

Furnace Improvements Services



Our Company

- FIS started in 1996.
- Delhi Office opened in 2005
- Pune CFD Office opened in 2015.
- Working directly with Owners and Operators for over 20 years
- Over 400 engineering studies and projects.
- Offer clients the best possible service, quality, and value



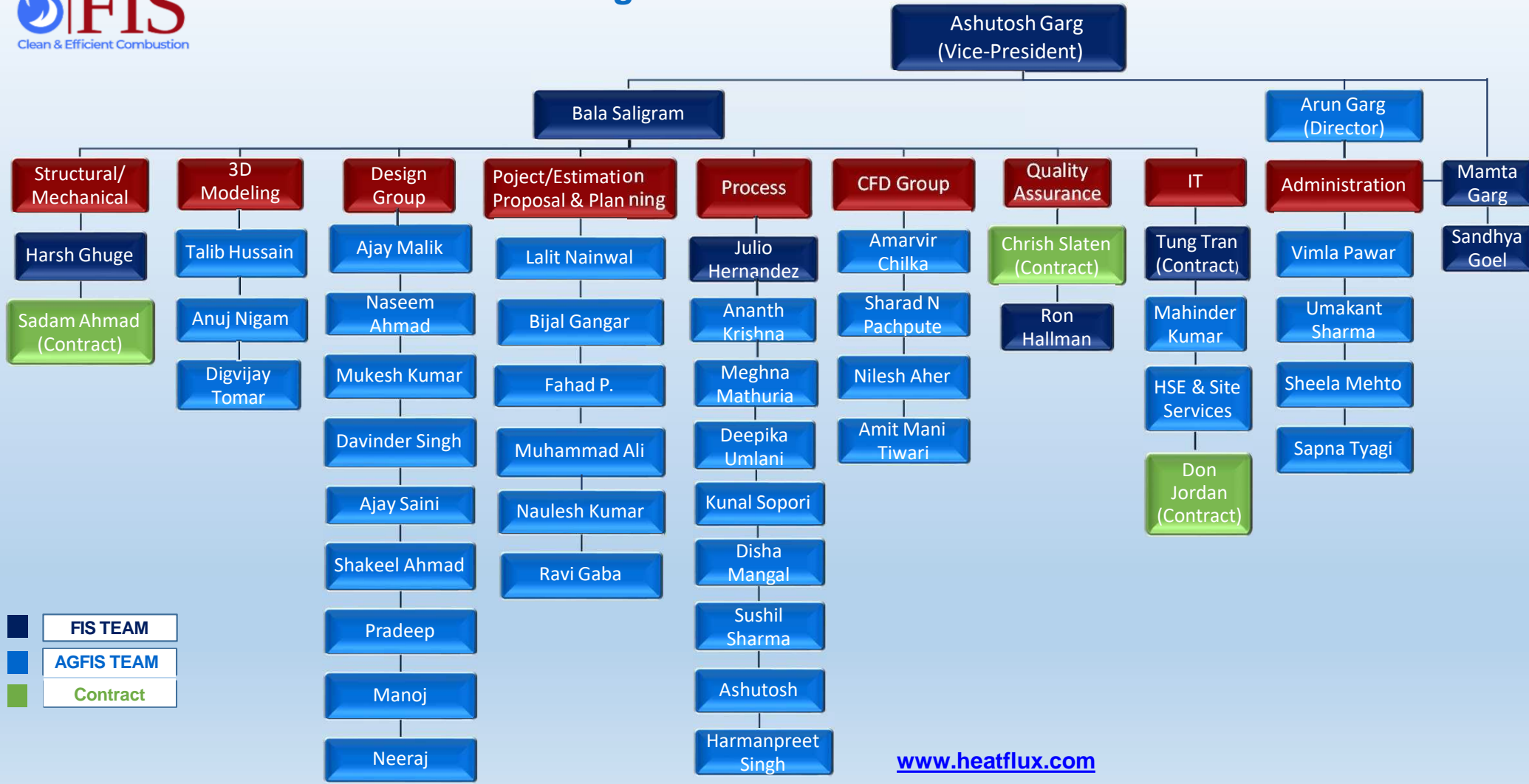
Our Dedicated Team



Challenge us with your project!

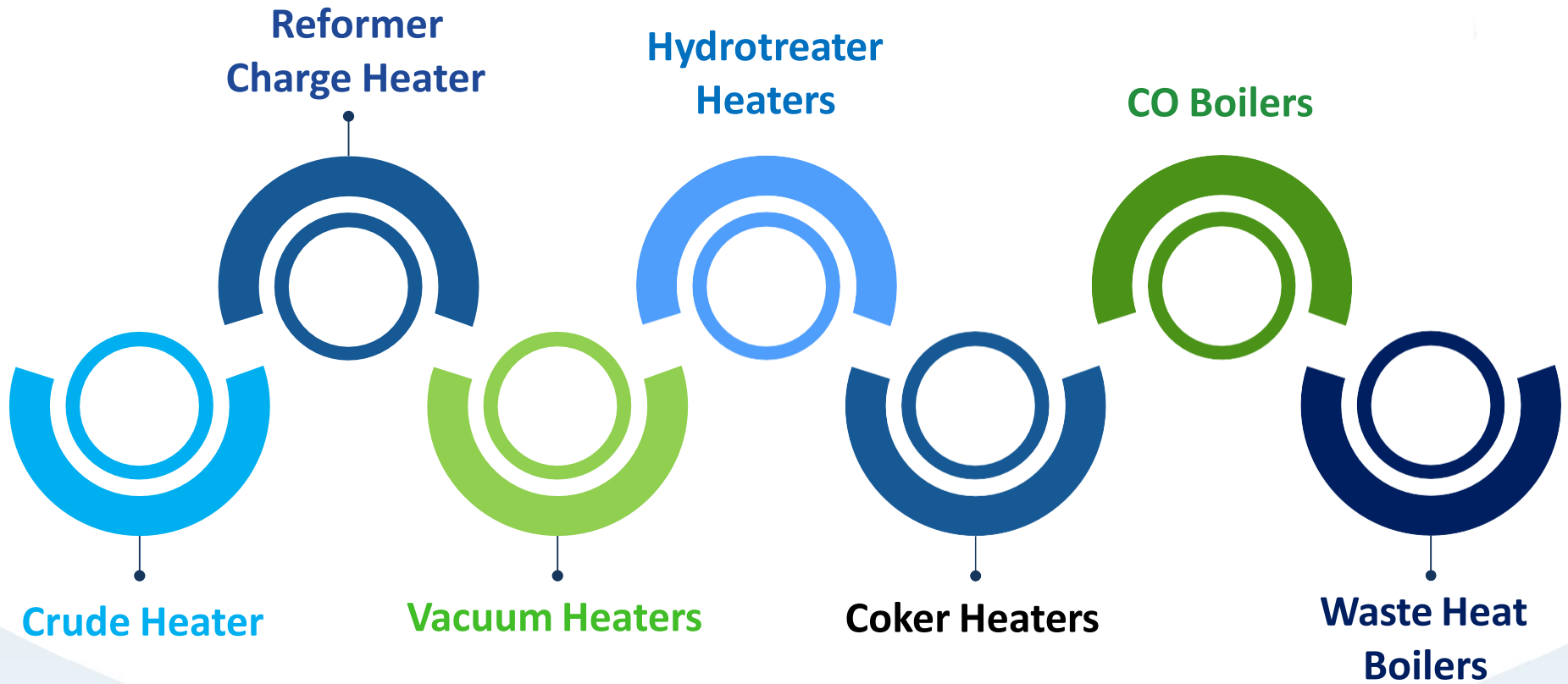


Furnace Improvements Services-Overall Organization Chart



■	FIS TEAM
■	AGFIS TEAM
■	Contract

Types of Heater



Scope of Services

- Process Design & CFD Modeling
- Detailed Engineering
- Project Services
- Hardware Supply
- Fabrication
- Erection
- Start-up Assistance

