CAPACITY IMPROVEMENT OF REFORMER HEATER

27 Years
FIS
Clean & Efficient Combustion

Case Study

Revamping fired heaters is a practical and effective way to improve the heater performance. This strategy focuses on working with existing components, and as a result, capital investment and downtime are minimized.

This study emphasizes the capacity improvement of a Reformer heater.

Catalytic reforming unit converts straight chain naphtha into high octane aromatic hydrocarbons called reformate. The reformate has higher energy content than the straight chain naphtha feed and is used in blending of lead-free gasoline fuel.

Fired heaters being the largest consumer of fuel, refiners tend to operate these units at their maximum capacity. Revamping of heaters is the most effective way of getting extra capacity from the existing heaters.

SPLIT FLOW TECHNOLOGY

When refiners wish to increase the capacity of their fired heaters, FIS patented **"Split Flow Technology"** aims to improve the utilization of thermal energy for process heating. This design works very well to increase the capacity of fired heaters without increasing the process side pressure drop. This is achieved by splitting the process fluid into two parallel streams as- Main Stream and Split Stream. In Main Stream the fluid is heated in the radiant or a combination of radiant and convection section. In Split Stream the fluid is heated in the convection section. The two streams are then combined at the heater outlet. The split is designed by balancing the heat transfer and pressure drop with the radiant stream. Advantages of revamped design based on Split Flow Technology are as follows:

FIS has developed patented **SPLIT FLOW TECHNOLOGY** to increase the capacity of fired heaters with limiting pressure drop.

- Increased capacity at a lower pressure drop
- Improved efficiency
- Lower radiant heat fluxes
- Lower firebox temperatures
- Lower TMTs
- Lower installation costs

Introduction

This concept has proven to be very helpful to many fired heaters. This paper describes how this technology has helped a refiner in California to develop an economical and reliable capacity improvement scheme for their Reformer heater. The schematic representation of Split Flow Technology for Reformer heater is as portrayed in Figure 1.

