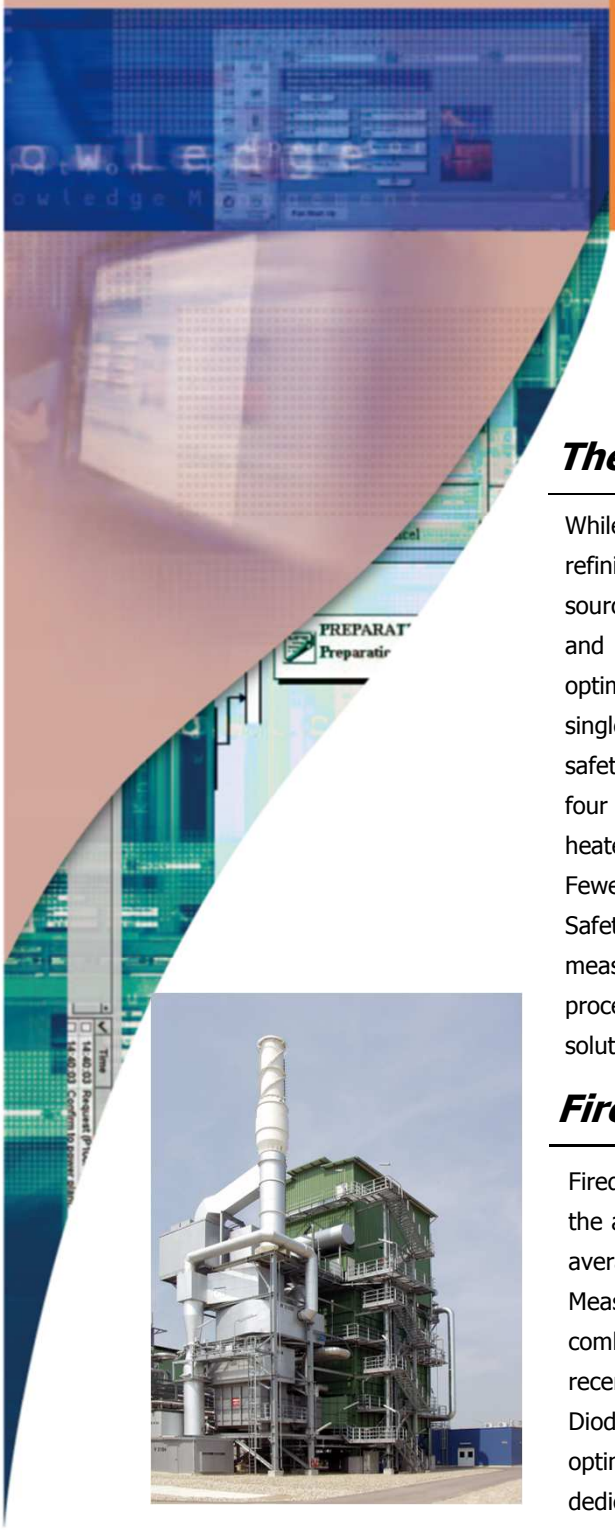
vigilantplantservices®

Solution Implementation Services™

# Fired heater application of TDLS



## Improving and sustaining the combustion asset

### *The value of this solution*

While, fired heaters are used throughout refining and petrochemical processes as the source of process heat, they have inherent risks and are generally operating at less than optimum efficiency. Yokogawa developed a single source solution to improve efficiency and safety of fired heaters. This solution addresses four major concerns (Figure 1) related to fired heaters and brings Higher energy efficiency, Fewer emissions, Extended heater life and Safety enhancement by combining world class measurement and automation technology with process knowledge, expertise and application solutions.

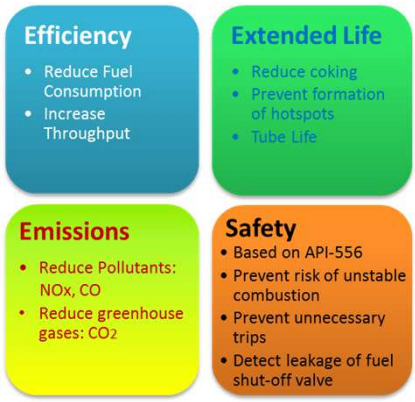



Figure 1:
Four major concerns of the heater

### *Fired heater optimization overview*

Fired heater optimization controls simultaneously both the air and fuel supply to the fired heater by measuring average gas concentrations across the radiant section. Measuring a cross section average concentration of combustion gases, such as $O_2$, $CO/CH_4$, has only recently been available through the use of the Tunable Diode Laser Spectroscopy (TDLS). The Fired heater optimization incorporates the TDLS analyzer with dedicated optimal combustion control logics.