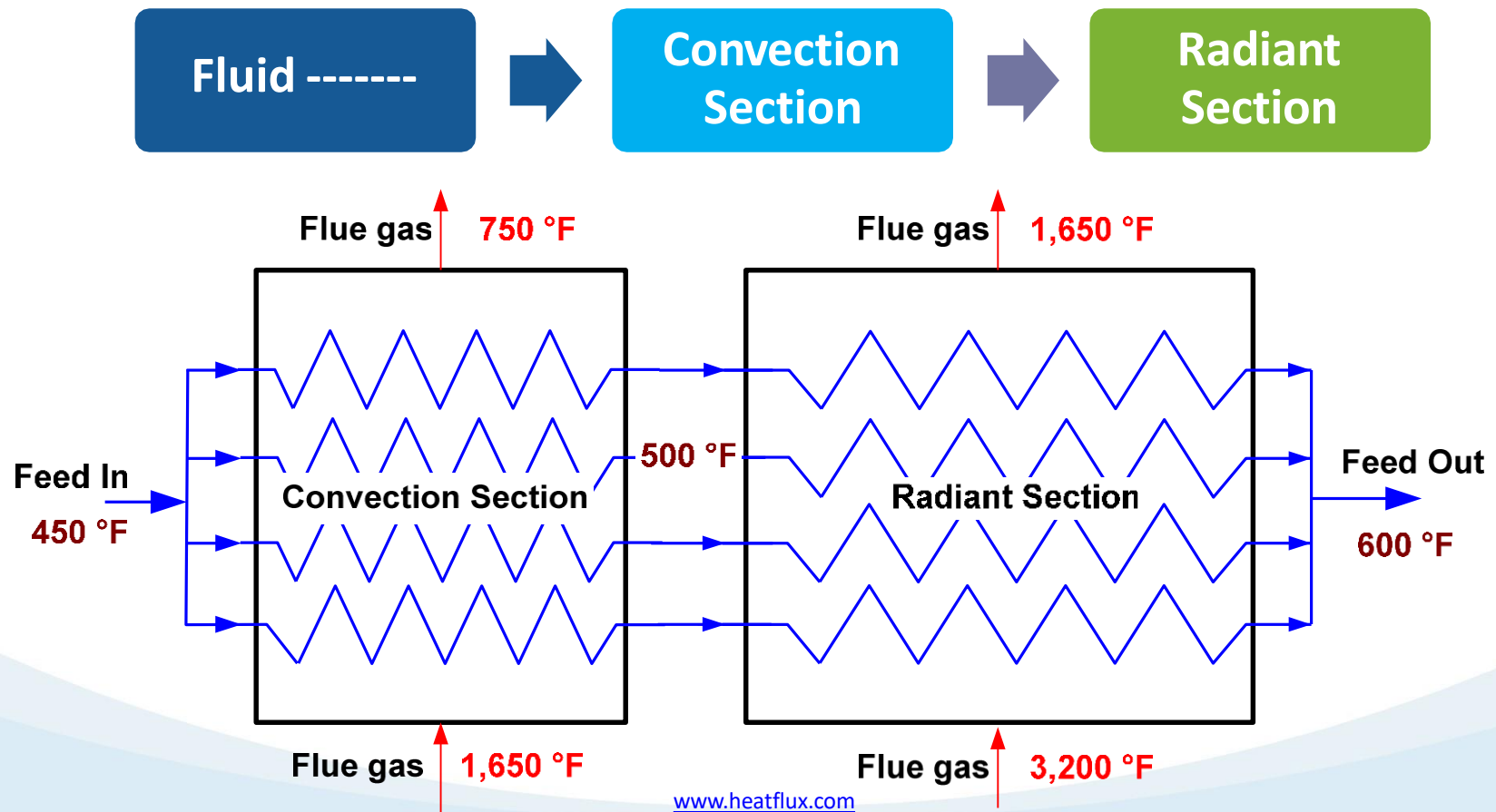
Some of Our Clients



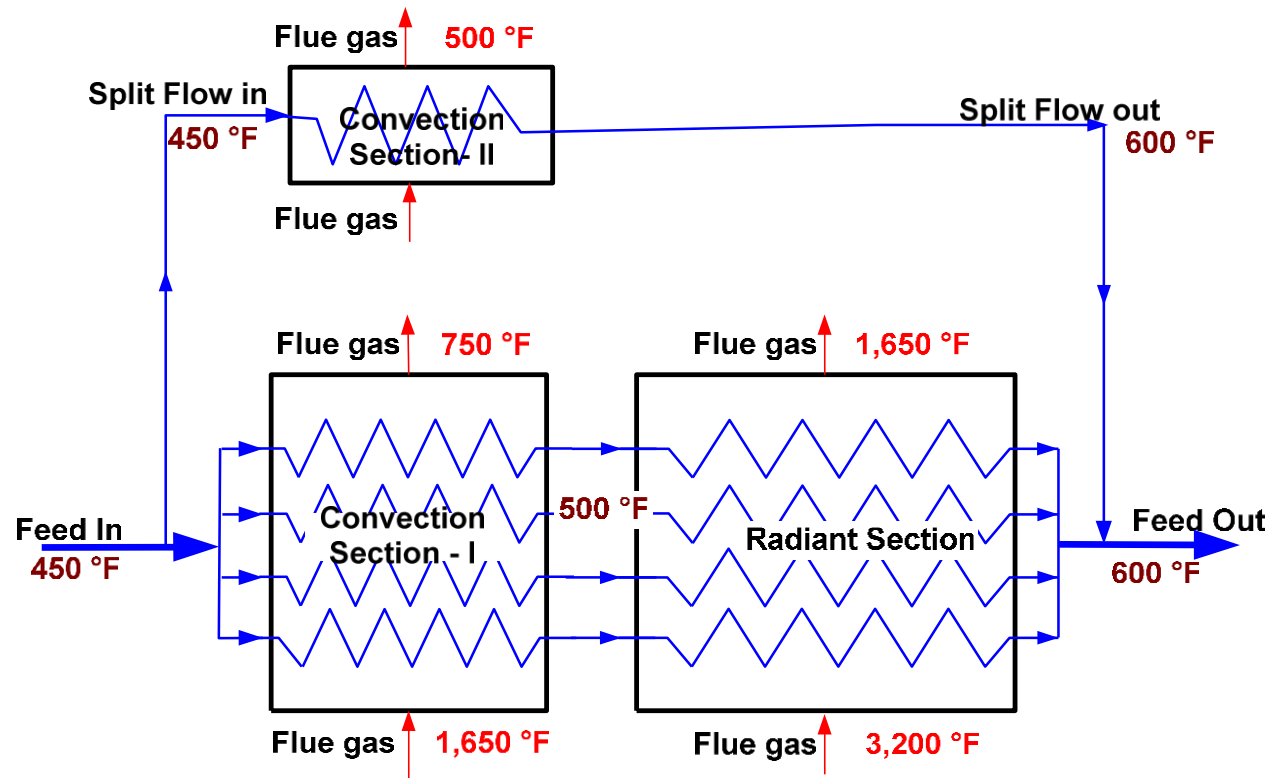
Sustainable solutions
Energy & Environment



