
ANDRITZ
Air pollution control.
High-tech solutions are often based on simple ideas.
www.andritz.com

Clean environment
for a better tomorrow

ANDRITZ AG is a leading supplier of innovative air pollution control technologies. Our product range combines 30+ years' experience with the specific knowledge gained from hundreds of installations around the world. ANDRITZ AG is a partner you can rely on.

CONTENTS

▲ Lauta, Germany

Thanks to our wide portfolio of flue gas cleaning technologies and long experience engineering and executing projects, ANDRITZ AG can handle the challenges posed by your process. We are reliable and innovative – an ideal partner to help you meet your environmental and financial goals.

▲ Voerde, Germany

Air pollution control technology applications for

- Power stations
- Energy-from-Waste plants
- Biomass plants
- Industrial plants

Maintaining the energy efficiency of your processes, complying with the strictest licensing procedures, and developing tailor-made solutions for your plant are the cornerstones of our approach.

▲ Ruien, Belgium

Working hand in hand with the environment: Air pollution control

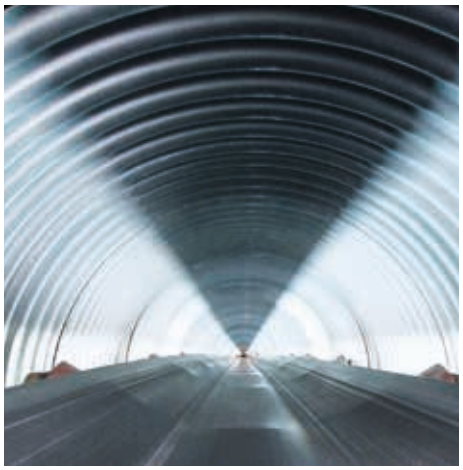
Clean air is the basis of a healthy life. Air pollution causes discomfort or harm to people and other living organisms. It is our mission to prevent air pollution from power generation and industrial processes.

Even with heavy subsidies and incentives, renewable and environmentally friendly energy sources will only meet part of the world's future demand for power. Continued reliance on thermal power stations is a given. With this reality, it is critical to make thermal power generation cleaner and more sustainable. It is our mission and target to reduce the air-borne pollutants and safely dispose of them.

ANDRITZ AG delivers environmentally friendly flue gas cleaning solutions, tailored to the needs of our clients and their operating environments, which result in significantly sustained emissions reduction.

We are an environmental technology pioneer with a history in air pollution control spanning 30+ years. Our products range from flue gas scrubbers for power stations to complex flue gas cleaning systems for Energy-from-Waste plants. With many reference projects in service, ANDRITZ AG is one of the leading companies in this field.

Cutting-edge engineering tools and global R&D collaboration with a network of recognized partners and universities lay the foundation for our work. Early identification of each client's needs help us make a long-term contribution to clean air and a clean environment.



▲ Gypsum conveyor belt

A product range for all requirements
From single systems to turnkey plants

Several concepts to choose from depending on the upstream processes and potential pollutants to be filtered out, including tailored solutions for industrial applications.

Depending on the upstream combustion of fossil fuels, biomass, waste, or industrial residues, there are different pollutants requiring special components to filter them out. The availability of flue gas cleaning (FGC) additives and residue disposal facilities also influences the concept chosen. In addition, different national and international laws for the achievement of emission thresholds must be considered.

Wet flue gas cleaning systems

ANDRITZ AG offers limestone flue gas desulphurization (FGD) scrubbers with high reliability and availability. We have enhanced this basic technology to a most modern cleaning technology (FGDplus).

Dry flue gas cleaning systems

Our dry flue gas cleaning system TurboSorp is a well proven one-step cleaning solution with very compact designs. We also build special lime or sodium bicarbonate dry sorption reactors for the adsorptive cleaning process.

SCR DeNOx systems

We utilize the Selective Catalytic Reduction (SCR) process technology for the denitrification of flue gas – both as high-dust and as tail-end configurations. Dioxins and furans can also be decomposed with the SCR tail-end configuration.

Combined/Multi-stage FGC systems

Having a complete product portfolio allows us to comply with the most difficult tasks in flue gas cleaning through the intelligent combination of our processes and technologies. We can successfully meet even the most stringent demands of our customers – such as high raw gas concentrations, minimum clean gas concentrations, or even zero emissions.

