

# Reduce N<sub>2</sub>O emissions. Earn money

NO<sub>x</sub> and N<sub>2</sub>O removal

NO<sub>x</sub> and N<sub>2</sub>O removal reduces your greenhouse gas footprint, resulting in significant savings from day one.

Removing N<sub>2</sub>O with a secondary catalyst is less than 90% efficient.

Typically, you'll see N<sub>2</sub>O emissions increasing over the gauze campaign as catalyst performance declines. As a consequence, N<sub>2</sub>O intensity levels can reach into hundreds of ppm's. If this happens, your nitric acid plant could face additional CO<sub>2</sub> market costs.

Preventing this risk is easy. With the tertiary catalyst TertiNOx™ from Topsoe.

### Remove N<sub>2</sub>O up to 99%

Unlike pellet catalysts and complex reactor designs, TertiNOx™ is a high-activity monolith catalyst that removes up to 99% of N<sub>2</sub>O. It will fit into your current reactor or even a smaller, simpler one.

You'll find the results impressive. For example, at a CO<sub>2</sub> price of 25 EUR/ton CO<sub>2</sub> eq., a 1000 MTPD nitric acid plant will annually save more than EUR 1.5 million per 100 ppm N<sub>2</sub>O emission reduction - from day one.



Monolith from Haldor Topsoe

## Topsoe value-adding solutions

### N<sub>2</sub>O polisher for working secondary catalysts

The compact TertiNOx™ reactor functions as a N<sub>2</sub>O polisher to enhance N<sub>2</sub>O removal. The CO<sub>2</sub> equivalent savings can be substantial and the payback time short. If the secondary catalyst volume and DeNOx reactors are optimized, you can expect even faster payback times. The small footprint, high design flexibility, combined NOx and N<sub>2</sub>O removal and high catalytic activity means that a TertiNOx™ solution can be designed to replace your existing SCR installation.

### N<sub>2</sub>O abatement with TertiNOx™ catalysts

TertiNOx™ tertiary monolith catalysts remove up to 99% N<sub>2</sub>O when installed in the tail gas. Its compact reactor design (fig 1) gives you dual DeNOx and N<sub>2</sub>O removal performance already from 350°C/660°F. We can also customize an installation for your plant. No matter what your choice, you can depend on a long life of high activity and low-pressure drop.

### NH<sub>3</sub> slip management

The nitric acid process is especially sensitive to NH<sub>3</sub> slip. This means that large tertiary catalyst volumes are needed to get high performance. With TertiNOx™ slip solution, a dedicated NH<sub>3</sub> oxidation catalyst is installed as bottom layer. The result is high performance with less catalyst volume, providing a compact and competitive overall solution.

### Savings payment solution

Within the EU-ETS system, a TertiNOx™ installation will result in significant savings due to reduced N<sub>2</sub>O emissions. But it can be difficult to realize revamp projects due to the initial investment. Topsoe offer TertiNOx™ catalyst on a savings payment solution, you only pay with a fraction of the actual achieved savings of the TertiNOx™ installation with no additional payments for NOx emissions.

This solution significantly reduce CAPEX and financial risks of the project, making it easier to realize the project internally. Further, Topsoe will monitor performance of your installation, ensuring optimal performance and replacing catalyst when needed.

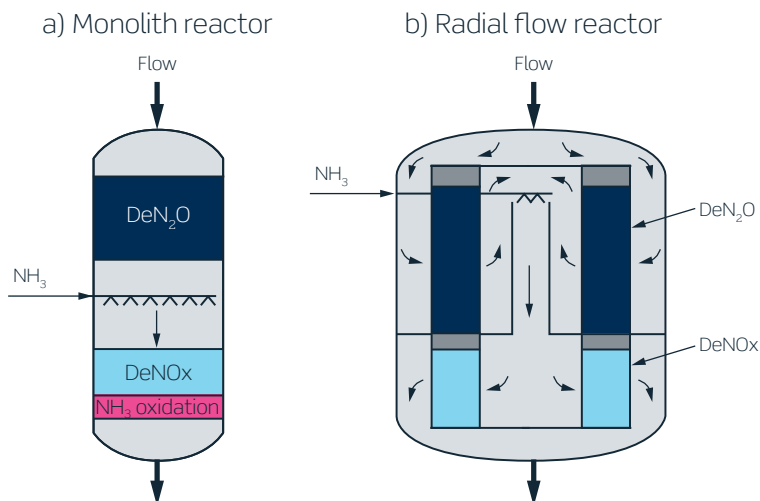


Fig. 1 The Monolith design (a) typically a lower pressure drop compared with a radial flow converter (b) using pellet catalysts. Tertiary pellet catalysts require a radial flow reactor design to keep pressure drop at acceptable levels. Pellet solutions require a large and complicated reactor, which is expensive for pressurized applications. The TertiNOx™ process utilizes a much simpler, smaller and more budget-friendly reactor.

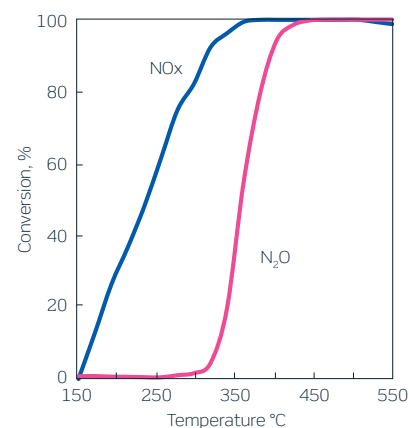


Fig. 2 Conversion vs. temperature



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