Typical Fired Heater

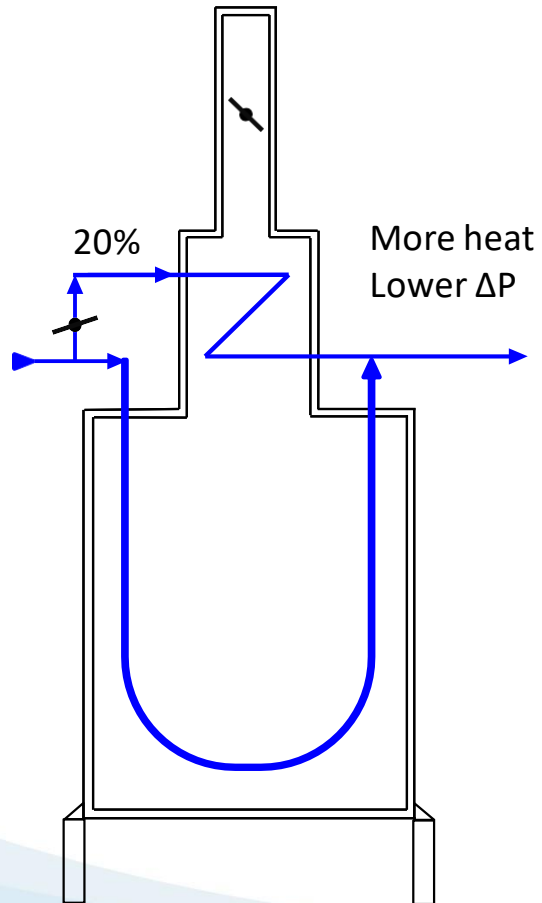


Split Flow* Fired Heater

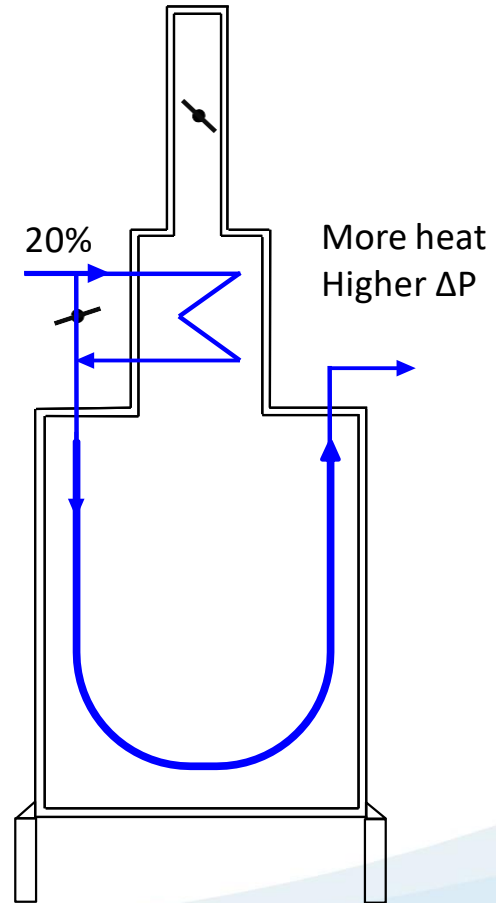


*Patented

Split Flow Heating



Slip Stream Heating



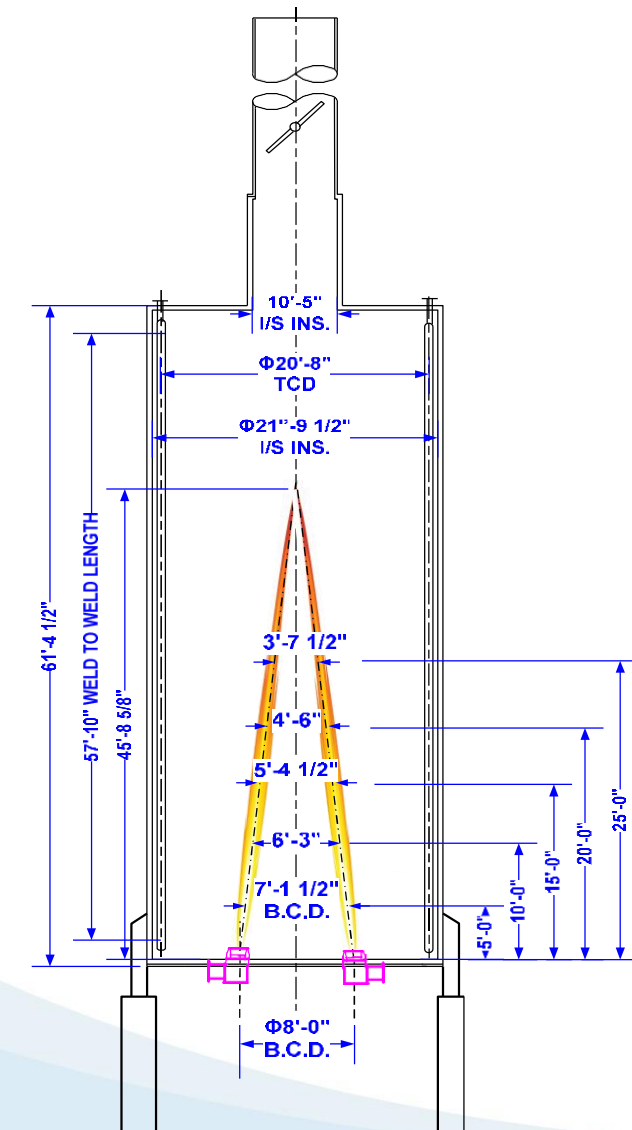
Split Flow References

1. *Citgo, Corpus Christi, Platformer Heater - 2002*
2. *Valero, Texas City, Reformer and NHT - 2005*
3. *Valero, Wilmington, Reformer Heater-2008*
4. *Alon, Big Spring, DHT Charge Heater – 2006*
5. *Alon, Big Spring, Hydrogen Heater– 2009*
6. *Alon Big Spring, Reboiler Heaters-2010*
7. *Phillips 66, WRR-Reformer Heaters – 2011*
8. *HPCL, Mumbai, Extract / Raffinate Recovery Heaters - 2012*