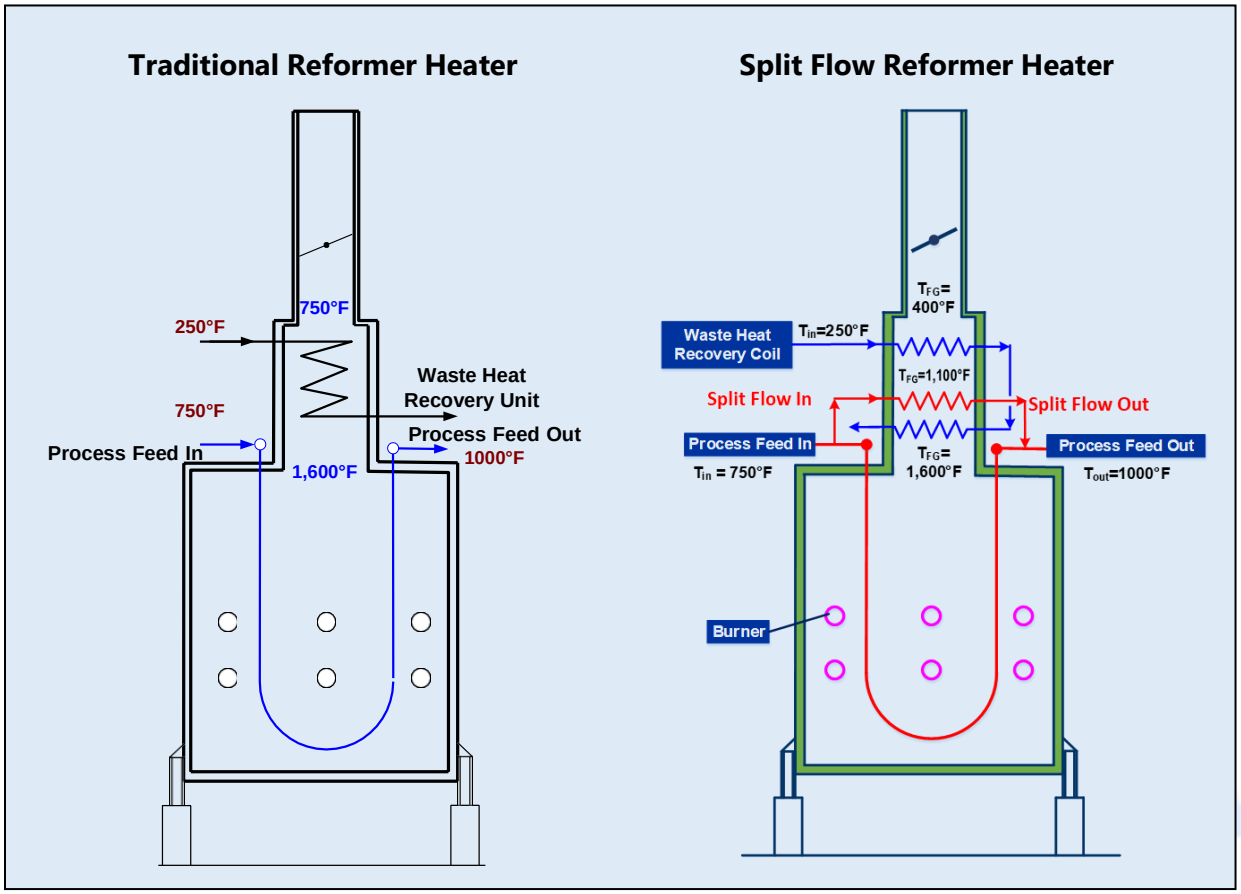

Figure 1: Reformer Heater Split Flow Technology

Case Study

In 2007, Furnace Improvements Services (FIS) was employed by a refinery in California to carry out a capacity improvement of the Reformer heater.

EXISTING DESIGN AND OPERATING DATA ANALYSIS

The Reformer heater is a three-cell (H-70-01/02/03) heater as portrayed in Figure 2. The heater was originally built in 1979 to process 12,000 BPD of feed. The heater was rated for 135.6 MMBtu/hr of total heat duty. The heater was running at 13,000 to 15,000 BPD charge rate.

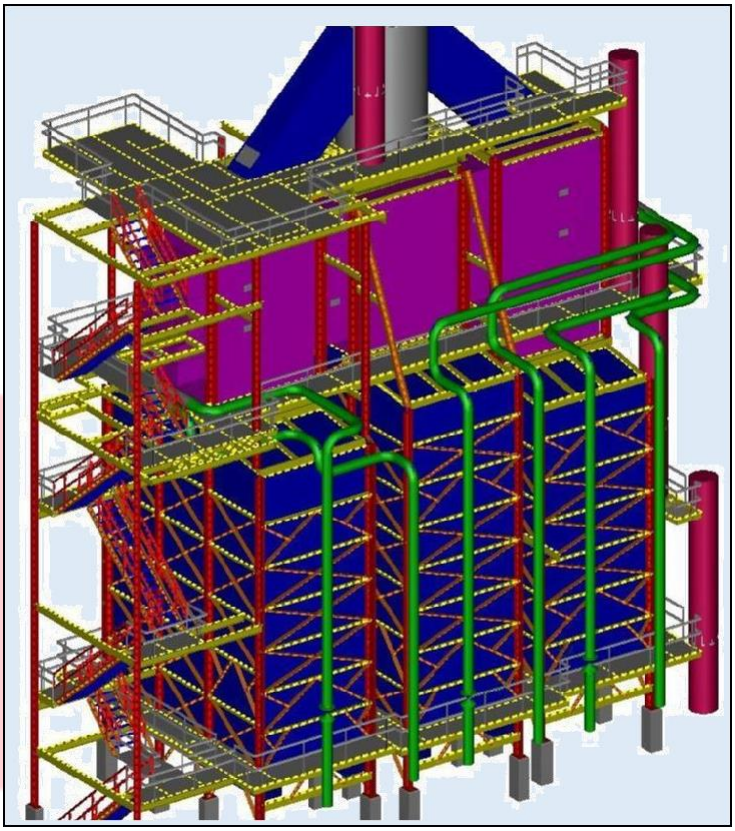

Figure 2: 3D model of the Reformer heater

Operating data analysis indicated the following:

- The convection section was in bad state, fins were fouled.
- The design thermal efficiency of the heater was about 88%. However, it was operating at ~81% efficiency.
- The stack temperature was higher by almost 300°F as compared to the original design.

