Practice of PPP Model in Waste-to-Energy Industry

Speaker: Eric Zhan

June 22nd 2021

Prepared for: the Fifth Meeting of the Infrastructure Financing and Public-Private Partnerships (PPP) Network of Asia and the Pacific
Contents

1. Development of Waste-to-Energy
2. Application of PPP Mode in Waste-to-Energy Industry
3. SUS’s Case Study
4. Waste-to-energy Boosts Carbon Neutrality
5. International Cooperation in Waste-to-Energy
1.1 MSW Treatment Method

Composting: Agricultural catalysis, complex process, less treatment capacity

Incineration: Volume reduction, healthy and safety, heat energy recovery

Landfill: Economical, unsustainable, covers a huge area, and potential pollution

Open Dumping is still in large quantity!
1.2 Rapid Growth of Waste-to-Energy in China

By 2020, China has more than 400 waste-to-energy plants in operation, with a processing capacity more than 400,000 tons/day; There are about 200 ~ 250 waste-to-energy under construction in China, with a processing capacity of about 200,000 ~ 250,000 tons / day.

The growth of front-end sanitation and waste sorting will increase the amount of MSW. Waste-to-Energy is going through a new development period. It is estimated that the domestic waste incineration capacity will reach 700,000 tons / day in 2022.

Due to the increase of garbage collection and transportation, the update and expansion of old incineration facilities, the waste-to-energy industry will continue to grow at a high speed until 2025, and the total scale of the industry is estimated to exceed 1.1 million tons/day; The total investment scale is estimated to be about 500 billion Chinese Yuan.
1.3 NIMBY Phenomenon

- Advanced Technology
  - Clean incineration technology
  - Advanced flue gas purification tech
  - Near zero leachate discharge technology
  - Ash treatment and resource utilization technology
  - The third generation ACC control system
  - Dioxin monitoring and control technology

- Strict Management & Monitoring
  - Strict national and local emission standard applied
  - Different level of monitoring and regular or random test from central government and local governments

- Involvement & Pay Back to Communities
  - Fully communicate and be transparent during the whole process, online display
  - Deindustrialization of Architecture
  - Science education base and propaganda
  - Pay back to neighbors with the service facilities
  - Benefit sharing

Service Oriented Government + Human Being Oriented Enterprises
Cooperation & Social Responsibilities
1.4 The Trend of International Waste Treatment

Recycling & WtE complementary to divert waste from landfills

EU 28 + Switzerland, Norway and Iceland
Municipal waste treatment trends 2001-2017 EU 28

Legend:
- Landfill -32% points
- Waste-to-Energy +12% points
- Recycling +19% points

Graph by CEWEP, Source: EUROSTAT 2019
Summary: the market of waste-to-energy in Japan and some European countries is pretty mature; The Chinese market is developing at full speed; Southeast Asia and Africa started to plan or implement some pilot projects.
2.1 Several PPP Operation Modes

- **Build-Own-Operate (BOO)**
- **Build-Operate-Transfer (BOT)**
- **Rebuild-Operate-Transfer (ROT)**
- **Transfer-Operate-Transfer (TOT)**
- **Lease-Operate-Transfer (LOT)**
- **Management Contract (DBO)**
- **Commissioned operation (O&M)**
- **Fully Publicized or Government Funded**

The Degree of Social Capital Risk Bearing

High

Private Capital Participation

High

Low
### 2.2 Comparison of Business Models of International MSW Treatment Facilities

<table>
<thead>
<tr>
<th>Nation</th>
<th>Investment</th>
<th>Construction</th>
<th>Operation</th>
<th>Sources of Facilities Income</th>
<th>Paying Subject</th>
<th>Business Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>America</td>
<td>Government</td>
<td>Enterprise</td>
<td>Enterprise</td>
<td>FIT$^1$ + Tipping Fee</td>
<td>Commercial/Resident</td>
<td>/</td>
</tr>
<tr>
<td>Germany</td>
<td>Government+Enterprise$^2$</td>
<td>Government+Enterprise$^2$</td>
<td>Enterprise</td>
<td>FIT + Subsidy (Subsidies, low-interest loans, tax relief, etc.)</td>
<td>Resident</td>
<td>/</td>
</tr>
<tr>
<td>Japan</td>
<td>Government</td>
<td>Enterprise</td>
<td>Enterprise</td>
<td>Tipping Fee</td>
<td>Government</td>
<td>DBO</td>
</tr>
<tr>
<td>China$^3$</td>
<td>Government+Enterprise</td>
<td>Enterprise</td>
<td>Enterprise</td>
<td>FIT + Tipping Fee</td>
<td>Government</td>
<td>BOT</td>
</tr>
</tbody>
</table>

