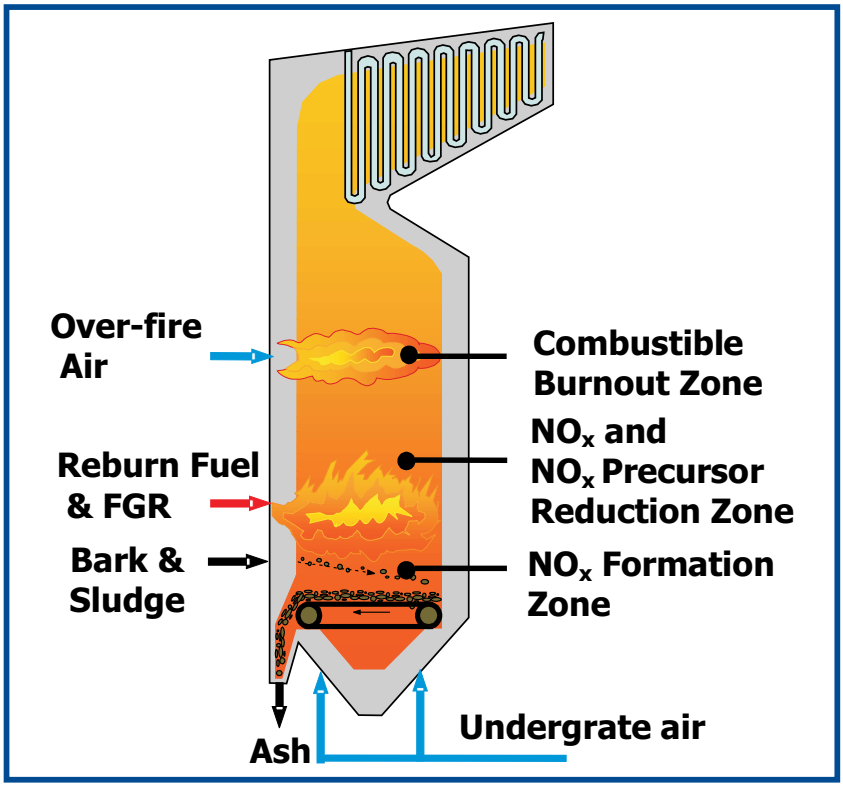
Utilization Of Non-Condensable Gases as "Reburn" Fuel

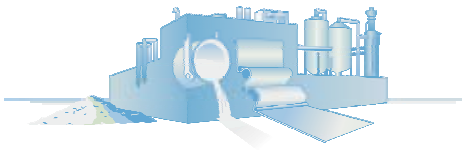
Improves Energy and Environmental Performance of Wood Products Mill

Pulp and paper mills require large amounts of energy, and routinely take advantage of the biomass, sludge, and other processing by-products as sources of fuel. A previously developed METHANE de-NO_X reburning technology is commercially successful in improving the efficiency and reducing the emissions of a mill's power-generating combustion system. Natural gas is the preferred reburn fuel with this technology. However, new cluster rules imposed by the Environmental Protection Agency are requiring the pulp and paper industry to use a higher percentage of their waste products for fuel and simultaneously reduce their air emissions, particularly NO_X.

With enactment of the new cluster rules, more non-condensable waste gas streams (NCGs) are generated—gases that must be disposed of in an environmentally sound manner. Since natural gas prices have also increased significantly, it is important that researchers develop methods to use these NCGs as potential reburn fuels for mill combustion systems, saving energy costs and ensuring safe disposal of these gases.



Three-stage combustion for stoker boilers demonstrating the reburn process for non-condensable waste gas stream.



Benefits for Our Industry and Our Nation

- Provides flexible disposal option for non-condensable waste gas streams
- Reduces use of natural gas compared with co-firing by more than 500 million scf (standard cubic foot) per boiler-year
- Uses an additional 10,000 tons of bark and/or hog fuel, and up to 32,000 tons of sludge as fuel per boiler-year
- Reduces NO_X emissions by 50% compared to a standard co-firing system
- Eliminates production of 6,000 metric tons per unit-year of CO_2 (because natural gas is not combusted)
- Eliminates need for co-firing burners and incinerator

Applications in Our Nation's Industry

There are about 150 wood waste-fired stoker boilers in U.S. mills that generate non-condensable gases. The potential market share for this technology is 60%. If the units are available for commercial use by early 2007, market saturation would occur in 5 to 12 years (depending on natural gas prices and enactment of new emissions standards).

Project Description

Goal: To develop an advanced version of the METHANE de-NO_X (MdN) reburn technology, which can utilize as reburn fuel non-condensable gases that are by-products of pulp and paper mills.

An MdN stoker boiler retrofit consists of four primary components: 1) a natural gas supply and injection system, 2) a flue gas recirculation system, 3) air distribution adjustments that may include over-fire air system modifications, and 4) control integration. Depending on operational conditions and constraints, the MdN process can reduce NO_X emissions by 30 - 50% and improve boiler thermal efficiency up to 2%, while stabilizing grate combustion and increasing the ability to fire difficult-to-burn fuels.

The project has resulted in the successful demonstration of the MdN technology on a bark- and sludge-fired boiler at a Boise Cascade paper mill in International Falls, MN and baseline testing and evaluation of two additional bark-fired stoker boilers at other mills. Another MdN system installed at a Georgia-Pacific paper mill at Port Hudson, LA in 2002 achieved NO_X reduction of over 30% on a 225,000-lb/h bark and gas co-fired stoker boiler. A second continuation project awarded in May 2004 has resulted in the design and installation of a modified over-fire air (OFA) and flue gas recirculation (FGR) system to further improve the boiler's energy and emissions performance.

Pathways and Milestones

- Demonstrated MdN Reburn performance benefits at Boise Cascade's commercial bark- and sludge-fired plant at International Falls, Minnesota (Completed December 2002)
- Implemented results of optimization studies in stoker boiler at Port Hudson site (Completed December 2005)
- Complete MdN Reburn Technology Manual to provide end-users a tool how technology can be used in each of four commercial designs

Commercialization

The target market of the MdN technology is stoker boilers meeting the following characteristics:

- Firing coal, wood/wood waste/paper mill primary sludge, or municipal solid waste.
- Heat input rates above 250 MMBtu/hr, either for a single stoker boiler or for multiple stoker boilers feeding a common stack, and
- Located in the 21 states of the Ozone Transport Region (OTR), California, or severe non-attainment regions in Texas (Houston/Beaumont and Dallas/Fort Worth).

These units are under the most pressure to reduce NO_X emissions, and MdN is well situated in the market to successfully compete with other NO_X reduction technologies in these market segments.

Project Partners

Gas Technology Institute
Des Plaines, IL

Boise Cascade Corporation
DeRidder, LA

Babcock Borsig Power
Worcester, MA

University of Illinois
Chicago, IL

Detroit Stoker Company
Monroe, MI

Fluent, Inc.
Lebanon, NH

Georgia-Pacific Corporation
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A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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