CAPACITY IMPROVEMENT

The client wanted to revamp the Reformer heater for 18,000 BPD capacity.

FIS recommended increasing the capacity of the heater using FIS patented Split Flow Technology as shown in Figure 3.

The conventional revamp option was to extend the existing radiant cells. Extending the radiant cells had disadvantages i.e. 1) Space limitation 2) Higher firing rates and 3) **Very high cost**

Case Study

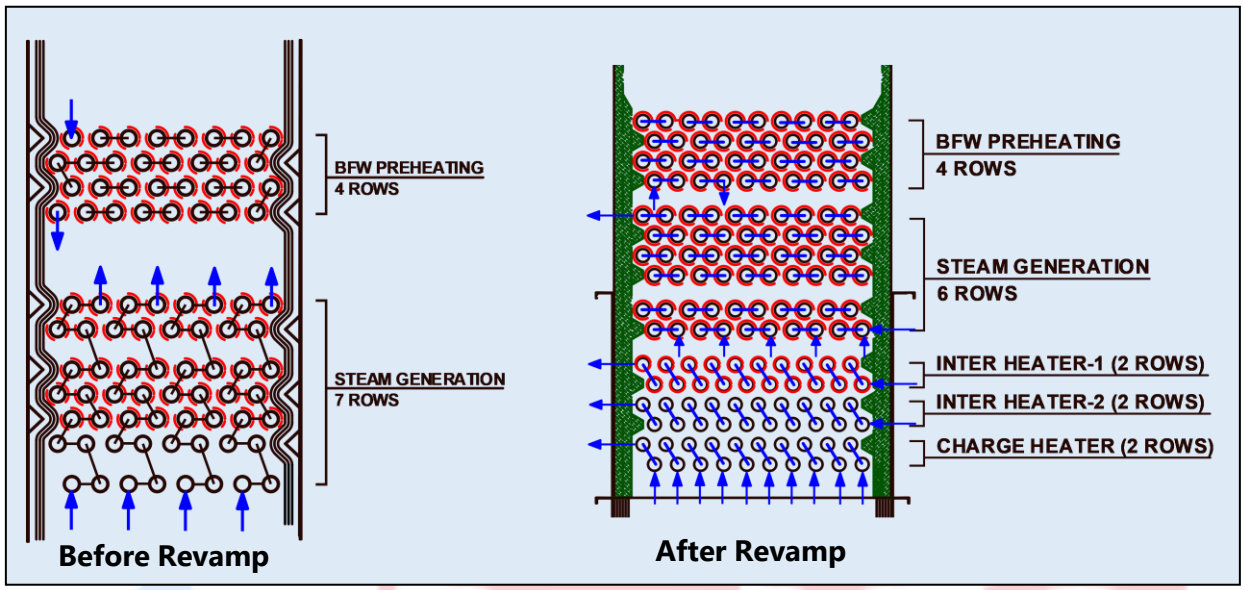

Figure 3: Convection section comparison of Reformer heater

Reformer Heaters Data Comparison			
Parameter	**Units**	**Total Process Duty**	**Steam Gen.**
Design Heat Duty	MMBtu/hr	84.03	51.58
Revamped Heat Duty	MMBtu/hr	113.0	47.85
Extra Duty Required	MMBtu/hr	28.08	-
Re-Rated Radiant Duty	MMBtu/hr	87.81	-
Re-Rated Convection Duty	MMBtu/hr	25.20	47.85

Salient features of the revamped design are as follows:

- Capacity of the heater improved by ~58% over original design.
- New convection section heat duty increased by 41.6%.
- The overall heater efficiency improved by 9%
- The flue gas temperature is alleviated by 348°F.
- The fuel savings were estimated to be **1.55 Million US$/year** based on 9$/MMBtu fuel gas price

FIS carried out the entire scope of activities from conceptualization to commissioning of this heater revamp. The heater was successfully commissioned in February 2008.

