„Oczyszczanie spalin, AQCS, technologie odsiarczania i systemy odpylania“

Polsko-Niemiecka Izba Przemysłowo-Handlowa - Konferencja:

„Technologie ochrony powietrza i ochrony przed hałasem. Rynek polski i niemiecki.“

Kraków, 25.09.2018

Dipl.-Ing. Joachim Braasch
Sales Manager
Doosan Lentjes GmbH
Flue gas cleaning, AQCS, Desulphurisation Technology and Dust Removal Systems – for fossil-fired Power Plants and CHP Plants.

- Doosan Lentjes GmbH, a German Technology supplier for Dry FGD
- Circoclean® FGD Technology :
  - Basic Flow Sheet
  - Plant Design
  - Typical Layout & References
- Range of Application
- Doosan Lentjes’ Capabilities
- Customer Benefits
- Questions & Answers
## Part of the Doosan Group

<table>
<thead>
<tr>
<th>Doosan Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doosan Heavy Industries &amp; Construction</td>
</tr>
</tbody>
</table>

### Business Groups

<table>
<thead>
<tr>
<th>Casting &amp; Forging</th>
<th>Nuclear</th>
<th>Power Service</th>
<th>Turbine</th>
<th>EPC</th>
<th>Water</th>
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</thead>
</table>

### Turnover (2016) & Employees (2016)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 Billion €*</td>
<td>16,693</td>
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</tbody>
</table>

*Exchange rate from May 2017
Doosan Lentjes is the global Center of Competence for CFB, WtE and AQCS in DHI and has its own R&D center for these technologies.
Our Product Lines — CFB, WtE and AQCS

**CFB**
- Circulating Fluidised Bed
- **Top tier level CFB OEM technology**
- **References:** 113 units (22 GW_{th}, max. 330 MW_{e})

**WtE**
- Waste-to-Energy
- **Top tier WtE OEM technology**
- **References:** 77 units (9 mill t/a, max. 35 t/h)
- Chute-to-stack or full turnkey supply solutions

**AQCS**
- Air Quality Control Systems
- **Various AQCS OEM technologies**
- **References:**
  - Wet FGD: 196 units (71 GW_{e}, max. 1,000 MW_{e})
  - Seawater FGD: 15 units (9 GW_{e}, max. 700 MW_{e})
  - Circoclean® FGD / FGC: 90 units (13 GW_{e}, max. 305 MW_{e})
  - SCR DeNO_x
  - Fabric Filters and ESP
Circoclean® FGD / FGC Technology – Origin

<table>
<thead>
<tr>
<th>Year</th>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Doosan Lentjes GmbH</td>
</tr>
<tr>
<td>2007</td>
<td>AE&amp;E Lentjes GmbH</td>
</tr>
<tr>
<td>2004</td>
<td>Lentjes GmbH</td>
</tr>
<tr>
<td>2004</td>
<td>Lurgi Lentjes AG</td>
</tr>
<tr>
<td>2002</td>
<td>Lurgi Energie und Entsorgung GmbH</td>
</tr>
<tr>
<td>1998</td>
<td>Lurgi Lentjes Bischoff GmbH</td>
</tr>
<tr>
<td>1996</td>
<td>Lentjes Bischoff GmbH</td>
</tr>
<tr>
<td>1984</td>
<td>Gottfried Bischoff GmbH &amp; Co. KG</td>
</tr>
<tr>
<td>1910</td>
<td>Gottfried Bischoff GmbH &amp; Co. KG</td>
</tr>
</tbody>
</table>

1910 – Foundation

2002 – Acquisition by Lentjes

2004 – Acquisition by Lentjes

2007 – Acquisition by Doosan

1984 – Acquisition by Lentjes

1996 – Acquisition by Lentjes

2002 – Acquisition by Doosan

2007 – Acquisition by Doosan

2011 – Acquisition by Doosan
Circoclean® FGD – Basic Flow Sheet
Circoclean® FGD / FGC Plant Design

- Circoclean® Reactor (1)
- Filter (2)
- Venturi Nozzle (3)
Reactor Design

- Reactor (cylindrical part)
- Venturi
- Outlet connected to Filter
- Process Water
- Product Recirculation
- Hydrated Lime
- Raw Gas Inlet

Doosan Lentjes
Range of Application

- New-build and retrofit
- Power stations and waste-to-energy plants
- Size: 300 MW<sub>e</sub> and even larger
- Wide range of fuels: coal, lignite, heavy fuel oil, municipal and industrial waste
- SO<sub>2</sub>, SO<sub>3</sub>, HCl, HF removal efficiency of 99% and even greater
- Usage of hydrated lime as additive
- Hydration of burnt lime on site possible
- Usage of limestone in fuel, calcined in upstream CFB boiler
- Removal of PCDD, PCDF and heavy metals with optional activated carbon injection
Typical Layout

- FGD Clean Gas Duct (1)
- FGD Recirculation Duct (2)
- FGD Bypass (3)
- FGD Raw Gas Duct (4)
- Existing Flue Gas Duct (5)
Doosan Lentjes’ Capabilities

Circoclean® FGD / FGC Technology

- More than 30 years of experience
- Worldwide proven technology is own IP of Doosan Lentjes
- High number of references – 13 GWₑ in total
- Reactor and filter technology (FF or ESP) from one hand
- Engineering, procurement, construction (turnkey)
- After sales service

Filters

- More than 300 fabric filters built to date *
- High and low pressure pulse jet fabric filters available
- More than 600 electrostatic precipitators built to date *

*Doosan Lentjes in cooperation with Envirotex

Case Study: Frankfurt a.M. / Germany

Contract award: 2003
Project: Delivery of four new WtE process lines, also encompassing a Circoclean® FGC system
Main fuel: MSW
Flue gas flow (wet): 3 x 114,000 Nm³/h
## Circoclean® FGD Plant References

<table>
<thead>
<tr>
<th>Location</th>
<th>Customer</th>
<th>Capacity</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pomorzany, Poland</td>
<td>PGE GiEK Zespół Elektrowni Dolna Odra</td>
<td>2 x 156 MW&lt;sub&gt;th&lt;/sub&gt;</td>
<td>Coal</td>
</tr>
<tr>
<td>Iasi, Romania</td>
<td>Iasi Municipality</td>
<td>1 x 285 MW&lt;sub&gt;th&lt;/sub&gt;</td>
<td>Hard coal</td>
</tr>
<tr>
<td>Mejillones, Chile</td>
<td>AES / Empresa Eléctrica Cochrane</td>
<td>2 x 250 Mw&lt;sub&gt;e&lt;/sub&gt;</td>
<td>Hard coal</td>
</tr>
</tbody>
</table>
Customer Benefits

- Moderate process water consumption
- Small power consumption
- Small foot print
- No waste water – dry particles only
- High SO$_3$ removal
- No flue gas re-heating
- Reactor made of carbon steel
- Easy adoption to higher SO$_x$ removal
- Attractive investment costs

Case Study: Iaşi, Romania

Contract award: 2014
Project: Delivery of key
Circoclean® FGD technology
Main fuel: Lignite
Plant output: 1 x 50 MW$_e$
Flue gas flow (wet): 623,500 Nm$^3$/h
Thank you!

Dziękuję za uwagę

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dl.info@doosan.com