

Reinhold Environmental Ltd.



2008 NOx-Combustion Round
Table & Expo Presentation

February 4-5, 2008 in Richmond, VA

Combustion & Sootblowing Optimization at OMU Elmer Smith

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Reinhold NOx Conference
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Overview

- OMU's Elmer Smith Station
- Optimization Goals
- Combustion Optimization
- Sootblowing Optimization
- Need for Global Approach

OMU Elmer Smith Station (ESS)

Largest Kentucky municipal
electric/water system

Serving the community
for 106 years

2 coal-fired units,
416 MW



Overview of OMU Units

OMU Unit #1

- 155 MW Cyclone
- Coal – bituminous, 12-16% ash, 2-4% sulfur; tire waste – < 5%
- SCR – ozone season
- ABT, OFA, Scrubber
- DCS – Metso
- Historian – PI
- NeuCo Optimizers

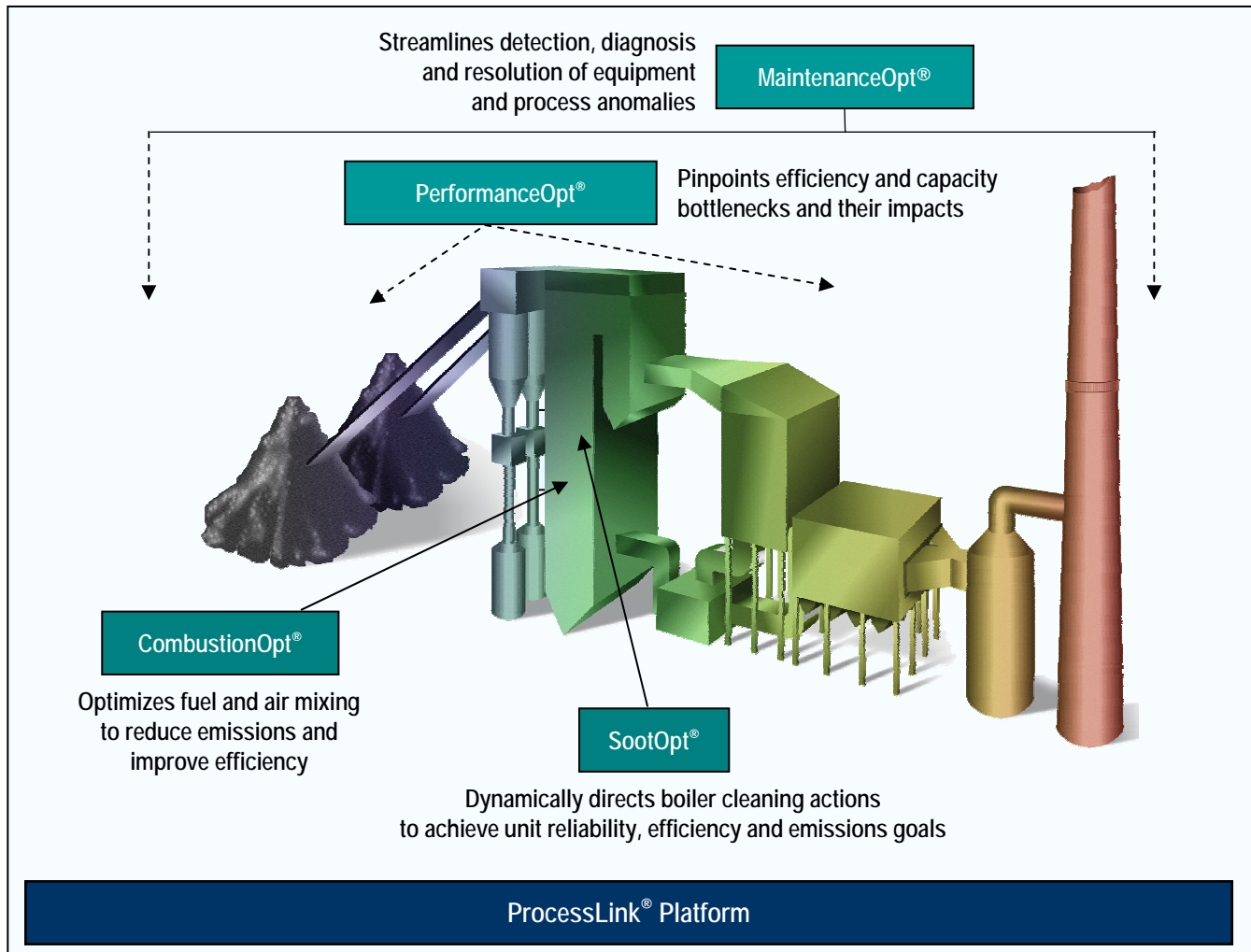
OMU Unit #2

- 290 MW T-Fired
- Coal – bituminous, 12-16% ash, 2-4% sulfur
- SNCR – ozone season
- ABT, OFA, Scrubber
- DCS – Metso
- Historian – PI
- NeuCo Optimizers

OMU Optimization Goals

- To be able to make tradeoff decisions that are truly optimal
- To roll up all of our information sources to paint a broad picture to understand:
 - What tradeoffs we're making
 - What we can achieve operationally
 - Where we're operationally limited
 - How equipment changes impact:
 - Efficiency
 - Operations Costs
 - Maintenance

Optimization Systems Deployed



Combustion Optimization @ ESS #2

- Goals:
 - Reduce operating costs via improved boiler efficiency
 - Reduce NOx emissions
 - Better SH/RH steam temperature control

SootOpt @ ESS #2

- Goals:
 - Get steam temperatures closer to setpoint
 - Lower spray flows
 - Lower exit gas temperature
 - Reduce opacity excursions
 - Better coordinate compressed air use
 - Improve consistency
 - Run each blower at least once a shift

- Situation:
 - PLC based soot blowing control system
 - 43 IRs, 16 IKs and 4 AH blowers
 - Shared SB air supply sources between units
 - Prevailing soot blowing guidelines:
 - Clean based on operator's judgment
 - Clean at least once per shift

