

A Smart Combustion™ Approach to Quantify and Evaluate Leakage Air Effects in Fired Heaters

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USA

The logo for John Zink Hamworthy Combustion is positioned on the right side of the slide. It features a stylized white 'K' icon to the left of the company name. The name is written in a bold, sans-serif font, with 'JOHN ZINK' and 'HAMWORTHY' in white and 'COMBUSTION' in a smaller, lighter blue font. The background of the right side of the slide is a blue-tinted photograph of an industrial facility, showing tall distillation columns and complex piping structures.

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Outline

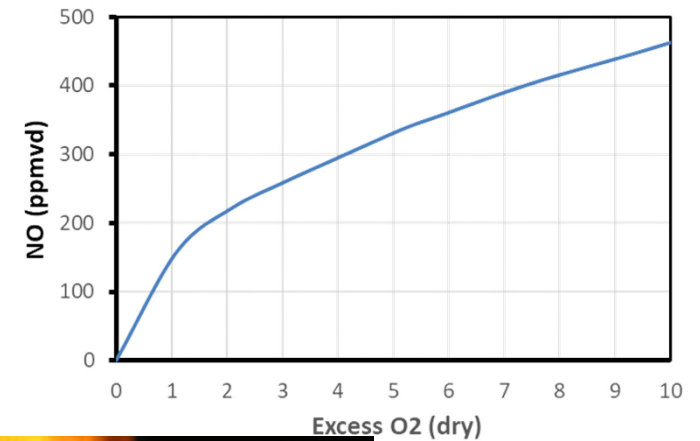
- Introduction
- Effects on Heater Operations
- Typical Air Leakage Sources
- Locating Leaks
- Corrective Actions
- Smart Combustion™
- Conclusions

Introduction

- Air infiltration is sometimes called “tramp air”
- Tramp air = any air going into a heater not through the burners
- Most fired heaters run at negative pressure so ambient air is pulled in through openings
- Tramp air is a common problem for fired heaters:
 - Many heaters are old & have developed cracks
 - Some heaters have high draft levels that pulls in air through openings
 - Lots of penetrations through heater walls that are not well-sealed
 - Improper management of burner dampers
- Process burners designed for all combustion air to come through them