▲ Pfaffenau, Austria

Trbovlje, Slovenia ▼

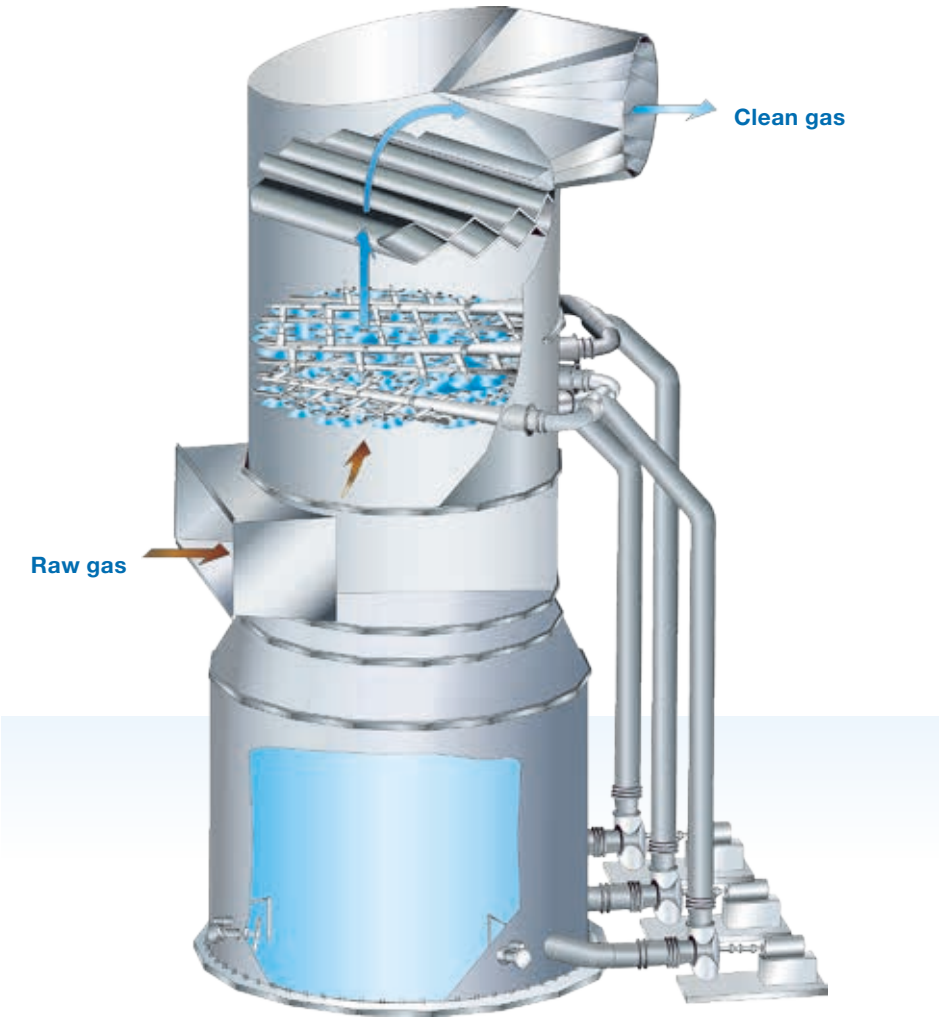
Highly efficient processes for low emissions: Wet flue gas cleaning systems

Limestone flue gas desulphurization (FGD) are well-proven and cost-effective. They have been in use in power stations since the 1970s. We have innovated a better scrubber design which stands out for its reliability and high availability. Plant economics have also been optimized, ensuring low capital and operating costs.

Limestone FGD: a new dimension

In international terms, ANDRITZ AG's Limestone FGD sets new standards. At the Neurath power plant (2 x 1100 MW), two of our scrubbers with a diameter of 23.6 m are being installed to accommodate a flue gas flow of 4.7 mio. m^3/h [stp, wet]. The engineering and construction of what is currently the world's largest scrubber is a tribute to the innovative engineering tools and on-site experience of the ANDRITZ AG team.

The unique scrubber design, in combination with the optimal application of the technology to match the needs of a customer represents our trademark. Technical and economic optimization ensures lower capital and operating costs.



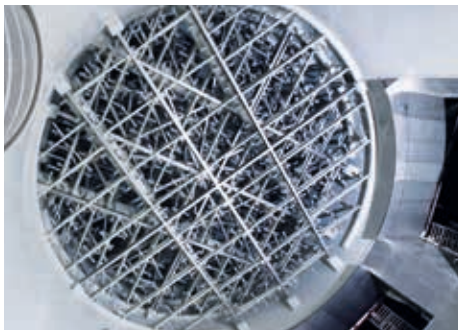
Wet limestone scrubbing process ▲

▲ Neurath, Germany

Limestone FGD: advanced scrubber design

The nucleus of our design is the scrubber, which is an open spraying tower that has been enhanced in recent years using computerized simulation techniques. We have been conducting intensive development work in this field since 1995 and today enjoy a leading position which not only allows us to simulate flow and temperature profiles, but also to calculate the distribution of SO_2 concentrations in the scrubber.