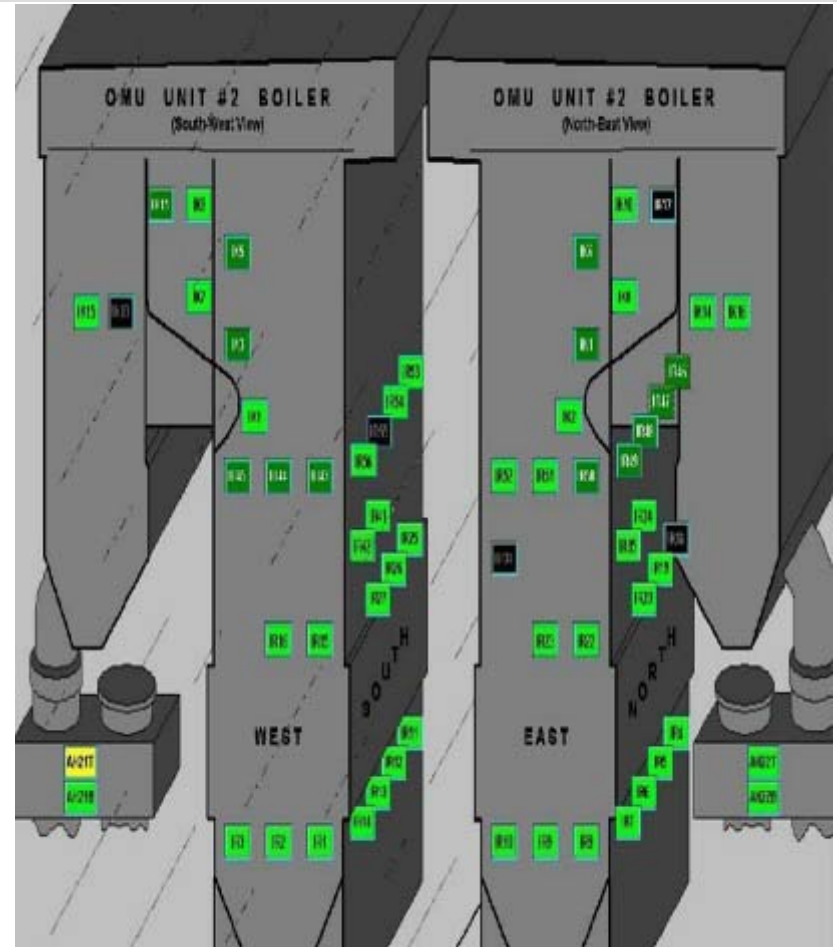
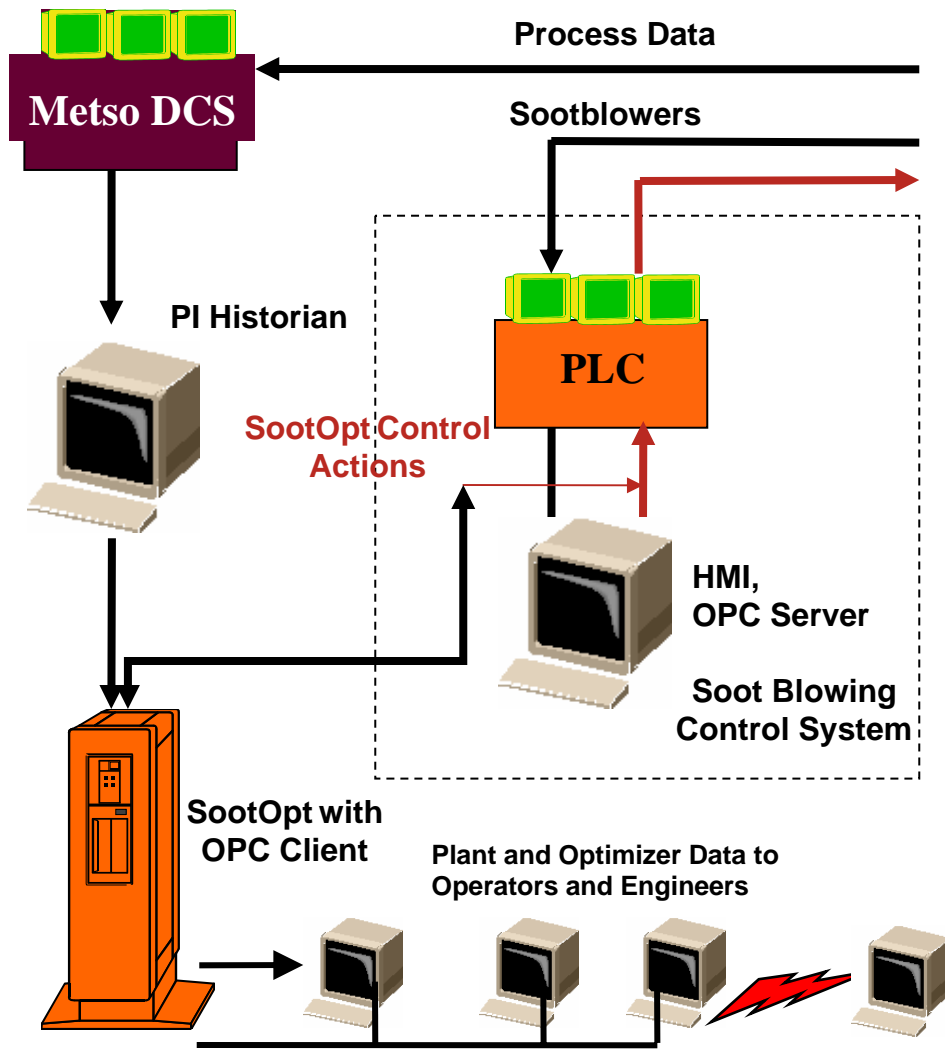
CombustionOpt Deployment

