

Application of Combustion Optimization to Reduce Activated Carbon Requirements for MATS Compliance

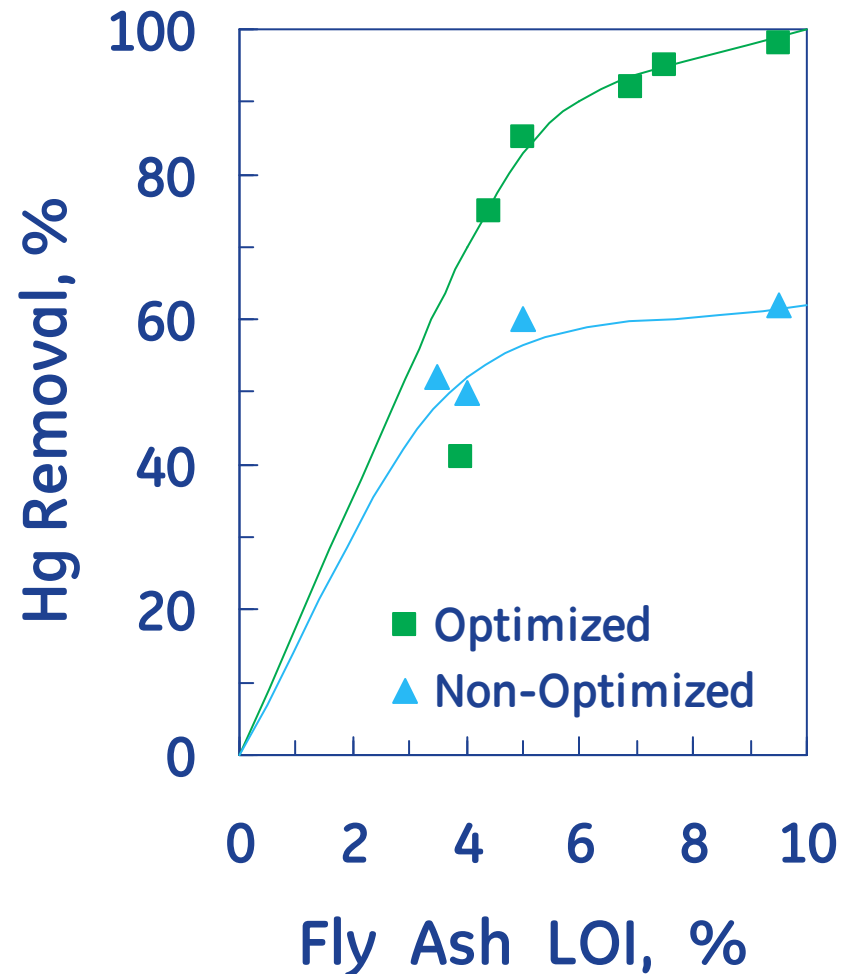
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GE Energy

McIlvaine Hot Topic Hour
April 18, 2013



Introduction

- Activated carbon injection system optimization
- Combustion optimization to enhance “native” Hg capture on fly ash
- Demonstrate over 70% mercury removal and reduce activated carbon injection