During comparisons of simulator data with actual plant measurements, the flow and temperature profiles have verified our design parameters. The result is a scrubber that is characterized by minimum dimensions, adaptable scrubber entry and exit geometry, and the optimum layout of the spray nozzles and spray banks. This results in a uniform SO_2 profile in combination with the highest possible superficial velocity in the scrubber – removing the most pollutants and utilizing the least power.



▲ Scrubber, Neurath, Germany

The scrubber also benefits from the use of the latest materials and construction methods. GRP absorbers and reinforced concrete absorbers with polypropylene linings are used in addition to the proven steel absorbers with a variety of inner linings or stainless steel.

Key features

- Outstanding for all fuels (lignite, hard coal, oil, biomass, waste)
- SO_2 removal > 99%
- Maximum HCl and HF removal levels
- Gypsum as a saleable end product
- Flue gas volume flows of up to 5,000,000 m^3/h [stp, wet] per scrubber
- Limestone as a favorably priced absorption agent
- Low operating costs and power consumption
- Open spray tower, low pressure loss
- Options for materials of construction (high alloy, carbon steel with rubber lining, concrete with PP-lining, glass fiber reinforced plastics)

Product innovations

FGDplus: A novel flue gas desulphurization scrubber system that maximizes SO_2 and dust removal while keeping energy inputs to a minimum. Bromium-based mercury removal: Simple, proven technology in operation at coal-fired power stations and Energy-from-Waste plants.

FGDplus: innovative scrubber

Starting with CFD modeling and lab investigations, ANDRITZ AG made fundamental changes to the conventional mass transfer concept for flue gas desulphurization scrubbers. Following prototyping and pilot plant work, we can now point to long-term operation at a demonstration plant under actual power station conditions.

FGDplus: design characteristics

The FGDplus uses a “tracked mass transfer” concept in the absorber tower to minimize mass transfer resistances and energy input. Existing open spray tower scrubbers can be retrofitted to a new level of performance with this innovation, with the spray levels modified. Depending on the application, this results in reduced power consumption and/or lower SO_2 emissions.

The extended FGDplus concept involves the integration of a wet electrostatic precipitator (WESP) with our scrubber system. This achieves the SO_2 dust (PM1.0) and aerosol separation efficiency necessary for zero emission power stations – a basic prerequisite for future post combustion carbon capture applications.

Bromine-based mercury removal

Mercury is a highly toxic heavy metal which is present in most types of coal (typically in the 0.2 mg/kg range, though much higher concentrations are not uncommon). Mercury is mainly released in its elemental form (metallic mercury) through combustion.

ANDRITZ AG licenses a technology for bromine-based mercury separation that achieves flue gas mercury removal rates of 90% and more. This is made possible by controlled oxidation of the mercury which is then scrubbed out of the flue gas.

Wet Scrubber made of Concrete/polypropylene applying slip form technique
◀ Lünen, Germany

FGDplus demonstration plant at RWE lignite power plant
◀ Niederaußem, Germany

Effective and compact – one-step solution

Dry flue gas cleaning systems

Our dry flue gas cleaning systems meet the requirements for complying with the world's strictest emissions legislation, the desire for low consumption of additives, the need for minimal residues, and the installation simplicity of a compact design.

TurboSorp

TurboSorp is the ideal solution for flue gas cleaning downstream of biomass incinerations, RDF-fired boilers, or Energy-from-Waste plants and other industrial applications.