Inclined Firing System*

FIS Patented Technology

- 12 burner system
- TCD of 23'-7⁷/₈"



Inclined Firing References

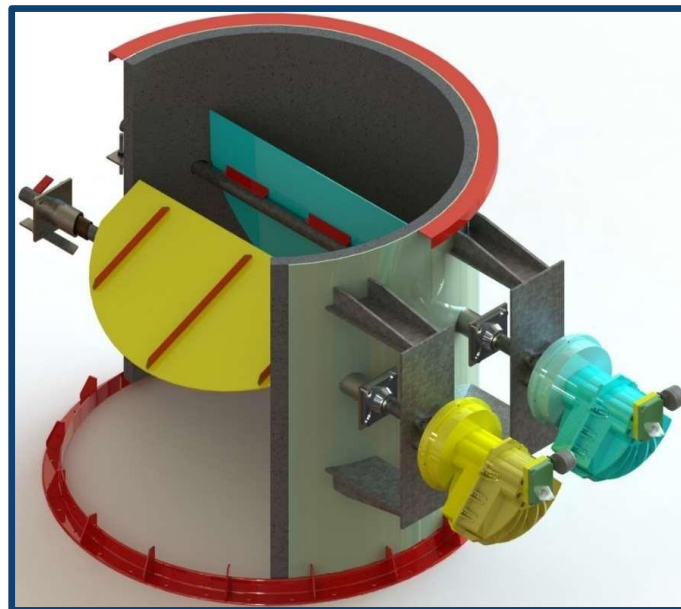
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Smart Dampers

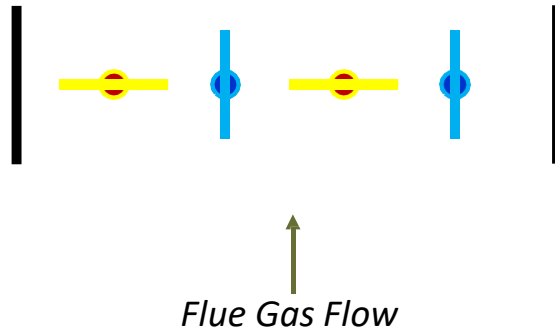
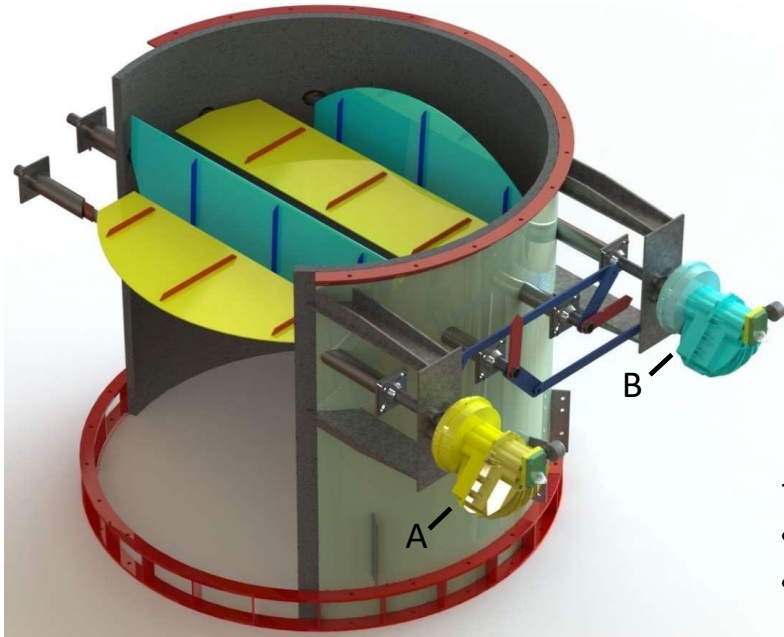
* Save Energy and Improve Reliability of fired heaters



- Ashutosh Garg
- Furnace Improvements Services Inc

* Patent Pending

Smart Stack Damper Blades



- Position of Actuator / Dampers at heater start-up
- Actuator **A** remains closed
 - Actuator **B** Remains open

Furnace Improvements



Revamp Projects

CITGO, Corpus Christi

No. 4 Platformer Heater Revamp

- **Objective:**
- **Improve Efficiency**
 - Stack temperature was 1100° F
- Reduce NOx
- Our cost was 1/2 of the conventional revamp cost



#4 Platformer Heater Data Comparison

Item	Units	Before Revamp	After Revamp
Capacity	BPD	18,500	24,000
Heat Duty	MM Btu/hr	158.0	194.5
Heat Release	MM Btu/hr	234	225
Efficiency	%	67.50	86.60
Stack Temp.	°F	1,092	478
Fuel	MSCFH	244	242.8
Fuel Savings	\$/annum	5.8 Million* *Based on \$6.0 / MM Btu	

#4 Platformer Heater Before and After Revamp



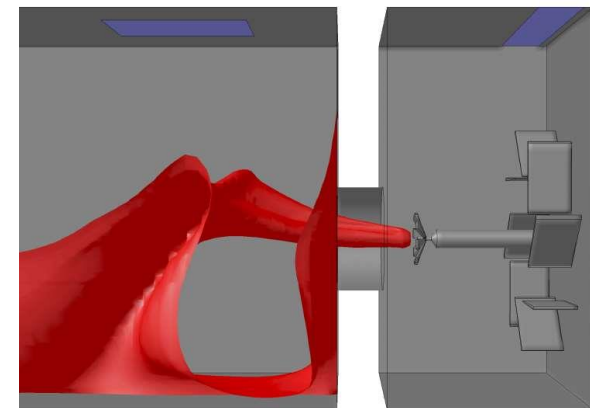
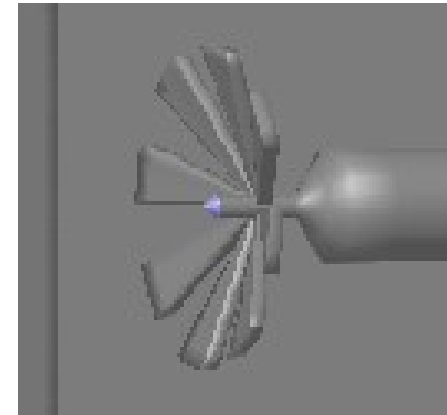
Before