- Configured to bias fuel and air controls in closed loop
- Integrated with Max 1000++ DCS
- Adaptive models of NO_x, RH temps, O₂ Probes, Mill Dp
- Trying to balance SCR Inlet NO_x and RH temps was a primary challenge on Unit 1, also steady out SCR Inlet conditions
- Unit 2 is an SNCR unit, so during NO_x season COpt had model using chem flow
- Usual Home Page and Analysis drill down views

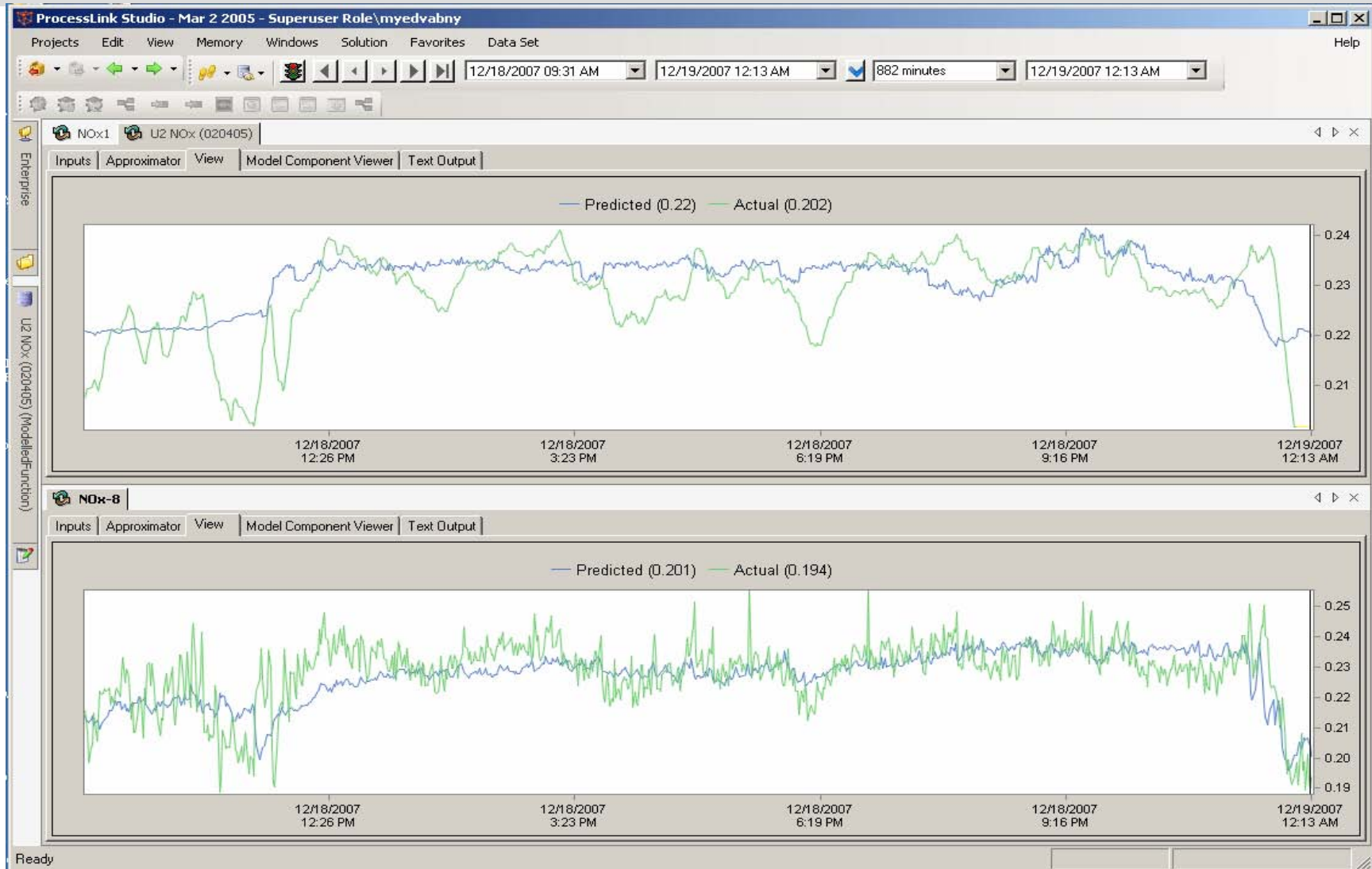
SootOpt Deployment

- SootOpt configured to control actuation of individual sootblowers in closed-loop
- Adaptive NN + heuristics to balance tradeoffs between plant specific optimization objectives
- Adaptive device selection technique to identify most effective blowers for the desired objectives
- Heuristics to ensure minimum blower actuations
- SootOpt homepage and drill-down views
- Utilizing cleanliness factors from PerformanceOpt
- SootOpt and CombustionOpt share model inputs, models

Unit 2 Sootblowing System Overview



Integrated Boiler Optimization



Integrated Boiler Optimization

ProcessLink Studio - Mar 2 2005 - Superuser Role\myedvabny

Projects Edit View Memory Windows Solution Favorites Data Set Help

12/18/2007 09:31 AM 12/19/2007 12:13 AM 882 minutes 12/19/2007 12:13 AM

NOx1 U2 NOx (020405)

Inputs Approximator View Model Component Viewer Text Output

Setup Expected Result State Input Tuning Debug

