

STEEL

Project Fact Sheet

Hot Strip Mill Transfer Bar Rapidfire™ Edge Heat Project



BENEFITS

Based on a plant producing 3 million tons of steel coil per year:

- Energy savings of 28 percent (gas consumed will drop from 83 million to 60 million cubic feet)
- CO₂ emissions cut by 1310 tons
- NO_x cut by 6 tons
- Capital and installation costs more than 90 percent lower than reheat furnaces
- Strength and ductility of the final product increased compared to conventional heating processes

APPLICATIONS

The Rapidfire™ Edge Heater applies to hot strip mill transfer bar heating in the production of steel and coils.

INNOVATIVE EDGE HEATER PRODUCES HIGHER QUALITY STEEL WITH FEWER DEFECTS WHILE REDUCING ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS

Weirton Steel, with financial assistance from the Department of Energy's NICE³ Program, is demonstrating an effective edge heater that reheats the transfer bar edges of steel slabs during processing. The Rapidfire™ Edge Heater, developed by Air Products and Chemicals, Inc. (APCI), for the Gas Research Institute (GRI), addresses the problem of edge-related defects that occur during the production of sheet steel coils. During the gauge reduction process, the Rapidfire™ Edge Heater effectively maintains a hot-working temperature, the primary processing factor affecting grain size of steel and the resultant key mechanical characteristics of the end product: strength, hardness, and ductility.

In a typical hot strip mill, steel slabs are overheated to ensure that edges remain hot enough for final processing. Once a slab has "dropped out" of a reheat furnace and into the open air, the temperature bar drops by 700°F. This drastic temperature loss results in uneven cooling that causes cracks and creates shape and metallurgical variations on the slab, particularly on surface edges. When overheating is inadequate, the product exhibits poor mechanical properties at the edges and will usually be rejected for having too low a finishing temperature. Devices, such as heat retention covers, do not effectively maintain even slab temperatures. Using induction heaters is another approach to keep slab temperatures constant, but these heaters are five times more expensive to operate than the Rapidfire™ system.

To ensure more evenly heated slabs, the Rapidfire™ Edge Heater employs a GRI-patented process that incorporates APCI oxygen-natural gas burners to generate higher-temperature flames. The approach transfer bar is guided so that heat is efficiently transferred into the bar's working edges. This reduces the need to overheat slabs and produces fewer edge-related defects. This unique system uses 28 percent less energy than current methods. In addition, it lowers capital costs and eliminates pollutants because burning pure oxygen (rather than regular air) with natural gas reduces CO₂ and NO_x emissions.

RAPIDFIRE™ EDGE HEATER



The Rapidfire™ Edge Heater ensures evenly heated steel slabs to produce a higher quality product at less cost.



Project Description

Goal: Demonstrate that the Rapidfire™ Edge Heater produces higher quality steel with fewer edge-related flaws.

The edge heater employs oxygen-natural gas burners (rather than air-fired) to produce higher-temperature flames directly onto transfer bar edges. As the bar approaches the finishing mill, a straddle guiding bar centers it and ensures that its edges receive the brunt of heat from the oxygen-gas burners. Nearly 2000°F hotter than a conventional air-natural gas flame, the Rapidfire™ flame impinges directly on the metal being heated. The burner contains many individual oxygen and natural gas ports to improve mixing of gases and provide a uniform flame pattern. Burner ports are configured longitudinally, allowing the flame to match the transfer bar's edge as it passes through the centering guides. Through more direct and uniform flame distribution onto the metal, this system provides much higher heat transfer rates. Other technologies, such as reheat furnaces that are far more energy intensive and require great amounts of preheated combustion air, do not prevent uneven transfer bar cooling, a problem that the Rapidfire™ system eliminates.

Weirton Steel is demonstrating this new technology with assistance from the Gas Research Institute, the West Virginia Energy Efficiency Program, and the NICE³ Program in the Department of Energy's Office of Industrial Technologies.

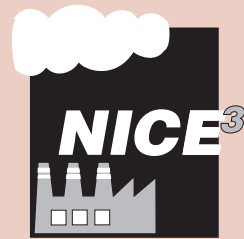
Progress and Milestones

- Preliminary design of the centering guide system and other components were scheduled for completion in December 1999.
- The purchase, installation, and pretesting of equipment began in December 1999 and are anticipated to be complete by December 2000.
- Edge heater commissioning and demonstration is anticipated to commence in December 2000 with completion in March 2001.

INDUSTRY 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.***

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NICE³—National Industrial Competitiveness through Energy, Environment, and 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 partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies. Total project cost for a single award must be cost-shared at a minimum of 50% by a combination of state and industrial partner dollars. The DOE share for each award shall not exceed \$500,000 to the industrial partner and up to \$25,000 to the sponsoring state agency for a maximum of \$525,000.

PROJECT PARTNERS

Gas Research Institute
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NICE³ Program
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DOE/GO-102000-0947
Order# NICE³ST-8
Revised October 2000