

## Reduce NOx Emissions while Improving Fuel Efficiency



*ThermoX analyzers help you to optimize combustion efficiency and minimize NOx emissions.*

- || NOx emissions are subject to regulatory controls in many parts of the world.
- || You can minimize NOx emissions by monitoring oxygen and combustibles using a flue gas analyzer.
- || A high temperature sample point close to the flame source eliminates errors on the oxygen measurement from tramp air leakage.
- || With ThermoX WDG-IVC and WDG-HPIIC analyzers, you can reduce NOx while improving fuel efficiency.

One of the easiest and most cost-effective ways to reduce NOx and improve fuel efficiency is to measure oxygen and combustibles.

NOx emissions from combustion sources contribute to the formation of ground-level ozone and fine particles. For this reason, most countries have regulations limiting the amount of NOx which can be emitted from combustion plants. In the USA, the Transport Rule establishes a strict program for NOx reductions in many areas. This makes NOx control an important consideration for plant operators.

### What is NOx?

In a combustion process, fuel is burned in air to produce heat. Nitrogen and oxygen molecules from the air dissociate to their atomic forms at the high temperatures typically found in flames. These produce NO as they react with the remaining air molecules. The dissociation takes place mainly at temperatures above 1600°C (2900°F).

## How to Limit NOx Emissions

One of the easiest and most cost-effective ways to limit NOx emissions is to limit the amount of available oxygen, which can combine with nitrogen to form NO.

Because the mixing of air and fuel can never be perfect, some excess air is required to ensure complete combustion. If too little excess air is available, the combustibles in the flue gas rise dramatically. Knowing the oxygen and combustibles concentrations in the flue gas allows the amount of excess air to be controlled while maintaining good combustion efficiency. The optimum control point to minimize NOx emissions and efficiency losses is shown in Figure 1.

The optimum operating point depends on load conditions, age of equipment, fuel type and process conditions. By continuously monitoring the amount of oxygen and combustibles in the flue gas, prompt adjustments can be made to maintain optimum burner conditions.

When relying on an O<sub>2</sub> and combustibles measurement to control combustion efficiency and minimize NOx, the analyzer needs to be placed as close to the combustion process as practical. Tramp air leakage downstream from the combustion process can cause the analyzer to read incorrectly. Also, the closer to the process the analyzer is placed, the faster the analyzer will respond to changing conditions.

## Thermox Flue Gas Analyzers

The Thermox models WDG-IVC and WDG-HPIIC monitor both oxygen and combustibles in flue gases. Oxygen is measured using zirconium oxide sensor technology. Combustibles in the flue gas are detected using a catalytic sensor. Both of these flue gas analyzers can be placed close to the flame source (1540°C - HPII; 1760°C - IVC), thus eliminating tramp air leakage effects on oxygen readings.

The WDG-IVC sets the standard for fast and accurate response in a flue gas analyzer and is ideal for light oils and gas applications. The WDG-HPIIC is specifically tailored for high particulate applications, such as those found in coal-fired boilers. Both analyzers can be used with either the Series 2000 controller or the integrated IQ controller. The controllers provide analog outputs, alarm contacts, and an RS-485 interface, which can be integrated into your overall boiler and NOx control system.

### COMBUSTION EFFICIENCY

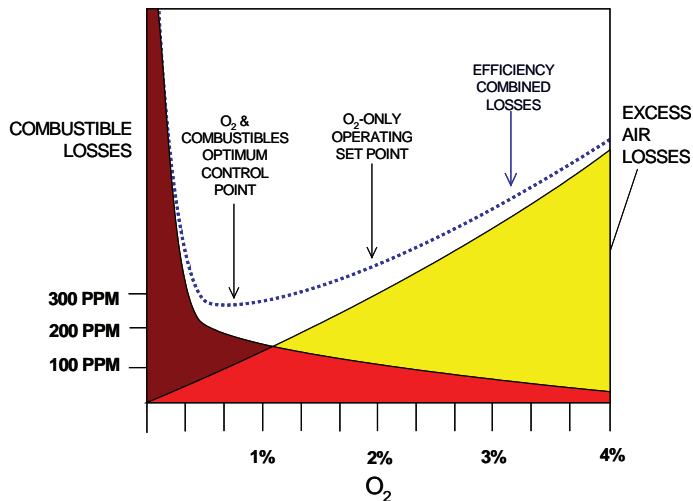


Figure 1. Combustibles vs. Excess Oxygen showing efficiency losses (this figure for illustration purposes only).



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