**Note:** 1. FIT: Feed in tariff; 2. Some factories in Germany, eg. EEW; 3. Most of the projects in China are based on BOT mode, except Beijing, Shanghai, Guangzhou, Shenzhen, Tianjin and Chongqing.
## 2.3 China Practice: Legislation and Policy Framework

<table>
<thead>
<tr>
<th>Time</th>
<th>Policy</th>
<th>Key Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st July 2017</td>
<td>&quot;Notice on the Full Implementation of the PPP Model in Sewage and Waste Treatment Projects Involved by the Government&quot; Ministry of Finance and Construction [2017] No. 455</td>
<td>PPP mode is fully implemented in the new sewage and waste treatment projects participated by the government. Orderly promote the transformation of existing projects into PPP mode.</td>
</tr>
<tr>
<td>10th Nov. 2017</td>
<td>Notice on standardizing the project database management of PPP comprehensive information platform (CBJ [2017] No. 92)</td>
<td>Standardizing the operation of PPP projects, non-conforming or long-term no progress of PPP projects will be cleared out of the warehouse, unified new project warehousing standards.</td>
</tr>
<tr>
<td>4th May 2018</td>
<td>Strengthening the &quot;red line&quot; of the 10% limit of the financial affordability of PPP projects -- Summary and analysis report on the financial affordability of PPP projects.</td>
<td>Standardize the bottom line of operation and strictly control the red line of 10% of financial affordability; Improve the system for demonstrating financial affordability and speed up the establishment of a monitoring and early warning system for fiscal expenditure responsibility.</td>
</tr>
<tr>
<td>5th August 2018</td>
<td>National plan for deepening the reform of &quot;deregulation, management and service&quot; and transforming government functions, GBF [2018] No.79</td>
<td>The Ministry of justice, the national development and Reform Commission and the Ministry of finance are required to formulate and issue the regulations on cooperation between government and social capital in infrastructure and public services by the end of 2018. The improvement of the regulations will further promote the sound development of PPP from the perspective of top-level legislation.</td>
</tr>
<tr>
<td>10th Nov. 2018</td>
<td>Notice on strengthening the management of China's Government Enterprise Cooperative Investment Fund</td>
<td>China's PPP fund is required to actively support and serve major national strategies and key areas, and increase investment in public service industries such as health, culture and tourism; Pay attention to the balance of regions and fields, and increase the support for the remote areas in the West and the northeast provinces. Private enterprises should be inclined to participate in PPP projects. We should not only invest in large projects but not in small ones, in developed projects but not in underdeveloped areas, and in projects involving state-owned enterprises but not private enterprises.</td>
</tr>
<tr>
<td>15th Nov. 2018</td>
<td>GAAP 8 - liabilities</td>
<td>It is clear that the obligations formed by future economic business or events are not current obligations and should not be recognized as liabilities; In addition, the definition of liabilities requires that the amount meeting the obligation can be measured reliably, but PPP projects cannot agree on a fixed return and need to pay according to the performance evaluation results of public services. Therefore, there is no obligation to pay a reliable amount when signing the contract. Therefore, the future expenditure responsibility of PPP is not a liability of the government.</td>
</tr>
</tbody>
</table>
At present, China's waste-to-energy market has become a very competitive one. The competition and deeply localized supply chain lower the CAPEX. At the same time, this reflected on the lower of the tipping fees. Combined with the improvement of operational efficiency, the industry’s average returns have improved significantly, and it is expected that there is still room for improvement in the future. And this will also lead to a win-win model between the public and private stakeholders.

