

Boiler manufacturer reduces emissions for more efficient and environmentally friendly operations.

Schneider Electric solution helps gas-fired boilers meet new NOx air quality standards.



Industry

Industrial Process Heat and HVAC

Application

Equipment Manufacturing – Boilers

Challenge

To provide an integrated product/system solution that allows boilers to meet new environmental requirements regarding NOx air standards through all phases of boiler operation.

Solution

Through close support during the research and development process, Schneider Electric was able to implement standard variable frequency drive applications (Altivar 21/31/61) on a boiler air supply line to provide precise management of NOx emissions.

This integrated solution also helped the OEM extend added value to its end-use customers:

- Energy savings through lower operating demand on blowers
- Reduced acoustical noise by lower operating speeds
- Lower maintenance by removing mechanical elements from system

Impact

OEM boilers not only meet new NOx emission standards, but also allow the entire boiler system to run more efficiently and environmentally friendly for end-use customers.



Introduction

With a goal of creating greener and more environmentally friendly operations, many states and localities are working with an increased sensitivity to improving air quality by reducing NOx (Nitrogen Oxide) emissions in their areas. NOx is a generic term for mono-nitrogen oxides (NO and NO₂) which are typically produced during high-temperature combustion processes.

When NOx and volatile organic compounds (VOCs) react in the presence of sunlight, they form a photochemical smog. This presents a significant form of air pollution, especially during the summer months. Individuals who are susceptible to adverse effects of smog, such as children, people with lung diseases and those who work or exercise outdoors, may be at risk for damage to lung tissues and a reduction in lung function.

Beginning in 2008, many counties in California and Texas enacted stringent NOx emission standards. Of these, Los Angeles county has one of the most stringent emission standards, 9PPM (parts per million), while other areas have enacted emission standards of 12 to 15PPM.



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Key Product Solutions

Examples of components used as part of the variable frequency drive application on a boiler air supply line:



Altivar 21



Altivar 31



Altivar 61

Customer Problem

A major North American boiler manufacturer has been in business for over 50 years with a product line featuring both natural gas-fired and oil-fired boiler units. Representing a large share of their sales, their natural gas-fired boilers are used in various commercial and industrial applications, producing hot water or steam for heating commercial facilities and process heating for industrial customers. The key ingredients for combustion in these boilers are fuel (natural gas) and oxygen (air). In order to maximize the efficiency of the combustion and keep the NOx levels low, a precise mixture of these fuels is required.

For the OEM's natural gas-fired boilers, a servo driven butterfly valve is used for the gas fuel and a servo driven damper for the air mixture. Since hot water or steam demands in a building are not constant during the day and fluctuate during the seasons, a boiler has to react and follow the demand load. This results in light load periods where the boiler is not required to work as hard, resulting in a lower input of air and fuel for combustion. During these low combustion periods, the air damper is typically closed and does not allow for precise airflow control. This lack of accurate control can create an inefficient combustion situation that can result in increases of NOx emissions and challenges in meeting new air quality regulations.

Schneider Electric Solution

The customer's solution came from the dedicated support provided by Schneider Electric during the application development. By working closely with the OEM throughout the research and development process, our engineering and business support teams applied their technical, regulatory and application development expertise to propose and implement a viable solution that helped ensure that the OEM's boilers not only met NOx emission standards, but also improved their operational efficiency for end-use customers.

By working with the OEM, we found that a more precise management of the boiler's combustion airflow can be realized, especially at low burn rates, by controlling the speed of the air blower with a variable frequency drive (VFD), as opposed to restricting the airflow via a damper. This allows the boiler to maintain an efficient burn while keeping NOx emissions low.

Installation and Performance

By introducing an Altivar 21/31/61 VFD application on Air Supply Line, the OEM can now meet emerging air quality standards for NO_x, including the higher level standards set for California and Texas. The benefits of this solution extend beyond meeting emission standards, as they additionally make the entire boiler system more efficient and environmentally friendly:

- **End-user energy savings** – as the affinity laws show, on centrifugal loads such as pumps and fans/blowers, the amount of power to run the load goes down as the speed decreases. Since most boilers follow the demand load and therefore do not run at full capacity all the time, the combustion air blower will run at lower speeds to meet lower combustion demands. Therefore, applying a drive to control the blower speed will generate energy savings for the end user.
- **Lower noise acoustics** – the blower, among all the components in a boiler system, is the device that generates the most audible noise, particularly at full speed. In most applications, the blower will not need to run at full speed all the time, thereby reducing the speed of the blower with the drive dramatically reduces the audible noise.
- **Lower maintenance costs with higher reliability** – since the air damper is a mechanical device with moving parts, the VFD removes the need for a damper. By removing a device that requires maintenance and can break down, the VFD makes the system more reliable, with lower maintenance costs.



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