We are all making efforts to deal responsibly with our resources and with nature. Much has already been achieved in this respect.
1. Company and Plant References
2. Technologies
3. Summary
1. Company and Plant References
Lentjes?

A few words about the company ...
Lentjes GmbH

- Lentjes is a process lead international EPC turnkey contractor with a worldwide network in industrially active markets
- Lentjes is a pure engineering company with in-house proprietary technologies and processes for EfW plants (grate systems, steam generators, FGC systems)
- Over 80 contracts in the waste to energy sector since 1990
- Wide international experience
- Involvement in early stage regarding planning questions
- Local presence in key markets ensures deliverability
Turnkey EPC Expertise in

- Engineering (for all combustion systems, boilers, FGC processes, civils, water-steam-cycle, electrical, I&C, etc.)
- Procurement / International Sourcing
- Construction
- Project Management
- Quality Assurance / Health & Safety
- Construction Management
- Training, Commissioning, Performance Testing
GEA Group Aktiengesellschaft

Turnover €4.5 billion
Employees 17,500

Customised Systems
- Refrigeration
- Air Treatment

Process Equipment
- Mechanical Separation
- Dairy Farm Systems
- Process Equipment

Process Engineering
- Process Equipment
- Energy Technology

Plants
- Lentjes GmbH
  Turnover ~ €350 m
  350 employees

- Lurgi AG
- Zimmer AG
- Lurgi Bischoff GmbH
Latest News ....

- GEA has decided to concentrate on the component business, thus the Plant Engineering Division has been sold.
- Lentjes has recently found new owner in ATEC Industries.
- ATEC Industries will continue and strengthen all former Lentjes’ activities in the future.
- Lentjes will remain a strong and reliable partner in the ‘Energy from Waste’ business.
Headquarters Ratingen / Germany
Lentjes Portfolio

Energy Division
- Fossil Fired Power Plants
- Combined Cycle Power Plants
- Flue Gas Desulphurisation

Environment Division
- Hazardous Waste Incineration
- Biomass to Energy
- Sewage Sludge Incineration
- Energy from Waste
# Lentjes Product Portfolio

## Energy Division
- **Fossil Fired Power Plants**
  - Circulating Fluidised Bed
  - Combined Cycle Power Plants
  - Co-Generation and Industrial Power Plants

## Environment Division
- **Flue Gas Cleaning Power Plants**
  - Desulphurisation
    - Wet - FGD
    - Seawater - FGD
    - CFB - FGD
    - Ammonia - FGD
  - Denitrification
    - SCR - Technology

## Energy from Waste Plants
- **Treatment Plants for Industrial Waste/Residues**
  - Sewage Sludge
  - Rotary Kiln
  - Fluidised Bed
  - Flue Gas Cleaning

## Biomass to Energy Plants
- **Energy from Waste Plants**
  - Grate Systems
  - Circulating Fluidised Bed
  - ROWITEC®
  - Flue Gas Cleaning

## Flue Gas Cleaning
- **Biomass to Energy Plants**
  - Circulating Fluidised Bed
  - Grate Systems
  - Flue Gas Cleaning
<table>
<thead>
<tr>
<th>Technologies of Energy and Environment Divisions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
</tr>
<tr>
<td>CCPP</td>
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<tr>
<td>CFB</td>
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<tr>
<td>Flue Gas Desulphurisation</td>
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<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>Energy-from-Waste and Biomass Plants</td>
</tr>
<tr>
<td>Sewage Sludge Incineration</td>
</tr>
<tr>
<td>Hazardous Waste Incineration</td>
</tr>
</tbody>
</table>
GAVI Wijster / NL, Water cooled grate
3 x 20 t/h

