



## Lenox Insights

# Boiler Camera System Reduces Emission by As Much As 20%

**Combustion Consultant Uses High-Temperature TV System In Diagnosing, Tuning Plant Boilers For Optimum Efficiency.**

Entropy Technology & Environmental Consultants (ETEC), Houston, TX, receives calls from electric utilities, refineries, chemical plants and other facilities throughout the U.S. who want to evaluate the combustion in their furnaces to improve performance and reduce emissions.

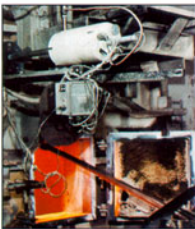
Stephen Wood, president of ETEC, personally responds to each call. Traveling to the site, he first checks the interior of the boilers using portable high-temperature color TV cameras which can spot potential problems long before they would actually occur. He views burners and other locations in real time on a portable TV monitor.

He then combines these observations with extensive measurements of furnace conditions and determines the best operational parameters of the combustion system.

Wood uses a closed circuit TV (CCTV) system, called FireSight™ (from Lenox Instrument Co., Inc., Treviso, PA) which can withstand temperatures of 3,500°F.

He inserts the camera's air-cooled lens through a port so that it surveys the entire interior, including burners, from the boiler's inside wall.

"We use the CCTV system in conjunction with programs to evaluate the combustion impacts of burner malfunctions as well as the impact of induced flue gas recirculation systems on the combustion



*FireSight unit mounted through wall of boiler. Portable unit available for multi-boiler use.*



*Actual image taken through FireSight lens.*

process," Wood says. (These recirculation systems route a portion of the exhaust gas back into the system, where it is combined with air for further combustion. The result is lower flame temperature and lower NOx emissions.)

In evaluating the combustion process, Wood measures "back end" conditions such as exhaust gas emissions, carbon monoxide, nitric oxide and excess oxygen.

"When we also have the enhancement of seeing the furnace flame, knowing exactly what's going on inside the furnace, we can prevent a lot of potential problems from occurring," he says. "We've discovered long-standing problems which no one was really aware of until we were able to look at the burners with the camera. We discovered the problems and customers adjusted accordingly."

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*This story published in **Power** and in **Hydrocarbon Processing** magazines.*



Portable diagnostic FireSight system, ideally designed for field inspection of boilers, furnaces, kilns or incinerators.

FireSight has frequently detected flame impinging on boiler tube surfaces, which can cause furnace tube failure. "Before I began using the camera system three years ago, I would look through an observation door of the furnace but I couldn't see flame impingement with the naked eye," Wood says. "I could only view a localized area of the furnace. The camera now provides a means for identifying, in advance, problems like tube failure or equipment outage, which are very costly. If you have tube leaks, you may have to take the furnace off-line for repair. In the case of a large utility in peak operation, this could cost hundreds of thousands of dollars."

Besides detecting potential problems, the CCTV system also shows flame distribution within the furnace, helping ETEC provide a more well-balanced combustion "tuning" process to increase overall performance and reduce emissions as much as 20 percent. "Optimizing the combustion process often saves thousands of dollars a year and helps comply with stringent emissions standards," Wood says.

After determining the best operational parameters from the visual, emission and other data, ETEC develops guidelines for operators of the furnace to comply with. These guidelines include such parameters as recommended settings for burners, dampers and registers. ETEC also develops troubleshooting guidelines so that, if a problem occurs, plant maintenance engineers can follow a diagnostic checklist to find out where the problem is occurring and correct it.

Wood found out about FireSight while he was adjusting furnace settings at a utility in Louisiana. "Someone had information on the system, and I arranged to have one of the cameras delivered to the site," he says. "I saw the real value of FireSight when I began using it."

Wood usually employs two FireSight systems, which are usually shipped to the site by Lenox Instrument Co. One of the cameras has a direct viewing lens; the other a side viewing lens. Positioned high in the furnace, the two look down on the entire interior, including burners, and provide a complete picture of what's happening. Wood frequently videotapes what the camera observes. He can then enlarge sections of the tape for closer study, or make still photos from it for reports.

The single most important component of the FireSight System is an air-cooled periscope, called a "furnace lens," which penetrates the wall of the boiler within a protective "Wallbox," also air-cooled, which is the primary cooling shroud. An air-cooled quartz lens at the end of the periscope withstands the high interior temperatures, and is available with different fields of view.

A series of achromatic relay lenses within the periscope carries images from the lens to a closed-circuit compact CCD color TV camera within an air-cooled CCTV housing. The live images appear on a 13-inch color monitor which Wood watches, right at the boiler, often videotaping what he sees.

An operator can easily adjust the amount of light coming to the camera by operating a unique remote-controlled motorized iris and spot filter located in the furnace lens. This insures a high-quality picture at all times, even in the most intense light.

A vortex-type cool air generator provides a constant flow of cooled air into the CCTV housing and the Wallbox. (Air is supplied by the user in the form of compressed air.) The FireSight also includes an air filtration system which removes oil, water and particles from the compressed air which goes to the furnace lens.

The FireSight System can directly view combustion of coal, oil, gas and other fossil fuels. Originally designed for utility companies, it is widely used in chemical, petrochemical, trash-to-steam, glass, steel and many other plants. FireSight is often permanently installed for use by the operators.

Lenox Instrument Company developed the first commercial borescope for optical diagnosis in 1920 and utilized its knowledge of viewing technology in developing FireSight.

For further information on the FireSight Monitoring System, contact:



#### Lenox Instrument Co., Inc.

265 Andrews Road,  
Scottsville Industrial Park, Trevose, PA 19053-3427.  
Tel: (800) 356-1104 or (215) 322-9990  
Fax: (215) 322-6126.  
E-Mail: sales@lenoxinst.com  
Web: sales@lenoxinst.com