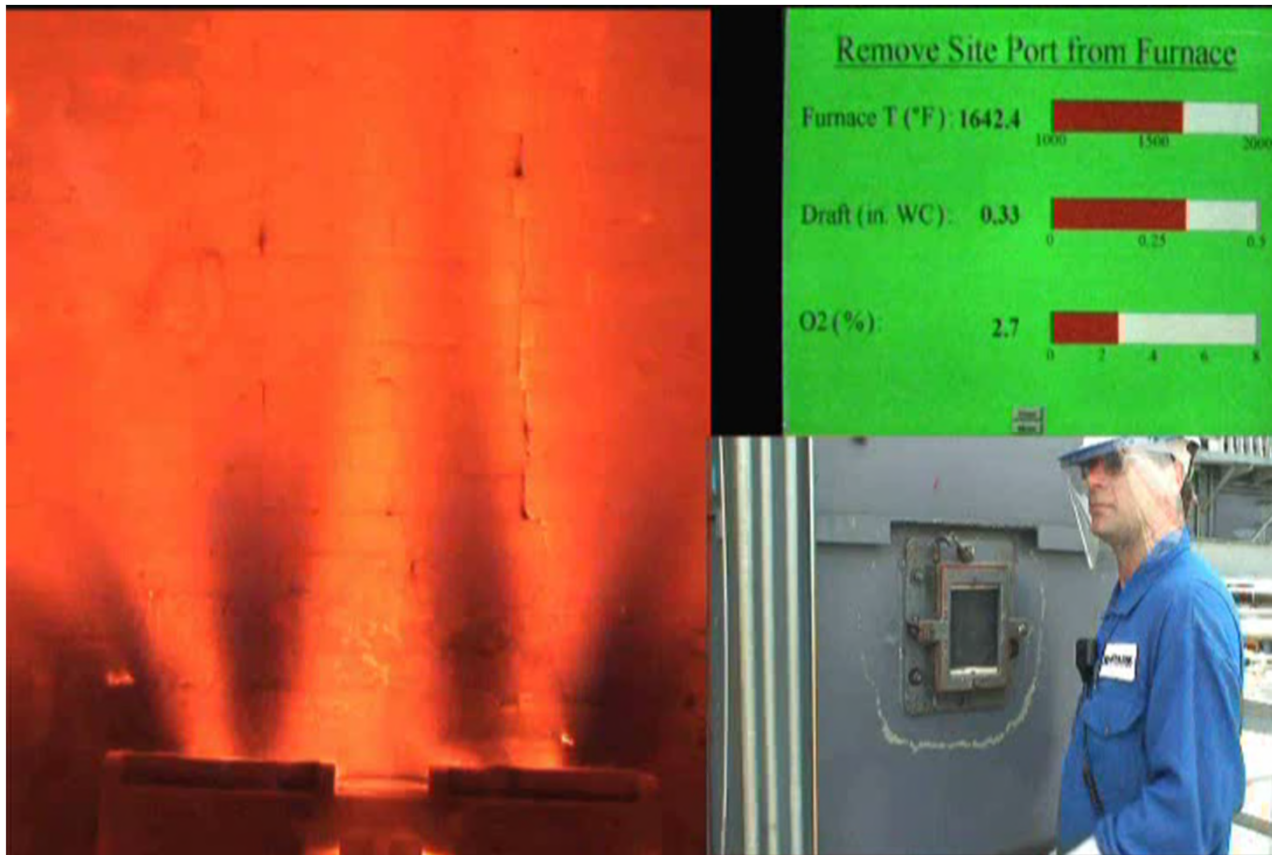
Effects on Heater Operations

- Increased NO_x
- High CO & Combustibles
- Flame Impingement
- Afterburning in the Convection Section
- Reduced Heater Efficiency
- Could limit heater draft (e.g., when induced draft fan or stack damper full open)



Reduced Heater Efficiency

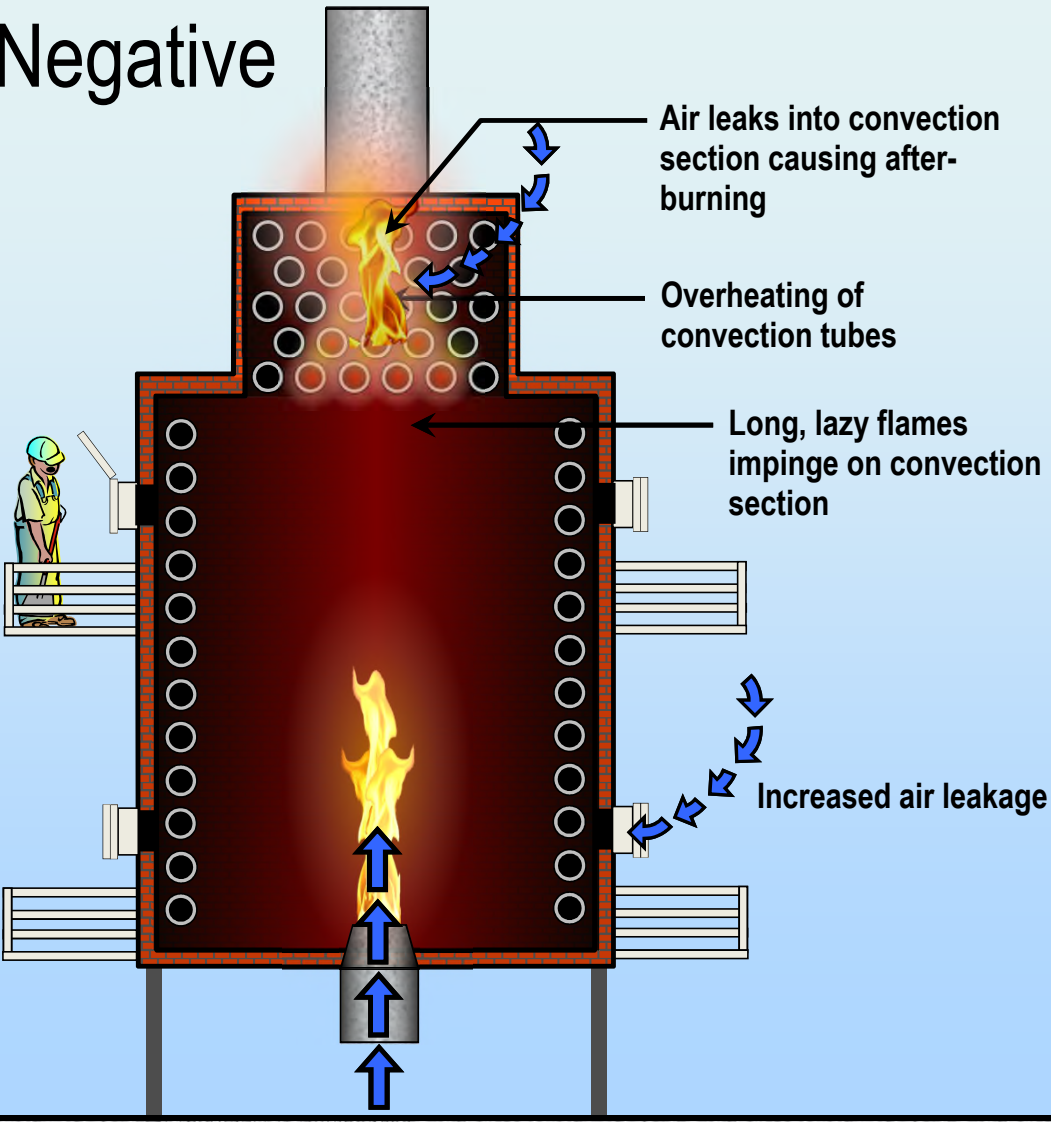
- Ambient air much cooler than flue gas & absorbs energy that is carried out the stack