Taoyuan / ROC, Roller Grate
2 x 28 t/h
Madrid / E, ROWITEC
3 x 9 t/h

Sleco / B, ROWITEC
3 x 20.8 t/h
Lenzing / D, CFB
110 MW\textsubscript{th}

Premnitz / D, CFB
60 MW\textsubscript{th}
Ebenhausen / D
2 x 50,000 t/a

Bayer AG Dormagen / D
45,000 t/a
Dordrecht / NL
3 x 12 t/h, 1 x 24 t/h

Crossness / UK
2 x 3,5 t/d, 5,2 MWel
SITA Kirklees, Huddersfield / UK
1 x 17 t/h

Shell Green, Manchester / UK
1 x 5.7 t/d Extension
Target Price Contract Award 2005
WRG Allington, Kent / UK
3 x 21.4 t/h
Colleferro / I

Madeira / P

Wuppertal / D

Budapest / H
### Recent Plant References Energy-from-Waste

<table>
<thead>
<tr>
<th>Start-up</th>
<th>Plant</th>
<th>Grate System</th>
<th>Throughput LHV (kJ/kg)</th>
<th>Waste</th>
<th>FGC System</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Taoyuan South / ROC</td>
<td>Roller Grate</td>
<td>2 x 675 t/d</td>
<td>9,600</td>
<td>MSW</td>
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<tr>
<td>2002</td>
<td>Kirklees / UK</td>
<td>Recipr. Grate</td>
<td>1 x 410 t/d</td>
<td>9,200</td>
<td>MSW</td>
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<tr>
<td>2002</td>
<td>Madeira / P</td>
<td>Roller Grate</td>
<td>2 x 192 t/d</td>
<td>7,800</td>
<td>MSW</td>
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<tr>
<td>2002</td>
<td>Terni / I</td>
<td>Reci. Grate w/c</td>
<td>1 x 300 t/d</td>
<td>15,000</td>
<td>SRF</td>
</tr>
<tr>
<td>2002</td>
<td>San Vittore / I</td>
<td>Reci. Grate w/c</td>
<td>1 x 300 t/d</td>
<td>15,000</td>
<td>SRF</td>
</tr>
<tr>
<td>2002</td>
<td>Colleferro I+II / I</td>
<td>Reci. Grate w/c</td>
<td>2 x 300 t/d</td>
<td>15,000</td>
<td>SRF</td>
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<tr>
<td>2002</td>
<td>Premnitz / D</td>
<td>CFB</td>
<td>1 x 60 MW&lt;sub&gt;th&lt;/sub&gt;</td>
<td>14,000</td>
<td>SRF</td>
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<tr>
<td>2003</td>
<td>Powergen / UK</td>
<td>FB</td>
<td>1 x 530 t/d</td>
<td>5,200</td>
<td>Paper Sludge</td>
</tr>
<tr>
<td>2003</td>
<td>Strongoli / I</td>
<td>CFB</td>
<td>2 x 20 MW&lt;sub&gt;el&lt;/sub&gt;</td>
<td>11,100</td>
<td>Biomass</td>
</tr>
<tr>
<td>2004</td>
<td>Budapest / H</td>
<td>Roller Grate</td>
<td>4 x 360 t/d</td>
<td>8,500</td>
<td>MSW</td>
</tr>
<tr>
<td>2005</td>
<td>Cantabria / E</td>
<td>Roller Grate</td>
<td>1 x 288 t/d</td>
<td>11,720</td>
<td>MSW</td>
</tr>
<tr>
<td>2006</td>
<td>Sleco / B</td>
<td>ROWITEC</td>
<td>3 x 495 t/d</td>
<td>8,300</td>
<td>50 % SRF 50 % Sludge</td>
</tr>
<tr>
<td>2006</td>
<td>Allington / UK</td>
<td>ROWITEC</td>
<td>3 x 513 t/d</td>
<td>9,200</td>
<td>MSW</td>
</tr>
<tr>
<td>2006</td>
<td>Frankfurt / D</td>
<td>Recipr. Grate</td>
<td>4 x 480 t/d</td>
<td>10,300</td>
<td>MSW</td>
</tr>
<tr>
<td>2008</td>
<td>Casteltermini / I</td>
<td>Reci. Grate w/c</td>
<td>2 x 413 t/d</td>
<td>12,560</td>
<td>SRF</td>
</tr>
<tr>
<td>2008</td>
<td>Augusta / I</td>
<td>Reci. Grate w/c</td>
<td>3 x 413 t/d</td>
<td>12,560</td>
<td>SRF</td>
</tr>
<tr>
<td>2008</td>
<td>Palermo / I</td>
<td>Reci. Grate w/c</td>
<td>3 x 552 t/d</td>
<td>11,550</td>
<td>SRF</td>
</tr>
<tr>
<td>2008</td>
<td>Manchester / UK</td>
<td>FB</td>
<td>1 x 140 t/d</td>
<td>12,600 (DS)</td>
<td>Sludge</td>
</tr>
</tbody>
</table>
Plant References Energy-from-Waste

