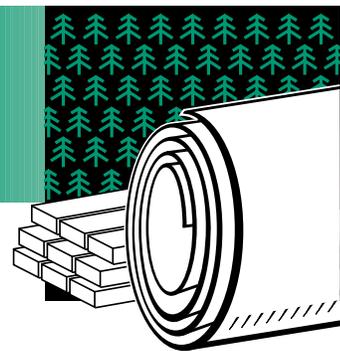


# FOREST PRODUCTS

## Project Fact Sheet



## SYSTEM FOR DETECTION AND CONTROL OF DEPOSITION IN KRAFT RECOVERY BOILERS

### BENEFITS

- Could save 82 billion Btu per installation annually
- Could save 3.1 trillion Btu annually by 2010
- Reduces soot blower steam usage
- Increases boiler up-time and slag falls due to less plugging
- Improves environmental compliance through increased operating stability
- Reduces consequences of pendant tube leaks due to earlier detection
- Improves operator confidence

### APPLICATIONS

The new technology is primarily applicable to Kraft chemical recovery boilers in the wood-pulping industry. The capacity of many Kraft pulp mills is constrained by deposits plugging the recovery boiler. The new system helps detect and control such deposits. The system's developer, Combustion Specialists, Inc., also believes this approach may be applicable to controlling deposits in coal-fired utility boilers and monitoring glass furnaces.

### INNOVATION RESULTS IN SYSTEM THAT MONITORS AND CONTROLS DEPOSITS ON PENDANT TUBES

Kraft chemical recovery boilers in pulp mills are large and expensive, with capacities typically exceeding 1000 tons of pulp per day. Because it is difficult to economically add small incremental units, the capacity of the chemical recovery boiler is often the major factor limiting the mill's production. Deposits on the boiler's pendant tubes can plug gas passages, reducing the boiler's availability. This plugging, in turn, can reduce the mill's production capacity.

Currently, no commercially available systems exist to detect and control deposition in Kraft chemical recovery boilers. Instead, the onset of plugging is detected by measuring draft loss across the convective section. Often, by the time a pressure drop is detected, the convective passes are already fouled, which requires a water wash with 36 to 48 hours of downtime to continue operation. Another indirect indication of fouling is the degree of steam attemperation needed to maintain the target steam temperature and the subsequent decrease in steam temperature once attemperation is discontinued. These measures are insensitive, however, and do not indicate the location of the fouling.

A new technology is designed to be far more effective at detecting and controlling plugging. The system uses a newly available infrared microbolometer, or ferroelectric array camera, together with on-line temperature measurements and advanced image-processing techniques to yield parameters for closed-loop control.

### PORTABLE DEPOSIT INSPECTION CAMERA



This new inspection technology, being developed by Combustion Specialists, Inc., helps detect and control deposits in Kraft recovery boilers.



## Project Description

**Goal:** Extend the system's capabilities to obtain images of deposits throughout the convective sections of the boiler and provide feedback to the mill's soot-blowing control system. Test the system on two boilers and in a glass furnace.

The advent of ferroelectric and microbolometer detector arrays, combined with the decrease in cost of computing power is now making on-line detection possible. These arrays are relatively inexpensive and do not require cooling, making them suitable for boiler applications. The new system for deposition detection will use a number of these sensing devices with sophisticated multi-point data processing to accurately detect and measure the deposition of plug-causing materials. This innovative new system is expected to produce clear images of the interior of the boiler from strategically placed sensors. The system is being designed to interface with existing soot blower controls and selectively operate soot blowers to reduce deposits in affected areas.

Combustion Specialists, Inc., is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the U.S. Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Refine optics and assemble image capture and processing system.
- Investigate particle scattering and improve sensitivity of imaging device.
- Develop off-axis imaging optics and image-processing software.
- Integrate the system with soot blower controls.
- Test the system on two boilers and a glass furnace.

## Economics and Commercial Potential

The new technology represents an excellent opportunity to save energy and reduce emissions in Kraft pulp mills. The system could save an estimated 15% of the steam used in Kraft recovery-boiler soot and an average of 82 billion Btu of diesel oil per installation each year. First sales for the technology are expected by 2003. Based on 30% market penetration by 2010, annual savings could be 3.1 trillion Btu with 38 units operating. Market penetration of 70% by 2020 could save 7.1 trillion Btu from 85 operating units.

The primary market for this system is approximately 250 large Kraft recovery boilers in the United States, 98 in Japan, 77 in Canada, and 60 in Scandinavia. Combustion Specialists, Inc. is targeting 10% penetration of this market, or about 50 installations, in the first 5 years. The estimated cost per installation is \$100,000, for total sales of \$5 million during this period. The secondary market for this system is the coal-fired utility industry.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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## INDUSTRY OF THE FUTURE—FOREST PRODUCTS AND AGENDA 2020

*In November 1994, DOE's Secretary of Energy and the Chairman of the American Forest and Paper Association signed a compact, establishing a research partnership involving the forest products industry and DOE. A key feature of this partnership was a strategic technology plan—**Agenda 2020: A Technology Vision and Research Agenda for America's Forest, Wood, and Paper Industry.** Agenda 2020 includes goals for the research partnership and a plan to address the industry's needs in six critical areas:*

- Energy performance
- Environmental performance
- Capital effectiveness
- Recycling
- Sensors and controls
- Sustainable forestry

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