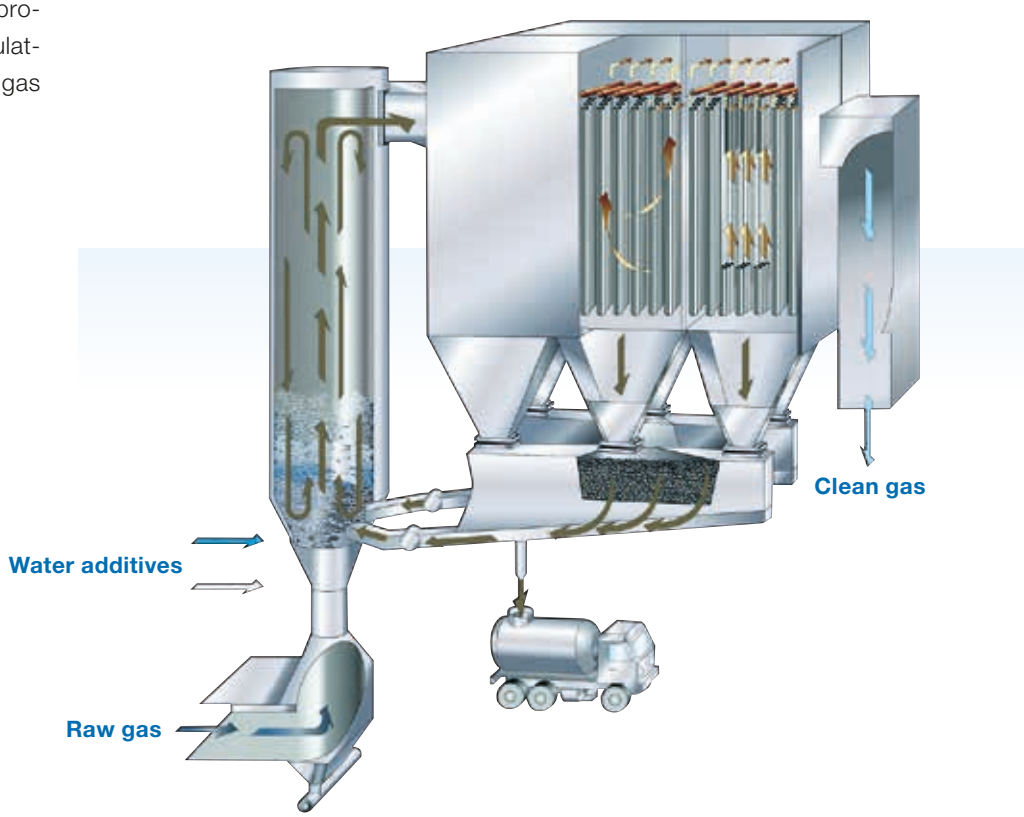
Turbo-CDS

Turbo-CDS is the right choice for flue gas cleaning downstream oil or coal-fired boilers.

Process

ANDRITZ AG's dry flue gas cleaning processes are based on well-proven circulating fluidized bed technology. The flue gas flows through a turboreactor from the bottom to the top and then enters a downstream particulate control device, which can be either a fabric filter or an electrostatic precipitator. Fly ash from incineration and fresh additives are dosed into the turboreactor, while a large part of the solid material from the reactor is fed back to the fluidized bed as recirculate. Water is also injected to lower the flue gas temperature and achieve higher separation performance.

If needed, activated carbon serves to provide excellent heavy metal and dioxin removal. As a result of advanced process management with regard to the operational temperature, solids recirculation, and the dosed additives, material consumption and the quantities of residue are kept to a minimum. The product of the process is a dry, powdery residue which – depending on its composition – can be landfilled or used as a filler (e.g. road construction) after stabilization.



Circulating Dry Scrubbing (CDS) process – TurboSorp ▲

◀ Moerdijk, Netherlands

Pratt, USA ▼

Low investment and maintenance cost

TurboSorp and Turbo-CDS systems are noteworthy for their compact designs. This allows for easier and lower cost installation in a plant. Fluidized bed technology does not employ rotating or wear parts, reducing the initial investment cost and the on-going maintenance costs. Due to the simplicity of the design of the system components, high levels of availability are typically achieved.

Dry sorption

In certain cases, especially for smaller plants and for optimized investments, a dry sorption process based on lime or sodium bicarbonate is an interesting alternative to CFB-based flue gas cleaning technology. The process features a reactor, where the dry powdered additive is injected and mixed with the flue gas, and a downstream fabric filter.

Sodium bicarbonate: for efficiency and low residue levels

The sodium bicarbonate process is used wherever residue quantities must be kept as small as possible. Due to the very high reactivity of sodium bicarbonate, only a small amount of it is required. The process is virtually independent of temperature and maximizes energy recovery.

Key features

- Proven technology with excellent references
- Removal of all pollutants in one step (dust, SO_2, SO_3, HCl, HF, dioxines, furanes, PCBs, heavy metals)
- Relatively low investment cost
- Compact design, easy retrofitting
- Simple aggregates, operation above dew point
- No corrosion, low maintenance
- High availability
- Low sorbent consumption due to recirculation
- High separation efficiency and low emissions
- Wastewater-free
- Compatible with low temperature SCR, no permanent reheating necessary

DeNOx plants
Selective Catalytic Reduction (SCR)

Technology for power stations, waste incineration, and industrial plants.