74 Lines in 43 Plants

equivalent to

1.107 tph or ~8.85 mio tpy
2. Technologies
# Lentjes’ Technologies Related to Waste Sector

## Furnace Types:
- Reciprocating Grate (air/water-cooled)
- Roller Grate
- Circulating Fluid Bed
- ROWITEC® Fluid Bed
- Fluidized Bed

## Heat Recovery Boilers:
- Horizontal / vertical multi pass systems
- Standard WTE parameters preferred

## Gas Cleaning:
- Conditioned Dry – CIRCOCLEAN®
- Semi Dry
- Wet Scrubbers
- SCR and SNCR
Grate Systems

Reciprocating Grate
Counter Reciprocating Grate

Application:
Incineration of MSW / SRF

Roller Grate

Application:
Incineration of MSW
Fluidised Bed Systems

ROWITEC®

Application:
Incineration of MSW / SRF + Sludge

CFB

Application:
Incineration of SRF
Typical Application Ranges of Technologies

- **Grate Firing**
  - Water cooled grate
  - Roller grate
  - Air cooled grate

- **Fluidized Bed Firing**
  - Circulating Fluidized Bed
  - Fluidized Bed ROWITEC®
  - Fluidized Bed for Sewage & Industrial Sludge

- LHV [MJ/kg] ranges:
  - Grate Firing: 14 to 18
  - Fluidized Bed Firing: 10 to 12

- Gross Heat Input [MW] ranges:
  - Grate Firing: 50 to 150
  - Fluidized Bed Firing: 50 to 150

- Fuel throughput [Mg/h] ranges:
  - Grate Firing: 40 to 50
  - Fluidized Bed Firing: 40 to 50

- Drying might be required.
Roller Grate
Roller Grate Section I
Roller Grate Section II
Roller Grate Side Wall
Grate Bar
Roller Grate Drives
Roller Grate Capability for High CV's

EfW Plant Wuppertal / D
Variation of Heating Values
- Roller Grate -

2002
2006
Average 2002 (11.8 MJ/kg)
Average 2006 (10.6 MJ/kg)
Combined Grate
Function of Grate Type 410 (Reciprocating)

Start Position
Moving rows

Middle Position

Final Position
Fixed rows
Function of Grate Type 510 (Counter Reciprocating)

Start Position

Middle Position

Final Position

counter moving rows

fixed rows

counter moving rows
Center Flow Combustion Chamber
Roller Grate / Reciprocating Grate

- Both meet all guarantees (burnout incl. siftings)
- Both have very good references
- Both present modern state-of-the-art design
- Roller Grate has lower energy use
- Roller Grate has less maintenance requirements
- Significant grate bar weight difference
- Roller Grate has a higher CV limit in standard form
- Geometry configuration is different (70 % difference in width has advantages for boiler design)
- Roller Grate has lower exchange rates
- Roller Grate applicable for both small and large units
ROWITEC® Fluidized Bed Firing
Process Principle

