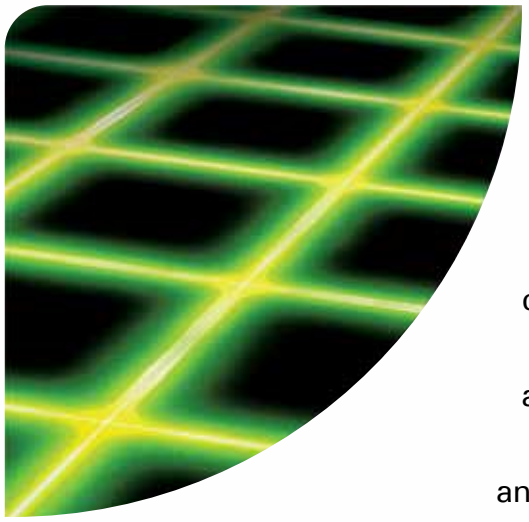
ZOLO
TECHNOLOGIES



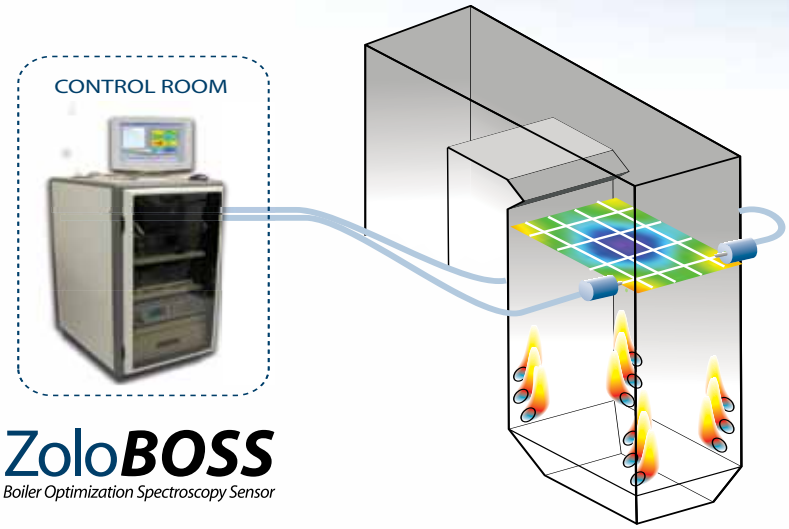
# Welcome

Founded in 1999, Zolo Technologies, Inc. provides unique instruments that simultaneously measure key combustion constituents in real-time and in ultra-harsh combustion environments such as fossil and biomass-fired power plants, waste-to-energy incinerators, industrial, petroleum and chemical refining processes or turbines.

Zolo Technologies employs innovative wavelength - multiplexed tunable diode laser absorption spectroscopy (WM-TDLAS) instruments which combine lasers, fiber-optics and sophisticated spatial presentation techniques to measure and map the combustion zone constituents.

