The CHINA market for Waste-to-Energy

Ivan Christiaens
Keppel Seghers Belgium NV
China population
China waste
Market worldwide 2008-2010

Geographic Distribution of Market Share of Plants / Awards in 2008-2010 (including Europe)

- China (PRC): 50.7%
- Europe: 27.5%
- USA: 5.7%
- Japan: 7.7%
- Russia: 2.4%
- India: 2.2%
- Azerbaijan: 1.8%
- South Korea: 1.7%
- Canada: 0.2%

Total: 89,964 tpd

Source: Vaccani, Zweig & Associates
Market size outside Europe (2008-2010)

Source: Vaccani, Zweig & Associates
Growth in WTE capacity in China, 2001-2009

Total WTE capacity, million tons/y

- Source: Yani Dong
## Market size
(source Vaccani, Zweig & Associates)

### Worldwide Plants / Awards per Country and Year, 2008 – 2010 excluding Europe

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Plants</td>
<td>Capacity t/d</td>
<td>No. of plants</td>
<td>Capacity t/d</td>
</tr>
<tr>
<td>China (PRC)</td>
<td>35</td>
<td>45339.6</td>
<td>18</td>
<td>21080.5</td>
</tr>
<tr>
<td>Japan</td>
<td>25</td>
<td>0'960.0</td>
<td>9</td>
<td>2'353.7</td>
</tr>
<tr>
<td>USA</td>
<td>5</td>
<td>5'122.6</td>
<td>3</td>
<td>3'466.6</td>
</tr>
<tr>
<td>Russia</td>
<td>1</td>
<td>2'160.0</td>
<td>1</td>
<td>2'160.0</td>
</tr>
<tr>
<td>India</td>
<td>2</td>
<td>1'988.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>1</td>
<td>1'384.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>South Korea</td>
<td>6</td>
<td>1'488.0</td>
<td>1</td>
<td>1'680.0</td>
</tr>
<tr>
<td>Canada</td>
<td>1</td>
<td>200.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76.0</strong></td>
<td><strong>65'161.4</strong></td>
<td><strong>32.0</strong></td>
<td><strong>28'247.8</strong></td>
</tr>
</tbody>
</table>
Market share

Capacity Awarded in 2008 – 2010 in China by Supplier / Developer

- HITZ: 10'090 tpd
- Keppel Segherc: 9'500 tpd
- Zhongde: 8'600 tpd
- CIS (Martin Grate): 7'301 tpd
- Ebara: 3'100 tpd
- MHI (Martin Grate): 2'500 tpd
- JFE: 2'300 tpd
- Volund: 2'250 tpd

Total: 45'640 tpd

info@cewep.eu  www.cewep.eu
China 12th five year plan (2011-2015)

• RMB 3.1 trillion (400 billion €) investment in the ‘environment protection’ related area.

• 800 billion RMB (100 billion €) for WtE plants.

• > 100 new WTE plants to be built
Typical Chinese Plant Layout
Typical Combustion Diagram 500 TPD

- **LHV min**
  - 4605 kJ/kg
  - 1100 kcal/kg

- **LHV nom**
  - 6490 kJ/kg
  - 1550 kcal/kg

- **LHV max**
  - 8374 kJ/kg
  - 2000 kcal/kg

- 70% = 26.3 MWth
- 100% = 37.6 MWth
- 110% = 41.3 MWth

- 70% = 14.6 tph
- 100% = 20.8 tph
- 110% = 22.9 tph

- **ABGHIF = temporary overload area**
- **ABCDEF = normal operating area**
Leachate Collection Under Furnace
## Contractual emission standards