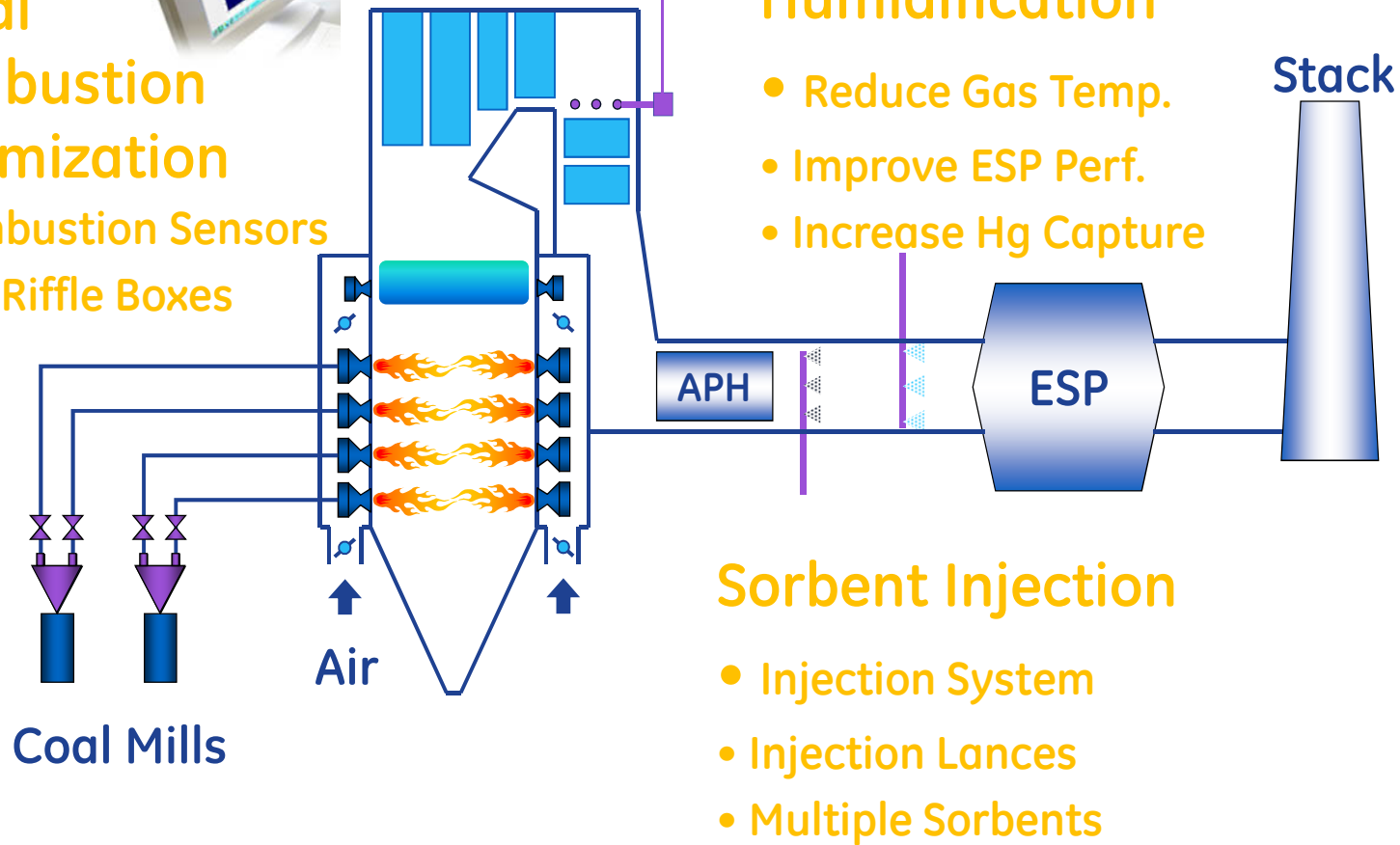


Pilot-scale data from Lissianski, et al.

Mercury Optimization Approach

Zonal Combustion Optimization

- Combustion Sensors
- Adj. Riffle Boxes



Coal Fired Boiler Demonstration Site

- **Boiler:** 250 MW Opposed Wall Fired
- **NO_x Control:** Low-NO_x Burners and Overfire Air
- **PM Controls**
 - Electrostatic Precipitator (SCA ~ 249 ft²/kacfm;
 - SO₃ Conditioning System



Progress Energy Lee Station, Unit 3

Eastern Bituminous Coal

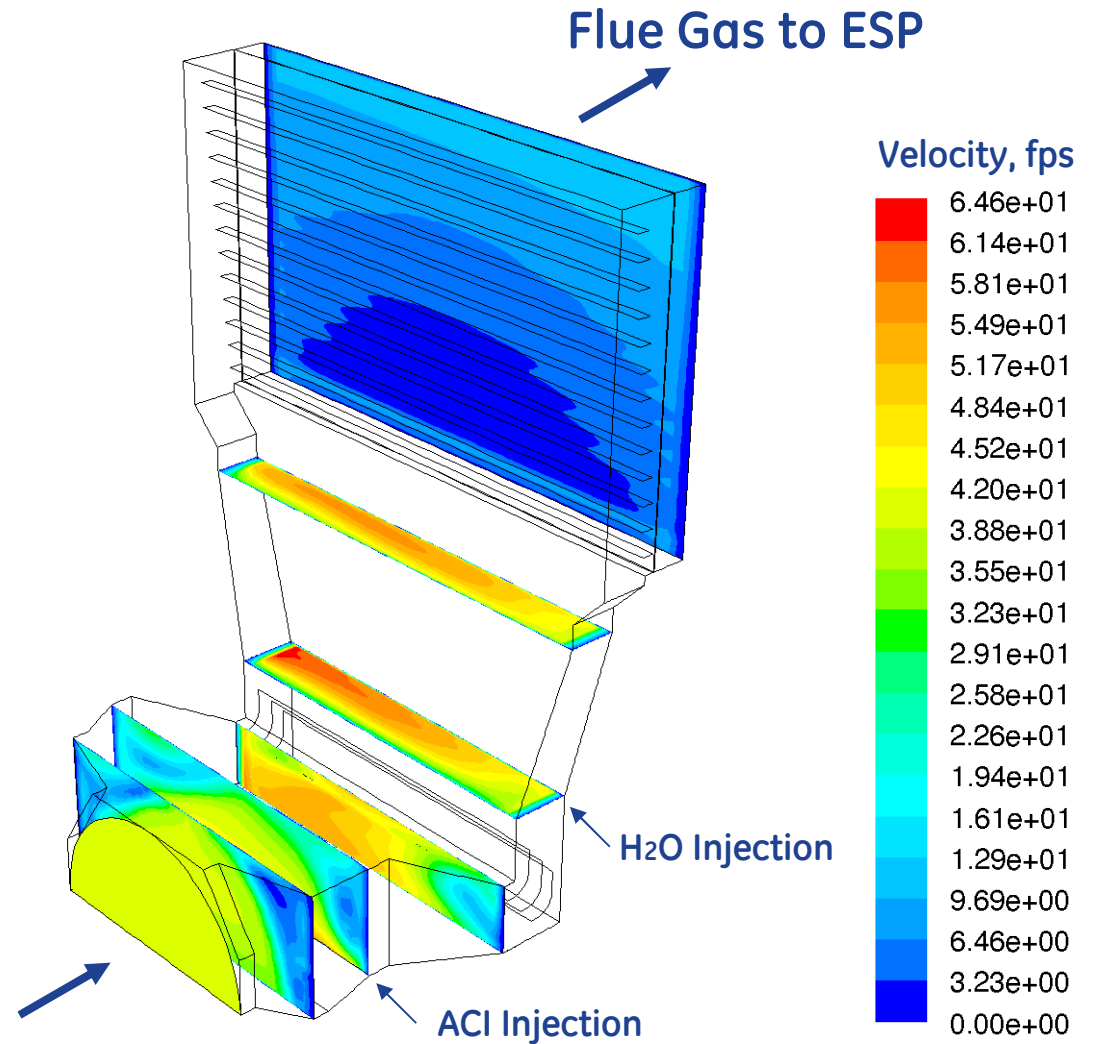
- HHV ~ 12,450 Btu/lb
- Sulfur ~ 0.82% wt.
- Hg ~ 5.0 lb/TBtu