1. Waste Feeder
2. Revolving Fluidised Bed
3. Fluidising Air
4. Flue Gas
5. Deflector Plate
6. Non-combustibles Discharge Chute
7. Inclined Nozzle Plate
ROWITEC® Fluidized Bed

1. Flue gases to boiler
2. Freeboard burner
3. Secondary air inlet nozzles
4. 2. Screen
5. Sand valve
6. Waste Feeder
7. Bed Material (sand storage silo)
8. Bed preheat burner
9. Primary air supply
10. Non combustibles discharge screw conveyor
11. 1. Screen
12. Magnetic separator
13. Bucket elevator
14. Non combustibles discharge conveyor
ROWITEC® Fluidized Bed
Madrid Integrated Waste Processing Facility
ROWITEC® Fluidized Bed
Madrid Integrated Waste Processing Facility
ROWITEC® Fluidized Bed
Bed Nozzles and Deflector Plates
ROWITEC® Fluidized Bed
Bootom Ash after Ferrous Metals Separation
ROWITEC® Fluidized Bed
Ferrous Metals separated from Bottom Ash
ROWITEC® Fluidized Bed Residues in Botton Ash
ROWITEC® Fluidized Bed Firing

- Improved heat transfer through the use of a sand bed.
- Rapid, complete combustion in the fluidized bed with a short retention time.
- High flexibility with regard to variations in the composition of the refuse.
- Ease of control due to staged, targeted combustion air feeding.
- Reducing atmosphere in the bed zone, therefore substantially lower NO\textsubscript{x} levels in the combustor.
- Complete combustion: the residual carbon content of the bed ash and fly ash is usually less than 0.1 wt. %.
- No moving parts in the hot combustor area.
Combustion System / Steam Generator I
Combustion System / Steam Generator II
Combustion System / Steam Generator III
Combustion System / Steam Generator IV
Horizontal / Vertical Boilers

- Both meet all guarantees
- Both have very good references
- Both present modern state-of-the-art design
- Horizontal boiler has less steam consumption
- Vertical boiler results in lower invest cost
- Vertical boiler requires higher buildings
- Horizontal boiler requires more space
- General tendency:
  - Horizontal boilers for small units
  - Vertical boilers for large units
Flue Gas Treatment Processes

Process Types
Flue Gas Treatment downstream Waste Incineration Plants

Dry Processes
- NEUTREC
- Ca(OH)₂ based processes

Wet Scrubbing
- Spray scrubbers
- Packed columns scrubbers
- Multi stage scrubbers
- Wet electrostatic precipitators

Catalytic/Non-Catalytic Processes
- Activated carbon processes
- SCR-DeNOₓ and DeDIOₓ
- SNCR-denitrification

Process Recovering
- Gypsum recovery
- HCl-recovery
- Recovery of NaCl/CaCl₂

Semi-Dry Processes
- CIRCOCLEAN
- Spray absorption
- Dry conditioned processes

Combined Processes
- Effluent free processes by means of evaporation and/or recovery of valuables

Adsorption Processes
- Transport reactor
- Fixed bed adsorber
- CFB
Comparison of Flue Gas Treatment Systems

<table>
<thead>
<tr>
<th>Dry / Dry Conditioned Processes</th>
<th>Wet Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Low Investment Costs</td>
<td>+ High Removal Efficiency</td>
</tr>
<tr>
<td>+ Low Maintenance and Operational Costs</td>
<td>+ Minimised (Stoichiometric) Sorbent Consumption</td>
</tr>
<tr>
<td>+ Effluent Free</td>
<td>+ Minimised Residue Production</td>
</tr>
<tr>
<td>- Limited Removal Efficiency</td>
<td>+ Minimised Residue Disposal Costs</td>
</tr>
<tr>
<td>- High Sorbent Consumption</td>
<td>- High Investment Costs</td>
</tr>
<tr>
<td>- High Residue Production</td>
<td>- High Maintenance and Operational Costs</td>
</tr>
<tr>
<td>- High Residue Disposal Costs</td>
<td>- Possibly Waste Water Treatment required</td>
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</table>