ANDRITZ AG was among the first companies in Europe to successfully employ SCR technology. The company now has numerous references in the DeNOx/SCR sector, which encompass a variety of applications. In addition to use in power plants (high dust configuration), we also have successfully employed SCR technology for waste incineration and other industrial processes.

We are able to specially select operational parameters and catalyst geometry and composition, thus ensuring optimum operation.

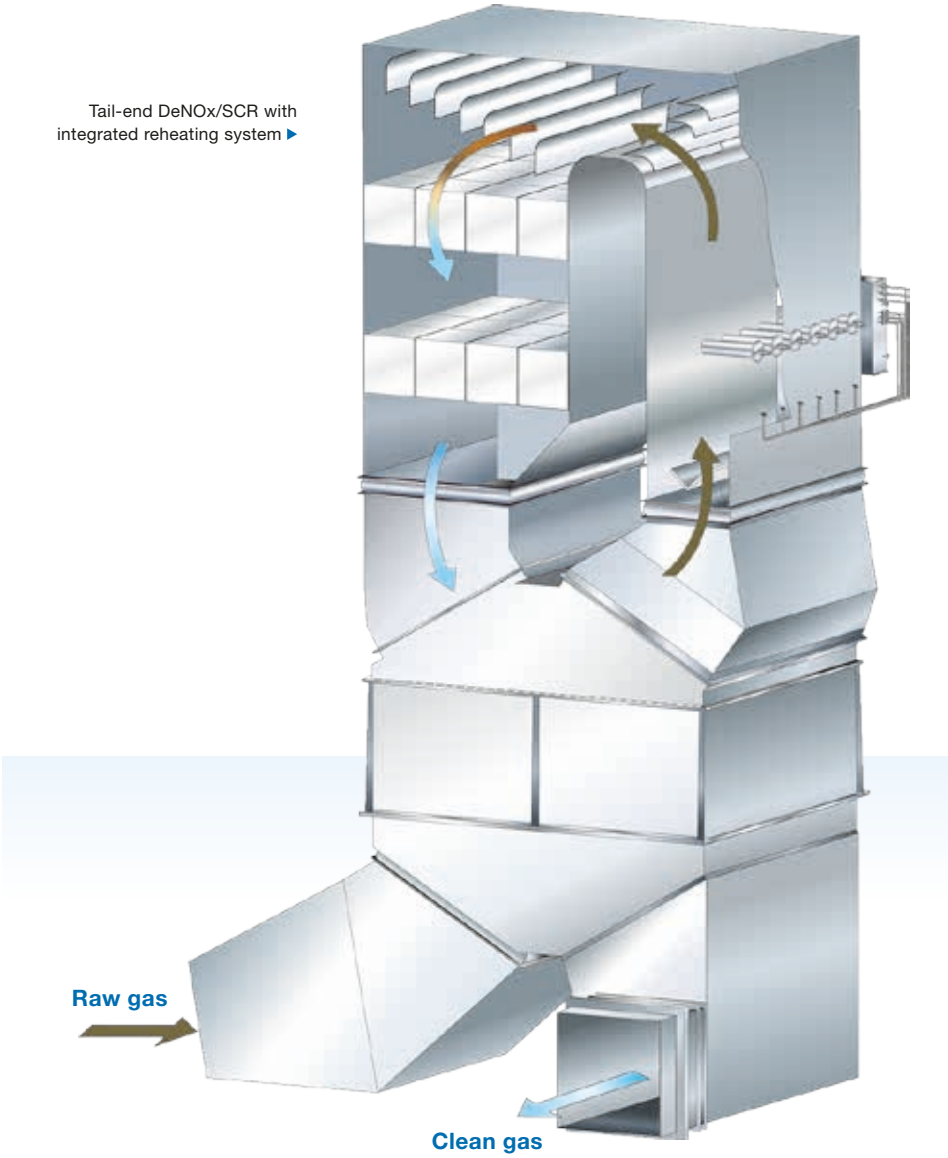
Our DeNOx/SCR systems are used in the following plants:

Power plants
- Gas-fired
- Oil-fired
- Coal-fired
- Biomass-fired

Waste incineration plants
- Household waste
- Hazardous waste
- Hospital waste

Industrial plants
- Steel industry
- Oil industry
- Pulp and paper industry

Tail-end DeNOx/SCR with integrated reheating system ▶



The location of the DeNOx/SCR system within the flue gas cleaning process depends on the type of fuel involved. Our tail-end configuration (see block flow diagram below) has proved to be highly effective in waste incineration and biomass-fired plants. The active centers of the catalyst are only harmed by a minimum of catalyst poisons, which results in a longer lifetime.