### Waste Incineration Treatment and Power Generation Scale Calculation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste to Energy treatment capacity (100 million tons/year)</td>
<td>0.95</td>
<td>1.09</td>
<td>1.31</td>
<td>1.51</td>
<td>1.73</td>
<td>1.88</td>
<td>2.03</td>
</tr>
<tr>
<td>Unit price of tipping fee (yuan/ton)</td>
<td>50</td>
<td>55</td>
<td>60</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Subtotal of tipping fee expenditure (100 million yuan)</td>
<td>47.63</td>
<td>60.14</td>
<td>78.74</td>
<td>105.92</td>
<td>121.35</td>
<td>131.51</td>
<td>142.20</td>
</tr>
<tr>
<td>Waste to Energy power generation (Kwh/ton)</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>Trend to be higher</td>
<td></td>
</tr>
<tr>
<td>FIT price (yuan/Kwh)</td>
<td>0.65</td>
<td>0.65</td>
<td>0.65</td>
<td>0.65</td>
<td>0.65</td>
<td>Trend to be lower</td>
<td></td>
</tr>
<tr>
<td>Subtotal of FIT expenditure (100 million yuan)</td>
<td>173.36</td>
<td>199.01</td>
<td>238.86</td>
<td>275.39</td>
<td>315.52</td>
<td>341.93</td>
<td>369.72</td>
</tr>
<tr>
<td>Total Revenue of Waste to Energy facilities (100 million yuan)</td>
<td>220.98</td>
<td>259.15</td>
<td>317.60</td>
<td>381.30</td>
<td>426.87</td>
<td>473.43</td>
<td>511.92</td>
</tr>
</tbody>
</table>

*Source: Calculated by Statistics Bureau, Ministry of Housing and Urban-Rural Development, Essence Securities Research Center*
2.4 Glance at Southeast Asia Region

- With the rapid economic growth, Southeast Asian countries need to face increasingly severe MSW problems. The proportion of open-air dumping exceeds 50% which even higher in some less developed areas.

- According to the Viet News Agency, at present, landfill and incineration\(^1\) are the main waste disposal methods in Southeast Asian countries. This treatment method causes pollution, especially to the running river, underground water and the sea. There are only about 10 operational waste-to-energy plants in Southeast Asia.

- The International Finance Corporation, a subsidiary of the World Bank, predicts that by 2022, the global market value of waste treatment and waste-to-energy plants will reach **US$80 billion**. Obviously, ASEAN, which has insufficient infrastructure for waste disposal, will be one of the markets with huge potential.

- But the obstacle lies in the legal system, especially the PPP mode is not sound, there is no systematic policy framework and master planning to support the development of the waste-to-energy industry.

Note: 1. Incineration: traditional combustion without energy recovery
3.1 ECO-INDUSTRIAL PARK-- Realize the dual cycle of material and energy

SUS contributes to investment, operation and maintenance of Eco-Industrial Park based on the principle of Waste-to-Energy along with integrated treatment facilities of sludge, medical, kitchen, food, C&D and electronic waste, etc.

The recovered heat from WtE plant can provide required energy for sludge drying, kitchen waste fermentation and medical waste required steaming, etc. The combustible particles of the residue can be re-injected into the Waste-to-Energy facilities. In this manner, the circulation of material can be realized.
3.2 ECO-INDUSTRIAL PARK —SUS Track Records in China

As of March 2021

- **Waste-to-Energy**
  around 60 projects
  Capacity **90,000+ t/d**

- **Sludge Treatment**
  1280+ t/d

- **Food Waste**
  830+ t/d

- **Industrial Waste**
  100+ t/d

- **Medical Waste**
  45+ t/d
3.3 Projects Portfolio

<table>
<thead>
<tr>
<th>City</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhuhai</td>
<td>1,200 + 1,800 tpd</td>
</tr>
<tr>
<td>Qingdao</td>
<td>2,250 tpd</td>
</tr>
<tr>
<td>Taiyuan</td>
<td>3,000 tpd</td>
</tr>
<tr>
<td>Nanjing</td>
<td></td>
</tr>
<tr>
<td>Fuzhou</td>
<td></td>
</tr>
<tr>
<td>Taizhou</td>
<td></td>
</tr>
<tr>
<td>Nanning</td>
<td></td>
</tr>
<tr>
<td>Wuhan</td>
<td></td>
</tr>
<tr>
<td>Liuzhou</td>
<td></td>
</tr>
<tr>
<td>Shenyang</td>
<td></td>
</tr>
<tr>
<td>Jiaxing</td>
<td></td>
</tr>
<tr>
<td>Wuzhou</td>
<td>2,000 tpd</td>
</tr>
<tr>
<td>Xi’an</td>
<td>2,250 tpd</td>
</tr>
<tr>
<td>Hangzhou</td>
<td>5,220 tpd</td>
</tr>
<tr>
<td>Huangdao</td>
<td>2,250+1,500 tpd</td>
</tr>
<tr>
<td>Sanhe</td>
<td>2,000 tpd</td>
</tr>
<tr>
<td>Nanchang</td>
<td>2,400+1,200 tpd</td>
</tr>
</tbody>
</table>
3.4 Case Study - Wuzhou Eco-industrial Park

