Low NO\textsubscript{x} Burners & OFA System

Grand River Dam Authority – Coal Fired Complex

Customer
Grand River Dam Authority
Coal Fired Complex Units 1 & 2

Completion Dates
Fall 2012 – Unit 2
Spring 2013 – Unit 1

Services Provided
- EPC Services
- Burner Design
- OFA design
- CFD modeling
- Procurement
- Installation
- Startup, commissioning
- Overall project management
- Construction management
- Combustion tuning

Pre-Installation
Boiler Performance
Burner Heat Input = 240 mmBtu/hr
NO\textsubscript{X} = 0.35 – 0.53 lb/mmBtu
CO ~ 100 ppm

Post-Installation
Boiler Performance Test
NO\textsubscript{X} = 0.168 lb/mmBtu
CO < 50-200 ppm

Project Summary
Power & Industrial Services provided complete turn-key services to Grand River Dam Authority to improve NO\textsubscript{X} and combustion with the design, fabrication, installation, start-up and combustion tuning of new low NO\textsubscript{X} burners and a new overfire air system at the Coal Fired Complex Units 1 & 2 located near Chouteau, Oklahoma.

Project Features
- Computational Fluid Dynamic Modeling
- Low NO\textsubscript{X} Burners, designed and manufactured by Power & Industrial Services, including new igniters and scanners
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- New Burner Management System
- Full Balance of Plant Engineering including Mechanical, Electrical, and Control System Design
- Complete Installation Services including Construction Management and Scheduling
- Combustion Optimization and Performance Testing

Project Description
Grand River Dam Authority retained the services of Power & Industrial Services to engineer, design, manufacture, and install a combustion system upgrade project that included the replacement of 24 low NO\textsubscript{X} burners and a new 12 port overfire air system on both units. Both units are opposed wall fired 500 + MWg FW boilers firing low sulfur PRB coal.

The main goal of the project was to improve combustion and operation of the boiler while lowering NO\textsubscript{X} and CO and keeping unburned carbon to a minimum.

One of the challenges facing GRDA with the existing burners was very high NO\textsubscript{X} levels at reduced boiler loads. Power & Industrial provided a new burner/OFA design solution that reduced low load NO\textsubscript{X} levels by 60 to 75%.
Low NO\textsubscript{x} Burners & OFA System

*Henderson Municipal Power & Light – Station 2 – Unit 1*

**Customer**
HMP&L
Big Rivers Electric Corporation
Robards, KY

**Completion Date**
Summer 2012

**Services Provided**
- Burner Design
- CFD modeling
- Installation Support
- Startup, commissioning

**Pre-Installation**

**Boiler Performance**
NO\textsubscript{x} = 0.50 lb/mmBtu
CO ~ 100-600 ppm

**Post-Installation**

**Boiler Performance**
NO\textsubscript{x} = 0.38-0.42 lb/mmBtu
CO < 20-30 ppm

---

**Project Summary**

Power & Industrial Services provided new Low NO\textsubscript{x} Burners to HMP&L and BREC in order to improve NO\textsubscript{x} and combustion. Power & Industrial designed, fabricated and delivered the burners.

**Project Features**

- Computational Fluid Dynamic Modeling
- Low NO\textsubscript{x} Burners, designed and manufactured by Power & Industrial Services
- New Coal Elbows with P&I Ropebreaker Flatback Technology

**Project Description**

BREC retained the services of Power & Industrial Services to engineer, design, manufacture, and deliver a combustion system upgrade project that included the replacement of 8 low NO\textsubscript{x} burners on their Station 2 Unit 1 boiler. Unit 1 is a single wall fired 165 MWg Riley boiler firing 12,200 Btu/lb eastern bituminous coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO\textsubscript{x} and CO and keeping unburned carbon to a minimum. The original windbox is very small and subsequent burner length was very limited. Power & Industrial utilized SolidWorks modeling to help overcome the limitations.