Time (min.)	0	1	
Temp (degF)	1643	1565	
Draft (in. WC)	0.32	0.21	
O2 (%)	2.7	7.2	

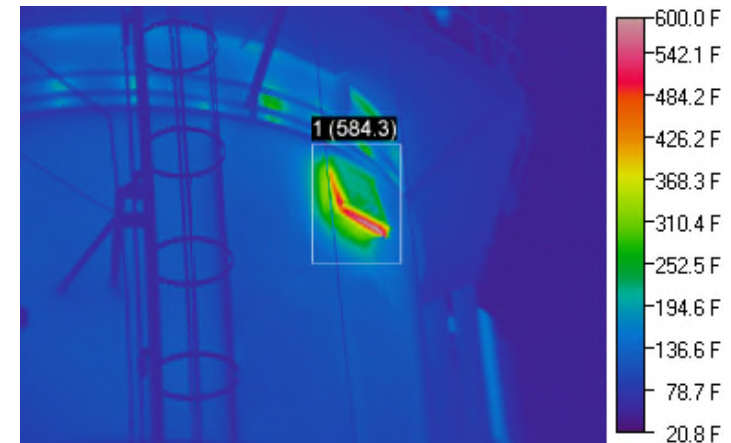
Heater Pressure too Negative

IWORTHY



Typical Air Leakage Sources

- Convection Section
- Header Boxes
- Process Tube Penetrations
- Sight Ports / Access Doors
- Explosion/Pressure Relief Doors
- Air Registers Open on Out-of-Service Burners
- Broken Steam Line



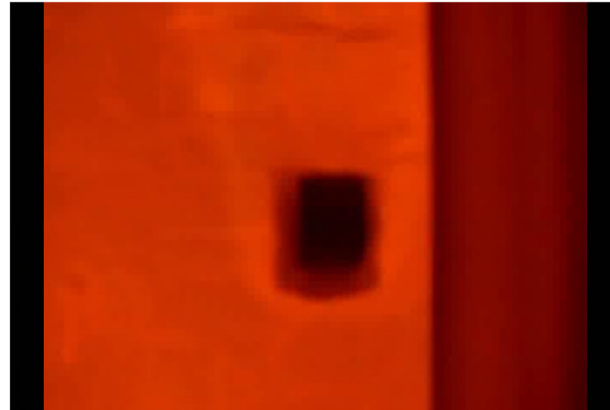
Corrective Actions

- Adjust draft & O₂ to proper levels
 - Make sure stack dampers for adjusting draft are operational
 - Make sure burner registers/dampers for adjusting excess O₂ are operational
- Seal leaks
 - Ceramic blanket
 - Engineered tube seals
 - Braided rope gasket
 - High temperature (500°F) silicone sealant
 - Weld/fix cracks
- Close sight ports when not in use
 - Make sure sight ports are closed after usage
 - Consider replacing sight ports with sealed design
- Close air registers on out-of-service burners

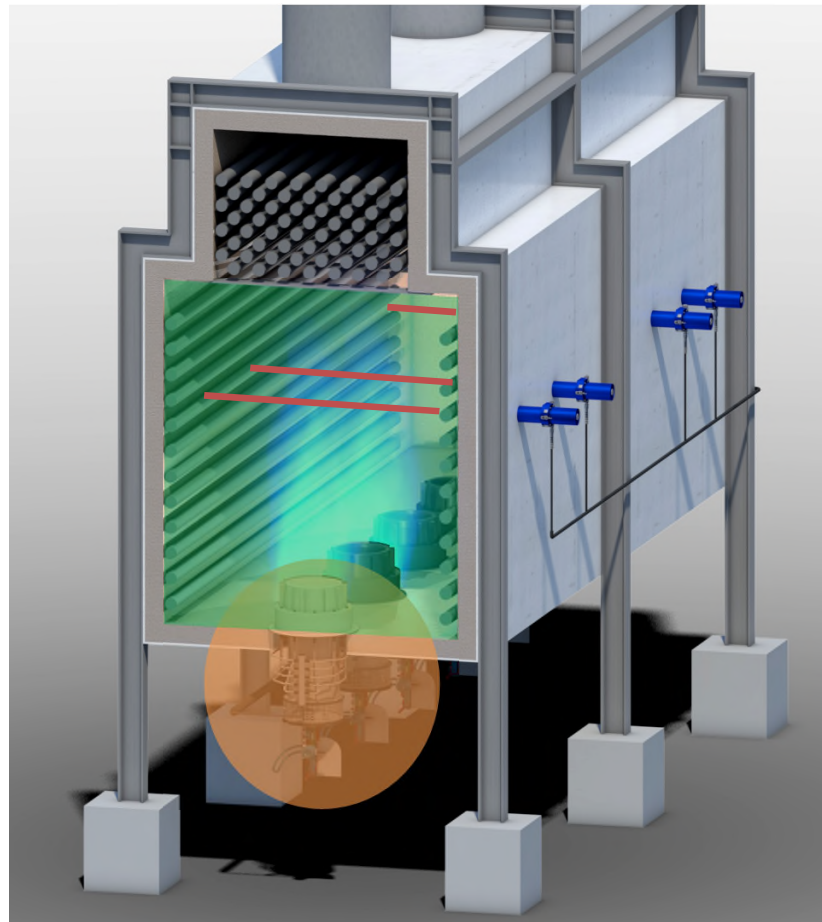
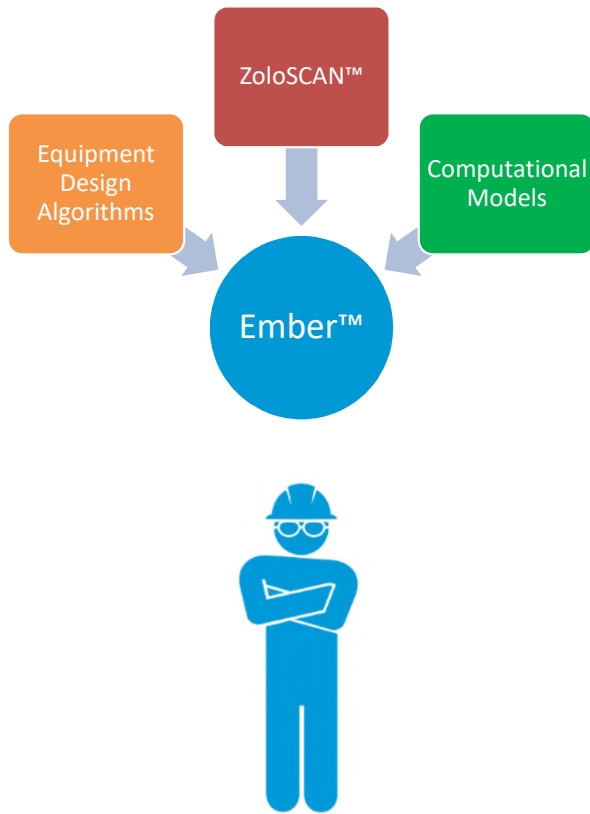