Activated Carbon Injection (ACI) System

ESP Inlet Duct Characteristics

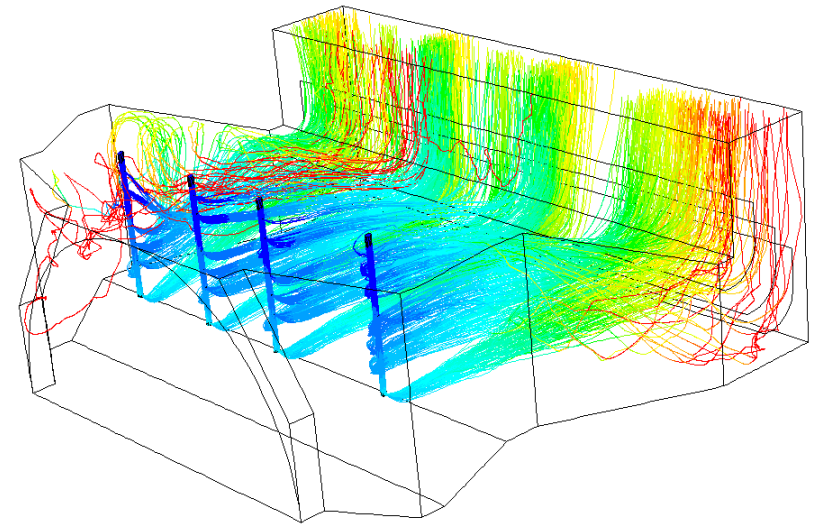
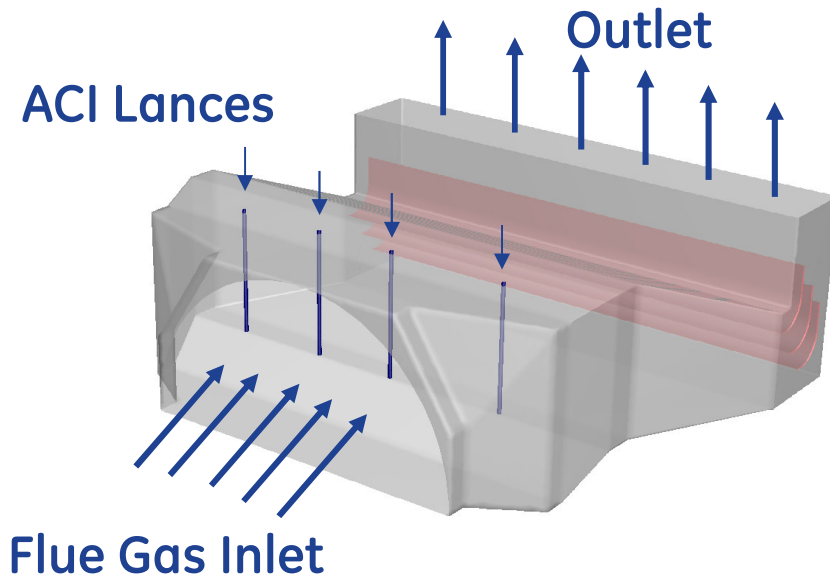