Creation	NMSE	MSE	R
1/21/2008 11:13:11 AM	0.288	0.001	0.845
1/20/2008 12:34:24 AM	0.297	0.001	0.839
1/21/2008 11:14:11 AM	0.304	0.001	0.835
1/20/2008 12:40:32 AM	0.312	0.001	0.83
1/21/2008 11:28:33 AM	0.314	0.001	0.829
1/20/2008 12:36:10 AM	0.315	0.001	0.828
1/18/2008 7:49:37 AM	0.361	0.001	0.804
1/18/2008 7:57:01 AM	0.374	0.002	0.796
1/5/2008 9:41:53 PM	0.54	0.002	0.732
1/12/2008 5:53:14 AM	0.486	0.002	0.728
1/4/2008 5:44:37 PM	0.808	0.003	0.632
1/13/2008 10:24:35 PM	0.668	0.003	0.656
1/15/2008 7:26:10 AM	0.701	0.003	0.649
1/18/2008 7:56:19 AM	0.75	0.003	0.633
1/8/2008 12:55:23 PM	0.855	0.003	0.629

Committee Stats

NMSE:

MSE:

* R:

Save Retune

Clear View Log

NOx-8

Inputs Approximator View Model Component Viewer Text Output

Setup Expected Result State Input Tuning Debug

Creation	NMSE	MSE	R
1/22/2008 2:54:31 PM	0.068	0	0.966
1/22/2008 3:10:25 PM	0.075	0	0.962
1/22/2008 3:00:12 PM	0.079	0	0.96
1/22/2008 3:03:13 PM	0.08	0	0.96
1/22/2008 3:20:12 PM	0.081	0	0.959
1/21/2008 12:56:21 PM	0.083	0	0.958
1/19/2008 2:32:25 PM	0.083	0	0.958
1/21/2008 12:43:10 PM	0.085	0	0.958
1/21/2008 12:48:53 PM	0.087	0	0.956
1/19/2008 2:40:07 PM	0.088	0	0.955
1/21/2008 12:59:27 PM	0.091	0	0.954
1/13/2008 12:52:19 PM	0.1	0	0.952
1/21/2008 12:59:02 PM	0.098	0	0.951
1/17/2008 10:16:51 PM	0.11	0	0.95
1/11/2008 11:48:55 PM	0.112	0	0.944

Committee Stats

NMSE:

MSE:

