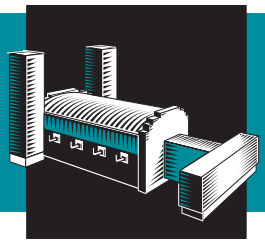
Technology Success Story

GLASS



Oxygen-Enriched Air Staging

Benefits

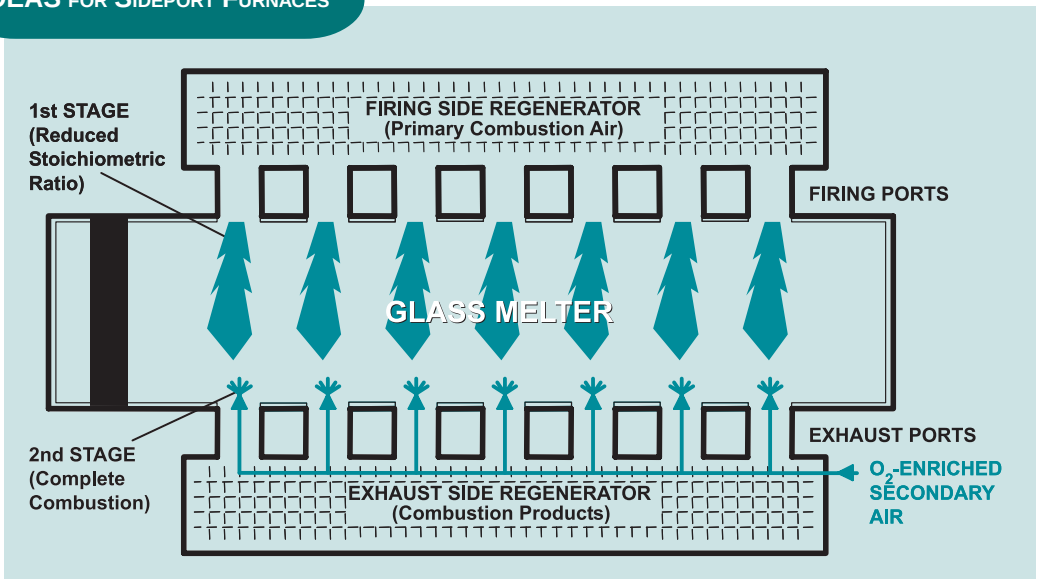
- Reduces NO_x levels by an average of 60 percent to as low as 2 pounds of NO_x per ton of glass, enabling glass producers to meet stringent environmental regulations
- Costs less than competitive technologies because fuel consumption is not increased, the OEAS process takes place inside the existing glass melter, and capital, installation, and maintenance costs are low.
- Glass quality is unaffected
- Requires little or no maintenance
- Can be installed on all air-fired endport and sideport regenerative glass melters
- Can be installed on new furnaces or as a retrofit on working furnaces.

A Cost-Effective Method for Reducing NO_x Emissions

Nitrogen oxides (NO_x) are an important precursor to both ozone and acid rain formation, and are a target of environmental regulations. For the most part, the federal government relies on states to improve air quality, and stringent regional NO_x regulations are already taking effect in many states. Air-fired regenerative glass melters, operated with very high air-preheat temperatures to improve efficiency, are a significant source of industrial NO_x emissions. Glass companies are under pressure to find cost-effective ways to reduce the NO_x emitted from their glass melting furnaces while maintaining furnace efficiencies and glass quality.

Furnaces producing different types of glass generate different amounts of NO_x, and regulations vary regionally. But one generalization can be made. The glass industry must find a way to meet regulations cost-effectively. Without a cost-effective method that can reduce NO_x emissions, some companies might be forced to decrease production or shut down facilities. A number of air-fired regenerative glass furnaces have been replaced with oxygen-fired melters. While oxygen firing greatly reduces NO_x formation and lowers furnace energy demands, this approach is more costly than oxygen-enriched air staging. Add-on NO_x reduction technologies can remove NO_x from exhaust gas, but these approaches increase the capital and energy costs of glass production. The Oxygen-Enriched Air Staging (OEAS) technology, patented and developed by the Gas Technology Institute (GTI) and licensed by Combustion Tec, provides a cost-effective means to dramatically decrease NO_x production in air-fired regenerative glass melters. OEAS decreases NO_x formed during the combustion process on both endport and sideport regenerative furnaces.

OEAS for Sideport Furnaces



Oxygen-enriched air staging uses a two-stage process to reduce NO_x formation.

Solution

Developed by the Gas Technology Institute (GTI), Oxygen-Enriched Air Staging (OEAS) is a retrofit that provides NO_x reduction on all endport and sideport air-fired regenerative glass melters. OEAS involves reducing the amount of primary combustion air entering through the firing port. The lower air to fuel ratio decreases NO_x formation in the flame, but incomplete combustion generates carbon monoxide and leaves some hydrocarbons unburned. Air or oxygen-enriched air is injected into the furnace near the exhaust port to complete combustion in a second stage within the furnace in order to assure complete combustion and heat release. The second stage completes combustion without increasing NO_x production.

The process is the most economical control technology for NO_x emissions because fuel consumption is not increased. The technology also has no effect upon glass quality or furnace superstructure, and can even increase furnace productivity.

Results

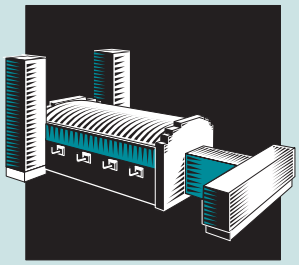
With the Department of Energy's Office of Industrial Technologies providing $700,000 in funding in addition to funding from the Gas Research Institute (now combined with GTI), Southern California Gas Company, and the GTI Sustaining Membership Program, the OEAS technology was successfully proven in a demonstration at an Owens-Brockway facility. OEAS is now a commercial technology. The retrofit has been successfully installed on ten furnaces (seven endport and three sideport) in facilities belonging to Anchor Glass, Owens-Brockway Glass Containers, and Rocky Mountain Bottle. Depending on the furnace, OEAS reduced NO_x by 30 to 75 percent on these furnaces with final NO_x levels as low as 2 lb/ton of glass. In 1996, the technology also received an R&D 100 Award.

Combustion Tec, the glass brand of Eclipse Inc., has licensed the OEAS technology and commercially installed OEAS on container glass endport and sideport furnaces. Combustion Tec continues to market OEAS to the container glass segment and is marketing the technology to other segments of the glass industry. This technology has been recently extended to a float-glass furnace. GTI plans to research applications of OEAS to high temperature furnaces used in other industries.

Comparison of NOx Reduction Technologies

	NOx Reduction (%)	Cost Increase ($/Ton Glass)	Cost ($/Ton NOx)
Cullet Preheating	5	1.00	5000
Electric Boosting	30	8.50	7100
Selective Non-Catalytic Reduction	75	4.15	1382
OEAS	65	1.50	585
Selective Catalytic Reduction	75	9.00	3000
Oxy-Fuel Firing	85	8.00	2352

Notes:
For 250-TPD Furnace Operating at 8-lb NOx/ton glass
Cost calculations per OAQPS Control Cost Manual, EPA 450/3-90-006, January 1990
OEAS Oxygen @ $0.25/CCF (LOX); Oxy-Fuel Oxygen @ $0.15/CCF (on-site)



Partners

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