Photograph of duct work between air preheater (APH) exit and ESP inlet

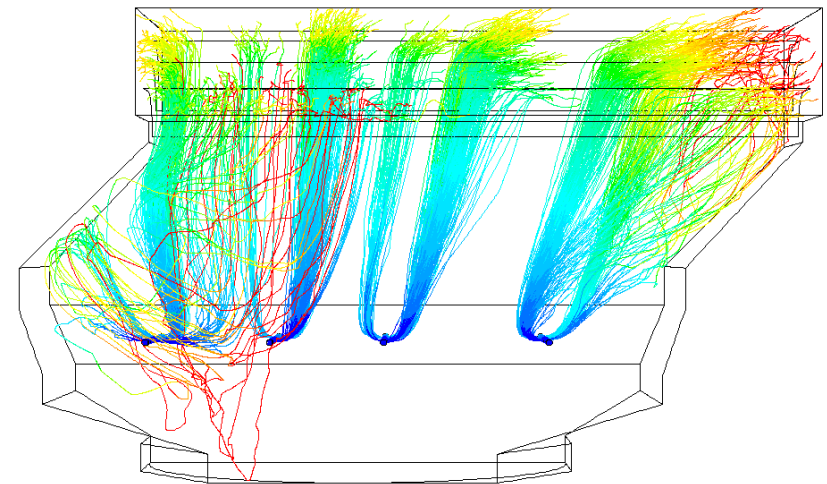


Flue Gas from APH

ACI Lance Design Optimization



- CFD applied to optimize transport flow rate and lance design.
- Lance placement based upon existing ports.