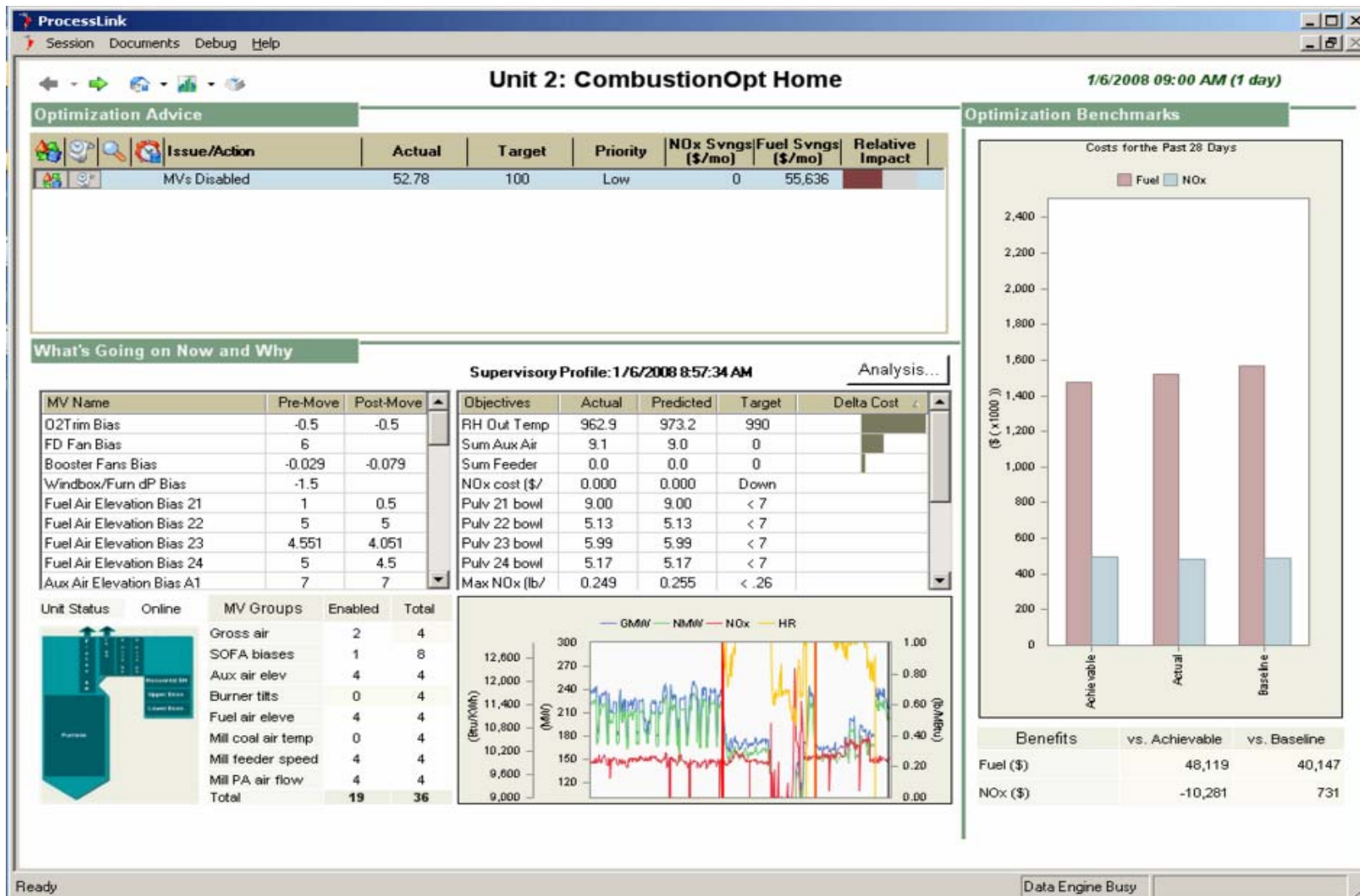
* R:

Save Retune

Clear View Log

Ready

CombustionOpt Home Page



CombustionOpt Analysis

