FLUE GAS CLEANING
WE ARE THE RIGHT TEAM FOR SPECIAL CHALLENGES!
Upgrades to existing flue gas cleaning systems and retrofits of state-of-the-art equipment for sulphur dioxide, nitric oxide, mercury and dust removal are our day-to-day business – and this is reflected in our extensive reference list and by the satisfaction of our customers.

OUR KNOWLEDGE AND EXPERIENCE HELP YOU TO MEET CURRENT ENVIRONMENTAL REQUIREMENTS IN THE MOST COST-EFFECTIVE MANNER!
RELY ON GOOD EXPERIENCES AND MEET YOUR EMISSION REQUIREMENTS
Protection of our natural resources for the sake of future generations motivates us to constantly improve our technical solutions to control the emission limits of industrial facilities. Furthermore, emission limit values for dust, NOx and SOx for such facilities are constantly being revised by legislation.

TURN OUR EXPERIENCE INTO YOUR ADVANTAGE!
CONTACT
Dr. Axel Thielmann
Department Manager Proposals Flue Gas Cleaning
axel.thielmann@steinmueller.com
+49 (0)2261 / 78950 - 145
REFERENCE CLIENT
Feasibility study for retrofit of an SCR plant,
Heide Refinery, Germany
Raffinerie Heide GmbH,
Hemmingsedt, Germany
Study for upgrade options of air pollution control equipment in answer to BREF 2017
ContourGlobal Maritsa East 3,
Sofia, Bulgaria
Feasibility study for co-firing of petcoke, 200 t/h,
Heavy Fuel Oil and Low-Pressure Gas, Shell Wesseling, Germany
Shell Deutschland Oil GmbH,
Wesseling, Germany
Engineering and supply of an SNCR test plant to optimize the existing SNCR, Cement Plant Rüdersdorf, Germany
CEMEX Zement GmbH,
Rüdersdorf, Germany
Concept design study: assessment, comparison and selection of feasible NOX reduction technologies and concept engineering for a total of 10 bituminous coal fired power stations, South Africa
Eskom Enterprises,
Johannesburg, South Africa
Supply and implementation of a new oil and gas firing system at a steam generator plus retrofit of a catalytic DeNOX system, 200 t/h, Heavy Fuel Oil and Low-Pressure Gas, Shell Wesseling, Germany
Shell Deutschland Oil GmbH,
Wesseling, Germany
Licence and know-how transfer agreement for catalytic DeNOX system, China
Guizhou XingYun Environment Protection Co. Ltd.,
Guiyang, P.R. of China
Owner’s engineering for 3 SCR installations, modification of 5 steam generators, 75 t/h, 110 t/h, 150 t/h, firing Refinery Residues, Oil and Gas, Mineral Oil Refinery Oberrhein (MIRO), Germany
MIRO Karlsruhe, Germany
Engineering and retrofit of an SCR-DeNOX plant, 200 t/h, Heavy Fuel Oil and Low-Pressure Gas, Shell Rheinland Refinery, Germany
Shell Deutschland Oil GmbH,
Wesseling, Germany
LEGEND
PS  Power Station  SCR  Selective Catalytic Reduction
PF  Pulverized Fuel  STP  Standard Temperature and Pressure
CHP  Combined Heat & Power Plant  HRSG  Heat Recovery Steam Generator
FGD  Flue Gas Desulphurization  CFB  Circulating Fluidized Bed
ESP  Electrostatic Precipitator

FLUE GAS CLEANING
NOX REDUCTION SYSTEMS

APPLICATION
Power Plants and Industrial Boilers
• Low NOx Burners (LNB)
• Selective catalytic reduction (SCR) with honeycomb catalyst with plate catalyst
• Selective non-catalytic reduction (SNCR) e.g. in the cement industry
Benefits
• Reduction of NOx and NH3 emissions
• Extension of fuel range
• High availability
• Increase of operational flexibility
• Reduced NH3 consumption

TECHNICAL DATA
Emissions:
• NOX < 50 mg/m³ (STP)
• NH3 slip < 1 mg/m³

FUEL TYPE
• Bituminous coal
• Heavy fuel oil & residues
• Waste/Sludge
• Lignite
• Biomass co-firing

SCOPE OF SUPPLY
• Consultancy
• Process engineering
• Mechanical design
• CFD simulations
• Supply & Installation
• Optimization between LNB and SCR / SNCR
• Adaptation of boiler and water-steam cycle
• Adaptation of heating surfaces
• Optimization of flue gas distribution and NH3 injection
• Commissioning
• Licensing

