SmartProcess®

Plant Optimization & Performance Software

EMERSON™
Process Management

SmartProcess®

Environmental Management

- NOx / SO2 cap compliance
- NOx / CO / CO_2 minimization
- Opacity Reductions

Unit Performance

- Heat Rate Improvements
- Combustion Efficiency
- LOI reductions

Generation Management

- Fleet / Economic Optimizer
- Global Performance Advisor

Operational Flexibility

- Dispatch Response
- Ramp Rate Improvements

A Comprehensive Suite of Intelligent Software Modules Designed to Improve Plant Performance

SmartProcess®

- Economic Optimizer
- Fleet Optimizer
- Combustion Optimizer
- Cyclone Boiler Optimizer
- Steam Temperature Optimizer
- Sootblower Optimizer
- Fluidized Bed Optimizer
- SCR and FGD Optimizer
- Precipitator Optimizer
- Unit Response Optimizer
- Global Performance Advisor
- Enterprise Data Server

Benefits

SmartProcess®

- Heat rate improvements 1/2% to 1 1/2%
- NOx Reductions 15% to 35%
- Opacity Reductions 15% to 30%
- Increased Capacity 1% to 2%
- 1% of MCR per minute improvement in ramp rate
- Reduced tube leaks and associated forced outages
- Improve fleet management capabilities
- Optimize plant environmental equipment such as SCRs and scrubbers

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Years of experience in process control design, implementation, and field installation

AES Alliant Energy Ameren Energy Generating American Electric Power Constellation Power Source Generation Dairyland Po egy Power Generat Edison Mission m. T. Kosciusz ntergy Louisian thority Keyspan oration (KEPCO evada Power Public Service of New Hampshire Saudi Electric Company Seminole Electric Cooperative Sempra Energy Resources Southern California Edison University of Michigan We Energies Xcel Energy Zespol Elektrownia Ostroleka, S.A.

With more than 200 SmartProcess installations on many different control systems, Emerson is the *market leader* in advanced control.

What makes SmartProcess different?

TECHNOLOGY

Advanced control and optimization solutions incorporate **fuzzy logic**, **neural networks**, **model predictive control**, and **optimization engines** designed specifically for the power industry needs

Browser-based user interfaces

Closed loop integration – Integrates directly with any DCS or can be deployed via other protocols like OPC or OSISoft PI

Automated testing tools for quick, efficient implementation

What makes SmartProcess different?

FLEXIBILITY

DCS platform independent

Versatility to optimize for **multiple objectives** under **varying conditions**

Dynamic routines that steady-state approaches cannot match – Optimizer runs every 10 to 20 seconds, outperforming all other comparable products

Adapts and **learns** changing plant conditions

What makes SmartProcess different?

ADAPTABILITY

No daily maintenance – SmartProcess **self adapts** to the subtle long term changes in the plant dynamics

Data validation tools and **comprehensive support** capabilities available

Easily upgraded with base plant control system upgrades/migrations

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Deployment

- Platform independence allows SmartProcess to be implemented on Ovation, WDPF or any other distributed control system
- Integration by Emerson Process Management personnel
  - Each team includes a boiler/combustion expert, a DCS field engineer to perform DCS changes, and a neural network/optimization expert for model building and on-line tuning
- Implementation includes an initial site analysis, and can be completed in less than 3 months
- Non-intrusive implementation (I.e. no outage required, can be easily turned on or off)
- Low maintenance costs - 1 year 100% support
  - No runtime fees
  - No maintenance fees

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RESULTS!

SmartProcess
Combustion Optimizer
- Improves heat rate
- Reduces emissions
- Controls opacity levels

SmartProcess
Cyclone Boiler Optimizer
- Improves NOx levels
- Optimizes boiler combustion processes
- Improves steam temperature

SmartProcess
Fluidized Bed Optimizer
- Achieves stable boiler operation
- Reduces emissions
- Tracks performance variances
- Achieves ideal SO_2 absorption rate

SmartProcess
FGD Optimizer
- Prevents limestone binding
- Achieves better SO_2 removal

SmartProcess
Precipitator Optimizer
- Optimizes cleaning sequences
- Minimizes particle emissions

SmartProcess
SCR Optimizer
- Lowers operating costs
- Maintains optimum temperature and pressure

SmartProcess
Unit Response Optimizer
- Improves unit stability
- Increases ramp rates
- Increases startup efficiency

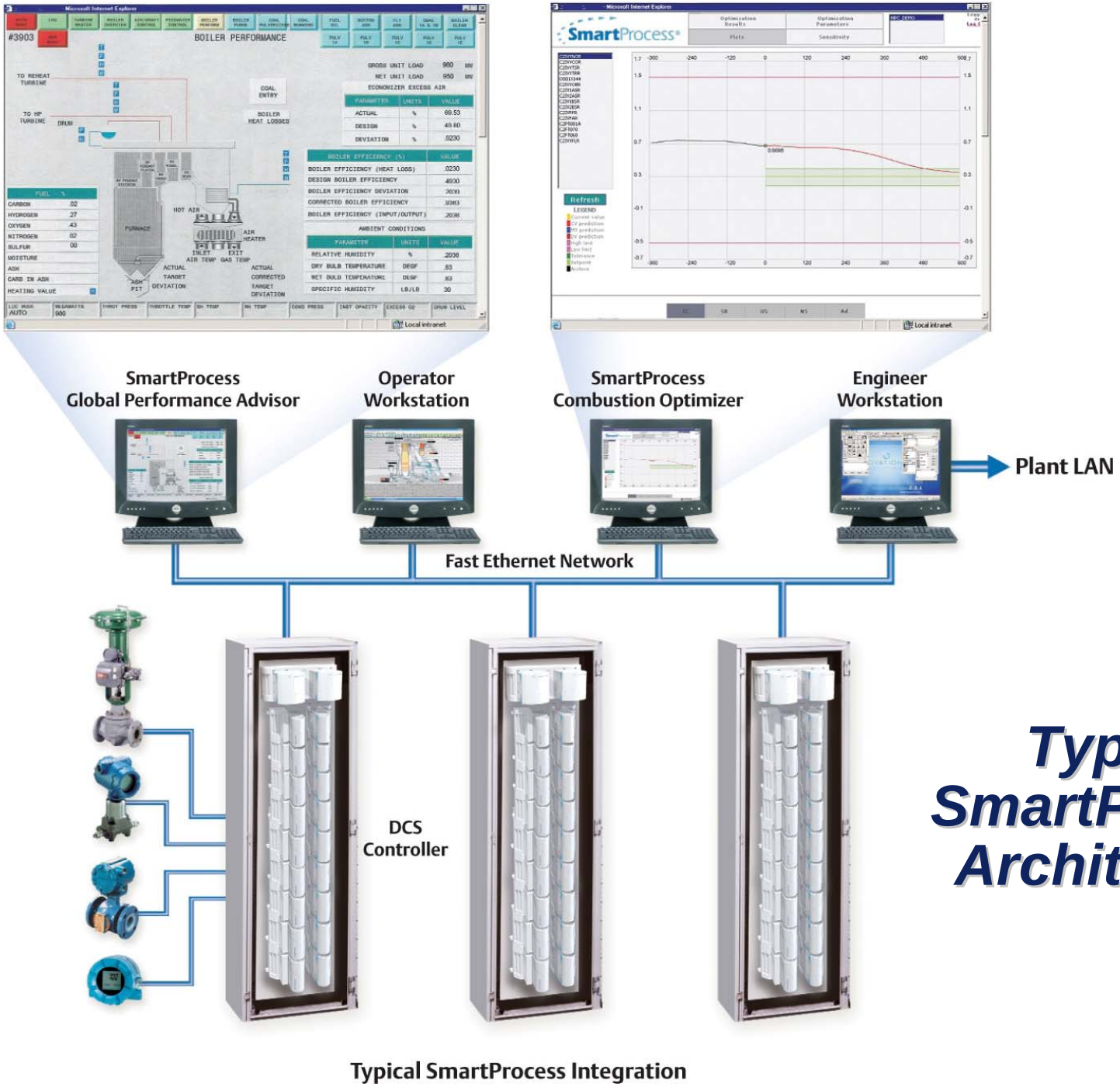
SmartProcess
Economic Optimizer
- Optimizes heat rate across multiple units
- Optimizes varying cogeneration electricity and steam demands
- Reduces maintenance costs

SmartProcess
Steam Temperature Optimizer
- Improves ramp rates
- Minimizes temperature variations

SmartProcess
Sootblower Optimizer
- Delivers optimal cleanliness
- Balances blowing sequences

SmartProcess
Global Performance Advisor
- Tracks heat rate deviations and cost of deviations
- Reduces operating costs

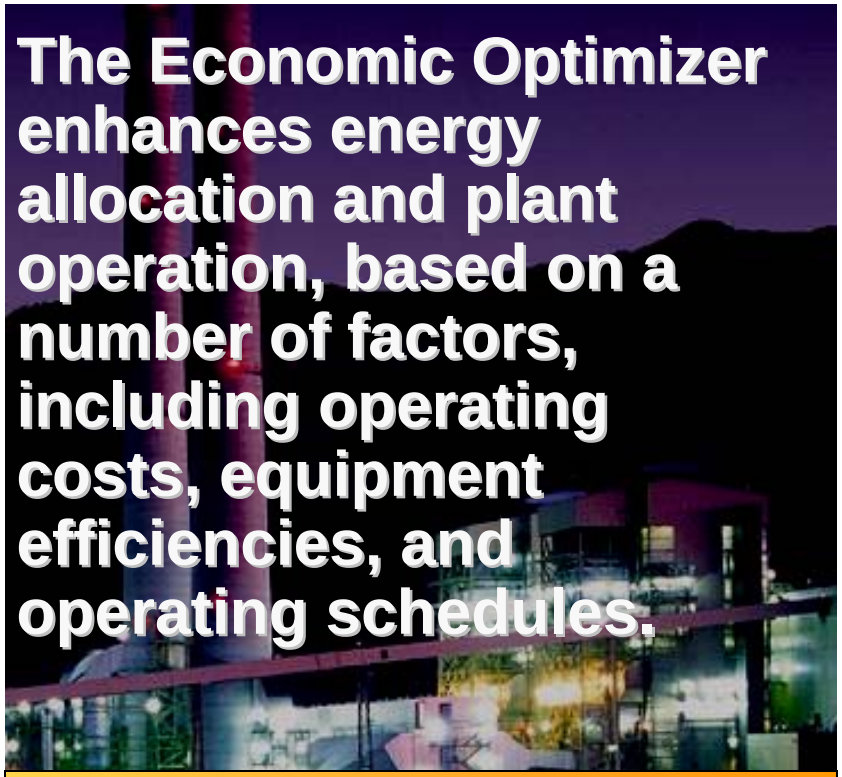
SmartProcess
Fleet Optimizer
- Provides regional optimization of multiple units for emissions, heat rate, and revenue
- Provides browser-based visualization of fleet performance



Typical SmartProcess Architecture

Typical SmartProcess Integration

Economic Optimizer



Unify islands of optimization with an overall plant model

- Applications
  - Fleet wide economic analysis
  - Reduces operating costs on multiple equipment type plant configurations
  - CHP, Combined cycle plants, Co-generation facilities
  - Pumping networks
  - Fuel blending strategies
  - Cooling tower optimization

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Fleet Optimizer

Operate cost-effectively while achieving SO2 or NOx compliance.

- Results
  - Replicates and/or diversifies calculations used for business decisions
  - Provides reporting for O&M costs and real time heat rate
  - Predicts emission cap compliance based on load forecasts
  - Actively optimizes plant settings to achieve desired compliance target margins
  - Provides data redundancy of key variables

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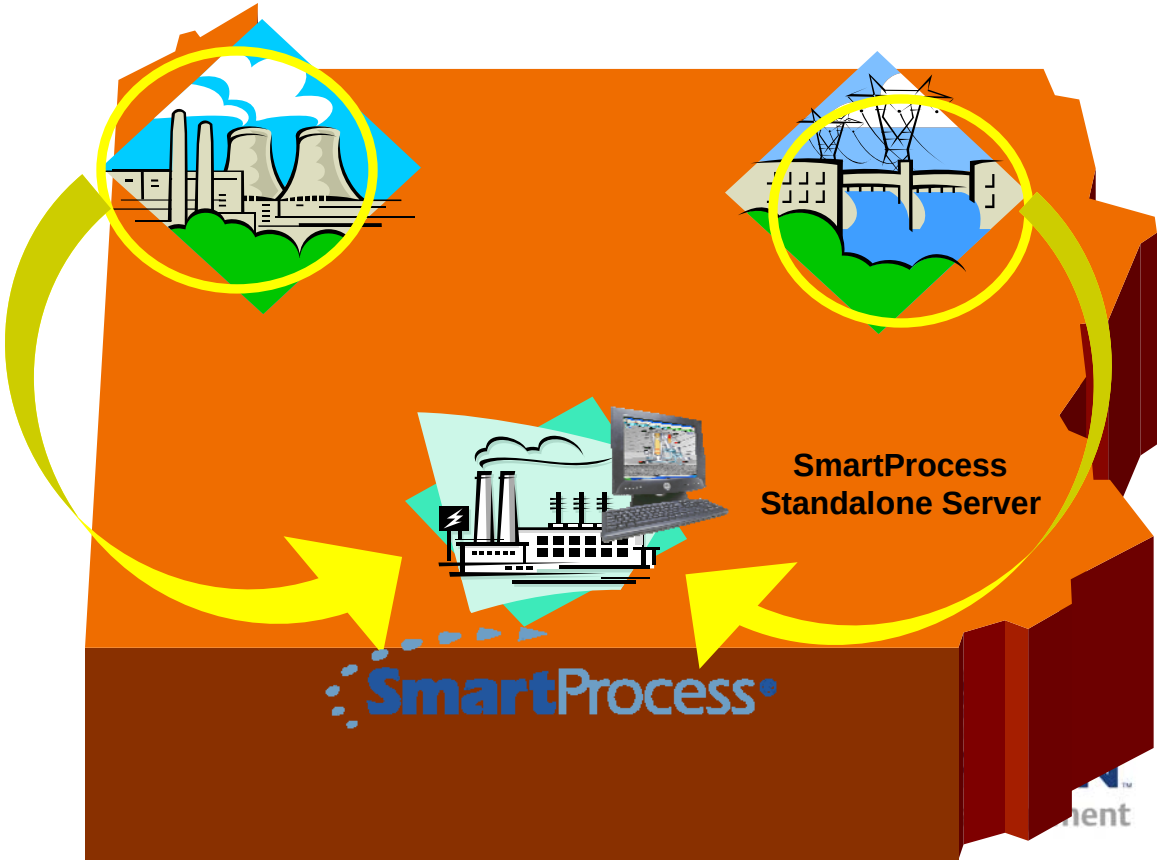
Optimizing Fleet-Wide Control

The Fleet Emissions Optimizer uses data from multiple areas of the plant for fleet to achieve industry objectives.

- Environmental Compliance
- Decreased Operations Costs
- Increased Profitability



The Fleet Emissions Optimizer collects data from segregated areas throughout the fleet…

- Operating Labor Costs
- Heat Rate Penalties
- Maintenance Costs
- Current Emissions Rate
- Emissions Cap Compliance
- Changing Plant Conditions

… and tracks fleet performance over time to create an efficiency curve that adjusts with daily operations and plans for future scenarios.

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Fleet Emissions Optimization Objectives

- Determine optimum SO_2 emission rate for FGD systems so that the total amount of SO_2 produced does not exceed the yearly cap
- Report and control for removal efficiency >70%
- Optimize for the most cost effective flue gas scrubbing

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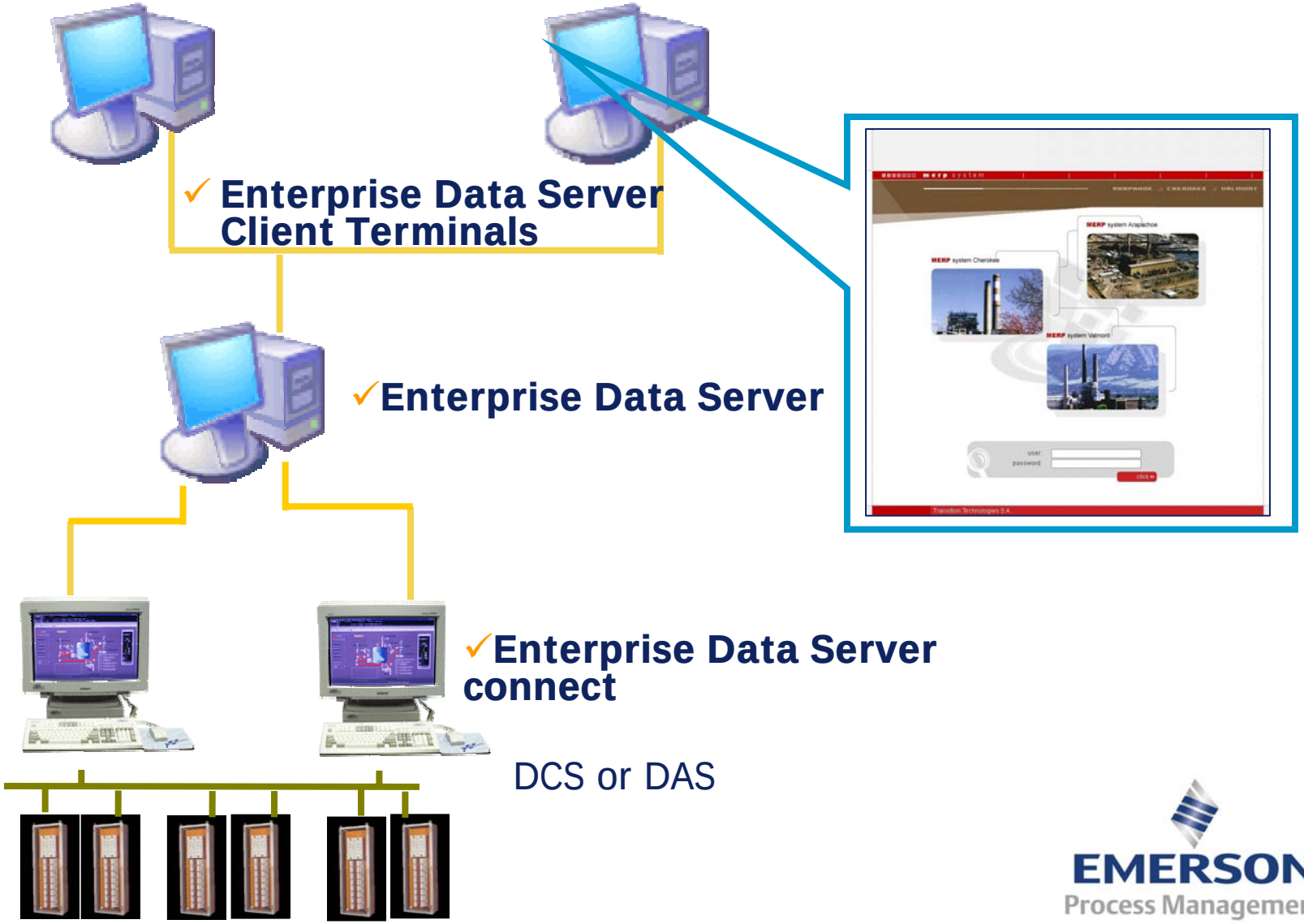
Fleet Optimizer Architecture



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MERP-system - Microsoft Internet Explorer

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Address http://170.152.23.230/charts.php Go

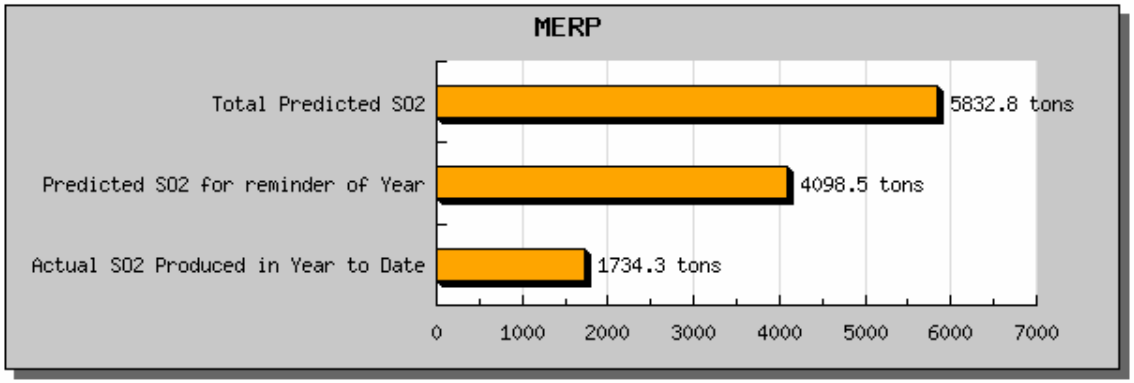
* deadband values for each quarter of year			
I	II	III	IV
30%	20%	15%	5%