The results of this project included near elimination of the boiler backpass slagging. The new burner design also reduced waterwall flame impingement. The resulting CO emissions were very low. Additionally, the new burner design will significantly reduce long term maintenance costs.
Low NO\textsubscript{x} Burners & OFA System
Nebraska Public Power District – GGS Unit 1

Customer
Nebraska Public Power District
Gerald Gentlemen Station Unit 1

Completion Date
April 2006

Services Provided
• CFD Modeling
• Overfire Air System Design & Manufacturing
• Low NO\textsubscript{x} Burner Design & Manufacturing
• Procurement
• Fabrication
• Technical Field Support

Pre-Installation
Boiler Performance
NO\textsubscript{x} = 0.46 lb/mmBtu; CO > 200 ppm; O\textsubscript{2} = 3.2 %

Post-Installation
Boiler Performance Test
NO\textsubscript{x} = 0.20 lb/mmBtu; CO = 100 ppm; O\textsubscript{2} = 2.65 %

Project Summary
Power & Industrial Services designed and supplied new burners and an overfire air system to NPPD in an effort to improve NO\textsubscript{x} and combustion with the replacement of existing burners and a new overfire air system at Nebraska Public Power District’s Gerald Gentleman Station Unit 1, located in Sutherland, Nebraska.

Project Features
• Computational Fluid Dynamic Modeling
• Low NO\textsubscript{x} Burners, designed and manufactured by Power & Industrial Services Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Services
• Combustion Optimization

Project Description
NPPD retained the services of Power & Industrial Services to engineer, design and manufacture, and deliver a combustion system upgrade project that included replacement low NO\textsubscript{x} burners and a new overfire air system on their Gerald Gentlemen’s Unit 1. Gerald Gentleman’s Unit 1 is a wall fired 665 MW FW boiler firing low sulfur PRB coal. The unit includes sixteen burners on the front and rear walls arranged in four rows of four and 12 overfire air ports were added 6 on the front and 6 on the rear wall of the boiler. The original equipment was FW Scroll Burners installed in 1979. The main goal of the project was to improve the combustion environment of the boiler while lowering NO\textsubscript{x} and keeping CO and unburned carbon to a minimum.
Low NO\textsubscript{x} Burners & OFA System
Northern Indiana Public Service Company – RMSGS Unit 15

Customer
Northern Indiana Public Service Company
R.M. Schahfer Generating Station Unit 15

Completion Date
February 2009

Services Provided
• CFD Modeling
• Overfire Air System Design & Manufacturing
• Low NO\textsubscript{x} Burner Design & Manufacturing
• Procurement
• Fabrication
• Technical Field Support

Pre-Installation
Boiler Performance
NO\textsubscript{x} = 0.27 lb/mmBtu; CO > 200 ppm; O\textsubscript{2} = 3.0 %

Project Summary
Power & Industrial Services worked with Northern Indiana Public Service Company in an effort to improve NO\textsubscript{x} and combustion with the design and supply of new low NO\textsubscript{x} burners and a new overfire air system at the RM Schahfer Generating Station Unit 15 located near Wheatfield, Indiana. This unit had previously been retrofitted with low NO\textsubscript{x} burners in 1995.

Project Features
• Computational Fluid Dynamic Modeling
• Low NO\textsubscript{x} Burners, designed and manufactured by Power & Industrial Services
• Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
• Combustion Optimization
• Integration of existing scanners and igniters into the new Low NO\textsubscript{x} Burners

Project Description
Northern Indiana Public Service Company retained the services of Power & Industrial Services to engineer, design, manufacture, and deliver a combustion system upgrade project that included replacement of 24 low NO\textsubscript{x} burners and a new overfire air system on their RM Schahfer Station Unit 15. Unit 15 is an opposed wall fired 510 MWg FW boiler firing low sulfur PRB coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO\textsubscript{x} and keeping CO and unburned carbon to a minimum.
Low NO$_x$ Burners & OFA System

Kansas City Power & Light – Iatan Unit 1

Customer
Kansas City Power & Light
Iatan Station – Unit 1

Completion Date
January 2009

Services Provided
- EPC Services
- Burner Design
- OFA design
- CFD modeling
- Procurement
- Installation
- Startup, commissioning
- Overall project management
- Construction management
- Combustion tuning

Pre-Installation
Boiler Performance
Burner Heat Input = 130 mmBtu/hr
NOx = 0.38 lb/mmBtu
CO > 1000 ppm

Post-Installation
Boiler Performance Test
Burner Heat Input = 143 mmBtu/hr
NOx = 0.18 lb/mmBtu
CO < 50-150 ppm

Project Summary
Power & Industrial Services provided complete turn-key services to Kansas City Power & Light to improve NO$_x$ and combustion with the design, fabrication, installation, start-up and combustion tuning of new low NO$_x$ burners and a new overfire air system at the Iatan Plant Unit 1.