Locating Leaks

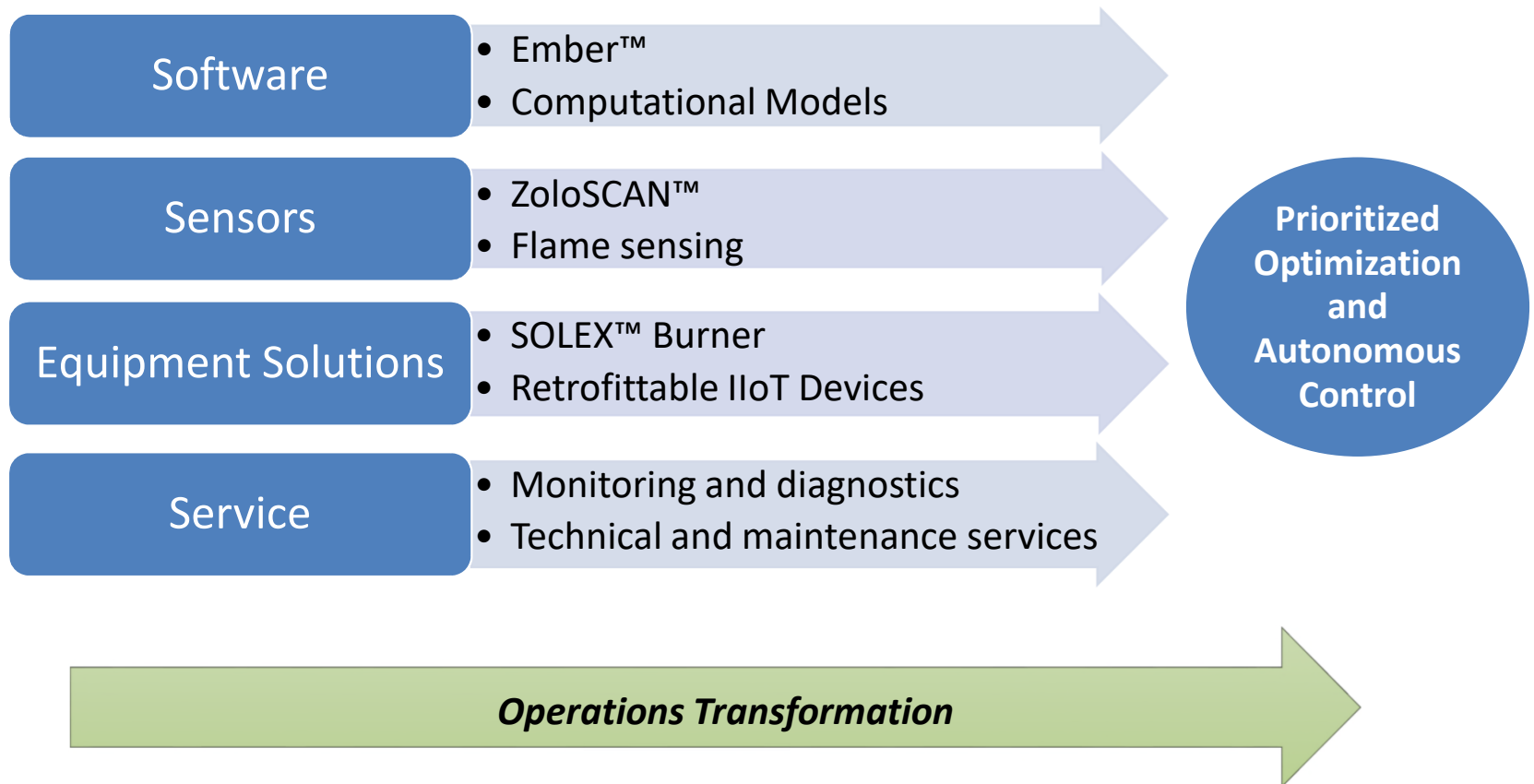
- Dark spots inside heater
- Paint missing / discoloration
- Smoke testing
- Flow indicator
- Who is responsible for identifying leaks?
 - Operators
 - Inspectors
 - Engineers
 - Automated monitoring capabilities



