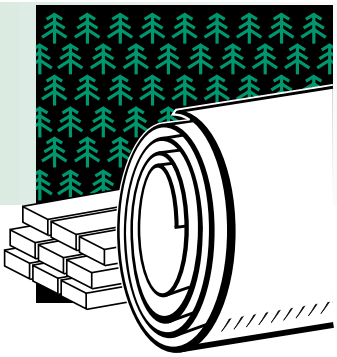

Development of METHANE de-NOx® Reburning Process for Wood Waste, Sludge, and Biomass Fired Stoker Boilers

Benefits

- Ease of retrofitting the technology
- Low capital cost of the retrofit
- Increase of 2 percent in boiler thermal efficiency
- Reduced natural gas input
- Increased sludge firing capacity
- Total energy savings of 0.16×10^{12} Btu/boiler/year
- Reduction in air emissions of NOx, CO, and VOCs
- Total annual savings of $670,000/boiler

Applications

The new technology will be applicable to a wide range of waste wood- and sludge-fired boilers. Assuming widespread adoption of the METHANE de-NOx® technology, these designs will cover the variety of boilers in the forest products industry that would need to be retrofitted. In addition, a commercialization and business plan will be available to transfer the successful technology to industry.

Application of Proven Technology Will Improve Energy and Environmental Performance of Forest Products Industry

The METHANE de-NOx® reburning technology has been successfully demonstrated in commercial power plants using municipal solid waste and coal as fuels. In the presence of the technology, the combustion systems operated more efficiently; required less maintenance; reduced emissions of NOx, CO, and VOCs by more than 50 percent; and increased thermal efficiency of the boilers by more than 2 percent compared to conventional cofiring. Researchers are now studying the application of the reburning technology to the forest products industry, making use of the fuels so abundant as by-products of this industry: biomass, wood wastes, and sludges. The low-cost METHANE de-NOx® technology is easily installed as a retrofit to industrial boilers, without the need to modify the boiler itself (see Figure 1).

In adopting this technology, the forest products industry will avoid the handling and landfilling costs of the waste products remaining after processing. These waste products have traditionally been difficult to burn in boilers because of their low combustion temperatures and abundant emissions. However, baseline tests of a waste wood boiler retrofitted with the METHANE de-NOx® technology showed the benefits of increased sludge feed, reduced requirements for supplemental natural gas fuel, and increased boiler efficiency. In addition, emissions from the system met air quality standards.

Return Technology for Boilers

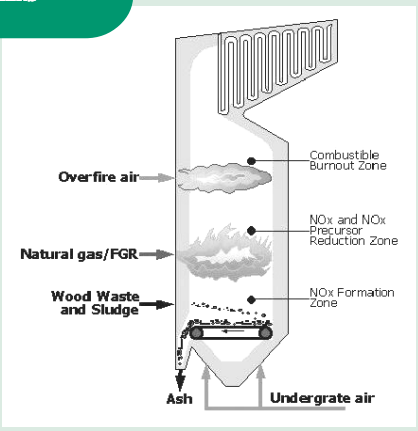

Figure 1. The diagram shows a spreader stoker boiler with the METHANE de-NOx technology retrofit.

Project Description

Goal: To promote the application of the METHANE de-NOx® reburn technology to the forest products industry in order to use the waste materials and biomass that are by-products of the industry in an efficient and environmentally friendly manner.

In the METHANE de-NOx® reburn technology, natural gas is injected directly into the lower region of the primary flame zone, just above the combustion grate, as shown in Figure 1. This increases and stabilizes the average combustion temperature and improves combustion of high-moisture-content fuels; provides more uniform temperature profiles, which reduces peak temperature; and reduces the available oxygen to minimize NOx formation. NOx precursors decompose and react in the primary combustion zone, forming molecular nitrogen rather than NOx. (This is in contrast to conventional reburning, where natural gas is injected above the primary combustion zone after the majority of NOx has been formed.)

The research consists of two phases. In Phase I, the objective is to validate the METHANE de-NOx® reburn technology over the short term (i.e., 1 month) on an existing pilot-scale stoker, using biomass and wood waste solids and sludges from the forest products industry. In Phase II, the performance of the technology will be confirmed over a longer time period of continuous operation (i.e., 3-6 months) on three commercial-scale biomass and/or wood waste solid and sludge fired stoker boilers. Engineering designs of the technology will be developed to facilitate its application to a wide range of boiler types in the industry. The thrust of the program is to maximize the combustion and energy efficiencies of the system while also maintaining or decreasing air emissions, using 10 percent or less natural-gas auxiliary fuel.

Progress & Milestones

- Three patents related to the technology are held by the Institute of Gas Technology.
- A METHANE de-NOx® reburn process was put into full-scale, continuous operation at Bosie Cascade's International Falls, MN mill in December 1999. It received AF&PA's Environmental and Energy Achievement Award by demonstrating:
  - — Increased sludge firing rate of 1.2 -1.3 ton/hr to up to 4 ton/hr;
  - — Increased thermal efficiency by 1-2%;
  - — Reduction in NOx emissions by more than 50%; and
  - — Reduction in natural gas input of 25%.
- Long-term, phase II analysis of operating data shows continued demonstration of increased sludge combustion and effective NOx reduction.

Project Partners

Institute of Gas Technology
Des Plaines, IL

Detroit Stoker Company
Monroe, MI

Fluent Incorporated
Laconia, NH

Reaction Engineering International

Sargent & Lundy LLC
Chicago, IL

Boise Cascade Corporation
Boise, ID

Gas Research Institute
Chicago, IL

IGT Sustaining Mebership Program
Des Plains, IL

For Additional Information, Please Contact:

Charles Russomanno
Office of Industrial Technologies
Phone: (202) 586-7543
Fax: (202) 586-1658
E-mail: charles.russomanno@ee.doe.gov

Dr. Joseph Rabovitser
Institute of Gas Technology
1700 S. Mt. Prospect Road
Des Plaines, IL 60018
Phone: (847) 768-0548
Fax: (847) 768-0600
E-mail: joseph.rabovitser@gastechnology.org

Stan Wohadlo
Institute of Gas Technology
1700 S. Mt. Prospect Road
Des Plaines, IL 60018
Phone: (847) 768-0594
E-mail: swohadlo@igt.org

Visit our home page at
www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency and
Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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