MERP Reports & Analysis

Unit	Cherokee1	Cherokee2	Cherokee3	Cherokee4	Arapahoe3	Arapahoe4	Valmont
Actual SO2 Emission Rate	0.365154	0.000000	0.073745	0.090919	-0.000122	0.328857	0.079600
Optimal SO2 Emission Rate	0.424319	0.000000	0.042432	0.042432	0.000000	0.320070	0.034865

Actual MERP system removal: 76.40

Daily MERP system removal: 88.37



You are logged as:

ess2

logout

Emerson Process '2003

Done Internet

MERP-system - Microsoft Internet Explorer

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main menu

Reports

- Daily SO2 Prediction data
- Daily Load Forecast
- Month - SO2 emission
- Month - SO2 removal
- Year

Applications

- Optimization package
- What-If
- Auto/Manual status

CEMS

- MERP system
- Emission limits

Analysis

- 150Z report
- Fuel Analysis
- Operation&Maintenance costs
  - Variable costs
  - Fixed costs
  - Total costs
  - Detail costs

COST

- Generation costs
- SO2 costs

You are logged as:

ess2

logout

Emerson Process '2003

http://170.152.23.230/common.php# Internet

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http://170.152.23.230/total_costs.php

merp system

ARAPAHOE .:: CHEROKEE .:: VALMONT

main menu

MERP Costs Estimates for Emission Control			
Total Variable Costs [USD]	**Arapahoe**	**Cherokee**	**Valmont**
Year 2003	830 855.26	3 282 952.39	808 734.47
Year 2004	0.00	0.00	0.00
Total Fixed Costs [USD]	**Arapahoe**	**Cherokee**	**Valmont**
Year 2003	183 532.00	1 069 243.52	582 432.00
Year 2004	0.00	0.00	0.00
Total Costs [USD]	**Arapahoe**	**Cherokee**	**Valmont**
Year 2003	1 014 387.26	4 352 195.91	1 391 166.47
Year 2004	0.00	0.00	0.00

Fleet Emissions Optimizer Summary

- Resides on a central server(s)
  - Can be clustered
- Collects disparate data from various parts of the plant or fleet
- Analyzes the data to determine the best ranges of operation to balance fiscal goals with environmental requirements
- Manages air emissions and environmental costs at the fleet level

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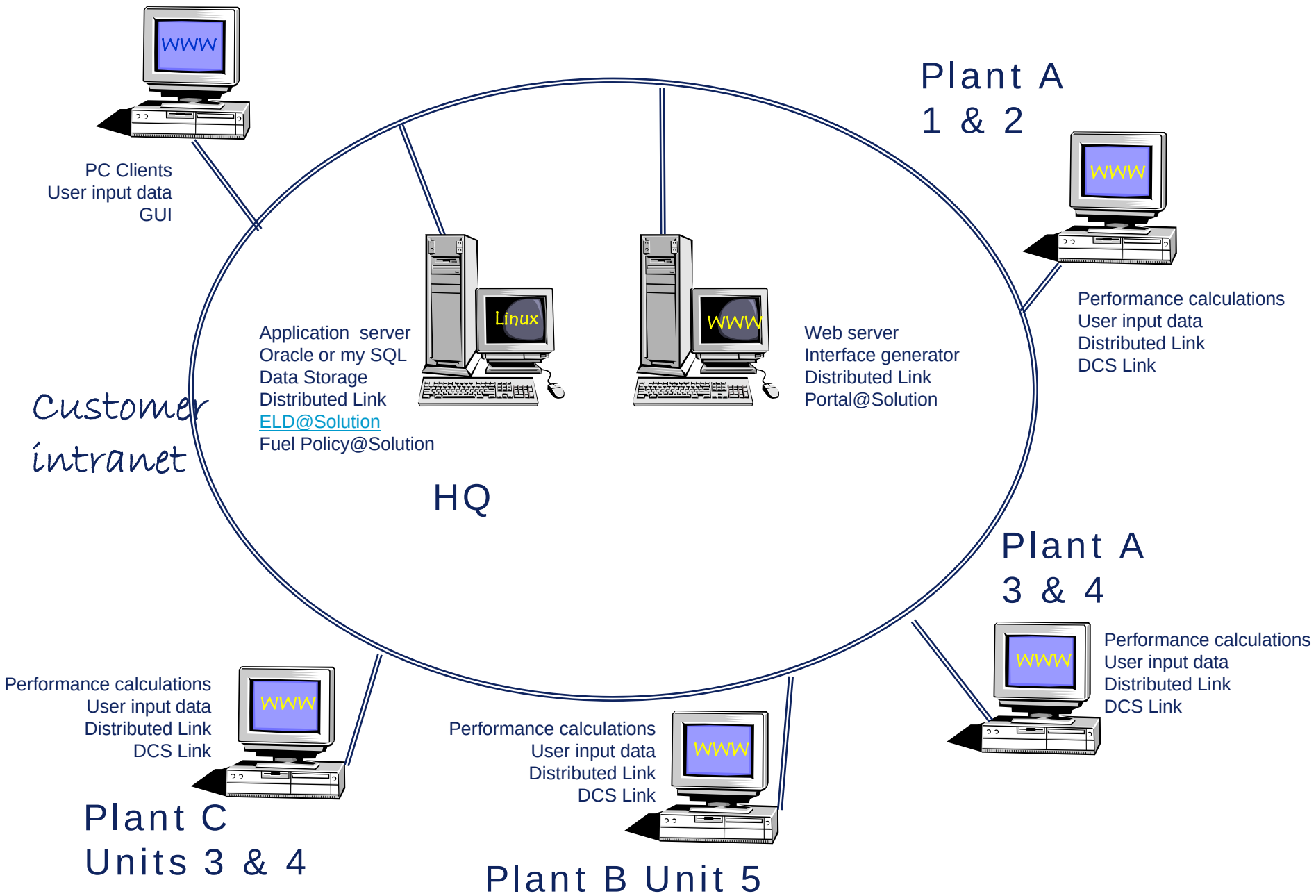
WWW
PC Clients
User input data
GUI
Plant A
1 & 2
WWW
Performance calculations
User input data
Distributed Link
DCS Link
Linux
Application server
Oracle or my SQL
Data Storage
Distributed Link
ELD@Solution
Fuel Policy@Solution
WWW
Web server
Interface generator
Distributed Link
Portal@Solution
Customer
intranet
HQ
Plant A
3 & 4
WWW
Performance calculations
User input data
Distributed Link
DCS Link
Performance calculations
User input data
Distributed Link
DCS Link
WWW
Plant C
Units 3 & 4
Performance calculations
User input data
Distributed Link
DCS Link
WWW
Plant B Unit 5

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Xcel Energy™

merp system

ARAPAHOE .:: CHEROKEE .:: VALMONT

Arapahoe power plant

Cherokee power plant

MERP system

Valmont power plant

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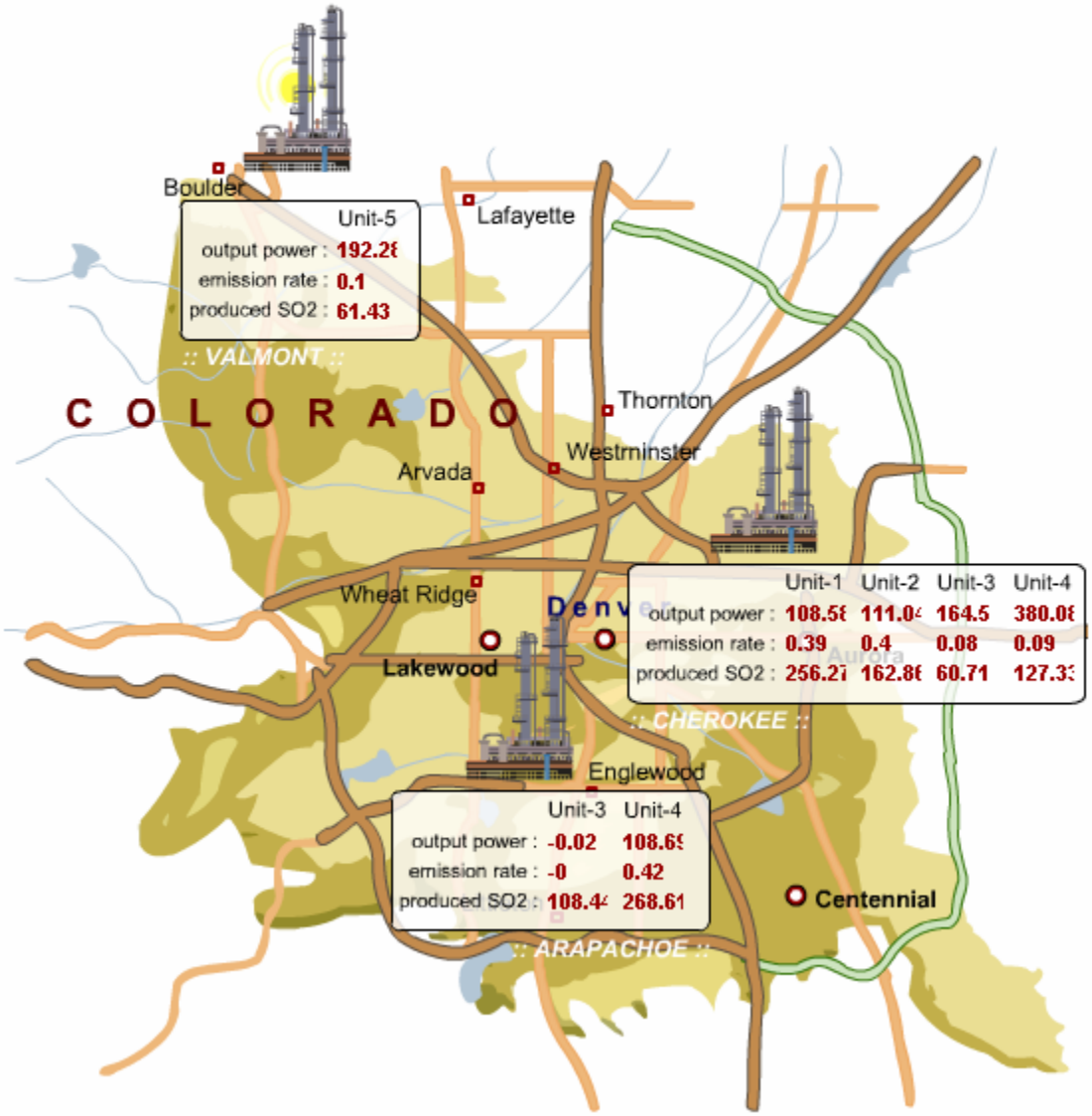
main menu



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Xcel Energy™

merp system

ARAPAHOE :: CHEROKEE :: VALMONT

main menu

Reports

- Daily SO2 Prediction data
- Month - SO2 emission
- Month - SO2 removal
- Year

Applications

- Optimization package
- What-If

CEMS

- MERP system
- Emission limits

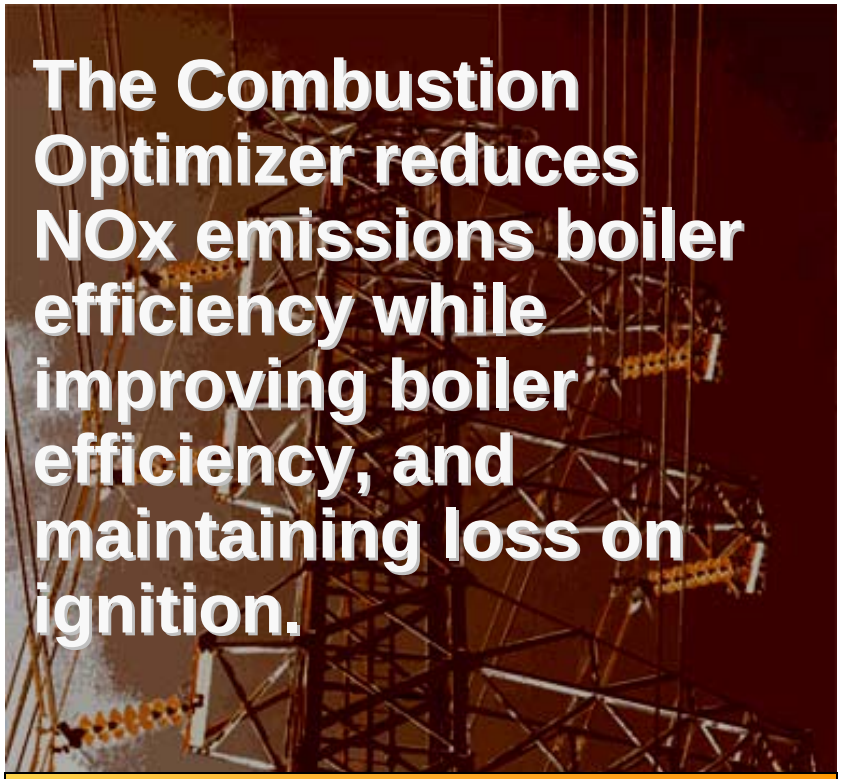
Analysis

- 150Z report
- Fuel Analysis
- Operation&Maintenance costs

COST

- Generation costs
- SO2 costs

Combustion Optimizer



Increase the efficiency of your boiler combustion process.

- Results
  - Reduces NOx and CO emission levels
  - Improves heat rate up to 1.5%
  - Reduces plant maintenance costs
  - Maximizes staged combustion efficiency
  - Controls and reduces measured opacity levels

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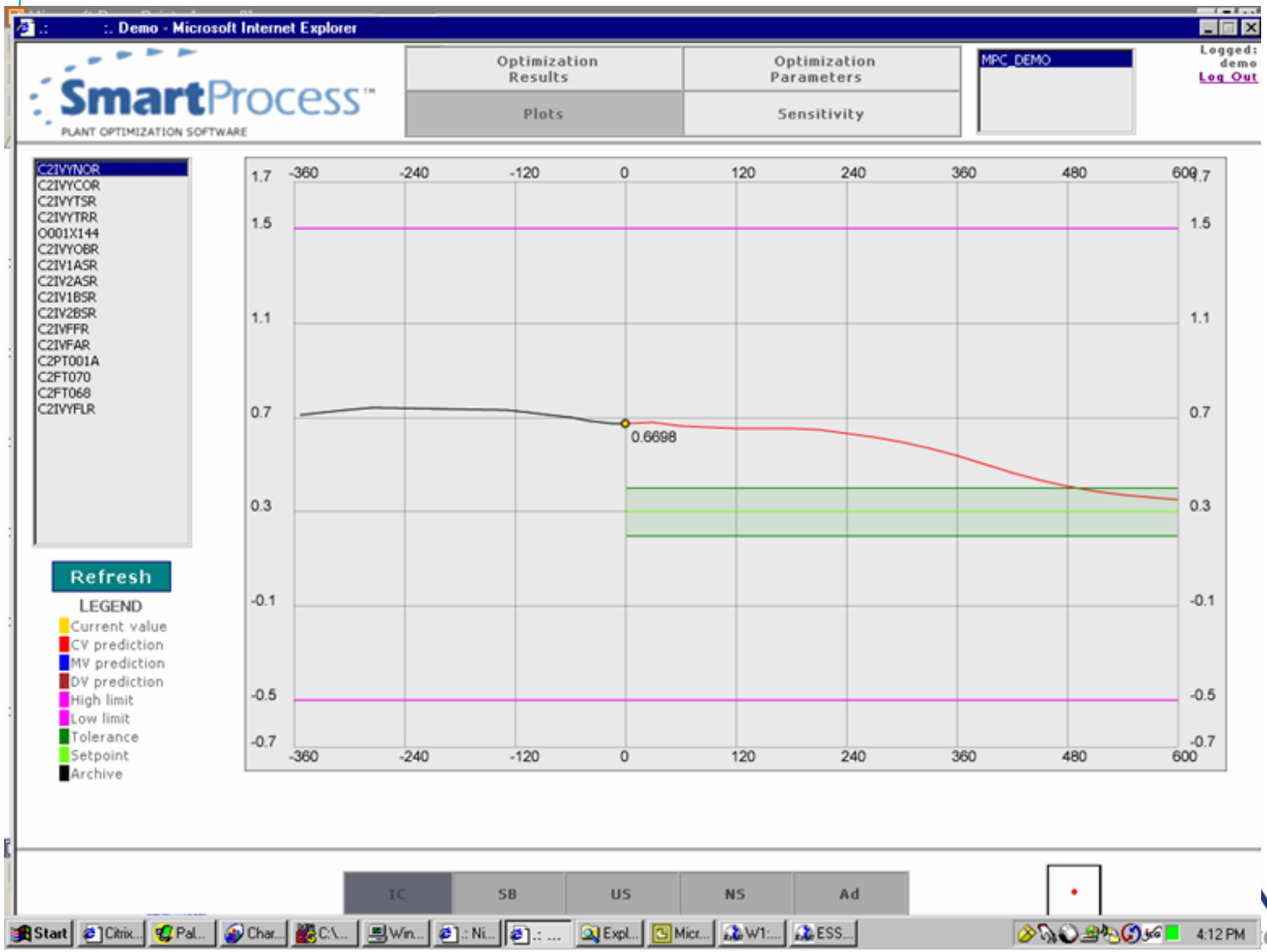
Combustion Optimizer tools:SmartEngine



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Web based interface

.: Nikitta : Sherco :. - Microsoft Internet Explorer

SmartProcess™
PLANT OPTIMIZATION SOFTWARE

Optimization Results | Optimization Parameters | Learning | Custom Data
Plots | Sensitivity | Setpoints

BOPT

Logged: Michał Izydorski
LOGOUT

Setpoints (optimization goals and constraints)

TYPE	NAME	VALUE	SETPOINT	WEIGHT	ZONE	MIN_VALUE	MAX_VALUE	MIN_STEP	MAX_STEP	QUALITY	EDIT
CV	WW1759	84.8	86	100	0.1					0	
CV	D1NOEAST	141.1	80	10	20					0	
CV	D1NOWEST	225.2	150	10	20					2.1495	
CV	D1O2AVG_EAST	3.13	3	400000	0.05					0	
CV	D1O2AVG_WEST	3.14	3	400000	0.05					0	
CV	D11APHGO	296.6	300	1	5					0	
CV	D12APHGO	316.9	300	1	5					0	
CV	D1COEAST	149.2	100	10	100					0	
CV	D1COWEST	178.5	100	10	100					0	
MV	D11AA_DMD	50	0	0	5	0	100	-0.35	0.35	0	
MV	D12AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	0	
MV	D13AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	2.1495	
MV	D14AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	0	
MV	D15AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	2.1495	
MV	D16AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	0	
MV	D17AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	0	
MV	D18AA_DMD	34.9	0	0	5	0	100	-0.35	0.35	0	
MV	D11FDRSC	126.8	0	0	2	0	160	-0.2	0.2	0	
MV	D12FDRSC	126.7	0	0	2	0	160	-0.2	0.2	0	
MV	D13FDRSC	125.5	0	0	2	0	160	-0.2	0.2	0	
MV	D14FDRSC	125.8	0	0	2	0	160	-0.2	0.2	0	
MV	D15FDRSC	125.6	0	0	2	0	160	-0.2	0.2	0	
MV	D16FDRSC	125.3	0	0	2	0	160	-0.2	0.2	0	
MV	D17FDRSC	90.5	0	0	2	0	160	-0.2	0.2	0	
MV	D11OA_DMD	31.9	0	0	5	0	100	-0.35	0.35	0	
MV	D12OA_DMD	49.5	0	0	5	0	100	-0.35	0.35	0	
MV	D1O2_SP	5	3.3	10000	0.15	0	10	-0.015	0.015	0	

