Generating waste is not an art, recovering its energy and resources is.

Global Use and Future Prospects of Waste-to-Energy Technologies
Contents

• Introduction
• WTE situation / market tendencies
  - Global
  - Europe
  - Asia
• MARTIN technologies
• Summary
MARTIN GmbH

- MARTIN is an engineering company (Munich, Germany)
- MARTIN does not operate its own workshops
- MARTIN is highly specialised in waste incineration
- MARTIN acts as
  - General contractor
  - Consortium leader
  - Contractor for stoker / boiler units
  - Engineering provider for cooperation partners
  - Engineering provider for licensing partners
- MARTIN is active worldwide
MARTIN technology – combustion systems

- Reverse-acting grate
- Horizontal grate
- SITY 2000
Cooperation partners / licensing partners

**CNIM**
Constructions Industrielles
de la Méditerranée
Paris and La Seyne-sur Mer
FRANCE

**MITSUBISHI HEAVY INDUSTRIES, LTD.**
Mitsubishi Heavy Industries, Ltd.
Tokyo and Yokohama
JAPAN

**COVANTA ENERGY**
Fairfield, New Jersey
USA

**MES**
Martin Engineering Systems, Ltd.
London
GREAT BRITAIN

**CHONGQING**
Chongqing Luneng Environment Co.
Chongqing
CHINA

**SHI**
Sumitomo Heavy Industries, Ltd.
Tokyo
JAPAN
MARTIN – plants in 26 countries worldwide

**North America** in 2 countries
- 32 plants
- 73 lines
- 30,771 Mg/d capacity

**Europe** in 16 countries
- 199 plants
- 332 lines
- 101,504 Mg/d capacity

**Asia** in 7 countries
- 113 plants
- 260 lines
- 61,902 Mg/d capacity

**South America** in 1 country
- 2 plants
- 4 lines
- 600 Mg/d capacity

**Total**
- 346 Plants
- 669 Lines
- 194,778 Mg/d Capacity

Global market share ≈ 33%

Status: 8 December 2006
Main Competitors in the WTE market

- FISIA Babcock Environment
- Lentjes (sold to A-Tec)
- Martin - ”Family”
- Von Roll (AE+E / A-Tec)
- Foster Wheeler (FB only)
- KAB - Takuma
- Keppel Seghers
- Litwin
- Oschatz
- Stiefel
- Termomeccanica (Kawasaki grate)
- Tiru (France only, Laurent Bouillet system)
- Vinci (France only, Stiefel grate)
- Vølund (mainly Scandinavia)
- Worldwide Power Systems (Koch grate)

15 Competitors

4 competitors with strong presence  11 competitors with occasional presence
Global WTE situation

- Market volume is growing in Europe and Asia
- Minor activities in USA
- South and Middle-American countries show increasing interest in WTE / financing unclear
- No WTE activities in Africa and Australia
- Leading technologies are grate-based systems
- NIMBY and NIMTO effects
WTE market tendencies in Europe

- Market volume is growing in most European countries
- European directives for waste treatment support WTE
- Landfill taxes in several countries
- In some countries subsidies for electricity from renewable waste fractions
- Market is clearly dominated by grate-based systems
- Gasification and pyrolysis systems failed
- Fluidised bed systems are used only in few cases for special wastes or waste fractions
- MBT / Co-combustion (RDF) are still in discussion
Energy efficiency in Europe

Premium for electricity from renewable waste components

• 80.0 €/MWh (variable) on the "green market" for 8 years in Italy
  e.g. ASM Brescia

• 14.5 €/MWh for 10 years if efficiency > 26% in the Netherlands (2003)
  e.g. AVI Amsterdam

• 23.4 €/MWh in Spain (Directive 1998)
  e.g. Bilbao (30% premium on the electricity price)
Market share of thermal treatment will increase due to
- Legislative regulations
- Lack of alternatives
- Increasing acceptance

Total yearly market volume will be > 3 billion EURO
- New capacities to be installed
- Increasing demand for replacement of existing facilities

Source: Vaccani, Zweig & Associates
**Price development 1995 – 200X**

*Central Europe (A, CH, D, NL, S)*

**Definition:**

\[
\text{total invest [Euro/ton/year]} = \frac{\text{[total plant invest]}}{\text{[total plant incineration capacity per year]}}
\]
WTE market tendencies in Asia

• Good market volumes in China, Japan, Korea and Taiwan
• Largest market still Japan
  - ≈ 80% grate-based plants, ≈ 20% fluidized bed plants
  - Incineration residues must be vitrified to meet regulations
• Biggest growth rate in China
• Singapore and Taiwan close to saturation
• Beginning of promising planning activities in Hong Kong, Malaysia and Thailand
• Other South-East Asian countries still „waiting“ (e.g. Indonesia, Philippines, …)
• No incineration projects in South-Asia (India, Pakistan, …)
Conversion technologies

Germany
• Large R&D programs in the 1990s
• Large scale reference plants of Siemens and Thermoselect systems
• All plants have been shut down due to inadequate performance (several billion Euro losses by industry)