Sorbent Injection System



- 250 ft³ day silo
- 20 ton bulk trailer
- Bulk bag unloader

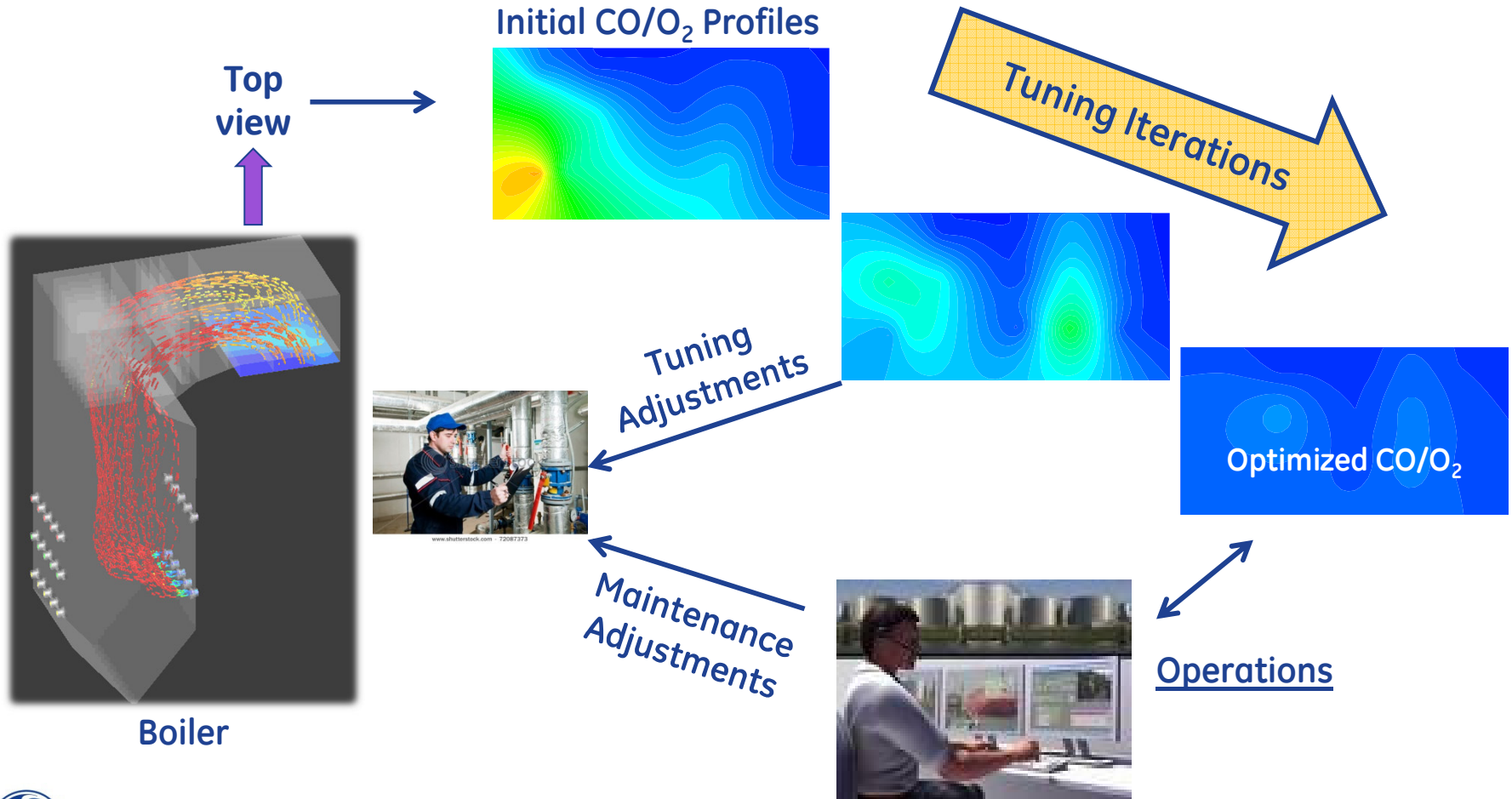
Combustion Optimization



imagination at work

Zonal Combustion Tuning

Combustion sensors provide spatial O₂ and CO data to assist boiler tuning and operation

