NOx Reduction of Six Fired Heaters

Furnace Improvements Services (FIS) was requested to develop a NOx reduction study on six heaters. The client wanted their NOx emissions to be reduced to 0.025 lb NOx/MMBtu. Along with their request for NOx reduction, they also needed some of their heaters to be rerated.

FIS analyzed all the heaters thoroughly, evaluated different schemes, and arrived at a conclusion of replacing the existing burners with Ultra Low NOx burners.

Pre-flash Reboiler

The heater was built in 1979 as a vertical cylindrical heater with an absorbed duty of 25 MMBtu/hr and a feed rate of 135,827 lb/hr. FIS proposed the following:

- Replacing the existing burners with Next Generation Ultra Low NOx Burners.
- Reducing the duty of the heater from 25 to 15.5 MMBtu/hr.
- Flame impingement problem can be avoided by using the FIS' patent pending Inclined Firing Technology.
- The thermal efficiency of the heater will be increased by 4%

Charge / Stripper Reboiler

The heater was built in 1958 and was revamped in 1979 with 15 burners on the charge side and 13 burners on the Stripper reboiler side.

The charge heater has an absorbed heat duty of 10.09 MMBtu/hr and a feed rate of 135,501 lb/hr. The stripper reboiler has an absorbed heat duty of 15.49 MMBtu/hr and a feed rate of 264,494 lb/hr. FIS proposed the following:

- The 28 floor fired burners will be replaced with 8 wall fired burners.
- The existing burners will be replaced with Next Generation Ultra Low NOx burners.
- The thermal efficiency of the heater will be increased by 3%

Case Studies (FIS-290)

Platformer Heater

The Platformer was built in 1979 based on process requirements set forth by UOP. This Platformer Heater is a vertical arbor ("U") tube heater with 3 radiant sections, a common convection section, and a stack. The heater has an absorbed duty of 115.9 MMBtu/hr. FIS proposed the following:

- The number of burners will be increased from 30 to 52.
- The existing burners will be replaced with Next Generation Ultra Low NO_x (NGUL) burners.
- The thermal efficiency of the heater will be increased by 3%

Vacuum Heater

Vacuum heater is a horizontal tube cabin heater built in 1995. The heater is designed for a feed rate of 351,000 lb/hr and an absorbed duty of 42 MMBtu/hr. This heater had high stack temperatures. FIS proposed the following:

- The numbers of burners will be increased from 6 to 9 burners.
- The absorbed duty will be reduced from 42 to 36.5 MMBtu/hr (as requested by the client).
- The existing burners will be replaced with Next Generation Ultra Low NOx burners.
- **New convection section will reduce the firing rate and create fuel savings of USD $ 36,000 per year**
- The thermal efficiency of the heater was increased by 4%.

Charge Heater

The heater was built as a vertical cylindrical heater in 1964, upgraded in 1979, purchased, rerated, and relocated from California to El Dorado refinery in 1993. The heater is designed for a feed rate of 26,930 BPD and an absorbed heat duty of 26.48 MMBtu/hr. FIS proposed the following:

- The existing burners will be replaced with Next Generation Ultra Low NOx burners.
- The absorbed duty of the heater will be reduced from 26.48 to 23.60 MMBtu/hr
- Flame impingement problems can be avoided by using FIS patent inclined firing technology.

- The thermal efficiency of the heater will be increased by 3%

Cat Cracker Heater

The Cat Cracker was built as a vertical cylindrical heater in 1978. The heater was designed for a feed rate of 22,570 BPD and an absorbed heat duty of 40 MMBtu/hr. FIS proposed the following:

- Replacing the existing burners with Next Generation Ultra Low NO_x Burners.
- Reducing the absorbed duty from 40 to 25.9 MMBtu/hr
- Flame impingement problems can be avoided by using FIS patent pending Inclined Firing Technology.
- The thermal efficiency of the heater will be increased by 3%