ENERGY UTILIZATION TECHNOLOGY

FOCUS

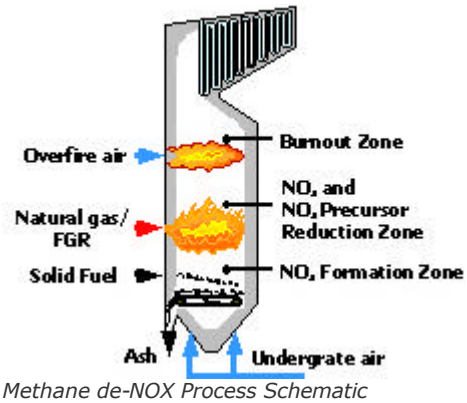
Methane de-NOX® for Stoker Boilers

About 2,000 stoker boilers in the U.S. fire coal, municipal solid waste (MSW), biomass and other solid fuels. Owners must control gaseous and particulate emissions, tube erosion, slagging and fouling of heat transfer surfaces. GTI's METHANE de-NOX® is a combustion modification process that significantly reduces stoker nitrogen oxide (NO_X) emissions while providing increased boiler performance and enhanced combustion of problem fuels. The process is aimed at boiler operators seeking to minimize total cost for reducing emissions while increasing their boiler's energy performance.

Objective

Develop and commercialize a cost-effective natural gas reburning process for reducing NO_x emissions and improving the combustion performance of solid-fuel-fired stoker combustors.

Benefits



Methane de-NOX Process Schematic

- ? METHANE de-NOX can reduce NO_x up to 70% without undesirable by-product emissions
- ? On MSW, METHANE de-NOX can reduce dioxin emission levels by more than 80%
- ? Technology retrofit is easily accomplished without major outage
- ? Site-specific operational improvements include reduced unburned carbon in ash, increased grate combustion of difficult-to-burn high-moisture waste fuels such as sludge, and improved boiler thermal efficiency by 1-2%
- ? Boiler operators realize better control of transient conditions.

Technology Description

METHANE de-NOX, a gas reburn technology developed by GTI, reduces NO_x emissions and improves grate combustion of solid-fuel-fired stoker combustors. Nitrogen oxide levels are readily lowered without increasing other undesirable emissions. During the process of this patented technology, natural gas and recirculated flue gases (FGR enhances mixing) are injected strategically above the combustion grate to create an oxygen-deficient zone. Direct injection of natural gas into the combustion zone reduces the availability of oxygen that could result in NO_x formation. Under these conditions, a significant part of NO_x precursors decompose and react, forming molecular nitrogen rather than NO_x.

Tests documented that the added heat release from natural gas combustion above the stoker grate stabilizes the firing of solid fuel. This improves combustion of difficult-to-burn waste fuels (e.g., those with a high moisture content).

Overfire air (OFA) is injected at a higher elevation in the furnace to allow sufficient residence time to complete the reburn reactions. Adding OFA burns out the remaining combustibles and carbon monoxide (CO) in the furnace gases.

Status

GTI demonstrated METHANE de-NOX on commercial-scale MSW-, coal- and wood-waste/biomass-fired stoker boilers. Results show that the process effectively reduces NO_x emissions by 50-70% and can improve boiler efficiency by 1-2%. Depending on the level of NO_x reduction required, natural gas injection ranges between 5 and 25% of the total boiler heat load. NO_x is reduced while maintaining acceptable levels of CO.

R&D Magazine awarded METHANE de-NOX its 1997 R&D 100 Award for environmental and performance potential. Japan's Environmental Agency recognized METHANE de-NOX with an Environmental Prize, and the process received the 1999 AF&PA Environmental and Energy Achievement Award.

GTI is actively involved in technology transfer and deployment with its commercial licensee, ESA Environmental Solutions. Working closely with end-users and partners, GTI continues to participate in testing, modeling and design for commercial applications.

With support from DOE and industry, GTI is also extending the applicability of the technology to include greater use of recovery fuels.

Commercial Demonstrations To Date

? 100 T/D Mass Burn Incinerator, Olmsted County Waste-to-Energy Facility Unit #1 (Rochester, Minnesota)

? 240-MW Cogeneration Plant, Eight – 360 MMBtu/h Coal-Fired Stoker Boilers, Cogentrix Inc. (Richmond, Virginia)

? 300 MMBtu/h Hog Fuel-Fired Stoker Boiler, Boise Cascade Corporation Paper Mill #2 Boiler (International Falls, Minnesota)

Partners

? U.S. Department of Energy– Office of Industrial Technologies (OIT)

? ESA Environmental Solutions

? GTI Sustaining Membership Program

? Consortium of Gas Companies

? Gas Research Institute

July 2003