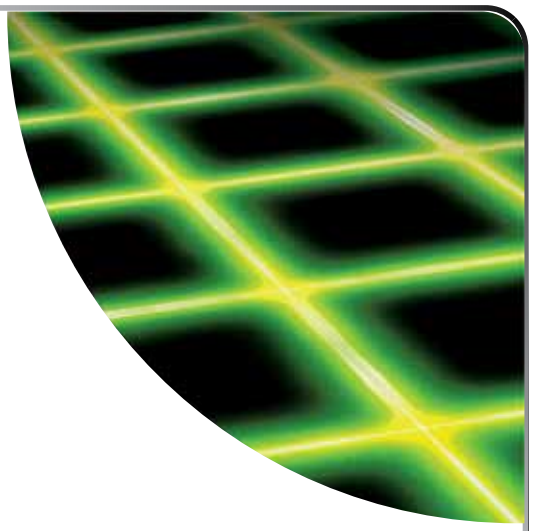
## better measurements, better results

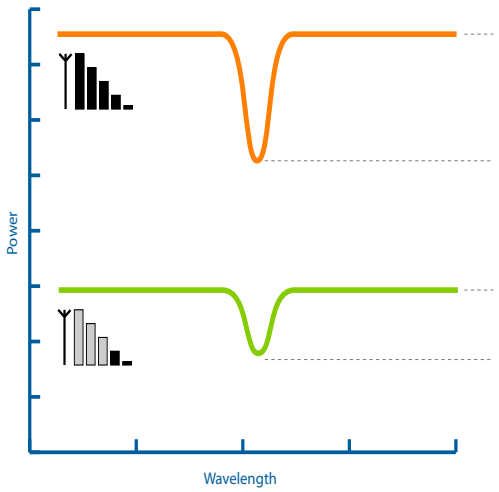
The Zolo***BOSS***™ (**B**oiler **O**ptimization **S**pectroscopy **S**ensor) laser-based instruments provides real-time , simultaneous, spatial measurements of temperature, $O_2$, CO, $CO_2$ and $H_2O$ directly in harsh combustion environments. With this critical process information, operators and engineers can balance combustion, improve the process efficiency and reduce NOx and $CO_2$ emissions.



# Zolo*BOSS*

## How Does It Work?



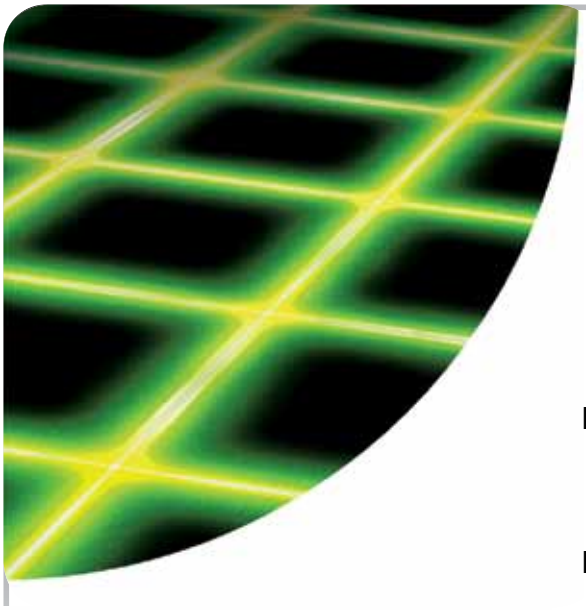



CO concentration is a function of the ratio of $P/P_{abs}$. Even as the signal varies, like a cell-phone signal, the ratio and thus the measurement of concentration remains the same.

The Zolo***BOSS*** utilizes a well proven technique known as Tunable Diode Laser Absorption Spectroscopy (TDLAS) which is based on the premise that every molecule has a unique light absorption characteristic or "fingerprint". Developed in collaboration with Stanford University, TDLAS employs industry standard telecom diode lasers tuned to unique absorption frequencies for each measured constituent.

Scanning the laser light around a narrow frequency, in other words slightly above and below this frequency, the amount of light absorbed ($P_{abs}$) and not absorbed (P) is accurately measured as it goes through the gas. The ratio of the non-absorbed and absorbed light or $P/P_{abs}$ is a function of the constituent concentration in the gas. It is this ratio of $P/P_{abs}$ that is important and not exactly how much light made it across the furnace or through the gas. Therefore, the measurement is mostly independent of dust, ash or opacity in the flue gas. Since the light absorption characteristics are well documented and never change, the system does not need field calibration.

The Zolo***BOSS*** combines several lasers, at selected frequencies, onto a single optical fiber and then transmits the light across the furnace or flue gas. Light is then collected by a receiver on the other side of the furnace and transmitted back to the control rack where the ratio of unabsorbed light to absorbed light is calculated to determine the average constituent concentrations along the laser path. Each path simultaneously measures the average concentration of $O_2$, CO, $CO_2$, $H_2O$, and temperature. Multiple paths are arranged to create spatial profiles of the constituents.