IC | SS | NS | US | OR

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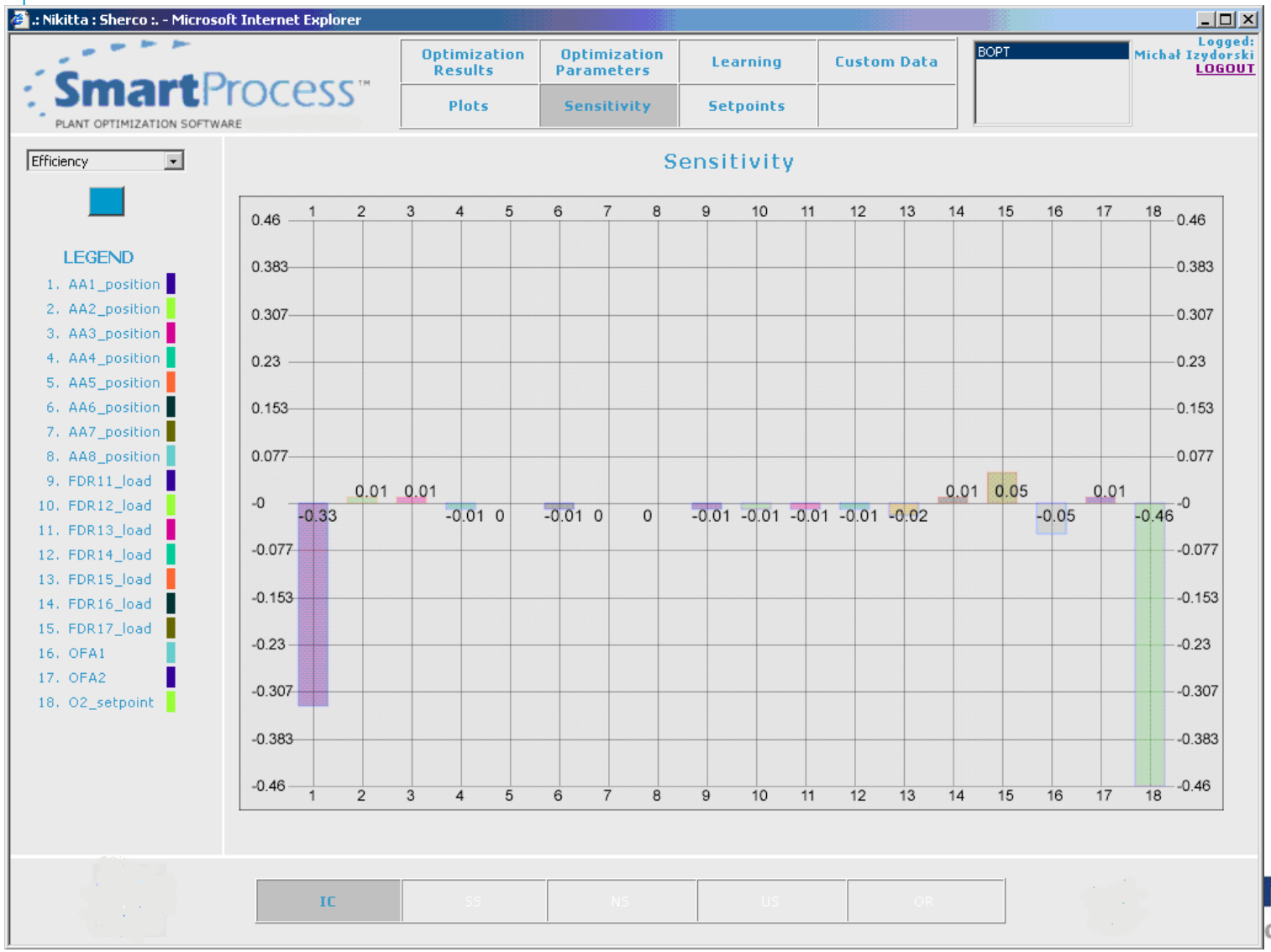
Sensitivity Analysis User interface



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Case Study
Plant Optimization – Midwest Utility Unit #2

Company:	AEG
Site:	Newton Station

Unit:	Unit #2
Location:	Newton, IL, USA
MW:	615
Boiler:	Alstom (CE)
Turbine:	GE
Primary Fuel:	Coal
Application:	NOx Optimization Steam Temp Optimization

- 20.1% Average NOx Improvements
- 1% HR Improvements at high loads
- Issues driving the need for change
  - 2003 emissions mandate to maintain NOx below **0.13** #/mmBTU
  - Avoid installing SCR
  - Sell/Trade NOx credits
- 4 month project cycle
- No outage required
- Payback of 9 months on NOx improvements 8 months on (>$400K) from Heat rate improvement

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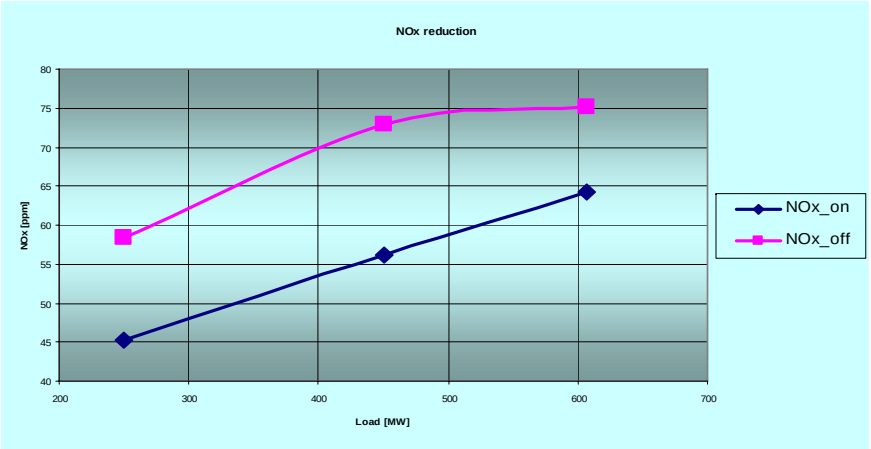
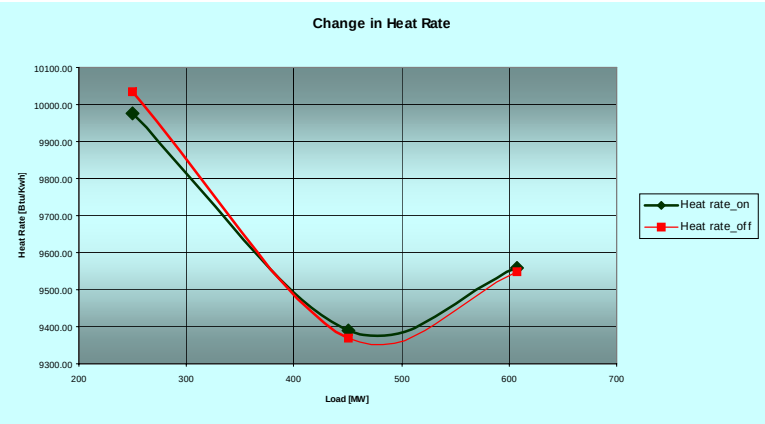
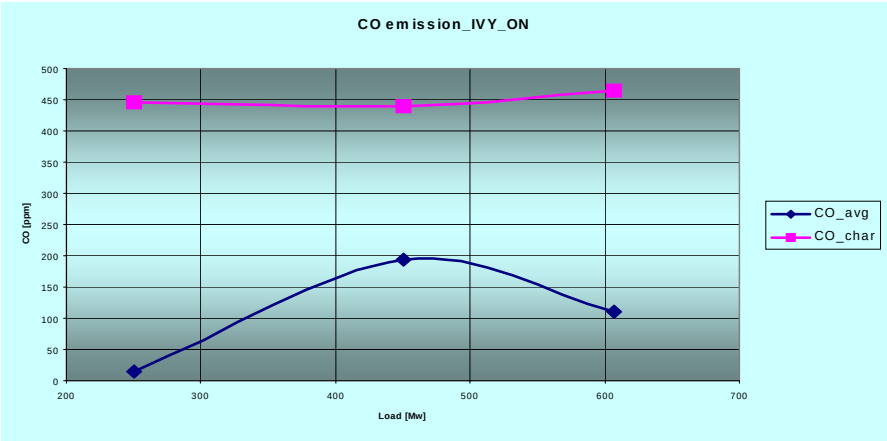
Midwest Utility Unit #2 NOx Optimization Results Overview – NOx Mode (100%)



NOx Reduction



Maintain Heat rate



Below Average CO Levels

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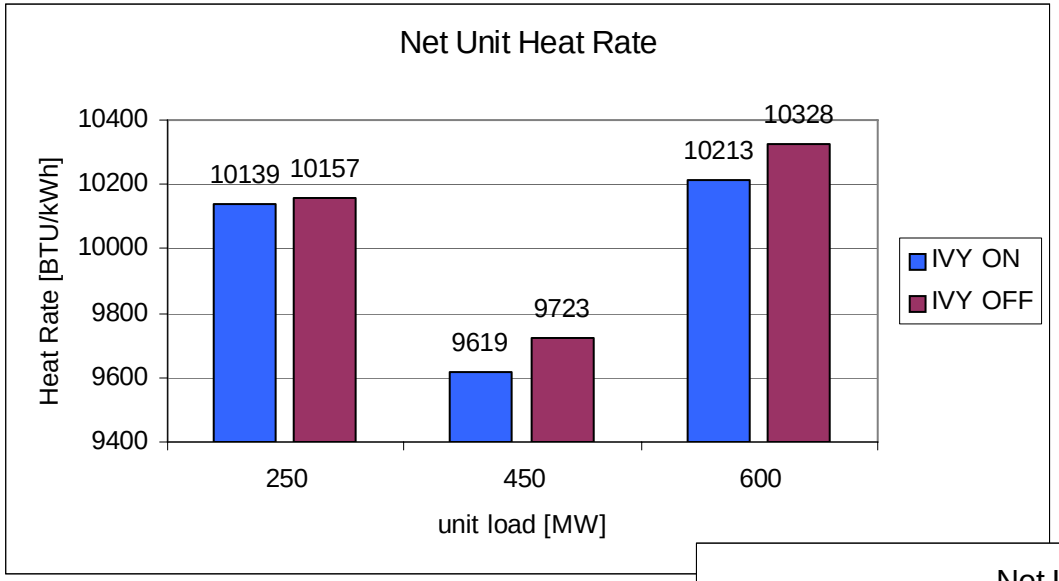
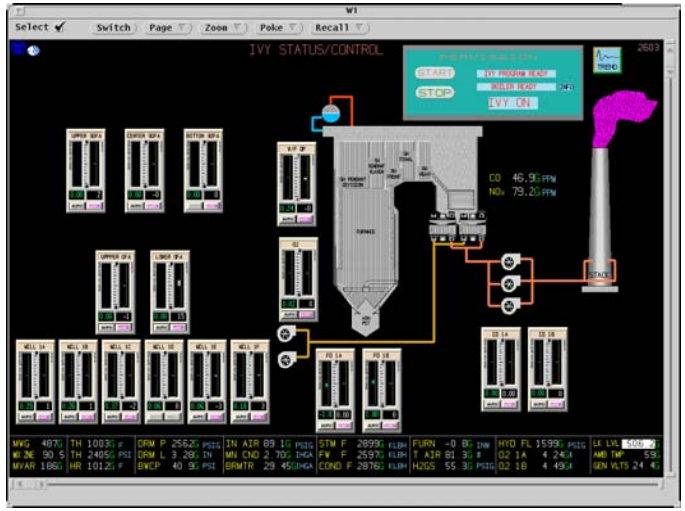
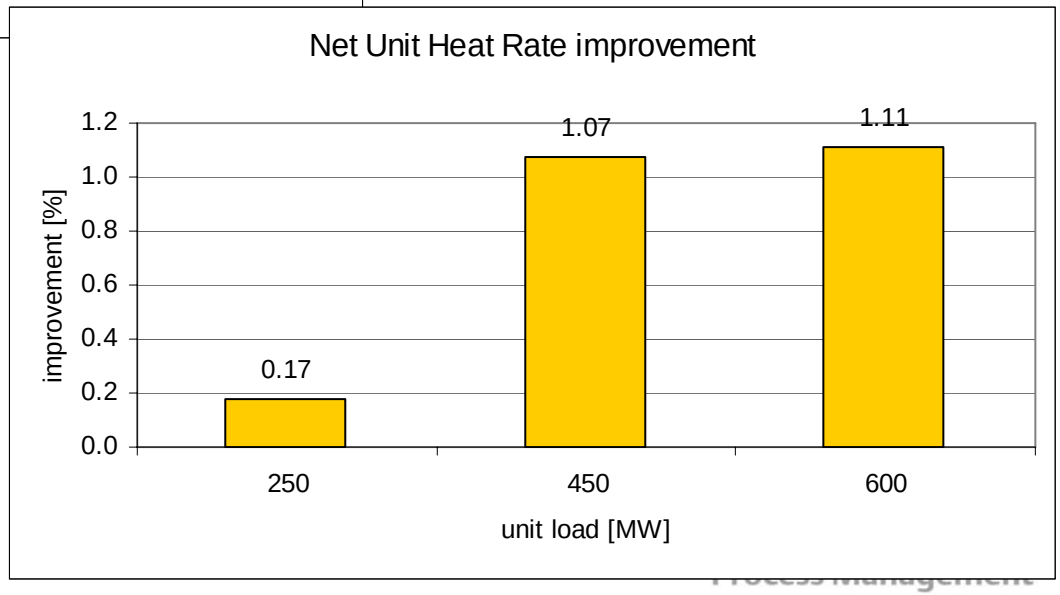
Midwest Utility Unit #2 NOx Optimization Results Overview – HR Mode (100%)





Ave. of 1% improvement in Heat Rate over the typical Load range of 450 to 600 MW equals

$407,000



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Case Study #44
Plant Optimization – Dynegy Hennepin #2

Company:	Dynegy
Site:	Hennepin

Unit:	Unit #2
Location:	Hennepin, IL
MW:	250
Boiler:	Alstom (CE)
Turbine:	GE
Primary Fuel:	Coal
Application:	NOx Optimization

- 13% Average NOx Improvements
- Issues driving the need for change
  - Drive plant average below .13 #/mmBTU
  - Prior solution ineffective
- Real-time optimization of NOx emissions and heat rate optimization
- 4 month project cycle
- No outage required
- Head to head comparison against “other “ competitive solution

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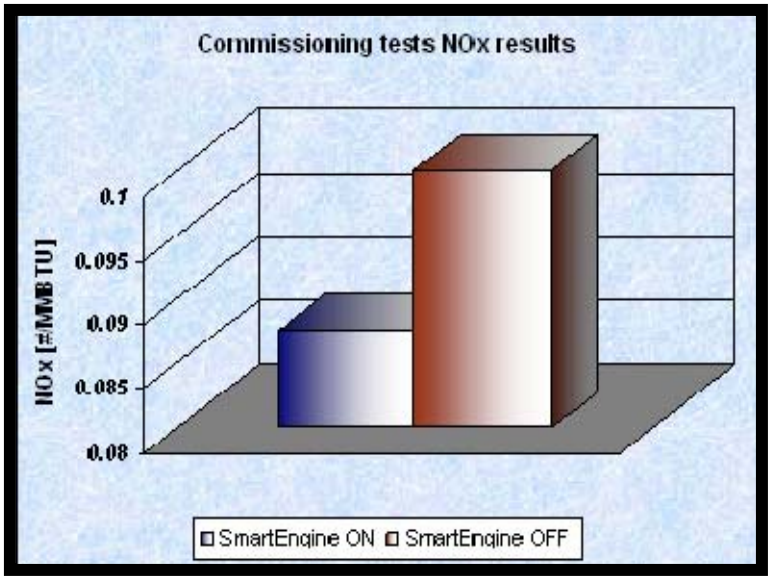
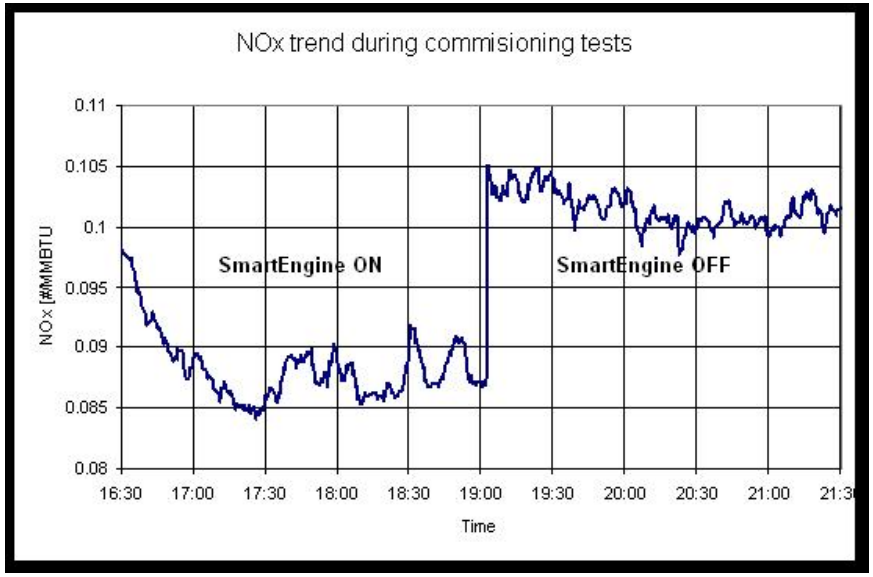
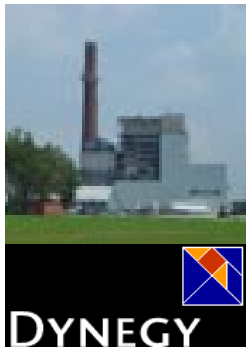
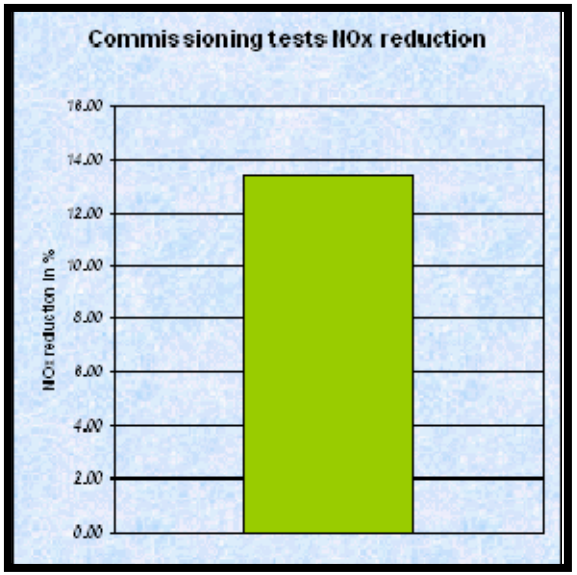
Recent BCO results for NOX









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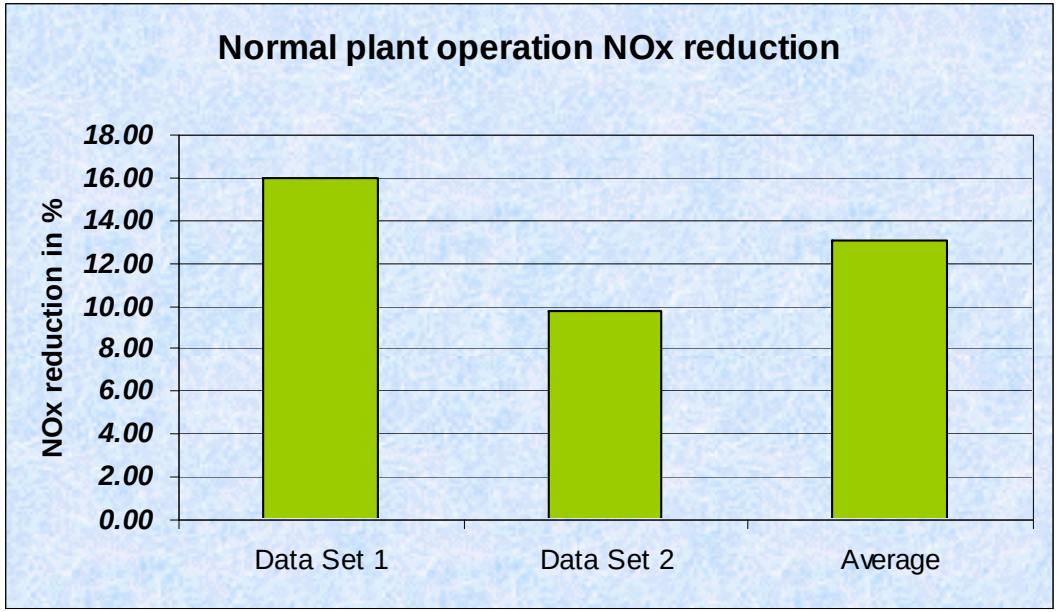
Summary



SmartEngine ON Load > 190MW January 25th, 2004 to March 3rd, 2004	Baseline - SmartEngine OFF Load > 190MW June 1st, 2003 to August 16th, 2003
NOX	**NOX**
0.112	0.141

Change in %

NOX
-21.17%

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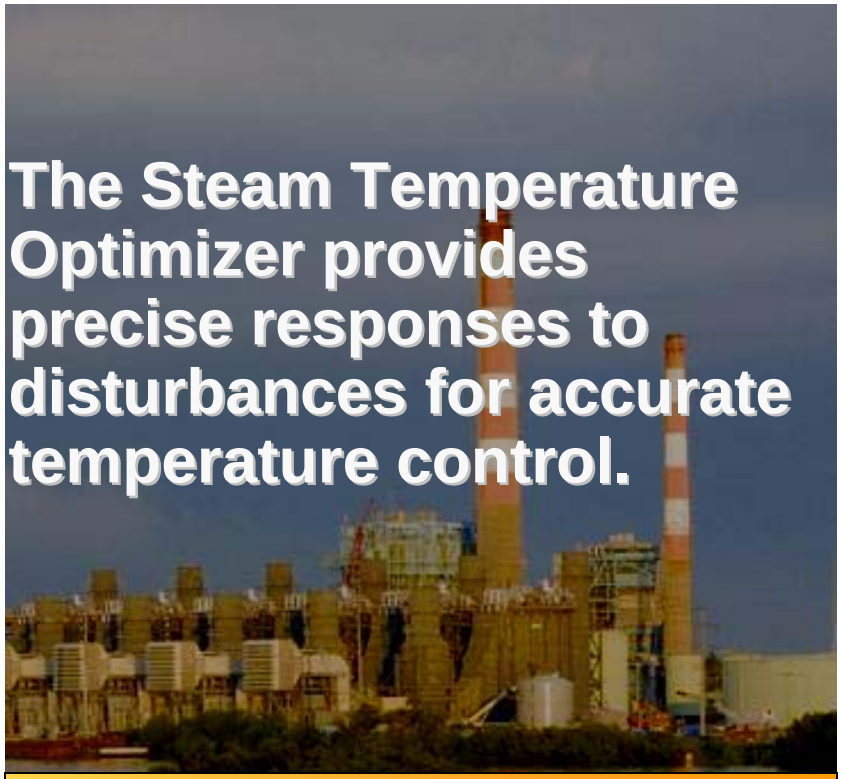
Steam Temperature Optimizer



Improve steam temperature for faster ramp rates.

