STEEL
Project Fact Sheet

Steel Reheating for Further Processing

Oxy-fuel Burners Can Reduce Steel Furnace Energy Use By Up To 45%

Benefits

- Potential to reduce energy consumption by 30-45% per ton of steel
- Potential to reduce NO_x emissions by 60-90% per ton of steel
- Annual projected energy savings: 112 billion Btu (one furnace)
- Annual projected cost savings: $240,000 (one furnace)
- Reduces waste heat
- Eliminates recuperator
- Eliminates installation of NO_x removal equipment

Applications

- Steel and glass industry
- Any combustion system

Steel reheating is an energy-intensive process requiring uniform temperature distribution within reheating furnaces. Historically, “recuperators” have been used to preheat combustion air, thereby conserving energy. More recent innovations include oxygen enrichment and the use of regenerative burners, which provide higher preheat air temperatures than recuperators. These processes have limitations such as equipment deterioration, decreasing energy efficiency over time, high maintenance costs, and increased NO_x emissions with increased air preheat temperature, unless special equipment is used.

Praxair, Inc., supplier of oxygen and other industrial gases to the steel industry, proposes to introduce an innovative oxy-fuel burner technology (using 100% oxygen) to the steel reheating industry. Oxy-fuel combustion reduces or eliminates nitrogen in combustion air and substantially reduces waste heat carried out with flue gas. Based on technology currently used in the glass, hazardous waste, and aluminum industries, Praxair has developed and patented low temperature, oxy-fuel burners that can be used in high temperature industrial furnaces where temperature uniformity is critical and extremely low NO_x emissions are desired.

Oxy-fuel Burners Reduce Energy Use

Photo courtesy of Bethlehem Steel

Oxy-fuel burners have the potential to save steel mills, like this one, significant money and energy.

The technical goal of the project, sponsored in part by DOE's NICE^3 program, is to demonstrate the use of oxy-fuel burners in a slab reheat furnace while reducing energy consumption by 45% and NO_x emissions by 90% within the converted furnace zones. Successful implementation of this technology also will eliminate the need to periodically replace recuperators and install NO_x removal equipment.

The low NO_x feature of this system is expected to be a general requirement of the steel industry of the future. Bethlehem Steel is starting up its system in May 1998.

Savings Potential for Steel Industry

Continuous furnaces, which are more fuel-efficient than batch furnaces, represent much of steel production. On average, reheating consumes 2.2 million Btu per ton of steel. Overall fuel savings with this technology are estimated at 35%, since there is less potential benefit in more fuel-efficient furnaces. Given 100 million tons of steel per year, the potential industry-wide annual fuel savings are 7.7 x 10^{13} Btu.

Applicability to Other Industries

This technology has been used in the glass industry, and in general would apply to any combustion system. Fuel savings and economics favor higher temperature processes, such as steel and glass.

Estimated Energy Savings (Btu per year)

Furnace with Conventional Burners*	250 billion
Furnace with Oxy-Fuel Burners	138 billion
Savings	112 billion

Estimated Annualized Utility Cost

Furnace with Conventional Burners*	$620,000
Furnace with Oxy-Fuel Burners	$380,000
Savings	$240,000

***Producing 120,000 tons of steel/year.**

Industries of the Future—Steel

Through OIT's Industries of the Future initiative, the Steel Association, on behalf of the steel industry, has partnered with the U.S. Department of Energy (DOE) to spur technological innovations that will reduce energy consumption, pollution, and production costs. In March 1996, the industry outlined its vision for maintaining and building its competitive position in the world market in the document, ***The Re-emergent Steel Industry: Industry/Government Partnerships for the Future.***

OIT Steel Industry Team Leader: Scott Richlen (202) 586-2078

NICE^3—National Industrial Competitiveness through Energy, Environment, Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $400,000. Grants fund up to 50% of total project cost for up to 3 years.

Project Partners

Praxair, Inc., Tarrytown, NY

Bethlehem Steel Corp., Chesterton, IN

Indiana Department of Commerce, Energy Policy Division

For More Information

NICE^3 Web site:
http://www.oit.doe.gov/Access/nice3/

NICE^3 program contact:
Steve Blazek
Golden Field Office, DOE
1617 Cole Boulevard
Golden, CO 80401
(303) 275-4723
(303) 275-4273 (fax)
steve_blazek@nrel.gov

Praxair: Ron Selines
(914) 345-6467

Bethlehem Steel: Tony Martocci,
(610) 694-6657

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

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