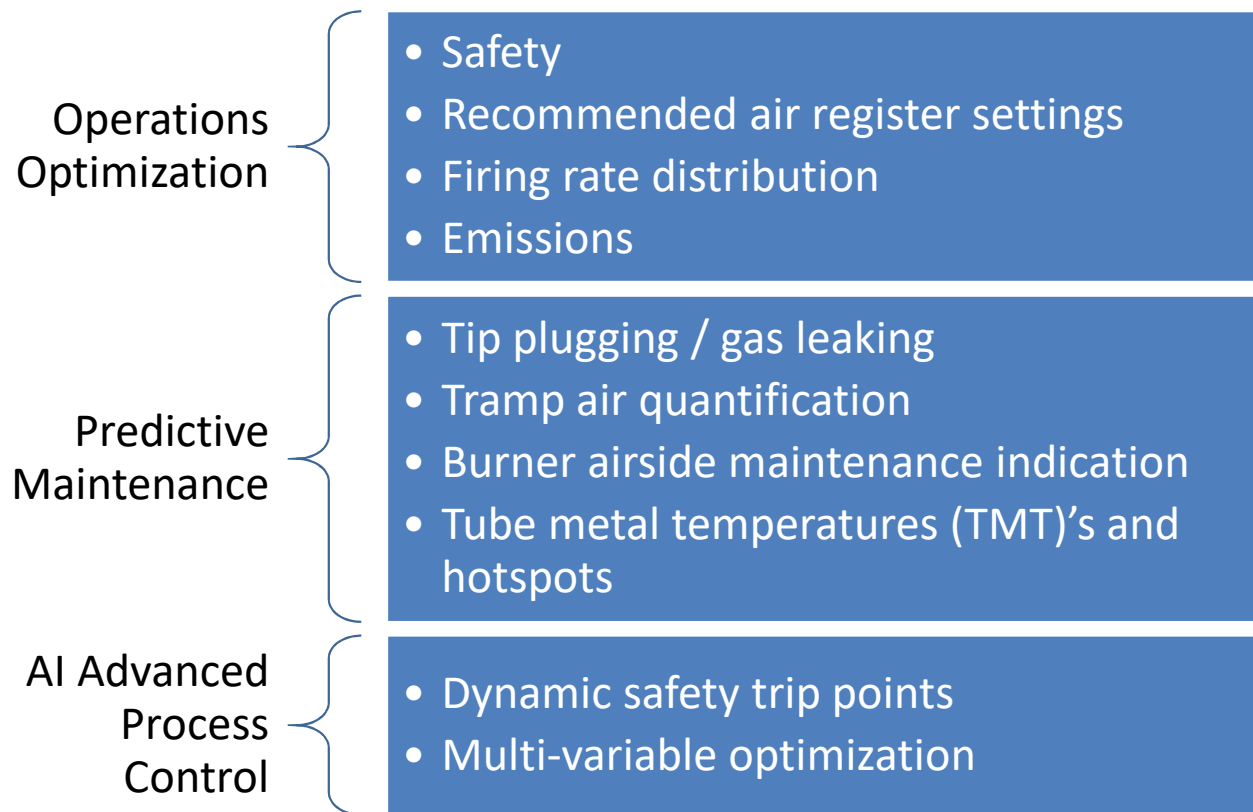
Smart Combustion™ Optimization in Fired Heaters