- Results
  - Improves ramp rates up to 1% of MCR per minute
  - Minimizes temperature variations by up to 75%
  - Controls spray valves, tilts, pass dampers, for accurate temperature
  - Multivariable control strategy to maintain optimum steam temperature

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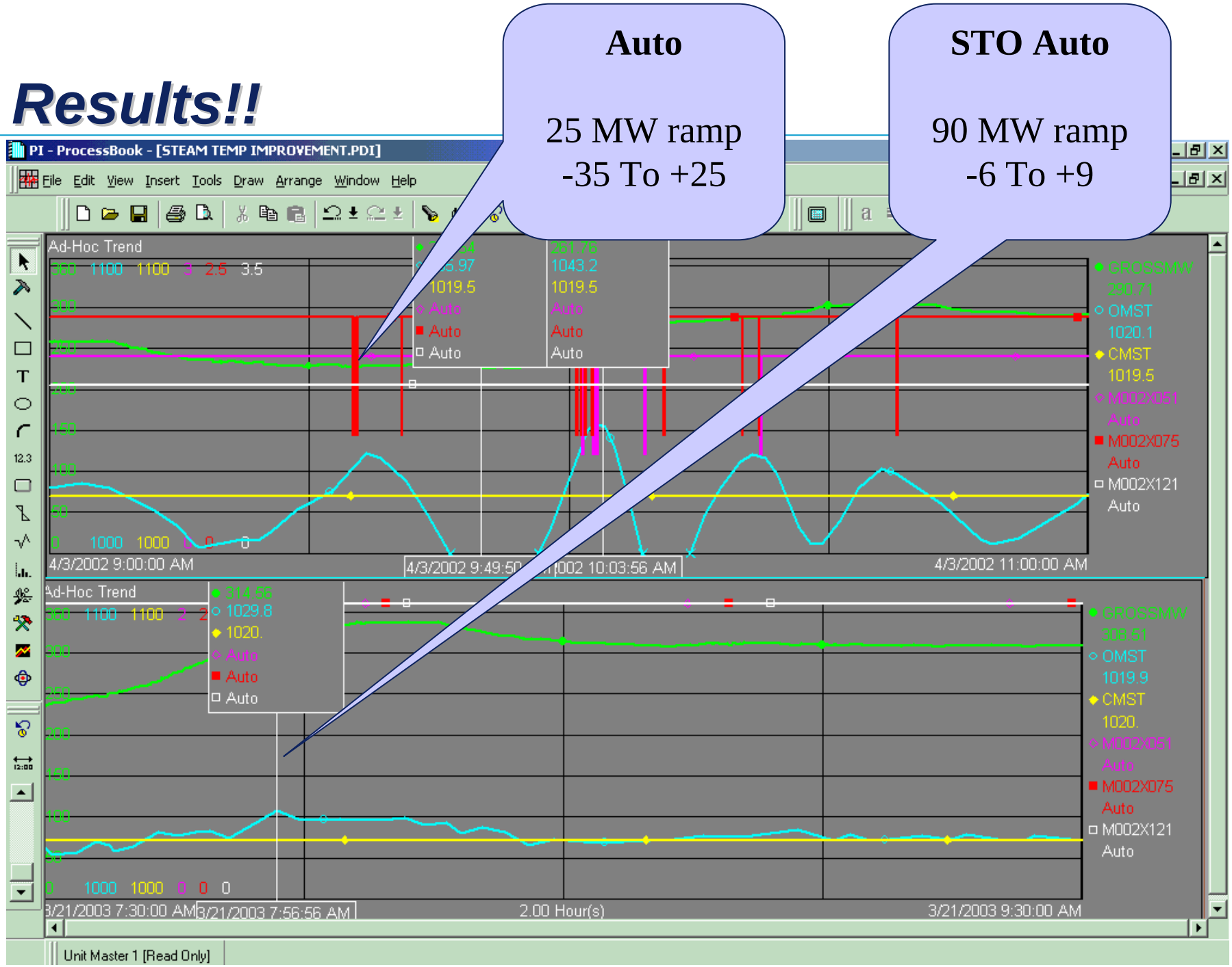
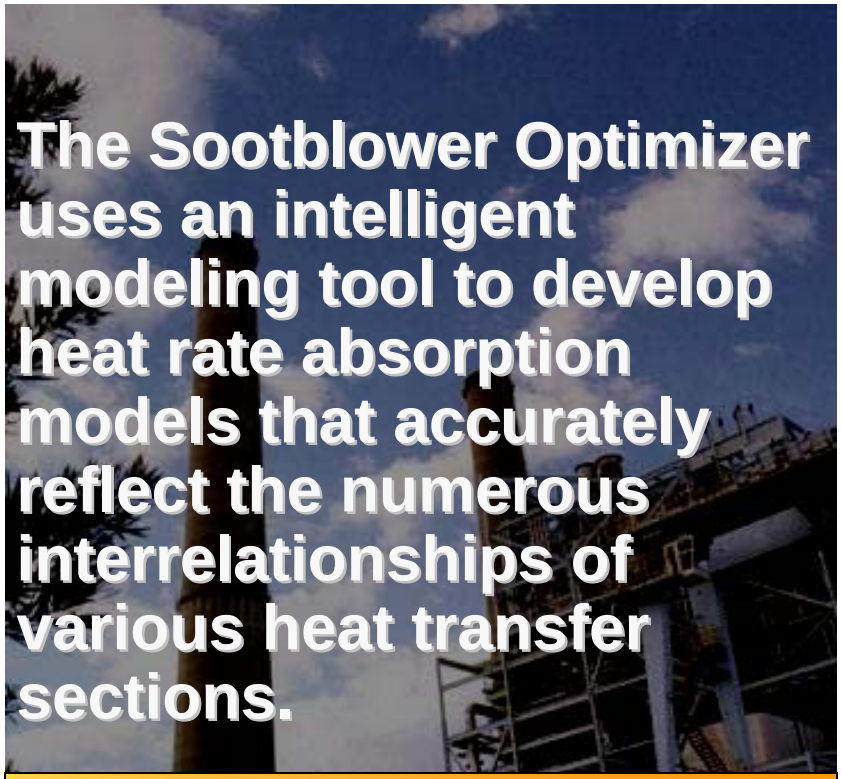
Results!!


Auto
25 MW ramp
-35 To +25
STO Auto
90 MW ramp
-6 To +9
PI - ProcessBook - [STEAM TEMP IMPROVEMENT.PDI]
File Edit View Insert Tools Draw Arrange Window Help
Ad-Hoc Trend
GROSSMW
290.71
OMST
1020.1
CMST
1019.5
M002X051
Auto
M002X075
Auto
M002X121
Auto
4/3/2002 9:00:00 AM
4/3/2002 11:00:00 AM
Ad-Hoc Trend
GROSSMW
308.51
OMST
1019.9
CMST
1020.
M002X051
Auto
M002X075
Auto
M002X121
Auto
3/21/2003 7:30:00 AM
3/21/2003 7:56:56 AM
2.00 Hour(s)
3/21/2003 9:30:00 AM
Unit Master 1 [Read Only]

Sootblower Optimizer

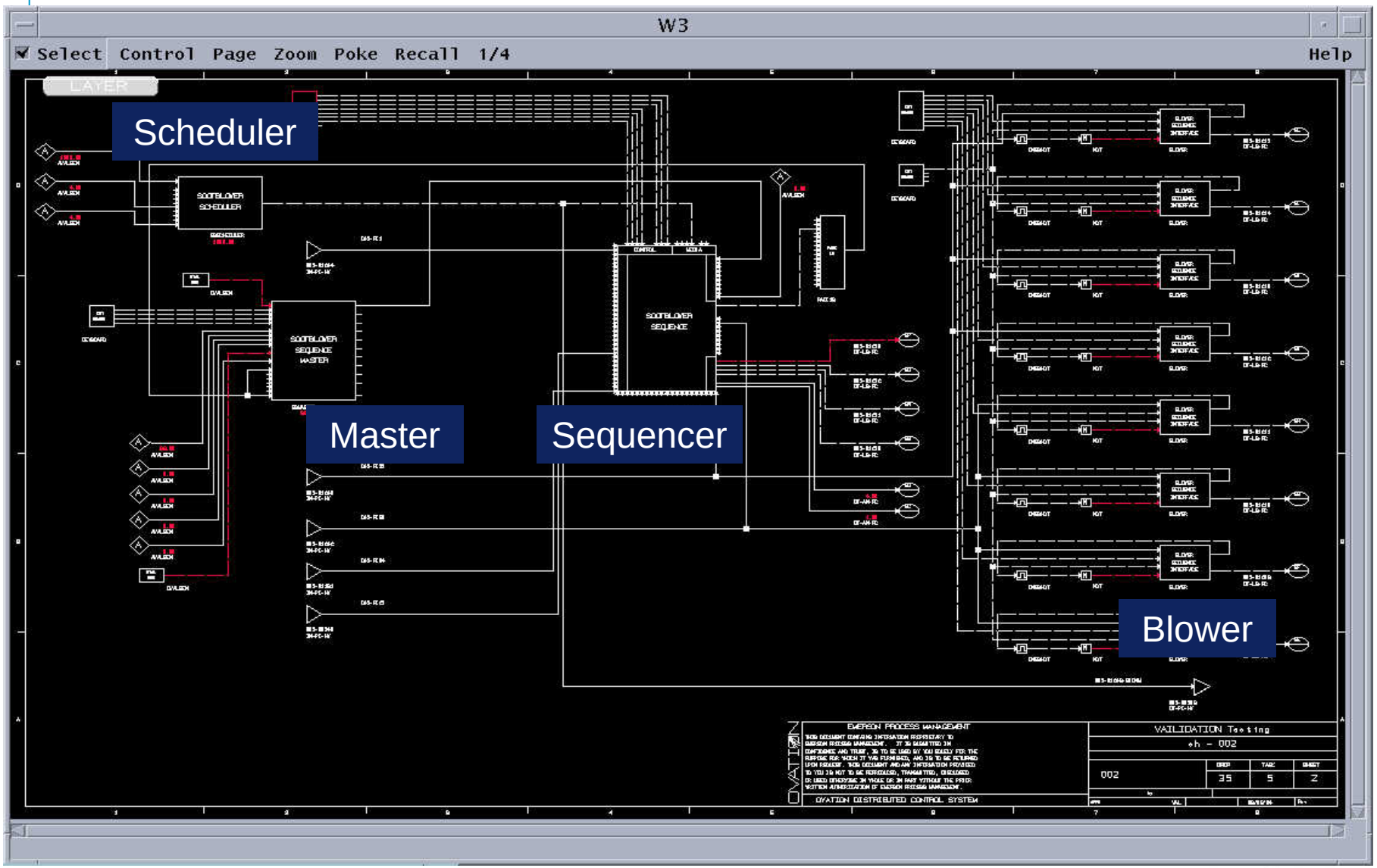


Ensure efficient sootblowing.

- Results
  - Delivers optimal cleanliness, resulting in a 0.5% heat rate improvement
  - Decreases soot accumulation
  - Improves overall boiler efficiency
  - Balances blowing sequences
  - Minimizes unnecessary steam usage
  - Reduces opacity spikes
  - Reduces NOx formations
  - Enhances steam temperature variability

EMERSON
Process Management

Sootblower Control Illustration



SmartEngine Sootblower

:. Demo - Microsoft Internet Explorer

SmartProcess™
PLANT OPTIMIZATION SOFTWARE

Key Process Parameters	Sequence Off-time	Input Data Conditioning	Model Adaptation
Sootblower Operation Advisor	Section Cleanliness Model Selection	Configuration	Plots

Logged: demo
Log Out

BOILER SECTION	DESIRED CLEANLINESS	ACTUAL CLEANLINESS	DIFFERENCE	PRIORITIES	EDIT
Water Wall	0.97	1.008	0.038		
Secondary Superheater	0.99	-0	-0.99		
Intermediate Superheater	1.02	1.08	0.06		
Finished Superheater	1	0.872	-0.128		
Reheater	1.02	0.875	-0.145		
Primary Superheater	1	1.113	0.113		
Economizer	0.95	0.81	-0.14		
Air Heater	0.95	0.964	0.014		

Treshold	0.1	
Selection	manual	

RECOMMENDED SEQUENCES:

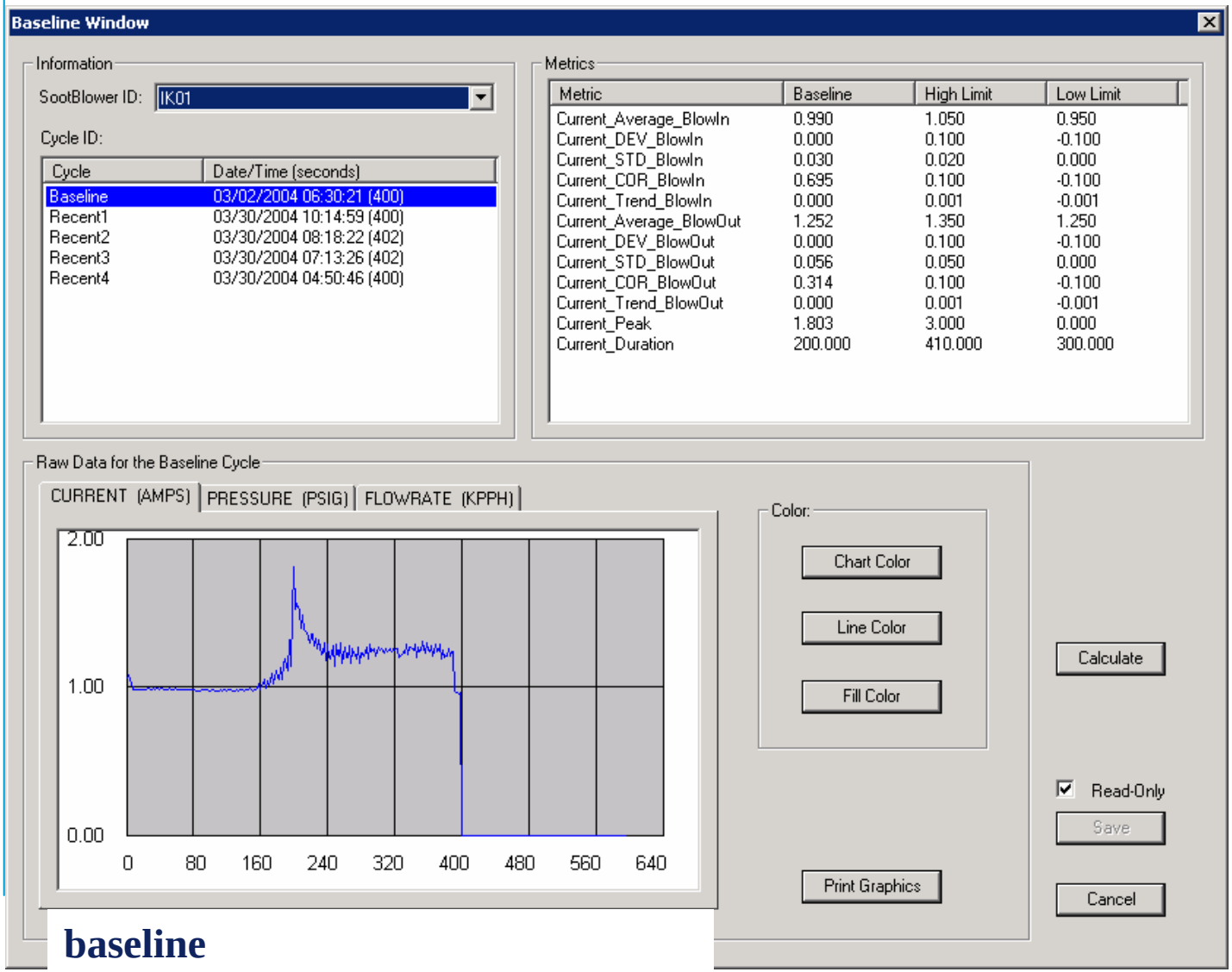
ACTUAL SEQUENCES:

Archive

Jul 9 2003 04:11:47 PM : Cleanliness Algorithm: Secondary Superheater is fouled. However no appropriate sequence can be choosen. Reheater is fouled. However no appropriate sequence can be choosen. Economizer is fouled. However no appropriate sequence can be choosen. Finished Superheater is fouled. However no appropriate sequence can be choosen.
Jul 9 2003 04:11:47 PM : Steam Temp. Algorithm: Load is high, reheater steam temp. is high. No action is recommended.
Jul 9 2003 04:11:47 PM : Time Algorithm: No sequence has exceeded its maximum off-time. No action is recommended.
Jul 9 2003 04:11:47 PM : Running sequences: Seq01, Seq02, Seq03, Seq04, Seq06, Seq08, Seq10, Seq11, Seq12, Seq14, Seq16, Seq17, Seq18.
Jul 9 2003 04:11:47 PM : Recommended sequences: no sequence is recommended.
Jul 9 2003 04:11:24 PM : Cleanliness Algorithm: Secondary Superheater is fouled. However no appropriate sequence can be choosen. Reheater is fouled. However no appropriate sequence can be choosen. Economizer is fouled. However no appropriate sequence can be choosen. Finished Superheater is fouled. However no appropriate sequence can be choosen.
Jul 9 2003 04:11:24 PM : Steam Temp. Algorithm: Load is high, reheater steam temp. is high. No action is recommended.
Jul 9 2003 04:11:24 PM : Time Algorithm: No sequence has exceeded its maximum off-time. No action is recommended.
Jul 9 2003 04:11:24 PM : Running sequences: Seq01, Seq02, Seq03, Seq04, Seq06, Seq08, Seq10, Seq11, Seq12, Seq14, Seq16, Seq18.
Jul 9 2003 04:11:24 PM : Recommended sequences: no sequence is recommended.
Jul 9 2003 04:10:49 PM : Cleanliness Algorithm: Secondary Superheater is fouled. However no appropriate sequence can be choosen. Reheater is