RETROFITTED SCR FOR LOW NOx EMISSIONS
## FLUE GAS CLEANING

### FLUE GAS DESULPHURIZATION SYSTEMS

**TRAY BASKET**

- Flexible Modular System for Retrofit
- Increase of Removal Efficiency
- Reduction of Power Consumption

### APPLICATION

- Power Plants and Industrial Boilers
  - Wet FGD (also with tray technology)
  - Spray dryer absorption system (SDA)
  - Circulating fluidized bed system (CFB-FGD)
  - Duct sorbent injection (DSI)

### Benefits

- Reduction of pollutant emissions (SO₂, SO₃, mercury, dust)
- Increase of operational flexibility
- Optimized consumption of limestone
- Optimized distribution of oxidation air
- Reduction of auxiliary energy consumption

### TECHNICAL DATA

- SO₂ < 130 mg/m³ (STP) corresponding to removal efficiencies > 99 %
- Dust < 3 mg/m³ (STP)
- Upgrade with neutral pressure drop design possible

### FUEL TYPE

- Bituminous Coal
- Lignite
- Biomass co-firing
- Waste/Sludge
- Oil

### SCOPE OF SUPPLY

- Retrofit, Revamping and New-Built FGDs
  - Consultancy [e.g. for BREF compliance]
  - Process engineering
  - CFD simulations
  - Mechanical design
  - Supply & Installation
  - Optimization concepts
  - Commissioning
  - Licensing

### REFERENCE LIST EXCERPT

<table>
<thead>
<tr>
<th>REFERENCE</th>
<th>CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering for optimization of absorber, 5.2 MWel, Sewage Sludge,</td>
<td>Hamburg Stadtentwässerung AöR, Hamburg,</td>
</tr>
<tr>
<td>Hamburg Wasser, Germany</td>
<td>Germany</td>
</tr>
<tr>
<td>Detail engineering and supply of 23 additional tray baskets, 480 MWel,</td>
<td>Grosskraftwerk Mannheim AG, Mannheim,</td>
</tr>
<tr>
<td>Bituminous Coal, Mannheim PS Unit 8, Germany</td>
<td>Germany</td>
</tr>
<tr>
<td>Engineering and supply of a tray level for wet FGD, 22 MWth,</td>
<td>AGR Betriebsführung GmbH, Herten, Germany</td>
</tr>
<tr>
<td>Herten Waste-to-energy plant Unit IM 1, Germany</td>
<td></td>
</tr>
<tr>
<td>Study of upgrade options for air pollution control equipment in</td>
<td>ContourGlobal Maritsa East 3, Sofia,</td>
</tr>
<tr>
<td>answer to BREF 2017</td>
<td>Bulgaria</td>
</tr>
<tr>
<td>Engineering for the conversion of absorber from lime to limestone,</td>
<td>Sudzucker Plant Brottewitz, Germany</td>
</tr>
<tr>
<td>35 t/h, Lignite, Plant Brottewitz, Germany</td>
<td></td>
</tr>
<tr>
<td>Licence for dry CFB-FGD technology, 6 x 686 MWel, Bituminous Coal,</td>
<td>Eskom Enterprises, Johannesburg, South</td>
</tr>
<tr>
<td>Kendal PS, South Africa</td>
<td>Africa</td>
</tr>
<tr>
<td>Retrofit of a tray for FGD scrubber upgrade, 2 x 110 MWel, Lignite,</td>
<td>Slovenske elektrarne a.s., Bratislava, Slovak Republic</td>
</tr>
<tr>
<td>Novaky PS, Slovakia</td>
<td></td>
</tr>
<tr>
<td>Feasibility study for the retrofit of a flue gas desulphurization plant,</td>
<td>International Paper Kwidzyn Sp. z.o.o.,</td>
</tr>
<tr>
<td>3 x 50 MWel, Bituminous Coal, International Paper Kwidzyn, Poland</td>
<td>Kwidzyn, Poland</td>
</tr>
<tr>
<td>Retrofit of a tray for FGD scrubber upgrade, 86 MWel, Lignite,</td>
<td>Mitteldeutsche Braunkohle-</td>
</tr>
<tr>
<td>Deuben PS, Germany</td>
<td>gesellschaft GmbH, Germany</td>
</tr>
<tr>
<td>Retrofit of a tray for FGD scrubber upgrade, 600 t/h, Fenne PS,</td>
<td>Steag AG Saar-Völklingen, Germany</td>
</tr>
<tr>
<td>Bituminous Coal, Völklingen, Germany</td>
<td></td>
</tr>
<tr>
<td>Engineering and key component supply for a Wet FGD, 150 MWel,</td>
<td>LAB GmbH, Germany for Electrocentrale</td>
</tr>
<tr>
<td>Lignite, Paroseni PS, Romania</td>
<td>Paroseni S.A., Romania</td>
</tr>
<tr>
<td>FGD Tender evaluation, 6 x 800 MWel, Bituminous Coal, Kusile PS,</td>
<td>Eskom Enterprises, Johannesburg, South</td>
</tr>
<tr>
<td>South Africa</td>
<td>Africa</td>
</tr>
</tbody>
</table>