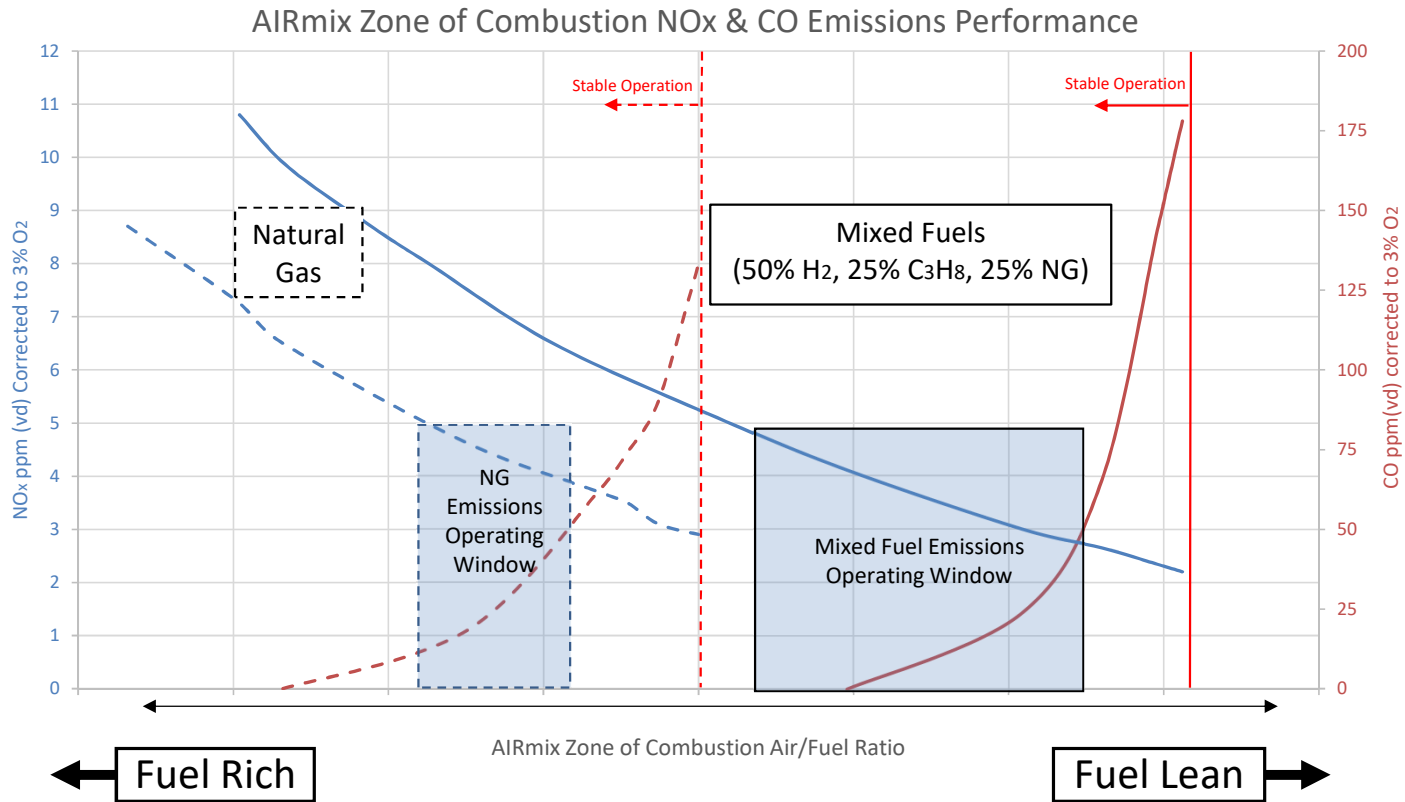
Smart Combustion™ Optimization



Ember Technology Insights

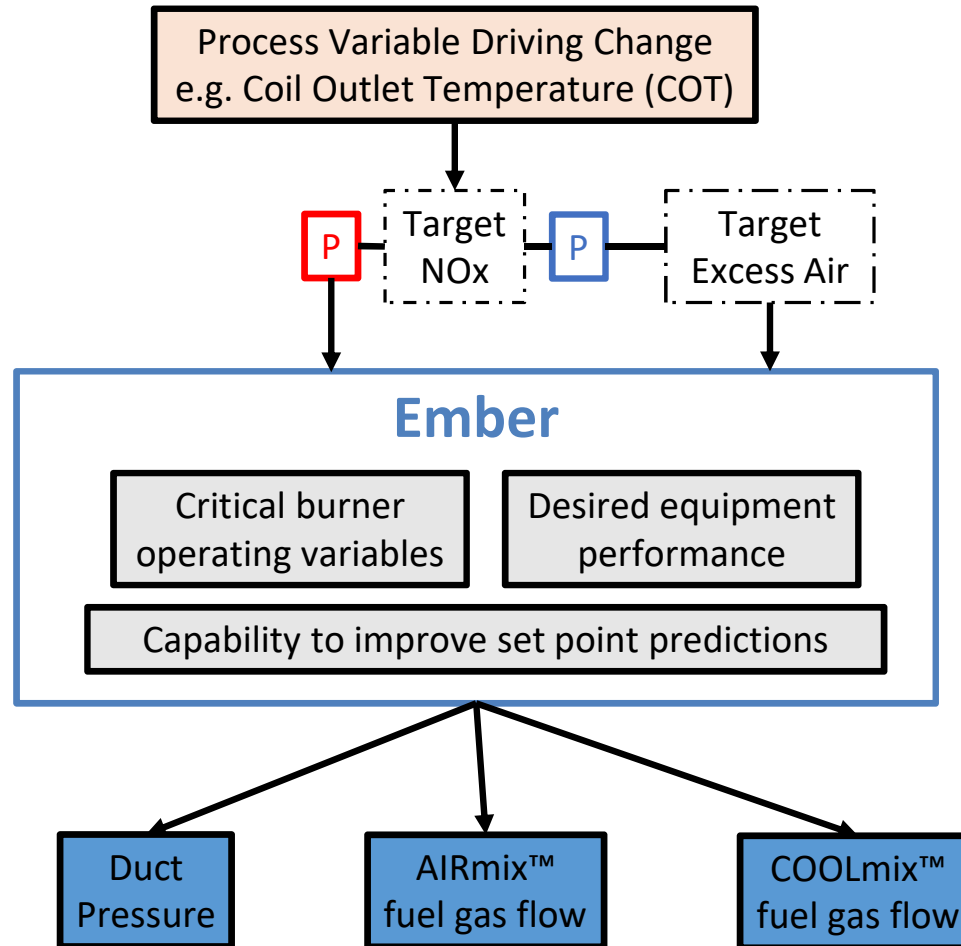


AIRmix™ Emissions & Operating Windows

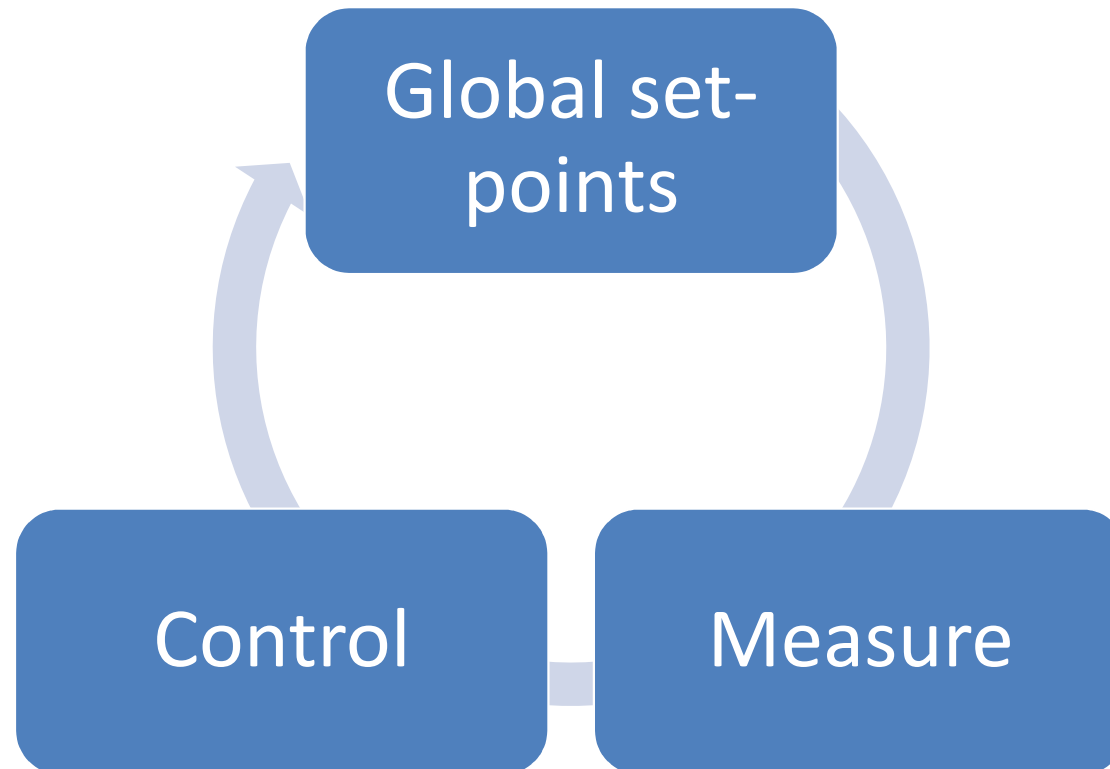


SOLEX™ Automated Operation

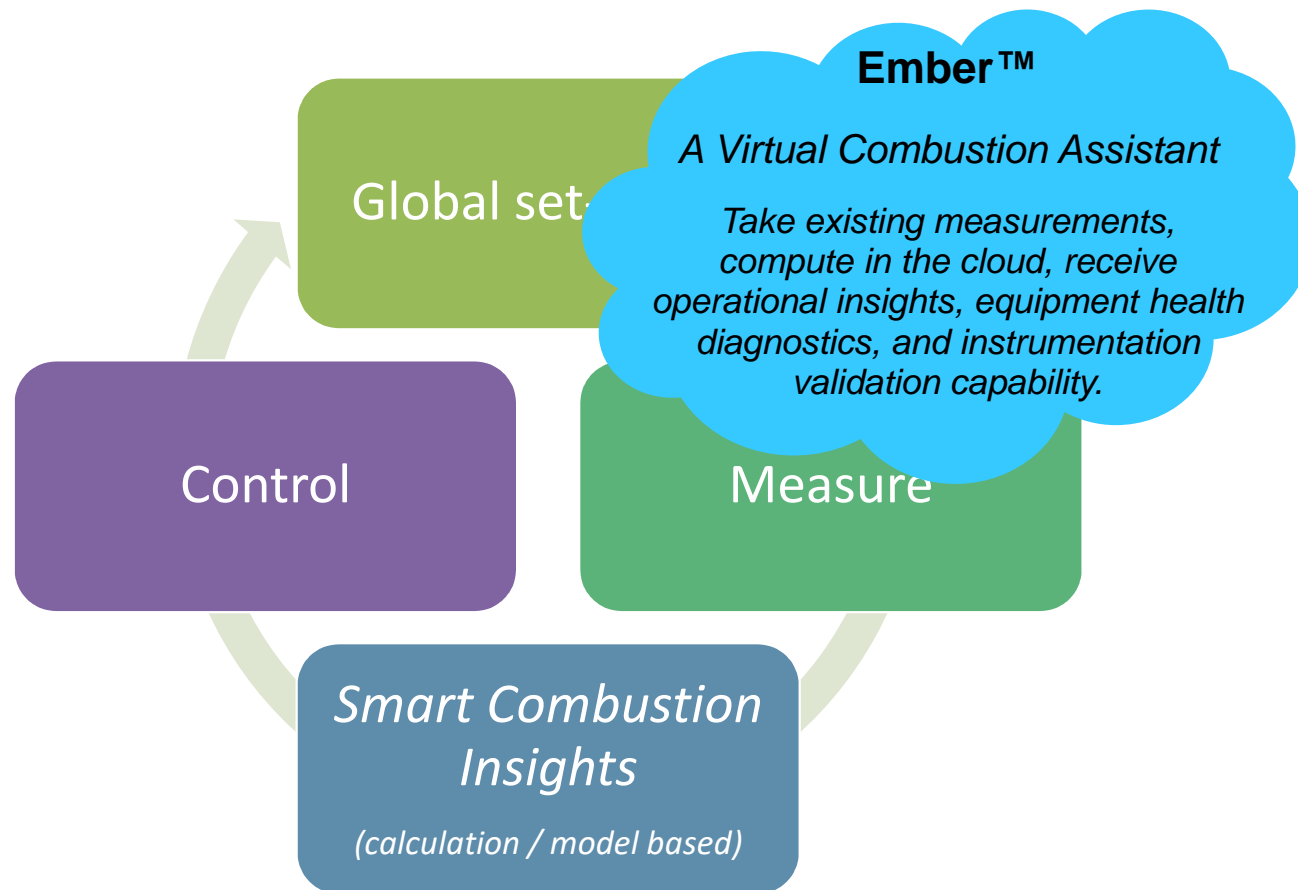
- P Autoignition Permissive **not** met