IC	SB	US	NS	Ad

Soot blower signature analysis



baseline

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Process Management

Status tool and Reports

Recent Monitoring

Configuration Information

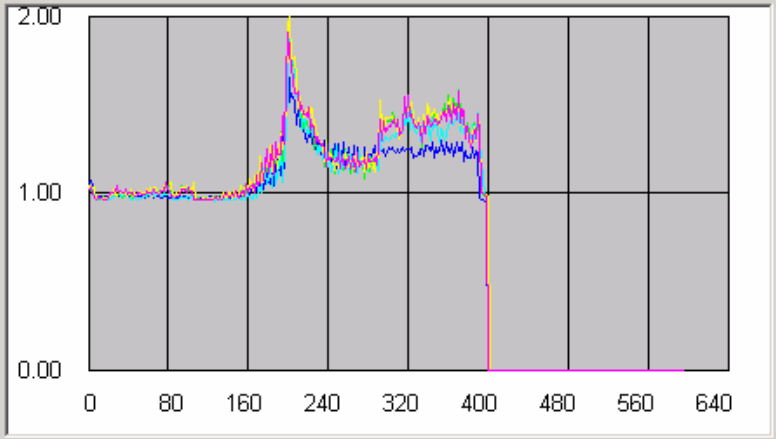
SootBlower ID: IK01 Description: Soot Blower IK01

Metrics Comparison

Metric	Baseline	Last Cycle	2nd Last Cycle	3rd Last Cycle	4th Last Cycle
Current_Average_BlowIn	0.99018 (1.05/0.95)	1.0114	0.98661	1.01968	1.01127
Current_DEV_BlowIn	0 (0.1/-0.1)	0.02122	0.00357	0.0295	0.02109
Current_STD_BlowIn	0.02969 (0.02/0)	0.05076	0.04098	0.05778	0.05592
Current_COR_BlowIn	0.69457 (0.1/-0.1)	0.6487	0.52391	0.60943	0.68757
Current_Trend_BlowIn	0 (0.001/-0.001)	0.00106	0.00057	0.00107	0.00097
Current_Average_BlowOut	1.25177 (1.35/1.25)	1.33811	1.30845	1.35416	1.34034
Current_DEV_BlowOut	0 (0.1/-0.1)	0.08634	0.05668	0.10239	0.08857
Current_STD_BlowOut	0.05551 (0.05/0)	0.13056	0.10553	0.13029	0.12084
Current_COR_BlowOut	0.31389 (0.1/-0.1)	0.78147	0.70803	0.7761	0.79699
Current_Trend_BlowOut	0 (0.001/-0.001)	0.00221	0.00138	0.00157	0.00157
Current_Peak	1.80328 (3/0)	1.98486	1.91925	2.00775	1.9162
Current_Duration	200 (410/300)	398	401	401	399

Raw Data for the all the Cycles

CURRENT (AMPS) | PRESSURE (PSIG) | FLOWRATE (KPPH)



Cycle Display Info:

Show Data

Baseline: 03/02/2004 06:30:21

Last Cycle: 03/30/2004 10:14:59 (400 sec)

2nd Last Cycle: 03/30/2004 08:18:22 (402 sec)

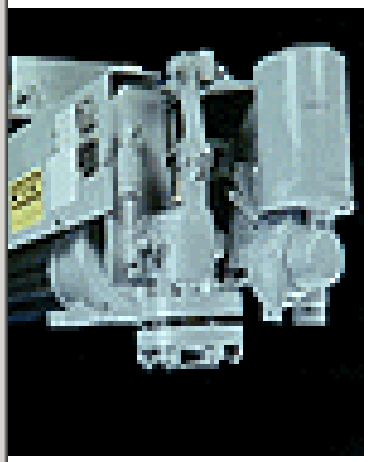
3rd Last Cycle: 03/30/2004 07:13:26 (402 sec)

4th Last Cycle: 03/30/2004 04:50:46 (400 sec)

Chart Color | Line Color | Fill Color

Print Graphics

Done



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ocess Management

Case Study: Sootblower Optimization
Southern California Edison - Mohave Unit #1

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

Company:	Southern California Edison
Site:	Mohave Station

Unit:	Unit #1
Location:	Laughlin, NV
MW:	800
Boiler:	Alstom (CE)
Turbine:	GE
Primary Fuel:	Coal
Application:	Steam Temperature Optimization

- Heat transfer rate increases
  - 8-10 % water wall and div superheaters
  - 6-7% final superheater and front reheat
  - 2-4% rear reheat and economizer
- Opacity reduction
- Issues driving the need for change:
  - Reduced opacity spikes during sootblowing and load ramps
- Real-time sootblower optimization
- 5 month project cycle
- No outage required
- Estimated payback of 8 months

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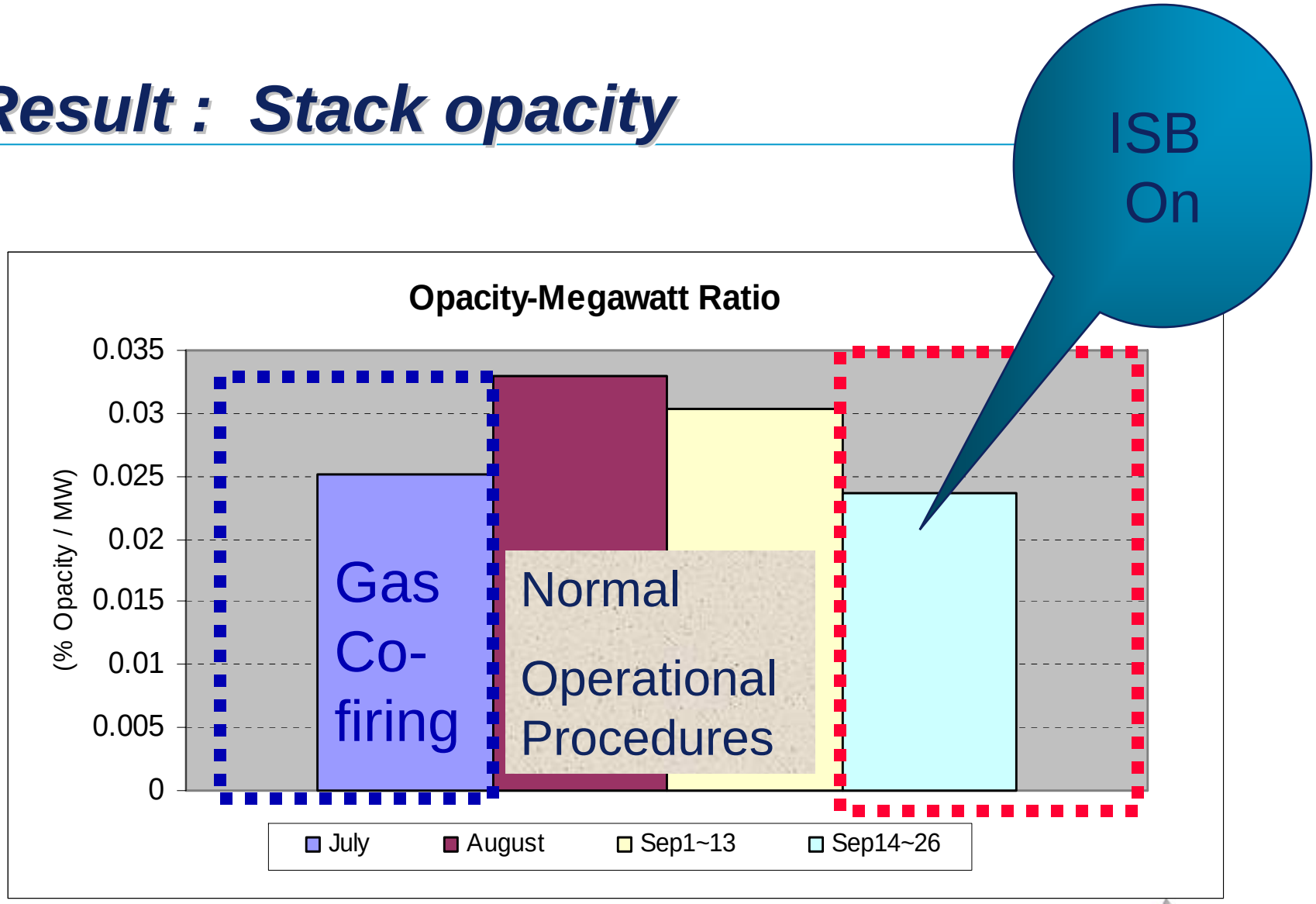
Result : Stack opacity



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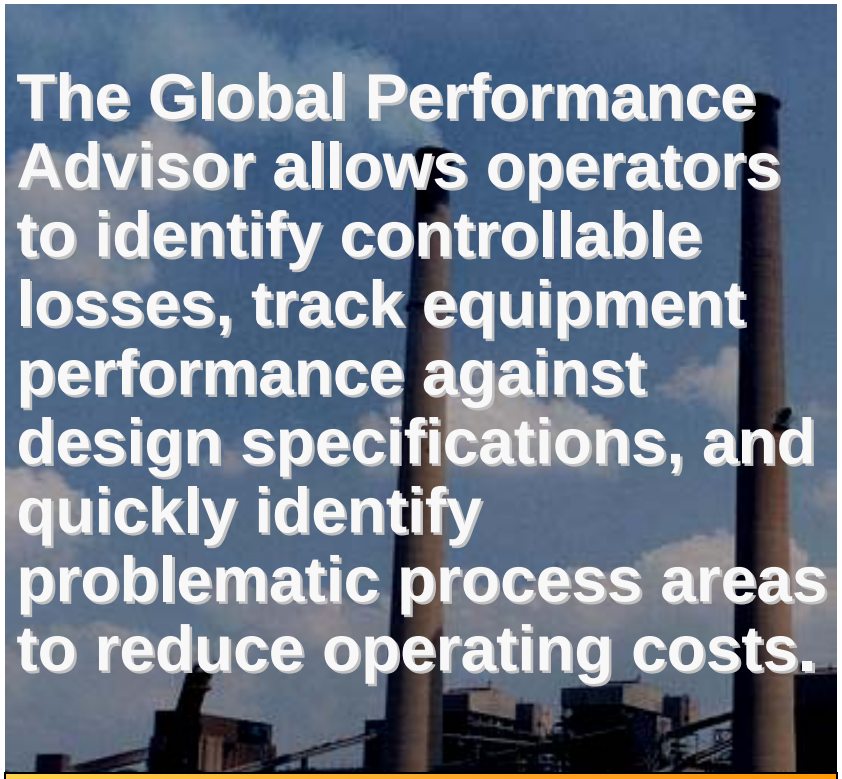
Process Management

Global Performance Advisor



Monitor and benchmark plant performance.

- Results
  - Reduces operating costs by tracking unit heat rate penalty costs over time and indicating dollars lost due to equipment performance deviations
  - Calculates net unit heat rate and tracks heat rate deviations
  - Displays deviations and cost of deviations to help operators determine corrective action or flag equipment repair and maintenance needs.

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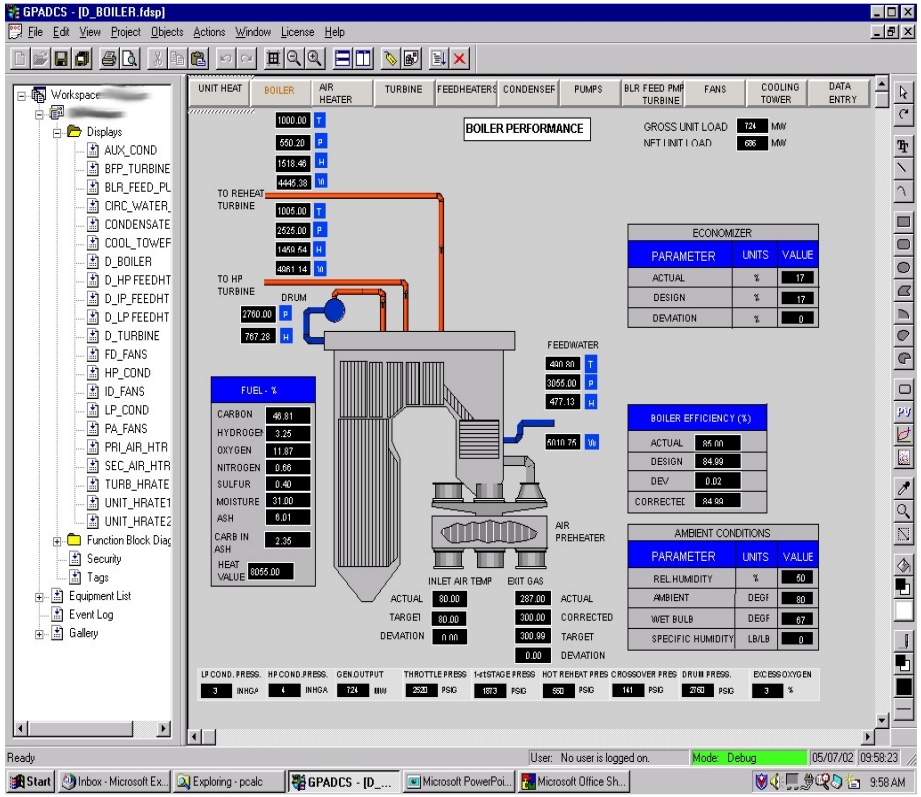
Global Performance Advisor

- Unit Heat Rate Module
- Turbine Heat Rate Module
- Turbogenerator Heat Balance
- Condenser Performance Module
- Boiler Performance Module
- Economizer Performance Module
- Boiler Feedwater Feedheater Train
- Boiler Feedpump Turbine Module
- Fan Efficiency Module
- Large Pump Performance Module
- Cooling Tower Module



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Process Management

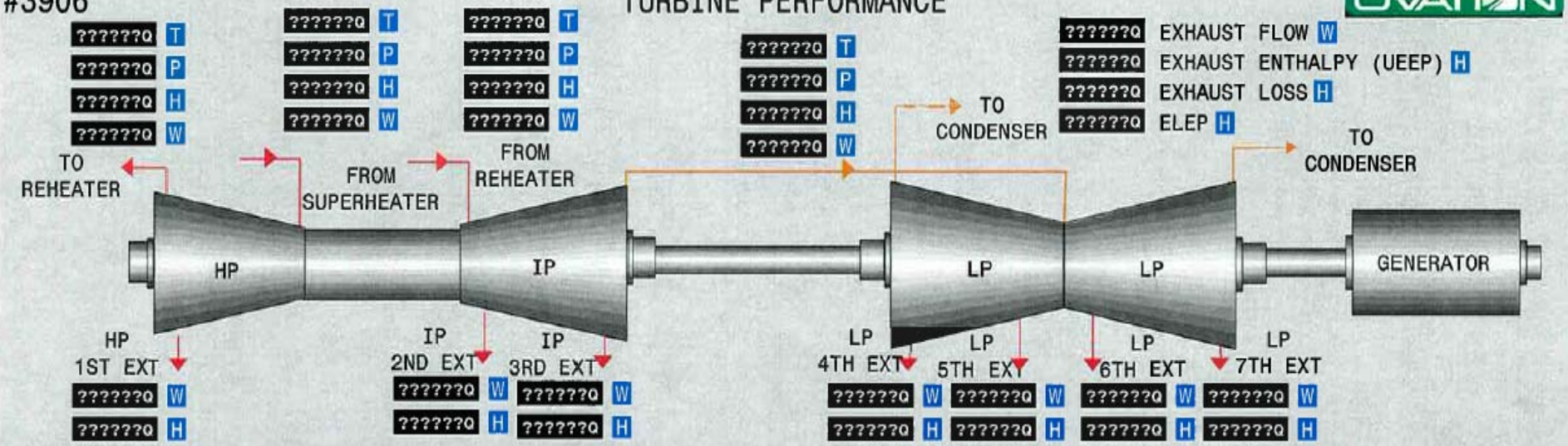
MAIN MENU | LDC | TURBINE MASTER | BOILER OVERVIEW | AIR/DRAFT CONTROL | FEEDWATER CONTROL | TURB PP CONTROL | TURB VLV CONTROL | GLAND STEAM 1 | GLAND STEAM 2 | LUBE OIL SYSTEM | EMERGENCY TRIP | REACTIVE CAPABILITY | ROTOR STRESS | STEAM CHEST

GPA MENU | TURBINE PERFORM | TURBINE HEAT | GENERATOR PRESYNC | ATC PRESTART | TURBINE ROLL | TURBINE WTR DTCT | ATC HOLD/ TRIPS | TURBINE SUPERVISOR | TURBINE TEMPS | GENERATOR SYSTEMS

#3906

TURBINE PERFORMANCE

OVATION



TURBINE SECTION PERFORMANCE

PARAMETER	ENG UNIT	HP	IP	LP	REHEAT
ACTUAL EFFICIENCY	%	??????Q	??????Q	??????Q	??????Q
DESIGN EFFICIENCY	%	??????Q	??????Q	??????Q	??????Q
DEVIATION	%	??????Q	??????Q	??????Q	??????Q
PCT LOAD GENERATION	%	??????Q	??????Q	??????Q	??????Q
EXHAUST MOISTURE	%			??????Q	

GENERATOR PERFORMANCE

PARAMETER	UNITS	VALUE
GROSS OUTPUT	MW	??????Q
NET OUTPUT	MW	??????Q
AUXILIARY POWER	MW	??????Q
TOTAL GENERATOR LOSSES	MW	??????Q
GENERATOR EFFICIENCY	%	??????Q
APPARENT POWER	MVA	??????Q
POWER FACTOR	REAL	??????Q

PARAMETER ENTRY

KEY PRESSURES

PARAMETER	ENG UNIT	ACTUAL	CORRECTED
FIRST STAGE	PSIG	??????Q	??????Q
REHEAT	PSIG	??????Q	??????Q
CROSSOVER	PSIG	??????Q	??????Q

LDC MODE	MEGAWATTS	THROT PRESS	THROTTLE TEMP	SH TEMP	RH TEMP	COND PRESS	INST OPACITY	EXCESS O2	DRUM LEVEL
	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????

