Instrumentation and Controls for Coal Fired Power Plants
Air & Coal Flow Measurement Systems

OFA
IBAM
Pf-FLO
PA
SA
O2 and CO

Proven solutions for a tough industry
Coal Flow Measurement

- Microwave mass measurement
- Cross-correlation velocity measurement

![Diagram of coal flow measurement](image)
Mass (Density) and Velocity

**Mass (Density)**

- **Scale Min:** 0%
- **Scale Max:** 200%

**History Trend - Density**

- Jan 14, 2005: 200%
- Jan 14, 12:00:00: 175%
- Jan 14, 16:00:00: 150%
- Jan 15, 00:00:00: 125%
- Jan 15, 08:00:00: 100%

**Velocity**

- **Scale Min:** 0%
- **Scale Max:** 200%

**History Trend - Velocity**

- Jan 14, 2005: 200%
- Jan 14, 12:00:00: 175%
- Jan 14, 16:00:00: 150%
- Jan 15, 00:00:00: 125%
- Jan 15, 08:00:00: 100%
Proven solutions for a tough industry
Coal Pipe Balance - Adjustable Orifice
Burner to Burner Balancing
Coal Pipe Balance - Adjustable Orifice
Coal Flow Balancing
Mill Trip Ignoring Low Velocity
Avoiding Mill Trip with 5% PA Increase
Pulverizer Overview

- Automatic PA “kicker” for lowest pipe velocity limit
Prevent Burner/Pipe Fires

Proven solutions for a tough industry
Secondary Air Measurement

Wind Tunnel Testing at Air Monitor HQ

**Equation 2:** Inner Vane Position - 15° Open, Outer Vane Position - 55° Open

Coefficient = 0.0000335938\(X^4\) - 0.001321146\(X^3\) + 0.0179408814\(X^2\) - 0.0886535541\(X\) + 0.8467944546

**Equation 3:** Inner Vane Position - 15° Open, Outer Vane Position - 60° Open

Coefficient = 0.0000718750\(X^4\) - 0.0025442917\(X^3\) + 0.0314818818\(X^2\) - 0.1504645772\(X\) + 0.9413919352
Why Automate SA Dampers?

- Dynamic windbox flow profiles
  - Fluctuating windbox pressure
  - Ash build-up
Burner SA
Measurement – IBAMs
F/A Screens in Control Room

Proven solutions for a tough industry
New F/A Screens in Control Room

Proven solutions for a tough industry
Why CO?

• O2 Measurement not reliable – drift and effects of boiler in-leakage.
• Reducing excess air leads to NOx reduction.
• To safely reduce excess air, need to measure CO.
• Measuring CO can help identify and correct poor combustion.
Combine CO and O2 Measurement
Multi-Points in Common Enclosure

Extraction Probe with filter system
Recent Project Results (54 burner 770 MW unit)

- **Boiler Efficiency Increase = 0.5%**
  - Annual fuel savings

- **Combustion NOx Reduction**
  - 7% at full load, 15-25% at part load
  - Annual Ammonia Reagent Usage Reduction
  - SCR Catalyst Life Extension

- **Fan Auxiliary Power Savings**

- **LOI Reduction**