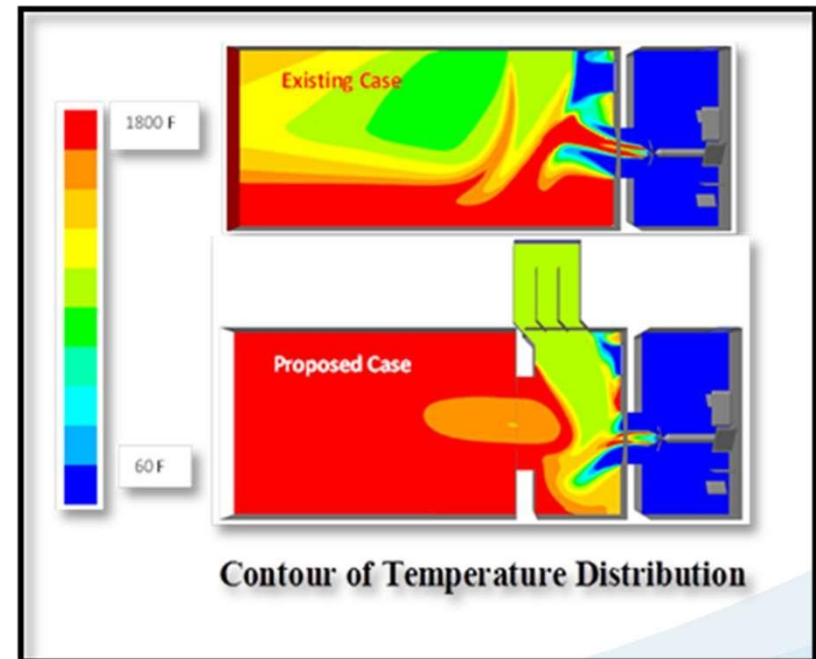
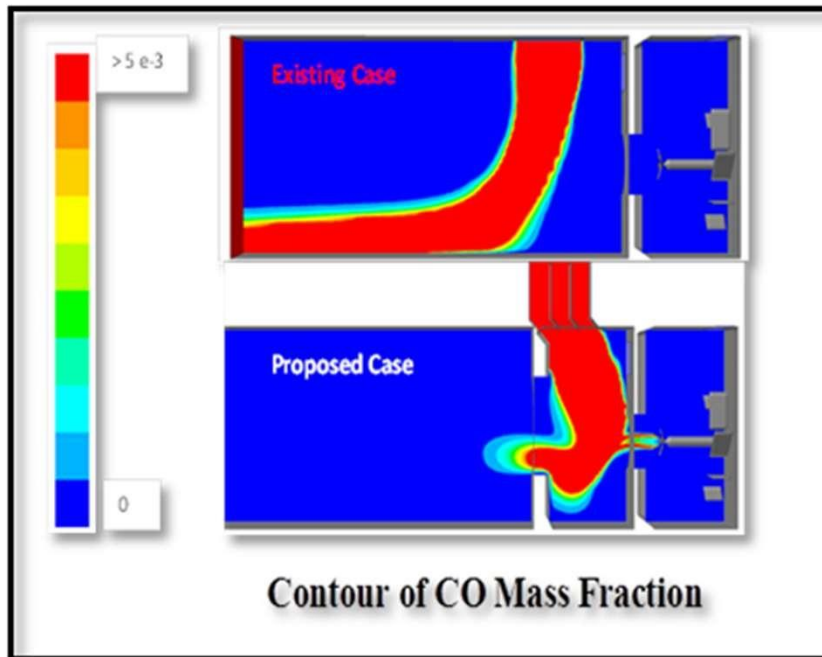
After

Phillips -66 WRR CO Boilers

- Modeling CO Boilers for correct temperature window for SCR Installation
- Making changes in the coils to ensure correct temperature
- **Eliminate CO Slippage**
 - **CFD Modeling**
- Structural analysis of boiler for higher pressure
- One boiler running for 6 months after modifications

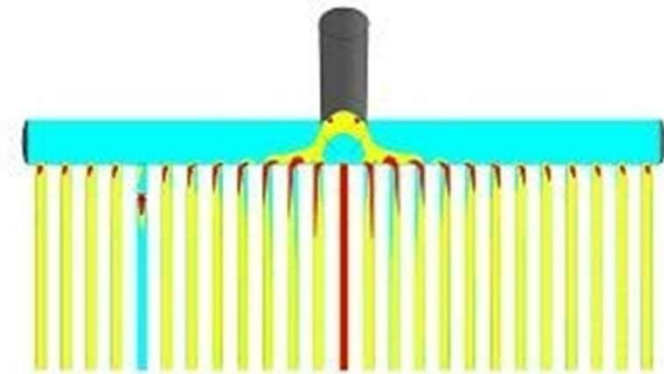


CFD Modeling of CO Boiler Combustion Chamber Phillips66, WoodRiver, IL

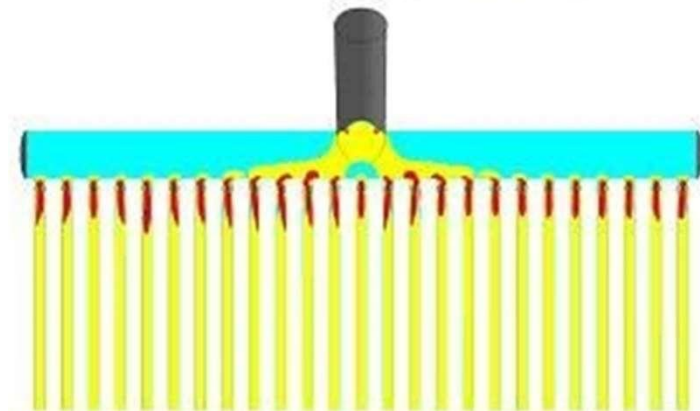


Phillips66 Linden Refinery Economizer - CO Boiler

- 💡 Recurrent tube failures in economizer
- 💡 CFD modeling of economizer coil
- 💡 Redesign of economizer coil