MAIN MENU | LDC | TURBINE MASTER | BOILER OVERVIEW | AIR/DRAFT CONTROL | FEEDWATER CONTROL | TURB PP CONTROL | TURB VLV CONTROL | GLAND STEAM 1 | GLAND STEAM 2 | LUBE OIL SYSTEM | EMERGENCY TRIP | REACTIVE CAPABILITY | ROTOR STRESS | STEAM CHEST

GPA MENU | TURBINE PERFORM | TURBINE HEAT | GENERATOR PRESYNC | ATC PRESTART | TURBINE ROLL | TURBINE WTR DTCT | ATC HOLD/ TRIPS | TURBINE SUPERVISOR | TURBINE TEMPS | GENERATOR SYSTEMS

#3905

TURBINE HEAT RATE/GENERATOR OUTPUT

OVATION

GROSS TURBINE CYCLE HEAT RATE

PARAMETERS	ENG UNIT	VALUE
ACTUAL	BTU/KWH	??????Q
DESIGN	BTU/KWH	??????Q
DEVIATION	BTU/KWH	??????Q
CORRECTED	BTU/KWH	??????Q

GENERATOR OUTPUT

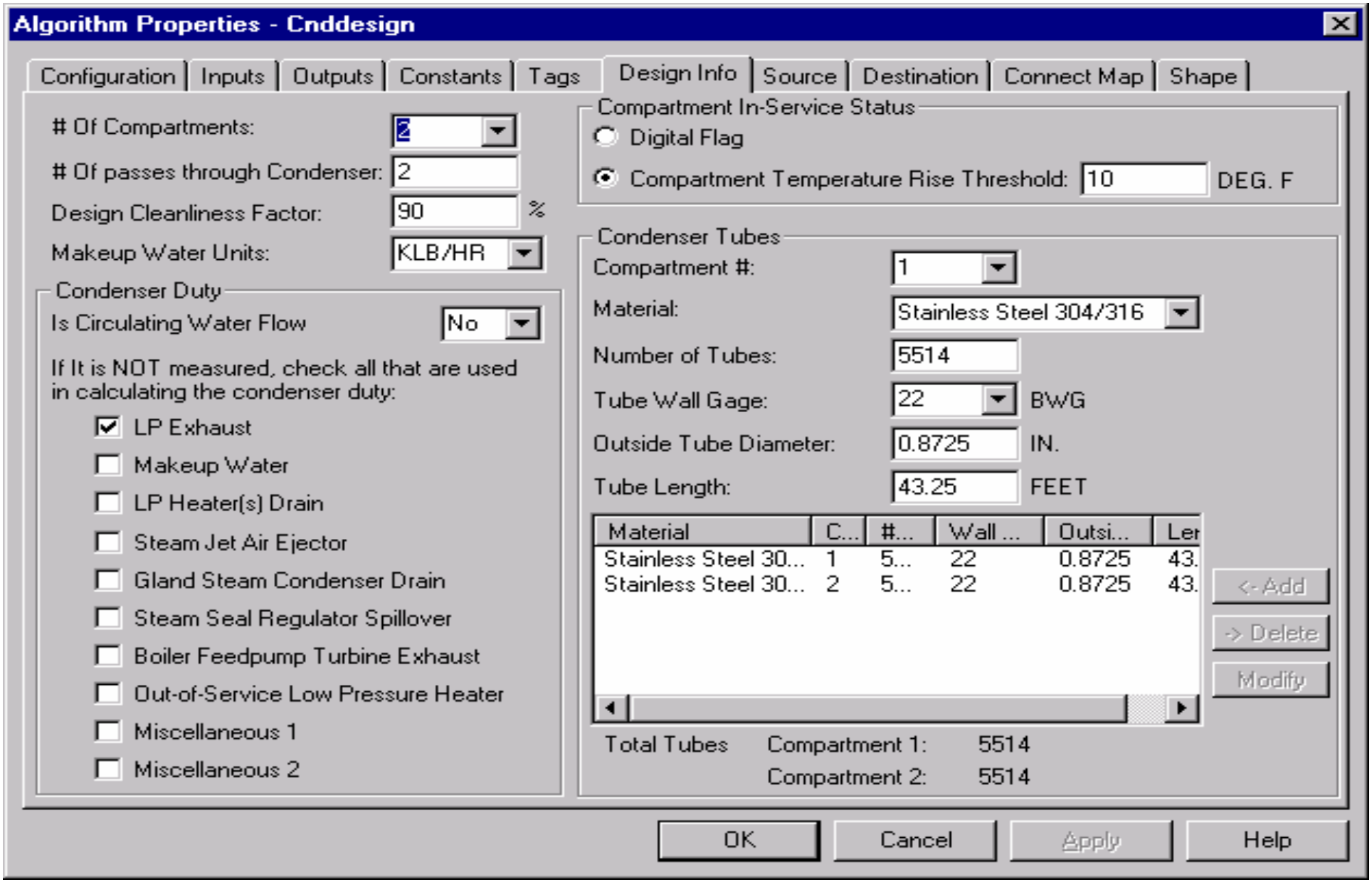
PARAMETERS	ENG UNIT	VALUE
GROSS OUTPUT	MW	??????Q
TOTAL CORRECTION	MW	??????Q
CORRECTED OUTPUT	MW	??????Q

DETAILED HEAT RATE / OUTPUT CORRECTION DATA

PARAMETERS	ENG UNIT	DESIGN VALUE	ACTUAL VALUE	OUTPUT DEVIATION (MW) -2 -1 0 1 2		HEAT RATE DEV (BTU/KWH) 50 25 0 -25 -50	
THROTTLE STEAM TEMP	DEGF	??????Q	??????Q	??????Q		??????Q	
REHEAT STEAM TEMP	DEGF	??????Q	??????Q	??????Q		??????Q	
THROTTLE STEAM PRESS	PSIG	??????Q	??????Q	??????Q		??????Q	
REHEAT PRESS DROP	%	??????Q	??????Q	??????Q		??????Q	
EXHAUST PRESS	IN HGA	??????Q	??????Q	??????Q		??????Q	
REHEAT SPRAY FLOW	KLB/HR	??????Q	??????Q	??????Q		??????Q	
SUPERHEAT SPRAY FLOW	KLB/HR	??????Q	??????Q	??????Q		??????Q	
BFP TURB EXT STEAM	KLB/HR	??????Q	??????Q	??????Q		??????Q	
MAKE UP WATER	KLB/HR	??????Q	??????Q	??????Q		??????Q	
CONDSR SUBCOOL	DEGF	??????Q	??????Q	??????Q		??????Q	
TOP HEATER TTD	DEGF	??????Q	??????Q	??????Q		??????Q	
OTHER HTRS COMBINED TTD	DEGF					??????Q	
TOTALS				??????Q		??????Q	

LDC MODE	MEGAWATTS	THROT PRESS	THROTTLE TEMP	SH TEMP	RH TEMP	COND PRESS	INST OPACITY	EXCESS O2	DRUM LEVEL
	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????	?????Q?????

Condenser Design Data Screen



#3907

CONDENSER PERFORMANCE

OVATION

GROSS UNIT LOAD ??????Q MW

NET UNIT LOAD ??????Q MW

MISC DRAINS ??????Q W ??????Q H

AUX COND DRAIN ??????Q W ??????Q H

LP TURBINE EXHAUST ??????Q H ??????Q T ??????Q W ??????Q P INHGA

CIRC WATER OUTLET ??????Q W (GPM) ??????Q T ??????Q T

CIRC WATER INLET ??????Q W (GPM) ??????Q T ??????Q T

CONDENSER TUBES
TOTAL ??????Q
PLUGGED ??????Q
EFFECT ??????Q

HOTWELL ??????Q T

MAKEUP WATER ??????Q W ??????Q H

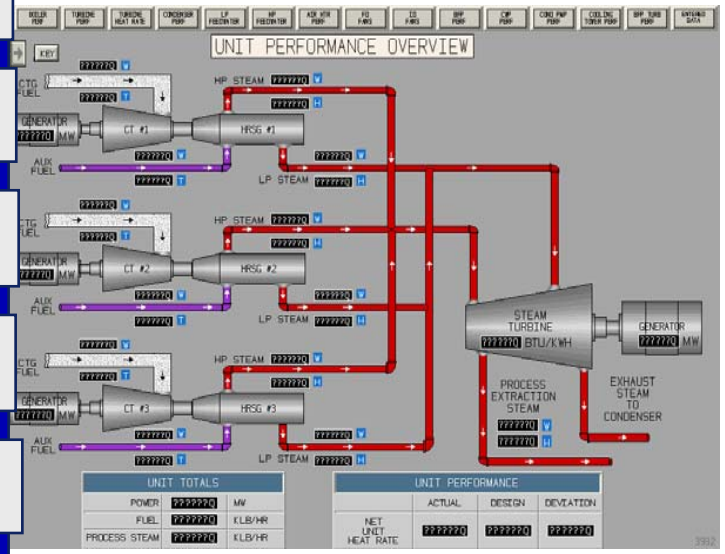
TO CONDENSATE PUMPS ??????Q W ??????Q H

PARAMETER	UNITS	ACTUAL	EXPECTED (CLEAN CONDITION)
BACK PRESSURE	INHGA	??????Q	??????Q
HEAT TRANSFER COEFFICIENT	BTU/(HR*FT^2*^{o}F)	??????Q	??????Q
CLEANLINESS	%	??????Q	??????Q
TERMINAL TEMP DIFFERENCE	DEGF	??????Q	
INITIAL TEMP DIFFERENCE	DEGF	??????Q	
SUBCOOLING	DEGF	??????Q	
LOG MEAN TEMP DIFFERENCE	DEGF	??????Q	
CIRC WATER VELOCITY	FT/SEC	??????Q	
CONDENSER DUTY	MBTU/HR	??????Q	

PARAMETER ENTRY

Fully, Configured Dynamic Link Library Containing Plant-Specific Performance Calculations

- **Unit Heat Rate Module**
- **Turbine Heat Rate Module**
- **TG Heat Balance & Efficiency Module**
- **HRSG Performance Module**
- **Combustion Turb. Performance Module**
- **Condenser Performance Module**
- **Cooling Tower Module**
- **Large Pump Performance Module**



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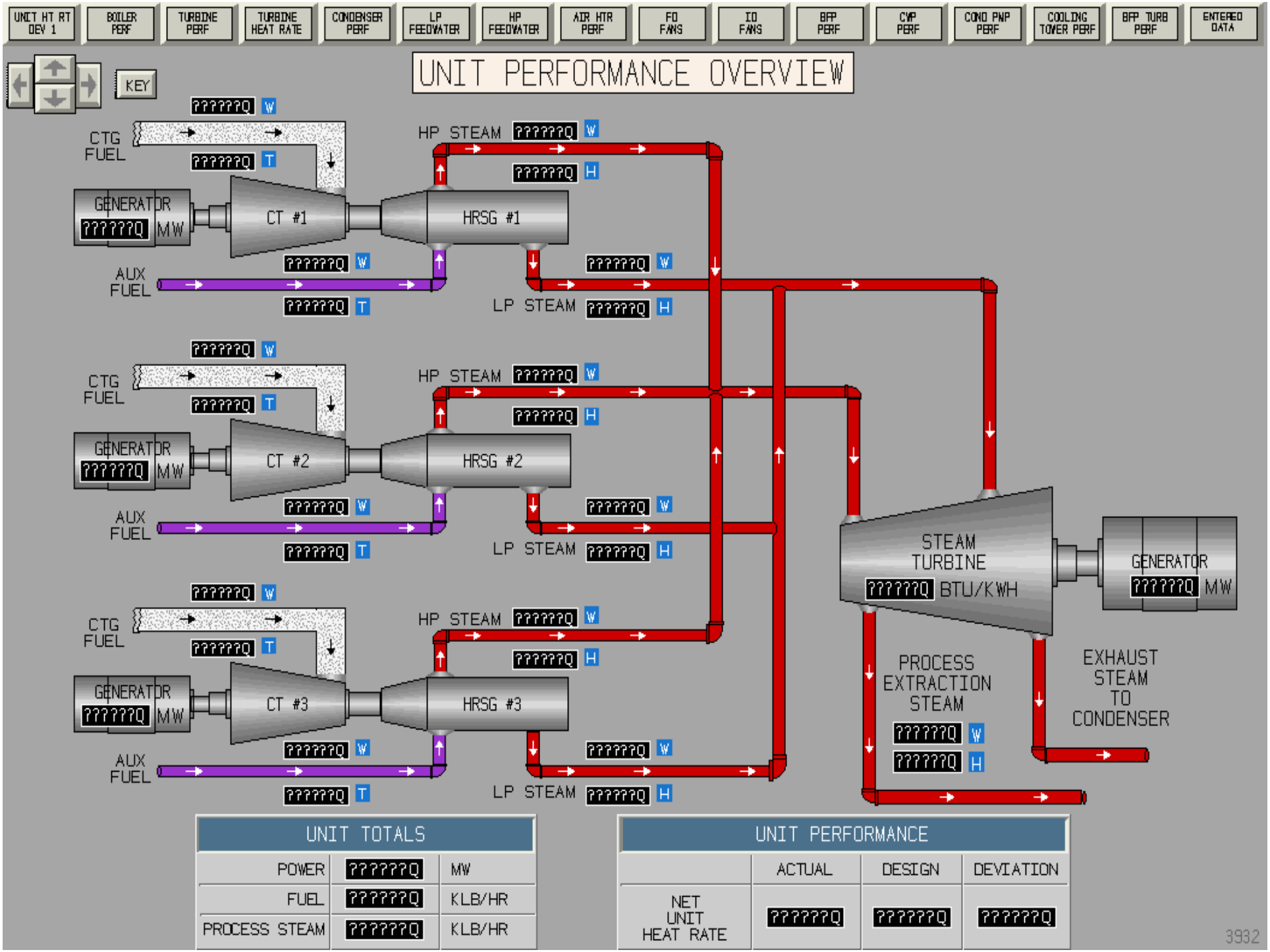
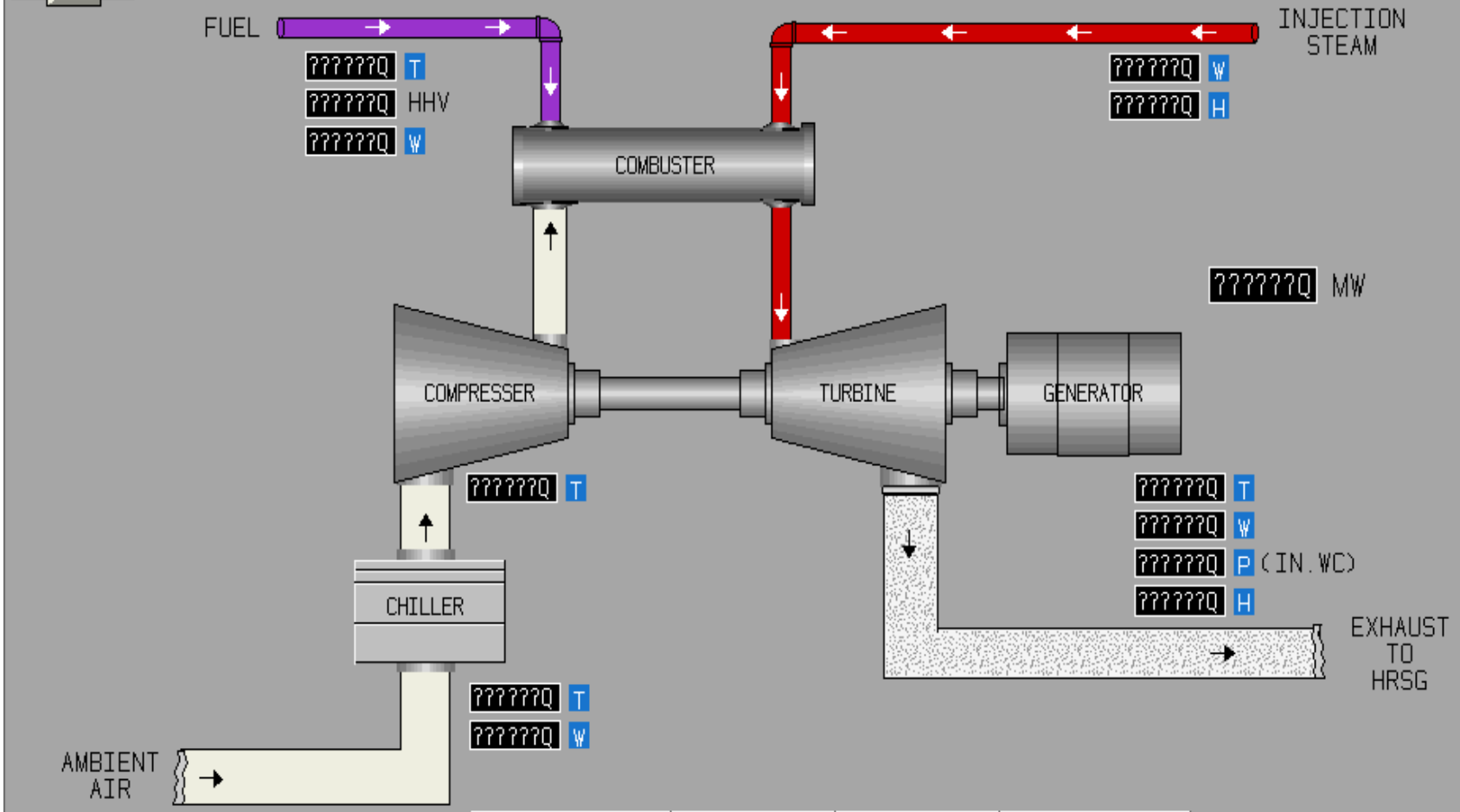
Process Management


UNIT HT RT DEV 1
BOILER PERF
TURBINE PERF
TURBINE HEAT RATE
CONDENSER PERF
LP FEEDWATER
HP FEEDWATER
AIR HTR PERF
FD FANS
ID FANS
BFP PERF
CWP PERF
COND PMP PERF
COOLING TOWER PERF
BFP TURB PERF
ENTERED DATA
KEY
UNIT PERFORMANCE OVERVIEW
CTG FUEL
GENERATOR
MW
CT #1
HRSG #1
CT #2
HRSG #2
CT #3
HRSG #3
AUX FUEL
HP STEAM
LP STEAM
STEAM TURBINE
BTU/KWH
PROCESS EXTRACTION STEAM
EXHAUST STEAM TO CONDENSER
UNIT TOTALS
POWER
FUEL
PROCESS STEAM
KLB/HR
UNIT PERFORMANCE
ACTUAL
DESIGN
DEVIATION
NET UNIT HEAT RATE
3932