Wet Processes
MHKW Frankfurt (Old Plant)
### MHKW Frankfurt
Comparison of Design Data

<table>
<thead>
<tr>
<th></th>
<th>Old Plant</th>
<th>New Plant</th>
</tr>
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<tbody>
<tr>
<td>Annual Capacity t/a</td>
<td>447.000</td>
<td>525.000</td>
</tr>
<tr>
<td>Number of Lines</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Capacity per Line t/h</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>LHV @ MCR MJ/kg</td>
<td>9,2</td>
<td>10,3 (8,0 – 14,0)</td>
</tr>
<tr>
<td>Steam Parameter °C/bar</td>
<td>500/60</td>
<td>500/60</td>
</tr>
<tr>
<td>Boiler Design</td>
<td>3-Pass + Horiz.</td>
<td>1-Pass + Horizontal</td>
</tr>
<tr>
<td>Flue Gas Cleaning System</td>
<td>Semidry, ESP, Fabric Filter</td>
<td>Cond. dry Circoclean with PAC</td>
</tr>
<tr>
<td>Emission Values</td>
<td>17. BlmSchV</td>
<td>17. BlmSchV</td>
</tr>
</tbody>
</table>
MHKW Frankfurt
Typical Operation Data (mg/m$_3$)

<table>
<thead>
<tr>
<th></th>
<th>Raw gas</th>
<th>Clean gas Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl</td>
<td>600 – 750</td>
<td>7,5</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>160 – 270</td>
<td>8,4</td>
</tr>
<tr>
<td>CO</td>
<td></td>
<td>8,6</td>
</tr>
<tr>
<td>C$_{ges}$</td>
<td></td>
<td>0,5</td>
</tr>
<tr>
<td>NO$_x$</td>
<td></td>
<td>180</td>
</tr>
<tr>
<td>Hg</td>
<td></td>
<td>0,002</td>
</tr>
<tr>
<td>Dust</td>
<td></td>
<td>0,5</td>
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</tbody>
</table>
MHKW Frankfurt
Impressions during the Erection I
MHWK Frankfurt
Impressions during the Erection II
MHKW Frankfurt
Impressions during the Erection III
MHKW Frankfurt
(New Plant)
Taoyuan South
Plant Location
### Technical Data

<table>
<thead>
<tr>
<th>Service Area</th>
<th>25 km Radius, Southern Taoyuan County (near International Airport), 950,000 Inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal / Commercial Waste</td>
<td>420,000 t/a</td>
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<tr>
<td>Waste Bunker Volume</td>
<td>12,000 m³</td>
</tr>
<tr>
<td>Waste Pre-treatment System</td>
<td>none</td>
</tr>
<tr>
<td>Incineration</td>
<td>2 x 28,125 t/h</td>
</tr>
<tr>
<td>Grate Type</td>
<td>Roller Grate</td>
</tr>
<tr>
<td>Heating Value Waste</td>
<td>5.9 – 13.4 MJ/kg (9.6)</td>
</tr>
<tr>
<td>Incineration Temperature</td>
<td>1100°C</td>
</tr>
<tr>
<td>Steam Generation per Boiler</td>
<td>85 t/h, 40 bar, 400°C</td>
</tr>
<tr>
<td>Power Generation</td>
<td>40 MWₐ, 4 MWₐth District Heat</td>
</tr>
<tr>
<td>Flue Gas Cleaning System</td>
<td>2 x 160,000 m³/h, Spray Dryer (Semi-dry) with Baghouse, Provisions for SNCR</td>
</tr>
<tr>
<td>Emission Limits</td>
<td>Acc. to Taiwan EPA</td>
</tr>
<tr>
<td>Land Required</td>
<td>200 m x 175 m</td>
</tr>
</tbody>
</table>
Taoyuan South
Flow Diagram

