About JFE

JFE’s WTE Technology
Group Structure

JFE Holdings (est. 2002)

- JFE Steel
  - Net Sales (million $): 25,000
  - Employees: 43,000

- JFE Shoji Trade
  - Net Sales (million $): 16,800
  - Employees: 1,300

- Japan Marine United
  - Net Sales (million $): 2,300
  - Employees: 6,500

- JFE Engineering
  - Net Sales (million $): 3,200
  - Employees: 8,500

Est. 1912
Est. 1951

NKK
Kawasaki Steel

JFE Engineering Corporation
Business Field

Industrial Machinery

Steel Structure

Environment

Energy

Net Sales (mil USD)
3,200

18%
9%
25%
48%
JFE’s Environmental Solutions

Municipal Solid Waste

Waste to Energy Plant

RDF Production Plant

RDF Power Plant

Sewage Treatment

Sewage Sludge Incinerator

Power Generation using Digestion Gas

Biomass

Biomass Power Plant

Recycling

Home appliances

PET Plastic bottles

Florescent lamps
JFE’s Track Record in Japan

EPC

WTE presence in Japan since 1968
171 plants (354 Furnaces)

O&M

Operation 68 Plants
Maintenance 115 Plants
JFE’s Track Record Overseas

230 Projects
About JFE

JFE’s WTE Technology
Waste in Japan & JFE’s Experience

JFE has kept developing its technology as the waste characteristics changed.

Yokohama (900tpd)  Fukuoka (600tpd)  Tokyo (600tpd)  Yokohama (1,200tpd)  Osaka (900tpd)

LHV of Waste (kJ/kg)

LHV : Lower Heating Value

<table>
<thead>
<tr>
<th>Year</th>
<th>Yokohama</th>
<th>Fukuoka</th>
<th>Tokyo</th>
<th>Osaka</th>
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<tbody>
<tr>
<td>1965</td>
<td>2000</td>
<td>4,000</td>
<td>6,000</td>
<td>8,000</td>
</tr>
<tr>
<td>1970</td>
<td>10,000</td>
<td>12,000</td>
<td>14,000</td>
<td>16,000</td>
</tr>
<tr>
<td>1975</td>
<td>16,000</td>
<td>18,000</td>
<td>20,000</td>
<td>22,000</td>
</tr>
<tr>
<td>1980</td>
<td>22,000</td>
<td>24,000</td>
<td>26,000</td>
<td>28,000</td>
</tr>
<tr>
<td>1985</td>
<td>28,000</td>
<td>30,000</td>
<td>32,000</td>
<td>34,000</td>
</tr>
<tr>
<td>1990</td>
<td>34,000</td>
<td>36,000</td>
<td>38,000</td>
<td>40,000</td>
</tr>
<tr>
<td>1995</td>
<td>40,000</td>
<td>42,000</td>
<td>44,000</td>
<td>46,000</td>
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<tr>
<td>2000</td>
<td>46,000</td>
<td>48,000</td>
<td>50,000</td>
<td>52,000</td>
</tr>
<tr>
<td>2005</td>
<td>52,000</td>
<td>54,000</td>
<td>56,000</td>
<td>58,000</td>
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LHV of MSW in:  Design condition
- max
- average
- minimum

JFE Engineering Corporation
Typical Process Flow of WtE Plant
Furnace Profile

- Waste
- Hopper
- Chute
- Furnace
- Waste feeder
- Exhaust gas
- Boiler
- Intermediate ceiling
- High temperature Air nozzle
- Bottom ash

JFE Engineering Corporation
2-Way Flue Gas Furnace

**Secondary Combustion Zone**

For unburned gas: Oxidation reaction

$$2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$$

For combustion gas: Reduction reaction

$$\text{NOx} + \text{NH}_3 \rightarrow \text{N}_2 + \text{H}_2\text{O}$$

**Complete Combustion Achieved**

- **Unburned gas:** CO, H\(_2\), NH\(_3\)
- **Combusted gas:** O\(_2\), NO\(_x\), CO\(_2\)

**Intermediate ceiling**

**Drying Zone**

**Combustion and post-combustion Zone**
Stable Combustion with Low Excess Air

Blowing high-temperature air forms stable combustion region.

Thermal decomposition is accelerated.

Stable combustion is achieved even with low excess air ratio.

Low NOx, CO, DXN
JFE Hyper Grate System

- Minimized ash drop between grates
- High-Speed Air Flow minimizes dropping of molten aluminum.
- High pressure drop at grate enables uniform air flow throughout the entire grate

**Movable Grate**

**Fixed Grate**

**Water-cooling Grate**

**Air Injection Port**

**Combustion Air**
Stoker Furnace (Fujimi, TOKYO)

**Completion**  
March 2013

**Capacity**  
288 ton/day (144TPD × 2 lines)

**Power Gen.**  
9.7MW

**Flue gas treat.**  
Gas cooling tower, NaOH injection system, dry-type flue gas treatment system, bag filter, deNOx reactor

**Ignition Loss of Bottom Ash**  
≤3%

### Design calorific value of waste

<table>
<thead>
<tr>
<th></th>
<th>Min. LHV</th>
<th>Ave. LHV</th>
<th>Max. LHV</th>
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<tbody>
<tr>
<td></td>
<td>5,850kJ/kg</td>
<td>9,610kJ/kg</td>
<td>13,380kJ/kg</td>
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<tr>
<td></td>
<td>1,400kcal/kg</td>
<td>2,300kcal/kg</td>
<td>3,200kcal/kg</td>
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</table>

### Emission Performance

<table>
<thead>
<tr>
<th></th>
<th>Regulatory Standards</th>
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</thead>
<tbody>
<tr>
<td>Dust &amp; Fly Ash</td>
<td>&lt;0.001g/Nm³</td>
</tr>
<tr>
<td>SOx</td>
<td>Ave. 2.25ppm</td>
</tr>
<tr>
<td>NOx</td>
<td>Ave. 21ppm</td>
</tr>
<tr>
<td>HCl</td>
<td>Ave. 1.4ppm</td>
</tr>
<tr>
<td>DXN</td>
<td>0.000014ng-0.00014ng-TEQ/Nm³</td>
</tr>
<tr>
<td>Hg</td>
<td>&lt;0.005mg/Nm³</td>
</tr>
</tbody>
</table>

### Entrance Weighing Bridge

### Waste Crane Control Room

### Waste Pit
Thank you for your kind attention.