Due to the use of a reheating system, the investment and operating costs are higher for the tail-end configuration which is therefore mainly used in industrial applications.

The high dust configuration is preferred for power plants (coal, gas, oil), as the costs for reheating can be avoided. ANDRITZ AG has an extensive database concerning catalyst life for a variety of fuels. Consequently, we are able to optimize and minimize the catalyst volume for every application.

▲ VA Stahl, Austria

▼ Mellach, Austria

Compliance with lowest emission values

Multi-stage / Combined flue gas cleaning

ANDRITZ AG has the competence to combine and optimize systems for special requirements.

Current legislation regarding waste disposal and emissions levels required state-of-the-art flue gas cleaning systems. Selective pollutant removal is required, which not only aims to achieve minimum emissions in tandem with low operating costs, but also enables the recovery of recyclable by-products and a linked reduction in the volume of highly pollutant residues.

ANDRITZ AG is the perfect partner for tailored solutions meeting both environmental and procedural requirements. We accompany our clients through the whole investment process, beginning with project development through plant commissioning, and then service support for the life of the system.

Our flue gas cleaning systems are designed in modules. This helps us to configure and combine technologies in order to meet specific requirements:

- Dry flue gas cleaning (TurboSorp or Dry Sorption)
- DeNOx/SCR systems
- Multi-stage wet scrubbing
- Spray absorption

Mainz, Germany ▲

▲ Spittelau, Austria

▼ Rybnik, Poland

One-stop shopping

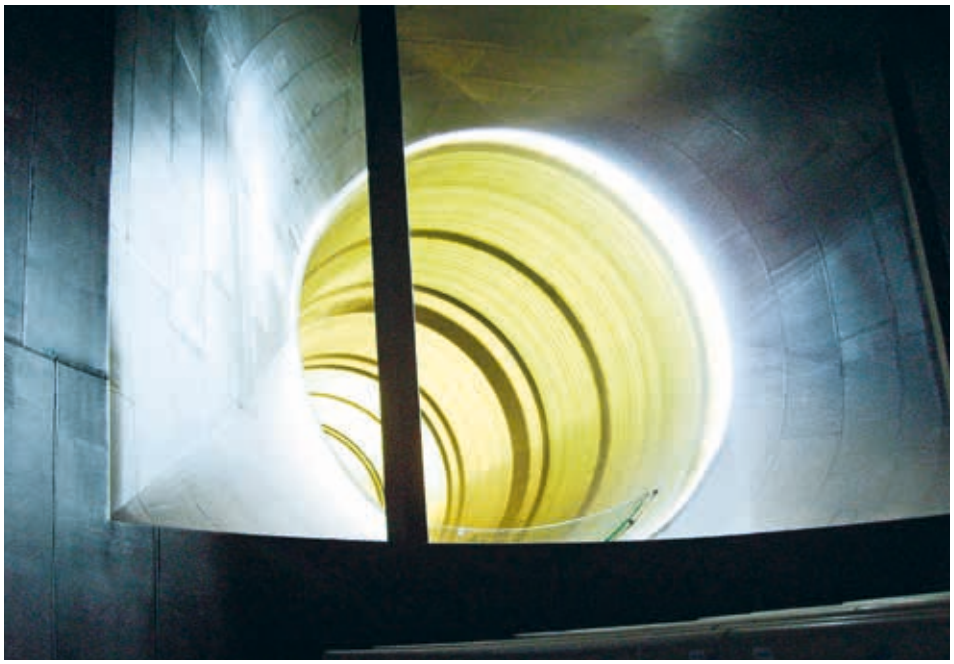
Overall plant competence – turnkey solutions

ANDRITZ AG offers equipment, systems, and turnkey solutions to meet the most demanding requirements for quality, efficiency, reliability, and sustainability. Our experience allows you to take advantage of integrated, customized solutions and expertise from a single source.

Based on 30+ years of experience in air pollution control, it is one of ANDRITZ AG's core competences to provide turnkey installations of flue gas cleaning plants.

These installations can be for new or retrofit situations. The international scope of our business has equipped us with the best design and project execution procedures to ensure that our installations are completed to our customers' satisfaction.

With turnkey supply from us, you can focus on the more important aspects of your core business, knowing that we will pay attention to the details of executing your air pollution control project on time, on budget.