The park includes:

- Waste-to-Energy 2,000 tpd
- Kitchen waste treatment plant 200 tpd
- Sludge treatment plant 200 tpd
- Medical waste treatment plant 5 tpd
- Slag Comprehensive Utilization Plant
- Leachate treatment plant
- Sanitary landfill

Total Investment: 1.15 billion Chinese Yuan
Land: 480 Mu
Concession Period: 30 years
Construction Started: November 2018
COD: July 2020
Model: BOT

Green PPP Demonstration Project of National Development and Reform Commission (NDRC)
PPP Demonstration Project of Ministry of Finance (MoF)
3.4 Case Study - Wuzhou Eco-industrial Park

Operational Mode Diagram of the PPP Project
3.4 Case Study - Wuzhou Eco-industrial Park

CSR Highlights:
- Comprehensive waste treatment
- Saving natural resource equivalent to 65,000 tons standard coal per year
- CO₂ emission reduction 130,000 ton per year
- Saving land resource 480,000 sqm comparing to conventional treatment facilities
- Environment protection education center
- Open park for public visiting and interactive activities
3.4 Case Study - Qingdao Waste to Energy Project

Key Figures:
- Waste-to-Energy 2,250 tpd
- Sludge treatment capacity 500 tpd
- Total Investment: 1.15 billion Chinese Yuan
- The facade design by French design firm AIA adopts the elements of "beehive" + "rose" (City Flower of Qingdao)
- Use the waste heat from WtE plant to dry the sludge, and the dried sludge incinerated in the WtE plant. This minimizes the generation of odors and has excellent synergistic effects;
- Concession Period: 30 years
- Construction Started: Jan 2018
- COD: Aug 2019
- Model: BOT
3.4 Case Study - Qingdao Waste to Energy Project

Qingdao Waste to Energy Project

CSR Highlights:

- Temporarily treatment of medical waste exceeded 1,600 tons during the Covid pandemic period
- Saving natural resource equivalent to 124,000 tons standard coal per year
- CO₂ emission reduction 800,000 ton per year
- Saving land resource 660,000 sqm comparing to conventional treatment facilities
- Environment protection education center
- Basketball court, gym area, and greenery park open to local communities for free
- More than 1,000 visitors since operation
3.5 Conclusion

The Key of the Win – Win Model for waste to energy projects
Lower the risk for development and policy guarantee for the private sector;
Lower the risk for delivery and operational risk for the government at a affordable cost;
Risk-sharing model leads to the bankability and the further leverage of private resources.
4. Introduction to SUS International Business

SUS Environment established an international business department in 2014, focusing on Southeast Asia, deepening into Africa, and deploying in South America, Europe, and Australia. With the investment and operation of waste-to-energy projects as the core, it combines complete equipment and engineering to go global and cooperate with partners to build Eco-industry Parks.

Working Together

Let solid waste treatment become another beautiful international business card for China

On the afternoon of March 25, 2019, local time in France, under the witness of the leaders of China and France, SUS Environment signed the "Renewable Energy Development Platform" with China Investment Corporation, French National Investment Bank, and French Qair at the Elysee Palace Co-construction work agreement", locked the first batch of 2 billion euro project investment intention.
On April 8, 2019, a loan agreement was signed with the Asian Development Bank. This is the first time the international institution has supported the construction of a low-carbon Eco-industrial park in more than 50 years.

On May 8, 2019, SUS signed a cooperation agreement with the International Environmental Technology Center (IETC) of the United Nations Environment Program.

On May 30, 2019, SUS was invited to participate in the "High-end Dialogue" session of the 10th International Infrastructure Investment and Construction Summit Forum to share SUS' experience.

On September 10, 2019, at the Fifth Africa Investment Forum, SUS and the CADFund signed a strategic cooperation agreement. The two parties will carry out project investment cooperation in Africa and Portuguese-speaking countries.

On May 21, 2019, SUS signed a cooperation agreement with the International Environmental Technology Center (IETC) of the United Nations Environment Program.
4. Introduction to SUS International Business

Market Performance

- Project pipelines: nearly 70, with a scale of over 70,000 tons/day
- Established representative offices in Vietnam, Thailand and Indonesia
- Substantial launch of projects in Southeast Asia, Africa and the others
Create a Cleaner and More Friendly Living Environment!

Contact:
Eric Zhan
Deputy General Manager
International Business Department
Shanghai SUS Environment Co., Ltd.
zhanliang@shjec.cn / M: +86-18911155318