Project Features
- Computational Fluid Dynamic Modeling
- Low NO$_x$ Burners, designed and manufactured by Power & Industrial Services, including new igniters and scanners
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- Extensive Overfire Air system ductwork design, supply and installation
- Combustion Optimization

Project Description
Kansas City Power & Light retained the services of Power & Industrial Services to engineer, design, manufacture, and install a combustion system upgrade project that included the replacement of 56 low NO$_x$ burners and a new 18 port overfire air system on their Iatan Plant Unit 1. Unit 1 is an opposed wall fired 710 MWg B&W boiler firing low sulfur PRB coal. The main goal of the project was to improve combustion and operation of the boiler while lowering NO$_x$ and CO and keeping unburned carbon to a minimum.
Low NOx Burners & OFA System
San Miguel Electric Cooperative – San Miguel Plant

Customer
San Miguel Generating Plant
Unit 1

Completion Date
May 2004

Services Provided
• Overfire Air System Design & Manufacturing
• Low NOx Burner Design & Manufacturing
• Procurement
• Fabrication
• Technical Field Support

Pre-Installation
Boiler Performance
NOx = 0.40 lb/mmBtu
CO = 200 ppm

Post-Installation
Boiler Performance
NOx = 0.17 lb/mmBtu
CO = 100 ppm

Project Summary
Power & Industrial Services provided new Low NOx Burners to San Miguel Electric Cooperative to improve NOx and combustion. Power & Industrial designed, fabricated, delivered replacement burners within 20 weeks after receipt of order.

Project Features
• Low NOx Burners, designed and manufactured by Power & Industrial Services
• A delivery schedule that no other manufacturer could meet

Project Description
San Miguel Electric Cooperative retained the services of Power & Industrial Services to design, manufacture and deliver 42 replacement low NOx burners at the San Miguel Plant. The Unit is an opposed wall fired 440 MWg B&W boiler firing lignite. The customer had a very short lead time for the project and Power & Industrial was able to make delivery within 20 weeks.
Low NO\textsubscript{x} Burners & OFA System  

*Tri-State Generation & Transmission Association*

**Customer**  
Tri-State Generation & Transmission Association – Craig Station Unit 3

**Completion Date**  
May 2009

**Services Provided**  
- CFD Modeling
- Overfire Air System Design & Manufacturing
- Low NO\textsubscript{x} Burner Design & Manufacturing
- Procurement
- Fabrication
- Technical Field Support

**Pre-Installation**  
**Boiler Performance**  
NO\textsubscript{x} = 0.50 lb/mmBtu  
CO > 500 ppm; O\textsubscript{2} = 3.5 %

**Post-Installation**  
**Boiler Performance**  
NO\textsubscript{x} = 0.275 lb/mmBtu  
CO < 100 ppm; O\textsubscript{2} = 2.75 %

**Project Summary**  
Power & Industrial provided design and manufacturing services for the retrofit of new Low NO\textsubscript{x} Burners and overfire air system at Craig Station Unit 3 located near Craig, Colorado.

**Project Features**  
- Computational Fluid Dynamic Modeling
- Low NO\textsubscript{x} Burners, designed and manufactured by Power & Industrial Services
- Overfire Air Ports & Bent Tube Panels, designed and manufactured by Power & Industrial Service
- Combustion Optimization
- Integration of existing scanners and igniters into the new Low NO\textsubscript{x} Burners

**Project Description**  
Tri-State Generation and Transmission Cooperative’s plant improvement project included environmental system upgrades on Unit 3 at the Craig Station. As part of the overall project, Power & Industrial provided design and manufacturing services for the retrofit of new Low NO\textsubscript{x} Burners and overfire air system. Unit 3 is a 475 MW B&W wall fired boiler. The boiler has 40 burners and 12 overfire air ports located on the front and rear walls of the boiler.