▲▼ Ledvice, Czech Republic

Looking ahead
Research & Development

Our lifeblood is a strong, on-going R&D program. We use state-of-the-art engineering and realization tools to find new and improved environmental processes for today, tomorrow, and longer into the future.

We have excellent R&D facilities for continuous optimization of our processes and products. A corporate laboratory with extensive test equipment, as well as access to technical centers and lab-scale plants at select universities in combination with our own pilot plants at various power stations put us in an excellent position to do development work for our customers and ourselves. The project summaries below are examples of our main R&D focus at present.

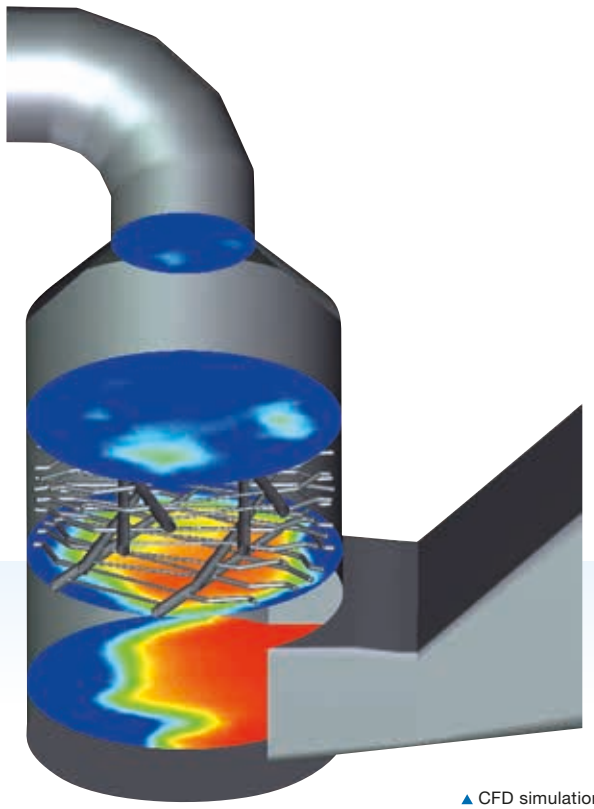
Carbon capture and storage (CCS)

We are looking for innovative ways to create a low carbon future. We are focusing on two different post-combustion technologies: CO_2 scrubbing processes based on liquids (MEA, ionic liquids etc.) and carbonate looping processes (third generation technology). Our work on CO_2 scrubbing involves investigating the performance of a variety of CO_2 solvents and testing a range of absorption systems in our pilot facilities (one at a hard coal-fired power plant in Austria). A key project component is a series of practical benchmarking tests of several CO_2 solvents including ionic liquids and conventional solvents.

Our intent is to design an optimized plant, including all the necessary equipment for a post-combustion carbon capture (PCC) facility. In order to achieve this ambitious target, we have fully engineered and designed a pilot plant. Now we are concentrating on up-scaling for demo-sized projects. For the carbonate looping technology we are embedded in an international team of partners in the power supply, lime, and cement industries, as well as universities.

CFD simulation

Computational fluid dynamics (CFD) simulation provides local and/or time resolved visualization of flow and transport processes in multi-phase processes. For example, pollutant concentrations in apparatus can be pinpointed locally and temporarily. Over the years, CFD simulation has enabled us to improve our processes, using calculation models developed in-house.



▲ CFD simulation of a wet scrubber

▼ Tušimice, Czech Republic: old and new

Keeping your plant in shape and up-to-date

Reviving old plants to meet new requirements

Increasingly stringent environmental regulations may provide the sustainable basis for future generations, but they also expose the limits of older FGC installations. We offer full support for modernizing the air pollution control systems of older power plants and industrial facilities.

It is not just the new coal-fired power plant projects that are facing more stringent emissions control requirements. Recent bills passed by the European Union demand increasing SO_2 removal efficiencies for existing scrubber systems.

FGDplus is a tailor-made solution – not only for greenfield projects, but also for retrofitting existing open spray towers. It is one module for increased SO_2 removal efficiency and its application on the power market is only one tool available to our modernization specialists. The reduction of NOx, heavy metals, and particulate matter emissions are other technologies in our portfolio for modernizations.

Our experts have the tools and experience to handle the demanding tasks linked to retrofit installations in existing plants. While every project requires the strong partnership of supplier and client during the execution, it is even more critical for a retrofit or modernization. Close cooperation between the experts of both teams creates a sound basis for a successful plant modernization.