### LEGEND

- PS: Power Station
- PF: Pulverized Fuel
- CHP: Combined Heat & Power Plant
- SCR: Selective Catalytic Reduction
- STP: Standard Temperature and Pressure
- HRSG: Heat Recovery Steam Generator
- FGD: Flue Gas Desulphurization
- CFB: Circulating Fluidized Bed
- ESP: Electrostatic Precipitator
**APPLICATION**
- Fields of application
  - Thermal power plants
  - Waste incineration plants
- Scope of application
  - Mercury balance assessments
  - Integrated engineering solutions for individual applications
- Benefits
  - Increase of operational flexibility
  - Reduction of mercury emissions
  - Proven and robust technologies

**AVAILABLE TECHNOLOGIES**
- Adsorption in the dust collector by adding (doped) activated carbon
- Separation in the flue gas desulphurization process
- Adding (doped) activated carbon
- Adding precipitating or complexing agent
- Separation at tail end
- Implementation of sorbent polymer catalyst (SPC)

**SCOPE OF SUPPLY**
- Consultancy and optimization concepts
- Process engineering
- Engineering, supply and installation of components, e.g. adsorbent storage and injection systems

---

**REFERENCE LIST EXCERPT**

<table>
<thead>
<tr>
<th>REFERENCE</th>
<th>CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording of mercury deposition in correlation to SO2 deposition. Assessment of approach and departure behaviour as well as localization of specific mercury emissions, Fenne PS, Germany</td>
<td>Fenne PS, Germany</td>
</tr>
<tr>
<td>Conversion of the neutralizing agent in the REA scrubber and evaluation of the degree of mercury removal, Brottewitz plant, Germany</td>
<td>Südzucker Brottewitz plant, Germany</td>
</tr>
<tr>
<td>Assessment of wet-chemical heavy metal precipitation and integration into the absorber water cycle, Mehrum PS, Germany</td>
<td>Mehrum PS, Germany</td>
</tr>
<tr>
<td>Optimization of wet flue gas cleaning for the reduction of heavy metal sludge while maintaining the production of salable gypsum, sewage sludge incineration, Vera Hamburg, Germany</td>
<td>Vera Hamburg, Germany</td>
</tr>
<tr>
<td>Optimizing wet flue gas cleaning, increasing SO2 capture, without reducing Hg deposition in a two-stage wet scrubber, Herten plant, Germany</td>
<td>RZR Herten, Germany</td>
</tr>
<tr>
<td>BREF impact study, assessment and concept development, etc. on mercury removal in the FGD Maritza East 3 PS, Bulgaria</td>
<td>Maritza East 3 PS, Bulgaria</td>
</tr>
<tr>
<td>Petcoke (co-)combustion study, taking into account the rise of various heavy metals, Shell Wesseling, Germany</td>
<td>Shell Wesseling, Germany</td>
</tr>
<tr>
<td>Offer activated carbon injection in front of E-filter for mercury adsorption, Schkopau PS, Germany</td>
<td>Schkopau PS, Germany</td>
</tr>
<tr>
<td>Engineering support for Hg balancing, 11 x 250 MWel, Lignite, Jänschwalde PS, Germany</td>
<td>Jänschwalde PS, Germany</td>
</tr>
</tbody>
</table>

---

**LEGEND**

- PS  Power Station
- PF  Pulverized Fuel
- CHP  Combined Heat & Power Plant
- SCR  Selective Catalytic Reduction
- STP  Standard Temperature and Pressure
- HRSG  Heat Recovery Steam Generator
- FGD  Flue Gas Desulphurization
- CFB  Circulating Fluidized Bed
- ESP  Electrostatic Precipitator
**APPLICATION**
- Power Plants and Industrial Boilers
  - Dry electrostatic precipitator
  - Fabric filters also in combination with dry FGD (CFB-FGD)
  - Wet electrostatic precipitator
- Benefits
  - Reduction of dust emissions
  - Extension of fuel range
  - Upgrade of ESPs within existing footprint and structure
  - Energy savings through optimized high voltage supply
  - High availability
  - Increase of operational flexibility