# ZoloBOSS

## Key Features

Real-time, in-situ measurements directly in the furnace:

- Temperature, $H_20$, CO, $CO_2$ and $O_2$
- Path average measurement for each path

Easy installation:

- 3/8x3 inch slot (1x8 cm) in water-wall membrane

Spatial profiles and furnace balancing information

Integrates into DCS or combustion optimizer via OPC

Automatic laser alignment as load changes

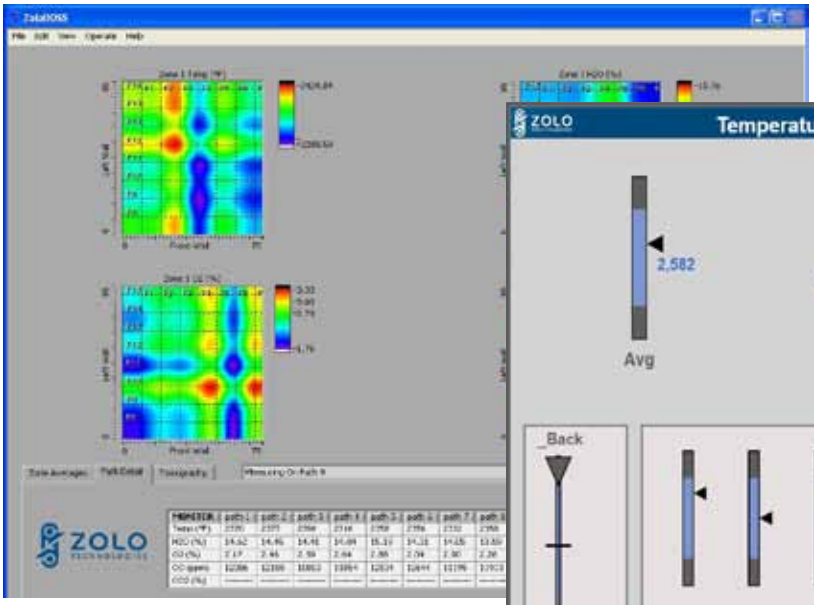
Automatic port rodder system keeps slot clear of slag

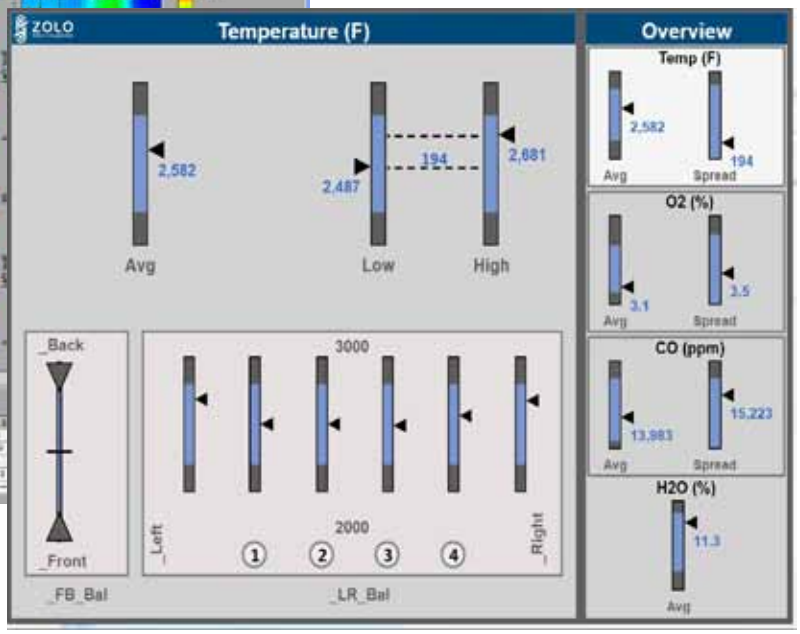
No cooling required up to 185°F (85°C)

No field calibration required

Low maintenance:

- Periodic window cleaning is required
- Performed while boiler is operating

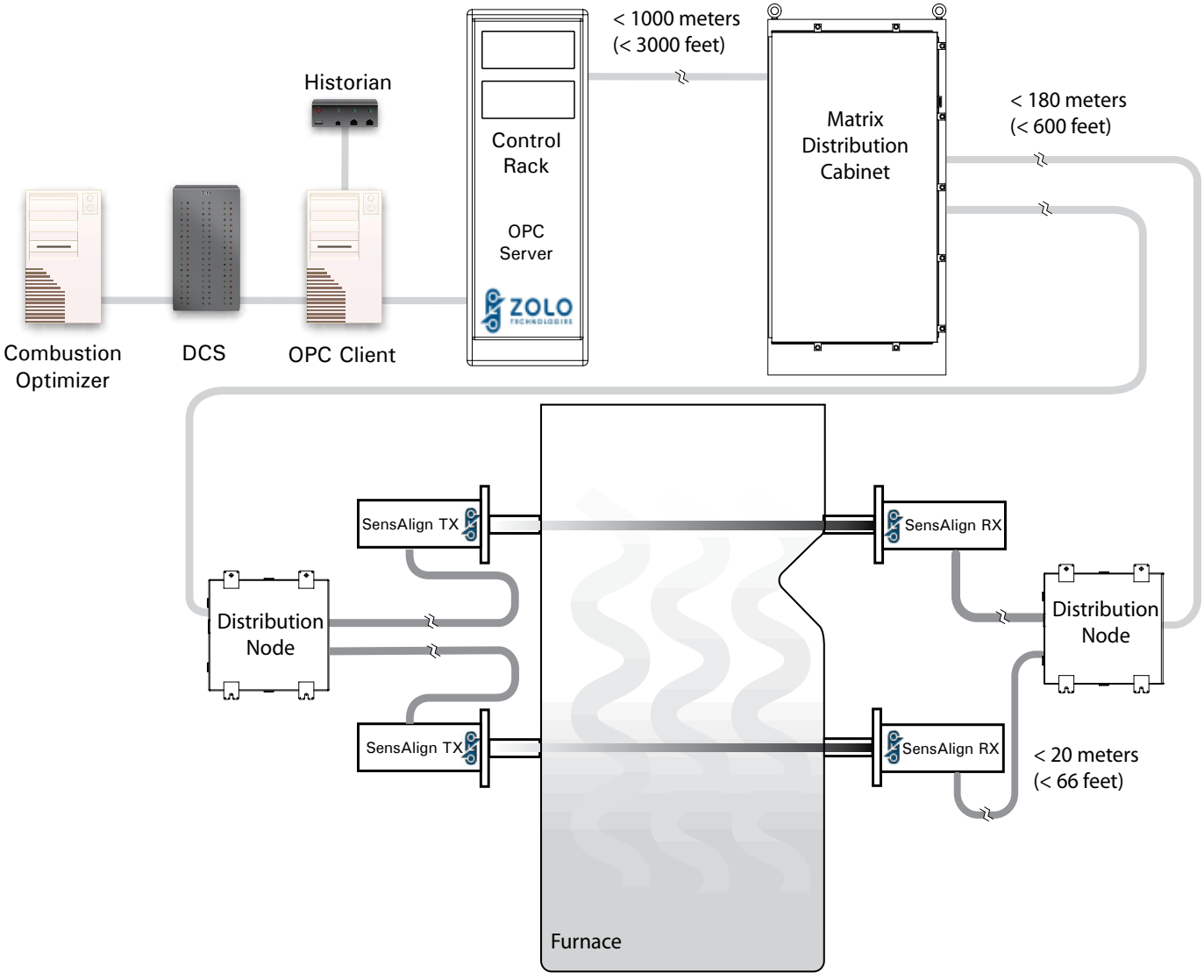




ZoloBOSS
Boiler Optimization Spectroscopy Sensor

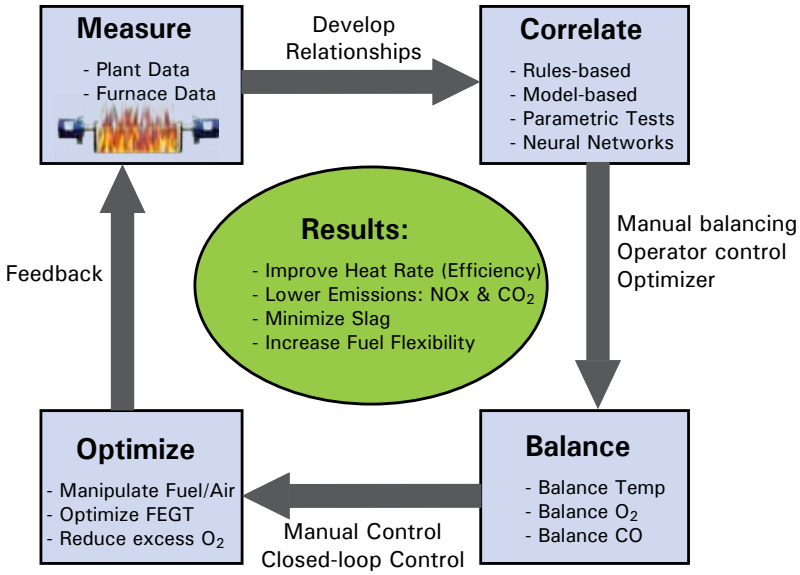
# ZoloBOSS

## System Diagram



# Balanced Combustion

# Optimized Combustion

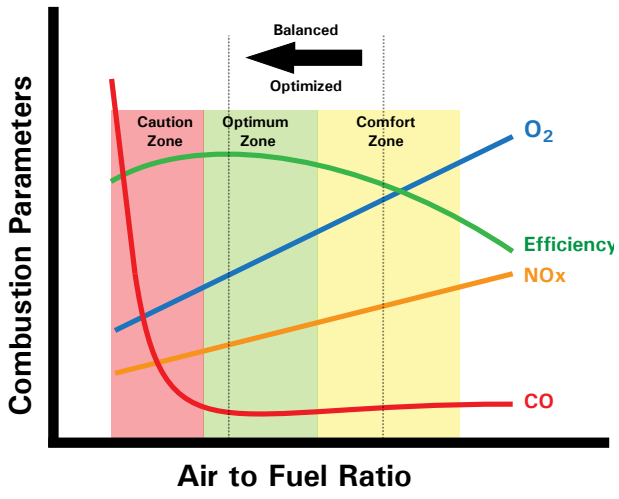



To effectively optimize combustion, key plant data, including real-time, in-furnace combustion data is required. Traditional sensors can not survive in the high temperature furnace environment. Plus, the back-end location of these sensors does not always provide good correlation with combustion settings such as secondary and over-fired air. The Zolo**BOSS** provides real-time measurements of temperature, $H_2O$, $O_2$ and CO directly in the combustion area.

Strong correlations developed between the Zolo***BOSS*** measurements and specific burner and air flow settings can be used to maintain a balanced combustion profile. Proper combustion balance permits operation at the optimum air to fuel settings (such as lower excess $O_2$) without the negative impacts of corrosion, slag formation, high CO and high LOI. Balanced and optimized combustion can be sustained through either manual control or the Zolo***BOSS*** data can be fully integrated into a closed-loop combustion optimizer.

