

# CASE STUDY

## Servomex Combustion Control & Emissions Monitoring

### THE CHALLENGE

Industry has long used coal, oil, and now natural gas as a low-cost fuel source for electrical and /or process heat generation. Regardless of the fuel source, nitrogen oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), more generally referred to as NO<sub>x</sub>, along with particulate matter (smoke/dust) are created during the combustion process, releasing toxic gases into the atmosphere if they are not removed first. NO<sub>x</sub> and dust are the leading causes of human respiratory problems and government agencies worldwide are promulgating stronger measures designed to reduce air pollution.



### WHAT CAN BE DONE?

By monitoring various gas components produced during the combustion cycle, the amount of pollutants released into the atmosphere can be tightly controlled, balancing fuel savings through combustion optimization with reduced emissions (CO and NO<sub>x</sub>), all of which can quickly add up to lower operating expenses while maintaining regulatory compliance.

Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR) are the most effective NO<sub>x</sub> reduction and control processes used in industrial combustion applications.

### THE SERVOMEX SOLUTION

Our customers rely on Servomex to provide rapid, accurate and long lasting gas monitoring equipment that helps them save millions in operational expenses by balancing the amount of fuel or air consumed by the fired-heater (or boiler) with the amount of gaseous pollutants created during the combustion process. These operational practices produce overall lower fuel cost, longer lifetimes of pollution control and exhaust equipment, all the while keeping the environment safe by ensuring the plant is below the permitted emissions limits.

## Combustion Optimization Monitoring

By monitoring the amount of air or oxygen (O<sub>2</sub>) along with any incomplete combustion of fuel (carbon monoxide, CO) inside the combustion chamber, the Servomex Laser 3 Plus Tunable Diode Lasers (TDLs) provide real time feedback for direct dynamic optimization of the combustion process. By controlling the O<sub>2</sub> range to 3-5% within the combustion chamber saves fuel and reduces the CO and NO<sub>x</sub> emissions simultaneously. Because the Laser 3 Plus analyzer is intrinsically safe it also plays a critical dual role as combustion and process safety monitor, saving the plant money.