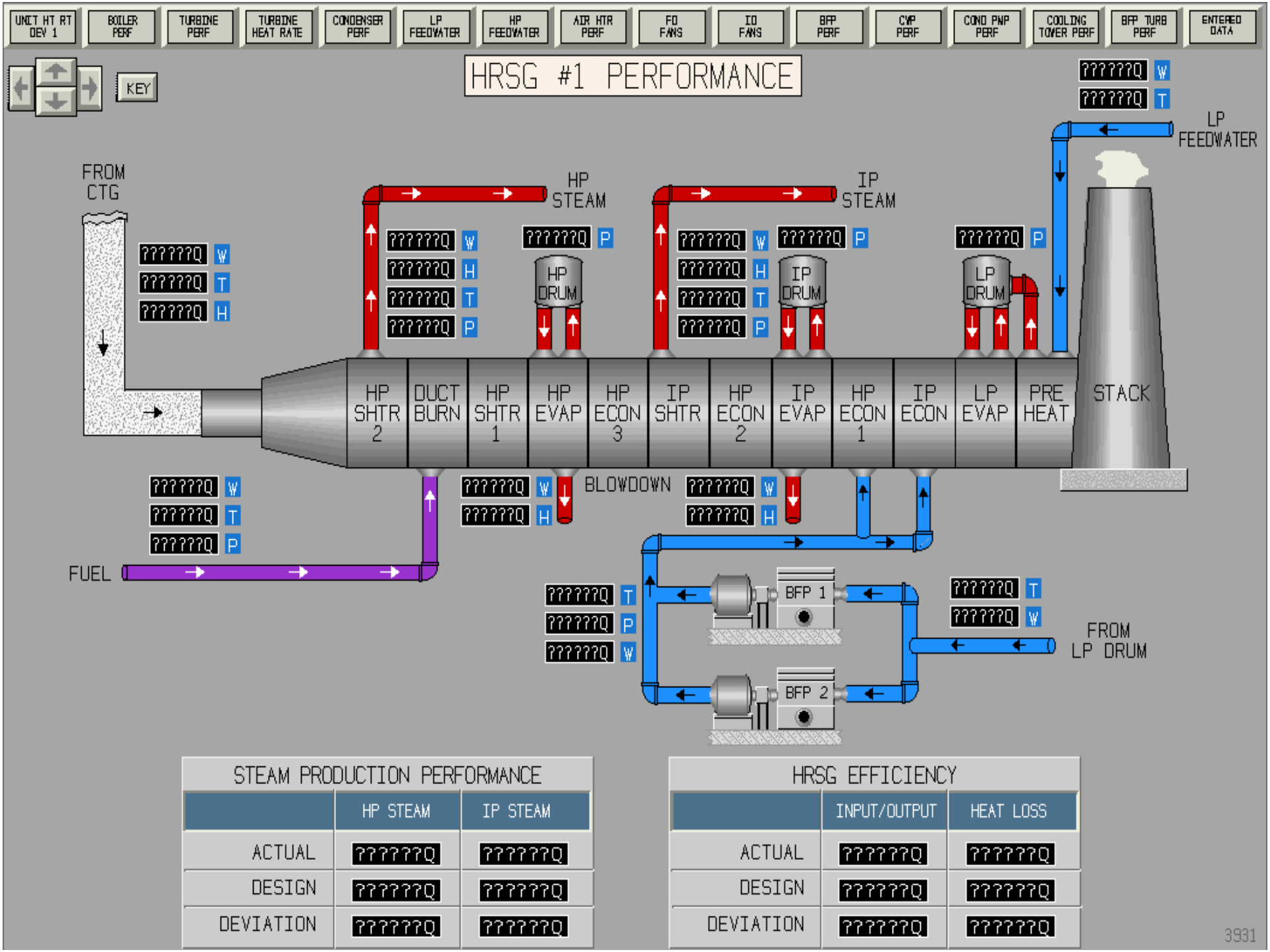
KEY

COMBUSTION TURBINE #1 PERFORMANCE

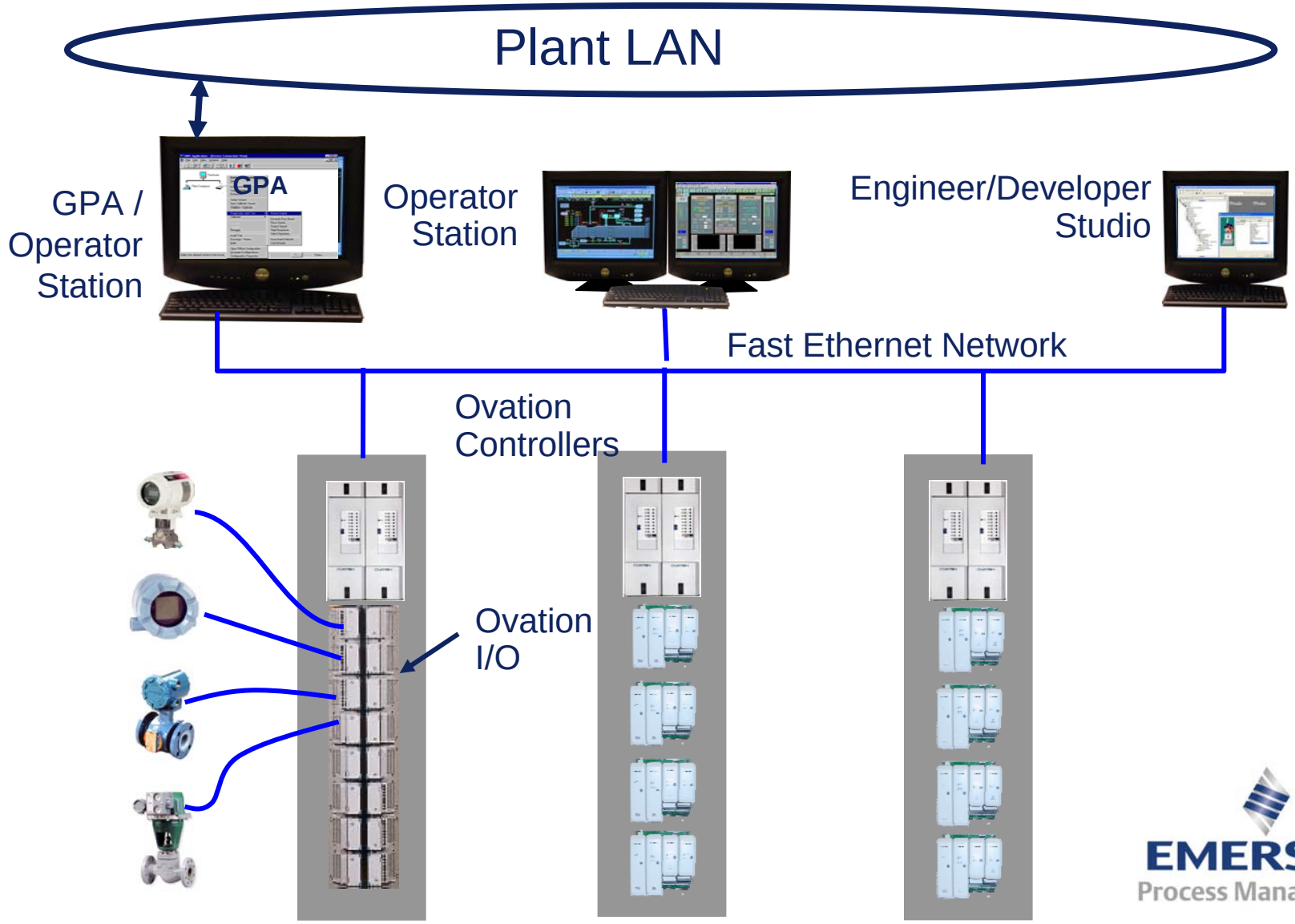


	HEAT RATE (BTU/KWH)	EFFICIENCY (%)	POWER OUTPUT (MW)
ACTUAL	??????Q	??????Q	??????Q
CORRECTED	??????Q	??????Q	??????Q
DESIGN	??????Q	??????Q	
DEVIATION	??????Q	??????Q	

3930


UNIT HT RT DEV 1
BOILER PERF
TURBINE PERF
TURBINE HEAT RATE
CONDENSER PERF
LP FEEDWATER
HP FEEDWATER
AIR HTR PERF
FD FANS
ID FANS
BFP PERF
CWP PERF
COND PNP PERF
COOLING TOWER PERF
BFP TURB PERF
ENTERED DATA
KEY
HRSG #1 PERFORMANCE
FROM CTG
HP STEAM
IP STEAM
LP FEEDWATER
HP DRUM
IP DRUM
LP DRUM
HP SHTR 2
DUCT BURN
HP SHTR 1
HP EVAP
HP ECON 3
IP SHTR
HP ECON 2
IP EVAP
HP ECON 1
IP ECON
LP EVAP
PRE HEAT
STACK
BLOWDOWN
FUEL
BFP 1
BFP 2
FROM LP DRUM
STEAM PRODUCTION PERFORMANCE
HP STEAM
IP STEAM
ACTUAL
DESIGN
DEVIATION
HRSG EFFICIENCY
INPUT/OUTPUT
HEAT LOSS
3931

Typical Ovation GPA



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Enterprise Data Server (EDS) Integration Software

The Enterprise Diagnostic Server (EDS) collects and processes plant data. It allows users to access current and historical data gathered from control systems and other plant data sources.

- Up to 100,000 process point capability
- Operates on various systems, including Linux, Windows NT, Windows 2000, Windows 95, and Sun Solaris
- All-in-one capabilities: alarms, visualization, reports, calculations, archival data storage, optimization, and advanced analysis
- Gathers data from the entire enterprise or multiple sources in one place
- Unified source of data for analysis, calculations, and process optimization
- Flexible source for visualization and reporting

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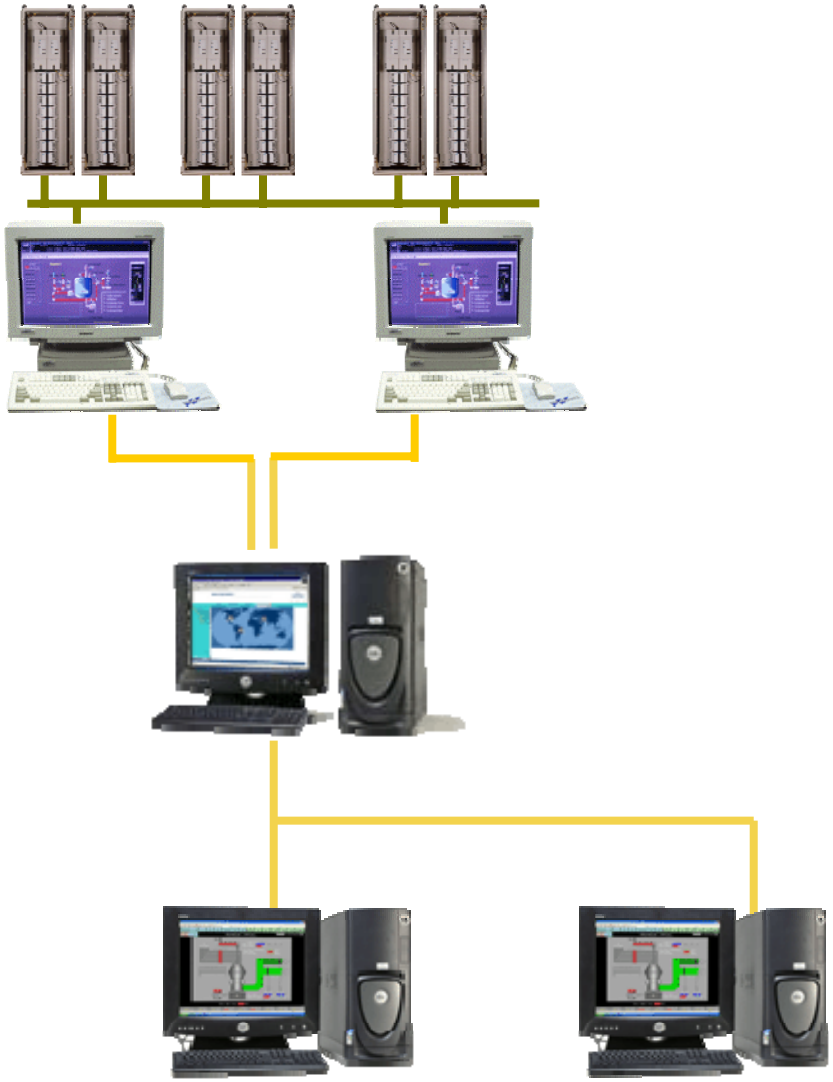
Process Management

EDS Structure



DCS or DAS

(EDS connect)

EDS Server

EDS Terminals

EMERSON
Process Management

Performance Monitoring System Data Validation and Substitution

- Developed as standalone algorithm with OPC interface
- Load data step has data analysis for bad data, unrecognized values, unknown error tags, overlapping and lack of data samples
- Neural model for key sensors such as fuel flows, feedwater flows, etc.
- Traditional approaches to secondary sensors, such as substitute values, curves, etc.
- Full scale replacement data via ULS module

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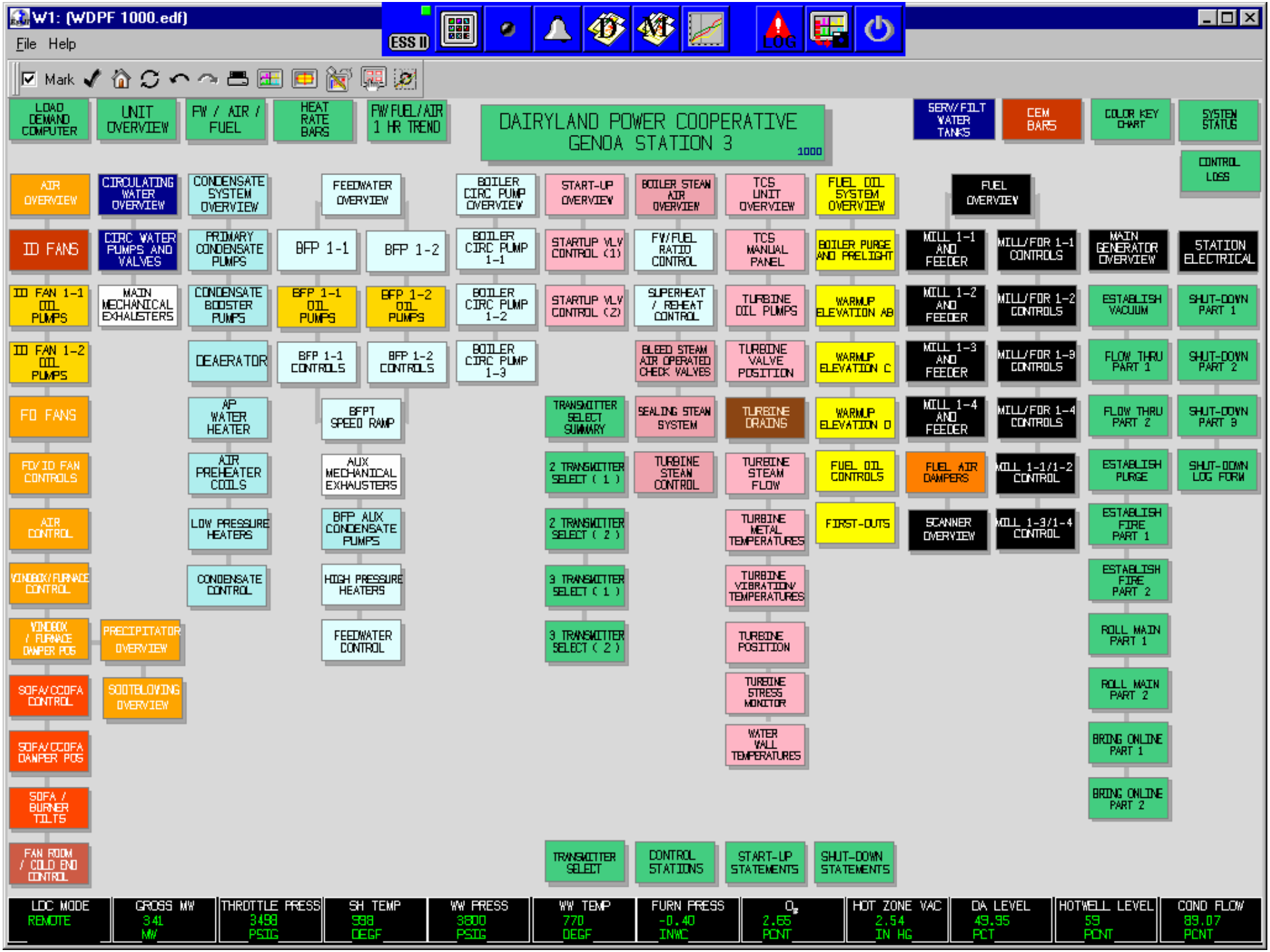
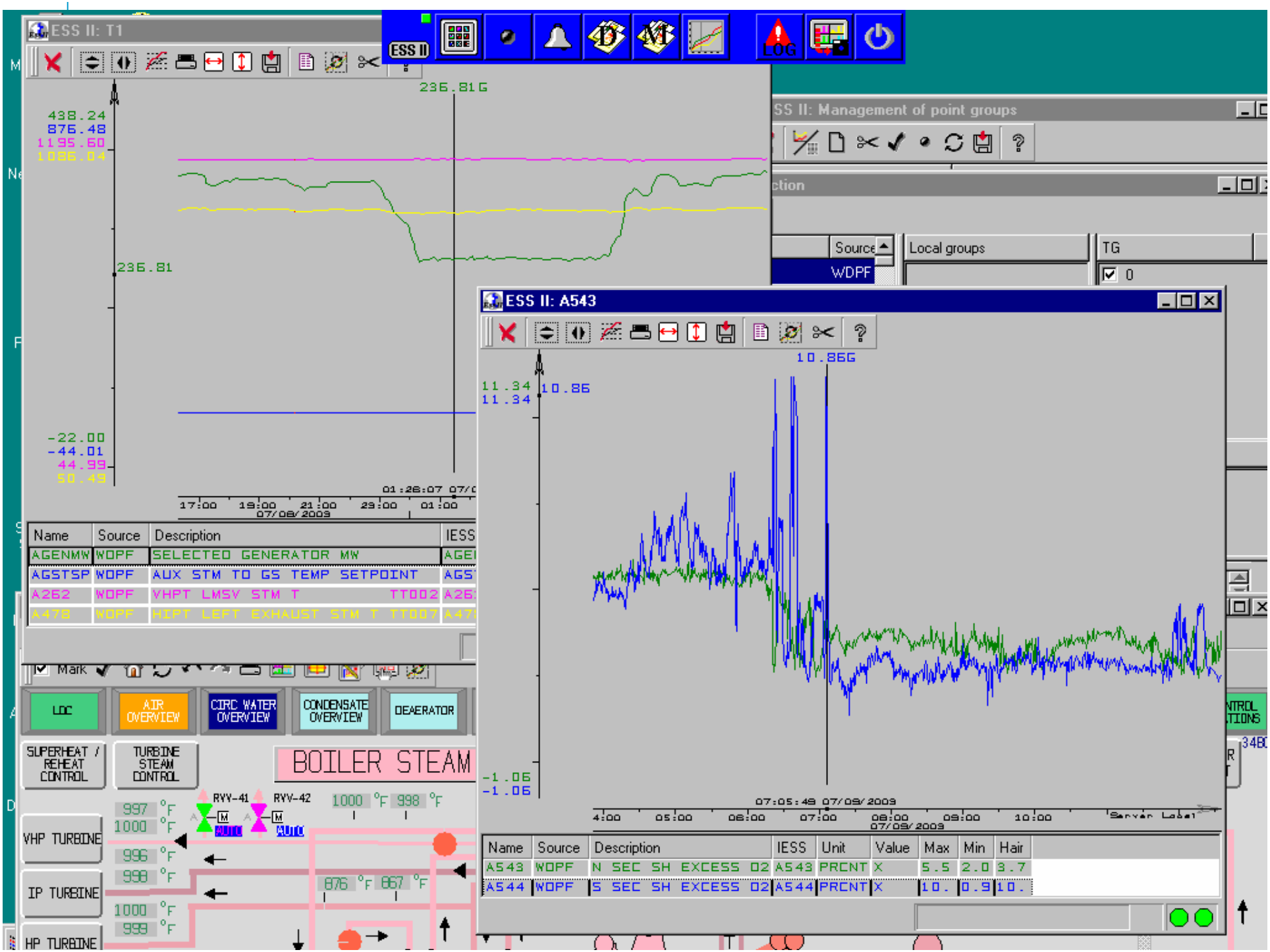
Process Management


W1: (WDPF 1000.edf)
File Help
ESS II
LOG
Mark
LOAD DEMAND COMPUTER
UNIT OVERVIEW
FW / AIR / FUEL
HEAT RATE BARS
FW/FUEL/AIR 1 HR TREND
DAIRYLAND POWER COOPERATIVE
GENOA STATION 3
1000
SERV/FILT WATER TANKS
CEM BARS
COLOR KEY CHART
SYSTEM STATUS
CONTROL LOSS
AIR OVERVIEW
CIRCULATING WATER OVERVIEW
CONDENSATE SYSTEM OVERVIEW
FEEDWATER OVERVIEW
BOILER CIRC PUMP OVERVIEW
START-UP OVERVIEW
BOILER STEAM AIR OVERVIEW
TCS UNIT OVERVIEW
FUEL OIL SYSTEM OVERVIEW
FUEL OVERVIEW
ID FANS
CIRC WATER PUMPS AND VALVES
PRIMARY CONDENSATE PUMPS
BFP 1-1
BFP 1-2
BOILER CIRC PUMP 1-1
STARTUP VLV CONTROL (1)
FW/FUEL RATIO CONTROL
TCS MANUAL PANEL
BOILER PURGE AND PRELIGHT
MILL 1-1 AND FEEDER
MILL/FOR 1-1 CONTROLS
MAIN GENERATOR OVERVIEW
STATION ELECTRICAL
ID FAN 1-1 OIL PUMPS
MAIN MECHANICAL EXHAUSTERS
CONDENSATE BOOSTER PUMPS
BFP 1-1 OIL PUMPS
BFP 1-2 OIL PUMPS
BOILER CIRC PUMP 1-2
STARTUP VLV CONTROL (2)
SUPERHEAT / REHEAT CONTROL
TURBINE OIL PUMPS
WARMUP ELEVATION AB
MILL 1-2 AND FEEDER
MILL/FOR 1-2 CONTROLS
ESTABLISH VACUUM
SHUT-DOWN PART 1
ID FAN 1-2 OIL PUMPS
DEAERATOR
BFP 1-1 CONTROLS
BFP 1-2 CONTROLS
BOILER CIRC PUMP 1-3
BLEED STEAM AIR OPERATED CHECK VALVES
TURBINE VALVE POSITION
WARMUP ELEVATION C
MILL 1-3 AND FEEDER
MILL/FOR 1-3 CONTROLS
FLOW THRU PART 1
SHUT-DOWN PART 2
FD FANS
AP WATER HEATER
BFPT SPEED RAMP
TRANSMITTER SELECT SUMMARY
SEALING STEAM SYSTEM
TURBINE DRAINS
WARMUP ELEVATION D
MILL 1-4 AND FEEDER
MILL/FOR 1-4 CONTROLS
FLOW THRU PART 2
SHUT-DOWN PART 3
FD/ID FAN CONTROLS
AIR PREHEATER COILS
AUX MECHANICAL EXHAUSTERS
2 TRANSMITTER SELECT (1)
TURBINE STEAM CONTROL
TURBINE STEAM FLOW
FUEL OIL CONTROLS
FUEL AIR DAMPERS
MILL 1-1/1-2 CONTROL
ESTABLISH PURGE
SHUT-DOWN LOG FORM
AIR CONTROL
LOW PRESSURE HEATERS
BFP AUX CONDENSATE PUMPS
2 TRANSMITTER SELECT (2)
TURBINE METAL TEMPERATURES
FIRST-OUTS
SCANNER OVERVIEW
MILL 1-3/1-4 CONTROL
ESTABLISH FIRE PART 1
WINDBOX/FURNACE CONTROL
CONDENSATE CONTROL
HIGH PRESSURE HEATERS
3 TRANSMITTER SELECT (1)
TURBINE VIBRATION/ TEMPERATURES
ESTABLISH FIRE PART 2
WINDBOX / FURNACE DAMPER POS
PRECIPITATOR OVERVIEW
FEEDWATER CONTROL
3 TRANSMITTER SELECT (2)
TURBINE POSITION
ROLL MAIN PART 1
SOFA/OCOFA CONTROL
SOOTBLOWING OVERVIEW
TURBINE STRESS MONITOR
ROLL MAIN PART 2
SOFA/OCOFA DAMPER POS
WATER WALL TEMPERATURES
BRING ONLINE PART 1
SOFA / BURNER TILTS
BRING ONLINE PART 2
FAN ROOM / COLD END CONTROL
TRANSMITTER SELECT
CONTROL STATIONS
START-UP STATEMENTS
SHUT-DOWN STATEMENTS
LDC MODE REMOTE
GROSS MW 341 MW
THROTTLE PRESS 3498 PSIG
SH TEMP 988 DEGF
WW PRESS 3800 PSIG
WW TEMP 770 DEGF
FURN PRESS -0.40 INWC
O2 2.65 PCNT
HOT ZONE VAC 2.54 IN HG
DA LEVEL 49.95 PCT
HOTWELL LEVEL 59 PCNT
COND FLOW 89.07 PCNT