Contours of Velocity in Old Setup



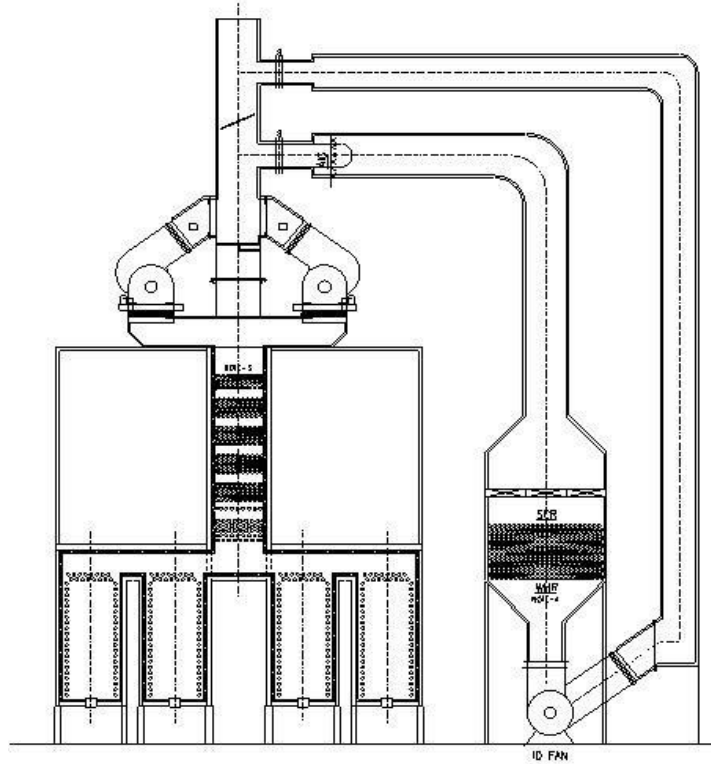
Contours of Velocity in Proposed Setup

Phillips66 Alliance Refinery NOx Reduction—Crude Heater

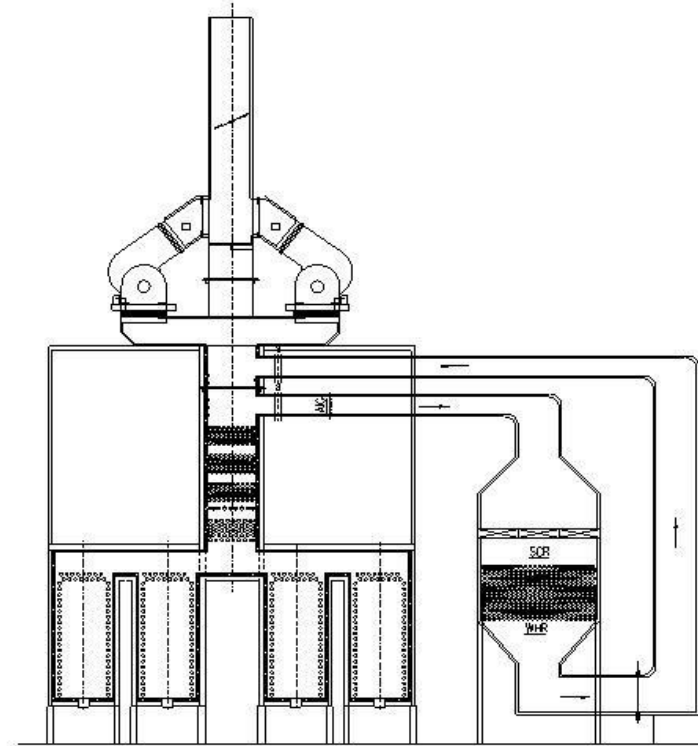
- 💡 Biggest heater ~ 750 MMBtu/hr
- 💡 SCR unit
- 💡 FIS Novel Concept saved \$ 5 Million
- 💡 New WHR section
- 💡 Modify ID & FD fans
- 💡 Efficiency Improvement by 3.5%



Phillips66 Alliance Refinery SCR Scheme



CONVENTIONAL SCR SCHEME



FIS SCR SCHEME

Overall hardware savings: USD 5 Million

- No ID Fan Require
- Smaller Flue Gas Duct
- No Stack Modifications Require

Phillips66 Borger Refinery NOx Reduction – CO Boiler

- Conversion from CO Boiler to NG Boiler
- NOx (<0.02 lb/MMBtu)
- 450K lbs/hr Boiler
- Installation of Ultra Low NOx Burners
- Flue gas recirculation with steam injection
- New economizer section (4% efficiency improvement)



Premcor Port Arthur Refinery

Reactor Charge Heater

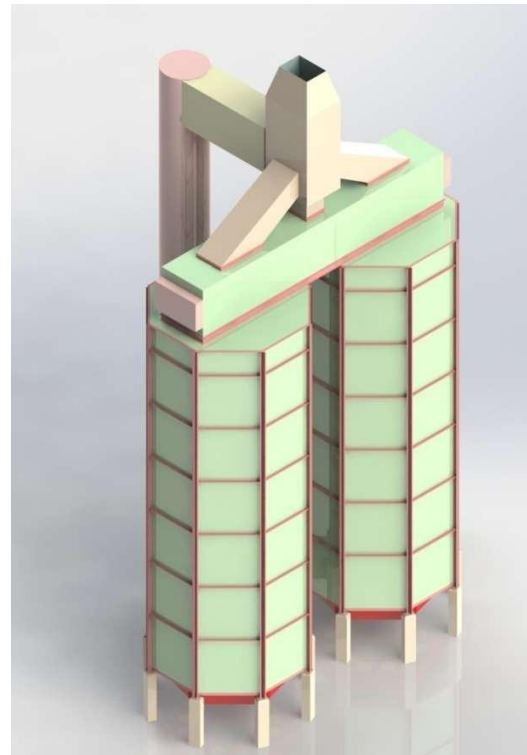
- Rerate heater to minimize pressure drop
- 8 pass heater converted to 4 pass heater
- Tube size increased from 4” to 8”
- Burners relocated
- New tight shut off stack damper



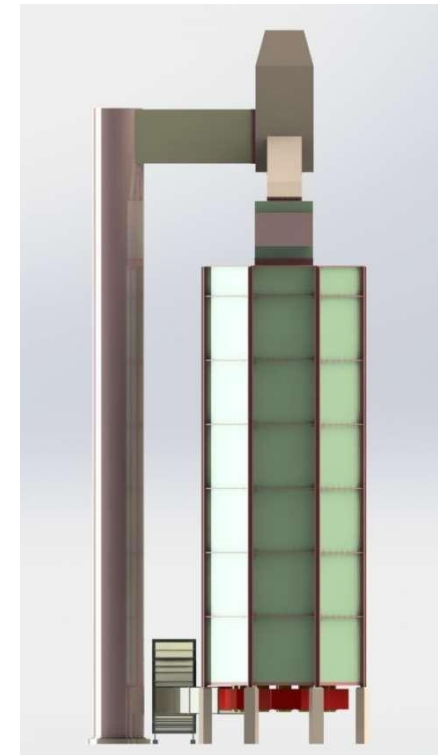
Citgo, Corpus Christi Inclined Firing Technology



