We provide the most effective ways of significantly reducing nitric oxide and/or nitrogen dioxide (NO\textsubscript{X}) in raw gas emissions, which contribute to acid rain and photochemical oxidation in the atmosphere as well as respiratory diseases. We offer Selective Catalytic Reduction (SCR), Selective Non-Catalytic Reduction (SNCR) and Hybrid SNCR/SCR Systems.

We can help you evaluate which system is best for your needs, considering your combustion process, operating parameters, NO\textsubscript{X} flue gas levels, emission reduction targets and CAPEX and OPEX availability. Based on this data, our experts can design, build, install and commission a customized NO\textsubscript{X} reduction solution.

**WHY CHOOSE OUR DENO\textsubscript{X} SOLUTIONS?**

- **The highest NO\textsubscript{X} reduction rates**
  Depending on the system and your process parameters, we can achieve 95% NO\textsubscript{X} reduction.

- **Ensured results**
  Our long-time experience in CFD modeling ensures field results reproduce theoretical CFD analyses.

- **Low maintenance**
  Our systems do not corrode as operations occur above dew-point.

- **A fast and reliable team**
  We can install and commission quickly, with little or no downtime, depending on the DeNO\textsubscript{X} system chosen.

- **Low OPEX options**
  Our engineers carefully study the reactions to provide low reagent consumption while selecting the appropriate catalyst to offer a low regeneration cycle.
SELECTIVE CATALYTIC REDUCTION (SCR)

Selective Catalytic Reduction (SCR) is the optimal NO\textsubscript{X} control system, able to achieve up to 95\% NO\textsubscript{X} reduction in combustion processes. It can therefore meet stricter incoming legislation.

SCR converts NO\textsubscript{X} into diatomic nitrogen, N\textsubscript{2}, and water, H\textsubscript{2}O, with the aid of a catalyst. A gaseous reductant, typically anhydrous ammonia, aqueous ammonia or urea, is added to a stream of flue or exhaust gas before the gas enters the catalyst chamber. SCR takes place at the end of the air pollution control process, after air filtration has taken place.

WE OFFER TWO SCR DENOX SYSTEMS:

- **High-Dust DeNO\textsubscript{X} systems**
  - Ideal for power plants, cement plants and cogeneration & heat recovery systems

- **Tail-End DeNO\textsubscript{X} systems**
  - Ideal for the biomass industry, incinerators and cement plants

THE ADVANTAGES:

1. **Optimum effectiveness.** Our SCR system reduces NO\textsubscript{X} by up to 95\%.
2. **Reagent flexibility.** We can design a SCR system using either urea or ammonia.
3. **Customized catalytic chambers.** Our catalytic chambers are tailored to your needs and are designed for mechanical stability and a long service life, meaning lower OPEX than other such systems. The catalytic layers are completely extruded titanium dioxide (TiO\textsubscript{2}), resulting in photocatalysis.
4. Sensitive to the need for a low regeneration cycle, we are experts at selecting an appropriate catalyst, based on your gas and ammonia distribution, to offer a long catalyst lifetime.

SELECTIVE NON-CATALYTIC REDUCTION (SNCR)

Selective Non-Catalytic Reduction (SNCR) is a good option for conventional power plants that burn biomass, waste, coal and oil as well as for cement plants and waste incinerators.

THE ADVANTAGES:

1. **Effective.** Our SNCR systems will reduce NO\textsubscript{X} by up to 65\%, depending on your process parameters.
2. **Cost-effective in terms of CAPEX.** Our experts can advise you as to whether this lower cost option is viable with your process parameters and your emission reduction targets.
3. **Optimized use of reagent.** Our system’s high temperature converts urea to ammonia without the need to install external burners to transform the reagent.
4. **Low maintenance.** Our fully automated system monitors and optimizes the SNCR process remotely and can send any malfunction data directly to the control room of the plant.
5. **Fast installation.** We pre-commission the modules off-site to secure a smooth integration of the SNCR system at your plant. Often installation does not require any plant downtime.

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**HYBRID SNCR/SCR SYSTEMS**

Hybrids are a newer technology, often an ideal choice when high NO\(_X\) reduction is required and space is limited. They are the most flexible choice to reduce NO\(_X\) emissions.

Hybrid systems involve a SNCR treatment stage followed by a SCR treatment stage. Our Hybrid systems are tailored to your needs: the percentage of the system acting as SNCR and the percentage acting as SCR vary depending on the process data of your facility.