W1: (Net1 3316.edf)
File Help
Mark
Background
LOC
AIR OVERVIEW
CIRC WATER OVERVIEW
CONDENSATE OVERVIEW
DEAERATOR
FEEDWATER OVERVIEW
BOILER CIRC PUMP OVERVIEW
START-UP OVERVIEW
BLR STM AIR OVERVIEW
TCS UNIT OVERVIEW
MAIN GEN OVERVIEW
FUEL OIL SYSTEM OVERVIEW
FUEL OVERVIEW
CONTROL STATIONS
3316
MASTER FUEL TRIP
FUEL OVERVIEW
COAL FLAME SCANNERS
MILL 1-1
MILL 1-2
MILL 1-3
MILL 1-4
FEEDER SPEED
HOT AIR GATE
HOT AIR
COLD AIR
COLD AIR DAMPER
AIR IN
AIR OUT
PRI AIR
EXHAUST DISCHARGE GATE
FW/FUEL RATIO MODE
IS VALVE
MILL 1-1 OVERVIEW
MILL 1-1 CONTROL
MILL 1-2 OVERVIEW
MILL 1-2 CONTROL
MILL 1-3 OVERVIEW
MILL 1-3 CONTROL
MILL 1-4 OVERVIEW
MILL 1-4 CONTROL
STEAM INERT
WATER DELUGE
LOC MODE
GROSS MW
THROTTLE PRESS
SH TEMP
WW PRESS
WW TEMP
FURN PRESS
HOT ZONE VAC
DA LEVEL
HOTWELL LEVEL
FDWTR FLOW


ESS II: T1
ESS II
LOG
236.81G
438.24
876.48
1195.60
1086.04
236.81
-22.00
-44.01
44.99
50.49
17:00
19:00
21:00
23:00
01:00
07/08/2009
Name
Source
Description
IESS
AGENMW
WDPF
SELECTED GENERATOR MW
AGSTSP
AUX STM TO GS TEMP SETPOINT
A262
VHPT LMSV STM T
TT002
A478
HIPT LEFT EXHAUST STM T
TT007
Mark
LOC
AIR OVERVIEW
CIRC WATER OVERVIEW
CONDENSATE OVERVIEW
DEAERATOR
SUPERHEAT / REHEAT CONTROL
TURBINE STEAM CONTROL
BOILER STEAM
RVV-41
RVV-42
AUTO
VHP TURBINE
IP TURBINE
HP TURBINE
997 °F
1000 °F
996 °F
998 °F
1000 °F
999 °F
1000 °F
998 °F
876 °F
867 °F
ESS II: Management of point groups
Source
Local groups
TG
WDPF
0
ESS II: A543
10.86G
11.34
11.34
10.86
-1.06
-1.06
07:05:49 07/09/2009
4:00
05:00
06:00
07:00
08:00
09:00
10:00
07/09/2009
Name
Source
Description
IESS
Unit
Value
Max
Min
Hair
A543
WDPF
N SEC SH EXCESS O2
A543
PRCNT
X
5.5
2.0
3.7
A544
WDPF
S SEC SH EXCESS O2
A544
PRCNT
X
10.
0.9
10.

My Computer Palm Desktop

ESS II

ESS II: Events - List

Timestamp	Type	Kind	Priority	Name	Description	Value	Level
15:13:01 07/09/2003	ALRM	IMPORTED LOW	4	D3BOSHOUTABS	Superheater outlet heat abs.	***	0.000
15:12:13 07/09/2003	ALRM	IMPORTED LOW	2	D3MWCNT	Megawatt	***	0.000
15:09:43 07/09/2003	ALRM	IMPORTED LOW	6	D3BOPSHTABS	Primary superheater heat abs.	***	0.000
15:09:40 07/09/2003	ALRM	IMPORTED LOW	8	D3BOPLTNABS	Superheater platen heat abs.	***	0.000
15:07:16 07/09/2003	ALRM	IMPORTED HIGH	5	D3RHSWFLOW	Rhtr spray water flow	***	0.000
15:03:31 07/09/2003	ALRM	IMPORTED LOW	7	D3BOREHTABS	Reheater heat abs.	***	0.000
15:01:10 07/09/2003	ALRM	IMPORTED LOW	4	D3WIPST	steam temp.	***	0.000
15:00:40 07/09/2003	ALRM	IMPORTED LOW	7	D3W2STGSWFLO	2nd stage spray water flow	***	0.000
14:51:16 07/09/2003	ALRM	IMPORTED HIGH	2	ULS_02_C1	Component 1	***	4.400
14:51:03 07/09/2003	ALRM	IMPORTED HIGH	7	D3BOOPACITY	Opacity	***	0.000
14:51:03 07/09/2003	ALRM	IMPORTED LOW	2	D3SAW24	time signal	***	0.000
14:21:21 07/09/2003	ALRM	IMPORTED LOW	2	D3AIRHTRABS	Airheater heat abs.	***	0.000
13:20:18 07/09/2003	ALRM	IMPORTED HIGH	1	A591	MAIN TURB OIL TNK REL HUMIDITY	***	90.0
11:05:11 07/09/2003	ALRM	IMPORTED HIGH	1	AIP219	SEALING STEAM HEADER PRESSURE	***	6.0
10:15:19 07/09/2003	ALRM	IMPORTED HIGH	1	AIP066	TURB GLAND SEAL STM PRESS	***	14.0
07:02:19 07/09/2003	ALRM	IMPORTED	4	DIEC05	BFP 1-1 GLAND SEAL TROUBLE	***	
20:14:35 07/08/2003	ALRM	IMPORTED	2	MBP0023D	BUNKER #1 CARBON MONOXIDE	***	
20:14:35 07/08/2003	ALRM	IMPORTED HIGH	1	AITREPP	MAIN TURB. ROTOR ECC. PK-PK	***	0.0
20:14:35 07/08/2003	ALRM	IMPORTED	4	DGTH11AU	EH SKID#1 MOTOR#1 AUTO PB TEXT	***	
20:14:35 07/08/2003	ALRM	IMPORTED	4	DGTH12AU	EH SKID#1 MOTOR#2 AUTO PB TEXT	***	
20:14:35 07/08/2003	ALRM	IMPORTED	4	DGTH21AU	EH SKID#2 MOTOR#1 AUTO PB TEXT	***	
20:14:35 07/08/2003	ALRM	IMPORTED	4	DGTH22AU	EH SKID#2 MOTOR#2 AUTO PB TEXT	***	
20:14:35 07/08/2003	ALRM	IMPORTED	4	XARBV8OP	RBV-8 FAIL TO OPEN	***	
20:14:34 07/08/2003	ALRM	IMPORTED	4	DICD06	HOT WTR EXP TANK HI-LO LEVEL	***	
20:14:34 07/08/2003	ALRM	IMPORTED	4	DIEC06	BFPT 1-1 OIL CLR OUTLET TEMP	***	

Mode
- (•) List
- ( ) History
- ( ) Unacknow

Groups
- [x] 0
- [x] 1

Sources
- [x] CALC
- [x] GPA
- [x] SERVER
- [x] Simulate
- [x] SmartEng
- [x] WDPF

Point types
- [x] Analog
- [x] Binary
- [x] Packed
- [x] Time
- [x] Other

Priorities
- [x] 1
- [x] 2
- [x] 3
- [x] 4
- [x] 5
- [x] 6
- [x] 7
- [x] 8

Shown: 25/25

Start

Reporting functions

ESS II: Report definer

File Edit Format Help

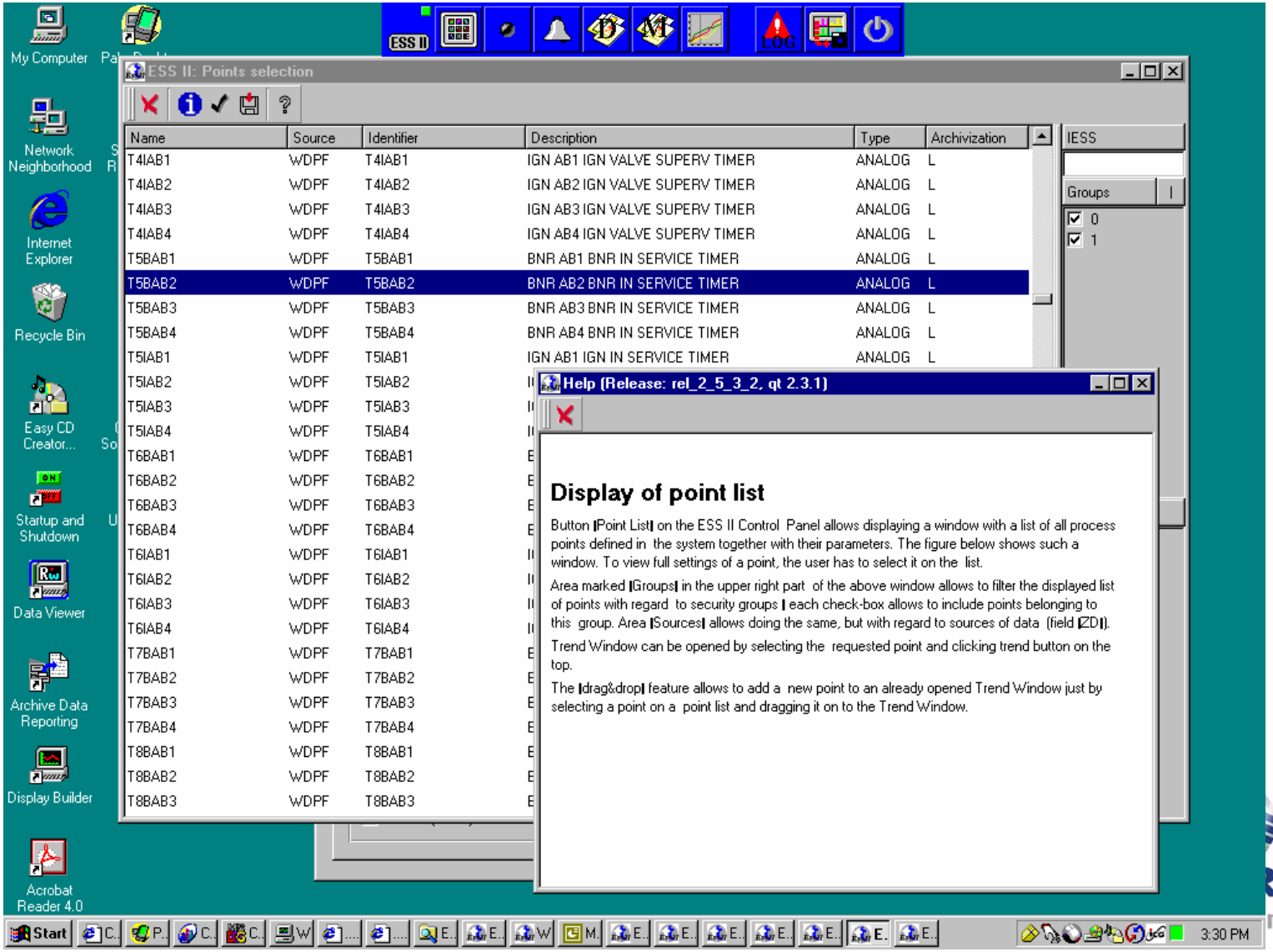
AGENMW

	A-1	B-2	C-3
1	POWER PLANT REPORT		
2		*Average production*	
3		*Done*	15:23:13 07/09/2003
4		*Period*	00:00:00 07/09/2003
5		*Interval [s]*	3600
6		*Points*	AGENMW
7		*Unit*	MW
8		*Operator's name*	
9			*SELECTED GENERATOR MW*
10	*Start time*	*End time*	*Result*
11	00:00:00 07/09/2003	01:00:00 07/09/2003	240
12	01:00:00 07/09/2003	02:00:00 07/09/2003	237
13	02:00:00 07/09/2003	03:00:00 07/09/2003	237
14	03:00:00 07/09/2003	04:00:00 07/09/2003	238
15	04:00:00 07/09/2003	05:00:00 07/09/2003	237
16	05:00:00 07/09/2003	06:00:00 07/09/2003	237
17	06:00:00 07/09/2003	07:00:00 07/09/2003	246
18	07:00:00 07/09/2003	08:00:00 07/09/2003	313
19	08:00:00 07/09/2003	09:00:00 07/09/2003	335
20	09:00:00 07/09/2003	10:00:00 07/09/2003	327
21	10:00:00 07/09/2003	11:00:00 07/09/2003	337
22	11:00:00 07/09/2003	12:00:00 07/09/2003	341
23	12:00:00 07/09/2003	13:00:00 07/09/2003	336
24	13:00:00 07/09/2003	14:00:00 07/09/2003	339
25	14:00:00 07/09/2003	15:00:00 07/09/2003	340
26	15:00:00 07/09/2003	16:00:00 07/09/2003	340
27	16:00:00 07/09/2003	17:00:00 07/09/2003	#NODATA
28	17:00:00 07/09/2003	18:00:00 07/09/2003	#NODATA

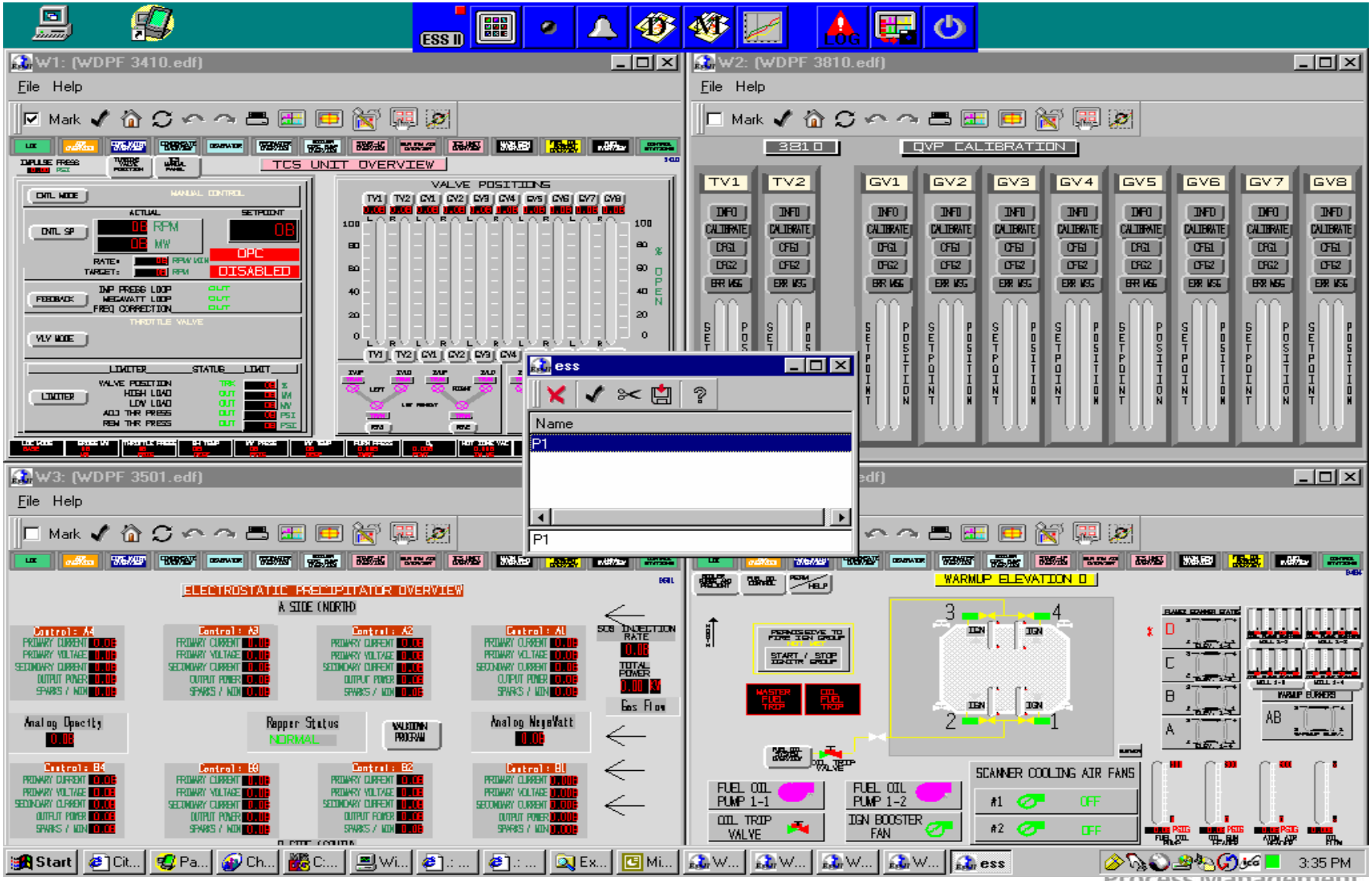
r4.rdf

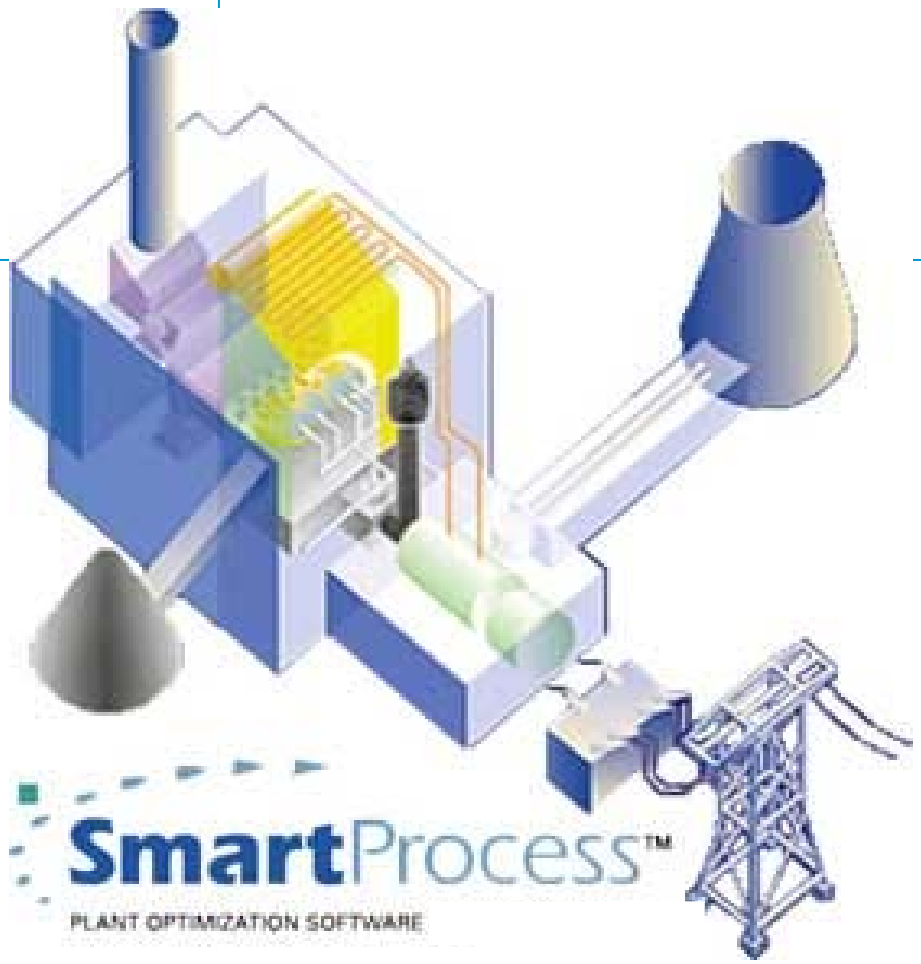
Start 3:25 PM

Point list and help



Profile definition





Questions?

EMERSON™
Process Management