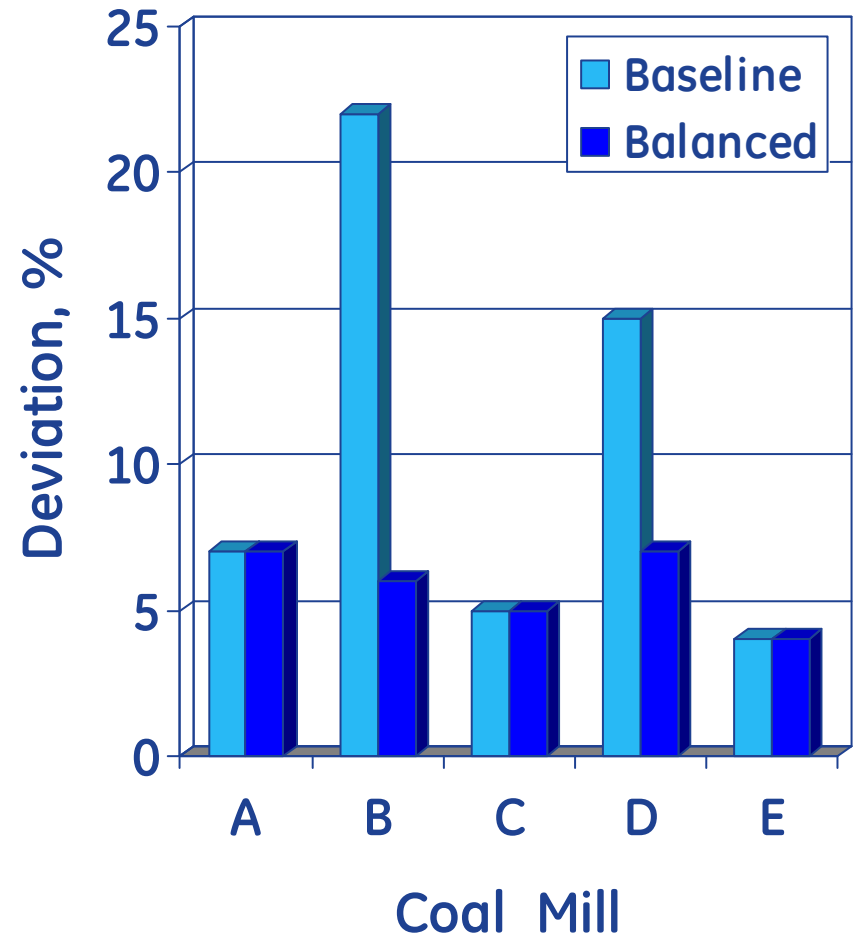


Combustion Optimization

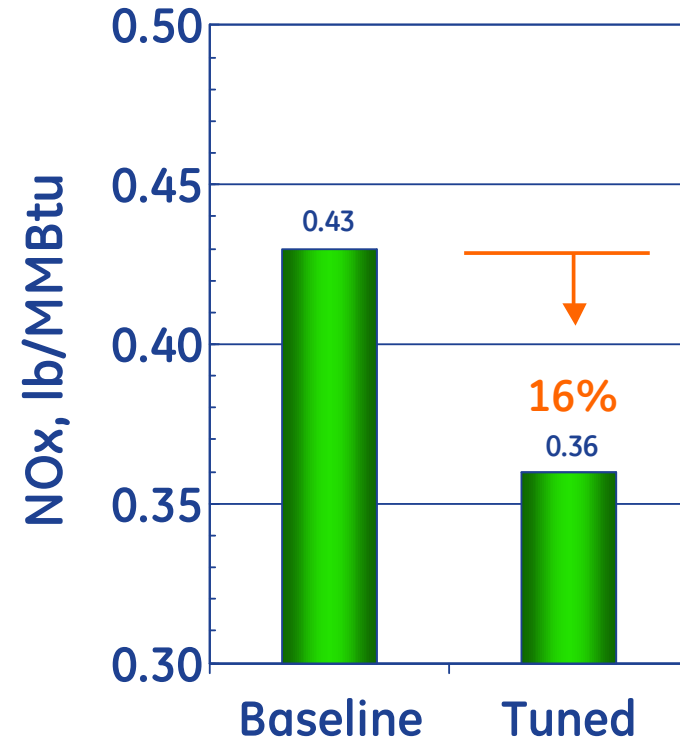
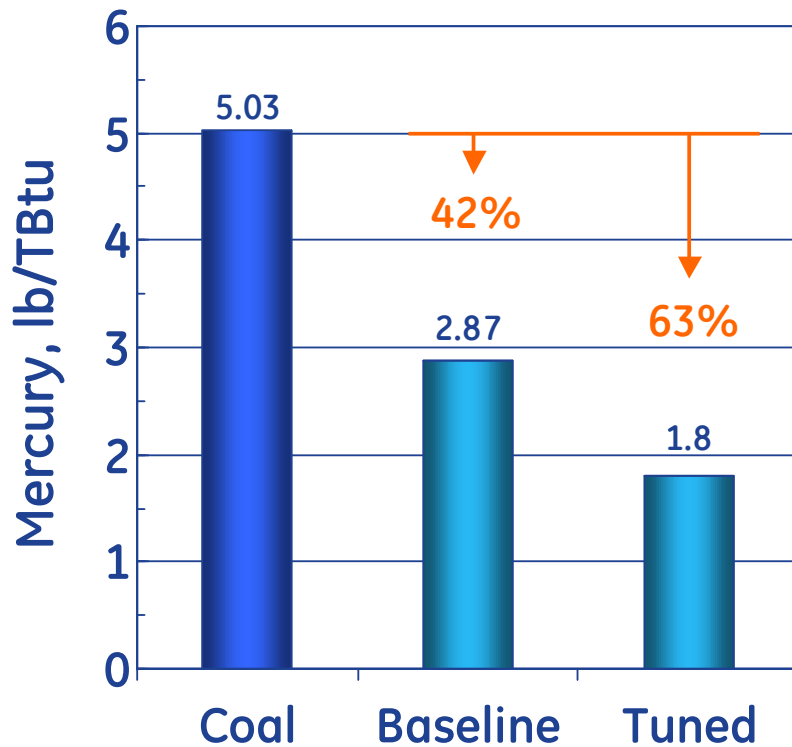
Coal flow balancing: coal flow deviation < 10%.

Air flow balancing: oxygen distribution balanced to within 15% ($\pm 0.48\%$ O₂).

Burner tuning: achieved good stability and lowered NO_x emissions.