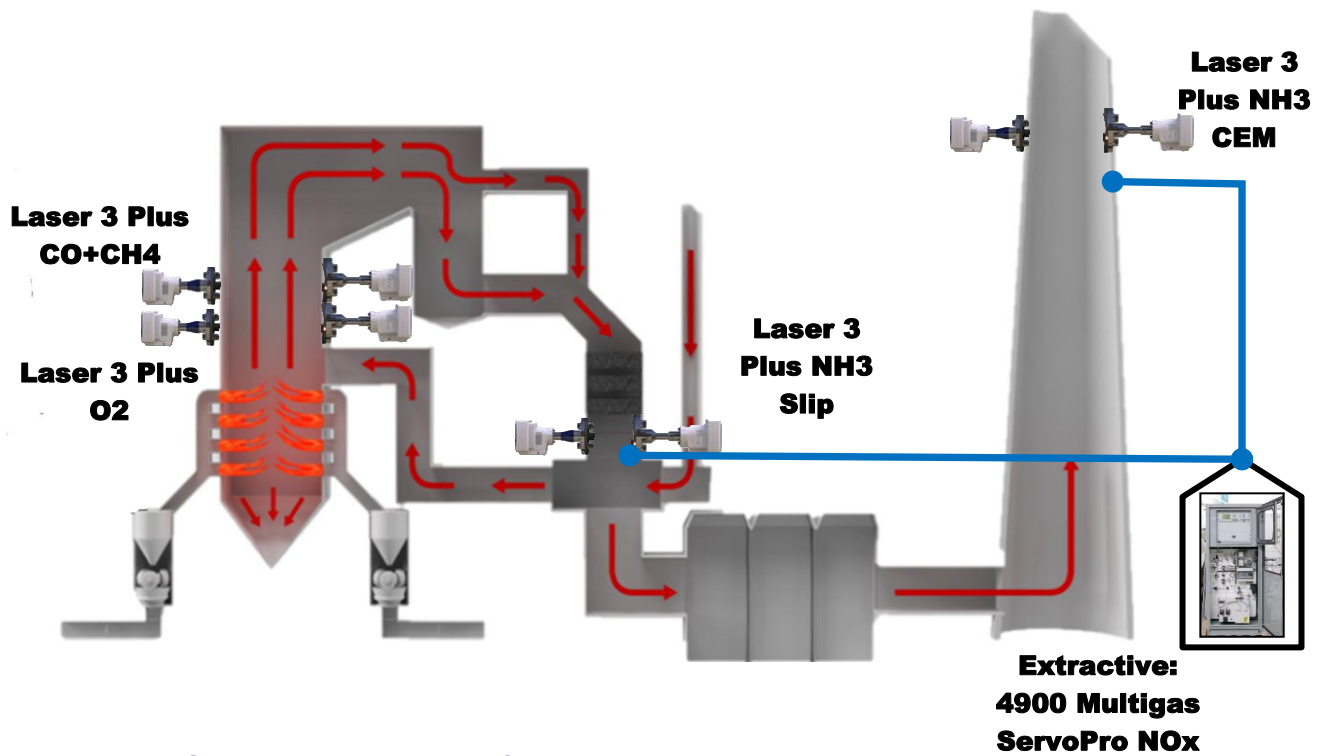
## Pollution Control Monitoring

The exhaust from the combustion process is passed through emission reduction equipment, which generally includes an SCR or SNCR unit, which uses excess ammonia (NH<sub>3</sub> generally in the form of Urea) to reduce NO<sub>x</sub> emissions up to 96%. While SCR / SNCRs reduce NO<sub>x</sub> released to the environment, if too much NH<sub>3</sub> is used it triggers more issues as a particulate matter precursor for PM<sub>2.5</sub>, directly impacting the air quality. Installing a Servomex *in-situ* Laser 3 Plus NH<sub>3</sub> Slip TDL at the outlet of the SCR/SNCR provides continuous and accurate NH<sub>3</sub> Slip concentration along with better NO<sub>x</sub> reduction control. Optimizing the amount of NH<sub>3</sub> at the SCR/SNCR directly impacts the plant operational cost by saving on Urea / NH<sub>3</sub> reagent, reducing downstream equipment corrosion, and increasing the lifetime of the catalyst.

## Continuous Emissions Monitoring (CEM)

Once the exhaust gas passes through the rest of the combustion pollution control equipment, it is then released to the atmosphere via a chimney or stack where all required gas components and particulate matter are monitored for compliance. Servomex provides several different technologies within our analyzer portfolio, their use depending on the emissions limit set by the governing body. The Servomex 4900 Multigas and the Servopro NO<sub>x</sub> analyzers are used to monitor the amount of NO<sub>x</sub>, while the Servomex 4900 Multigas analyzer can also be used to monitor CO, NO<sub>x</sub>, SO<sub>2</sub>, CH<sub>4</sub> and other gaseous pollutants along with O<sub>2</sub> and CO<sub>2</sub> needed for compliance reporting all within one small compact system. If NH<sub>3</sub> is needed for compliance monitoring the *in-situ* Laser 3 Plus NH<sub>3</sub> CEM TDL is easily installed across the stack.





## THE ENVIRONMENTAL IMPACT

By deploying Servomex gas analyzers at the combustion stage, our customers directly control the amount of gaseous pollutants that enter their pollution control equipment. Not only is this good for the environment but it also increases the longevity of our customer's pollution control equipment and ensures that they always meet their regulatory compliance all the while reducing operational costs.

### *Impact of Combining Emissions Reduction and Combustion Optimization*

Controlling and tuning the combustion process to the optimized 3-5% O<sub>2</sub> range which minimizes the CO and NO<sub>x</sub> emissions, can save plants from \$16,789/yr for sources rated < 10MMBtu/Hr up to \$107,159/yr for sources rated 100 – 150 10MMBtu/Hr.

### *Impact of NH<sub>3</sub> Slip Monitoring*

- (1) Catalyst longevity increased by just 6 months provides an Annual Catalyst Replacement Cost savings for a 112 MW Coal Fired Boiler of \$33,165
- (2) Reduction in annual NH<sub>3</sub> Reagent usage savings for a 112 MW Coal Fired Boiler of \$7,519 tuning and controlling the NH<sub>3</sub>/NO<sub>x</sub> ratio at 1:1 rate
- (3) Reduction in annual NH<sub>3</sub> Reagent usage savings for a 112 MW Natural Gas Fired Gas Turbine of \$15,237 tuning and controlling the NH<sub>3</sub>/NO<sub>x</sub> ratio at 1:1 rate.

## References

TRC White Paper "Dollars and Sense: Boiler Tuning as a Best Management Practice"

EPA Air Pollution Control Cost Manual, Section 4 – NO<sub>x</sub> Controls, Chapter 2 -Selective Catalytic Reduction (updated 06/12/2019)