<table>
<thead>
<tr>
<th>Location</th>
<th>Suzhou II</th>
<th>Jinan</th>
<th>Bai Ge Hu</th>
<th>Binhai</th>
<th>Chengdu</th>
<th>Bao An II</th>
<th>EU 2000/76 EC unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>daily average</td>
<td>daily average</td>
<td>daily average</td>
<td>daily average</td>
<td>daily average</td>
<td>daily average</td>
<td>daily average</td>
</tr>
<tr>
<td>Dust</td>
<td>30</td>
<td>30</td>
<td>25</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>HCl</td>
<td>50 (1)</td>
<td>50 (1)</td>
<td>50</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>HF</td>
<td>2 (1)</td>
<td>2 (1)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sox (as SO2)</td>
<td>260 (1)</td>
<td>260 (1)</td>
<td>180</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Nox (as NO2)</td>
<td>400 (1)</td>
<td>380 (1)</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>CO</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>TOC</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Hg</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,05 (2)</td>
<td>0,05 (2)</td>
<td>0,05 (2)</td>
</tr>
<tr>
<td>Cd</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,05 (2)(3)</td>
<td>0,05 (2)(3)</td>
<td>0,05 (2)(3)</td>
</tr>
<tr>
<td>Pb</td>
<td>1,6</td>
<td>1,6</td>
<td>1,6</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
</tr>
<tr>
<td>As, Cr, Co, Cu,…</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
<td>0,5 (2)</td>
</tr>
<tr>
<td>PCDD/F</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
<td>0,1</td>
</tr>
<tr>
<td>Flue gas opacity</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes:

(1) : hourly average
(2) : average over sample period (30 min - 8h)
(3) : Cd + Tl
Key Chinese players

Mainly state owned enterprises doing
- Investment
- Organising the construction (project management)
- O&M
- (Technology Supply)
Shenzhen Energy
China – NANSAN/BAOAN

Client: Shenzhen Energy
Capacity: 2 x 400 tonnes/day + 3 x 400 tonnes/day
Start-up: 2004
Shenzhen Energy
China – Baoan II

Client: Shenzen Energy
Capacity: 4 x 750 tonnes/day
Start-up: 2012
China Everbright International

China – JIANGYIN/CHANGZHOU/SUZhou

Client: China Everbright International
Capacity: several plants of 2 x 400 tonnes/day, 2 x 350 TPD
Start-up: Operational since 2008
China Everbright International

China – JINAN

Client: China Everbright International

Capacity: 4 x 500 tonnes/day

Start-up: Operational since 2011
Cost Analysis

• **Investment amount**
  – 30,000 - 45,000 €/ton per day

• **O&M cost**
  – 6-23 €/ton
Gate fees

- Typical cities: 6 – 15 €/ton
- Some rich cities: 25 – 30 €/ton
### Gate fees

- **Tipping fees Jiangnan/Jiangbei tenders**:

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>EBI</th>
<th>SEE</th>
<th>CECIC</th>
<th>ENFI</th>
<th>SEC</th>
<th>Jiangsu Saite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiangnan</td>
<td>RMB/ton</td>
<td>77,4</td>
<td>69</td>
<td>80</td>
<td>62</td>
<td>89</td>
<td>87</td>
</tr>
<tr>
<td>Jiangbei</td>
<td>RMB/ton</td>
<td>80,2</td>
<td>85,8</td>
<td>93</td>
<td>66</td>
<td>76</td>
<td>80,2</td>
</tr>
<tr>
<td>Electricity</td>
<td>RMB/kWh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0,646</td>
<td></td>
</tr>
</tbody>
</table>

*info@cewep.eu  ▸ www.cewep.eu*
Electricity Revenue

• Gross electricity generation ranges from 280 to 330 kWh/ton waste.

• Electricity tariffs are high (8.3 € cent/kWh) but limited to 280 kWh/ton waste

• Lower IPP tariff applies > 280 kWh/ton waste
Revenue Analysis

- Electricity income is 70-85% of the revenue.
- Tipping fee is 15-30% of the revenue.
- Income is 1/3 of a similar European plant.
Tendencies in the Chinese market

- Short delivery times
  - Construction period: 18-24 months
  - Grate delivery time: 4-8 months

- More public protest (NIMBY)
CECIC

China – BAI GE HU (Shenzhen)

Client: CECIC
Capacity: 3 x 400 tonnes/day
Start-up: On hold for several years
Tendencies in the Chinese market

• More localisation & local competition
• Chinese technology suppliers becoming active overseas
• Chinese project developers show interest to go abroad
Tendencies in Chinese market

• IP protection has become a concern
IP protection in CHINA

- The tiles even show the KEPPEL SEGHERS TILE MODEL NUMBER!
The Hong Kong market

- HK generates 18,000t MSW daily, 13,300t (74%) are landfilled, the rest recycled.

- 3 operational landfills scheduled to close in the years to come.

- HK Govt plans 2 WTEs

- First WTE project in Hong Kong
  - Capacity first WTE plant: 2800 TPD
  - Offshore land reclamation + coastal protection works
  - Construction of marine berths