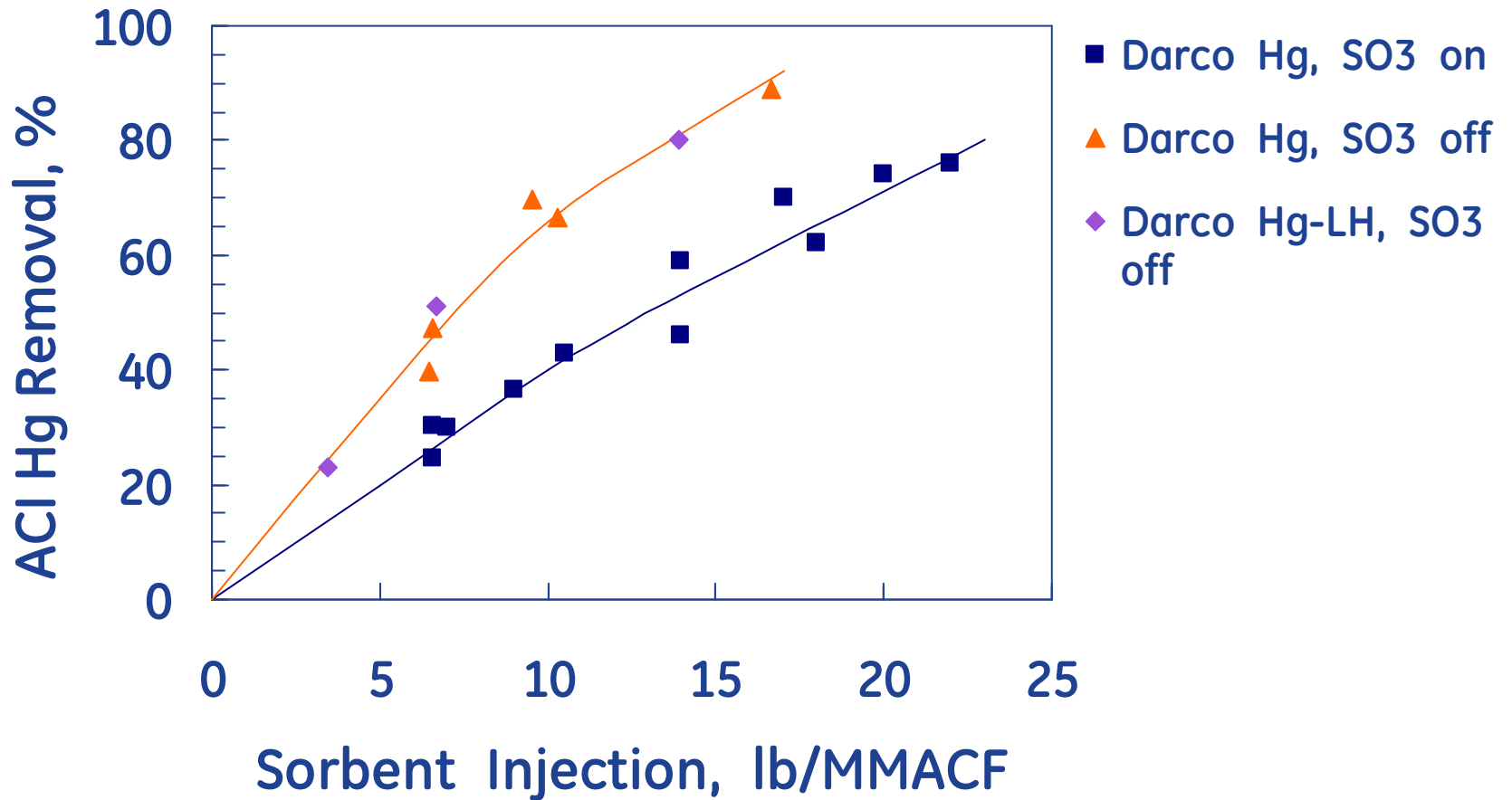


Impact of combustion optimization on stack mercury emissions & NO_x



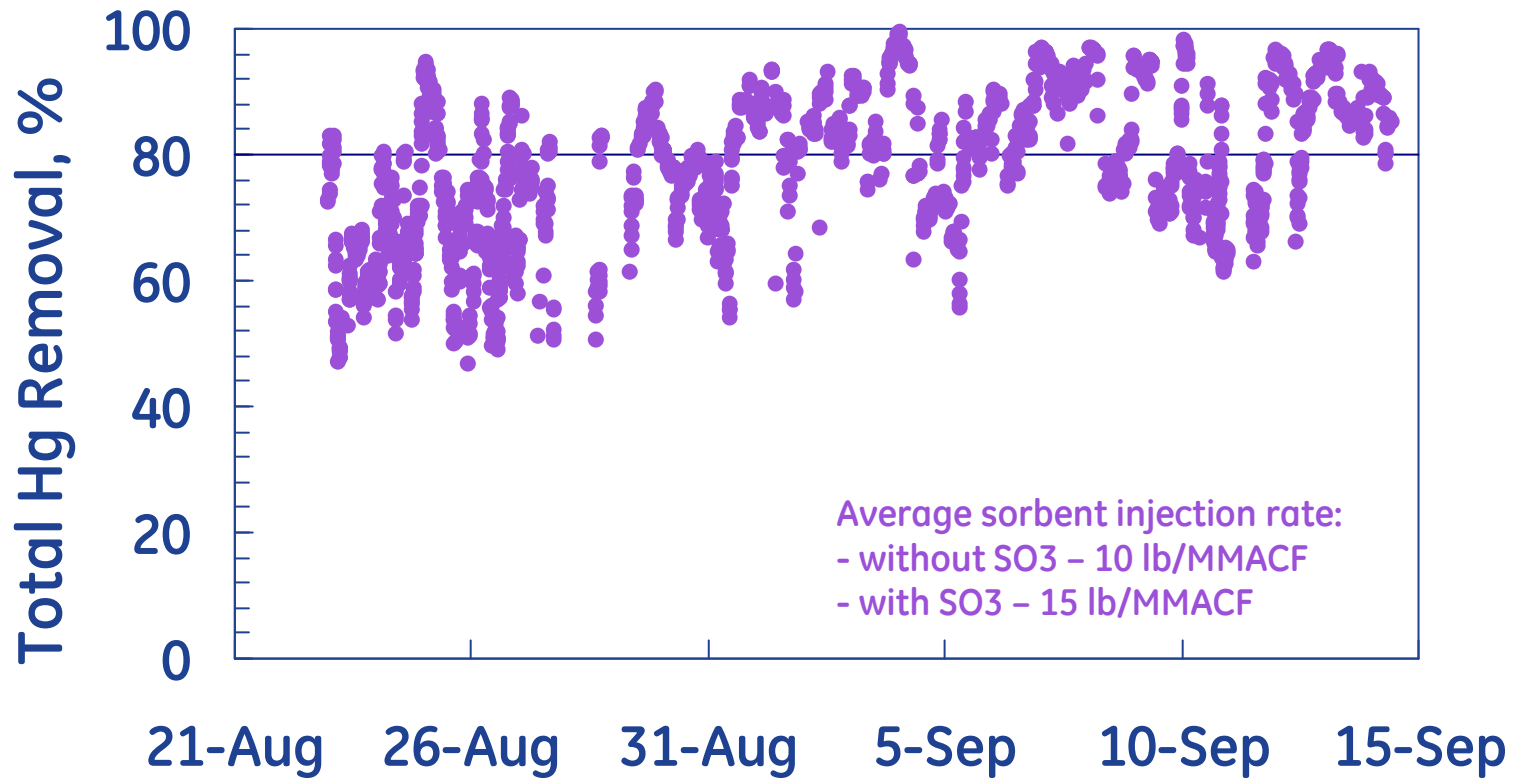
Activated Carbon Injection Performance

Sorbent Performance Characterization

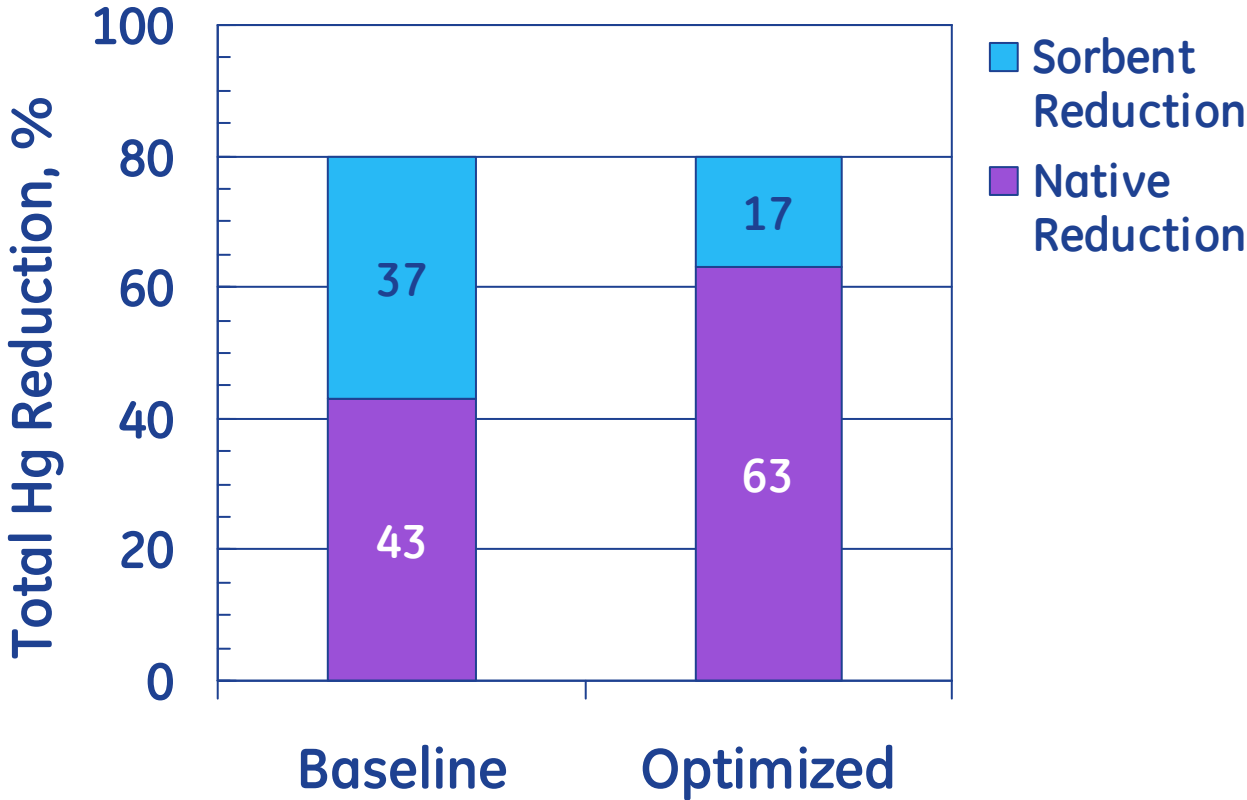


Darco Hg 30-Day Performance Test

Overall Mercury Reduction



Combustion optimization can reduce sorbent requirements



Summary

- Combustion optimization improved “native” mercury capture
- Existing SO₃ conditioning required twice the injection rate for the same mercury removal
- Long-term testing averaged 79% mercury removal
- Sorbent Injection impact on ESP performance were mitigated
- GE’s approach can reduce NO_x and CO emissions, improve reliability and heat rate while providing mercury control