Our expertise covers every aspect of plant engineering and modernization. We aim at minimizing downtime. This ensures a cost-effective operation and minimum loss of production.

- We analyze specimens in our laboratory and provide accurate conclusions without delay
- We develop and implement optimization concepts for your plant
- We identify the most cost-effective solution for your specific challenges with respect to both investment and operational expenses
- We take care of the planning and execution from project development to plant commissioning to support during warranty period
- We provide tailor-made solutions for the modernization of FGC facilities based on your needs and interests

References

Neurath F/G, Germany
Wet Limestone FGD

Customer: RWE Power
Capacity: 2 x 1,100 MWel, 2 x 4,850,000 m³/h [stp, wet]
Fuel: Lignite
Start-up: 2011

Karlsruhe, Germany
Wet Limestone FGD

Customer: EnBW
Capacity: 910 MWel, 2,500,000 m³/h [stp, wet]
Fuel: Hard coal
Start-up: 2011

Rybnik, Poland
Wet Limestone FGD

Customer: Elektrownia Rybnik
Capacity: 4 x 200 MWel, 2 x 1,320,000 m³/h [stp, wet]
Fuel: Hard coal
Start-up: 2008

Linz 04-05, Austria
SCR DeNOx

Customer: VA STAHL
Capacity: 2 x 150,000 m³/h [stp, wet]
Fuel: Blast-furnace gas, coke-oven gas
Start-up: 2004 / 2005

MHKW Mainz, Germany
Multi-stage FGC plant

Customer: EGM Mainz
Capacity: 2 x 93,000 m³/h [stp, wet]
Fuel: Domestic waste
Start-up: 2003

TA Lauta, Germany
Multi-stage FGC plant

Customer: Ravon Lauta
Capacity: 2 x 76,000 m³/h [stp, wet]
Fuel: Domestic waste
Start-up: 2002

Turceni, Romania
Wet Limestone FGD

Customer: S.C. Complexul Energetic Turceni S.A.
Capacity: 4 x 330 MWel, 4 x 1,723,000 m³/h [stp, wet]
Fuel: lignite
Start-up: 2011

Yunus Emre, Turkey
Dry FGD (Turbo-CDS)

Customer: Vitkovice / Adularya
Capacity: 2 x 145 MWel, 2 x 610,000 m³/h [stp, wet]
Fuel: lignite
Start-up: 2013

Witzenhausen, Germany
Dry FGC (TurboSorp)

Customer: SCA Witzenhausen
Capacity: 220,000 m³/h [stp, wet]
Fuel: sludge, rejects, RDF, biogas
Start-up: 2008

Tusimice II, Czech Republic
Wet Limestone FGD

Customer: CEZ
Capacity: 4 x 200 MWel , 2 x 1,780,000 m³/h [stp, wet]
Fuel: Lignite
Start-up: 2009 / 2010

Linyi, China
Dry FGD (TurboSorp)

Customer: Wuxi Panasia
Capacity: 135 MWel, 630,000 m³/h [stp, wet]
Fuel: Hard coal
Start-up: 2006

Moerdijk, Netherlands
FGC (TurboSorp) and SCR

Customer: BMC Moerdijk
Capacity: 250,000 m³/h [stp, wet]
Fuel: Poultry litter
Start-Up: 2008

Ledvice, Czech Republic
Wet Limestone FGD

Customer: CEZ
Capacity: 1 x 660 MWel, 2,518,000 m³/h [stp, wet]
Fuel: lignite
Start-up: 2012

Slovnaft, Slovak Republic
Wet Limestone FGD

Customer: MOL
Capacity: 2 x 505,000 m³/h [stp, wet]
Fuel: residues from Refinery, heavy oil
Start-up: 2011

Lünen, Germany
Wet Limestone FGD

Customer: Trianel
Capacity: 1 x 800 MWel, 1,965,000 m³/h [stp, wet]
Fuel: hard coal
Start-up: 2012

Glückstadt, Germany
Dry FGC (TurboSorp)

Customer: HKWG Glückstadt
Capacity: 160,000 m³/h [stp, wet]
Fuel: RDF, sludge, coal
Start-up: 2009

Mellach, Austria
SCR DeNOx

Customer: Siemens / Verbund ATP
Capacity: 2 x 400 MWel, 2 x 2,100,000 m³/h [stp, wet]
Fuel: natural gas
Start-up: 2011

Pratt, USA
Dry FGD (TurboSorp)

Customer: Pratt Industries
Capacity: 200,000 m³/h [stp, wet]
Fuel: rejects, carpets, sludge, wood, plastic waste
Start-up: 2009

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