FRONT VIEW

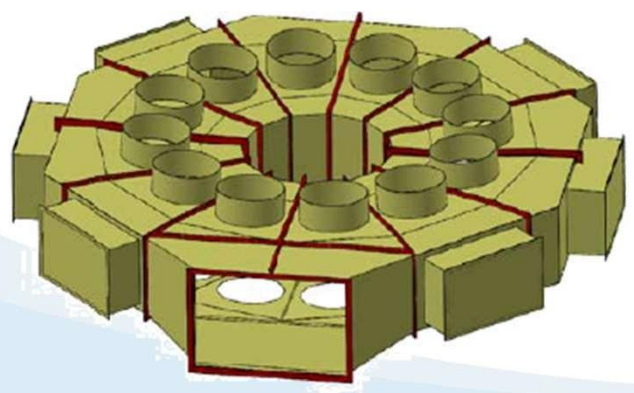
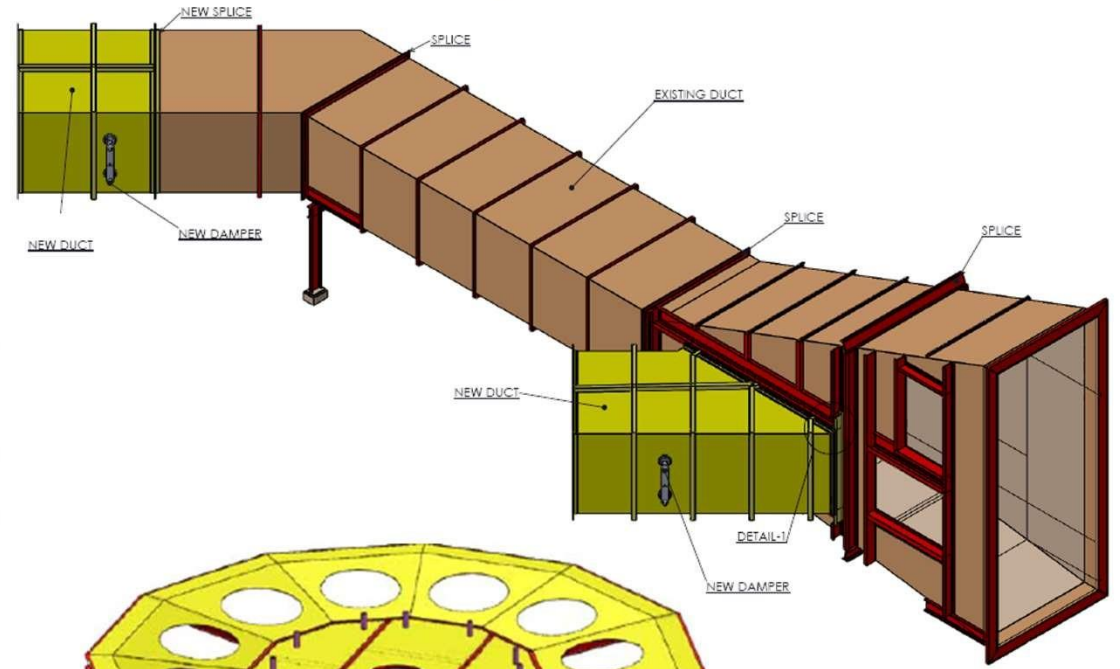
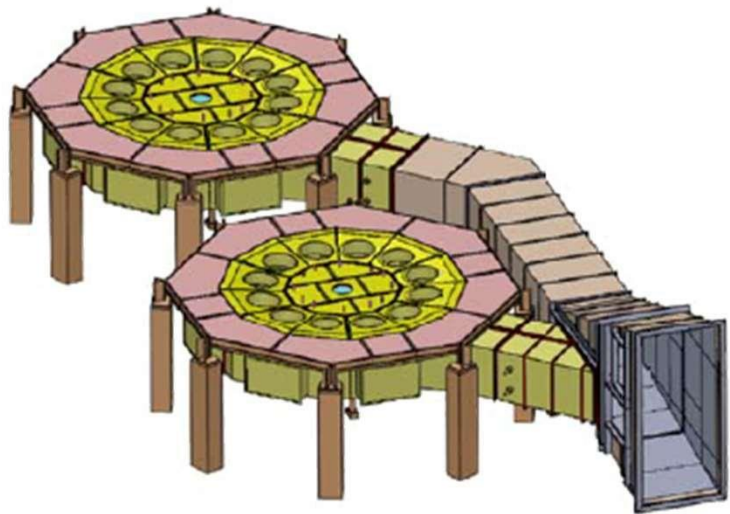


ISOMETRIC VIEW



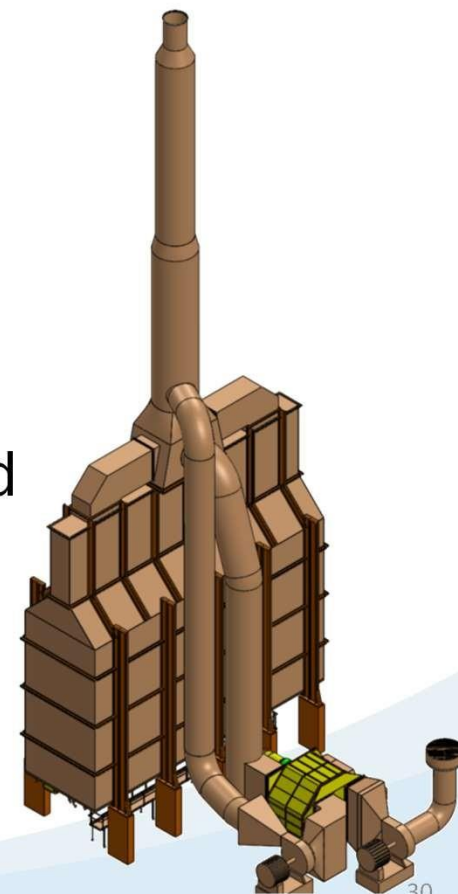
SIDE VIEW

Crude Heater for CITGO – Corpus Christi

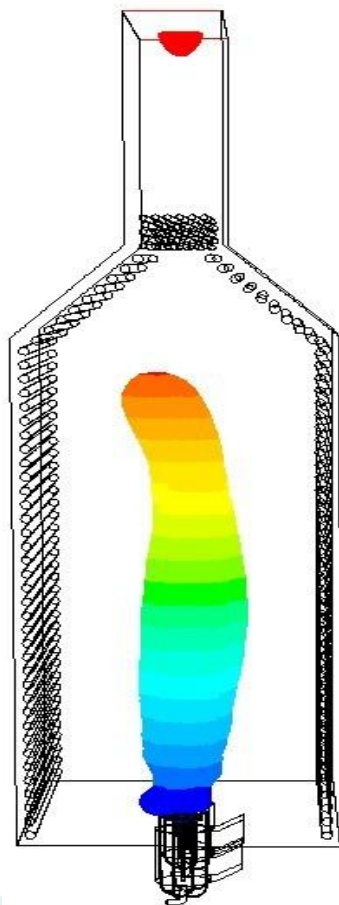
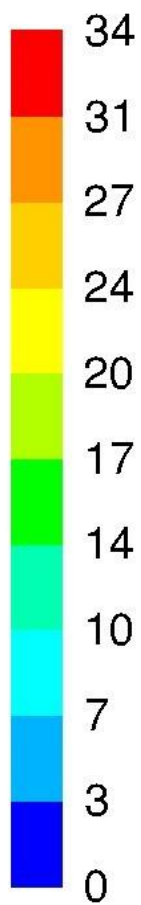


Phillips 66 Crude Heater

- Client having high tube metal temperatures in the crude heater and decoking every 3 months.
- Cabin heater with six large burners with long flames
- FIS came up with a solution to install 18 ultra Low Nox Burners to reduce the flame length and reduce tube metal temperatures
- Job executed successfully and heater running very well for last two years at 110% capacity.