FIS Revamp Solutions

FIS designs revamp solutions of the project based on customer specific requirements, which extend from an engineering study to detailed engineering and execution, as portrayed in Figure 4.

FIS revamp projects are generally focused on following areas:

- Capacity Increase
- Efficiency Improvement
- NOx Reduction

FIS scope of services includes activities exhibited in Figure 5.

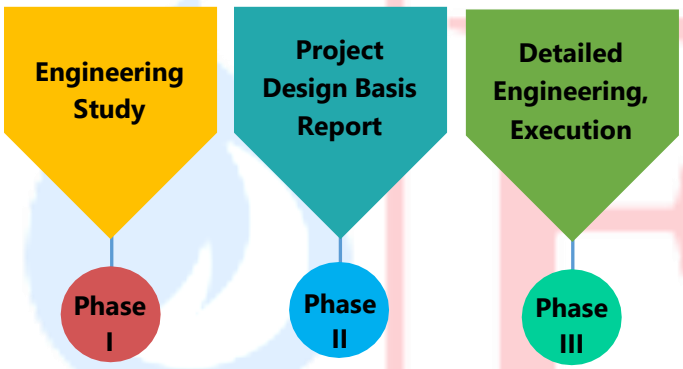

Figure 4: Typical fired heater/ boiler revamp project phases

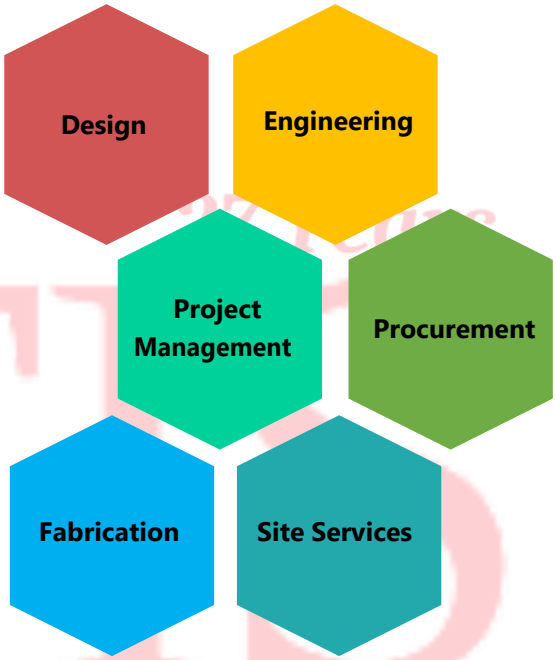

Figure 5: Furnace Improvements example of scope of services

CONCLUSION

Fired heaters being major consumers of energy in the refinery and petrochemical industries, efficiency improvements even by 1-2% can lead to huge fuel savings.

Furnace Improvements Services (FIS) is based in Sugar Land, Texas. We have been improving the efficiency and capacity of our clients' fired heaters, boilers and waste heat recovery units and reducing their NOx emissions for over 23 years. We have handled more than 400 engineering studies and projects for Valero, Phillips66, Citgo, Total, Delek, Sasol and other refineries around the world.

27 Years

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Furnace Improvements Services

Uniform Heat Transfer in Fired Heaters

Furnace Improvements Services
1650 Highway 6, Ste. 440
Sugar Land, TX 77478
(281) 980-0325 Fax: 1-877-395-0760

AG Furnace Improvements Pvt. Ltd.
A-74, Ground Floor, Sector-2, Noida.
Uttar Pradesh-201301
Phone:+91-120-4146823

For more information
For more information please contact FIS by email at
info@heatflux.com
or
Visit us online at www.heatflux.com