项目注册情况
Registered CDM projects

CDM注册项目: 7715个
垃圾处理CDM项目: 364个 (5%)

Registered CDM projects: 7715 projects
Registered CDM projects in waste disposal: 364 (5%)

- 风电
- 水电
- 生物质能
- 甲烷逃逸
- 光伏发电
- 垃圾处理
- 能效
- 林业
- 化石能源转换
- 其他

Wind
Hydro
Biomass energy
Methane avoidance
Solar PV
waste disposal
EE
Forest carbon sink
Fossil fuel switch
other

Source: Sinocarbon Innovation & Investment
CDM in China

CDM项目减排量签发情况
Issuance of CERs

签发项目：2915个
签发减排量：167785万tCO₂e
垃圾处理领域的减排量：8010万tCO₂e（5%）

CDM projects with issuance： 2915 projects
Issued CERs: 1677.85 million tCO₂e
Issued CERs in waste disposal: 80.1million tCO₂e (5%)

- 风电: Wind
- 水电: Hydro
- 生物质能: Biomass energy
- 甲烷逸逸: Methane avoidance
- 光伏发电: Solar PV
- 垃圾处理: waste disposal
- 能效: EE
- 林业: Forest carbon sink
- 化石能源转换: Fossil fuel switch
- HFCs: HFCs
- N2O: N2O
- 其他: other

Source: Sinocarbon Innovation & Investment
Waste sector climate change in mitigation

- Solid waste treatment (固体废弃物处理): 33.8%;
- wastewater handling (废水处理): 57.3%;
- waste incineration (non-energy use) (废弃物焚烧处理 (非能源使用)): 8.9%.

Source: First Biennial Update Report on Climate Change
## Carbon emission accounting results for China's urban wastewater industry

<table>
<thead>
<tr>
<th>Type of emission</th>
<th>Processing procedure</th>
<th>CO₂</th>
<th>CH₄</th>
<th>N₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct emission</td>
<td>Wastewater treatment</td>
<td>0.6290</td>
<td>0.0153</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landfills</td>
<td>0.3070</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Incineration</td>
<td>0.0252</td>
<td>0.0350</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anaerobic digestion</td>
<td>0.0427</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indirect emission</td>
<td>Power consumption</td>
<td>10.4358</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10.4358</td>
<td>1.0039</td>
<td>0.0503</td>
</tr>
</tbody>
</table>

**Carbon Emissions:** 47.11 Mton CO₂ₑ

Source: Ke WANG, RUC, Progress and Prospects of Climate Negotiation after the Paris Agreement and the Significance of Mitigation Actions of Waste Treatment, 2018/08/29
## Analysis results of the emission reduction potential of wastewater Treatment

<table>
<thead>
<tr>
<th>Measures</th>
<th>Emission reduction potential (10,000 tons CO2/year)</th>
<th>Technology incremental cost for emission reduction (CNY/tCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement of wastewater treatment and system optimization</td>
<td>-312.39</td>
<td>-43.54</td>
</tr>
<tr>
<td>Aeration optimization system</td>
<td>-76.73</td>
<td>-390.99</td>
</tr>
<tr>
<td>Energy recovery from wastewater treatment plants</td>
<td>-284.98</td>
<td>-387.99</td>
</tr>
</tbody>
</table>

Source: Ke WANG, RUC, Progress and Prospects of Climate Negotiation after the Paris Agreement and the Significance of Mitigation Actions of Waste Treatment, 2018/08/29
## Analysis results of sludge treatment and reduction potential

<table>
<thead>
<tr>
<th>Measures</th>
<th>Emission reduction potential (10,000 tons CO2/year)</th>
<th>Technology incremental cost for emission reduction (CNY/tCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal hydrolysis-anaerobic digestion-biogas utilization heat drying (10% water content)-coal substitutes (e.g. in power plants or cement kilns)</td>
<td>-20.77</td>
<td>0.5</td>
</tr>
<tr>
<td>Anaerobic digestion-biogas utilization-landfills (using landfill gas)</td>
<td>-20.43</td>
<td>-0.92</td>
</tr>
<tr>
<td>Thermal hydrolysis-anaerobic digestion-biogas utilization land utilization</td>
<td>-20.30</td>
<td>0.25</td>
</tr>
<tr>
<td>Anaerobic digestion-biogas utilization-compost-land utilization</td>
<td>-20.13</td>
<td>-0.81</td>
</tr>
<tr>
<td>Anaerobic digestion-biogas utilization-land utilization</td>
<td>-19.79</td>
<td>-0.43</td>
</tr>
<tr>
<td>Compost-land utilization</td>
<td>-18.80</td>
<td>0.13</td>
</tr>
<tr>
<td>Lime stabilization-land utilization</td>
<td>-17.10</td>
<td>-0.28</td>
</tr>
<tr>
<td>Anaerobic digestion-biogas utilization-landfills</td>
<td>-16.14</td>
<td>-1.16</td>
</tr>
</tbody>
</table>
Thanks for your attention!
Xiangyang Municipal Sludge and Food Waste Treatment Project

Wenlong Dou
Company: HELEX, China
Email: 45887460@QQ.com
Beginning during the project was implemented.
Our PRIORITIES

• Treat incremental and stocked sewage sludge simultaneously

• Co-digestion with food waste
Marketing Methane and Biosolids
Layout of Vein Industry Chain
Methane Capture & Usage

- 1500—4000 M³ CNG Biogas/Day
- 60—90 Tons Organic Charcoal/Day
Methane Capture → Low Carbon Cities