Reducing the Cost of Compliance by Staying in Compliance

Engine Systems
Concerns about your natural gas engines

• Uptime?
• Reliability?
• Operating Costs?
• Maintenance Costs?
• Others?
Emission Compliance is another concern!

- Layers of Emission Regulations
  - Federal – State – Local
  - NESHAP Area Source
    - 4SRB, >500 hp
    - Aug.11, 2011

- Possible Inspections
  - Now – not an issue!
  - Future – more frequent?

It’s just Part of Doing Business
Compliance issues are complicated!

- How do I know when the engine is out of compliance?
- What happens when you’re Not in Compliance?
- What do you need to do to Stay in Compliance?
- Will the engine stay in compliance if conditions change?

It all costs money!!
Other issues are of concern too!

- Cylinder misfires
- Unbalanced cylinder banks
- Difficult to start the engine
- Multiple control loops (speed/load and A/F) are confusing

How do you know what’s wrong?

These cost money too!
**E³ Rich Burn System Addresses These Concerns**

- Low Emissions
- 3-Way Catalyst
- Fuel Flexibility
- Reliability

**Fuels:**
- Natural Gas
- Field Gas
- Coal-Bed Methane

**E³ Rich-Burn**
- Fuels: Single, Variable Quality
- BMEP: Low to High
- Bore: Low to High

**Mechanical Drive**
- Generators
E³ Rich Burn System Overview

- Measures critical parameters
- Continuously controls engine and catalyst performance
- On-board Logging, Alarming, and Shutdown
• Keeps the emissions in compliance

• Alarms misfire conditions reducing catalysts damage

• Balances engine banks improving performance

• Makes the engine easier to start

• Can combine speed/load control with compliance control

• Ignition control signal to advance cylinder firing

• On-board diagnostics
E³ StableSense™ Technology makes it happen

- StableSense™ sensors
- New StableSense™ Control Software
- Systems Approach

Specifically designed to keep you in compliance
Proven in the field to reduce cost

- **California**
  - CATERPILLAR 3412
  - Water Pump application
  - Highly variable load
  - In compliance over 8000 hours with no tweaking

- **Wyoming**
  - Waukesha 7044
  - Gas compressor application
  - In compliance over 6000 hours with no tweaking

Staying in compliance saved them money!!