- P Autoignition Permissive met
- XX Operator Input
- SP Set Point



Typical “Global” Combustion Control

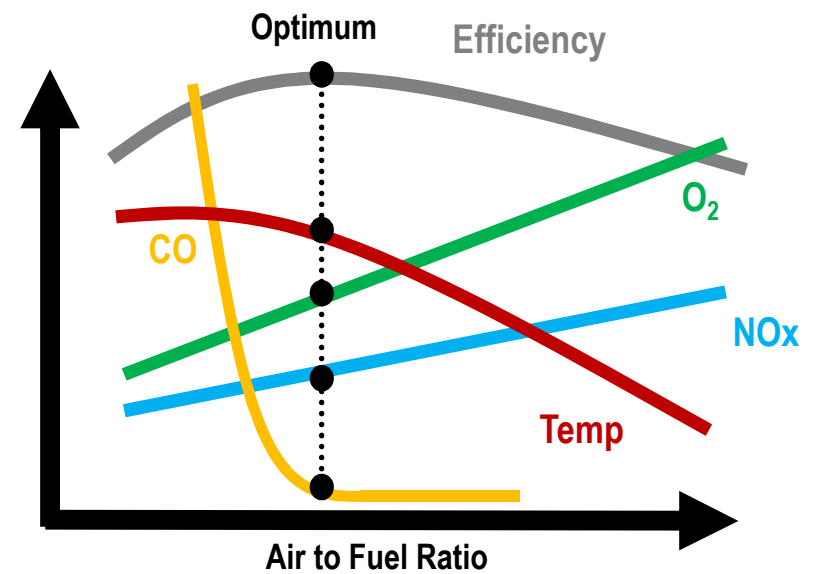


Smart Combustion Control for SOLEX



Value Proposition

- Improve safety
- Reduce emissions
- Reduce fuel consumption
- Increase production
- Increase run-length
- Increase equipment life
- Reduce unplanned events



Conclusions

- Tramp air leakage is a big problem with lots of bad consequences
- Lots of potential sources for air leaks
- Larger leaks usually easy to find
- Seal up leaks to minimize tramp air infiltration

Questions?





Thank You!



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