1. Waste Tipping
2. Incinerator with Steam Generator
3. Deslagging
4. Spray Absorber
5. Bag Filter
6. Residue Silos
7. Cement Silo
8. Solidification
9. Turbo Generator Set and Water / Steam - Cycle
Plant Model
Plant Impressions
Plant Impressions

Lentjes

[Images of various industrial settings and equipment]

70
Plant Impressions
Plant Impressions
## Taoyuan South Operation Data

<table>
<thead>
<tr>
<th>Year / Month</th>
<th>#1 Incinerator</th>
<th>#2 Incinerator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation hour</td>
<td>Treatment tonnage</td>
</tr>
<tr>
<td>200201</td>
<td>744</td>
<td>21147.07</td>
</tr>
<tr>
<td>200202</td>
<td>672</td>
<td>18720.49</td>
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<tr>
<td>200203</td>
<td>744</td>
<td>21048.29</td>
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<tr>
<td>200204</td>
<td>456</td>
<td>12275.28</td>
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<tr>
<td>200205</td>
<td>744</td>
<td>19431.81</td>
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<tr>
<td>200206</td>
<td>699</td>
<td>19021.61</td>
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<tr>
<td>200207</td>
<td>744</td>
<td>21378.9</td>
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<td>200208</td>
<td>744</td>
<td>20061.29</td>
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<tr>
<td>200209</td>
<td>720</td>
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<tr>
<td>200210</td>
<td>299</td>
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<td>200211</td>
<td>720</td>
<td>16812.76</td>
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<tr>
<td>200212</td>
<td>744</td>
<td>18965.85</td>
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<td><strong>Total</strong></td>
<td><strong>8030</strong></td>
<td><strong>215293.76</strong></td>
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<table>
<thead>
<tr>
<th>Year / Month</th>
<th>#1 Incinerator</th>
<th>#2 Incinerator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation hour</td>
<td>Treatment tonnage</td>
</tr>
<tr>
<td>200301</td>
<td>744</td>
<td>20211.92</td>
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<tr>
<td>200302</td>
<td>672</td>
<td>19461.47</td>
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<tr>
<td>200303</td>
<td>680</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>2096</strong></td>
<td><strong>39673.39</strong></td>
</tr>
</tbody>
</table>
3. Summary
Lithuania Projects

- Lithuania EfW facilities will require
  - Large Contractor with Parent Company Backing ✓
  - Long Term Commitment to European EfW Market ✓
  - Robust Guarantees ✓
  - Bankability ✓
Lithuania Projects

- Lentjes provides …
  - Type and range of technologies ✓
  - Ability to meet capacity range ✓
  - Experience and references in PL ✓
High level technologies for the incineration of waste are available and allow economic and efficient disposal concepts.

All technologies fulfil the requirements for

- large units
- high efficiency

A decision for a system must be taken on a project specific basis!

The aim must remain:

*Environmentally safe and reliable incineration of waste.*
Lentjes GmbH Forward Market Philosophy

- Build on sustained presence in key WTE markets
- Select target projects technically and commercially
- Maintain turnkey capability
- Longterm WTE experience with multiple references
- Continue to offer proven technology
- Maintain Lentjes’ reputation for quality process plants
- Increase market share in Waste to Energy markets
Win-Win-Position

Lithuania

- Requires waste management solutions incorporating steam/power experts

Lentjes GmbH

- Turnkey Contractor
- In House Chute to Stack Technologies
- Strong Market Presence
- Bankability
... is the worldwide experienced EPC General Contractor with proprietary technical solutions for solid and liquid, hazardous and non-hazardous waste incineration plants.
Thank you for your attention!

Gunnar Lischke
Sales Director
Lentjes

We have Technologies
We have Know-how
We have References