**COMPARISON TABLE: SCR, SNCR & HYBRID SYSTEMS**

<table>
<thead>
<tr>
<th></th>
<th>SCR</th>
<th>SNCR</th>
<th>HYBRID</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO(_X) reduction efficiency</strong></td>
<td>Up to 95%</td>
<td>Up to 65%</td>
<td>Up to 90%</td>
</tr>
<tr>
<td><strong>Temperature window</strong></td>
<td>180°-510°C</td>
<td>870°-1150°C</td>
<td>SNCR: 870°-1150°C SCR: 180°-510°C</td>
</tr>
<tr>
<td><strong>Reactant</strong></td>
<td>Ammonia or urea</td>
<td>Ammonia or urea</td>
<td>Ammonia or urea</td>
</tr>
<tr>
<td><strong>Ammonia conversion unit</strong></td>
<td>Required if using urea depending on T°</td>
<td>Not required</td>
<td>Required if using urea</td>
</tr>
<tr>
<td><strong>Reactor</strong></td>
<td>Catalytic</td>
<td>- None -</td>
<td>Direct injection + small catalyst</td>
</tr>
<tr>
<td><strong>Catalyst regeneration</strong></td>
<td>Sometimes required</td>
<td>None</td>
<td>Sometimes required</td>
</tr>
<tr>
<td><strong>Waste disposal</strong></td>
<td>Spent catalyst</td>
<td>None</td>
<td>Spent catalyst</td>
</tr>
<tr>
<td><strong>Catalyst volume</strong></td>
<td>Major</td>
<td>None</td>
<td>Minor</td>
</tr>
<tr>
<td><strong>Capital investment costs</strong></td>
<td>Higher</td>
<td>Lower</td>
<td>Balanced with OPEX</td>
</tr>
<tr>
<td><strong>Plot requirements</strong></td>
<td>Major</td>
<td>Minor</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>3 to 5 years (typical catalyst life)</td>
<td>Low</td>
<td>3 to 5 years (typical catalyst life)</td>
</tr>
<tr>
<td><strong>Ammonia/NO(_X) (molar ratio)</strong></td>
<td>1-1.05</td>
<td>1.0-1.5</td>
<td>1-1.05</td>
</tr>
<tr>
<td><strong>Ammonia slip</strong></td>
<td>5 to 10 ppmvd</td>
<td>20 to 50 ppmvd</td>
<td>5 to 10 ppmvd</td>
</tr>
<tr>
<td><strong>Retrofit</strong></td>
<td>Depends on current layout</td>
<td>Easy</td>
<td>Depends on current layout</td>
</tr>
<tr>
<td><strong>Mechanical draft</strong></td>
<td>Required</td>
<td>Not required</td>
<td>Required</td>
</tr>
<tr>
<td><strong>Energy consumption</strong></td>
<td>High: ID fan + dosing system</td>
<td>Low</td>
<td>High: ID fan + dosing system</td>
</tr>
</tbody>
</table>

**THE ADVANTAGES:**

1. **Highly effective.** Our Hybrid systems reduce NO\(_X\) emissions by up to 90% and are ideal when a high NO\(_X\) removal is required.
2. **Cost-effective in terms of CAPEX.** Our experts can advise you as to whether this lower cost solution is a viable option with your process parameters and your targets.
3. **Lower operating costs.** Our Hybrid system is more cost-effective to run than SCR technology, partly because less catalyst is needed and there's a better reagent use.
4. **Compact.** Our Hybrid solution requires limited space.

The best system for your air pollution control needs depends on a number of factors: installed equipment, space limitations and air pollution control goals. Contact us today to have one of our experts recommend the best system for your process parameters.
Anhydrous ammonia is the preferred reagent where possible, as it is most effective in reducing NO\textsubscript{x} emissions.

Anhydrous ammonia does require proper storage, correct handling and competence regarding ammonia properties to maintain safety. Our team offers on-site training to ensure your staff and your investment remain safe.

**THE ADVANTAGES:**
- Contains 100% reactive component, offering the highest efficiency
- Lower transportation costs, as the efficiency of the reagent translates into fewer necessary shipments
- Less tendency to form nitrous oxide and carbon monoxide than urea
- Reduced probability of fouling and corroding equipment downstream of the injection point

Ammonia solution is also a recommended choice and is safer to use than anhydrous ammonia since the vapor pressure is greatly reduced by water.

Ammonia solution must be correctly handled and stored. We can offer your team training on how to safely handle this product.

**THE ADVANTAGES:**
- More efficient than urea and safer than anhydrous ammonia
- Less risk associated with its transport, storage and handling than anhydrous ammonia
- Does not freeze
- Less possibility of fouling and corroding equipment downstream of the injection point compared to urea

Urea is widely used and is the safest choice. It is, however, less efficient, as urea must be converted to ammonia prior to the NO\textsubscript{x} reduction process.

**THE ADVANTAGES:**
- Poses fewer risks in the workplace and doesn’t require specific training
- Non-hazardous, non-volatile, non-explosive and non-flammable
- The best solution for in-furnace injection

**THE DISADVANTAGES:**
- Can lead to additional nitrous oxide or carbon monoxide emissions
- Less effective
- More likely to foul and corrode equipment downstream of the injection point
- Leaks lead to white salt precipitates giving an aged look to equipment
- Scaling and clogging are likely when blended with hard water for DeNO\textsubscript{x} operation
- Needs sufficient heat to avoid freezing
- In case of Tail-End SCR, the urea must be converted to ammonia before the SCR process
OUR COMPLETE PRODUCT PORTFOLIO

Our highly efficient and innovative filtration solutions can secure a better reaction from your flue gas treatment (FGT) system. From design to commissioning, we can provide everything necessary to optimize your emissions reduction system from air filtration to flue gas treatment, including conditioning, storage and handling systems.

OUR ONE-STEP CLEANING SOLUTION

Our proven system removes all pollutants (dust, SO\(_x\), NO\(_x\), mercury, HCl, HF, dioxins, furans, heavy metals), while offering an easy, low-cost installation and a highly compact design. Whether to meet current air emission reduction targets – or to prepare for future regulations – our One-Step Cleaning Solution is a cost-effective way to adhere to all environmental legislation.

MODELLING

We use Ansys's Fluent software to accurately design and study every solution. This allows us to engineer and analyze each system’s broad physical capabilities, optimize the fluid dynamics and study the efficiency of pollutants removal. When a computerized simulation is not sufficient, we undertake a physical simulation on a 1:7 scale in our Milan workshop.

Redecam offers a comprehensive portfolio of air filtration, flue gas treatment (FGT), gas conditioning and transportation, handling & storage products. Please contact us to see how we can take care of all your air pollution control needs.