Japan
• More then 90 plants in operation
• Poor efficiency with respect to cost, energy and availability
• New technologies (gasification, pyrolysis) show significant deficiencies in operational behavior
Thermal treatment of waste (WTE, EfW)

- Reduction of weight / volume of waste
- Concentration of pollutants
- Reduction of climate gas emissions
  Closing of landfill / biogenic part 50 - 60%
- Use of energy / protection of resources
  Electricity / process steam / district heating
- Production of secondary raw material
  Quality of residues / metals

Component of sustainable waste management

“Waste as a Resource“
**Discussion of technologies**

- **Conversion**
  - 350 kWh/t \((\eta = 13\%)\)
  - Inert ash
  - 5 µg/t dioxin output

- **SYNCOM-Plus**
  - 500 kWh/t \((\eta = 18\%)\)
  - Inert ash
  - 5 µg/t dioxin output

- **MBT/Co-combustion**
  - 250 kWh/t \((\eta = 8\%)\)
  - Pollutant in product
  - 50 µg/t dioxin output

- **EfW (as BAT)**
  - 500 kWh/t \((\eta = 18\%)\)
  - Non hazardous ash
  - 50 µg/t dioxin output

- **High efficiency EfW**
  - 700 kWh/t \((\eta = 25\%)\)
  - Non hazardous ash
  - 50 µg/t dioxin output

**Process**
- Net power output
- Product quality
- Total dioxin output

**Landfilling**
- 0 kWh/t \((\eta = 0\%)\)
- Non hazardous waste
- 50 µg/t dioxin output

**Energy**
MARTIN technology – response to the market

Combustion
- Infrared camera
- Advanced combustion control system
- SYNCOM
- NO_x reduction

Energy efficiency
- New plant concepts
- Wall superheater
- Corrosion research

Residues
- SYNCOM-Plus
- Dry ash discharge
- Treatment of fly ash
Evolution of energy recovery in WTE plants

Sao Paulo 1959

Toulon 1984 / 1993
Power (40 bar / 400 °C)
Heat

Brescia 1998 / 2004
Power (61 bar / 450 °C)
Heat

Bilbao 2004
Power (100 bar / 540 °C)

Amsterdam 1992 / 2007
Power (135 bar / 440 °C)
Heat

Malmö 2003 / 2008
Power (40 bar / 400 °C)
Heat (flue gas condensation)
Efficiency – optimized conventional type
Brescia concept

- low excess air ratio
- cooling of flue gases to 130°C
- high efficiency equipment, e.g. variable-frequency motor drives
- high steam pressure and temperature: 60 bar / 450°C

Standard 18 %  Net efficiency of 24 % (electrical)
Efficiency – intermediate superheating
Amsterdam concept

135 bar 335°C
130 bar 440°C
14 bar 13 bar 190°C 320°C
0.03 bar 25°C

Superheater
Reheater

Standard 18 %
Net efficiency of 30 %
(electrical)
DIOXIN DESTRUCTION

ENERGY RECOVERY

FLUE GAS CLEANING

FLUE GAS RECOVERY

INTERING OF BOTTOM ASH

Bottom ash recirculation

Increase in fuel bed temperature

Oxygen enrichment

Air preheater

Wet-mechanical treatment of bottom ash

Fuel bed temperature > 1150 °C

Flue gas flow reduced by 35 %

Fly ash recirculation

IR camera

Coke or activated carbon

Flue gas recirculation

Residual waste

Residual waste

Boiler

SINTERING OF BOTTOM ASH

IR camera

IR camera

Granulate

Metals

Fly ash

Residues

REUSABLE PRODUCTS

Loss on ignition < 0.1 %

Lead leaching < 0.01 mg/l

< 0.1 %

< 0.01 mg/l

< 0.1 %

< 0.01 mg/l
MARTIN technology – SYNCOM-Plus

WTE Facility Arnoldstein, Austria

Pilot plant SYNCOM-Plus
MARTIN technology – SYNCOM-Plus

Fraction < 3 mm
Granulate > 3 mm
Recirculation
Recovery

SYNCOM bottom ash

Sludge

18.05.2007
NAWTEC 15
May 21-23, 2007 – Miami, FL
MARTIN technology – R&D

- High-temperature anemometer
- Suction pyrometer
- IR camera
- Ball instrument
- Insertable thermocouples
- Temperature probes

Measurements
MARTIN technology – R&D

Eco-efficiency

treatment or disposal of waste

Ecotoxicity

Numeric modeling

• CFD
• waste-bed modeling
Summary

- Restrictions and regulations for disposal and treatment of waste in numerous countries
- Leading technologies in WTE (EfW) are grate-based systems
- SYNCOM-Plus offers similar advantages to those of conversion technologies
  - Ash quality / metal recovery / dioxin output
  - Additional advantages
    - Energy recovery / availability / cost
- Climate change debate and premiums for electricity generated by waste will lead to increased efficiency requirements for renewable energy generated from waste (heat / power)
- MARTIN is currently working on further projects
Contacts

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