**TECHNICAL DATA**
- Emissions:
  - Dust < 8 mg/m³ (STP)
  - In combination with Wet FGD upgrades: Dust < 3 mg/m³ (STP)

**FUEL TYPE**
- Bituminous coal
- Lignite
- Biomass co-firing
- Waste/Sludge
- Oil

**SCOPE OF SUPPLY**
- Retrofit, Revamping and New-Built
- Consultancy (e.g. for BREF compliance)
- Process engineering
- Mechanical design
- CFD simulations of flue gas path and flow optimization
- Supply & installation
- Optimization concepts
- Commissioning
- Licensing

**REFERENCES**

<table>
<thead>
<tr>
<th>REFERENCE</th>
<th>CLIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study of upgrade options for dust removal system (ESP versus FGD tray) in answer to BREF 2017</td>
<td>SLOVNAFT, a.s., Bratislava, Slovak Republic</td>
</tr>
<tr>
<td>Study of upgrade options for air pollution control equipment in answer to BREF 2018</td>
<td>ContourGlobal Maritsa East 3, Sofia, Bulgaria</td>
</tr>
<tr>
<td>CFD calculations flow optimization, Milazzo Refinery, Italy</td>
<td>Raffineria di Milazzo S.C.p.A., Milazzo, Italy</td>
</tr>
<tr>
<td>Retrofit of TR sets and control equipment for electrostatic precipitator, 166,000 m³/h (STP), Milazzo Refinery, Italy</td>
<td>Raffineria di Milazzo S.C.p.A., Milazzo, Italy</td>
</tr>
<tr>
<td>Boiler and ESP design study and know-how transfer for 6 x 600 MWel, Bituminous Coal, Tutuka PS, South Africa</td>
<td>Eskom Enterprises, Johannesburg, South Africa</td>
</tr>
<tr>
<td>Rehabilitation and optimization of ESP, 610,000 m³/h (STP), Lignite, Govora PS, Romania</td>
<td>CET Govora, Râmnicu Vâlcea, Romania</td>
</tr>
<tr>
<td>Rehabilitation of electrostatic precipitator behind fluidized catalytic cracker plant (FCC), 166,000 m³/h (STP), Milazzo Refinery, Italy</td>
<td>Raffineria di Milazzo S.C.p.A., Milazzo, Italy</td>
</tr>
<tr>
<td>Rehabilitation of electrostatic precipitator behind fluidized catalytic cracker plant (FCC), 90,000 m³/h (STP), BP Refinery Gelsenkirchen, Germany</td>
<td>Ruhr Oel GmbH, Gelsenkirchen, Germany</td>
</tr>
<tr>
<td>Concept engineering study for the optimization of ESPs, 6 x 600 MWel, Bituminous Coal, Tutuka PS, South Africa</td>
<td>Eskom Enterprises, Johannesburg, South Africa</td>
</tr>
<tr>
<td>CFD flow simulation and optimization for ESP downstream pyrite roaster in sulphuric acid plant, 30,000 m³/h (STP), Haldor Topsoe Plant, Denmark</td>
<td>Ion Blast Ltd., Helsinki, Finland</td>
</tr>
<tr>
<td>CFD flow simulation for ESP, shale oil plant, 119,000 m³/h (STP), Eesti Energia Narva, Estonia</td>
<td>Ion Blast Ltd., Helsinki, Finland</td>
</tr>
</tbody>
</table>

**LEGEND**
- PS: Power Station
- PF: Pulverized Fuel
- CHP: Combined Heat & Power Plant
- SCR: Selective Catalytic Reduction
- STP: Standard Temperature and Pressure
- HRSG: Heat Recovery Steam Generator
- FGD: Flue Gas Desulphurization
- CFB: Circulating Fluidized Bed
- ESP: Electrostatic Precipitator
RELY ON GOOD EXPERIENCES

steinmüller engineering
The Engineers Company
RELY ON GOOD EXPERIENCES

YOU CAN COUNT ON US AS EXPERTS IN THE AREAS OF

- COMBUSTION SYSTEMS
- FLUE GAS CLEANING
- STEAM GENERATION

ALLOW US TO ASSIST YOU IN YOUR EFFORT TO MEET UP-TO-DATE ENVIRONMENTAL DEMANDS WHILE REMAINING ECONOMICALLY EFFICIENT!