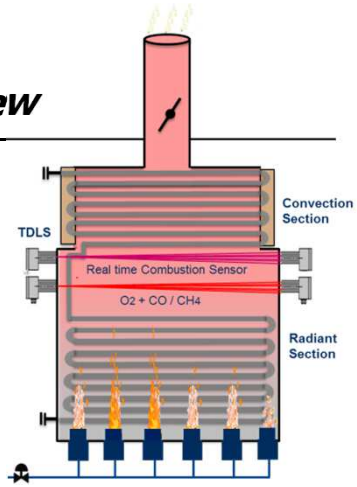



Figure 2: Average gas measurement

Bulletin 43G01D11-01EN

# Fired heater application of TDLS

## Measurement and Control technology for Combustion Safety and Optimization

The Fired heater optimization system consists of TDLS-$O_2$ and CO/$CH_4$ in-situ analyzer system, a DCS-Combustion Controller and related Field instruments.

- TDLS technology for gas concentration measurements on 2 second intervals
- A combustion control system for control of fuel and air flow based on fired heater models
- Field instruments for additional of air and fuel control as needed

The optimization functions provide improving the heater efficiency while maintaining the safety. Figure 4 shows, flue gas condition in the firebox. Fuel rich condition increases explosion risk by combustible gas accumulation. On the other hand, excessive air rich condition gives huge heat loss and affects furnace life. The Fired heater optimization maintains excess air in the optimal area for Efficiency, Emissions, Extended heater life and Safety. Figure 5 shows comparison example for the concerns between conventional fired heater management and Yokogawa Fired heater optimization.

TDLS for flue gas concentration


Field instruments

Yokogawa DCS-Combustion Controller

Figure 3: Principal components

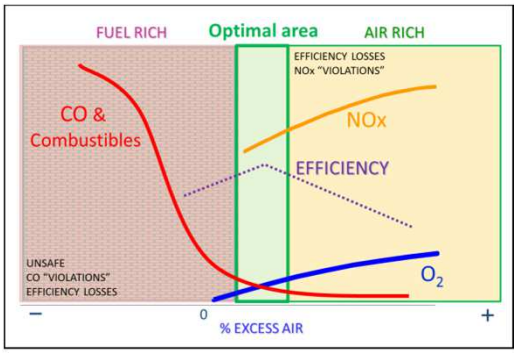



Figure 4: Excess air ratio against Combustion efficiency

| Concerns | Conventional fired heater management | Yokogawa Fired heater optimization |
|---|---|---|
| Fuel leakage | Leaky burner block valves go undetected, setting the stage for an explosive ignition attempt | The presence of $CH_4$ is sensed, so unsafe ignition attempts are prevented |
| Combustion failure detection | Unsafe fuel rich combustion goes undetected due to lack of air control and inadequate flue gas analysis. (Slow response times at stack) | Reliable, stable, and fast analysis for $O_2$ and CO/$CH_4$ in the radiant section prevents an unsafe combustion environment |
| Combustion efficiency | Operator prefers high $O_2$ operation to minimize the possibility of a fuel rich environment, for safety, which gives poor efficiency | Safe combustion control with fuel/air cross limits and CO/$O_2$ under automatic trim control, which minimizes fuel consumption while preventing fuel rich conditions |
| After-burning | High level of combustibles may cause after-burning in convection section or base of stack | Quick combustion zone analysis and safety control functions eliminate an after-burning |

Figure 5: Conventional fired heater management vs. Yokogawa Fired heater optimization

## Site survey session

As a best practice, Yokogawa recommends an introduction of the Fired heater optimization with a site survey session. The initial session identifies:

- Issues and solutions of the target heater
- A note of the changes needed to the target heater that requires detailed engineering
- Customer benefit from the solutions
- A number of TDLS analyzers and its installation location on the target heater

## Case study

Yokogawa has many project experiences of safety and efficiency improvement of the fired heaters. In most case, We have achieved the fuel saving of approx. 5%.

Fired heater type (Example)

- Reformer unit heater
- HDS unit heater
- Aromatics unit heater (Xylene)

vigilantplant.®
The clear path to operational excellence

SEE CLEARLY | KNOW IN ADVANCE | ACT WITH AGILITY

VigilantPlant is Yokogawa's automation concept for safe, reliable, and profitable plant operations. VigilantPlant aims to enable an ongoing state of Operational Excellence where plant personnel are watchful and attentive, well-informed, and ready to take actions that optimize plant and business performance.

**YOKOGAWA ELECTRIC CORPORATION**
World Headquarter
9-32, Nakacho 2-chome, Musashino-shi, Tokyo 180-8750, Japan
Tel: 81-422-52-8824 Fax: 81-422-52-7048
URL: http://www.yokogawa.com/



YOKOGAWA