Waste to Energy in Urbanized Cities

Ms. Liao, Wan Tsun

Bureau of Energy
Ministry of Economic Affairs

March 21, 2019
Hong Kong, China
Waste-to-Energy in Chinese Taipei
RE Policies on WtE
Incentives
Concluding Remarks
Waste-to-Energy in Chinese Taipei (1/3)

- **Demographics**
  - Area: 36,000km²
  - Population: 23 millions
  - Population density: 649 people/km² (urbanization: 78%)

- **Solid waste generation and disposal**
  - Total solid waste: ~26 Mts/y
    (Including MSW: ~7.5 Mts/y)

*MSW: Municipal Solid Waste*
Waste-to-Energy in Chinese Taipei (2/3)

- One of the highest recycling rates in the world.
- Nearly 60% general waste disposal is recycled.
- 40% general waste goes to incinerators (624 MW, 3.4 TWh/y).

Source: Environmental Protection Administration, Chinese Taipei
Chinese Taipei relies on imports for 98.7% of its energy.

Bio-power target and planning

<table>
<thead>
<tr>
<th></th>
<th>2018.12: 726.6 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1.38% of total electricity installed capacity)</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
</tr>
<tr>
<td>• MSW/Industrial Waste: 629 MW</td>
<td>• MSW/Industrial Waste: 656 MW</td>
</tr>
<tr>
<td>Biomass</td>
<td></td>
</tr>
<tr>
<td>• Biogas: 20.2 MW</td>
<td>• Biogas: 34 MW</td>
</tr>
<tr>
<td></td>
<td>• Agricultural Waste: 77.3 MW</td>
</tr>
<tr>
<td></td>
<td>• Agricultural Waste: 123 MW</td>
</tr>
</tbody>
</table>

Strategy

- **bio-fuels** from agro-forestry wastes.
- **biomass** energy in base-load power plant and co-generation system.
- **biogas** from wastewater and animal manure
In July of 2009, Chinese Taipei promulgated the **Renewable Energy Development Act**.

The core strategy of the Act is a Feed-in-Tariff system.
Mechanism of Feed-in Tariffs

- A Committee is formed to decide the calculation formula and feed-in tariffs. Tariffs and formula should be reviewed annually, referring to technical advancement, cost variation, goal achievement status, etc.

- Solar PV tariff rates are set on date when generating equipment installations are completed. Other technologies have tariff rates set on the Power Purchasing Agreement (PPA) signing date.
  
  - tariffs applied for 20 years
  
  - PPA is a very important credit for banks to provide project financing
RE Policies on WtE (3/3)

➢ Feed-in Tariff

- For Refuse-derived fuel (RDF) : 3.8945 NTD/kWh (@2019)
- For biomass energy (biogas) : 5.0874 NTD/kWh (@2019)

1 USD = 30.85 NTD
MOEA announced the “Direction of Subsidizing Program for Biogas Power Generation System” on January 22, 2013

• Requirement:
  Installed capacity per application: 30 kW – 500 kW

• Subsidiary items:
  (1) 1 million NTD for dissemination
  (2) Installation subsidies up to 45,000 NTD per kW
  (3) 600,000 NTD for a 3-year demonstrative operation

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Capacity</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Pintung</td>
<td>195 kW</td>
<td>Operating</td>
</tr>
<tr>
<td></td>
<td>Chunghua</td>
<td>195 kW</td>
<td>Operating</td>
</tr>
<tr>
<td>2014</td>
<td>Pintung</td>
<td>65 kW</td>
<td>Operating</td>
</tr>
<tr>
<td>2015</td>
<td>Yunlin</td>
<td>495 kW</td>
<td>Construction</td>
</tr>
<tr>
<td>2016</td>
<td>Chiayi</td>
<td>130 kW</td>
<td>Testing</td>
</tr>
<tr>
<td></td>
<td>Chiayi</td>
<td>225 kW</td>
<td>Testing</td>
</tr>
<tr>
<td></td>
<td>Tainan</td>
<td>260 kW</td>
<td>Testing</td>
</tr>
<tr>
<td>2018</td>
<td>Pintung</td>
<td>325 kW</td>
<td>Testing</td>
</tr>
</tbody>
</table>

1 USD = 30.85 NTD
Incentives (2/5)

- **Biogas power promotion (by COA)**
  - According to “Directions of Electricity-Generating Reward and Subsidy for Pig Farms”, different reward schemes and subsidies for pig farms based on various scales are on going.
  - The COA has lowered the interest rate of **Policy-Oriented Special Agricultural Loan** to 1.04% while the loan limit increase from NT$10 million to NT$30 million.
  - In addition, expert counseling group was set up to visit livestock farms and solve relevant issues.

Source: Council of Agriculture (COA), Chinese Taipei
Biogas power promotion (by EPA)

- **Subsidies to Expand Use of Animal Wastes for Power Generation**
  - Encourage large livestock operations to collect manure from small scale livestock operations

Source: Environmental Protection Administration, Chinese Taipei
Diversified Waste Treatment Plan (by EPA)

- 24 incinerators, the first one was built in 1984, and 19 of them have been in operation for more than 15 years.
- the EPA provides economic incentives for waste treatment diversification
- Six focuses of the plan:
  - Diversified Waste Treatment Plan (by EPA)
  - Implementation period: 2017 – 2022 (6 years)
  - Work items:
    - Assessment and planning of 19 incinerators
    - Improvement projects for 11 incinerators
    - Rewards and subsidies during facility upgrade and garbage transfer coordination
    - Subsidies for garbage transfer during facility upgrade constructions
    - Subsidies for garbage transfer
    - Introduction of advanced and mature modularized technology based on regional needs
    - Supervision of each work item
    - Establishment of three bioenergy plants using kitchen waste

Source: Environmental Protection Administration, Chinese Taipei
Incentives (5/5)

Diversified Waste Treatment Plan (by EPA)

- Upgrading incinerators and related treatment facilities, and integrating overseas experiences
- Developing innovative technologies
- Gradually building a circular economy, diversified waste utilization technology

![Diversified Waste Treatment Strategy Flowchart](image-url)

Source: Environmental Protection Administration, Chinese Taipei
Concluding Remarks

- A transition from conventional energy systems to one based on renewable resources is necessary.
- Waste to energy is one of the most ecological way of turning residual waste into energy.
- Chinese Taipei’s effective waste management policy provides a good foundation for developing waste-to-energy.

Source: Bali Refuse Incineration Plant
Thank you for your attention.