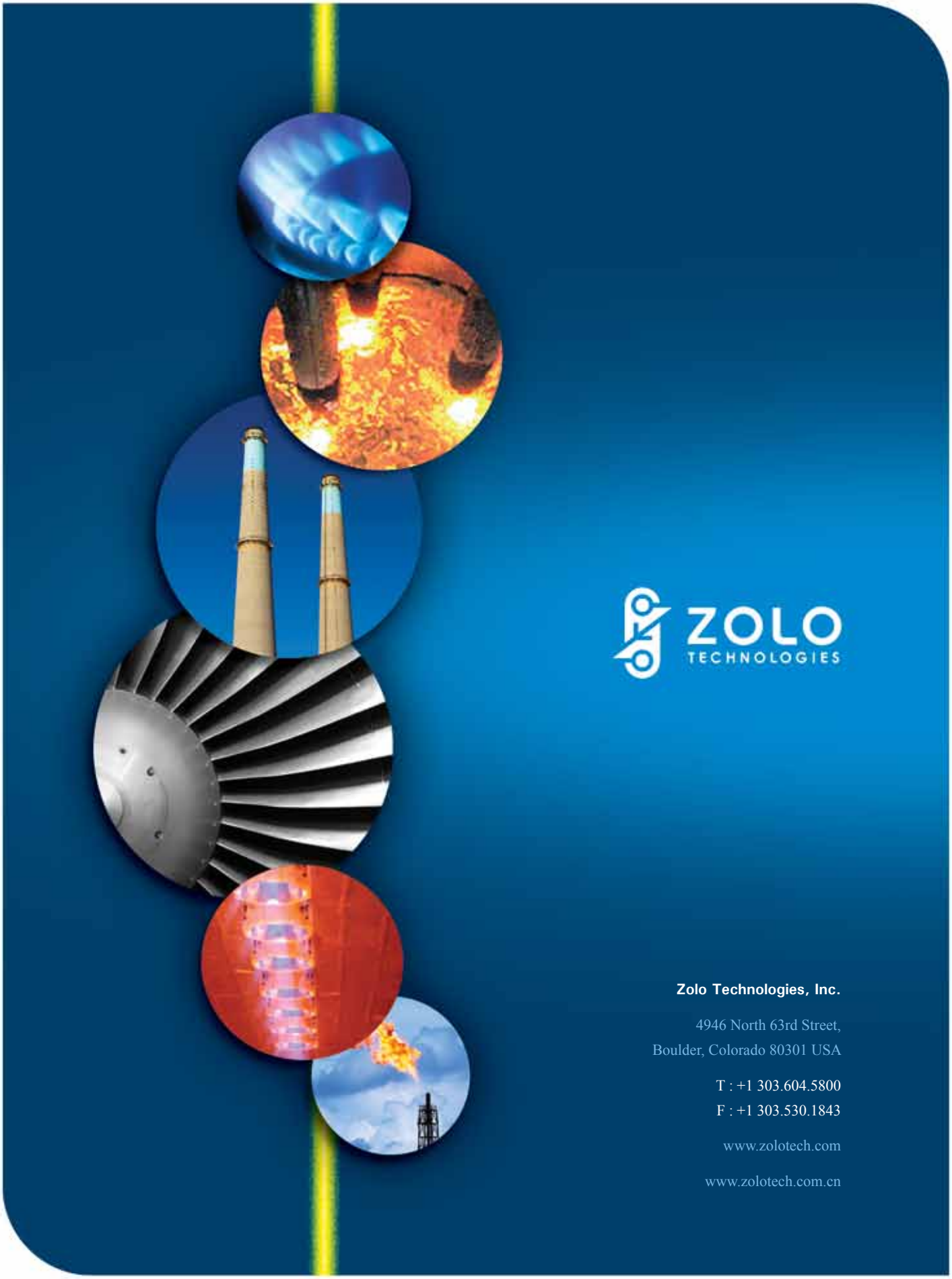
# Benefits

- Increased efficiency
- Lower emissions: NOx and $CO_2$
- Maintain CO and LOI limitations
- Lower auxiliary fan loads
- Minimize slagging
- Maintain ideal FEGT
- Increase fuel flexibility
- Adjust to frequent load changes



# Zolo*BOSS*
## Sample Installations

| Customer | Boiler Size | Boiler Type | Location |
|---|---|---|---|
| Tri-State | 250 MW | T-Fired | USA |
| Platte River Power | 270 MW | T-Fired | USA |
| Arizona Public Service | 300 MW | T-Fired | USA |
| CPS Energy (2) | 450 MW | T-Fired | USA |
| MN Power (2) | 550 MW | T-Fired | USA |
| Huaneng Power | 660 MW | T-Fired | China |
| RWE (4) | 660 MW | T-Fired | Germany |
| KOSEP (2) | 800 MW | T-Fired | South Korea |
| Alliant Energy | 800 MW | T-Fired (twin) | USA |
| GenOn | 900 MW | T-Fired (twin) | USA |
| KOMIPO (2) | 500 MW | Wall-Fired | South Korea |
| KCPL | 680 MW | Wall-Fired | USA |
| DTE (2) | 680 MW | Wall-Fired | USA |
| AEP | 1300 MW | Wall-Fired | USA |
| Basin Electric | 440 MW | Cyclone | USA |
| Mark E (biomass co-fire) | 275 MW | Down-shot | Germany |



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