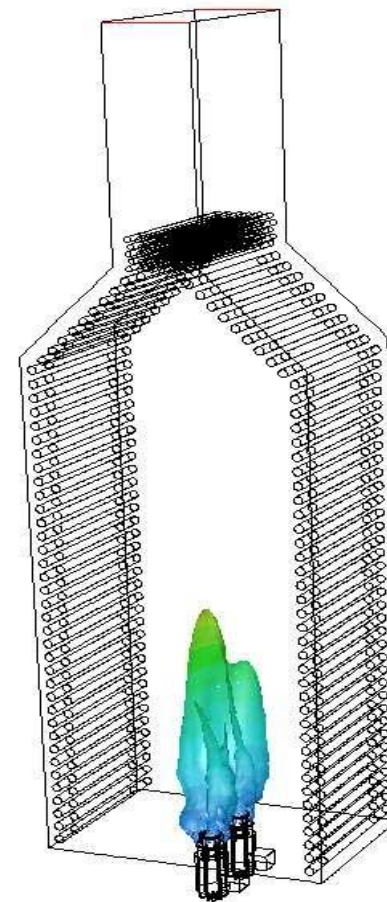


Flame Colored by Height (ft)



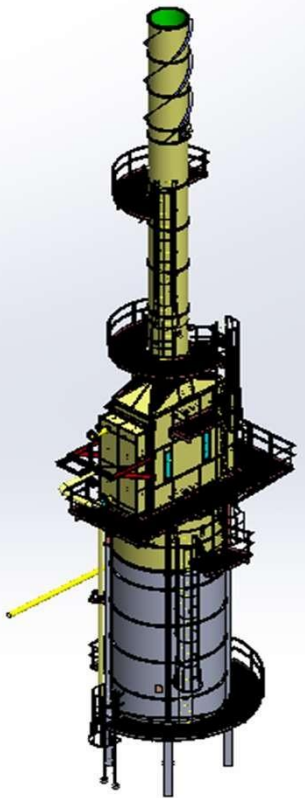
Base Case

CO 2000 PPM



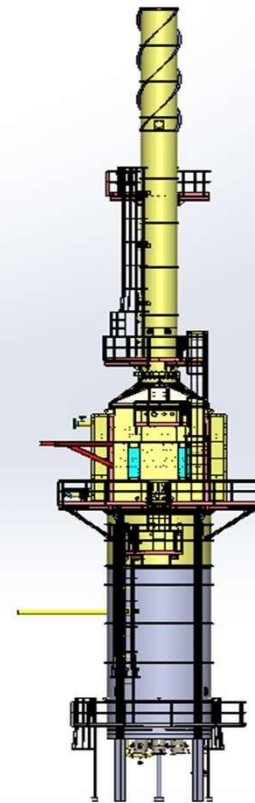
Proposed Case

Country Mark Indiana DHT Heater Revamp



ISOMETRIC VIEW

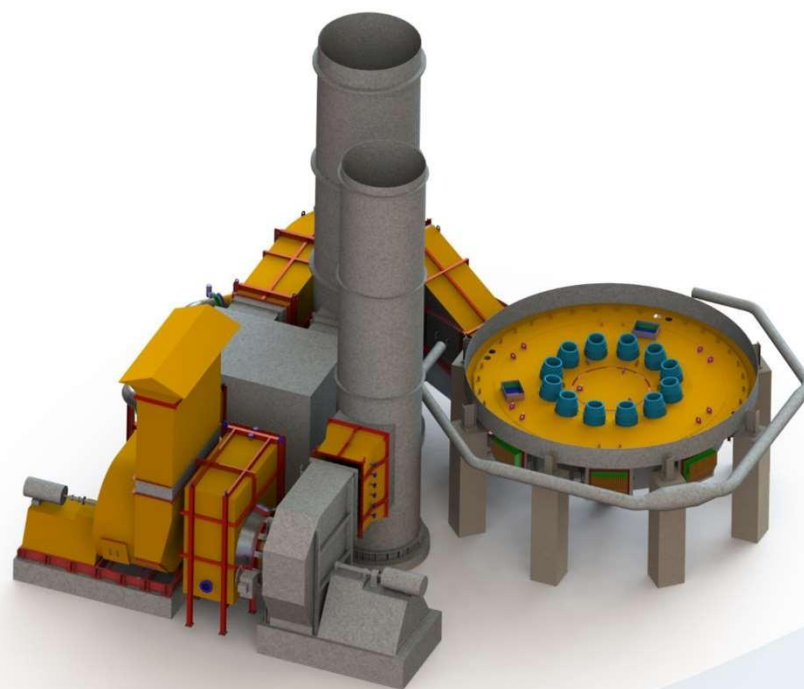
Increased Capacity by 60%
Added Radiant Section
Added New Convection Section
Installed Inclined Firing
Had 3 burners, Installed 4 burners
Heater working for past 5 years



SIDE VIEW

Valero Texas City

- Crude Heater Coking very frequently
- Low mass velocity and high flux rate causing coking
- Burners very close to the tubes
- FIS implement inclined firing technology in this heater.
- Tube metal temperatures are lower by 100F+.
- Higher capacity on Natural Draft



Furnace Improvements

New Heater Projects

Phillips66 Wood River Refinery

- New Wider Heater on existing foundation
- 42.82 MMBtu/hr Vacuum heater
- Complete Modularization
- Turn key supply
- Erection completed in 10 days
- Commissioned in 2009

Technical Manager Comment:

"...we talked about the performance of the heater since startup. It has been fantastic! This is one of the most efficient heaters in the refinery. It's a lot different when you have a tight firebox. Great job!!!"



CITGO

Corpus Christi, TX

- 49 MMBtu/hr Combined Feed Heater
- Design, Engineering & Supply
- Commissioned 2005



Devon Energy Riverton, WY

- 25 MMBTU/hr Hot Oil Heater
- Design, engineering, supply, erection and commissioning
- Piping, Instrumentation & Foundation
- Commissioned in 2007



Phillips66 Wood River Refinery

- 165 MMBtu/hr hot oilheater
- **Modular Construction**
- Design, engineering and supply
- **9 months delivery**
- Commissioned in 2009



FIS-384 Supply Of Visbreaker Charge Heater

Staatsoile, Paramaribo, Suriname



Client forgot to order this heater
FIS supplied a new heater in 4 months time



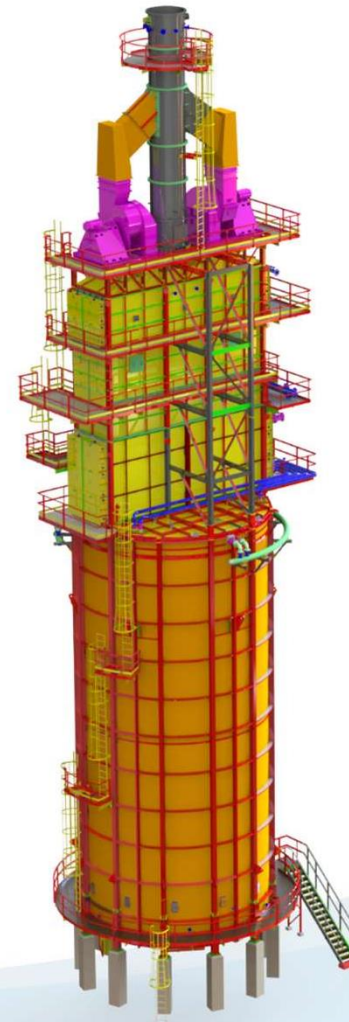
Gladiuex Processing

- Turnkey Supply of 25 MMBtu/hr Hot Oil Heater
- Heater fitted with spider jet burners
- Burners installed inclined firing
- Heater burning 3 waste gases with high calorific value



Sasol Fluor Hot Oil Heater

- New hot oil heater 126 MMBtu/hr
- Tight on plot plan
- Split stream air preheater
- Convection mounted SCR and ID fans





Thank You Very Much !

...

**Give us a chance to bid on your fired
heaters projects.**